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REPORT OF OPENING SESSION

The Opening Session started at 09:00 hours on October 29, 2007. Dr. Tokio Wada, Chairman of PICES, welcomed delegates, observers and researchers to Victoria and formally declared that the PICES Sixteenth Annual Meeting was open. The session agenda is appended as *OP Endnote 1*.

Welcome address on behalf of the host country

Mr. Paul Sprout (Regional Director-General, Fisheries and Oceans Canada) welcomed participants on behalf of the host country (*OP Endnote 2*).

Remarks by representatives of Contracting Parties and the Chairman of PICES

Dr. Wada invited Dr. Yuji Uozumi (Counselor, Resources Enhancement Promotion Department, Fisheries Agency, Japan) to make a statement on behalf of the Japanese Government. Dr. Uozumi addressed the session and his remarks are appended to the report as *OP Endnote 3*.

Dr. Wada called upon Mr. Handi Guo (Division Director, Department of International Cooperation, Ministry of Agriculture, People's Republic of China) to speak on behalf of the Chinese Government. Mr. Guo addressed the session and his remarks are appended to the report as *OP Endnote 4*.

Dr. Wada then asked Mr. Kwang-Youl Park (Division Director, Marine Policy Bureau, Ministry of Maritime Affairs and Fisheries, Republic of Korea) to make a statement on behalf of the Korean Government. Dr. Park addressed the session and his remarks are appended to the report as *OP Endnote 5*.

Dr. Wada invited Dr. Lev Bocharov (Director-General, Pacific Scientific Research Fisheries Center, State Committee for Fisheries, Russian Federation) to speak on behalf of the Russian Government. Dr. Bocharov addressed the session and his remarks are appended to the report as *OP Endnote 6*.

Dr. Wada requested Dr. Samuel Pooley (Director, Pacific Islands Fisheries Science Center, National Marine Fisheries Service, United States of America) to make a statement on behalf of the U.S. Government. Dr. Pooley addressed the session and his remarks are appended to the report as *OP Endnote 7*.

Dr. Wada called upon Dr. Laura Richards (Regional Director of Science, Pacific Region, Fisheries and Oceans Canada) to speak on behalf of the Canadian Government. Dr. Richards addressed the session and her remarks are appended to the report as *OP Endnote 8*.

Dr. Wada thanked Mr. Sprout and all the delegates for their remarks, and addressed the participants on behalf of PICES. His remarks are appended to the report as *OP Endnote 9*.

Wooster Award presentation ceremony

Dr. Wada and Dr. Kuh Kim, PICES Science Board Chairman, conducted the 2007 Wooster Award presentation ceremony. First, Dr. Wada introduced the Wooster Award:

In 2000, PICES established an award for scientists who have made significant contributions to North Pacific marine science, who have achieved sustained excellence in research, teaching, or administration, who have worked to integrate the various disciplines of the marine sciences, and preferably, all of these in association with PICES. The award was named in honour of Prof. Warren S. Wooster, the principal founder and the first Chairman of PICES, a world-renowned researcher of climate

variability and fisheries production, and an ambassador of international scientific co-operation.

Prior recipients of the Wooster Award are Prof. Michael M. Mullin (2001), Prof. Yutaka Nagata (2002), Prof. William Pearcy (2003), Prof. Paul H. LeBlond (2004), Dr. Daniel Ware (2005) and Dr. Makoto Kashiwai (2006), and I would like to ask Dr. Kuh Kim, PICES Science Board Chairman, to announce the recipient of the Wooster Award for 2007.

Dr. Kim quoted the following Science Board citation for the 2007 Wooster Award (reading of the citation was accompanied by a special slide show dedicated to Dr. Kenneth Denman):

It gives me great pleasure to announce that the Wooster Award for 2007 is being given to Dr. Kenneth L. Denman, a world-renowned interdisciplinary ocean scientist.

Ken has authored more than 75 primary journal articles, book chapters or review papers on air–sea interaction, lower trophic-level biological production, and the role of the ocean in the global climate system. He was born and raised in the city of Calgary, Alberta. For those of you unfamiliar with Canadian geography, Calgary is located in the transition zone between the foothills of the Rocky Mountains and the vast Canadian prairie. Calgary is a long, long way from any ocean. As you will see in the accompanying photos, Ken never lost his affinity for mountains.

After completing a Bachelor of Science degree at the University of Calgary, Ken began graduate studies in physical oceanography at the Institute of Oceanography at the University of British Columbia, under the direction of Prof. Mike Miyake. The Institute was best known at that time for its advanced work on air–sea interaction, but the influence of Prof. Tim Parsons and others at the Institute stimulated what were, at the time, novel interdisciplinary collaborations. This was to have a significant effect on Ken's career.

With his shiny new Ph.D. in hand, Ken took a position as junior scientist at the Bedford Institute of Oceanography where he worked closely with Trevor Platt. They applied approaches used in meteorology and physical oceanography to the study of plankton. This was an important contribution to biological oceanography as the field was then dominated by descriptive science. The application of advanced analytical techniques to field data, satellite observations and numerical models is a hallmark of Ken's career.

In 1977, he returned to the Pacific coast as a research scientist in the Ocean Ecology Laboratory at the newly constructed Institute of Ocean Sciences (IOS). He continued to apply advanced techniques to practical problems in biological oceanography. In recognition of his skill, energy and leadership, Ken was promoted to senior positions in science and management in the Department, where Ken eventually discovered his deep dislike for matters of bureaucracy and administration, and returned to being a senior research scientist at IOS.

Having bridged the fields of physical and biological oceanography, Ken turned his attention to chemistry, to the ocean carbon cycle, and to its importance in the global climate system. He played a leading role in many aspects of both the international and Canadian JGOFS, GLOBEC and SOLAS programs. These interests ultimately led him to work on the Intergovernmental Panel on Climate Change (IPCC) as a convenor and Lead Author in the 1995 Assessment, and as Coordinating Lead Author for the Fourth Assessment Report that was completed last spring. He shares with his IPCC colleagues the reward of a Nobel Peace Prize "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change."

Ken was very active in the earlier history of PICES. He was a Canadian member of the BIO Committee from its very first meetings until

2000, a member of Working Group 6 on the Subarctic Gyre, *and Working Group 7 on* Modeling Ocean Circulation. *He worked to integrate the JGOFS North Pacific Task Team into PICES activities. In addition to his personal contributions to science, he also mentored, encouraged and entrained younger scientists into PICES activities. Many of these individuals are in the room today – you know who you are!*

Ken has been an adjunct professor at both the University of Victoria and the University of British Columbia, and for the last several years, he has been spending most of his time working at the Canadian Centre for Climate Modelling and Analysis, a branch of Environment Canada located on the campus of the University of Victoria. There, he is engaged in an interdepartmental effort to develop a global atmosphere, land and ocean climate model, complete with an ocean carbon cycle.

Please join me in congratulating Dr. Kenneth Denman as the 2007 Wooster Award winner.

Unfortunately, Prof. Wooster was unable to join this ceremony, but he kindly sent a message to Dr. Denman. Dr. Wada read the following tribute from Prof. Wooster:

It is a privilege to endorse the selection of Ken Denman for the Wooster Award, not only for his many services to PICES but also for his cross-disciplinary scientific approach that epitomizes the aspirations of PICES from its inception. When I read his list of research interests and resulting publications, I see them all as significant contributions to the unifying question that has motivated the organization from the beginning – "What is the nature of the subarctic Pacific ecosystem and how is it affected over periods of months to centuries by changes in the physical environment, by interactions among components of the ecosystem, and by human activities?" *In particular, he has brought his insight as a physicist to an assessment of the physical and biological mechanisms whereby these ecosystem changes are effected. It is through the efforts of Ken Denman and his colleagues, and the support of organizations such as PICES, that we can hope one day to establish a more sustainable relationship with the North Pacific and its flora and fauna.*

Dr. Wada presented a commemorative plaque to Dr. Denman (a permanent plaque identifying Wooster Award winners resides at the PICES Secretariat), who accepted the award with the following remarks:

It is a great honour and privilege to be selected as the recipient of the 2007 Wooster Award. The citation is very flattering, and I would like to thank the people who nominated me for the award. I first went to Ocean Station Papa in May 1972, early in the 51 years of oceanographic sampling there, although at the time I thought that it was already a very long time series. Since then, except for five years when I worked at the Bedford Institute of Oceanography in Halifax on Canada's Atlantic coast, I have worked towards understanding first the physics, then the planktonic ecology, and more recently the biogeochemistry of the subarctic Northeast Pacific Ocean. Two Canadian scientists from the Department of Fisheries and Oceans influenced my scientific path early on. First, Sus Tabata had published two fascinating papers on the time series measurements at Ocean Station Papa that guided my Ph.D. thesis research on the dynamics of the upper mixed layer of the ocean. Second, Tim Parsons, as I was finishing my thesis, encouraged me to look beyond physics and apply my expertise in physics to the planktonic ecosystem and related biogeo-chemical cycles. I followed his advice and as a result have had a wonderful and fascinating career studying the interactions between physical, biological and chemical processes in the North Pacific. So, I thank you all for this great honour, and I thank Warren Wooster for his vision and perseverance in getting PICES started.

PICES "Year-in-Review" 2007

Dr. Kuh Kim reviewed PICES' scientific accomplishments since the Fifteenth Annual Meeting (*OP Endnote 10*).

Keynote lecture

The 2007 keynote lecture entitled "*The North Pacific, human activity, and climate change*" was given by Dr. Kenneth Denman (Department of Fisheries and Oceans, and Canadian Centre for Climate Modelling and Analysis) as a part of the Science Board Symposium on "*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*". The abstract of his presentation is appended to the report as *OP Endnote 11*.

The Opening Session closed at 10:40 a.m.

OP Endnote 1

Opening Session agenda

1. Opening by Dr. Tokio Wada, Chairman of PICES
2. Welcome address on behalf of the host country by Mr. Paul Sprout, Regional Director-General, Fisheries and Oceans Canada
3. Remarks by representatives of Contracting Parties
   - Dr. Yuji Uozumi (Counselor, Resources Enhancement Promotion Department, Fisheries Agency, Japan)
   - Mr. Handi Guo (Division Director, Department of International Cooperation, Ministry of Agriculture, People's Republic of China)
   - Mr. Kwang-Youl Park (Division Director, Marine Policy Bureau, Ministry of Maritime Affairs and Fisheries, Republic of Korea)
   - Dr. Lev N. Bocharov (Director-General, Pacific Scientific Research Fisheries Center, State Committee for Fisheries, Russian Federation)
   - Dr. Samuel Pooley (Director, Pacific Islands Fisheries Science Center, National Marine Fisheries Service, United States of America)
   - Dr. Laura Richards (Regional Director of Science, Pacific Region, Fisheries and Oceans Canada)
4. Remarks by Dr. Tokio Wada, Chairman of PICES
5. 2007 Wooster Award presentation ceremony
6. PICES "Year-in-Review" *2007* by the Chairman of Science Board, Dr. Kuh Kim
7. Closing Remarks/Announcements

OP Endnote 2

Welcome address on behalf of the host country by Mr. Paul Sprout

Mr. Chairman, delegates, ladies and gentlemen: Good morning. On behalf of the Government of Canada, and my department, Fisheries and Oceans Canada, it is my great pleasure to welcome you to Victoria and to the PICES Sixteenth Annual Meeting. This is a very special event for us because it marks the beginning of a year-long celebration of a century of marine science in Canada. The Pacific Biological Station in Nanaimo, a two-hour drive north of here, and the St. Andrews Biological Station on the east coast of Canada, were both established in 1908. We have planned a number of events over the next 12 months to celebrate what has been a remarkable 100 years of innovation and excellence in marine science.

The theme of this year's PICES meeting – "*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*" – speaks to the value of the work that has been done in the past century, and the need to continue this work in the future. This theme has real meaning for my department. As the Regional Director-General of Fisheries and Oceans Canada in the Pacific Region, I know that the changes occurring in the North Pacific impact on our work on a day-to-day basis. Changes in marine conditions and in the marine survival of fish stocks directly influence the decisions I and others make on managing fisheries and fish habitat.

In British Columbia, salmon is a cultural icon of immense importance, particularly to our First Nations and coastal communities. We have major commercial and recreational fisheries for salmon, in addition to food, social and ceremonial First Nation fisheries, and salmon aquaculture. However, since the mid-1990s, we have witnessed lower ocean productivity, lower ocean survival rates for salmon, and consequently, reduced salmon returns. This has led to economic upheaval in the commercial fisheries and a major restructuring of our commercial salmon fleet. The 2007 salmon season offers a good illustration. One of our most important salmon rivers is the Fraser River near Vancouver. Each year, based on the size of the spawning population four years earlier and on-average ocean survival, Fisheries and Oceans Canada develops pre-season estimates of the likely returns of the four main run timings of sockeye. These estimates help to develop fishing plans for the upcoming season. In 2007, however, the in-season test fisheries made it clear that the actual number of sockeye returning to the Fraser River would be less than 25% of our pre-season estimate. As a consequence, First Nations' food, social and ceremonial fisheries were curtailed, and the commercial fishery was closed for only the second time in its history. The previous closure of the commercial fishery occurred just two years ago, in 2005.

Although we do not understand the mechanism, we do know that the poor return of sockeye in 2007 was associated with three unusually warm years in the eastern North Pacific between 2002 and 2005. Sockeye salmon in the Fraser River are near the southern end of their range. Given the projections for warming over this century, we can likely anticipate more fishery restrictions in the years ahead, as well as conservation concerns. This will probably occur either because of poor survival in the Pacific Ocean or because of higher in-river mortalities related to high water temperatures and low water flows as the adult fish return to spawn. We need to learn more about climate change and the potential impacts on fish and fisheries to help us prepare for an uncertain future.

I understand that you will have more discussions on the new science program for PICES during this meeting. That program – "FUTURE" – "Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems," has obvious links to the problem of salmon survival that I just described. The vision of FUTURE: "to *understand* and *forecast* responses of North Pacific marine ecosystems to climate change and human activities" and "to broadly *communicate* this scientific information" resonates strongly with the strategic interests of my department. I look forward to hearing about the results of your discussions.

Understanding the changes occurring in our oceans will help us to better respond to them. It is my hope that this understanding and the knowledge being generated through the work of organizations such as yours, as well as by the science program of Fisheries and Oceans Canada, will help us to find actions for the challenges facing Fraser River sockeye, and answers for the people who treasure this wonderful resource.

To conclude, I would like to wish you a pleasant stay in the beautiful city of Victoria. I trust that your discussions are productive and I hope that you return home excited and eager to take on the many scientific challenges ahead.

OP Endnote 3

Remarks at the Opening Session by Dr. Yuji Uozumi (Japan)

Mr. Chairman, distinguished delegates, ladies and gentlemen: First of all, on behalf of Japan and the Japanese delegation, I would like to express sincere thanks to the Government of Canada, and the local organizing committee for kindly hosting the Sixteenth Annual Meeting of PICES here in Victoria. I also thank the PICES Secretariat for preparing for the meeting. We are sure that all your excellent efforts will make this meeting fruitful.

This year's Nobel Peace Prize has been awarded to the Intergovernmental Panel on Climate Change. This is a very symbolic topic for environmental issues, which are also very symbolic to the North Pacific Ocean. We know that many changes in the marine environment and marine ecosystems of the North Pacific are induced by changes in climate. We also know already that PICES plays a very important role in studying these environmental changes and their effects on marine ecosystems, and in making future projections. Therefore, PICES is now planning a new science program, FUTURE, which is being built as a successor to the CCCC Program, and is expected to be beneficial for understanding the effects of climate change on the ocean environment and for forecasting the responses of the North Pacific marine ecosystem to these changes. The scientific findings of the various PICES scientific programs will present valuable answers to the questions about what managers should do in light of these changes.

Related to these climate changes, harmful aquatic organisms such as red tide algae, giant jellyfish, and invasive species have caused various damages to fishing activities and have disturbed the marine ecosystems. These issues are particularly serious for developing countries. PICES created a Section to focus on *Ecology of Harmful Algal Blooms in the North Pacific* and recently established a Working Group on *Non-indigenous Aquatic Species*. Japan decided to provide a voluntary financial contribution to PICES to support the activities of these expert groups. Japan is interested in seeing that these activities contribute to the establishment of a network around the Pacific Rim, and capacity building in the developing countries.

Finally, I really wish that activities of the PICES scientific community can foster closer international cooperation to carry out our important tasks more productively. I also wish that every participant can have productive days here in Victoria. Thank you very much.

OP Endnote 4

Remarks at the Opening Session by Mr. Handi Guo (People's Republic of China)

Honourable Chairman of PICES, Dr. Tokio Wada, distinguished delegates, ladies and gentlemen: First, on behalf of the Chinese delegation, I would like to extend our congratulations to the opening of the PICES Sixteenth Annual Meeting, and to express our gratitude to the Canadian Government and the PICES Secretariat for making excellent preparations for the meeting.

It has been 16 years since PICES was established, and it has made a significant contribution to marine scientific research in the North Pacific. During these 16 years, the marine environment has gone through changes. We are now faced with the challenge of climate change, which is causing harm to marine ecosystems and to marine biological resources. Therefore, I am delighted to see that PICES, an organization dedicated to marine science, has already drafted a Science Plan for its next future integrative scientific program, which will focus on research of climate change and marine ecosystems. This program will be reviewed by the Governing Council at this Annual Meeting. We hold that it is consistent with the Chinese Government's principles and position concerning the issue of climate change to carry out research on the impact of climate change on marine ecosystems and related international cooperation under the framework of PICES. I do hope that, apart from protecting the marine ecosystem, the research on the North Pacific marine ecosystem can also promote the sustainable development of fisheries.

Finally, I wish for complete success of the PICES Sixteenth Annual Meeting, and hope to meet all of you again in Dalian, China, next year. Thank you.

OP Endnote 5

Remarks at the Opening Session by Mr. Kwang-Youl Park (Republic of Korea)

Dear Dr. Tokio Wada, Chairman of PICES, distinguished delegates, ladies and gentlemen: On behalf of the Republic of Korea and the Korean delegation, I would like to express my sincere gratitude for the invitation to the Sixteenth Annual Meeting of PICES. Also, my special thanks go to the Government of Canada and to the PICES Secretariat for their efforts to prepare for this meeting.

As the UN IPCC reports seriously warned, the challenges facing the ocean and coast, such as the changing of sea water temperature and rising of sea levels, are brought up as critical issues. Considering that the North Pacific region is densely populated and has significant economic activities, we should pay more attention to this region. In this regard, the theme for this Annual Meeting, "*The challenging North Pacific: Previous patterns, future projections and ecosystem impacts*" is, I think, very timely and appropriate.

The Korean Government is willing to fully support PICES and to cooperate with member countries to deal with the relevant issues of this theme. Within this context, I am very happy to inform you that the Korean Government will host the Eighteenth Annual Meeting of PICES in 2009, in Busan, the biggest port city and hub of ocean science and technology of Korea.

Also, I would like to take this opportunity to introduce the Korean Government's effort to be the host of the World EXPO in the year of 2012, in the beautiful coastal city of Yeosu. "*The Living Ocean and Coast*" was chosen by the Korean Government as the main theme of the EXPO. This theme is exactly in line with the spirit of PICES and the topics we are going to discuss in this Annual Meeting. If Yeosu is confirmed as the host city in Paris next month, the Korean Government will propose to hold a global ocean conference next year in partnership with PICES and IOC. I hope all of you will take part in this event and share your experiences and expertise. I think that we will be able to find solutions for imminent ocean issues and present new visions for the common prosperity of humankind. I would like to ask for your interest and support in such events.

And finally, I wish all of you great success and rewarding results from the Sixteenth Annual Meeting in this beautiful island city of Victoria. Thank you.

OP Endnote 6

Remarks at the Opening Session by Dr. Lev N. Bocharov (Russian Federation)

Dear Mr. Chairman, distinguished delegates of PICES member countries, dear participants, ladies and gentlemen: First of all, I would like to thank our Canadian colleagues for the invitation to the capital of beautiful British Columbia which has been chosen as a place for this year's PICES Annual Meeting. On behalf of the Russian delegation I would like to thank sincerely Fisheries and Oceans Canada, and the PICES Secretariat for the excellent work done during the preparation of this meeting.

In the past 16 years since the origin of our Organization, the scale of PICES activities has strongly expanded, with significant work being carried out between Annual Meetings. Relationships within the PICES community became stronger and cooperation with other international organizations and programs is developing successfully. First among these is the North Pacific Anadromous Fish Commission (NPAFC) which recently held its Fifteenth Annual Meeting in Vladivostok as a guest of the Russian Government and TINRO-Centre, which I head. I served as a PICES representative at the NPAFC meeting and noted that activities of our Organization were highly appreciated.

Participation at PICES XVI by observers from many organizations with an interest in the study

and use of the World Ocean is a confirmation of constantly growing interest in PICES around the world. Moreover, Russia is glad to see that the number of countries participating in PICES activities is going to increase.

Once again I would like to stress that the Russian Federation is constantly paying much attention to the study of the World Ocean, and PICES' growing activities receive our regular support and are highly appreciated in Russia.

Undoubtedly, in the first half of the current century, great changes will occur in ocean science in general, and in fishery science in particular. An ecosystem approach to the study of the ocean will be widely used in the utilization of numerous marine resources and in the development of mariculture in all countries. PICES, as a progressive scientific system, is ready to take a lead in this process. The scientific community of PICES member countries has done, without excessive modesty, an excellent job during preparations for FUTURE, the new integrative science program of PICES. The draft Science Plan for FUTURE will be refined and filled with new ideas at this Annual Meeting, and I am quite positive about that!

In conclusion, I would like to wish all of the participants of the PICES Sixteenth Annual Meeting a successful and productive time for work. Thank you for your attention.

OP Endnote 7

Remarks at the Opening Session by Dr. Samuel Pooley (U.S.A.)

Good morning, distinguished delegates and fellow scientists. The United States is very pleased to be participating in this Sixteenth Annual Meeting of PICES hosted by our neighbor to the north in this beautiful island location, Victoria.

PICES continues to be a vibrant and important forum for collaboration on matters of scientific, as well as conservation and management, importance to the countries of the North Pacific. The United States is particularly pleased with the success of this year's Conference for Early Career Scientists focusing on "*New frontiers in marine science*" held in Baltimore, Maryland, jointly with ICES. This conference was important for two reasons: first, because it provided an excellent opportunity for early career scientists to meet and exchange ideas, and second, because it marked on-going collaboration between ICES and PICES. Both are important for the growth and development of PICES and marine science in the North Pacific.

The United States is also very pleased with the on-going success of the PICES Intern Program that has brought young scientists here to Victoria to work with the PICES Secretariat. We look forward to continued success for this program, and the United States pledges to continue supporting the PICES Intern Program to the extent possible.

Finally, this is a very important meeting for PICES as we consider the future of the Organization in terms of its integrative science program. The Study Group on *Future Integrative Scientific Program(s)* has worked very hard to develop this important program, and we look forward to substantive discussion on the program at this meeting. Without pre-judging any of these conversations, we look forward to increased attention to the impact of climate and understanding it in more systematic ways in terms of the impacts of multiple stressors on North Pacific Ocean ecosystems, such as increased heat content and ocean acidification. This is also consistent with NOAA's increasing emphasis on integrated ecosystem assessments for large marine ecosystems.

With that, we thank the Government of Canada and the Secretariat of PICES for your preparations for what we are sure will be a very productive meeting. Thank you.

OP Endnote 8

Remarks at the Opening Session by Dr. Laura Richards (Canada)

Mr. Chairman, distinguished guests and colleagues: On behalf of Canada and the Canadian delegation, I would like to echo the warm welcome to you that was expressed by Mr. Sprout a few minutes ago. It is our pleasure to welcome you to Victoria and to the home city of the PICES Secretariat.

As Mr. Sprout already mentioned, this event is particularly special for Fisheries and Oceans Canada, since it marks the beginning of a year-long celebration to recognize 100 years of science at St. Andrews Biological Station on Canada's east coast and the Pacific Biological Station at Nanaimo, on Canada's west coast, a two-hour drive north of Victoria. In 2008, as part of this celebration, Canada is also hosting the Annual Meeting of the American Fisheries Society in Ottawa and the ICES Annual Science Conference in Halifax.

But to return to PICES, I would like to acknowledge another busy and successful year. I am particularly pleased to see the progress we have made in moving forward with FUTURE, our next major science program, and I look forward to concluding our discussions this week. FUTURE gives us the opportunity to shape a new direction for PICES and to ensure that the work we do together aligns with priority needs within our own countries. The issues around forecasting and uncertainty are ones that we all face. By working together, with our different views and experiences, we can solve our problems more effectively. The diversity of ecosystems around the North Pacific gives us a wonderful laboratory in which we can learn by comparing our successes and failures.

In closing, I would like to express my sincere thanks to those staff members from Fisheries and Oceans Canada who worked hard along side the staff of the PICES Secretariat to put this meeting together. Canada is proud to host the Secretariat in our facilities at the Institute of Ocean Sciences, and we recognize many benefits of a close working relationship. When the Annual Meeting is near the Secretariat's home in Canada, the Secretariat staff organize and coordinate more of the activities than when the meeting is hosted in another PICES country. We acknowledge and appreciate their support.

Again, welcome to Victoria. Thank you.

OP Endnote 9

Welcome address by Dr. Tokio Wada, Chairman of PICES

Mr. Paul Sprout, distinguished delegates, guests, ladies and gentlemen of the PICES family, welcome again to the Sixteenth Annual Meeting of our Organization. It gives me great pleasure to greet you. First of all, on behalf of all the PICES members, I would like to express our hearty thanks to our hosts for their hospitality and hard work to organize this Annual Meeting.

As Mr. Paul Sprout and Dr. Richards mentioned in their remarks, the year of 2008 is a memorable year for marine science in Canada. One hundred years ago, in 1908, the Pacific Biological Station (PBS) was established in Nanaimo. Since its establishment, PBS has contributed greatly to the knowledge of fisheries oceanography of the North Pacific, and has been a good and strong partner of PICES. On behalf of PICES, I would like to say "*Please accept our congratulations on your upcoming centennial anniversary*." I wish you continuous scientific success and good luck for the next centennial.

PICES has conducted various scientific activities from its inception, and now PICES has become a renowned marine science organization in the world. The PICES-GLOBEC CCCC (Climate Change and Carrying Capacity) Program was the first integrated and very successful science program of the Organization. The Program has contributed greatly to clarify the ecosystem response to climate variability in the North

Pacific, and has also showed us that scientists from different countries and disciplines can work together toward a common objective.

There are growing expectations from PICES Contracting Parties to bring back our scientific achievements to support their policy making. The impact of global warming on marine environments and living resources is not only a scientific issue, but also a serious problem for the safety and comfort of human life. In addition, conservation of bio-diversity and genetic diversity of ecosystems and populations are quite urgent issues for the sustainable use of marine living resources under largely fluctuating environments. In order to cope with these issues and to return the scientific results to human society, it is expected that PICES should enhance a close and strategic relationship among the Contracting Parties, and broadly cooperate with other countries and organizations that have common interests with us beyond oceans and borders.

During this Annual Meeting, we will discuss a successor to the CCCC Program called FUTURE, Forecasting and Understanding of Trends, Uncertainty and Responses of North Pacific Marine Ecosystems. Based on the results from the CCCC Program, FUTURE aims to achieve an in-depth understanding of ecosystem dynamics of the North Pacific under the present and future ocean climate variability. FUTURE will also focus on various human dimensions of ecosystem dynamics and will consider how to communicate the scientific results to policy makers of the Contracting Parties.

To stimulate our present activities, and to take a more important role in marine science in the world, we will also discuss frameworks needed to establish closer and more comprehensive relationships with various bodies outside of PICES. I hope that through the intensive discussions at this Annual Meeting, a new direction of PICES will be oriented toward building a bridge between marine science and human society in the North Pacific.

I was elected as the Chairman of PICES at the last Annual Meeting in Yokohama. This is my first opportunity to serve in this highly responsible position. I fully understand that my knowledge and experience are not enough to fulfill these responsibilities. However, I would like to do my best to inherit the dreams and passions of PICES' ancestors for international scientific cooperation in the North Pacific, and to pass these on to the next generation. I would like to ask all of you for your cooperation.

PICES is now not only expected to analyze scientific questions, but also expected to know how to cope with various problems in the North Pacific. And we can do it. I believe that this Annual Meeting will be the dawn of a new era of PICES. Thank you very much for your attention.

OP Endnote 10

PICES "Year-in-Review" 2007 by Dr. Kuh Kim, Chairman of Science Board

This year has been most remarkable and, indeed, a milestone was reached in the publication of a special issue of *Ecological Modelling* on NEMURO, which stands for "North Pacific Ecosystem Model for Understanding Regional Oceanography", and NEMURO.FISH which is "NEMURO For Including Saury and Herring". This was the culmination of international teamwork and energy over a period of 7 years and 10 international workshops. Drs. Michio Kishi, Bernard Megrey, Shin-ichi Ito and Francisco Werner edited this special issue which contains 17 papers. This publication might be the best example to demonstrate why PICES exists and what PICES can do.

The editors and contributors dedicated this special issue to Dr. Daniel Ware, who was their colleague, mentor and friend. Dan was the first Chairman of the PICES Science Board who helped guide the establishment of PICES' first science program on Climate Change and Carrying Capacity and later became a key member of its MODEL Task Team within this

program. The Wooster Award was awarded to Dan in 2005.

I must add that Dr. Kishi recently received two prestigious awards, in part, for his contribution to the development of NEMURO and NEMURO.FISH: the Uda Prize from the Japan Society of Fisheries Oceanography in April 2006, and the Prize of the Oceanographic Society of Japan, the highest prize in oceanography in Japan, in March of this year.

Currently in press are two more major publications: selected papers from the 2006 Symposium to mark the 50th anniversary of Line-P will be published in November 2007 in *Progress in Oceanography* (Vol. 75, No. 2) as a special issue titled "*Time series of the Northeast Pacific Ocean*" (Guest editors: Angelica Peña, Steven Bograd and Alexander Bychkov), and a set of papers presented at the 2005 GLOBEC/ESSAS Symposium on "*Climate variability on sub-Arctic marine ecosystems*" will appear in December 2007 as a special issue of *Deep-Sea Research II* (Guest editors: George Hunt, Kenneth Drinkwater, Skip McKinnell and David Mackas). I would like to express our thanks to the guest editors of all these special issues for their outstanding efforts to make these publications possible in time.

PICES continues to produce scientific reports. *PICES Scientific Report No. 33* is the proceedings of the 2006 PICES/NPRB workshop on "*Integration of ecological indicators of the North Pacific with emphasis on the Bering Sea*".

PICES also introduced its new electronic Technical Report Series this year. Technical Report No. 1 (*Metadata Federation of PICES Member Countries*) describes the history of the PICES Metadata Federation Project that PICES initiated with the objectives of creating standardized metadata descriptions of national, institutional and agency databases, and serving those descriptions in a World-Wide-Web-based, one-stop environment with search and delivery capabilities. This is a living document and the goal is to keep it current.

The much anticipated "*Guide to Best Practices for Ocean CO_2 Measurements*" is being published as *PICES Special Publication No. 3*, and is edited by Andrew Dickson, Christopher Sabine and James Christian. This Guide will allow scientists from different countries to use the same standardized methods for their surveys and will allow a Pacific-wide synthesis of ocean CO_2 based on national surveys.

An American Fisheries Society book on "*The ecology of juvenile salmon in the Northeast Pacific Ocean: Regional Comparisons*", edited by Churchill Grimes, Richard Brodeur, Lewis Haldorson and Skip McKinnell, will also be out soon.

Next year, we expect to see several special issues of primary journals. For example, selected papers from the PICES XV Topic Session on "*The human dimensions of jellyfish blooms*" will be published in *Plankton and Benthos Research*; papers from the SEEDS-II experiment will appear in *Deep-Sea Research II*; a set of papers from the 2006 PICES/GLOBEC Symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" will be published in *Progress in Oceanography*; and selected papers from the CREAMS/PICES Workshop on "*Model-data inter-comparison for the Japan/ East Sea*" in the *Journal of Marine Systems*.

As well, selected papers from three major conferences co-sponsored by PICES in 2007 (the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*", the 5th International Conference on "*Marine bioinvasions*" and the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*") will be published either as a special issue or as part of a regular series of *ICES Journal of Marine Science.*

Finally, selected papers from the recently completed NAFO/PICES/ICES Symposium on "*Reproductive and recruitment processes of exploited marine fish stocks*" are scheduled for publication in the *Journal of Northwest Atlantic Fishery Science* in 2009.

Since the last Annual Meeting in Yokohama, PICES has had a very busy year. A total of 14 meetings were co-sponsored by PICES and convened around the world. Not only was it a busy year, but also an unusual one because PICES was involved in co-sponsoring 3 major inter-sessional meetings.

In May 2007, PICES and ICES worked with the U.S. National Sea Grant College Program and MIT Sea Grant College Program to organize the 5th International Conference on "*Marine bioinvasions*" in Cambridge, U.S.A. Immediately following this conference, the first ever meeting between PICES WG on *Non-indigenous Aquatic Species* and ICES Working Group on *Introductions and Transfers of Marine Organisms* and ICES/IOC/IMO WG on *Ballast and Other Ship Vectors* was held.

Later in the same month, the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*", co-sponsored by PICES, ICES and GLOBEC, was convened in Hiroshima, Japan, after long and meticulous planning. This was the first time this symposium had been held outside of Europe, and its location allowed for greater participation by Pacific Rim countries. Three hundred and thirty-four participants from 46 countries attended this symposium, and presented 141 papers and 250 posters. The scale of this meeting was as big as PICES Annual Meetings, and the four conveners of this symposium deserve congratulations for its resounding success.

In June 2007, an ICES/PICES Conference for Early Career Scientists on "*New frontiers in marine science*" was held near Baltimore, U.S.A. This conference was different from any of our past conferences. The idea for this meeting was conceived four years ago in preparation for the next generation of PICES scientists. It was unique in the sense that it was designed to encourage early career scientists to share knowledge and to help build networks across disciplines and international borders that will undoubtedly last for decades. Nearly 100 early career scientists from 20 nations attended this conference which featured six theme sessions, each with a keynote speaker, for a total of 65 oral and 33 poster presentations. The conference was a resounding success, accomplishing its goals and more. Let us congratulate the success of this conference and express our thanks for organizing this event to the Scientific Steering Committee members, Franz Mueter, Sukyung Kang, Julie Keister, Elizabeth North, Angel Lopez-Urrutia, Jens Floeter, and to the Coordinators of this conference, Skip McKinnell from PICES and Adi Kellermann from ICES.

PICES was also active in co-sponsoring a number of workshops. In June 2007, the Second Annual Meeting of the GLOBEC regional program on Ecosystem Studies of Sub-Arctic Seas (ESSAS) was held in Hakodate, Japan. At this meeting PICES co-sponsored two workshops, on the "*Evaluation of climate scenarios for sub-arctic regions*" and on "*The role of seasonal sea ice cover in marine ecosystems*".

As a capacity building activity, PICES co-sponsored a 3-day training workshop, held in April 2007, in La Paz, Mexico, on "*Techniques for building multi-trophic level marine ecosystem models with special emphasis on NEMURO and NEMURO.FISH*", for Ph.D.-level Mexican scientists.

A workshop on "*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes*" was convened by the PICES Climate Forcing and Marine Ecosystem Response Task Team (CFAME), in May 2007, in Seattle on the U.S. west coast. The goal of this workshop was to finalize the working hypotheses of mechanisms linking climate to key species and ecosystem processes in three major marine ecosystems in PICES regions. A PICES/NPRB workshop on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*" was held at the same location in July 2007.

PICES and ICES have very close ties in many activities. At the 2007 ICES Annual Science Conference held last month in Helsinki, three joint Theme Sessions were convened: on

"*Integrating observations and models to improve predictions of ecosystem response to physical variability*", on "*Comparative marine ecosystem structure and function: Descriptors and characteristics*" and on "*The ecosystem approach: What's the impact on marine science, science based advice and management of marine ecosystems?*". During our Annual Meeting here in Victoria, two joint Topic Sessions will be held, on "*Fisheries interactions and local ecology*" and on "*Operational forecasts of oceans and ecosystems*".

Several international symposia of interest to PICES are awaiting your participation. In December of this year the First CLIOTOP Symposium on "*Climate impacts on oceanic top predators*" co-sponsored by PICES and other organizations will be held in La Paz, Mexico. In May 2008, an International Symposium on "*Effects of climate change on the world's oceans*" will be held in Spain, co-sponsored by ICES, PICES and IOC, with support from other organizations. This meeting will be followed by an International Symposium on "*Coping with global change in marine social–ecological systems*" held in Rome in July 2008. In August 2008, an International Symposium on "*Herring: Linking biology, ecology and status of populations in the context of changing environments*" will be held in Galway, Ireland, co-sponsored by ICES, PICES and GLOBEC.

Since the last Annual Meeting, there has been major progress in the development of the next PICES integrative Science Program "FUTURE" which stands for "Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems". At a workshop held in Yokohama last April, consensus was reached on a set of key questions to guide the overall outline for the Science Plan, and a draft of the Science Plan has been placed on the PICES website for your comments. Committee meetings on Wednesday, October 31, will be an opportunity to express your views on the Plan. Through an Open Forum on FUTURE on Thursday afternoon, November 1, followed by the workshop of the Study Group on *Future Integrative Science Program* on November 3, the Science Plan will be refined for review by external experts this winter. We expect that the final Science Plan will be adopted in time for an Implementation Plan workshop to be held in the spring of 2008.

The overarching question which will guide FUTURE activities for the next decade is, "*Given current and expected pressures, what is the future of the North Pacific?*" There are three themes to be addressed:

1. How does ecosystem structure and function determine an ecosystem's response to natural and anthropogenic forcing?
2. How do physical and chemical processes respond to natural and anthropogenic forcing and how are ecosystems likely to respond to these changes in abiotic processes?
3. How do human activities impact coastal marine ecosystems and their interactions with offshore and terrestrial systems?

FUTURE will be launched at PICES XVII which will be held next year in Dalian, China, under the theme of "*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE*".

At this meeting there will a noteworthy event. Governing Council and Science Board agreed to establish a new award, called the PICES Ocean Monitoring Service Award. This award is to recognize organizations, groups and outstanding individuals that have contributed significantly to the advancement of marine science in the North Pacific through long-term monitoring and/or data management in the North Pacific. Nominations for this award may be made by individuals or groups from PICES member countries. A description of this award will soon be made available on the PICES website.

Now I would like to close the 2007 report with my personal note. What is PICES? When I first attended a PICES Annual Meeting about 10 years ago, I did not know what PICES stood for. I thought it should be NPMSO (North Pacific Marine Science Organization). After serving three years as the Science Board Chairman, I have learned that **P** means *Partnership*, **I** is for

Interdisciplinary, **C** means *Collaboration*, **E** is for *Exploration*, and **S** is, of course, for *Science*. At the same time **S** in PICES means, I believe, *Service*. PICES should serve the people around the North Pacific Ocean and PICES should also serve the North Pacific itself for the generations to come. Thank you.

OP Endnote 11

"The North Pacific, human activity, and climate change"

Abstract of the keynote lecture by Dr. Kenneth Denman

(Department of Fisheries and Oceans, Canadian Centre for Climate Modelling and Analysis)

Humans are profoundly altering the oceans – by changing the climate through the burning of fossil fuels, by overfishing, and by physical and chemical alteration of the coastal zone. Human-induced warming of the oceans can be detected to depths of thousands of meters. The rate of sea level rise, due to the warming expansion of seawater and freshwater input from glacial and snow melt, has accelerated over the last two decades. Nearly half the CO_2 that has been emitted into the atmosphere through human activities, primarily fossil fuel and biomass burning, now resides in the oceans. This "anthropogenic" CO_2 can be detected to the bottom of the ocean, and has already made it more acidic, further reducing the ocean's ability to accept more CO_2 from the atmosphere. In Canada, in 2006 we marked 50 years of sampling along Line P and at Ocean Station Papa, and this year marks 100 years of sampling fisheries ecosystems by the Pacific Biological Station. From these and sustained sampling programmes by other PICES member nations, we have determined that the subarctic North Pacific represents the state of future global oceans. It is more stratified. Subsurface dissolved oxygen is decreasing. And the depth below which calcareous organisms are subjected to dissolution is already only a few hundred metres in some areas. By 2100, this increasing acidity in the North Pacific risks the dissolution and disappearance of calcareous organisms such as coccolithophorids, pteropods and the cold water corals found in some British Columbia fjords. More frequent harmful algal blooms seem to occur in some coastal regions, and 'dead zones' with anoxic conditions that kill large numbers of benthic invertebrates may be more frequent in others. To what extent are these findings caused by human activities and climate change? From coupled carbon–climate models we can forecast future CO_2-related changes in the North Pacific seawater for different scenarios of human development, but we cannot yet predict how the community structure of marine planktonic foodwebs will change, and what the possible feedbacks will be, both to ocean biogeochemical cycles and to higher trophic levels including living marine resources. We need to develop such 'end-to-end' foodweb and biogeochemistry models and embed them in comprehensive climate models. This modelling requires sustained sampling and focused scientific studies in both the coastal and open ocean. PICES collaboration is essential to address this challenge.

REPORT OF GOVERNING COUNCIL

The Governing Council met from 9:00–18:30 hours on November 4, 2007 and from 9:00–14:30 hours on November 5, under the chairmanship of Dr. Tokio Wada. All Contracting Parties were represented at the meeting (*GC Endnote 1*). At the first session, the Chairman welcomed attendees, introduced the agenda and suggested the order in which to take up the various items. The agenda was adopted as presented (*GC Endnote 2*). This report summarizes the treatment of each agenda item during the course of the two sessions.

Report on Administration (Agenda Item 3)

The Executive Secretary summarized the activities of the Organization since PICES XV. Council reviewed and adopted the report (*GC Endnote 3*).

During the discussion, Japan brought up the issue of the name for the body of water surrounded by the Japanese Archipelago, coastal region of Russia, and the Korean Peninsula, which is currently in dispute between the countries concerned. Japan's position is that the only name "Sea of Japan" or "Japan Sea" should be used in the international arena, as this name is historically and geographically established (*GC Endnote 4*). Korea responded that their position is that the names "East Sea" and "Japan Sea (Sea of Japan)" should be used simultaneously, until a final resolution is agreed upon between the relevant countries (*GC Endnote 4*). The Chairman thanked both delegates for expressing their views and pointed out that PICES understands the different positions of both countries, but the Organization is in no position to make any judgment on this issue.

Report of 2007 Governing Council inter-sessional meeting (Agenda Item 4)

The practice of holding inter-sessional meetings of Science Board and Governing Council is only 5 years old, but it has already become an integral part of PICES management providing an essential opportunity for mid-term reviews of scientific activities and in-depth discussions on administrative issues of the Organization.

At the invitation of the Japanese National Delegate, Dr. Hideki Nakano, three consecutive events were held in April 2007, in Yokohama, Japan, with co-sponsorship from the Fisheries Research Agency. The fifth inter-sessional Science Board/Governing Council meeting was convened on April 19, preceded on April 16–18 by a workshop to develop a Science Plan for a new integrative scientific program of PICES, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems), and followed by a Governing Council meeting in the morning of April 20. The report of the 2007 inter-sessional Science Board can be found elsewhere in this Annual Report. A summary report of the inter-sessional Council meeting is appended as *GC Endnote 5*. An article entitled "*The 2007 inter-sessional Science Board and Governing Council meeting: A note from the Chairman*", that briefly summarizes the results from both meetings, was published by Dr. Wada and is in the latest issue of PICES Press (Vol. 15, No. 2).

Membership and observers from other countries (Agenda Item 5)

The Secretariat did not receive proposals from any country to accede to the PICES Convention.

The Chairman pointed out that expansion of involvement with PICES among Pacific Rim countries has been the subject of discussion in Council. Earlier, Council expressed a strong interest in encouraging Mexico to accede to the PICES Convention (an initial resolution was adopted at PICES VIII, Decision 99/A/5), and spent significant efforts in doing so. In 2005, Council also requested Dr. Vera Alexander,

former PICES Chairman, to make inquiries to four Pacific Rim countries that are currently affiliated members of ICES (Australia, Chile, New Zealand and Peru), to determine their interest in having a greater role in activities of PICES, or even joining membership if the Organization was at some point to expand its geographic scope (Decision 05/A/6). Details can be found in the 1999–2006 PICES Annual Reports.

Responses indicating an interest in taking up the dialogue were received from 3 leading scientific institutions: CSIRO Marine and Atmospheric Research (CSIRO, Australia), National Institute of Water and Atmospheric Research (NIWA, New Zealand) and Instituto del Mar del Perú (IMARPE, Peru). Observers from the two institutions, Drs. John Gunn (Deputy Chief, CSIRO) and Julie Hall (Biological Oceanography Program Leader, NIWA), attended PICES XV (October 2006, Yokohama, Japan) and gave presentations on the structure and activities of their organizations and potential areas for their cooperation with PICES at the first session of Council on October 17, 2006. IMARPE was unable to send an observer to this meeting, but an invitation was extended to PICES to visit IMARPE to inform scientists and authorities about activities of the Organization, and to discuss how PICES and IMARPE can work together in the future. This invitation was accepted by Council.

The Executive Secretary reported on contacts and activities that took place after PICES XV.

Mexico

Ways are being explored to use the Mexican Fisheries Society as a base to greater cooperation and interaction between marine scientists in Mexico and PICES. Dr. Salvador E. Lluch-Cota, President of the Mexican Fisheries Society and Mexican Chapter of the American Fisheries Society, became the main contact in this regard. After adopting its formal constitution in 2006, these two organizations held their first biannual meeting from May 2–4, 2007, in La Paz. The meeting provided an opportunity for PICES to inform Mexican scientists on the latest developments within the Organization and to better understand their main interests. In a plenary talk given at the Opening Session, Dr. John E. Stein (PICES Science Board Chairman-elect) described the structure and general activities of the Organization, and highlighted the development of a new PICES integrative scientific program, FUTURE. In addition, a display of PICES publications was organized during this meeting. After the meeting all publications were donated to the library of CIBNOR (Centro de Investigacienes Biológicas del Noroeste). PICES also co-sponsored a 3-day training workshop on "*Techniques for building multi-trophic level marine ecosystem models, with special emphasis on NEMURO and NEMURO.FISH*" for Ph.D.-level Mexican scientists, held in conjunction with the meeting. The next biannual meeting of the Mexican Fisheries Society will take place in Ensenada in 2009, where strong participation of PICES scientists is anticipated. Five Mexican scientists attended PICES XVI.

Australia

An invitation was extended to CSIRO to be present as an observer to PICES XVI. Responses from Dr. David Smith (Acting Deputy Chief) and Dr. John Keesing (Senior Principal Research Scientist) indicated that CSIRO was unable to send a formal representative this time, but they are very keen to participate in the next PICES Annual Meeting to be held in October 2008, in Dalian, China. Three CSIRO scientists (experts on ecosystem-based management) attended PICES XVI.

New Zealand

An invitation was extended to NIWA to be present as an observer at PICES XVI. Dr. Julie Hall served again as their representative. Two more scientists from New Zealand (1 from NIWA and 1 from University of Otago) attended the meeting.

Peru

Dr. R. Ian Perry, PICES member of the Scientific Steering Committee for the conference

on "*The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries*" hosted by IMARPE in Lima, in November 2006, met with Rear-Admiral Hector Soldi-Soldi (Chairman of the Board of IMARPE) and Dr. Renato Guevara-Carrasco (Scientific Director of IMARPE) to discuss potential areas and means for collaboration. It was noted in this discussion that IMARPE is not an academic institution, but focuses on providing advice to the government. Obvious topics of cross-interest with PICES include ecosystem-based approaches. Of particular interest to IMARPE is building scientific capacity and graduate training. An invitation was extended to IMARPE to be present as an observer at PICES XVI.

The Executive Secretary had a meeting with Rear-Admiral Soldi-Soldi and Dr. Guevara-Carrasco during the 2nd Global Conference on *Large Marine Ecosystems* (September 2007, Qingdao, China) to discuss the structure, procedures and activities of PICES and the latest developments within the Organization. At this meeting, Rear-Admiral Soldi-Soldi pointed out that the Board of IMARPE had expressed strong interest in working jointly with PICES on common research issues and sending an observer to PICES XVI. Dr. Francisco Chavez, member of the Board of IMARPE, attended the meeting as their representative and gave a presentation on the structure and activities of IMARPE and potential areas for cooperation with PICES at the first session of Council on November 4.

All observers and contact points requested to be informed on actions decided by PICES on an affiliated member status (see Agenda Item 6).

Report of the Study Group on *Scientific Cooperation between PICES and Non-member Countries* (Agenda Item 6)

At PICES XV, a Study Group on *Scientific Cooperation between PICES and Non-member Countries* (SG-SC) was established, under the direction of Council, to explore options on how scientific cooperation with other (non-member) countries could be best achieved (Decision 06/A/6). A draft SG-SC report was presented by its Chairman, Dr. Laura Richards, at the 2007 inter-sessional Science Board/Governing Council meeting, and a final report was given at the first session of Council. The report was adopted by Council (Decision 07/A/4), and is included elsewhere in this Annual Report.

The Study Group was unanimously negative to the idea of amending the PICES Convention to expand the "area concerned". However, recognizing the scientific necessity and advantages of cooperating with non-member countries, SG-SC suggested that an affiliate member status be established by PICES, similar to the arrangement implemented some time ago by ICES. Following a request by Council at the 2007 inter-sessional meeting, a draft *Affiliate Member Policy* was developed and presented by Dr. Richards (*GC Endnote 6*). It was noted that if this document is approved, the *PICES Financial Regulations* would need to be amended to reflect financial obligations imposed with the granting of an affiliate status. The *PICES Rules of Procedure* would also need to be amended to allow scientists from affiliate organizations/institutes to participate as members of the Scientific and Technical Committees, Scientific Program and all temporary expert groups in addition to the existing provision for Advisory Panels. The specific privileges of participation would need to be resolved for each type of group, depending on the needs of the Organization. For Study Groups, the *Rules of Procedure* would also need to be amended to allow for Co-Chairman positions.

The proposed *Affiliate Member Policy* was reviewed, and major concerns expressed by Contracting Parties were: (1) policy and procedure for selecting an affiliate member, and (2) influence of the affiliate status system on the current practices of PICES. Council was unable to reach consensus on adoption of the document and agreed to further discuss this issue at next year's Annual Meeting. Each Contracting Party was requested to send their comments on the draft policy to the Executive Secretary. If possible, the recommended changes will be embedded in the document, and the new draft will be circulated to Council prior to PICES XVII.

Relations with relevant organizations and programs (Agenda Item 7)

Letters of invitation to attend PICES XVI were sent to organizations and programs on the agreed 2006–2007 *Standing List of International and Regional Organizations and Programs*, and the following sent their observers:

Asia-Pacific Economic Cooperation' WG on *Fisheries* (APEC-FWG)	Mr. Robert Day
Argo International Program	Dr. Howard J. Freeland
Bering Ecosystem Study (BEST)	Dr. George L. Hunt, Jr.
Climate Variability and Predictability Program (CLIVAR)	Dr. William R. Crawford
Ecosystem Study of Sub-Arctic Seas (ESSAS)	Dr. Kenneth Drinkwater
Global Carbon Project (GCP)	Dr. Christopher L. Sabine
Global Ocean Ecosystem Dynamics (GLOBEC)	Dr. Francisco E. Werner
Global Ocean Observing System (GOOS)	Dr. Henrik Enevoldsen
Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)	Dr. Julie Hall
Inter-American Tropical Tuna Commission (IATTC)	Dr. Richard Deriso
Intergovernmental Oceanographic Commission (IOC)	Dr. Henrik Enevoldsen
International Arctic Science Committee (IASC)	Dr. Martin Bergmann
International Association of Marine Science Libraries (IAMSLIC)	Mr. Brian Voss
	Ms. Janet Webster
International Council for the Exploration of the Sea (ICES)	Dr. Gerd Hubold
	Dr. Adolf Kellermann
International Ocean Carbon Coordinated Project (IOCCP)	Dr. Maria Hood
International Pacific Halibut Commission (IPHC)	Dr. Steven Hare
	Dr. Bruce Leaman
International Whaling Commission (IWC)	Dr. Hidehiro Kato
North Pacific Anadromous Fish Commission (NPAFC)	Dr. James Irvine
	Dr. Shigehiko Urawa
North Pacific Research Board (NPRB)	Dr. Clarence Pautzke
	Dr. Francis Wiese
	Ms. Carrie Eischens
Northwest Association of Networked Ocean Observing Systems (NANOOS)	Dr. Jack Barth
Pacific Coast Observing System (PaCOOS)	Dr. Usha Varanasi
Scientific Committee on Oceanic Research (SCOR)	Dr. Bjørn Sundby
Surface Ocean Low Atmosphere Study (SOLAS)	Dr. Shigenobu Takeda
IOC Sub-Commission for the Western Pacific (WESTPAC)	Mr. Wenxi Zhu
World Climate Research Programme (WCRP)	Dr. William R. Crawford
Western Pacific Fishery Management Council (WPFMC)	Ms. Marcia Hamilton

The Executive Secretary provided a report on communication with the relevant international and national organizations and programs since last year's Annual Meeting (see *GC Endnote* 3 for details). He also pointed out that this year:

- Drs. Francisco Werner (Chairman of GLOBEC SSC), Adolf Kellermann (Head of ICES Science Programme) and Bjørn Sundby (President of SCOR) were invited to attend the Science Board meeting (October 28) to discuss cooperation between their respective programs/organizations and PICES.
- Representatives of several others programs and organizations (APEC-FWG, Argo, BEST, CLIVAR, ESSAS, IMBER, IOC, IASC, IOCCP, IPHC, IWC, NANOOS, NPAFC, NPRB, PaCOOS and SOLAS) participated in the meetings of PICES Standing Committees or their subsidiary bodies and expressed their views on potential areas of collaboration with PICES.
- Some programs and organizations (Argo, BEST, ESSAS, IMBER, IPHC, NANOOS, NPAFC, NPRB, PaCOOS, SOLAS, WESTPAC and WPFMC) had posters on

display outlining general information about these programs and organizations and highlighting their scientific objectives and recent activities.

- Representatives of IAMSLIC gave a brief presentation at the F&A Committee meeting (October 31) on findings and recommendations from the review of the PICES Publication Program, with a focus on the option of a transition to electronic publishing.

At the first session of Council on November 4, time was reserved for Dr. Gerd Hubold (General Secretary of ICES) to address Council on the most recent developments concerning the ICES reforms and potential areas of collaboration between ICES and PICES. Among other issues, he strongly supported the idea of a joint ICES-PICES Annual Meeting, with shared science activities and separate business meetings (see also Agenda Item 11). His presentation was well received and raised many questions on similarities and differences in operations of the two Organizations. The Chairman thanked Dr. Hubold for attending and communicating his thoughts, and assured him that PICES will continue expanding its relationships with ICES, and that all proposals will be carefully considered by relevant Committees and Science Board.

At PICES XIV, Council pointed out the importance of establishing relations with the Asia Pacific Economic Cooperation (APEC), and suggested that potential areas of cooperation with APEC Working Groups on *Fisheries* (APEC-FWG) and *Marine Resources Conservation* (APEC-MRC) be developed. This year, APEC-FWC accepted an invitation and sent an observer to PICES XVI, who addressed the Fishery Science Committee.

Council reviewed the progress made in the integration and coordination of PICES activities with other international and national scientific organizations/programs of regional and global scale, and approved the revised *Standing List* (Decision 07/S/9) and agreed with identified priorities for interaction in 2007–2008, as recommended by Science Board.

Next integrative scientific program of PICES (Agenda Item 8)

Dr. John Stein (Science Board Chairman-elect) reported on the progress made in the development of a new PICES integrative scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems).

In November 2006, a work plan with associated timelines was prepared, taking into consideration the U.S. comments on the planning of FUTURE submitted in writing after PICES XV (*GC Endnote 5* in 2007 PICES Annual Report). According to the work plan, approved by Council in December 2006, the following steps in moving forward were made:

- A Writing Team (SP-WT) was established in January 2007, through Council approval process, with the responsibility of drafting the Science Plan for FUTURE. This Team includes 14 scientists representing all Contracting Parties.
- SP-WT held its first 2-day meeting on February 16–17, 2007, in Seattle (U.S.A.), to discuss the basic structure and key questions of the Science Plan. The meeting was attended by 11 of 14 members and several invitees.
- A 3-day workshop was held April 16–18, 2007, in Yokohama, Japan, in conjunction with the inter-sessional Science Board meeting, to: (1) review the goals, objectives, organization and key elements of the Science Plan for FUTURE; (2) define and prioritize the key questions to be answered; and (3) determine strategic approaches to answering the questions. At the workshop, consensus was reached on a set of key questions, an overall outline for the Science Plan was developed, and the next steps to complete a full draft of the Science Plan were identified. Participation by Science Board and Council members contributed greatly to the success of the workshop.
- A subset of SP-WT (those who were not on cruises or otherwise engaged) met from June 19–20, 2007, again in Seattle, to begin

developing a full draft of the Science Plan. The June version of the Science Plan was sent to all SP-WT members and then was revised according to their comments.
- The draft Science Plan was circulated to Council, Science Board, F&A Committee, SG-FISP and SP-WT on September 20 and was made available on the PICES website on October 1, for review and comments. All Committee Chairmen were requested to circulate the draft Science Plan to members of their Committees and relevant subsidiary groups to ensure comments and productive discussion at their Committee meetings during PICES XVI.
- Two special events to review the draft Science Plan for FUTURE were held at PICES XVI: an Open Forum on November 1 and a FISP workshop on November 3.

The Science Plan for FUTURE, revised based on comments received at these two gatherings, was approved in principle by Council (Decision 07/S/1), subject to minor modifications to be completed by the end of 2007. The final version is included as *GC Appendix C* and also posted on the PICES website.

Council endorsed both activities proposed by Science Board for 2008:
- A 2-day workshop to develop an Implementation Plan for FUTURE to be held in April 2008, in conjunction with an inter-sessional Science Board meeting; and
- A 1-day Science Board Symposium on "*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE*", with most oral presentations invited, to be convened at PICES XVII.

At the recommendation of the F&A Committee, Council approved that $40,000 from the encumbered funds designated for high-priority projects be earmarked for FUTURE (Decision 07/A/3(v)).

Capacity building activities (Agenda Item 9)

PICES' strategy for capacity building was approved in 2003, and is available on the PICES website at http://www.pices.int/about/capacity_strategy.pdf. At the 2005 inter-sessional Science Board/Governing Council meeting (April 2006, Seattle, U.S.A.), the following capacity building initiatives were identified as the most important:
- 2007 ICES/PICES Early Career Scientists Conference;
- PICES summer schools on marine sciences;
- travel support for early carrer scientists to attend PICES Annual Meetings;
- workshops on ecological modeling;
- international student exchange;
- PICES Intern Program.

<u>2007 ICES/PICES Conference for Early Career Scientists (ECS)</u>

The ICES/PICES "*New frontiers in marine science*" conference for early career scientists (ECS) was held from June 26–29, 2007, near Baltimore, Maryland, U.S.A. The objective of the conference was to encourage new scientists to share knowledge and to begin to build networks across disciplines and international borders. The conference featured six theme sessions, and a total of 65 talks and 33 posters were presented by nearly 100 scientists from 20 nations. A brief summary of the conference was published in PICES Press (July 2007, Vol. 15, No. 2, 2007). A detailed report is included elsewhere in this Annual Report. Council concluded that the conference was a resounding success and that the most immediate and long-lasting benefit for most participants was the development of personal and institutional contacts that will persist for decades.

ICES provided US $90,000 for the conference to cover the venue and local arrangements. PICES' direct expenses were about $74,000 to cover the contract for local organization of the conference, publication of the announcement, and travel costs for invited speakers and selected scientists. In addition, PICES' in-kind contribution included: development of the conference website, compilation of the Book of Abstracts, and financial arrangements. Due to successful fund-raising (US $15,000 from the North Pacific Research Board, US $30,000 from the U.S. National Marine Fisheries Service, and US $2,000 from the Korea Ocean Research &

Development Institute), only slightly above $25,000 was used from the $45,000 earmarked in PICES budget (from the encumbered funds designated for high-priority projects) for the conference.

PICES schools on marine sciences

The first PICES Summer School on "*Ocean circulation and ecosystem modeling*" (co-sponsored by the Seoul National University, the Korea Ocean Research & Development Institute, the Korean Ministry of Maritime Affairs and Fisheries, the National Fisheries Research and Development Institute, and the Brain Korea 21 (BK 21) Program of the Korean Ministry of Education and Human Resources) was held August 23–25, 2006, in Busan, Korea, in conjunction with the CREAMS/PICES workshop on "*Model-data inter-comparison for the Japan/East Sea*". Thirty-seven students from 8 countries (including all six PICES member countries) attended the summer school: 1 from Canada, 1 from Chile, 2 from China, 2 from Indonesia, 10 from Japan, 13 from Korea, 4 from Russia, and 4 from U.S.A. The summary report of the school was published in PICES Press (January 2007, Vol. 15, No. 1).

Council supported a proposal submitted through the BIO Committee (*BIO Endnote 7*) to organize the second PICES Summer School on "*Biomass-based management and ecosystem approach*" to be held from August 23–26, 2008 (tentative dates), at Hokkaido University, in Hakodate, Japan. Potential co-sponsors include: the Japanese Society for the Promotion of Science, the Hokkaido University Sustainable Government Project and the Asia Pacific Network.

The third PICES Summer School on "*Recent methods of investigating red-tide organisms and controlling red tides*" has being planned for August 2009, in Busan, Korea. It is now possible that its theme will change to "*Satellite oceanography*" to be in line with a launch of a Korean satellite in 2009. The first PICES Winter School on "*Field survey of sea ice area*" was originally proposed for late February or early March 2008, in Vladivostok, Russia, but it will be postponed for 1 year to resolve funding and logistical problems.

Travel support for early career scientists

In 2007, about $33,000 from the Trust Fund were spent to support participation of early career scientists from all PICES member countries in PICES XVI, the 4th Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" (May 2007, Hiroshima, Japan) and the SOLAS Open Science Meeting (March 2007, Xiamen, China). Applications received for this support and their dispositions were reported at the F&A Committee meeting. The amount above includes about $10,000 provided by SCOR, GLOBEC and the U.S. National Science Foundation (NSF) for PICES XVI. Council expressed their thanks to these organizations for their continuing support.

Workshops on ecological modeling

It was recommended that PICES partner with other organizations/programs to broaden applications of the NEMURO and NEMURO.FISH models developed by the MODEL Task Team. In 2007, the main endeavor in this direction was a 3-day training workshop on "*Techniques for building multi-trophic level marine ecosystem models, with special emphasis on NEMURO and NEMURO.FISH*" for Ph.D.-level Mexican scientists. The workshop was held April 26–28, 2007, in La Paz, Mexico, and was co-sponsored by the International Fisheries Section of the American Fisheries Society, the Mexican Chapter of the Western Division of the American Fisheries Society, and the U.S. National Marine Fisheries Service. Council commended these organizations and also Drs. Bernard A. Megrey (U.S.A.) and Salvador Lluch-Cota (Mexico), who coordinated the project, for their efforts.

International student exchanges

Even though there is a provision (clause iv(c)) in the *PICES Trust Fund Guidelines* that allows using the resources in the Fund to support visits

by scientists to laboratories for collaboration or training related to scientific projects sponsored by the Organization, the Secretariat did not receive any requests for support. Dr. George Boehlert re-iterated his earlier proposal that for international student exchange, PICES should explore the possibility of matching funds with the U.S. Office of International Science and Engineering at NSF. So far, no action has been taken in this direction.

PICES Intern Program

The PICES Intern Program was approved in 1999 (Decision 99/A/7) and commenced in 2000. The Intern Program assists in the professional development of marine scientists and managers from PICES Contracting Parties, and increases the capacity of the PICES Secretariat to support the work of the Organization. From May 2000–October 2007, 8 scientists from three countries (3 from China, 3 from Korea and 2 from Russia) have worked as interns at the PICES Secretariat. The description of the Intern Program and the guidelines for application and selection of interns are posted on the PICES website (http://www.pices.int/projects/intern.aspx).

Mr. Xuewu Guo (Yellow Sea Fisheries Research Institute, Chinese Academy of Fisheries Sciences) is the 2007 PICES intern. His term started on February 1, 2007. The Executive Secretary reported that because of the excellent performance of Mr. Guo and additional funding received for the Intern Program, his originally-offered 8-month term was extended to 12 months. Council endorsed this decision.

In July 2007, Mr. Key-Seok Choe (Project Management Team, Planning Department, KORDI) was nominated and consequently approved as the 2008 PICES intern. His term is expected to start on February 1, 2008. At the meeting of the F&A Committee, Korea announced a voluntary contribution of US $10,000 to the Trust Fund in 2008. This will allow the originally-offered 8 months to be extended to 12 months, assuming good performance by the intern.

Given that Mr. Choe's term will continue until January 31, 2009, Council extended the deadline of nominations for the 2009 PICES internship until the Governing Council meeting at PICES XVII (Decision 07/A/6(ii)).

The Intern Program has been financed solely by voluntary contributions. The Executive Secretary reported that in 2007, the U.S. National Marine Fisheries Service (NMFS) and Fisheries and Oceans Canada (DFO) contributed $14,500 and $10,000, respectively, to the Trust Fund for the Program. It was indicated that NMFS and DFO have been the most generous partners for this activity to date, providing for the period from 2000–2007 approximately $135,000 and $71,500, respectively, for the Program. Council thanked both organizations and KORDI for their support of the Intern Program, and instructed the Executive Secretary to invite all Contracting Parties to make voluntary contributions to maintain the Program in 2008 and beyond (Decision 07/A/6(i)).

Council confirmed that the stipend should be kept at the current level of $2,000 per month. The nominating Contracting Party could consider supplementing this modest stipend, depending on the intern's personal circumstances (Decision 07/A/6(iii)).

Improvement of participation in PICES activities (Agenda Item 10)

The discussion focused again on two following unresolved issues:

- *Inter-agency coordination*: Within Contracting Parties, different agencies have the principal responsibility for interaction with PICES. The lead agencies often do not represent the interest of other agencies or coordinate PICES interactions with them. In fact, few countries have an effective inter-agency coordination mechanism. The problem of inter-agency cooperation and coordination is one that must be faced at the national level, and PICES can only urge that it be recognized and solved at that level (Decision 96/S/6). The formation of a national committee to enhance and coordinate involvement of scientists in

PICES activities, as recommended by the PICES Review Committee, might be the appropriate solution.

- *Appointed scientists*: The main activities of permanent Committees and temporary expert groups take place at meetings, especially during PICES Annual Meetings. While it is obviously important for appointed scientists to attend such meetings, and *Rule 1(iii)* of the PICES Rules of Procedure explicitly states that "*each Contracting Party shall bear the expenses of its own Delegation to all meetings authorized by the Council, held pursuant to this Convention*", Contracting Parties often fail to support the attendance of their appointed members at Annual Meetings. The work of Committees and expert groups is thereby seriously impaired. The funding problem is not disconnected from the inter-agency problem. It is easier to support appointed members, if the costs of participation can be shared among interested agencies.

The Executive Secretary reported on the implementation of Council's decisions to target improving the participation of scientists from Contracting Parties in the activities of the Standing Committees and their subsidiary bodies and presented background graphic material for the last 6 years (2002–2007) to better assess problems existing in various countries. Council requested that this information be circulated to Contracting Parties and updated prior to PICES XVII.

National membership lists

The Secretariat is updating membership lists on the PICES website as frequently as new information is provided by National Delegates (http://www.pices.int/members/default.aspx). Following Decisions 03/S/7(ii) and 04/S/7(ii), national membership lists have also been included as Appendices in the Annual Reports since 2003. This practice will continue to maintain a historical record of PICES membership, and to assist in improving participation in the activities of the Organization.

National membership review

National Delegates were requested to regularly review their national membership and make changes as appropriate (Decisions 03/S/7(ii) and 04/S/7(ii)). Nevertheless, all Contracting Parties have Committee or expert group members who never, or rarely, attend PICES Annual Meetings. The problem is most serious with the People's Republic of China.

Review of temporary expert groups

At the request of Council (Decision 04/S/7(i)), Science Board performed a review of the temporary expert groups (Working Groups, Study Groups, Task Teams, Advisory Panels) established since the inception of the Organization. This evaluation was undertaken to get an idea of whether or not the current approach of the formation and financing of these groups is working. An assessment report prepared by Dr. Michael G. Foreman (POC Chairman) is included in this Annual Report.

PICES Handbook and Guidelines for Chairmen and Convenors

Council requested that relevant information be provided to National Delegates by the Secretariat to be used when selecting members for PICES Committees and temporary expert groups, and clarifying their responsibilities at the time of their appointment (Decision 03/S/7(iii)). The second edition of the PICES Handbook published and circulated in 2006 serves the purpose. This publication includes all basic documents regulating the functioning of the Organization, such as the PICES Convention, the Headquarters Agreement between PICES and the Government of Canada, the revised PICES Rules of Procedure, Financial Regulations and Trust Fund Guidelines, the PICES Strategic Plan, and the historical list of PICES officers. These documents can be also found at http://www.pices.int/about/default.aspx. National Delegates are encouraged to use the materials from the PICES Handbook as a guide when appointing members to various PICES Committees and expert groups.

The F&A Committee recommended approval of the document tentatively titled "*Roles and responsibilities of Chairmen and members of PICES groups*", which is based on the revised *Guidelines for Chairmen and Convenors* (developed in 1999 and amended in 2001) and incorporates the most important elements of Dr. Foreman's analysis – a summary of the conditions that make for productive and successful temporary groups. This document cannot be finalized until after the FUTURE Implementation Plan is completed, but could provide useful guidance over the next 1–2 years. Its publication on the PICES website was recommended.

Schedule and financing of future Annual Meetings (Agenda Item 11)

At the 2006 inter-sessional meeting (April 2006, Honolulu, U.S.A.), Council approved the proposal of China to host the PICES Seventeenth Annual Meeting in 2008, in Dalian, with the National Marine Environmental Monitoring Center (NMEMC) of the State Oceanic Administration (SOA) as the local organizer (Decision 06/A/7(ii)). PICES XVII will be held from October 23–November 2, 2008, under the theme "*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE*". The description of the theme was developed by Science Board at PICES XVI and can be found in *SB Endnote 4*. Brief information on the status of preparations for the meeting was provided by the Chinese delegation and by the Executive Secretary, who visited Dalian in early September 2007. At the recommendation of the F&A Committee, Council agreed to provide $40,000 to China to partially cover costs for the meeting (Decision 07/A/5(i)).

At the 2007 inter-sessional meeting (April 2007, Yokohama, Japan), Council accepted an invitation from Korea to host the PICES Eighteenth Annual Meeting in 2009. Council approved holding the meeting from October 23–November 1, 2009, in Busan, with the National Fisheries Research and Development Institute (NFRDI) as the local organizer (Decision 07/A/5(ii)). The proposed theme of the meeting, "*Understanding ecosystem dynamics, pursuing ecosystem approaches to management*", was supported in principle, and the description of the theme will be finalized by Science Board at PICES XVII. Brief information on the status of preparations for the meeting was provided by the Korean delegation.

In keeping with the six-year rotation cycle (Decision 94/A/6), the United States of America was requested to consider the possibility of holding the PICES Nineteenth Annual Meeting in 2010. The U.S. delegation confirmed their willingness to host PICES XIX, and this invitation was accepted by Council (Decision 07/A/5(iii)). Interest was indicated in exploring the opportunity of a joint ICES-PICES Annual Meeting, with shared science activities and separate business meetings (Decision 07/A/5(iii)). This idea was strongly supported by Dr. Gerd Hubold (ICES General Secretary) who attended the meeting by the invitation of Council.

During the presentation of the Science Board report (Agenda Item 12), Dr. Stein pointed out that with the current structure of PICES Annual Meetings, Chairmen of Standing Committees do not have enough time to properly summarize proposals from their subsidiary bodies, and Science Board does not have enough time to review recommendations from the Committees and prepare a detailed report for Council. He suggested that some guidance is needed on what Council would like to see in the report, how it should be presented, and what are the criteria that Science Board should use to evaluate and rank proposals. It was agreed that an improved structure for communication from Science Board to Council should be developed. The PICES Chairman will work with the Science Board Chairman, the F&A Chairman and the Secretariat to prepare a proposal for discussion at the next Annual Meeting.

Council confirmed that the practice of charging a registration fee for future PICES Annual Meetings should continue, and accepted the same registration fee structure for 2008 as was maintained for 2004–2007 (Decision 07/A/5(iv)). It was noted that the proposal of introducing a

1-day registration fee and not charging a registration fee for invited observers was not supported by the F&A Committee. Fees will be collected by the Secretariat and credited to the Working Capital Fund to support high priority projects and the Intern Program, and to cover costs associated with Annual Meetings. The allocation among these three purposes should be flexible and decided by the Executive Secretary (Decision 04/A/5(iv)).

Council re-iterated its support for the concept of inter-sessional Science Board meetings with the participation of Council members, but stressed again that the need for such a meeting should be evaluated each year and that, given meeting costs (including time commitment of the members), an inter-sessional meeting should be held only if the agenda is substantive. Council thanked the Fisheries Research Agency of Japan for co-sponsoring the 2007 inter-sessional Science Board and Governing Council meetings.

Council approved an inter-sessional Science Board meeting to be held in conjunction with a workshop to develop an Implementation Plan for the new integrative scientific program of PICES, FUTURE, and accepted an offer from the United States to host both events in Seattle, in April 2008. Holding an inter-sessional Council meeting in 2008 was not supported (Decision 07/A/5(v)).

Report of Science Board (Agenda Item 12)

The Science Board met under the chairmanship of Dr. Kuh Kim. Dr. Kim and Stein attended the second session of Council on November 5 and presented the report to Council. Dr. Stein also summarized the outcome of the November FISP workshop, and recommendations on next steps in the development of FUTURE. The report was approved by Council, and is included elsewhere in this Annual Report. Some details are given in *GC Appendices A–D.*

In the presentation, a special emphasis was placed on the development of the next version of the North Pacific Ecosystem Status Report (NPESR). The final report of the Study Group on *Ecosystem Status Reporting* (SG-ESR) was presented to Science Board at PICES XVI and is included elsewhere in this Annual Report. Science Board unanimously endorsed proceeding with the "incremental" improvement" version (Option 2) which builds on the experiences of the pilot report published in 2004. The timeline for completion of the next report is anticipated to be 2 years after initiation, and the estimated budget is about $250,000. To facilitate better comparisons among regions and a more comprehensive synthesis, greater top-down control of the report was suggested. Dr. Skip McKinnell was endorsed by Science Board to lead the preparation and publication of the NPESR.

The Executive Secretary reminded that at the recommendation of the F&A Committee, Council approved that approximately $103,000 from the encumbered funds designated for high-priority PICES projects be earmarked for the preparation of NPESR (Decision 07/A/3(v)). With an unused part of the first allotment (~$22,900) of the NPRB grant received in 2005, the second allotment ($53,100) of this grant and a voluntary contribution of US$40,000 offered by Korea, both to be provided in 2008, the amount of accumulated funds (~$219,000) is sufficient to start the project. At the same time, he noted that Dr. McKinnell could take on the responsibility as the leader of the project only after some adjustment to his present duties within the PICES Secretariat.

After intensive discussion, Council approved in principle the "incremental" improvement" approach to the development of the next NPESR and agreed to discuss this issue again at PICES XVII when a more detail workplan for the project is prepared.

At the 2007 inter-sessional meeting, Council approved the establishment of the PICES Ocean Monitoring Service Award (POMA) to recognize organizations, groups or individuals that have contributed significantly to the advancement of marine science in the North Pacific through long-term monitoring and/or management of data associated with ocean conditions and marine bio-resources (Decision 07/A/9). Council endorsed the description of (POMA) developed by Science Board at PICES XVI (*GC*

Appendix D). The first award will be given at the 2008 PICES Annual Meeting in Dalian, China.

Report of F&A Committee (Agenda Item 13)

The Finance and Administration Committee (F&A) met under the chairmanship of Dr. Laura Richards, who presented the report to Council on November 4. The report was approved by Council, and is included elsewhere in this Annual Report. Details are given in *GC Appendix A* (Decisions 07/A/1–07/A/6).

13.1 Audited accounts for fiscal year 2006

At the recommendation of F&A, Council accepted the audited accounts of *FY* 2006 (*F&A Endnote 3*, Decision 07/A/1).

13.2 Annual contributions

Council reviewed the payment schedule of annual fees to the Organization (*F&A Endnote 4*), and noted that all Contracting Parties met their financial obligations for *FY* 2007. Even though only the Japanese contribution arrived prior to the due date (January 1, 2007), the timeliness of payment from other Contracting Parties is either stable or improved. By April 2007, annual contributions were received from five of six Contracting Parties. China's progress is notable, with the time of the payment moved from the fourth or late third quarter in 2000–2005 to early July in 2007.

Council instructed the Executive Secretary to send a letter to Contracting Parties commending them for their performance in submitting annual contributions for 2007, and describing the difficulties that late and partial payment causes the Organization (Decision 07/A/2(i)).

Council re-iterated that for the planning of their funding requests for annual contributions, Contracting Parties should continue to use the guideline generally accepted at PICES VIII (Decision 99/A/2(ii)), which states that "*the annual contributions will increase at the rate of inflation in Canada*" (Decision 07/A/2(ii)).

13.3 Fund-raising activities

As current funding constraints from an increase in annual contributions only at the rate of inflation in Canada can impede improvement and development of the Organization, fund-raising continues to be an important component of PICES activities. External funding and voluntary contributions received for the period since PICES XV for various activities of the Organization are reflected in *GC Endnote 3* and *F&A Endnote 5*. It was pointed out that the level of external funding for PICES activities has increased significantly over the last several years, and from 2004–2007, the amount of funds from voluntary contributions, grants and partnerships was about 30–50% of the total annual contribution by Contracting Parties. Most of the funding offers have specific product and service requirements and put additional burden on the Secretariat, the size and structure of which have remained unchanged since 1995. In order to help manage the extra workload and offset extra expenses of the Secretariat, an overhead is now being charged to some projects (where appropriate). The overhead funds can be used, if necessary, to hire contract help.

13.4 Budget

Estimated accounts for fiscal year 2007

The estimated accounts for *FY* 2007 were reviewed by the F&A Committee and approved by Council (Decision 07/A/3(i)).

Relocation and Home Leave Fund

The status of the Relocation and Home Leave Fund was reviewed. At the end of *FY* 2007, the RHLF is estimated at less than $2,000 below the currently required amount of $110,000. At the recommendation of F&A, Council approved that the level of the Relocation and Home Leave Fund be allowed to vary between $90,000 and $110,000 to minimize the need for small transfers between funds (Decision 07/A/3(iii)).

Trust Fund

In *FY* 2007, more than $60,000 from the Trust

Fund was used to finance the Intern Program, and to support participation of young scientists from all Contracting Parties and scientists from countries with "economies in transition" to scientific meetings organized and co-sponsored by PICES. These expenditures were only partly compensated for by interest earned by the Fund, the voluntary contributions for the Intern Program, and travel grants from SCOR. Council approved a transfer from the Working Capital Fund to the Trust Fund to recover the 2007 expenses, and to restore the Trust Fund to the level of $110,000 by the end of the fiscal year (Decision 07/A/3(iv)).

Following the revised guidelines for operating the Trust Fund adopted last year (Decision 06/A/4(i)), the Executive Secretary provided a detail report on applications received for support from the Trust Fund and their disposition.

Working Capital Fund

After inter-fund transfers approved by Council (Decisions 07/A/3(ii) and 07/A/3(iv)), the amount of funds available in the Working Capital Fund is estimated at about $290,660. This includes $182,449 in encumbered funds held for special and high-priority PICES projects with completion in 2008–2010, and $108,211 in "operating" funds. [Additional income and external funding for the period since PICES XVI brought the total amount of funds in the Working Capital Fund to the level of $354,500 and the amount of encumbered funds to the level of $215,500.]

Council decided that $40,000 from the encumbered funds designated for high-priority PICES projects (about $143,000) be earmarked for the development of FUTURE, and the remainder be earmarked for the North Pacific Ecosystem Status Report (Decision 07/A/3(v)).

Proposed budget for fiscal year 2008

Council approved the proposed *FY* 2008 budget of $762,000 (*F&A Endnote 7*). The amount of $96,000 will be transferred from the Working Capital Fund to balance the budget, setting the total annual contribution at $666,000, and the 2008 annual fee at $111,000 per Contracting Party (Decision 07/A/3(ii)).

Forecast budget for fiscal year 2009

The *FY* 2009 forecast budget of $778,000 was examined by the F&A Committee and presented to Council for information only. It was pointed out though that if the inflation rate in Canada stays near 2.5%, then the 2009 annual fee should be set at the level of $113,800 per Contracting Party and a transfer of $95,200 from the Working Capital Fund would be required to balance the budget. The *FY* 2009 budget will be further discussed at PICES XVII.

Executive Secretary position (Agenda Item 14)

Dr. Alexander Bychkov was appointed as the Executive Secretary of PICES for a 5-year term on June 1, 1999. In 2002, he was re-appointed for a second 5-year term, which started on June 1, 2004 and will expire on May 31, 2009. He has strongly supported the administration of PICES over the last more than ten years, including a 3-year term from May 1, 1996, to May 31, 1999, when he served as the Assistant Executive Secretary.

At the recommendation of the United States and in accordance with Financial Regulations 12(i), Council approved the establishment of an Executive Committee to complete an annual performance review of the Executive Secretary (Decision 07/A/7(i)). Terms of reference and membership of the Executive Committee are listed in *GC Appendix B*. It was also decided that at its first meeting, the Executive Committee will review achievements of the current Executive Secretary for the previous three years, in preparation for his possible re-appointment. As decision on re-appointment shall be made at least 12 months prior to the end of the term, Council agreed, in accordance with the Article VII of the Convention and Rule 4 of the Rules of Procedure, to vote on the results of the evaluation by correspondence before April 30, 2008 (Decision 07/A/7(ii)).

Deputy Executive Secretary position (Agenda Item 15)

Dr. Stewart (Skip) M. McKinnell was appointed as the Deputy (Assistant) Executive Secretary of PICES for a 3-year term on September 7, 1999. He was re-appointed in this position twice, and his third term of office will expire on September 6, 2008. Over eight years, Dr. McKinnell has been supporting the scientific activities of the Organization, with his distinguished ability in managing various scientific projects and publications of special issues of primary journals and valuable scientific reports (including the pilot North Pacific Ecosystem Status Report), as well as the preparation and operations of PICES Annual Meetings and conferences sponsored by PICES.

The Executive Secretary pointed out that Article VIII of the PICES Convention gives him the authority to appoint staff to the Secretariat and strongly argued to offer Dr. McKinnell another 3-year term to be started September 7, 2008. Council approved this recommendation (Decision 07/A/8).

Other business (Agenda Item 16)

(a) Report on a project "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" supported by the Japanese Trust Fund

At the 2007 inter-sessional Governing Council meeting, it was officially announced that the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency (JFA), will provide a voluntary contribution to PICES for a project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" (see *GC Endnote 5* for details). The Executive Secretary informed Council that the requited set of documents was submitted to MAFF on June 20, 2007, and the amount of $184,980 was transferred to PICES on July 26. He provided a brief report on activities within the project and the disposition of the fund for the period until October 31.

(b) Study Group on *PICES Communications* (SG-COM)

Dr. Boehlert introduced a proposal to establish a Study Group on *PICES Communications* (SG-COM) under the direction of Council, and this proposal was approved (Decision 07/S/7(i)). Reasons for forming SG-COM are summarized in the Background section of the document appended as *GC Endnote 7*. The overall goal of the Study Group is to identify the target audiences for output from PICES activities and to propose mechanisms to communicate with them. The terms of reference for SG-COM are described in *GC Appendix B* and *GC Endnote 7*. A tentative schedule for the Study Group is also included in *GC Endnote 7*. Originally, two alternative schedules were suggested: an accelerated schedule with the final SG-COM report presented for approval at PICES XVII (Dalian, China) in October 2008, and a slower schedule with the final report submitted at PICES XVIII (Busan, Korea) in October 2009. At the recommendation of Canada, the slower schedule was adopted.

GC Endnote 1

Participation list

Canada
Serge Labonté
Laura Richards

Japan
Hideki Nakano (advisor)
Yuji Uozumi

People's Republic of China
Handi Guo (alternate delegate)
Yingren Li (advisor)
Shengzhi Sun (advisor)
Gongke Tan (advisor)
Dongmei Tang (alternate delegate)

Republic of Korea
Kyu-Kui Jung (advisor)
Jin-Yeong Kim (alternate delegate)
Kwang-Youl Park

Russia
Lev N. Bocharov
Oleg Katugin (advisor, November 4 only)
Igor Shevchenko (advisor, November 5 only)

U.S.A.
George W. Boehlert
Justin R. Grubich (advisor)
Patricia Livingston (advisor)
Samuel Pooley

Other
Vera Alexander (PICES Past-Chairman)
Alexander Bychkov (Executive Secretary)
Francisco Chavez (IMARPE, Peru, November 5 only)
Gerd Hubold (ICES General Secretary)
Kuh Kim (Science Board Chairman, November 5 only)
Skip McKinnell (Deputy Executive Secretary, November 5 only)
John E. Stein (Science Board Chairman-elect, November 5 only)
Tokio Wada (PICES Chairman)

GC Endnote 2

Governing Council meeting agenda

1. Opening remarks
2. Adoption of agenda and meeting procedures
3. Report on administration
4. Report of 2007 inter-sessional Governing Council meeting
5. Membership and observers from other countries
6. Report of the Study Group on *Scientific Co-operation between PICES and Non-member Countries*
7. Relations with relevant international and regional organizations and programs
8. Next integrative scientific program of PICES
9. Capacity building activities
10. Improvement of participation in PICES activities
11. Schedule and financing of future Annual Meetings
12. Report and recommendations of Science Board
13. Report and recommendations of the Finance and Administration Committee
14. Executive Secretary position
15. Deputy Executive Secretary position
16. Other business
    (a) Report on a project "*Development of the prevention systems for harmful organism's expansion in the Pacific Rim*" supported by the Japanese Trust Fund
    (b) Proposal to form a Study Group on *PICES Communications*

GC Endnote 3

Report on Administration for 2007

I. Annual contributions

According to *Regulation 5* of the PICES Financial Regulations, all national contributions to PICES are payable by the first day of the financial year (January 1) to which they relate. Dues for 2007 were paid as follows:

Japan---------- December 5, 2006
U.S.A. ---------- January 10, 2007
Canada ---------- January 23, 2007
Russian Federation ---------- February 13, 2007
Republic of Korea ---------- April 3, 2006
People's Republic of China ----- July 3, 2006

All Contracting Parties met their financial obligations for *FY* 2007. Even though only the Japanese contribution arrived prior to the due date, the timeliness of payment from other Contracting Parties is either stable or improved. China's progress is notable, with the time of the payment moved from the fourth or late third quarters in 2000–2005 to early July in 2007.

II. External and additional funding

Details on external funding and voluntary contributions received since PICES XV are included in *F&A Endnote 5*.

III. Inter-sessional meetings

Since PICES XV (October 2006), the following inter-sessional symposia/workshops/meetings were convened/sponsored, for which financial, travel and logistical arrangements were made:

- an International Conference on "*The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries*" (co-sponsored by IMARPE, IRD, NASA, FAO, GLOBEC, ICES, PICES and IMBER), November 27–December 1, 2006, Lima, Peru;
- a 2-day meeting of the FISP Writing Team, February 16–17, 2007, Seattle, U.S.A.;
- a 2-day inter-sessional meeting of CREAMS-AP, April 11–12, Qingdao, China;
- a 3-day workshop to develop a Science Plan for a Future Integrative Scientific Program of PICES and an inter-sessional Science Board/Governing Council meeting (co-sponsored by the Fisheries Research Agency of Japan), April 16–19, 2007, Yokohama, Japan;
- a 3-day training workshop on "*Techniques for building multi-trophic level marine ecosystem models, with special emphasis on NEMURO and NEMURO.FISH*" (co-sponsored by the American Fisheries Society, Mexican Fisheries Society, U.S. National Marine Fisheries Service and PICES), April 26–28, 2007, La Paz, Mexico;
- a display of PICES publications at the joint meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society, May 2–4, 2007, La Paz, Mexico;
- a 3-day CFAME workshop on "*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*", May 21–23, 2007, Seattle, U.S.A.;
- a 5th International Conference on "*Marine bioinvasions*" (co-sponsored by ICES, PICES, the U.S. National Sea Grant College Program and the MIT Sea Grant College Program), May 21–24, 2007, Cambridge, U.S.A.;
- a 2-day joint meeting of PICES WG 21 on *Non-indigenous Aquatic Species*, ICES WG on *Introductions and Transfers of Marine Organisms* and ICES/IOC/IMO WG on *Ballast and Other Ship Vectors*, May 25–26, 2007, in Cambridge, U.S.A.;
- a 4th International Zooplankton Production Symposium on "*Human and climate forcing*

of zooplankton populations" (co-sponsored by PICES, ICES and GLOBEC), May 28–June 1, 2007, Hiroshima, Japan;
- ESSAS/PICES workshops on "*Evaluation of climate scenarios for subarctic regions*" (1 day) and "*The role of seasonal sea ice cover in marine ecosystems*" (2 days), June 4–6, 2007, Hakodate, Japan;
- an ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*", June 26–29, 2007, Baltimore, U.S.A.;
- a 2-day PICES/NPRB workshop on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*", July 19–20, Seattle, U.S.A.;
- ICES/PICES Theme Sessions on "*Integrating observations and models to improve predictions of ecosystem response to physical variability*", on "*Comparative marine ecosystem structure and function: Descriptors and characteristics*" and on "*The ecosystem approach: What's the impact on marine science, science based advice and management of marine ecosystems*" at the ICES Annual Science Conference, September 17–21, 2007, Helsinki, Finland;
- An International Symposium on "*Reproductive and recruitment processes in exploited marine fish stocks*" (co-sponsored by NAFO, PICES and ICES), October 1–3, 2007, in Lisbon, Portugal.

The following workshops were convened in conjunction with PICES XVI in Victoria, Canada:
- a ½-day BIO (MIE-AP) workshop on "*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*";
- a 1-day FIS workshop on "*Methods for standardizing trawl surveys to ensure constant catchability*";
- a 1-day FIS/MEQ workshop on "*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*";
- a 1-day MEQ workshop on "*Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophyes*", preceded by a ½-day laboratory demonstration on *Heterosigma* cell and toxin detection;
- a ½-day MONITOR/BIO workshop on "*Measuring and monitoring primary productivity in the North Pacific*";
- a 1½-day POC/CCCC workshop on "*Climate scenarios for ecosystem modeling*";
- a ½-day FIS workshop on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*", Phase II.

Preparations, arrangements or planning are in progress for:
- an International CLIOTOP Symposium on "*Climate impacts on oceanic top predators*" (co-sponsored by GLOBEC, IMBER, SCOR, PICES, EUR-OCEANS, NOAA, IRD, CLS, PFRP, CIBNOR and CICIMAR), December 3–7, 2007, La Paz, Mexico;
- an inter-sessional WG 21 meeting to evaluate the protocols and reach final agreement on standards, data elements and data entry templates for the MIS (Marine/Estuarine Invasive Species) Database for the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*", late February or early March 2008, Seattle, U.S.A.;
- an International Symposium on "*Effects of climate change on the world's oceans*" (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR, WCRP, DFO, NOAA, NASA), May 19–23, 2008, Gijón, Spain;
- an International Symposium on "*Coping with global change in marine social-ecological systems*" (co-sponsored by GLOBEC, EUR-OCEANS, FAO, IRD, SCOR, IMBER and PICES), July 8–11, 2008 in Rome, Italy;
- an International Symposium on "*Herring: Linking biology, ecology and status of populations in the context of changing environments"* (co-sponsored by ICES, PICES and GLOBEC), August 26–29, 2008, Galway, Ireland.

IV. Publications

Publications produced after PICES XV or still in progress include:

Primary journals

- Collection of papers on NEMURO and NEMURO.FISH in a special issue of *Ecological Modelling* on "*Modeling of North Pacific Marine Ecosystems*" (Guest Editors: M.J. Kishi, B.A. Megrey, S.-I. Ito and F.E. Werner) – published in March 2007, Vol. 202, Nos. 1-2;
- Selected papers from the Symposium on "*Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P*" in a special issue of *Progress in Oceanography* (Guest Editors: M.A. Peña, S.J. Bograd and A. Bychkov) – published in November 2007, Vol. 75, No. 2;
- Selected papers from the GLOBEC/ESSAS Symposium in a special issue of *Deep-Sea Research II* on "*Climate variability and sub-arctic marine ecosystems*" (Guest Editors: G.L. Hunt, K. Drinkwater, S. McKinnell and D.L. Mackas) – expected to be published in December 2007, Vol. 54, Nos. 23-26.

Peer-review process is in progress for several special issues:

- Selected papers from the PICES XV Topic Session on "*The human dimension of jellyfish blooms*" in a special issue of *Plankton and Benthos Research* (Guest Editors: H. Iizumi and K. Ishii) – will be published in spring 2008;
- Selected papers from the Humboldt Current Ecosystem Conference in a special issue of *Progress in Oceanography* – expected to be published in 2008;
- Selected papers from the PICES/GLOBEC Symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" in a special issue of *Progress in Oceanography* (Guest Editors: H. Batchelder and S. Kim) – expected to be published in 2008;
- Selected papers from the 2006 CREAMS/PICES Workshop on "*Model-data inter-comparison for the Japan/East Sea*" in a special issue of *Journal of Marine Systems* (Guest Editors: K.-I. Chang, C. Mooers, J.-H. Yoon and S.-I. Ito) – expected to be published in 2008;
- Selected papers from the 5th International Conference on "*Marine bioinvasions*" in a special issue of *ICES Journal of Marine Science* (Guest Editors: J. Carlton and J. Pederson) – expected to be published in 2008;
- Selected papers from the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" in a special issue of *ICES Journal of Marine Science* (Guest Editors: M. Dagg, R. Harris, L. Valdés and S.-I. Uye) – expected to be published in 2008;
- Selected papers on krill from the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" in a special volume of *Deep-Sea Research II*, (Guest Editors: W. Peterson and S. Kawaguchi) – expected to be published in 2008;
- Selected papers from the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*" as a section in a regular issue of *ICES Journal of Marine Science* (Guest Editors: F. Mueter, E. North) – expected to be published in 2008;
- Selected papers from the SEEDS-II experiment in a special issue of *Progress in Oceanography* or *Deep-Sea Research II* (Guest editors: A. Tsuda, M. Wells, M. Uematsu and H. Saito) – expected to be published in 2008.
- Selected papers from the International Symposium on "*Reproductive and recruitment processes of exploited marine fish stocks*" in a special issue of *Journal of Northwest Atlantic Fishery Science* (Guest Editors: R.D. Brodeur, M. Dickey-Collas and E. Trippel) – expected to be published in 2009;

PICES Special Publication

- Dickson, A.G., Sabine, C.L. and Christian, J.R. (Eds.). 2007. Guide to best practices for ocean CO_2 measurements. PICES Special Publication 3, 191 pp.

PICES Scientific Report Series

- Kruse, G.H., Livingston, P., Overland, J.E., Jamieson, G.S., McKinnell, S. and Perry, R.I. (Eds.). 2006. Report of the PICES/NPRB workshop on "*Integration of ecological indicators of the North Pacific*

with emphasis on the Bering Sea". PICES. Sci. Rep. No. 33, 109 pp.

The following reports are expected to be published by the end of 2007 or in 2008:

- Hollowed, A.B., Beamish, R.J and Schirripa, M.J. (Eds.). Report of FIS workshops on "*Forecasting climate impacts on fish production of commercially exploited fish and shellfish*";
- Beamish, R.J. and Yatsu, A. (Eds.). Final report of WG 16 on *Climate change, shifts in fish production, and fisheries management.*

PICES Technical Report Series

- Megrey, B.A., Macklin, S.A., Bahl, K. and Klawitter, P.D. (Eds.). 2006. TCODE report on "*Metadata federation of PICES member countries*". PICES Tech. Rep. No. 1 (electronic publication).

Other publications

- PICES 2006 Annual Report;
- Book of Abstracts for the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*";
- Book of Abstracts for the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*";
- Announcement, poster and Book of Abstracts for PICES XVI;
- Poster for PICES XVII;
- American Fisheries Society book on "*The ecology of juvenile salmon in the Northeast Pacific Ocean: Regional comparisons*" (Guest Editors: C. Grimes, R.D. Brodeur, L. Haldorson and S. McKinnell), 2007.

PICES Press – newsletters

- Two regular issues: Vol. 15, No. 1 (January 2007) and Vol. 15, No. 2 (July 2007).

A review of the PICES Publication Program, with a focus on the option of a transition to electronic publishing, was performed by the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC). It was carried out by two members of IAMSLIC, Janet Webster (Oregon State University Libraries, Newport, OR) and Brian Voss (NOAA Libraries, Seattle, WA), who worked closely with the PICES Secretariat throughout the review process. The review of the PICES Publication Program and the associated Action Plan were presented to the F&A Committee at PICES XVI.

V. Representation at other organization meetings and travel by PICES officers

- Dr. Alexander Bychkov (Executive Secretary) represented PICES at the NPAFC Fourteenth Annual Meeting (October 2006, Vancouver, Canada);
- Dr. R. Ian Perry represent PICES (as a member of the SSC) at the International Conference on "*The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries*" and at the meeting with the Chairman of the Board and the Scientific Director of IMARPE (November 2006, Lima, Peru);
- Dr. Skip McKinnell (Deputy Executive Secretary) attended as an invited participant the workshop on "*Climate impacts on the California Current Ecosystems*" (November 2006, La Jolla, U.S.A.);
- Dr. Vyacheslav Lobanov (member of MONITOR) represented PICES at the 11th Session of IOC/WESTPAC Coordinating Committee for the North-East Asian Regional Global Ocean Observing System (January 2007, Bangkok, Thailand);
- Drs. Bychkov and McKinnell travelled in February 2007 to Seattle, U.S.A., to attend the Symposium on "*The future of fisheries science in North America*", meet with representatives of IAMSLIC on issues related to a review of the PICES Publication Program, and participate in the FISP Writing Team meeting;
- Dr. Phillip R. Mundy (SG-GOOS Chairman) represented PICES at the 10th GOOS Scientific Steering Committee meeting (March 2007, Seoul, Korea);
- Dr. McKinnell represented PICES (as a member of the SSC) at the workshop on "*Coastal salmon ocean ecosystem*" (March 2007, Newport, U.S.A.);
- Ms. Darlene Smith (WG 21 Co-Chairman) represented PICES at the meetings of the

ICES/IOC/IMO Working Group on *Ballast and Other Ship Vectors* and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (March 2007, Dubrovnik, Croatia);

- Dr. Kuh Kim (Science Board Chairman), Dr. Vera Alexander (PICES Past-Chairman) and members of the Secretariat travelled in April 2007, to Yokohama, Japan, for the workshop to develop a Science Plan for a Future Integrative Scientific Program of PICES and an inter-sessional Science Board/Governing Council meeting;
- Dr. John E. Stein (Science Board Chairman-elect) represented PICES at the joint meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society (May 2007, La Paz, Mexico);
- Dr. Bychkov visited the Ministry of Maritime Affairs and Fisheries to discuss a complex of questions related to the participation of Korean scientists in activities of PICES (May 2007, Seoul, Korea);
- Dr. McKinnell represented PICES at the PaCOOS Board Meeting (May 2007, Seattle, U.S.A.);
- Drs. Harold P. Batchelder and Michio Kishi (CCCC Co-Chairmen) represented PICES at the GLOBEC Scientific Steering Committee meeting (May 2007, Hiroshima, Japan);
- Members of the Secretariat travelled in May 2007, to Hiroshima, Japan, as organizers for the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*";
- Dr. McKinnell represented PICES at the 2nd ESSAS (Ecosystem Studies of Sub-Arctic Seas) Annual Meeting (June 2007, Hakodate, Japan);
- Dr. Bychkov represented PICES at the 24th General Assembly of the Intergovernmental Oceanographic Commission (June 2007, Paris, France);
- Dr. McKinnell, Ms. Julia Yazvenko (Data-base and Web Administrator) and Mr. Xue-wu Guo (PICES Intern) travelled in June 2007 to Baltimore, U.S.A. as organizers for the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*";
- Drs. Tokio Wada (PICES Chairman) and Bychkov and Ms. Christina Chiu (Deputy on Administration) visited China in September 2007, to discuss a complex of questions related to the participation of Chinese scientists in activities of PICES with representatives of the State Oceanic Administration, Ministry of Agriculture and Chinese Academy of Fishery Sciences, and to review preparations for the 2008 PICES Annual Meeting in Dalian;
- Drs. McKinnell, Perry and Glen Jamieson served as PICES convenors to ICES/PICES Theme Sessions on "*Integrating observations and models to improve predictions of ecosystem response to physical variability*", on "*Comparative marine ecosystem structure and function: Descriptors and characteristics*" and on "*The ecosystem approach: What's the impact on marine science, science-based advice and management of marine ecosystems*" at the ICES Annual Science Conference (September 2007, Helsinki, Finland);
- Dr. McKinnell was an invited participant at the U.S. GLOBEC Pan-regional Synthesis Workshop (September 2007, Seattle, U.S.A.) and the Ocean Acidification Workshop (October 2007, La Jolla, U.S.A.);
- Dr. Lev Bocharov (PICES Vice-Chairman) represented PICES at the NPAFC Fifteenth Annual Meeting (October 2007, Vladivostok, Russia);
- Drs. Wada, Alexander and Kim travelled in October 2007, to Victoria, Canada, for PICES XVI;
- Drs. Nathan Mantua and William Sydeman will serve as PICES plenary speakers at the international CLIOTOP symposium on "*Climate impacts on oceanic top predators*", and Dr. McKinnell will represent PICES at the CLIOTOP SSC meeting (December 2007, la Paz, Mexico);
- Dr. Bychkov will represent PICES at the 3rd Japan-China-Korea GLOBEC symposium (December 2007, Hakodate, Japan).

VI. Relations with international scientific organizations and programs

The following reflects relationships with international scientific organizations and programs of regional and global scale, and with regional

scientific and monitoring efforts in the North Pacific:

International Program for Deployment of profiling floats (Argo)

- Dr. Howard Freeland (Argo Science Team Co-Chairman) attended PICES XVI as an observer and addressed POC and MONITOR on potential areas for collaboration between Argo and PICES. Argo also had a poster at this meeting outlining general information and highlighting scientific objectives and recent activities of the project.

International Research Programme on Climate Variability and Predictability (CLIVAR)

- PICES Working Group 20 on *Evaluation of Climate Change Projections* is the appropriate avenue to enhance collaboration with CLIVAR through its Pacific Panel. Currently, Dr. William Crawford (Canada) serves as a liaison between two groups.

Ecosystem Studies of Sub-Arctic Seas (ESSAS)

- In May 2005, PICES co-sponsored and served as the local organizer for the GLOBEC Symposium on "*Climate variability and sub-arctic marine ecosystems*" held in Victoria, Canada. Selected papers from the symposium will be published in December 2007, in a special issue of *Deep-Sea Research II* (Guest Editors: G.L. Hunt, K. Drinkwater, S.M. McKinnell and D.L. Mackas).
- PICES co-sponsored workshops on "*Evaluation of climate scenarios for subarctic regions*" and "*The role of seasonal sea ice cover in marine ecosystems*" convened during the ESSAS Second Annual Meeting (June 4–9, 2007, Hakodate, Japan).
- Drs. Kenneth Drinkwater and George Hunt (ESSAS SSC Co-Chairmen) attended PICES XVI as observers and addressed several PICES Committees on potential areas of cooperation between ESSAS and its U.S. component for the Bering Sea (BEST) and PICES. ESSAS and BEST also had posters at this meeting outlining general information and highlighting scientific objectives and recent activities of both projects.

Global Ocean Ecosystem Dynamics project (GLOBEC)

- The PICES Climate Change and Carrying Capacity (CCCC) Program provides a mechanism for integrating national GLOBEC research programs in the North Pacific and is a regional component of the international GLOBEC effort.
- The PICES/GLOBEC Symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" was held April 19–21, 2006, in Honolulu, U.S.A. A special issue of *Progress in Oceanography* from the symposium (Guest Editors: H. Batchelder and S. Kim), to be published in 2008, is considered as a part of GLOBEC synthesis efforts.
- PICES and GLOBEC worked together to organize the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" (May 28–June 1, 2007, in Hiroshima, Japan). Two special issues resulting from the symposium, one in the *ICES Journal of Marine Science* (Guest Editors: M. Dagg, R. Harris, L. Valdés and S.-I. Uye) and another in *Deep-Sea Research II* (Guest Editors: W. Peterson and S. Kawaguchi), are expected to be published in 2008.
- GLOBEC allocated $5,000 US to co-sponsor the CCCC/FIS Topic Session on "*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*" at PICES XVI, by covering travel costs of one invited speaker and two early career scientists.
- PICES agreed to co-sponsor two symposia led by GLOBEC: on "*Climate impacts on oceanic top predators*" (December 3–7, 2007, La Paz, Mexico) and on "*Coping with global change in marine social-ecological systems*" (July 8–11, 2008, in Rome, Italy).
- GLOBEC agreed to co-sponsor the PICES/ICES/IOC Symposium on "*Effects of climate change on the world's oceans*" (May 19–23, 2008, in Gijón, Spain).
- PICES was represented as an observer at the GLOBEC SSC meeting (May 2007,

Hiroshima, Japan). Drs. Francisco E. Werner (GLOBEC SSC Chairman) and Ian Perry (GLOBEC SSC Chairman-elect) attended PICES XVI as observers and briefed Science Board on GLOBEC's synthesis and integration efforts and discuss PICES' involvement in these activities.

Global Ocean Observing System (GOOS)

- At the 2005 inter-sessional Science Board/Governing Council meeting, GOOS integration was identified as high priority PICES activity. At PICES XIV, Council established a Study Group to develop a strategy for GOOS (SG-GOOS), under the direction of MONITOR. This Study Group recommended that PICES should focus on the coordination and facilitation of North Pacific regional projects by providing a forum for representatives of the existing North Pacific observing systems to develop international cross-GRA (GOOS Regional Alliance) observing projects, improve observing technologies, and compare data and information sharing protocols.
- PICES was represented as an observer at the 11th Session of IOC/WESTPAC Coordinating Committee for NEAR-GOOS (January 2007, Bangkok, Thailand), the 10th GOOS Scientific Steering Committee meeting (March 2007, Seoul, Korea) and the PaCOOS Board Meeting (May 2007, Seattle, U.S.A.). Dr. Henrik Enevoldsen attended PICES XVI as a GOOS observer.
- Two Topic Sessions highly relevant to GOOS were convened at PICES XVI: "*Operational forecasts of oceans and ecosystems*" and "*Recent advancements in ocean observing systems: Scientific discoveries, technical developments and data management, analysis and delivery*", with commercial displays set up around the theme of ocean observatories.

International Council for the Exploration of the Sea (ICES)

- ICES and PICES worked with the U.S. National Sea Grant College Program and the MIT Sea Grant College Program to organize the 5th International Conference on "*Marine bioinvasions*" (May 21–24, 2007, in Cambridge, U.S.A.). Selected papers from this conference are expected to be published in a special issue of *ICES Journal of Marine Science* (Guest Editors: J. Carlton and J. Pederson).
- Ms. Darlene Smith (WG 21 Co-Chairman) attended the annual meetings of the ICES/IOC/IMO Working Group on *Ballast and Other Ship Vectors* (WGBOSV) and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (WGITMO) in March 2007, in Dubrovnik, Croatia, to discuss possible co-operation on marine bioinvasions, The first ever joint meeting of WG 21, WGBOSV and WGITMO was held immediately after the "*Marine bioinvasions*" Conference (May 25–26, 2007). Dr. Judith Pederson (Chairman of WGITMO) participated in the annual meeting of WG 21 at PICES XVI.
- ICES' experts on marine bioinvasions will be involved in the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" to be conducted from April 1, 2007 to March 31, 2012).
- ICES was one of the three main international sponsors (with PICES and GLOBEC) for the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" (May 28–June 1, 2007, in Hiroshima, Japan).
- The ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*" was held June 26–29, 2007, in Baltimore, U.S.A. The goal of the conference was to encourage new scientists to share knowledge and to begin to build networks across disciplines and international borders. Selected papers from the conference are expected to be published in 2008, as a section in a regular issue of *ICES Journal of Marine Science* (Guest Editors: F. Mueter and E. North).
- ICES and PICES joined NAFO in organizing the International Symposium on "*Reproductive and recruitment processes in exploited marine fish stocks*" (October 1–3, 2007, in Lisbon, Portugal).

- PICES co-sponsored three Theme Sessions on "*Integrating observations and models to improve predictions of ecosystem response to physical variability*", "*Comparative marine ecosystem structure and function: Descriptors and characteristics*" and "*The ecosystem approach: What's the impact on marine science, science-based advice and management of marine ecosystems?*" at the 2007 ICES Annual Science Conference (September 17–21, 2007, Helsinki, Finland).
- ICES co-sponsored two Topic Sessions on "*Fisheries interactions and local ecology*" and "*Operational forecasts of oceans and ecosystems*" at PICES XVI.
- ICES and PICES initiated the organization of the International Symposium on "*Effects of climate change on the world's oceans*" to be held May 19–23, 2008, Gijón, Spain.
- PICES is working with ICES and GLOBEC to convene the International Symposium on "*Herring: Linking biology, ecology and status of populations in the context of changing environments*" (August 26–29, 2008, Galway, Ireland).
- Dr. Gerd Hubold (ICES General Secretary) attended PICES XVI and address Council on the most recent developments concerning the ICES reforms and potential areas of collaboration for the two organizations. Dr. Adolf Kellermann (ICES Head of Science Program) participated in the Science Board meeting to discuss ongoing and future joint ICES/PICES activities.

Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)

- Dr. Julie Hall (IMBER SSC Chairman) attended PICES XVI as an observer and addressed the BIO Committee on potential areas for cooperation between IMBER and PICES. IMBER also had a poster at this meeting outlining general information and highlighting scientific objectives and recent activities of the project.
- There is a strong interest in including issues of marine biogeochemistry and food webs that would link PICES with IMBER in a new integrative scientific program of PICES.

Intergovernmental Oceanographic Commission of UNESCO (IOC)

In 2002, IOC and PICES agreed to cooperate on four fronts: (i) monitoring (see under GOOS); (ii) ecosystem indicators (see under SCOR); (iii) CO_2 data integration and synthesis (see under IOCCP); and (iv) harmful algal blooms (see below).

- In June 2005, IOC and PICES signed a formal agreement to establish a partnership in systematically compiling, storing and presenting on-line, records on harmful algal events. Event records are to be compiled and stored annually in the format specified in the HAE-DAT database. HAE-DAT is hosted at the IOC server in Paris and is presented with equal credit to the partner organizations (PICES and ICES). Building a common data resource allows inter-comparison of HAB species composition and magnitude of environmental and economic impacts. Discussion on this joint work continued at PICES XVI.
- IOC experts on harmful algal blooms will be involved in the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" to be conducted from April 1, 2007 to March 31, 2012).
- PICES was represented as an observer at the 24th General Assembly of IOC (June 2007, Paris, France), and Dr. Henrik Enevoldsen attended PICES XVI as an IOC observer.
- IOC joined ICES and PICES in organizing the International Symposium on "*Effects of climate change on the world's oceans*" to be held May 19–23, 2008, Gijón, Spain.

International Ocean Carbon Coordinated Project (IOCCP)

- IOCCP is working on establishing international agreements on observation methods, best practices, data management, and data sharing that will lead to the joint development of global data products and synthesis activities documenting the ocean carbon cycle. PICES, through its Working Groups on *CO_2 in the North Pacific* (WG 13, 1998–2001) and *Biogeochemical Data Integration and Synthesis* (WG 17, 2002–

2005), and the Section on *Carbon and Climate* (2006–present), has been long acting as a regional coordinator for these activities. The Section on *Carbon and Climate* provides clear channels of communication to IOCCP, and to large-scale IGBP programs such as SOLAS and IMBER.

- IOCCP and PICES co-sponsored the preparation of the "*Guide to best practices for ocean CO_2 measurements*" to be published as PICES Special Publication 3 (Eds. A.G. Dickson. C.L. Sabine and J.R. Christian) in December 2007.
- Drs. Christopher Sabine (IOCCP SSC Chairman) and Maria Hood (IOCCP Coordinator) attended PICES XVI and addressed POC and BIO on potential areas for cooperation between IOCCP and PICES.

North Atlantic Fisheries Organization (NAFO)

- NAFO and PICES (with ICES as another sponsor) partnered to organize the International Symposium on "*Reproductive and recruitment processes in exploited marine fish stocks*" held October 1–3, 2007, in Lisbon, Portugal. Selected papers from this symposium are expected to be published in 2009, as a special issue of *Journal of Northwest Atlantic Fishery Science* (Guest Editors: R.D. Brodeur, M. Dickey-Collas and E. Trippel).

North Pacific Anadromous Fish Commission (NPAFC)

- The Bering Sea/Aleutian Island region is a focus of research for both NPAFC and PICES. NPAFC provided an opportunity to scientists involved in the PICES Micronekton Sampling Inter-calibration Experiment to use one their BASIS Program cruises (September 2007, on the NOAA research vessel, *Oscar Dyson*) to sample micronekton in the Bering Sea.
- Dr. Lev Bocharov (PICES Vice-Chairman) represented PICES at the NPAFC Fifteenth Annual Meeting (October 2007, Vladivostok, Russia). Drs. Shigehiko Urawa (Deputy Executive Director) and Jim Irvine (Co-Chairman of Working Group on *Stock Assessment*) were present as observers at PICES XV. Dr. Urawa addressed FIS on potential areas for collaboration between the two organizations. Dr. Irvine presented information on the status of Pacific salmon in the North Pacific at the meeting of MONITOR as input to update the North Pacific Ecosystem Status Report. NPAFC also had a poster at this meeting outlining general information and highlighting scientific objectives and recent activities of the organization.

North Pacific Research Board (NPRB)

- The PICES project on "*Integration of ecological indicators for the North Pacific with emphasis on the Bering Sea*", funded by NPRB (a grant of $99,957 US), was successfully completed by publishing proceedings of the PICES/NPRB workshop as PICES Scientific Report No. 33 in December 2006.
- NPRB provided $15,000 US for the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*" (June 26–29, 2007, in Baltimore, U.S.A.), $5,000 US for the ESSAS/PICES workshops on "*Evaluation of climate scenarios for subarctic regions*" and "*The role of seasonal sea ice cover in marine ecosystems*" (June 4–6, 2007, Hakodate, Japan), and $10,000 US for the FIS workshop on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*" (July 19–20, 2007, Seattle, U.S.A.).
- Drs. Clarence Pautzke (Executive Director) and Francis Wiese (Science Director) represented NPRB at PICES XVI and addressed PICES Committees on their potential involvement in various initiatives supported by the Board. NPRB also had a poster at this meeting outlining general information and highlighting scientific projects and recent activities of the organization.

Scientific Committee on Oceanic Research (SCOR)

Relationships with GLOBEC, SOLAS, IMBER and IOCCP are reflected separately. Other collaborations between PICES and scientific

projects and groups established/co-sponsored by SCOR are listed below.

- PICES strongly supported the formation of the SCOR WG 125 on *Global Comparisons of Zooplankton Time Series* and agreed to provide funding for one additional member from the North Pacific (Dr. Harold Batchelder, Oregon State University, U.S.A.) to participate in its activities. The 2007 meeting of this Working Group was held in conjunction with the 4th Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" (May 28–June 1, 2007, Hiroshima, Japan), and their 2008 workshop will be convened immediately prior to the PICES/ICES/IOC symposium on "*Effects of climate change on the world's oceans*" (May 19–23, 2008, in Gijón, Spain).
- SCOR provided $6,000 US for scientists from countries with "economies in transition" to participate in the 4th Zooplankton Production Symposium and $5,000 US to attend SCOR-relevant sessions at PICES XVI. SCOR also committed $7,500 US to the symposium on "*The effects of climate change on the world's oceans*".
- The International Advisory Hydrography Group (IAGH), sponsored by SCOR, met in conjunction with PICES XVI.
- Since 2005, the PICES HAB Section has convened an annual series of workshops to document existing knowledge on the eco-physiology of HAB species that impact all, or most, countries in the North Pacific. The SCOR GEOHAB Program is invited to play an active role in future workshops of this series.
- Dr. Bjørn Sundby (President of SCOR) attended PICES XVI as an observer to discuss ongoing and future collaborations between the two organizations.

<u>Surface Ocean-Lower Atmosphere Study (SOLAS)</u>

- PICES provided travel support for young Asian scientists to attend the SOLAS Open Science Meeting held in March 2007, in Xiamen (People's Republic of China).
- Dr. Shigenobu Takeda (SOLAS SSC member) represented SOLAS at PICES XVI and addressed BIO on potential areas for cooperation between the two organizations. SOLAS also had a poster at this meeting outlining general information and highlighting scientific objectives and recent activities of the project.
- Meso-scale iron enhancement experiments are an important part in the agenda of both SOLAS and PICES. The results of the first two international collaborative field projects in the subarctic Pacific, **S**ubarctic Pacific Iron **E**xperiment for **E**cosystem **D**ynamics **S**tudy (SEEDS-I) and **S**ubarctic **E**cosystem **R**esponse to **I**ron **E**nrichment **S**tudy (SERIES), organized under the umbrella of PICES, were published in special issues of *Progress in Oceanography* (2005, Vol. 64, Nos. 2-4, pp. 91–324) and *Deep-Sea Research II* (2006, Vol. 53, Nos. 20-22, pp. 2005–2454). Selected papers from the SEEDS-II experiment are expected to be published in 2008 in a special issue of *Progress in Oceanography* (Guest editors: A. Tsuda, M. Wells, M. Uematsu and H. Saito).

VII. PICES Intern Program

See GC Agenda Item 9 and F&A Agenda Item 8 for details.

VIII. PICES website/database

The most important changes to the website implemented after PICES XV include:

<u>PICES website maintenance:</u>

- Updating pages and posting new information on membership, publications, meetings, *etc*.;
- Developing the new "financial support on-line" page that allows on-line CV and financial support form submission and dynamic database update;
- Moving the site to a new PICES server and moving publications and Power Point presentations to the hosting server allowing for faster download (work in progress to be completed by the end of 2007).

<u>Symposium/conference websites:</u>

New websites were created and have been supported for the following meetings:

(1) ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*"; (2) 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*"; (3) PICES Sixteenth Annual Meeting; and (4) International Symposium on "*Effects of climate change on the world's oceans*". This includes:

- art work;
- site development and support (*e.g.*, changes to schedules, scientific program, dynamic sub-pages with information about the registrants and submitted abstracts, *etc*.);
- database support;
- compiling and posting Book of Abstracts;
- formatting and posting Power Point presentations;
- development and Best Presentations pages;
- development of the customized, dynamic private pages for after-meeting manuscript submissions (password-protected pages, allowing immediate manuscript uploading/ downloading; providing editors control of the submissions and permitting them to make changes on-line without engaging a second party).

CPR project site and database (work in progress)

- Data presentation on this new site (with a new database) is dynamic, as opposed to the current static presentation on SAHFOS site, and allows user-database interaction. Information can be presented and withdrawn in the form of graphs and tables. Due to the capacity of the current PICES server and a new type of the database, the site will be open to the public only after the Annual Meeting, when PICES home page is moved to a new server.

GC Endnote 4

Statements on the naming of "the Sea in dispute"
(as submitted by presenters, with grammar corrected)

Statement by Dr. Yuji Uozumi (Delegate of Japan)

I would like to express the Japanese official position on the expression for the Sea of Japan in relation to the recent activities and publications in PICES. I found an inappropriate expression for the Sea of Japan such as for the CREAMS workshop held in Korea in 2006. Japan regrets this inappropriate expression. I do not want to explain the Japanese official position related to the expression for Sea of Japan in detail now to avoid wasting time. But please understand the Japanese official position. Japan opposes the use of other expressions than the Sea of Japan in any occasion and publication, especially in PICES' official documents. Japan really wishes PICES to make more effort to eliminate this kind of inappropriateness from now on.

Statement by Mr. Kwang-Youl Park (Delegate of Korea)

Our Japanese colleague raised the issue of the naming of the sea area located between the Korean Peninsula and the Japanese Archipelago. With regard to this issue, we all are aware that PICES has adopted the simultaneous use of "Japan Sea (Sea of Japan)" and "East Sea" from 1995 until now. This practice is in line with the resolution of the International Hydrographic Organization (IMO), and that of the UN Conference on the Standardization of Geographic Names. These resolutions endorse the principle of simultaneous use of different names for a shared geographical feature when the countries concerned do not agree on a common name. In recent years, the cases of the dual use of "East Sea" and "Sea of Japan" have been increasing worldwide. Even the publication of the Japanese Ministry of Foreign Affairs shows that 20 percent of non-governmental cartographers used both names in 2005, which is a sharp increase from less than three percent in 2000. Korea, therefore, calls upon PICES to maintain its position of using both names in its publications until such time when Korea and Japan agree on a common name.

GC Endnote 5

Summary report of the 2007 inter-sessional Governing Council meeting

The 2007 inter-sessional Governing Council meeting was held on April 20, under the chairmanship of Dr. Tokio Wada. All Contracting Parties were represented at the meeting. The Chairman also invited Drs. Kuh Kim (Science Board Chairman) and John Stein (Science Board Chairman-elect) to attend. The agenda and the list of participants for the meeting are provided at the end of this section.

Report of the Study Group on *Scientific Cooperation between PICES and Non-member Countries*

At PICES XV (October 2006, Yokohama, Japan), a Study Group (SG-SC) on *Scientific Cooperation between PICES and Non-member Countries* was established, under the direction of Council, to identify options and propose mechanisms for such cooperation (Decision 06/A/6). The Study Group is chaired by the F&A Chairman, Dr. Laura Richards, and its membership includes one representative from each Contracting Party (unfortunately China did not nominate a member to SG-SC), plus a representative from Science Board and a representative from the Secretariat.

A draft SG-SC report was presented by Dr. Richards. The Study Group was unanimously negative to the idea of amending the PICES Convention to expand the "area concerned". However, recognizing the scientific necessity and advantages of cooperating with non-member countries, SG-SC suggested that an affiliate member status be established, similar to the arrangement implemented some time ago by ICES. After intensive discussions, Council accepted this recommendation and requested that an affiliate policy document be developed for discussion at PICES XVI. China and Korea pointed out that more information is needed to make a decision on the affiliate status, especially on how such a system would influence the current structure and management of the Organization. Russia proposed that some statistical analysis of external participation be added to the final SG-GC report. The United States asked that the document be reviewed by Science Board before submitting to Council for approval.

Report of the Study Group on *Ecosystem Status Reporting*

A Study Group on *Ecosystem Status Reporting* (SG-ESR) was established at PICES XV, under the direction of Science Board (Decision 06/S/6), to develop options and budgets for paper and electronic versions of the North Pacific Ecosystem Status Report (NPESR). The Study Group is chaired by Mr. Robin Brown (Canada), and its membership includes one representative from each Contracting Party and a representative from the Secretariat. At the inter-sessional Science Board meeting on April 19, Dr. Skip McKinnell presented a draft SG-ESR report which provided the following four options for consideration: (1) the report focussed on some subset of issues; (2) the "incremental" improvement" report; (3) the "strategic" North Pacific ecosystem assessment, tightly bound to the future integrative scientific program of PICES; and (4) the "integrated" ecosystem assessment. Science Board was able to narrow the options down to two: the "incremental" improvement" report (option 2) and the "integrated" ecosystem assessment (option 4). The Study Group was requested to finalize the report by PICES XVI and submit it to Council in order to determine what Contacting Parties consider the preferred option.

There was consensus at the Council meeting that the pilot NPESR was a flagship product of PICES, and that a strategy for the development of an updated version should take into consideration the amount of resources that the Organization can afford and the high expectations from Contracting Parties for a product. It was also pointed out that the draft SG-ESR report includes the costs associated with regional workshops and report production, but does not outline the costs borne by Contracting Parties. The Study Group was asked to estimate in their final report the "true"

costs in time and effort of producing a report based on option 2.

Recommendations from the 2007 inter-sessional Science Board meeting

Council reviewed several recommendations from the inter-sessional Science Board meeting, and the following decisions were made:

- Dr. Vasily Radashevsky (Russia) was appointed as the Co-Chairman of the Working Group 21 on *Non-indigenous Aquatic Species*. Ms. Darlene Smith (Canada) serves as the other Co-Chairman. This Working Group was established at PICES XIV (October 2005, Vladivostok, Russia), under the direction of MEQ (Decision 05/S/6).
- PICES sponsorship was approved for: (1) an International Symposium on "*Climate impacts on oceanic top predators*" (co-sponsored by GLOBEC, IMBER, SCOR, PICES, EUR-OCEANS, NOAA, IRD, CLS, PFRP, CIBNOR and CICIMAR), to be held December 3–7, 2007, La Paz, Mexico; (2) an International Symposium on "*Coping with global change in marine social-ecological systems*" (co-sponsored by GLOBEC, EUR-OCEANS, FAO, IRD, SCOR, IMBER and PICES), to be convened July 8–11, 2008 in Rome, Italy; and (3) an International Symposium on "*Herring: Linking biology, ecology and status of populations in the context of changing environments"* (co-sponsored by ICES, PICES and GLOBEC), to be held August 26–29, 2008, Galway, Ireland.
- The principles of a new PICES award for monitoring and data management activities were approved. This award will recognize organizations, groups or individuals that have contributed significantly to the advancement of marine science in the North Pacific through long-term monitoring and/or management of data associated with ocean conditions and marine bio-resources. Nominations are to be submitted to the PICES Secretariat. Recommendation for a recipient(s) will be made by the MONITOR and TCODE Technical Committees, with selection to be made by Science Board. Science Board was requested to finalize the name and description of the award for approval PICES XVI. The first award will be given at PICES XVII.

Science Board report on the April 2007 FISP workshop

A workshop to develop a Science Plan for a Future Integrative Scientific Program (FISP) of PICES was held on April 16–18, 2007, immediately prior to the inter-sessional Science Board/Governing Council meeting. The purpose of the FISP workshop was to: (1) review the goals, objectives, organization and key elements of the Science Plan for the new program entitled FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems); (2) define and prioritize the key questions to be answered; and (3) determine strategic approaches to answering the questions. Participants of this workshop included members of the FISP Writing Team, FISP Study Group, Science Board and Governing Council, and several invitees.

Dr. John E. Stein (FISP Writing Team Leader) provided a brief report of the FISP workshop. He indicated that considerable progress was made at the workshop: (1) consensus was reached on a set of key questions; (2) an overall outline for the Science Plan was developed, and (3) the next steps to complete a full draft of the Science Plan were identified. These steps include:

- holding a meeting of the FISP Writing Team to begin developing a full draft of the Science Plan (June 2007);
- circulating the draft Science Plan to Council and Science Board, and posting it on the PICES website for comments from the scientific community (September 2007);
- organizing an Open Forum and a FISP workshop at PICES XVI to discuss the draft, review comments received, and revise the Science Plan, if required (November 2007);
- undertaking internal and external review of the revised Science Plan (February 2008);
- submitting the Science Plan for approval by Council at the April 2008 inter-sessional Science Board/ Governing Council meeting.

Future PICES Annual Meetings and inter-sessional Science Board/Governing Council meetings

Dr. Richards reviewed the status of preparations for the PICES Sixteenth Annual Meeting to be held from October 26–November 5, 2007, in Victoria, Canada. She re-iterated that the Canadian government is not planning to ask PICES for any funds to cover Annual Meeting costs.

Mr. Gongke Tan provided brief information on the status of preparations for the PICES Seventeenth Annual Meeting to be held from October 23–November 2, 2008, in Dalian, China.

Council approved the proposal of Korea to host the PICES Eighteenth Annual Meeting in 2009. It was agreed that Korea will suggest the venue and dates for this meeting by August 31, 2007.

Council deferred its decision on an inter-sessional Science Board/Governing Council meeting in 2008 until PICES XVI. Science Board has already indicated the importance of having such a meeting for the approval of a Science Plan for the new integrative scientific program of PICES (FUTURE) and suggested that this meeting be held in conjunction with a workshop to develop an Implementation Plan for FUTURE.

PICES Intern Program

The Executive Secretary reported that following Decision 06/A/8(ii), Contracting Parties were invited to support the PICES Intern Program in 2007 and beyond. In response to this request, the U.S. National Marine Fisheries Service (NMFS) and Fisheries and Oceans Canada (DFO) provided $15,000 US and $10,000 CND, respectively, to the Trust Fund for this activity. With these contributions, the amount of funds is now sufficient to maintain the Intern Program in 2007–2008. The Chairman thanked NMFS and DFO for their continuing support of the Intern Program.

The 2008 term of the Intern Program is expected to start on February 1, 2008. At PICES XV, Council extended the deadline of nominations for this term until the 2007 inter-sessional Governing Council meeting (Decision 06/A/8(iii)). No applications were received by that time. At the meeting, Korea, in particular, was encouraged to nominate candidates for the 2008 term by July 31, 2007.

Financial and administrative matters

The Executive Secretary reported on the 2007 annual fee payment dates, and provided information on extra-budgetary contributions received since PICES XV for various activities initiated/sponsored by PICES. The Chairman thanked the Contracting Parties for making voluntary contributions.

The Japanese delegate, Dr. Hideki Nakano, officially announced that the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency, will make a voluntary contribution to PICES for a project entitled "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*". The anticipated duration of the project is 5 years (from April 1, 2007 to March 31, 2012), with a total funding of approximately $924,900. The budget for the first year (April 1, 2007–March 31, 2008) is $184,980. This contribution is from the Official Development Assistance (ODA) fund, and therefore, it is required to involve developing Pacific Rim countries in activities under this project. A set of documents for requesting a transfer of funds to PICES should be submitted to MAFF within 2 months (by June 20, 2007).

The Executive Secretary informed Council that in the preliminary discussion with representatives of the Fishery Agency it was agreed that:

- Project participants will include the Section on *Ecology of Harmful Algal Blooms in the North Pacific* (HAB Section) and Working Group on *Non-indigenous Aquatic Species* (WG 21). Each group will oversee a specific sub-project led by a Principle Investigator. Objectives of these sub-projects will be detailed in the Workplan.

- The Marine Environmental Quality Committee (MEQ) will be responsible for the scientific implementation of the project. The MEQ Chairman will act as a Scientific Coordinator for the project, and will report annually to MEQ and Science Board.
- The Executive Secretary will be responsible for the management of the fund and annual reporting on its disposition to Council and to the Government of Japan, within 120 days following every fiscal year end.
- To support the objectives of the project and to ensure that its activities have a minimal impact on the workload of the existing staff of the PICES Secretariat, the Executive Secretary will contract additional staff (Project Assistant) as required. A 10% overhead on the annual budget will be retained to offset expenses related to the Secretariat's involvement in the project.
- A separate bank account will be established to deposit the remitted funds. Interest earned in the account will be credited to the project and used in consultation with MAFF. Any funds remaining after the completion of every fiscal year of the project will be reported and disposed of in consultation with MAFF.

Participation list of 2007 inter-sessional Governing Council meeting

Canada
Laura Richards

Japan
Ryoko Henna (advisor)
Tokimasa Kobayashi (advisor)
Hideki Nakano
Yuji Uozumi (advisor)

People's Republic of China
Gongke Tan (alternate delegate)

Republic of Korea
Jung-Hwa Choi (advisor)
Kyoung-Jin Kim (alternate delegate)
Ig-Chan Pang

Russia
Lev N. Bocharov
Anna Karulina (advisor)
Igor Shevchenko (advisor)

U.S.A.
Samuel Pooley (delegate)

Other
Tokio Wada (PICES Chairman)
Vera Alexander (PICES Past Chairman)
Kuh Kim (Science Board Chairman)
John E. Stein (Science Board Chairman-elect)
Alexander Bychkov (Executive Secretary)
Skip McKinnell (Deputy Executive Secretary)

2007 inter-sessional Governing Council meeting agenda

1. Welcome and introductions
2. Approval of agenda
3. Report of the Study Group on *Scientific Cooperation between PICES and Non-member Countries*
4. Report of the Study Group on *Ecosystem Status Reporting*
5. Recommendations from the 2007 inter-sessional Science Board meeting
6. Science Board report on the April 2007 FISP workshop
7. Future PICES Annual Meetings and inter-sessional Science Board/Governing Council meetings
8. PICES Intern Program
9. Financial and administrative matters
10. Other business

GC Endnote 6

CRITERIA GOVERNING ACCEPTANCE OF AN AFFILIATE OF THE NORTH PACIFIC MARINE SCIENCE ORGANIZATION

1. Background

1.1 In accordance with Article XIV (clause 2) of the PICES Convention, only "*States desiring to accede to the Convention may so notify the Depository which shall notify the Contracting Parties*." Thus, accession is the only method of application for membership.

1.2 Article II of the PICES Convention states "The area which the activities of the Organization concern shall be the temperate and sub-Arctic region of the North Pacific Ocean and its adjacent seas, especially northward from 30 degrees North Latitude, hereinafter referred to as the "area concerned". Activities of the Organization, for scientific reasons, may extend farther southward in the North Pacific Ocean."

1.3 It is widely accepted that the societal issues and research needs that motivate PICES are global in scope. Thus, PICES benefits from interactions with scientists and scientific organizations/institutions from around the world. As one of the world's leading marine science organizations, PICES also recognises a responsibility to build scientific capacity.

1.4 Atmospheric and oceanic processes occurring in regions beyond the PICES area of concern are affecting North Pacific marine ecosystems and their dynamics. Furthermore, many of the issues addressed by PICES are not unique to the North Pacific. These realities led to a suggestion that expanded cooperation between PICES and scientific organizations/institutions in other regions of the Pacific Ocean might serve their mutual interests. It has also become increasingly evident that scientists from these regions have the background and expertise to contribute in a meaningful way to PICES activities.

1.5 At the 2006 PICES Annual Meeting, the Governing Council established the Study Group on *Scientific Cooperation between PICES and Non-member Countries* (Decision 06/A/6) to recommend to the Council how this could be achieved.

1.6 The term "Affiliate" refers to research organizations/institutions that represent scientists in non-member countries, in accordance with the conditions described in this document.

2. Acquiring PICES Affiliate status

2.1 To further the interests of PICES and to support the needs of scientists of countries within the area concerned whose Governments have yet to accede to the PICES Convention, or of countries outside the current geographical scope of PICES, the Governing Council may grant, to a research organization/institution that represents scientists in a non-member country, status as a PICES Affiliate.

2.2 The granting of Affiliate status for a research organization/institution shall be considered in the light of Article III of the PICES Convention, which indicates that PICES is expected "*(a) to promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources, including but not necessarily limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and impacts upon it from human activities; and (b) to promote the collection and exchange of information and data related to marine scientific research in the area concerned*." The organizations/institutions considered for Affiliate status will be nationally or internationally respected scientific establishments engaged in research activities which fall within the range of the PICES Convention. These basic

criteria shall be essential prerequisites for the status of Affiliate; they do not convey, however, any right to claim that status.

2.3 To avoid multiple representations from any country in PICES, Affiliate status will normally be granted to only one research organization/institute per country. Affiliate status will normally, but not necessarily, be granted to the first research organization/institution which applies from a specific country, on condition that it meets the specific criteria defined in 2.2, and that it adheres to the rules governing the activities of an Affiliate.

2.4 The Governing Council reserves the right to select, from a number of applicants, the most appropriate one to be granted Affiliate status. The Council may, as it sees fit, consult with the competent authorities in the country concerned. Such consultations may be held at any time.

2.5 The status of Affiliate for an applicant shall be approved by a Decision of the Governing Council. After approving a research organization/institute as an Affiliate, no other application for Affiliate status from the same country will be considered, unless the first organization/ institution ceases to be an Affiliate, or its Affiliate status is revoked (see below).

2.6 The Governing Council reserves the right to introduce a maximum number of Affiliates.

2.7 Affiliate status will end automatically if the country where the Affiliate is located accedes to the PICES Convention.

2.8 An organization/institution may withdraw from the status of Affiliate by informing the Governing Council in writing. A withdrawal will come into force by the end of the year in which the withdrawal has been declared. Affiliate status may be revoked by the Governing Council at any time.

3 Obligations imposed with the granting of Affiliate status

The granting of Affiliate status to a non-member country research organization/institution shall impose the following obligations:

- to recognise the basic aims and objectives of PICES and to support its work;
- to respect the scientific nature of discussions at all PICES meetings attended by its experts;
- to make a financial contribution to PICES prior to January 1 of the year to which the contribution applies, in an amount to be determined annually by the Governing Council through approval of its budget;
- to serve as the national contact/ correspondent for PICES, making all necessary arrangements or agreements between different interested organizations/ institutions at a national level, while allowing access to PICES activity and information by the entire scientific community relevant to PICES;
- to ensure that the expertise of their participants in PICES Scientific and Technical Committees and expert groups is appropriate to the terms of reference of such groups.

4. Privileges conferred by acceptance of Affiliate status

4.1 The affiliate organization/institute would make a financial contribution to PICES to support the operation of the Organization, but the contribution could be substantially less than the contribution of the Contracting Parties, approximately 10% of the current annual contribution per Contracting Party.

4.2 Scientists from affiliated organizations/ institutes could be members of a Scientific (BIO, FIS, MEQ, POC) and Technical (TCODE, MONITOR) Committee, or a Scientific Program of PICES. They could not chair these Committees/Programs.

4.3 Scientists from affiliate organizations/ institutes could be members of an expert group (Sections, Working Groups, Study Groups, Task Teams, and Advisory Panels) of PICES. They could also co-chair any of these groups. In the case of an Affiliate Co-Chairman, however, an arrangement would be required with one of the Co-Chairmen from a Contracting Party.

4.4 The PICES Rules of Procedure would need to be amended to allow scientists from affiliate organizations/institutes to participate as members of the Scientific and Technical Committees, Scientific Program and all expert groups in addition to the existing provision for Advisory Panels. The specific privileges of participation would need to be resolved for each type of group, depending on the needs of the Organization. For Study Groups, the PICES Rules of Procedure would also need to be amended to allow for Co-Chairmanship (*i.e.*, one Chairman is sufficient if that person is from a Contracting Party; otherwise a Co-Chairman should be chosen who meets the geographic balance requirements).

4.5 The PICES Financial Regulations would need to be amended to reflect financial obligations imposed with the granting of Affiliate status.

4.6 As per the current Trust Fund Guideline (iii), scientists from affiliate organizations/ institutes would not be eligible to apply for financial support to participate in PICES activities. The affiliate organization/ institute would be expected to cover the costs of their scientists' participation.

5. Applying for Affiliate status

A research organization/institution from a non-member country seeking Affiliate status with PICES for the purposes of participating in activities of the Organization shall submit a written application to the Executive Secretary at least 3 months in advance of a PICES Annual Meeting, containing the following information:

- the name of the organization/institution with (tele)communication addresses of its headquarters;
- the national/international affiliation of the institute and its main mandate;
- the research fields and disciplines covered by the organization/institution or its subsidiaries;
- the structure and membership of the organization/institution, including the number of full-time employees;
- the size of its annual budget and source(s) of income.

GC Endnote 7

Study Group on *PICES Communication*

Background

All scientific organizations have a responsibility to communicate their results widely. In the PICES Strategic Plan, the mission calls for: i) synthesizing scientific information regarding the regions, and making the results widely available, and ii) informing interested parties and the public about marine ecosystem issues. The strategies to achieve this mission include Goal 8 ("Make the scientific products of PICES accessible"), which focuses on communicating the results of PICES scientific activities broadly, explicitly mentioning high quality publications, the PICES website, and production and dissemination of educational materials. The plan does not explicitly identify the audiences that should receive this information.

Scientific communication has many dimensions, and the approaches to be taken are dependent upon the audiences one hopes to reach. Audiences may include the scientific community, management agencies, governments, and the general public. Scientists traditionally involved in PICES lack the expertise and, often, the will, to communicate beyond the scientific community. The FUTURE Science Plan has identified the need to improve communications, particularly to science to policy makers and managers. A discussion of the FUTURE Science Plan concluded that the issues and communication challenges apply across the entire PICES community. In addition, a recent review of PICES Publication Program by representatives of the International Association of Marine Science Libraries and Information Centers

(IAMSLIC) made recommendations in certain areas of communication. Thus, it is timely to convene a Study Group, which will address communication in PICES and make recommendations for actions.

PICES is extremely strong in its core capacities, *i.e.*, exchange of ideas and collaboration among scientists in the North Pacific. The evidence for this is seen in the sustained high levels of participation in PICES meetings and expert groups. Publications by North Pacific scientists are reaching major international peer review journals, books and other media. Many of these publications show multiple authors from more than one country, demonstrating evidence of increasing collaboration and communication.

The communication of scientific information to policy makers, managers and society is an increasing priority for PICES because member countries are being asked to explain more about what is happening in the seas. Little is known, systematically, about how scientific information from PICES is delivered on a national and sub-national basis to policy makers and managers. Preliminary information indicates that the delivery pathways differ among PICES member countries. Relatively little attention is given to distributing PICES results to the general public.

An important area that PICES needs to understand is the different cultural views about marine ecosystems across the Pacific Basin. Different attitudes about the importance of marine ecosystems exist on opposite sides of the Pacific and perhaps within countries based on the specification of the objectives. We are at an early stage in the development of ecosystem-based management and can benefit from the pursuit of alternative approaches toward defining ecosystem-based management and national objectives. PICES communications should work to improve the understanding of those attitudes, furthering our ability to collaborate as scientists and as societies.

The overall goal of the Study Group is to identify the target audiences for outputs from PICES activities and to propose mechanisms to communicate with them.

Terms of reference

- To identify PICES objectives for communications consistent with the PICES Strategic Plan, Action Plans of Standing Committees, and the FUTURE Science Plan;
- To evaluate the principal audiences for scientific and other products in PICES;
- To evaluate the role that PICES should play in educating diverse audiences about the marine ecosystems of the North Pacific;
- To review options for PICES products and partnerships (including national member resources) that can accomplish the communication objectives for these audiences;
- To deliver a report on the overall goals of communications that PICES should undertake, with recommendations for how PICES should develop internal structure to accomplish them.

Membership

The Study Group should consist of members appointed by all member countries. Expertise in different aspects of communication (including outreach and public education) should be included.

Term and Schedule

- December 2007: Appoint members from all member countries by e-mail request from the Executive Secretary (action by Council);
- January 2008: Decide upon chairmanship (action by Council), and initiate e-mail communication to refine tasks and develop report outline (action by appointed Study Group Chairman);
- April 2008: Meeting (in person if possible, remotely if required) to develop a rough draft of the report for review and discussion; agree on writing and revision responsibilities among members;
- July 2008: Develop a full draft of the report;
- October 2008: Hold an Open Forum on PICES communications and a meeting of the Study Group at PICES XVII (Dalian, China);
- April 2009: Submit the final report to Governing Council for approval (by correspondence) to allow decisions on recommendations by the Study Group at PICES XVIII (Busan, Korea).

GC Appendix A

2007 Governing Council decisions

07/A/1: Auditor

Council accepted the *FY* 2006 audited accounts.

07/A/2: Annual contributions

i. Council instructed the Executive Secretary to send a letter to Contracting Parties commending them for improved performance in submitting annual contributions for *FY* 2007, and describing the difficulties that late and/or partial payment causes the Organization.
ii. For planning of their funding requests for annual contributions, Contracting Parties should continue to use the guideline generally accepted at the PICES Eighth Annual Meeting (Decision 99/A/2(ii)), which states that the annual contributions will increase at the rate of inflation in Canada.

07/A/3: Budget

i. Council accepted the estimated accounts for *FY* 2007.
ii. Council approved the 2008 budget of $762,000. The amount of $96,000 will be transferred from the Working Capital Fund to balance the budget, setting the total annual contribution at $666,000, and the 2008 annual fee at $111,000 per Contracting Party.
iii. Council decided that the level of the Relocation and Home Leave Fund be allowed to vary between $90,000 and $110,000 to minimize the need for small transfers between funds.
iv. Council approved a transfer from the Working Capital Fund to the Trust Fund to recover the 2007 expenses, and to restore the Trust Fund to the level of $110,000 by the end of the fiscal year.
v. Council approved that $40,000 from the encumbered funds designated for high-priority projects be earmarked for the new PICES integrative scientific program (FUTURE) and the remainder (~$103,000) be earmarked for the North Pacific Ecosystem Status Report.

07/A/4: Scientific cooperation with non-member countries

Council adopted the final report of the Study Group on *Scientific Cooperation between PICES and Non-member Countries*.

07/A/5: Schedule and financing of future Annual Meetings and inter-sessional Science Board/Governing Council meetings

i. Council agreed to provide $40,000 to China to partially cover costs for the PICES Seventeenth Annual Meeting to be held October 23–November 2, 2008, in Dalian.
ii. Council approved the proposal of Korea to host the PICES Eighteenth Annual Meeting from October 23–November 1, 2009, in Busan, with the National Fisheries Research and Development Institute (NFRDI) as the local organizer. The theme of the Annual Meeting will be "*Understanding **e**cosystem dynamics, pursuing ecosystem approaches to management*".
iii. Council accepted an invitation from the United States of America of holding the PICES Nineteenth Annual Meeting in 2010, in Seattle, U.S.A. Interest was indicated in exploring the possibility of a joint ICES-PICES Annual Meeting, with shared science activities and separate business meetings.
iv. Council accepted the same registration fee structure for 2008 as was maintained for 2004–2007:

Type of registration fee	CDN $
Regular	225
Early	150
Student	50
Spousal	50

v. Council approved an inter-sessional Science Board meeting to be held in conjunction with a workshop to develop an Implementation Plan for the new integrative

scientific program of PICES, FUTURE, and accepted an offer from the United States to host both events in Seattle, in April 2008. Holding an inter-sessional Council meeting in 2008 was not supported.

07/A/6: Intern Program

i. Council instructed the Executive Secretary to invite Contracting Parties to provide voluntary contributions to support the Intern Program in 2008 and beyond.
ii. Council extended the deadline of nominations for the 2009 PICES Internship until the Governing Council meeting at PICES XVII.
iii. Council confirmed that the stipend should be kept at the current level of $2,000 per month. The nominating Contracting Party could consider supplementing this modest stipend, depending on the intern's personal circumstances.

07/A/7: Executive Committee of Council for evaluating the Executive Secretary performance

i. In accordance with Financial Regulations 12(i), Council established an Executive Committee to complete annual performance review of the Executive Secretary. Terms of reference and membership of the Executive Committee are listed in *GC Appendix B*.
ii. At its first meeting, the Executive Committee will review achievements of the current Executive Secretary for the previous three years, in preparation for his possible re-appointment. As decision on re-appointment shall be made at least 12 months prior to the end of the term, Council agreed, in accordance with the Article VII of the Convention and Rule 4 of the Rules of Procedure, to vote on the results of the evaluation by correspondence before April 30, 2008.

07/A/8: Deputy Executive Secretary position

Council approved re-appointment of Dr. Stewart (Skip) McKinnell, Deputy Executive Secretary, for a fourth 3-year term to be started September 7, 2008.

07/A/9: PICES Ocean Monitoring Service Award (POMA)

Council approved the establishment of the PICES Ocean Monitoring Service Award (POMA). This award will recognize organizations, groups or individuals that have contributed significantly to the advancement of marine science in the North Pacific through long-term monitoring and/or management of data associated with ocean conditions and marine bio-resources (see description of POMA in *GC Appendix D*). The first award will be given at the 2008 PICES Annual Meeting in Dalian, China.

07/S/1: New integrative scientific program of PICES, FUTURE

Council approved the Science Plan (*GC Appendix C*) for the new PICES integrative scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems).

07/S/2: PICES Sixteenth Annual Meeting

The following workshops are to be convened (a List of Acronyms can be found at the end of the Annual Report):

- A 1-day BIO workshop on "*Oceanic eco-dynamics comparison of subarctic Pacific*";
- A 1-day MEQ workshop on "*Review of selected harmful algae in the PICES Region: IV*. Karenia *and* Prorocentrum" proceeded by a ½-day laboratory demonstration;
- A 1-day MONITOR/ESSAS workshop on "*Status of marine ecosystems in the sub-Arctic and Arctic seas – Preliminary results of IPY field monitoring in 2007 and 2008*";
- A 1½-day CCCC/POC/FIS workshop on "*Climate scenarios for ecosystem modeling (II)*";
- A 1-day CCCC/ESSAS workshop on "*Marine ecosystem model inter-comparisons*".

The following scientific sessions are to be convened (a List of Acronyms can be found at the end of the Annual Report):

- A 1-day Science Board Symposium on "*Beyond observations to achieving*

understanding and forecasting in a changing North Pacific: Forward to the FUTURE";
- A ½-day BIO Contributed Paper Session;
- A 1-day BIO Topic Session on "*End-to-end foodwebs: Impacts of a changing ocean*";
- A ½-day BIO/MEQ Topic Session on "*Seabirds and marine mammals as environmental indicators*";
- A 1-day FIS Contributed Paper Session;
- A ¾-day FIS Topic Session on "*Institutions and ecosystem-based approaches for sustainable fisheries under fluctuating marine resources*";
- A ½-day FIS Topic Session on "*Effects of fisheries bycatch and discards on marine ecosystems and methods to mitigate the effects*";
- A ¾-day MEQ/FIS Topic Session on "*Mariculture technology and husbandry for alternate and developing culture species*";
- A ½-day MEQ Topic Session on "*Connecting the human and natural dimensions of marine ecosystems and marine management in the PICES context*";
- A 1-day MEQ Topic Session on "*Consequences of non-indigenous species introductions*";
- A ½-day MEQ Topic Session on "*Species succession and long-term data set analysis pertaining to harmful algal blooms*";
- A 1-day MONITOR/TCODE/BIO Topic Session on "*Linking biology, chemistry, and physics in our observational systems – present status and FUTURE needs*";
- A 1-day POC Contributed Paper Session
- A ¾-day POC Topic Session on "*Coastal upwelling processes and their ecological effects*";
- A 1-day CCCC/POC Topic Session on "*Marine system forecast models: Moving forward to the FUTURE*".

07/S/3: Inter-sessional meetings/workshops

The following inter-sessional meetings and workshops are to be convened/co-sponsored in 2008 and beyond (a List of Acronyms can be found at the end of the Annual Report):

- A 2-day inter-sessional meeting of WG 19 on *Ecosystem-based management science and its application to the North Pacific*, February 21–22, 2008, Seattle, U.S.A.;
- A 3-day inter-sessional WG 21 meeting to evaluate the protocols and reach final agreement on standards, data elements and data entry templates for the Marine/ Estuarine Invasive Species Database for the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*", March 3–5, 2008, Busan, Korea;
- A 2-day ICES/PICES workshop on "*Environmental interactions of mariculture*", April 14–15, 2008, Victoria, Canada;
- A 3-day CFAME workshop on "*Linking and visualizing climate forcing and marine ecosystem changes: A comparative approach*", April 15–17, 2008, Honolulu, U.S.A.;
- A 2-day workshop to develop an Implementation Plan for FUTURE in conjunction with a 1-day inter-sessional Science Board meeting, April 23–25, 2008, Seattle, U.S.A.;
- An International Symposium on "*Effects of climate change on the world's oceans*" (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR and WCRP), May 19–23, 2008, Gijón, Spain;
- An International Symposium on "*Coping with global change in marine social-ecological systems*" (co-sponsored by GLOBEC, EUR-OCEANS, FAO, IRD, SCOR, IMBER and PICES), July 8–11, 2008 in Rome, Italy;
- A 4-day 2nd PICES Summer School on "*Biomass-based management*", August 22–25, 2008, Hakodate, Japan;
- A 3-day 4th PICES workshop on "*The Okhotsk Sea and adjacent areas*", August 27–29, 2008, Abashiri, Japan;
- An International Symposium on "*Herring: Linking biology, ecology and status of populations in the context of changing environments*" (co-sponsored by ICES, PICES and GLOBEC), August 26–29, 2008, Galway, Ireland;

- ESSAS/PICES workshops at the ESSAS Annual Meeting, September 15–19, 2008, Halifax, Canada;
- ICES/PICES Theme Sessions on "*Coupled physical and biological models: Parameterization, validation, and applications*", "*Marine spatial planning in support of integrated management – tools, methods, and approaches*", and "*New methodology for tracking fish, mammal, and seabird behaviour and migrations*" at the ICES Annual Science Conference, September 22–26, 2008, Halifax, Canada;
- A PICES/ICES Theme Session on "*The effects of ocean acidification on fisheries and ecosystems*" at the International Symposium on "*The ocean in a high CO_2 world – II*" (co-sponsored by SCOR, IOC, IAEA and IGBP), October 6–8, 2008, Monaco;
- An ICES/PICES/GLOBEC workshop on "*Changes in distribution and abundance of clupeiform small pelagic fish in relation to climate variability and global change*", November 3–7, 2008, Kiel, Germany;
- An International Symposium on "*Rebuilding depleted fish stocks: Biology, ecology, social science and management strategies*" (co-sponsored by ICES, PICES and UNCOVER), November 3–6, 2009, Warnemünde/Rostok, Germany;
- An International Symposium on "*Collection and interpretation of fishery-dependent data*" (co-sponsored by ICES, FAO and PICES), summer 2010, Galway, Ireland.

07/S/4: Travel support

PICES will provide travel support for:

PICES XVII

- Invited speakers for Topic Sessions at the Annual Meeting with the normal allocation of approximately $5,000 per Committee and the CCCC Program; additional requests are subject to fund availability;
- Six invited speakers for the Science Board Symposium;
- An invited participant to attend the initial meeting of a Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim*;
- Two invited speakers for the BIO workshop on "*Oceanic ecodynamics comparison of subarctic Pacific*";
- Two invited speakers for the MEQ workshop on "*Review of selected harmful algae in the PICES region: IV.* Karenia *and* Prorocentrum";
- An invited speaker for the MONITOR/ ESSAS workshop on "*Status of marine ecosystems in the subarctic and arctic seas – Preliminary results of IPY field monitoring in 2007 and 2008*";
- An invited speaker for the CCCC/ESSAS workshop on "*Marine ecosystem model inter-comparisons*".

Inter-sessional meetings

- A representative of MONITOR to attend the Eleventh Session of the GOOS Scientific Steering Committee (GSSC-XI), April 7–10, Paris, France;
- Asian scientists (up to $10,000) to participate in the ICES/PICES meeting on "*Environmental interactions of mariculture*", April 14–15, 2008, Victoria, Canada;
- A Co-Chairman of WG 20 on *Evaluations of Climate Change Projections*, a Korean scientist (Yellow Sea/East China Sea fish expert) and a North American scientist (California Current fish or plankton expert) to attend the CFAME workshop on "*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*", April 15–17, 2008, Honolulu, U.S.A.;
- A PICES affiliate member of SCOR Working Group 125 on *Global Zooplankton Comparisons* to attend the Working Group meeting and the workshop on "*Zooplankton and climate: Response modes and linkages among regions, regimes, and trophic levels*", May 15–18, 2008, Gijón, Spain;
- PICES convenor and members of the Scientific Steering Committee for the International Symposium on "*Effects of climate change on the world's oceans*", May 19–23, 2008, Gijón, Spain;

- A PICES representative to attend the 41st Session of the IOC Executive Council, June 24–July 1, 2008, Paris, France;
- A PICES member of the Discussion Panel for the International Symposium on "*Coping with global change in marine social-ecological systems*", July 8–11, 2008, Rome, Italy;
- A guest lecturer and early career scientists from Asian to attend the 2nd PICES Summer School on "*Biomass-based management*", August 22–25, 2008, Hakodate, Japan;
- An invited speaker and Russian scientists to participate in the 4th PICES workshop on "*The Okhotsk Sea and adjacent areas*", August 27–29, 2008, Abashiri, Japan;
- PICES members of the Scientific Steering Committee for the International Symposium on "*Herring: Linking biology, ecology and status of populations in the context of changing environments*", August 26–29, 2008, Galway, Ireland;
- A member of WG 20 and a representative of the CCCC Program (an ecosystem modeler) to attend the ESSAS Annual Meeting, September 15–19, 2008, Halifax, Canada;
- PICES convenors for the joint ICES/PICES Theme Sessions at the ICES Annual Science Conference, September 22–26, 2008, Halifax, Canada;
- A PICES representative and 1 or 2 invited speakers to attend the International Symposium on "*The ocean in a high CO_2 world – II*", October 6–8, 2008, Monaco;
- A PICES representative to attend the NPAFC Sixteenth Annual Meeting, November 17–21, 2008, Seattle, U.S.A.;
- A PICES convenor for the ICES/PICES workshop on "*Changes in distribution and abundance of clupeiform small pelagic fish in relation to climate variability and global change*", November 2008, Kiel, Germany;
- A PICES convenor for the symposium on "*Rebuilding depleted fish stocks: Biology, ecology, social science and management strategies*", November 2–5, 2009, Warnemünde/Rostok, Germany;
- A PICES convenor/speaker for the International Symposium on "*Collection and interpretation of fishery-dependent data*", summer 2010, Galway, Ireland;
- A member of MIE-AP (Dr. Andrey Suntsov, Newport, U.S.A.) to visit University of British Columbia (Vancouver, Canada) to complete identification of fish collected during the MIE-1 cruise.

07/S/5: Publications

The following publications are to be produced:

Special issues of primary journals (2008–2009)

- *Plankton and Benthos Research* (spring 2008; Guest Editors: H. Iizumi and K. Ishii) – selected papers from the PICES XV Topic Session on "*The human dimension of jellyfish blooms*";
- *Progress in Oceanography* (2008; Guest Editors: H. Batchelder and S. Kim) – selected papers from the PICES/GLOBEC Symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*";
- *Journal of Marine Systems* (2008; Guest Editors: K.-I. Chang, S.-I. Ito, C. Mooers and J.-H. Yoon) – selected papers from the 2006 CREAMS/PICES workshop on "*Model–data inter-comparison for the Japan/East Sea*";
- *ICES Journal of Marine Science* (2008; Guest Editors: M. Dagg, R. Harris, L. Valdez and S.-I. Uye) – Selected papers from the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*";
- *Deep-Sea Research II* (2008; Guest Editors: W. Peterson and S. Kawaguchi) – Selected papers on krill from the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*";
- *ICES Journal of Marine Science* (2008; Guest Editors: F. Mueter and E. North) – Selected papers from the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*" (it will be a section in a regular issue);
- *Deep-Sea Research II* (2008/09; Guest Editors: A. Tsuda, M. Wells, M. Uematsu and H. Saito) – Selected papers from the SEEDS-II experiment;

- *Journal of Oceanography* (2009; Guest Editors: T. Saino, J.R. Christian, K. Lee and TBA) – Selected papers from the PICES XV Topic Session on "*Decadal changes in carbon biogeochemistry in the North Pacific*" (it will be a section in a regular issue);
- *Journal of Northwest Atlantic Fishery Science* (2009; Guest Editors: R. Brodeur, M. Dickey-Collas and E. Trippel) – Selected papers from the International Symposium on "*Reproductive and recruitment processes of exploited marine fish stocks*";
- *Fisheries Research* (2009; Guest Editors: G.H. Kruse, Y. Ishida, T. Perry, V.I. Radchenko and C.-I. Zhang) – Selected papers from the PICES XVI Topic Session on "*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*";
- *Deep-Sea Research II* (2009; Guest Editors: W. Sydeman, S. McKinnell and S. Minobe) – selected papers on results of PICES XVI Topic Session on "*Phenology and climate change in the North Pacific: Implications of variability in timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*";
- Progress in Oceanography (2009; Guest Editors: B.A. Megrey, J.S. Link and E. Moksness) – selected papers from the ICES/ PICES Theme Session on "*Comparative marine ecosystem structure and function: Descriptors and characteristics*" at the 2007 ICES Annual Science Conference.

PICES Scientific Report series (2008–2010)

- Report of 2007 FIS workshops on "*Forecasting climate impacts on fish production*" (2008; Editors: A.B. Hollowed, R.J. Beamish and M.J. Schirripa);
- Final report of WG 16 on *Climate Change Shifts in Fish Production, and Fisheries Management* (approved in 2002 for publication in 2004; delayed until early 2008 pending review of third draft by FIS; Editors: R.J. Beamish and A. Yatsu);
- Results of annual MEQ workshops on "*Review of selected harmful algae in the PICES region*": Alexandrium *and* Pseudo-nitzchia (2005), Cochlodinium *and* Dinophysis (2006) *and* Heterosigma (2007) (2009/2010; Editors: TBD);
- Final report of WG19 on *Ecosystem-based management science and its application to the North Pacific* (early 2009; Editors: G. Jamieson, P. Livingston and C.-I. Zhang);
- Final report for the CCCC Program (2009; Editor: M. Kishi);
- A summary of the activities of the CFAME Task Team (may be merged with the final CCCC report).

PICES Technical Report series (2008)

- An updated version of the report on "*Metadata federation of PICES member countries*".

07/S/6: Future of current groups

i. The revised terms of reference for MONITOR were approved (*GC Appendix B*).
ii. The following Study Groups completed their terms of reference and should be disbanded (final reports of these groups are included elsewhere in this Annual Report):
    - A Study Group on *Scientific Cooperation between PICES and Non-member Countries* (under the direction of Council);
    - A Study Group on *Ecosystem Status Reporting* (under the direction of Science Board);
    - A Study Group on *Marine Aquaculture and Ranching in the PICES Region* (under the direction of Science Board);
    - A Study Group *to Develop a Strategy for GOOS* (under the direction of MONITOR).

07/S/7: New PICES groups

i. A Study Group on *PICES Communication* has been established under the direction of Council, with terms of references, membership and timeline as described in *GC Appendix B* and *GC Endnote 7*.
ii. A Working Group (WG 22) on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* has been established under the direction of BIO, with 3-year duration and terms of reference

as described in *GC Appendix B*.

iii. A Working Group (WG 23) on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* has been established under the direction of BIO, with 3-year duration and terms of reference as described in *GC Appendix B*.

07/S/8: Chairmen and Vice-Chairmen for permanent Committees and expert groups

The following reflects changes and continuations in Chairmanship/Vice-Chairmanship for Scientific and Technical Committees and expert groups:

- Dr. John E. Stein (U.S.A.) to replace Dr. Kuh Kim (Korea) as Chairman of Science Board;
- Dr. Sinjae Yoo (Korea) to become Vice-Chairman of Science Board;
- Dr. Michael J. Dagg (U.S.A.) to serve a second 3-year term as BIO Chairman;
- Dr. Hiroya Sugisaki (Japan) to replace Dr. Jeffrey M. Napp (U.S.A.) as MONITOR Chairman;
- Dr. Phillip R. Mundy (U.S.A.) to replace Dr. Sei-Ichi Saitoh (Japan) as MONITOR Vice-Chairman;
- Dr. Michael G. Foreman to serve a second 3-year term as POC Chairman;
- Dr. Bernard A. Megrey (U.S.A.) to replace Dr. Igor Shevchenko (Russia) as TCODE Chairman;
- Dr. Kyu-Kui Jung (Korea) to replace Dr. Megrey as TCODE Vice-Chairman;
- Dr. Vasily Radashevsky (Russia) to serve as Co-Chairman of WG 21 on *Non-indigenous Aquatic Species*;
- Dr. Kerim Aydin (U.S.A.) to continue as Co-Chairman of CFAME up to, but not including, PICES XVII.

07/S/9: Relations with other organizations and programs

Council approved the revised *Standing List of International and Regional Organizations and Programs* (*SB Endnote 3*) and agreed with the identified priorities for interaction in 2007-2008.

GC Appendix B

Executive Committee of Council for evaluating the Executive Secretary performance

Terms of reference

1. The Executive Committee will complete an annual review of the Executive Secretary performance by April 1 each year, following the general guideline for executive positions in the Canadian public service, and will report to Council at each Annual Meeting.
2. The review will include a written description of achievements for the previous year and tasks for the coming year, along with an overall evaluation of the achievements.
3. The evaluation will be used to set the level of performance pay, following the Canadian policy for executives.

Membership

The Executive Committee will be chaired by the PICES Chairman, with the Chairmen of Science Board and F&A Committee as members.

Study Group on *PICES Communication*

Terms of reference

1. To identify objectives for communications consistent with the PICES Strategic Plan, Action Plans of Standing Committees, and the FUTURE Science Plan;
2. To evaluate the principal audiences for scientific and other products in PICES;
3. To evaluate the role that PICES should play in educating diverse audiences about the marine ecosystems of the North Pacific;
4. To review options for PICES products and partnerships (including national member resources) that can accomplish the communication objectives for these audiences;
5. To deliver a report on the overall goals of communications that PICES should undertake, with recommendations for how PICES should develop internal structure to accomplish them.

Technical Committee on Monitoring (MONITOR)

Revised terms of reference

1. Identify principal monitoring needs of the PICES region, and develop approaches to meet these needs, including training and capacity building;
2. Serve as a forum for coordination and development of inter-regional and international components of the North Pacific Ocean Observing Systems, including the GLOBAL Ocean Observing System, GOOS. Facilitate method development and inter-comparison workshops to promote calibration, standardization and harmonization of data sets;
3. Serve as the senior editorial board of the North Pacific Ecosystem Status Report, reporting to Science Board; serve as senior editorial board for PICES web pages on major monitoring efforts in the North Pacific, including the annual reporting of important time series;
4. Recommend interim meetings to address monitoring needs and PICES–GOOS activities;
5. Provide annual reports to Science Board and the Secretariat on monitoring activities in relation to PICES;
6. Interact with TCODE on management issues of monitoring data.

Note that TOR 3 may be further modified based on the decision of the Science Board on how to proceed with the writing and production of the Ecosystem Status Report.

Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean*

Terms of reference:

1. Compile and synthesize available iron biogeochemistry data in the North Pacific;
2. Review the past and ongoing laboratory, field and modeling studies on iron biogeochemistry and its impact on biological productivity and marine ecosystems in the North Pacific Ocean;
3. Determine the natural supplies of iron to the North Pacific, which includes atmospheric dust transport and movement of iron-enriched waters, and examine linkages between iron supply and ecosystem responses;
4. Identify gaps and issues related to experimental and modeling activities, encourage and plan national and international scientific programs on iron biogeochemistry and its impact on marine ecosystems in the North Pacific;
5. Elucidate the role of iron as a potential regulator of harmful algal bloom (HAB) in coastal ecosystems of the North Pacific.

Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim*

Terms of reference:

1. Assemble lists of existing data (including metadata) that contribute to an analysis of the comparative ecology of *Euphausia pacifica* and *Thysanoessa* species. Identify gaps in our understanding of krill ecology, life history and population dynamics.
2. Prepare a research plan to help fill gaps in our understanding, and aid regional collaborative research efforts. Explore ways and means of facilitating exchange of scientists between laboratories and on research cruises.
3. Convene "hands-on" practical workshops with krill biologists (including students and established scientists) from PICES member countries to help them initiate and carry out krill research programs. These workshops could be convened before each PICES meeting, or at other times as appropriate. Protocols for experimental work have been already published on the PICES website at: http://www.pices.int/projects/Euphasiid/PICES%20Protocols%20COMPLETE.pdf.
4. Initiate euphausiid research programs in PICES member countries which will include sampling on a regular basis (biweekly-monthly) to determine seasonal cycles of spawning and growth, and incubations of live animals for measurement of brood size and molting rates.
5. Work with modelers to better parameterize euphausiids in the NEMURO and other models so as to explore their role in coastal and oceanic food chains.
6. Convene a krill workshop at the GLOBEC Open Science Meeting (June 2009).
7. Organize a Krill Symposium or a Topic Session at PICES XX in 2011, and submit a set of krill synthesis papers for a special issue of a scientific peer-reviewed journal.

GC Appendix C

A New Science Program for PICES: FUTURE

FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems) is an integrative Science Program undertaken by the member nations and affiliates of PICES to understand how marine ecosystems in the North Pacific respond to climate change and human activities, to forecast ecosystem status based on a contemporary understanding of how nature functions, and to communicate new insights to its members, governments, stakeholders and the public.

FUTURE will make advances by:

- Investigating the mechanisms underlying ecosystem response to natural and anthropogenic forcings;
- Improving forecasting capabilities and providing estimates of the uncertainty associated with these forecasts; and
- Developing more effective ways to convey knowledge and predictions.

FUTURE will build upon the Climate Change and Carrying Capacity (CCCC) Program that PICES initiated in cooperation with GLOBEC in the mid-1990s. The CCCC Program contributed significantly in stimulating and facilitating research on the links between climate variability, more than global warming, and marine ecosystem responses and dynamics with an emphasis on understanding how climate might alter the carrying capacity for a few species of fish. It then evolved into a program with much broader interests providing the first systematic, North Pacific-wide attempt to understand and document the physical and ecological processes that link large, low-frequency signals with population and ecosystem dynamics, which led to significant improvements in biophysical modeling and coupled climate–ocean modeling. Because of CCCC we know far more about the role of iron in oceanic systems, about direct and indirect effects of climate on marine organisms, populations and ecosystems, and about what processes are likely the most important—meaning we have improved understanding of the mechanisms. The CCCC Program emphasized climate change and impacts only, whereas FUTURE will place greater emphasis on societal concerns that arise from three potential threats to North Pacific ecosystems:

- Irreparable damage to non-renewable resources and the loss of resilience and productivity of natural environmental capital and services such as renewable resources and habitats;
- Loss of socioeconomic opportunities due to natural and anthropogenic change in marine ecosystems; and
- Increased challenges faced by managers and policy makers from unpredictable ecosystem responses to climate change and human activities.

These issues are driving a need to increase basic scientific understanding of ecosystem processes, to reduce predictive uncertainty of the ecological consequences of these threats, and to translate the information for use in decision making. FUTURE will build on improved understanding of marine ecosystem structure and function that has been gained during the past decade through diverse monitoring, observation, and retrospective studies and modeling activities conducted by PICES countries.

The success of FUTURE will require that our improved understanding of processes and mechanisms leads to an increased forecasting capability and to increased societal awareness of the status of the North Pacific ecosystems. The linkages between climate, ecosystems and societies will be explored to clarify both how human activities will alter the ecosystems of the North Pacific and how options for human use of these ecosystems will change.

Scientific Priorities

- The effects of climate and climate change on physical, geochemical and biological processes at geographical scales ranging from the North Pacific basin and its marginal seas to the coastal regions of interest to PICES member countries;
- Marine ecosystem responses on seasonal to decadal time scales and the consequences of these responses to ecosystem goods and services (*e.g.*, provisioning of foods, regulation of carbon and nutrient cycles, cultural and recreational benefits);
- Ecological interactions and connections between estuarine, coastal and offshore waters, the western and eastern Pacific, and the northern and equatorial Pacific;
- Direct and indirect effects of human activities, such as fishing, aquaculture, introduced species, habitat alteration, pollution, and greenhouse gas emissions and their consequences for member countries;
- Cumulative effects of multiple ecosystem stresses on biological diversity and ecosystem resilience and productivity with a better understanding of thresholds, buffers and amplifiers of change;
- Risk-based ecological assessments within a policy/management framework to communicate future states of nature, their implications, and uncertainties to decision-makers and the public.

Scientific Imperative

The Intergovernmental Panel on Climate Change (IPCC) concluded, in its fourth assessment report in 2007, that the evidence for global warming of the climate system is unequivocal:

- Globally averaged air and ocean temperatures are increasing, accompanied by widespread melting of snow and ice raising the globally averaged sea level. Average northern hemisphere air temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past 1300 years.
- Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.
- Anthropogenic warming could lead to some impacts that are abrupt, irreversible and severe, depending upon the rate and magnitude of the climate change.

It is against this backdrop of change that PICES is embarking on its next major Scientific Program. It is clear that increasing concentrations of greenhouse gases have launched the world onto a trajectory of change without a clear sense of the ultimate consequences. What is not so clear, and this must be a focus of FUTURE, is the manner and degree to which these global or hemispheric changes are manifested in the North Pacific Ocean and at a regional scale on land and in coastal seas. Both changing climate and increasing human activities are causing changes in North Pacific ecosystems. These changes are affecting ecosystem composition, structure and function in ways that are incompletely understood and possibly unprecedented. There is uncertainty of the magnitude and extent of the change that is occurring because large parts of the North Pacific Ocean and its marginal seas are not monitored or observed regularly. To improve our understanding we must increase observations of the North Pacific and study the mechanisms that underlie an ecosystem's response to the various pressures.

The North Pacific Ocean and its marginal seas are often characterized by strong contrasts among its sub-regions, cross-basin inverse correlations of sea surface temperature being foremost among these. The area of concern to PICES is so large that warming in one area is often accompanied by cooling in another. Understanding how these contrasts are likely to change, if at all, will be an important element of FUTURE. But global warming and its consequences are not the only issue. Natural and anthropogenic pressures are causing the oceans to acidify, while pollution, extirpations, invasive species, anoxia, habitat loss, and exploitation affect the coastal zones. Many species have not yet recovered from past or current

over-exploitation, and there is ongoing damage to non-renewable resources. Plant and animal abundance and distribution, productivity of exploited and unexploited species, food-webs, biodiversity and general ecological resilience are all affected by these pressures.

While the trajectory of some of the major changes is now generally known, there is a great deal of uncertainty about their local magnitudes, their potential interactions and their impacts on North Pacific ecosystems. This uncertainty is caused by a lack of understanding of how the major drivers will individually, collectively and interactively affect ecosystem composition, structure and function and insufficient knowledge of the linkages between oceanic, coastal and terrestrial ecosystems. These major uncertainties hamper the ability of the scientific community to provide reliable estimates of the future status of ecosystems. FUTURE will improve these estimates and communicate them effectively so that science can better support policy. This view has led to the identification of an overarching question for FUTURE.

"What is the future of the North Pacific given current and expected pressures?"

Research Themes

FUTURE is organized around three research themes that are best characterized as key questions. Each of the key questions has a list of more specific questions that define an approach to address a research theme.

1. What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?
   1.1. What are the important physical, chemical and biological processes that underlie the structure and function of ecosystems?
   1.2. How might changing physical, chemical and biological processes cause alterations to ecosystem structure and function?
   1.3. How do changes in ecosystem structure[1] affect the relationships between ecosystem components[2]?
   1.4. How might changes in ecosystem structure and function affect an ecosystem's resilience or vulnerability to natural and anthropogenic forcing?
   1.5. What thresholds, buffers and amplifiers are associated with maintaining ecosystem resilience?
   1.6. What do the answers to the above sub-questions imply about the ability to predict future states of ecosystems and how they might respond to natural and anthropogenic forcing?

2. How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?
   2.1. How has the important physical, chemical and biological processes changed, how are they changing, and how might they change as a result of climate change and human activities?
   2.2. What factors might be mediating changes in the physical, chemical and biological processes?
   2.3. How does physical forcing, including climate variability and climate change, affect the processes underlying ecosystem structure and function?
   2.4. How do human uses of marine resources affect the processes underlying ecosystem structure and function?
   2.5. How are human uses of marine resources affected by changes in ecosystem structure and function?

[1] Such as species composition, population structure and dynamics, *etc*.
[2] Such as species interactions, habitat usage, biological rates and biological diversity.

2.6. How can understanding of these ecosystem processes and relationships, as addressed in the preceding sub-questions, be used to forecast ecosystem response?
2.7. What are the consequences of projected climate changes for the ecosystems and their goods and services?

3. How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?
   3.1. What are the dominant anthropogenic pressures in coastal marine ecosystems and how are they changing?
   3.2. How are these anthropogenic pressures and climate forcings, including sea level rise, affecting nearshore and coastal ecosystems and their interactions with offshore and terrestrial systems?
   3.3. How do multiple anthropogenic stressors interact to alter the structure and function of the systems, and what are the cumulative effects?
   3.4. What will be the consequences of projected coastal ecosystem changes and what is the predictability and uncertainty of forecasted changes?
   3.5. How can we effectively use our understanding of coastal ecosystem processes and mechanisms to identify the nature and causes of ecosystem changes and to develop strategies for sustainable use?

Related to all three research themes is the goal of improving our capability to convey in a clear and effective way how societies will be affected by a changing North Pacific marine environment. The following question captures the goal of improved communication of the science from FUTURE.

"How can forecasts, uncertainty and consequences of ecosystem change be communicated effectively to society?"

Scientific Strategies

Scientific strategies for FUTURE will be fully developed in the FUTURE Implementation Plan. These strategies will include data compilation and retrospective studies, monitoring, mathematical modeling and process studies, all done with the FUTURE perspectives of understanding, forecasting and communicating.

Data compilation and retrospective studies will be used to identify the key physical, chemical and biological processes that are at highest risk from climate change and other anthropogenic stresses. Recommendations will be developed on future monitoring of the North Pacific so that ecosystem change of societal importance can be detected and understood. Monitoring will also provide the data needed for mathematical model development that will range from fine-scale models for coastal areas to whole ecosystem models of multiple trophic levels, including humans and top-predators. Improved understanding of mechanisms will be essential to understand how human uses of the ecosystem and climate change may interact, as well as to improve the capacity for forecasting ecosystem response and consequences of climate change for ecosystem goods and services.

As forecasting is a central element of FUTURE, it is important to note that specific forecasting strategies vary according to temporal and spatial scales. Seasonal forecasts of ecosystems rely on observations and seasonal forecasts of physical and chemical conditions which often depend on the output of operational mid-range weather forecasts. Regional forecasts will require accurate downscaling of global climate models/projections and, at times, linkage of oceanic models to hydrographic models of watersheds to capture the dynamics of coastal ecosystems influenced by large rivers. Only very recently have efforts been underway to downscale global climate projections for use at local scales. Due to their relatively coarse spatial resolution, existing climate models can be more readily used for basin-scale forecasts.

Forecasts of the state of marine ecosystems on decadal time scales require knowledge of the linkages and relationships within the present system, understanding of how these linkages might change with changing climate, and a good comprehension of future environmental conditions. Currently, efforts are being devoted to the latter. During the course of FUTURE, reasonable forecasts of the physical environment will be anticipated and used as they emerge. On multi-decadal time scales, the global warming signature may dominate internal climate variability and this will allow projections for marine ecosystems from global warming scenarios for the North Pacific. While forecasts of the future of North Pacific ecosystems will be a focus of FUTURE, nowcasts of the current state of ecosystems will provide an important context for predictions of future states.

Improving the understanding of mechanisms and increasing forecasting capability will require improved coordination of data accessibility and dissemination, evaluation and application of new technologies from molecular and genetic techniques to remote sensing. Finally, informational tools (*e.g.*, synthesis documents, websites and translations of the science for non-scientific audiences) that are specifically designed to work for each member country will be needed to effectively deliver the science from FUTURE to the public and governments of PICES member countries.

Anticipated Benefits

The scientific research, communication and outreach that occur during the 10-year life of FUTURE will increase understanding of the processes and mechanisms regulating ecosystems of the North Pacific and provide a sound scientific basis for developing scenarios of ecosystem response to climate change and other human-use influences. The anticipated benefits and products will include:

- Increased understanding of physical, chemical and biological linkages and ecosystem responses to anthropogenic and climate forcings;
- Coordinated monitoring and descriptions of the current state of ecosystems;
- Forecasts of future states of North Pacific marine ecosystems and their associated uncertainty;
- Better quantitative and qualitative forecasts, with specified uncertainty, of ecosystem responses to climate change and increasing human influence;
- IPCC-like reports on responses of North Pacific ecosystems to climate change;
- An improved scientific basis for managing coastal ecosystems to sustain ecosystem services and to mitigate various environmental problems;
- Quantification of the benefits and risks associated with different management strategies;
- Region-specific assessments of topical issues (*e.g.*, harmful algal blooms, eutrophication, native and alien species range changes, anoxia, and ocean acidification);
- Increased data sharing, access and dissemination with a focus on coordination and metadata;
- Increased marine science capabilities in PICES member countries;
- Increased participation in PICES of younger scientists and a greater role for social and economic scientists;
- Increased public awareness of the ecosystem changes in the North Pacific.

FUTURE will improve understanding of the North Pacific Ocean, including its climate, biological processes and human communities, and will enhance wise use of this information by governments and society at large.

GC Appendix D

PICES Ocean Monitoring Service Award (POMA)

Background

Progress in many aspects of marine science is based on ocean observations, monitoring, and the management and dissemination of the data provided by these activities. Long-term monitoring observations are particularly critical to detecting and understanding ecosystem changes. It is widely recognized that these fundamental activities often lack the glamour and respect that typically accompany scientific achievements that rely on monitoring and observation. Unfortunately, the consequences are that monitoring activities are often taken for granted or even targeted for budget cuts when PICES member countries experience financial constraints. With this in mind, it was proposed at the 2006 Annual Meeting in Yokohama, Japan, that a new PICES award be established to acknowledge monitoring and data management activities that contribute to the progress of marine science in the North Pacific. The principles of the award were approved at the 2007 inter-sessional Science Board/Governing Council meeting, also in Yokohama, and the name and description of the award were finalized at the 2007 Annual Meeting in Victoria, Canada.

Aims

The PICES Ocean Monitoring Service Award (POMA) aims to recognize organizations, groups and outstanding individuals that have contributed significantly to the advancement of marine science in the North Pacific through long-term ocean monitoring and data management. The award also strives to enlighten the public on the importance of those activities as fundamental to marine science. It draws attention to an important aspect of the PICES Convention that is not so much in the limelight: "*to promote the collection and exchange of information and data related to marine scientific research in the area concerned*."

Eligibility

The award is given for significant contributions to the progress of marine science in the North Pacific through long-term monitoring operations, management of data associated with ocean conditions and marine bio-resources in the region, or both categories. Recipients may include, for example, research vessels, research or administrative institutes or portions thereof, or technical groups involved in monitoring, data management and dissemination, or a combination of these activities. Outstanding individual efforts may also be recognized.

Nomination and selection

Nominations from individuals or groups from PICES member countries should be sent with supporting documentation to the Executive Secretary by the deadline specified in the *Call for Nominations* at the PICES website. The Technical Committee on Monitoring (MONITOR) and Technical Committee on Data Exchange (TCODE) will evaluate independently the documents submitted with each nomination, and recommend some or all of the nominations for consideration by Science Board. Evaluations will include the relevance, duration and balance of activities (ocean observations, resource monitoring, data management, *etc*.). If more than one nomination is considered worthy of recognition by MONITOR or TCODE, rank preferences will be provided to Science Board by each Technical Committee. A maximum of one award will be given each year. To keep a large pool of potential candidates, Science Board will reserve any surplus of recommendations for review in subsequent years. Those nominated but not recommended by a Technical Committee must be re-submitted if they are to be considered for the next year.

Award and presentation

The award consists of a certificate signed by the PICES Chairman and the PICES Science Board Chairman, which will be presented to the recipients (or their representative) at the Opening Session of the PICES Annual Meeting. No financial support from PICES will be provided to the recipient to attend the Annual Meeting where

the award is given. Should any representative be unable to attend the Annual Meeting, a Delegate of the recipient's country will be asked to accept the award on behalf of the recipient.

REPORT OF THE FINANCE AND ADMINISTRATION COMMITTEE

The Finance and Administration Committee (hereafter F&A) met from 09:00–15:30 on October 31, and from 10:00–11:00 on November 2, 2007, under the chairmanship of Dr. Laura Richards.

Opening remarks (Agenda Item 1)

The Chairman called the meeting to order, welcomed the participants and requested an introduction of members for each delegation. All Contracting Parties were present at the meeting (*F&A Endnote 1*).

Adoption of agenda (Agenda Item 2)

The Committee reviewed and approved the draft agenda (*F&A Endnote 2*).

Audited accounts for *FY* 2006 (Agenda Item 3)

The *FY* 2006 financial statements were submitted to *Flader & Hale* on March 22, 2007, and the Auditor's Report was completed on April 5, 2007. Hard copies of the report were distributed to all Contracting Parties at the fifth inter-sessional Council meeting held April 20, 2007, in Yokohama, Japan. Some minor mistakes were discovered in the text of the report (not in the numbers). After correcting these mistakes, the edited version of the 2006 Auditor's Report (*F&A Endnote 3*) was circulated by e-mail and by mail to all Contracting Parties at the end of April. In the auditor's opinion, the financial statements are an accurate representation of the financial position of the Organization as of December 31, 2006. The Committee reviewed the Auditor's Report and recommended it for approval by Council.

Annual contributions (Agenda Item 4)

As stated in Financial Regulation 5(ii), all national contributions to PICES "*shall be considered due as of the first day of the financial year (January 1) to which they relate*". The Executive Secretary reported on the 2007 annual fee payment dates, and provided information on the payment schedule of national contributions for the last 8 years (*F&A Endnote 4*).

The Committee noted that all Contracting Parties met their financial obligations for 2007. China explained that their payment was later than the other Contracting Parties because of the timing of their budget approval process. The Committee recommended that Council instruct the Executive Secretary to send a letter to Contracting Parties commending them for their performance in submitting annual contributions for 2007, and describing the difficulties that late and partial payment causes the Organization.

Both Japan and China expressed concerns about the continual increases in the annual contributions. However, the Committee continued to recommend that for planning purposes, Contracting Parties should use the guideline generally accepted at the PICES Eighth Annual Meeting (Decision 99/A/2(ii)), which states that "*the annual contributions will increase at the rate of inflation in Canada*". This should assist member countries in preparing timely funding requests to cover annual contributions, and the Executive Secretary in developing future budgets.

Fund-raising activities (Agenda Item 5)

The Executive Secretary reported on fund-raising efforts for the period since PICES XV (*F&A Endnote 5*). Fund-raising continues to be an important component of PICES activities, and about a third of the current operational budget is supported by external contributions and partnerships. In order to help manage the extra workload and offset extra expenses of the Secretariat, an overhead is now being charged to some projects (where appropriate). The overhead funds can be used, if necessary, to hire contract help.

Report on PICES Publication Program (F&A Agenda Item 6)

Publishing is an expensive and time-consuming activity; however the products generated are important in fulfilling the Organization's mission. At PICES XV (October 2006, Yokohama, Japan), the F&A Committee directed the Executive Secretary to undertake a review of the PICES Publication Program, with a focus on the option of a transition to electronic publishing.

The International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) was requested to perform the review. It was carried out by two members of IAMSLIC, Janet Webster (Oregon State University Libraries, Newport, OR) and Brian Voss (NOAA Libraries, Seattle, WA), who worked closely with the PICES Secretariat throughout the review process. According to recommendations from the F&A Committee, the workplan aimed to:

1. Explore the impact of PICES publications on the scientific and management community;
2. Breakdown PICES publications into various categories and review for each category: (a) printing and distribution costs; (b) current distribution; (c) current coverage in indexing and abstracting services; (d) options for creating digital format; and (e) options for archiving in both digital and print formats;
3. Examine impacts of moving the existing print distribution system to an increased reliance on digital formats, and explore mitigation measures to rectify any resulting distribution problems;
4. Examine impacts on Secretariat infra-structure and document archival processes;
5. Discuss impacts of any changes in printing/distribution on each of the Contracting Parties;
6. Recommend options and an Action Plan to the F&A Committee.

Janet Webster and Brian Voss presented their findings and recommendations to the Committee (*F&A Endnote 6*). The complete document entitled "2007 Review of PICES Publication Program" is included elsewhere in this Annual Report. The Committee expressed thanks to IAMSLIC for their complete and thorough review. The Committee noted that the Action Plan was presented without an indication of the priority for each item. Furthermore, some items were cheap and easy to implement, while others required a funding commitment. The Committee recommended that (1) the Action Plan be adopted in principle, (2) implementation of the components proceed with the assistance of the PICES intern and any budget flexibility, and (3) the Executive Secretary develop priorities and costing and report on progress at PICES XVII.

Financing of high priority projects (Agenda Item 7)

The Committee discussed the usage of the encumbered funds designated for high-priority PICES projects (about $143,000), as identified by Science Board (see also F&A Agenda Item 9e). The Committee recommended that $40,000 be earmarked for the development of FUTURE, the new integrative scientific program of PICES, and that the remainder be earmarked for the preparation of the next North Pacific Ecosystem Status Report. The Committee noted that additional funds will be required to complete the status report under the proposed plan and recommended a further review of costs. Korea offered a voluntary contribution of $40,000 in 2008 to support the project, which was acknowledged with thanks.

PICES Intern Program (Agenda Item 8)

The Committee reviewed the current status of the Intern Program. Mr. Xuewu Guo (Yellow Sea Fisheries Research Institute, Chinese Academy of Fisheries Sciences) was selected as the intern at the 2006 inter-sessional Governing Council meeting (April 2006, Honolulu, U.S.A.). His term started on February 1, 2007. Because of the excellent performance of Mr. Guo and additional funding received for the Intern Program, the originally-offered 8-month term was extended to 12 months. This allowed Mr. Guo to be involved in the organization of PICES XVI (October 2007, Victoria, Canada) and preparation of the 2007 Annual Report.

At PICES XV (October 2006, Yokohama, Japan), Council extended the deadline of nominations for the 2008 PICES Internship until the 2007 inter-sessional Governing Council meeting (Decision 06/A/8(iii)). No applications were received by that time. On July 23, 2007, Mr. Key-Seok Choe (Project Management Team, Planning Department, KORDI) was nominated and consequently approved as the intern for the 2008 term. An offer was made to Mr. Choi on July 30, 2007, and it was accepted on July 31, 2007. He plans to start work at the Secretariat on February 1, 2008. The initial period of his appointment was 8 months. However, at the Committee meeting, Korea announced a voluntary contribution of $10,000 in 2008, which will allow Mr. Choe's term to be extended to 12 months.

Given that Mr. Choe's term will continue until January 31, 2009, the Committee recommends that the deadline for nominations for the next intern be extended until the first Governing Council session at PICES XVII in Dalian, China.

The PICES Intern Program has been financed solely by voluntary contributions. The U.S. National Marine Fisheries Service (NMFS) and Fisheries and Oceans Canada (DFO) have been the most generous partners for this activity to date. From 2000–2007, NMFS and DFO provided approximately $135,000 and $71,500, respectively, to the Trust Fund to support the Intern Program. The Committee recommended that Council thank both organizations for their continuing support of the Intern Program, and instructed the Executive Secretary to invite all Contracting Parties to provide voluntary contributions supporting the Program in 2008 and beyond.

Budget (Agenda Item 9)

Estimated accounts for *FY* 2007 (Agenda Item 9a)

The Committee reviewed the estimated accounts for *FY* 2007 and recommended their acceptance by Council.

Interest and other income (Agenda Item 9b)

In *FY* 2007, the estimated total income is $529,648. This amount includes the income of $163,836 from "guaranteed" sources, $130,501 from other sources, $145,311 in voluntary contributions and grants ($112,611 credited to the Working Capital Fund and $32,700 credited to the Trust Fund), and a transfer of $90,000 from DFO for PICES XVI.

In addition, the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF), through the Fisheries Agency, contributed $184,980 for the first year (from April 1, 2007–March 31, 2008) of the PICES project entitled "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*". The anticipated duration of the Project is 5 years (from April 1, 2007–March 31, 2012), with a total funding of $924,900. According to the agreed financial principles for the project: (1) a separate bank account has been established to deposit the remitted funds; (2) interest earned in the account will be credited to the project and used in consultation with MAFF; (3) any funds remaining after the completion of every fiscal year of the project will be reported and disposed of in consultation with MAFF; (4) additional staff (Project Assistant) will be contracted as required to support the objectives of the project and to ensure that its activities have a minimal impact on the workload of the existing staff of the PICES Secretariat; and (5) a 10% overhead on the annual budget ($18,500) will be retained to offset expenses related to the Secretariat's involvement in the project.

Relocation and Home Leave Fund (Agenda Item 9c)

The Relocation and Home Leave Fund (RHLF) is currently set at $110,000. At the end of *FY* 2007, the RHLF is estimated at less than $2,000 below the currently required amount of $110,000. The Committee recommended that the level of the RHLF be allowed to vary between $90,000 and $110,000 to minimize the need for small transfers between funds.

Trust Fund (Agenda Item 9d)

In *FY* 2007, the total TRF income is estimated at $35,300 ($32,700 in voluntary contributions and grants) and estimated expenses are $63,820. The Committee recommended a transfer from the Working Capital Fund to recover the 2007 expenses and restore the Trust Fund to the level of $110,000.

Working Capital Fund (Agenda Item 9e)

In *FY* 2007, the total WCF estimated income and expenses are $490,888 ($112,611 are in voluntary contributions and grants) and $396,672, respectively. After recommended inter-fund transfers, the amount of funds available in WCF at the fiscal year end is estimated at $290,660. This includes $182,449 in encumbered funds and $108,211 in "operating" funds. The Committee also discussed the usage of the encumbered funds designated for high-priority PICES projects (about $143,000), and the recommendations are described under F&A Agenda Item 7.

Budget for *FY* 2008 and forecast budget for *FY* 2009 (Agenda Item 9f)

At PICES XIV, the Committee noted that, from the high expectations placed on PICES, a case could be made to raise the contributions from Contracting Parties. To assess the relevance of any significant increase in annual contributions, the Executive Secretary was asked to study how the Organization might finance the anticipated growth in its activities from savings accrued as a result of reducing current expenditures. To assist in this analysis, F&A members were requested to consider which activities could be scaled back in order to operate PICES within the current (or a lower) budget. After extensive discussion at PICES XV, the Committee agreed that more work was still required to understand how PICES could operate within its budget. Canada (Mr. Serge Labonté) agreed to meet with the Secretariat to prepare options for presentation at the F&A meeting in 2007.

The Committee found the new format for budget presentation (*F&A Endnote 7*) easier to follow than the previous format and recommended its use in future Committee meetings. In addition, the Committee noted that the "base" budget from guaranteed sources was sufficient to fund the salary of one additional member of the Secretariat staff. The Committee recommended that the Executive Secretary consider options, and if permanent staffing is desired, present a recommendation to the Committee at PICES XVII in accordance with the Rules of Procedure 10(iv). China also requested that additional information on salary scales and adjustments for the Secretariat staff be presented at PICES XVII, in accordance with Financial Regulations 12(i).

Following these discussions, the Committee reviewed the proposed *FY* 2008 budget of $762,000 (*F&A Endnote 7*) and recommended its approval by Council. The Committee also recommended a transfer of $96,000 from the Working Capital Fund to balance the budget, setting the total annual contribution at $666,000, and the 2008 fees at $111,000 per Contracting Party. The 2008 annual fee is 2.3% higher than in 2007, and this increase was noted to be consistent with the guideline generally accepted at the PICES Eighth Annual Meeting (Decision 99/A/2(ii)), stating that "*the annual contribution will increase at the rate of inflation in Canada*". The annual Canadian Consumer Price Index (CPI) reported in the middle of the PICES fiscal year (May–July) is used as a measure of inflation. The annual CPI provided by the Bank of Canada with a reference to Statistics Canada was 2.2% in April, May, June and July 2007.

The Executive Secretary presented the forecast *FY* 2009 budget of $778,000 and noted that this budget is prepared based on preliminary information available as of August 25, 2007 and is 2.1% higher than the *FY* 2008 budget. If the inflation rate in Canada stays near 2.5%, then the 2009 annual fee should be set at the level of $113,800 per Contracting Party. The total annual contribution would be $682,800, and a transfer of $95,200 from the Working Capital Fund would be required to balance the budget.

Schedule and financing of future Annual Meetings (Agenda Item 10)

PICES XVII will be held October 24 – November 2, 2008, in Dalian, China, under the theme "*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE*" (Decision 06/A/7(ii)). The Chinese delegation provided a brief update on the preparations for this Annual Meeting and confirmed that they require $40,000 from the General Fund to help offset the high costs for the meeting.

At the 2007 inter-sessional meeting (April 2007, Yokohama, Japan), Council accepted an invitation to hold PICES XVII in Korea. The Korean delegation provided a brief update on the preparations for the Annual Meeting, which is now planned for Busan, with the National Fisheries Research and Development Institute (NFRDI) as the local organizer. The recommended date for the Opening Session is October 26, 2009.

In keeping with the six-year rotation cycle (Decision 94/A/6), the United States of America should be invited to explore the possibility of hosting PICES XIX in 2010, and inform the Secretariat on this matter by March 31, 2008. The U.S. delegation confirmed their willingness to host PICES XIX. Furthermore, they indicated interest in exploring the possibility of a joint ICES–PICES Annual Meeting, with shared science activities and separate business meetings.

At PICES X (October 2001, Victoria, Canada), Council approved the charging of a registration fee for future Annual Meetings of the Organization and indicated that the registration fee structure should be reviewed annually (Decision 01/A/4(iv)). It was agreed that the fees have to be collected by the Secretariat and used to support high priority projects and the Intern Program, and to cover costs associated with Annual Meetings; the allocation among these three purposes should be flexible and decided by the Executive Secretary (Decision 04/A/5(iv)). The Committee reviewed the registration fee structure and recommended that Council maintain the same fee structure for PICES XVII in 2008, as for the previous three Annual Meetings:

Type of registration fee	CDN $
Regular	225
Early	150
Student	50
Spousal	50

At PICES XIV (October 2005, Vladivostok, Russia), Council re-iterated its support for the concept of inter-sessional Science Board meetings with the participation of Council members, but suggested that the need for such a meeting should be evaluated each year and that, given meeting costs (including time commitment of the members), an inter-sessional meeting should be held only if the agenda is substantive. The Committee re-iterated these views in 2007. In particular, China and Korea did not support an inter-sessional Council meeting in 2008.

Science Board has already indicated the importance of having an inter-sessional meeting in 2008, to finalize a Science Plan for the new integrative scientific program of PICES (FUTURE). It is suggested that this meeting be held in conjunction with a workshop to develop an Implementation Plan for FUTURE. The United States of America offered to host the 2008 inter-sessional Science Board meeting in Seattle and proposed the week of April 14, 2008 as the most convenient date.

PICES Handbook (Agenda Item 11)

The approval of the new PICES Rules of Procedure in 2006 resulted in the necessity of substantial changes in the *Handbook (Guidelines) for Chairmen and Convenors* developed in 1999 and amended in 2001. In addition, a set of guidelines for future PICES temporary expert groups was drafted by the POC Chairman, Dr. Michael Foreman, based on his analysis of the performance of the temporary expert groups (Working Groups, Study Groups, Task Teams, and Advisory Panels) established since the inception of the Organization. This evaluation was undertaken by Science Board at the request of Council (Decision 04/S/7(i)) to

understand whether the current approach of the formation and financing of these groups is working. At PICES XV, the F&A Committee suggested that, given the extensive overlap between these two documents, they should be merged and the resulting document should be submitted for approval at PICES XVI and then added to the PICES Handbook.

The Committee recommended approval of the document "*Roles and responsibilities of Chairmen and members of PICES groups*", which is based on the revised *Guidelines for Chairmen and Convenors* and incorporates the most important elements of Dr. Foreman's analysis – a summary of the conditions that make for productive and successful temporary groups. The Committee recognized that this was a work in progress which cannot be finalized until after the FUTURE Implementation Plan is completed. However, given the ease and low cost of replacing documents within the PICES Handbook binder, this document could provide useful guidance over the next 1–2 years.

Administrative matters (Agenda Item 12)

The Committee reviewed the progress on the status of income tax levies for personnel at the PICES Secretariat. The extension of the tax levy practice for federal taxes to Canadian employees of the PICES Secretariat has resulted in the increase of revenue from $22,000–25,000 in *FY*s 2003–2005 to $47,502 in *FY* 2006 (incomplete year) and an estimated $67,876 in *FY* 2007. These amounts are the differences between the levy in lieu of taxes and tax refund for the Executive Secretary plus expenses for services of *Flader & Hale* directly related to this tax levy.

Space, facilities and services for the PICES Secretariat office (Agenda Item 13)

PICES has a Headquarters Agreement with the Government of Canada that entered into force on December 15, 1993. In accordance with this agreement, Fisheries and Oceans Canada (DFO) has hosted the PICES Secretariat at the Institute of Ocean Sciences (IOS) in Sidney, British Columbia, Canada.

The agreement between PICES and DFO on general administrative services is expected to continue indefinitely with a periodic review, but the last time the agreement was amended is more than five years ago (on April 1, 2002), and it does not reflect current arrangements. In *FY* 2007, PICES is to pay an annual sum of $23,500 for postage and $2,000 for janitorial/ maintenance services. Telephone and fax lines and internet access, previously covered in the amount of $2,500 under the agreement, are currently paid by PICES to *Telus* and *Shaw* directly. At the same time, real expenses for postage are substantially higher, and DFO provided $15,000 to partially offset these expenses. The new agreement between PICES and DFO should take into account the substantial increase in mailing costs by *Canada Post* and the costs that have shifted to PICES.

China offered to work with the Secretariat to update its mailing list and assist in minimizing postage.

Other business (Agenda Item 14)

No other business was raised.

Adoption of the F&A report and recommendations to Council (Agenda Item 15)

The draft report was circulated and approved by all F&A members. All recommendations to Council were brought forward by Dr. Richards at their meeting on November 4, 2007.

F&A Endnote 1

Participation list

Canada
Robin M. Brown
Serge Labonté

Japan
Hideki Nakano
Yuji Uozumi (advisor)

People's Republic of China
Handi Guo
Shengzhi Sun
Yingren Li (advisor)
Gongke Tan (advisor)
Dongmei Tang (advisor)

Republic of Korea
Kwang-Youl Park
Kyu-Kui Jung (advisor)
Jin-Yeong Kim (advisor)

Russia
Igor Shevchenko

U.S.A.
Justin R. Grubich
Patricia Livingston

Other
Laura Richards (F&A Chairman)
Tokio Wada (PICES Chairman)
Alexander Bychkov (Executive Secretary)
George Boehlert (U.S. National Delegate)
Brian Voss (IAMSLIC)
Janet Webster (IAMSLIC)

F&A Endnote 2

F&A Committee meeting agenda

1. Welcome and opening remarks
2. Adoption of agenda and meeting procedures
3. Audited accounts for fiscal year 2006
4. Annual contributions
5. Fund-raising activities
6. Report on PICES Publication Program
7. Financing of PICES high priority projects
8. PICES Intern Program
9. Budget
   a. Estimated accounts for fiscal year 2007
   b. Interest and other income
   c. Relocation and Home Leave Fund
   d. Trust Fund
   e. Working Capital Fund
   f. Proposed budget for *FY* 2008 and forecast budget for *FY* 2009
10. Schedule and financing of future Annual Meetings
11. Additions to PICES Handbook
12. Administrative matters
13. Space, facilities and services for the PICES Secretariat office
14. Other business
15. F&A report and recommendations to Governing Council

F&A Endnote 3

Auditor's Report (2006) to the Organization

To the Council of the
North Pacific Marine Science Organization

We have audited the statement of financial position of North Pacific Marine Science Organization as at December 31, 2006 and the statement of operations and changes in fund balances for the year then ended. These financial statements are the responsibility of the organization's management. Our responsibility is to express an opinion on these financial statements based on our audit.

We conducted our audit in accordance with Canadian generally accepted auditing standards. Those standards require that we plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In our opinion, these financial statements present fairly, in all material respects, the financial position of the organization as at December 31, 2006 and the results of its operations and changes in fund balances for the year then ended in accordance with Canadian generally accepted accounting principles.

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Sidney, BC
April 5, 2007

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
STATEMENT OF FINANCIAL POSITION
AS AT DECEMBER 31, 2006

ASSETS

	2006	2005
CURRENT ASSETS		
Cash and short term deposits (note 3)	$ 726,512	$ 800,990
Accounts receivable	57,538	14,500
Prepaid expenses	2,665	2,560
	$ **786,715**	$ **818,050**

LIABILITIES

CURRENT LIABILITIES		
Accounts payable	$ 48,545	$ 56,683
Funds held for contracting parties (note 4)	108,500	105,500
	157,045	162,183

FUND BALANCES

WORKING CAPITAL FUND (note 3)	414,964	435,867
TRUST FUND	110,000	110,000
RELOCATION AND HOME LEAVE FUND	104,706	110,000
	629,670	655,867
	$ **786,715**	$ **818,050**

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
STATEMENT OF OPERATIONS AND CHANGES IN FUND BALANCES
FOR THE YEAR ENDED DECEMBER 31, 2006

	General Fund	Working Capital Fund	Trust Fund	Relocation and Home Leave Fund	2006 Total	2005 Total
FUND BALANCES, beginning of year	$ -	$ 435,867	$ 110,000	$ 110,000	$ 655,867	$ 590,326
SOURCES OF FUNDS						
Contributions from Contracting Parties	633,000	-	-	-	633,000	615,000
Budgeted transfer to General Fund (note 5)	97,000	(97,000)	-	-	-	-
Voluntary contributions and grants (note 6)	-	143,952	45,055	-	189,007	304,795
Interest and other income (note 7)	-	161,449	3,125	2,938	167,512	116,613
	730,000	208,401	48,180	2,938	989,519	1,036,408
FUND BALANCES, before expenditures	730,000	644,268	158,180	112,938	1,645,386	1,626,734
EXPENDITURES						
Personnel services (note 8)	399,572	46,720	-	-	446,292	390,132
Annual Meeting	39,060	3,011	-	-	42,071	55,434
Special meetings	56,719	159,240	-	-	215,959	157,442
Travel	81,000	-	39,581	-	120,581	132,355
Printing	66,242	-	-	-	66,242	128,523
Communication	35,457	-	-	-	35,457	31,792
Equipment	6,868	-	-	-	6,868	7,374
Supplies	7,375	-	-	-	7,375	9,130
Contractual services	15,883	19,200	-	-	35,083	37,200
Miscellaneous	3,726	-	-	-	3,726	3,681
Intern program	-	-	26,394	-	26,394	14,459
Relocation	-	-	-	8,232	8,232	-
Foreign exchange loss (note 9)	1,436	-	-	-	1,436	3,345
	713,338	228,171	65,975	8,232	1,015,716	970,867
NET FUNDS AVAILABLE	16,662	416,097	92,205	104,706	629,670	655,867
TRANSFER TO WORKING CAPITAL FUND (note 3)	(16,662)	16,662	-	-	-	-
INTERFUND TRANSFERS (note 5)	-	(17,795)	17,795	-	-	-
FUND BALANCES, end of year	$ -	$ 414,964	$ 110,000	$ 104,706	$ 629,670	$ 655,867

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 2006

1. PURPOSE OF ORGANIZATION

The North Pacific Marine Science Organization (PICES) is an intergovernmental non-profit scientific organization whose present members include Canada, Japan, the People's Republic of China, the Republic of Korea, the Russian Federation and the United States of America. The purpose of the Organization is to promote and coordinate marine scientific research in order to advance scientific knowledge of the North Pacific and adjacent seas.

2. ACCOUNTING POLICIES

The financial statements are prepared in accordance with the North Pacific Marine Science Organization's Financial Regulations and are prepared in accordance with Canadian generally accepted accounting principles. The following is a summary of the significant accounting policies used in the preparation of these financial statements:

(a) Fund Accounting
The Working Capital Fund represents the accumulated excess of contributions provided from Contracting Parties over expenditures in the General Fund. The purposes of the General Fund and Working Capital Fund are established by Regulation 6 of the Organization Financial Regulation.

The Trust Fund was established in 1994 for the purpose of facilitating participation of a broad spectrum of scientists in activities of the Organization.

The Relocation and Home Leave Fund was established in 1995 to pay relocation and home leave expenses of new employees and their dependents to the seat of the Secretariat and removal after period of employment has ended, and to provide home leave for international staff. This fund is set at $110,000.

(b) Capital Assets
Capital assets acquired by the Organization are expensed in the year of acquisition. During the current year the organization purchased $6,868 of capital assets.

(c) Contributions
Contributions from Contracting Parties are recorded in the year in which they relate to. All other contributions and grants are recorded in the year received.

(d) Income Tax
The Organization is a non-taxable organization under the Privileges and Immunities (International Organizations) Act (Canada).

(e) Foreign Exchange
Transactions originating in foreign currencies are translated at the exchange rate prevailing at the transaction dates. Assets and liabilities denominated in foreign currency are translated to equivalent Canadian amounts at the current rate of exchange at the statement of financial position date.

(f) Financial Instruments
The Organization's financial instruments consist of cash and short term deposits, accounts receivable and accounts payable. Unless otherwise noted, it is management's opinion that the Organization is not exposed to significant interest, currency or credit risks.

(g) Use of Estimates
The preparation of financial statements in conformity with Canadian generally accepted accounting principles requires management to make estimates and assumptions that effect the reported amounts of assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

3. WORKING CAPITAL FUND

Of the total amount in the Working Capital Fund, $199,270 is restricted for specific designated projects.

Pursuant to decision 06/A/3(ii) of the Governing Council, $94,000 of the funds held in the Working Capital Fund will be transferred to the General Fund at the beginning of the 2007 fiscal year to reduce 2007 contributions.

Pursuant to Financial Regulation 6 (iii), the Working Capital Fund is to be increased/decreased by the surplus/deficit in the General Fund.

4. FUNDS HELD FOR CONTRACTING PARTIES

The funds held for Contracting Parties is an advance contribution from Japan in the amount of $108,500.

5. INTERFUND TRANSFERS

The Governing Council approved the transfer of $97,000 at the beginning of 2006 from the Working Capital Fund to the General Fund (Decision 05/A/3/ii) in order to facilitate in the reduction of the annual contribution fee per Contracting Part.

The Governing Council approved the transfer of funds from the Working Capital Fund to restore the Trust Fund to $110,000 (Decision 06/A/4/ii). The amount of the transfer was $17,795.

6. VOLUNTARY CONTRIBUTIONS AND GRANTS

	Working Capital Fund	Trust Fund
AFSC (U.S.A.) contribution for ESSAS/PICES Workshop	$ 5,643	$ -
PIFSC (U.S.A.) contribution for interim meeting	3,003	-
Contributions for 2006 CCCC Symposium:		
GLOBEC	11,380	-
GLOBEC (U.S.A.)	13,787	-
KORDI (Korea)	3,431	-
WPFMC (U.S.A.)	17,361	-
DFO (Canada) contribution for 2006 Line-P Symposium	3,975	-
GLOBEC contribution for Zooplankton Symposium	5,339	-
Korean contribution for position at Secretariat	19,200	-
NPRB (U.S.A.) funds for the Bering Sea Indicators Project	44,090	-
NPRB (U.S.A.) contribution for young scientists	16,743	-
Contributions for Intern Program:		
AFSC (U.S.A.)	-	11,286
PIFSC (U.S.A.)	-	17,094
SCOR travel grants for the CCCC Symposium and PICES XV	-	16,675
	$ 143,952	$ 45,055

7. INTEREST AND OTHER INCOME

	Working Capital Fund	Trust Fund	Relocation and Home Leave Fund
Interest income	$ 12,367	$ 3,125	$ 2,938
Income tax levies	47,502	-	-
GST, PST and WCB rebates	8,110	-	-
Registration Fees for PICES XV	67,298	-	-
Registration Fees for CCCC Symposium	12,217	-	-
Registration Fees for Line-P Symposium	7,855	-	-
Registration Fees for Zooplankton Symposium	4,491	-	-
Other income	1,609	-	-
	$ 161,449	$ 3,125	$ 2,938

8. PERSONNEL SERVICES

The expenditures from the Working Capital Fund for personnel services in 2006 include retroactive salary and benefit adjustments for staff members ($14,965) and a lump sum payment to the IFC Pension Plan to cover a deficit ($31,755).

9. FOREIGN EXCHANGE LOSS

At year end all funds held in foreign currency (US $73,381) are converted to Canadian dollars using the December 31 exchange rate. A foreign exchange loss has been reported on the current year financial statements; this amount is an unbudgeted item which has been caused by the ongoing fluctuations in the US dollar (2006 = 1.1653, 2005 =1.1659), and not by the actual purchase or sale of any foreign currencies.

10. FINANCIAL STATEMENTS

A statement of cash flows has not been presented, as the required information is readily apparent from the other financial statements presented and the notes to the financial statements.

F&A Endnote 4

Payment schedule of annual contributions, 2000–2007

	Canada	*China*	*Japan*	*Korea*	*Russia*	*U.S.A.*
2000	Feb. 9, 00	Aug. 29, 00	Nov. 30, 99	June 1, 00	Nov. 2, 00	Jan. 18, 00
2001	Jan. 24, 01	Dec. 10, 01	Dec. 13, 00	Aug. 23, 01	May 18, 01	Jan. 3, 01
2002	Jan. 21, 02	Oct. 8, 02	Nov. 27, 01	Aug. 26, 02	June 10, 02	Dec. 24, 01
2003	Jan. 13, 03	Oct. 3, 03	Dec. 11, 02	May 5, 03	Apr. 2, 03	Dec. 6, 02
2004	Jan. 5, 04	Aug.10, 04	Dec. 26, 03	Mar. 24, 04	Mar. 2, 04	Feb. 9, 04
2005	Dec. 24, 04	Sept. 22, 05	Mar. 2, 05	Mar. 30, 05	Mar. 31, 05	Jan. 10, 05
2006	Dec. 28, 05	Aug. 1, 06	Dec. 15, 05	Feb. 8, 06	Feb. 28, 06	Jan. 30, 06
2007	Jan. 23, 07	July 3, 07	Dec. 5, 06	Apr. 3, 07	Feb. 13, 07	Jan. 10, 07

F&A Endnote 5

External funding and special contributions received since PICES XV

Since PICES XV (October 2006, Yokohama, Japan), the following extra-budgetary contributions for various activities initiated/sponsored by PICES were received:

Special projects

- The Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency (JFA), contributed $184,980 for the first year (from April 1, 2007 – March 31, 2008) of the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*". The anticipated duration of the Project is 5 years (from April 1, 2007 – March 31, 2012), with a total funding of $924,900.

Symposia/sessions/workshops

- The North Pacific Research Board (NPRB, U.S.A.) provided US $5,000 for the ESSAS/PICES workshops on "*Evaluation of climate scenarios for sub-Arctic regions*" and "*The role of seasonal sea ice cover in marine ecosystems*" (June 4–6, 2007, Hakodate, Japan), and US $10,000 for the FIS workshop on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*" (July 19–20, 2007, Seattle, U.S.A.).
- The Fisheries Research Agency of Japan co-sponsored the 2007 inter-sessional Science Board/ Governing Council meeting and the workshop to develop a Science Plan for a Future Integrative Scientific Program (FISP) of PICES (April 16–19, 2007, Yokohama, Japan).
- The International Council for the Exploration of the Sea (ICES) co-sponsored the FIS/CCCC/BIO Topic Session on "*Fisheries interactions and local ecology*" and the POC/CCCC/MONITOR Topic Session on "*Operational forecast of oceans and ecosystems*" at PICES XVI, by covering travel costs of some invited speakers for these sessions.

- The Global Ocean Ecosystem Dynamics Project (GLOBEC) co-sponsored the CCCC/FIS Topic Session on "*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*" at PICES XVI, by covering travel costs of one invited speaker for this session.
- The U.S. National Oceanic and Atmospheric Administration (NOAA), the U.S. National Aeronautics and Space Administration (NASA) and Fisheries and Oceans Canada (DFO) committed US $50,000, US $20,000 and CND $20,000, respectively, to the symposium on "*Effects of climate change on the world's oceans*" (May 19–23, 2008, Gijón, Spain).

Capacity building

- The U.S. National Marine Fisheries Service (NMFS) and DFO contributed US $15,000 and CDN $10,000, respectively, to the Trust Fund to support the PICES Intern Program.
- The U.S. National Marine Fisheries Service and the Korean Ocean Research and Development Institute (KORDI) provided US $30,000 and US $2,000, respectively, for the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*" (June 26–29, 2007, Baltimore, U.S.A.). [In 2006, the North Pacific Research Board (U.S.A.) allocated US $15,000 for this Conference.]
- The Scientific Committee on Oceanic Research (SCOR) allocated US $5,000 to support travel of scientists from countries with "economies in transition" to PICES XVI, and US $7,500 to the symposium on "*Effects of climate change on the world's oceans*" (May 19–23, 2008, Gijón, Spain).
- GLOBEC offered US $2,500 to cover travel costs of early career scientists to attend GLOBEC-related scientific sessions at PICES XVI.
- The International Fisheries Section of the American Fisheries Society, the Mexican Chapter of the Western Division of the American Fisheries Society, and the U.S. NMFS co-sponsored a 3-day MODEL training workshop (April 26–28, La Paz, B.C.S., Mexico) on "*Techniques for building multi-trophic level marine ecosystem models, with special emphasis on NEMURO and NEMURO.FISH*" for Ph.D.-level Mexican scientists. Drs. Bernard A. Megrey (U.S.A.) and Salvador Lluch-Cota (Mexico) coordinated the project.

Operations of the PICES Secretariat

- Korea contributed $19,200 to support a part-time contract position at the PICES Secretariat.
- Fisheries and Oceans Canada provided $15,000 to partially offset expenses for postage.

Other

- Commercial displays set up around the theme of ocean observatories were organized in conjunction with the MONITOR/TCODE Topic Session on "*Recent advancements in ocean observing systems: Scientific discoveries, technical developments and data management, analysis and delivery*" at PICES XVI. Revenue from the displays is estimated at $4,500.

F&A Endnote 6

Action Plan based on 2007 PICES Publications Review

Actions:	To be performed by:
A. Managing the Publication Workflow	
1. Establish a new position (if only temporary) to assist with carrying out recommended actions and to consolidate and manage the whole publications workflow.	PICES Secretariat/PICES Finance and Administration Committee
2. Post the PICES Style Manual (Instructions to Authors and Editors) to the PICES website. Add similar information to print publications as appropriate.	PICES Executive Secretary, PICES Database and Web Administrator, publishing contractors
B. Increasing Recognition of PICES as a Publisher	
1. Include recommended citation formats and summaries of publications on additional series as appropriate.	PICES Secretariat and publishing contractors
2. Investigate possibilities of branding PICES at the article level in the journal special issues.	PICES Secretariat/Commercial publishers
3. Add information on the PICES publications introductory web page for ordering publications as well as more specific contact information for publications.	PICES Database and Web Administrator
C. Enhancing Access through Library and Indexer Cooperation	
1. Enhance existing OCLC catalog records with links to current digital versions of PICES publications.	PICES/IAMSLIC cooperative effort
2. Establish agreements with select libraries for ongoing print archiving, following surveys under Part D.	PICES/IAMSLIC/Contracting Parties cooperative effort
3. Establish agreements with commercial indexers that insure indexing of all PICES publications to the article level.	PICES Secretariat/Commercial indexing partnership
4. Add all publications to a searchable digital repository following pilot project in Part E.	PICES Secretariat
D. Improving Distribution Efficiencies	
1. Review and enhance data on distribution lists.	PICES Secretariat
2. Create and conduct surveys of each of the three groups of PICES distribution recipients and Contracting Parties.	PICES Secretariat/IAMSLIC cooperative effort
3. Add RSS functionality to website.	PICES Database and Web Administrator
E. Increasing Visibility and Ensuring Perpetuity through a Digital Repository	
1. Establish a pilot project to develop a collection of PICES Publications in the IAMSLIC digital repository 'Aquatic Commons'.	PICES/IAMSLIC cooperative effort
2. Retrospectively scan items to complete the collection of digital publications.	PICES Database and Web Administrator
3. Negotiate with publishers for the right to deposit appropriate versions of journal articles into the repository and/or on the PICES website.	PICES Secretariat/Commercial publishing partnership
4. Develop a copyright agreement between PICES and all authors that grants PICES rights to archive and provide access to digital content.	PICES Secretariat

F&A Endnote 7

PROPOSED *FY* 2008 BUDGET

Source	**Amount**
Annual contributions from six Contracting Parties	666,000
Guaranteed adjustments	96,000
Net income tax levies	70,000
Tax (GST, PST) rebates	10,000
Interest	16,000
Total	**762,000**

Additional income	**Amount**
Overhead from MAFF project	18,500
Registration fees from Annual Meeting	40,000
Encumbered funds from DFO for postage	5,000
Total	**63,500**

External funding	**Amount**
Encumbered funds for PICES projects	
NPESR	22,920
CCCC Symposium	10,470
High-priority projects	144,060
Anticipated funds for PICES projects	
NPESR (from NPRB)	52,920
2008 Climate Change Symposium	90,000
Total	**320,370**

Category	**Base**	**Additional Income**	**External funding**
Personnel services	500,000		
Annual Meeting	40,000	10,000	
Special meetings/travel	116,000	37,500	
Publications	56,000	11,000	
Communications	30,000	5,000	
Office/Administrative expenses	20,000		
Projects			320,370
Total	**762,000**	**63,500**	**320,370**

REPORT OF THE 2007 INTER-SESSIONAL SCIENCE BOARD MEETING

The fifth inter-sessional Science Board meeting, with the participation of Governing Council, met from 9:00–17:30 hours on April 19, 2007 at Work Pia, Yokohama, Japan, following a successful 3-day workshop to develop a science plan for the new PICES integrative scientific program (FUTURE) prior to the inter-sessional meeting. Science Board Chairman, Prof. Kuh Kim, welcomed participants (*SB-IM Endnote 1*) to the meeting and thanked Chairman-elect, Dr. John E. Stein, for his efforts in organizing and convening the workshop and those present at the inter-sessional meeting who had participated at the workshop. The meeting agenda is provided in *SB-IM Endnote 2*.

Mid-term updates (Agenda Items 2 and 14)

Biological Oceanography Committee (BIO)

BIO Committee Chairman, Dr. Michael Dagg, reported that BIO is sponsoring/co-sponsoring 2 topic sessions, 1 paper session and 2 workshops at PICES XVI and that convenors and invited speakers are in place. Dr. Dagg, who is one of the convenors of the 4th International Zooplankton Production Symposium, to be held in Hiroshima, Japan, May 28–June 1, 2007, reported that the symposium plans were progressing well due to the efforts of the major convenor, Dr. Shin-ichi Uye, of Japan, and the PICES Secretariat. A total of 469 abstracts were submitted for 10 plenary sessions and 3 workshops.

The North Pacific Research Board (NPRB) is developing a program entitled "*Bering Sea Integrated Ecosystem Research Program*" (BSIERP) in which it is providing $14M to be combined with about $10M (plus logistical support) from the National Science Foundation (NSF) BEST program to study the entire Bering Sea ecosystem over a 4- to 6-year timeframe. An attempt is being made to coordinate funding and science objectives from NPRB and NSF into a single "ecosystem level" program with NSF focusing on lower trophic levels and NPRB focusing on the upper levels. Proposals are being reviewed. NPRB is also developing a smaller ($6M) IERP for the Gulf of Alaska.

The Bering Ecosystem Study (BEST) program went on its first cruise April 11, 2007 to study the impact of seasonal ice cover on the shelf of the eastern Bering Sea. ESSAS (Ecosystem Studies of the Sub-Arctic Seas) is planning a series of PICES co-sponsored workshops and annual SSC meeting for June 4–8, 2007 in Hakodate, Japan. About 40 scientists from 7 or more countries are expected to attend a 2-day workshop on "*The role of seasonal sea ice cover in marine ecosystems*", co-convened by MONITOR Vice-Chairman, Dr. Sei-Ichi Saitoh, a 1-day workshop on "*Evaluation of future ESSAS climate scenarios*" convened by POC/CFAME member, Dr. James E. Overland, and a ½-day discussion of modeling approaches to comparisons of how climate change will affect the sub-arctic seas and their ability to support sustainable fisheries. ESSAS is involved in helping to organize an activity in the IPY program through a sub-program, Ecosystem Studies of Subarctic and Arctic Regions (ESSAR), which IPY has chosen to be the lead group for about 20 groups. The Oceanic Ecodynamics Comparison in the Subarctic Pacific (OECOS) program, in which the western and eastern gyres of the subarctic North Pacific were to be compared, was funded by Japan to study the western gyre. The Japanese team, led by Dr. Tom Ikeda, completed its first, exploratory, cruise (March 6–16, 2007) and a second, longer cruise is scheduled soon. The U.S. proposal to study the eastern gyre, led by Dr. Charles B. Miller, was submitted to NSF and declined. Dr. Miller will look elsewhere for funding.

Dr. Dagg has now received draft terms of reference from IFEP-AP to form a Working Group with proposed title "*Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean*". New members from additional PICES countries are being considered,

and a new hypothesis on the mechanisms controlling phytoplankton production in the subarctic North Pacific is being formulated. IFEP Co-Chairman, Dr. C.S. Wong, is preparing a synthesis manuscript as a contribution to Dr. Atushi Tsuda's special volume on SEEDS I and II and SERIES.

Fishery Science Committee (FIS)

FIS Committee Chairman, Dr. Gordon H. Kruse, informed the meeting that FIS will be sponsoring/co-sponsoring 5 topic sessions and 2 workshops at PICES XVI. PICES Scientific Report No. 33 of the "*PICES/NPRB workshop on integration of ecological indicators of the North Pacific with emphasis on the Bering Sea*" was finalized and published in December 2006 and Dr. Kruse has arranged to publish a special issue in the journal *Fisheries Research* for PICES XVI topic session S4, "*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*." The FIS Committee recommended that PICES co-sponsor the Linking Herring Symposium, to be held in Galway, Ireland from August 26–29, 2008, by funding travel for PICES members, Drs. Brenda Norcross and Prof. Yoshiro Watanabe, to attend. The Committee also recommended that PICES co-sponsor the CLIOTOP Symposium (see Agenda Item 11).

The FIS Committee recommended publication of the WG 16 report on "*Impacts of climate and climate change on the key species in the subarctic Pacific*" after a FIS sub-committee had reviewed a revised draft. Prior to publication, a number of scientific and technical issues must be addressed by WG 16 report authors. WG member, Dr. Steven Bograd, will work with report author, Dr. Richard Beamish, to prepare a synopsis. Science Board raised concerns about the relevancy of a body of work to be published in 2008 when the report had been approved by Council in 2003. Another concern was that the contents needed to reflect what was stated in the title of the report.

Action

Dr. Kruse:

2.FIS.1 Confirm that Dr. Bograd is working with Dr. Beamish on a WG 16 report synopsis and that WG 16 report contents and title match. Dr. Kruse to send subcommittee comments to Dr. Beamish to be addressed prior to submission to the PICES Secretariat. Dr. Kruse to review the next revision to verify that the final satisfactory edits have been made.

Marine Environmental Quality Committee (MEQ)

Dr. Glen Jamieson, Chairman of the MEQ Committee informed everyone that he, as Co-Chairman of the Working Group on *Ecosystem-based Management Science and its Application to the North Pacific* (WG 19), had been nominated by PICES to co-convene Theme Session R, "*The ecosystem approach: What is the impact on marine science, science based advice and management of marine ecosystems?*" at the ICES Annual Science Conference (ASC) in Helsinki, Finland to be held September 17–21, 2007. The *Harmful Algal Bloom* Section (HAB-S) Co-Chairman, Dr. Vera Trainer, submitted a proposal to Japan to fund an early warning system for toxins in seafood and seawater in developing countries.

Working Group on *Non-indigenous Aquatic Species* (WG 21) has been working on developing its links with ICES/IOC/IMO Working Group on *Ballast and Other Ship Vectors* (WGBOSV) and ICES Working Group on *Introductions and Transfers of Marine Organisms* (WGITMO) and all 3 groups will meet May 24–25, 2007 to forge links between PICES and ICES for joint projects. Work has been slow on completing WG 21's terms of reference 1–4. WG Co-Chairman, Darlene Smith, did not receive much feedback from China or Korea and suggested that members should participate throughout the year – not just at the Annual Meeting. WG21 is involved in 2 topic sessions and 1 workshop at PICES XVI. The WG had requested a topic session on invasive species, but agreed to postpone their request until the Annual Meeting in Dalian, China, owing to the fifth International Conference on "*Marine bioinvasions*" taking place in May 2007.

The Working Group recommended to Science Board the appointment to Co-Chairman of WG21 member, Dr. Vasily Radashevsky.

Technical Committee on Monitoring (MONITOR)

MONITOR Vice-Chairman, Dr. Sei-Ichi Saitoh, reported on the status of the *Continuous Plankton Recorder Survey in the North Pacific* Advisory Panel (CPR-AP). The E–W (Vancouver, Canada–Japan) transect has a new CTD fluorometer mounted on the CPR and sampling was completed between March 19–April 3, 2007, with plans to sample twice more in 2007. The N–S transect (Cook Inlet–Puget Sound, U.S.A.) was sampled from April 7–11, and will continue to be sampled approximately monthly until September 2007. Funding for the N–S transect is in place for the entire 2007 field season but the E–W transect was funded only for the sampling that just took place. The Sir Alister Hardy Foundation for Ocean Science (SAHFOS) is prepared to cover the costs of the summer and fall transects in order to ensure that there will be no gaps in sampling, but it is crucial that funding be sought beyond 2007. There will be no funding for either transect beyond 2007, but proposals will be submitted to the Exxon Valdes Oil Spill Trustee Council (EVOSTC) and a proposal to the NSF is being considered. Executive Secretary, Dr. Alexander Bychkov, informed members that the Secretariat and CPR-AP member, Dr. Sonia Batten, are working together to place the E–W database on the PICES website.

The GOOS Scientific Steering Committee (SSG-GOOS) has endorsed the North Pacific CPR program as an ocean monitoring tool. The eleventh session of the IOC/WESTPAC Coordinating Committee for the NEAR-GOOS took place in Bangkok, Thailand, January 18–19, 2007, in which SG-GOOS member, Dr. Vacheslay Lobanov, presented a report on MONITOR and its GOOS-related activities. The NEAR-GOOS Coordinating Committee expressed intentions to keep in close contact with PICES on developing ocean monitoring in the North Pacific and its marginal seas. At PICES XV, SSG-GOOS recommended that the existing GOOS program should be coordinated by PICES and a North Pacific GOOS pilot project should not be initiated. Therefore, terms of reference will need to be revised and proposed at PICES XVI. Dr. Phillip Mundy attended the 10th session of the GOOS SSC (GSSC-X) in Seoul, Korea on March 13–16, 2007, and submitted a report of GSSC-X to the Secretariat that will not only initiate the exchange of information between GSSC and PICES entities engaged in ocean observing activities, but will also serve GSSC as a reference to the ocean observing activities of PICES.

MONITOR will be sponsoring 1 topic session and co-sponsoring 1 topic session and 1 WS at PICES XVI.

Action

Dr. Alexander

2.MONITOR.1 Contact new Exxon Valdes program managers regarding CPR funding.

2.MONITOR.2 Check if NSF will fund CPR until EVOS can get its funding in place if there is a funding gap.

Drs. Napp/Saitoh

2.MONITOR.3 propose new terms of reference for GOOS at PICES XVI.

Physical Oceanography and Climate Committee (POC)

POC Committee Chairman, Dr. Michael Foreman, presented his Committee report to Science Board. POC will be sponsoring a paper session and co-sponsoring 3 topic sessions and 1 workshop at PICES XVI. Dr. Foreman will be a co-convenor at the ICES/PICES/IOC Symposium on "*Effects of climate change on the world oceans*" scheduled for May 19–23, 2008 in Gijón, Spain. The Committee's Action Plan has been updated and in the next 5 years POC wants to address the coordination of carbon-related issues in the North Pacific and the evaluation of climate change projections from the 4th assessment report of IPCC. POC/WG 20 plans to determine the major circulation and physical/geochemical changes for the North

Pacific and its marginal seas as projected by the latest global climate models, and plans to provide a summary of these changes in a manner that will be useful to other PICES Committees and Groups.

The Section on *Carbon and Climate* (CC-S) is progressing very well and wants to add more members (from Canada and Japan). The Best Practices Guide website has been set up and numerous reviews have been received. Plans are to have the manual ready in June prior to the IOC meeting. CC-S is addressing its first term of reference by initiating the data synthesis process, and is proceeding as planned. Partial travel support was provided to WG 20 members, Drs. Muyin Wang and Enrique Curchitser to attend the ESSAS workshop (see BIO Committee report, above) in Hakodate, Japan, from June 4-8, 2007. WG 20 members, Drs. Ig-Chan Pang and Jai-Ho Oh, will work together to adapt Dr. Oh's high-resolution atmospheric model to an ocean circulation model for the Yellow and East China Seas. The Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (CREAMS/PICES-AP) will be holding their inter-sessional meeting in Qingdao, China, on May 18–19, 2007. Plans are being made to have a second summer school, in Hakodate in 2008. A special issue of the *Journal of Marine Systems*, arising from selected papers presented in the CREAMS/PICES international workshop on "*Model/data intercomparison for the Japan/East Sea*", held August 21–25, 2006 in Busan, Korea, is tentatively scheduled for publication by the end of 2007. A joint Korean–Russian cruise and Korean–Japanese cruise will take place in the Japan/East Sea in 2007.

Technical Committee on Data Exchange (TCODE)

TCODE Technical Committee Chairman, Dr. Igor Shevchenko, announced that the Committee will continue to support HAB-S work with the HAE-DAT and required metadata. The Committee is sponsoring 1 topic session and is organizing 1 scientific/e-poster session at PICES XVI. TCODE is collaborating with the ICES Working Group on *Data and Information Management* (WGDIM) and has 1 TCODE member (Georgy Moiseenko) who is also a member of WGDIM. TCODE is continuing its Federated Metadata project. In 2005 Korea became a member of the PICES Marine Metadata Federation, and Far East Russia became a partner shortly after. In 2006 Japan joined, completing the Phase II Metadata Federation proposal to include Japan. Phase III is being carried out to bring China into the Federation. The PICES Metadata Federation now includes 5 nodes from 4 countries (Japan, Republic of Korea, Russia, and U.S.A.). A Chinese node will be added in 2007. TCODE is investigating the utility of an Asian-side metadata server. TCODE is continuing to work closely with the Secretariat on providing advice on information archiving and e-publishing, and interacting with MONITOR to coordinate and manage monitoring data.

Climate Change and Carrying Capacity Program Implementation Panel (CCCC-IP)

Program Implementation Panel Co-Chairman, Dr. Harold Batchelder, reported that the MODEL Task Team had reached a milestone by having 19 contributions on NEMURO and NEMURO.FISH published in a special issue of *Ecological Modelling* in February 2007. MODEL has been working with the Secretariat to update its website so that there is public access to all MODEL reports, workshop archives, and NEMURO model code. MODEL was contacted by Dr. Ivo Grigorov of the Euro-Oceans project for the purpose of including the NEMURO models in the Euro-Oceans online database of ocean models and CCCC Co-Chairman, Prof. Michio Kishi, worked with Dr. Grigorov to provide the data. Additional material relating to other NEMURO-related models and links to the Eur-Oceans project are planned for the MODEL webpage on the PICES website. MODEL TT Chairman, Dr. Thomas Wainwright, and member, Dr. Shin-ichi Ito, attended an FRA international workshop on "*Collaborative studies for ecosystem variation and climate change in the North Pacific*" held on October 21–23, 2006, in Yokohama, which compared plankton research in the Odate and CalCOFI regions, and considered the use of NEMURO and related models as tools for future

studies in the two regions. The project on *Software framework for integrating marine ecosystem model*, which was funded by NOAA in 2005, is still in progress, and it is expected that the Fortran model code will be available in the summer of 2007, with documentation and web interface later in the year. The project will integrate NEMURO and NEMURO.FISH in the Earth System Modeling Framework (ESMF), provide a web-based interface for the NEMURO and NEMURO.FISH models, and provide users' guides and documentation on the web. MODEL TT member, Dr. Francisco Werner, led a proposal to the U.S. NSF Partnership for International Research and Education (PIRE) program for the purpose of linking Norwegian, Japanese, and U.S. research on marine ecosystems and forecasting. This project will have a strong emphasis on education as well as research, with inclusion of summer schools/workshops to be held in Japan, Norway and NCAR in the U.S. Research objectives include the study of climate effects on subarctic marine ecosystems, and thus would be related to work under the ESSAS program. A final decision should be made by June 2007.

An inter-sessional *Climate Forecasting and Marine Ecosystems* (CFAME) Task Team workshop on "*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*" is planned for May 21–23, 2007, in Seattle, U.S.A. Planning for this workshop, which was to focus on formalizing conceptual mechanisms of climate forcing and then apply comparative approaches to the California Current system, the Sea of Okhotsk, the East China/Yellow Seas, and the Kuroshio/Oyashio Current system, has been slow. Originally intended to complete work begun at the 2006 ASC, an agenda has not yet been developed, the venue was selected only recently, and CFAME national representation is made up only by Canada, U.S. and Japan.

As the CCCC Program is nearing its completion, Dr. Batchelder presented a proposed PICES scientific report outline on the summary of the 4Cs Program and stated that any feedback from Science Board would be welcome. The report will take approximately 1½ years to finish. CCCC and/or its Task Teams will be co-sponsoring 3 topic sessions and 1 workshop, and the Program will sponsor a paper session at PICES XVI.

Report of the Study Group on *Ecosystem Status Reporting* (Agenda Item 3)

Dr. Skip McKinnell, PICES Deputy Executive Secretary, presented the findings of the report on the behalf of the Study Group on *Ecosystem Status Reporting* Chairman, Mr. Robin Brown. From the terms of reference created under Science Board (Decision 06/S/6), the SG developed 4 options for consideration at the inter-sessional Science Board/Governing Council meeting. Science Board was able to narrow the options down to 2: Incremental improvement ESR and integrated ecosystem assessment. Members were divided as to whether the ESR should tie in with FUTURE or could be started earlier. Dr. Bychkov stated that funds were available but that people willing to devote time to the report was an issue. There was consensus that the report was a flagship product of PICES and should not be abandoned.

Action

SG-ESR

3.0 Finalize the report within 1 month and, on behalf of Science Board, submit to Council in order to determine what member countries consider the preferred option.

Report of the Study Group on *Marine Aquaculture and Ranching in the PICES Region* (Agenda Item 4)

Tasks were circulated to members of the Study Group on *Marine Aquaculture and Ranching in the PICES Region* by Study Group Chairman, Dr. Michael Rust, but responses could not be collected and summarized in time to present a progress report to the inter-sessional Science Board/Governing Council meeting in Yokohama.

Status of proposed publications (Agenda Item 5)

The Executive Secretary reviewed the items that were slated for publication or had been published. FIS Chairman, Dr. Kruse, stated that

arrangements had been made with the journal *Fisheries Research* to have a special issue on selected papers from PICES XVI Topic Session, "*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*", and requested that this item be added to the PICES list of proposed publications for 2007 and beyond.

Status of proposed inter-sessional workshops/ symposia (Agenda Item 6)

The proposal by Prof. Kishi for a 4th International Workshop on *Okhotsk Sea and adjacent areas* was deferred from summer 2007 to 2008 so that a financial request could be made at PICES XVI. NOAA has contributed $30K towards costs for the Early Career Scientists Conference scheduled for June 26–29, 2007 in Baltimore, U.S.A.

Status of preparations for PICES XVI (Agenda Item 7)

Good progress is being made on preparations for PICES XVI in Victoria, Canada, with the venue set and invited speakers in place for the Science Board Symposium. The meeting in Victoria will be 1 day longer because of the addition of the FISP Workshop on FUTURE. At PICES XV in Yokohama, Science Board had proposed 4 parallel sessions for the meeting in Victoria but Council recommended that the sessions be reduced to 3. Science Board was able to implement the request by adjusting the duration of some sessions. GLOBEC and ICES have contributed funds to co-sponsor 1 and 2 topic sessions, respectively. Visas to Canada will need to be issued for only Chinese and Russian participants.

Selection of PICES XVII theme (Agenda Item 8)

The Science Board Chairman stated that because the proposed theme for PICES XVII in Dalian, China, was received just prior to PICES XV, Science Board did not have time to review it for discussion at that time, but the members did note that the original proposal was too narrow to draw wide participation for the next Annual Meeting. Since FUTURE will be implemented at PICES XVII, Prof. Kim felt it would be appropriate to make the Science Board Symposium the occasion to address the final themes of FUTURE and highly desirable to invite speakers to the Science Board Symposium who will play a key role in FUTURE. He noted that a number of key words in China's original proposal are the same as those addressed in the FISP planning documents, and considered it reasonable to prepare an abstract in anticipation of those invited speakers although the key players for FUTURE were not yet known. A draft of the science plan for FUTURE will be presented at an Open Forum at PICES XVI and it is anticipated that Science Board will have a better idea of the scope and themes for FUTURE by this time. Prof. Kim therefore proposed finalizing the theme abstract for PICES XVII at the Science Board meeting immediately after the closing of PICES XVI so that the science plan draft could be considered.

Action

Science Board:

8.0 Finalize the theme abstract by PICES XVI.

2007 Wooster Award (Agenda Item 9)

Three nominations for the 2007 Wooster Award were reviewed and discussed by Science Board *in camera*. The recipient will be announced at PICES XVI. The remaining 2 nominations will remain for consideration at next year's inter-sessional meeting.

Capacity building actions (Agenda Item 10)

Professor Kishi will undertake the responsibility to co-ordinate scheduling and venue for a fourth international workshop on the "*Okhotsk Sea and adjacent areas*", a second OECOS workshop (to be proposed at PICES XVI), and a second CREAMS/PICES summer school in 2008. Dr. Bychkov requested that the Secretariat be informed on details for the second summer school as soon as they were known. BrainKorea21, the Korea-PICES, Korea-GLOBEC and China's SOA support matching funds with PICES to allow the participation of Korean and Chinese early career scientists, respectively, in PICES Annual Meetings and workshops/symposia.

Action

Prof. Kishi

10.1 Co-ordinate scheduling and venue for 3 events proposed to take place in 2008 with the other convenors.

Interactions with other organizations (Agenda Item 11)

The FIS Committee recommended that PICES co-sponsor the CLIOTOP (CLimate Impacts on Oceanic TOp Predators) Symposium to be held La Paz, Mexico, from December 3–7, 2007, by supporting the attendance of 2 plenary speakers, Drs. William Sydeman (or alternate George Hunt) and Nathan Mantua.

The Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society will be holding their first biannual meeting on "*Challenges to fisheries and aquatic sciences in Mexico*" from May 2–4, 2007 in La Paz, Mexico. PICES will use this meeting as a vehicle to bring awareness of PICES activities to the Mexican scientific community and to encourage interest and participation in potential affiliation with PICES. Dr. Stein will attend a plenary meeting to present information on the vision and activities of PICES. A stand will be set up to display PICES books, special publications, selected Scientific Reports, and recent primary journals of interest to Centro de Investigaciones Biológicas del Noroeste (CIBNOR). The publications will remain with CIBNOR's library which PICES has added to its mailing list.

Science Board declined the North Atlantic Salmon Conservation Organization's (NASCO) invitation to co-sponsor a symposium on "*Salmon at sea – Causes of marine mortality of Pacific and Atlantic salmon and implications for their management*" scheduled for 2010 mainly because the topic was not of interest to all PICES member countries.

Science Board endorsed the proposal to co-sponsor a GLOBEC/Eur-Oceans/FAO symposium on "*Coping with global change in marine social-ecological systems*" scheduled for July 2008 in Rome, Italy. Members thought it would be useful topic for FUTURE to move into as well as being relevant to the Ecosystem Status Report.

Science Board endorsed the Secretariat's proposal to mail the WOCE Pacific Ocean Atlas of physical and chemical parameters, compiled by Dr. Lynne Talley of Scripps Institution of Oceanography, to Chinese and Russian libraries. To minimize distribution costs, the atlas will be presented to Chinese and Russian participants at PICES XVI to take back to their respective libraries.

Action

Dr. Kruse/Secretariat:

11.1 Send a letter to NASCO declining their invitation.

Secretariat:

11.2 Provide WOCE atlases to Chinese/Russian libraries in care of selected scientists when they come to PICES XVI.

Status of proposed changes in membership (Agenda Item 12)

As there was still concern about lack of membership or participation in some PICES categories, the Secretariat will send formal letters of request for members to be appointed from Canada, China, and Korea. Dr. Sinjae Yoo, national delegate of Korea, indicated that there was an expert who expressed interest in joining MBM-AP.

Action

Secretariat:

12.1 Send letters of request for members for CC-S and MBM-AP to national delegates.

Dr. Yoo:

12.2 Ensure that letter from MBM expert is channeled to the Secretariat.

Committee Chairmen and Vice-Chairmen (Agenda Item 13)

The Science Board Chairman instructed Committee Chairmen whose terms were coming to an end to consult with the Secretariat about replacements or extensions so that these could be in place to ensure stability for the implementation of FUTURE. He also asked that an open mind be

kept about having Vice-Chairmen on Committees that currently do not have them.

Other items (Agenda Item 14)

The Study Group on *Scientific Cooperation* (SG-SC) between PICES and non-member countries was approved by Council at PICES XV in 2006 (Decision 06/A/6). SG Chairman, Dr. Laura Richards, thanked Science Board members for their comments on the draft report being presented at the inter-sessional meeting. Dr. Richards stated that the purpose of the report was to try to identify options and propose mechanisms for scientific cooperation between PICES and non-member countries. The SG strongly urged the same membership to be kept rather than expanding the terms of the Convention. The SG looked at affiliate status and asked Science Board to consider what kind of roles they would like affiliate countries to have. Suggested questions included: 1) What would be the processes for selecting an affiliate institution? 2) How would PICES interact with scientists from non-affiliate institutions in a country with a recognized affiliate? 3) What would be the costs to the Secretariat that would be associated with expanded scientific cooperation?

Dr. Bychkov announced that national delegate for Korea, Dr. Ig-Chan Pang, will make a statement on Korea's acceptance to host PICES XVIII at Council's inter-sessioanl meeting, April 20, 2007. The Annual Meeting will take place October 2009 in Seoul, Busan, or Yosu.

Science Board endorsed the idea of presenting a PICES award certificate to an organization(s), group(s), or individual(s) that have contributed to marine science in the North Pacific through long-term monitoring and/or data management of various ocean conditions and marine resources. Nominations and letters of recommendation can be sent to the Secretariat. Recommendation for a recipient(s) will be made by the MONITOR and TCODE Technical Committees with final approval to be made by Science Board. (Update: On May 6, 2007, Science Board voted to have the award named the "PICES Ocean Monitoring Service Award (POMA)". A description of the new award will be finalized at PICES XVI and the first POMA will be awarded at PICES XVII.)

Dr. Batchelder announced that Professor Kishi was awarded the Japan Oceanographic Prize of the Oceanographic Society of Japan in early 2007 and that in the previous year he was the recipient of the Uda Prize, awarded by the Japan Society of Fisheries Oceanography.

Action

Dr. Batchelder

14.1 Circulate the SG-SC draft report to Science Board for review and comments.

Dr. Kim

14.2 Circulate proposed titles of a PICES award certificate to Science Board for review and finalization.

SB-IM Endnote 1

Participation list

Science Board members

Harold P. Batchelder (Co-Chairman, CCCC-IP)
Michael J. Dagg (Chairman, BIO)
Michael G. Foreman (Chairman, POC)
Glen Jamieson (Chairman, MEQ)
Kuh Kim (Chairman, Science Board)
Michio J. Kishi (Co-Chairman, CCCC-IP)
Gordon H. Kruse (Chairman, FIS)
Sei-Ichi Saitoh (Co-Chairman, MONITOR)
Igor I. Shevchenko (Chairman, TCODE)
John E. Stein (Chairman-elect, Science Board)
Gongke Tan (Representative of People's Republic of China)
Sinjae Yoo (Representative of Republic of Korea)

Governing Council members and advisors

Vera Alexander (Past Chairman, PICES)
Lev N. Bocharov (Vice-Chairman, PICES)
Anna Karulina (advisor, Russia)
Oleg Katugin (advisor, Russia)
Kyoung-Jin Kim (alternate delegate, Republic of Korea)
Tokimasa Kobayashi (advisor, Japan)
Hideki Nakano (national delegate, Japan)
Ig-Chan Pang (national delegate, Republic of Korea)
Samuel Pooley (national delegate, U.S.A.)
Laura Richards (national delegate, Canada)
Igor Shevchenko (advisor, Russia)
Gongke Tan (alternate national delegate, People's Republic of China)
Yuji Uozumi (advisor, Japan)
Tokio Wada (Chairman, PICES)

PICES Secretariat

Alexander Bychkov (Executive Secretary)
Christina Chiu (Deputy Executive Secretary on Administration)
Skip McKinnell (Deputy Executive Secretary)

SB-IM Endnote 2

Science Board/Governing Council Inter-sessional meeting agenda

Thursday, April 19, 2007

1. Welcome and introduction
2. Mid-term update on activities of Committees and CCCC Program and their subsidiary bodies
   - 2.1 BIO Committee (Michael J. Dagg)
   - 2.2 FIS Committee (Gordon H. Kruse)
   - 2.3 MEQ Committee (Glen Jamieson)
   - 2.4 POC Committee (Michael G. Foreman)
   - 2.5 MONITOR Technical Committee (Sei-Ichi Saitoh)
   - 2.6 TCODE Technical Committee (Igor Shevchenko)
   - 2.7 CCCC-IP (Harold Batchelder; Michio Kishi)
3. Report of the Study Group on *Ecosystem Status Reporting*
4. Report of the Study Group on *Marine Aquaculture and Ranching in the PICES Region*
5. Status of proposed publications
6. Status of proposed inter-sessional workshops/symposia
7. Status of preparations for PICES XVI
8. Selection of PICES XVII theme (China, 2008)
9. 2007 Wooster Award
10. Capacity building actions
11. Interactions with other organizations
12. Status of proposed changes in membership for committees/program and their subsidiary bodies
13. Committee Chairmen and Vice-Chairmen
14. Other items

REPORT OF SCIENCE BOARD

The Science Board met from 12:30–14:00 on October 28, 2007, to review the agenda and to discuss items related to the upcoming scientific sessions at the Annual Meeting and other topics. An Open Science Forum on the next integrative science program of PICES, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems), version 4.2, was held November 1 from 17:30–18:30. On November 3, the Study Group on the *Future Integrative Science Plan* met for a 1-day workshop to review and discuss comments received from the PICES Committees/Program and broader community and to discuss tasks and schedules of the final draft. Science Board reconvened November 4 from 9:00–17:30 to address the remainder of the agenda. Ms. Rosalie Rutka served as rapporteur for the Science Board meetings (See *SB Endnote 1* for a list of participants).

October 28, 2007

Science Board Chairman, Dr. Kuh Kim, welcomed members and guests and called the meeting to order. The agenda was discussed and adopted as presented in *SB Endnote 2*.

Review of procedures for Science Board Symposium and Session awards and Closing Session (Agenda Item 2)

Science Board agreed that one Best Oral and one Best Poster Presentation Award would be given by each Committee/Program Chairman (the exception being the MONITOR and TCODE Committees, which would split the Best Oral and Best Poster Presentation awards), regardless of the number of Topic/Contributed Papers Sessions sponsored. Committee/Program Chairmen would select Best Oral Presentation recipients who were early career scientists from these sessions. The Science Board Symposium Best Oral Presentation Award would be open to everyone, as would Best Poster Presentation Awards for all sessions. Each Chairman was responsible for selecting the award recipients.

The Closing Session would consist of a brief summary by the Science Board Chairman of how eligibility for the awards was determined, followed by presentations of awards from each Committee and Program. It was agreed that Committee/Program Chairmen would encourage award recipients to remain for the Closing Session.

Relations with specific international programs/organizations (Agenda Item 3)

Invited observers, Dr. Francisco E. Werner (Chairman of GLOBEC Scientific Steering Committee), R. Ian Perry (Chairman of GLOBEC Scientific Steering Committee as of January 1, 2008) and Dr. Adolf Kellermann (Head, ICES Science Programme) gave presentations on their respective organizations. Drs. Perry and Kellermann invited PICES to co-sponsor various events. Dr. Bjørn Sundby (President, SCOR Executive Committee) invited PICES to be involved in a SCOR Working Group and to partner with SCOR in capacity building by establishing an oceanographic school(s) in developing regions of the world.

Members were unanimously in favour of accepting affiliates to the North Pacific Marine Science Organization but needed more time to review and discuss the criteria for acquiring PICES affiliate status. Science Board agreed to continue discussions at the next (inter-sessional) meeting.

Report of the Study Group on *Ecosystem Status Reporting* (Agenda Items 4 and 13)

The Chairman of the Study Group on *Ecosystem Status Reporting*, Mr. Robin Brown, presented the final report of the Study Group's views on

producing the next version of the North Pacific Ecosystem Status Report (NPESR). At the request of Governing Council at the 2007 inter-sessional Science Board/Governing Council meeting, the Study Group augmented its report to include estimates of the in-direct (in-kind) costs to the Members of preparing electronic and paper versions of the report.

Science Board unanimously endorsed proceeding with the "Incremental Improvement" Ecosystem Status Report which builds on the experiences of the pilot project. The timeline for completion of the report is anticipated to be 2 years after initiation, based upon estimates provided by the Secretariat. The next report is anticipated to require workshops organized along disciplinary lines to fill some of the obvious gaps that arose during the development of the pilot project. To facilitate better comparisons among regions and a more comprehensive synthesis, greater top-down control of the report will be needed for continuity and standardization.

The report could be integrated closely with FUTURE since FUTURE and the NPESR were identified as high priority activities (at the 2005 inter-sessional Science Board/Governing Council meeting in Seattle, U.S.A.). Science Board agreed that $40,000 should be set aside for FUTURE-related activities and that the remainder of the funds currently designated for high priority activities should be used for the NPESR. Science Board also recommended that a portion of the NPESR funds should be set aside to provide ongoing updates to the electronic version of the report. Dr. Skip McKinnell was unanimously endorsed by Science Board to lead the preparation and publication of the next NPESR. Science Board recognized that Dr. McKinnell could not take on this responsibility without some adjustment to his present duties within the PICES Secretariat.

Implementation of Science Board recommendations and Governing Council decisions from PICES XV and the 2007 inter-sessional SB/GC meeting (Agenda Item 5)

Science Board accepted the report on decisions and recommendations from PICES XV (see *GC Endnote 3*) and the 2007 inter-sessional Science Board/Governing Council meeting that were of relevance.

Status of action items from the 2007 inter-sessional SB/GC meeting (Agenda Item 6)

Dr. Gordon Kruse, Chairman of the FIS Committee, reported that a third draft of the WG 16 report on "*Impacts of climate and climate change on the key species in the fisheries of the North Pacific*", for publication as a PICES Scientific Report, was delivered to him for review prior to the PICES Sixteenth Annual Meeting, and that his final review was pending.

MONITOR Committee Chairman, Dr. Jeffrey Napp, presented the new terms of reference of the Committee (*MONITOR Endnote 4*) which would clarify MONITOR's role in facilitating cooperation, communication and coordination among all ocean observing systems in the North Pacific.

November 4, 2007

Report of elections of new Committee Chairmen (Agenda Item 7)

The following reflects changes and continuations in Chairmanship/Vice-Chairmanship for Scientific and Technical Committees and expert groups:

- Dr. John Stein to replace Dr. Kuh Kim as Science Board Chairman;
- Dr. Michael Dagg to serve a second term as BIO Committee Chairman;
- Dr. Michael Foreman to serve a second term as POC Committee Chairman;
- Dr. Hiroya Sugisaki to replace Dr. Jeffrey Napp as MONITOR Committee Chairman;
- Dr. Phillip Mundy to replace Dr. Sei-Ichi Saitoh as MONITOR Committee Vice-Chairman;
- Dr. Bernard Megrey to replace Dr. Igor Shevchenko as TCODE Committee Chairman;
- Dr. Kyu-Kui Jung to replace Dr. Bernard Megrey as TCODE Committee Vice-

Chairman;
- Dr. Sinjae Yoo to become Vice-Chairman of Science Board;
- Dr. Kerim Aydin to continue as Co-Chairman of CFAME Task Team up to, but not including, PICES XVII.

Reports from Scientific and Technical Committee and IP/EC CCCC Program Chairmen (Agenda Item 9)

Reports were presented by Committee and IP/EC CCCC Program Chairmen to Science Board. Specific details of the individual reports can be found elsewhere in this Annual Report.

Update of Action Plans (Agenda Items 9a and 9c)

Once the implementation workshop on FUTURE, scheduled for April 2008, has been initiated, Action Plans should be updated to align with the new program.

Proposals for inter-sessional activities, including travel and publications (Agenda Item 9b)

Inter-sessional activities

- An inter-sessional meeting of WG 19 on *Ecosystem-based management science and its application to the North Pacific*, February 2008, Seattle, U.S.A.;
- An ICES/PICES workshop on "*Environmental interactions of mariculture*", April 2008, Victoria, Canada;
- An inter-sessional CFAME workshop on "*Linking and visualizing climate forcing mechanisms and marine ecosystem changes: A comparative approach*", April 2008, Honolulu, U.S.A.;
- A workshop to develop an Implementation Plan for future for FUTURE and an inter-sessional Science Board/Governing Council meeting, April 2008, Seattle, U.S.A.;
- An international Symposium on "*Effects of climate change on the world's oceans*" (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR and WCRP), May 19–23, 2008, Gijón, Spain;
- An international Symposium on "*Coping with global change in marine social-ecological systems*" (co-sponsored by GLOBEC, EUR-OCEANS, FAO, IRD, SCOR, IMBER and PICES), July 8–11, 2008 in Rome, Italy;
- A 2nd CREAMS/PICES summer school on "*Ecosystem-based management*", August 23–25, 2008, Hakodate, Japan;
- A 4th International Workshop on "*The Okhotsk Sea and adjacent areas*", August 2008, Abashiri, Japan;
- An international Symposium on "*Herring: Linking biology, ecology and status of populations in the context of changing environments"* (co-sponsored by ICES, PICES and GLOBEC), August 26–29, 2008, Galway, Ireland;
- A PICES/CREAMS Workshop on "*Flux studies in marginal seas*", August 2008, Seoul, Korea;
- An ESSAS/PICES workshops at the ESSAS Annual Meeting, September 15–19, 2008, Halifax, Canada;
- ICES/PICES Theme Sessions on "*Coupled physical and biological models: Parameterization, validation, and applications*", "*Marine spatial planning in support of integrated management – tools, methods, and approaches*", and "*New methodology for tracking fish, mammal, and seabird behaviour and migrations*" at the ICES Annual Science Conference, September 22–26, 2008, Halifax, Canada;
- A PICES/ICES Theme Session on "*The effects of ocean acidification on fisheries and ecosystems*" at the International Symposium on "*The Ocean in a High CO_2 World – II*" (co-sponsored by SCOR, IOC, IAEA and IGBP), October 6–8, 2008, Monaco;
- An ICES/PICES/GLOBEC workshop on "*Changes in distribution and abundance of clupeiform small pelagic fish in relation to climate variability and global change*", November 3–7, 2008, Kiel, Germany;
- An International Symposium on "*Rebuilding depleted fish stocks: Biology, ecology, social science and management strategies*" (co-sponsored by ICES, PICES and

UNCOVER), November 3–6, 2009, Warnemünde/Rostok, Germany;
- An International Symposium on "*Collection and interpretation of fishery-dependent data*" (co-sponsored by ICES, FAO and PICES), summer 2010, Galway, Ireland.

Travel requests

PICES XVII
- 6 invited speakers for the Science Board Symposium;
- 2 invited speakers for the BIO/OECOS Workshop;
- 1 invited participant to attend the initial meeting of BIO WG on euphasiids;
- 2 invited speakers for MEQ (HAB-S) workshop on *Review of selected harmful algae in the PICES region: IV*. Karenia *and* Prorocentrum;
- 1 invited speaker from ICES (ICES to fund speaker) for the MONITOR/TCODE/BIO Topic Session on "*Linking biology, ecology, and physics in our observational systems – present status and FUTURE needs*";
- 1 invited speaker for CCCC workshop on "*Marine ecosystem model inter-comparison project*";
- 1 invited speaker for CCCC/POC Topic Session on "Marine system forecast models: Moving forward to the FUTURE".

Inter-sessional meetings
- 1 MONITOR representative to attend the GOOS Scientific Steering Committee meeting (GSSC-XI) (April 2008);
- $10K for Asian travel to University of Victoria mariculture workshop (April 14–18, 2008, Victoria, Canada);
- A Co-Chairman of WG 20 on *Evaluations of Climate Change Projections*, 1 Korean scientist (Yellow Sea/East China Sea fish expert) and 1 North American scientist (California Current fish or plankton expert) to attend the CFAME workshop on "*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*", April 15–17, 2008, Honolulu, U.S.A.;
- A PICES affiliate member of SCOR Working Group 125 on *Global zooplankton comparisons* to attend the workshop on "*Zooplankton and climate: response modes and linkages among regions, regimes, and trophic levels*", May 18, 2008, Gijon, Spain;
- 1 PICES convenor and members of the Scientific Steering Committee for the International Symposium on "*Effects of climate change on the world's oceans*", May 19–23, 2008, Gijón, Spain;
- A PICES member of the Discussion Panel for the International Symposium on "*Coping with global change in marine social-ecological systems*", July 8–11, 2008, Rome, Italy;
- 1 invited speaker for the 4th International Workshop on the "*Okhotsk Sea and adjacent areas*" (August 2008, Hakodate, Japan);
- 1 guest lecturer for a 2nd CREAMS/PICES summer school on "*Biomass-based management*"" (August 23–26, 2008, Hakodate, Japan);
- A member of WG 20 and a representative of the CCCC Program (an ecosystem modeler) to attend the ESSAS Annual Meeting, September 15–19, 2008, Halifax, Canada;
- 1 PICES co-convenor at the ICES Annual Meeting theme session on "*New methodology for tracking fish, mammals and marine seabird migrations and behavior*" (September 22–26, 2008, Halifax, Canada);
- 1 PICES co-convenor/speaker for an ICES Annual Meeting theme session on "*Coupled physical and biological models: Parameterization, validation and applications*" (September 22–26, 2008, Halifax, Canada);
- 1 PICES co-convenor for ICES Annual Meeting theme session on "*Marine spatial planning in support of integrated management – tools, methods, and approaches*" (September 22–26, 2008, Halifax, Canada);
- A PICES representative and 1 or 2 invited speakers to attend the International Symposium on "*The ocean in a high CO_2 world*", October 6–8, 2008, Monaco;
- A PICES convenor for the ICES/PICES Workshop on "*Changes in distribution and abundance of clupeiform small pelagic fish in relation to climate variability and global*

change" (November 2008, Kiel, Germany);
- A PICES convenor for the symposium on "*Rebuilding depleted fish stocks: Biology, ecology, social science and management strategies*", November 2–5, 2009, Warnemünde/Rostok, Germany;
- A PICES convenor/speaker for the International Symposium on "*Collection and interpretation of fishery-dependent data*", summer 2010, Galway, Ireland.

Publications

Special issues of primary journals (2008–2009)
- *Plankton and Benthos Research* (2008; Guest Editors: H. Iizumi and K. Ishii) – selected papers from the PICES XV Topic Session on "*The human dimension of jellyfish blooms*" (approved in 2006);
- *Progress in Oceanography* (2008; Guest Editors: H. Batchelder and S. Kim) – selected papers from the PICES/GLOBEC symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" (approved in 2005);
- *Journal of Marine Systems* (2008; Guest Editors: K.-I. Chang, C. Mooers, J.-H. Yoon and S.-I. Ito) – selected papers from the 2006 CREAMS/PICES Workshop on "Model–data inter-comparison for the Japan/East Sea";
- *ICES Journal of Marine Science* (2008; Guest Editors: M. Dagg, R. Harris, L. Valdez and S.-I. Uye) – Selected papers from the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" (approved in 2007);
- *Deep-Sea Research II* (2008; Guest Editors: W. Peterson and S. Kawaguchi) – Selected papers on krill from the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" (approved in 2007);
- *ICES Journal of Marine Science* (2008; Guest Editors: F. Mueter and E. North) – Selected papers from the ICES/PICES Early Career Scientists Conference on "*New frontiers in marine science*" for a section the the regular issue (approved in 2007);
- *Deep-Sea Research II* (2008; Guest Editors: A. Tsuda, M. Wells, M. Uematsu and H. Saito) – Selected papers from the SEEDS-II experiment;
- *Journal of Northwest Atlantic Fishery Science* (2008; Guest Editors: R.D. Brodeur, M. Dickey-Collas and E. Trippel) – Selected papers from the International Symposium on "*Reproductive and recruitment processes of exploited marine fish stocks*";
- *Fisheries Research* (2008; Guest Editors: G.H. Kruse, Y. Ishida, T. Perry, V. Radchenko and C.-I. Zhang) – Selected papers from the PICES XVI Topic Session on "*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks"*;
- *Journal of Oceanography* (2008/9; Guest Editors: T. Saino, J.R. Christian, K. Lee and TBA) – selected papers from the PICES XV Topic Session on "*Decadal changes in carbon biogeochemistry in the North Pacific*" (approved in 2007);
- *Deep-Sea Research II* (2009; Guest Editors: S. McKinnell, W. Sydeman, S. Minobe) – selected papers on results of PICES XVI Topic Session on "*Phenology and climate change in the North Pacific: Implications of variability in timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*";
- *Progress in Oceanography* (2009; Guest Editors: B.A. Megrey, J.S. Link and E. Moksness) – selected papers from the ICES/ PICES Theme Session on "*Comparative marine ecosystem structure and function: Descriptors and characteristics*" at the 2007 ICES Annual Science Conference.

PICES Scientific Report series (2008–2009)
- Report of 2007 FIS workshops on "*Forecasting climate impacts on fish production*" (2008; Editors: A. Hollowed, R. Beamish and M. Schirripa);
- Final report of WG 16 on *Climate Change Shifts in Fish Production, and Fisheries Management* (approved in 2002 for publication in 2004; delayed until early 2008 pending review of third draft by FIS; Editors: R. Beamish and A. Yatsu);

- Results of annual HAB workshops on "*Review of selected harmful algae in the PICES region": Alexandrium* and *Pseudo-nitzchia* (2005), *Cochlodinium* and *Dinophysis* (2006) and *Heterosigma* (2007) (2008/2009; Editors: TBD);
- Final report of WG19 on *Ecosystem-based management science and its application to the North Pacific* (early 2009; Editors: G. Jamieson, P. Livingston and C.-I. Zhang);
- Final report for the CCCC Program (2009; Editor: M. Kishi);
- A summary of the activities of the CFAME Task Team (may be merged with CCCC report).

PICES Technical Report series (2008)
- An updated version of "*Metadata federation of PICES member countries*".

Other publications
- Summary paper of SEEDS I, II, and SERIES in *Eos* (2008; S. Takeda);
- WG 19 Brochure on "*Ecosystem-based management science and its application to the North Pacific*" (late 2008; G. Jamieson, P. Livingston and C.-I. Zhang);
- Results from the CCCC Program distributed among several chapters of the GLOBEC Synthesis Book (2009/2010; H. Batchelder and S. Kim);
- Announcement, poster and Book of Abstracts for PICES XVII;
- Two issues of PICES Press (newsletter);
- PICES 2008 Annual Report.

Other
- Rental of web services co-sponsored by TCODE/MONITOR Committees to test PICES web resources capability for FUTURE-related events ($2.5k for 12 months).

<u>Standing list of international and regional organizations and programs (Agenda Item 9d)</u>

The Standing List of International Organizations and Programs facilitates PICES interactions with other programs and indicates high priority organizations/programs to whose meetings PICES should pursue collaborative issues with (see *SB Endnote 3* for a revised list).

Report of the Study Group on *Marine Aquaculture and Ranching in the PICES Region* and recommendations for new working groups and other subsidiary bodies and (Agenda Items 8 and 10)

Dr. Michael Rust, Chairman of the Study Group on *Marine Aquaculture and Ranching in the PICES Region* (SG-MAR) presented his group's finalized report that addressed the Study Group's four terms of reference. Feedback from former WG 18 on *Mariculture in the 21st Century – The Intersection between Ecology, Socio-economics and Production* was solicited as to why the WG had limited success in achieving its terms of reference. Responses included 1) none of the members had input to the terms of reference, 2) the expertise of the members were not in synchrony, 3) a lack of existing personnel relationships among the Working Group, and 4) the isolated position of aquaculture within the larger framework of PICES. Based on the responses of each PICES member country, the Study Group developed a list of highest priority needs of marine aquaculture and/or ocean ranching science for the next 5 to 10 years. Based on the priorities, the Study Group recommended the formation of two working groups in marine aquaculture for joint activities in PICES.

Science Board recommended waiting until after a 2008 ICES/PICES-co-sponsored workshop at the University of Victoria, Canada, to assess whether or not there was sufficient interest to warrant establishing a Working Group on *Environmental Risk Assessment and Interactions of Marine Aquaculture* and a Working Group on *Technology and Management for Production Aquaculture*.

Science Board recommended establishing:
- a new Working Group on *Iron Supply and Its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* subject to adding two additional term of references.

- a new Working Group on Euphausia pacifica *in Continental Shelf and Slope Waters around the Pacific Rim* and changing the species title to the more generic "krill".

Science Board recommended deferring the proposal to form a Study Group on *Indicators of Human Well-being* by MEQ until the next Science Board inter-sessional meeting when plans for the Study Group, following a proposed MEQ session on this topic in Dalian (see below), were more fully developed. Science Board recommended deferring the proposal for a FIS Working Group on *Management Strategies to Address the Implications of Climate Variability and Climate Change on Trends in Fish and Shellfish Production* until next Annual Meeting so that POC/WG 20 could be involved.

PICES XVII theme and description, draft schedule of scientific sessions and workshops (Agenda Item 11)

Science Board agreed that the theme for PICES XVII, to be held in Dalian, China, from October 23 to November 2, 2008, should be "*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE*". During PICES XVI, Prof. Kuh Kim appointed members, Drs. Harold Batchelder, Michael Dagg and Michael Foreman, to edit the existing draft of the theme for better comprehension and clarity and to have the final version prepared for the November 3 Science Board meeting (see *SB Endnote 4*). The following sessions and workshops, in order of Committee/Program, were recommended to be convened.

1-day Science Board Symposium
Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE

1-day BIO Topic Session
End-to-end foodwebs: Impacts of a changing ocean

½-day BIO/MEQ Topic Session
Seabirds and marine mammals as environmental indicators

½-day BIO Contributed Paper Session

1-day BIO Workshop
Oceanic ecodynamics comparison in the subarctic Pacific

½-day FIS Topic Session
Effects of fisheries bycatch and discards on marine ecosystems and methods to mitigate the effects

¾-day FIS Topic Session
Institutions and ecosystem-based approaches for sustainable fisheries under fluctuating marine resources

1-day FIS Contributed Paper Session

1-day MEQ Topic Session
Consequences of non-indigenous species introductions

½-day MEQ Topic Session
Human dimension sciences relevance for PICES (later renamed to *Connecting the human and natural dimensions of marine ecosystems and marine management in the PICES context*)

½-day MEQ Topic Session
Environmental regulation of species succession: The use of long-term data sets to understand HAB species dominance (later renamed to *Species succession and long-term data set analysis pertaining to harmful algal blooms*)

¾-day MEQ/FIS Topic Session
Mariculture technology and husbandry for alternate and developing culture species

1-day MEQ Workshop
Review of selected harmful algae in the PICES region: IV. Karenia *and* Prorocentrum and a ½-day lab demonstration.

1-day MONITOR/ TCODE/BIO Topic Session
Linking biology, chemistry, and physics in our observational systems – present status and FUTURE needs

1-day MONITOR/ESSAS Workshop
Status of marine ecosystems in the sub-Arctic

and Arctic seas – Preliminary results of IPY field monitoring in 2007 and 2008

¾-day POC Topic Session
Coastal upwelling processes and their ecological effects

1-day POC Contributed Paper Session

1-day CCCC/POC Topic Session
Marine system forecast models: Moving forward to the FUTURE

1-day CCCC/ESSAS Workshop
Marine ecosystem model inter-comparisons

1½-day CCCC/POC/FIS Workshop
Climate scenarios for ecosystem modeling (II)

The description of the PICES Ocean Monitoring Service Award (POMA) was endorsed by Science Board. (See *GC Appendix D*)

Selection of PICES XVIII theme and description (Agenda Item 12)

Science Board agreed in principle with the proposed theme for PICES XVIII in Busan, Korea in 2009, entitled "*Understanding ecosystem dynamics, pursuing ecosystem approaches to management*".

High Priority activities (Agenda Item 13)

Science Board updated the list of high priority activities, identified at the third inter-sessional Science Board/Governing Council meeting in Seattle, U.S.A. in 2005, to: (1) Implementation (formerly "Development") of PICES future integrative scientific program, (2) North Pacific Ecosystem Status Report, and (3) International exchange and capacity building.

Next inter-sessional Science Board meeting (Agenda Item 14)

Science Board recommended holding the next inter-sessional Science Board meeting in the third week of April, 2008 in Seattle, U.S.A., to coincide with the implementation of the science program of FUTURE.

Other business (Agenda Item 15)

Dr. Glen Jamieson, Chairman of the MEQ Committee, presented a brief update of the Japanese-funded PICES projects on *Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*, scheduled to run for 5 years. Funding for the first year was to be split between the Section on Harmful Algal Blooms (HAB-S) sub-project and the Marine/Estuarine Invasive Species (MIS) sub-project. As a capacity building activity, HAB-S will conduct a training workshop in Vietnam to develop methodologies in year 1. Inter-sessional WG 21 experts are planning to meet in late February or early March 2008, in Korea to evaluate proposed AIS documentation protocols and reach final agreement on standards, data elements and data entry templates for the MIS (Marine/Estuarine Invasive Species) Database for the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*". Each member country will provide information on a pilot MIS taxon (bivalves) that will be entered into an MIS database for further development.

Best Presentation and Poster Awards

Dr. Muyin Wang (U.S.A.) received the Best Presentation Award at the Science Board Symposium for her paper (co-authored with James E. Overland) on *Future climate of North Pacific projected by IPCC models*. The other Awards can be found in Committees and Program.

Dr. Kim thanked Dr. Foreman for organizing the curling event, as the host country sport, and all the Committee Chairmen for working well together.

SB Endnote 1

Participation List

Members

Harold P. Batchelder (Co-Chairman, CCCC-IP)
Michael J. Dagg (Chairman, BIO)
Michael G. Foreman (Chairman, POC)
Glen Jamieson (Chairman, MEQ)
Kuh Kim (Chairman, Science Board)
Michio J. Kishi (Co-Chairman, CCCC-IP)
Gordon H. Kruse (Chairman, FIS)
Jeffrey M. Napp (Chairman, MONITOR)
Igor I. Shevchenko (Chairman, TCODE)
John E. Stein (Chairman-elect, Science Board)
Fangli Qiao (Science Board, representative of China)
Sinjae Yoo (Science Board, representative of Korea)

Invited Observers

Stewart (Skip) M. McKinnell (Deputy Executive Secretary, PICES)
Francisco E. Werner (Chairman, GLOBEC Scientific Steering Committee)
R. Ian Perry (Ex-officio member, GLOBEC Scientific Steering Committee)
Adolf Kellermann (Head, ICES Science Programme, ICES)
Bjørn Sundby (President, SCOR Executive Committee)

SB Endnote 2

Science Board meeting agenda

Sunday, October 28, 2007 (12:30 – 14:00)

1. Welcome and adoption of agenda
2. Review of procedures for Science Board Symposium and Session awards, FISP and Closing Session
3. Relations with specific international programs/organizations
4. Report of the Study Group on *Ecosystem Status Reporting*
5. Implementation of Science board recommendations and Governing Council decisions from PICES XV and the 2007 inter-sessional SB/GC meeting
6. Status of Action items from the 2007 inter-sessional SB/GC meeting

Saturday, November 3, 2007

FISP Open Forum

Sunday, November 4, 2007 (9:00–18:00)

7. Report of elections of new Committee Chairmen
8. Report of the Study Group on *Marine Aquaculture and Ranching in the PICES Region*
9. Reports from Scientific and Technical Committees and CCCC Program
10. Recommendations for new working groups and other subsidiary bodies

11 PICES XVII (2008, China) theme and description, draft schedule of scientific sessions and workshops
12 Selection of PICES XVIII (2009, Korea) theme and description
13 High priority activities
14 Next inter-sessional Science Board meeting
15 Other business

SB Endnote 3

Revised *Standing List of International and Regional Organizations and Programs*

PICES is expanding its relationships with international scientific organizations of regional and global scale, and with regional scientific and monitoring efforts in the North Pacific that are aligned with the PICES ecosystem research focus. These regional programs may involve several PICES member countries and cover international areas of high ecological importance. Annually, the Science Board examines and revises the *Standing List of International and Regional Organizations and Programs*. Additionally, it selects a subset of organizations and programs that are considered to have the highest priority (marked by *) for PICES with respect to scientific cooperation and facilitation in the coming year.

The 2007 addition to the list, below, was:

PAG	Pacific Arctic Group

This list will be used, in part, to assist the Executive Secretary and Science Board in decisions regarding travel to meetings of other international organizations.

ACIA	Arctic Climate Impact Assessment Program (ACIA of AMAP)
AFSCAR	American Fisheries Society Program on Climate and Aquatic Resources
AMAP	Arctic Monitoring and Assessment Program
AOOS*	Alaska Ocean Observing System
APEC-MRC*	Marine Resources Conservation WG, Asia Pacific Economic Cooperation
APEC-FWG*	Fisheries Working Group, Asia Pacific Economic Cooperation
APFIC	Asia-Pacific Fisheries Commission
APN	Asia-Pacific Network for Global Change Research
Argo*	International Program for deployment of profiling floats (linked with GOOS)
BEST*	Bering Ecosystem Study
CLIVAR*	Climate Variability and Predictability Program
CoML*	Census of Marine Life
CREAMS*	Circulation Research in the East Asian Marginal Seas
DBCP	Data Buoy Cooperation Panel
ECOR	Engineering Committee on Oceanic Resources
ESSAS*	Ecosystem Studies of Sub-Arctic Seas
FAO	Food and Agriculture Organization
GCOS*	Global Climate Observing System
GEM*	Gulf of Alaska Ecosystem Monitoring and Research Program of *Exxon Valdez* Oil Spill Trustee Council (EVOS)
GEOSS	Global Earth Observing System of Systems
GESAMP	Group of Experts on Scientific Aspects of Marine Pollution
GIPME	Global Investigation of Pollution in the Marine Environment
GLOBEC*	Global Ocean Ecosystem Dynamics
GOOS*	Global Ocean Observing System
IAMSLIC	International Association of Marine Science Libraries
IASC	International Arctic Science Committee
IATTC	Inter-American Tropical Tuna Commission
ICES*	International Council for the Exploration of the Sea
ICSU	International Council of Scientific Unions
IGBP*	International Geosphere-Biosphere Program
IGOSS	Integrated Global Ocean Services System
IMBER*	Integrated Marine Biogeochemistry and Ecosystems Research (former OCEANS)

IMO	International Maritime Organization
IOC*	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange
IPCC*	Intergovernmental Panel on Climate Change
IPHC	International Pacific Halibut Commission
IWC	International Whaling Commission
NAFO	Northwest Atlantic Fisheries Organization
NANOOS-IOOS	Northwest Association of Networked Ocean Observing Systems – Integrated Ocean Observing System
NASCO	North Atlantic Salmon Conservation Organization
NEAR-GOOS*	North East Asian Regional GOOS
NOWPAP*	Northwest Pacific Action Plan
NPAFC*	North Pacific Anadromous Fish Commission
NPFMC	North Pacific Fishery Management Council
NPRB*	North Pacific Research Board
PaCOOS*	Pacific Coast Observing System
PAG	Pacific Arctic Group
PORSEC	Pacific Ocean Remote Sensing Conference
PSA	Pacific Science Association
PSC	Pacific Salmon Commission
PSG	Pacific Seabird Group
SAHFOS*	Sir Alister Hardy Foundation for Ocean Science
SCOPE	Scientific Committee on Problems of the Environment
SCOR*	Scientific Committee on Oceanic Research
SOLAS*	Surface Ocean Low Atmosphere Study
SPC	South Pacific Commission
SPREP	South Pacific Regional Environmental Program
START	South Asian Regional Committee for the System for Analysis, Research and Training
UNEP	United Nations Environment Program
WCRP	World Climate Research Program
WESTPAC*	Cooperative Study of the Western Pacific, IOC Sub Committee for the Western Pacific
WMO	World Meteorological Organization

SB Endnote 4

Theme for PICES XVII (Dalian, China)

Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE

FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems), the new Science Program undertaken by PICES Member Nations and their affiliates, has the broad goals of i) understanding the responses of marine ecosystems in the North Pacific to climate change and human activities at basin-wide and regional scales, ii) providing forecasts of what might be expected based on a current understanding of how nature works, and iii) communicating this information effectively to its Members and to society in general. Past advances in understanding marine ecosystems in the North Pacific have been largely based either on the direct analysis of observations, or the development of conceptual and numerical models that help describe the processes underlying the observations. Though these activities will continue to play an important role in FUTURE, the provision of forecasts and estimates of their associated uncertainties necessitates moving beyond observationally based understanding so that ecosystem responses

to natural and anthropogenic changes can be anticipated and communicated effectively to society.

The Science Board Symposium at PICES XVII invites presentations to address the goals of FUTURE and the three key research questions that it identifies, specifically:

1. What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?
2. How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?
3. How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?

Presentations addressing other components of the FUTURE program such as i) communicating scientific information to governments, policy makers, and society at large, and ii) forging partnerships with social scientists, are also welcome.

REPORT OF BIOLOGICAL OCEANOGRAPHY COMMITTEE

The Biological Oceanography Committee (hereafter BIO) met from 16:00–19:30 hours on October 31, 2007. The Chairman, Dr. Michael J. Dagg, called the meeting to order and welcomed the participants (*BIO Endnote 1*). The proposed agenda was reviewed and approved without additions (*BIO Endnote 2*).

Progress reports of existing subsidiary bodies (Agenda Item 3)

Presently, the following three expert groups report only to BIO: the Advisory Panel on *Marine Birds and Mammals* (MBM-AP), the Advisory Panel on *Micronekton Sampling Inter-calibration Experiment* (MIE-AP), and the Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific Ocean* (IFEP-AP). The Section on *Carbon and Climate* (CC-S) is a joint expert group under BIO and POC. The full progress reports of all these subsidiary bodies are included elsewhere in this Annual Report.

A brief report of MBM-AP activities was given by Dr. Hidehiro Kato, MBM-AP Co-Chairman. He focused on the results of the PICES XVI BIO/FIS/POC Topic Session on "*Phenology and climate change in the North Pacific*" (S11) and on a proposal for MBM-AP to update the PICES Scientific Report No. 14 (2000) on "*Predation by marine birds and mammals in the subarctic North Pacific Ocean*" produced by PICES Working Group 11 on *Consumption of Marine Resources by Marine Birds and Mammals* by 2010. The Panel also proposed a ½-day BIO/MEQ Topic Session at PICES XVII on "*Seabirds and marine mammals as environmental indicators*" (*MBM-AP Endnote 4*). Dr. Kato has attended the International Whaling Commission (IWC) Scientific Committee meetings for the past several years. He requested and received endorsement from BIO to continue serving as a liaison between PICES and IWC.

A summary report of IFEP-AP activities was given by Dr. Shigenobu Takeda, IFEP-AP Co-Chairman. At the final meeting of the Panel held on October 30, it was agreed that IFEP-AP had completed its terms of reference and should be disbanded. A new Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* has been proposed under the direction of BIO (*IFEP-AP Endnote 4*).

Neither of the MIE-AP Co-Chairmen, Drs. Evgeny Pakhomov or Dr. Orio Yamamura, was present to make a report to BIO. A written report from the Panel was received after the Annual Meeting.

A report from CC-S was given by Dr. Toshiro Saino, CC-S Co-Chairman. He summarized briefly the successful PICES XVI POC/BIO Topic Session on "*Decadal changes in carbon biogeochemistry in the North Pacific*" (S2), and provided an update on the progress in integration of Pacific carbon data and preparation of the "*Guide to Best Practices for Ocean CO_2 Measurements*". Changes to the terms of reference for CC-S were proposed to include "ocean acidification" (*CC-S Endnote 4*). The modified terms of reference will be circulated for review and discussion to BIO members and will be finalized and presented for approval at the 2008 inter-sessional Science Board meeting.

Proposals for new subsidiary bodies (Agenda Item 4)

A Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* was proposed on behalf of IFEP-AP by Dr. Takeda (*IFEP-AP Endnote 4*). Development of this Working Group has been ongoing for the past year. The draft terms of reference were presented at the inter-sessional Science Board meeting in April 2007 and revised based on the recommendations from the BIO Chairman. BIO endorsed this Working Group and recommended Drs. Fei Chai (U.S.A.) and Shigenobu Takeda (Japan) as Co-Chairmen.

A Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* was proposed by Dr. William T. Peterson (*BIO Endnote 3*). This Working Group will build on PICES activities related to euphausiids that have been conducted over the past several years. This Working Group was also endorsed by the Committee. Proposed Co-Chairmen are Drs. Peterson (U.S.A.), Hiroaki Saito (Japan) and Song Sun (China).

Dr. Young-Shil Kang (Korea) will lead the preparation of a report on methodology and standards for sampling giant jellyfish. This jellyfish is an increasing problem in coastal waters of the western Pacific. The report will be given to BIO at PICES XVII.

Summaries of sessions and workshops at PICES XVI (Agenda Item 5)

Summaries written by convenors of each session and workshop can be found in the *Session Summaries* chapter of the Annual Report. The list of BIO-sponsored events at PICES XVI included:

- a 1-day BIO/POC Topic Session (S2; Oct. 30) on "*Decadal changes in carbon biogeochemistry in the North Pacific*"; Co-Convenors: James Christian (Canada) and Toshiro Saino (Japan);
- a 1-day BIO/FIS/POC Topic Session (S11; Nov. 2) on "*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*"; Co-Convenors: Elizabeth A. Logerwell (U.S.A.), David L. Mackas (Canada), Shoshiro Minobe (Japan) and William J. Sydeman (U.S.A.);
- a 1-day BIO Contributed Paper Session (Nov. 1); Co-Convenors: Michael J. Dagg (U.S.A.), Michio J. Kishi (Japan) and Angelica Peña (Canada);
- a ½-day BIO Workshop (W1; Oct. 28) on "*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*"; Co-Conveners: Evgeny A. Pakhomov (Canada) and Orio Yamamura (Japan);
- a ½-day MONITOR/BIO Workshop (W5; Oct. 27) on "*Measuring and monitoring primary productivity in the North Pacific*"; Co-conveners: Paul J. Harrison (Canada) and Sei-Ichi Saitoh (Japan).

Drs. Michio Kishi, Angelica Peña, Patricia Wheeler and Atsushi Yamaguchi selected the winners for the BIO Best Presentation Award and the BIO Best Poster Award from among those given at the S11 Topic Session and the BIO Contributed Paper Session (POC handled the joint POC/BIO Topic Session S2). The BIO Best Presentation Award was given to Takumi Nonomura (University of Tokyo, Japan) for his paper (co-authored by Atsushi Tsuda, Ichiro Yasuda and Shuhei Nishida) on "*Distribution patterns of* Calanus sinicus *and* C. jashnovi *(Copepoda: Calanoida) in the western temperate North Pacific: Relations with the Kuroshio Extension*". Dr. Goh Onitsuka (National Fisheries University, Japan) won the BIO Best Poster Award for his poster (co-authored by Itsushi Uno, Tetsuo Yanagi and Jong-Hwan Yoon) on "*Effect of atmospheric nitrogen on the lower trophic ecosystem in the Japan/East Sea*".

Symposia and workshops (Agenda Item 6)

(a) Completed events

Dr. Dagg provided a brief report on the highly successful PICES/ICES/GLOBEC-sponsored, 4th International Zooplankton Production Symposium held in May 2007, in Hiroshima Japan. Dr. Kuh Kim, Chairman of Science Board, had previously presented a summary of this symposium in his remarks at the Opening Session. More details are available in the most recent issue of *PICES Press* (Vol. 15, No. 2).

(b) Upcoming events

BIO scientific sessions at PICES XVII

The next PICES Annual Meeting (PICES XVII) will be held October 24–November 2, 2008, in Dalian, China. The theme for this meeting is "*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the FUTURE*". The Committee recommends that the following

scientific sessions (in order of priority) be convened at PICES XVII:

- a ½-day or 1-day BIO Contributed Paper Session with papers focused on biological aspects of the meeting theme;
- a ½-day BIO/MEQ Topic Session on "*Seabirds and marine mammals as environmental indicators*" (*MBM-AP Endnote 4*);
- a 1-day BIO Topic Session "*End-to-end food webs: Impacts of a changing ocean*" (*BIO Endnote 4*); if approved, a possibility of co-sponsorship by IMBER for the session will be explored;
- a 1-day MONITOR/TCODE/BIO Topic Session on "*Linking biology, chemistry, and physics in our observational systems – present status and FUTURE needs*" (*MONITOR Endnote 6*);
- a 1-day BIO/FIS Topic Session on "*Ecosystem status in the North Pacific Ocean: Mechanisms and prediction*".

BIO-sponsored workshops for 2008

A 1-day workshop on "*Oceanic ecodynamics comparison of subarctic Pacific*" (OECOS workshop) at PICES XVII was proposed by Dr. Atsushi Yamaguchi (*BIO Endnote 5*). After discussion about how to get some east–west comparisons as originally intended, the workshop was endorsed. It was decided to invite some participants from the Eastern Pacific region who have recently done related types of research, even though the eastern component of OECOS was not funded.

BIO also supported a 3-day 4th PICES workshop on "*The Okhotsk Sea and adjacent areas*" proposed by Dr. Kishi (*BIO Endnote 6*). This was initially proposed at PICES XV, but postponed for 1 year after discussion. The workshop will be held in late August 2008, in Abashiri, Japan, and its goals are: (a) to exchange and share most recent and basic knowledge on the sea; (b) to identify key scientific questions; (c) to identify gaps of knowledge and necessary approaches; (d) to develop the Okhotsk Sea component of PICES FUTURE Program.

2008 PICES Summer School

In August 2006, the 1st PICES Summer School on "*Ocean circulation and ecosystem modeling*" was organized in Busan, Korea. More than 30 students from 9 countries (including all PICES member countries) attended lectures, seminars and practical exercises. After this successful effort, PICES members at Hokkaido University (Drs. M. Kaeriyama, M.J. Kishi, Y. Sakurai and S.-I. Saitoh) proposed to hold the 2nd PICES Summer School in August 2008 (immediately prior to the workshop on "*The Okhotsk Sea and adjacent areas*"), in Hakodate, Japan. The theme is "*Biomass-based management*" (*BIO Endnote 7*). BIO strongly supported this activity.

Theme for PICES XVIII

The theme proposed by Korea for PICES XVIII (2009), "*Understanding ecosystem dynamics, pursuing ecosystem approaches to management*", was discussed and endorsed by BIO.

Relationships with international programs and organizations (Agenda Item 7)

Dr. George L. Hunt provided brief information on the status of a U.S. program titled "*Bering Sea Integrated Ecosystem Research Plan*" (BSIERP), jointly supported by the National Science Foundation (NSF) and the North Pacific Research Board (NPRB). Detailed information is available at http://bsierp.nprb.org/index.htm.

Dr. Takeda gave a short presentation on the SOLAS (Surface Ocean Low Atmosphere Study) program, highlighting several potential areas for linkages between BIO and SOLAS, including potential collaboration with the proposed Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean*.

Dr. Julie Hall briefly reviewed the overall goals and activities of the IMBER (Integrated Marine Biogeochemistry and Ecosystem Research) program, highlighting the many areas of potential collaborations between PICES and IMBER and identifying some possible activities

with BIO. An IMBER sponsorship has been proposed for the BIO Topic Session on "*End-to-end food webs: Impacts of a changing ocean*" at PICES XVII.

Dr. Hunt gave a short presentation on the activities of a GLOBEC regional program on Ecosystem Studies of Sub-Arctic Seas (ESSAS) planned for the next year, emphasizing a workshop on "*Ecosystem models*" at the ESSAS Annual Meeting to be held September 15–19, 2008, in Halifax, Canada, immediately prior to the ICES Annual Science Conference (ASC).

There was brief discussion of the ICES ASC to be held September 22–26, 2008, in Halifax Canada, and possible participation by PICES in one or more of their Theme Sessions. The most relevant session was deemed to be "*Coupled physical and biological models*", and it was decided to request that PICES provide travel support for one BIO member to attend.

Dr. Kato requested and received endorsement by BIO to continue serving as a liaison between PICES and IWC. A report of the 59th IWC Scientific Committee meeting was submitted (*MBM-AP Endnote 5*).

Financial requests (Agenda Item 8)

Financial requests associated with proposed BIO activities for the next year were discussed and listed in order of priority (this does not include invited speakers for BIO-sponsored scientific sessions at PICES XVII):

- 2 invited speakers for the PICES XVII OECOS workshop;
- 1 participant, probably a student, to attend the initial meeting of the Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* at PICES XVII;
- 1 invited speaker for the 4th PICES workshop on "*The Okhotsk Sea and adjacent areas*";
- 1 guest lecturer for the 2nd PICES Summer School on "*Biomass-based management*";
- 1 participant for the ESSAS workshop on "*Ecosystem models*" at the 2008 ESSAS Annual Meeting;
- 1 co-convenor for the joint ICES/PICES Theme Session on "*Coupled physical and biological models*" at the 2008 ICES ASC;
- Travel for Dr. Andrey Suntsov (MIE-AP) from Newport (U.S.A.) to Vancouver (Canada) to complete identification of fish from the MIE-1 cruise;
- 1 MIE-AP Co-Chairman (Dr. Evgeny Pakhomov) to attend PICES XVII.

Publications (Agenda Item 9)

New publications

A special volume of a peer-reviewed scientific journal has been proposed as an outlet for papers presented at the BIO/FIS/POC Topic Session on "*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans).*" The session convenors will be the Guest Editors.

Previously approved

- Selected papers from the PICES XV BIO/FIS Topic Session on "*The human dimensions of jellyfish blooms*" will be published in a special volume of *Plankton and Benthos Research* (Guest Editors: H. Iizumi and H. Ishii) in early 2008.
- 25–30 papers from the 4th International Zooplankton Production Symposium will be published in a special volume of the ICES *Journal of Marine Science* (Guest Editors: M. Dagg, R. Harris, L. Valdés and S. Uye) in mid 2008.
- About 15 papers on krill from the same symposium will be published in a special volume of *Deep-Sea Research II* (Guest Editors: W. Peterson and S. Kawaguchi) in late 2008.
- A special issue of *Deep-Sea Research II* (Guest Editors: A. Tsuda, M. Wells, M. Uematsu and H. Saito) from the SEEDS-II experiment is anticipated to be published in 2008. The manuscript submission deadline was mid-October 2007. Sixteen papers have been submitted as of today, and 2 papers are expected shortly.

BIO Action Plan (Agenda Item 10)

The current version of the BIO Action Plan was distributed prior to PICES XVII. The BIO Chairman agreed to incorporate the actions proposed at this meeting into the Action Plan and circulate it to Committee members. It will then be posted on the PICES website.

FUTURE Science Plan (Agenda Item 11)

Opportunity was provided for BIO Committee members to comment on the most recent version (4.2) of the Science Plan for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems), that had been circulated prior to the meeting. On behalf of BIO, Dr. Dagg will present these suggestions at the upcoming Open Forum on November 1 and at the FISP workshop on November 3.

Chairmanship of BIO (Agenda Item 12)

Dr. Skip McKinnell (PICES Secretariat) conducted a brief discussion about the status of the Chairmanship of BIO, noting that the term of Dr. Dagg expires after this Annual Meeting. An election was held, and Dr. Dagg was elected by acclamation for a second 3-year term.

Other items (Agenda Item 13)

There were no other issues brought forward.

BIO Endnote 1

Participation list

Members

Michael J. Dagg (U.S.A., Chairman)
Richard D. Brodeur (U.S.A.)
Young Shil Kang (Korea)
Michio J. Kishi (Japan)
Angelica Peña (Canada)
Vladimir Radchenko (Russia)
Patricia A. Wheeler (U.S.A.)
Atsushi Yamaguchi (Japan)
Sinjae Yoo (Korea)
Ming Yuan Zhu (China)

Observers

Harold P. Batchelder (U.S.A.)
Fei Chai (U.S.A.)
Seok-Gwan Choi (Korea)
Justin Grubich (U.S.A.)
Julie Hall (IMBER)
George L. Hunt, Jr. (U.S.A.)
Hidehiro Kato (Japan)
Hideki Nakano (Japan)
William T. Peterson (U.S.A.)
Christopher Sabine (U.S.A.)
Toshiro Saino (Japan)
Hiroaki Saito (Japan)
Shigenobu Takeda (Japan)
Tom Wainwright (U.S.A.)
Shuichi Watanabe (Japan)
C.S. Wong (Canada)

BIO Endnote 2

BIO meeting agenda

1. Welcome and introductions
2. Approval of agenda
3. Progress reports of subsidiary bodies:
   - MIE-AP
   - MBM-AP
   - IFEP-AP
   - CC-S
4. Proposals for new subsidiary bodies:
   - Working Group on iron supply
   - Working Group on euphausiids
   - Group to develop appropriate standards for sampling giant jellyfish

5. Summaries of scientific sessions/workshops at PICES XVI
6. Symposia and workshops
   (a) Completed events:
   - 4th International Zooplankton Production Symposium

   (b) Upcoming events:
   - BIO scientific sessions at PICES XVII
   - BIO sponsored workshops in 2008
   - 2nd PICES Summer School
   - Science Board Symposium at PICES XVII – suggestions for invited speakers
   - Theme for PICES XVIII (2009, Korea)
   - ESSAS workshops
7. Relationships with other international programs and organizations
   a. BSIERP
   b. SOLAS
   c. IMBER
   d. ESSAS
   e. ICES
   f. IWC
8. Financial requests
9. Publications for upcoming year
10. BIO Action Plan update
11. FISP update
12. BIO Chairmanship
13. Other items

BIO Endnote 3

Proposal for a Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim*

Duration: October 2007–October 2011
Parent Committee: BIO

Background

Euphausiids are among the most important links in coastal and oceanic food webs, transferring energy from primary and secondary producers to higher trophic level animals such as salmon, herring, sardines, mackerel, Pacific whiting, sablefish, many rockfish species, auklets, shearwaters and whales. Given their importance in the food chain, euphausiids may be considered keystone sentinel species. One species of euphausiid, *Euphausia pacifica*, is of special interest because it ranges from the cool upwelling regions off Baja California, Mexico, California, Oregon, Washington and British Columbia, into the downwelling environment of the Gulf of Alaska, and across the Pacific through the Transition Zone, then south through the western Pacific from Russia to China. In the western Pacific this species inhabits waters where temperatures range from sub-arctic to sub-tropical (the Oyashio, the Kuroshio, the Japan/East Sea, and the East China and Yellow Seas). There are few species that occupy such a wide variety of ecosystems and such a wide range of latitudes. Thus, we ask, "*What are the unique characteristics of the life history of this cosmopolitan euphausiid species that allows it not only to populate but dominate such a wide variety of ecosystems*?"

Surprisingly little information is available on the seasonal cycles of abundance, feeding, reproduction or growth rates of these animals. Comparative studies are needed to understand their trophic status, their adaptations which allow them to prosper in so many different regions, and to learn how climate change may affect their population dynamics. Given that many scientists within PICES have made great progress in applying NEMURO and ECOSIM models to the study of ecosystem dynamics, PICES scientists would benefit greatly from better estimates of euphausiid biomass and vital rates so as to properly parameterize the euphausiid component of these models. Improvements to the models will result in a tool that will allow us to investigate quantitatively the role of euphausiids in food chain dynamics.

PICES scientists are also uniquely capable of increasing our understanding of euphausiids because many oceanographic stations and monitoring lines are routinely sampled for hydrography and zooplankton. PICES scientists could easily incorporate sampling of euphausiids into these existing monitoring programs (by sampling at night) and, with some instructions and basic supplies, could learn how to collect

living animals at night to make measurements of reproduction, molting and growth rates.

Studies which focus on this single species, *Euphausia pacifica*, will provide a common starting point for international exchanges and partnerships. Another genera, *Thysanoessa* is also of particular interest because of dominance by several species in the Bering Sea, the Sea of Okhotsk, and coastal upwelling waters of the California Current. Scientists from the PICES member countries have much information and experience to share, and all would benefit from an increased understanding of this species. Moreover, scientific exchanges involving research cruises or visits to laboratories will further foster an exchange of ideas and will promote long-term collaborations among students as well as established research scientists.

Terms of reference

1. Assemble lists of existing data (including metadata) that contribute to an analysis of the comparative ecology of *Euphausia pacifica* and *Thysanoessa* species. Identify gaps in our understanding of krill ecology, life history and population dynamics.
2. Prepare a research plan to help fill gaps in our understanding and aid regional collaborative research efforts. Explore ways and means of facilitating exchange of scientists between laboratories and on research cruises.
3. Convene "hands-on" practical workshops with krill biologists (including students and established scientists) from PICES member countries to help them initiate and carry out krill research programs. These workshops could be convened before each PICES meeting, or at other times as appropriate. Protocols for experimental work have been already published on the PICES website at: http://www.pices.int/projects/Euphasiid/PICES%20Protocols%20COMPLETE.pdf.
4. Initiate euphausiid research programs in PICES member countries which will include sampling on a regular basis (biweekly-monthly) to determine seasonal cycles of spawning and growth, and incubations of live animals for measurement of brood size and molting rates.
5. Work with modelers to better parameterize euphausiids in the NEMURO and other models so as to explore their role in coastal and oceanic food chains.
6. Convene a krill workshop at the GLOBEC Open Science Meeting (June 2009).
7. Organize a Krill Symposium or a Topic Session at PICES XX in 2011, and submit a set of krill synthesis papers for a special issue of a scientific peer-reviewed journal.

Recommended membership

Canada
David L. Mackas (Institute of Ocean Sciences)

China
Sun Song (Institute of Oceanology, CAS; Co-Chairman)
Huilian Liu (Institute of Oceanology, CAS)

Japan
Michio Kishi (Hokkaido University)
Yuji Okazaki (Tohoku National Fisheries Research Institute)
Hiroaki Saito (National Research Institute of Far Seas Fisheries; Co-Chairman)
Kenji Taki (National Research Institute of Far Seas Fisheries)

Korea
Se-Jong Ju (Korea Ocean Research and Development Institute)
Young-Shil Kang (National Fisheries Research and Development Institute)
Hyoung-Chul Shin (Korea Polar Research Institute)

Russia
Anatoly Volkov (TINRO-Center)

U.S.A.
Michael J. Dagg (Louisiana Universities Marine Consortium)
William T. Peterson (Hatfield Marine Science Center; Co-Chairman)
Alexei Pinchuk (University of Alaska)
Tracy Shaw (Cooperative Institute for Marine Resources Studies)

Timetable

October 2007–October 2008
- Appoint members;
- Have each member work on compiling data (with metadata) available;
- Chairman to prepare a "proposal" for how we will (a) fill gaps in our understanding, and (b) how to facilitate scientist exchange programs.

October 2008–October 2009
- Discuss data/metadata at PICES XVII (2008): What kinds of data do we all have? Are there unpublished theses and other unpublished data available?
- Ratify a research plan that is designed to fill gaps in our understanding;
- Discuss joint efforts with the MODEL Task Team;
- Discuss ways and means of implementing scientific exchanges;
- Co-convene a joint PICES/GLOBEC Krill Workshop at the GLOBEC Open Science Meeting (May 2009).

October 2009–October 2010
- Convene a workshop at PICES XVIII (2009) to review status of research and modeling of krill dynamics.

October 2010–October 2011
- Convene a workshop at PICES XIX (2010);
- Discuss results of research
- Convene a Krill Symposium or a Topic Session at PICES XX (2011) to include (if possible) the Antarctic Krill community of scientists;
- WG ends at PICES XX in October 2011.

BIO Endnote 4

Proposal for a 1-day BIO Topic Session at PICES XVII on
"End-to-end food webs: Impacts of a changing ocean"

A holistic end-to-end approach is needed to study the impacts of global change in marine food webs, including the influences on biogeochemistry and feedbacks to climate. This approach is encapsulated by the term "end-to-end food webs", which is defined as "feeding interactions, nutrient flows and feedbacks in an end-to-end food web of primary producers, consumers and decomposers". This food web approach retains the energy transfer and nutrient cycles of traditional food webs, but emphasizes the importance of understanding food web dynamics simultaneously at all levels and scales. To achieve an integrated understanding of end-to-end food web dynamics requires a merging of knowledge from many marine-related disciplines, including those concerned with global climate, marine food webs, marine ecosystems, marine biogeochemistry and biodiversity.

Recommended convenors: Hiroaki Saito (Japan), Sinjae Yoo (Korea) and TBD (HTL expert).

Potential Co-sponsor: IMBER.

BIO Endnote 5

Proposal for a 1-day workshop at PICES XVII on
"Oceanic ecodynamics comparison of subarctic Pacific"

OECOS (**O**ceanic **E**codynamics **CO**mparison in the **S**ubarctic Pacific) is a PICES project, originally aiming to advance our understanding of the dynamics of lower trophic levels in the pelagic systems of the subarctic Pacific through a comparison of the east–west regions at a new level of detail. The first OECOS workshop was held in May 2005, at Oregon University (U.S.A.), and participants from Japan (western Pacific region) and the U.S. and Canada (eastern Pacific region) discussed gaps in our knowledge about ecosystem dynamics of both eastern and western sectors of the subarctic Pacific, and new coordinated approaches for future research

activities (PICES Scientific Report No. 32, 2006). In March–April 2007, the western group (OECOS WEST) conducted two cruises to the Oyashio region before and during massive spring phytoplankton blooms. In both cruises, high-frequency samplings were made of various biological components (bacteria, phytoplankton, micro-, meso- and macrozooplankton, and micronekton) and nutrients (including iron). To aid analysis of the origin and history of water masses at the study sites, frequent CTD casts and satellite monitoring of SST and water color were made. Drifting sediment traps were tracked to collect setting particles from the upper layers. At this workshop, recent achievements of OECOS WEST will be presented and discussed along with new OECOS WEST and EAST research prospects.

Recommended convenors: Charles B. Miller (U.S.A.) and Atsushi Yamaguchi (Japan).

BIO Endnote 6

Proposal for a 3-day 4th PICES workshop on "*The Okhotsk Sea and adjacent areas*"

Background

The Okhotsk Sea is one of the most biologically productive regions in the world with high fisheries production. Several previous reports indicate that primary productivity in the Okhotsk Sea is very high especially on the continental shelf (Saitoh *et al.*, 1996; Sorokin and Sorokin, 1999). The Okhotsk Sea is also well known as one of the southernmost zones of seasonal sea ice in the Northern Hemisphere. The most important factor required to characterize spatial and temporal variability of spring blooms was the timing of sea ice retreat (Matsumoto *et al*., 2004), while a secondary factor was the adjustment of insolation. The beginning of the spring bloom in the Okhotsk Sea depends on the adjustment of the light environment, and the presence of sea ice controls light intensity in the surface water and thereby the timing of the spring bloom (Okunishi *et al*., 2005). There is little information on iron concentration in the Okhotsk Sea, but Fe(III) solubility in the surface mixed layer is generally high and variable (0.3-0.7nM) in the southern Okhotsk Sea (Tani *et al*., 2003). The concentration of inorganic nitrogen varied in the upper mixed layer from 1-3 µM in the center of Okhotsk Sea in summer (Sorokin and Sorokin, 1999). Nitrate can be depleted after the spring phytoplankton bloom in the western region of the Okhotsk Sea (Nakatsuka *et al.*, 2004). These facts suggest that iron supply is higher in the Okhotsk Sea than in the western subarctic Pacific, and that phytoplankton growth is not limited by iron availability in the Okhotsk Sea. The main source of iron in the Okhotsk Sea is not known. At least along the coast of Hokkaido, the Okhotsk Sea is well known for its scallops, Hanasaki crab, chum salmon and herring resources. An important consideration in the region is that the food for benthic animals is mainly supplied by the ice algae and the spring bloom after the ice floes are removed.

Consequently, goals of this workshop are:

- to exchange and share most recent and basic knowledge on the sea;
- to identify key scientific questions;
- to identify gaps of knowledge and necessary approaches;
- to develop the Okhotsk Sea component of PICES FUTURE Program.

Dates and duration

A full 3-day workshop in late August 2008 (temporally from August 27–29)

Venue and transportation

Okhotsk campus of the Tokyo University of Agriculture Yasaka 196, Abashiri, Hokkaido, 099-2422 Japan (Airplane from Tokyo Haneda to Memanbetsu, 90 min; Bus airport–campus, 30 min).

Program structure (draft)

<u>Day 1</u>

- Invited presentations on what is known (potential invited speakers (without their

agreement): K.I. Ohshima, J.E. Overland, V.I. Radchenko)
- Submitted/selected papers on what is known
- Invited papers on gaps of knowledge and necessary approaches (potential invited speakers (without their agreement): G. Kantakov, T. Hirawake, F. Mueter)

Day 2 (morning)
- Invited presentations on key scientific questions and elements of the program (potential invited speakers (without their agreement): H. Mitsudera, T. Okunishi, Y. Sakurai, S. Taguchi, K. Tateyama, M. Fujii, S. McKinnell)
- Submitted/selected papers on element program proposals

Day 2 (afternoon)
- Group discussions on: (1) climate and oceanography (including sea-ice); (2) chemical and biological oceanography; (3) fisheries; (4) modeling studies; and (5) data and monitoring.

Day 3
- Plenary session for proposal synthesis

Estimated number of participants

Domestic participants: ~50
Overseas participants: ~30

Required arrangements

- One large lecture room for plenary sessions (~100 participants)
- At least 5 small lecture rooms for group discussions (~20 participants)
- Internet connections
- Coffee break facilities
- Lunch room and services
- Transportation between hotels

International Scientific Steering Committee

- Angelica Peña (BIO, Canada)
- Gordon H. Kruse (FIS, U.S.A.)
- Vyacheslav B. Lobanov (POC, Russia)
- Sei-Ichi Saitoh (MONITOR, Japan)
- Vladimir I. Radchenko (Russia)
- Yuri I. Zuenko (Russia)

Local Organizing Committee
- Akihiro Shiomoto (Tokyo University of Agriculture)
- Masahide Kaeriyama (Hokkaido University)
- Sei-Ichi Saitoh (Hokkaido University)
- Atsushi Yamaguchi (Hokkaido University)

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BIO Endnote 7

Proposal for a PICES/CREAMS Summer School on "*Biomass-based management*"

Background and objectives

In August 2006, the 1st PICES Summer School on "*Ocean circulation and ecosystem modeling*" was organized in Busan, Korea. More than 30 students from 9 countries (including all PICES member countries) attended lectures, seminars and practical exercises. At the conclusion of the school, it was recommended to hold a following summer school within a couple of years. PICES members at Hokkaido University, Drs. M. Kaeriyama, M.J. Kishi, Y. Sakurai and S.-I. Saitoh, discussed this matter and proposed to hold the 2nd PICES Summer School in August 2008 (immediately prior to the workshop on "*The Okhotsk Sea and adjacent areas*"), in Hakodate, Japan. The theme is "*Biomass-based management*.

Dates and duration

A full 3-day event in late August 2008 (temporarily from August 23–25)

Venue

Hakodate campus of Hokkaido University or Ohnuma Seminar house (both potential venues are located near Hakodate airport)

Program structure (tentative)

Day 0 (Aug. 22, Fri.)
Registration and Welcome Reception

Day1 (Aug. 23, Sat.)
09:00–09:30 Information from convenors,
09:30–11:00 Lecture on "*Ecological Footprint*" (lecturer to be supported by PICES is not decided yet; potential invitees are Susannah Buchan, William Rees, Mathis Wackernagel)
11:00–15:00 Practical class on calculation of ecological footprint
15:30–17:00 Discussion on the results

Day 2 (Aug. 24, Sun.)
09:00–10:00 Invited lecture on "*Biomass based management*" (lecturer to be supported by FRA is not decided yet, but someone from FRA, Japan)
10:00–12:00 Discussion on ecological-based management: What should we do?
13:00–14:00 Discussion on what software we can use
14:00–17:00 Practical class on ecosystem-based management planning (*e.g*., on whales, salmon, herring, *etc*.); making a flowchart of modeling

Day 3 (Aug. 25, Mon.)
09:00–14:00 Using NEMURO.FISH, Footprint software, or the other tools of numerical models, practicing of imaginary ocean ecological-based management or ecological footprint
14:00–16:00 Presentation by each group
17:00–19:00 Farewell party

Day 4 (Aug. 26, Tues.)
09:00–16:30 Excursion to fishermen's village and discussions with fishermen
09:00 Departure to Abashiri for the Okhotsk Sea workshop (for whose who are planning to attend)

REPORT OF FISHERY SCIENCE COMMITTEE

The meeting of the Fishery Science Committee (hereafter FIS) was held from 16:00–19:30 hours on October 31, 2007. The FIS Chairman, Dr. Gordon H. Kruse, called the meeting to order and welcomed the participants. The meeting was attended by 14 FIS members and 24 observers representing all PICES member countries (*FIS Endnote 1*). Dr. Anne B. Hollowed served as the rapporteur. The draft agenda was reviewed and accepted without changes (*FIS Endnote 2*).

Implementation of PICES XV decisions (Agenda Item 3)

At PICES XVI, FIS sponsored

- a 1-day CCCC/FIS Topic Session (S3) on "*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*";
- a 1-day FIS Topic Session (S4) on "*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*";
- a ¾-day FIS/CCCC/BIO Topic Session (S5) on "*Fisheries interactions and local ecology*";
- a ½-day MEQ/FIS Topic Session (S7) on "*Coldwater biogenic habitat in the North Pacific*";
- a 1-day BIO/FIS/POC Topic Session (S11) on "*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*";
- a 1-day FIS Contributed Paper Session;
- a 1-day FIS Workshop (W2) on "*Methods for standardizing trawl surveys to ensure constant catchability*"; and
- a 1-day FIS/MEQ Workshop (W3) on "*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*".

Summaries of these sessions and workshops can be found in the *Session Summaries* chapter of this Annual Report.

During the past year, FIS was very active in international symposia:

- The symposium on "*Reproductive and recruitment processes of exploited marine fish stocks*" (co-sponsored by NAFO, PICES and ICES) was held October 1–3, 2007, in Lisbon, Portugal. The PICES Co-convenor was Dr. Richard D. Brodeur (U.S.A.) and Scientific Steering Committee members were Drs. Suam Kim (Korea) and Jie Zheng (U.S.A.).
- Drs. Nathan Mantua and William Sydeman (U.S.A.) were invited by the organizers as PICES-sponsored speakers at the *CLIOTOP (CLimate Impacts on Oceanic Top Predators)* Symposium that was convened December 3–7, 2007, in La Paz, Mexico.
- Drs. Brenda Norcross (U.S.A.) and Yoshiro Watanabe (Japan), were selected to join the Scientific Committee for the upcoming International Symposium on "*Linking herring biology, ecology, and status of populations in a changing environment*" (co-sponsored by ICES, PICES and GLOBEC), to be held August 26–29, 2008 in Galway, Ireland.

At PICES XV, FIS identified Drs. Kruse, Mikhail Stepanenko, Elizabeth Logerwell, and Yukimasa Ishida as reviewers of the second draft of the Working Group 16 final report on "*Impacts of climate and climate change on the key species in the fisheries in the North Pacific*". In June 2007, the reviews were provided to Dr. Richard J. Beamish and additional revisions were sought prior to publication. The review team found that most of the substantive comments from a previous review had been addressed, except for those related to fisheries on the U.S. West Coast. Most other comments dealt with the need to standardize formats, correct spelling errors, and find missing references, *etc*. The report was revised, and the third draft (322 pages) was delivered to the FIS Chairman in late September 2007. That final review was completed in December 2007. It

was determined that many of the substantial comments had been addressed, although the lack of information on the California Current System continues to be a significant gap. Although a large number of editorial issues remained, the report was forwarded to the PICES Secretariat for copy editing and publication. This report represents a tremendous amount of work. Once published, it will provide useful information of wide interest to an international audience.

2007 FIS Best Presentation and Poster Awards (Agenda Item 4)

While the FIS Best Presentation Award is available to early career scientists only, the FIS Best Poster Award is open to all scientists. The recipient must be the senior author of the poster and must have attended the Annual Meeting. The awards for 2007 were selected from the FIS Contributed Paper Session and FIS Topic Session S4. Drs. Kruse and Michael Schirripa selected the best paper while the best poster was selected by Drs. Elizabeth A. Logerwell and Beamish. Naoki Tojo (Hokkaido University, Japan) won the FIS Best Presentation Award for the paper (co-authored by Akira Nishmura, Satoshi Honda, Tetsuichiro Funamoto, Seiji Katakura and Kazushi Miyashita) on "*Marine environment induced spatial dynamics of recruited walleye pollock juveniles* (Theragra chalcogramma) *and interactions with prey and predators along the Pacific coast of Hokkaido, Japan*". The FIS Best Poster Award was given to Dongwha Sohn (Oregon State University, U.S.A.) for the poster (co-authored Lorenzo Ciannelli, Janet Duffy-Anderson, Ann Matarese and Kevin M. Bailey) on "*Distribution and drift pathways of Greenland halibut,* Reinhardtius hippoglossoides*, during early life stage in the eastern Bering Sea*".

Workshops on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*" (Agenda Item 5a)

Dr. Hollowed reported on two FIS workshops on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*", co-sponsored by PICES and NPRB. The first workshop was held July 19–20, 2007, in Seattle, U.S.A., and the second follow-up workshop was convened on October 30, 2007, at PICES XVI. The proceedings of both workshops will be combined into one report to be published by PICES.

Progress report of the Study Group on *Marine Aquaculture and Ranching in the PICES Region* (Agenda Item 5b)

Dr. Toyomitsu Horii reported on the progress of a Study Group on *Marine Aquaculture and Ranching in the PICES Region* (SG-MAR). Working Group 18 on *Mariculture in the 21st Century – The Intersection between Ecology, Socio-economics and Production* was not successful in achieving its terms of reference. After this Working Group was disbanded at PICES XV, SG-MAR was formed under the direction of Science Board to evaluate how to make progress in this area of interest. After reviewing the factors inhibiting the progress of WG 18, SG-MAR recommended the formation of two Working Groups on: 1) *Environmental Risk Assessment and Interactions of Marine Aquaculture*, and b) *Technology and Management for Aquaculture.* It was proposed that the first Working Group, if approved, would sponsor a Topic Session on "*Mariculture technology and husbandry for alternate and developing culture species*" at PICES XVII. The session would highlight flatfish culture techniques, and breeding and disease management of Atlantic salmon stocks in Norway. It was also proposed that the second Working Group, if approved, would sponsor a Topic Session and a workshop in conjunction with PICES XVII in China, and a follow-up Topic Session at PICES XVIII in Korea.

Progress report of WG 19 on *Ecosystem-based Management Science and its Application to the North Pacific* (Agenda Item 5c)

Ms. Patricia Livingston reviewed activities of MEQ/FIS Working Group on *Ecosystem-based Management Science and its Application to the North Pacific* (WG 19). The Working Group received contributions from each nation, except China, regarding approaches to describe and implement a standard reporting format for EBM initiatives. These contributions are currently

under review. The Working Group assessed current national definitions of "eco-regions" but also noted that the World Wildlife Federation is leading a global effort to define eco-regions. Members of WG 19 will closely monitor this activity. Dr. Christopher Harvey, WG 19 member, is working with Dr. Elizabeth (Beth) Fulton (Australia) on a related effort.

The Working Group has also identified a list of quantitative ecosystem indicators and will report on the status of the development of these indicators within each of the PICES member countries. It was noted that human indicators have not been examined in detailed. WG 19 reviewed a draft Science Plan for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainties and **R**esponses of North Pacific Marine **E**cosystems), and noted that ecosystem indicators should be added to the list of deliverables.

A major gap in preparing the WG 19 final report is a lack of Chinese submissions and lack of participation from this country to date. Three options were proposed to complete the report:

- Get Chinese participation in an inter-sessional meeting in February 2008;
- Extend the Working Group for one more year and meet with Chinese scientists at the next PICES Annual Meeting in Dalian;
- Finalize the report without Chinese input.

PICES XVI workshop (W2) on "*Methods for standardizing trawl surveys to ensure constant catchability*" (Agenda Item 5d)

Dr. Kruse reported on the outcomes of the FIS workshop (W2) on "*Methods for standardizing trawl surveys to ensure constant catchability*". There were 27 participants representing all PICES countries. A full report of the workshop can be found in the *Session Summaries* section of this Annual Report. It was recommended that FIS should consider options about how the theme of fishing gear research and survey technology can be continued by PICES in the future. Several approaches were discussed to address this issue, including holding a FIS Topic Session at PICES XVII and the formation of a Working/Study Group patterned after the ICES Working Group on *Fishing Technology and Fish Behaviour*.

PICES XVI workshop (W3) on "*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*" (Agenda Item 5e)

WG 19 sponsored a workshop (W3) prior to PICES XVI in Victoria. This workshop noted the lack of socio-economic information to track the human dimension and received input regarding approaches currently underway to develop risk assessment frameworks in Australia and through use of the ATLANTIS model as a framework for management strategy evaluations. It was recommended that a Study Group on *Indicators of Human Well-being: Benefits, Health and Choice* be formed. A Topic Session for PICES XVII was proposed with a tentative title "*Human drivers, indicators, and other human dimensions in the marine environment*". A full report of the workshop can be found in the *Session Summaries* section of this Annual Report.

Relations with other international programs and organizations (Agenda Item 6)

Dr. Steven Hare reviewed the research activities of the International Pacific Halibut Commission (IPHC). He described the Commission's annual surveys and offered opportunities for collaboration with PICES from these survey platforms.

Dr. Shigehiko Urawa described the research activities of the North Pacific Anadromous Fish Commission (NPAFC). He noted their plans to hold a scientific symposium on the scientific findings of the BASIS (Bering-Aleutian Salmon International Surveys) program in November 2008, titled "*Climate change, production trends, and carrying capacity of Pacific salmon in the Bering Sea and adjacent waters*". NPAFC is planning, jointly with the North Atlantic Salmon Conservation Organization (NASCO), a major symposium on salmon for 2010, and PICES co-sponsorship is invited. He also mentioned that the proceedings of the 2005 NPAFC–PICES joint symposium on "*The status of Pacific salmon and their role in North Pacific Marine*

Ecosystems" has been just published as NPAFC Bulletin No. 4 (http://www.npafc.org).

Dr. Beamish discussed a new NPAFC-sponsored effort to assess how salmon production is likely to change under a changing climate. NPAFC received substantial funding from the Moore Foundation to put together a group of 22 experts to meet and report on the future of salmon production in the North Pacific.

Mr. Robert Day discussed the research focus of the APEC (Asia-Pacific Economic Cooperation) Fisheries Working Group. APEC operates a cooperative, multilateral economic and trade forum. He noted that collaborations with APEC could address the human dimension of the PICES FUTURE program. He emphasize that, within the Fisheries Working Group, there is a research program focused on "*Ecosystem, Production, Processing, Trade and Markets*" and that scientists involved in this program are developing models to create an ensemble of scenarios of future trends in fisheries. He also inquired whether there was an opportunity to foster an organization similar to PICES that would address issues in the South Pacific.

FIS member, Dr. Alexander Glubokov, reported on a new fisheries management organization that has been formed with four consultative participants: Japan, Korea, Russia and U.S.A. The tentative name of this organization is "*New Principals of Regulation of Bottom Fishes*". The geographic region covered by the organization and its terms of reference are under discussion.

The Committee received proposals for PICES co-sponsorship of upcoming symposia with international organizations, and these proposals were discussed under Agenda Item 9.

Future Integrative Science Program (Agenda Item 7)

Dr. Kruse reviewed the history and status of development of the new PICES integrative scientific program, FUTURE. The Committee discussed the most recent version (4.2) of the FUTURE Science Plan and made the following recommendations:

- FIS supports the overall plan and appreciates the efforts of the Writing Team.
- FUTURE should consider setting priorities as the program is very ambitious, and priorities should be set to establish the most important items to be accomplished.
- Given the stated FUTURE challenges to involve social scientists and to communicate with policy makers, both areas in which PICES has limited expertise, FUTURE should emphasize collaboration with other programs and organizations with expertise in these areas.
- In order to be policy-relevant to business and other public sectors, PICES needs to communicate its research findings more rapidly, in addition to peer-reviewed publications.
- FIS can contribute to this need by ensuring that the FIS-related portions of FUTURE focus on emerging fishery science issues.
- The FISP Writing Team should consult with policy makers to ensure that FUTURE includes research themes that are directly relevant to their needs.
- The PICES Secretariat can contribute to this effort by improving their approach to communication and dissemination of science to the public.
- Given the emphasis on human activities and aquaculture in FUTURE, PICES should consider the formation a Mariculture Committee, as expertise in this area within PICES is currently limited.

Review of FIS Action Plan (Agenda Item 8)

Dr. Kruse proposed revisions of the FIS Action Plan and distributed them to the Committee for review on September 19, 2007. Comments were received from a number of FIS members, and an updated draft was prepared and sent to the Committee on October 18, 2007. This second revised version was discussed at the FIS meeting. The Committee accepted the changes proposed so far and recommended that the plan be reviewed carefully again next year after FUTURE has been adopted. The revised FIS Action Plan has been posted on the PICES website. FIS is going to consider developing priorities in their Action Plan next year.

Proposals for PICES co-sponsorship of future international symposia and workshops (Agenda Item 9)

A number of proposals were received for PICES to co-sponsor international symposia and workshops.

Dr. Jürgen Alheit presented a proposal for an ICES/PICES/GLOBEC-SPACC workshop on "*Changes in distribution and abundance of clupeiform small pelagic fish in relation to climate variability and global change*" to be held in November 2008, in Kiel, Germany. FIS placed a high priority on this effort and endorses travel support for a PICES co-convenor. FIS recommended that, if supported, consideration should be given for a co-convenor from the western North Pacific; to be resolved by correspondence.

Dr. R. Ian Perry described the International Symposium on "*Coping with global change in marine social-ecological systems*" (co-sponsored by GLOBEC, EUR-OCEANS, FAO, IRD, SCOR, IMBER and PICES) to be convened July 8–11, 2008 in Rome, Italy. This effort was given a high priority because it complements new and existing efforts. FIS discussed the level of PICES involvement and suggested 1–2 potential invited speakers from the North Pacific.

Dr. Kruse briefly reviewed the International Symposium on "*Effects of climate change on the world's oceans*" (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR and WCRP) to be held May 19–23, 2008, Gijón, Spain. Co-sponsorship of this symposium was approved in 2006, and PICES is represented among the convenors, Scientific Steering Committee (SSC), and invited speakers. Two of its scientific sessions may be of greater interest to FIS members: Theme Session 4.2 on "*Impacts of climate change on marine ecosystems – Impacts on upper trophic levels*" and Theme Session 5 on "*Scenarios-mitigation-reduction of impact of future climate change on the marine environment – from regional to global scale*". In conjunction with the symposium, there will be a workshop on "*Linking climate to trends in productivity of key commercial species in the World's oceans*". The workshop convenors requested support for 1–2 scientists from PICES to attend, and FIS endorsed this request.

FIS discussed the International Symposium on "*Eastern boundary upwelling ecosystems: Integrative and comparative approaches*" (co-sponsored by GLOBEC, IMBER, SOLAS, EUR-OCEANS and IRD) to be held June 2–6, 2008, Las Palmas, Spain. PICES was invited to join this effort after the SSC was already formed. Members from the North Pacific include Drs. Jack Barth (MONITOR) and Cynthia Tynan. FIS did not give a high priority to this event.

FIS was informed that the 4th PICES workshop on "*The Okhotsk Sea and adjacent areas*" would be convened in late August 2008, in Abashiri, Japan. However, no other information was available. FIS advice on co-convenors will be developed subsequently by correspondence.

FIS was informed that the 2nd CREAMS/PICES Summer School on "*Biomass-based management*" would be held in late August 2008, in Hakodate, Japan. However, no additional information was available.

ICES requested PICES sponsorship for International Symposia on "*Issues confronting the deep oceans*" (April 2009), and "*Rebuilding depleted fish stocks: Biology, ecology, social science and management strategies*" (autumn 2009), and "*Collection and interpretation of fishery dependent data*" (summer 2010). Among these, FIS placed highest priority on the second symposium and the next priority on the third symposium. The level of PICES budget and other financial obligations may determine whether PICES would be able to co-sponsor one or both of these symposia. No priority was placed on "*Issues confronting the deep oceans*".

ICES also requested PICES to co-sponsor Theme Sessions at the 2008 Annual Science Conference (Halifax). Among these, FIS placed highest priority on sessions: (1) "*New methodology for tracking fish, mammals and marine seabird migrations and behavior*", and (2) "*Size is almost everything! Size and trait-*

based processes and models in ecosystems and management". A third session was of interest to PICES, but the title was too vague to evaluate, namely "*The life history, dynamics and exploitation of living marine resources: Advances in knowledge and methodology*".

Planning for PICES XVII (Agenda Item 10)

Proposals for Topic Sessions included:

1. "*Existing and future institutions for sustainable fisheries management under resource fluctuations*" (M. Makino);
2. "*Fisheries institutions and fishers for ecosystem-based management*" (M. Makino);
3. "*Ecosystem status in the North Pacific Ocean: mechanisms and production*" (jointly with BIO);
4. "*Methods for reducing bycatch and discarding in commercial fisheries*" (or as a workshop) (D. Somerton);
5. "*Mariculture technology and husbandry for alternate and developing culture species*" (Jie Kong, jointly with MEQ);
6. "*Social and human dimensions*" (WG 19, jointly with MEQ).

FIS recommended that the first two of the proposed sessions should be combined and consider some elements of the third proposed session. The merged session was finalized after PICES XVI and approved as a ¾-day FIS Topic Session titled "*Institutions and ecosystem-based approaches for sustainable fisheries under fluctuating marine resources*" (*FIS Endnote 3*).

FIS discussed the merits of the fourth proposed session and recommended that this session should emphasize the science, and less technology, of bycatch, as described in Action Item 2.2 of the FIS Action Plan. The revised session was finalized after PICES XVI and approved as a ½-day FIS Topic Session titled "*Effects of fisheries bycatch and discards on marine ecosystems and methods to mitigate the effects*" (*FIS Endnote 4*).

FIS members expressed concern about the technology-only emphasis of the fifth proposed session and recommended that this session should be modified to include the science of the ecosystem impacts of mariculture. The finalized description of the approved ¾-day MEQ/FIS Topic Session, completed after PICES XVI, reflects this interest (*FIS Endnote 5*).

Ms. Patricia Livingston informed FIS that Dr. Glen Jamieson was proposing the last Topic Session as an MEQ Topic Session. FIS had no further discussion of this proposal.

In summary, FIS recommended that three Topic Sessions be convened at PICES XVII:

- a ¾-day FIS Topic Session on "*Institutions and ecosystem-based approaches for sustainable fisheries under fluctuating marine resources*";
- a ½-day FIS Topic Session on "*Effects of fisheries bycatch and discards on marine ecosystems and methods to mitigate the effects*";
- a ¾-day MEQ/FIS Topic Session "*Mariculture technology and husbandry for alternate and developing culture species.*

Finally, the Committee unanimously approved having a 1-day FIS Contributed Paper Session at PICES XVII.

Proposals for new FIS subsidiary bodies (Agenda Item 11)

FIS received a proposal for a Study Group on *Indicators of Human Well-being: Benefits Health and Choice* (recommended by WG 19). FIS recommended that this proposal should be re-visited next year after the symposium on "*Coping with global change in marine social-ecological systems*".

FIS received proposals for the following three Working Groups on: (1) *Environment Risk Assessment and Interactions of Marine Aquaculture*, (2) *Technology and Management for Aquaculture*, and (3) *Implications of Climate Variability and Climate Change on Trends in Commercially Important Fish and Shellfish.*
FIS considered that the objectives of the proposed Working Group on *Technology and Management for Aquaculture* could be addressed through Topic Sessions at PICES Annual Meetings without forming a Working Group

with such limited terms of reference. The Committee placed a high priority on two other proposals. FIS recommended that the Working Group on *Environment Risk Assessment and Interactions of Marine Aquaculture* could be co-sponsored with MEQ, as it is consistent with the goals of WG 19. The proposal to form a Working Group on *Implications of Climate Variability and Climate Change on Trends in Commercially Important Fish and Shellfish* (*FIS Endnote 6*) received strong support from the Committee. It was indicated that this effort is consistent with the activities envisioned under FUTURE and that PICES-sponsored work in this area would provide a good start to this line of research that is likely to become an ongoing effort in FUTURE. It was noted that the title of the Working Group could be shortened to reflect emphasis on commercially exploited species (so the title reported here is tentative). It was also suggested that a phased approach to initially implement forecasts for those species with the most complete information on climate linkages would be best. For other species with incomplete information, a scenario approach may be best until research confirms the nature of climate linkages for those species. Dr. Hollowed proposed that if the Working Group is approved, its first meeting should be held in conjunction with PICES XVII in Dalian.

Proposal for FIS inter-sessional meetings (Agenda Item 12)

No inter-sessional workshops are planned, except those discussed under Agenda Item 9.

Theme for PICES XVIII (Agenda Item 13)

The proposed theme for PICES XVIII (2009, Korea) is "*Understanding ecosystem dynamics, pursuing ecosystem approaches to management"*. Unfortunately, there was insufficient time to discuss this topic.

Proposed publications (Agenda Item 14)

It is intended that the final report of WG 16 on *Climate Change, Shifts in Fish Production, and Fisheries Management* will be published as a PICES Scientific Report in 2008.

A set of selected papers from the PICES XVI FIS Topic Session on "*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*" is planned to be published as a special issue of *Fisheries Research*.

Requests for travel support (Agenda Item 15)

There was insufficient time to discuss this issue but it is anticipated that 1 to 2 invited speakers would be sought for each FIS-sponsored Topic Session at PICES XVII. If two proposed Working Groups are approved, travel support to their meetings must be considered. Travel support to proposed PICES co-sponsored symposia and workshops was discussed previously.

Other business (Agenda Item 16)

No other business was raised.

FIS Endnote 1

Participation list

Members

Richard J. Beamish (Canada)
Elena P. Dulepova (Russia)
Alexander Glubokov (Russia)
Toyomitsu Horii (Japan)
Yukimasa Ishida (Japan)
Kong Jie (China)
Masahide Kaeriyama (Japan)
Jin-Yeong Kim (Korea)
Gordon H. Kruse (U.S.A., Chairman)
Elizabeth A. Logerwell (U.S.A.)
Ted Perry (Canada)
Laura Richards (Canada)
Michael Schirripa (U.S.A.)
Chang-Ik Zhang (Korea)

Observers

Jürgen Alheit (Germany)
George Boehlert (U.S.A.)
Jung Hwa Choi (Korea)
Robert Day (APEC-FWG)
Rick Deriso (IATTC)
Caihong Fu (Canada)
Garilova Galina (Russia)
Steven Hare (IPHC)
Anne B. Hollowed (U.S.A.)
Suam Kim (Korea)
Jacquelynne King (Canada)
Tokimasa Kobayashi (Japan)
Geoff Krause (Canada)
Jae Bong Lee (Korea)
Hyun Jeong Lim (Korea)
Patricia A. Livingston (U.S.A.)
Mitsutaku Makino (Japan)
Gordon A. (Sandy) McFarlane (Canada)
R. Ian Perry (Canada)
Shigehiko Urawa (NPAFC)
Mikhail Stepanenko (Russia)
Akihiko Yatsu (Japan)
Inja Yeon (Korea)
Tokio Wada (PICES Chairman)

FIS Endnote 2

FIS meeting agenda

1. Welcome, introductions, and nomination of a rapporteur
2. Adoption of agenda
3. Implementation of PICES XV decisions
4. 2007 Best Presentation and Poster Awards
5. Status reports of FIS-related groups/activities
   a. Workshops on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*"
   b. Study Group on *Marine Aquaculture and Ranching in the PICES Region*
   c. Working Group 19 on *Ecosystem-based Management Science and its Application to the North Pacific*
   d. PICES XVI workshop on "*Methods for standardizing trawl surveys to ensure constant catchability*" (W2)
   e. PICES XVI workshop on "*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*" (W3)
6. Relations with other international programs and organizations
   a. IPHC (S. Hare)
   b. NPAFC (S. Urawa, R. Beamish)
   c. APEC FWG (R. Day)
   d. Other organizations
7. Future Integrative Science Program
8. Review of FIS Action Plan
9. Proposals for PICES co-sponsorship of future international symposia and workshops
10. Planning for PICES XVII
11. Proposals for new FIS subsidiary bodies
12. Proposals for FIS inter-sessional meetings
13. Theme for PICES XVIII (2009, Korea)
14. Proposed publications
15. Travel support requests
16. Other business

FIS Endnote 3

A ¾-day FIS Topic Session at PICES XVII on "*Institutions and ecosystem-based approaches for sustainable fisheries under fluctuating marine resources*"

In PICES member countries, some fisheries resources are in high abundance and healthy, but others are decreasing or already depleted. Most causes of stock declines can be ascribed to climate changes and overfishing. Stocks in declining or depleted conditions require prompt management actions based on sound science. This session will provide opportunities to address such questions as: (1) how do current fishery institutions address sustainable fisheries and what institutional changes may be necessary to fully implement an ecosystem-based approach to fisheries management? (2) What are the roles of fishers and government concerning sustainable fisheries under fluctuating resources? (3) How should fishery management strategies recognize and address changes in productivity prior to, during and after regime shifts? and (4) What kind of information and research activities are needed to support sustainable fisheries management in an ecosystem context, given regime shifts? This session encourages papers addressing institutions, management strategies, and research supporting sustainable fisheries management of fluctuating marine resources using ecosystem-based approaches. Lessons from other marine ecosystems are invited for comparison to the PICES region. A publication in a special issue of a primary journal or in the PICES Scientific Report Series is intended as an outcome of the session.

Recommended convenors: David Fluharty (U.S.A.), Xianshi Jin (China), Mitsutaku Makino (Japan), Vladimir Radchenko (Russia), Laura Richards (Canada) and Chang-Ik Zhang (Korea).

FIS Endnote 4

A ½-day FIS Topic Session at PICES XVII on
"*Effects of fisheries bycatch and discards on marine ecosystems and methods to mitigate the effects*"

Commercial fisheries using gears, such as bottom trawling, capture both target and non-target species. In some instances, bycatch mortality is sufficiently high to adversely affect the stock status and productivity of non-target species. To minimize unintended impacts on the environment, commercial fisheries should strive to increase their selectivity by reducing the bycatch of birds, mammals, turtles and other non-target species, as well as by reducing the catch and discard of undersized commercial species. This session will examine the magnitude of bycatch of non-target species, effects of bycatch mortality on the health of non-target stocks, and recent research on methodology to reduce bycatch and discards in the PICES region. Particular emphasis will be placed on studies that have resulted in changes in commercial fishing practices.

Recommended convenors: David A. Somerton (U.S.A.) and Hui Chun An (Korea).

FIS Endnote 5

A ¾-day MEQ/FIS Topic Session on at PICES XVII on
"Mariculture technology and husbandry for alternate and developing culture species"

After considering the recommendations of the Study Group on Mariculture, PICES representatives have agreed that they share a common interest in the development of a highly efficient, environmentally friendly and diverse aquaculture industry. The diversification of aquaculture operations through the culture of new species and the use of innovative grow out technologies is of world-wide interest to both industry investors and the agencies responsible for ecosystem protection. New species and technologies may offer economic opportunities while providing solutions to the perception that current aquaculture practices threaten natural habitat and wild stocks. In many Pacific Rim countries recent developments of effective and efficient fish feed, development of animal husbandry protocols to ensure fish health and welfare, use of biotelemetry procedures to evaluate grow out facilities from the perspective of the fish, and advances in reproductive physiology using state-of-the-art molecular techniques show promise for enabling the socio-economic acceptance of aquaculture operations while preventing or mitigating environmental impacts. A variety of tools presently exist that permit the modeling of environmental risk from these developments and the subsequent incorporation of risk into an ecosystem management scheme. We encourage presentations that highlight scientific developments in the field of mariculture, particularly those that support the diversification of the industry and enable sustainable development while serving to protect natural ecosystems and wild stocks.

FIS Endnote 6

Proposal for a Working Group on *Implications of Climate Variability and Climate Change on Trends in Commercially Important Fish and Shellfish*

An interdisciplinary Working Group to facilitate a coordinated international research effort to forecast climate change impacts on the distribution and production of major fisheries in the Northern Hemisphere is proposed. The objectives of the Working Group are to:

- review the activities of existing programs within each nation;
- examine the evidence for climate impacts on production of commercial fish species;
- develop medium-term to long-term forecasts of climate impacts on fish production; and
- assess the performance of management strategies to respond to these changes in production.

An interdisciplinary team of scientists representing the fields of climatology (global climate modeling), oceanography (physical and biological oceanography, and coupled bio-physical models), fisheries oceanography, fish population dynamics, fisheries assessment, fisheries economics and ecosystem modeling will be assembled. This team would identify climate scenarios for use in forecasting and then develop tools for predicting climate impacts on commercial fish production. These tools will be used to develop quantitative forecasts of fish production around the Pacific Rim. The Working Group will provide a forum for discussion of four components needed to complete the forecasts in a timely and coordinated fashion including: (1) IPCC scenarios, (2) predictions of oceanographic impacts, (3) modeling approaches, and (4) scenarios for natural resource use and enhancement.

This Working Group builds on the work of the Climate Forcing and Marine Ecosystems Task Team (CFAME) and continues collaboration between FIS and POC via interactions with the Working Group 20 on *Evaluations of Climate Change Projections*. This effort is directly responsive to FUTURE and will encourage timely completion of early forecasts and associated management implications that can be

used by FUTURE Task Teams to formulate cooperative research programs focused on improving forecasting skill through knowledge of processes influencing marine fish production.

Expected benefits from this effort are as follows:

- International consensus could be reached on new directions for fisheries modeling and techniques for incorporation of ecosystem indicators and climate forcing in stock assessments.
- It is anticipated that the results of the coordinated research effort will be utilized by a broad spectrum of individuals outside of the research community. Stakeholders who rely on fish and shellfish resources will utilize the forecasts to anticipate changes that would influence their businesses and communities. Fisheries managers will utilize the forecasts to evaluate whether actions are needed to sustain fisheries in their regions. Conservation groups will be interested to better understand the regional and species-specific risks and challenges that climate change poses for species of interest.

The life span of the Working Group is 3 years and its milestones are:

- October 2008 – Convene an inter-sessional workshop to present forecasting results and to introduce techniques for evaluating management strategy evaluations;
- October 2009 – Report on implications of climate change and climate variability on commercial fish species (a contribution to the North Pacific Ecosystem Status Report);
- December 2009 – Finalize manuscript for publication in peer-reviewed literature.

Proposal proponents: Anne B. Hollowed and Michael Schirripa (U.S.A.) and Richard J. Beamish (Canada).

REPORT OF MARINE ENVIRONMENTAL QUALITY COMMITTEE

The meeting of the Marine Environmental Quality Committee (hereafter MEQ) was held from 16:00–19:00 hours on October 31, 2007. The Chairman, Dr. Glen S. Jamieson, called the meeting to order and welcomed the participants and observers *(MEQ Endnote 1*). New Japanese members, Drs. Shigeru Itakura and Yasunori Watanabe, have recently joined the Committee, although only Dr. Watababe was able to attend PICES XVI. There continues to be an overall issue of having full participation in MEQ by all PICES member countries. At this meeting, only 9 of the 17 members of MEQ attended from 5 countries. The Committee again expressed its concern that there was no official participation by China this year; although 2 observers from this country were present.

The draft agenda was reviewed and adopted *(MEQ Endnote 2)*. Ms. Darlene Smith served as the rapporteur.

Issues arising from PICES XV decisions (Agenda Item 3)

There were no pressing issues for the Committee pending from last year's meeting in Yokohama (Japan). The Chairman briefly summarized the report of the inter-sessional Science Board/ Governing Council meeting (April 2007, Yokohama, Japan.). The agenda was modified at this stage to include a report from WG 21 on *Non-indigenous Aquatic Species*, and Agenda Items 4 and 5 were combined.

Progress reports of MEQ subsidiary bodies (Agenda Items 4-5)

Section on *Ecology of harmful algal blooms in the North Pacific* (HAB-S)

Dr. Hak-Gyoon Kim, HAB-S Co-Chairman, reported on the results of their workshop (W4) on "*Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful radiophytes*" and laboratory demonstrations on rapid detection of Rhapidophytes in natural samples using DNA probe based assay, and microscopic observations and detailed analysis of Rhaphidophyte taxonomy; MEQ Topic Session (S6) on "*The relative contributions of offshore and inshore sources to harmful algal bloom development and persistence in the PICES region*", and the HAB Section (HAB-S) business meeting convened at PICES XVI. Summaries of the workshop and Topic Session can be found in the *Session Summaries* chapter of this Annual Report.

For PICES XVII, HAB-S recommends continuing an annual series of workshops to document the existing knowledge on the eco-physiology of HAB species that impact all, or most, countries in the North Pacific. The proposed topic is "*Review of selected harmful algae in the PICES region: IV. Karenia and Prorocentrum*", with a 1-day workshop and a ½-day laboratory demo (*HAB-S Endnote 3*).

Other activities proposed for PICES XVII are: a ½-day Topic Session on "*Environmental regulation of species succession: The use of long-term data sets to understand HAB species dominance*" (tentative title*; HAB-S Endnote 4*), and a business meeting with national reports of HAB events in 2007–2008.

Due to changes in key people responsible for HAB data in some PICES member countries, several new people were suggested as primary contacts for HAE-DAT entry for their countries. These new contacts are: Hao Guo (China), Yang Soon Kang (Korea) and Tatiana Morozova (Russia). It was requested that the respective member countries consider appointing these scientists to become HAB Section members (or at least adding them to the HAB-S e-mail list).

It was also indicated that the invited speakers of past and future workshops on "*Review of selected harmful algae in the PICES region*" will be contacted to determine their interest in

writing 3- to 5-page summaries and extensive bibliographies based on their presentations. The goal is to combine these summaries into a review to be published as a PICES Scientific Report by 2010. The full HAB-S report is included elsewhere in this Annual Report.

WG 19 on *Ecosystem-based Management Science and its Application to the North Pacific*

Dr. Jamieson, WG 19 Co-Chairman, reported on the activities of the Working Group and the results of their successful and well-attended workshop (W3) at PICES XVI on "*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*". The summary of the workshop and the full report of WG 19 are included elsewhere in this Annual Report. It was noted that, to date, the Working Group again has had no participation from China, so there is no data or input with respect to EBM initiatives occurring in this country.

WG 19 members are expected to submit material for the final report by January 1, 2008, whereupon the lead authors and Co-Chairmen will begin merging the data and information. As the lack of Chinese data is a major gap, and input by Chinese scientists is hoped for, options for completing the report are:

1. Achieve Chinese participation in an inter-sessional meeting in February 2009 (in Seattle, U.S.A. or China);
2. Extend the Working Group for one more year and meet with the Chinese scientists at the next PICES Annual Meeting in Dalian, China;
3. Finalize the report without Chinese input (least desirable option).

WG 19 hopes to have a draft of the final report by late January 2008, to send to Chinese scientists prior to a meeting with them, so they can see what contribution is desired.

Following the WG 19 meeting, it was realized that a brochure on EBM was to be published in 2008. However, this topic was not discussed at this year's meeting. The Working Group still plans to produce a brochure (the concept was approved by Science Board last year), but only when the final report is complete. Information in the brochure will be a subset of information from the full WG 19 report (ocean management activities, eco-region definitions, indicators). Discussion of brochure content will occur via e-mail, or at an inter-sessional meeting or at next year's Annual Meeting.

WG 19 also considered the possible structure and content of the North Pacific Ecosystem Status Report (NPESR), and suggested enhancing the next report with information on pollution and socio-economics. Discussion focused on the need to identify key pressures in each region, and on how indicators on status and trends describing human well-being should be determined. Further discussion on these topics will be required.

WG 21 on *Non-Indigenous Aquatic Species*

Ms. Darlene Smith, WG 21 Co-Chairman, presented a brief report on the activities of the Working Group and their second meeting at PICES XVI. Dr. Vasily Radashevsky (Russia) was appointed as another WG 21 Co-Chairman. A 1-day MEQ Topic Session on "*Consequences of non-indigenous species introductions*" was proposed for PICES XVII (*WG 21 Endnote 4*). Travel funds are requested for one invited speaker to attend this session.

Other activities proposed in conjunction with PICES XVII are: the first rapid assessment survey to be conducted in two locations to be confirmed, and a 2-day WG 21 business meeting, with emphasis on a MNIS (marine non-indigenous species) component of a PICES project entitled "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" supported by a voluntary contribution from the Ministry of Agriculture, Forestry and Fisheries of Japan.

The Working Group also requested to hold an inter-sessional meeting to evaluate the protocols and reach final agreement on standards, data elements and data entry templates for the WG 21 MNIS database.

The full report of Working Group 21 can be found elsewhere in this Annual Report.

Study Group on *Marine Aquaculture and Ranching in the PICES Region* (SG-MAR)

Dr. Toyomatsu Horii presented a draft of the SG-MAR final report (see *MEQ Endnote 4* for SG-MAR terms of reference). The report was also given to FIS. The full SG-MAR report is included elsewhere in this Annual Report.

While it is difficult to say why PICES WG 18 on *Mariculture in the 21st Century – The Intersection between Ecology, Socio-economics and Production* was not fully successful, several possibilities were pointed out by its members. These include: (1) the development of the terms of reference; (2) the expertise of the members; (3) the lack of pre-existing personnel relationships among the group; and (4) the isolated position of aquaculture within the larger framework of PICES.

SG-MAR assessed the highest priority marine aquaculture and/or ocean ranching science needs for the next 5–10 years in each PICES member country. From this assessment, two issues had highest priority:

- development of aquaculture technology and systems;
- management of stocking and supplemented fisheries; and
- estimation of the carrying capacity of commercial aquaculture activities.

To address identified priority areas, SG-MAR recommended formation of two new PICES Working Groups on: (1) *Environmental Risk Assessment and Interactions of Marine Aquaculture* (WG-ERAIMA; under MEQ/FIS or MEQ) and (2) *Technology and Management for Aquaculture* (WG-TMA; under FIS/MEQ or FIS).

If established, WG-ERAIMA would:

- hold a joint ICES/PICES meeting in April 2008 on "*Environmental interactions of mariculture*";
- convene a Topic Session on "*Estimation of environmental carrying capacity for commercial aquaculture*" at PICES XVIII (2009, Korea);
- develop a white paper on recommendations on how to improve highest risk aspects of aquaculture.

If established, WG-TMA would:

- hold a 1-day Topic Session on "*Mariculture technology and husbandry for alternate and developing culture species*" at PICES XVII (2008, China; *FIS Endnote 5*);
- conduct a 1-day laboratory demonstration, tour or workshop on a topic that is special to Dalian, China;
- convene a Topic Session on "*Evaluation of stocking technologies to rebuild, and sustain capture fisheries*" at PICES XVIII.

The Committee has some concerns about what was being proposed. Firstly, that it may be difficult to establish two new Working Groups at this time because of existing on-going MEQ expert groups (HAB-S, WG 19 and WG 21). Dr. Horii indicated if only one group could be established the priority group for MEQ would be the one on environmental risk assessment (ERAIMA). Secondly, the Committee discussed whether it might be more appropriate to have a Working Group on risk assessment approaches in general, *i.e.*, to consider issues broader than mariculture alone, as risk assessments are already being done by many, if not all, member countries on a variety of topics. For example, Canada is conducting peer-reviewed risk assessments on salmon cage culture–environment interactions and shellfish–aquaculture environment interactions, and the United States evaluates human health risks as a result of toxin levels in fish feeds, *etc*. As risk assessments occur in many fields besides mariculture, a more comprehensive analysis of appropriate methodologies and issues may be relevant to PICES. A possible Working Group could be, for example, on "*Ecological and Human Risk Assessment Issues*".

The issue of marine aquaculture continues to be of great interest to all PICES member countries, so how best to proceed remains an important topic. These recommendations should therefore

also be considered by MEQ and FIS for inclusion in their Action Plans.

Proposals for new subsidiary bodies (Agenda Item 7)

Socio-economic issues seem to be integral to the activities of so many PICES expert groups, and thus WG 19 recommended to establish a Study Group on *Indicators of Human Well-being: Benefits, Health* under Science Board (see WG 19 report for terms of reference). This proposal was supported by MEQ. If the Study Group is approved, suggested criteria for nomination of membership are to be qualified social scientists, primarily those with strong economics background, with an understanding of natural science, particularly marine science, who are working on questions relating to marine ecosystem approaches and management issues.

Discussion on two new Working Groups proposed by SG-MAR can be found under Agenda Item 4 (see SG-MAR report for mission, strategy and goals of these Working Groups).

New PICES integrative scientific program, FUTURE (Agenda Item 8)

The Committee again had a good discussion and, overall, endorsed the direction outlined in the current draft Science Plan (version 4.2) for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems). Members also found that these directions are well aligned with the objectives of MEQ.

Review and discussion of MEQ Action Plan (Agenda Item 9)

Because of the on-going development of the next integrative scientific program of PICES, the Committee did not review the MEQ Action Plan (*MEQ Endnote 3*) as it will likely evolve once FUTURE is finalized. Nonetheless, the Committee had spent a considerable amount of time on the Action Plan in 2005, and thus concluded that it is reasonably complete and reflects existing objectives of MEQ.

MEQ Best Presentation and Poster Awards (Agenda Item 10)

The MEQ Best Presentation Award was given to Xuelei Zhang (First Institute of Oceanography, China) for his paper (co-authored by Z.J. Xu and M.Y. Zhu) on "*Impact of atmospheric dust on phytoplankton growth in the Yellow Sea and western Pacific"* presented at the MEQ Topic Session on "*The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region*".

Chunjiang Guan (National Marine Environmental Monitoring Center, China) won the MEQ Best Poster Award for his paper (co-authored by Hao Guo and Wen Zhao) on "*Accumulation and elimination of* Alexandrium tamarense *toxins by the scallop,* Argopectens irradias".

Planning for PICES XVII (Agenda Item 11)

The Committee proposed that the following Topic Sessions and workshops to be convened at PICES XVII:

- a ½-day MEQ Topic Session on "*Environmental regulation of species succession: The use of long-term data sets to understand HAB species dominance*" (tentative title*; HAB Endnote 4*);
- a 1-day MEQ Topic Session on "*Human dimension sciences relevance for PICES*" (tentative title; *MEQ Endnote 5*);
- a 1-day MEQ Topic Session on *"Consequences of non-indigenous species Introductions"* (*WG 21 Endnote 4*);
- a 1-day MEQ/FIS Topic Session on "*Mariculture technology and husbandry for alternate and developing culture species"* (*FIS Endnote 5*);
- a 1-day MEQ workshop on "*Review of selected harmful algae in the PICES region: IV.* Karenia *and* Prorocentrum" preceded by a ½-day laboratory demonstration *(HAB-S Endnote 3)*.

Theme for PICES XVIII (Agenda Item 12)

No suggestions were provided.

PICES web site (Agenda Item 13)

No time was spent on this issue at the meeting.

Relations with other international programs and organizations (Agenda Item 14)

In anticipation that a PICES Working Group on mariculture issues will be established, likely one dealing in some capacity with risk assessment, collaboration with the ICES Working Group on *Environmental Interactions of Mariculture* (WGEIM) is recommended. Some SG-MAR members thought that a risk assessment approach may be too difficult and costly to apply in the PICES region. Nevertheless, the Study Group recommended that PICES accept the opportunity for a joint workshop with WGEIM to be held in April 2008, in Victoria, Canada, and use this opportunity to train PICES scientists in risk assessment.

The Committee reviewed activities scheduled for the 2008 ICES Annual Science Conference (September 23–26, 2008, Halifax, Canada). MEQ recommended that PICES co-convene one or both of the following Theme Sessions: "*Marine spatial planning in support of integrated management – tools, methods, and approaches* [ICES convenors: Stuart Rogers (UK), Robert O'Boyle (Canada)]" and "*How much habitat is enough? Evaluating habitats in terms of their ecosystem function, goods and services*" [ICES convenors: Stephen K. Brown (NOAA, USA), David Conover (JNCC, UK; tentative), Jake Rice (DFO, Canada; tentative)]".

At the WG 21 meeting, Dr. Gil Rilov invited PICES to co-sponsor, with the U.S. National Sea Grant Office and ICES, the 6th International Conference on "*Marine bioinvasions*" to be held in late August or early September 2009, in Portland, Oregon, U.S.A. WG 21 recommended that PICES support the conference and requested that one of its Scientific Steering Committee (SSC) members be from WG 21. Dr. Yoon Lee (Korea) volunteered to serve on the SSC. MEQ endorsed this proposal and suggested that support be at the level previously provided to the 5th International Conference on "*Marine bioinvasions*" convened in May 2007, in Cambridge, MA, U.S.A. This is considerably less than the amount requested by the organizers (see WG 21 report).

Finally, there was discussion by both HAB-S and WG 21 about their activities under a project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" supported by the very welcome and significant Japanese voluntary contribution (~CDN$ 1 million) provided to PICES for Pacific harmful algal bloom and invasive species studies during the next 5 years.

Items with financial implications (Agenda Item 15)

Proposed inter-sessional meetings

The following inter-sessional meetings were endorsed:

- A 2-day inter-sessional meeting of WG 19 on *Ecosystem-based Management Science and its application to the North Pacific* to discuss progress towards the preparation of the WG 19 final report and obtain Chinese input to the report (February 2008, Seattle, U.S.A.);
- A 3-day inter-sessional WG 21 meeting to evaluate the protocols and reach final agreement on standards, data elements and data entry templates for the WG 21 Marine/Estuarine Invasive Species Database (January 30–31, 2008, in Seattle, U.S.A.); [Update: Dates and location were changed to March 3–5, 2008 in Busan, Korea;]
- A 2-day ICES/PICES workshop on "*Environmental interactions of mariculture*" (April 14–15, 2008, Victoria, Canada).

Proposed publications

The following publications, mentioned at last year's Annual Meeting are now expected to occur in 2008–2009:

- a paper in a primary journal on national eco-region approaches based on the results of the PICES XV workshop on "*Criteria relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area*" (2008)*;*

- a final report of WG19 on *Ecosystem-based Management Science and its Application to the North Pacific* (early 2009);
- a WG19 brochure on ecosystem-based management in a format similar to the FERRRS Advisory Report (2009).

Travel requests

Travel support is requested for:

- 2 invited speakers for the MEQ workshop on "*Review of selected harmful algae in the PICES region: IV*. Karenia *and* Prorocentrum" (*HAB Endnote 3*)*;*
- 1 invited speaker for the MEQ Topic Session on "*Environmental regulation of species succession: The use of long-term data sets to understand HAB species dominance*" (*HAB Endnote 4*)*;*
- 2 invited speakers for the MEQ Topic Session on "*Consequences of non-indigenous species introductions*" (*WG 21 Endnote 4*)*;*
- 2 invited speakers, 1 from the western Pacific and 1 from the eastern Pacific, for the MEQ Topic Session on "*Human dimension sciences relevance for PICES*" (*MEQ Endnote 5*).
- 2 invited speakers for the MEQ/FIS Topic Session on "*Mariculture technology and husbandry for alternate and developing culture species*" (*FIS Endnote 5*);
- A PICES convenor for the ICES/PICES Theme Session on "*Marine spatial planning in support of integrated management – tools, methods, and approaches* and/or on "*How much habitat is enough? Evaluating habitats in terms of their ecosystem function, goods and services*".

MEQ Endnote 1

Participation list

Members

Tatyana Belan (Russia)
Glen S. Jamieson (Canada, Chairman)
Hak-Gyoon Kim (Korea)
Kunio Kohata (Japan)
Olga Lukyanova (Russia)
Steve Rumrill (U.S.A.)
Darlene Smith (Canada)
Yasunori Watanabe (Japan)
Michael Watson (U.S.A.)

Observers

Alexander Bychkov (PICES)
Vasily Radashevsky (Russia)
Thomas Therriault (Canada)
Anastasia Chernove (Russia)
Ichiro Imai (Japan)
Toyomatsu Horii (Japan)
Jie Kong (China)
Yoichiro Ishibashi (Japan)
Chang-Gu Kang (Korea)
Jinhui Wang (China)
David Fluharty (U.S.A.)
Waldo Wakefield (U.S.A.)
Luzviminda Dimaano (Philippines)

MEQ Endnote 2

MEQ meeting agenda

1. Welcome and introductions
2. Approval of agenda
3. Business from last year's Annual Meeting
4. Progress report of MEQ-related subsidiary bodies:
   - Section on *Ecology of Harmful Algal Blooms in the North Pacific*
   - MEQ/FIS WG 19 on *Ecosystem-based Management Science and its Application to the North Pacific*

- MEQ WG 21 on *Non-Indigenous Aquatic Species*
- Study Group on *Marine Aquaculture and Ranching in the PICES Region*

5. Report on "*Development of the prevention system for harmful organism's expansion in the Pacific Rim*"; a project supported by a voluntary contribution by the Government of Japan:
6. Reports on inter-sessional meetings
7. Proposals for new subsidiary bodies (require terms of reference and list of potential members)
8. Discussion on the next major PICES scientific program, FUTURE: Roles for MEQ and respective member countries
9. Review/discussion of the MEQ Action Plan
10. MEQ Best Presentation and Poster Award
11. Planning for PICES XVII (Dalian, China)
12. Theme for PICES XVIII (Busan, Korea)
13. PICES web site – MEQ content
14. Relations with other international programs and organizations
15. Items with financial implications
16. Other business
17. Preparation of MEQ report and recommendations to Science Board

MEQ Endnote 3

MEQ Action Plan

Mission of the MEQ Committee

The MEQ Committee will expand its science from physical/chemical quality as related to toxic contaminants to include: structure, process, and function of the marine system that sustains both ecosystem and human health. Ecosystem health will ultimately affect human health. Rather than focusing on physical drivers of ecosystem change, MEQ is concentrating on anthropogenic drivers of marine ecosystem health. The Committee notes that each nation has a different approach and management structure for insuring marine environmental quality, which in turn, influences the direction and relative priority for research and science advice. In other words, each culture and society has a different view of what quality represents. It is important to make sure that the efforts of MEQ include, and are useful to, each PICES member country.

Ecological health issues can include:

- Disease, biological pollution, bacteria, HABs;
- Biodiversity, species introductions and unintentional introductions of exotic species;
- Sustainability of the ecosystem, future use of resources;
- Integrated coastal zone management, ecosystem-based management;
- Predictive models, ecological forecasting.

Given the above view of MEQ's mission, the Committee made the following revisions to the list of issues in the current MEQ Action Plan.

Issues that were deleted because the focus is too narrow or they are the purview of another PICES Scientific Committee are:

- Impacts of climate change on coastal ecosystems;
- Biogeochemical processes regulating contaminant dynamics in sediments;
- Harmonization of existing methods used in PICES countries;

Issues remaining unchanged, altered to broaden focus, or included *de novo* are as follows:

- Mariculture;
- Biological and physical transport of anthropogenic substances in the marine environment;
- Anthropogenic impacts on benthic habitat (formerly in the Plan as "trawling effects on benthic habitat");
- Identification and assessment of emerging chemical and biological pollutants (including exotic species), and their impacts on marine ecosystems;
- Definition of indicators or biological markers of marine ecosystem health, with relevance to human health and welfare;
- Needing further clarification is a topic addressing anthropogenic impacts on trophic

dynamics and biodiversity that impact system sustainability.

Strategy of the MEQ Committee

The PICES mission has five central themes:
A. Advancing scientific knowledge;
B. Applying scientific knowledge;
C. Fostering partnerships;
D. Ensuring a modern organization in support of PICES activities; and
E. Distributing PICES scientific information.

Specific goals are identified within each of these themes. The Actions of MEQ will seek to meet goals under each of the themes.

Theme A Advancing scientific knowledge

Goal 1 Understand the physical, chemical, and biological functioning of marine ecosystems

Action 1.1 Address the substantial need for improved data and information on the occurrence and mechanisms of harmful species in the North Pacific:
Task 1.1.1 Conduct a workshop on HAB species (*Dinophysis* and *Cochlodinium*) in 2006;
Task 1.1.2 Hold a scientific session on HAB research in the western Pacific (2006);
Task 1.1.3 Initiate discussion of the role of cnidarians and ctenophores in the marine environment.

Action 1.2 Develop a process for conducting holistic assessments of the impact of human activities, and identify a suite of indicators or variables that will facilitate the monitoring of ecosystem status:
Task 1.2.1 Produce an assessment of the spatial and temporal patterns of contaminants for inclusion in the NPESR;
Task 1.2.2 In conjunction with 1.2.1, initiate assessment of relationship between contaminant levels and their effects on marine ecosystems.

Goal 2 Understand and quantify the impacts of human activities and climate on marine ecosystems

Action 2.1 Evaluate and increase knowledge in PICES of the potential impacts of aquaculture on ecosystems of the North Pacific:
Task 2.1.1 Hold a scientific session on "*Aquaculture and the sustainable management of the marine environment*";
Task 2.1.2 Hold a workshop to train PICES scientists in methods to conduct risk assessments on aquaculture activities (note the ICES Code of Practice for Introductions and Transfer of Marine Organisms).

Action 2.2 Evaluate and increase knowledge on the potential impacts of intentional and accidental introductions of non-native species and their vectors of introductions, and collaborate with ICES on introductions and transfers of non-indigenous organisms, including genetically modified organisms:
Task 2.2.1 Propose a PICES WG on introduced species (2006);
Task 2.2.2 Participate in the International Marine Bioinvasions Conference (2007);
Task 2.2.3 Conduct a joint PICES/ICES workshop on introduced species (2007/8).

Action 2.3 Evaluate and increase under-standing of how human health issues are inextricably linked to ocean conditions, primarily in coastal areas:
Task 2.3.1 Conduct a workshop/session on "*Oceans and human health*" issues in the North Pacific.

Action 2.4 Develop the scientific basis for an ecosystem approach to management, including assessments and the provision of scientific advice:
Task 2.4.1 Identify and evaluate the use of indicators for assessing the

achievement of ecosystem-based management;

Task 2.4.2 Continue and expand the development of ecosystem models that facilitate the assessment of monitoring and scientific knowledge of ecosystem functions in a holistic manner;

Task 2.4.3 Hold a scientific session on approaches to designating eco-regions and areas that are ecologically and biologically significant (2006);

Task 2.4.4 Develop country reports on approaches to ecosystem-based management (2006);

Task 2.4.5 Hold a symposium on the science of ecosystem-based management.

Goal 3 Provide advice on methods and tools to guide scientific activities

Action 3.1 Examine and assess methods for measuring HAB species and toxins for use by scientists and agencies of PICES member countries:

Task 3.1.1 Conduct a workshop at PICES XIV to review methods *Pseudo-nitzschia* and *Alexandrium*;

Task 3.1.2 Work to develop capacity for Russian scientists to assess and monitor HAB species and toxin levels;

Task 3.1.3 Conduct a series of laboratory demonstrations of DSP detection.

Theme B Applying scientific knowledge

Goal 4 Provide scientific advice towards wise use of the North Pacific Ocean

Action 4.1 None

Theme C Fostering partnerships

Goal 5 Promote collaboration with organizations, scientific programs, and stakeholders that are relevant to the PICES goals

Action 5.1 Develop an approach for formal linkages with ICES/IOC/IMO WGBOSV (WG on *Ballast and Other Ship Vectors*) and/or the ICES WGITMO (WG on *Introductions and Transfers of Marine Organisms*) over the long term.

Goal 6 Promote collaboration among scientists within PICES

Action 6.1 Develop and maintain joint activities of PICES scientists with IOC in development of an international HAB database (HAE-DAT):

Task 6.1.1 Prepare event reports for 2001–03.

Action 6.2 Provide input to the implementation of activities of GEOHAB and IOC Intergovernmental Panel on Harmful Algal Blooms in the PICES area, such as the HAB database (see 6.1).

Theme D Ensuring a modern organization in support of PICES activities

Goal 7 Provide an effective infrastructure to support PICES programs

Action 7.1 None

Theme E Distributing PICES scientific information

Goal 8 Make the scientific products of PICES accessible

Action 8.1 Publish Working Group reports:

Task 8.1.1 Publish country reports on status of mariculture in PICES member countries in the PICES Scientific Report series;

Task 8.1.2 Publish inventories on non-indigenous organisms for PICES member countries in the PICES Scientific Report series;

Task 8.1.3 Publish a brochure on ecosystem based management.

MEQ Endnote 4

Terms of Reference for a Study Group on
Marine Aquaculture and Ranching in the PICES Region

1. Review and assess the reasons why PICES WG 18 had limited success in achieving their Terms of Reference;
2. Develop a list, by PICES member country, of the highest priority (but no more then 10)
3. Marine aquaculture and/or ocean ranching science needs;
4. Develop recommendations of goals and action items for the next 5–10 years that could be included in Action Plans of MEQ or FIS.

MEQ Endnote 5

Proposal for a 1-day MEQ Topic Session at PICES XVII on
"Human dimension sciences relevance for PICES"

[later renamed to "*Connecting the human and natural dimensions of marine ecosystems and marine management in the PICES context*"]

A complete definition of marine ecosystems includes the human components. Consideration of ecosystem-based management, at least within the natural sciences, usually leaves out the human dimensions, or includes it only as fishing effort. For ecosystem-based management to succeed, however, humans need to be included. This session builds on the Science Board Symposium of 2003 titled "*Human dimensions of ecosystem variability*". Human relationships and how humans interact with the ocean have been changing in nature and strength over time. Natural variability in marine systems can be large, but so are socio-economic pressures and considerations relating to marine environments. Determining appropriate socio-economic indicators to complement indicators of natural climate variability, *e.g.*, for ecosystem-based management, is an ongoing challenge. This session will address these interactions between natural and socio-economic issues in the context of ecosystem-based management. Specifically, it will consider: (1) What are the criteria to determine relevant socio-economic indicators of human well-being related to marine issues for PICES member countries? (2) What are appropriate indicators to monitor changes in management objectives and human well-being relevant to changing ecosystem structure and production? (3) How might decisions that are made to enhance human well-being likely to impact (positively or negatively) the nature and functions of marine ecosystems? This session theme will continue to explore the many ways that humans interact with marine ecosystems and the scientific efforts to quantify and predict human impacts on the dynamics of such systems.

Recommended convenors: David Fluharty (U.S.A.), Mitsutaku Makino (Japan), Ian Perry (Canada) and Chang-Ik Zhang (Korea)

Request: travel expenses for 2 invited speakers (1 from each of the eastern and western Pacific).

REPORT OF PHYSICAL OCEANOGRAPHY AND CLIMATE COMMITTEE

The meeting of the Physical Oceanography and Climate Committee (hereafter POC) was held from 16:00–19:00 hours on October 31, 2007. The Chairman, Dr. Michael G. Foreman, called the meeting to order and welcomed members and observers (*POC Endnote 1*). Dr. James E. Overland served as the rapporteur. The Chairman welcomed Dr. Nathan Mantua as a new member of the Committee. Several changes were made to the draft agenda in order to accommodate cancellations and additions to the presentations from international organizations and programs (Agenda Item 6). The revised agenda was adopted (*POC Endnote 2*).

Completion of PICES XV decisions (Agenda Item 3)

a. Two members of WG 20 on *Evaluations of Climate Change Projections*, Drs. Muyin Wang and Enrique Curchitser, attended ESSAS workshops on "*Evaluation of climate scenarios for subarctic regions*" and "*The role of seasonal sea ice cover in marine ecosystems*" held on June 4–6, 2007, in Hakodate, Japan, with partial travel support from PICES.
b. The BIO/POC Topic Session on "*Decadal changes in carbon biogeochemistry in the North Pacific*" proposed for PICES XVI was approved by Science Board.
c. The POC Contributed Paper Session proposed for PICES XVI was approved by Science Board.
d. The POC/CCCC/MONITOR Topic Session on "*Operational forecasts of oceans and ecosystems*" proposed for PICES XVI was approved by Science Board.
e. The BIO/FIS/POC Topic Session on "*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*" proposed for PICES XVI was approved by Science Board.
f. The POC/CCCC workshop on "*Climate scenarios for ecosystem modeling*" proposed for PICES XVI was approved by Science Board.
g. The ICES/PICES Early Career Scientists Conference entitled "*New frontiers in marine science*" was successfully held on June 26–29, 2007, in Baltimore, U.S.A. The summary of this conference can be found elsewhere in this Annual Report.
h. Dr. Foreman gave a brief report on the planning for the ICES/PICES/IOC Symposium on "*Effects of climate change on the world's oceans*" to be held May 19–23, 2008, in Gijón, Spain, and all POC and WG 20 members were encouraged to attend. Dr. Foreman is co-convening a session on "*Past and future variability and change in ocean climate: Climate model projections*", and a WG 20 meeting will be held if a sufficient number of members attend.
i. Dr. James R. Christian reported that the "*Guide to best practices for ocean CO_2 measurements*" has been completed and will be published by the end of this year as PICES Special Publication No. 3/IOCCP Report No. 8.

Progress report of the Section on *Carbon and climate* (Agenda Item 4a)

Dr. Christian, Co-Chairman of the Section on *Carbon and Climate* (CC-S), briefly reported on their successful Topic Session (Agenda Item 3b above) and annual meeting at PICES XVI. Draft changes to the terms of reference for CC-S were presented (*CC-S Endnote 4*) and will be finalized by the inter-sessional Science Board meeting in April 2008. Details can be found in the CC-S chapter of this Annual Report.

Progress report of the CREAMS/PICES Advisory Panel (Agenda Item 4b)

Dr. Yasunori Sakurai, Co-Chairman of the Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (CREAMS-AP) gave a brief report of activities in the past year, including their annual meeting at PICES XVI and plans for 2008 and beyond. Details can be found in the CREAMS-AP chapter of this Annual Report.

Progress report of WG 20 on "*Evaluation of Climate Change Projections*" (Agenda Item 4c)

Dr. Foreman gave a brief report of the activities of WG 20 over the last year. The details can be found in the WG 20 chapter of this Annual Report. Highlights included: i) member attendance at the ESSAS workshops in Hakodate, Japan (Agenda Item 3a above); ii) a successful workshop with CFAME (Agenda Item 3f above) that had approximately 50 attendees on the first day, 23 on the second and that resulted in the request for a shopping list of climate variables to be provided for the CFAME inter-sessional workshop in April 2008; iii) a business meeting at PICES XVI in which WG 20's role in the next PICES integrative scientific program (FUTURE) was discussed; and iv) a possible inter-sessional WG 20 meeting at the 2008 Gijón symposium, pending sufficient attendance (Agenda Item 3h above).

Relations with other international programs and organizations (Agenda Item 5)

Six presentations were given:

a. Dr. Hee-Dong Jeong gave a brief summary of NEAR-GOOS (North-East Asian Regional Global Ocean Observing System) activities for the past year, including the provision of historical and real-time databases, and those planned for 2008.
b. Dr. Howard J. Freeland, Co-Chairman of the Argo Science Team, outlined successes and problems with the Argo program. Four recommendations for PICES member countries were given (*POC Endnote 3*) and the Committee unanimously agreed that they be carried forward to Science Board.
c. Dr. William R. Crawford, member of the Pacific CLIVAR (Climate Variability and Predictability Program) Panel, summarized their activities for the past year.
d. Dr. Kenneth Drinkwater, Co-Chairman of the ESSAS (Ecosystem Studies of Sub-Arctic Seas) Steering Committee, provided a summary of their activities for the past year and those planned for 2008. He asked PICES to support travel for one WG 20/ POC member to attend the next ESSAS Annual Meeting to be held in September 2008, in Halifax, Canada.
e. Dr. George L. Hunt, Chairman of BEST (Bering Sea Ecosystem Study), reported that 8 related sub-projects have been funded (total $35M) by the National Science Foundation and North Pacific Research Board for BEST and BSIERP (Bering Sea Integrated Ecosystem Research) programs.
f. Dr. Foreman reported that the International Council for the Exploration of the Sea (ICES) was looking for PICES support for Theme Sessions at their Annual Science Conference to be held in September 2008, in Halifax, Canada. The only session that seemed applicable to POC was "*Coupled physical and biological models: Parameterization, validation, and application*". It was recommended that travel support be given for an interested POC or BIO member to co-convene this session. (If practical, this could be the same person attending the ESSAS workshop since it is just before the ICES Annual Science Conference.)

Election of Chairman and Vice-Chairman (Agenda item 6)

Dr. Foreman was elected unanimously as POC Chairman for the second 3-year term. Dr. Ichiro Yasuda will also continue to serve as POC Vice-Chairman.

POC Action Plan (Agenda Item 7)

POC agreed that since the POC Action Plan was updated prior to the inter-sessional Science Board meeting in April 2007, it need not be reviewed further at the Annual Meeting.

Discussion of PICES' next scientific program, FUTURE (Agenda Item 8)

This item was moved to the end of the meeting as it was expected to consume as much time as was available. The Chairman gave a brief summary of the history leading up to the present draft Science Plan (version 4.2) for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems). The Plan had been sent by e-mail to all committee members one month prior to this Annual Meeting and had also been posted on the PICES website. Dr. Foreman stated that although he hoped that POC would play a stronger role in FUTURE than it did in CCCC, he did not feel the present document reflected this desire. His feeling was that in the CCCC Program the physical and geochemical components of climate were assumed to be known, and the emphasis was on biological response. As there is still much to learn about physical/geochemical variability in the North Pacific, he did not feel this was appropriate then, nor is it now. Thus, FUTURE should not follow the CCCC Program in pushing physical and chemical oceanography into the background. With this in mind, possible changes to the key and secondary questions were suggested. A lengthy discussion followed and concluded by endorsing changes that would give more focus to understanding the physical and geochemical processes and uncertainties associated with climate patterns and projections. On behalf of POC, Dr. Foreman will present these suggestions at the upcoming Open Forum on November 1 and at the FISP workshop on November 3.

Planning PICES XVII (Agenda Item 9)

Dr. Thomas C. Wainwright proposed a 1-day Topic Session on "*Marine system forecast models: Moving forward to the FUTURE*", to be jointly sponsored by MODEL (CCCC) and POC (*MODEL Endnote 3*). The Committee suggested that "models" be deleted from the title but otherwise supported the proposal and indicated they would be prepared to request travel support for one invited speaker.

Two further Topic Sessions were proposed by Dr. Fangli Qiao, but after some discussion it was decided that only one Topic Session entitled "*Coastal upwelling processes and their ecological effects*" should be supported (*POC Endnote 4*). Co-sponsorship from FIS and BIO would be requested but if not forthcoming, the Committee decided it could handle it alone. Travel support will be requested for one invited speaker.

Though not presented in time for the POC meeting, MONITOR asked POC to co-sponsor their joint Topic Session with TCODE and BIO entitled "*Linking biology, chemistry, and physics in our observational systems – present status and FUTURE needs*" (*MONITOR Endnote 6*). At the Science Board meeting, Dr. Foreman agreed to support this proposal along with the associated request for an invited speaker.

The Committee supported holding a 1-day POC Contributed Paper Session to be convened by Drs. Foreman and Yasuda; it was indicated that this session does not require invited speakers.

The Committee also approved the request for a joint CCCC/POC workshop, tentatively entitled "*Climate scenarios for ecosystem modeling (II)*" (*CFAME Endnote 4*). There will be no invited speakers.

No names of potential invited speakers for the Science Board Symposium at PICES XVII were suggested.

PICES XVIII theme (Agenda Item 10)

The theme proposed by Korea for PICES XVIII was not available to be discussed at the meeting.

Ranked requests with financial implications (Agenda Item 11)

<u>Inter-sessional travel support requests</u>

After considerable discussion, the Committee agreed to forward the following list of ranked requests for financial support to Science Board:

a. WG 20 Co-Chairmen to attend the inter-sessional CFAME workshop on "*Linking and*

visualizing climate forcing and marine ecosystem changes: A comparative approach" to be convened in April 2008, in Honolulu, U.S.A. (*CFAME Endnote 3*);

b. a guest lecturer for the PICES Summer School on "*Biomass-based management*" to be held in August 2008, in Hakodate, Japan;
c. a WG 20/POC member to attend the ESSAS workshop to be held in September 2008, in Halifax, Canada;
d. an invited speaker for the PICES/CREAMS workshop on "*Flux studies in marginal seas*", to be held in August 2008, in Seoul, Korea (tentative);
e. a PICES convenor for a joint ICES/PICES Theme Session on "*Coupled physical and biological models: Parameterization, validation, and applications*" at the ICES Annual Science Conference in September 2008, in Halifax, Canada (could possibly be combined with request c);
f. a session convenor to attend the symposium on "*Effects of climate change on the world's oceans*" and possible WG 20 inter-sessional meeting to be held in May 2008, in Gijón, Spain;
g. a member of CC-S to attend the conference on "*The ocean in a high CO_2 world –II*" to be convened in October 2008, in Monaco.

PICES XVII travel support requests

For PICES XVII, travel support is requested for 1 invited speaker for each of the three Topic Sessions that POC has agreed to co-sponsor.

Proposed publications for 2008 and beyond

Nothing was foreseen.

POC Best Presentation and Best Poster Awards (Agenda Item 12)

Drs. Steven Bograd, Christian, Foreman and Yasuda acted as judges for the POC Best Presentation Award and the POC Best Poster Award to be given to an early career scientist presenting in the POC Contributed Paper Session and the BIO/POC Topic Session S2. The recipients were: Hitoshi Kaneko (University of Tokyo, Japan) for his paper (co-authored with Ichiro Yasuda) on "*Current and turbulence observations of North Pacific intermediate water in the Kuroshio-Oyashio confluence region*" (POC Contributed Paper Session), and Chun-Ok Jo (Seoul National University, Korea) for her poster (co-authored with Kyung-Ryul Kim) on "*Decadal changes of phytoplankton activity during spring in the southern East/Japan Sea*" (BIO/POC Topic Session S2).

Other business (Agenda Item 13)

No other business was raised.

Adoption of Report and Science Board Recommendations (Agenda Item 14)

The preceding report was circulated and approved by POC members. All recommendations were brought forward by Dr. Foreman to Science Board at its meeting on November 4, 2007.

POC Endnote 1

Participation list

Members

Steven J. Bograd (U.S.A.)
Kyung-Il Chang (Korea)
James R. Christian (Canada)
Michael G. Foreman (Canada, Chairman)
Shin-ichi Ito (Japan)
Hee-Dong Jeong (Korea)
Nathan Mantua (U.S.A.)
James E. Overland (U.S.A.)
Young-Gyu Park (Korea)
Elena Ustinova (Russia)
Fan Wang (China)
Ichiro Yasuda (Japan, Co-Chairman)
Yury I. Zuenko (Russia)

Observers

William R. Crawford (Canada)
Kenneth F. Drinkwater (Norway)
Howard J. Freeland (Canada)
Akira Nakadate (Japan)
Ig-Chan Pang (Korea)
Fangli Qiao (China)
David Rivas (U.S.A.)
Konstatin Rogachev (Russia)
Christopher L. Sabine (U.S.A.)
Yasunori Sakurai (CREAMS-AP Co-Chairman, Japan)
Yasuhiro Yamanaka (WG 20 Co-Chairman, Japan)

POC Endnote 2

POC meeting agenda

1. Welcome, introductions, opening remarks
2. Changes to, adoption of, agenda and appointment of rapporteur
3. Completion of PICES XV decisions:
   a. ESSAS workshops on "*Evaluation of climate scenarios for subarctic regions*" and "*The role of seasonal sea ice cover in marine ecosystems*", June 4–6, 2007, Hakodate, Japan
   b. PICES XVI BIO/POC Topic Session "*Decadal changes in carbon biogeochemistry in the North Pacific*"
   c. PICES XVI POC Contributed Paper Session
   d. PICES XVI POC/MONITOR/CCCC Topic Session "*Operational forecasts of oceans and ecosystems*"
   e. PICES XVI BIO/FIS/POC Topic Session "*Phenology and climate change in the North Pacific:…*"
   f. PICES XVI POC/CCCC Workshop on "*Climate scenarios for ecosystem modeling* XV"
   g. Early Career Scientists Conference on "*New frontiers in marine science*", June 26–29, 2007, Baltimore, U.S.A.
   h. ICES/PICES/IOC Symposium on "*Effects of climate change on the world's oceans*", May 19–23 2008, Gijón (Spain)
   i. PICES Special Publication No. 3: *Guide to best practices for ocean CO_2 measurements*
4. Reports of existing subsidiary bodies
   a. Progress report of the Section on *Carbon and Climate* (Christian/Saino)
   b. Progress report of the Advisory Panel on *CREAMS/PICES Program in East Asian marginal seas* (Sakurai/Kim)
   c. Progress report of WG20 on "*Evaluation of climate change projections*" (Foreman/Yamanaka)
5. Relations with other international programs and organizations:
   a. NEAR-GOOS (Hee-Dong Jeong)
   b. Argo (Howard Freeland)
   c. CLIVAR (William Crawford)
   d. ESSAS (Kenneth Drinkwater)
   e. BEST/BSIERP (George Hunt, Jr.)
   f. ICES
6. Election of Chairman and Vice-Chairman
7. Discussion of the POC Action Plan
8. Discussion on the next major PICES scientific program, FUTURE
9. Planning PICES XVII in Dalian, China
10. Theme for PICES XVIII in Busan, Korea
11. Items with financial implications
12. POC Best Presentation and Poster Award
13. Other business
14. Adoption of POC report and recommendations to Science Board

POC Endnote 3

Recommendations to Science Board concerning the Project Argo

1. We (POC) recommend that countries contributing to Argo give serious consideration to the possibility that floats might be deployed most usefully in locations remote from their own nation's territorial waters.
2. We (POC) believe that Argo is valuable for all nations and strongly recommend that countries contributing to Argo develop funding systems sufficient to maintain their national arrays.
3. We (POC) wish to encourage all countries to ensure that a plan for completing their own delayed-mode quality control on Argo profiles is in place and being executed.
4. We (POC) wish to encourage all countries to assure the continued ability of Argo to remain within the terms established by the Law of the Sea. To this end we encourage countries that do not presently contribute to the Argo infrastructure to find a means of making an annual contribution.

POC Endnote 4

Proposal for a 1-day Topic Session at PICES XVII on
"Coastal upwelling processes and their ecological effects"

Upwelling is a key process in marine ecosystems linking physical oceanography, chemistry, and marine ecology. It brings rich nutrient water to the upper ocean so it has great impacts upon fisheries in these regions and on the ecological environment, and may also provide a suitable environment for harmful algal blooms. This session will focus on three aspects of upwelling: (1) observations, numerical modeling and mechanism analysis of upwelling and related processes; (2) the quantitative evaluation of upwelling on marine ecology (biological production, diversity, *etc*.); and (3) changes in upwelling systems as a result of climate change. The session should be helpful for the ecosystem-based management of the marine environment.

Co-sponsors: POC and potentially FIS and BIO.

Recommended convenors: Tal Ezer, (U.S.A.), Vyacheslav Lobanov (Russia) and Xingang Lü, (China).

REPORT OF TECHNICAL COMMITTEE ON DATA EXCHANGE

The meeting of the Technical Committee on Data Exchange (hereafter TCODE) was held from 16:00–19:15 hours on October 31, 2007. The Chairman, Dr. Igor I. Shevchenko, called the meeting to order and welcomed the participants. The meeting was attended by 11 TCODE members and 4 observers representing PICES member countries and international organizations (*TCODE Endnote 1*). Dr. John Holmes served as the rapporteur. The Committee reviewed the provisional agenda and adopted it without changes and additions (*TCODE Endnote 2*).

Review progress on items in the 2006/2007 work plan (Agenda Item 3)

PICES Federated Metadata Searching Project

Progress continued to be made with the PICES Federated Metadata Searching Project. All PICES member countries, except Canada, have clearinghouse nodes and are contributing metadata. The latest country brought on-line was China. In August 2007, a node was established at the National Marine Data and Information Service of the State Oceanographic Administration in Tianjin. A training course on FGDC (Federal Geographic Data Committee) metadata preparation was completed successfully. A suggestion was put forward and supported that an objective of the Federated Metadata Searching Project for the next year should be to report on how the remote server service performs. A progress report for 2007 will be provided by Dr. Bernard A. Megrey to the Secretariat for posting on the PICES website.

Canadian participation in the project is probably about a year away, and contributions will be through Canadian efforts to catalogue internal data holdings in a searchable database. The delay is related to the extensive IT reorganization that is currently occurring and the need for time to make necessary software improvements to the existing internal catalogue. Dr. Holmes will report back to TCODE on progress in Canada with respect to metadata records and how to identify parent records, *i.e.*, prevent duplication in multiple nodes or catalogues.

A proposal to purchase a remote server service for one year to consolidate all PICES metadata nodes was discussed. TINRO-Center has used GeoNetwork and GeoServer software, and a short presentation on this topic was given by Dr. Shevchenko. The software is written in Java and so can be used in Windows, Linux, and Unix environments. A suggestion was to install GeoNetwork and GeoServer on a consolidation server and test them in this virtual server environment. Dr. Megrey was asked to refocus the proposals to reflect discussions at TCODE and consider making them a joint proposal with MONITOR (*TCODE Endnote 3*).

Dr. Shevchenko also reported that in Russia they cannot connect to servers of the several metadata clearinghouses. An experiment was discussed on accessing clearinghouses from different locations to see if this is true for other countries.

Update TCODE Action Plan

Several minor changes to the TCODE Action Plan were discussed and approved. The Plan was updated and posted on the TCODE website (http://tcode.tinro.ru/pices16.html).

National annual reports (Agenda Item 4)

TCODE members presented national annual reports. These reports include lists of institutes and agencies, key persons contacts, links to data and metadata sets, ocean observing systems, data and metadata formats and standards, information technologies for collecting, measuring and enumerating marine organisms, marine data management programs that underpin marine science programs, data polices; software applicable in marine ecosystems studies and

modeling, publications on marine data management issues, education materials, *etc*. All reports will be posted at the TCODE website.

Canada:

One addition to the last year's report is the website for the National Science Data Management Committee (http://intradev.ncr.dfo-mpo.ca/science/nsdmc/index_e.htm). The goal of the Committee is to guide data management strategies and priorities. This activity includes items of direct interest to TCODE, such as data and metadata inventories, data and metadata standards, data access, and data archaeology.

Canada has established new funding for Cable Underwater Observatories through the academic funding system (not through government departments). There is both a coastal project (VENUS) and an offshore observatory (NEPTUNE). These activities will require a high performance Data Management and Archival System (DMAS) to handle the large amounts of data that may be produced by these systems. The NEPTUNE project has recruited an Assistant Director (Information Systems) to head up this activity. The candidate comes with a very strong background in astronomical data management, so there may be some interesting opportunities for "cross-fertilization" of ideas, approaches and techniques. VENUS is now "live" at the Patricia Bay node, with real-time data on-line at www.venus.uvic.ca/data/data_plots.html. Another node is being placed off Roberts Bank in the Strait of Georgia now and another ship is laying cable out to Endeavour Ridge hot vents.

Japan

The Fishery Agency data management activities are focused on the Japan/East Sea. One goal is to put together a modern database and make it searchable. The database implementation is behind schedule due to the need to bring in some older data. It is expected to be finished in the next year.

Three monitoring lines (off Hokkaido, near Tokyo, and in the East China Sea) are used to monitor the lower trophic levels every season, and the collected data are going into a database. These observations will continue until 2010.

There is no a generally accepted approach to the metadata bases design. Many old metadata records are in Japanese only. They should be translated into English, and this is very time-consuming.

China

All activities to join PICES Metadata Federation were completed. The software tools to support the metadata production are being tested. The main difficulty is to arrange translating metadata from Chinese to English.

Korea

Several agencies operate ocean databases and the Argo site and are involved in distribution of the data. A real-time coastal information system has been developed for monitoring aquaculture environments. The system is deployed on fish farms. Measured data (temperature, salinity and dissolved oxygen) play a crucial role in nowcasting/forecasting coastal ocean conditions and in reducing the risk of mass mortality caused by an abnormal change of the water quality. The Korean Ocean Data Center is developing a regional standard for QA/QC of the real-time data acquired from the seas around Korea.

Russia

Federal Ocean State System is now in use but is only available in Russian. The PICES Federated Metadata Searching Project was advertised by Dr. Shevchenko at a workshop held at TINRO-Center. He asked colleagues to use it, especially open-source software. In Russia, the technical problems seem to be easily solvable, the challenge is to get scientists to prepare and use metadata.

U.S.A.
During this year there was a lot of activity in terms of building a national profile for conversion to the new ISO 19115 standard. Several conversion programs were constructed

to do a cross-walk from FGDC to ISO. URLs are available for these reports. It is still not clear if discipline-specific profiles for ISO have been developed.

The WOCE Atlas has been updated in 2007 with physical and oceanographic parameters. This new version is a big improvement on the old one since it is friendlier and searchable.

Discussion of FUTURE (Agenda Item 5)

TCODE has not been actively involved in the development of a Science Plan for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems), but this will change at the implementation planning stage. The current statement in planning documents concerning data management is not clear on what data management TCODE can contribute. This activity in FUTURE may include building inventories and improving access to key retrospective datasets, providing on-line access to the PICES publications, Annual Meeting abstracts, *etc*. All these items may be listed in the Implementation Plan under Data and Information Management Services.

Planning for PICES XVII (Agenda Item 6)

TCODE proposed a joint scientific/e-poster session with MONITOR for PICES XVII on "*Data requirements and data sources to support FUTURE*". One of the goals of this session is to bring to the meeting national data repository managers who manage and provide the data. It is planned to discuss such questions as "what is metadata and what can be done using this information" and "how to get people involved in creating and using metadata". It was suggested to have presentations of data centers on what they have, can do and how to work better together. Representatives of national data centers and the ICES Working Group on *Data and Information Management* should be invited. After receiving a request from MONITOR to co-sponsor a Topic Session on "*Linking biology, chemistry, and physics in our observational systems – present status and FUTURE needs*" (*MONITOR Endnote 6*), it was agreed to incorporate these ideas into the joint session. TCODE nominated Hernan Garcia and Allen Macklin (U.S.A.), Toru Suzuki (Japan) and a representative of China (TBD) to serve as co-convenors.

Relations with other international programs and organizations (Agenda Item 7)

The PICES Standing List of International and Regional Organizations and Programs was discussed. This list is used in part to assist Science Board and the Executive Secretary in decisions regarding sending a representative to meetings of other international organizations and programs. It was suggested that the Pacific Arctic Group (http://www.arctic.noaa.gov/aro/pag/) be added to the list. The Pacific Arctic Group (PAG) is a loose confederacy of institutes and individuals having a Pacific perspective on Arctic Science. PAG themes include climate, contaminants, human dimensions and structure and function of Arctic ecosystems.

Elections of TCODE Chairman and Vice-Chairman (Agenda Item 8)

Drs. Megrey (U.S.A.) and Kyu-Kui Jung (Korea) were nominated by Dr. Shevchenko (seconded by Mr. Robin Brown) and unanimously elected for a 3-year term as the new Chairman and Vice-Chairman of TCODE, respectively. Their terms will begin immediately after the closing of PICES XVI. The Committee expressed its gratitude to Dr. Shevchenko for his leadership and valuable contribution to TCODE activities over the last six years.

PICES Ocean Monitoring Service Award (Agenda Item 9)

The PICES Ocean Monitoring Service Award (POMA) was established last year to recognize organizations, groups and outstanding individuals that have contributed significantly to the progress of marine science in the North Pacific through long-term ocean monitoring and management of data associated with ocean conditions and marine bio-resources in the region. Dr. Shevchenko recommended to nominate for the 2008 award the team led by Dr. Megrey and Mr. Allen Macklin

for advancing the PICES Federated Metadata Searching Project. The proposal was seconded by Dr. Holmes and supported by the Committee.

Items with financial implications (Agenda Item 10)

TCODE requests:

- Travel support for 1 invited speaker to attend the joint MONITOR/TCODE/BIO scientific/e-poster session at PICES XVII (*MONITOR Endnote 6*);
- US $2,490 for outsourcing a remote server for one year (*TCODE Endnote 3*).

TCODE work plan for 2006/2007 (Agenda Item 12)

Based on the discussion of all agenda items, the Committee adopted the following work plan:

- Continue to support HAB-S work with HAE-DAT database and required metadata (Responsibility – R. Brown);
- Co-organize scientific/e-poster Topic Session on "*Linking biology, chemistry, and physics in our observational systems – present status and FUTURE needs*" at PICES XVII (H. Garcia, A. Macklin, T. Suzuki);
- Continue collaboration with ICES Working Group on *Data and Information Management* (B. Megrey, G. Moiseenko, I. Shevchenko);
- Continue Federated Metadata Searching Project:
  - Implement remote server proposal (B. Megrey with national representatives);
  - Run the PICES clearinghouse nodes performance and experiment on accessing clearinghouses from different locations (B. Megrey with national representatives);
  - Report on metadata recording in Canada (J. Holmes);
- Update TCODE Action Plan (B. Megrey, I. Shevchenko);
- Coordinate activities with MONITOR (T. Royer).

TCODE Endnote 1

Participation list

Members

Robin Brown (Canada)
Hernan Garcia (U.S.A.)
John Holmes (Canada)
Kyu Kui Jung (Korea)
Bernard A. Megrey (U.S.A.)
Georgiy Moiseenko (Russia)
Thomas C. Royer (U.S.A.)
Igor Shevchenko (Russia, Chairman)
Toru Suzuki (Japan)
Tomowo Watanabe (Japan)
Ruguang Yin (China)

Observers

Kimberly Bahl (U.S.A.)
Jixiang Chen (China)
Janet Webster (U.S.A.)
Emmy Wong (Canada)

TCODE Endnote 2

TCODE meeting agenda

1. Welcome and introduction of members
2. Adoption of agenda
3. Review progress on items in the 2006/2007 workplan
   a. Continue to support HAB-S work with HAE-DAT database and required metadata (Robin Brown)
   b. Organize a scientific session/e-poster session at PICES XVI (Allen Macklin, Kyu-Kui Jung)
   c. Develop collaboration with ICES Working Group on *Data and Information Management* (Georgy Moiseenko, Bernard Megrey, Igor Shevchenko)

d. Continue Federated Metadata Searching Project (Allen Macklin, Bernard Megrey, Igor Shevchenko, Norio Baba)
   - Complete Phase II report and promote use of metadata
   - Carry out Phase III including capacity building
   - Investigate utility of Asian-side metadata server

e. Update TCODE Action Plan. (Robin Brown, Igor Shevchenko)

f. Coordinate activities with MONITOR (Thomas Royer)

4. National annual reports
5. Discussion of FUTURE
6. Planning for PICES XVII
7. Relations with other international programs and organizations
8. Election of Chairman and Vice-Chairman
9. PICES Ocean Monitoring Service Award
10. Items with financial implications
11. New business
12. TCODE Workplan for 2007/2008

TCODE Endnote 3

A TCODE/MONITOR proposal to establish a PICES remote server

Background

The need for scientific information within the PICES community is increasing and is expected to increase further when FUTURE becomes active. This information can consist of data, metadata, collaboration portals, PICES publications, direct and supporting material for the North Pacific Ecosystem Status report, and a web interface to quickly discover, access, and preliminarily evaluate this information. Even though some of these resources are available today, there is no one-stop PICES web interface to accomplish the tasks described above.

Proposal

We propose that PICES outsource (rent) a remote server for one year to test PICES web resource, and PICES should consider the cost as part of the scientific infrastructure of a maturing and quickly expanding PICES scientific program. For minimal annual costs PICES can rent a capable remote server with the following characteristics:

- Assignment of 16 dedicated IP addresses (needed to register country nodes to the metadatabase clearinghouse); this means one piece of hardware (the rented remote server) could act as 16 different virtual servers which would be more than enough to meet the needs of PICES;
- Multiple login accounts to give PICES users and developers required access;
- Root access for each login (or IP address) to allow installation of custom software and to perform account management;
- FTP access to allow transfer of information, data and software to the PICES remote server;
- Free system repair;
- OS updates and patches;
- 24/7/365 technical support (by phone and email); this means that any PICES member country, regardless of the time zone on which they work, will have access to technical support.

A capable remote server hardware configuration is minimally defined as:

- Windows Server 2003 operating system;
- Server hardware configuration;
- Pentium 2.5-2.8Ghz CPU;
- 1 GB RAM;
- 2 × 40GB RAID 1 hard disk storage;
- 100/1000Mbps CAT6 on 100 Mbps port with 75GB of Tier 1 internet bandwidth.

PICES services

Development test-bed for a PICES GeoNetwork web interface:
GeoNetwork is a free, open-source software system that offers many useful scientific services. It can offer metadata clearinghouse functions, document library management, map server data presentation functions and a data distribution interface. We propose that one

virtual server be allocated as a development server to test the functionality of GeoNetwork and its scientific potential to PICES. The TINRO-Center laboratory has experience in working with GeoNetwork.

Metadata clearinghouse:
The PICES Metadata Federation process has been successful at every incremental step. Participating laboratories have been enthusiastic about their involvement in the project, and we believe the clearinghouse has proven to be a valuable resource to PICES scientists. The time is right for the Organization to consolidate all PICES metadata nodes. We recommend that PICES assume the responsibility of providing the federation clearinghouse function, gather valuable Pacific-Rim metadata resources under one umbrella, and give it the unique and prominent PICES name it deserves – a recognizable trademark that communicates scientific excellence. We propose that one virtual server be allocated for serving the PICES metadata through the already established NSDI (National Spatial Data Infrastructure) clearinghouse, and that one virtual server be assigned to test GeoNetwork as a metadata clearinghouse.

PDF files:
PICES wants to place their library of large PDF files on a server connected to a high bandwidth data server so as to reduce download times by PICES users. We propose that PICES use one virtual server for this task.

Distribution point for North Pacific CPR value-added data products:
MONITOR is proposing to make some value-added products from the North Pacific CPR (Continuous Plankton Recorder) project available to the PICES community. We propose to satisfy this need with a remote server and use the CPR data library in the GeoNetwork test mentioned above.

Support for the North Pacific Ecosystem Status Report (NPESR):
Many people contribute to the NPESR. We propose to use a remote server to manage the many aspects of this complex project and, when possible, serve chapters and time series as living documents linked to actual data.

Cost considerations

There will be no software costs, as the communication software (Isite) and the clearinghouse and web interface software (GeoNetwork) needed for the metadatabase function are free open-source software.

There will be a direct cost to rent the remote server hardware. To approximate the cost, we have solicited bids from two vendors found on the World Wide Web, RackSpace and Adhost. The bid from Adhost is the lower of the two and is US $195/month plus a US $150 one-time setup fee. Using these figures, the annual estimated cost for a 12 month contract totals US $2,490. This is a relatively small cost for the services provided given that PICES has supported the Federated Metadata Searching Project for the past 3 years at US $4,000/yr.

Vendors

Many other options are available, but in our evaluation, the two bids from RackSpace and Adhost represent typical costs and the state-of-the-art in server farm service offerings. Server farms located in U.S.A. are preferred because they adhere to the high Tier 1 standards in terms of reliability, security and internet speed and because the internet data infrastructure in U.S.A. meets the highest worldwide standards for reliability. For example, the Adhost Data Center in Seattle offers the following:

- Data Center-physical characteristics,
- Dual access redundant power feeds,
- Power conditioning through redundant UPS (Uninterruptible Power Supply) and power backup units,
- Redundant cable routing system,
- Backup network equipment,
- Zoned dry-pipe pre-action fire suppression system,
- Power backup provided by multi-mW generators fed from diesel reservoirs,

- Two emergency wells to supply water to cooling towers if city water becomes unavailable,
- Data Center- network,
- Redundant Gig-E dedicated leased connections to multiple Tier 1 providers on diverse multiple paths,
- Redundant Cisco routers connected to redundant Cisco switches,
- 100% switch-based 100/1000 Mbps ports connected to Cisco switches.

Impacts on the PICES Secretariat

Since the clearinghouse node will be a rented remote server, there should be no impact on scare Secretariat resources for the metadata functions. Representatives from each member country will be responsible for maintaining and updating their own individual virtual nodes. Other use functions are already assumed within the Secretariat.

Benefits to PICES

For the metadatabase function, renting a remote server will consolidate all PICES metadata into one resource. PICES branding of individual country contributions will unite the commitment to the international effort. The GeoNetwork could prove to be a useful web tool, facilitating support of PICES scientific activities. Faster PDF downloads, serving valuable CPR data and NPESR living documents would provide a valuable service to the PICES community.

Benefits to participating Metadata Centers

Renting a remote server will eliminate security risk of opening a port though laboratory firewalls to the internet to permit connection of the node server by the clearinghouse server. Metadata will reside with the federation partner and will also be duplicated on the remote server. This additional backup of the metadata adds an additional layer of security.

REPORT OF THE TECHNICAL COMMITTEE ON MONITORING

The Technical Committee on Monitoring (hereafter MONITOR) met from 16:00–19:30 hours on October 31, 2007, under the chairmanship of Dr. Jeffrey M. Napp. Seven Committee members were present, and a total of 12 scientists from 5 of the 6 PICES member countries were in attendance (*MONITOR Endnote 1*). The meeting agenda (*MONITOR Endnote 2*) was very full and business was conducted at a brisk pace.

Best Presentation Awards (Agenda Item 2)

MONITOR was assigned responsibility to assess Topic Sessions on "*Recent advances in ocean observing systems: Scientific discoveries, technical developments, and data management, analysis and delivery*" (S8/S10) and "*Operational forecasts of oceans and ecosystems*" (S9) by Science Board Chairman, Dr. Kuh Kim. Topic Session S8/S10 oral presentations and posters were reviewed in collaboration with TCODE and Topic Session S9 oral presentations and posters were reviewed in collaboration with POC and CCCC. The Chairman thanked the volunteers in advance for their service.

The MONITOR Best Presentation Award was given to Hiroaki Tatebe (University of Tokyo, Japan) for his paper (co-authored by Ichiro Yasuda and Hiroaki Saito) on "*Horizontal transport of* Neocalanus *copepods in the subarctic and northern subtropical North Pacific*". Gitai Yahel (University of Victoria, Canada) won the MONITOR Best Poster Award for his poster (co-authored by Ruthy Yahel, Timor Katz, Boaz Lazar, Barak Herut and Verena Tunnicliffe) on "*Fish activity, a major mechanism for nutrient and carbon recycling from coastal marine sediments*".

Status of FUTURE (Agenda Item 3)

Dr. Napp briefed the Committee on the status of the new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems). Included in the presentation were the next steps in editing, approving, and implementing the Program. Committee members had been asked early in the week to review a draft Science Plan for FUTURE (version 4.2) available on the PICES website, and bring comments to the MONITOR meeting in preparation for the Open Forum that was held on November 1, 2007. A good discussion resulted with many excellent constructive comments. These were distilled and presented by Dr. Napp at the Open Forum (*MONITOR Endnote 3*). The FUTURE Science Plan Writing Team met on November 3 to consider the comments offered during the Open Forum as well as those sent previously by PICES scientists. MONITOR members were encouraged to send suggestions whenever new drafts were released for comment.

North Pacific Ecosystem Status Report (Agenda Item 4)

Dr. Napp informed the Committee on the recent discussion of how to produce future ecosystem status reports. In particular, he reviewed the recommendations of the Study Group on *Ecosystem Status Reporting* (SG-ESR) and the recommendation of the Science Board to incrementally improve and expand the printed version of the report. Current proposals for the report do not address web publishing of seminal time series for the PICES region. Since it is likely that a special Editorial Board will be assembled to guide the writing of the report (not MONITOR), ways to contribute were discussed. The Committee supported a suggestion by the Chairman that MONITOR design and maintain a PICES ecosystem status web page that would feature seminal time series from the PICES region. The site would rely on the cooperation of scientists from member countries to volunteer small sets of existing data from routine

collections, and to annually update them. The next step in the process will be to ask the Science Board to provide comments on this suggestion and tell the Committee if a formal proposal is necessary.

Progress report of the Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* (CPR-AP) and recommendations (Agenda Item 5)

Dr. Sonia D. Batten presented a report of the scientific accomplishments and present status of the North Pacific Continuous Plankton Recorder (CPR) project. The project continues to produce original research as well as important monitoring results. Since its inception in 1997, seven articles from the CPR data have been published in refereed journals and 3 articles on the seabird observations along the CPR lines have been submitted or published. A key area for ecosystem status and monitoring is the observation of changing phenology of planktonic organisms in the North Pacific.

Unfortunately, the funding situation is dire and without assistance the project will likely end after collections early in 2008. In the past, the North Pacific Research Board (NPRB) has funded the east–west transects (including bird and mammal observations), and the Exxon Valdez Oil Spill Trustee Council (EVOSTC) has funded the north–south transects. EVOSTC declined a recent proposal, and NPRB has promised only half of what was formerly granted. A research proposal to the U.S. National Science Foundation (NSF) was pending at the time of PICES XVI. Dr. Charles B. Miller, Chairman of CRP-AP, reported on behalf of the Panel and agreed with Dr. Batten's assessment of the project (the full CPR-AP report can be found elsewhere in this Annual Report). CPR-AP wholeheartedly endorsed the project as one of the premier monitoring efforts in the PICES region and recommended that MONITOR request that the Science Board approve the concept of a "North Pacific CRP consortium" that could distribute the project costs among a larger group of funding sources, while still allowing each contributor to share the recognition/credit of the scientific achievements. Furthermore, CPR-AP recommended that a request be made for the Executive Secretary of PICES send a letter asking the principal funding entities of monitoring activities in North America to join the consortium. The Committee discussed and approved the proposal. Drs. Batten and Miller were asked to draft a letter, and Dr. Napp will present it to the Science Board at the end of the week.

NPAFC contributions to the next Ecosystem Status Report (Agenda Item 6)

Dr. James Irvine, Chairman of the NPAFC (North Pacific Anadromous Fish Commission) Working Group on *Stock Assessment*, was invited to give a presentation on the potential contributions by that Commission to the next PICES Ecosystem Status Report. A chapter prepared by NPAFC for the pilot report contained only information about salmon catch in the North Pacific, but the Commission revealed that they would be prepared to provide more data related to the ecology and health of salmon stocks, *e.g.*, information about size-at-age, marine survival, changes in the timing of returns (migration behavior), and oceanic distributions for the various species. In short, data collected under the auspices of NPAFC could be used much more effectively to study the health or status of particular regions of the North Pacific Ocean. The Committee thanked Dr. Irvine for his presentation and discussed various ways that the information could be incorporated into the next report. One way would be to put all the information into a single chapter of the PICES Ecosystem Status Report, but MONITOR favored reporting salmon information in the regional chapters. The Committee recommended involvement NPAFC national representatives of PICES member countries so that the information can be integrated from regional perspectives.

Election of Chairman and Vice-Chairman (Agenda Item 7)

MONITOR held elections for a new Chairman and Vice-Chairman. Dr. Alexander Bychkov, Executive Secretary of PICES, officiated. Dr. Hiroya Sugisaki (Japan) was nominated by

Dr. Sei-Ichi Saitoh and was unanimously elected for a 3-year term as the Chairman of MONITOR. Dr. Philip Mundy was nominated by Dr. Napp and was unanimously elected as the Vice-Chairman of MONITOR. The Committee expressed its gratitude to Drs. Napp and Saitoh, former Chairman and Vice-Chairman of MONITOR, for their leadership and valuable contribution to MONITOR activities over the years. Drs. Napp and Saitoh pledged to help the newly elected officers in their new roles.

Global Ocean Observing System – GOOS (Agenda Item 8)

Dr. Mundy reported that the Study Group *to develop a strategy for GOOS* (SG-GOOS) was in the process of completing their terms of reference (TOR). The final report of the Study Group is included elsewhere in this Annual Report and is also available on the PICES website.

The first TOR asked SG-GOOS to identify and describe the major observing systems (present and proposed) in the PICES region, but this activity was superseded by a comparable effort led by the Intergovernmental Oceanographic Commission (IOC) of UNESCO. Rather than duplicate this effort, SG-GOOS decided to wait until the IOC report is released and then use their information.

The second TOR was to provide a recommendation and justification to MONITOR on whether or not PICES should propose a North Pacific GOOS pilot project to international GOOS (I-GOOS). This issue was discussed within the Study Group and with the GOOS Scientific Steering Committee when Dr. Mundy attended the 10th GOOS SSC meeting in March 2007, in Seoul, Korea. A copy of his presentation to the GOOS SSC is included in the 2007 SG-GOOS report (*SG-GOOS Endnotes 3* and *4*) and also posted on the SG-GOOS web page . The main recommendation of the Study Group is that PICES should focus its efforts on providing a forum for representatives of current and future observing systems where cross-GOOS Regional Alliances, including observing projects, observing technologies, and data and information sharing protocols, could be developed. MONITOR accepted this recommendation and agreed to forward it to the Science Board. This recommendation, if approved, would require changes in the terms of reference for MONITOR. *MONITOR Endnote 4* provides the current TOR, the changes suggested by SG-GOOS and the subsequent modifications proposed by the Science Board.

SG-GOOS also requested that a representative of MONITOR be sent annually to GOOS SSC meetings to report on North Pacific monitoring activities, emphasizing projects that span observing regions and international boundaries, progress in establishing sensor technologies for scientifically sound observing systems, and progress in the use of common information exchange methods.

Dr. Vyacheslav B. Lobanov attended the 11th Session of the IOC/WESTPAC Coordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS) in January 2007, in Bangkok, Thailand. His report is included in the 2007 SG-GOOS report (*SG-GOOS Endnote 2*). He also kindly prepared a summary of the meeting results that was presented by Dr. Mundy. A copy of this presentation is posted on the SG-GOOS web page.

Dr. Napp thanked all SG-GOOS members for their service.

Planning for PICES XVII (Agenda Item 9)

MONITOR strongly supported the following two proposals for PICES XVII:

- Dr. Saitoh proposed a 1-day MONITOR workshop on "*Status of marine ecosystems in the sub-Arctic and Arctic seas – Preliminary results of IPY field monitoring in 2007 and 2008*" to be co-sponsored by ESSAS (*MONITOR Endnote 5*).
- Recommended conveners are: Drs. Saitoh (Japan), George Hunt (U.S.A.), Kenneth Drinkwater (Norway) with representatives from China, Korea and Russia to be named.
- Dr. Napp proposed a 1-day MONITOR Topic Session entitled "*Linking biology, chemistry, and physics in our observational systems – present status and FUTURE*

needs" (*MONITOR Endnote 6*). The goals of the session are to: 1) define and specify the types, frequency, and spatial resolution of observational data required for our current numerical models; 2) review existing and emerging advanced technologies capable of supplying biomass and species or functional group information; 3) showcase novel data assimilation techniques, formal organization of data or database frameworks that facilitate the operational use of observational data to predict the affects of anthropogenic and climate forcing on the major ecosystems of the North Pacific. There was initial interest by Drs. Napp (U.S.A.) and Young Jae Ro (Korea) to be Convenors from MONITOR. A request was sent to POC, BIO, and TCODE to see if they wanted to co-sponsor the session. TCODE and BIO accepted, and TCODE nominated Hernan Garcia and Allen Macklin (U.S.A.), Toru Suzuki (Japan) and a representative of China to serve as Co-Convenors.

Joint symposia and sessions with ICES (Agenda Item 10)

MONITOR examined the provided list of ICES symposia and scientific sessions. There was interest in co-sponsoring a joint Theme Sessions on "*Coupled physical and biological models*" at the 2008 ICES Annual Science Conference.

PICES Ocean Monitoring Service Award (Agenda Item 11)

The Chairman announced that a new PICES Ocean Monitoring Service Award (POMA) was established last year to recognize organizations, groups and outstanding individuals that have contributed significantly to the progress of marine science in the North Pacific through long-term ocean monitoring and management of data associated with ocean conditions and marine bio-resources in the region. Nominations will be requested by the Secretariat prior to March 15, 2008. MONITOR and TCODE will recommend a recipient, with final approval by the Science Board at their inter-sessional meeting in April 2008. The first award will be presented at the Opening Session of PICES XVIII in Dalian, China. The Secretariat will design a nomination form for the award.

There was discussion about what entities would be appropriate recipients for the award. For example, if a particular ship had been active in the creation of an important time series would it be the ship or the sponsoring program that should be nominated for the award? Committee members felt that the sponsoring program (university or agency) would be the appropriate recipient.

National reports (Agenda Item 12)

The following Committee members made short presentations on national monitoring activities relevant to PICES:

- Canada: Dr. Mackas
- Japan: Drs. Saitoh and Sugisaki
- Korea: Dr. Ro
- United States: Drs. Barth, Mundy, and Napp

MONITOR Endnote 1

Participation list

Members

Jack Barth (U.S.A.)
David L. Mackas (Canada)
Phillip R. Mundy (U.S.A.)
Jeffrey M. Napp (U.S.A., Chairman)
Young Jae Ro (Korea)
Sei-Ichi Saitoh (Japan, Vice-Chairman)
Hiroya Sugisaki (Japan)

Observers

Sonia D. Batten (Canada)
Alexander Bychkov (PICES Secretariat)
Lyse Godbout (Canada)
Chuanlin Huo (China)
James Irvine (Canada)
Charles B. Miller (U.S.A.)
Thomas C. Royer (U.S.A., TCODE)

MONITOR Endnote 2

MONITOR meeting agenda

1. Welcome and introductions
2. 2007 MONITOR Best Presentation and Best Poster Awards
3. Status of FUTURE and comments on a draft Science Plan (version 4.2)
4. North Pacific Ecosystem Status Report: SG-ESR and Science Board recommendations
5. Progress report of the Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* and recommendations
6. NPAFC presentation and discussion on contribution to the next Ecosystem Status Report
7. Election of Chairman and Vice-Chairman
8. GOOS-related issues
   a. Report from the Study Group on GOOS
   b. Recommended changes to the terms of reference for MONITOR
   c. Report on NEAR-GOOS
9. Planning for PICES XVII
10. Joint symposia and sessions with ICES
11. PICES Ocean Monitoring Service Award
12. National reports of relevant monitor and observation activities

MONITOR Endnote 3

MONITOR Comments on a draft Science Plan for FUTURE (version 4.2)

Forecasting

- More emphasis on data assimilation; TCODE does not have an explicit role in the present draft.
- More emphasis on real-time dissemination of information from observation networks; Need efficient data QC and analyses, effective alarm and advisory systems for public and business sectors.

Understanding

- Emphasis appears to be on prediction; increase focus on assimilation of data and mechanistic models for better understanding.

Trends

- Increased emphasis on better integration of physical and biological observations. Are GCOOS observations on the correct time and space scales for biological predictions?
- Observation networks often rely on point estimates and gridded data, but important processes and trophic transfer often occur at "hotspots";
- Seek a balance for observations of mean system state *versus* "events"; Allow for adaptive strategies in observation systems that enhance our understanding by increasing observation frequency and spatial resolution during events;
- Will the observation systems we rely upon today be supported tomorrow (*e.g.*, satellite remote sensing)?

Ecosystems

- How do we measure ecosystem structure?
- Does FUTURE build on existing national and regional research plans (*e.g.*, Gulf of Alaska Ecosystem Monitoring, GOOS, BSIERP)?

MONITOR Endnote 4

Recommended modifications to the MONITOR Terms of Reference

Current terms of reference

1. Identify principal monitoring needs of the PICES region;
2. Develop approaches to meet these needs, including training and capacity building;
3. Serve as a forum for coordination and development of the PICES components of the Global Ocean Observing System, GOOS, including possible method development and inter-comparison workshops to facilitate calibration, standardization and harmonization of data sets;
4. Serve as the senior editorial board of the North Pacific Ecosystem Status Report (NPESR), reporting to Science Board;
5. Recommend interim meetings to address monitoring needs, PICES-GOOS activities, and development of the NPESR;
6. Provide Annual Reports to Science Board and the PICES Secretariat on monitoring activities in relation to PICES;
7. Interact with TCODE on management issues of monitoring data.

SG-GOOS recommended replacing TOR 1, 2, 3 and 7 with the following:

- Identify principal monitoring needs of the PICES region and approaches to meet these needs by serving as a forum for coordination and development of inter-regional and international components of the North Pacific ocean observing systems, including the Global Ocean Observing System, GOOS, and including facilitation of method development and inter-comparison workshops to facilitate calibration, standardization, and harmonization of data sets;
- Provide annual reports to the Science Board and the PICES Secretariat on monitoring activities in the PICES areas.

After discussion at the inter-sessional Science Board meeting in Yokohama, Japan, the proposal was changed to the following:

Modified terms of reference

1. Identify principal monitoring needs of the PICES region, and develop approaches to meet these needs, including training and capacity building;
2. Serve as a forum for coordination and development of inter-regional and international components of the North Pacific Ocean Observing Systems, including the GLOBAL Ocean Observing System, GOOS. Facilitate method development and inter-comparison workshops to promote calibration, standardization and harmonization of data sets;
3. Serve as the senior editorial board of the North Pacific Ecosystem Status Report, reporting to Science Board; serve as senior editorial board for PICES web pages on major monitoring efforts in the North Pacific, including the annual reporting of important time series;
4. Recommend interim meetings to address monitoring needs and PICES–GOOS activities;
5. Provide annual reports to Science Board and the Secretariat on monitoring activities in relation to PICES;
6. Interact with TCODE on management issues of monitoring data.

Note that TOR 3 may be further modified based on the decision of the Science Board on how to proceed with the writing and production of the Ecosystem Status Report.

MONITOR Endnote 5

Proposal for a 1-day MONITOR workshop at PICES XVII on
"Status of marine ecosystems in the sub-Arctic and Arctic seas – Preliminary results of IPY field monitoring in 2007 and 2008"

The sub-Arctic and Arctic seas have distinct marine ecosystems that are affected by seasonal sea ice. During the summer, the water column is stratified by melt water from retreating sea ice, and phytoplankton are found near the sea surface, where the incoming sunlight is sufficient for photosynthesis. These summer conditions result in the highest primary production in the world's oceans and support high levels of fishery resources. Algae that live on the bottom of sea ice also play an important role in maintaining fishery resources by falling and decomposing on the sea floor in summer. Recently, global climate change has become a cause for concern. The greenhouse effect, produced by increasing anthropogenic CO_2 emissions, has induced increases in atmospheric and seawater temperatures. The effect of such increases on the cryosphere of the Arctic is already visible, and understanding its direct and indirect effects on the physical and chemical environments and the responses of marine ecosystems is critical. However, the knowledge of most aspects and responses of marine ecosystems to global climate change is still inadequate. PICES nations have conducted several field programs in these regions during the International Polar Year (IPY) 2007–2008. This workshop will discuss the features and mechanisms of the responses of marine ecosystems to global climate change in the Arctic and sub-Arctic seas, based on results from the IPY cruises in 2007 and 2008.

Recommended convenors: Kenneth Drinkwater (Norway), George L. Hunt, Jr. (U.S.A.), Sei-Ichi Saitoh (Japan) and others TBD.

MONITOR Endnote 6

Proposal for a 1-day MONITOR/TCODE/BIO Topic Session at PICES XVII on
"Linking biology, chemistry, and physics in our observational systems – present status and FUTURE needs"

Numerical models are becoming increasingly complex, attempting to integrate vertically and horizontally ecosystem forcing, processes and predictions across multiple trophic levels from bacteria to human populations. Data requirements for daily, seasonal, annual and decadal predictions differ according to single species, species assemblages or multi-trophic level interests. To add to the challenge, the types of sensors and frequency of measurements vary greatly across ecosystem components, particularly the biological sector. This session encourages contributions that: (1) define and specify the types, frequency, duration and spatial resolution of observational data required for current numerical models; (2) review existing and emerging advanced technologies capable of supplying biomass and species or functional group information; (3) review existing and emerging data sources and technologies capable of integrating these data with physical and chemical information; and (4) showcase novel data assimilation techniques and formal organization of data or database frameworks that facilitate the operational use of observational data to predict the effects of anthropogenic and climate forcing on the major ecosystems of the North Pacific.

Recommended Conveners: Jeffrey M. Napp (U.S.A.) and Young Jae Ro (Korea) from MONITOR; Hernan Garcia and Allen Macklin (U.S.A.), Toru Suzuki (Japan) and a Chinese representative from TCODE.

REPORT OF SECTION ON CARBON AND CLIMATE

The meeting of the Section on *Carbon and Climate* (hereafter CC-S) was held from 09:00–17:00 hours on October 28, 2007. Drs. James Christian and Toshiro Saino co-chaired the meeting attended by 13 members and 12 observers (*CC-S Endnote 1*). The draft agenda was reviewed and adopted unanimously (*CC-S Endnote 2*).

Membership (Agenda Item 2)

The new member from Canada, Dr. Sophia Johannessen, was introduced to the group. Appointment of additional members from Japan and China was discussed but will be left to the national delegates to finalize. There may be new CC-S members added later to reflect an intensified focus on the biological impacts of ocean acidification.

Methods manual for CO_2 measurements (Agenda Item 3)

Dr. Christian provided an update on the progress of the "*Guide to Best Practices for Ocean CO_2 Measurements*". The editors, Dr. Christian, Andrew Dickson and Christopher L. Sabine, and the PICES Secretariat have finished editing the Guide, and it will be published this year as PICES Special Publication No. 3/IOCCP Report No. 8. This publication has been made possible due to support by PICES, International Ocean Carbon Coordination Project (IOCCP) co-sponsored by SCOR (Scientific Committee on Oceanic Research) and IOC (Intergovernmental Oceanographic Commission of UNESCO), and the Carbon Dioxide Information Analysis Center (CDIAC). Interactive web-based community review was open for approximately 3 months on a server at CDIAC, and many CC-S members participated.

It was suggested that more than the originally planned 800 hard copies of the Guide should be printed, and that an electronic version be hosted at CDIAC. The Guide is envisioned as an evolving document, updated where necessary. Comments and suggestions for use in preparing future versions are welcome.

There was some discussion of translating the Guide into other languages but no decisions were made. A partial Japanese translation of the 1994 edition exists. The consensus was that this version should remain online at CDIAC, but be clearly marked that it is not the current version.

Topic Session at PICES XVI and plans for publication (Agenda Item 4)

A 1-day BIO/POC Topic Session on "*Decadal changes in carbon biogeochemistry in the North Pacific*" (S2) was held at PICES XVI. This was the first scientific session sponsored by CC-S. Drs. Christian and Saino served as co-convenors and Dr. Taro Takahashi (U.S.A.) was the invited speaker. Two dozen abstracts from all PICES member countries were submitted (for details see the *Session Summaries* chapter of this Annual Report). Selected papers from this session will be published in 2009 as a special section in a regular issue of *Journal of Oceanography*. Dr. Saino, Editor of the journal, will coordinate this process and select the Guest Editors.

Reports on collaborating organizations and agencies (Agenda Item 5)

Reports were given on several national and international programs relevant to the mandate of CC-S: IOCCP, Global Carbon Project (GCP) and CLIVAR/CO_2 Repeat hydrography by Dr. Sabine; U.S. Ocean and Biogeochemistry Group (US–OCB) by Dr. Richard A. Feely; Japan–SOLAS and Japan–IMBER by Dr. Saino, and CarboOcean by Dr. Robert Key. Dr. Feely also gave an extensive report from the U.S. Scoping Workshop on "*Ocean acidification research*" held October 9–11, 2007, in San Diego.

Data integration for synthesis (Agenda Item 6)

The carbon data synthesis has been a key focus of CC-S activities, and significant progress has been made in the past year. Drs. Key (U.S.A.) and Nobuo Tsurushima (Japan) were invited to attend the meeting as observers. Dr. Key has extensive experience in assembling integrated data sets for GLODAP (Global Ocean Data Analysis Project) and CARINA (Carbon dioxide in the Atlantic Ocean). Dr. Tsurushima was selected at PICES XV to lead the synthesis effort for the Northwest Pacific. Dr. Masao Ishii (Japan) was also invited but was unable to attend. He distributed a proposal for a Data Synthesis Implementation Plan which was adopted with revisions (*CC-S Endnote 3*).

Presentations from Drs. Alexander Kozyr and Toru Suzuki detailed the progress of their respective Data Centers, CDIAC and MIRC (JHA's Marine Information Research Center). Dr. Suzuki provided extensive and detailed statistics regarding the spatial and temporal distribution of data, which suggests that this data set promises substantial progress over what is currently available in understanding interannual-to-interdecadal variability. Dr. Suzuki has catalogued, or been promised by the Principal Investigator, 186 cruises, not including those where only pH was measured, and currently holds in his possession the data from around 50% of these cruises. Dr. Kozyr has a somewhat smaller inventory but has actual possession of 100% of the data catalogued.

The consensus of the Section was that there needs to be a date to close data submission, which was tentatively set as January 2009. Dr. Key expressed the opinion that most of the cross-calibration work for synthesis could not begin until the raw data set was finalized (*i.e.*, until data submission was closed). The members did not see a need to set a format for metadata.

The exact strategy for second level quality control (second QC) was not determined. Regional sub-group leaders have been appointed (see the 2006 CC-S Annual Report) but the membership in these groups is not yet determined. Regional sub-groups will need to meet to determine strategy for second QC.

Future activities (Agenda Item 7)

Next year's PICES Annual Meeting will take place very close to the international symposium on "*The ocean in a high CO_2 world – II*" to be convened October 6–8, 2008, in Monaco. It was suggested that the CC-S meeting could be held there instead of at PICES XVII in Dalian, China, as it is likely that some members would be unable to attend both events.

The Section decided not to have a Topic Session at PICES XVII. A Topic Session will be planned for PICES XVIII (October 2009), with ocean acidification as the tentative theme.

Terms of reference (Agenda Item 8)

The CC-S terms of reference were revised slightly to reflect an intensified focus on ocean acidification (*CC-S Endnote 4*). The revisions were presented at the POC and BIO meetings later in the week.

CC-S Endnote 1

Participation list

Members

James Christian (Canada, Co-Chairman)
Richard A. Feely (U.S.A.)
Hernan Garcia (U.S.A.)
Sophia Johanessen (Canada)
Alex Kozyr (U.S.A.)
Kitack Lee (Korea)
Lisa A. Miller (Canada)
Tsuneo Ono (Japan)
Christopher L. Sabine (U.S.A.)
Toshiro Saino (Japan, Co-chairman)
Toru Suzuki (Japan)
Shuichi Watanabe (Japan)
Yutaka Watanabe (Japan)

Observers

Alexander Bychkov (PICES)
Fei Chai (U.S.A.)
Michael J. Dagg (U.S.A.)
Robert Key (U.S.A.)
Skip McKinnell (PICES)
Akira Nakadate (Japan)
Yukihiko Nojiri (Japan)
Taro Takahashi (U.S.A.)
Takayuki Tokieda (Japan)
Atsushi Tsuda (Japan)
Hiromichi Tsumori (Japan)
Nobuo Tsurushima (Japan)

CC-S Endnote 2

CC-S meeting agenda

1. Welcome, aims of the meeting, approval of agenda
2. Discussion of CC-S membership and introduction of new members
3. Methods manual for CO_2 measurements
4. Topic Session at PICES XVI and plans for publication
5. Reports on collaborating organizations and agencies
6. Data integration for synthesis: What progress has been made, what still needs to be done? Are the original objectives and guiding principles still relevant or need revisions? What do different member delegations need to bring their data into the synthesis?
7. Future activities
8. Discussion of revised Terms of Reference

CC-S Endnote 3

Data Synthesis Implementation Plan

Overall goals

- Create a database of water column CO_2-related data for the Pacific;
- Produce an internally consistent database that has gone through a second level quality control (second QC). Here, we define the first level QC as QC by a PI, including flagging of data, and second level QC as activities to correct for the offset among cruises or stations by way of cross-over, MLR analyses, internal consistency among carbon parameters, *etc*;
- Bring together research groups that measure water-column CO_2-related parameters in the Pacific;
- Provide a forum for regional working groups for data collection and analysis;
- Estimate anthropogenic CO_2 and variability of ocean carbon chemistry in the Pacific from regional-to-basin scales;
- Provide data for studies of ocean carbon chemistry.

Area
- The North Pacific, Equatorial Pacific, South Pacific, and their marginal seas;
- Pacific sector of the Southern Ocean, including south of Australia. These data may be shared with the Southern Ocean Carbon Synthesis group of CARBOOCEAN led by M. Hoppema (AWI, Germany).

Data
- Hydrographic and chemical data sets including DIC, alkalinity, pH, pCO_2, DOC, ^{13}C, ^{14}C, nutrients, oxygen, and transient tracers such as CFCs, CCl_4, SF_6, *etc*. $^3H/^3He$, chlorophyll + phaeopigment;
- Readable electronic format, preferably WHP exchange format with WHP quality flags and version (update) information (column order cannot be standardized);
- Metadata, such as method of analysis and information on quality control, and the list of the related publications (citing these helps the contributing PIs).

Collection and archive
- Open data sets available from Data Centers such as CCHDO, CDIAC, WDCGG, and websites of organizations and programs (PIs must agree to make their data public, following the first QC);
- Data not included in the GLODAP database;
- Data sets will be stored at MIRC and/or CDIAC and prepared for the second level QC;
- Working synthesis database will be developed and available only to the PIs who submitted a data set, and synthesis regional sub-groups of PICES CC-S. Modelers who are interested in using the data can access the database by contacting a sub-group member;
- PICES database will be published and will be open to the public through participating Data Centers;
- In PICES database publications, credit will be given to all PIs who submitted data sets.

Action items
- Establish PICES database regional sub-groups for the Northeast Pacific, Northwest Pacific, Equatorial Pacific, and South Pacific;
- Toru Suzuki (MIRC) and Alexander Kozyr (CDIAC) are responsible for PICES database cruise and data inventory;
- Target date to compile the first version of the data set is January 1, 2009;
- Regional working groups will gather as much data as possible prior to September 1, 2008 deadline. The GLODAP/CARINA method for the second QC will be used as a primary model. Details of how this will be carried out and the final stages of data-gathering will be discussed at the CC-S meeting in the fall of 2008;
- Second QC will require additional meetings of regional sub-groups or full CC-S. Funds will be requested from PICES and IOCCP to support this.

CC-S Endnote 4

Revised terms of reference for the Section on *Carbon and Climate*

Suggested changes appear in bold.

1. Coordinate and encourage ongoing and planned national and international syntheses of carbon cycle research studies in the North Pacific and, where necessary and appropriate, for the larger Pacific basin;
2. Ensure effective two-way communication with other international scientific groups that have a responsibility for coordination of ocean carbon studies, such as the International Ocean Carbon Coordination Project (IOCCP), CLIVAR/CO_2 Repeat Hydrography and the SOLAS/IMBER implementation group for carbon research;
3. Review the existing information on carbon cycling in the North Pacific, including anthropogenic carbon, the biological pump, impacts **of ocean acidification** on marine biota, and possible feedbacks to atmospheric greenhouse gases; identify gaps in our knowledge, and make prioritized recommendations for future research.

4. Periodically review the status of the methodology of CO_2 measurements including the preparation of standards and reference materials, and advise on inter-calibration and quality control procedures;
5. Identify suitable data sets on the oceanic CO_2 system in the Pacific region as they become available, and recommend the mechanisms of data and information exchange;
6. Carry out and publish (in the refereed literature) basin-scale syntheses of carbon cycling in the North Pacific, including new data whenever appropriate, and encourage scientific interpretation of these evolving data sets;
7. Organize symposiums, workshops, or annual meeting sessions on the **carbon cycle, ocean acidification,** and climate studies in the North Pacific.

REPORT OF SECTION ON ECOLOGY OF HARMFUL ALGAL BLOOMS IN THE NORTH PACIFIC

The Section on *Ecology of Harmful Algal Blooms in the North Pacific* (hereafter HAB-S) met from 09:00–18:00 hours on October 28, 2007. The HAB-S meeting was attended by members from all PICES member countries and 18 observers (*HAB-S Endnote 1*). The proposed agenda was approved (*HAB-S Endnote 2*).

Overview of WG 15 and review of HAB-S terms of reference (Agenda Item 3)

After presenting an overview of the terms of reference for Working Group (WG 15) on *Ecology of Harmful Algal Blooms in the North Pacific* and giving a brief history on the origin of this Working Group, Dr. Vera L. Trainer reviewed the terms of reference of HAB-S.

Events at PICES XVI (Agenda Item 4)

Summaries of the MEQ Topic Session (S6) on "*The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region*" and the MEQ workshop and laboratory demonstration (W4) on "*Review of selected harmful algae in the PICES region: III.* Heterosigma akashiwo *and other harmful raphidophytes*" at PICES XVI can be found in the *Session Summaries* chapter of this Annual Report.

Plans for PICES XVII (Agenda Item 5)

The Section proposed the following events for PICES XVII:

- A 1-day MEQ workshop on the "*Review of selected harmful algae in the PICES region: IV.* Karenia *and* Prorocentrum", co-convened by Drs. Trainer (U.S.A.) and Mingyuan Zhu (China). The workshop will be preceded by a ½-day laboratory demonstration on *Karenia* and *Prorocentrum* identification and detection methods, organized by Drs. Hao Guo (China), Zhu, and Trainer (*HAB-S Endnote 3*). A product from the workshop will be a list of recommendations to help guide collaborative HAB research priorities in PICES countries over the next 5 years. Travel funds are requested for 2 invited speakers to attend the workshop.
- A ½-day MEQ Topic Session on "*Environmental regulation of species succession: The use of long-term data sets to understand HAB species dominance*" [This title was later changed to "*Species succession and long-term data set analysis pertaining to harmful algal blooms*"], co-convened by Drs. Hak-Gyoon Kim (Korea) and Mark Wells (U.S.A.) (*HAB-S Endnote 4*). Travel funds are requested for 1 invited speaker to attend the session.
- A 1-day HAB-S meeting, including national reports of HAB events in 2006–2007 and a discussion of HAE-DAT use. Countries are requested to input HAB event data directly online to HAE-DAT for 2004 and 2005.

National reports and Harmful Algal Event Database (HAE-DAT) use summary (Agenda Item 6)

Canada

Dr. Charles Trick stated that Canada has a weak monitoring program. The Canadian Food Inspection Agency tests seafood sold in stores, and is beginning to talk about accepting HAB data. There is a significant turnover of staff conducting the shellfish testing. Most problems in Canada are associated with fish killing species. The Harmful Algae Monitoring Program (HAMP) is motivated and funded by fish farmers (Nicky Haugh is the person currently working with the fish farmers on Vancouver Island). The database for this federal agency may eventually be made available for posting on HAE-DAT.

China

Dr. Zhu reported that China is divided by seas: Bohai, Yellow, and East China – with the most frequent HAB area in the South China Sea. A total of 93 bloom events occurred in 2006, (20,000 km^2) of which 41 were toxic (less than half yet covering 15,000 km^2). The main toxic species were *Karenia mikimotoi, Phaeocystis globosa, Cochlodinium, Phaeocystis.* There are ongoing problems with dense blooms of *Microcystis* in the Three Gorges Dam region, resulting in no drinking water in some areas. The shellfish toxins ASP (amnesic shellfish poisoning), PSP, DSP are detected in Shanghai market seafood. ASP has not been detected yet in China (perhaps 1 report). DSP is a major problem. A first phase of the Chinese Ecology and Oceanography on Harmful Algal Blooms program (CEOHAB) was completed in 2006. A second phase will look at the increasing HAB trend, yearly jellyfish blooms and hypoxia. The National High Tech Project will develop a HAB monitoring system between 2007 and 2010.

Japan

Dr. Yasunori Watanabe informed that there are 39 local governments with coastlines in Japan, but 7 area codes. Each area code includes many prefectures. The Bureau of Consumption and Safety has no phytoplankton species information. Paralytic shellfish poisoning (PSP) and diarrheic shellfish poisoning (DSP) data are reported by area code. Dr. Watanabe presented a table of annual occurrences of PSP (from 18 in 2000 to 37 in 2006) and DSP (from 4 33 in 1999 to 4 in 2005). Deficiencies in data reporting are made up by the FEIS/Fisheries Research Agency. ALOS (Advanced Land Observing System), the Japanese earth observing satellite program, can be used to detect *Chattonella* and *Cochlodinium* blooms using an advanced visible and near infrared radiometry. Aerial photography is also used to monitor for blooms.

Korea

Dr. Kim reported that Korea's HAB database will be housed at the National Fisheries Research and Development Institute (NFRDI). The Korean Oceanographic Data Center will provide most of the data to HAE-DAT. *Cochlodinium* blooms are the main fish killers. The third largest bloom occurred in 2007 during which 28,000 metric tons of clay were dispersed. Three toxins are monitored as follows: 55 stations for PSP (mainly from March–May on the south coast), 15 stations for DSP, with sporadic sampling, and 40 stations for ASP, but again, only sporadically. Current research activities are looking for *Pfisteria*-like species in Korea and studying the effects of clay use on the benthic ecosystems.

Russia

Dr. Olga Lukyanova informed that shellfish sampling for toxins was done in Peter the Great Bay (Japan/East Sea), near Vladivostok. Testing of several mollusk species for ASP (using HPLC) and PSP (ELISA) showed that these toxins were not over the permitted level. Species monitored are *Mytilus trossulus*, *Crenomytilus grayanus,* and *Modiolus difficilis*.

U.S.A

Dr. Trainer related that various West Coast agencies in Alaska, Washington, Oregon and California report PSP and toxins. However, there are no reports of phytoplankton. Each coastal State has a representative who submits annual HAE-DAT reports to the National HAB office in Woods Hole, Massachusetts. The 5-year ECOHAB Pacific North West program studying the ecology and oceanography of *Pseudo-nitzschia* species is coming to a close in 2007. A new program, SoundToxins, is a phytoplankton monitoring program in Puget Sound, Washington, intended to give fish and shellfish farmers an early warning of HAB events.

Joint ICES–PICES Database: HAE-DAT (Agenda Item 7)

Dr. Monica Lion gave the HAE-DAT summary and an online demonstration of the database hosted by the IODE (International Oceanographic Data Exchange) Project Office in Oostende, Belgium (http:// www.iode.org/haedat). The

testing period was completed last year by PICES HAB-S together with ICES-WGHABD, IOC-ANCA, and IOC-FANSA. A summary section will be added to the web database to provide information on the following:

- What is a HAE?
- information on HAE-areas;
- short descriptions of the national monitoring programs on which the records of HAE-DAT are based;
- addition of legends on the maps;
- adjustment of the map minimum zoom to the whole country (the ability to zoom in and out on the maps like Google maps).

There will be only one user name and password per country. The national focal point persons (see recommendations to MEQ) will be responsible for submitting data to HAE-DAT. The next steps are to develop an integrated Harmful Algae Information System (HAIS), building on existing data products by IOC and its partners.

Several people were suggested as new primary contacts for data entry into HAE-DAT. This was necessary due to changes in key people responsible for HAB data in their countries. The new contacts are: Yang Soon Kang (Korea) to replace Hak-Gyoon Kim, Hao Guo (China) to replace Mingyuan Zhu, and Tatiana Morozova (Russia) to replace Tatiana Orlova. It was requested that the respective member countries consider appointing these scientists to become HAB Section members (or at least adding them to the HAB-S e-mail list).

Publications (Agenda Item 8)

The invited speakers of the HAB-S workshops on *Cochlodinium* and *Dinophysis*, *Alexandrium* and *Pseudo-nitzscha*, *Heterosigma*, *Karenia*, and *Prorocentrum* will be contacted to determine their interest in writing 3- to 5-page summaries and extensive bibliographies based on their presentations. The goal is to combine these summaries into a *Review of selected harmful algae in the PICES region* and publish this review as a PICES Scientific Report by 2010.

HAB-S Endnote 1

Participation list

Members

Ichiro Imai (Japan)
Hak-Gyoon Kim (Korea, Co-Chairman)
Olga Lukyanova (Russia)
Vera L. Trainer (U.S.A., Co-Chairman)
Charles Trick (Canada)
Yasunori Watanabe (Japan)
Mingyuan Zhu (China)

Observers

Robin Brown (Canada)
Luzviminda Dimaano (Philippines)
Henrik Enevoldsen (IOC)
Hao Guo (China)
Julian Herndon (U.S.A.)
Yoichiro Ishibashi (Japan)
Takashi Kamiyama (Japan)
Kunio Kohata (Japan)
Yoon Lee (Korea)
Ruixiang Li (China)
Monica Lion (IOC)
Jinhui Wang (China)
Lijun Wang (China)
Quan Weimin (China)
Chen Yagu (China)
Shi Li Yan (China)
Wenxi Zhu (China)
Zhaohui Zhang (China)

HAB Endnote 2

HAB-S meeting agenda

1. Welcome and introductions
2. Approval of agenda
3. Overview of terms of reference and history of WG 15, and review of terms of reference of HAB-S
4. Events at PICES XVI
5. Plans for PICES XVII
6. National reports and HAE-DAT use summary
7. Joint ICES-PICES HAE-DAT database
8. Publications

HAB-S Endnote 3

Proposal for a 1-day workshop and a ½-day **laboratory demonstration at PICES XVII on *"Review of selected harmful algae in the PICES region: IV.* Karenia *and* Prorocentrum"**

This workshop is the fourth of an annual series in which harmful algal bloom (HAB) species that impact all or most countries in the North Pacific are discussed in detail. In 2008, we will focus on two fish-killing species *Karenia* and *Prorocentrum*. *Karenia mikimotoi* is known to kill both wild and cultured fish in China, Korea and Japan. Although this species is absent, to date, in the eastern Pacific, other species from the genus *Karenia* are known to kill fish in the southeastern U.S. *Prorocentrum* is a "red tide" species that forms dense, colored blooms in China, Korea and Japan, resulting in economic loss to fisheries due to reduced consumer confidence. *Prorocentrum* blooms are relatively rare in the eastern Pacific, but have been documented occasionally in areas of the U.S. and Canada. The integration of information from each country will advance our understanding of these organisms. Topics will include modes of toxicity, distribution, impact (differences between toxic and nontoxic strains), as well as physiology and ecology in each of the member countries. In particular, we would like to identify additional studies needed specifically to understand the difference in occurrence and toxicity of these organisms in the eastern and western Pacific. The workshop will produce a list of recommendations to help guide collaborative HAB research priorities in PICES member countries over the next five years. The workshop will be preceded by a half-day laboratory demonstration on *Karenia* and *Prorocentrum* identification and detection methods.

Recommended convenors: Vera L. Trainer (U.S.A.) and Mingyuan Zhu (China).

Potential invited speakers: Daniel Baden (U.S.A.), Lu Dou Ding (China), Steven Morton (U.S.A.), Jacob Larsen (Denmark), Song Hui Lu (China), Karen Steidinger (U.S.A.) and Dr. Yamaguchi (Japan). The co-convenors will make the final decision regarding which expert speakers to invite.

HAB-S Endnote 4

Proposal for a ½-day MEQ Topic Session at PICES XVII on
"Environmental regulation of species succession: The use of long-term data sets to understand HAB species dominance" [later renamed to "*Species succession and long-term data set analysis pertaining to harmful algal blooms*"]

Increasing numbers of harmful algal bloom (HAB) events in many coastal locations are a result of significant changes in the dominant species compared to earlier periods. These changes may stem from introductions of new species or from range extensions, but they seem more likely to have arisen from changes in the environmental conditions that promote the dominance of a particular HAB species. Often, it has been concluded that anthropogenic influences on hydrology, land-use, nutrient inputs, *etc*. are the root cause of these changes, but there are examples of HAB incursions into regions that lack these pressures. An ecosystem approach focusing on decadal-scale changes in environmental conditions and planktonic species composition may provide some clarity on the causes of intensified HAB events. Talks on physical-scale to nutrient-scale factors that may affect species succession towards HAB species dominance are especially welcome.

Recommended convenors: Hak-Gyoon Kim (Korea) and Mark Wells (U.S.A.).

Potential invited speakers: Theodor Smayda (U.S.A.) and an Asian scientist (TBD). The co-convenors will make the final decision regarding which expert speakers to invite.

REPORT OF WORKING GROUP 19 ON ECOSYSTEM-BASED MANAGEMENT SCIENCE

The Working Group on *Ecosystem-based Management Science and its Application to the North Pacific* (hereafter WG 19) held its third meeting on October 27–28, 2007, under the co-chairmanship of Drs. Glen Jamieson and Chang-Ik Zhang, and Ms. Patricia Livingston. A list of participants and meeting agenda can be found in *WG 19 Endnotes 1* and *2*.

Description and implementation of a standard reporting format for EBM initiatives (Agenda Item 2)

Descriptions received from member countries were disparate and are being compiled into a summary. Still missing is a contribution from China. WG 19 discussed a conceptual spectrum of the ecosystem-based management (EBM) from single species fishery management to integrated (multi-sectoral) marine management and talked about trying to display national situations on the spectrum. Lists of government agencies involved in implementing EBM are being assembled.

Participants from each country were asked to provide Dr. David Fluharty a few paragraphs which outline where each nation is located on the Ecosystem Approach to Management (EAM) spectrum (*sensu* Sainsbury slide), including endangered species legislation, marine protected areas (MPA), or heritage site designations.

Dr. Fluharty discussed the possibility of incorporating a list of treaties dealing with transboundary stock management into the report. This document could be enhanced by adding aquaculture activities and their management. Categories in the report are expected to include: (1) definitions, (2) objectives, (3) legislation and agencies with marine management authority, (4) environmental assessment requirements in decision making, and (5) endangered species protection, marine sanctuaries, national heritage or other MPA designation processes. Target date for completion of this chapter of the WG 19 final report is the end of December 2007.

Definitions of "eco-regions" and criteria for defining ecological boundaries relevant to PICES (Agenda Item 3)

Dr. Christopher Harvey gave an update of the "eco-region" chapter of the WG 19 final report. Currently, the discussion section needs more work and regional figures are not yet in a common format. There was discussion about the World Wildlife Fund MEOW (Marine Ecosystems of the World) initiative and how this might overlap with PICES efforts to define eco-regions. It was determined that governments of member countries are pursuing individual definitions and frameworks for eco-regions, a situation that must be highlighted. It is not clear whether MEOW's system will be adopted, but national efforts could be compared with their regions. Some details and refinement of the discussion have to be finalized, but this chapter of the report is virtually complete, although lacking a contribution from China.

Dr. Elizabeth Fulton presented a report on the consequences of ocean management scenarios that ignore eco-region boundaries in favour of national boundaries. An artificial national boundary was generated between States in an existing model of southeast Australian waters, creating two artificial Exclusive Economic Zones (EEZs). Different management scenarios (loosely based on the range of management methods existing in the PICES region) were implemented, with contrasting options within these two EEZs. This meant that there were two management regions that spanned parts of a single eco-region – with some but not all species moving across the border between the two quasi-nations. Results for a range of indicators (drawn from the list constructed by Perry *et al.*) were

presented. This gave insight into the state of the system overall and the relative performance of the management methods. Results included:

- different levels of production with different management approaches (although this result might not occur in regions with a dominant signal from upwelling);
- less biomass in forage groups if target species were managed sustainably and higher trophic levels were conserved;
- any kind of management helps maintain target species biomass (*vs.* an unconstrained baseline scenario);
- for species with even moderate degrees of mobility (or more), effective management in one "nation" subsidizes catches and biomass taken by the other, but is still beneficial as it also raises overall system state;
- top predators benefit from more prey but this signal can be diffused by large scale (including seasonal) movements following rich prey sources/locations;
- cephalopods dropped in biomass slightly because of increase in top predators;
- habitat has the potential to benefit from management, but success is not a given (it is sensitive to the magnitude and specific implementation and types of management);
- from an EBM perspective, management in one region is helpful but perhaps not as effective as if management was coordinated across the regions.

One question that has not been addressed in this modeling work to date is whether the benefits seen from implementing effective management in one nation's waters, even if the neighbouring country is not being as efficient, are cost-effective. This research will be targeted for publication by Drs. Fulton and Harvey in the peer reviewed literature, however, some illustrative examples and results will be incorporated in the WG 19 final report to highlight ecosystem issues arising from differential management across boundaries.

Evaluation of indicators and summary of monitoring efforts (Agenda Items 4 and 5)

An overview of the indicators chapter of the WG 19 final report was provided, and discussion points were outlined and agreed upon. The next step was for each member country to suggest whether the indicators listed in Table 2 of the chapter had been calculated yet for a particular region in each nation and whether there are data available to do so. Dr. Perry will coordinate this effort. Tables from some countries were finished at the meeting, but others will need input from national experts. Most indicators were related to effects of fishing and not to the broader types of impacts from other marine sectors. The participants expanded the third recommendation in the chapter to explore the development and use of socio-economic indicators. There was discussion about social indicators such as the spatial distribution and numbers of jobs. Those data are difficult to obtain in some countries. ICES examples in that regard can be found in the 2006 Report of the Ecosystem Effects of Fishing (Sections 4.2–4.4, pp. 92–106, Tables 4.2.4, 4.4.3). Indicator availability tables from each country will be completed by the end of December 2007 and will be added to this chapter of the report.

FIS/MEQ workshop at PICES XVI (Agenda Item 6)

A full report of the FIS/MEQ workshop on "*Comparative analysis of frameworks to develop ecosystem-based approach to management and research needed for implementation*" (W3) can be found in the *Session Summaries* chapter of this Annual Report. The workshop made progress in highlighting issues related to the implementation of EBM in PICES member countries. It was clear from the presentations that member countries are in different stages of EBM implementation. Some are still working on incorporating an ecosystem approach to fisheries management, while others have national legislation that provides a mechanism for implementing cross-sectoral approaches to the management of marine activities to ensure environmental protection. The degree of advancement might be related partly to the nature of the different human pressures being exerted on the marine environment. Even some of the countries that appeared to be more advanced in their implementation mentioned problems in actually making cross-sectoral management work in marine ecosystems.

Overarching legislation that requires action may be needed. It was clear that more than one agency was involved in EBM activities in each country, and a challenge is to get agencies to work together in implementation. It was noted that the legislation that typically led to cross-sectoral implementation was some form of endangered species legislation.

Data requirements for EBM were discussed. The Australian experience demonstrated that implementation could involve both highly quantitative approaches and models if data are available, but could also include methods to evaluate ecosystem status and potential impacts in qualitative ways. The ICES experience exhibited how highly-evolved data gathering for EBM advice could be, although it was noted that highly-evolved advice did not necessarily translate into the political will to follow such advice. MONITOR outlined some of the data requirements that would necessitate its involvement and that of all of the PICES Committees. The workshop noted particularly the lack of socio-economic data to assist in decision-making in an EBM context.

Analytical tools are being developed to aid in EBM, and these include the highly structured risk assessment framework of Australia that allows for both quantitative and qualitative evaluation of risks, and determinations of when action is needed. The MODEL Task Team described a suite of modeling tools that might be used to understand impacts of climate variability on marine ecosystems. Models such as ATLANTIS can help in the evaluation of management strategies, and these seem to be important tools to further decision-making.

Communicating the results of EBM activities is ongoing in member countries. Some are using highly-structured reporting instruments such as ecosystem assessment documents. The ICES advisory structure communicates EBM advice in a tactical way that is highly evolved, although its success in implementing EBM might not be so advanced. Reporting of ecosystem status is crucial but it was recognized that identification and reporting of ecosystem pressures and ecosystem responses to management are significant pieces in conveying EBM progress. Communicating measures of human health was noted to be essential in this regard. The role of PICES in communicating EBM was seen to be more of a strategic one. There is a variety of potential scales useful in reporting results.

A major outstanding research gap is the need for social science indicators and information. The advancement of risk assessment frameworks and tools seemed particularly important. Perhaps Working Groups on *Human Dimensions of Implementing EBM* or *Evaluation of Risk Assessment Tools and Frameworks* might be worthwhile to consider in the future.

WG 19 final report and 2008 inter-sessional meeting planning (Agenda Item 7)

National submissions of the above material are due to January 1, 2008, after which the lead authors and Co-Chairmen will begin merging the data into a final report. A major gap is a lack of Chinese submissions and lack of participation from this country to date. Options relating to finalization of the WG 19 report are thus:

- Get Chinese participation in an inter-sessional meeting in February 2008 (options Seattle or China);
- Extend the Working Group for one more year and meet with Chinese scientists at the next PICES Annual Meeting in Dalian;
- Finalize the report without Chinese input.

WG 19 hopes to have a draft of the final report by late January to send to the Chinese prior to the inter-sessional meeting, so they can see what contribution is desired from them.

After the meeting adjourned, it was realized that WG 19 originally intended to publish a brochure on EBM in 2008 but this topic was not discussed at the meeting. In hindsight, such a publication would have been premature as the final report has yet to be written. WG 19 still plans to produce a brochure (the concept was approved by Science Board last year), but after the final report is complete. Its contents would be a subset of information compiled in the final report. Discussion of contents of the brochure will be conducted either via email, at the inter-

sessional meeting, or at next year's Annual Meeting.

Structure and content of North Pacific Ecosystem Status Report and EBM-related topics for inclusion (Agenda Item 8)

An incremental improvement version of the 2004 pilot report is being recommended by Science Board (*SG-ESR Endnote 2*). WG 19 suggests enhancing the next report with information on pollution and socio-economics. The discussion focused on the need to identify key pressures in each region, and on how should indicators on status and trends describing human well-being be determined. Further discussion on these topics will be required.

Establishing a PICES Study Group on *Indicators of Human Well-being: Benefits, Health* is recommended to assist in this effort. Terms of reference for this group might include:

1. Identify potential indicators of human well-being and human impacts in relation to PICES marine ecosystem status and trends. Evaluate the Millennium Ecosystem Report Indicators for their appropriateness.
2. How might these measures be quantified and standardized across member countries? Are the data available to quantify these?
3. How can these measures be used in ecosystem models and management strategy evaluation frameworks?
4. Identify longer-term issues that might be covered by a Working Group on this topic (governance structures for implementation, *etc.*).

Membership for this Study Group should consist of qualified social scientists, primarily those with strong economics background, with an understanding of natural sciences, particularly marine science, who are working on questions relating to marine ecosystem approaches and management issues.

Comments on FUTURE (Agenda Item 9)

The participants evaluated a draft Science Plan for a new PICES integrative scientific program on ***F****orecasting and* ***U****nderstanding* ***T****rends,* ***U****ncertainties and* ***R****esponses of North Pacific Marine* ***E****cosystems* (FUTURE) in the context of advancing science and communication in support of EBM. The communications aspect of this program is very important and should be discussed and outlined more clearly with a strategic view of identifying the audiences and appropriate methods of communication. The status and trends information is newsworthy and needs communication.

Models are important to project future ecosystem states, and the program has a heavy emphasis on that aspect. WG 19 members thought that the deliverables for the program also have to include status and trend indicators and an improved, coordinated monitoring system to support indicator data requirements. Society needs to hear about human health, food security, role of climate, and potential for unanticipated ecosystem change.

WG 19 Endnote 1

Participation list

Members

Elena Dulepova (Russia)
David Fluharty (U.S.A.)
Christopher Harvey (U.S.A.)
Glen Jamieson (Canada, Co-Chairman)
Jae Bong Lee (Korea)
Patricia Livingston (U.S.A, Co-Chairman.)
Mitsutaku Makino (Japan)
R. Ian Perry (Canada)
Vladimir Radchenko (Russia)
In-Ja Yeon (Korea)
Chang-Ik Zhang (Korea)

Observers

Elizabeth Fulton (Australia)
Xuewu Guo (PICES Secretariat)
Woo-Seok Gwak (Korea)
Oleg Katugin (Russia)
Kenji Konishi (Japan)
Skip McKinnell (PICES Secretariat)
Thomas Okey (Canada)
Jake Rice (Canada)
John Stein (U.S.A.)
Mikhail Stepanenko (Russia)
Zhaohui Xhang (China)
Mingyuan Zhu (China)

WG 19 Endnote 2

WG 19 meeting agenda

October 27, 2007

1. Welcome and introductions
2. National definitions of EBM, making sure to expand beyond EBFM and list agencies that are involved in broader sectors, other than fisheries. Brief description of each country's ocean management report contents
3. National reports: Review national definitions of "eco-regions" and identify criteria that could be used for defining ecological boundaries relevant to PICES
4. Evaluation of the indicators from the 2004 Symposium on "*Quantitative ecosystem indicators for fisheries management*" for usefulness and application to EBM in the North Pacific, but broaden the terms of reference to encompass not just Paris symposium, but also NPRB indicators project and the types of indicators summarized by Elizabeth Fulton
5. National reports on monitoring efforts that address the types of indicators described in item 4 above, as well as identify gaps. Member countries will focus on an eco-region that is most representative of their EBM efforts

October 28, 2007

6. Discuss content of FIS/MEQ Workshop on "*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*" (W3) at PICES XVI and incorporate into the report
7. Initiate discussion of structure of final report, deliverables and time frames; Planning for a 2008 inter-sessional meeting
8. Advice on structure and content of the North Pacific Ecosystem Status Report; suggest EBM-related topics for inclusion in the report
9. Discuss next major PICES scientific program, FUTURE, and provide comments

REPORT OF WORKING GROUP 20 ON EVALUATIONS OF CLIMATE CHANGE PROJECTIONS

The Working Group on *Evaluations of Climate Change Projections* (hereafter WG 20) held its second meeting from 14:00–18:00 hours on October 27, 2007. After introductory formalities to members and observers (*WG 20 Endnote 1*) were conducted by Co-Chairmen, Drs. Michael G. Foreman and Yasuhiro Yamanaka, the draft agenda was reviewed and adopted without changes (*WG 20 Endnote 2*). Dr. Muyin Wang agreed to serve as the rapporteur.

Discussion of a workshop with CFAME and update on terms of reference (Agenda Items 3 and 4)

The meeting began with a discussion of the recently concluded joint workshop on "*Climate scenarios for ecosystem modeling*" (W6) with the Climate Forcing and Marine Ecosystems Task Team (CFAME). The following was requested by CFAME from WG 20, preferably by their inter-sessional meeting in April 2008 and certainly by their final meeting in October 2008:

1. Graphic representations of climate/ocean states under climate warming for each of the three ecosystems selected by CFAME. For the Kuroshio/Oyashio, this representation will be based on detailed model results available from a high-resolution Japanese global climate model to which Dr. Yamanaka has coupled his biological COCO–NEMURO model. For the California Current System, this representation will be based on either results from a high-resolution Regional Ocean Model System (ROMS) climate model, or if this is not available, from downscaled global climate model values. For the Yellow and East China Seas, this graphic will also be based on either regional climate model output or downscaled values from global climate models.
2. Detailed output from Dr. Yamanaka's COCO–NEMURO model simulations for the Kuroshio/Oyashio region for 2007–2030 (or whatever projection time period he chooses).
3. A comparison of the atmospheric component in the Japanese high-resolution Model for Interdisciplinary Research on Climate (MIROC) with other climate models to assess the range of variability and determine any biases that could potentially affect the results arising from (2) above.
4. Climate change variables (such as SST, stratification, circulation) for the California Current System (north, central and south sub-regions) that have either been taken from regional climate models, or downscaled from global climate models.

The second and fourth requests were viewed as potentially longer-term products that could be included in the CFAME final report to provide future PICES groups with relevant climate parameters. Dr. Foreman will work with regional representatives in coordinating delivery of the first request. Dr. Yamanaka will work on the second, Drs. Wang and James E. Overland will work on the third, and Dr. Foreman will work with Drs. Wang, Overland, Enrique Curchitser, Arthur J. Miller and Emanuele Di Lorenzo on the fourth. It was also reported that CFAME will invite the WG 20 Co-Chairmen to attend their inter-sessional meeting in Honolulu in April 2008 (*CFAME Endnote 3*) in order to receive immediate feedback on revised descriptions of relevant physical processes for the three selected ecosystems.

In addition to the updates on WG 20 activities, Dr. Miller gave a short presentation on a recent climate workshop on "*The known, unknown, and unknowable*" at the Scripps Institution of Oceanography, and Dr. Young-Gyu Park provided an update on his regional Finite Volume Coastal Ocean Model (FVCOM) for the waters surrounding Korea.

Next major PICES scientific program (Agenda Item 5)

A lively discussion took place on the latest draft (version 4.2) of a Science Plan for a new PICES integrative scientific program on **F**orecasting and **U**nderstanding **T**rends, **U**ncertainties and **R**esponses of North Pacific Marine **E**cosystems (FUTURE). Dr. Foreman felt that physical and geochemical issues were not given sufficient recognition in the Science Plan for the role they will be playing in providing forecasts (and associated uncertainties) of ecosystems that are changing due to climate and other anthropogenic effects. Possible revisions to key and secondary questions were discussed and general agreement was given to a draft presentation by POC at the FUTURE Open Forum on November 1.

Future WG 20 workshops and meetings (Agenda Item 6)

Dr. Foreman briefly described the upcoming International Symposium on the "*Effects of climate change on the world's oceans*" to be convened May 19–23, 2008, in Gijón, Spain. PICES has booked a room so that WG 20 can hold an informal meeting at this symposium if a sufficient number of members attend. The invitation to participate in this meeting was also extended to CFAME members.

CFAME has expressed interest in holding another joint workshop with WG 20 on "*Climate scenarios for ecosystem modeling II*" at the 2008 PICES Annual Meeting (*CFAME Endnote 4*). Dr. Gordon A. (Sandy) McFarlane (CFAME) will be co-convening the workshop with either Dr. Foreman or Dr. Yamanaka.

Items with financial implications (Agenda Item 7)

Travel support was requested for:

- one WG 20 member to attend the next ESSAS Annual Meeting to be held in September 2008, in Halifax, Canada;
- Dr. Foreman to attend the Gijón Symposium where he will be co-convening a session on "*Past and future variability and change in ocean climate: Climate model projections*".

Other business (Agenda Item 8)

No other business was discussed.

WG 20 Endnote 1

Participation list

Members

Enrique Curchitser (U.S.A.)
Emanuele Di Lorenzo (U.S.A.)
Michael G. Foreman (Canada, Co-Chairman)
Hiroyasu Hasumi (Japan)
Arthur J. Miller (U.S.A.)
Young-Gyu Park (Korea)
Muyin Wang (U.S.A.)
Elena Ustinova (Russia)
Yasuhiro Yamanaka (Japan, Co-Chairman)

Observers

Yong-Kyu Choi (Korea)
Albert J. Hermann (U.S.A.)
Phillip R. Mundy (U.S.A.)
Thomas C. Royer (U.S.A.)

WG 20 Endnote 2

WG 20 meeting agenda

1. Welcome, introductions, opening remarks
2. Adoption of agenda and appointment of rapporteur
3. Discussion of, and action items arising from, a workshop with CFAME
4. Updates on work related to WG 20 terms of reference
5. Discussion on the next major PICES scientific program, FUTURE: Roles for WG 20 and respective member countries
6. Future WG 20 workshops/meetings
   (i) Climate Change Symposium, Gijón, Spain, May 2008
   (ii) PICES XVII, Dailan, China, Oct.–Nov. 2008
   (iii) other?
7. Items with financial implications
   (i) Travel support requests:
      a. ESSAS Annual Meeting, Halifax, September 2008
      b. Climate Change Symposium, Gijón, Spain, May 2008
   (ii) Other items
8. Other business
9. Adoption of report for presentation at POC committee meeting

REPORT OF WG 21 ON NON-INDIGENOUS AQUATIC SPECIES

The Working Group on *Non-Indigenous Aquatic Species* (hereafter WG 21) held its second meeting October 26–27, 2007, under the co-chairmanship of Ms. Darlene L. Smith and Dr. Vasily Radashevsky. A list of participants and meeting agenda can be found in *WG 21 Endnotes 1* and *2*.

Country/Agency reports (Agenda Items 2)

Canada

Fisheries and Oceans Canada (DFO) is the federal government agency responsible for marine non-indigenous species in Canada. The DFO non-indigenous species program consists of three elements: research, monitoring and risk assessment. DFO has also worked with the National Science and Engineering Research Council of Canada to establish a national research program called the Canadian Aquatic Invasive Species Network (CAISN). CAISN includes scientists from 19 Canadian universities and several DFO laboratories. The primary species of concern include: European green crab, tunicates (5–7 species), New Zealand mudsnail and perciform fishes in freshwater.

People's Republic of China

It is estimated that there are about 140 marine alien species in China. Mariculture and international shipping are the two main vectors by which non-indigenous species are introduced to China. *Spartina alterniflora* and *Spartina anglica* were introduced in 1979 to protected beaches and had spread extensively causing major ecological damage. *Mytilopsis sallei* has also been introduced and is causing serious damage to the mariculture industry and native species. Another non-indigenous species is *Crepidula onyx* which reduces biodiversity and fouls pisciculture cages. Some harmful algae blooms species are suspected to have been introduced to the China seas via ballast water. They have caused economic losses to aquaculture and fisheries operations with serious environmental and human health impacts.

China has established the following targets by the year 2010:

- To develop a basic understanding of the present status of marine alien invasive species in coastal China, such as exotic species and their distributions, invasive species distribution and impacts, *etc*.;
- To establish prevention and control systems for marine alien invasive species;
- To establish methods to assess the impacts of marine biological invasions.

By the year 2015, through strengthening the study of marine exotic invasive species ecology, a basic understanding of mechanisms of invasion will be built up. Meanwhile, technologies for elimination and control of invasive species will be developed to control or reduce the impacts resulting from a few dominant invasive species.

Republic of Korea

In 2007, harmful algal blooms (HABs) occurred from August–September (a total of 44 days). These included *Cochlodinium polykrikoides* from the South Sea to Japan/East Sea, and *Chattonella* spp. in Chonsu Bay (Yellow Sea). Total damage was about $US 12 million, mostly to halibut, red bream, *etc*.

Research activities associated with HABs and invasive species include:

- Rapid detection of *Cochlodinium* using sandwich hybridization and whole cell hybridization;
- Development of molecular techniques for detection of *Pfiesteria* and *Pfiesteria*-like sp.;
- National Census of Marine Ecosystem (conducted by "Law of Marine Ecosystem Conservation and Management"; the 1st phase

is from 2006–2015 (10yrs), and the budget of US$1.5 million for 2007);
- National Institute of Marine Bioresources (established by "Law of Marine Ecosystem Conservation and Management"; the construction period is from 2007–2013 (5yrs), with the total budget of US $150 million, and the budget of US$ 25 million for 2008);
- Marine invasive species: Preparation of "Manual for Field Study"; barnacle monitoring (Ulsan port, Guryongpo port); general observation at Baekryung Is. (Yellow Sea), Ulreung Is. (Japan/East Sea) and Chuja Is. (South Sea);
- Development of ballast water treatment and monitoring (conducted by KORDI under "Marine Environment Management Law", with the budget of US$ 0.2 million);
- Development of ballast water treatment system and preparation of "Field Manual of Ballast Water Monitoring".

Russia

The current status of non-indigenous fish species distribution and abundance in Peter the Great Bay was given. There are 19 non-indigenous fish species found in this area. The general conclusions of this work are:
- A composition of non-indigenous fish species in the estuaries of Peter the Great Bay was determined. Due to a significant part in biomass of all the fishes (*e.g.*, 10% and 13% in the ichthyofauna of Artemovka and Razdolnaya Rivers, respectively), they are of great importance in the functioning of estuary ichthyocenes of the rivers.
- In the early 2000s, Khanka bitterlings *Acanthorodeus chankaensis*, lookup *Culter alburnus*, lazy gudgeon *Sarcocheilchthys czerskii*, *Sarcocheilchthys* sp., Soldatov's catfish *Silurus soldatovi*, European pike-perch *Sander lucioperca* and northern snakehead *Channa argus* were introduced into the Razdolnaya River.
- Silver carp, bigheads, grass carp and European pike-perch form ephemeral, not numerous populations that include only adult individuals. Rounded gudgeon, Khanka bitterlings, *Acanthorodeus* sp., Korean sawbelly, lazy gudgeon, northern snakehead and lookup have formed independent populations in Razdolnaya River. The quantity of lookup in Razdolnaya River has now reached a commercial value.

United States of America

Three main agencies in the United States are responsible for managing marine invasive species: National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), and the U.S. Fish and Wildlife Service (F&WS). Some of the major invaders on the U.S. Pacific Coast are:
- European green crab (dominant competitor; regulates the structure of benthic communities through predation; at high densities limits the distribution of some benthic invertebrates);
- Various species of tunicates (high potential for environmental and ecosystem damage; overgrow and displace native sea grasses, sponges, hydroids, anemones, limpets, oysters, mussels, scallops, barnacles, bryozoans, and other species of sea squirts; negative effects on aquaculture industry);
- Snowflake coral (threatens Hawai'i's $30-million-a-year black coral industry; hull fouling and aquarium trade).

NOAA along with the U.S. F&WS, and the U.S. Maritime Administration, in cooperation with various States, conducts research on ballast water treatment technologies at two facilities, one located at the Great Lakes and one located in NOAA's North West Region.

The Aquatic Nuisance Species Task Force, headed by NOAA and the U.S. F&WS, supports development of management plans for aquatic nuisance species in the United States. Resources for research are limited, with the majority going towards management. A major focus now is rapid response planning. Hazard Analysis of Critical Control Point (HACCP) is currently being investigated as a model for responding to invasive species.

EPA is focused on the results of a recent court decision requiring the Agency to regulate ballast water discharge, including all boats with outboard motors. EPA will use the discharge standards of the International Maritime Organization.

Dr. Mark Sytsma gave a presentation on the status of a *Spartina* spp. invasion on the Pacific coast of the United States and provided details of the management and eradication programs.

Science presentations (Agenda Item 3)

Three presentations were given by WG 21 members from the People's Republic of China, the Russian Federation and Japan:

- Lijun Wang: *Assessment of the genetic impact of introduced* Strongylocentratus intermedius *on native sea urchin populations*;
- Vasily Radashevsky: *Studies on invasive species in the Far-Eastern Part of Russia*;
- Hiroshi Kawai: *Biogeography and trans-ocean introductions of the green algae* Ulva spp. *from/to Japan, deduced from the identifications based on molecular markers*.

WG 21 terms of reference (Agenda Item 4)

WG 21 proposes to amend its terms of reference to reflect practical constraints on the work and the two projects funded with the Japanese voluntary contribution (*WG 21 Endnote 3*). These were submitted for approval to the MEQ Committee.

Joint PICES-ICES meeting summary and further co-operation (Agenda Item 5)

Dr. Judith Pederson provided the summary of the joint meeting of PICES WG 21, ICES WG on *Introductions and Transfers of Marine Organisms* (WGITMO) and ICES/IOC/IMO WG on *Ballast and Other Ship Vectors*, (WGBOSBV) held May 25–26, 2007, in Cambridge, U.S.A., with emphasis on the following points:

- Potential projects for "*Development of the prevention systems for harmful organism's expansion in the Pacific Rim*";
- Lack of taxonomic expertise limiting ICES-PICES exchange;
- Need for the registry of taxonomic experts;
- Adding AIS (Aquatic Invasive Species) data based on NISBase;
- Use bivalve molluscs for database testing;
- Ballast water and biofouling as potential vectors;
- ICES Ballast Water Sampling Guidelines – review of ballast water issues, including early detection, rapid response, impacts, costs, successes, and failures from world-wide examples; role of government and citizens in an EDRR (Early Detection and Rapid Response) system.

Suggestions for future co-operation include:

- ICES Code of Practice for the Introduction and Transfer of Marine Organisms;
- Risk assessments or analysis;
- Guidelines for sampling ballast water;
- Other areas for joint projects, including hull fouling.

Database prototype (Agenda Item 6)

The morning session of the second day opened with a presentation on the WG 21 marine non-indigenous species (MNIS) database prototype that Dr. Henry Lee II and Ms. Deborah Reusser had developed based on the EPA-USGS PCEIS (Pacific Coast Ecosystem Information System) spatial database. Dr. Lee gave an overview of the database that is designed to provide biological, ecological and geo-spatial information. Each attendee received a copy of the manual and a disk with the program. The initial exercise is to enter invasive bivalves of the North Pacific for testing the prototype database. With the database, species information can be entered, edited, and exported. With the input of standardized data across the countries, the data are easily queried. The morning session focused on the details of using the database and issues that arose during the discussion. The major items and action items or conclusions that emerged from the discussion are described below.

The database uses Microsoft Access as the software for developing relationships among the

various components, and this poses a problem for Macintosh users who rely on FileMaker as the database management software.

Action item: Determine how to link File Maker to Access.

The prototype is built so that members from each PICES country can enter and maintain their own database. The main menu offers a variety of options: searching for species, adding/editing species, adding publications, exporting and importing data, documentation, acknowledgements, and exiting. One of the important decisions to be made by the group was the level of biographic detail that would be captured by the program. The Nature Conservancy biogeography regions were used as the basis for making decisions. The bio-geographic hierarchy extends from the North Temperate Pacific Realm > Provinces > Eco-region > Waterbody Eco-region > Sub-component in Waterbody > Site Specific (latitude/longitude).

Consensus decision is to: (1) extend to the Waterbody Eco-region and sub-divisions as this would permit analysis of the data appropriate to the scale for PICES countries; and (2) include latitudes and longitudes as database fields.

Adding a reference with each species, either as a publication or as the name of the person entering the data, is required. The program has several features that make entering the data easier, including options for removing and editing data, accessing publication data, adding relevant ecosystem and MNIS data, and viewing and extracting data. In order to test the database, it was initially suggested that each country would input data on bivalves, however, some countries may add other data, *e.g.*, barnacles. Each country will input data and a training workshop on use of the database will be held to walk through the revised protocols. For several countries, it would take time to identify the individuals who would input the data.

Action item: Each country will input data over the next couple of months and correspond with Ms. Reusser if any problems are encountered. Ideally the data entry should be completed before December 31, 2007.

Consensus decision is: to hold a workshop to evaluate the protocols and reach final agreement on standards, data elements and data entry templates for the MNIS database on January 30–31, 2008, in Seattle, U.S.A.

Action item: Each country is to submit names of two representatives to be invited to attend the workshop to Ms. Smith by November 30, 2007, especially countries where visas are needed.

Update: Dates and location were changed to March 3–5, 2008 in Busan, Korea.

Planning for PICES XVII (Agenda Item 7)

WG 21 proposed a 1-day Topic Session (including posters) on marine non-indigenous species to be held at PICES XVII (*WG 21 Endnote 4*). This session will focus on ecological and economic impacts of marine non-indigenous species and ballast water technologies. Potential invited speakers are: David Pimentel, Andrew Cohen, James Carlton, Daniel Simberloff (for the Eastern Pacific) and Jiakuan Chen (for the Western Pacific).

Work plan for database and taxonomy initiatives (Agenda Item 8)

In April 2007, the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency (JFA) of Japan, provided a voluntary contribution to PICES for a project entitled "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*". The project is anticipated to run for five years (from April 1, 2007 to March 31, 2012). It has two distinct components, one on MNIS and the other on HABs conducted by WG 21 and Section on *Ecology of Harmful Algal Blooms in the North Pacific* (HAB-S), respectively.

Within the MNIS sub-project, two initiatives have been identified: (1) development of a MNIS database; and (2) development of a

taxonomic system to allow identification and documentation of MNIS establishment outside of their native range. Details for activities under the Database Initiative are outlined in Agenda Item 6. Under the Taxonomic Initiative, WG 21 proposes to conduct a rapid MNIS assessment survey in each PICES member country. These assessments will focus on two port locations within the member country hosting the PICES Annual Meeting and be held immediately prior to the Annual Meeting, using taxonomic experts and students from the host country and Pacific Rim experts as needed. The first rapid assessment survey is scheduled for October 19–23, 2008, in conjunction with PICES XVII. The proposed surveys will be complemented by sub-tidal collectors for biofouling organisms deployed at selected sites in PICES member countries. A revised work plan for 2008–2009 can be found in *WG 21 Endnote 5*.

Sixth International Marine Bioinvasions Conference (Agenda Item 9)

Dr. Gil Rilov presented an overview of the 6th International Conference on "*Marine bioinvasions*" to be held in late August or early September 2009, at Portland State University (PSU), Portland, Oregon, U.S.A. Dr. Sytsma will serve as the local host.

The *Marine bioinvasions* Conference has focused on scientific and management issues related to marine introductions and focused on vectors, distribution, ecological impacts and evolutionary consequences, and related topics. The Conference also continues to identify new topics and emerging issues. As with the 5th Conference, co-sponsorship by the U.S. National Sea Grant Office, the International Council for the Exploration of the Sea (ICES) and PICES is welcome. Planning for the Conference is still in the initial stages. WG 21 is interested in supporting the Conference and requested to have a representative on of the Scientific Steering Committee (SSC). Dr. Yoon Lee (Korea) volunteered to serve on SSC. It was also suggested to propose that a special session on Pacific Rim invasive species be included in the program. Conference organizers requested the following financial support from PICES:

- 2007–08 Fiscal Year $10,000
- 2008–09 Fiscal Year $10,000
- 2009–10 Fiscal Year $30,000

Aquatic invasive species/climate change connection (Agenda Item 10)

How can WG 21 promote further discussion and/or research regarding the aquatic invasive species/climate change connection in the North Pacific? Dr. Paul Heimowitz raised this as an important upcoming issue and advised that the American Aquatic Nuisance Species Task Force will be discussing this issue at its meeting on November 27, 2007. The state of research on this issue is still in its infancy. The ICES WGITMO has provided some information relating invasions to current and temperature changes to OSPAR Commission. Discussion concluded that researchers will have to focus on this issue in the future and that there will be a need to distinguish between expansion range of non-indigenous species and expansion range of native species.

Next WG 21 meeting (Agenda Item 11)

WG 21 members propose to meet for two days at PICES XVII in Dalian, China. The purpose of this meeting will be to:

- review the draft report due at the end of WG 21's current mandate;
- review progress of the database project and develop a work plan for Year 3; and
- review progress of the taxonomy project (including the rapid assessment survey) and develop a work plan for Year 3.

The Co-Chairmen closed the meeting by thanking everyone for their full participation, and by giving special thanks to the meeting guests who provided valuable input.

WG 21 Endnote 1

Participation list

Members

Evgenyi I. Barabanshchikov (Russia)
Blake E. Feist (U.S.A.)
Graham E. Gillespie (Canada)
Paul Heimowitz (U.S.A.)
Hiroshi Kawai (Japan)
Henry Lee II (U.S.A.)
Sam-Geon Lee (Korea)
Yoon Lee (Korea)
Vasily Radashevsky (Russia, Co-Chairman)
Darlene L. Smith (Canada, Co-Chairman)
Mark D. Sytsma (U.S.A.)
Thomas W. Therriault (Canada)
Lijun Wang (China)
Li Zheng (China)

Observers

Hak Gyoon Kim (Korea)
Judith Pederson (U.S.A.)
Deborah Reusser (U.S.A.)
Gil Rilov (U.S.A.)
Greg Ruiz (U.S.A)

WG 21 Endnote 2

WG 21 meeting agenda

October 26, 2008

1. Opening remarks and introductions
2. Country/Agency reports (15 minutes presentation + 5 minutes discussion each)
3. Science presentations (15 minutes presentation + 5 minutes discussion each)
4. WG 21 terms of reference: Discussion on progress and plans for completion
5. Joint PICES-ICES meeting summary and further co-operation (J. Pederson)

October 27, 2007

6. Database prototype: presentation (H. Lee II and D. Reusser) and discussion (All)
7. Topic Session on non-indigenous aquatic species at PICES XVII (Dalian, China)
8. Development of detailed work plan for database and taxonomy initiatives (including planning of the 2008 workshop) funded by a voluntary contribution from Japan
9. Sixth International Conference on "*Marine bioinvasions*" (2009): Discussion of PICES WG 21 support/involvement
10. How can WG 21 promote further discussion/research on the aquatic invasive species/climate change connection in the North Pacific? (P. Heimowitz)
11. Next WG 21 meeting and closing remarks

WG 21 Endnote 3

Proposed revisions to WG 21 terms of reference

1. Initiate compilation of an inventory of marine non-indigenous species in PICES member countries together with a compilation of definitions of terms and recommendations on use of these terms. Summarize the situation on bioinvasions in PICES member countries;
2. Increase taxonomic capacity of PICES member countries through rapid assessment surveys and possibly through creation of a web-based taxonomy tool;
3. Initiate compilation of an inventory of scientific experts on marine non-indigenous species subject areas and of the relevant national research programs and projects underway in PICES member countries;
4. Summarize existing requirements for ballast water management (*e.g.*, discharge and monitoring requirements) in PICES member countries;
5. Summarize research related to impacts of ballast water and best practices for ballast

water management in PICES member countries;
6. Coordinate activities of the PICES WG 21 with related Working Groups in ICES through joint meetings of these groups;
7. Develop and recommend an approach for formal linkages between PICES and ICES on aquatic non-indigenous species;
8. Publish final report summarizing results and recommendations.

WG 21 Endnote 4

Proposal for a 1- day Topic Session at PICES XVII on
"Consequences of non-indigenous species introductions"

Non-indigenous species (NIS) are ubiquitous throughout the World's marine, coastal and estuarine waters. There is little doubt that human mediated dispersal of NIS and subsequent establishment of NIS has altered biodiversity, species assemblages, food web dynamics, and trophic structure and interactions in marine ecosystems. These alterations have ecological, biological, evolutionary and economic consequences, especially in coastal and estuarine systems. It is ironic that mariculture and the global shipping trade have been identified as the most affected economically, given that these two activities are often identified as the primary vectors of marine NIS introductions. This session will address the impacts of marine NIS on the ecosystems in which they have invaded. Examples of impacts include, but are not limited to, biological, ecological, evolutionary, and economic. While abstracts addressing any type of economic impact will be considered, preference will be given to research projects focusing on ballast water and bio-fouling diagnostic and treatment technologies.

Convenors: Blake Feist (U.S.A.) and TBD

WG 21 Endnote 5

A 2008/2009 work plan for database and taxonomy initiatives of a marine non-indigenous species (MNIS) project funded by a voluntary contribution from Japan

DEVELOPMENT OF A COMPREHENSIVE MNIS DATABASE

Principal Investigator

Dr. Henry Lee II (Environment and Protection Agency, U.S.A.)

Database development

A template for standards and elements of relevant scientific data (scientific and common names, native range distribution and invasion range distribution(s), life histories, habitat requirements, ecological roles, impacts of invasions, and management and mitigation measures undertaken in invaded countries) will be developed and documented, based on the United States Environmental Protection Agency (EPA) and the United States Geological Survey (USGS) "Pacific Coast Ecosystem Information System" (PCEIS) spatial database.

Beta testing of the database

Focus will be on entry of data for a pilot NIS taxon (bivalves) by all PICES member countries. In situations where limited NIS bivalve data exist, another NIS taxa or native data will be used for testing purposes. Potential limitations identified through this exercise will be discussed at the proposed inter-sessional meeting.

Meeting to obtain consensus on database format, standards and elements

An inter-sessional meeting of WG 21 will be held after beta testing is completed (mid-winter 2008, in either Seattle, U.S.A. or Korea) to evaluate the database protocol and to reach final agreement on standards, data elements and data entry templates.

RAPID ASSESSMENT SURVEYS IN PICES MEMBER COUNTRIES

Principal Investigator

Dr. Thomas Therriault (Fisheries and Oceans Canada)

Purpose

Non-indigenous species (NIS) have the potential to alter habitats and biological diversity and can have economic and ecological impacts. There is a need for good taxonomy and consistency for sampling approaches in PICES member countries and other Pacific Rim countries. To better understand MNIS in PICES member countries, rapid assessment surveys will be carried out to gather and compare species information among countries. We have a unique opportunity at the 2008 PICES Annual Meeting in Dalian, China, to conduct the first rapid assessment survey and include taxonomic experts and students from each member country. If successful, this would be repeated in subsequent years in each PICES country the year they host the PICES Annual Meeting. All data collected would be entered into the PICES MNIS database being developed by WG 21.

Rapid assessment survey scope

Two separate locations in each country will be selected. Locations will be determined by the host country and could include areas near international shipping ports and aquaculture facilities as these are two major vectors for the introduction of marine non-indigenous species. Within each of the two locations, three different habitats will be selected for rapid assessment:

- intertidal habitat;
- floating docks/structures (*e.g.*, aquaculture facilities) that support subtidal biofouling organisms; and
- pilings/piers associated with commercial shipping activities that support biofouling organisms.

A total of six sampling sites will be assessed during the survey characterizing both the native and non-native species using available taxonomic experts. All species encountered during the survey (or found on collectors or in traps) will be identified to the lowest taxonomic level possible. For 2008, it is suggested to focus the survey on Dalian Port (Yellow Sea) and Ba Yu Quan (Bohai Sea) as both are close to the Annual Meeting site and represent two different marine environments. The proposed locations have to be confirmed by the State Oceanic Administration.

Methods

The proposed project will examine community assemblages in both intertidal and subtidal habitats through two components:

The first component is sampling native and non-native species in various marine habitats such as:

- intertidal shoreline;
- commercial shipping piers or docks;
- floating structures such as aquaculture facilities; and
- baited traps to sample mobile fauna such as decopods (*e.g.*, crabs).

The second component will capture settlement of biofouling organisms over a period of 6 months. To do this we will:

- deploy settlement plates and collectors six months prior to the rapid assessment survey to sample subtidal biofouling communities;
- other PICES member countries wishing to do so, may also deploy settlement plates and collectors at the same time to provide additional information for comparison.

Previous rapid assessment surveys in the United States have used standardized methods and they may be referred to for establishing a protocol for PICES member countries. Two examples can be found in the following papers:

- Cohen, A.N. *et al.* (2000) Report of the Washington State Exotics Expedition 2000: A rapid assessment survey of exotic species in Elliot Bay, Totten/Eld Inlets and Willapa Bay. In: Washington State Department of Natural Resources, Olympia WA, pp. 46.
- Cohen, A.N. *et al.* (2005) Rapid assessment survey for exotic organisms in southern

California bays and harbors, and abundance in port and non-port areas. Biological Invasions 7: 995–1002.

Required resources

Each rapid assessment survey will require the participation of the PICES host country's taxonomic experts representing the variety of non-indigenous marine taxa that have had significant negative ecological or economic consequences. These may include taxonomists specializing in ascidians (tunicates), crustaceans (crabs, barnacles, amphipods), mollusks (gastropods, bivalves), worms (polychaetes), cnidarians (hydroids, anemones) and algae. Taxonomic experts and students (primarily from the host country) who are familiar with these groups will form the bulk of the assessment team. The rest of the team could include experts from PICES member countries and other Pacific Rim countries. Representatives from other PICES member countries who will be involved in future rapid assessments should also participate. This approach ensures that highly qualified individuals confirm species identification while allowing training for students and taxonomic generalists. The list of experts from the host country should be provided 6 months in advance of the rapid assessment survey to permit sufficient time to identify additional required experts from other countries. Judith Pederson, Chairman of the ICES Working Group on *Introductions and Transfers of Marine Organisms*, will serve as a resource person for this project.

Vehicles will be needed to transport the rapid assessment survey team to sampling sites. A small boat will be required to access potential floating/pier sites. The following sampling gears will be needed: (1) standard plankton nets for sampling phytoplankton and zooplankton; (2) standard traps (Fukui folding traps?) and groundlines for sampling decapods; and (3) tools (rakes, shovels, screens) to sample intertidal infaunal organisms. SCUBA divers, if available, could be used to sample subtidal species, but this is optional. Laboratory facilities with compound light microscopes and stereoscopes (dissecting scopes) will be required. Specimens will be photographed. Preliminary identifications are made in the field. However, all samples are taken back to a laboratory for verification and archiving. Some effort should be made to identify in advance and provide taxonomic reference books for each country (some may have to be purchased).

Funding

Travel and accommodation expenses for taxonomic experts and students will be covered under the taxonomy initiative of the MNIS project funded by a voluntary contribution from the Japanese government.

REPORT OF STUDY GROUP ON GOOS

Due to scheduling conflicts, a pre-meeting was held to brief Dr. Jeffrey M. Napp, MONITOR Chairman, on the report of the Study Group to develop a strategy for GOOS (hereafter SG-GOOS). Two SG-GOOS members, Drs. Vyacheslav Lobanov and Dong-Young Lee, were unable to attend the Annual Meeting but participated by e-mail for the preparation of the report (*SG-GOOS Endnote 1*). This report was discussed and recommended for submission to MONITOR.

Activities in 2007

- Reports for 2006 and 2007 activities are posted on the SG- GOOS web page.
- In January 2007, Dr. Lobanov represented PICES at the 11th Session of the IOC/WESTPAC Coordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS) in Bangkok, Thailand (*SG-GOOS Endnote 2*).
- In March 2007, Dr. Phillip R. Mundy, SG-GOOS Chairman, presented a report on activities of MONITOR at the 10th GOOS Scientific Steering Committee (GOOS SSC) meeting in Seoul, Korea (*SG-GOOS Endnote 3*). Dr. Dong-Young Lee also attended this meeting as GOOS SSC Vice Chairman and a member of SG-GOOS. The results of the meeting are described in *SG-GOOS Endnote 4.* The Study Group wishes to thank GOOS SSC members and its Chairman, Dr. John Field, for their consideration of the issues and for their invitation for PICES to participate in the GOOS SSC meeting. Special thanks to Dr. Dong-Young Lee, for his support and hospitality during the SSC meeting.

Recommendations

It is recommended that:

- Starting in 2007, MONITOR, in cooperation with TCODE, focus its activities on providing a forum for representatives of the existing North Pacific observing systems in which cross-GRA (GOOS Regional Alliance) observing projects (inter-regional and international), observing technologies, and data and information sharing protocols would be developed.
- The terms of reference of MONITOR be modified to explicitly include facilitation of cooperation, communication, and coordination among North Pacific ocean observing systems. This affects existing terms of reference 1, 2, 3, and 7. These four terms of reference should be replaced by the following two:
  a. Identify principal monitoring needs of the PICES region and approaches to meet these needs by serving as a forum for coordination and development of inter-regional and international components of the North Pacific ocean observing systems, including the Global Ocean Observing System (GOOS) and including method development and inter-comparison workshops to facilitate calibration, standardization and harmonization of data sets;
  b. Provide Annual Reports to Science Board and the PICES Secretariat on monitoring activities in the PICES area.
- A representative of MONITOR be sent annually to GOOS SSC meetings to exchange reports on North Pacific monitoring activities, emphasizing projects that span observing regions and international boundaries (*e.g.*, such as the Continuous Plankton Recorder surveys), progress in establishing sensor technologies for scientifically sound observing systems, and progress in the use of common information exchange methods (*e.g.*, such as the Global Telecommunications System, GTS). Having a MONITOR representative to attend this meetings will:
  a. Meet the PICES mission of promoting cooperation and collaboration in marine sciences among member countries; a

forum for international collaboration within each region is much needed;

b. Clarify MONITOR's terms of reference to facilitate international cooperation in the development of observing projects, observing systems and means of data gathering and information exchange;
c. Provide a forum to assist in the production of the North Pacific Ecosystem Status Report, which is among the responsibilities of PICES.

Identification of North Pacific observing systems

The identification of specific data types by observing systems has been deferred pending the results of the Intergovernmental Oceanographic Commission (IOC) Circular Letter No. 2199 requesting that member states provide "National contributions to the Global Ocean Observing System" which will be available at PICES XVII, and subsequent reports of MONITOR. Two summary information tables were provided in the 2006 SG-GOOS report.

SG-GOOS Endnote 1

Participation list

Members

William R. Crawford (Canada)
Phillip R. Mundy (U.S.A., Chairman)
Sei-Ichi Saitoh (Japan)

Participants by correspondence

Dong-Young Lee (Korea)
Vyacheslav Lobanov (Russia)

SG-GOOS Endnote 2

11th Session of the IOC/WESTPAC Coordinating Committee for the North-East Asian Regional Global Ocean Observing System (provided by Dr. Vyacheslav Lobanov)

Introduction

In accordance with the recommendation of MONITOR that PICES should play a strong role in the coordination and facilitation of North Pacific regional GOOS projects and to advance contacts with the relevant GOOS Regional Alliances to explore ways in which PICES can enable their development, Dr. Vyacheslav Lobanov (Russia) was present as an observer at the 11th Session of the IOC/WESTPAC Coordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS-CC-XI). The meeting was held on January 18–19, 2007, in Bangkok, Thailand, and was organized by the IOC/UNESCO Regional Secretariat for the Western Pacific (IOC/WESTPAC), with support from the Department of Marine and Coastal Resources (DMCR) of the Ministry of Natural Resources and Environment (MNRE), Thailand. The meeting was attended by the Coordinating Committee (CC) members from participating countries, NEAR-GOOS working group leaders, observers from regional programs/organizations, and representatives of related Thailand agencies.

NEAR-GOOS was initiated in 1996 upon the formal adoption of its Implementation Plan and Operational Manual by the 29th Executive Council of IOC. As a regional pilot project of GOOS, it has been undertaken in partnership between the Japan, People's Republic of China, the Republic of Korea and the Russian Federation as a WESTPAC activity. The most important successes of NEAR-GOOS in its first phase (1996–2003) have been the consolidation of a functional two-mode distributed Internet-based database structure in the partner countries, and the linkage of this structure with one Regional Real-Time Database (RRTDB) and one Regional Delayed-Mode Database

(RDMDB) responsible for the receipt and merging of data in this region. The data in the RRTDB include only major physical parameters, while information available through the RDMDB is more diverse. At its 9th Session in 2004, the CC approved the Strategic Plan for the second phase of NEAR-GOOS (2004–2008), with the goal to provide the "Development of a basic integrated ocean observing and operational forecasting system in the NEAR-GOOS area adhering to the GOOS Principles and building on the data management and exchange mechanisms developed in the first phase through the inclusion of additional parameters, increased coverage in space and time, the generation of a generic suite of data products and adequate quality control and quality assurance procedures".

Objectives of the 11th Session

NEAR-GOOS is governed by the CC which consists of two representatives from each member country and holds its meetings annually. The major tasks of the 11th Session were to:

- review the status of NEAR-GOOS and the progress made during the inter-sessional period, including activity of regional and national databases and related national activities;
- review the activities of NEAR-GOOS Working Groups (WG on *New Generation Sea Surface Temperature* and WG on *Data management*) and to make recommendations for their plans as well as to discuss formation of two new Working Groups (WG on *Monitoring Using Drifter and Buoys* and WG on *Regional Sea Projects*);
- discuss the follow-up activities towards the goals of NEAR-GOOS in its second phase (2004–2008);
- identify the role of NEAR-GOOS in global GOOS development and effective ways to interact with other GRAs (the 3rd GOOS Regional Forum, the Global Coastal Network, GSSC-X Scientific Workshop, SEA-GOOS, *etc.*)
- exchange information on related programs in the region to identify possible areas in cooperation with other related regional programs and projects, such as the ODIN-WESTPAC, NOWPAP, Yellow Sea LME, PICES, *etc.*

Status of NEAR-GOOS

The NEAR-GOOS data exchange system, consisting of regional and national databases, continued its operation over the reporting year quite successfully. The number of registered uses of the RRTDB has been around 105 while the number of FTP accesses varied from 3,000 to 10,000 hits/month. The total number of accesses to the RDMDB top page in 2006 has increased by almost 4,000 hits compared with that in 2005. Forty different types of data are being handled by RDMDB: 37 types from RRTDB and 3 types from other sources. As of December 31, 2006, 35 GB of oceanographic/ marine and meteorological data are available – an increase of 10 GB in comparison with the amount reported to the previous session. Further improvements and modifications in national NEAR-GOOS databases in China, Korea and Russia were reported. An increase in the amount of data, number of data providers, sources of information and their accessibility were presented for most data holdings, however, with varying success. Extensive development of the observing system involved in NEAR-GOOS was demonstrated in Korea, where a growing network of coastal stations, moorings, buoys and open-sea platforms are to be found. A joint Korean–China activity, the development of a Yellow Sea Operational Oceanography System (YOOS), will essentially contribute to NEAR-GOOS. In addition to regional data sets, most of the databases are linked with other international projects, such as Argo, GTSPP, and JCOMM. In addition to data, there is a large amount of metadata and other oceanographic products available from the databases.

Some problems, however, exist in the NEAR-GOOS data exchange system. The restrictions on data exchange, especially in real-time mode, particularly in China and Russia, result in a limited number and sources of available data. Each of the member countries still has no complete integrated system which would operationally acquire, hold and provide to users all oceanographic data on a national level, but

progress toward construction of such a system is going on in every country. Information on NEAR-GOOS databases is listed in Table 1 below.

As a capacity building activity, a training course on *NEAR-GOOS Data Management* was organized by the Japan Oceanographic Data Center (JODC). This is the eighth training course that has been hosted biannually by JODC for oceanographic data managers and researchers from WESTPAC countries.

Two Working Groups established at the 10th Session of the NEAR-GOOS CC – WG on *Data Management* and WG on *New Generation SST* – reported on their activities and plans. One of the major tasks of the WG on *Data Management* is to include chemical and biological parameters in NEAR-GOOS databases. As the first step, an inventory of *in situ* chlorophyll and total suspended materials data available in the region will be prepared along with recommendation of their incorporation into an existing data exchange system.

Further development of NEAR-GOOS

A brief discussion was focused on establishing other working groups as discussed at previous CC meeting, WG on *Monitoring Using Drifters and Buoys* and WG on *Regional Sea Projects*. However, these issues were not properly prepared for CC consideration, and it was suggested to postpone the discussion until the next CC meeting.

Another suggestion on the further promotion of NEAR-GOOS is related to the development of satellite ocean color remote sensing. The Ocean Color Project is one of the major activities of the IOC/WESTPAC Ocean Remote Sensing Program. It was agreed to support an initiative of NOWPAP to organize in 2007 the Remote Sensing Training Course on *Data Analysis for Oceanography* and to recommend co-sponsorship of this activity by IOC/WESTPAC.

Collaboration with related programs in the region

Progress in other GOOS Regional Alliances (GRAs) and related regional programs/projects such as SEA-GOOS, UNEP/NOWPAP, PICES, YSLME, was presented by the observers. There was consensus on the importance of closer collaboration with these organizations and programs/projects in order to share efforts and resources for developing a sustained oceanographic observing system in the region. In particular, the importance of closer networking among GRAs and support for the recommendations of the 3rd GOOS Regional Forum was noted.

Joint activity with YSLME on database development and linking of databases with NOWPAP was welcomed. The newly established partnership of IOC/WESTPAC with YSLME and PEMSEA was also highlighted. A Memorandum of Understanding with the YSLME Project Management Office and a Letter of Cooperation with the PEMSEA Regional

Table 1 NEAR-GOOS databases

Country	Database	Responsible organization	Address
Japan	Regional RTDB	JMA	http://goos.kishou.go.jp
Japan	Regional DMDB	JODC	http://near-goos1.jodc.go.jp
China	National RTDB	NMEFC	http://www.nmefc.gov.cn
China	National DMDB	NMDIS	
Korea	National RTDB	KORDI	http://near-goos.kordi.re.kr
Korea	National DMDB	NFRDI	http://kodc2.nfrdi.re.kr:8001/home/eng/near-goos
Russia	National RTDB	FERHRI	http://rus.ferhri.ru/esimo/Projects/Neargoos
Russia	National DMDB	POI	http://www.pacificinfo.ru

Program Office were signed at the 3rd Meeting of Project Steering Committee of YSLME in November 2006 and at the Inaugural Partnership Meeting of the East Asian Seas Congress in December 2006, respectively. Considering the expertise of NOWPAP, YSLME, IOC/ WESTPAC, it was noted that regional cooperation needs to be further promoted on remote sensing. It was suggested that IOC/WESTPAC co-sponsor with NOWPAP the Remote Sensing Training Course on *Data Analysis for Oceanography* which would be based on the existing training course currently hosted by JODC, with its extension toward inclusion of remote sensing.

Recognizing that ocean data and information related activities and networking of the participating organizations that carry out major NEAR-GOOS activities will further the efficient development and improvement of ocean data and information capability in the region, the NEAR-GOOS CC supported a pilot project proposal of an Ocean and Data Information Network for the WESTPAC region (ODIN-WESTPAC-PP) and invited all NEAR-GOOS participating organizations to take part in the pilot project when it will be approved by IODE.

A presentation was given on PICES and major activities of its Technical Committee on Monitoring (MONITOR). PICES' intention to support and coordinate monitoring activity in the northern North Pacific and recommendations of PICES Study Group on GOOS were reported. Also explained was PICES' vision of its possible participation in GOOS at the current stage as a coordinating body and forum for development of cross-GRAs observing projects, observing technologies, and data and information sharing protocols. Other monitoring-related activity by PICES, such as the North Pacific Continuous Plankton Recorder Project, Ecosystem Status Report and outcomes of PICES XV scientific sessions were also presented. The NEAR-GOOS CC expressed its intention to keep close contact with PICES on developing ocean monitoring in the North Pacific and its marginal seas.

Other issues

With the completion of the 2-year term of Mr. Takashi Yoshida, Ms. Shaohua Lin, Director-General of National Marine Data and Information Services, State Oceanic Administration, P.R. China was elected as a new chairperson of the Coordinating Committee for NEAR-GOOS for next two years.

Conclusions

1. NEAR-GOOS provides access to various oceanographic data that are useful for the PICES community. Some problems in easy and fast international data exchange still exist. However, the volume of available data, number of parameters, data providers and users have been steadily increasing. The growing number of database accesses proves the usefulness of the data.
2. To include chemical/ecological parameters into NEAR-GOOS databases, as requested by PICES and other organizations, would take some time. However, several products, such as graphical information, metadata, *etc.* useful to marine chemists and biologists, in addition to physical parameters, is becoming available on the web pages of NEAR-GOOS partner-organizations. In some cases it is done jointly with PICES under TCODE-supported projects.
3. Over its more than 10-year history, NEAR-GOOS has developed technology in oceano-graphic data management, data exchange and services, and communication with data providers and users. This experience would be useful for new ocean observing systems developing in the eastern PICES area.
4. The experience gained in developing observing systems on the American side of the Pacific using comprehensive modern instruments would help NEAR-GOOS in improving its observational network.
5. NEAR-GOOS is an official component of GOOS endorsed by IOC, WMO and UNEP. As one of 13 officially recognized GRAs, it has a well established political background on an international level. However, practical support on a national level for

NEAR-GOOS in some countries is seriously lacking. It may be expected that with increasing GRA consolidation and sharing resources with related organizations and programs in the region, this would be improved.

6. Further development of NEAR-GOOS would require an increased public awareness of involving more partners/data providers as organizations and individual scientists. PICES could help in this area by promoting NEAR-GOOS in the PICES community.

More details about NEAR-GOOS and its 11th CC Session can be found at www.ioc-goos.org and westpac.unescobkk.org.

SG-GOOS Endnote 3

PICES report to the 10th GOOS Scientific Steering Committee
(provided by Dr. Phillip Mundy)

Dr. Phillip R. Mundy, SG-GOOS Chairman, presented the following report at the 10th Session of the Global Ocean Observing System Scientific Steering Committee (GSSC-X) held March 13–16, 2007, in Seoul, Korea.

Background

The North Pacific Marine Science Organization (PICES) is an international intergovernmental scientific organization established by convention in 1992 to promote and coordinate marine scientific research in the northern North Pacific and adjacent seas. Its current members are Canada, Japan, People's Republic of China, Republic of Korea, the Russian Federation, and the United States of America. This report initiates an exchange of information between the Global Ocean Observing System Scientific Steering Committee (GSSC) and PICES. The expectation is that the exchange of information will be mutually beneficial by furthering the shared goal of developing ocean observing capabilities in the North Pacific region. The report is also intended to serve GSSC as a reference to ocean observing activities of PICES.

MONITOR Technical Committee

Following the first PICES–GOOS workshop on October 8, 1999, in Vladivostok, Russia, it was proposed that the terms of reference for the MONITOR Task Team of the PICES/GLOBEC CCCC (Climate Change and Carrying Capacity) Program be modified to include the requirement for the Task Team to develop an Action Plan for how PICES should take an active and leading role in further development and implementation of GOOS at a North Pacific level. The Action Plan would:

- identify existing ocean observations in the coastal and open North Pacific that are relevant to GOOS;
- develop a PICES–GOOS implementation plan based on existing routine observations and augmented by new observations as appropriate; and
- provide a structured plan on how to transfer relevant CCCC Program activities to a PICES–GOOS program.

At the recommendation of its Science Board, a Technical Committee on Monitoring (MONITOR) was established by PICES in October 2004 to replace the MONITOR Task Team with a standing committee. MONITOR (http://www.pices.int/members/committees/MONITOR.aspx) is charged with identifying principal monitoring needs of the PICES region and developing approaches to meet these needs, including training and capacity building. The terms of reference call for MONITOR to serve as a forum for coordination and development of the PICES components of the Global Ocean Observing System (GOOS), including possible method development and inter-comparison workshops. In cooperation with the Technical Committee on Data Exchange (TCODE), MONITOR is to facilitate calibration, standardization and harmonization of data sets. Its members serve as the senior editorial board of the North Pacific Ecosystem Status Report (NPESR). MONITOR also recommends meetings to address monitoring needs, PICES–

GOOS activities, and development of the NPESR. MONITOR is also responsible for overseeing the ocean observing activities of PICES on vessels of opportunity.

SG-GOOS, MONITOR Study Group to develop a strategy for GOOS

The Study Group was approved in October 2005 for a term of two years. The terms of reference (http://www.pices.int/members/study_groups/SG-GOOS.aspx) call for SG-GOOS to identify and describe the major observing systems (present and proposed) in the PICES region, including description of general data types, contact information, and data transmission (real-time *vs*. delayed), and to provide a recommendation and justification to MONITOR on whether or not PICES should propose a North Pacific GOOS pilot project to I-GOOS. In its October 2006 report to MONITOR, SG-GOOS recommended against the pilot project, but presented a number of recommendations for closer relations between PICES and I-GOOS. Those recommendations identified a need to contact the Chairman of GSSC (Dr. John Field) to make him aware of PICES' wish for a closer working relationship. A recommendation was also made to continue to improve working relationships with existing observing systems in the North Pacific (*i.e.*, NEAR-GOOS and IOOS). Dr. Vyacheslav Lobanov of SG-GOOS attended the (most recent) Eleventh Session of IOC/WESTPAC Coordinating Committee for NEAR-GOOS (NEAR-GOOS-CC-XI) held January 18–19, 2007, in Bangkok, Thailand as a PICES representative. A further recommendation was for PICES to be represented at Tenth Session of GSSC to be held March 13–16, 2007, in Seoul, Korea., which is the impetus for this report. The Vice-Chairman of GSSC (Dr. Dong-Young Lee) is aware of these recommendations, as he is also a member of SG-GOOS.

Advisory Panel on the *Continuous Plankton Recorder Survey in the North Pacific* (CPR-AP)

In the late 1990s, funding for a pilot project to operate a continuous plankton recorder (CPR) survey in the North Pacific was obtained from the Exxon Valdez Oil Spill Trustee Council. PICES formed the CPR Advisory Panel in October 1998 (http://www.pices.int/members/advisory_panels/CPR.aspx) to review and advise PICES on the most appropriate locations, timing and frequency of CPR routes for "A Continuous Plankton Recorder Monitoring Program for the eastern North Pacific and Southern Bering Sea". The terms of reference call for CPR-AP to provide technical advice on parameters to be measured for additional monitoring initiatives and to advise on linkages to other potential initiatives in the North Pacific and elsewhere. The experts on CPR-AP have been influential in securing funding for the project, an element which has been crucial to its success, as the sources of funding have changed several times since the survey was initiated 1997 by the Sir Alister Hardy Foundation for Ocean Science, SAHFOS. In addition, the Panel has been consulted by program scientists on developing routes and the types of observations collected.

PICES has facilitated the funding and operation of the North Pacific CPR, which is operated by SAHFOS (Sonia Batten) and funded from a number of sources, including the Exxon Valdez Oil Spill Trustee Council and the North Pacific Research Board. Established in 1997, the NPCPR currently occupies two routes, the AT and the VJ. The AT route lies between Tacoma (Washington) and Anchorage (Alaska). In 2005, the *Horizon Kodiak* made six sets of three tows each on this route, with a total of 7946 nautical miles being logged. The VJ route from Vancouver (Canada) to Japan, as towed by the *Skaubryn* in 2005, executed seven 500-nautical mile tows. At 3500 nautical miles VJ is the longest CPR route in the world. In 2005, total length of VJ tows was 10.500 nautical miles. Information on the NPCPR project can be found on the SAHFOS and PICES websites (http://192.171.163.165/pacific_project.htm and http://www.pices.int/projects/tcprsotnp/CPR_Description.pdf.

North Pacific Ecosystem Status Report

PICES will be reporting on North Pacific marine ecosystems periodically to review and summarize their status and trends, and to consider the factors that are causing, or are expected to cause, change

in the near future. The first report, "Marine Ecosystems of the North Pacific" was published in late 2004 (http://www.pices.int/publications/special_publications/NPESR/2005/npesr_2005.aspx). It is based largely on geographic locations and subjects for which time series data or information was readily available. In addition, the report identifies locations and subjects where data were collected but are not yet available.

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SG-GOOS Endnote 4

Results of representation by PICES at the 10th GOOS Scientific Steering Committee

Background

Following the recommendations of MONITOR, as adopted by the PICES Science Board at PICES XV, the Chairman of SG-GOOS, Dr. Phillip R. Mundy, contacted Dr. John Field, Chairman of GSSC, to inform him of the activities of PICES relevant to international GOOS (I-GOOS). Dr. Field subsequently issued an invitation for PICES to send a representative to GSSC-X to brief its members on PICES and its activities. In consultation with the Chairman of MONITOR, Dr. Jeffrey Napp, the Secretariat arranged for Dr. Mundy to represent PICES at

GSSC-X. The representation was based on the contents of a report that is now available on the SG-GOOS page of the PICES website, and on the GSSC-X website (http://www.ioc-goos.org/gssc10), along with all of the documents and presentations made at the meeting.

Summary

The GSSC-X meeting was preceded by a workshop to review global and regional issues in developing networks for collecting and distributing observations on the open ocean and coastal regions. The presentations from the workshop provided an overview of 1) coastal observations, 2) regional marine environment and ecosystem modeling, and 3) data management and assimilation. In keeping with the location of the meeting, there was a focus on the Asia-Pacific region. The presentations confirmed the pattern of relatively advanced observing capabilities in the open ocean and relatively uncoordinated coastal observing systems. Nonetheless, significant advances in observing systems were apparent for the coasts of China, Korea and Japan, and the west coast of Africa.

To cite one example, Dr. Changsheng Chen presented a small-scale model of circulation appropriate to complex coastal environments. His presentation, "*Ecosystem environment in the East China Sea: Dense algal bloom and its impacts on local and remote ocean systems*", was an example from among several applications of the model, which also include an application in the Gulf of Alaska. To cite another example, rapid advances in coastal Africa have been made possible by the World Bank's support of the Benguela Current Large Marine Ecosystem program (BCLME) off the coast of South Africa. Some of the work in BCLME is part of an international initiative, the Chlorophyll Ocean Globally Integrated Network (ChloroGIN). ChloroGIN aims to improve quality and availability of surface measurements of chlorophyll and temperature to support identification of harmful algal blooms, and enhanced fisheries management off the coasts of South America, Africa and India. Further details on advances in developing observing systems are available in the documents on the GSSC-X website.

Two outcomes from the GSSC-X meeting are of particular relevance to PICES:

- an endorsement of the North Pacific CPR (Continuous Plankton Recorder) survey as an ocean observing tool for measuring long-term changes, and
- a standing invitation for PICES to be present as an observer in future GSSC meetings.

The endorsement of the North Pacific CPR survey was not specifically requested by Dr. Mundy, but came as an outgrowth of the PICES presentation. GSSC members were impressed with this project, enthusiastic about its continuation, and disappointed to learn of the uncertain nature of the funding. The GSSC had previously endorsed the CPR as an ocean observing method, so the extension of the endorsement to the PICES CPR project was readily acceptable to all members.

The GSSC extended its invitation to PICES to participate as an observer in future GSSC meetings in recognition of PICES' role in establishing and coordinating the operation of observing projects, such as the CPR, that cross the boundaries of existing GOOS Regional Alliances in Northeast Asia and North America. Participation by PICES in I-GOOS, at the level of scientific discourse, was acceptable to all committee members and Dr. Keith Alverson, Director of GOOS Project Office. ICES was also invited to provide a permanent observer to the GSSC in the same action of the GSSC. Details on all the GSSC actions, as well all the information presented at the workshop are available on the website cited above.

REPORT OF STUDY GROUP ON ECOSYSTEM STATUS REPORTING

Terms of reference

At PICES XV (October 2006, Yokohama, Japan), Governing Council formed a Study Group on *Ecosystem Status Reporting* (hereafter SG-ESR), under the direction of Science Board (Decision 06/S/6), with terms of reference as follows:

1. To develop options and budgets for paper and electronic versions of the North Pacific Ecosystem Status Report;
2. To provide its report by April 15, 2007, for consideration at the 2007 inter-sessional Science Board meeting.

Membership

It was agreed that the SG-ESR membership will include one representative from each member country and a representative from the Secretariat. Mr. Robin Brown (Canada) was recommended by Science Board and appointed by Council as Chairman of the Study Group. The full approved membership is listed below:

Canada	Robin Brown (Chairman)
China	Mingyuan Zhu
Japan	Akihiko Yatsu
Korea	Young-Shil Kang
Russia	Elena Dulepova
U.S.A.	Patricia Livingston
Secretariat	Skip McKinnell

Study Group process

The Study Group worked by correspondence. Terms of reference, relevant reports (including the output from the 2005 MONITOR Workshop) were reviewed, and approach for preparing this report was agreed upon. Through this process, SG-ESR developed the four options presented here. Each option describes a variation of the Ecosystem Status Report. For each option, the nature of the report, who would do the work, and the costs, were described, along with a summary of the advantages and disadvantages of each approach. In addition, some options for funding this activity were developed.

At the 2007 inter-sessional Science Board meeting (Yokohama, Japan), the preference was given to the "incremental" improvement" report (Option 2) and the "integrated" ecosystem assessment (Option 4). At the follow-up inter-sessional Governing Council meeting, SG-ESR was requested to determine the "level of effort", including the costs borne by member countries, required to complete Option 2. This information was compiled in the section on costs.

Highlights of options

Option 1: "Focused" report (*SG-ESR Endnote 1*)

- choose a smaller and more tractable objective;
- identify a smaller team to do the work;
- (possibly) base on a much more limited set of indicators.

Option 2: "Incremental improvement" report (*SG-ESR Endnote 2*)

- retain the same scope and structure as the 2004 report;
- attempt to fill some of the identified gaps;
- produce a report similar to the pilot version, working (over the years) to improve the completeness and quality in steps.

Option 3: "Strategic North Pacific ecosystem assessment" (*SG-ESR Endnote 3*)

- produce tightly focused "extracts" of information from regional seas/LMEs;
- make structure/focus to be defined by a new integrative scientific program of PICES.

Option 4: "Integrated ecosystem assessment" report (*SG-ESR Endnote 4*)

- develop consistent (or reasonably complete) integrated ecosystem assessments for each regional sea/LME;

- assemble North Pacific Ecosystem Status report through integration and analysis of the products from these ecosystem assessments.

Costs

The costs for the four options are summarized in Table 1. The costs for the first ESR (pilot project) are included for comparison. A more complete explanation of costs is provided with each detailed description of the options in the Endnotes.

For each of the four options, direct costs were estimated. These costs included the expenses of running workshops, graphic design, report production and development of web products, but did not include the "in-kind" contributions by member countries for their scientific staff or the costs for these scientists to travel to workshops and other activities. In Table 1 these "costs" were identified in the row labeled "People (in-kind contribution by members)", but no value was assigned. After receiving a draft report at the inter-sessional meeting, Council requested that SG-ESR provide an estimate of the level of effort involved.

SG-ESR understands that many scientists in member countries provide valuable input at the regional workshops and it would be very difficult to estimate this total contribution. Furthermore, there are usually one or two very dedicated individuals who take on the work of assembling the input from the regional workshops. To estimate the level of effort, SG-ESR used the outline of major chapters from the pilot report and focused on the level of effort for the chapter coordinators (Table 2).

In assembling these costs, it should be recognized that some regions/chapters were more difficult to produce based on the practical issues, such as the number of countries (and languages) of the PICES nations that border on these regions and the current availability of "ecosystem-level" data and analyses for these areas.

Funding options

Funding for new PICES activities is always a challenge. The member countries are generally resistant to increases in the annual fees that exceed the rate of inflation. Some strategies might include:

- "Self-funded" – Member countries agree to provide the key personnel and their costs (travel, *etc.*) of participation. While this is the generalized model for participation in PICES activities, it is not always possible for each of the countries to cover the costs of all the relevant experts.
- Voluntary contributions – While this option has been in place for several years and has been used effectively, relatively few parties have chosen to contribute in this manner.

Table 1 Summary of the direct costs (in $K) for each of the four options

	Option 1	**Option 2**	**Option 3**	**Option 4**	
	Focused	**Incremental**	**Strategic**	**IEA**	***Pilot Project***
Workshops and reports	205	248	300	188	*130*
People (In-kind contribution by members)					*0*
Secretariat					*115*
Overhead					*0*
Total	205	248	300	188	*245*

Table 2 Workload for lead scientists to prepare the next Ecosystem Status Report (Option 2)

Chapter/Section	Estimated workload for Chapter coordinators
Synthesis	1 person month + 1 person month from the Secretariat
Ocean and climate changes	1 person month + 1 person month from the Secretariat
Yellow Sea/East China Sea	3 person months
Japan/East Sea	3 person months
Okhotsk Sea	2 person months
Oyashio/Kuroshio	2 person months
Western Subarctic Gyre	3 person months
Bering Sea	3 person months
Gulf of Alaska	2 person months
California Current	2 person months
Gulf of California	2 person months
Transition Zone	2 person months
Tuna	*(not estimated) provided by the Inter-American Tropical Tuna Commission*
Halibut	*(not estimated) provided by the International Pacific Halibut Commission*
Pacific salmon	*(not estimated) provided by the North Pacific Anadromous Fisheries Commission*

- Special levy – Member countries agree to special contributions to the Organization being directed to this activity. This might enable the countries to justify an apparent increase to the budget for a specific deliverable/product and a specific (fixed and limited) time period for funding (not a permanent increase in annual fees).
- External funding – PICES has attracted support from foundations and the North Pacific Research Board.
- Some blend of the above.

Recommendation

The Study Group did not achieve consensus of a preferred option. Options 2 ("Incremental improvement" report) and 3 (Strategic North Pacific ecosystem assessment) were supported. Option 1 ("Focused" report) was considered to be too narrow to be useful and Option 4 (Integrated ecosystem assessment approach) was considered to be a desirable target in the long term, but impractical at present. The options are described in more detail on the following pages.

SG-ESR Endnote 1

Option 1: "Focused" report

1. Overview

PICES would agree to a more focused approach, with a more restricted objective, producing a shorter and less costly ESR, but lacking the inclusive approach of the pilot report. Strategies for reducing the focus might include:

   a. Focus on a much more restricted list of indicators and species;
   b. Focus on one part of the ecosystem for each report (*e.g.*, primary production; marine mammals);
   c. Focus on a single scale (basin-scale only; ignoring the Large Marine Ecosystem/enclosed sea scale).

2. Reporting interval
   a. Could be fairly frequent (annual) if the focus is sufficiently narrow.

3. Role of PICES Committees and Secretariat
   a. Science Board – select the focus for each annual component; identify which Committee and/or expert group was to lead the annual activity; take overall responsibility for progress, completion and quality control;
   b. Relevant Standing Committee(s) (varies with subject matter) – assemble and quality control the information; write the report;
   c. TCODE – assemble data, including metadata;
   d. PICES Secretariat – provide report editing, design, production, distribution and website.

4. Expectations of Contracting Parties (in addition to their "normal" PICES activities)
   a. Ensure that their national appointees on relevant committees and experts groups are willing and capable of representing their country OR identify alternates.

5. Cost implications
   a. Workshops to review and edit national contributions (conducted in conjunction with the Annual Meeting);
   b. Editing, publications and distribution costs (printed copies);
   c. Web version.

6. Advantages
   a. Relatively easy to accomplish;
   b. Over several years, the workload is transferred around the PICES Committee structure.

7. Disadvantages
   a. Does not demonstrate ecosystem linkages easily;
   b. Each report will have limited interest;
   c. It may be difficult to agree on the "constraints" – it is always easier to get people to agree to do everything;
   d. Focusing on a limited set of indicators will likely result in a very "commercial fisheries" focus;
   e. Developing consensus on a limited range of indicators has proven to be difficult in other fora and may inhibit improved scientific understanding.

8. Costs

Fiscal Year	Activity	Cost ($K)
2009	Symposium	100
2009	Synthesis workshop	25
2010	Graphic design	20
2010	Printing	30
2010	Distribution	30
	Total	**205**

SG-ESR Endnote 2

Option 2: "Incremental improvement" report

1. Overview
   a. PICES would repeat the 2004 report, taking advantage of the lessons learned and existing work, but attempting to address some of the identified shortfalls. More effort would be put for obtaining and integrating comparable data from across the Pacific and analyzing the assembled information (perhaps even assembling a dataset that could be used for subsequent analyses and scientific publications);
   b. The report would be similar to the pilot report, with information on the regional seas and an expanded synthesis at the North Pacific ecosystem level.

2. Reporting interval
   a. Every five years (?). Based on this the target date for the next report would be the end of 2009.

3. Role of PICES Committees and Secretariat
   a. Science Board – provide general oversight of the report preparation process; integrate activities into PICES Committee Work Plans and into Annual Meetings; take overall responsibility for progress, completion and quality control;
   b. MONITOR Technical Committee – plan and execute workshops; develop (write) chapters; carry out quality control (with assistance from other Committees and expert groups); report on progress; identify shortfalls and recommend solutions;
   c. TCODE – assemble data, including metadata;
   d. PICES Secretariat – assist in organizing regional workshops; provide report editing, design, production, distribution and website.

4. Expectations of Contracting Parties (in addition to their "normal" PICES activities)
   a. Ensure that their national appointees on relevant committees and expert groups are willing and capable of representing their country OR identify alternates. This is a substantial task, and for success, PICES nations will have to devote significant amounts of time from some of their key scientists.

5. Cost implications
   a. Multiple regional workshops for coastal/ marginal seas/LMEs;
   b. Thematic workshops to fill identified gaps in the 2004 report;
   c. Workshops to review and edit regional contributions (in conjunction with the Annual Meeting, if practical);
   d. One or more integration/synthesis workshops to work with the assembled data series and carry out some preliminary ecosystem-wide analyses;
   e. Editing, publications and distribution costs (printed copies);
   f. Web version.

6. Advantages
   a. Provides a comprehensive description of the state of ecosystems in the North Pacific;
   b. Builds on experience from the pilot report;
   c. Is similar to/builds upon some existing national activities;
   d. Provides a path for incremental improvement;
   e. Could lead to very interesting analyses and scientific debates from compiled datasets;
   f. Costs and effort required may decline (slowly) after several report production cycles.

7. Disadvantages
   a. Requires strong leadership at the regional seas/LME level and greater attention to standardizing approaches in preparation for the data integration phase;
   b. Needs support of many scientists from Contracting Parties;

c. Will be difficult to ensure a consistent level of reporting across many ecosystem components and many regional seas/LMEs;
d. Will be expensive;
e. "Burst mode" – one intensive year of work in a 5-year cycle may be difficult to integrate into the annual focus of most PICES activities.

8. Costs

Fiscal Year	Activity	Cost ($K)
2008	Regional workshops	40
2008	Thematic workshops	50
2008	Graphic design	30
2009	Synthesis workshop	60
2009	Printing	40
2009	Distribution	23
2009	Internet	5
	Total	**248**

SG-ESR Endnote 3

Option 3: Strategic North Pacific ecosystem assessment

1. Overview
   a. PICES would develop a report which is focused on the North Pacific, basin-scale level, with reduced contributions/ details at the regional seas/ LME scale. More effort would be put on obtaining and integrating comparable data from across the Pacific and analyzing the assembled information (perhaps even assembling a dataset that could be used for subsequent analyses and scientific publications);
   b. The details of the report structure and focus would be tightly "bound" to the requirements/direction of the Study Group on *Future Integrative Scientific Program(s)* (SG-FISP) (which is not yet fully described);
   c. The report would draw heavily on eco-system monitoring/reporting activities in regional seas/LMEs that are being carried out by existing national and international activities. It may be necessary for PICES to lead this in some regional seas/LMEs where there is no such program in place.

2. Reporting interval
   a. Every five years (?). Based on the plans for development of the next PICES integrative scientific program, the target date for the next report would be the end of 2013 (5 years after the development of the FISP Implementation Plan).

3. Role of PICES Committees and Secretariat
   a. Science Board – provide general oversight of the report preparation process; integrate activities into FISP Study Group Work Plans and into Annual Meeting;
   b. FISP (PICES Scientific Program, not yet created) – determine the focus, scope and strategy; lead the process for defining and developing the required inputs and the workshop process for data integration and analysis; outline sub-tasks for Standing Committees and expert groups; write the report;
   c. Standing Committees and expert groups – execute tasks assigned by FISP, including analyses and written reports on sub-components; carry out review and quality control on components;
   d. TCODE – assemble data, including metadata;
   e. PICES Secretariat – assist in organizing regional workshops; provide report editing, design, production, distribution and website.

4. Expectations for Contracting Parties (in addition to their "normal" PICES activities)
   a. Ensure that their national appointees on relevant committees and expert groups are willing and capable of representing their country OR identify alternates. This is a substantial task, and for success, PICES nations will have to

devote significant amounts of time from some of their key scientists.

5. Cost implications
   a. Workshops to define the requirements for Ecosystem Assessment, based on the Strategic and Implementation Plans developed for FISP;
   b. Thematic workshops to fill identified gaps in the 2004 report;
   c. One or more integration/synthesis workshops to work with the assembled data series and carry out some preliminary ecosystem-wide analyses;
   d. Editing, publications and distribution costs (printed copies);
   e. Web version.

6. Advantages
   a. Provides a comprehensive description of the North Pacific ecosystem;
   b. Provides a shorter report with a tighter focus;
   c. Is more closely "bound" to the core activity of PICES (FISP);
   d. Could lead to very interesting analyses and scientific debates from compiled datasets;
   e. Costs and effort required may decline (slowly) after several report production cycles.

7. Disadvantages
   a. Requires strong leadership (from FISP SSC/SG-FISP) to define the objectives for the report and strategy for its delivery;
   b. FISP is not yet defined, and this will delay production;
   c. Needs support of many scientists from Contracting Parties;
   d. Less information at the regional seas/LME level will be presented in the report;
   e. It may be a challenge to get an adequate quantity and quality of information for all regional seas/LMEs;
   f. "Burst mode" – one intensive year of work in a 5-year cycle may be difficult to integrate into the annual focus of most PICES activities.

8. Costs

Fiscal Year	Activity	Cost ($K)
2008	FISP NP Status workshop	10
2009	FISP Scientific Report	15
2009	FISP NP Status workshop	10
2010	FISP Scientific Report	15
2010	FISP NP Status workshop	10
2011	FISP Scientific Report	15
2011	FISP NP Status workshop	10
2012	FISP Scientific Report	15
2012	FISP symposium	100
2012	Graphic design	20
2013	Scientific Report	20
2013	Printing	30
2013	Distribution	30
	Total	**300**

SG-ESR Endnote 4

Option 4: Integrated ecosystem assessment approach

1. Overview
   a. PICES would expand upon the process developed for the 2004 pilot report, by developing times series of suites of key indicators of ecosystem status. These indicators will be assessed, along with modeling results, to propose reference values for the desired state of various marine ecosystems, and capability will be developed to forecast future states of the ecosystem resulting from various "perturbations" or pressures (fisheries removals, climate change, coastal development, pollution);
   b. Each Contracting Party would participate in producing this information at the regional seas/LME level, and the main PICES activity would be to integrate the information for the entire North Pacific;
   c. The actual direction and rate of progress would be determined by the degree of

correspondence of this approach with the activities of FISP.

2. Reporting interval
   a. Every 5 years (?). Based on this the target date for the next report would be 2009.

3. Role of PICES Committees and Secretariat
   a. Science Board – define and approve the scope and structure of the report; provide oversight of the report preparation process; integrate activities into PICES Committee Work Plans and into Annual Meeting;
   b. Scientific Committees – recommend procedures and approaches for conducting integrated ecosystem assessments; execute tasks assigned by Science Board, including analyses and written reports on sub-components; carry out review and quality control on components;
   c. MONITOR Technical Committee – develop recommendations for Science Board (workshops, *etc.*) and report progress, identify shortfalls and recommend solutions; write the report;
   d. TCODE – assemble data, including metadata;
   e. PICES Secretariat – assist in organizing regional workshops; provide report editing, design, production, distribution and website.

4. Expectations for Contracting Parties (in addition to their "normal" PICES activities):
   a. Ensure that their national appointees on relevant committees and expert groups are willing and capable of representing their country OR identify alternates. This is a substantial task, and for success, PICES nations will have to devote significant amounts of time from some of their key scientists;
   b. This option assumes that PICES Contracting Parties will commit to the application of some advanced ecosystem assessment processes for national waters and shared regional seas/LMEs.

5. Cost implications
   a. Multiple national and regional workshops to develop (reasonably) consistent national/regional approaches and capabilities;
   b. Multiple regional(?) workshops for coastal/marginal seas/LMEs;
   c. Workshops to review and edit regional contributions (in conjunction with the Annual Meeting, if practical);
   d. One or more integration/synthesis workshops to work with the assembled data series and carry out some preliminary ecosystem-wide analyses;
   e. Editing, publications and distribution costs (printed copies);
   f. Web version.

6. Advantages
   a. Documents the ecosystem status with many ecosystem components, and many regional seas/LMEs represented;
   b. Builds on the experience from the pilot report;
   c. Is similar to some national activities;
   d. Would provide a substantial improvement in output products (predictions for future states of ecosystems under various scenarios);
   e. Could lead to very interesting analyses and scientific debates from compiled datasets;
   f. Would allow for better international decision-making;
   g. Would be more consistent with other international activities (*e.g.*, IPCC reports);
   h. Costs and effort required may decline (slowly) over several report production cycles.

7. Disadvantages
   a. Requires scientific capacity that may not be present in all PICES Contacting Parties;
   b. Requires leadership at the national/regional/LME level and for the integration phase (North Pacific-wide);
   c. Needs support of many scientists from Contracting Parties;

d. Will be difficult to ensure a consistent level of reporting across many ecosystem components and many regional seas/LMEs;
e. Will be very expensive;
f. Would require a sustained effort over multiple years to prepare a first version.

8. Costs

Fiscal Year	Activity	Cost ($K)
2008	Planning workshop	40
2009	Synthesis workshop	50
2008	Graphic design	30
2009	Printing	40
2009	Distribution	23
2009	Internet	5
	Total	**188**

REPORT OF STUDY GROUP ON MARINE AQUACULTURE AND RANCHING IN THE PICES REGION

Terms of reference

At PICES XV (October 2006, Yokohama, Japan), a Study Group on *Marine Aquaculture and Ranching in the PICES Region* (hereafter SG-MAR) was established under the direction of Science Board (Decision 06/A/6), with terms of reference as follows:

1. To review and access why WG 18 had limited success in achieving its terms of reference;
2. To determine the highest priority marine aquaculture and/or ocean ranching science needs (< 10) for the next 5–10 years in each PICES member country;
3. To develop recommendations for joint activities in marine aquaculture and/or ocean ranching using the PICES Action Plan format;
4. To provide its draft report by September 2007 and be prepared to discuss and finalize the report at PICES XVI (October 2007, Victoria, Canada).

The approved membership of the Study Group is included in *SG-MAR Endnote 1*.

Executive Summary

The Study Group worked over the past 8 months by correspondence to address its four terms of reference. To deal with the first item, an e-mail was sent to former members of the Working Group on *Mariculture in the 21st Century – The Intersection between Ecology, Socio-economics and Production* (WG 18 was approved at PICES XII in October 2003 and disbanded at PICES XV in October 2006 due to inadequate progress in achieving its tasks), but very few responses were received (*SG-MAR Endnote 2*). This reflects WG 18 itself which suffered from lack of participation. Numerous factors may have led to the low participation and they are presented in the report below. Low participation is a sign that the work or work products of the Working Group are not relevant to the members. Even if these products are a high priority for PICES leadership, they first and foremost have to be meaningful to the Working Group members themselves.

To determine the highest priority marine aquaculture and ocean ranching science needs for the next 10 years, each country was asked to develop a list independently, and send it to SG-MAR Chairman, Dr. Michael Rust, for consolidation (*SG-MAR Endnote 3*). These lists (*SG-MAR Endnote 4*) were combined into like items and then examined to see if any higher order grouping was possible. Priorities were divided into two groups, depending on their relation to environmental impacts of commercial aquaculture or ranching or to advancements in technology. Priorities were developed based on the number of countries listing a given topic. The three top priorities (cited by 6, or 5 of 6 countries) were related to:

- development of aquaculture technology and systems;
- management of stocking and supplemented fisheries; and
- estimation of the carrying capacity of commercial aquaculture activities.

Recommendations

Based on these priorities, SG-MAR recommends the formation of up to two PICES Working Groups to foster joint activities on:

1. *Environmental Risk Assessment and Interactions of Marine Aquaculture*;
2. *Technology and Management for Aquaculture.*

Mission, Strategy and Action Plans for each Working Group are presented in *SG-MAR Endnotes 5 and 6.* Potential sponsoring committees could be: MEQ for #1 and FIS for #2. Alternatively, a new Aquaculture Committee

could sponsor both Working Groups, or they could be supported jointly by MEQ and FIS.

SG-MAR TOR #1: To review and access why WG 18 had limited success in achieving its terms of reference

The Working Group on "*Mariculture in the 21st Century – The Intersection between Ecology, Socio-economics and Production*" (WG 18) was approved at PICES XII (October 2003, Seoul, Korea), with the following terms of reference:

1. Review and report on the current status and projected trends in aquaculture in marine and estuarine regions of PICES that substantively contribute to world aquaculture;
2. Develop an overview of current and emerging issues, with respect to environmental and ecosystem function, sustainability of production (*e.g.*, carrying capacity of ecosystems), and socio-economics;
3. Convene a workshop on "*Scientific issues for sustainable aquaculture in the PICES region*". A product from the workshop would be recommendations for a PICES Action Plan on scientific issues of mariculture.

WG 18 first met at the PICES XIII in Honolulu, U.S.A., then again at PICES XIV in Vladivostok, Russia and PICES XV in Yokohama, Japan. To its credit, WG 18 had accomplishments. Three scientific sessions were held in Honolulu, Vladivostok and Yokohama. Reports from each country were produced and published by PICES. Had the Working Group continued, it might have been possible to have overviews of current and emerging issues developed (TOR #2), based on the three scientific sessions held. These products fell largely to SG-MAR by producing this report.

To address the first SG-MAR term of reference, an e-mail (*SG-MAR Endnote 2*) was sent to all the members of former WG 18 to solicit their input on the reasons why the Working Group was able to only partially fulfill its terms of reference. The following is a synthesis of the few responses that were received.

While it is difficult to say why WG 18 was not fully successful, several possibilities exist and were pointed out by its members. These include: (1) the development of the terms of reference; (2) the expertise of the members; (3) the lack of pre-existing personnel relationships among the group; and (4) the isolated position of aquaculture within the larger framework of PICES.

Most, if not all the scientists in WG 18 were new to PICES and were invited at the recommend-dation of PICES members who did not have a background in aquaculture. The terms of reference were also developed by scientists who were not active in aquaculture, and the usefulness of some of the terms was questionable. For example, FAO and various national agencies typically have organizations to track status and trends by country and region (TOR #1) so why would PICES want to duplicate that?

There was an initial social inertia as scientists got to know each other and the PICES system. This was made more difficult by the diversity of specializations among the group and the isolated nature of aquaculture within the larger PICES framework. Much of the rest of PICES is of low relevance to aquaculture scientists, and aquaculture is of low relevance to other PICES expert groups. This combination provided little incentive for members to attend the Annual Meetings. Since most scientists have limited travel budgets they were forced to choose between attending PICES Annual Meetings or international aquaculture meetings.

In the end, the combination of these factors, and possibly others, resulted in low participation in the Working Group. Low participation is a sign that the work or work products of the group are not relevant to the members. Even if these products are a high priority for PICES leadership, they first and foremost have to be meaningful to the Working Group members themselves.

SG-MAR TOR #2: High priority marine aquaculture science needs (5–10 years)

For this term of reference, each country was asked (*SG-MAR Endnote 3*) to provide the top ten aquaculture priorities over the next 5–10 years. Responses were tallied and grouped where similar priorities were identified by more than one country. They are presented below in order of the number of countries expressing them as a priority. The unedited responses are provided in *SG-MAR Endnote 4*. Identified priority research areas include:

Development of aquaculture technology and systems (all Contracting Parties):
- Development of efficient, environmentally-friendly, and industry-diversifying culture technologies for fish, shellfish, and algal species and the polyculture of these groups;
- Improvement of technology for open-ocean and multi-tropic level aquaculture;
- Technology development should be inclusive of that needed to increase production and/or decrease the environmental footprint.

Stocking, population dynamics and management of supplemented stocks (Canada, China, Japan, Korea, U.S.A.):
- Evaluation and improvement of stocking;
- Assessment of the risks (genetic, harvest, ecological and disease) from interaction between cultured (commercial escapes), enhanced (hatchery releases) and wild fish;
- Development of technology to minimize wild/cultured fish interactions;
- Assessment of efficacy of programs for stock rebuilding and management;
- Evaluation of the effect of stocking on resource fluctuation and improvement of stocking technology;
- Application of fisheries management and population dynamics models to marine ranching activities.

Estimation of carrying capacity for aquaculture activities (Canada, China, Korea, Russia, U.S.A.):
- Development of biological and oceanographic models;
- Use of models to determine best zones for aquaculture;
- Collection of lab and field data to allow prediction of ecological effects (near and far-field) of aquaculture;
- Determination of carrying capacity of aquaculture areas and for released species;
- Monitoring and prediction of the impacts of global climate change on aquaculture industries;
- Development of methods to assess risk to ecosystem and industry.

Disease treatment development (Canada, China, Russia, U.S.A.):
- Investigation of disease transmission (bi-directional) between wild and cultured stocks;
- Development of aquaculture vaccines and other effective treatments.

Genetic management of aquaculture and released stocks (Canada, China, Japan, U.S.A.):
- Use of biotechnology, genomics, and genetics to improve commercially important traits (*e.g.*, growth, disease resistance and reproduction) and the assessment of improvements;
- Development of methods to maintain wild type genetic diversity in stocking programs.

Feeds development (Canada, Japan, U.S.A.):
- Development of environmentally friendly feeds and cost-effective feeders for marine organisms.

Assessment of the impact of aquaculture on species at risk (Canada)

Investigation of the potential for fishermen to self-regulate fisheries resources management (Korea):
- If they control their capture amount, size and periods for resources management by themselves, the marine ranching program may be more effective (Korea).

Development of alternative income sources for fishermen to reduce capture (Korea):
- When they have another income source tied to the ocean, they will make an effort to sustain marine resources. Therefore, we should investigate developing alternative

income sources focused on ocean tourism and leisure. Consideration of infrastructure needs for developing tourist areas should also be considered.

These various priorities for aquaculture research can also be grouped by general topic as presented in Table 1. The priorities clearly fall into three over-arching topics: (1) Technology improvement, (2) Environmental carrying capacity, and (3) Social and economic issues. In all three topics, there could also be a distinction between aquaculture used for commercial production and aquaculture used for resource management (enhancement or ranching). The priorities identified as socio-economic issues are not unique to aquaculture, but also include the capture fisheries sector.

Table 1 Priority aquaculture research areas and numbers of Member Countries interested

Topic Group	Specific Topic	Nos.
Technology development	Development of husbandry techniques	6
	Genetic management (breeding/improvement)	4
	Disease treatments	4
	Feeds development	3
Environmental issues	Evaluation of stocking	5
Risk, Monitoring, Modeling and Management of released organisms	Carrying capacity	5
	Genetic management (maintaining wild genotypes)	4
and	Population dynamics and management of stocked populations	5
	Impacts on highly vulnerable resources	1
Risk, Monitoring, Modeling and Management of commercial aquaculture systems	Provision of self-regulation for fisheries resources management	1
Socio-economic issues	Provision of self-regulation for fisheries resources management	1
	Development of alternative income sources for fishermen	1

SG-MAR TOR #3: To develop recommendations for joint activities in marine aquaculture and/or ocean ranching using the PICES Action Plan format

ICES, the older sister organization to PICES, has a long history of Working Groups dealing with aquaculture. Currently, they have groups focused on technology (marine fish, shellfish, genetics and animal welfare) and environmental interactions (environmental interactions of mariculture). Groups that are easily identified with aquaculture make up about 6 of the ~100 groups working under ICES. Several more likely have aspects of their work related to aquaculture (*e.g.*, salmon or basic physiology). Aquaculture-related groups within ICES seem to be focused on themes that would appeal to specialists. Given that the PICES region has a large and more diverse aquaculture sector than the Atlantic, it would appear that an effort of a similar or greater magnitude would be desirable.

It is clear from the diversity of topics that are associated with aquaculture that there is a large degree of specialization. A symposium could easily address any of the 31 topics listed in *SG-MAR Endnote 4*. Given the priorities of PICES member countries, there is a pressing need to: (1) develop, improve and evaluate aquaculture technology, and (2) assess impacts and limits to the environment. The latter was often expressed as determining the carrying capacity for a given aquaculture activity (whether for release or production) and identifying the environmental risks associated with aquaculture. In many ways these two aspects of aquaculture go hand in hand because,

as technology improves, the environmental footprint of the industry will likely change. In most cases, improvements in technology should lead to reductions in environmental impacts. For example, improved feeds will pollute less and utilize fewer marine resources. Improved vaccines will reduce disease in cultured fish and the risk of transfer it to wild stocks. Improved cage designs will reduce the risk of escapes, and improved hatcheries will reduce the reliance on catching juveniles in the wild. This has been the case in the salmon net-pen industry, for example.

We suggest that PICES groups working on aquaculture technology focus on technology and methods that provide both an economic and environmental benefit. This should aid in their adoption by the end-user groups and reduce the footprint of aquaculture activities.

Several topics are associated with a need to understand, assess, and manage risk in various areas of aquaculture. Risk assessments may be useful as a common way to approach a wide array of issues related to aquaculture and may help to guide and set priorities for the development of improved aquaculture technologies and practices. This topic is timely as PICES was asked to join with the ICES Working Group on *Environmental Interactions of Mariculture* (WGEIM) to convene a joint meeting from April 14–18, 2008, in Victoria, Canada. Reports produced over the last three years by WGEIM are impressive because it has developed and applied environmental risk assessment to marine aquaculture. The Working Group's reports are available from the ICES website. While some SG-MAR members felt that the risk assessment approach may be too difficult and costly to apply in the PICES region, the Study Group recommends that PICES accept the opportunity for a joint workshop, use it to train PICES scientists in risk assessment, and launch a Working Group in this area (*Environmental Risk Assessment and Interactions of Marine Aquaculture* – ERAIMA). A proposal along these lines is described in greater detail in *SG-MAR Endnote 5*. The application of risk assessment to issues identified in the PICES region could not only be a unifying approach for PICES groups focused on aquaculture but also with ICES and other international efforts.

Given the priorities of PICES member countries, SG-MAR also recommends forming a PICES Working Group to focus on *Technology and Management for Aquaculture* (TMA). A more complete description of the proposal appears in *SG-MAR Endnote 6.*

We should wait until after the 2008 ICES/PICES workshop before adopting final terms of reference and action plans for either of these groups. There would be an emphasis on the development of technology and an assessment of the impacts of those technologies on the environment by both groups, with a goal of encouraging technologies that have both an economic and environmental benefit.

To avoid the difficulties faced by WG 18, the Study Group recommends that the terms of reference for these new groups be finalized by the members themselves, using the draft terms provided in *SG-MAR Endnotes 5* and *6*, and this report as a guide. Opportunities may exist at PICES XVII (Dalian, China, October 2008), at the World Aquaculture Society Meeting (Busan, Korea, February 2008) or at the World Fisheries Congress (Yokohama, Japan, October 2008) to attract aquaculture scientists to these groups.

Although a recommendation for reporting relationships for these proposed Working Groups is beyond the scope of the terms of reference for SG-MAR, it is included for consideration. These Working Groups could report to the existing PICES Committees, with ERAIMA falling under MEQ, and TMA under FIS. Alternatively, there may be some advantage of forming a new Committee focused solely on aquaculture, or they could have joint support by MEQ and FIS.

SG-MAR Endnote 1

SG-MAR membership

Dmitry Galanin (Russia)
Galina S. Gavrilova (Russia)
Toyomitsu Horii (Japan)
Jie Kong (China)
Hyun Jeong Lim (Korea)
Michael B. Rust (U.S.A., Chairman)
Terri Sutherland (Canada)

SG-MAR Endnote 2

E-mail to members of Working Group 18 on
Mariculture in the 21st Century – The Intersection between Ecology, Socio-economics and Production

Dear PICES WG 18 member,

I am writing you for two reasons. First to provide you with a copy of the final reports for the WG 18 meeting (with recommendations) and the Topic Session on "*Aquaculture and sustainable management of the marine ecosystems*" held at PICES XV in Yokohama, Japan. These are both attached. I am happy to discuss either of these two documents if you have any questions.

Second reason is to ask for your thoughts on how the Working Group could have been more productive. As most of you know, WG 18 was dissolved by the Governing Council at their meeting in Yokohama largely due to a perception on the part of MEQ that the group was not meeting its terms of reference. A Study Group was formed: (1) to determine why the terms were not met, and (2) to recommend what PICES role in aquaculture should be in the future.

As the last activity of WG 18, I would appreciate hearing your thoughts on these two items to provide guidance to this new Study Group. It will help PICES become a more effective Organization. I will keep all responses anonymous and will just provide a general result with suggestions to the Study Group. The Study Group is formed for only one year and will deliver its report this fall at the Annual Meeting in Victoria, Canada.

Thank you for your time and help with this matter. It has been a pleasure working on WG 18 with you all. I hope we will have a chance to work together again.

Mike

Michael B. Rust, Ph.D.
Northwest Fisheries Science Center
2725 Montlake Blvd E
Seattle, WA 98112 USA

SG-MAR Endnote 3

E-mail to members of Study Group on *Marine Aquaculture and Ranching in the PICES Region*

Dear Marine Aquaculture Study Group,

First of all, let me welcome you all to the PICES Study Group on Marine Aquaculture. I look forward to our dialogue over the next 8 months. As a Study Group we have limited time to produce a document and presentation addressing our terms of reference. According to the PICES Rules of Procedure (Rule 15):

"A Study Group is established by the Council or an Executive Committee, with the approval of the Council, for a period not normally exceeding one year, with specific terms of reference, to consider any scientific, policy, advisory and/or financial issue of interest to the Organization and to provide recommendations thereon. A Study Group:

(i) shall normally consist of members appointed by the Contracting Parties, and by the Council;

(ii) shall establish one Chairman according to Rule 17;
(iii) shall be disbanded after submitting their final report and recommendations."

We have been asked by PICES to provide some guidance on what PICES' role should be in aquaculture science. Specifically our terms of reference are:

1. To review and access why WG 18 had limited success in achieving its terms of reference;
2. To determine the highest priority marine aquaculture and/or ocean ranching science needs (< 10) for the next 5–10 years in each PICES member country;
3. To develop recommendations for joint activities in marine aquaculture and/or ocean ranching using the PICES Action Plan format;
4. To provide its draft report by September 2007 and be prepared to discuss and finalize the report at PICES XVI (October 2007, Victoria, Canada).

I would like to address these one at a time and propose that we get started as outlined below. Let me know your comments and concerns.

TOR #1: To review and access why WG 18 had limited success in achieving its terms of reference

I would like this group to spend the least amount of time on this issue. I have already sent an e-mail to the members of WG 18 asking for their input on this. When I hear back from most of WG 18, I will summarize this and include it in the report. Those of you who were on WG 18 and are also on this SG, please respond to my other e-mail and then help me to review the draft of the report that I will send out this spring, once I have input from the WG 18 members.

TOR #2: To determine the highest priority marine aquaculture and/or ocean ranching science needs (< 10) for the next 5–10 years in each PICES member country

I think this will be the most important and rewarding part of our work. I would like to approach this in the following manner. By April 2nd, I would like to have each member send me a short list with justification of the top 10 priorities for the next 5–10 years from your own countries' point of view. By the end of April, I will incorporate these into a draft to circulate back to you. I would then like to have an e-mail discussion to develop the final list and justifications. Please feel free to seek the input of your countrymen and others on this topic. In discussions with John Stein, PICES Science Board Chairman, this appears to be the most important part of our work. I would like to be mostly finished with this part by the end of May so we have time to devote to TOR 3.

TOR #3: To develop recommendations for joint activities in marine aquaculture and/or ocean ranching using the PICES Action Plan format

First of all, I had to look up what the PICES Action Plan format was. I have attached the Action Plans for MEQ and FIS (the original parent committees for WG 18) for your information. They basically have four parts: 1) a Mission Statement, 2) a Strategy Statement, 3) a list of goals and 4) Actions to achieve the goals. The work we do under TOR 2 should relate to our list of goals. So the main effort under this item is to come up with actions to achieve the goals. Once those are in place, the mission and strategy should be fairly easy to write. I would like to have this part done by the end of June. We should be able to do this with an e-mail discussion. I will try to capture the ideas and add them to the draft and have the "complete" first draft by mid-July. This should allow time for each SG member to circulate the draft, provide input and edits long before the document is due in September and the presentation in October.

TOR #4: To provide its draft report by September 2007 and be prepared to discuss and finalize the report at PICES XVI (October 2007, Victoria, Canada)

Note the document is due in September. I have a very busy late summer (August–September), so it will be difficult for me to complete the document if we delay the time schedule. The PICES Annual Meeting is in October. I plan on attending, and hope most of the group can also be there. If anyone wants to volunteer to give the presentation let me know. We can work on the presentation in September.

For now the first deliverable that we need to work on is for TOR 2 above. Please compile a list of the top 10 priorities for the next 5–10 years from your own countries point of view. Then please add a short explanation of why they are high priority. You should not feel constrained to considering environmental impacts of aquaculture for this exercise. This is due to me by April 2, 2007. I plan on also calling some colleagues in Europe to determine what our sister organization, ICES, has as priorities in aquaculture and will provide a short summary.

Finally, I have attached a copy of the PICES Strategic Plan and added the link to our study group at the bottom of this message. The PICES Strategic Plan might help in framing your thoughts as we get going. Thank you all for agreeing to participate on this Study Group. I look forward to hearing your thoughts!

Sincerely,

Michael B. Rust Ph.D.
Northwest Fisheries Science Center
2725 Montlake Blvd E
Seattle, WA 98112 USA

http://www.pices.int/members/study_groups/SG-MAR.aspx

SG-MAR Endnote 4

Aquaculture priorities (unedited) for the next ten years provided by PICES member countries

Countries are not identified and no priority is implied by the order in which the priorities appear in the following.

Development of efficient technologies to grow bivalves, echinoderms, algae, and salmons with additional commodity output and to restore the abundance of valuable commercial species. The development of both intensive (farm) and extensive methods of cultivation is planned. At the present stage, hydrocole cultivation technique is mastered and the conditions (including trophic ones) for the accelerated production of biomass have been provided.

Ecological aspects
For working-out of strategies of the sustainable development of marine aquaculture within the coastal waters, the potentialities of the water areas should be assessed taking into account their carrying capacity for different trophic groupings of hydrocoles (filter feeders, detritophages, phytophages). It is also necessary to perform a zoning of the coast and to provide the possible schemes of poly-cultural farms of mariculture under different conditions of the coastal areas.

Assessment of risks in the mariculture activities which can be combined into climatic, ecological and economic groups.

Monitoring of environmental factors
In these days, global warming is the most serious problem worldwide. It brought on a lot of changes of environmental factor. These changes also lead to the variation of oceanic ecosystem and also produce change of carrying capacity in specific area. According to this result we must choose what species are appropriate releasing species and what kind of ranching we make. Therefore first of all, we need monitoring of environmental factors.

Estimation of carrying capacity
To develop marine ranching places, we have to estimate the carrying capacity of objective area. Because when we know the exact carrying capacity, we can decide the releasing amount of fisheries resources, artificial reefs and also how

much we have to increase the productivity in coastal area.

Estimate the amount of natural resources

To perform the marine aquaculture and/or ocean ranching, we should estimate the biomass. We can determine it by the investigation of the fisheries capture amount, species, and size in which we are supposed to make marine ranching places. After those investigations, we can decide the TAC (Total Allowance Catch) more exactly, and also we can decide the capture size and time of releasing fisheries resources.

Examine the effect of discharged resources

At first we have to know appropriate feeds amount for releasing fisheries resources and sustaining ecosystem. We also have to release the fisheries resources when they can adjust their releasing environment through the adjustment periods. If we discharge the resources, we have to monitor the effect of those releasing seeds whether they have some effect in their releasing region.

Provision of self-regulation for fisheries resources management

Most of all, to perform the marine ranching places; it is the important thing, which the fisherman has to have provision of self-regulation for fisheries resources management. If they control their capture amount, size and periods for resources management by themselves, we can perform the marine ranching program very effectively.

Development of alternative income sources for fisherman

To avoid excessive capture, we need development of alternative income sources for fisherman. When they have another income sources in the sea, they will make an effort to sustain ocean resources. Therefore we are considering about the developing of alternative income sources by formation of ocean tourism and leisure industries in the place of marine ranching. It also need infrastructure to make tourist city.

Diseases of aquatic organisms

Investigating disease transmission (bi-directional) between wild and cultured stocks and developing aquaculture vaccines.

Improve disease diagnostics and control

Medical-prophylactic measures in mariculture farms and plantations take on special significance in connection with expanded cultivation. The necessary research studies are: 1) prophylaxis, diagnostics, treatment of infections and immune resistance elevation of marine hydrocoles under conditions of the farm cultivation; 2) micro-biological and eco-toxicological monitoring of the coastal waters condition within zones of commercial plantations of mariculture. Estimation of physiological state of marine hydrobionts under conditions of aquaculture farms and wild populations.

Modeling aquaculture in the ecosystem

Developing biological and oceanographic models, collecting lab and field data to allow prediction of ecological effects (near and far-field) of aquaculture, and determining carrying capacity of aquaculture areas.

Environmental risk assessment

Assessing the risk of genetic and ecological interaction between cultured, enhanced (*e.g.*, hatchery) and wild fish, developing technology to minimize wild/cultured fish interactions, and assessing efficacy of captive breeding programs for endangered stock rebuilding.

Assessing the impact of aquaculture on species at risk

Culture technology development

Developing high-efficiency, environmentally-friendly, and industry-diversifying culture technologies for salmon, alternate fish, shellfish, and algal species.

Biotechnology

Using biotechnology, genomics, and genetics to improve commercially important traits (*e.g.*, growth and reproduction) and assess changes from wild type for use in risk assessments.

Develop and establish technical and economic feasibility with special emphasis on hatchery development, land based and offshore production systems to support commercial marine aquaculture and enhancement of wild stocks.

Assess environmental impacts of current marine aquaculture production systems and species, including fish and shellfish for both commercial marine aquaculture and enhancement of wild stocks.

Conduct nutrition research involving alternative protein based diets and influence of diet on product quality.

Develop environmental models and GIS tools to aid site selection for new facilities.

Develop technical, hands-on training programs in marine hatchery operations and management to support commercial marine aquaculture and enhancement of wild stocks.

Develop synthesis papers (*i.e.*, executive summary and journal publication) for the following topics: a) environmental impacts of marine production systems; b) alternative protein feeds and potential impacts; and c) disease transmission from aquaculture to wild stocks and *vice versa*, and status of ecologically acceptable treatments and preventives; and genetic technologies and environmental risk analysis.

Improve stock enhancement technology to minimize damage to ecosystems and bio-diversity.

Evaluate the effect of stocking on resource fluctuations and improve effectiveness of stocking.

Develop marine polyculture (multi-tropic level aquaculture) with a combination of finfish, shellfish and seaweeds.

Improve seed production (hatchery technology) for difficult species such as eel and greater amberjack.

Develop alternatives to fish meal for diets.

Develop automated feeding systems to reduce cost and improve efficiency.

Develop open ocean cage culture technology (off-shore aquaculture).

Develop bluefin tuna culture technology.

Develop selective breeding technology to improve disease resistance, improve growth, improve efficiency and so on.

SG-MAR Endnote 5

Proposal for a Working Group on
***Environmental Risk Assessment and Interactions of Marine Aquaculture* – ERAIMA**

Mission

Develop standard methods and tools to assess and compare likelihood and severity of the environmental impacts of aquaculture. Make recommendations on how to improve highest risk aspects of aquaculture. Develop models to predict and manage aquaculture activities within the carrying capacity of the environment.

Strategy

To hold a joint workshop and training session with the ICES Working Group on *Environmental Interactions of Mariculture* (WGEIM) to develop risk assessment expertise in the PICES region. Hold a follow-up session on carrying capacity of commercial aquaculture. The session would highlight models to predict carrying capacity of commercial aquaculture that can be used for management. Final results to be reported in a white paper and published as a PICES Scientific Report. Maintain contact with ICES on this topic and consider recurring joint meetings.

Goals and actions

1. To develop and standardize risk assessment methods applied to environmental aspects of aquaculture.
2. To hold a joint meeting with ICES in April 2008. This meeting will review a number of issues related to mariculture under the broad themes of sustainability, climate change and marine spatial planning. More specifically, some proposed areas of discussion could include:
   a. Sustainable development – the precautionary approach, uncertainty and risk assessment/risk analysis, indicators of sustainability;
   b. How good is our ability to predict far-field effects and carrying capacity?
   c. Opportunity costs associated with decisions not to allow development;
   d. Adoption/integration and application of risk assessment techniques to PICES region aquaculture industries.
3. To hold a scientific session at PICES XVIII (2009, Korea) on "*Estimation of environmental carrying capacity for commercial aquaculture*" (Convenors TBD). Papers from this session to be published in the PICES Scientific Report series or a journal.
4. Develop a white paper with recommendations on how to improve highest risk aspects of aquaculture. The white paper would also review state of knowledge of tools for risk assessment (Impact models? Carrying capacity models, *etc*.? Can they be applied to the North Pacific?) and make recommendations for the next steps needed to deal with risks from marine aquaculture to the environment. Publish the white paper as a PICES Scientific Report.

SG-MAR Endnote 6

Proposal for a Working Group on *Technology and Management for Aquaculture* – TMA

Mission

To identify and improve aquaculture technologies with the potential for economic and environmental benefits (eco-effective technologies).

Strategy

To hold a joint workshop on technologies and management approaches that has the potential to improve the economic and environmental performance of commercial aquaculture industries and stocking programs. The Working Group will use focused symposia to articulate and improve such technology and approaches.

Goals and actions

1. Based on the prioritized areas developed under SG-MAR TOR #2, hold a symposium on the top areas for commercial and enhancement aquaculture (technology and husbandry development and evaluation of stocking) with the goal of articulating the "state of the art" in each area and providing recommendations for improving the economic and environmental performance of such technologies.
2. To convene a Topic Session at PICES XVII (2008, Dalian, China) on "*Mariculture technology and husbandry for alternate and developing culture species*" (Convenors: Jie Kong and TBD). Papers from this session to be published in the PICES Scientific Report Series or in a journal. Also conduct a 1-day laboratory demonstration, tour or workshop on a topic that is special to China.
3. To hold a session/workshop at PICES XVIII (2009, Korea) on "*Evaluation of stocking technologies to rebuild, and sustain capture fisheries*" (Convenors TBD). Papers from this session to be published in the PICES Scientific Report series or in a journal.

REPORT OF STUDY GROUP ON SCIENTIFIC COOPERATION BETWEEN PICES AND NON-MEMBER COUNTRIES

Terms of reference

At PICES XV (October 2006, Yokohama, Japan), a Study Group on *Scientific Cooperation between PICES and Non-member Countries* (hereafter SG-SC) was established under the direction of Governing Council (Decision 06/A/6), with terms of reference as follows:

1. The Study Group will identify options and propose mechanisms for scientific cooperation between PICES and non-member countries, within the current Convention. The options considered will include a review of the ICES "Affiliate Status" arrangement and how it could be adapted to the needs of PICES. Benefits and drawbacks should be identified for each option in terms of the following:
   - scientific objectives of PICES;
   - financial/human resources implications;
   - needed changes to the PICES Rules of Procedure and Financial Regulations.
2. The Study Group will assess the benefits and challenges in terms of the scientific objectives of PICES of expanding the "area concerned", as specified under Article II of the Convention, to the Southern Pacific, and should provide a compilation of all countries' views on such a change to the Convention.
3. The Study Group should provide its report to Governing Council by August 15, 2007, for consideration at PICES XVI in Victoria (October 2007).

Membership

It was agreed that the Study Group will be chaired by the Chairman of the Finance and Administration Committee (Dr. Laura Richards), and its membership will include one representative from each Contracting Party, plus a representative from Science Board and a representative from the Secretariat. The full approved SG-SC membership is listed below:

Harold P. Batchelder (Science Board)
Alexander Bychkov (PICES Secretariat)
Alexandra Curtis (U.S.A.)
Chris Hemmingway (Canada)
Oleg Katugin (Russia)
Seok Jin Kang/Kyoung Jin Kim (Korea)
Hideki Nakano (Japan)
Laura Richards (Canada, Chairman)

Background

Atmospheric and oceanic processes in regions beyond the PICES area of concern affect North Pacific marine ecosystems and their dynamics. Many of the issues addressed by PICES are not unique to the North Pacific. These realities led to an idea that expanded cooperation between PICES and scientific institutions in other regions of the Pacific Ocean might serve their mutual interests. In recent years, it has become evident that scientists from these regions have the background and expertise to contribute in a meaningful way to PICES activities.

For the past several years, the Organization has attempted to interest Mexico in acceding to the PICES Convention. Details can be found in the 1999–2005 Annual Reports. While Mexican scientists are enthusiastic, no progress was made, perhaps due to economic and other factors. Scientists from other countries (*e.g.*, Australia and New Zealand) also participate relatively regularly in PICES Annual Meetings and make valuable contributions to events. However, these countries would not likely be interested in acceding to the PICES Convention because of the Area of Concern, which is specified in Article II as:

> "The area which the activities of the Organization concern shall be the temperate and sub-Arctic region of the North Pacific

> Ocean and its adjacent seas, especially northward from 30 degrees North Latitude, hereinafter referred to as the "area concerned". *Activities of the Organization, for scientific reasons, may extend farther southward in the North Pacific Ocean*." (emphasis added)

While the Convention allows the scientific activities of PICES to extend beyond the precise boundaries of the area concerned, the Convention does not expressly address activities south of the North Pacific Ocean. Thus, there is limited incentive for countries bordering the South Pacific Ocean to become full members of PICES without changing the Convention. Of course, if PICES continues to grow in prominence in Pacific marine science, others may become more interested in joining in the future.

The current Rules of Procedure allow for non-member State participation in PICES activities as follows:

- As *ex officio* members on Advisory Panels with the endorsement of Science Board and approval of Council (Rule 13(iv));
- As registered participants at Annual Meetings, as attendees at meetings of any group, except where participation has been limited by Council or is limited in the Convention or Rules of Procedure (Rule 20(iv));
- As attendees at Science Board or Finance and Administration Committee meetings upon invitation of the Chairman of Council or the Chairman of Science Board or Finance and Administration Committee, respectively (Rule 20(iii));
- Upon invitation by Council or an Executive Committee, as attendees to all or part of the meeting of Council or Executive Committee (Rule 20(v)).

To be explicit, the current rules do not allow scientists from non-member States to be members of any group except an Advisory Panel. These scientists can attend Annual Meetings and other events, and participate in the discussion and influence the decisions of most committees and groups. However, should a decision come to a vote, they are not eligible to participate. They are also not eligible for financial support from the PICES Trust Fund.

SG-SC was established to explore options for broadening the scope of scientific participation within PICES and to consider the consequences to the Rules of Procedure and/or Convention that would be required to facilitate this change. In particular, SG-SC was asked to review the ICES model of affiliate status for scientific institutions in non-member States.

View on changes to the PICES Convention

Based on responses from Study Group members, there is no interest at this time in pursuing a discussion around changes to the Convention. SG-SC recommends fully exploring options and mechanisms for broadening participation by non-member State scientists that are possible "within the current PICES Convention" before beginning to explore alternatives that would require modifications to the Convention.

Options for scientific cooperation within the current Convention

<u>Expanding cooperation with other organizations</u>

a. Organization of symposia, workshops, and publications with appropriate inter-governmental organizations (IGOs) or non-governmental organizations (NGOs) or on topics of importance to PICES that would benefit from the expertise of that organization;
b. Development of Memoranda of Understanding (MOU) with appropriate IGOs or NGOs that focus on other areas of the Pacific to allow cooperation on topics of importance to PICES that would benefit from the expertise of that organization, *e.g.*, through joint research plans and programs. PICES already has MOUs with ICES, IOC, NPAFC and IPHC.

These options are consistent with current operating arrangements within PICES. The desirability and cost of entering into any such arrangement are reviewed and approved (or rejected) during the annual planning process of Standing Committees and Scientific Programs

and their subsidiary groups, Science Board, Finance and Administration Committee and Council.

Expanding cooperation with non-member States

a. Inviting scientists of non-member States as speakers at PICES-sponsored events. PICES may contribute to the cost of participation through the budget allocated to that specific event. However, the number of invited speakers is limited, and PICES may choose to give priority to scientists from member States.
b. Encouraging scientists of non-member States to participate in Annual Meetings and to sit on Advisory Panels as allowed within the current Rules of Procedure. In this case, full costs of participation would be borne by the home State or institute.
c. Amending the Rules of Procedure to allow scientists from non-member States to serve as members of Standing Committees and their subsidiary groups, Scientific Programs and their subsidiary groups, and Study Groups, as recommended by Science Board and approved by Council. The amended Rules should also specify that affiliate members not be counted toward the quorum of any group.

ICES affiliate model

The ICES affiliate model, based on one institution per country, could be adapted to the PICES structure and requirements. The obligations and conditions of affiliate status could be similar to those specified in the ICES Affiliate Policy document, including a financial contribution as approved by Council to defray additional costs to the Secretariat. The privileges of affiliate status could, with suitable amendments to the Rules of Procedure, include participation on Standing Committees and their subsidiary groups, Scientific Programs and their subsidiary groups, and Study Groups, except as limited by Council. Such participation would be subject to the same limits as for Contracting Parties on numbers of appointees allowed per affiliate, and would normally exclude voting privileges and the ability to hold chairmanship positions.

Under the ICES affiliate status, "*a named institute or organization in a country is given the responsibility of representing the interests of that country within ICES, and of making all the advantages available to all relevant scientists in that country, not just the people in their own institute. The affiliate countries each pay an annual contribution which is about 1/12 of the minimal national contribution for a Member Nation*." There are several privileges conferred by acceptance of affiliate status: 1) scientists from affiliates may participate in most subsidiary committees of ICES; 2) participation by scientists representing affiliates in the ICES Annual Science Conference, symposia and publications of ICES shall be in accordance with the same conditions applying to scientists from member countries; and 3) ICES affiliates shall receive copies of a large subset of ICES publications (ICES Annual Report, Research reports, Study/Working Group reports, and ICES Newsletter).

If PICES were to institute a similar "affiliate" status, then a possible scenario is as follows:

a. The affiliate institute would make a financial contribution to PICES to support the operation of the Organization, but the contribution could be substantially less than the contribution of the six Contracting Parties, for example, 10% of the current annual fee per Contracting Party.
b. Scientists from affiliated institutes could be members of a Scientific Program (*e.g.*, CCCC), Scientific Committee (*e.g*., BIO, FIS, MEQ, POC), or Technical Committee (*e.g.*, TCODE, MONITOR). They could not be a Chairman.
c. Scientists from affiliate institutes could be full members on Sections, Task Teams, Study Groups, and Working Groups of PICES. They could also chair any of these groups. In the case of an affiliate Chairman, however, a Co-Chairmen arrangement would be preferable with one of the Co-Chairman from a Contracting Party. For Study Groups, the Rules of Procedure would need to be amended to allow for Co-

Chairmen (*i.e.*, one Chairman is sufficient if that person is from a Contacting Party; otherwise a Co-Chairman should be chosen who meets the geographic balance requirements).

d. The Rules of Procedure could be amended to allow scientists from affiliate institutes to participate as members of Groups in addition to Advisory Panels. The specific privileges of participation would need to be resolved for each type of group, depending on the needs of the Organization.

e. As per the current Trust Fund guidelines (iii), scientists from affiliate institutes would not be eligible to apply for financial support to participate in PICES activities. The affiliate institute would be expected to cover the costs of their scientists' participation.

REPORT OF IMPLEMENTATION PANEL ON THE CCCC PROGRAM

The Executive Committee of the Climate Change and Carrying Capacity Program Implementation Panel (hereafter CCCC-IP/EC) met from 14:00–16:30 hours on October 28, 2007. The meeting was chaired by Drs. Harold P. Batchelder and Michio J. Kishi. The Co-Chairmen welcomed the attendees and after brief introductions of those present (*CCCC Endnote 1*), the agenda was reviewed and adopted with slight modifications (*CCCC Endnote 2*).

Business from PICES XV (Agenda Item 3)

The minutes from PICES XV (October 2006, Yokohama, Japan) were accepted. No other items on-going from last year's meeting required discussion.

Review of procedures for Best Presentation Awards and Closing Ceremony

Awards for CCCC best oral and poster presentations were announced at the Closing Session. The PICES Secretariat provided a list of oral presentations in CCCC-sponsored sessions (Topic Sessions S3 and S5 and CCCC Contributed Paper Session) that were eligible for this award. Drs. Kishi and Batchelder agreed to serve as judges to determine the best CCCC oral presentation. Due to a conflict between the Topic Session S5 and the CCCC Contributed Paper Session (convened by both Co-Chairmen), Dr. Vera Agostini agreed to evaluate the oral presentations from Session S5. Drs. Suam Kim, Agostini, Thomas C. Wainwright and Batchelder agreed to select the CCCC Best Poster Award for PICES XVI. CCCC-IP/EC gave two Best Presentation Awards in 2007; one to Tadanori Fujino (Hokkaido University, Japan) for his presentation on "*Regime shift of mesopelagic fish – Long-term biomass index change of* Maurolicus japonicus *in the Japan/East Sea*" (co-authored by Kazushi Miyashita, Yasuma Hiroki, Tsuyoshi Shimura, Shinya Masuda and Tsuneo Goto) in the CCCC Contributed Paper Session, and the second to Motoko R. Kimura (Hokkaido University, Japan) for her presentation on "*A breakdown of habitat isolation among coastal fish by artificial habitat modification*" (co-authored with Hiroyuki Munehara) in the Topic Session S5. Shusaku Kobayashi (Hokkaido University, Japan) won the CCCC Best Poster Award for his paper on "*Brown trout (*Salmo trutta*) movements between a stream and the sea in Hokkaido, northern Japan*" (co-authored with Takaomi Arai, Kentaro Honda, Yuji Noda and Kazushi Miyashita).

Documentation of scientific sessions (Agenda Item 4)

CCCC-IP/EC discussed responsibilities for documenting CCCC-sponsored scientific sessions and workshops at PICES XVI. Dr. Batchelder reminded the Committee that documentation of scientific sessions and workshops is required from session/workshop convenors. At PICES XVI this responsibility rests with: Mr. Jake Schweigert for the CCCC/FIS Topic Session (S3) on "*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*"; Dr. Kerim Y. Aydin (who delegated responsibility to Dr. Elizabeth A. Logerwell) for the FIS/CCCC/BIO Topic Session (S5) on "*Fisheries interactions and local ecology*", Dr. Batchelder for the CCCC Contributed Paper Session, and Dr. Jacquelynne King for the POC/CCCC workshop (W6) on "*Climate scenarios for ecosystem modeling*". These session and workshop summaries were provided either to Dr. Batchelder or directly to the PICES Secretariat by the end of Friday, November 2, and are included in the *Session Summaries* chapter of this Annual Report.

Progress reports of Task Team activities (Agenda Item 5)

CCCC-IP/EC received brief oral reports of CCCC Task Team activities from the Co-Chairmen or representatives of MODEL (Conceptual/Theoretical and Modeling Studies Task Team) and CFAME (Climate Forcing and Marine Ecosystem Response Task Team). By November 2, both Task Teams provided written reports with a summary of progress made since PICES XV and recommendations for planned activities for 2008 (for details see MODEL and CFAME reports included elsewhere in this Annual Report).

Items of significance reported for CFAME were:

- An overview of the CFAME inter-sessional workshop (May 2007) on "*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*" where an approach was developed to enable comparison of climate forcing variables and mechanisms linking climate and key species in the California Current, Oyashio/Kuroshio, and East China Sea/Yellow Sea ecosystems;
- An overview of the recently completed 2-day workshop (October 26–27, 2007) on "*Climate scenarios for ecosystem modeling*" to develop and facilitate collaborations between CFAME and Working Group 20 on *Evaluations of Climate Change Projections* on forecasting the impacts of climate change (as represented by IPCC projection scenarios) on regional ecosystems and species of the North Pacific (the workshop was well attended, with ca. 50 participants from all PICES member countries);
- An 8-step plan for completing CFAME work in preparation for the conclusion of the CCCC Program following the 2008 PICES Annual Meeting (including workshops highlighted in the next two bullets);
- A proposal for an inter-sessional workshop (April 2008) on "*Linking and visualizing climate forcing and marine ecosystem changes: A comparative approach*" to examine the revisions made in each set of ecosystem mechanism tables for the three selected ecosystems after the 2007 CFAME workshops, and to review draft versions of the graphic representations of ecosystem mechanisms and climate/ocean scenarios provided by WG-20 prior to the workshop (*CFAME Endnote 3*);
- A proposal for a 1½-day workshop at PICES XVII on "*Climate scenarios for ecosystem modeling (II)*" to discuss the results from research activities related to applying output from WG 20 regional climate models and IPCC global models to CFAME ecosystem models and present them to the broader PICES community, with an emphasis to leading into FUTURE (*CFAME Endnote 4*);
- Discussion of the FUTURE Science Plan, with the following key recommendations: (1) to sustain the recent momentum in transitioning from the CCCC Program to FUTURE by supporting projects begun by CFAME and MODEL; (2) to give greater emphasis in FUTURE to ocean acidification, since it is viewed as an emerging and important societal issue; (3) to link FUTURE to a new U.S. activity on "*Comparative Analysis of Marine Ecosystem Organization*" (CAMEO), which has a strong marine resource management focus.

Items of significance reported for MODEL were:

- A new project proposed by Dr. Kishi on "*Bottom-up ecosystem-based management modeling using NEMURO and NEMURO.SAN*" (BUMBAM.NEMURO) to transition existing PICES ecosystem models into management analysis, and also to link NEMURO suite models with management-oriented models such as Ecopath with Ecosim;
- A proposal for a 1-day CCCC/POC Topic Session at PICES XVII on "*Marine system forecast models: Moving forward to the FUTURE*" with focus on multi-disciplinary coupled models designed to forecast marine systems in the PICES region, including both strategic (long-term) and tactical (short-term) forecasts linking across two or more disciplines (*MODEL Endnote 3*);
- A new PICES project proposed by Dr. Bernard A. Megrey on "*Marine ecosystem model inter-comparisons*" whose goal is quantitative comparison of different

structures and parameterizations of ecosystem models using identical physical forcing (*MODEL Endnote 4*);
- A proposal for a 1-day CCCC/ESSAS workshop at PICES XVII to launch the project on "*Marine ecosystem model inter-comparisons*" (*MODEL Endnote 5*);
- Opportunities for collaborative research under the pan-regional synthesis phase of U.S. GLOBEC and a new U.S. CAMEO initiative.

FUTURE Science Plan (Agenda Item 6)

CCCC IP/EC members reviewed the draft Science Plan (version 4.2) for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems). There was a general consensus that the direction of the proposed program is good, and that the focus is consistent with past and ongoing activities of the CCCC Program. Two major differences between CCCC and FUTURE are the emphasis on forecasting and on education, communication and outreach in the latter. FUTURE is consistent with the planned activities of MODEL and CFAME, and it is envisioned that the activities of these two Task Teams could easily be transitioned to, or transformed in, some fashion to be a part of the new program. Below are some specific comments on the FUTURE Science Plan that were presented at the Open Forum during PICES XVI:

1. The Science Plan's generic goals are understanding, forecasting, and communication. The document needs better balance of these three core elements. The present document overemphasizes the forecasting element relative to an apparent underemphasis on understanding and communication.
2. The Executive Summary and text overemphasize "models" as deliverables. Models are a tool to understanding and a means to provide forecasts; the deliverable should be scientific assessments of future conditions through improved understanding of mechanisms and incorporation of those mechanisms into forecast models.
3. Many different types of models are advocated in the current Science Plan—coupled climate–ocean models; coupled biophysical models; management models; ecological models that integrate across disciplines; perhaps socio-economic modeling of potential impacts of climate change scenarios. The emphasis on models of many kinds may require multiple modeling Task Teams, as in some cases the communities of scientists needed to do this modeling are greatly different or have not been previously involved in PICES.
4. Lack of mechanistic understanding of how climate is linked to the biology of key higher trophic level species will limit the ability to estimate impacts on fish from projected future climate scenarios. There should be an increased emphasis in the Science Plan on some short-term achievable goals.
5. The strategy-specific approach table near the end of the plan (retrospective, monitoring, *etc.*) is more appropriate to an Implementation Plan than to a Science Plan. A Science Plan should provide the vision, short- and long-term objectives, and rationale for the projected research that might occur under FUTURE. Details should be deferred to the Implementation Plan. The CCCC IP/EC members suggest deleting this detail from the Science Plan.
6. CFAME suggests that perhaps "ocean acidification" issues might be emphasized more in FUTURE than it is in the present version. It is possible (and even suggested) that changes in ocean acidity may be impacted by source waters, which may be "predictable" from climate projections coupled to regional circulation models. The severity of acidification-related impacts on ocean ecology might therefore be predictable.
7. Focus the early sections of the Science Plan on some of the positives rather than emphasizing the "doom and gloom" aspects of global warming. Global warming might lead to conditions that present new opportunities—perhaps new fisheries or expansions of species into new ranges, which might need scientific advice. The document needs a better balance of positives

and negatives (although it is likely that negatives will dominate, no matter what).

8. PICES scientific programs should, in general, emphasize "ecosystems", not just the fish populations within ecosystems. It has been difficult to attract and entrain physical oceanographers into some activities of PICES, perhaps because PICES and the CCCC Program are viewed more as a fish program than as an ecosystem program. The FUTURE Science Plan should maintain an emphasis on climate forcing and its impacts on marine ecosystems, not just on fish.
9. Many other comments received from the discussions held in the MODEL and CFAME meetings were guidance for implementation rather than Science Plan issues and are not summarized here, but were provided to the FISP Study Group.

Changes in CCCC-IP/EC and Task Team membership (Agenda Item 7)

CCCC-IP/EC thanked Dr. Aydin, current North American Co-Chairman of CFAME, for agreeing to continue in this position throughout the coming year for the purposes of inter-sessional work. However, he is unlikely to attend PICES XVII, so may ask that his responsibilities be delegated to another North American for that meeting.

MODEL noted that Canadian and Russian membership is poorly represented, but since the Task Team will be reorganized with the closing of the CCCC Program next year, there is no urgency to request new members at this time.

Proposals for new subsidiary bodies (Agenda Item 8)

The Executive Committee did not receive any proposals for new CCCC subsidiary bodies.

Planning for PICES XVII (Agenda Item 9)

The following sessions and workshops were proposed:

- a 1-day CCCC/POC Topic Session on "*Marine system forecast models: Moving forward to the FUTURE*" (*MODEL Endnote 3*);
- a CCCC Poster Session (*CCCC Endnote 3*);
- a 1½-day CCCC/POC workshop on "*Climate scenarios for ecosystem modeling (II)*" (*CFAME Endnote 4*); and,
- a 1-day CCCC/ESSAS workshop on "*Marine ecosystem model inter-comparisons*" (*MODEL Endnote 4*).

Theme proposal for PICES XVIII (Agenda Item 10)

CCCC-IP/EC has no specific suggestions for the Science Board Symposium theme at PICES XVIII (Busan, Korea).

Review of planned CCCC inter-sessional activities and travel support requests/ priorities (Agenda Item 11)

CCCC-IP endorsed a proposal by CFAME for an inter-sessional workshop on "*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*" (*CFAME Endnote 3*).

CCCC-IP/EC requests travel support for:

- 1 Korean scientist (Yellow Sea/East China Sea fish expert) and 1 North American scientist (California Current fish or plankton expert) to attend the CFAME inter-sessional workshop on "*Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach*" (priority level 1);
- 1 invited speaker for the CCCC/POC Topic Session at PICES XVII on "*Marine system forecast models: Moving forward to the FUTURE*"(priority level 1);
- 1 invited speaker for the CCCC/ESSAS workshop at PICES XVII on "*Marine ecosystem model inter-comparisons*" (priority level 2);
- 1 CFAME member to attend the 2008 ESSAS Annual Meeting in Halifax, Canada (priority level 3); it is noted that at least one CFAME member would already be attending as a current ESSAS member.

Report of the April 2006 CCCC Symposium (Agenda Item 12)

Dr. Batchelder reported on the status of the special issue resulting from the PICES/ GLOBEC Symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" (Co-conveners: Drs. Harold P. Batchelder and Suam Kim) held April 19–21, 2006, in Honolulu, U.S.A. A total of 90 scientists from 12 countries met in Hawaii. Nineteen papers were submitted for the special issue. Several have been rejected by reviewers and ~15 papers should be published, with a mix of papers on each of the three symposium sub-themes: (1) Regime shifts; (2) Ecosystem productivity and structural responses to physical forcing; and (3) Pan-Pacific comparisons. The target date for submitting the collection of recommended papers to the Chief Editor of *Progress in Oceanography* is January 2008.

CCCC Action Plan (Agenda Item 13)

No time was spent on this issue at the meeting, except for Dr. Batchelder suggesting that he will update the CCCC Action Plan using information provided by CFAME and MODEL.

Relations with other international programs and organizations (Agenda Item 14)

ICES and regional/national GLOBEC programs remain the highest priority relations for the CCCC Program. CCCC-IP/EC identified linkages with ICES, GLOBEC International, and the North Pacific Research Board (NPRB) as high priorities for the coming year. Also, there are several regional coastal observing programs in the Northeast Pacific (PaCOOS, PNW-IOOS, AOOS), as well as numerous programs in the Northwest Pacific (CREAMS, NEAR-GOOS, others), that PICES should maintain connections with. CCCC-IP must interact closely with NPAFC to address salmon issues of interest to the CCCC Program in the North Pacific.

Preparation of CCCC report to Science Board (Agenda Item 15)

Dr. Batchelder agreed to summarize the discussions and progress of CCCC for the near-term needs by Science Board and for the PICES Annual Report.

Other business (Agenda Item 16)

Projected CCCC publications

Proceedings from the 2006 PICES/GLOBEC Symposium will be published as a special issue of *Progress in Oceanography* in 2008 (Guest Editors: H. Batchelder and S. Kim).

A final report of the CCCC Program is expected to be published in the PICES Scientific Report series. It is likely that this report will be completed prior to PICES XVII. Drs. Kishi and Batchelder will take the lead on this, but anticipate asking for assistance from many of the past CCCC and Task Team Chairmen.

CCCC Endnote 1

Participation list

Members

Kerim Y. Aydin (U.S.A.)
Harold P. Batchelder (U.S.A., Co-Chairman)
William R. Crawford (Canada)
Suam Kim (Korea)
Michio J. Kishi (Japan, Co-Chairman)
William T. Peterson (U.S.A.)
Thomas C. Wainwright (U.S.A.)

Observers

Young-Shil Kang (Korea)
Yeong-Hye Kim (Korea)
Hyun-Jeong Lim (Korea)

CCCC Endnote 2

CCCC/IP-EC meeting agenda

1. Welcome and opening remarks
2. Adoption of agenda
3. Business from last year's meeting
4. Review of responsibilities for documenting CCCC Topic Sessions and workshops
5. Progress reports of Task Team (CFAME and MODEL) activities
6. PICES FUTURE Science Plan: Discussion and recommendations
7. Changes in CCCC-IP/EC and Task Team membership
8. Proposals for new CCCC subsidiary bodies
9. Planning for PICES XVII
10. Theme proposal for PICES XVIII
11. Review of planned CCCC inter-sessional activities and travel support requests
12. Report on the 2006 CCCC Symposium
13. CCCC Action Plan—Evaluation for accuracy; updating for CCCC activities
14. Relations with other international programs and organizations
15. Preparation of the CCCC report to Science Board
16. Other business

CCCC Endnote 3

Proposal for a CCCC Poster Session at PICES XVII

North Pacific ecosystems and their response to climate variability have experienced intense study through GLOBEC and similar programs over the past 10 years. The PICES Climate Change and Carrying Capacity (CCCC) Program addressed the question of "how do interannual and decadal variation in ocean conditions affect the species dominance, biomass and productivity of the key zooplankton and fish species in North Pacific ecosystems". Ultimately, a goal of the CCCC Program was to forecast possible consequences of climate variability on the North Pacific ecosystem. As the CCCC Program nears completion, it is worthwhile to examine the program's successes on addressing the key elements: climate change, carrying capacity, and forecasting. This evaluation will provide useful in moving forward with successor PICES integrative programs like FUTURE: Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems. We invite abstracts for posters that infer processes from patterns and link climate, ocean physics, populations and ecosystems. Provocative abstracts that retrospectively examine the successes and shortcomings of the CCCC Program are welcome, as are more traditional presentations on climate, ecosystems and forecasting.

Recommended convenors: Harold P. Batchelder (U.S.A.) and Michio J. Kishi (Japan).

REPORT OF CFAME TASK TEAM

The Climate Forcing and Marine Ecosystems Task Team (hereafter CFAME) met from 14:00–18:00 hours on October 27, 2007. Attending were 10 Task Team members and 6 observers (*CFAME Endnote 1*). The agenda was reviewed and adopted without changes (*CFAME Endnote 2*).

Review of accomplishments after PICES XV (Agenda Item 3)

May 2007 CFAME inter-sessional workshop

Dr. Kerim Y. Aydin provided an overview of the CFAME inter-sessional workshop on "*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*" held May 21–23, 2007, in Seattle, U.S.A., in which a methodology was discussed for forecasting changes in marine ecosystems from climate models (IPCC scenarios). At the workshop, an approach was developed for assembling and summarizing tables of forcing variables and intermediate mechanisms between global climate and marine species for the California Current, Oyashio/Kuroshio, and East China/Yellow Sea ecosystems. Initial drafts of these tables were created at the workshop and reviewed in the interim for presentation at the POC/CCCC workshop (W6) at PICES XVI.

PICES XVI CFAME workshop

Dr. Jacquelynne R. King provided an overview of the POC/CCCC workshop on "*Climate scenarios for ecosystem modeling*" held October 26–27, 2007, at PICES XVI in Victoria, Canada. The workshop was attended by 50 participants from all PICES member countries and included presentations from China, Korea, Russia, and the United States. The objective of this workshop was to facilitate discussion between CFAME and Working Group on *Evaluations of Climate Change Projections* (WG 20) on potential collaborative research on forecasting the impacts of climate change (as represented by IPCC projection scenarios) on regional ecosystems and species of the North Pacific. The workshop was opened with an overview of the terms of reference and workplans for CFAME and WG 20 by CFAME Co-Chairman, Dr. Aydin and WG 20 Co-Chairman, Dr. Michael Foreman. The overviews provided the context for overlap in research foci between these two groups. CFAME has focused on three North Pacific ecosystems that represent different dominant physical processes: (1) California Current System (boundary current with upwelling); (2) Kuroshio/Oyashio Current System (boundary currents); (3) Yellow Sea/East China Sea region (freshwater input). For each ecosystem, CFAME has developed conceptual models of the mechanisms relating climate forcing to the population dynamics of key species and to ecosystem processes. One of the goals for WG 20 is to facilitate analyses of climate effects on marine ecosystems and ecosystem feedbacks to climate by, for example, computing an ensemble of the IPCC model projections for the North Pacific and making these projections available to other PICES groups such as CFAME. The analyses could provide forecasts of regional parameters (such as sea surface temperature, sea ice cover, and river discharge) relevant to ecosystem processes identified within CFAME's conceptual models. Details of the workshop can be found in the *Session Summaries* chapter of this Annual Report.

Topic Sessions at PICES XVI

CFAME co-sponsored two sessions at this year's Annual Meeting: a 1-day CCCC/FIS Topic Session on "*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*" (S3) and a ½-day FIS/CCCC/BIO Topic Session on "*Fisheries interactions and local ecology*" (S5). Details of the sessions can be found in the *Session Summaries* chapter of this Annual Report.

Discussion of FUTURE and plan for research activities (Agenda Item 4)

The response of CFAME members to the Science Plan (version 4.2) for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems) was extremely encouraging. They felt that it well reflects PICES and also serves, in principle, as an excellent place to pick up from where the CCCC Program will leave off. However, in the absence of an Implementation Plan, CFAME members were concerned that there might not be a smooth transition, particularly, that momentum on projects begun by CFAME and MODEL might be delayed or abandoned. To this end, first, at least one "interim" activity was proposed by MODEL and CFAME (*MODEL Endnote 4*). Second, it was suggested that the Ocean Acidification topic within the FUTURE Science Plan might be ripe enough to pick up immediately, perhaps through a Working Group, although no specific project was proposed by CFAME.

Interactions with other groups on forecasting/ future efforts (Agenda Item 5)

ESSAS

Dr. George L. Hunt gave a presentation on the Ecosystem Studies of Sub-Arctic Seas (ESSAS). ESSAS is a GLOBEC regional program with attention to ecosystems with ice. The program has a 10-year lifespan and may become part of IMBER after GLOBEC is completed. Two ESSAS workshops on "*Evaluation of climate scenarios for subarctic regions*" and "*The role of seasonal sea ice cover in marine ecosystems*" were held in June 2007, in Hakodate, Japan, and co-sponsored by PICES. The second workshop resulted in two papers: one on hotspots and one on thresholds. The continuing theme in ESSAS is a modeling comparison of subarctic seas through Ecopath. There is also an upcoming University of British Columbia proposal through FAO (Food and Agriculture Organization) to provide funding for modeling all the Large Marine Ecosystems. Several comparative studies are underway, *e.g.*, NORCANN (Norway–Canada). Upcoming activities include a Theme Session on subarctic seas at the Ocean Sciences meeting in March 2008, in Orlando, U.S.A. An ESSAS Annual Meeting will be held in September 2008, in Halifax, Canada, and a request for travel for a CFAME member to this meeting was made (see Agenda Item 7).

CAMEO and ocean acidification initiative

Dr. Aydin gave a summary of some recent efforts and organizations which may be of interest to CFAME, including the U.S. NOAA CAMEO (Comparative Analysis of Marine Ecosystem Organization) program and initiatives on ocean acidification.

FIS forecasting workshops

On behalf of Dr. Anne B. Hollowed, Dr. Aydin gave a presentation on the inter-sessional FIS workshop, co-sponsored by PICES and NPRB, on "*Forecasting climate impacts on future production of commercially exploited fish and shellfish*" (July 19–20, 2007, Seattle, U.S.A) and plans for a follow-up workshop at PICES XVI. It was noted that, while the products of this workshop series differed from CFAME goals, and although they were excellent parallel efforts, much of the work plan developed from the first FIS workshop was similar or identical to work CFAME had performed or was currently completing. It is expected that results will be shared, but it was suggested that the best approach would be if FIS proposes a Topic Session leading on from this material at next year's Annual Meeting, and that a CFAME member be a co-convenor of this session (Dr. Gordon A. McFarlane was recommended to serve in this capacity). Due to the timing of the CFAME business meeting, no proposal for such a session was explicitly presented by FIS. Also, concern was expressed by members of WG 20 that the substantial work they were already performing for CFAME in extracting data from IPCC climate scenario models not be duplicated.

Planning for 2008 and beyond (Agenda Item 6)

CFAME work plan

The following 8-step plan was developed for completing CFAME work in preparation for the conclusion of the CCCC Program following next year's Annual Meeting. This plan was endorsed by CFAME members as a way to bring an excellent finale to this portion of the CCCC Program. Some of these steps are concurrent.

1. Team leaders for each set of ecosystem mechanism tables, Drs. Vera Agostini, Akihiko Yatsu and Young-Shil Kang (or a Korean invitee), will coordinate the review of details, providing explicit description of processes and definition of terms. Initial revisions can focus on 1–2 species (hake and sardine for the California Current; sardines and anchovy for the Kuroshio/Oyashio; hairtail and yellow croaker for the East China/Yellow Seas), but if possible, a revision will be attempted for all species that have already been completed. Drs. James Overland and Aydin will aid in this process by reviewing the tables and providing suggestions for what needs to be clarified and better defined by December 2007. The revised tables will be completed by April 2008.
2. Each ecosystem team will create graphic representations of our current knowledge of the physical processes impacting species' population dynamics. One graphic representation will be made for each of the three ecosystems, showing likely impacts under climate warming. Drafts will be prepared by April 2008.
3. CFAME will request from WG 20:
   a) Graphic representations of climate/ ocean states under climate warming for each of the three selected ecosystems: This is a short-term request to be completed preferably prior to a CFAME inter-sessional workshop in April 2008 and certainly by their final meeting in October 2008. For the Kuroshio/Oyashio this representation will be based on detailed model results available from a Japanese high-resolution global climate model coupled with a biological COCO–NEMURO model. For the California Current System, this representation will be based on either results from a high-resolution Regional Ocean Model System (ROMS) climate model, or if this is not available, from downscaled global climate model values. For the Yellow and East China Seas, this graphic will also be based on either regional climate model output or downscaled values from global climate models.
   b) Suggested detailed climate model outputs based on CFAME revisions of mechanism tables: This is a long-term request to be included as a shopping list in the CFAME final report; it could also provide future PICES expert groups with relevant output parameters from WG 20 models.
4. CFAME will hold an inter-sessional workshop on "*Linking and visualizing climate forcing and marine ecosystem changes: A comparative approach*" in April 2008, in Honolulu, U.S.A. (*CFAME Endnote 3*). The purpose of this meeting is to review and finalize the changes made in Action Item 1. In addition, CFAME will review draft versions of the graphic representations of ecosystem mechanisms (Action Item 2) and, if available, of climate–ocean scenarios (Action Item 3a). CFAME will invite the WG 20 Co-Chairmen to attend the workshop in order to receive immediate feedback on revised descriptions of relevant physical processes for the three selected ecosystems.
5. CFAME will hold, jointly with WG 20, a 1½-day workshop in conjunction with the PICES Annual Meeting in October 2008 (*CFAME Endnote 4*). The objective of this workshop is to finalize the report and to outline suggested next steps for PICES to undertake in reforming or revising CFAME under FUTURE.
6. CFAME expresses interest in being invited to give a synthesis talk of completed research at the Science Board Symposium at PICES XVII. Dr. Vera Agostini has agreed to be the presenter.
7. CFAME will complete the final report on research activities by October 2008.

8. This final report will include two examples of the types of climate change forecasts that could be provided and incorporated into the provision of forecasts of ecosystem change: (a) use of high resolution climate–ocean coupled model (COCO-NEMURO) available for the Kuroshio/Oyashio Current System; and (b) statistical downscaling from IPCC model forecasts for the California Current System.

PICES XVII

No CFAME-led Topic Sessions were proposed for next year's Annual Meeting, other than the workshop listed under Action Item 5 above. As it was previously mentioned in Agenda Item 5, CFAME would support a session on the joint FIS/CFAME work if FIS takes a lead.

Project proposal

Dr. Bernard Megrey proposed a PICES project on marine ecosystem model inter-comparisons (*MODEL Endnote 4*). CFAME felt that this project would be excellent: it would serve as a good and timely bridge between the CCCC Program and FUTURE, and it would be a forum for interactions with outside groups (*e.g.*, ESSAS, ICES, *etc.*). As such, CFAME lends this proposal its full support. However, as the mechanism for supporting the proposal was still under discussion, no specific requests or action items were recommended (it is expected that MODEL will take the lead).

PICES XVIII

CFAME members were encouraged to propose Topic Sessions for PICES XVIII (October 2009, Korea), but no sessions are currently suggested.

Travel requests for 2008 (Agenda Item 7)

Travel support is requested for:

- 1 Korean scientist (Yellow Sea/East China Sea fish expert) and 1 North American scientist (California Current fish or plankton expert) to attend the proposed inter-sessional CFAME workshop (*CFAME Endnote 3*); this was identified as the highest priority for successful completion of the CFAME work plan;
- 1 CFAME member to attend the 2008 ESSAS Annual Meeting in Halifax, Canada; this was identified as the second priority; while the Task Team felt it is good to encourage the collaboration and demonstrate a desire to work with ESSAS, it was noted that at least one CFAME member (and perhaps others) would already be attending as a current ESSAS member.

New business (Agenda Item 8)

No new business was discussed.

Rotation of membership (Agenda Item 9)

It was clarified that Dr. Aydin would remain Co-Chairman throughout the coming year for the purposes of inter-sessional work. Although he is unlikely to attend next year's Annual Meeting, he may delegate Co-Chairman tasks to another North American scientist for that meeting.

Announcements (Agenda Item 10)

MODEL members announced the publication of collection of papers on NEMURO and NEMURO.FISH in a special issue of *Ecological Modelling* (March 2007, Vol. 202, Nos. 1–2, pp. 1–224) on "Modeling of North Pacific Marine Ecosystems" (Guest Editors: M.J. Kishi, B.A. Megrey, S.-I. Ito and F.E. Werner).

CFAME Endnote 1

Participation list

Members

Vera Agostini (U.S.A.)
Kerim Y. Aydin (U.S.A., Co-Chairman)
William R. Crawford (Canada)
George L. Hunt, Jr. (U.S.A.)
Young-Shil Kang (Korea, Co-Chairman)
Jacquelynne R. King (Canada)
Gordon (Sandy) McFarlane (Canada)
Brenda Norcross (U.S.A.)
James E. Overland (U.S.A.)
Akihiko Yatsu (Japan)

Observers

Yongkyu Choi (Korea)
Kenneth Drinkwater (ESSAS, Norway)
Yeonghye Kim (Korea)
Bernard A. Megrey (U.S.A.)
Oleg Katugin (Russia)
Thomas C. Wainwright (U.S.A.)

CFAME Endnote 2

CFAME meeting agenda

1. Welcome and introductions
2. Adoption of agenda
3. Review of CFAME accomplishments after PICES XV:
   - CFAME inter-sessional workshop on "*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*"
   - POC/CCCC Workshop on "*Climate scenarios for ecosystem modeling*" at PICES XVI
   - Elucidating dynamic responses of North Pacific fish populations to climatic forcing: Influence of life-history strategy
   - Topic Sessions at PICES XVI
4. Discussion of FUTURE
5. Interactions with other groups on forecasting/future efforts
   - ESSAS
   - CAMEO
   - Ocean Acidification
   - FIS forecasting workshop
6. Planning for 2008 and beyond
7. Travel requests to future meetings
8. New business
9. Rotation of membership
10. Announcements
11. Adjournment

CFAME Endnote 3

Proposal for a 3-day CFAME inter-sessional workshop on *"Linking and visualizing climate-forcing mechanisms and marine ecosystem changes: A comparative approach"*

This inter-sessional workshop will bring together the three CFAME ecosystem teams which have been working together since May 2007 on each of three selected ecosystems: the California Current, the Kuroshio/Oyashio, and the Yellow Sea/East China Sea). Prior to the workshop, team leaders for each set of ecosystem mechanism tables, Drs. Vera Agostini, Akihiko Yatsu and Young-Shil Kang (or a Korean invitee), will coordinate the review of details, providing explicit description of processes and definition of terms. Initial revisions can focus on 1–2 species (hake and sardine for the California Current; sardines and anchovy for the Kuroshio/Oyashio; hairtail and yellow croaker for the East China/Yellow Seas), but if possible, a revision will be attempted for all species that have already been completed. Other CFAME members will aid in this process by reviewing the tables and providing suggestions for what needs to be clarified and better defined.

The purpose of this meeting is to examine the revisions made and review draft versions of the graphic representations of ecosystem mechanisms and climate/ocean scenarios provided by WG 20 prior to the meeting. A Co-Chairmen of WG 20 will be invited to attend the workshop in order to receive immediate feedback on revised descriptions of relevant physical processes.

At the workshop, each ecosystem team will create graphic representations of our current knowledge of the physical processes impacting species' population dynamics; one graphic representation will be made for each of the three selected ecosystems, showing likely impacts under climate warming. This work is intended for both scientific publications (PICES Scientific Report and peer-reviewed manuscripts to be drafted at the meeting) and for distribution to the broad audience as part of PICES contributions to forecasting future ecosystem states.

Date and location: April 2008, Honolulu, U.S.A.

Recommended convenors: Kerim Y. Aydin, James E. Overland (U.S.A.) and Young-Shil Kang (Korea).

Travel request: 1 scientist from Korea (Yellow Sea/East China Sea fish expert) and 1 scientist from North America (California Current fish or plankton expert).

CFAME Endnote 4

Proposal for a 1½-day CCCC/POC workshop at PICES XVII on
"Climate scenarios for ecosystem modeling (II)"

This workshop will include presentations from members of the CCCC Climate Forcing and Marine Ecosystem Task Team (CFAME) and the POC Working Group on *Evaluations of Climate Change Projections* (WG 20) on research activities related to applying output from WG 20 regional climate models, or IPCC (Intergovernmental Panel on Climate Change) global models, to CFAME ecosystem models.

CFAME is developing conceptual and empirical models of the mechanisms relating climate forcing to the population dynamics of species and to ecosystem processes. Their work has focused on three North Pacific ecosystems with different dominant physical processes: (1) California Current System (boundary current with upwelling); (2) Kuroshio/Oyashio Current System (boundary currents); and (3) Yellow Sea/East China Sea region (freshwater input). WG 20 is developing higher resolution regional coupled atmosphere–ocean models forced by IPCC global or regional models to provide forecasts of regional parameters (such as SST, sea ice cover, and river discharge) that are relevant to ecosystem processes.

In May 2007 (Seattle, U.S.A.), October 2007 (Victoria Canada), and April 2008 (Honolulu, U.S.A.), CFAME and WG 20 collaborated by producing comparative ecosystem metrics, developing climate scenario downscaling, and inferring predicted ecosystem states from climate downscaling and summarized explicit mechanisms linking fish production to climate. This workshop is the culmination of that effort, bringing CFAME and WG 20 members together to discuss the results and present them to the broader PICES community, with an emphasis to leading into the FUTURE integrated scientific program.

Recommended convenors: Michael G. Foreman (Canada) and Gordon A. McFarlane (Canada).

REPORT OF MODEL TASK TEAM

The meeting of the MODEL Task Team (hereafter MODEL) was held from 09:00–12:30 hours on October 28, 2007. The Co-Chairman, Dr. Thomas C. Wainwright, called the meeting to order and welcomed the participants (*MODEL Endnote 1*). The other Co-Chairman of MODEL, Dr. Wei Hao (China), was unable to attend the meeting. The draft agenda was reviewed and adopted without changes (*MODEL Endnote 2*).

MODEL accomplishments after PICES XV (Agenda Item 3)

Dr. Shin-ichi Ito reported on the Fisheries Research Agency (FRA) international workshop on "*Collaborative studies for ecosystem variation and climate change in the North Pacific*" held October 21–23, 2006, at the National Research Institute of Fisheries Science in Yokohama, Japan. The workshop was convened by Drs. Hiroya Sugisaki (FRA), Tsuneo Ono (FRA) and Ralf Georicke (Scripps Institution of Oceanography, U.S.A.), and a number of MODEL members and associates participated. The goals of the workshop were to:

- Compare long-term variation of CalCOFI/ CCE-LTER and A-line/ODATE data;
- Identify a set of "seeds" for collaborative studies between A-line/ODATE programs and CalCOFI/CCE-LTER programs;
- Examine the meaning of temporal variations apparent in temporally and regionally restricted time-series observation data, with inputs from basin-scale and/or high-resolution model studies;
- Elucidate potential biases in the data and, if possible, make a list of contrivances to compensate for such biases in the data analysis.

Follow-up plans from the workshop include continued efforts to compare data sets from the two areas, and the development of a hypothesized scenario which is able to explain lower trophic level production in the Pacific Basin.

Dr. Michio Kishi informed the participants that the NEMURO and NEMURO.FISH models are now documented on the EUR-OCEANS Model Shopping Tool web site (www.eur-oceans.eu).

Mr. Jake Schweigert reported on the Tri-national Sardine Forum held in November 2006, in Vancouver, Canada. This was the first time that Canada has hosted the meeting, which included representatives from Canada, Mexico and the United States. The meeting was composed of two focus sessions, one on a coast-wide survey design, and a second on the role of sardines in the ecosystem, which relates to MODEL work on incorporating sardine and anchovy into the NEMURO model suite.

Dr. Wainwright presented an update on the continuing project "*Software framework for integrating marine ecosystem models*" which was funded by NOAA in 2005 and is expected to be completed in the spring of 2008. The project is embedding NEMURO code within the Earth Systems Modeling Framework (ESMF) which will make this code easier to integrate into other U.S. Climate Change research efforts. To date, investigators have completed the development of an independent set of computer codes that replicates the published NEMURO model, created an ODE Solver module that provides four distinct solution methods, completed construction and testing of an Ocean Physics gridded component module for station A7 within ESMF, and are currently embedding the NEMURO model into the ESMF superstructure.

Dr. Yasuhiro Yamanaka reported on recent progress with NEMURO applications in Japan. As part of a 5-year CREST (Core Research for Evolutional Science and Technology) project, coupled COCO-NEMURO applications with high spatial resolution (1/4 × 1/6 degree) were developed for two domains: western North Pacific (led by Dr. Taketo Hashioka) and global (led by Dr. Hiroshi Sumata). These projects will

utilize a number of plankton models, including NEMURO, eNEMRUO, NEMURO(+Fe), NPZD, and PlankTOM5. These applications are currently in the testing stage, with complete analysis to be finished by 2011. In association with this project, Dr. Takeshi Okunishi is beginning to develop a sardine life-history and migration model using NEMURO.SAN. Work is also being conducted on a number of extensions to NEMURO. Dr. Naoki Yoshie is continuing to develop eNEMURO. Dr. Maki N. Aita is introducing iron cycles into NEMURO, and so far the results of this model match Southern Ocean observations much better than the original NEMURO. Dr. S. Lan Smith has introduced new multi-nutrient optimal kinetics into NEMURO for cell quota model (QeNEMURO).

Dr. Francisco E. Werner provided information on the integration of NEMURO into the Regional Ocean Model System (ROMS) model suite. The code is still being tested, but seems to be working properly. The code is available as part of the current ROMS code download package (http://www.ocean-modeling.org).

At PICES XVI, MODEL was involved with three events (details can be found in the *Session Summaries* chapter of this Annual Report):

- A 1-day CCCC/FIS Topic Session (S3) on "*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*";
- A 1-day POC/CCCC/MONITOR Topic Session (S9) on "*Operational forecasts of oceans and ecosystems*"; and
- a 1½-day POC/CCCC Workshop (W6) on "*Climate scenarios for ecosystem modeling*".

Discussion of FUTURE (Agenda Item 4)

MODEL reviewed the latest available version (version 4.2) of a Science Plan for a new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems). Comments from MODEL are related more to implementation than to the plan itself. Beyond continuing the current MODEL Task Team work, the following ideas have to be considered for FUTURE:

- There should be clear linkages between lower trophic modeling work and climate-related analyses (such as those of WG 20). There is a need to develop unified physics–biochemical–ecosystem models.
- For developing modeling approaches in FUTURE, there is a need to look at forecasting uncertainty as part of a more diverse/flexible modeling approach that is able to respond to "surprises" (unexpected results or events that do not fit into existing modeling approaches) and that can identify emergent behaviors of the modeled system. "Thinking outside the box", important to recognize when moving to new approaches, is required.
- There is a need to make management a part of modeling by including bio-economic models and fish stock dynamics models in the FUTURE tool suite.
- The goal should be to move toward fully-integrated (end-to-end) Earth Systems models. This will require experts in areas not presently represented among the PICES modeling community, and who should be invited to participate in the coming activities.

Planning for 2008 and beyond (Agenda Item 5)

Inter-sessional workshops

No inter-sessional workshops are planned for 2008.

Topic Sessions at PICES XVII

Dr. Wainwright presented a proposal for a 1-day workshop on "*Assessing and expressing uncertainty in marine ecosystem forecasts: Moving models forward to the FUTURE*" to take place at PICES XVII in Dalian. However, the Task Team felt that a broader scientific session would be more useful for the transition from the CCCC Program to FUTURE and recommended convening a 1-day joint CCCC/POC Topic Session with co-convenors from all PICES countries to encourage wide participation. The proposed session is described in *MODEL Endnote 3*.

Proposed future scientific work

A number of suggestions for future modeling work within PICES were discussed. These will not be pursued under the CCCC Program, but could become part of FUTURE. Dr. Kishi noted the importance of modeling sea ice dynamics and its effects on Arctic ecosystems. With the apparent sudden disappearance of Arctic Ocean sea-ice, PICES should be prepared for such an effort. He also suggested a project on "*Bottom-up ecosystem-based management modeling using NEMURO and NEMURO.SAN (BUMBAM.NEMURO)*". This project would transition existing PICES models into management analysis, and would link the NEMURO suite of models with management-oriented models such as Ecopath with Ecosim. Such work should be a high priority.

Dr. Werner described opportunities for collaborative work under U.S. GLOBEC's pan-regional synthesis phase and the upcoming U.S. CAMEO (Comparative Analysis of Marine Ecosystem Organization) program. Both efforts are focused on cross-system ecosystem comparisons. U.S. GLOBEC pan-regional synthesis projects can compare any of the U.S. GLOBEC study areas with other world ecosystems. Proposals are due in January 2008, and total funding for the program is expected to be about $2 million per year for 3 years. CAMEO has an explicit management focus, but a higher overall budget (about $10 million per year for 5 years). It is expected that the focus will be on supporting a few large sustained 5-year projects rather than a large number of small projects. The call for proposals may be issued near the end of 2007, with proposals due in the spring of 2008.

Dr. Bernard A. Megrey described the Ecosystem Studies of Sub-Arctic Seas (ESSAS), which is now a new regional program under GLOBEC. The program has three Working Groups (climate change, biophysical coupling, and ecosystem modeling) with substantial PICES member involvement. This is a possible source for collaboration with MODEL.

Dr. Megrey also requested MODEL support for the creation of a new PICES project on "*Marine ecosystem model inter-comparisons*" (*MODEL Endnote 4*). This was originally written as a working group proposal, but was modified to a PICES project on advice from the Secretariat. MODEL strongly endorsed the proposed work as necessary for the implementation of FUTURE, and supports creating an independent project so that work can proceed before FUTURE is fully in place. MODEL suggested a 3-year time frame which would be sufficient to accomplish the initial project goals, but will still allow the work to be integrated into FUTURE when that program is operational. It was further suggested that a small planning group be formed immediately to prepare for an initial workshop, co-sponsored by PICES and ESSAS, to be held at PICES XVII (*MODEL Endnote 5*).

Other planned meetings/workshops

Dr. Kishi is the lead organizer of the second CREAMS/PICES Summer School to be held in August 2008, in Hakodate, Japan. The theme of the school is biomass-based management, and lectures will focus on calculation of the "ecological footprint" and how to design an ecosystem management program (*BIO Endnote 7*).

Requests for travel (Agenda Item 6)

Travel support is requested for:

- 1 invited speaker for the CCCC/POC Topic Session on "*Marine system forecast models: Moving forward to the FUTURE"* (tentative title) at PICES XVII;
- 1 invited speaker for the CCCC/ESSAS workshop on "*Marine model inter-comparison project*" at PICES XVII.

Rotation of membership (Agenda Item 8)

It was noted that MODEL lacks members from Canada and Russia, and that some members from other countries are not regular attendees at the meetings. Given that MODEL will be reorganized with the closing of the CCCC Program next year, there is no urgency to request new members at this time.

MODEL Endnote 1

Participation list

Members

Shin-ichi Ito (Japan)
Michio J. Kishi (Japan)
Bernard A. Megrey (U.S.A.)
Goh Onitsuka (Japan)
Jake Schweigert (Canada)
Thomas C. Wainwright (U.S.A., Co-Chairman)
Francisco E. Werner (U.S.A.)
Yury I. Zuenko (Russia)

Observers

Vera Agostini (U.S.A.)
Fei Chai (U.S.A.)
Taketo Hashioka (Japan)
Yasuhiro Yamanaka (Japan)

MODEL Endnote 2

MODEL meeting agenda

1. Welcome and introduction
2. Adoption of agenda
3. Review of MODEL accomplishments after PICES XV:
   a. FRA international workshop on "*Collaborative studies for ecosystem variation and climate change in the North Pacific*" (November 2006, Yokohama, Japan)
   b. NEMURO model information included in EUR-OCEANS project
   c. Tri-national Sardine Forum (November 2006, Vancouver, Canada)
   d. Status of NOAA project "*Software framework for integrating marine ecosystem models*"
   e. Progress in coupling NEMURO and NEMURO.FISH models with higher resolution ocean circulation models under CREST program (Y. Yamanaka) and within ROMS
   f. Brief discussion/review/preview of workshops and scientific sessions at PICES XVI
4. Discussion of FUTURE
5. Planning for 2008 and beyond
   a. Inter-sessional workshops
   b. PICES XVII (October 2008, Dalian, China) – proposals for Topic Sessions and workshops.
   c. Proposals for future scientific work
   d. 2008 CREAMS/PICES Summer School
   e. PICES XVIII (October 2009, Korea)
6. Requests for travel to future meetings
7. Other new business
8. Rotation of membership
9. Announcements
10. Adjournment

MODEL Endnote 3

Proposal for a 1-day CCCC/POC Topic Session at PICES XVII on
"Marine system forecast models: Moving forward to the FUTURE"

As marine system models mature, they are increasingly used to forecast future conditions, both for understanding potential effects of climate change and for projecting system responses to management activities. In particular, the PICES FUTURE Program is focused on forecasting and understanding the responses of North Pacific marine systems to climate change and human activities. This work will reach beyond the models currently used by the PICES community to include models that provide system forecasts, assess uncertainty, and link together multiple levels of system organization. Achieving meaningful forecasts that are useful for management of marine resources will require cross-disciplinary

approaches that link processes ranging from atmospheric and ocean physics, through biology to socio-economic systems. This session will focus on multidisciplinary coupled models designed to forecast marine systems in the PICES region, including both strategic (long-term) and tactical (short-term) forecasts linking across two or more disciplines (such as physical oceanography, climate, ecosystem dynamics, marine resource management, or socio-economic systems). Presentations describing approaches to assessing and communicating the reliability (or uncertainty) of coupled marine system forecasts are particularly encouraged.

MODEL Endnote 4

Proposal for a PICES project on "*Marine ecosystem model inter-comparisons*"

Rational and justification

Past PICES modeling activity has concentrated on the development of the NEMURO family of models. The strategy of NEMURO was to develop and apply the same model to multiple locations in order to remove the "model" confounding effect and isolate localized or species effects. This process is moving forward and applications of the NEMURO family of models are progressing in several ecosystems in the North Atlantic as well as in the North Pacific (NEMURO special volume in *Ecological Modelling*, Vol. 202, ICES Annual Science Meeting, 2007).

Alternatively, when a single "correct" model cannot be identified *a priori*, a suite of models can be applied to the same system to determine not only which models are appropriate, but also the range of outcomes that may be expected. This is similar to the IPCC procedure for evaluating alternative climate models, a process that has been widely accepted. We propose to implement the same model evaluation process, except that we plan to use marine ecosystem models instead of climate prediction models. Thus, the idea behind the proposed project is to apply multiple ecosystem models to the same location/species and to use an ensemble model forecast to identify and compare predicted and observed responses of marine ecosystem types to global changes. To our knowledge this exercise has not been carried out with marine ecosystem models although other recent model comparison exercises have been undertaken using NPZ models (Friedrichs 2001; Friedrichs *et al.* 2007; Friedrichs and Hofmann 2001; Friedrichs *et al.* 2006; Hood *et al*. 2006) and Ecopath models (Taylor and Wolff 2007). Also Plagányi (2007) recently conducted an in depth qualitative analysis of the characteristics, data requirements and outputs of a large number of models appropriate for addressing management of fisheries in an ecosystem context.

Modeling is a central approach for comparative analyses of ecosystems, *i.e.* concerning the structures, functioning and impact responses of marine ecosystems. It is important for process and modeling studies to identify if inter-relationships amongst physical and biological variables are the same in different locations or whether certain relationships vary geographically, or if the conclusions are dependent on the particular applied modeling tool.

The ability to evaluate the range of ecosystem response from different modeling approaches will produce valuable outcomes. Through this process, we hope to be able to identify and characterize components of the major marine ecosystems which are likely to be affected at an early stage by global changes, to understand the responses to global change of each component of the ecosystem, focusing primarily on zooplankton which provide the prey base for upper trophic level fish species, and to use ecosystem models to pinpoint and compare predicted and observed responses of marine ecosystem types to global changes. We will also be able to detect which of the candidate models are the most successful at hind-casting in each of the ecosystems chosen for study.

A key outcome of these comparisons will be to identify "early-warning" indicators of large-scale ecosystem changes, and to learn the extent

to which these indicators are similar among a variety of ecosystems when multiple systems are analyzed. Early identification of potential indicators will provide opportunities for monitoring and assessment through planned field and modeling activities.

Comparative analysis is a valuable scientific activity since the size and complexity of marine ecosystems precludes conducting controlled *in situ* experiments. Comparative analysis is also a powerful procedure to underscore important similarities and differences between and among ecosystems.

We propose to use several species of copepods and Pacific krill (*Euphausia pacifica*) as the modeled indicator species. Modeling the lower trophic level with minimally ecologically complex models makes the modeling task easier with respect to parameterizing and configuring multiple models. These candidate species are widely distributed in the North Pacific, are well studied, and have what we believe to be ecological equivalents in the North Atlantic, thus facilitating collaboration with North Atlantic colleagues. For many, there also exist substantial, high quality time series. The final decision of the indicator species on which to focus will be decided by the working group once data sets are assembled and evaluated.

Project activities

- Prepare terms of reference;
- Evaluate and select potential models for comparison and their data needs. The Eur-Oceans Model Shopping Tool (www.eur-oceans.eu/WP3.1/shopping_tool/about.php) provides a large array of documented candidate models to choose from;
- Identify location(s) for comparisons;
- Identify comparison protocols;
- Compare model data needs against location data availability and compatibility;
- Identify the most appropriate indicator species, such as krill, to be used as the "metric" for correct model behavior. Appropriate reasons for selection might include: Pacific basin-wide distribution, well studied-known life history and biology, abundant data for model validation and calibration;
- Plan "pseudo-controlled" experiment;
- Evaluate results;
- Make recommendations;
- Note implications for resource managers or those studying the impact of climate change on marine ecosystems;
- Report results in PICES scientific reports and peer-reviewed scientific papers.

Participants

This depends partially on the geographic location on which the project is going to focus. We anticipate involvement of a total of 15–20 scientists, with one or two from each PICES member country and other scientists to be selected because of their familiarity with models that have originated outside the PICES region. Additional experts on the data sets available and on the life history of chosen organisms may be invited to participate during the process of selecting model organisms and ecosystem(s) to be modeled.

Sponsorship: ESSAS, PICES

Critical scientific linkages

- ESSAS Working Group on *Modeling Ecosystem Response*,
- PICES MODEL Task Team
- PICES Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim*

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MODEL Endnote 5

Proposal for a 1-day CCCC/ESSAS workshop at PICES XVII on "*Marine ecosystem model inter-comparisons*"

Comparative analysis is a valuable scientific activity because the size and complexity of marine ecosystems precludes conducting controlled *in situ* experiments. It is also a powerful technique for understanding the important similarities and differences between and among ecosystems. Modelling is a central approach to comparative analyses of ecosystem structure, function and responses. It is important to understand whether inter-relationships among physical, chemical and biological variables vary geographically, and the extent to which any particular conclusions depend on the model used to derive them. The model inter-comparison project will use different models to develop forecasts of different ecosystems and will use different models to compare forecasts of the same location/species. The intention of the project is to develop ensemble model forecasts to compare predicted and observed responses of marine ecosystem types to global changes– similar to the widely-accepted approach used by the IPCC (Intergovernmental Panel on Climate Change) to evaluate alternative climate models. The project will implement the same model evaluation process with marine ecosystem models rather than climate prediction models. A major goal of the workshop is to begin planning the work of the project. Workshop activities will include: (1) nomination and discussion of potential models (and their data needs) to compare (the Eur-Oceans Model Shopping Tool, http://www.eur-oceans.eu/WP3.1/shopping_tool/ about.php, provides a large array of documented models from which to choose); (2) nominate location(s) for comparisons; (3) identify comparison protocols to compare model performance, given data needs against location data availability and compatibility; (4) identify the most appropriate indicator species on which to base comparisons, such as krill, as the "metric" for correct model behavior; and (5) plan "pseudo-controlled" experiments. Workshop participants should have at least one of the following characteristics: (1) be familiar with ecosystem models from beyond the PICES region; (2) be knowledgeable about running models; (3) be experts on the life histories of selected organisms and data associated with them; and (4) have a broad perspective on marine ecosystems.

Recommended convenors: Bernard A. Megrey (U.S.A.) and an Asian scientist (TBD).

REPORT OF ADVISORY PANEL ON CREAMS/PICES PROGRAM IN EAST ASIAN MARGINAL SEAS

The Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (hereafter CREAMS-AP) was established in 2005, and met twice during 2006. The first meeting was convened on April 11–12, 2006, in Seoul, Korea, hosted by the Seoul National University, and the second meeting was held on October 15, 2006, at PICES XV in Yokohama, Japan. Recommendations from the 2006 meetings (*CREAMS-AP Endnote 1*) formed the basis for activities in 2007.

In 2007, the Panel had again two meetings: on May 18, in Qingdao, China, hosted by the First Institute of Oceanography of the State Oceanic Administration (*CREAMS-AP Endnote 2*), and on October 27, 2007, at PICES XVI in Victoria, Canada (*CREAMS-AP Endnote 4*).

Both meetings discussed recent results and plans on activities related to the CREAMS/PICES program in China, Japan, Korea and Russia, needs and possibilities for cooperative research and the role of PICES in their coordination, collaboration with existing monitoring efforts and other related organizations/programs in the area, capacity building issues, presentation and publication of the results (*CREAMS-AP Endnotes 3 and 5*). The following is a summary of the outcomes from these meetings (and their relation to the appropriate recommendations (R) from 2006).

Research activities:

- The Panel agreed on the need to carry out the cooperative physical–biological coupled study related to the recruitment process of pelagic fish and squid in the East China Sea, Yellow Sea, Bohai Sea and Japan/East Sea under the CREAMS/PICES Program. [R1]
- Joint Russian–Korean observations along 132ºE will continue. The next survey, organized by the Pacific Oceanological Institute and Seoul National University, is expected to take place in May 2007, aboard the R/V *Professor Gagarinsky*. [R2]
- Three joint Japanese–Korean cruises with sampling for trace elements (as a part of the Asian GEOTRACERS program), aboard the R/Vs *Hakuho Maru*, *Tansei Maru* and *Nagasaki Maru*, will cover the major part of the Japan/East Sea and the East China Sea in 2008/2009. [R1-R3]
- A joint Chinese–Korean study of the water circulation dynamics and its effects on the marine environment of the Yellow Sea will be proposed to advance our knowledge on this Large Marine Ecosystem and to further cooperative research between the two countries. [R1]

Capacity building activities:

- The first CREAMS/PICES Summer School on "*Ocean circulation and ecosystem modeling*" (co-sponsored by the Seoul National University, the Korean Ocean and Research Development Institute, the Korean Ministry of Maritime Affairs and Fisheries, the National Fisheries Research and Development Institute, and the Brain Korea 21 (BK 21) Program of the Korean Ministry of Education and Human Resources) was held in August 2006, in Busan, Korea, in conjunction with the CREAMS/PICES workshop on "*Model-data inter-comparison for the Japan/East Sea*". More than 30 students from 9 countries (including all PICES member countries) attended lectures, seminars and practical exercises. [R4]
- After this successful effort, there is a plan to organize the second CREAMS/PICES Summer School on "*Biomass-based management and ecosystem approach*" to be held from August 23-26, 2008 (tentative dates), at Hokkaido University, in Hakodate, Japan. Potential co-sponsors include: the Japanese Society for Promotion of Science (JSPS), the Hokkaido University Sustainable

Government Project and the Asia Pacific Network. There is an intention to invite to this school young scientists not only from PICES member countries, but also from South East Asian countries. [R4]

- Planning is also in progress for the first CREAMS/PICES Winter School on "*Field survey of sea ice area*". Originally, the school was proposed to be organized in late February or early March 2008, in Vladivostok, Russia, but it will be postponed for 1 year to resolve funding and logistical problems. [R4]
- The third CREAMS/PICES Summer School on "*Recent methods of investigating red-tide organisms and controlling red tides*" was planned for August 2009, in Busan, Korea. It is now possible that the theme will change to "*Satellite oceanography*". In 2009, a Korean satellite will be launched so timing for this event is good. [R4]

New funding:

- In order to get financial support for the CREAMS/ PICES international research and capacity building activities, a joint Japanese–Korean–Chinese project entitled "*Marine ecosystem response related to climate change in East Asian marginal seas*" was proposed under the A3 Foresight Program (August 2007–July 2010) to JSPS, KOSEF (Korean Science and Engineering Foundation) and NSF (National Science Foundation) of China. Unfortunately, the proposal was rejected by JSPS, but will be re-submitted next year. [R1-R4]

Publications:

- A book on "*Fisheries Oceanography in the Japan Sea*" will be published by the end of 2007 in Russian, with figure captions and tables in both Russian and English. It could be useful to translate this book into English sometime later.
- Manuscripts submitted for a special issue of *Journal of Marine Systems* (Guest Editors: K.-I. Chang, S.-I. Ito, C. Mooers and J.-H. Yoon) resulting from the CREAMS/PICES workshop on "*Model/ data inter-comparison for the Japan/East Sea*" are under review. It is expected that the volume will be published in 2008.

CREAMS/PICES Program as a component of FUTURE:

- Plans of the CREAMS/PICES Program as an international integrated multidisciplinary research of the East Asia marginal seas are in accordance with directions for the PICES new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems). The major contribution of the CREAMS/PICES program to FUTURE is a coordination of international activities on a regional level.

Next meetings:

- Two CREAMS-AP meetings are expected to be held in 2008. A spring meeting was planned for April or May in Vladivostok, but will be likely moved to another venue due to funding constraints. A fall meeting will be held at PICES XVII (Dalian, China).

CREAMS-AP Endnote 1

Recommendations from 2006 CREAMS-AP meetings

R1 To support continuation and development of existing national observational programs and, when possible, their coordination, including exchange information on cruise schedules, and data, samples, personnel and equipment sharing;

R2 To continue Russian–Korean observations along the repeated north–south sections in the Japan/East Sea (JES), and to start (beginning 2007) Korean–Japanese observations along the repeated west–east sections in the southern part of JES; more ecological parameters should be added to the observational programs;

R3 To implement a comprehensive international basin-scale survey of JES and adjacent areas in summer 2009; the survey should include hydrographic, chemical and biological

observations, sampling for trace elements (as a part of the Asian GEOTRACERS program), and observations carried out under regional national programs;

R4 To develop a CREAMS/PICES Capacity Building Program that will provide on-site training through international research at educational laboratories, training camps, inter-calibration centers, *etc*., and to organize summer and winter schools for students and young researchers;

R5 To collaborate with NEAR-GOOS on the development of an observing system, expansion of observational parameters and data sources (*e.g*., more satellite data), and improvement of international data exchange in the region;

R6 To strongly support PICES activities related to the development of the GOOS component for the North Pacific;

R7 To provide frequent updates on progress of the CREAMS/PICES Program via the PICES website, and to publish in 2006 brief information on the program in a special issue of *Oceanography* (by TOS).

CREAMS-AP Endnote 2

Third CREAMS-AP meeting: Participation list (May 18, 2007, Qingdao, China)

Members

Toshitaka Gamo (Japan)
Kyung-Ryul Kim (Korea, Co-Chairman)
Sumei Liu (China)
Yasunori Sakurai (Japan, Co-Chairman)
Fei Yu (China)
Yury I. Zuenko (Russia)

CREAMS-AP Endnote 3

Third CREAMS-AP meeting agenda (May 18, 2007, Qingdao, China)

1. Opening remarks
2. Approval of previous reports and agenda of the meeting
3. National reports on activities and plans related to CREAMS/PICES program
4. Progress on international cooperation on Japan/East Sea studies
   - Japan-Korea cooperation
   - Korea-Russia cooperation
5. Discussion on role of PICES in research coordination
6. Capacity building activities
   - 2008 CREAMS/PICES Summer School
   - CREAMS/PICES International Research and Educational Laboratory
7. Discussion on existing monitoring and data exchange systems in the region
   - NEAR-GOOS, GOOS, GRAND, GEOSS
   - GEOTRACES
8. CREAMS-AP role in FUTURE: EAST-II
9. Miscellaneous items
   - Special publications
   - A3 proposal
   - Next CREAMS-AP meeting and others
10. Closure

CREAMS-AP Endnote 4

Fourth CREAMS-AP meeting: Participation list (October 27, 2007, Victoria, Canada)

Members

Yasunori Sakurai (Japan, Co-Chairman)
Sinjae Yoo (Korea)
Yury I. Zuenko (Russia)

Observers

Kyung Il Chang (Korea)
Dong-Jing Kang (Korea)
Kuh Kim (Korea)
Michio Kishi (Japan)

CREAMS-AP Endnote 5

Fourth CREAMS-AP meeting agenda (October 27, 2007, Victoria, Canada)

1. Opening remarks (Y. Sakurai)
2. National reports on activities and plans related to CREAMS/PICES program:
   - Korea EAST-1 program: Workshop on the Korean EAST-I Program (June or July 2008, in Seoul)
   - Russian surveys
   - Recent activities of Japan-GLOBEC and projects related to the CREAMS/PICES program
3. Capacity building activities:
   - Korea-China-Japan GLOBEC symposium (December 2007, Hakodate, Japan)
   - CREAMS/PICES Summer School on *Biomass-based management* (August 2008, Hakodate, Japan)
   - CREAMS/PICES Winter School on "*Field survey of sea ice area*" (February or March 2009, Vladivostok, Russia)
   - Workshop on "*Flux studies in marginal seas*" (spring 2009)
   - CREAMS/PICES Summer School on *Recent methods of investigating red-tide organisms and controlling red tides* (planned for 2009 or 2010, Korea)
   - CREAMS/PICES International Research and Educational Laboratory
4. CREAMS-AP role in FUTURE
5. Miscellaneous items:
   - Book on "*Fisheries Oceanography in the Japan Sea*"
   - Special issue of *Journal of Marine Systems* on "*Model-data inter-comparison for the Japan/East Sea*" – set of selected papers from the 2006 CREAMS/PICES workshop
   - 4th PICES workshop on "*The Okhotsk Sea and adjacent areas*" (August 2008, Abashiri, Japan)
   - A3 proposal and other proposals
   - Next CREAMS-AP meeting and others
6. Closure

REPORT OF ADVISORY PANEL ON CONTINUOUS PLANKTON RECORDER SURVEY IN THE NORTH PACIFIC

The Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* (hereafter CPR-AP) met from 18:00–20:00 hours on October 28, 2007, under the chairmanship of Dr. Charles B. Miller. The list of participants and the meeting agenda can be found in *CPR-AP Endnotes 1* and *2*.

Funding for the North Pacific CPR project (Agenda Item 1)

The Advisory Panel focused on the increasing financial strain on the North Pacific CPR project, details of which were presented by Drs. Sonia D. Batten (Principal Investigator of the project) and William J. Sydeman (Principle Investigator of bird observations along the CPR lines).

Funding of the east–west CPR transect (Vancouver–Yokohama) by the North Pacific Research Board (NPRB) has been reduced to half of the level for 2007, enough for just one full CPR line in 2008. The seabird program funding has not yet been renewed, although some residual funds may support the write-up of the completed transects. The status of these residual funds, if any, is uncertain because of the departure of Dr. Sydeman from the Point Reyes Bird Observatory. It is also not clear where further seabird observing funding may come from since the current NPRB RFP does not include an appropriate category. Funding of the north–south CRP transect (Cook Inlet–Vancouver) will be terminated by the Exxon Valdez Oil Spill Trustee Council (EVOSTC) after 2007. A proposal to National Science Foundation (NSF) has not yet received a decision from that agency. That proposal with uncertain prospects required participation by a U.S. investigator, and Dr. Russell Hopcroft (University of Alaska, Fairbanks) is a Co-Principal Investigator on the proposal. In summer 2007, Dr. Batten had also approached Fisheries and Oceans Canada, and there is a possibility of some support after April 2008. If the NSF proposal fails, the plan for 2008 is that the CPR parent agency, the Sir Alister Hardy Foundation for Ocean Science (SAHFOS), may itself support a few north–south runs in 2008 to avoid losing continuity in the time series, but it cannot support work-up of the collected samples. Other funding must be found for that.

It was agreed that the Advisory Panel continue to endorse the CPR project, for which 2008 will be the eighth year, and proposed that a combination of agencies in the United States and Canada supporting marine science activities in the North Pacific be asked to form a consortium to fund the continuation of the CPR project. Member agencies of this consortium would contribute modest sums totaling to minimal financial support of the CPR project, and would receive recognition for its future scientific accomplishments. A draft letter was prepared after the meeting, presented to the Science Board by Dr. Jeffrey M. Napp (MONITOR Chairman), revised according to the Science Board's recommendations, and sent to suitable agencies by the PICES Executive Secretary.

Scientific activities of the project (Agenda Item 2)

A report on current scientific efforts and results for North Pacific plankton was presented by Dr. Batten at the meeting of MONITOR on October 31, 2007. The content of her talk is summarized in the minutes from that meeting. Strength of the North Pacific CPR project is that its results are not shelved for eventual evaluation but are promptly analyzed and published.

Dr. Sydeman reported on potential papers that he, working with Dr. David Hyrenbach and Mr. Michael Henry, will generate from the bird observations along the east–west transect.

Advantages of this data set are that all observations were made by one observer (Michael Henry), rigorous routines and modes of quantification were developed in advance of the study, and the wide geographic range and habitat variation (*e.g.*, shelf waters to oceanic reaches) of the observations demonstrated strong and recurring shifts in the seabird community. The Advisory Panel urged that this reporting be completed with all deliberate speed.

CPR-AP Endnote 1

Participation list

Members

Sonia D. Batten (Canada, SAHFOS)
David L. Mackas (Canada)
Charles B. Miller (U.S.A., Chairman)
Jeffrey M. Napp (U.S.A.)
Vladimir I. Radchenko (Russia)

Observers

William R. Crawford (Canada)
Michael Henry (U.S.A.)
David Hyrenbach (U.S.A.)
Phillip R. Mundy (U.S.A.)
William J. Sydeman (U.S.A.)
Sei-Ichi Saitoh (Japan)

CPR-AP Endnote 2

CPR-AP meeting agenda

1. Funding for the North Pacific CPR project
2. Scientific activities of the project.

REPORT OF ADVISORY PANEL ON IRON FERTILIZATION EXPERIMENT IN THE SUBARCTIC PACIFIC OCEAN

The final meeting of the Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific Ocean* (hereafter IFEP-AP) was held from 19:00–21:00 hours on October 30, 2007. The Panel Co-Chairmen, Drs. Shigenobu Takeda and C.S. Wong called the meeting to order and welcomed the participants (*IFEP-AP Endnote 1*). The draft agenda was reviewed and adopted (*IFEP-AP Endnote 2*). As the Advisory Panel has completed its terms of reference and will be disbanded in 2007, the Co-Chairmen expressed appreciation to the IFEP-AP members and to all scientists involved in international collaborative meso-scale iron enrichment field experiments developed, through the Advisory Panel, under the umbrella of PICES. SERIES (**S**ubarctic **E**cosystem **R**esponse to **I**ron **E**nrichment **S**tudy) was performed in the eastern subarctic Pacific in summer of 2002, and SEEDS-I and SEEDS-II (**S**ubarctic Pacific Iron **E**xperiment for **E**cosystem **D**ynamics **S**tudy) were conducted in the western subarctic Pacific in the summers of 2001 and 2004, respectively.

Publications (Agenda Item 3)

Important new findings from the first two iron enrichment field experiments were published in *Science* (SEEDS-I: Tsuda *et al.*, 2003, 300: 958–961) and *Nature* (SERIES: Boyd *et al.*, 2004, 428: 549–553). More detailed results from these experiments were communicated in special issues of *Progress in Oceanography*, 2005, Vol. 64, Nos. 2-4, pp. 91–324 (SEEDS-I) and *Deep-Sea Research II*, 2006, Vol. 53, Nos. 20-22, pp. 2005–2454 (SERIES).

A synthesis paper on SEEDS-II entitled "*Evidence for the grazing hypothesis: Grazing reduces phytoplankton responses of the HNLC ecosystem to iron enrichment in the western subarctic Pacific*" by Tsuda *et al.* will be published in the *Journal of Oceanography* in December 2007 (Vol. 63, pp. 983–994).

A special issue of *Deep-Sea Research II* on SEEDS-II is under preparation and is expected to be published in 2009 (Guest Editors: Atsushi Tsuda, Mark L. Wells, Mitsuo Uematsu and Hiroaki Saito). Sixteen papers have been submitted for this volume and 2 more papers will be submitted soon.

Papers related to SEEDS and SERIES that have been published in, or are being submitted to, peer-reviewed journals are listed in *IFEP-AP Endnote 3.*

Proposal of a new Working Group (Agenda Item 4)

IFEP-AP discussed and finalized the title, terms of reference and potential membership of a new PICES Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (*IFEP-AP Endnote 4*). The new Working Group should include experimentalists and modelers working on iron biogeochemistry and its impact on biological productivity and marine ecosystems. Atmospheric scientists have to be part of the group because atmospheric dust deposition is one of the key iron supply processes to the North Pacific Ocean. Iron could be a potential regulator of harmful algal blooms (HABs) in coastal ecosystems, and relevant experts should be included. The new Working Group will be proposed at the BIO Committee meeting.

IFEP-AP Endnote 1

Participation list

Members

Paul J. Harrison (Canada)
Jun Nishioka (Japan)
Hiroaki Saito (Japan)
Shigenobu Takeda (Japan, Co-Chairman)
Atsushi Tsuda (Japan)
C.S. Wong (Canada, Co-Chairman)

Observers

Fei Chai (U.S.A.)
James Christian (Canada)
Masa Fujii (Japan)
Tsuneo Ono (Japan)
Vera Trainer (U.S.A.)
Emmy Wong (Canada)

IFEP-AP Endnote 2

IFEP-AP meeting agenda

1. Welcome and opening remarks
2. Adoption of agenda
3. Recent publications
4. Proposal of a new working group

IFEP-AP Endnote 3

IFEP-AP Publications

Special issue: "*Results from the Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study (SEEDS-I)*"
Progress in Oceanography, 2005, Vol. 64, Nos. 2–4, pp. 91–324 (Guest Editor: A. Tsuda).

P.J. Harrison. Editorial. pp. 91–93.

S. Takeda and A. Tsuda. An *in situ* iron-enrichment experiment in the western subarctic Pacific (SEEDS): Introduction and summary. pp. 95–109.

D. Tsumune, J. Nishioka, A. Shimamoto, S. Takeda and A. Tsuda. Physical behavior of the SEEDS iron-fertilized patch by sulphur hexafluoride tracer release. pp. 111–127.

M. Kinugasa, T. Ishita, Y. Sohrin, K. Okamura, S. Takeda, J. Nishioka and A. Tsuda. Dynamics of trace metals during the subarctic Pacific iron experiment for ecosystem dynamics study (SEEDS2001). pp. 129–147.

Y. Noiri, I. Kudo, H. Kiyosawa, J. Nishioka and A. Tsuda. Influence of iron and temperature on growth, nutrient utilization ratios and phytoplankton species composition in the western subarctic Pacific Ocean during the SEEDS experiment. pp. 149–166.

K. Suzuki, A. Hinuma, H. Saito, H. Kiyosawa, H. Liu, T. Saino and A. Tsuda. esponses of phytoplankton and heterotrophic bacteria in the northwest subarctic Pacific to in situ iron fertilization as estimated by HPLC pigment analysis and flow cytometry. pp. 167–187.

A. Tsuda, H. Kiyosawa, A. Kuwata, M. Mochizuki, N. Shiga, H. Saito, S. Chiba, K. Imai, J. Nishioka and T. Ono. Responses of diatoms to iron-enrichment (SEEDS) in the western subarctic Pacific, temporal and spatial comparisons. pp. 189–205.

I. Kudo, Y. Noiri, K. Imai, Y. Nojiri, J. Nishioka and A. Tsuda. Primary productivity and nitrogenous nutrient assimilation dynamics during the Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study. pp. 207–221.

H. Saito, K. Suzuki, A. Hinuma, T. Ota, K. Fukami, H. Kiyosawa, T. Saino and A. Tsuda. Responses of microzooplankton to *in situ* iron fertilization in the western subarctic Pacific (SEEDS). pp. 223–236.

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N. Ramaiah, S. Takeda, K. Furuya, T. Yoshimura, J. Nishioka, T. Aono, Y. Nojiri, K. Imai, I. Kudo, H. Saito and A. Tsuda. Effect of iron enrichment on the dynamics of transparent exopolymer particles in the western subarctic Pacific. pp. 253–261.

T. Aono, M. Yamada, I. Kudo, K. Imai, Y. Nojiri and A. Tsuda. Export fluxes of particulate organic carbon estimated from 234Th/238U disequilibrium during the Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study (SEEDS 2001). pp. 263–282.

N. Yoshie, M. Fujii and Y. Yamanaka. Ecosystem changes after the SEEDS iron fertilization in the western North Pacific simulated by a one-dimensional ecosystem model. pp. 283–306.

M. Fujii, N. Yoshie, Y. Yamanaka and F. Chai. Simulated biogeochemical responses to iron enrichments in three high nutrient, low chlorophyll (HNLC) regions. pp. 307–324.

Special issue: "*Canadian SOLAS: Subarctic Ecosystem Response to Iron Enrichment (SERIES)*"
Deep-Sea Research II, 2006, Vol. 53, Nos. 20–22, pp. 2005–2454 (Guest Editors: P.J. Harrison, P.W. Boyd, M. Levasseur, A. Tsuda, R.B. Rivkin, S.O. Roy and W.L. Miller).

Dedication to Dr. Moire Wadleigh. p. 2005.

P.J. Harrison. SERIES (subarctic ecosystem response to iron enrichment study): A Canadian–Japanese contribution to our understanding of the iron–ocean–climate connection. pp. 2006–2011.

C.S. Law, W.R. Crawford, M.J. Smith, P.W. Boyd, C.S. Wong, Y. Nojiri, M. Robert, E.R. Abraham, W.K. Johnson, V. Forsland and M. Arychuk. Patch evolution and the biogeochemical impact of entrainment during an iron fertilisation experiment in the sub-Arctic Pacific. pp. 2012–2033.

D.A. Timothy, C.S. Wong, Y. Nojiri, D.C. Ianson and F.A. Whitney. The effects of patch expansion on budgets of C, N and Si for the Subarctic Ecosystem Response to Iron Enrichment Study (SERIES). pp. 2034–2052.

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A. Marchetti, N.D. Sherry, H. Kiyosawa, A. Tsuda and P.J. Harrison. Phytoplankton processes during a mesoscale iron enrichment in the NE subarctic Pacific: Part I—Biomass and assemblage. pp. 2095–2113.

A. Marchetti, P. Juneau, F.A. Whitney, C.S. Wong and P.J. Harrison. Phytoplankton processes during a mesoscale iron enrichment in the NE subarctic Pacific: Part II—Nutrient utilization. pp. 2114–2130.

A. Marchetti, N.D. Sherry, P. Juneau, R.F. Strzepek and P.J. Harrison. Phytoplankton processes during a mesoscale iron enrichment in the NE subarctic Pacific: Part III—Primary productivity. pp. 2131–2151.

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H. Saito, A. Tsuda, Y. Nojiri, J. Nishioka, S. Takeda, H. Kiyosawa, I. Kudo, Y. Noiri, T. Ono, Y. Taira, K. Suzuki, T. Yoshimura and P.W. Boyd. Nutrient and phytoplankton dynamics during the stationary and declining phases of a phytoplankton bloom induced by iron-enrichment in the eastern subarctic Pacific. pp. 2168–2181.

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I. Kudo, Y. Noiri, J. Nishioka, Y. Taira, H. Kiyosawa and A. Tsuda. Phytoplankton

community response to Fe and temperature gradients in the NE (SERIES) and NW (SEEDS) subarctic Pacific Ocean. pp. 2201–2213.

J.A. Needoba, A. Marchetti, M.F. Henry, P.J. Harrison, C.S. Wong, W.K. Johnson and T.F. Pedersen. Stable nitrogen isotope dynamics of a mesoscale iron enrichment experiment in the NE Subarctic Pacific. pp. 2214–2230.

M.S. Hale, R.B. Rivkin, P. Matthews, N.S.R. Agawin and W.K.W. Li. Microbial response to a mesoscale iron enrichment in the NE subarctic Pacific: Heterotrophic bacterial processes. pp. 2231–2247.

N.S.R. Agawin, M.S. Hale, R.B. Rivkin, P. Matthews and W.K.W. Li. Microbial response to a mesoscale iron enrichment in the NE Subarctic Pacific: Bacterial community composition. pp. 2248–2267.

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A. Tsuda, H. Saito, J. Nishioka, T. Ono, Y. Noiri and I. Kudo. Mesozooplankton response to iron enrichment during the diatom bloom and bloom decline in SERIES (NE Pacific). pp. 2281–2296.

S. Takeda, N. Yoshie, P.W. Boyd and Y. Yamanaka. Modeling studies investigating the causes of preferential depletion of silicic acid relative to nitrate during SERIES, a mesoscale iron enrichment in the NE subarctic Pacific. pp. 2297–2326.

K.L. Denman, C. Voelker, M.A. Peña and R.B. Rivkin. Modelling the ecosystem response to iron fertilization in the subarctic NE Pacific: The influence of grazing, and Si and N cycling on CO_2 drawdown. pp. 2327–2352.

M. Levasseur, M.G. Scarratt, S. Michaud, A. Merzouk, C.S. Wong, M. Arychuk, W. Richardson, R.B. Rivkin, M. Hale, E. Wong, A. Marchetti and H. Kiyosawa. DMSP and DMS dynamics during a mesoscale iron fertilization experiment in the Northeast Pacific—Part I: Temporal and vertical distributions. pp. 2353–2369.

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R.-C. Bouillon, W.L. Miller, M. Levasseur, M. Scarratt, A. Merzouk, S. Michaud and L. Ziolkowski. The effect of mesoscale iron enrichment on the marine photochemistry of dimethylsulfide in the NE subarctic Pacific. pp. 2384–2397.

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Boyd, P.W., Law, C.S., Wong, C.S., Nojiri, Y., Tsuda, A., Levasseur, M., Takeda, S., Rivkin, R., Harrison, P.J., Strzepek, R., Gower, J., McKay, R.M., Abraham, E., Arychuk, M., Barwell-Clarke, J., Crawford, W., Hale, M., Harada, K., Johnson, K., Kiyosawa, H., Kudo, I., Marchetti, A., Miller, W., Needoba, J., Nishioka, J., Ogawa, H., Page, J., Robert, M., Saito, H., Sastri, A., Sherry, N., Soutar, T., Sutherland, N., Taira, Y., Whitney, F., Wong, S.-K.E., Yoshimura, T. 2004. The decline and fate of an iron-induced subarctic phytoplankton bloom. *Nature* 428, 549–553.

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Synthesis publications

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Boyd, P.W., T. Jickells, C.S. Law, S. Blain, E.A. Boyle, K.O. Buesseler, K.H. Coale, J.J. Cullen, H.J.W. de Baar, M. Follows, M. Harvey, C. Lancelot, M. Levasseur, R. Pollard, R.B. Rivkin, J. Sarmiento, V. Schoemann, V. Smetacek, S. Takeda, A. Tsuda, S. Turner and A.J. Watson. 2007. Mesoscale iron-enrichment experiments 1993–2005: Synthesis and future directions. *Science*, 315, 612–617.

IFEP-AP Endnote 4

Proposal for a Working Group on
Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean

Duration: October 2007 – October 2010
Parent Committee: BIO

The primary goals of the Working Group are: a) to promote better understanding of natural and anthropogenic iron supplies to the North Pacific and their impact on biogeochemistry and ecosystems; and b) to facilitate closer ties among various research communities (aerosol, physical oceanography, biology, chemistry and modeling) to better integrate new findings and to provide needed feedback to help coordinate research activities.

Terms of reference

1. Compile and synthesize available iron biogeochemistry data in the North Pacific;
2. Review the past and ongoing laboratory, field and modeling studies on iron biogeochemistry and its impact on biological productivity and marine ecosystems in the North Pacific Ocean;
3. Determine the natural supplies of iron to the North Pacific, which includes atmospheric dust transport and movement of iron-enriched waters, and examine linkages between iron supply and ecosystem responses;
4. Identify gaps and issues related to experimental and modeling activities, encourage and plan national and international scientific programs on iron biogeochemistry and its impact on marine ecosystems in the North Pacific;
5. Elucidate the role of iron as a potential regulator of harmful algal bloom (HAB) in coastal ecosystems of the North Pacific.

Proposed members

Canada
James Christian
William R. Crawford
Paul J. Harrison
Maurice Levasseur
Charles Trick
C.S. Wong

Japan
Jun Nishioka
Hiroaki Saito
Shigenobu Takeda (Co-Chairman)
Mitsuo Uematsu
Yasuhiro Yamanaka

China
Liqi Chen
Xiuren Ning
Guangyu Shi

Korea
Kyung-Ryul Kim
Kitack Lee

Russia
Vladimir M. Shulkin

U.S.A.
Fei Chai (Co-Chairman)
William P. Cochlan
Natalie Mahowald
Suzanne Strom
Mark L. Wells

REPORT OF ADVISORY PANEL ON MARINE BIRDS AND MAMMALS

The seventh meeting of the PICES Advisory Panel on *Marine Birds and Mammals* (hereafter MBM-AP) was held from 19:00–21:30 hours on October 30, 2007. Drs. Hidehiro Kato and William J. Sydeman, MBM-AP Co-Chairmen, called the meeting to order and welcomed the members and observers (*MBM-AP Endnote 1*). The participants reiterated the need for the Panel which serves to generate interest in marine birds and mammals within the PICES community, and has been active in coordinating and facilitating multi-disciplinary investigations, symposia, and workshops for PICES (see *MBM-AP Endnote 2*). The draft agenda was reviewed and approved (*MBM-AP Endnote 3*).

PICES XVII Topic Session (Agenda Item 3)

The BIO/FIS/POC Topic Session on "*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*" (S11) was held two days after the MBM-AP meeting. Seventeen oral papers and 2 posters were presented. The session was expanded from ½ day to a full day due to high subscription. It was designed to be multi-disciplinary, including presentations on phytoplankton, zooplankton, fish and birds. A positive response from potential contributors is anticipated about publishing papers from the session in a special issue of a primary journal to be decided.

Updates to WG 11 report on marine birds and mammals and publications from previous MBM-AP workshops (Agenda Item 4)

The Panel discussed publications arising from previous MBM-AP workshops on time series of predator diets in the North Pacific held at PICES XIII and PICES XIV. This issue was discussed at last year's meeting as well. No progress has been made to publish these data as a compendium or theme section in a journal. Some material has been published independently by the contributors. Therefore, it was decided that this idea would not be pursued further.

The Panel spent a great deal of time considering the possibility of updating and revising the PICES Scientific Report on "*Predation by marine birds and mammals in the subarctic North Pacific Ocean*" (Hunt *et al.*, 2000) produced by PICES Working Group (WG 11) on *Consumption of Marine Resources by Marine Birds and Mammals*. It was agreed that this report is extremely valuable to the PICES community and that new data are available for an update. MBM-AP thought that providing a new report to the PICES community by 2010 would be a reasonable goal but that funding for the project would probably be necessary to update the document as envisioned. There are many excellent new datasets on both populations and diet that could be brought to the report to improve estimates of prey consumption. The Panel supported this idea as a high priority project, and will be seeking external support for updating the WG 11 report.

Various MBM-AP members volunteered to speak with members of the PICES modeling community to ascertain their needs, and to coordinate the update of the WG 11 report with modelers. The possibility of an inter-sessional PICES-sponsored MBM-AP/CFAME workshop to facilitate use of prey consumption estimates by modelers was discussed.

Activities at PICES XVII (Agenda Item 5)

MBM-AP proposed to convene a ½-day Topic Session on "*Seabirds and marine mammals as environmental indicators*" at PICES XVII (*MBM-AP Endnote 4*). The development of the session will be coordinated with BIO and MEQ.

Other potential Topic Sessions or workshops were "migration" and "birds and mammals as

oceanographers". These will be addressed in the future.

Participation in MBM-AP (Agenda Item 6)

There has been good participation on the Panel by Canada, Japan and the United States, and a Korean scientist attended the meeting on behalf of Panel member, Dr. Zang-Guen Kim. The Panel is concerned by the lack of national participation in its activities and recommends that:

- China be requested to assign experts on marine birds and mammals to the Panel; and
- Canada and Korea be asked to nominate seabird expert to serve on the Panel.

Report of the Pacific CPR: Marine Bird and Mammal Project (Agenda Item 7)

Dr. Sydeman reported on the accomplishments of the Continuous Plankton Recorder (CPR) Marine Bird and Mammal Project. The project has conducted 16 surveys of the North Pacific between June 2002 and June 2007. Funding for the project has been provided by the North Pacific Research Board. A number of papers have been published or are in preparation. A report on this project was also presented at the CPR-AP meeting on October 28, 2007. The MBM-AP recommends continuation of the project and hopes that existing and new funding can be procured.

National reports on climate change and marine birds and mammals (Agenda Item 8)

Due to time constraints, the Panel did not receive country reports on these activities.

Cooperation with IWC (Agenda Item 9)

Last year, Dr. Kato was nominated to serve as a liaison between PICES and the International Whaling Commission (IWC). His report of the 2007 IWC Scientific Committee meeting is included as *MBM-AP Endnote 5*.

Terms of Reference (Agenda Item 10)

The terms of reference were discussed (*MBM-AP Endnote 2*) and supported as written.

Vision statement (Agenda Item 11)

There was no discussion on this topic.

Other matters (Agenda Item 12)

Content of the PICES website on activities of MBM-AP requires some revision. The Panel members agreed to review the website and make suggestions for improving it.

There was discussion about the PICES North Pacific Ecosystem Status Report, and approach for its update (similar discussions were held last year). MBM-AP members and observers plan to contribute to the revision of this report.

MBM-AP Endnote 1

Participation list

Members

Hidehiro Kato (Japan, Co-Chairman)
Rolf Ream (U.S.A.)
William J. Sydeman (U.S.A., Co-Chairman)
Andrew Trites (Canada)
Yutaka Watanuki (Japan)

Observers

Douglas F. Bertram (Canada)*
Seok-Gwan Choi (Korea)

* former MBM-AP Co-Chairman

MBM-AP Endnote 2

MBM-AP Terms of Reference

1. Provide information and scientific expertise to the Biological Oceanography Committee, the CCCC Program, especially the Climate Forcing and Marine Ecosystems (CFAME) Task Team, and when necessary, to other Scientific and Technical Committees with regard to the biology and ecological roles of marine mammals and seabirds;
2. Identify important problems, scientific questions, and knowledge gaps in assessing the roles of marine mammals and seabirds in marine ecosystems;
3. Assemble relevant information on the biology of marine mammals and sea birds and disseminate it to the PICES community through scientific reports and symposia;
4. Develop strategies to improve collaborative, interdisciplinary research with marine mammal and seabird researchers and the PICES scientific community.

MBM-AP Endnote 3

MBM-AP meeting agenda

1. Welcome and introductions
2. Adoption of agenda
3. Review of upcoming BIO/FIS/POC Topic Session on "*Phenology and climate change in the North Pacific*" (S11)
4. Discussion of revision to the WG 11 final report and publication of results arising from previous MBM-AP workshops (PICES XIII and PICES XIV) on time series of predator diets in the North Pacific
5. Planning for PICES XVII (Dalian, China)
6. Participation in MBM-AP from member countries
7. Report of the Pacific CPR Program: Marine Bird and Mammal Project
8. Country reports – climate change and marine birds and mammals
9. Cooperation with the International Whaling Commission (IWC)
10. MBM-AP terms of reference – review
11. Vision statement – review
12. Other matters

MBM-AP Endnote 4

Proposal for a ½-day BIO/MEQ Topic Session at PICES XVII on *"Seabirds and marine mammals as environmental indicators"*

Marine birds and mammals have been shown to be sensitive indicators to changes in marine ecosystems. As highly visible upper trophic level secondary and tertiary consumers with high metabolic rates, changes in food webs and human impacts on marine environments are often amplified and revealed in the biology of these predators. For this session, we seek papers that: (1) demonstrate how and when marine birds and mammals can be used to monitor and evaluate ecosystem status and "health" (*e.g.*, HABs, contaminants, prey fields); (2) address new studies to improve the concept of seabirds and marine mammals as ecosystem indicators; and (3) present case studies on how this approach and information is and/or can be applied to pressing management and conservation questions.

Recommended convenors: Hidehiro Kato (Japan), Rolf Ream (U.S.A.) and Andrew Trites (Canada).

Recommended invited speakers: William Montevecchi (Canada) and Peter Ross (Canada).

MBM-AP Endnote 5

PICES observer report on the 59th IWC Scientific Committee Meeting

(Hidehiro Kato, Tokyo University of Marine Science and Technology, Japan)

The 59th Scientific Committee (SC) meeting of the International Whaling Commission (IWC) was held May 7–18, 2007, in Anchorage, Alaska. A total of 224 participants from 32 countries, including 64 invited experts, participated. A total of 13 international organizations (CMS, ICES, IATTC, ICCAT, CCAMLR, SO-GLOBEC, NAMMCO, IUCN, FAO-COFI, PICES, CITES, ECCO and SPAW) sent their observers to the meeting. PICES was especially welcomed by the IWC/SC.

There are seven sub-committees (*Revised management procedure; Aboriginal Subsistence Whaling Management Procedure; Bowhead, Right and Gray whales; In-depth assessment; Southern Hemisphere whales; Small cetaceans; Whale watching*) and six working groups (*Aboriginal whaling management procedure; Stock definition; Bycatch and other human-induced mortality; Environmental concerns; Ecosystem modeling; Special permit*) under the Scientific Committee. Every substantial issue has to be discussed by the sub-committee or the working group, and then forwarded to plenary of the committee. The Scientific Committee has worked mainly on comprehensive assessments (CA) of whale stocks, on implementation trials of Revised Management Procedure (RMP) after the cessation of commercial whaling, and agreed on the scientific base of RMP in 1996.

This year, the Scientific Committee focused especially on reviewing stock status of Southern Hemisphere humpback whales, Antarctic and North Pacific minke whales under the CA, as well as Western North Pacific gray whales with some concerns of recent entanglements. For a renewal of catch quota by aboriginal and subsistence whaling, there were comprehensive reviews on stock structure and other population parameters of bowhead whale stocks. Also discussions on JARPA (the Japanese scientific permit program in the Antarctic) review workshop were highlighted. The Scientific Committee also continued work on the general RMP issue, including implementation trials for Western North Pacific Bryde's whales and North Atlantic fin whales.

Under environmental issues, emerging and resurging diseases, handling of cetacean entanglements were mainly dealt with by the Working Group on *Environmental Concerns*, in addition to a review of pollution (Pollution 2000+) and cetacean habitats (SOCER – State of Cetacean Environment Report) programs including collaboration with SOWS and CCAMLR. It is also planned to have a workshop on "*Climate change and cetaceans*" in the near future.

This year, the Scientific Committee established an ecosystem modeling sub-group with focus on modeling of krill–krill predators in the Antarctic (in cooperation with CCAMLR) and ecological interaction (in cooperation with FAO).

The next annual Scientific Committee meeting will be held June 1–13, 2008, in Santiago, Chile.

REPORT OF ADVISORY PANEL ON MICRONEKTON SAMPLING INTER-CALIBRATION EXPERIMENT

A subset of the Advisory Panel on *Micronekton Sampling Inter-calibration Experiment* (hereafter MIE-AP) and several observers (*MIE-AP Endnote 1*) met on the evening of October 28, 2007, immediately after the BIO workshop on "*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*". Details of this workshop (W1) can be found in the *Session Summaries* chapter of this Annual Report. Discussion topics of the MIE-AP meeting are listed in *MIE-AP Endnote 2*.

Developments in micronekton quantification (Agenda Item 1)

Models were developed to predict backscattering volume to allow for comparisons between acoustic data and the net data. The new system, J-QUEST, was shown to quantify the epipelagic micronekton and nekton but appeared to be inefficient in detecting the mesopelagic fishes, and myctophids in particular. The discussion revolved around the possibility of using a red light or another part of the light spectrum to which myctophids are less sensitive. Experimental trials indicated that myctophids were able to detect and avoid J-QUEST while it used red light.

After briefly reviewing current sampling gears, present information points to the Matsuda–Oozeki–Hu Trawl (MOHT) gear as being among the most reliable and cost effective micronekton gears to date. It provides high quality and quantity micronekton sampling. Dr. Hiroya Sugisaki reported that the development of a closing/opening mechanism is underway (trials are to be conducted within months). Equipping MOHT with the opening/closing mechanism on the codend could put this gear in the position to become a standard micronekton gear world-wide, and in the North Pacific, in particular.

Comparison between ICES and PICES inter-calibration experiments (Agenda Item 2)

After a brief review of both ICES and PICES micronekton inter-calibration experiments, the Panel concluded that it is generally impossible to undertake a comparison of these experiments due mainly to incomparable gears used for sampling, and because the ICES experiment concentrated on mesozooplankton in a fjord system in Norway.

Progress on acoustic data analyses (Agenda Item 3)

Acoustic data from the MIE-2 cruise (Oyashio waters off Japan, September 27–October 3, 2005) are mostly analyzed and reconciled with the trawl data. Acoustic data collected during the MIE-1 cruise (off the west side of Oahu Island, Hawaii, October 6–13, 2004) still require some work and cleaning. Data collected during the MIE-3 cruise (the eastern Bering Sea, September 18–27, 2007) have yet to be released by the U.S. colleagues who provided the vessel. The data will be analyzed jointly by Japanese and U.S. scientists.

Compatibility of acoustic and trawl data (Agenda Item 4)

Preliminary results indicate that the comparability of the trawl and acoustic estimates is low. This points to problems associated with both sampling techniques, which have been discussed. The closest results were obtained between MOHT and acoustics. MIE-AP felt that research to improve the acoustics estimates should be continued.

Overview of MIE-3 (Agenda Item 5)

The third micronekton inter-calibration experiment (MIE-3) was carried out onboard the

R/V *Oscar Dyson* in the eastern Bering Sea, from September 18–27, 2007. The ship was engaged in the BASIS (Bering-Aleutian Salmon International Surveys) program under NPAFC, (North Pacific Anadromous Fish Commission) operated by the Auke Bay Laboratory, NOAA/NMFS. Dr. Jim Murphy kindly donated the ship time for the micronekton experiment. This experiment was led by Dr. Orio Yamamura (Hokkaido National Fishery Research Institute, Japan). Other participants included: Drs. Hiroki Yasuma (Hokkaido University, Japan) and Andrey Suntsov (Northwest Fisheries Science Center, U.S.A.).

The sampling gears planned to be compared were the 1.8-m Isaacs–Kid mid-water trawl (IKMT), MOHT and Cantrawl 300/262 rope trawl. However, due to the limited time available for the experiment, only IKMT and MOHT were used. A comparison between IKMT and MOHT was essential because there are so much historical data collected with an IKMT. Aside from the sampling gears, backscattering data were recorded using a Simrad EK-60 echosounder with 15, 38, 70, 120 and 200 kHz transducers.

Due to rough seas, the ship time assigned for the experiment was reduced to 24 hours. Therefore, the nets were deployed at a 60-m depth station near St. Paul Island instead of near the shelf break of the eastern Bering Sea. The sampling was in a day/night sequential design, with different gears towed sequentially at each location, with triplicate samples collected during daylight and night at the same ship speed (3 knots).

The catch was exclusively dominated by age-0 walleye pollock (>99%), offering a good opportunity for gear comparison. The nets showed similar catchability during daytime (1.1 times larger for MOHT in density estimate), but MOHT showed significantly higher catchability in night sampling (2.8 times higher). In the comparison of body length frequency distribution, MOHT caught slightly larger fish than IKMT, suggesting net avoidance from the latter net.

The echo sounding data are yet to be released by the U.S. colleagues and will be analyzed jointly by Japanese and U.S. scientists.

Future activities (Agenda Item 6)

The members of MIE-AP felt that there will be no further inter-calibration experiments. It appears to be extremely difficult to obtain ship time, and the Panel expressed its gratitude to the member countries that donated the ship time to conduct three experiments. The participants also concluded that much of the data have been worked up at this point, and some encouraging results were obtained.

There was unanimous agreement for the suggestion that it was time to prepare the final MIE-AP report and to write related publications in the peer-reviewed literature. It was suggested that some travel funds should be requested to facilitate the data analysis. In particular, the identification of fish and crustaceans collected during the MIE-1 cruise should be completed before writing the final report. In this regard, MIE-AP requested PICES to cover travel expenses for Dr. Suntsov to come from the Northwest Fisheries Science Center (Newport, Oregon) to the University of British Columbia (Vancouver) for 7–10 days to assist with fish identification. Furthermore, the MIE-3 cruise data need to be worked up.

Realistically, an advanced report on the MIE-AP activities could be available at the next PICES Annual Meeting in Dalian, China. Most of the work has been divided between groups of experts, and MIE-AP Co-Chairmen were charged with the task of overseeing the progress. To facilitate the development of the final report, MIE-AP requested financial support for one of Co-Chairmen (Dr. Evgeny Pakhomov) to travel to Dalian.

Below is a preliminary draft of the MIE-AP final report structure (the names listed in parentheses are responsible for writing each section):

1. Introduction, background, major idea of micronekton inter-calibration experiments (Brodeur, Pakhomov, Yamamura)

2. MIE-1
   - Description of the experiment
   - Composition and diversity indices of the samples: crustaceans (Pakhomov, Brodeur), fish (Suntsov), squid (Seki)
   - Abundance and (biomass) of the micronekton
   - Size structure (Pakhomov)
   - Acoustic data (Domokos)
   - Inter-comparison between gears and between gears and acoustics (All, lead: Pakhomov, Domokos)
3. MIE-2
   - Description of the experiment
   - Composition and diversity indices of the samples: crustaceans (Yamamura), fish (Yamamura), squid (Yamamura)
   - Abundance and (biomass) of the micronekton
   - Size structure (Yamamura)
   - Acoustic data (Yasuma)
   - Inter-comparison between gears and between gears and acoustics (lead: Yamamura)
4. MIE-3
   - Description of the experiment
   - Composition and diversity indices of the samples: crustaceans (Yamamura), fish (Suntsov, Yamamura), squid (Yamamura)
   - Abundance and (biomass) of the micronekton (Yamamura)
   - Size structure (Yamamura, Suntsov)
   - Acoustic data (Yasuma)
   - Inter-comparison between gears and between gears and acoustics (lead: Yamamura)
5. General conclusions and recommendations.

MIE-AP Endnote 1

Participation list

Members

Richard D. Brodeur (U.S.A.)
Kazushi Miyashita (Japan)
Evgeny A. Pakhomov (Canada, Co-Chairman)
Orio Yamamura (Japan, Co-Chairman)

Observers

Seok-Gwan Choi (Korea)
Reka Domokos (U.S.A.)
Yasuzumi Fujimori (Japan)
Hideki Hamaoka (Japan)
Julian A. (Tony) Koslow (U.S.A.)
Todd W. Miller (U.S.A.)
A. Jason Phillips (U.S.A.)
Hiroaki Saito (Japan)
Hiroya Sugisaki (Japan)
Andrei V. Suntsov (U.S.A.)
Hiroki Yasuma (Japan)

MIE-AP Endnote 2

MIE-AP meeting agenda

1. New developments in the field of micronekton quantification: Could acoustics be the way forward?
2. Is it possible to undertake a comparison between ICES and PICES inter-calibration experiments?
3. How far are we in the acoustic data set analyses?
4. Compatibility of acoustic and trawl data: Caveats, problems and solutions
5. Lessons from the MIE-3 cruise
6. An inter-sessional workshop to look at the data from 3 inter-calibration experiments and to discuss drafting of the MIE-AP report (schedule, contents and allotment of writers)

2007 Review of PICES Publication Program

Brian Voss, NOAA Libraries, Seattle, WA
Janet Webster, Oregon State University Libraries, Newport, OR

September 19, 2007

Contents

Executive Summary

Background

The North Pacific Marine Science Organization (PICES) was established in 1992 to promote and coordinate marine scientific research and data sharing challenges in the North Pacific Ocean. To fulfill this mission, a vigorous publications program has grown out of the crucial need for efficient communication with a highly varied audience. PICES publications are a record of the activities and scientific findings of the Organization. The following list describes the kinds of publications and their role(s):

- *Annual Reports* are the official administrative record of the Organization and they describe the various activities of PICES, including its meetings, expenditures, and planning, by calendar year.

- The *Scientific Report* series is used primarily to document PICES workshops and to provide a publishing venue for final reports of PICES Working Groups on given topics as well as planning reports as appropriate.
- *Special Publications* and *books* are published irregularly, tending to be of broader interest to a wider audience.
- *Abstract Books* provide brief summaries of presentations and posters at Annual Meetings and other symposia (co-) organized by PICES.
- *Special Issues* are collections of peer-reviewed articles in a variety of primary scientific journals, arising from symposia or topic sessions, occasionally published in collaboration with other organizations, using commercial publishers to extend the reach of PICES-related work.

The PICES Finance and Administration (F&A) Committee directed the Executive Secretary to undertake an external review of its publications program. Publishing is an expensive and time-consuming activity; however, the products generated are important in fulfilling the Organization's mission. PICES relies on a small, dedicated staff and the efforts of individual volunteers and organizational members to accomplish its publishing goals. In 2003, a similar program review was commissioned, so the current review provides an opportunity to consider options for the future with special consideration of electronic publishing and to evaluate the efficacy of the 2003 recommendations.

Objectives

The PICES Executive Secretary asked the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) to examine strategies to maintain the vitality of the PICES publications program while being mindful of costs and emerging options for communications. In February 2007, Brian Voss (NOAA Libraries) and Janet Webster (Oregon State University Libraries) met with Drs. Alex Bychkov and Skip McKinnell to plan the review. The following was agreed:

1. Create a matrix of PICES publications that covers the following factors:
    a. Printing and distribution costs (Appendix A)
    b. Options for creating in digital format (Appendix E)
    c. Options for archiving in both digital and print formats (Appendix E)
    d. Current distribution (Section 3. Data provided to Secretariat)
    e. Current coverage in indexing and abstracting services (Section 4)
2. Explore the impact of PICES publications on the scientific and management community.
3. Examine impacts of moving the existing print distribution system to an increased reliance on digital formats and explore mitigation measures to rectify any resulting distribution problems.
4. Examine impacts on Secretariat infrastructure and document archival processes.
5. Discuss impacts of any changes on each of the Contracting Parties.
6. Recommend options and Action Plan to the F&A Committee.

We examined the efficiency of the program primarily in terms of distribution and archiving practices and the degree to which PICES is reaching its intended audience in a timely fashion. We found that recommendations from a 2003 review were largely acted upon, with the major exception of adding dedicated staff to the publications activity: however, it may be too soon to see the full impact of those changes with regard to a more effective and efficient publications program.

Findings

In the course of the review, the variability in effective solutions for each audience or each publication series revealed a complexity that, in some cases, warrants further investigation. To most succinctly summarize our findings according to the preceding objectives, the following questions and answers outline the recommendations in the report and the associated action plan:

- What are the options for transition to electronic publications by series?

  Transition to electronic only versions of the Annual Reports represents the most significant opportunity for transition. With the exception of *PICES Press*, a reduction in print distribution of other series would result in negligible reduction in cost of print production and complete transition to electronic only production is not recommended at this time. Appendix E describes these options in more detail.

- What impacts on the existing distribution system (libraries; commercial distributors, *etc*.) will this transition have?

  We recommend conducting surveys of each distribution list (Individuals, Institutions, and Libraries) that recognize each group's differing function. The surveys will reveal necessary detail about the impacts on recipients of PICES publications as these groups and individuals are the primary "customers". Preferences for using print *versus* electronic versions as well as network infrastructure to support consistent access to electronic publications are crucial aspects of maintaining high satisfaction among PICES publications readers. Appendices C and D offer some suggestions for survey questions and possible actions based on results. In light of the recommendations, the PICES Secretariat has described potential impacts on printers and distributors as negligible.

- What mitigation measures (if any) are needed to rectify distribution problems resulting from this transition?

  We foresee libraries playing a crucial role as depository libraries in mitigating impacts from reduced print distribution. The customer survey is recommended to better identify measures required as a result of the initial stages of the transition and to better identify a timeframe for further opportunities to continue the transition in the future.

- What impacts on Secretariat infrastructure and document archival processes will this transition have?

  Short-term assistance via contractor or intern staffing would address the anticipated temporary increase in workload resulting from completion of the Action Plan. The proposed PICES/IAMSLIC cooperative digital repository pilot project using the existing IAMSLIC repository installation, *Aquatic Commons*, is intended to help test-drive many of the more significant changes that would be associated with additional archiving of electronic publications while having the least impact on the current work flow.

- How will this transition impact each of the Contracting Parties?

  The customer surveys and dialogue with the Secretariat would best identify these impacts as well as identify depository libraries in regions where collected data is lacking.

Across all series, we found that the publications program is effective in supporting the PICES mission in several ways:

- According to citation patterns and website use, all PICES publications are contributing to scientific dialogue, although more consistent and comprehensive indexing in *Fish and Fisheries Worldwide* and *Aquatic Sciences and Fisheries Abstracts* (ASFA) would enhance the visibility of PICES publications.
- Continued partnerships with commercial publishers are encouraged, especially if the rights to store digital copies of all articles on the PICES website are negotiated.

Aquatic Sciences and Fisheries Abstracts (ASFA) would enhance the visibility of PICES publications.

- Continued partnerships with commercial publishers are encouraged, especially if the rights to store digital copies of all articles on the PICES website are negotiated.
- Print versions of PICES publications are currently collected and archived at several key institutions, but distribution practices should be reviewed to focus on those institutions and to ensure that all appropriate institutions are archiving the print publications.
- Access to Special Issues of primary journals is adequate in the United States and Canada, but may be problematic in other PICES member countries.
- PICES publications are more accessible through the revamped PICES website. Usage data suggest that digital copies of existing publications are used and a variety of institutions and organizations link to the PICES website.
- Efforts should be made to convert the remaining publications to searchable PDF format. Additionally, PICES publications should be archived in an open access digital repository, allowing more robust, permanent digital access and archiving.
- The Secretariat manages the current level of publication adequately, reporting only occasional delays in production (Fig. 1). It has no capacity to expand. As PICES activity grows, it is anticipated that publication activity will expand. Increased staff or contractor time devoted to the publications process would ensure that publications are of a consistent quality, timely, well publicized, appropriately distributed, and digitally archived even as the program expands.

Throughout our review, it became apparent that PICES publications have a high value. They provide the primary conduit for basic communication of the science of the North Pacific Ocean by documenting conditions, examining problems, and proposing approaches. The communication of approaches and recommendations will be critical for future research directions as well as possible policy considerations. On a practical level, the PICES publications document the work and history of the organization and they promote international collaboration through the writing and editing process. PICES publications provide a record of the international research on and thinking about key scientific problems of the North Pacific.

1. Introduction

The report that follows describes our approach and clarifies our findings. We recommend options for strengthening the publications program in terms of efficiency and impact within the context of an organizational need to consider more reliance on electronic-only publication as a means to minimize printing and distribution costs. The first section evaluates the Organization's performance with respect to the recommendations from the 2003 Publication Review. The second section provides an overview of citation patterns as one means of assessing usage of PICES publications by the scientific community. The third and fourth sections explain alternatives for collecting, archiving, and indexing of PICES publications, as all are indicators of access. The final section summarizes our recommendations, addressing areas where efficiency may be gained in the production and distribution of print publications and positioning the organization for a smooth transition into a more robust digital production and distribution program. These recommendations focus on workflow changes, branding of the PICES name, and key partnerships with libraries and commercial indexers to help PICES ensure that print and digital archives are thorough, growing, and accessible. In addition, Appendix E contains the detailed characterizations of each published series used to inform the general recommendations, as well as additional recommendations for print and electronic distribution specific to each series.

2. Review of recommendations from 2003 review

In September 2003, W.L. Hobart (NOAA NMFS Scientific Publications Program) and G.J. Duker (Publications Program, NOAA NMFS Alaska Fisheries Science Center) reviewed the PICES publications program at the request of the PICES F&A Committee. Their charge was to examine the costs, methods, and possible efficiency of producing and distributing PICES publications. They made a variety of recommendations, most of which have been implemented (North Pacific Marine Science Organization, 2005). The major recommendations are listed below, describing the situation in 2003 and the actions taken:

1. PICES Secretariat was overloaded and publishing duties contributing to the overload. They recommended the addition of editorial staff or contracting for editorial assistance.
   Action: No editorial staff was added due to budgetary constraints; however, a successful contracting relationship has been in place since 2005. Workload is causing delays in some areas (Fig. 1).

2. PICES lacked a style manual and did not promote related editorial standards.
   Action: This manual has been compiled and is shared with authors and chairs of PICES working groups as appropriate. Secretariat staff uses in-house production guidelines for *PICES Press* and the Scientific Reports. The reports now have a consistent citation format as well as information on all PICES publications as a standard part of the report.

3. Some PICES publications lacked visible corporate identity so the Organization may not have been recognized for its support of the work.
   Action: While the PICES published series maintain a constant visual identity, the special journal issues remain problematic in terms of branding. Some (*Progress in Oceanography*) allow PICES to print the PICES logo on the cover while others do not. In either case, this visual clue does not persist in a digital environment. Additionally, authors' affiliations are associated with their home institution with rare mention of PICES affiliation.

4. PICES was not actively archiving its publications in a digital format.
   Action: Most PICES publications are available as PDF files on the PICES website.

5. The PICES website was out of date, making it difficult to access publications.
   Action: The website was completely revised to offer a clean, accessible venue.

6. PICES staff used Microsoft Word for much of its publication production and could benefit from an upgrade to a more robust, current desktop publishing platform.
   Action: This was not implemented due to the steep learning curve associated with specialized software and an inability to hire additional staff with these skills.

Since the 2003 report, the PICES publications program has continued with current staff providing the editorial guidance. The publications are more accessible through the PICES website as well as major commercial journals. Meanwhile, the information landscape continues to evolve.

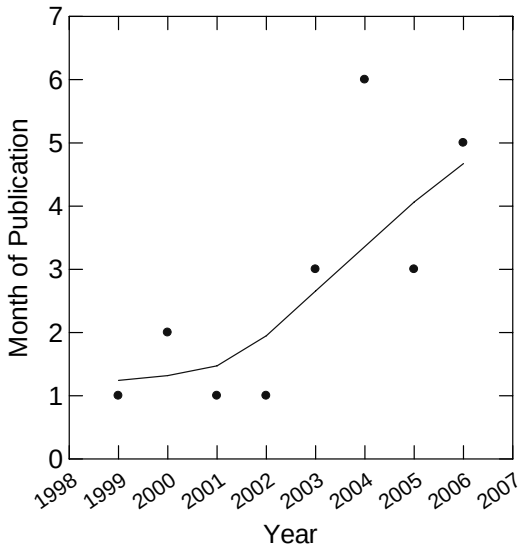

Figure 1 Trend in month of publication of the PICES Annual Report following the close of a fiscal year (month 0).

3. Assessing usage of PICES publications

Usage is a significant justification to continue the PICES publications program. Assessing usage, however, is not trivial and has inherent limitations, especially with grey literature (Webster and Collins, 2005). PICES Scientific Reports undergo varying levels of peer and editorial review, but are not recognized as peer-reviewed journals, and thus do not receive the same level of attention in commercial literature indexes. This limits their exposure and consequent use. With this as an explicit caveat, examining citation patterns can still be a useful indicator of usage by, and impact on, the scientific community. Other PICES publication series generally undergo even less peer review. Therefore, they are less often found in the commercial literature indexes.

Two indexes, *Web of Science* and *Scopus*, feature tools to assess impact by compiling citation rates to individual publications. *Google Scholar* is beginning to do this, but as yet is not very sophisticated. These tools focus on the peer-reviewed journal literature as their core data. Citations to grey literature appear if that literature is cited within the journal literature. For example, a citation to a PICES Scientific Report will appear if an article in one of the indexed journals cited it. However, the publications cited in a PICES Scientific Report will not appear as a matter of standard practice. *Web of Science* and *Scopus* were searched for citations to papers in PICES special journal issues as well as any PICES publications such as the Scientific Reports.

3a. Scientific Reports

Considering the "grey" nature of the report series, it is heartening to report that they are cited quite well (Table 1), especially in comparison to other grey literature report series (Cordes, 2002/2003; McDonald, Cordes and Wells, 2007). Eighteen of the first thirty reports are cited at least once in *Web of Science* while twenty-three are cited according to *Scopus*. *Scopus* claims to include a broader suite of source publications, hence the higher numbers of citations. The three most cited Scientific Reports are Numbers 2, 6, and 10, and all address the Okhotsk Sea. Perhaps this demonstrates a unique role of PICES in

covering a geographic area that was neglected previously in the English language scientific literature. The diminishing number of citations to more recent reports is expected given the lag time for a publication getting into circulation.

Table 1 Number of citations to PICES Scientific Reports in two indexing services

Scientific Report	Web of Science	Scopus
no.1	4	10
no.2	13	61
no.4	1	2
no.5	1	3
no.6	6	36
no.8	–	1
no.10	11	37
no.12	7	28
no.14	3	7
no.15	13	14
no.16	4	6
no.17	2	1
no.18	3	9
no.19	–	1
no.20	3	5
no.22	1	1
no.23	–	2
no.24	–	2
no.25	2	2
no.26	1	1
no.27	–	1
no.28	3	3
no.30	2	2
Total	80	235

3b. PICES special issues of primary journals

Citation rates of the special journal issues provide strong validation of the value of publishing in peer-reviewed, commercially published journals. Table 2 shows the total number of articles in each issue as well as the number of citations in both *Web of Science* and *Scopus*. Given that most scientific papers are not cited (some say up to 90% (Meho, 2007)), these numbers indicate that many PICES-sponsored articles are read and used.

Table 2 Citations to PICES Special Issue articles

Special Issue	# of Articles	# of citations in *Web of Science*	# of citations in *Scopus*
Progress in Oceanography v.43 n.2-4 (1999)	11	227	364
Progress in Oceanography v.47 n.2-4 (2000)	13	75	654
Progress in Oceanography v.49 n.1-4 (2001)	33	340	495
Journal of Oceanography v.58 n.5 (2002)	12	55	98
Progress in Oceanography v.55 n.1-2 (2002)	17	123	202
Canadian J. Fish. Aquat. Sci. v.59 n.12 (2002)	15	120	159
Deep Sea Research Part II v.49 n.24-25 (2002)	28	221	423
Journal of Oceanography v.59 n.4 (2003)	10	78	99
Progress in Oceanography v.57 n.3-4 (2003)	13	102	N/A
Marine Environmental Research v.57 n.1-2 (2004)	10	28	50
Journal of Oceanography v. 60 n.1 (2004)	13	85	74
Progress in Oceanography v.61 n.2-4 (2004)	10	21	28
ICES J. of Marine Science v.61 n.4 (2004)	28	108	125
Journal of Marine Systems v.50 n.1-2 (2004)	7	33	41
ICES J. of Marine Science v.62 n.3 (2005)	40	108	246
Deep Sea Research Part II v.52 n.5-6 (2005)	10	97	31
Progress in Oceanography v.64 n.2-4 (2005)	14	29	81
Deep Sea Research Part II v.53 n.3-4 (2006)	13	3	6
Progress in Oceanography v.68 n.2-4 (2006)	12	15	29
Deep-Sea Research Part II v.53 n.20-22 (2006)	25	0	1
Ecological Modelling v.202 n.1-2 (2007)	18	70	70
Total number of articles	352		
Total number of citations		1938	3276

Of course, some articles have more impact than others. Table 3 shows the most heavily cited in each of the special journal issues with older articles having more time to generate additional citations. Most articles have a classic citation pattern as illustrated by Figure 2 using citations to Minobe's 2000 article.

Table 3 Most cited PICES journal articles

Article cited	# of citations in *Web of Science*	# of citations in *Scopus*
Prog. Oceanogr. 43 (1999) Harrison	83	96
Prog. Oceanogr. 47 (2000) Minobe	54	69
Prog. Oceanogr. 49 (2001) Hollowed	52	50
J. Oceanogr. 58 (2002) Whitney	27	29
DSR 49 (2002) Honda	34	50
Prog. Oceanogr. 55 (2002) Hunt	24	26
J. Oceanogr. 59 (2003) Yasuda	24	28
Prog. Oceanogr. 57 (2003) Denman	20	N/A
ICES 61 (2004) Heath	12	16
Prog. Oceanogr. 61 (2004) Yamada	9	8
ICES 62 (2005) Rice	20	22
DSR 52 (2005) Whitney	11	9
Prog. Oceanogr. 64 (2005) Tsuda	7	16
Prog. Oceanogr. 68 (2006) Demaster	7	7

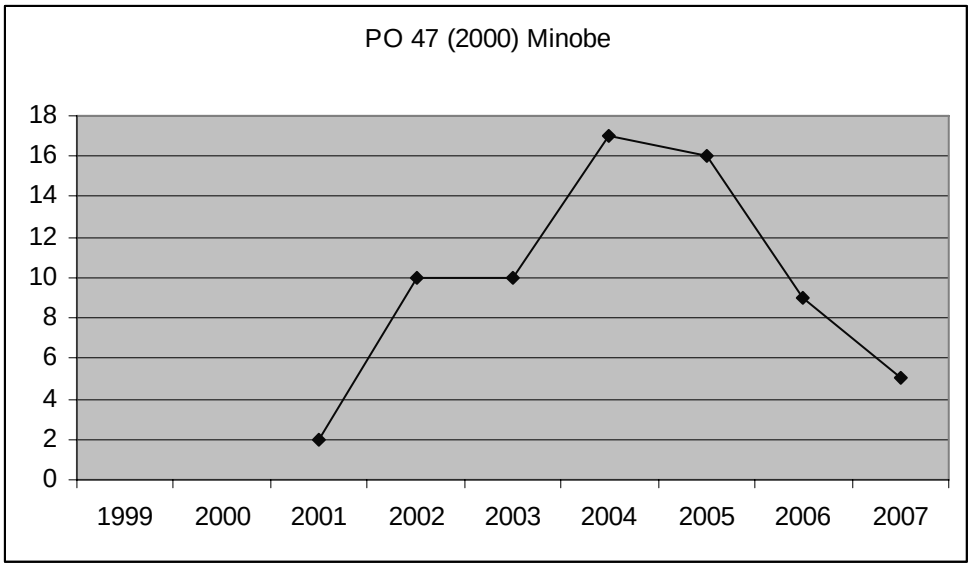

Figure 2 ***Web of Science*** **Citations to Minobe 2000**

Website usage statistics are another means of assessing usage of publications. While they have a unique set of limitations, they can still provide an indication of the effectiveness of the current digital distribution mechanism. Statistics gathered and provided by Julia Yazvenko, PICES Database and Web Administrator, indicated that over the past three years, PICES Special Publication No.1 (*Marine Ecosystems of the North Pacific*) and Scientific Report No. 23 (*Harmful Algal Blooms in the PICES Region of the North Pacific*) were the most frequently accessed publications on the website. Other frequently accessed publications were Scientific Report No. 22 (*PICES Science: the first ten years and a look to the future*), and Scientific Report No. 16 (*Environmental Assessment of Vancouver Harbour; Data Report for the PICES Practical Workshop*) following No. 23 in popularity. Other notably popular publications were the Abstract Book from the 13th annual meeting (Honolulu) and *Shark abundance increases in the Gulf of Alaska* in *PICES Press* (July 2000). Each publication series resides in its own directory on the PICES web server, so by comparing website usage statistics for each directory, it seems that series popularity can be ranked from highest to lowest as follows: Scientific Reports, *PICES Press*, Special Publications, Annual Reports, Brochures, and Abstract Books. Primary journal special issues are not included in this list because the articles are not available on the PICES website.

Overall, PICES publications contribute to the scientific dialogue. While the Special Issues of primary journals appear to have more impact on the scientific community, the Scientific Reports are serving an important role as well. Additionally, the PICES book, *Dynamics of the Bering Sea*, has been cited 128 times according to the *Web of Science*, demonstrating its value. Even articles in *PICES Press* have been cited, as have some annual meeting abstracts. A more thorough analysis of citation patterns is required to ascertain who is using the PICES publications. This may assist with questions of distribution of publications as well as marketing. Also, the data could be used to investigate patterns of international collaboration, another element of the PICES mission. At this point, we can safely say that many PICES publications are used and add value to the science of the North Pacific Ecosystem.

4. Current indexing of PICES publications

People use information they can find easily. If PICES publications are not well indexed or cataloged, they are not as accessible and their impact on the scientific community will be limited. PICES publications are discovered through word-of-mouth, and by searching tools such as library catalogs, web search engines, and specialized literature databases.

We examined some finding tools that are important in the marine science field. We looked at how well PICES publications were indexed in these resources as a reflection of how easily a person could identify PICES materials. Our search strategy focused on PICES or North Pacific Marine Science Organization as a publisher or corporate author. This allowed us to see if the tools acknowledged PICES as a corporate author, publisher, or sponsor of publications. These results would not include the journal special issues unless PICES is included as an author or publisher.

Excluding the 411 Special Issue articles, we found 514 items listed as PICES publications, including many articles that were published within the Scientific Reports. Table 4 indicates the variability in level of indexing of PICES published material. The difference between the Total Hits and Relevant Hits reveals the problem of precision with searching PICES as an author or publisher. Five of these tools are commercial indexes with the sixth, WAVES, being the library catalog for the Canadian Department of Fisheries and Oceans Libraries. Typically, we would expect fewer records in a library catalog than the commercial indexes as the catalog rarely covers materials to the article level.

Table 4 Indexing of PICES publications excluding journal articles

Index/Database searched	Total hits	Relevant hits
Aquatic Sciences and Fisheries Abstracts (ASFA)	258	159
BIOSIS	6	4
Fish and Fisheries Worldwide	399	360
WAVES (Catalog of DFO libraries)	80	64
Web of Science	21	20
Zoological Record (CSA)	77	39

There is little overlap among the various indexing tools, which suggests differing policies toward indexing, differing awareness of PICES publications, or both (Appendix B). The two major tools, *Aquatic Sciences and Fisheries Abstracts* (ASFA) and *Fish and Fisheries Worldwide*, share only 22 records, for instance. This is partly a distribution issue, and steps could be taken to ensure that these indexing entities receive copies of PICES publications. More importantly, in an effort to improve coverage the discrepancy may reflect a particular format bias of certain indexes (*e.g., Zoological Record* and *Web of Science*) or a priority given to the reports by others (*e.g., ASFA*).

An additional issue with indexing is the level of granularity (resolution). For example, many of the Scientific Reports include papers by various authors, yet few of the Scientific Reports are indexed at the resolution of the individual article, making those papers invisible. Table 5 summarizes the coverage of the Scientific Reports and their multiple articles by the indices. It reinforces the evidence for gaps in distribution, and the inconsistency of coverage within an index. It was interesting to note the variability in indexing of articles within a given Scientific Report. *ASFA* and *Fish and Fisheries Worldwide* have higher numbers than the others. However, neither index resolved all Scientific Reports to the article level, nor indexed the same ones. In general, *Fish and Fisheries Worldwide* covered more reports and with more depth than the other indices. It also indexes *PICES Press* more thoroughly at the article level.

Table 5 Indexing of Scientific Reports

Index or Catalog (Vendor)	Reports indexed as individual titles	# Reports indexed in some form (t=32)	# Report articles indexed (t≈302)
Aquatic Sciences and Fisheries Abstracts (CSA)	1-10	10	98
BIOSIS (Ovid)	0	0	0
Fish and Fisheries Worldwide (NISC)	1,8,9,11,13-16, 19-21, 25, 27-30	22	196
WAVES (DFO)	32	32	0
Zoological Record (CSA)	19, 30, 32	3	10
Web of Science (WOS)	0	0	0

Our examination of the current level of indexing of PICES publications reveals some significant areas of concern. Visibility and hence usage of PICES publications, in part, relies on consistent and thorough coverage in the major tools used by marine scientists. While libraries appear to collect the publications, access through commercial indexes is problematic. Scientists have to use multiple tools to identify PICES materials, and still would not find all items published under the auspices of PICES. Our concerns include consistency of coverage of the Scientific Reports at the report level as well as the depth of indexing at the article level. Underused publications caused by lack of granular access via commercial indexes may subsequently affect collection development decisions in the libraries as well.

5. Current collecting and archiving of PICES publications

5a. Printed publications

We gathered and examined data on archiving practices of libraries as a method of assessing access to print versions of PICES publications. Some libraries may link to digital copies in their catalog records, however, we wanted to ascertain the stability of print archives before introducing the concept of digital archives. Selected libraries provide satisfactory access to print and digital versions of PICES publications via their local catalogs. These are shared through the international, cooperative library catalog, WorldCat, provided by the Online Computer Library Center (OCLC). This provides exposure of the publications to the broader library community. People can use the OCLC database through its web interface that is freely available from http://www.worldcat.org. This tool provides good, open access to PICES material.

We used OCLC WorldCat as our primary data source, but we also reviewed the IAMSLIC membership to help identify additional collections not found in OCLC WorldCat, but likely to be in archives of member libraries located outside of North America. These two resources provide the means for libraries to enhance their services by sharing records to build their local catalogs, and supporting the lending and borrowing of items. Libraries voluntarily maintain memberships with these groups and can freely determine their level of participation. WorldCat data reveals a bias toward more active participation on the part of North American libraries. Together, these cooperative catalogs provide an efficient and somewhat effective method to obtain a picture of print archiving and access.

Table 6 suggests that PICES publications in print are adequately collected, and hence accessible to readers in North America. The exceptions are the Annual Meeting abstracts that are inconsistently collected by libraries, probably due to the distribution process. Access to publications via libraries located outside of North America is unclear. In part, this is a limitation of the OCLC WorldCat and indicates the need for more data on the collection policies of PICES Contracting Parties in Korea, China,

Japan, and Russia. In Appendix C, we address the issues and limitations in the form of suggested survey questions for PICES Contracting Parties. In Appendix D, based on geographic data collected on PICES distribution to libraries, identifiable holdings in OCLC WorldCat, and IAMSLIC affiliation, the organizations are characterized and selected as examples for various actions. The practices and preferences found via survey of PICES membership in these regions would have significant impacts on PICES' ability to migrate from print based publication toward greater reliance on electronic distribution.

Table 6 Number of libraries holding PICES publications displayed in WorldCat

Publication	# OCLC libraries
Annual Report Series	20
Scientific Reports Series	19
no.1	8
no.2	10
no.3	9
no.4	12
no.5	13
no.6	13
no.7	12
no.8	13
no.9	16
no.10	11
no.11	13
no.12	12
no.13	15
no.14	15
no.15	13
no.16	14
no.17	14
no.18	15
no.19	8
no.20	11
no.21	11
no.22	12
no.23	13
no.24	11
no.25	15
no.26	13
no.27	16
no.28	15
no.29	12
no.30	11
no.31	N/A
no.32	5
no.33	6
Special Publication Series	2
no.1	23
no.2	14

Publication	# OCLC libraries
Brochure(s)	6
PICES Press	16
Books	
Dynamics of the Bering Sea	60
Historical Atlas of the North Pacific Ocean	252
The Journey to PICES	39
Annual Meeting Abstracts	
1997	8
Primary Journal Literature	
Progress in Oceanography	611
Journal of Oceanography	87
Canadian Journal of Fisheries and Aquatic Sciences	609
Deep Sea Research Part II	214
Marine Environmental Research	192
ICES Journal of Marine Science	176
Journal of Marine Systems	88
Ecological Modelling	281

Access to print PICES publications appears somewhat robust; however, access is strongly dependent on where a user is geographically located and with which organization he/she is affiliated. For those not affiliated with PICES or an institution supporting a library with a PICES print collection, alternative means of acquiring copies are required. Resource sharing (interlibrary loan) is the primary means by which libraries augment their collections, and association memberships provide the means to make borrowing requests. So, we examined the PICES distribution system in terms of library affiliation, as this could be an indicator of access through resource sharing as well as local collections. Currently, there are 63 libraries on the PICES libraries distribution list and 69 on the PICES institution distribution list. There appear to be 14 PICES institutions on the current distribution list that have libraries affiliated with their Organization, but those libraries are not on the PICES library distribution list. Half of those 14 libraries have IAMSLIC affiliations. Half of the 63 libraries that receive PICES distribution and whose parent institutions receive PICES distribution as well have IAMSLIC affiliations. While geographic distribution and need for print distribution requires further examination, there is an opportunity for IAMSLIC and its network to not only help balance geographic distribution of PICES publications where needed, but also to help fill the gap as needed through resource sharing.

Collecting patterns in WorldCat demonstrate a strong commitment to print archiving among certain libraries. Approximately 35 of the 63 libraries receiving PICES distribution have some form of OCLC affiliation. Twenty-one of those libraries also have IAMSLIC affiliation. Those libraries are also included in the approximately 80 OCLC Libraries that hold at least one PICES publication and display those holdings on WorldCat. This reinforces the concept that IAMSLIC member libraries are committed to collecting and archiving PICES publications.

Several libraries are cataloging digital copies of PICES Scientific Reports in conjunction with the print copies, facilitating access through library catalogs. Our collection and archiving concerns include not only the robustness of the PICES digital archive and the current format of PICES digital documents, but also open access to journal articles and issues sponsored by PICES but hosted on commercial publishing websites.

While collection of, and access to, PICES published items appears adequate, challenges arise when considering the commercially published journal issues. Collecting these major commercial journals is expensive and many smaller institutions cannot afford the subscription cost for either print or electronic copies. Access is controlled by subscription, either institutional or personal. Furthermore, copyright issues generally prevent libraries from lending or copying an entire issue of a given journal. Consequently, this significant component of the PICES publication program may not be adequately accessible to all PICES members or other interested parties. Solutions exist, including negotiation with publishers for the right to archive articles in an open digital repository, or publishing in a non-commercial venue without copyright restrictions, such as the PICES special publications series. The Creative Commons (http://creativecommons.org/) and Scholarly Publishing and Academic Research Coalition (http://www.arl.org/sparc/) provide examples of ways to work with copyright agreements so authors' rights are respected and publishers' work acknowledged yet access is more open. The degree to which publishers pursue adherence to copyright restrictions is often determined by the publisher's need to maintain profitability. PICES, as a publisher, may choose to take a less restrictive stance on copyright as a means to increase accessibility to its publications.

5b. Digital publications

The availability of almost all PICES publications in digital format from the PICES website is positive. This assumes, however, that most people interested in a PICES publication can identify it and then have adequate computer and network capability to download files.

One indicator of access to, and use of, electronic versions of PICES publications is to examine the number and location of organizations linking to the PICES site on the web. We used a Google application to identify websites that linked to the PICES website (Table 7). Only two sites, a Chinese mirror of PICES (mari-biotech.nstl.gov.cn) and the Center for Global Environmental Research (Japan, www-cger.nies.go.jp), have a specific link to the PICES publications page (www.pices.int/publications/). Many more link to the PICES website (www.pices.int). As Google does not index data contained within library catalogs and literature databases, these results do not reflect organizations providing links to PICES publications from within their organizational databases.

Table 7 Websites of organizations linking to the PICES website

International organizations	
Intergovernmental Oceanographic Commission UNESCO	ioc.unesco.org
PICES Technical Committee for Data Exchange	tcode.tinro.ru/
UNEP Regional Seas Programme	www.unep.org/regionalseas/
NOWPAP (Northwest Pacific Action Plan)	www.nowpap.org
International Pacific Halibut Commission	www.iphc.washington.edu
International Commission for the Conservation of Atlantic Tunas	www.iccat.es
Climate Variability and Predictability (CLIVAR) of the World Climate Research Programme	www.clivar.org/
United Nations Atlas of the Oceans	www.oceansatlas.com
International Whaling Commission	www.iwcoffice.org
North Pacific Research Board	www.nprb.org/
Canada	
Department of Fisheries and Oceans Canada	
Scientific Committee on Problems in the Environment (University of Victoria)	web.uvic.ca/ceor/scope
Watershed Watch Salmon Society (British Columbia)	www.watershed-watch.org

2WE Marine and Coastal Environmental Consultants (Canada)	www.2weassociates.com
Institute for Social Ecological Studies (University of Victoria)	web.uvic.ca/ceor/ises/
Japan	
Agriculture, Forestry and Fisheries Research Council of Japan	kokushi.job.affrc.go.jp
Biophilia Journal	www.biophilia.jp
Japan Agency for Marine-Earth Science and Technology	www.jamstec.go.jp
Fisheries Oceanography Division, TNFRI	cse.fra.affrc.go.jp
Ocean Research Institute of the University of Tokyo	cod.ori.u-tokyo.ac.jp
Fisheries Agency of Japan	www.jfa.maff.go.jp
Environmental Information and Communication Network	www.invasivespeciesinfo.gov
United States	
US National Oceanic atmospheric Administration Pacific Marine Environmental Lab	www.pmel.noaa.gov
US National Oceanic atmospheric Administration Alaska Fisheries Science Center	www.afsc.noaa.gov
US National Invasive Species Information	www.invasivespeciesinfo.gov
Interenvironment (California Institute of Public Affairs)	www.interenvironment.org
Joint Global Ocean Flux Study	ijgofs.whoi.edu

This breadth of linking suggests the importance of a well organized, current website that encourages usage and stimulates interest. However, the lack of links to the PICES website from Korean, Chinese, and Russian institutions is troublesome. There may be institutional barriers to linking. This is another issue that the PICES membership may be able to address.

6. Recommendations

We used the recommendations of the 2003 Review as background because some of the concerns remain in 2007 and it is important to reiterate them in light of the current information climate. We also reflect on the importance of positioning PICES to respond to the changes in scientific communication in the near- and long-term future. We framed the recommendations around general issues and suggested actions to address them:

A. Managing the publication workflow
B. Increasing recognition of PICES as a publisher
C. Enhancing access through library and indexer cooperation
D. Improving distribution efficiency
E. Increasing visibility and ensuring perpetuity through a digital repository

A. Managing the publication workflow

Duties from editing to layout are shared among Secretariat staff and contractors. This work demands a significant time commitment from key staff. The 2003 Review recommended hiring a full-time editor and part time webmaster. We also recognize the need for additional staffing either through added contracts or incorporation of current contractors into the PICES staff.

Recommendation A1: Establish a new position to consolidate and manage the whole workflow from the call for papers to archiving.

Recommendation A2: Post the PICES Style Manual to the PICES website highlighting the Instructions to Authors and Editors sections. As contact information changes and procedures change, time spent

answering questions will be minimized if contributing authors can find current procedures online including clear instructions to authors/editors. Print publications should also include instructions to authors or references to instructions on the website as appropriate.

Recommendation A3: As part of the workflow, continue to convert publications to text- searchable PDFs. This is the current standard used by PICES as it allows comprehensive searchability and accessibility to the blind community.

Financial Implications: Recommendation A1 requires discussion of financial consequences, as there are several options. Currently, $20,000 in funds is used to contract for publishing assistance, which covers part of the publishing activity. Additional staff time is currently dedicated to the endeavor, although this is difficult to quantify. Contractual help is cost effective in this situation, but funds would need to be secured to ensure an ongoing contract and increase that contract as needed. One option may be a short-term contract that manages and documents the implementation of the other recommendations. Taken individually, the majority of the other recommendations can be carried out with existing staff, but collectively represent a significant amount of staff time in the short term. Done successfully, this may allow staff and contractors to return to existing levels and work with greater efficiency and effectiveness in the long term. While contract staff continue to play a large role in the publications process, documented procedures are crucial in retaining institutional knowledge in the event of staff turnover. Recommendations A2 and A3 have little financial impact and can be accomplished with existing staff.

B. Increasing recognition of PICES as a publisher

It is important to have PICES listed as the publishing or sponsoring body on all of its publications. This increases awareness of PICES in the scientific community. To accomplish this, PICES should be listed on each publication in a way that it will be entered as a searchable name in literature databases and library catalogs. This will not only increase the visibility of the PICES name within resources used by the scientific community, but will also make an easier task of tracking distribution and archiving.

Recommendation B1: Include a recommended format for the item citation in every publication. As previously recognized, this has been done in the Scientific Report and Special Publication series, but may also be of value in the remaining publications.

Recommendation B2: Include the summary of publications currently appearing on the Scientific Reports, in the remaining series. If a back cover summary is not appropriate, perhaps an additional summary could be added to the "About PICES" section in other publications.

Recommendation B3: Investigate the possibility of branding PICES at the article level in the Special Issues. Options to consider include a logo on the article page, inclusion of PICES as a sponsor or corporate author, or an acknowledgment of PICES sponsorship. Such branding will make PICES more recognizable in the online environment. This element is also of concern when considering a digital repository implementation as discussed below.

Recommendation B4: Add information on the PICES publications introductory web page for ordering publications as well as more specific contact information for publications.

Financial Implications: Recommendations B1, B2 have little financial impact and can be accomplished with existing staff. Recommendation B3 could be investigated by existing staff and would have little financial impact in terms of staffing. Commercial publishing agreements may require additional fees for specialized publishing needs. Recommendation B4 has little negative financial impact in terms as it can be accomplished with existing staff. It may have a positive financial impact if it is determined that selling publications is an appropriate and feasible source of revenue.

Additional note: We considered a recommendation to explore a PICES journal as a means of controlling branding, image, and content. While intriguing, especially in the digital environment, it requires significant further investigation on the part of the PICES Secretariat, with both commercial and non-profit publishers, as to the organizational needs to viably market and support a regularly published journal. The PICES Secretariat has also indicated some investigation of this option in the past. Rather, we recommend continuing to work with selected journals to incrementally achieve greater visibility.

C. Enhancing access through library and indexer cooperation

As shown above, identifying PICES publications and obtaining copies are not optimal due to inconsistent indexing and collecting. The primary searchable sources for literature related to the subject content covered by PICES publications are *Fish and Fisheries Worldwide*, and *Aquatic Sciences and Fisheries Abstracts (ASFA)*, OCLC WorldCat (cooperative library catalog) and IAMSLIC Libraries. So, PICES should focus on these entities to strengthen coverage of PICES publications.

Recommendation C1: Enhance existing OCLC catalog records with links to current digital versions of PICES publications. This is quite simple if working with a willing cataloger.

Recommendation C2: Establish agreements with select libraries for ongoing, dedicated print archiving. These libraries should be selected through consultation with PICES national partners as well as recognition of historic collection commitments.

Recommendation C3: Ensure indexing of all PICES publications to the article level. Options of this include becoming an ASFA partner, contracting with a library to do the indexing for inclusion in ASFA, or negotiating with NISC for ongoing indexing for *Fish and Fisheries Worldwide.*

Recommendation C4: Add all publications to a searchable digital repository. While PICES posts the Scientific Reports and *PICES Press* in multiple parts, it is worthwhile to have other digital copies available both for improved access and greater security.

Financial Implications: Recommendation C1 would have little financial impact and can be accomplished through agreement(s) with an IAMSLIC member(s). Recommendation C2 would have little financial impact and can be accomplished through partnerships among the PICES Secretariat, IAMSLIC, and PICES national partners. Recommendation C3 would likely require some financial commitment to become an ASFA partner or to establish a long-term commitment with library staff to do the indexing. Recommendation C4 requires discussion of financial consequences, as there are several options. At minimum, a partnership with IAMSLIC to use their digital repository, *Aquatic Commons*, may require some funding for contract services. An in-house repository would require equipment, staffing, and some training. More detail would be available regarding financial impact following the pilot project discussed in Recommendation E1.

D. Improving distribution efficiencies

A related element to improved visibility is more efficient distribution of both print and electronic publications. While mailing is used for print distribution, alerting technology is useful for electronic distribution.

Recommendation D1: Review the three distribution lists to identify duplicate addresses. Add email addresses, distribution preferences, and library affiliation to member records as a basis for upcoming surveys as well as to facilitate future electronic distribution.

Recommendation D2: Review distribution of PICES publications to look for areas to reduce costs while enhancing geographic coverage and archival commitment. Survey Contracting Parties, libraries, individuals and institutional representatives with specific questions and requests. The chart in Appendix D, based on data collected on PICES library and organizational members, their geographic location and their identifiable holdings in OCLC WorldCat, suggests a possible approach to this survey.

Recommendation D3: Add Really Simple Syndication (RSS) feed capability to the PICES website. This is a means to instantly notify the user of new content on a website or in a repository and can contain summary information and links to the new content at the site. This may help convince some to drop print distribution. RSS feeds are XML (Extensible Markup Language) files created automatically by blog or repository software, which are regularly checked by a user's RSS reader.

Recommendation D4: When adding new names to any distribution list, identify affiliations to existing recipients, willingness to receive email alerts, RSS feeds, and electronic versions of new publications. Give existing members an opportunity to use an electronic alerting and delivery option. Consider fees for print option.

Financial Implications: Recommendation D1 has little financial impact and can be accomplished with existing staff. Recommendation D2 has little financial impact. Existing staff could accomplish the initial review, but short-term intern or contract staff, along with IAMSLIC assistance, is recommended to manage a survey. Recommendations D3 and D4 have little financial impact and can be accomplished with existing staff.

E. Increasing visibility and ensuring perpetuity through a digital repository

The revision of the PICES website following the 2003 Publication Review was a major step toward increased electronic accessibility to PICES publications. Given recent developments in digital archive practice, we suggest serious consideration of participation in a digital repository, an online service to collect, archive and provide access to the electronic information. Repository software provides a permanent handle or item address that makes linking to individual items stable even through server migrations and other potentially disruptive upgrades to technology. Use of a digital repository will increase the accessibility of publications through standard metadata that improves searching. Metadata is data such as the title, author, format, and content that describe a publication. A structured metadata record allows a user to search more effectively and efficiently by using assigned keywords instead of searching an entire full-text database. For example, the user can retrieve only publications that are significantly about phytoplankton instead of retrieving any publication with the word, phytoplankton. A standard metadata format allows different repositories to seamlessly search, harvest, and share records.

While digital repositories are attractive for the number of benefits they provide with regard to archiving, access, and distribution costs must be considered before deciding on an ideal implementation. Hosting a unique instance of a repository provides the most flexibility in terms of presentation and control of content yet, represents the highest cost in equipment, network needs, and staff. Contributing to an existing digital repository negates the need for onsite servers and appropriate software. The cost for this alternative is in staff time to contribute items (*e.g.*, 5 to 15 minutes per entry). PICES editors, authors, and partner libraries could share this effort. Digital repositories are designed to have the lowest possible threshold to author submissions in order to encourage contribution.

Repositories generally employ a standard protocol for harvesting metadata and repository content that builds off a standard metadata format. This standardization makes an institution's publications equally accessible regardless of the repository software used. The IAMSLIC digital repository, *Aquatic Commons*, may be an ideal resource for digital archiving of PICES publications for its pre-existing

technical support and adherence to the standards that optimize access and distribution. Branding of PICES publications should be possible within the repository through development of an introductory page and the addition of a PICES publisher/sponsor field in the metadata on every item.

Recommendation E1: Establish a cooperative pilot project with IAMSLIC to develop a collection of PICES publications in the IAMSLIC *Aquatic Commons*. This could be done on contract with IAMSLIC or in-house with willing staff. Components of such a project would include development of policies for what to include, discussion of workflow, and graphic design that conveys a PICES presence.

Recommendation E2: Retrospectively scan items to complete the collection of digital publications. Retrospective scanning is an important consideration for any digital collection. The sheer number of pages being considered is perhaps the primary consideration when planning a retrospective scanning project. Current office technology can often handle scanning and OCR tasks on a small scale but large collections may require contract work. In either case, the value of a complete collection should not be overlooked.

Recommendation E3: Negotiate with publishers for the right to deposit appropriate versions of journal articles into the repository or on the PICES website. Journal literature written by numerous authors falls under an array of copyright restrictions. If journal literature is to be added to a digital repository, policies and procedures should be in place to insure that copyright is not violated.

Recommendation E4: Develop a copyright agreement between PICES and all authors that grants PICES rights to archive and distribute to digital content. This could be a relatively simple form that authors sign at the Annual Meeting or when submitting a section of a scientific report. Some care should be taken to file completed agreements, although this could be done electronically.

Financial Implications: Recommendation E1 requires discussion about financial consequence as it involves partnership with IAMSLIC on either a contract or joint project basis. Further discussion would also clarify the workload required by either partner. Given the apparently small amount of scanning needed for a complete digital collection, Recommendation E2 has little financial impact and can be accomplished with existing staff. Recommendations E3 and E4 have little financial impact and can be accomplished with existing staff.

7. Summary

The PICES Publication program is critical to the mission of PICES as it promotes the organization, encourages international collaboration, and communicates important science to the world. The possibilities for enhancing PICES publications are many and vary in cost and effort. The above recommendations reflect this and run from the mundane to the complex. IAMSLIC is interested in continuing to work with PICES to ensure better access to PICES publications through stable print archiving, targeted distribution, consistent indexing, and improved use of the electronic environment. We suggest these four cooperative actions as one response to this review that will control costs while improving use of PICES publications.

Proposed cooperative actions between PICES and IAMSLIC:

- Create a PICES collection within the IAMSLIC digital repository, *Aquatic Commons,* beginning with the PICES Scientific Reports.
- Survey those on the PICES libraries distribution list to complete assessment of collection policies.
- Develop memorandum of understanding with selected libraries on establishment of print archives of PICES publications.
- Complete the addition of links to electronic versions of PICES publications in existing WorldCat records.

8. References

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Webster, Janet G. & Jean Collins. 2005. *Fisheries Information in Developing Countries: Support to the Implementation of the 1995 FAO Code of Conduct for Responsible Fisheries*. FAO Fisheries Circular No. 1006. Food and Agriculture Organization of the U.N.: Rome. 127 pp. http://hdl.handle.net/1957/222

9. Appendices

Appendix A. PICES publications: Information on compiling, printing and distribution costs [1,2]

No.	Type of publication	# Printed	# Mailed	Cost of compiling and design	Cost of printing	Cost of mailing[13]
1	*PICES Press* (32-40 pp)	1600-1700	~1500	1,200-1,700	6,800-8,900	
2	Annual Reports (~300 pp)	400	~400	3,400-4,000	8,000-9,500	
3	Scientific Reports (~50-190 pp)	400[3]	~400	500-5,800[4]	3,800-13,300[4]	
4	Special Publications (~280/50)[5]	600/450	~450	14,500/3,900	40,750/10,250	
5	Brochures (12 pp)[6]	2,000	~1,500	3,500	4,250	
6	AM Announcement (12 pp)[7]	1,600-2000	~1,500	1,250-1,550	3,400-4,200	
7	AM Poster	600-800	~500	500-850[8]	2,400-3,300	
8	AM Book of Abstracts[9]	400-550	None[10]	~600[11]	5,600-9,000	
9	Primary journals[12]	Determined by publisher	50-100	None	None	

1 Information for 2004-2007 was used to prepare this table.
2 All costs are in Canadian dollars.
3 Standard run; in special cases up to 550 copies.
4 Costs are highly variable depending on total number of pages and color graphics.
5 Limited experience (PICES has produced only two very different Special Publications).
6 Limited experience (PICES has produced only one brochure so far).
7 AM stands for the Annual Meeting.
8 Includes right to reproduce image(s).
9 Since 2003, the Abstract Book has been printed by the AM host country, with or without financial support from PICES.
10 Distributed at the Annual Meeting.
11 The PICES Database and Web Administrator and the Intern perform the majority of work.
12 PICES purchases copies and mails them to PICES members with the relevant expertise and to libraries in Russia and China.
13 A fixed annual sum of $23,500 is paid for postage under the agreement between PICES and *Fisheries and Oceans Canada.*

Appendix B. Overlap of records between various indexing tools (The lack of significant overlap indicates inconsistent coverage.)

Overlap between indices	ASFA	BIOSIS	FFW	WAVES	WOS	ZOO
Aquatic Sciences and Fisheries Abstracts (CSA)	–	1	22	16	1	1
BIOSIS (Ovid)	1	–	1	1	1	2
Fish and Fisheries Worldwide (NISC)	22	1	–	23	2	4
WAVES (DFO)	16	1	23	–	2	8
Web of Science (WOS)	1	1	1	1	–	2
Zoological Record (CSA)	1	2	4	8	2	–

Appendix C. Suggestions for survey of PICES and North Pacific IAMSLIC members on library practices

1. How is a given library using their OCLC/IAMSLIC membership? If their holdings are not fully reflected in WorldCat, are they shown in the local catalog? If they have non-lender status in WorldCat, do they offer lending services through other means? If so, to whom?
2. Member symbols can represent one library system with several physical locations or they can represent individual units. If a symbol represents a system with wide geographic range, more research into actual holdings may be necessary to determine actual archive access.
3. Libraries may catalog a series like the Scientific Report series, as one title (the series title) with several volumes or analytically with a separate record for each report in the series. If a library catalogs in the former manner, more research into actual holdings may be necessary to determine actual archive access.
4. While both OCLC and IAMSLIC are open to international membership, the majority of active participation is centered on the North American continent. What is the culture and practice of cataloging and sharing in organizations or countries with little or no OCLC or IAMSLIC membership?
5. Do some PICES Members use library resources and services from other geographically adjacent organizations?
6. Are PICES Members or individuals regularly contributing their distribution copies to accessible collections for use by others within their community?
7. What are the differences between publications in terms of the need for archive access to PICES member/stakeholder readers versus non-stakeholders or the general public?
8. How are links to outside websites determined for an institutional website? Is this a way to increase access to PICES publications?

Appendix D. Condition of libraries at PICES member sites with recommended actions

Summary of Condition	Recommended action	PICES Member sites
Libraries have no or very few identifiable holdings, but may support work of Contracting Parties.	Further inquiry into archiving and access practices warranted.	• TINRO • KORDI • Hokkaido University • Scripps Institution of Oceanography (duplication of holdings with other West Coast U.S. libraries more actively archiving) • Institute for Oceanology Academia Sinica
Libraries have no or very few identifiable holdings. Unlikely to support work of Contracting Parties or other work in the North Pacific. Other libraries in the region do thorough archiving.	Address the option of eliminating distribution copies to these sites.	• University of British Columbia • University of Alaska Fairbanks • Bedford Institute of Oceanography • National Institute of Water and Atmospheric Research (NIWA)
Reasonable numbers of identifiable library holdings show dedication to archiving and support of PICES research.	Continue print distribution and establish MOU to insure dedication to archiving.	• Oregon State University • University of Washington • NOAA / National Marine Fisheries Service (perhaps a subset of actual library members) • Fisheries and Oceans Canada (DFO) (regional distribution needs may require further inquiry
Libraries have no or very few identifiable holdings, but may support work of Contracting Parties or other work in the North Pacific. Institutional or individual PICES members may be associated with these libraries. Institutions have associated libraries but are not PICES members on the library distribution list. There is generally a regional lack of library holdings.	Address those organizations/libraries to determine their interest in increasing support of PICES research through more active archiving.	• Global Carbon Project/ Earth Observation Centre • Intergovernmental Oceanographic Commission • International Ocean Carbon Coordination Project • Food and Agriculture Organization of UN

Appendix E. Descriptions of and Recommendations for PICES publication series

ANNUAL REPORTS

Recommendations for transition to electronic format

- An electronic copy should also be archived in an open access repository in addition to the copy available on the PICES website.
- Continue distribution online with current digital format, which breaks document into sections for smaller files sizes online and stores as searchable PDF.
- Digital only publication and distribution may save production and mailing costs while having minimal impact on intended audience.
- Offer email alerts, RSS feeds, when new reports are available online.

General description

- Primary audience – Representatives of PICES Members Nations.
- Secondary audience – Interested scientists in PICES or supporting organizations as well as the North Pacific research community and science historians.
- Average length – 300 pages
- Level of citation – Not generally cited in the scientific literature. Not peer reviewed.
- Currency – Initially of immediate use to primary audience, however, quickly becomes administrative record for all audiences. Not included in current alerting services, however, not needed. Digital repository can provide necessary level of alerting.

Distribution, indexing and archiving

- Distribution – Approximately 400 copies are printed and mailed to PICES members and limited institutional distribution list. Also available online.
- Indexing – Inconsistently indexed. Issues after 1998 do not appear in the major indices.
- Library holdings – Twenty libraries report holdings in OCLC including major PICES partners.
- The Secretariat maintains a print archive.

Cost

- Approximately $12,450.00 per run of 400. $31.13 per report and $0.10 per page, with additional mailing costs at a percentage of the annual sum for postage under the PICES-DFO agreement

Other recommendations

- Additional limited print archive in key libraries co-located with members of the primary audience would be desirable.
- Limit print copies given the length and purpose.

SCIENTIFIC REPORTS

Recommendations for transition to electronic format

- An electronic copy should also be archived in an open access repository in addition to the copy available on the PICES website.
- Continue distribution online with current digital format, which breaks document into sections for smaller files sizes online and stores as searchable PDF.
- Offer email alerts, RSS feeds, when new reports are available online.

General description

- Primary audience – Scientific community of North Pacific Ocean researchers.
- Secondary audience – Administrators at funding institutions in the North Pacific scientific community and researchers focusing on other regions.
- Average length – Approximately 120 pages
- Level of citation – These are proceedings of workshops, reports from scientific working groups, data reports and planning reports that undergo some peer review, but not at the level of primary journal literature. Most cited PICES publication outside of special issues in the primary journal literature.
- Currency – Of timely use to primary audience. Portions may eventually become administrative record to all audiences. Not included in current alerting services, but may be of value. Digital repository can provide necessary level of alerting.

Distribution, indexing and archiving

- Distribution – Approximately 400 copies are printed and mailed to PICES members and limited institutional distribution list. Also available online.
- Indexing – Inconsistently indexed. Nature of grey literature causes these reports to frequently fall between the primary realms of books and journal articles. Lack of authoritative citation format creates difficulty in tracking citations.
- Library holdings – Print archive currently at an average level of 12 OCLC holdings per report including major PICES partners.
- The Secretariat maintains a print archive.

Cost

- Approximately $11,200.00 per run of 400. $28.00 per report and $0.23 per page, with additional mailing costs at a percentage of the annual sum for postage under the PICES-DFO agreement

Other recommendations

- Assess needs for holdings in additional key libraries co-located with members of the primary audience.
- Limit number of print copies given length and interested audience.
- Limiting print distribution to PICES library members may save little in production and mailing costs, but increase efficiency while having minimal impact on intended audience.
- Make additional print copies available from PICES for a fee to help recover costs.

SPECIAL PUBLICATIONS

Recommendations for transition to electronic format

- An electronic copy should also be archived in an open access repository in addition to the copy available on the PICES website.
- Continue distribution online with current digital format, which breaks document into sections for smaller files sizes online and stores as searchable PDF.
- Offer email alerts, RSS feeds, when new publications are available online.

General description

- Primary audience – Administrators at funding institutions in the North Pacific, scientific community and researchers focusing on other regions. Lay audience interested in North Pacific ecosystems.
- Secondary audience – Scientific community of North Pacific Ocean researchers.
- Level of citation – Not generally cited in the scientific literature. Not peer reviewed.

- Currency – Of timely use to primary and secondary audiences. Will continue to provide a solid overview of North Pacific ecosystem and the scientific challenges it presents. Not included in current alerting services. Digital repository can provide necessary level of alerting.
- Average length – Approximately 163 pages (n = 2)

Distribution, indexing and archiving
- Distribution – Approximately 525 copies are printed and 450 mailed to PICES members and limited institutional distribution list. Also available online.
- Indexing – Inconsistently indexed.
- Library holdings – An average of 19 (n = 2) libraries report holdings in OCLC including major PICES partners.
- The Secretariat maintains a print archive.

Cost
- Approximately $34,700.00 per run of 525. $66.10 per report and $0.40 per page, with additional mailing costs at a percentage of the annual sum for postage under the PICES-DFO agreement.

Other recommendations
- Assess needs for holdings in additional key libraries collocated with members of the primary audience as well as geographic coverage for secondary audience would be desirable.
- Continue to use full-color. Though expensive, it remains an effective marketing tool.
- Print distribution should include all stakeholder parties as well as additional libraries and organizations where marketing may be effective.
- Make additional print copies available from PICES for a fee to help recover costs.

BOOKS

Recommendations for transition to electronic format
- Investigate feasibility of hosting full-text on PICES website and offering access for a fee to recoup costs.
- If some form of electronic full-text access is considered desirable, distribute online with current digital format, which breaks document into sections for smaller files sizes online and stores as searchable PDF.
- Offer email alerts, RSS feeds, when new books are available.

General description
- Primary audience – Scientific community of North Pacific Ocean researchers.
- Secondary audience – Administrators at funding institutions in the North Pacific scientific community and researchers focusing on other regions.
- Level of citation – Infrequently cited in the scientific literature when compared to journal special issues, though level of peer review and quality is equal.
- Currency – Of timely use to primary audience and secondary audiences. Will continue to provide solid scientific background of North Pacific ecosystem and the scientific challenges it presents. Not included in current alerting services. Digital repository can provide necessary level of alerting.

Distribution, indexing and archiving

- Distribution – Variable numbers of copies are printed and mailed to PICES members and limited institutional distribution list. Available for purchase through commercial venues. Portions available online but not complete text.
- Indexing – Inconsistently indexed due to policies of commercial indexes that focus on journal literature.
- Library holdings – An average of 156 (n = 2) libraries report holdings in OCLC including major PICES partners.
- The Secretariat maintains a print archive.

Cost

- Production costs vary and additional mailing costs are a percentage of the annual sum for postage under the PICES-DFO agreement.

Other recommendations

- Additional limited print archive in key libraries collocated with members of the primary audience would be desirable.
- Length makes limited print copies desirable.
- Print distribution remains limited to paying customers. Price should be set to recover costs of production and mailing at minimum.

PICES PRESS

Recommendations for transition to electronic format

- An electronic copy should also be archived in an open access repository in addition to the copy available on the PICES website.
- Continue distribution online with current digital format, which breaks document into sections for smaller files sizes online and stores as searchable PDF.
- Offer email alerts, RSS feeds, when new issues are available online.

General description

- Primary audience – Planning members of the PICES organization and supporting organizations, scientific community of North Pacific Ocean researchers, lay audience, and researchers focusing on other regions.
- Secondary audience – N/A.
- Level of citation – Not generally cited in the scientific literature. Not peer reviewed.
- Currency – Of timely use to entire audience as it serves a current update and marketing function. Not included in current alerting services, however may not be needed. Digital repository and/or email distribution can provide necessary level of alerting.
- Average length – Approximately 36 pages.

Distribution, indexing and archiving

- Distribution – Approximately 1650 copies are printed and 1500 mailed to PICES members and limited institutional distribution list. Also available online.
- Indexing – Inconsistently indexed.
- Library holdings – Sixteen libraries report holdings in OCLC including major PICES partners.
- The Secretariat maintains a print archive.

Cost

- Approximately $9,300 per run of 1650. $5.64 per report and $0.16 per page, with additional mailing costs at a percentage of the annual sum for postage under the PICES-DFO agreement.

Other recommendations

- Additional limited print archive in key libraries collocated with members of the primary audience would be desirable.
- Continue to publish in print as needed as length makes this feasible at relatively low cost. Numbers needed may diminish if members elect electronic distribution.
- At 1650 copies, the print run of PICES Press is the only series for which a reduction, but not elimination, of the print run will provide any significant cost savings.
- Additional print copies or subscriptions available from PICES free of charge may help increase the effectiveness of the marketing aspect of this publication.

PRIMARY JOURNALS

Recommendations for transition to electronic format

- Include PICES acknowledgement and branding at the article level where possible.
- Following negotiations with publishers, an electronic copy of copyright compliant articles should be archived in an open access repository in addition to the PICES website.

General description

- Primary audience – Scientific community of North Pacific Ocean researchers.
- Secondary audience – Administrators at funding institutions in the North Pacific scientific community and researchers focusing on other regions.
- Level of citation – Peer reviewed primary scientific journal literature. Cited regularly in a standard format used by literature indexing services.
- Currency – Of timely use to primary and secondary audience. Science will continue to be valid and useful into the future. Included in current alerting services, but digital repository can provide addition level of alerting. Twenty-one special issues over eight years.
- Average length – N/A

Distribution, indexing and archiving

- Distribution – Not automatically distributed to PICES distribution lists though small number mailed by PICES per request. Also available online through institutional licenses to commercial publisher websites.
- Indexing – Thorough indexing in all of the appropriate commercial index services.
- Library holdings – 24 PICES member libraries also in OCLC hold an average of 3.375 of the 8 journal titles publishing special issues.
- The Secretariat maintains a print archive. Journals generally well distributed to and archived by libraries in a wide geographic range.

Cost

- No production cost. 50 to 100 issues mailed at a percentage of the annual sum for postage under the PICES-DFO agreement.

Other recommendations

- Continue to publish PICES special issues as they are of interest to a wide audience and are an efficient alternative to introduction of a PICES journal to the market.

Guidelines for PICES Temporary Expert Groups

Contents

1. Introduction

The purpose of this document is to provide guidelines for the creation of PICES Working Groups, Study Groups, Sections, Task Teams and Advisory Panels, and to describe the duties and responsibilities of the Chairman (or Co-Chairmen) and the members of these groups. It outlines necessary tasks and working procedures and provides advice on the organization and completion of tasks in order to facilitate the work of the North Pacific Marine Science Organization (PICES). Many of these guidelines were adapted from three documents published by PICES or the International Council for the Exploration of the Sea (ICES): "North Pacific Marine Science Organization – Rules of Procedure", "Matters of practical interest to Chairmen of PICES Groups and Session Convenors" and "Guidelines for Chairs of ICES Committees and Expert Groups".

2. Group Definitions

A ***Working Group*** is a group of scientists, generally established by a Scientific Committee, with the endorsement of the Science Board and approval of the Council, for a period of typically three years, to undertake specific terms of reference and to report to the Organization on their findings. A ***Working Group***:

(a) shall consist of members appointed by the Contracting Parties, after considering any recommendations concerning membership by the Science Board;
(b) shall establish Co-Chairmen, according to Rule 17 in the PICES Rules of Procedure;
(c) shall be disbanded either after preparing their final report, or, as determined by the Science Board, for inadequate progress in achieving their tasks.

A ***Study Group*** is established by the PICES Council, or an Executive Committee, with the approval of the Council, for a period not normally exceeding one year. It has specific terms of reference to consider any scientific, policy, advisory and/or financial issue of interest to the Organization and to provide recommendations thereon. A ***Study Group***:

(a) shall normally consist of members appointed by the Contracting Parties, and by the Council;
(b) shall establish one Chairman according to Rule 17 in the PICES Rules of Procedure;
(c) shall be disbanded after submitting their final report and recommendations.

A ***Section*** is an ongoing sub-committee established by a Scientific Committee, with the endorsement of the Science Board and approval by the Council, to consider in greater detail, topics of sufficient general importance to the Organization to warrant ongoing attention, but only when sufficient expertise is lacking on a Scientific Committee. A ***Section***:

(a) shall consist of members appointed by the Contracting Parties, after considering any recommendations concerning membership by the Science Board;
(b) shall establish Co-Chairmen according to Rule 17 in the PICES Rules of Procedure;
(c) be responsible to, and be reviewed regularly by the parent Scientific Committee.

A ***Task Team*** is a group of scientists established with the endorsement of the Science Board and approval by the Council with a specific focus to conduct the work of a Scientific Program. A ***Task Team***:

(a) shall consist of members, appointed by the Contracting Parties;
(b) shall establish Co-Chairmen according to Rule 17 in the PICES Rules of Procedure.

An ***Advisory Panel*** is a group of scientists established with the endorsement of the Science Board and approval by the Council to coordinate and provide scientific advice on a field or experimental activities of a Scientific Committee or Scientific Program. An ***Advisory Panel***:

(a) shall consist of members appointed by the Contracting Parties, after considering any recommendations concerning membership proposed by the Science Board;
(b) may, with the endorsement of the Science Board and approval of the Council, include *ex officio* members from other organizations and/or non-Contracting Parties;
(c) shall establish Co-Chairmen according to Rule 17 in the PICES Rules of Procedure;
(d) shall be disbanded after the work is complete.

3. Group Creation

The first step in creating any of these groups is drafting the terms of reference (TOR) and there are several ways that this can be done. Three successful approaches are:

(a) organizing a special session or workshop at a PICES Annual Meeting wherein the problem(s) of study is discussed and the TOR are drafted;
(b) having an individual draft the TOR and post them on the PICES website for comment;
(c) having an individual draft the TOR and present them to the supporting committee for modification and approval.

In each case, the outcome needs to be the TOR that have been approved by at least one supporting committee. Once this is done, the proposal can be forwarded to the Science Board for their endorsement.

4. Terms of Reference

The TOR should either be linked to the PICES Strategic Plan and/or the supporting Committee's Action Plan, or identify and fill a gap in one of those plans. These TOR need to be clear, focused, and achievable within the lifetime of the group. See links within http://www.pices.int/members/working_groups/default.aspx for some TOR examples. The expert group life span, often three years, should be specified as part of the TOR. The TOR must be approved by the Science Board.

5. Membership and Chairmen or Co-Chairmen

Potential expert group members are usually, but not always, suggested by the group organizers. There should be at least one member from each of the PICES Contracting Parties, and in cases when the organizers have not suggested members from a country, the respective national delegates are requested to do so. All members need to be approved by their respective national delegates, and these delegates are not bound to follow the suggestions of the group organizers. However, the Contracting Parties are obliged to ensure that:

a) the members they approve are committed to working toward the goals of the group, and
b) there is funding for the members to attend group meetings and workshops. The number of members in an expert group typically ranges between fifteen and twenty-four.

A Chairman or Co-Chairmen is/are recommended by the Science Board for approval by the Council and shall assume office when group membership has been confirmed by the Executive Secretary. They are often, but not always, the organizers of the group. With the exception of Sections, a Chairman or Co-Chairmen usually serve(s) for the lifetime of the group. As is the practice with most PICES bodies, it is recommended that if there are two Co-Chairmen, they be from opposite sides of the Pacific. If group members need to be replaced, either by their own choosing or if the Chairman/Co-Chairmen feel they are not contributing to the group activities, the Chairman/Co-Chairmen must notify the respective national delegates and the PICES Secretariat, and if possible recommend replacements.

6. Group Activities

Groups are free to set their own schedule for activities. They usually have meetings or workshops at the time of the PICES Annual Meeting (as most members will be attending) and often schedule at least one other meeting between these sessions. The PICES Secretariat can provide support to help organize these activities. Expenses for group members to attend PICES Annual Meetings have to come from national sources. Requests to provide partial funding to support the travel costs of invited speakers to meetings/workshops (either annual or inter-sessional) should be made annually though the supporting PICES Committee and must be approved by the Science Board. Additional funds to cover inter-sessional meeting/workshop expenses and to carry out the research specified in the TOR need to be raised by the group members, either by submitting proposals to national or international agencies, or from available resources at their home institutions.

Regular electronic communication among members is a key for the group to be effective. The PICES website maintains e-mail address lists for each expert group and has created a facility for sending correspondence to all group members. In addition, a password-protected web page can be created to facilitate the exchange of opinions, files and data.

7. Deliverables

Expert groups must submit annual reports that will be included in the PICES Annual Report. If they hold inter-sessional meetings or workshops, it is also recommended that they submit an article for the PICES Press newsletter and consider publication of a report in the PICES Scientific Report series. A final report must also be submitted at the end of the expert group's lifetime and this is usually reviewed and published as a formal PICES publication (Annual or Scientific Report, book, or brochure).

8. Financial Support for Research

Though PICES can provide funding to support some travel to, and infrastructure to help organize, workshops, it does not provide funding to carry out the research itself. If such funding is needed, it must be found from international or national organizations, usually through a proposal process.

9. Responsibilities and Functions of the Chairman or Co-Chairmen

The Chairman or Co-Chairmen of Working Groups, Study Groups, Sections, Task Teams and Advisory Panels should:

- preside over meetings of the group concerned and regulate their procedure, and assign an appointment to draft minutes;
- prepare an agenda for each meeting of the group, and circulate to all members before the meeting;
- ensure the successful completion of the TOR of the group within the timeframe approved by the Governing Council;
- maintain good communication among members;
- maintain good communication with the parent Committee(s) by:
    - preparing written progress reports for their parent Committee (at most twice annually),
    - attending meetings of the parent committee(s), as required;
- plan and implement activities of the group;
- provide a final draft agenda to the Secretariat at least one month before the meeting;
- Prepare final reports to the parent Committee(s) for review at the end of the assignment. Typically, these are published as a PICES Scientific Report.

10. Collaboration with Outside Organizations

Though not necessary, collaboration with organizations outside PICES is encouraged. This provides a wider perspective for the research, the opportunity for joint activities, and in some cases the opportunity to access additional resources.

11. Key Ingredients to a Successful Expert Group

At the inter-sessional PICES Science Board Meeting in April 2005, Dr. Michael Foreman was asked to prepare an assessment report of previous PICES expert groups. Letters were sent to all past and present Chairmen or Co-Chairmen (Appendices 1 and 2) asking them to address the following issues: i) specific successes, failures and impacts of the group; ii) the overall expert group concept, processes, procedures and how they could be improved; iii) the influence of the expert group on the direction of the science that was its focus; iv) the key ingredients for a successful expert group; and v) other relevant comments. A summary of the results was presented at the Science Board Meeting at PICES XIV and is given in Appendix 3. For comparative purposes, Bjorn Sundby's evaluation of SCOR Working Groups is included as Appendix 4.

In particular, the key ingredients for a successful working group were found to be:

a) A clear mandate,
b) Resources (funding and time),
c) Collaboration with other organizations outside PICES,
d) Leadership,
e) Enthusiasm,
f) Active and dedicated members,
g) Frequent communications.

Appendix 1: Expert Group Survey Recipients

		Position	**E-mail address**
1	Lynne D. Talley	WG 1 Chairman	ltalley@ucsd.edu
2	Richard Addison	WG 2 Chairman	rfaddison@saltspring.com
3	Tokio Wada	WG 3 Co-Chairman, WG 16 Co-Chairman, REX Co-Chairman	wadat@affrc.go.jp
4	John R. Hunter	WG 3 Co-Chairman	John.Hunter@noaa.gov
5	Stewart McKinnell	WG 4 Co-Chairman	mckinnell@pices.int
6	Al. Tyler	WG 5 Chairman	tyler@sfos.uaf.edu
7	Brent Hargreaves	WG 6 Co-Chairman	hargreavesb@dfo-mpo.gc.ca
8	Takashige Sugimoto	WG 6 Co-Chairman	sugimoto@ori.u-tokyo.ac.jp
9	Paul H. LeBlond	WG 7 Co-Chairman	leblond@gulfislands.com
10	Masahiro Endoh	WG 7 Co-Chairman	endoh@ccsr.u-tokyo.ac.jp
11	Ming-Jiang Zhou	WG 8 Co-Chairman	mjzhou@ms.qdio.ac.cn
12	John Stein	WG 8 Co-Chairman	John.E.Stein@noaa.gov
13	Kimio Hanawa	WG 9 Co-Chairman	hanawa@pol.geophys.tohoku.ac.jp
14	Bruce A. Taft	WG 9 Co-Chairman, MONITOR Co-Chairman	bat65@aol.com
15	Sang-Kyung Byun	WG 10 Co-Chairman	skbyun@kordi.re.kr
16	C.N.K. Mooers	WG 10 Co-Chairman	cmooers@rsmas.miami.edu
17	Hidehiro. Kato	WG 11 Co-Chairman, MBM-AP Co-Chairman	katohide@affrc.go.jp
18	George.L. Hunt, Jr.	WG 11 Co-Chairman	glhunt@uci.edu
19	Vitaly E. Rodin	WG 12 Co-Chairman	root@tinro.marine.su
20	Robert S. Otto	WG 12 Co-Chairman	Robert.S.Otto@noaa.gov
21	Yukihiro Nojiri	WG 13 Co-Chairman WG 17 Co-Chairman	nojiri@nies.go.jp
22	Richard A. Feely	WG 13 Co-Chairman	Richard.A.Feely@noaa.gov
23	Nikolay V. Parin	WG 14 Co-Chairman	npar@fish.comcp.msk.su
24	Richard D. Brodeur	WG 14 Co-Chairman	Rick.Brodeur@noaa.gov
25	F.J.R (Max) Taylor	WG 15 Co-Chairman	maxt@unixg.ubc.ca
26	Tatiana Yu. Orlova	WG 15 Co-Chairman	torlova@whoi.edu
27	Richard J. Beamish	WG 16 Co-Chairman, BASS Co-Chairman	BeamishR@pac.dfo-mpo.gc.ca
28	Akihiko Yatsu	WG 16 Co-Chairman, BASS Co-Chairman, CFAME Co-Chairman	yatsua@fra.affrc.go.jp
29	Andrew G Dickson	WG 17 Co-Chairman	adickson@ucsd.edu
30	Ik-Kyo Chung	WG 18 Co-Chairman	ikchung@pusan.ac.kr
31	Carolyn S. Friedman	WG 18 Co-Chairman	carolynf@u.washington.edu
32	Glen Jamieson	SG & WG 19 Co-Chairman	JamiesonG@pac.dfo-mpo.gc.ca
33	Chang-Ik Zhang	SG & WG 19 Co-Chairman	cizhang@pknu.ac.kr
34	Ian Perry	NP Ecosystem Status Report, MODEL Co-Chairman, Science Board Chairman	perryi@pac.dfo-mpo.gc.ca
35	Jacquelynne R. King	FERRRS Chairman	KingJac@pac.dfo-mpo.gc.ca
36	Patricia Livingston	Science Board Chairman	Pat.Livingston@noaa.gov
37	Gordon A. McFarlane	BASS Co-Chairman	mcfarlanes@pac.dfo-mpo.gc.ca

		Position	**E-mail address**
38	Kerim Y. Aydin	BASS Co-Chairman CFAME Co-Chairman	Kerim.Aydin@noaa.gov
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40	Makoto Terazaki	BASS Co-Chairman	terazaki@ori.u-tokyo.ac.jp
41	Shin-ichi Ito	MODEL Co-Chairman	goito@affrc.go.jp
42	Michio J. Kishi	MODEL Co-Chairman	mjkishi@nifty.com
43	Sinjae Yoo	MODEL Co-Chairman	sjyoo@kordi.re.kr
44	Bernard A. Megrey	MODEL Co-Chairman	Bern.Megrey@noaa.gov
45	Francisco E. Werner	MODEL Co-Chairman	cisco@unc.edu
46	Tokimasa Kobayashi	REX Co-Chairman	tokikoba@affrc.go.jp
47	Yoshiro Watanabe	REX Co-Chairman	ywat@affrc.go.jp
48	Vladimir I. Radchenko	REX Co-Chairman	vlrad@sakhniro.ru
49	Anne B. Hollowed	REX Co-Chairman	Anne.Hollowed@noaa.gov
50	William T. Peterson	REX Co-Chairman	Bill.Peterson@noaa.gov
51	David L. Mackas	MONITOR Co-Chairman	Mackasd@pac.dfo-mpo.gc.ca
52	Kaouru Nakata	MONITOR Co-Chairman	may31@affrc.go.jp
53	Sei-Ichi Saitoh	MONITOR Co-Chairman	ssaitoh@salmon.fish.hokudai.ac.jp
54	Yasunori Sakurai	MONITOR Chairman	sakurai@fish.hokudai.ac.jp
55	Phillip R. Mundy	MONITOR Co-Chairman	mundy@gci.net
56	Charles B. Miller	CPR-AP Chairman	cmiller@coas.oregonstate.edu
57	C.S. Wong	IFEP Co-Chairman	WongCS@pac.dfo-mpo.gc.ca
58	Shigenobu Takeda	IFEP Co-Chairman	atakeda@mail.ecc.u-tokyo.ac.jp
59	William J. Sydeman	MBM Co-Chairman	wjsydeman@prbo.org
60	Evgeny Pakhomov	MIE Co-Chairman	epakhomov@eos.ubc.ca
61	Orio Yamamura	MIE Co-Chairman	orioy@fra.affrc.go.jp
62	Harold Batchelder	CCCC Co-Chairman	hbatchelder@coas.oregonstate.edu
63	Suam Kim	CCCC Co-Chairman	suamkim@pknu.ac.kr

Appendix 2: Sample Letter Sent to Chairmen/Co-Chairmen of Expert Groups

North Pacific
Marine Science
Organization

June13, 2005

Prof. Paul H. LeBlond
leblond@gulfislands.com

Dear Paul:

The Science Board of the North Pacific Marine Science Organization (PICES) is in the process of evaluating the performance of its working groups, study groups, and task teams. As you were the Co-Chairman of WG 7 on the **Modeling of the subarctic North Pacific circulation**, we welcome your comments on the successes, failures, and impacts of that group, as well as the overall working group concept and processes.

We are also interested in your opinions on the influence that WG 7 had on the direction of the science that was its focus. In other words, what were the less tangible results of the groups' activities and publications, such as the opening of new areas of research, or the development of new research collaborations, specific new research programs, or related publications by other groups? Please consider any international and/or national results of which you are aware. Your response does not need to be long (e.g., one page or shorter), but please be specific. This information will be used to help PICES examine how its working groups have influenced different disciplines of oceanography and should help us plan for the success of future working groups. In this latter regard, we are also interested in your thoughts on how the working group processes and procedures could be improved and what you feel are the key ingredients for a successful working group.

I will be providing a summary of your responses, along with those from other working group leaders, to the PICES Science Board at our next annual meeting in Vladivostok in early October. In order to allow sufficient time to compile and organize the survey results, I would appreciate a response (via mail, fax, or email) by **August 1, 2005.** Please cc this response to Julia Yazvenko at the PICES secretariat.

PICES thanks you for previous and continuing contributions to North Pacific marine science and in particular, for assistance in this survey.

Sincerely,

Michael Foreman
Chair, Physical Oceanography and Climate Committee
North Pacific Marine Science Organization
foremanm@pac.dfo-mpo.gc.ca
Fax: 250-363-6746

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c/o Institute of Ocean Sciences
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Appendix 3: PICES Expert Group Assessment Report, September 8, 2005

On June 13, 2005, sixty-three letters were sent out to past and present Chairmen or Co-Chairmen of PICES Working Groups, Study Groups, Task Teams, and Advisory Panels. A sample letter and the complete list of the recipients are included as Appendices 1 and 2. As of August 15, 2005 twelve replies were received. They have not been included here as one participant requested confidentiality. A summary of the responses, with reference to the specific questions that were posed, follows.

1. Specific successes, failures, and impacts of expert Groups

1. Symposia, workshops, reports, books: Almost all responses listed one or more of these as a notable success. Workshops enhanced continuing collaboration among participants (WG2, Addison).
2. The Batchelder letter listed numerous successes for each of the four CCCC task teams: REX, BASS, MONITOR, and MODEL.
3. Not all of the PICES member nations were actively involved in all group activities. The non-participation in the early stages of CCCC will probably mean that an education, outreach and training effort will be needed in the future (Batchelder).
4. The most notable success of WG14 was the spinoff of the Micronekton Intercalibration Advisory Panel which conducted a successful international cruise and is planning another. In collaboration with other groups, two Symposia were held and proceedings published.
5. WG14 brought in some people who had not previously been involved with PICES and now they are active members of the organization.
6. The most valuable success of the MODEL Task Team is the NEMURO model (Ito). This includes NEMURO.FISH (with REX), a version coupled to ECOPATH/ECOSYM (with BASS, and another coupled with a population dynamics model to provide biomass estimates. A failure might be the lack of strong contributions from several PICES countries until the last year. This failure is mainly caused by the different interests within PICES countries; U.S., Canada and Japan are interested in the open ocean, but other countries are more interested in their marginal seas.
7. The WG 7 report was a realistic summary of the state of the art in numerical modeling of the North Pacific at that time and set realistic constraints to the ecological modeling dreams of the CCCC Program. The Working Group participants developed lasting contacts and learned from each other in the process of exchanging information and preparing a report (LeBlond).
8. WG 4 recommended that its objectives were more clearly suited to an ongoing organizational entity within PICES, and GC/SB established the first Technical Committee on Data Exchange (TCODE).
9. PICES distributed a publication (Department of Fisheries and Oceans (Canada) Technical Report) containing previously unpublished, detailed Station Papa zooplankton data (WG 4, McKinnell).
10. The Science Board and the North Pacific Ecosystem Status Report Working Group were very successful – the former for collectively providing a scientific leadership role and perhaps a sense of direction, forward momentum, and a shared goal for PICES science, and the latter for building a group of talented and capable scientists also with a shared goal and the enthusiasm to develop something new (Perry).
11. The successful aspect of the MODEL Task Team is that it made a substantial progress in defining a lower trophic model structure and developing codes. The lower trophic model has been named "NEMURO", which includes a maximum of 15 compartments. The NEMURO model is gaining visibility among researchers interested in ecosystem responses to climate forcing as well as in the modeling community (Yoo).
12. The unsuccessful side of MODEL is that it did not catch up with the CCCC timeline. CCCC will be 10 years old in 2006 and is now in its concluding phase. The methods to couple the LTL and

HTL have been studied for the past years by the Task Team. Although there was some progress but the results are not yet fully applicable (Yoo).

13. Participation at the last WG19 meeting in 2004 was not so satisfactory; only a few members attended. No members participated from three countries (Zhang).

2. Overall expert group concept, processes, procedures and how they could be improved

1. *Active Participation of all Members*: The overall Working Group concept is good but PICES and the member nations need to ensure that all members of the Working Group come to the meetings and actively participate in activities, including reports (Brodeur).
2. *Continued Participation*: Many in WG 5 felt that there was no direct place for them in organized activities of PICES after the Working Group dissolved. Most continued to attend PICES meetings when they could get funding, and they contributed research papers. But the Bering Sea ceased to be a focus of any group within PICES (Tyler).

3. Influence of the expert group on the direction of the science that was its focus

1. Discussions and collaborations stimulated interest in topics that otherwise would not have been viewed as a high priority by some member countries (Addison).
2. Though not all the original CCCC proposals were achieved, CCCC has significantly advanced, either directly or indirectly, our understanding of the impacts of climate variability on marine organisms and productivity of the North Pacific, and some of the mechanisms involved (Batchelder).
3. Most PICES Working Groups spend their time consolidating information from various countries on a topic of interest and do not make significant advances in science direction. It is important for Working Groups to spend their initial time together because it helps them have a common frame of reference with regard to what is presently known or not known about their topic of interest. If Working Groups had more time to work beyond this initial phase of inquiry, they could have more scientific influence. Working Groups take a while to get established, form working relationships, and get common ideas for future work together. Working Group members have been known to express regret that their Working Group was being disbanded in order to make way for another Working Group (Livingston).
4. In terms of broader influences, the scientific fields opened by Science Board (and coming from the scientists of PICES themselves with perhaps some steering by Science Board) will prove to be important to PICES and are at the forefront of scientific themes developing worldwide. These include ecosystem-based approaches, harmful algal blooms, climate variability and climate change impacts to living resources and the provision of concise scientific advice on this topic, and the characteristics and comparisons of recent marine ecosystem conditions throughout the North Pacific (Perry).
5. Most of the scientists of WG 5 have continued to carry out research on the Bering Sea, and the Working Group was very important in shaping the work of these individuals. The contacts made during workshop meetings continued to be very valuable. The book that resulted (Dynamics of the Bering Sea) has continued to be an enormous source of information for those involved in research programs (Tyler).
6. Typical ecosystem modeling activities involve physics and the lower trophic level. There have not been many attempts that aimed at physics-LTL-HTL modeling as a whole. The most important impact that the MODEL Task Team has had on the community is that it specifically aimed at those links with some novel approaches. The NEMURO model-related papers have been published in good journals including "*Ecological Modelling*" and a special issue covering the outputs from the Task Team activities is now underway (Yoo).

4. What are the key ingredients for a successful expert group?

1. *Focus, clear mandate*:
   i. The Working Group needs a well-defined focus that is truly relevant for all member countries. The WG 2 Chairman stated that "the real problem for this Group was that there is no urgent trans-Pacific ("quasi-hemispheric") issue that demanded a co-ordinated international response in the way that (perhaps) there are fisheries management or large-scale oceanographic process issues. The closest we had to a trans-Pacific MEQ issue is that of long- range transport of certain pollutants, and I suppose that if I had to do it all over again I'd push for a focus on that." Due the large geographic expanse of the North Pacific, issues in one sub-region may not be relevant in others. Consequently, most governments (and their scientists) see environmental issues as being mainly (but not exclusively) "regional" rather than "quasi-hemispheric" and so see no real need for harmonisation over a large geographic scale (Addison).
   ii. The initial terms of reference for WG 4 were far too general and their scope too broad to be effective as an assignment of 2–3 years duration (McKinnell).
   iii. A clear mandate, with clear terms of reference, goals, and deliverables are necessary for Working Group success. It is preferable that this comes initially (at least) from the scientists rather than being dictated by "the hierarchy", although some refinement and direction from "the hierarchy" will likely be needed (Perry).

2. *Resources (funding and time):*
   i. PICES provides a structure for international co-operation but ultimately its activities depend largely on the "volunteer" efforts of its members. These are generally either government scientists, or university professors who are funded through government grants. If governments do not see the Working Group issue as being a high priority, then any initiative to address that issue is unlikely to attract government funding. The bottom line is that if PICES wants to focus on a trans-Pacific issue it must find appropriate funding (Addison)!
   ii. A key factor for the success of the MODEL task team was funding support (Ito).
   iii. Governments appointed their representatives then failed to provide funds to attend Working Group meetings (whether they were inter-sessional or during the Annual Meeting) (McKinnell).
   iv. Funding from the Gulf Ecosystem Monitoring (Exxon Valdez Oil Spill Trust Fund) for the Continuous Plankton Recorder Program is likely to disappear after 2007. Funding is also available from the North Pacific Research Board but its long term viability "remains to be tested". PICES support has helped, and will continue to be needed, to sustain the program (Miller, CPR-AP).
   v. Without sufficient money, the members of the Group never get a chance to meet as a full group. Without sufficient time on the part of the participants, they never get anything done – this is partly connected to the participants' enthusiasm for the work of the Group, and whether they have been "appointed' or actively "requested" to join (Perry).
   vi. The key factor for a successful Working Group is the active participation of all countries. We need to look for some ways to promote participation by, for example, supporting travel money for key members from each country (Zhang).

3. *Collaboration with other organizations outside PICES*:
   i. Cross fertilization between the CCCCs Program and the U.S. GLOBEC Northeast Pacific Program benefited both groups (Batchelder).
   ii. PICES interactions with ICES, NPAFC, and the international (IGBP/SCOR/IOC) GLOBEC program were particularly noteworthy in the success of the Ecosystem Status Report Working Group (Perry).

4. *Leadership*:
   i. The energy, creativity, interest, and time-devotion of the leaders of each of the CCCC Task Teams were keys to their productivity. Vested, proactive leadership led to the success of the Task Team activities and to that of the CCCC group overall (Batchelder).
   ii. Strong leadership is perhaps the most important ingredient for a successful Working Group. A strong leader needs to inspire enthusiasm and provide a vision or goal for the Group, but also should not overly dominate the Group – *i.e.*, the participants need to "buy into" the vision provided by the leader(s). A strong leader to some extent can overcome the drawbacks of not having a clear mandate (Perry).

5. *Enthusiasm:*
   i. Scientists should be enthusiastic and the Working Groups should promote not only scientific activity but also introduce techniques and educate new scientists (Ito).
   ii. Enthusiasm for the topic, preferably from more than one scientist from more than one member nation, is needed. Again, this usually comes from the scientists, but not exclusively: all of us recognize and can get excited about a stimulating idea (Perry).

6. *Active and dedicated members:*
   i. Probably most important is a Chairman who is able to divide the tasks up in a meaningful way. The biggest problem are members who are not committed to the Working Group or too busy to do the assigned tasks. A solution might be changing the way members are nominated. Having national delegates actively screening the interest and ability of nominated Working Group members might help. The delegates could poll prospective Working Group members regarding their ability to meet the time commitments involved. Working Groups could also focus their work more at mini-workshops where most of the work is done, instead of expecting members to work on tasks National delegates need to verify that there will be financial support from the member's country to pay for their travel to these Working Group meetings (Livingston).
   ii. The Working Groups not only need a strong leader but also cooperative members. The Working Group membership recommendation from each PICES country is important (Ito).

7. *Frequent communications*, both amongst the members of the group, but also with its parent group: The former is needed to develop the shared vision and goal, and to keep activity at some continuous level for the duration of the group; the latter is necessary to ensure the group is on-track with the objectives initially established by the parent group, and to be plugged into the "larger picture" (Perry).

5. **Other relevant comments**:

1. Richard Addison listed the following notable differences between PICES and ICES that has led to PICES needing to operate in quite a different way.
   i. ICES has a *formal* role to provide scientific advice to its members especially on issues which cross international boundaries; PICES has no such role (yet);
   ii. ICES deals generally and mostly with the NE Atlantic–North Sea–Baltic area (even though Canada and the U.S.A. are members); in practice this means that ICES' interests are focused on "regional scale" issues (in contrast to the focus of PICES which is on the North Pacific — almost a hemispheric focus; well, a much larger scale than ICES' focus, anyway);
   iii. ICES has a much larger membership than PICES, but ICES' membership is much more culturally homogenous (all essentially northern European) and probably at a much more similar level of economic and scientific development (though that latter statement may not be quite true now that the Baltic states have joined …)

2. The main focus of PICES should be on essential physical and ecosystem studies rather than fishery management as the fish species in PICES countries do not overlapped exactly. Also, if we only focus on the fishery management, it will restrict the funding resources. Therefore, I consider that "physical and ecosystem response to the climate changes including the global change in the North Pacific" is a preferable theme for PICES in the next decade, although it is not so different from the current CCCC's objective. Fishery management should be treated as one of the ecosystem problems (Ito).

Appendix 4: Bjørn Sundby's Evaluation of SCOR Working Groups

In 2002–2003, the SCOR Secretariat sent letters to former chairs and/or members of SCOR Working Groups 66 to 105. This set of Working Groups was selected because most of the Chairs and members were still living, and because their work was concluded sufficiently long ago that some may have borne fruit beyond their final publications. This group of respondents might produce positively biased information; nevertheless, it seemed like the group most likely to answer.

The groups were queried about (1) the influence of their Working Groups on the direction of the science that was the focus of the group and (2) the less-tangible results of the groups' activities and publications, such as the opening of new areas of research, or the development of new research collaborations, specific new research programs, or related publications by other groups. SCOR also asked for thoughts about how the Working Group processes and procedures could be improved. Responses were received from members of 25 of the 38 Working Groups considered.

Impact of Working Groups

The following are some of the positive comments about SCOR Working Groups.

- WG 59 (Mathematical Models in Biological Oceanography) and WG 73 (Ecological Theory in Relation to Biological Oceanography): *Regarding the less tangible results of our WG activities, I believe that the most important influence was on JGOFS. All four of the Working Group's books greatly influenced JGOFS in its strategy for sampling the ocean, since they bear on uncertainty of natural systems in the ocean and the need to link physics and biology in a whole systems approach.*
- WG 71 (Particulate Biogeochemical Processes): *The deliberations and recommendations of WG 71 had a very positive influence in contributing to the development of programs on Marine Biogeochemistry.*
- WG 78 (Determination of Photosynthetic Pigments in Seawater): *The book that was published by the WG a number of years ago is now a standard in most laboratories and on the desk of many (most) researchers. The chapters of the book cover practically all aspects of pigment studies that one can imagine. A very useful work, for beginners and experts. It is still up-to-date, which indicates that the Working Group did the best job that could be done.*
- WG 83 (Wave Modelling): *The monograph* Dynamics and Modeling of Ocean Waves *was widely used as a standard reference work on ocean modeling.*
- WG 91 (Chemical Evolution and Origin of Life in Marine Hydrothermal Systems): *At times I talk about our SCOR Working Group with my fellow co-authors. We still think the report is very up to date and are proud of its contents. We very much appreciate the support we received from SCOR. A month ago I attended the 13th International Conference on the Origin of Life and 10th ISSOL Meeting in Oaxaca, Mexico. The 'Hydrothermal Model' for life's origin was referred to in every second contribution, both with regard to Earth, Mars as well as Jupiter's moon Europa. I like to*

believe that one reason for this ongoing paradigm change is due to the publication of our SCOR report ten years ago.

- *WG 105* (The Impact of World Fisheries on the Stability and Biodiversity of Marine Ecosystems): *It is my impression that the* ICES Journal of Marine Science *issue on the "ecosystem effects of fishing" is a landmark synthesis of this broad issue. Having essentially all of the most up-to-date information together in a single volume is very timely. The recognition by the global scientific community that marine fishing activities have had a broad range of impacts on ecosystem structure and function is an important first step in changing the conservation objectives of this sector. In addition to having an influence on marine policy issues for fisheries management the activities of the Working Group have contributed to the generation of international teams that are addressing specific research questions.*

These comments provide a snapshot of the general success of SCOR Working Groups and the Working Group model. Not all Working Groups have been successful, as shown by the following comments.

- *The word 'working' suggests activity and production. Where the objective of Working Groups has been to provide a synthesis of a subject area, my personal impression has been that the outputs have been disappointing, perhaps because committees do not construct lively and really critical texts. There are some tasks which do require Working Groups (and perhaps such matters as the development of measurement protocols, undertaking inter-comparison tests and setting of quality standards may be in this category). There may also be areas which lead to the subsequent release of funding, but few of us are sufficiently farsighted to identify seedling subjects which require the nurture and encouragement which a SCOR WG might provide in time to be effective.*

Some Working Groups "failed" because

- They never met. From WG 87 (Fine-scale Distribution of Gelatinous Planktonic Animals): *To my knowledge this working group never met and never did anything!! This was upsetting to those of us who were supposed to be involved.*
- They lost interest: *"As you know, WG 94* (Altimeter Data and In-situ Current Observations) *essentially dissolved after its first year. My recollection is that we decided that most of the work related to this would be done without the need for a Working Group."*
- Time passed – things changed: "*WG 80* (Role of Phase Transfer Processes in the Cycling of Trace Metals in Estuaries) *was formed in 1986 and worked initially via correspondance. By the time we held our first meeting in Plymouth UK in October 1989 just over half the first draft manuscripts had been received. By the time we were able to schedule the second meeting (April 1991) several problems had arisen. The fall of the former USSR and political problems in China had made communication difficult and several members of the group had serious health problems. In addition, authors who had drafted chapters and submitted them early in the process requested that they be returned for updating. The material was therefore not ready for publication. In the event, the good intentions of the authors at Jekyll Island did not convert into completed manuscripts…I have no doubt that the participants, and their science programmes, benefited significantly from the formation of the Working Group. It is a matter of great regret that we were unable to share these benefits with the wider scientific community through the publication of our deliberations."* WG 104 (The Role of Wave Breaking on Upper Ocean Dynamics) also disbanded without a product for a similar reason.

Lessons Learned

Some lessons can be learned from the performance of past Working Groups, particularly the failures:

- The focus of the WG has to be sharp, and the (minimum) deliverables have to be specified:

"*I have reviewed the papers I have on file from WG 90* (Chemical and Biological Oceanographic Sensor Technology)*, and was surprised to re-read the terms of reference, which are not particularly clearly defined: comparison with the experience of getting WG 109* (Biogeochemistry of Iron in Seawater) *approved, and with discussions at recent SCOR meetings I have attended suggest that SCOR has become much more aware of the need for clearly defined and achievable terms of reference. Interestingly, no deliverable (report, book, review article…) was identified in SCOR's decision to set up the Working Group. Again, this is in contrast to current practice where SCOR is rightly very keen to see that the expected output of the Working Group is defined from the beginning."*

It is important that the Group finish their work within the expected four years, so as to not lose momentum and leadership. In order for a Group to finish in four years, its terms of reference must be clear and achievable and SCOR should ensure that it has enough funding available for annual meetings of its Working Groups. The topic should truly be a "hot topic" that the Working Group can help to advance significantly.

- The success of a Working Group depends critically on the Chair, who must be chosen with great care. The Chair must be passionate about the topic and known to be organized and productive. Working Groups are not merely discussion groups.
- Members must be told explicitly what is expected of them.
- Make sure that the members have the necessary expertise. For example, in relation to WG 89 (Sea Level and Erosion of the World's Coastlines): *I suggested several names for potential committee members based on their research on the topic of WG 89, and a few of them were appointed. SCOR selected other members, mainly from third-world countries, individuals I had not known previously. This resulted in a somewhat schizophrenic committee, with half of the members having a reasonable scientific knowledge of how coasts respond to sea-level changes, the focus of WG 89. The other members were concerned mainly with the social impacts of sea-level rise, and although of interest as the background motivation for WG 89, these members were only able to make limited contributions when we dealt with the scientific and engineering issues.*
- The timeline is important. The Working Group should be monitored closely and produce annual progress reports, as opposed to activity reports.

Visibility of SCOR WG products

An important issue that was raised by past participants in SCOR working groups relates to the visibility of the group's products.

- *WG 71* (Particulate Biogeochemical Processes)*: I must add that the "visibility" of our report has been low. This is reflected in the very low citation the report has received in various types of publications. The impact of WG 71 (and perhaps other Working Groups) would have been more if its reports and recommendations were brought to the attention of more scientists working in the field. SCOR should explore avenues to increase the visibility and profile of its Working Groups.*

SCOR Working Group reports of earlier years were often published in the "gray literature" as technical reports and sometimes only in the *SCOR Proceedings*! Visibility has increased in recent years as the final product of many Working Groups is often a special issue of a peer-reviewed journal, which presumably reaches other scientists who work on that topic. Slightly less visible are books by major publishers, which may be priced too high for the average scientist or library to purchase.

The visibility and accessibility of SCOR Working Group products could be increased by:

- Making working group products available for downloading on the SCOR Web site;
- Making working group products available on CDs;
- Favoring publishers who are willing to allow open access to Working Group products (*e.g.*, ASLO);
- Finding other ways to spread the word about the working group results, such as funding Working Group Chairs to present the Working Group's findings at international meetings.

SUMMARY OF SCIENTIFIC SESSIONS AND WORKSHOPS

Science Board Symposium (S1)
The changing North Pacific: Previous patterns, future projections, and ecosystem impacts

Co-Conveners: Kuh Kim (SB), Michael J. Dagg (BIO), Gordon H. Kruse (FIS), Glen Jamieson (MEQ), Jeffrey J. Napp (MONITOR), Michael G. Foreman (POC), Igor I. Shevchenko (TCODE), Harold P. Batchelder (CCCC), Michio J. Kishi (CCCC) and Fangli Qiao (China)

Background

The PICES Special Publication, "*Marine Ecosystems of the North Pacific*", concluded that "during the past five years profound changes have occurred in the North Pacific climate system, in the composition, abundance and distribution of its living marine resources, and in the human societies that depend on the North Pacific Ocean and its resources". This symposium has built on studies of climate variability and other anthropogenic impacts in the North Pacific and its marginal seas, the latest North Pacific climate projections (whose results have been summarized in the Fourth Assessment Report of the Inter-governmental Panel for Climate Change), future scenarios for direct human forcing by population growth and fishing, and the combined impacts that these changes have already had, and can be expected to have, on North Pacific ecosystems. The symposium addressed issues such as: 1) trends *versus* variability; 2) synergisms between climate and direct human forcing; 3) ecosystem indicators and their applicability in the future; 4) impacts arising from regional changes (*e.g.*, less ice-cover in the Bering Sea and Sea of Okhotsk, aquatic bioinvasions); 5) the effects of terrestrial climate change (*e.g.*, river discharge); 6) how projected global change and anthropogenic impacts may alter sustainability of the North Pacific; and 7) what the key messages should be for policy makers regarding sustainability of the North Pacific. Talks describing links with climate change in the Arctic and the International Polar Year Projects were also welcome.

Summary of presentations

The Science Board Symposium was held on Monday, October 29, 2007 and consisted of 14 oral presentations (including 1 keynote and 6 invited talks) plus 9 posters. It was intended to build on studies of climate variability and other anthropogenic impacts in the North Pacific and its marine seas, including the latest North Pacific climate projections, future scenarios for direct human forcing by population growth and fishing and the combined impacts that these changes have already have or can be expected to have on the North Pacific marine ecosystems. The keynote talk by Kenneth Denman (also recipient of the 2007 Wooster Award) set the stage for the session by introducing the core observations and projections from the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Included in his presentation were the key results of many of the talks that followed in this session. Dr. Denman demonstrated the connectedness of the many components in a marine ecosystem and he urged the audience to consider them as a system, not as isolated components. He also compared the time course of global change to that of evolution and asked if organisms would be able to adapt given the magnitude of change expected during the next 100 years.

The remaining talks were very diverse in their approach and focus, and reflected the breadth of PICES interest and national representation. Richard Feely focused on how absorption of atmospheric CO_2 by the oceans has begun to change the chemical buffering of the oceans, how rapidly some of these changes have occurred, and what changes in ocean chemistry may be expected in the future. He speculated on how fundamental changes to the pH and carbonate systems may change the structure and function of a variety of marine ecosystems from

deep water corals to coastal food webs. He also emphasized that while the chemical equations governing the state of the oceans were well known, the subtle effects on the biological systems will be difficult to predict. Issues such as how genetics, physiology of individual species, community responses and biological feedbacks will respond to acidification are uncertain. Greg Flato provided background information necessary to understand the evolution of the IPCC reports and gave a summary of results from the Fourth Assessment Report, which included the many different leading indicators used by the panel. One observation to note is that the disappearance of sea ice from the Arctic is occurring more rapidly than predicted by the suite of IPCC global models. William Merryfield focused on how changing climate has altered the structure of the upper water column through changes to the mixed layer depth. Mixed layer depth is a fundamental property of the upper oceans, and it affects processes such as exchange of heat and gas with the atmosphere and nutrient replenishment for biological production. Observed decreases in the mixed layer depth at Ocean Station Papa are comparable to the change predicted by the ensemble of models used by the previous speakers. The models projected about a 20% decrease in the mixed layer volume that will be available to interact with the atmosphere between 1990 and 2090. This may act as a negative feedback, slowing the rate at which oceans absorb new CO_2, resulting in a faster rate of increase of atmospheric carbon dioxide. Muyin Wang used the IPCC - A1B scenario to predict the future climate of the North Pacific Ocean. They focused on several leading indicators or processes: sea ice, upwelling, PDO–Aleutian Low and uncertainty. In their projections the Aleutian Low will deepen and move slightly northward between 2050 and 2100 altering the storm tracks across the North Pacific Ocean and the patterns of precipitation across North America. Yasunori Sakurai took a different approach. He began with the life history of a single, commercially important species (Japanese common squid, *Todarodes pacificus*) and speculated on how hypothesized changes in the temperature and currents around Japan would affect the survival and recruitment of this important species. Included in his presentation was a new method to predict recruitment and catch of squid one year prior to recruitment. Steven Murawski explained how the major fisheries agency in the United States was proposing to use integrated ecosystem assessments as a first step towards ecosystem-based management of living marine resources. He discussed the objective of having knowledge of the state of ecosystems on equal footing with population assessments and the necessity to develop ecosystem governance systems that would be equipped to manage tradeoffs, and apply adaptive approaches. The United States National Oceanic and Atmospheric Administration (NOAA) will begin two pilot projects on the west coast of North America, in the California Current and Alaska large marine ecosystems, to try to apply Integrated Ecosystem Assessment. Chang-Ik Zhang, in a talk later in the session, presented a parallel case for application of Ecosystem-Based Management (EBM) for the Republic of Korea. They emphasized the dual action of anthropogenic (fishing) and climate change threats to the sustainability of fisheries, particularly when an ecosystem is already stressed or damaged. They presented the recent actions taken by the Republic of Korea to help implement EBM and institute environmentally sound management practices. Francisco Werner focused on tools for examining future changes to lower trophic levels and individual fish species through coupled physical–biological models such as NEMURO. He urged the audience to consider ways to link quantitative models directly to whole ecosystems and human use of those systems. They proposed the following three goals: 5 years – models are fully integrated; 10 years – models will bridge ecology and biogeography; 15 years – quantitative predictions for ecosystems, including human uses of ecosystems through incorporation of bio-economic models. David Preikshot found that their assessment models for North Pacific salmon worked best when climate and environmental indices were added to the assessment. Emmanuele DiLorenzo investigated mechanisms to explain sources of variability in observations of nutrients, salinity, and chlorophyll in the eastern North Pacific Ocean.

Their new index, the North Pacific Gyral Oscillation (NPGO) is related to the strength of the subarctic and subtropical gyres in the North Pacific. Yaqu Chen documented the anthropogenic pressures placed on the Yangtze River estuary in China. They presented methods used successfully to restore the health of the system. Gregory Ruiz provided the audience with background information on patterns and trends in bio-invasions along the west coast of North America and then speculated on how those patterns and trends might respond to the effects of climate change in the future such as opening of the Arctic to year round shipping. Lastly, Thomas Okey closed the session with a presentation on Imaginative Synthesis Groups as a strategic collaboration among scientists of various disciplines to assess climate impacts. He asked for input from the audience on innovative tools and assessments that included both western science and traditional education and knowledge that could be used in the future to assess impacts and vulnerability of ecosystems to climate change.

List of papers

Oral presentations

Gregory M. Flato (Invited)
A brief summary of results from the IPCC Fourth Assessment Report

Emanuele Di Lorenzo and Niklas Schneider
A North Pacific gyre-scale oscillation: Mechanisms of ocean's physical-biological response to climate forcing

Gregory M. Ruiz (Invited)
Biogeography of marine invasions: Current status and future predictions

William J. Merryfield and Suelji Kwon
Changes in North Pacific mixed layer depth in the 20th and 21st centuries as simulated by coupled climate models

Dave Preikshot and Nathan Mantua
Comparisons of modeled climate and lower trophic level time series for the North Pacific from 1950 to 2002

Francisco E. Werner, Bernard A. Megrey, Michio J. Kishi, Kenneth A. Rose, Shin-ichi Ito, Yasuhiro Yamanaka, Maki Noguchi-Aita and Taketo Hashioka
Extensions of the NEMURO models for use in studies of future climate scenarios

Muyin Wang and James E. Overland
Future climate of North Pacific projected by IPCC models

Steven A. Murawski (Invited)
Integrated ecosystem assessments: The first step in ecosystem-based management of living marine resources

Yaqu Chen, Zhijie Hu, Weifeng Gu, Yonghua Jiang, Weimin Quan and Liyan Shi
Long-term change and ecological restoration of the Yangtze River estuarine ecosystem in past decades

Chang-Ik Zhang, Suam Kim and Jae Bong Lee (Invited)
Marine ecosystems, fisheries and the ecosystem-based resource management in Korea

Richard. A. Feely, Christopher L. Sabine, Victoria Fabry, Robert Byrne, J. Martin Hernandez-Ayon, Debby Ianson and Burke Hales (Invited)
Ocean acidification: Present status and future implications for marine ecosystems in the North Pacific

Yasunori Sakurai and Michio J. Kishi (Invited)
Prediction of life strategy and stock fluctuation of the Japanese common squid, *Todarodes pacificus*, related to climate change during the 21st century

Thomas A. Okey
The changing Pacific: A strategic collaboration for assessing climate impacts and developing effective policy for adaptation

Kenneth Denman (Keynote)
The North Pacific, human activity, and climate change

Posters

Valentina V. Kasyan
Bioaccumulation of heavy metal in zooplankton (Copepoda) from the Amursky Bay, Japan/East Sea

Vladimir I. Ponomarev and Elena V. Dmitrieva
Changing global-regional linkages in the Northwest Pacific and Northeast Asia

K. David Hyrenbach, Ken H. Morgan, Mike F. Henry, Chris Rintoul, Gary Drew, John Piatt and William Sydeman
Documenting changes in the distribution and abundance of warm-water gadfly petrels (*Pterodroma* spp.) in the subarctic North Pacific using vessels of opportunity (2002 - 2006)

Inga A. Nemchinova
Impact of towed airgun arrays, used in seismic exploration, on marine zooplankton from the northeastern Sakhalin shelf coastal waters

Alexander V. Moshchenko, Anastasia S. Chernova and Tatyana S. Lishavskaya
Long-term changes in the marine environment in apex parts of Amur Bay (Peter the Great Bay in the Japan/East Sea)

Olga N. Lukyanova, Margarita D. Boyarova and Andrey P. Chernyaev
Seabirds as bioindicators of POPs in the marginal seas of northwestern Pacific

BIO/POC Topic Session (S2)
Decadal changes in carbon biogeochemistry in the North Pacific

Co-Convenors: *James Christian (Canada) and Toshiro Saino (Japan)*

Background

This session was the first effort by the PICES Section on *Carbon and Climate* to synthesize the current understanding on inter-relationship between the carbon cycle and climate in the Pacific. Emphasis was placed on decadal change in carbon cycling, *e.g.*, anthropogenic carbon, air–sea exchange of CO_2, the biological pump, impacts of increasing levels of carbon dioxide on carbonate chemistry and marine biota, and possible feedbacks to atmospheric greenhouse gases. We expected that the session will enable us to update our understanding of the relationships between the carbon cycle, marine biota, and climate in the Pacific, and to identify gaps in our knowledge for future research in areas of importance for the PICES Section on *Carbon and Climate*.

Summary of presentations

This session focused on decadal ("low-frequency") variability of biogeochemical cycles in the North Pacific. Topics ranged widely covering pCO_2, DIC (dissolved inorganic carbon), nutrients, phytoplankton, models and observations, and coastal and open ocean areas. The keynote speaker was Taro Takahashi (U.S.A.), who described the progressive construction of a global surface pCO_2 data set and trends observed in the data as more timeseries information becomes available. The global mean rate of growth of ocean surface pCO_2 is similar to the growth of atmospheric CO_2. C.S. Wong and Sophia Johannessen (Canada) showed a detailed time series for the Northeast Pacific (Gulf of Alaska) where the oceanic trend is similar to the global mean, although in some parts of the northern North Pacific the trend is very different from the global mean. Kitack Lee (Korea) showed that uptake of anthropogenic CO_2 by the Japan/East Sea has all but stopped in recent years due to reduced efficiency of the mechanisms that transport CO_2 to the deep ocean. Tsuneo Ono (Japan) examined regional trends in surface silicate and phosphate concentrations and concluded that up to half of currently nutrient-replete surface waters in the North Pacific could become nutrient depleted this century if these trends continue. There were four modelling talks and an excellent integration of modelling with observationally based presentations. Anand Gnanadesikan (U.S.A.) presented a provocative hypothesis about the ventilation of the North Pacific thermocline, based on modelling studies, but apparently robust to exactly which ocean model is used. Chun-Ok Jo (Korea) was given the best poster award (selected from among all posters contributed to the POC Paper Session and several other POC-sponsored sessions) for her poster "Decadal changes of phytoplankton activity during spring in the southern East/Japan Sea". This was a very successful inaugural topic session for the Carbon and Climate Section (CC-S) and the research presented shows that CC-S objectives are being addressed by scientists in PICES nations.

List of papers

Oral presentations

Debby Ianson, Richard A. Feely, Chris L. Sabine and J. Martin Hernandez-Ayon
Annual carbon fluxes in the coastal Northwest Pacific

Taro Takahashi, Stewart C. Sutherland, Rik Wanninkhof, Colm Sweeney, Richard A. Feely, Burke Hales, Gernot Friederich, Francisco Chavez, Andrew Watson, Dorothee C.E. Bakker, Ute Schuster, Nicolas Metzl, Hisayuki Yoshikawa-Inoue, Masao Ishii, Takashi Midorikawa, Christopher Sabine, Mario Hopemma, Jon Olafsson, Thorarinn S. Arnarson, Bronte Tilbrook, Truls Johannessen, Are Olsen, Richard Bellerby, Hein J.W. de Baar, Yukihiro Nojiri, C.S. Wong, Bruno Delille and N.R. Bates (Invited)
Climatological mean and decadal change in surface ocean pCO_2, and net sea–air CO_2 flux over the global oceans

Yutaka W. Watanabe
Decadal change in N/P/Si ratio over the North Pacific subpolar region

Christopher L. Sabine, Richard A. Feely, Frank Millero, Andrew Dickson, Chris Langdon, Sabine Mecking, Jim Swift and Dana Greeley
Decadal changes in Pacific Ocean inorganic carbon

Tsuneo Ono and Akihiro Shiomoto
Decadal trend of summer nutrient content in the North Pacific HNLC region

Makio Honda (presented by Shuichi Watanabe)
Interannual variability of the biological pump in the northwestern North Pacific

Akira Nakadate, Hitomi Kamiya, Takashi Midorikawa, Masao Ishii and Toshiya Nakano
Interannual variability of winter oceanic CO_2 along 137°E in the western North Pacific

Kitack Lee and Guen-Ha Park
No recent uptake of anthropogenic CO_2 by the East/Japan Sea

Kimio Hanawa and Shusaku Sugimoto
Reemergence of winter SST anomalies and spring chlorophyll-a concentration in the central North Pacific

Hernan E. Garcia, Tim P. Boyer, Sydney Levitus, John I. Antonov and Ricardo A. Locarnini
Seasonal to decadal variability in phosphate in the upper ocean

Nobuo Tsurushima, Koh Harada and Yutaka W. Watanabe
Spatial distribution and temporal change of dissolved inorganic carbon in the western North Pacific

Masahide Wakita, Shuichi Watanabe, Akihiko Murata, Nobuo Tsurushima, Makio Honda, Yuichiro Kumamoto, Hajime Kawakami and Kazuhiko Matsumoto
Temporal variability of dissolved inorganic carbon at the K2 and KNOT time-series stations in the western North Pacific

Shinichi S. Tanaka and Yutaka W. Watanabe
The effect of bubble injection on concentrations of N_2 and Ar in the western North Pacific

James R. Christian, Kenneth L. Denman and Konstantin Zahariev
The North Pacific Ocean in the enhanced greenhouse

C.S. Wong, Shau-King Emmy Wong, Sophia Johannessen, Liusen Xie and John Page
Time-series of pCO_2 (partial pressure of CO_2) at Station P / Line P in the sub-arctic Northeast Pacific Ocean

Hiromichi Tsumori and Yukihiro Nojiri
Trend analysis of ocean pCO_2 and the air–sea CO_2 flux in the North Pacific

Fei Chai, Guimei Liu, Huijie Xue, Lei Shi and Yi Chao
Variability of the carbon cycle and productivity in the China Seas during 1960-2006: A three-dimensional physical-biogeochemical modeling study

Anand Gnanadesikan and Keith B. Rodgers
Ventilation variability in the North Pacific as simulated by a coupled climate model

Posters

Masahiko Fujii, Yasuhiro Yamanaka, Yukihiro Nojiri, Michio J. Kishi and Fei Chai
Comparison of seasonal characteristics in carbon biogeochemistry among the subarctic North Pacific stations described with a NEMURO-based marine ecosystem model

Chun-Ok Jo and Kyung-Ryul Kim
Decadal changes of phytoplankton activity during spring in the southern East/Japan Sea

Akihiko Murata, Yuichiro Kumamoto, Ken'ichi Sasaki, Shuichi Watanabe and Masao Fukasawa
Decadal increases of anthropogenic CO_2 in the subtropical and tropical oceans along the WOCE P10 line

Yukihiro Nojiri, Hitoshi Mukai, Hiromichi Tsumori, Takeshi Egashira, Katsumoto Kinoshita and Hideshi Kimoto
Development of pCO_2 measuring buoy in the surface ocean

Takayuki Tokieda, Masao Ishii, Shu Saito, Daisuke Sasano, Takashi Midorikawa and Akira Nakadate
Evaluation of changes in ocean circulation and anthropogenic CO_2 storage based on CFCs age in the western North Pacific

Pete Davison, David M. Checkley, Jr. and Tony Koslow
Is diel vertical migration important to oceanic carbon export flux?

Ruixiang Li, Yan Li and Mingyuan Zhu
Long term variation of phytoplankton in the Yellow Sea in spring

Takeshi Yoshimura, Jun Nishioka, Koji Suzuki, Hiroshi Hattori, Hiroshi Kiyosawa, Daisuke Tsumune, Kazuhiro Misumi and Takeshi Nakatsuka
Responses of phytoplankton assemblage and organic carbon dynamics to CO_2 increase

Hongbo Li, Tian Xiao, Wuchang Zhang, Sanjun Zhao and Ruihua Lv
Spatial and temporal variation of bacterioplankton population in the southern Yellow Sea, China

CCCC/FIS Topic Session (S3)
Towards ecosystem-based management: Recent developments and successes in multi-species modeling

Co-Convenors: Vera Agostini (U.S.A.), Shin-ichi Ito (Japan), Jae-Bong Lee (Korea) and Jake Schweigert (Canada)

Background

Ecosystem-based management is becoming a focus for many fisheries and their management agencies worldwide. Much of the success of this initiative will require improvements in understanding the interactions and linkages among species at both the lower trophic level (LTL) and higher trophic level (HTL) within regional ecosystems. The recent success of modeling tools such as NEMURO.FISH in linking LTL forcing to the forecasting of fish growth for a number of pelagic forage species is encouraging. Ecosystem-based management will require the extension of this and/or similar approaches to multi-species systems. A variety of modeling tools is already in wide use to address this issue, including Ecopath/Ecosim, NEMURO, various IBM models, and others. This session focused on contrasting different approaches to multi-species modeling and evaluating their performance as a vehicle for assessing and forecasting the effects of climate change on ecosystem function. Presentations that highlighted critical ecosystem interactions relevant for fishery management were encouraged, as well as discussions on how knowledge of these interactions will move us closer to ecosystem-based fishery management.

Summary of presentations

The session had three invited speakers who provided overviews of different approaches to ecosystem description and modelling. They ranged from Ecopath/Ecosim to an individual-based model (IBM) approach in OSMOSE to a small scale, two-species model without lower trophic level (LTL) inputs. The contributed papers described approaches that are attempting to model ecosystems, with the ultimate goal of providing management advice. Approaches ranged from complex network models that include several trophic levels to simpler approaches that focus on interactions between two to many species of fish. The models were either coupled or uncoupled from LTL inputs. Increasingly, there have been efforts to incorporate more complex geophysical forcing in the models with bottom-up LTL inputs. A common theme in the discussion was the need to include more data fitting (in a statistical sense) rather than driving the models with fixed or assumed parameter values. It was evident from the session discussion that no individual approach was preferred and each had strengths and weaknesses, depending on the question that was being addressed. A few papers presented results of comparing ecosystem indicators

generated from a couple of different ecosystem models in the vein of the IPCC approach to climate modelling. It is likely that future research in this area will include further inter-comparison of ecosystem modelling tools that will ultimately lead to more accurate and useful descriptions of ecosystem processes.

List of papers

Oral presentations

Takeshi Okunishi, Yasuhiro Yamanaka and Shin-ichi Ito
A migration model of Japanese sardine using artificial neural network

Jake Rice
"Charmingly simple models" – Adding climate to size-based fish community models

Motomitsu Takahashi, Hiroshi Nishida, Akihiko Yatsu and Yoshiro Watanabe
Contrasting growth responses to climate-ocean regimes develop alternative population dynamics between anchovy and sardine in the western North Pacific

Yunne Shin and Morgane Travers (Invited)
Coupling ROMS-NPZD and OSMOSE models for an end-to-end modelling of the Benguela upwelling ecosystem

Villy Christensen, Joe Buszowski, Robyn Forrest, Fang Gao, Carie Hoover, Joe Hui, Sherman Lai, Jeroen Steenbeek, William Walters and Carl Walters (Invited)
Ecopath with Ecosim 6: New generation ecosystem modeling package

Zach A. Ferdaña and Michael W. Beck
Ecosystem-based management for the seas: A planning application using spatial information on marine biodiversity and fishery production

Ivonne Ortiz, Robert Francis and Kerim Aydin
Effects of space and scale in the marine food-web structure of the Aleutian Archipelago

Jeremy S. Collie, Kiersten L. Curti and John H. Steele
End-to-end models of the Georges Bank ecosystem: Implications for ecosystem-based fisheries management

Kray Van Kirk, Terrance J. Quinn II and Jeremy Collie
Estimating predation mortality with a three-species model in the Gulf of Alaska

Jason S. Link, Laurel Col, William Overholtz, John O'Reilly, Vincent Guida, Jack Green, David Dow, Debra Palka, Chris Legault, Joseph Vitaliano, Carolyn Griswold, Michael Fogarty and Kevin Friedland
Evaluating the role of small pelagics in the Gulf of Maine: EMAX scenarios of energy flow

Shin-ichi Ito, Taizo Morioka, Yasuhiro Ueno, Satoshi Suyama and Masayasu Nakagami
Experimental approaches to improve the accuracy of NEMURO.FISH saury growth model

Sarah Gaichas, Garrett Odell, Robert Francis and Kerim Aydin
Fishing the Gulf of Alaska marine food web: Do predator prey interactions imply ecosystem thresholds?

Michio J. Kishi, Kenneth A. Rose, Shin-ichi Ito, Bernard A. Megrey, Francisco E. Werner, Maki Noguchi-Aita, Taketo Hashioka, Yasuhiro Yamanaka, Yasuko Kamezawa, Kazuto Nakajima and Daiki Mukai
Overview of application of the NEMURO-bioenergetic coupled model on north-western Pacific fishes

Young Il Seo, Joo Il Kim, Taek Yun Oh, Sun Kil Lee, Chang Ik Zhang, Jae Bong Lee and Jung Hwa Choi
Stock assessment of small yellow croaker considering the impact of yellow goosefish predation in the East China Sea of Korea

N. Taylor, D. Preikshot, N. Mantua, R. Peterman, B. Dorner, G. Ruggerone, C. Walters, K. Myers, T. Walker and R. Hilborn
The effects of ocean carrying capacity, density-dependent growth and mortality on Pacific salmon

Maki Suda (Invited)
Two-species population dynamics model for Japanese sardine and chub mackerel using object oriented modelling

Posters

Fumitake Shido, Yasuhiro Yamanaka, Shin-ichi Ito, Taketo Hashioka, Daiki Mukai and Michio J. Kishi
A two-dimensional fish model simulating biomass and population of Pacific saury

FIS Topic Session (S4)
Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks

Co-Convenors: Yukimasa Ishida (Japan), Gordon H. Kruse (U.S.A.), Ted Perry (Canada), Vladimir I. Radchenko (Russia) and Chang-Ik Zhang (Korea)

Background

An ecosystem approach to fisheries (EAF) recognizes the complexity of ecosystems and the interconnections between its component parts and is being advocated by many fisheries management bodies. In PICES countries, some fisheries resources are healthy and in high abundance, but others are decreasing or already depleted. Most causes of stock declines can be ascribed to climate change and overfishing. Stocks in declining or depleted conditions require prompt appropriate management actions, perhaps including ecosystem approaches. This session considered papers that examined: (1) major factors responsible for the status of fish stocks, particularly those that are decreasing or depleted; (2) limits to traditional fishery management measures to address causes of stock declines; (3) new perspectives on fishery management that promote sustainable fishery management from an ecosystem perspective; and (4) case studies of rebuilding plans for depleted stocks – their successes and failures.

Summary of presentations

The session consisted of 13 oral and 15 poster presentations. The invited paper by Stratis Gavaris (Canada) described the steps in fisheries management planning and decision making and the science needed to support planning and decisions, in order to conserve productivity, biodiversity and habitat. There are many strategies to work on and priority should be given to fishing mortality, incidental mortality and habitat disturbance. He also pointed out that the ecosystem approach is about managing human activities, not the ecosystem. The second invited paper by Alan Sinclair (Canada) showed that Atlantic cod in eastern Canada recovered rapidly from a low level during the 1970s due to high juvenile survival rates and high growth rates. However, recovery since low population levels in the early 1990s has been poor due to a low recruitment and growth rates, and high natural mortality rates. Consequently, the stocks may not be sustainable even at zero fishing mortality. Other species, especially crab and shrimp, have increased in the absence of cod. Natural mortality can change over time. Fishing, especially high exploitation rates, can affect fish size at age and productivity.

Ian Perry (Canada) reviewed a number of studies that illustrated how the combined effects of fishing and climate change are multiplicative rather than additive. He concluded that fishing can simplify population, community and ecosystem structure, making them more susceptible to climate change. Management approaches need to maintain the resilience of the ecosystem and its components to the interacting effects of climate and fishing.

Other contributed papers reported case studies in different species and different regions of the North Pacific. For example, Hee Park (Korea) described an approach to move toward ecosystem-based assessment and management for Korean fisheries by 2010. He outlined the use of indicators for sustainability, biodiversity and habitat reference points to evaluate improvements in fisheries management, and to compare the state of species, fisheries, and ecosystems. Inja Yeon reported that Korean blue crab declined dramatically from the late 1980s through 2006 despite traditional fishery management measures. Broader ecosystem considerations are now being applied, including habitat improvement especially by removal of ghost fishing gear, an extended spawning period closure and better enforcement of closures. Tetsuichiro Funamoto (Japan) described the benefit of increasing the spawning stock biomass in order to rebuild two Japanese walleye pollock stocks, one for which declines are related to recruitment rate per spawner, the

other for which declines are related to recruitment rate per spawner as well as the spawning stock biomass. Gordon Kruse (U.S.A.) showed how a fishery closure in 1983 for Bristol Bay red king crab due to low abundance failed to maintain a healthy stock through the mid 1990s. A rebuilding plan was developed in 1996 to include an effective spawning biomass target, and a fishery threshold above which exploitation could be increased as abundance increased. Additional ecosystem-based management actions included limits on crab bycatch in other fisheries and habitat protection by banning mobile bottom-contact gear in an area important for juvenile red king crab rearing and another important for adult crabs. The convenors are planning to publish a special issue of the journal, *Fisheries Research*, containing peer-reviewed papers from the session.

List of papers

Oral presentations

Ashleen J. Benson, Sean P. Cox and Aaron Springford
An evaluation of stock structure in Pacific herring

Hiroshi Nishida, Masayuki Noto, Atsushi Kawabata and Chikako Watanabe
Assessment of the Japanese sardine (*Sardinops melanostictus*) stock in the northwestern Pacific for Japanese management system

Alan Sinclair and Doug Swain (Invited)
Collapse and lack of recovery of cod (*Gadus morhua*) in the Northwest Atlantic: Lessons for fisheries management

Jae Bong Lee, Anne B. Hollowed and Chang-Ik Zhang
Comparing ecosystem variations between eastern and western North Pacific using ecosystem indicators

Kevin T. Hill
Decline and recovery of Pacific sardines along the Pacific coast of North America: The roles of climate and fishing

Hee Won Park, Chang-Ik Zhang, Suam Kim, Donald Gunderson, Jae Bong Lee and Jong Hee Lee
Ecosystem-based fisheries resource assessment and management system in Korea

Thomas C. Wainwright, William T. Peterson, Peter W. Lawson and Edmundo Casillas
Environmental indicators and Pacific salmon conservation

Melissa A. Haltuch, André E. Punt and Martin W. Dorn
Evaluating biomass reference points in a variable environment

Inja Yeon, Mi Young Song, Myoung Ho Shon, Hak Jin Hwang and Yang Jae Im
Possible new management measures for stock rebuilding of blue crab, *Portunus trituberculatus* (Miers), in western Korean waters

Vladimir I. Radchenko
Problems of TAC forecast development for multi-species fisheries in the Sakhalin-Kuriles region

Gordon H. Kruse and Jie Zheng
Recovery of the Bristol Bay stock of red king crabs under a rebuilding plan

Stratis Gavaris (Invited)
Science support for fisheries management decisions in an Ecosystem Approach context

R. Ian Perry, Benjamin Planque, Simon Jennings, Keith Brander, Philippe Cury and Christian Möllmann
Sensitivity of marine systems to climate and fishing: Concepts, issues and management responses

Tetsuichiro Funamoto, Satoshi Honda, Keizo Yabuki and Akihiko Yatsu
Suggestion of management measures for two walleye pollock stocks around northern Japan

Masahide Kaeriyama and Hideaki Kudo
Sustainable fisheries management of Pacific salmon (*Oncorhynchus* spp.) based on the ecosystem approach

Ronald W. Tanasichuk
The effects of variations in euphausiid and Pacific hake biomasses on the productivity of British Columbian stocks of Pacific herring (*Clupea pallasi*)

Weimin Quan, Liyan Shi and Yaqu Chen
The food web in the Yangtze River estuary: A synthesis of existing knowledge

Posters

Peter S. Rand, Peter A. McHugh and Matthew Goslin
A global assessment of sockeye salmon (*Oncorhynchus nerka*) status using IUCN criteria

Toyomitsu Horii and Yoshiyuki Nakamura
An approach to recover abalone resources by TAC control based on RPS trends calculated with production model

Inja Yeon, C.I. Zhang, M.H. Shon, Y.J. Im and H.J. Whang
An ecosystem-based assessment of the blue crab stock and management strategy in the Yellow Sea

William R. Bechtol and Gordon H. Kruse
Environmental constraints to rebuilding of Kodiak red king crab

Liyan Shi, Weimin Quan and Yaqu Chen
Faunal utilization of created inter-tidal oyster reef in the Yangtze River estuary

Carrie A. Holt, André Punt and Nathan Mantua
Incorporating climate information into rebuilding analyses for overfished groundfish stocks

Yongjun Tian
Interannual-interdecadal variations in the abundance of spear squid *Loligo bleekeri* in the southwestern Japan/East Sea: Impacts of the late 1980s climatic regime shift and trawl fishing with recommendations for management

Todd W. Miller, Koji Omori, Hideki Hamaoka and Hidejiro Onishi
Marine versus terrestrial sources of production to the Seto Inland Sea, Japan

Sun Kil Lee, Young Il Seo, Joo Il Kim, Taek Yun Oh and Won Seok Yang
Rebuilding stock of the Yeo-Ja Bay ecosystem in the Southern Sea of Korea – Dominant group and ecosystem structure of the Yeo-Ja Bay

Yukimasa Ishida, Tetsuichiro Funamoto, Satoshi Honda, Keizou Yabuki, Hiroshi Nishida and Chikako Watanabe
Review of Japanese sardine, chub mackerel, and walleye pollock fisheries management from the view point of ecosystem approach

Caihong Fu, Beiwei Lu and Jake Schweigert
Searching for major factors responsible for the decline of the eulachon population in the Fraser River using artificial neural networks

Chang-Ik Zhang, Jae Bong Lee, Sun Kil Lee and Bernard A. Megrey
Structure and function of three marine ecosystems in Korea: A comparative study

FIS/CCCC/BIO Topic Session (S5)
Fisheries interactions and local ecology

Co-Convenors: Kerim Y. Aydin (U.S.A.), Masahide Kaeriyama (Japan), Jason Link (U.S.A.) and Elizabeth A. Logerwell (U.S.A.)

Co-sponsored by ICES

Background

Ecosystem models are often employed to evaluate the effects of fishing and to distinguish natural variability from human impacts. These models typically operate at large spatial and temporal scales, which are appropriate for their goals and objectives. However, these models would benefit from better information on local-scale processes as there are likely to be bottlenecks at short time scales and small spatial scales that are critical to understanding recruitment variability. Similarly, there may be critical foraging interactions that happen at local scales, particularly for central place foragers such as marine mammals and seabirds. Small-scale effects of fishing such as "localized depletion" may have ecosystem-level consequences. More information on local-scale survival, foraging, movement, reproduction and pelagic habitat selection would allow food-web and population dynamics modelers to make better scenarios of the effects of natural variability and/or fishing on ecosystems. Papers were solicited on the following topics: (1) current ecosystem models and the assumptions that require further research; (2) techniques for assessing climate impacts on predator-prey interactions at top trophic levels; (3) techniques for assessing local-scale dynamics of survival, foraging, movement, reproduction and pelagic habitat selection; and (4) techniques for assessing prey field response to fishing.

Summary of presentations

The session consisted of 13 oral presentations and 15 posters describing both field and modeling studies. Field studies examined ecological interactions, such as habitat use, predation mortality, survival and local fishing impacts. The modeling studies addressed the effects of climate on processes such as survival and predator-prey interactions. One presentation on use of habitat by fish showed how artificial habitat modifications can break down habitat isolation and lead to inter-specific hybridization. Another emphasized how the extent to which fishing disturbs fish habitat depends on habitat type, species, and changing climatic conditions. Self-organizing maps indicated patterns of species diversity that could be driven by different habitat or environmental conditions among regions. Pelagic habitat use was the focus of a study of the physical processes that drive variability in fur seal foraging areas. Studies of predation mortality showed that mortality for the species of interest (pollock and shrimp) was higher than previously expected and could have important implications for recruitment and abundance. A study of salmon survival indicated that long periods of low water temperatures in coastal areas is associated with lower survival of salmon. Water temperature, along with zooplankton biomass was also found to influence the catch of Pacific cod off Korea. Diurnal changes in vertical distribution of zooplankton were found to be important for the feeding ecology of Pacific salmon. Studies of the effects of fishing on prey availability for top predators (*i.e.*, sea lions) indicated that localized trawl exclusion zones would prevent prey depletion for locally abundant and non-mobile fish but for other more mobile fish species local management measures would be less effective. Two modeling studies described innovative approaches to study ecological interactions. One study examined basin-scale climate forcing but narrowed the observed local response and model dynamics to reflect local conditions and minimize differences in model formulations in each region. The other used path analysis to arrive at a "middle ground" between correlative models and complete understanding of all mechanisms driving ecological responses (such as reproductive success).

List of papers

Oral Presentations

Motoko R. Kimura and Hiroyuki Munehara (Invited)
A breakdown of habitat isolation among coastal fish by artificial habitat modification

Ikue Mio, Hideaki Kudo and Masahide Kaeriyama
Are foraging habits of Pacific salmon (*Oncorhynchus* spp.) reflected in food habits in the North Pacific?

Orio Yamamura (Invited)
Assessment of predation mortality of juvenile pollock in the coastal area

Jung Hwa Choi, Jong Hwa Park, Dae Soo Chang, Jung Nyun Kim, Hak Jin Hwang, Mi Young Song, Joo Il Kim, Young Il Seo, Sung Il Lee and Sang Chul Yoon
Designing fish management boundaries in Korean waters using Self-Organizing Maps (SOM)

Susanne F. McDermott, Elizabeth A. Logerwell, Ivonne Ortiz and V. Haist
Fishery interaction and availability of Atka mackerel prey for Steller sea lions: Results from local abundance and movement study of Atka mackerel

Michel J. Kaiser, Jan G. Hiddink and Hilmar Hinz (Invited)
Fishing and climate modifies habitat use and availability for fish

M. Elizabeth Conners and Peter T. Munro
Localized depletion experiment for Bering Sea Pacific cod

Jason S. Link and Josef Idoine
Mortality of shrimp *Pandalus borealis*: Local influence of predation in the Gulf of Maine

Sangdeok Chung and Suam Kim
Relationship between Pacific cod (*Gadus macrocephalus*) catch and environmental factors off eastern Korea

Mitsuhiro Nagata, Yasuyuki Miyakoshi, Takanori Iwao and Masahide Kaeriyama
Survivals of Hokkaido chum salmon affected by coastal seawater temperature during their early ocean life

Jeremy T. Sterling, Rolf R. Ream, Devin S. Johnson and Thomas S. Gelatt
The role of physical processes in the summertime life of the northern fur seal

B.K. Wells, J.C. Field, J.A. Thayer, C.B. Grimes, S.J. Bograd, W.J. Sydeman, F.B. Schwing and R. Hewitt
Untangling the relationships between climate, prey, and top predators in an ocean ecosystem

Bernard A. Megrey, Kenneth A. Rose, Shin-ichi Ito, Douglas E. Hay, Francisco E. Werner, Michio J. Kishi, Yasuhiro Yamanaka, Maki Noguchi-Aita, Jake F. Schweigert and Matthew B. Foster
Using model experiments to explore the impact of basin-scale climate forcing on localized upper-trophic-level marine ecosystem production

Posters

L. Godbout, M. Trudel, J. Irvine, C. Wood, K. Larsen, K. McKeegan, M. Grove and A. Schmitt
A stable isotope method to discriminate the orgin of nerkids (*Oncorhynchus nerka*) in BC lakes

Sung Il Lee, Hyung Kee Cha, Sang Chul Yoon, Young Seop Kim, Dae Soo Chang and Jae Hyeong Yang
Age and growth of *Arctoscopus japonicus* in the East/Japan Sea

Paige Drobny, Brenda Norcross and Nate Bickford
Age, growth and movement of the squid species *Berryteuthis magister* in the Eastern Bering Sea

Jarrod A. Santora, Christian S. Reiss and Richard R. Veit
Annual spatial variability of krill influences seabird foraging behavior near Elephant Island, Antarctica

Shusaku Kobayashi, Takaomi Arai, Kentaro Honda, Yuji Noda and Kazushi Miyashita
Brown trout (*Salmo trutta*) movements between a stream and the sea in Hokkaido, northern Japan

Sungtae Kim, Sukgeun Jung and Jinyoung Kim
Distribution, feeding and growth of Japanese Spanish mackerel (*Scomberomorus niphonius*) in the southern Korean sea

Zhaohui Zhang, Shufeng Ye and Mingyuan Zhu
Ecosystem services valuation of coastal aquaculture

Kimberly Rand
Longitudinal growth differences in Atka mackerel (*Pleurogrammus monopterygius*): Using a bioenergetic model to identify underlying mechanisms

Kenji Konishi, Tsutomu Tamura and Koji Matsuoka
Recent feeding habits of sei whale *Balaenoptera borealis* in pelagic waters of the western North Pacific based on data collected from 2002 to 2006

Sandi Neidetcher and Elizabeth A. Logerwell
Spatial and temporal patterns in Pacific cod reproductive maturity in the Bering Sea

Oleg A. Ivanov and Vitaly V. Sukhanov
Species structure of epipelagic nekton of the Okhotsk Sea

Feng-ao Lin and Jingfeng Fan
The analysis of reasons for mass-death of culturing pufferfish (*Fugu rubripes*) caused by 0# light oil spilled on the sea

V.F. Bugaev, B.B. Vronsky, L.O. Zavarina and Zh. Kh. Zorbidi
The analysis of the interactions between generations of the Kamchatka River salmons including sockeye, chinook, chum and coho

Richard D. Brodeur and Cheryl A. Morgan
The Columbia River plume as an ecotone and habitat for juvenile chinook salmon

V.F. Bugaev
The correlation between the abundance of sockeye salmon *Oncorhynchus nerka* of the Kamchatka River by periods of different state of stock abundance dynamics of Kamchatkan pink salmon *Oncorhynchus gorbuscha*

MEQ Topic Session (S6)
The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region

Co-Convenors: Hao Guo (China) and Vera L. Trainer (U.S.A.)

Background

There is increasing recognition that some harmful algal blooms (HABs) affecting coastal waters may not have local origins but are advected from offshore waters. This session highlighted recent advances in studying the processes involved in near-shore *versus* off-shore development and transport of harmful algal blooms in the coastal waters of the PICES region. Of particular interest were field studies where the relative importance of local *versus* remote development of HABs has been assessed. The session invited papers describing known off-shore and near-shore initiation sites, seedbeds, and the physical factors that facilitate transport of HABs to coastal sites where they may impact fisheries.

Summary of presentations

This session highlighted what is known about initiation and transport processes that result in HAB impacts on coastal fisheries. Off the coast of Washington State, the Juan de Fuca eddy is an initiation site for toxigenic *Pseudo-nitzschia* blooms. This unique upwelling site is a retentive feature that is formed by estuarine flow, winds and tides. Use of models allows us to determine which physical, biological and chemical factors are important in the development of the Juan de Fuca eddy and in its ability to retain particles (cells). In the eastern Pacific, HAB species retention in frontal zones was a mechanism for overwintering. Such overwintering allowed HAB species to survive until the next growing season. Moderate upwelling conditions during the summer followed by late season storms were conditions leading to shellfish closures due to HABs in Washington State. In China, physical processes such as the timing of the monsoon, water column stability and the advance of currents play an important role in the formation of dinoflagellate blooms. Anthropogenic factors are thought to influence HAB occurrence in the Philippines. Possible impacts of climate change on the development of certain HABs were discussed. Because estuarine flow and upwelled water properties may change, the intensity of HABs will also be influenced by climate change in the future.

List of papers

Oral presentations

Angelica Peña and Michael Foreman
Biophysical modeling of the Juan de Fuca Eddy in the Pacific Northwest

Douding Lu and Dedi Zhu (Invited)
Blooms of dinoflagellates in the East China Sea – Possible linkages to physical processes

Mingyuan Zhu, Mingjiang Zhou and Ruixiang Li (Invited)
HAB process in the coastal water of Zhejiang province, East China Sea

Xuelei Zhang, Z.J. Xu and M.Y. Zhu
Impact of atmospheric dust on phytoplankton growth in the Yellow Sea and western Pacific

Michael Foreman, Wendy Callendar, Amy MacFadyen, Barbara Hickey, Vera Trainer, Angelica Peña, Richard Thomson and Emanuele Di Lorenzo (Invited)
Juan de Fuca Eddy generation and its relevance to harmful algal bloom development along the outer Washington coast

Luzviminda M. Dimaano, Lewelen A. Arcaya, Joseph Chester M. Malaca, Francis Martin M. Mirasol and Mark Joseph D. Tan
The distribution of three toxic epiphytic dinoflagellates as potential bioindicators of anthropogenic pollutants in the reefs of San Fernando, La Union, Philippines

Amoreena MacFadyen, Barbara Hickey, Vera Trainer and William Cochlan
The Juan de Fuca Eddy – An initiation site for toxigenic *Pseudo-nitzschia* blooms impacting the Washington coast

Posters

Chunjiang Guan, Hao Guo and Wen Zhao
Accumulation and elimination of *Alexandrium tamarense* toxins by the scallop, *Argopectens irradias*

Zongling Wang, Ruixiang Li, Mingyuan Zhu, Xiao Liu, Yanju Hao and Xihua You
The density-dependent interspecific competition between *Prorocentrum donghaiense* and *Alexandrium tamarense*

Yaobing Wang, Binxia Cao, Yan Yin and Hao Guo
The relationship between algical bacteria and *Alexandrium tamarense*

MEQ/FIS Topic Session (S7)
Coldwater biogenic habitat in the North Pacific

Co-Convenors: Glen S. Jamieson (Canada), J. Anthony Koslow (U.S.A.) and Jin-Yeong Kim (Korea)

Background

Some of the marine fauna that are most vulnerable to physical disturbances are the long-lived, slow growing and physically fragile species (corals and sponges) that provide biogenic habitat in deep water. It is increasingly recognized worldwide that deep-water biogenic habitat protection needs protection, so its consideration by PICES is timely. Conservation of such habitat has become a high priority in the eastern North Pacific in particular, and large areas have recently been established to exclude bottom trawling to protect deep-water corals and sponges. Considerable effort is being expended in American waters at least to identify and determine coral distributions and to assess their ecological role as fishery habitat.

Summary of presentations

This session included presentations that described: 1) distributions of deep-water biogenic habitat in the Pacific and particularly, the eastern North Pacific; 2) the ecological role of biogenic structures such as habitat for commercial and other species; and 3) some of the management measures currently applied or being considered to conserve these species and the habitat they provide. The invited speaker, Alexander Rogers (United Kingdom) discussed factors influencing overall coral spatial distribution – aragonite saturation, oxygen concentration and % saturation, depth, temperature, and high nutrient levels (negative influence). Deep-water corals are concentrated on the peaks of sea mounts and on continental margins and slopes, down to about 1000 m. Locations are likely largely determined by the presence of current jets (moderate to high) along continental margins, internal wave influences, iceberg plow tracks, and the availability of hard substrata. Association of deep-water corals and sponges with other species seems to be largely mutalistic to accidental, but studies are few. The application of fishery management measures to vulnerable marine ecosystems (VMEs) was discussed by a number of papers, and it was pointed out that many gear types can have negative impacts, and that a coral or sponge bycatch is often the first indicator of the presence of deep-water biogenic habitat. Other papers listed known regional coral species and their distributions, and fishing stressors affecting their distribution. The only paper from the western North Pacific considered dominant biogenic habitat species in Korean communities, the importance of biogenic structure there, and ongoing efforts to recover biogenic habitat. Nearshore barren areas were observed to be abundant, so seaweed bed recovery is now a particular priority.

List of papers

Oral presentations

Edward J. Gregr and Glen S. Jamieson
An ecological classification of sponge and coral habitat in Pacific Canadian waters

Alex D. Rogers (Invited)
Biogenic habitats in the deep sea: Biodiversity and interactions with fisheries

Curt E. Whitmire and M. Elizabeth Clarke
Census of deep-sea/cold-water corals off the western coast of the United States

Glen S. Jamieson
Deep-water biogenic habitat in Pacific Canada: Challenges to its conservation

W. Waldo Wakefield and Brian N. Tissot
Ecological associations between structure-forming invertebrates and demersal fishes on Heceta Bank, Oregon

Jeffrey B. Marliave and Donna M. Gibbs
Ecological function as rockfish nursery habitat of cloud sponges in Howe Sound and Strait of Georgia, British Columbia

Jin-Yeong Kim, Hyung-Kee Cha, Kwang-Ho Choi, Jong-Hwa Park and Sukgeun Jung
Long-term change in dominant fishery species and their cold-water habitats in the Korean coastal waters

Doug Woodby, Dave Carlile and Lee Hulbert
Predictive modeling of coral and sponge distribution in the central Aleutian Islands

Malcolm Clark, Derek Tittensor and Alex D. Rogers
Seamounts, deep-sea corals, and fisheries in the Pacific Ocean

Posters

Sung Eun Park, Won Chan Lee, Hyun Taik Oh, Sok Jin Hong, Rae-Hong Jung and Sang Pil Yoon
Numerical experiments on the stably stratified flow over a shallow seamount in a channel

Jessica L. Finney, E.J. Gregr, Glen S. Jamieson and S. Patton
Predicting suitable habitat for deep sea coral in British Columbia

MONITOR/TCODE Topic Session (S8/S10)

Recent advances in ocean observing systems: Scientific discoveries, technical developments, and data management, analysis and delivery

Co-Convenors: John (Jack) Barth (U.S.A.), Kyu Kui Jung (Korea), S. Allen Macklin (U.S.A.), Young Jae Ro (Korea) and Verena Tunnicliffe (Canada)

Background

Given the rapid development of ocean observing systems across the North Pacific, it is timely to discuss their use for scientific discovery and ecosystem research, and to describe the technical advancements in ocean sensors, observational platforms, and improvements in data management and exchange. By providing sustained interdisciplinary observations of atmospheric and oceanic processes, observing systems can capture important events influencing ocean ecosystems. Advanced sensors and platforms are creating new opportunities for deciphering ecosystem dynamics. With the increase in data return across observatories, it is critical that data management and interchange be addressed. Papers were welcomed on: scientific discoveries made possible by ocean observing systems; observed climate impacts on ocean ecosystems and fisheries; advanced ocean sensors including optical, acoustic and genomic devices; autonomous platforms including underwater vehicles and vertical profilers; data management and exchange; and interoperability among ocean observatories. The intention was to have a mixture of scientific and technical talks on ocean observing systems.

Summary of presentations

This session combined the ocean observing topics originally proposed as Topic Session S8 with the data management topics proposed under S10. The combination was mutually beneficial and led to much interest at PICES XVI. Bernard A. Megrey (U.S.A) ably stood in as a co-convenor in Allen Macklin's absence. The S8/S10 session included 16 oral presentations, five of which were invited, and there were 16 posters, four of which were electronic ("E-

posters"). The session was also accompanied by week-long displays by AXYS Technologies Inc., the Victoria Experimental Network Under the Sea (VENUS), the Canadian Scientific Submersible Facility, NEPTUNE Canada and Roper Resources, Ltd. John Dower (Canada) led off the session by reviewing the advantages of real-time, continuous ("always on") ocean observing *versus* previous, mostly ship-based (weather limited) and satellite remote sensed (surface only). He pointed out that ocean observing is interdisciplinary and that continuous sampling allows the detection of events and adaptive sampling. As an example, Dr. Dower reviewed the VENUS observing system, in particular the use of a high data volume Zooplankton Acoustic Profiler (ZAP). This system was recently used to detect "bioturbulence." He concluded by saying that recent ocean observing efforts will be a "revolution," but will we be ready for it? Mairi Best and Benoit Pirenne (Canada) reviewed the science and data management, respectively, of the NEPTUNE Canada ocean observatory presently being installed off the shelf and deep ocean to the west of Vancouver Island. Dr. Best pointed out how the scientific community contributed to the design of the NEPTUNE Canada network. Dr. Pirenne described the three tasks for a data management system: data acquisition and storage; data access; and instrument and infrastructure control and monitoring. The latter is linked to the event detection and reaction, intended to be performed automatically with computers as much as possible in the era of "always on" ocean observing. Dr. Pirenne concluded by pointing out that it was perfectly reasonable to store (two copies in different locations!) data from the observatory (~100 Terabytes/year), but that a close look was needed at data compression. David Foley (U.S.A.) described the use of satellite remote sensed data to create ocean "products," for example, maps of preferred fish habitat based on temperature. He pointed out that we are in the "Golden Age" of satellite remote sensing, but that after 2012 it cannot be guaranteed which satellites will still be in orbit. Dr. Foley described data access methods that transparently deliver data to "clients" like Matlab, R, IDL, GIS and Linux programs. He concluded by asking for advice on potential products and assessing methods.

The next three talks described ocean observing systems in Japan and Korea aimed at improving our understanding and ability to predict the behavior of ocean ecosystems. Hidekatsu Yamazaki (Japan) described a system for observing and modeling red (and blue!) tide in Tokyo Bay. Toshiro Saino (Japan) presented results using a new profiling mooring system equipped with bio-optical sensors for the study of primary production. Young Jae Ro (Korea) detailed an ocean observing system for the southern coast of Korea targeted at societally important questions about aquaculture and hypoxia in semi-enclosed seas.

Jack Barth (U.S.A.) summarized the use of new autonomous underwater vehicle gliders to continuously sample coastal waters for physical, chemical and bio-optical properties. The gliders allow vertical sections of ocean properties to be returned in near real-time for monitoring of ocean conditions and inclusion in data-assimilating coastal circulation and ecosystem models. Two talks focused on underwater acoustics, led off by an excellent overview by Svein Vagle (Canada). He described the bio-acoustics system deployed on VENUS and emphasized the importance of event detection to trigger the full capabilities of a high-bandwidth acoustic system. David Welch (Canada) reviewed the Pacific Ocean Shelf Tracking (POST) program, in particular its high degree of success in both maintaining hydrophone nodes and in tracking acoustically tagged fish in coastal waters.

Steven Rumrill (U.S.A.) reviewed an estuarine observing system in South Slough National Estuarine Research Reserve, southern Oregon, U.S.A, and emphasized the importance of designing a science-driven observatory. Two talks focused on using long, cross-Pacific transects to monitor ocean ecosystems. Sonia Batten (representing SAHFOS) reviewed the status of the North Pacific Continuous Plankton Recorder observing effort and Michael Henry (U.S.A.) described the repeated seabird observations made from a voluntary observing

ship transiting the North Pacific between Canada and Asia.

Graduate students contributed to the session including Hanna Na, from Seoul National University, who investigated the accuracy and utility of land-based coastal radar for measuring ocean currents, and Liying Wan, from the Chinese National Marine Environmental Forecasting Center, who described the use of an advanced Kalman filter for combining data with ocean circulation models. The session benefited from a number of excellent poster presentations, including descriptions of new technology (underwater cabled observatories, vertical profilers) and electronic-posters demonstrating data management systems, ocean atlases and the visualization of three-dimensional, time-dependent ocean model output.

List of papers

Oral presentaions

Liying Wan, Jiang Zhu, Changxiang Yan, Hui Wang, Laurent Bertino and Zhanggui Wang
A "dressed" ensemble Kalman filter for data assimilation using the Hybrid Coordinate Ocean Model

Steven S. Rumrill
A question-based approach to environmental monitoring within the South Slough National Estuarine Research Reserve, Oregon, USA

Hanna Na, Kuh Kim and Kyung-Il Chang
Accuracy of surface current velocity measurements obtained from HF radar along the east coast of Korea

Toshiro Saino (Invited)
An ocean observing system for carbon cycle studies

John A. Barth, R. Kipp Shearman, Anatoli Erofeev, Tristan Peery, Murray D. Levine, Walt Waldorf and Craig Risien
Autonomous underwater glider observations off central Oregon and the Oregon Coastal Ocean Observing System (OrCOOS)

Svein Vagle (Invited)
Continuous monitoring of marine mammals, natural and man made noise in Georgia Strait and Saanich Inlet using the VENUS observatory

David G. Foley
Delivery and application of oceanographic satellite data in the era of integrated ocean observing systems

Hidekatsu Yamazaki, Yuji Kitade and Yusaku Kokubu (Invited)
Developing a diagnostic system to assess red tide of Tokyo Bay

John Dower, Ian Beveridge and Richard Dewey (Invited)
Drinking from the fire hose: Moving from the limitations of under-sampled field data to the prospect of "always on" data streams

Young Jae Ro and Kwang Young Jung
Integrative approach for the coastal dynamics and ecosystem in the Kangjin Bay, South Sea, Korea

Todd D. O'Brien, David L. Mackas, Mark D. Ohman and remaining WG-125 members
Issues and methods for analyzing zooplankton time series – Sample applications of the SCOR WG125 toolkit

Mairi M.R. Best, B.D. Bornhold, S.K. Juniper and C.R. Barnes
NEPTUNE Canada regional cabled observatory: Science plan

David W. Welch and George Jackson
POST – A permanent continental-scale ocean observing array for fisheries research: Performance and scientific relevance

Sonia D. Batten
The CPR: Antique technology observing today's oceans

Mike F. Henry, Sonia D. Batten, K. David Hyrenbach, Ken H. Morgan and Bill J. Sydeman
The meso-scale response of subarctic North Pacific seabird community structure to lower trophic level abundance and diversity

Benoît Pirenne (Invited)
The NEPTUNE Canada Cabled Observatory Data Management System: Capturing and delivering terabytes of data each day

Posters

Joon-Yong Yang, Kyu-Kui Jung, Hee-Dong Jeong, Young-Sang Suh and Chang-Su Jung
A real-time coastal information system for aquaculture environmental monitoring

John A. Barth, Murray D. Levine, Walt Waldorf, Andrew Barnard, Bruce Rhoades, Alex Derr, John Koegler and Daniel Whiteman
A vertical profiling mooring for coastal observations: Coastal Autonomous Profiling and Boundary Layer System (CAPABLE)

Susan Banahan
An overview of the Ocean Observatories Initiative (OOI) network

Yong Yao and Shenglin Ye
Application of satellite altimeter data in analysis and prediction of the sea surface wind and wave fields over the China Sea and Western Pacific Ocean

John A. Barth, R. Kipp Shearman, Anatoli Erofeev, Tristan Peery, Murray D. Levine, Walt Waldorf and Craig Risien
Autonomous underwater glider observations off central Oregon and the Oregon Coastal Ocean Observing System (OrCOOS)

Thomas C. Royer and Chester E. Grosch
Coastal freshwater discharge in the Northeast Pacific using an updated hydrology model

Elena Dmitrieva, Vladimir Ponomarev, Natalia Rudykh, Nina Savelieva and Igor Rostov
Data integration from different sources for the study of long-term variability in the ocean - Atmosphere system over the Japan/East Sea (E-Poster)

Yoshiyuki Kaneda
Dense Ocean floor Network system for Earthquakes and Tsunamis (DONET)

Chuanlin Huo, Zhengxian Yang, Quan Wen and Daoming Guan
Development and implementation of a multi-sectoral marine environmental monitoring programme for Bohai Sea

Gitai Yahel, Ruthy Yahel, Timor Katz, Boaz Lazar, Barak Herut and Verena Tunnicliffe
Fish activity, a major mechanism for nutrient and carbon recycling from coastal marine sediments

Albert J. Hermann, Christopher W. Moore, Sarah Hinckley, Carolina Parada, Elizabeth L. Dobbins and Dale B. Haidvogel
Immersive visualization online: A modern approach for the rapid exploration of Eulerian and individual-based models (E-Poster)

E.D.Vjazilov, N.N. Mikhailov, I.D. Rostov, N.I. Rudykh, V.I. Rostov and E.V. Dmitrieva
National unified system of information on the World Ocean condition of Russia: Improvement and operational details (E-Poster)

Igor Rostov, Natalia Rudykh, Vladimir Rostov, Alexander Pan, Anton Gavrev, Elena Dmitrieva, Valentina Moroz and Olga Trusenkova
New electronic atlases on oceanography of the Eastern Asia seas (E-Poster)

S. Allen Macklin, Bernard A. Megrey, Kimberly Bahl and Ruguang Yin
Pacific-wide marine metadata management and delivery: The PICES Metadata Federation

Jie Su, Yaobing Wang and Di Yang
Research on the stability of Escherichia coli as an indicator for detecting fecal pollution in seawater

Peter G. Phibbs and Stephen Lentz
Technology for cabled ocean observatories and their vertical profiler systems

POC/CCCC/MONITOR Topic Session (S9)
Operational forecasts of oceans and ecosystems

Co-Convenors: Michael G. Foreman (Canada), Shin-ichi Ito (Japan), Skip McKinnell (PICES) and Francisco E. Werner (U.S.A.)

Background

Numerical models of ocean dynamics are becoming increasingly sophisticated and are now used to forecast future ocean states. The forecasts vary in geographic scale from local embayments to the global ocean, and on temporal scales, from one day to several years. Improvements in ocean forecasting will contribute directly to forecasts of fisheries where the linkages between ocean dynamics, fish migration, and fishery ground formation are understood. Likewise, lower trophic level (LTL) ecosystem models have been coupled to numerical models of ocean circulation and tested at many sites. LTL models can now anticipate the production of planktonic prey and biomass when the state of the ocean is captured accurately by ocean circulation models. Moreover, fish growth and recruitment models are starting to be coupled to LTL ecosystem models. The growing interest in ecosystem-based management, and the need to develop a management/decision policy will no doubt rely

upon forecasts from coupled physical–ecosystem models. To fully realize the potential of model-based products for ecosystem-based management, a relatively high predictability of ocean structures is essential. This session will review the current status of operational ocean prediction models, discuss the ability of physical models to forecast ecosystem state and clarify the approaches needed for future studies and improvements. Ideally, we seek papers describing operational forecasts of oceans and/or ecosystem-state and, more importantly, evaluations of their performance. Operational forecasts can be based on numerical or statistical models, and comparisons of these two approaches are welcome.

Summary of presentations

From the presentation by invited speaker Masafumi Kamachi of the Japan Meteorological Research Institute, the participants learned how changes in the path of the Kuroshio along the Pacific coast of Japan can be forecast from numerical models with lead times of one to two months. The development of a major meander in this current has significant effects on the catches of fishes such as skipjack and mackerel. Sensitivity tests with this model indicated that the inclusion/exclusion of hydrographic data from Project Argo had the greatest influence on the accuracy of the forecast. Assimilation of hydrographic data from prefectural fisheries institutes in Japan provided important improvements to the model results in the Japan Coastal Ocean Predictability Experiment (JCOPE) and JCOPE2. These data had not traditionally been assimilated into coastal models but a data system has now been established to facilitate this. It was interesting to note, however, that an intimate connection to current data is required to keep the models on track. Research activities and modeling by University of British Columbia scientists from the Strait of Georgia Ecosystem Modelling (STRATOGEM) project have seen the development of a capacity for accurate forecasts of the timing of the spring bloom in the Strait of Georgia during the last two years. Invited speaker, Alain Vézina from the Bedford Institute of Oceanography, Canada, discussed general issues associated with developing complexity and simplicity in modeling frameworks. We learned from William Crawford (Canada) how the classical global warming signal for the northern hemisphere is not strongly evident in all parts of the hemisphere; it is relatively weak in the northeastern Pacific as a consequence of changing wind patterns. The progress of operational oceanography and forecasting varies significantly among regions. In some locations, program objectives have focused on the generation of hypotheses but elsewhere, greater advances have been made in the implementation of operational strategies. Einar Svendsen from Norway/ICES described in an invited presentation the current state of operational infrastructure in European countries, complementing the presentation by Masafumi Kamachi of Japan. Taken in combination, these discussions suggest that greater cooperation between ICES and PICES in developing operational oceanography might lead to the accelerated development of capacity in this area.

List of papers

Oral Presentations

Alain F. Vézina, Charles Hannah and Mike St. John (Invited)
A top-down approach to modelling marine ecosystems in the context of physical-biological modelling

Masafumi Kamachi, Toshiya Nakano, Satoshi Matsumoto, Norihisa Usui, Yosuke Fujii and Shiroh Ishizaki (Invited)
An example of operational ocean data assimilation and prediction

William Crawford and Ian Perry
Eastern Gulf of Alaska: Climate variability, future projections and ecosystem impacts

Hiroaki Tatebe, Ichiro Yasuda and Hiroaki Saito
Horizontal transport of *Neocalanus* copepods in the subarctic and northern subtropical North Pacific

Wei Cheng, Al Hermann, Sarah Hinckley and Ken Coyle
Interannual variability in the Gulf of Alaska: A perspective based on a coupled bio-physical model

George V. Shevchenko and George G. Novinenko
Monitoring of temperature conditions in the Sea of Okhotsk

Einar Svendsen (Invited)
Operational oceanography and the ecosystem approach

Albert J. Hermann, Thomas M. Powell, Wei Cheng and Sarah Hinckley
Performance of NEMURO with the Regional Ocean Modeling System (ROMS) for the Coastal Gulf of Alaska

Shin-ichi Ito, Shigeho Kakehi, Yasumasa Miyazawa, Takashi Setou, Kosei Komatsu, Manabu Shimizu, Akira Kusaka, Kazuyuki Uehara, Yugo Shimizu, Akira Okuno and Hiroshi Kuroda
Predictability of location of the Kuroshio Extension and the Oyashio First Branch by JCOPE

Susan E. Allen, A. Kathleen Collins, Douglas J. Latornell and Rich Pawlowicz
Predicting the timing of the spring bloom in the Strait of Georgia

Edmundo Casillas and William Peterson
Recent high-frequency variability in the PDO and ocean conditions in the northern California Current: Impacts on ecosystem structure and salmon growth and survival

Elena I. Ustinova and Yury D. Sorokin
Statistical forecasting of ice cover in the Far-Eastern Seas

Yury I. Zuenko, E.I. Ustinova, V.N. Vdovin, V.A. Nuzhdin, Z.G. Ivankova and N.T. Dolganova
Temporal lags between changes of climatic indices and some components of the Japan/East Sea ecosystem

Yasumasa Miyazawa, Takashi Kagimoto and Kosei Komatsu
Water mass structure in the Kuroshio-Oyashio mixed water region reproduced by JCOPE2

Posters

Yong-Kyu Choi, Young-Sang Suh, Ki-Tack Seong, Sang-Woo Kim, Won-Deuk Yoon, Woo-Jin Go, In-Seong Han and Joon Yong-Yang
Bimonthly variation of synoptic features in hydrography and nutrient in the Southern Sea of Korea

J.J. Colbert, Thomas C. Wainwright and Bernard A. Megrey
Linking the NEMURO suite into the Earth Systems Modeling Framework

BIO/FIS/POC Topic Session (S11)

Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)

Co-Convenors: Elizabeth A. Logerwell (U.S.A.), David L. Mackas (Canada), Shoshiro Minobe (Japan) and William J. Sydeman (U.S.A.)

Background

Ecosystems of the North Pacific Ocean are characterized by strong seasonal variability in productivity. The Inter-governmental Panel on Climate Change (IPCC) projections indicate that substantial changes in phenology (timing events) and the biological interactions that depend on the seasonal cycle are likely. Several mechanistic hypotheses have been set forth to explain changes in fish production in relation to phenology, including "match-mismatch" and "optimal environmental window", yet there have been few tests of these ideas. In light of climate change predictions and recent changes in phenology in some North Pacific ecosystems (*e.g.*, late upwelling in the California Current in 2005/2006), the session focused on the implications of changes in the timing of seasonal zooplankton production to upper trophic level organisms through changes in their trophic ecology, physiology and behavior. Physical environmental changes that influence phenology also were within the scope of this session. Papers which test hypotheses, present new theoretical treatments, and/or provide models of life history variation were encouraged. In particular, integrated, multi-trophic level, multi-disciplinary analyses were sought. We anticipate publication of the papers from this topic session in primary literature.

Summary of presentations

On November 2, 2007, as part of the PICES Sixteenth Annual Meeting and under the auspices of the BIO/FIS/POC Committees, we held a topic session entitled "*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*". The underlying reason for hosting this topic was that most marine ecosystems of the North Pacific Ocean are characterized by strong seasonal variability in productivity. IPCC projections indicate that one of the likely consequences of climate change and global /ocean warming may be substantial changes in "phenology" (*i.e.*, timing) of key ecological events. If climate change causes changes in the relative timing of productivity between trophic levels, many of the biological interactions that depend on synchronicity in abundance, availability and/or spatial distribution may be disrupted. Several mechanistic hypotheses have been put forth that deal with within-season variation in ocean climate, primary and secondary productivity and trophic interactions between predators and prey. Such hypotheses, including "match-mismatch" (Cushing, Lack) and "optimal environmental window" (Cury and Roy), have been used to explain variability in the fish and seabird recruitment, yet there have been comparatively few tests of these ideas despite its apparent application to many temperate and sub-arctic seas.

In light of IPCC predictions and observations of remarkable and unprecedented phenological changes in many northern hemisphere marine ecosystems (*e.g.*, delayed upwelling in the California Current in 2005), we sought to address the possible ubiquitous nature of the match-mismatch hypothesis, in particular, in seasonal seas of the northern hemisphere. With substantial contributions for colleagues both within and outside the PICES community, we addressed patterns, causes, consequences, and management implications of changes in the timing of oceanographic process from primary production to top predators through changes in their trophic ecology, physiology and behavior. We sought and received a series of multi-trophic level, multi-disciplinary contributions that made for one of the most thought-provoking and dynamic topic sessions of PICES XVI. We are now in the process of collating manuscripts for a special volume in *Deep-Sea Research II*, based in large part on this topic session.

The topic session opened with a brilliant invited presentation by Joel Marcel Durant (University of Oslo, Norway), in which he provided a compelling overview of the match-mismatch hypothesis and its potential application in global climate change biology. Yutaka Watanuki (Hokkaido University, Japan) provided a second outstanding invited presentation on prey-switching in a seabird relative to climate variability in the Japan Sea. In total, 17 oral presentations and 1 poster presentation were contributed. Papers in the session covered many aspects of seasonal timings in the ocean, but the most striking characteristic of all contributions was the extent of vertical integration in each of the marine ecosystems under consideration, both of the overall session dimensions and within individual papers. A rough classification of the datasets and results among the six 'trophic levels' considered (temperature to other modes of the physical environment and physical forcing; phytoplankton; zooplankton; fish; seabirds) showed a minimum of two, an average of three, and a maximum of five trophic levels considered per paper. Multi-trophic level relationships between climate variability and the seasonality of phytoplankton and zooplankton production was considered in detail by about one third of the contributors (Sonia Batten and David Mackas, Sanae Chiba and Kosei Sasaoka, Rana El-Sabaawi *et al.*, Yulia Tananaeva and Marat Bogdanov, Kazuaki Tadakoro *et al.*, and Andrew Thomas *et al.*). Interrelationships for the upper trophic levels included work on jellyfish (Jennifer Purcell), cod (Benjamin Laurel *et al.*), salmonids (Christine Abraham *et al.*, Richard Beamish *et al.*, Ronald Tanasichuk, and William Peterson *et al.*), sardines (Rubén Rodriguez *et al.* and Atsushi Tsuda *et al.*), and seabirds (Steven Bograd *et al.*, Douglas Bertram *et al.*, Joël Durant, and Yutaka Watanuki *et al.*). Overall, this fortuitous balanced approach to complex material resulted in a highly successful

topic session; the convenors were delighted with every presentation.

Finally, it was noteworthy that while this topic session was held on the last day of PICES XVI, attendance was considerable. Approximately 70 conference participants filled the room to capacity, a testament to the general interest in the topic session and quality of the contributions. Indeed, with "standing room only" in the morning, the session was subsequently moved to a larger venue for the afternoon contributions.

List of papers

Oral presentations

Benjamin J. Laurel, Thomas P. Hurst and Lorenzo Ciannelli
An experimental examination of temperature interactions in the 'match-mismatch' hypothesis for Pacific cod larvae

Douglas F. Bertram, Anne Harfenist and April Hedd
Cassin's Auklet nestling diet reveals latitudinal variation in surface timing of *Neocalanus cristatus* prey biomass in BC: Mismatch likelihood is greater in warmer, southern waters

Sonia D. Batten and David L. Mackas
Changes in development timing and cohort width of *Neocalanus plumchrus* / *flemingeri* copepods in the eastern North Pacific

Sanae Chiba and Kosei Sasaoka
Climatic forcing and phytoplankton phenology over the North Pacific 1997-2006

Kazuaki Tadokoro, Yuji Okazaki and Hiroya Sugisaki
Decadal scale variations in developmental timing of *Neocalanus* copepod populations in the Oyashio waters, western North Pacific

Jennifer E. Purcell
Effects of temperature and light on the phenology of jellyfish

Atsushi Tsuda, Takumi Nonomura, Mitsuhiro Toratani and Sachihiko Itoh
Food availability for Japanese sardine larvae in the Kuroshio extension area

Andrew Thomas, Peter Brickley and Stephanie Henson
Large-scale time and space patterns of chlorophyll phenology in the NE Pacific

Richard J. Beamish, Ruston M. Sweeting and Chrys M. Neville
Managing a Strait of Georgia ecosystem

Joël M. Durant (Invited)
Match-mismatch, trophic interactions and climate change

William T. Peterson, Leah Feinberg, Tracy Shaw, Jennifer L. Menkel and Jay Peterson
Phenology of coastal copepod species: Implications for productivity at various trophic levels in the Oregon upwelling zone

Rubén Rodríguez-Sánchez, Marlene Manzano, Héctor Villalobos, Mati Kahru, Daniel Lluch-Belda and Sofía Ortega-García
Possible mechanisms underlying abundance changes of Pacific sardine (*Sardinops caeruleus*) in the California Current System during the last warming regime (1980-1997)

Rana W. El-Sabaawi, Akash R. Sastri and John F. Dower
Potential consequences of interannual variability in lower trophic level dynamics on energy transfer in the Strait of Georgia

Yulia N. Tananaeva and Marat A. Bogdanov
SST and ice conditions' variability in different parts of North West Pacific, its influence on phytoplankton production and fishery resources

Ronald W. Tanasichuk
The effect of variations in timing and magnitude of euphausiid productivity on return variability of Somass River sockeye (*Oncorhynchus nerka*) salmon

Steven J. Bograd, William J. Sydeman and Christine Abraham
The phenology of coastal upwelling in the California Current System

Yutaka Watanuki, Motohiro Ito, Tomohiro Deguchi and Shoshiro Minobe (Invited)
Timing of breeding and prey switching in Rhinoceros Auklets; match-mismatch of the phenology explains between year variation of chick growth

Posters

Christine L. Abraham, William J. Sydeman and G. Vernon Byrd
Seabird-sockeye salmon co-variation in the eastern Bering Sea: Phenology as an ecosystem indicator and salmonid predictor?

BIO Paper Session

Co-Convenors: Michael J. Dagg (U.S.A.), Michio J. Kishi (Japan) and Angelica Peña (Canada)

Background

The theme of PICES XVI is *"The changing North Pacific: Previous patterns, future projections, and ecosystem impacts"*. In this session, we welcomed papers on biological aspects of the PICES XVI theme as well as papers on other aspects of biological oceanography in the North Pacific and its marginal seas. Young scientists were especially encouraged to submit papers to this session.

Summary of presentations

The BIO Paper session this year was a full day of oral presentations on aspects of biological oceanography in the North Pacific Ocean, complemented by 12 poster presentations. Contributions were made from all PICES countries. As expected in such an open session, topics ranged widely across many aspects of biological oceanography. Presentations were made on iron limitation, on dimethyl sulphide (DMS) production and fates, on the Changjiang river plume, on long-term patterns in North Pacific surface chlorophyll, on the spatial and temporal variability of chlorophyll concentration and zooplankton biomass and composition in the western North Pacific and its relationship to physical characteristics, and on aspects of the biology of North Pacific biota, including copepods, euphausiids, fish, squid, and whales. Rounding out the total was a contribution on NPZ modeling and a presentation on an invasive sessile tunicate. The convenors made a special effort to encourage young scientists and this resulted in 8 of the 18 talks being given by persons with their PhDs awarded within the past 5 years. We will continue to encourage young marine biologists to present their science at the BIO session next year.

List of papers

Oral presentations

Brie J. Lindsey and Harold P. Batchelder
A *Euphausia pacifica* bioenergetic model for the California Current System

Shigenobu Takeda, Atsushi Tsuda, Philip W. Boyd, Paul J. Harrison, Isao Kudo, Maurice Levasseur, Jun Nishioka, Yukihiro Nojiri, Hiroaki Saito, Koji Suzuki, Mark Wells and C.S. Wong
Biogeochemical responses of planktonic ecosystems during three meso-scale iron enrichment experiments in the subarctic North Pacific

Ai Ueda, Toru Kobari and Deborah K. Steinberg
Body allometry and chemical composition of interzonally migrating copepods in the subarctic Pacific Ocean

Jeffrey J. Polovina, Melanie Abecassis and Evan A. Howell
Changes in oceanic surface chlorophyll in the North Pacific over the past decade: Is the North Pacific getting bluer?

Nadja Steiner and Ken Denman
Development of a mechanistic DMS model – Parameter sensitivities in a single column

Toru Kobari, Ai Ueda, Deborah K. Steinberg, Minoru Kitamura and Atsushi Tsuda
Development of ontogenetically migrating copepods in the Western Subarctic Gyre

Ryosuke Okamoto, Tsutomu Tamura, Kenji Konishi and Hidehiro Kato
Differences in foods and feeding habits in common minke and sei whales in the western North Pacific based on samples collected under the JARPN II survey project

Takumi Nonomura, Atsushi Tsuda, Ichiro Yasuda and Shuhei Nishida
Distribution patterns of *Calanus sinicus* and *C. jashnovi* (Copepoda: Calanoida) in the western temperate North Pacific: Relations with the Kuroshio Extension

Shin-ichi Ito, Kenneth A. Rose, Naoki Yoshie, Bernard A. Megrey, Michio J. Kishi and Francisco E. Werner
Evaluation of an automated approach for calibrating the NEMURO nutrient-phytoplankton-zooplankton food web model

Hiroshige Tanaka, Seiji Ohshimo and Ichiro Aoki
Feeding habits of mesopelagic fishes off the coast of western Kyushu, Japan

Suguru Okamoto and Sei-ichi Saitoh
Impact of the Kuroshio Extension on spatial and temporal variability of chlorophyll a concentration

Atsushi Yamaguchi, Naonobu Shiga, Tsutomu Ikeda, Yoshihiko Kamei and Keiichiro Sakaoka
Interannual/latitudinal variations in abundance, biomass, community structure and estimated production of epipelagaic mesozooplankton along 155°E longitude in the western North Pacific during spring

Olga Yu. Tyurneva, Vladimir V. Vertyankin, Yuri M. Yakovlev, Valery A. Vladimirov and Vladimir N. Burkanov
Occurrence of gray whales (*Eschrichtius robustus*) of the endangered western population off the east coast of the Kamchatka Peninsula

Oleg N. Katugin, Gennady A. Shevtsov, Mikhail A. Zuev and Anna V. Dakus
Patterns of size structure and ecology in the northern gonate squid (*Boreoteuthis borealis*) in the Okhotsk Sea and northwestern Pacific Ocean

Thomas W. Therriault, Leif-Matthias Herborg and Cathryn L. Clarke
Predicted changes in the distribution of the non-indigenous tunicate *Styela clava* along the west coast of North America with emphasis on Canadian waters

Jun Nishioka, Tsuneo Ono and Hiroaki Saito
Seasonal variability of micro-nutrient concentrations in the Oyashio region

Jinhui Wang, Yutao Qin, Caicai Liu, Haofei Zhang, Yawei Sun and Lian Cao
Variability of sand transport flux in the Changjiang River and its influence on the ecosystem and resources of the East China Sea

Posters

Alexander V. Zavolokin, Natalya S. Kosenok and Igor I. Glebov
Abundance, distribution and feeding habits of jellyfish in the upper epipelagical of the western Bering Sea

A. Jason Phillips, Richard D. Brodeur and Andrey Suntsov
Community structure of micronekton in the Northern California Current System

Hyung-Ku Kang, Chang Rae Lee and Sinjae Yoo
Comparison of vertical distribution of suspended fecal pellets and production of copepod fecal pellets in the Ulleung Basin between 2005 and 2006

Tatyana A. Belan, Elena M. Latkovskaya and Alexey V. Berezov
Composition and distribution pattern of benthic communities of Chayvo Bay (Northeast Sakhalin Island)

Goh Onitsuka, Itsushi Uno, Tetsuo Yanagi and Jong-Hwan Yoon
Effect of atmospheric nitrogen input on the lower trophic ecosystem in the Japan/East Sea

Vladimir I. Radchenko
Estimation of diurnal vertical migration rate of the Sea of Okhotsk zooplankton with assumption of net avoidance

Elena Dulepova and Vladimir Dulepov
Long-term fluctuation of zooplankton bioproductivity in the western Bering Sea

Pung Guk Jang, Kyoungsoon Shin, Dong Hyun Shon, Woong-Seo Kim and Dongsup Lee
Spatial and temporal distribution of inorganic nutrients and nutrient ratios as controls on composition of phytoplankton in the western channel of the Korea Strait

Guoying Du, Yunhee Kang, Moonho Son, Jaeran Hwang, Soonmo An and Ikkyo Chung
Spatio-temporal variation of intertidal microphytobenthos in the Nakdong Estuary, Korea

Koji Omori, Hidejiro Ohnishi, Toru Fukumoto, Shunsuke Takahashi, Hideki Hamaoka, Miyuki Ohnishi, Kenji Yoshino, Genkai Kato and Todd W. Miller
Two sources of primary production of sand bank ecosystems in Seto Inland Sea, Japan

CCCC Paper Session

Co-Convenors: Harold P. Batchelder (U.S.A.) and Michio J. Kishi (Japan)

Background

North Pacific ecosystems and their response to climate variability have experienced intense study through GLOBEC and similar programs over the past 10 years. The PICES Climate Change and Carrying Capacity (CCCC) Program addressed the question of "how do interannual and decadal variations in ocean conditions affect the species dominance, biomass and productivity of the key zooplankton and fish species in North Pacific ecosystems?". Ultimately, a goal of the CCCC Program was to forecast possible consequences of climate variability on the North Pacific ecosystem. As the CCCC Program nears completion, it is worthwhile to examine the program's successes on addressing the key elements: climate change, carrying capacity, and forecasting. This evaluation will provide useful information for moving forward with successor PICES integrative programs like FUTURE: Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems. We invited abstracts that infer processes from patterns and link climate, ocean physics, populations and ecosystems. Provocative abstracts that retrospectively examine the successes and shortcomings of the CCCC Program were welcomed, as were more traditional presentations on climate, ecosystems and forecasting.

List of papers

Oral presentations

James J. Ruzicka, Thomas C. Wainwright and William T. Peterson
A simple production model for the Oregon upwelling ecosystem: Investigating the effect of interannual variability in copepod community composition

Richard D. Brodeur, William T. Peterson, Toby D. Auth, Heather L. Soulen, Maria M. Parnel and Ashley A. Emerson
Abundance and diversity of coastal fish larvae as indicators of recent changes in ocean and climate conditions in the Oregon upwelling zone

George D. Jackson, B.R. Ward, R.S. McKinley and D.W. Welch
Application of the POST acoustic array to a critical marine conservation problem for juvenile steelhead trout (*Oncorhynchus mykiss*) in British Columbia

William T. Peterson, Thomas C. Wainwright and James J. Ruzicka
Climate change scenarios for continental shelf waters of the Northern California Current: Potential impacts of changes in upwelling, stratification, seasonal cycles of production and the PDO on pelagic ecosystems

Suam Kim, Sukyung Kang, Hyunju Seo, Eunjung Kim and Minho Kang
Climate variability and chum salmon production and survival in the North Pacific

C. Tracy Shaw, Leah R. Feinberg and William T. Peterson
Interannual variability in abundance, growth and spawning of the euphausiids *Euphausia pacifica* and *Thysaonessa spinifera* off Newport, OR, USA

Sachihiko Itoh, Ichiro Yasuda, Haruka Nishikawa, Hideharu Sasaki and Yoshikazu Sasai
Modelling the transport and environmental variability of larval Japanese sardine (*Sardinops melanostictus*) and Japanese anchovy (*Englaulis japonicus*) in the western North Pacific

David L. Mackas and Jackie King
Multivariate classification of zooplankton life history strategies

Jennifer L. Menkel, William T. Peterson, Jesse F. Lamb, Julie E. Keister and T. O'Higgins
Northern California Current (WA, OR, northern CA) hot spots of abundance for *Euphausia pacifica* and *Thysanoessa spinifera*

Brigitte Dorner, Randall M. Peterman, Cindy Bessey and Franz J. Mueter
North-south location of the North Pacific Current and its influence on temporal variation in recruits per spawner in northeastern Pacific salmon (Oncorhynchus) populations

Tadanori Fujino, Kazushi Miyashita, Yasuma Hiroki, Tsuyoshi Shimura, Shinya Masuda and Tsuneo Goto
Regime shift of mesopelagic fish – Long-term biomass index change of *Maurolicus japonicus* in the Japan/East Sea

Harold P. Batchelder, Brie J. Lindsey and Brendan Reser
Retentive structures, transport and connectivity in coastal ecosystems: Using a quantitative particle tracking metric to describe spatio-temporal patterns

Nandita Sarkar, Thomas C. Royer and Chester E. Grosch
Seasonal and interannual variability of mixed layer depths along the Seward Line in the Northern Gulf of Alaska

Julie E. Keister, William T. Peterson and P. Ted Strub
Zooplankton populations and circulation vary interannually to effect cross-shelf advection of biomass in the northern California Current

Posters

Young-Shil Kang, In-Seong Han and Donghyun Lim
Climate-related variations in oceanographic condition and mesozooplankton in the southwestern East China Sea after the mid 1990s

Xan Augerot, Ray Hilborn, Nathan Mantua, Kate Myers, Randall Peterman, Dave Preikshot, Peter Rand, Greg Ruggerone, Daniel Schindler, Jack Stanford, Nathan Taylor, Trey Walker and Carl Walters
The salmon MALBEC project: A North Pacific scale study to support salmon conservation planning

FIS Paper Session

Convenor: Gordon H. Kruse (U.S.A.)

Background

Fishery science is a broad field in the PICES region, owing in part to the diversity of species, water masses, and fisheries of the North Pacific Ocean. The FIS Paper Session enhances FIS activities in PICES by fostering participation by more fisheries scientists with different interests in annual meetings. The FIS paper session invited topics in fisheries science and fisheries oceanography in the North Pacific and its marginal seas.

Summary of presentations

The FIS Paper Session in 2007 included 19 oral presentations and 24 posters that covered a wide variety of fish species from five PICES-member countries plus Mexico and Romania. Taxa covered during presentations included gadids, salmon, invertebrates (*e.g.*, crab, shrimp, squid), small and large pelagic fish species, and marine mammals. Novel methods included the use of fractals to study time series of fish catches, a Geographic Information System approach toward stock assessment, integration of environmental data into marine mammal stock assessment, acoustic measurements of *Sargassum* beds, and whole ecosystem comparisons. Processes that were investigated included spawning migrations (*e.g.*, sockeye salmon), larval drift (*e.g.*, squid paralarvae, Greenland halibut), age and growth (*e.g.*, spiny dogfish, Pacific cod, salmon), predator–prey interactions (*e.g.*, pollock), range extensions (*e.g.*, Pacific hake), and environmental effects on the distribution of species and fisheries (*e.g.*, tuna, saury, northern anchovy, sea lion prey). Classical fishery research studies remain important, but this session represented a continuing trend in recent years toward ecosystem-based research of exploited fish and invertebrates in the PICES region. Based on the number of presentations and posters and the high quality of the presentations, the FIS paper session at PICES XVI was very successful.

List of papers

Oral presentations

Sarah Gaichas, Georg Skaret, Jannike Falk-Petersen, Jason S. Link, William Overholtz, Bernard A. Megrey, Harald Gjøsæter, William Stockhausen, Are Dommasnes and Kerim Aydin
A comparison of community and trophic structure in four marine ecosystems based on energy budgets and system metrics

Marc Trudel, David L. Mackas and Asit Mazumder
Assessing the effects of ocean conditions on the growth and survival of Pacific salmon in British Columbia and Alaska

Franz J. Mueter, Cecilie Broms, Ken Drinkwater, Kevin Friedland, Jon Hare, George Hunt Jr., Webjørn Melle and Maureen Taylor
Comparison of 4 Northern Hemisphere regions: Ecosystem responses to recent oceanographic variability

Toby D. Auth
Distribution and community structure of ichthyoplankton from the northern and central California Current in May 2004–2006

Sayaka Nakatsuka, Akinori Takasuka, Hiroshi Kubota and Yoshioki Oozeki
Estimating daily ration of skipjack tuna on larval and juvenile anchovy in the Kuroshio–Oyashio transition region in early summer

Woo-Seok Gwak
Genetic approach for the assessment of a stock enhancement of Pacific cod (*Gadus macrocephalus*)

Mikhail A. Stepanenko, Elena V. Gritsay and Svetlana Yu. Glebova
Impact of environment and exploitation on the interannual variability eastern Bering Sea pollock: Abundance and distribution

John R. Brandon, André E. Punt, Paul R. Wade, Wayne L. Perryman, Richard D. Methot, Mark N. Maunder and George M. Watters
Integrating environmental data into marine mammal stock assessments: Application to the eastern North Pacific gray whale

Naoki Tojo, Akira Nishmura, Satoshi Honda, Tetsuichiro Funamoto, Seiji Katakura and Kazushi Miyashita
Marine environment induced spatial dynamics of recruited walleye pollock juveniles (*Theragra chalcogramma*) and interactions with prey and predators along the Pacific coast of Hokkaido, Japan

Rodrigo M. Montes, R. Ian Perry, E.A. Pakhomov and J.A. Boutillier
Novel time series methods (fractals) applied to Eastern Pacific fisheries

Alexander I. Glubokov
Population structure of the Bering Sea pollock and functional structure of it range in recent decades

Edward J. Gregr, Rowenna Flinn, Mathew Bermann and Gaku Ishimura
Predicting the relative abundance of pinniped prey in the Gulf of Alaska

Nanami Kumagai, Hidetada Kiyofuji, Hideaki Kidokoro and Sei-Ichi Saitoh
Prediction and of Japanese common squid (*Todarodes pacificus*) fishing grounds using generalized additive models in the Japan/East Sea

Inja Yeon, Myoung Ho Sohn, Mi Young Song, Hak Jin Hwang and Yang Jae Im
Research program for stock rebuilding of blue crab, *Portunus trituberculatus*, in the western sea of Korea

Leonardo Huato-Soberanis and Martha J. Haro-Garay
Spawning migrations in fish: A case study of the sockeye salmon from the Fraser River in British Columbia

You Jung Kwon, D.H. An, C.I. Zhang and D.Y. Moon
Standardization of CPUE for bigeye (*Thunnus obesus*) and yellowfin (*Thunnus albacares*) tunas of Korean longline fishery in the Indian Ocean

Jung Jin Kim, Suam Kim and Hwa Hyun Lee
Summer occurrence and transport process of common squid (*Todarodes pacificus*) paralarvae in the East China Sea

Michael J. Schirripa
Testing two methods of including environmental factors into stock assessments

Oleg Bulatov, Boris Kotenev, Georgiy Moiseenko and Vladimir Borisov
The GIS method application for the stock assessment of the walleye pollock and the Northeast Arctic cod

Posters

Jong Hee Lee and Chang-Ik Zhang
A study on the assessment of the large purse seine fishery off Korea based on principles of the Marine Stewardship Council

Kenji Minami, Kazushi Miyashita, Akira Hamano, Takeshi Nakamura, Yuta Maruoka and Hiroki Yasuma
Acoustic measurement of *Sargassum* beds in coastal area of western Honshu, Japan

Yeong Hye Kim, Dong Woo Lee, Seon Jae Hwang, Byung Kyu Hong, Soo Ha Choi
Age and growth of Pacific cod, *Gadus macrocephalus* in the East/Japan Sea

Cindy A. Tribuzio and Gordon H. Kruse
An alternative approach to estimating worn annuli for aging of spiny dogfish (*Squalus acanthias*) spines

Eugene V. Samko, Nafanail V. Bulatov and Alexander V. Kapshiter
Anticyclonic eddies of various origin southeastward from Hokkaido and their influence on saury fishery

Joo-il Kim, Young-il Seo and Sukgeun Jung
Daily biomass and production of Pacific anchovy, *Engraulis japonicus*, in the southern coastal area of Korea

Masakazu Shinto, Hideaki Kudo and Masahide Kaeriyama
Development of the olfactory organ in chum salmon (*Oncorynchus keta*) during migration

Dongwha Sohn, Lorenzo Ciannelli, Janet Duffy-Anderson, Ann Matarese and Kevin M. Bailey
Distribution and drift pathways of Greenland halibut, *Reinhardtius hippoglossoides*, during early life stage in the eastern Bering Sea

Marisa N.C. Litz, Robert L. Emmett, Selina S. Heppell and Richard D. Brodeur
Ecological considerations for northern anchovy abundance and distribution in the northern California Current

Yuya Yokoyama, Hideaki Kudo and Masahide Kaeriyama
Estimating escapement and spawning capacity of pink salmon (*Oncorhynchus gorbuscha*) at rivers in the Shiretoko World Natural Heritage area

Sukgeun Jung, Sun-do Hwang, Joo-il Kim, Young-il Seo and Jin-yeong Kim
Fecundity and growth-dependent mortality of Pacific anchovy (*Engraulis japonicus*)

Andrey Suntsov and Richard Brodeur
Feeding ecology of three dominant lanternfish species (Myctophidae) off Oregon

Ryota Yokotani, Naotaka Imai, Hideaki Kudo and Masahide Kaeriyama
Genetic differentiation between early-run and late-run populations of the Yurappu River chum salmon *Oncorhynchus keta* using the mitochondrial DNA analysis

Carrie J. Johnson, Robert L. Emmett and Gordon McFarlane
Jack mackerel (*Trachurus symmetricus*) abundance, distribution, diet, and associated relationships to oceanographic conditions in the northern California Current

Rodrigo M. Montes, R. Ian Perry, E.A. Pakhomov and J.A. Boutillier
Long-term patterns in sea surface temperature (SST) and smooth pink shrimp (*Pandalus jordani*) catches off the west coast of Vancouver Island, Canada

Nikolina Petkova Kovatcheva
Maintenance of red king crab stocks in the North Pacific using mariculture methods

A. Jason Phillips, Stephen Ralston, Richard D. Brodeur, Toby D. Auth, Robert L. Emmett, Carrie J. Johnson and Vidar G. Wespestad
Recent pre-recruit Pacific hake (*Merluccius productus*) occurrences in the northern California Current suggest a northward expansion of their spawning area

Bernard A. Megrey, Jon Hare, Are Dommasnes, Harald Gjøsæter, William Stockhausen, William Overholtz, Sarah Gaichas, Georg Skaret, Jannike Falk-Petersen, Jason S. Link and Kevin Friedland
Recruitment variation in functionally equivalent fish stocks: A cross-ecosystem comparison

Richard D. Brodeur, E. Howell, J. Polovina, L. Ciannelli, W.G. Pearcy, R.M. Laurs and J. Childers
Spatial and temporal variations in albacore habitat in the Northeast Pacific using remotely-sensed environmental data

Galina V. Belova
Spawning and fecundity of highly abundant fishes of the family Bathylagidae in the Russian Far Eastern seas and adjacent waters of the northwestern Pacific Ocean

Dae Sun Son, Chae Woo Ma and Wongyu Park
Survival rate and growth of larval swimming crab, *Portunus trituberculartus*, in the laboratory

Jie Zheng
Temporal changes in size at maturity and their implications for fisheries management for eastern Bering Sea Tanner crab

Jun Yamamoto, Miyuki Hirose, Tetsuya Ohtani, Katashi Sugimoto, Kazue Hirase, Nobuo Shimamoto, Tsuyoshi Shimura, Natsumi Honda, Yasuzumi Fujimori and Tohru Mukai
Transportation of organic matter to the sea floor by carrion falls of the giant jellyfish (*Nemopilema nomurai*) in the Japan/East Sea

Sukgeun Jung
Yield-per-recruitment of Pacific anchovy (*Engraulis japonicus*) in Korean coastal waters

POC Paper Session

Co-Convenors: Michael G. Foreman (Canada) and Ichiro Yasuda (Japan)

Background

Papers were invited on all aspects of physical and biogeochemical oceanography and climate in the North Pacific and its marginal seas.

Summary of presentations

The session consisted of 33 oral presentations and 15 posters covering a wide range of physical and biogeochemical oceanographic research. Ichiro Yasuda, Steven Bograd and Fangli Qiao assisted Mike Foreman in chairing sub-sessions over the 2-day presentation period. The first day included interesting talks related to 1) climate changes in the North Pacific (James Overland, Howard Freeland) and sub-Arctic seas (Kenneth Drinkwater), 2) the role of surface wave-induced mixing in climate models (Fangli Qiao), 3) effects of the 18.6 year nodal tidal cycle in the Kuril Island passages (Ichiro Yasuda, Satoshi Osafune), 4) breathing and bifurcation modes in the North Pacific (Patrick Cummins), 5) features off the Kuril Islands (Alexander Rabinvich, George Shevchenko) and Sakhalin (Viachesalv Makarov), 6) eddies in various regions of the North Pacific (Konstantin Rogachev, Hiromichi Ueno, and Carol Ladd), 7) the structure of the California Undercurrent (Maxim Krassovski), and viii) seasonal variability off the west coast of Baja California (Oleg Zaitsev).

Apart from one presentation on Ekman pumping along the Seward line off Alaska (Isaac Schroeder), another on the role of wind stress errors in data assimilation (Tsuyoshi Wakamatsu), and a third on gas exchanges at Station Papa, the second day of talks focused on the eastern Pacific. It included talks on 1) turbulence measurements in Bussol Strait and the Kuroshio/Oyashio confluence region (Masahiro Yagi, Hitoshi Kaneko), 2) various features in the Japan/East (Young-Gyu Park, Oleg Trusenkova, Natalia Rudykh) and Yellow and East China (Ig-Chan Pang, Byung-Ho Lim) Seas, 3) aggregation mechanisms in Academy Bay (Konstantin Rogachev), 4) the role of Siberian Rivers and Bering Strait water in the circulation of the Arctic Ocean (Victor Kuzin), 5) physical features of harmful algal blooms off southern Korea, 6) Argo data and the baroclinic structure of the subarctic gyre (Masatoshi Sato), 7) mixing in the Oyashio (Tokihiro Kono), 8) internal tide generation (Dejun Dai), and 9) possible roles of biota in climate change (Vadim Navrotsky).

All speakers were commended for interesting presentations and posters.

List of papers

Oral presentations

Tokihiro Kono, Masatoshi Sato and Tsutomu Ikeda
A mixing process of the Oyashio water as revealed by sequential observations off southeast Hokkaido, Japan (OECOS-WEST)

Hiromichi Ueno, H.J. Freeland, W.R. Crawford, H. Onishi, E. Oka and T. Suga
Anticyclonic eddies in the Alaskan Stream

Masatoshi Sato and Tokihiro Kono
Baroclinic structure in the subarctic gyre of the North Pacific from the Argo float CTD data

Satoshi Osafune and Ichiro Yasuda
Bidecadal variation in the region south of Japan and relation between the large meander of the Kuroshio and the 18.6-year period nodal tidal cycle

Richard E. Thomson, Georgy V. Shevchenko and Alexander B. Rabinovich
Coastally trapped diurnal waves observed along the South Kuril Islands

Kenneth F. Drinkwater, Cecilie Broms, Kevin Friedland, Jon Hare, George Hunt Jr., Webjørn Melle, Franz J. Mueter and Maureen Taylor
Comparison of 4 Northern Hemisphere regions: Physical oceanographic responses to recent climate variability

Hitoshi Kaneko and Ichiro Yasuda
Current and turbulence observations of North Pacific intermediate water in the Kuroshio-Oyashio confluence region

Carol Ladd, W.R. Crawford, W.K. Johnson, N.B. Kachel, P.J. Stabeno and F. Whitney
Eddies in the eastern Gulf of Alaska

Isaac D. Schroeder, Thomas C. Royer and Chester E. Grosch
Ekman pumping along the Seward Line in the Northern Gulf of Alaska

Nadja Steiner, Svein Vagle, Ken Denman and Craig McNeil
Gas exchange at Station Papa – Simulated and observed O_2, N_2 and CO_2 cycling

Konstantin A. Rogachev, Eddy C. Carmack and Michael Foreman
Mechanisms of lateral circulation in Academy and other bays of the Shantar Archipelago, Sea of Okhotsk

Howard J. Freeland, P.G. Myers and M. Li
Mixed-layer depths along Line-P - The annual cycle and recent variability

Byung-Ho Lim, Kyung-Il Chang, Mark Wimbush, Jae-Hun Park, Magdalena Andres and JongJin Park
Near 60-day variation of the Kuroshio observed in the East China Sea

Phyllis J. Stabeno and James E. Overland
New climate states during the last decade in the North Pacific

Victor I. Kuzin, Elena N. Golubeva and Gennady A. Platov
Numerical simulation of the propagation of the Bering Sea and Siberian river waters to the Arctic – North Atlantic

Tsuyoshi Wakamatsu, Michael Foreman, Patrick Cummins and Josef Cherniawsky
On the influence of random wind stress errors on the four-dimensional, mid-latitude, ocean inverse problem

Vadim V. Navrotsky
On the World Ocean as the primary natural cause of Global Climate Change

Hee-Dong Jeong, Yeong Gong, Yang Ho Choi and Chang Su Jeong
Physical oceanographic features of HABs in the southern coast of Korea

Natalia Rudykh
Salinity variability in the Japan/East Sea

Ig-Chan Pang and Jae-Hong Moon
Seasonal circulation in the Yellow Sea and the East China Sea

Oleg Zaitsev, Carlos J. Robinson and Orzo Sanchez-Montante
Seasonal variability of oceanographic conditions on the Pacific continental shelf of the southern Baja California peninsula

Gennady I. Yurasov and Natalia I. Rudykh
Some features of Peter the Great Bay hydrological regime in the fall–winter period

Olga Trusenkova, Vyacheslav Lobanov and Dmitry Kaplunenko
SST anomalies related to wind stress curl patterns in the Japan/East Sea

Viacheslav G. Makarov, Valentina D. Budaeva and Oleg V. Zaitsev
Summer density distribution near the north-eastern coast of Sakhalin based on the parametric modeling of vertical structure

Ichiro Yasuda
The 18.6-year nodal tidal cycle and bidecadal ENSO/PDO

Maxim V. Krassovski and Richard E. Thomson
The California Undercurrent off the west coast of Vancouver Island

Young-Gyu Park and Sang-Wook Yeh
The effects of the Tsushima Warm Current on the East/Japan Sea

Fangli Qiao, Yongzeng Yang, Zhenya Song, Guohong Fang and Yeli Yuan
The role of the ocean in East Asian climate change

Dejun Dai, Fangli Qiao and Yeli Yuan
Using the transform method to study the generation of internal tides

Patrick Cummins and Howard Freeland
Variability of the North Pacific Current and its bifurcation

Masahiro Yagi and Ichiro Yasuda
Variability of vertical diffusivity at the eastern gap of the Bussol' Strait

George V. Shevchenko and Alexander A. Romanov
Wave structure of tidal motions near the North Kuril Islands as revealed from the satellite altimetry measurements

Konstantin Rogachev
Zonal jet streams in the Pacific western subarctic

Posters

Vladimir Ponomarev, N.I. Savelieva and E.V. Dmitrieva
Amur River discharge, ice cover of the Okhotsk Sea, Tatar Strait and the atmospheric indices of the Asia-Pacific region – The assessment of relationships

Nandita Sarkar, Thomas C. Royer and Chester E. Grosch
Are deepening mixed layers responsible for transporting deep nutrients into surface waters in the northern Gulf of Alaska?

Antonina M. Polyakova
Atmospheric circulation over the Northern Pacific

Tsuyoshi Wakamatsu and Michael Foreman
Data assimilation studies at the Institute of Ocean Sciences for estimating the North Pacific Ocean circulation

Antonina M. Polyakova
Extreme distribution of floating ice in the NW Pacific

Galina A. Vlasova
Influence of atmospheric processes on water circulation in the 200-m layer of the Sea of Okhotsk on the basis of modelling

Sachiko Oguma, Tsuneo Ono and Akira Kusaka
Interannual variation of the water mass mixing ratio in spring revealed by δ13C-δ18O distribution in the coastal region off eastern Hokkaido

Viacheslav G. Makarov and Sergei N. Bulgakov
Modeling of barotropic eddy evolution near a chain of islands

Larisa S. Muktepavel
Spatial-temporaral variability of shore polynias in the northern Sea of Okhotsk

Alexander A. Nikitin and Genady I. Yurasov
Surface thermal fronts in the Japan/East Sea

Valentina V. Moroz and K.T. Bogdanov
The water structure and circulation variability in the Komandor-Kamchatka area

Ichiro Yasuda, Sachihiko Itoh, Masahiro Yagi, Satoshi Osafune, Hitoshi Kaneko, Hideo Nagae, Takeshi Nakatsuka and Jun Nishioka
Turbulence observations around the Kuril Straits

Sung-Tae Jang, Jae Hak Lee, Chang-Woong Shin and Chang-Su Hong
Vertical mixing in the Ulleung Basin in the East/Japan Sea

Talgat R. Kilmatov and Vera A.Petrova
Why and when is the jet of the Kuroshio Extension destroyed?

Hong Sik Min, Young Ho Kim and Cheol-Ho Kim
Year-to-year variability of cold water in the southwestern region of the East/Japan Sea

Posters from International Organizations/Programs

Howard J. Freeland
Argo – An ocean observing system for the 21st century

Kenneth F. Drinkwater and George L. Hunt Jr.
Ecosystem Studies of Sub-Arctic Seas (ESSAS)

Clarence Pautzke, W. Wiseman and F. Wiese
North Pacific Research Board and National Science Foundation partner in comprehensive study of eastern Bering Sea ecosystem

George L. Hunt Jr. and K. David Hyrenbach
The Bering Sea Ecosystem Study (BEST): A new program for the eastern Bering Sea

Observer Poster Session

Posters providing general information and highlighting scientific objectives and recent activities of scientific organizations, programs and monitoring efforts of regional and global scale were presented.

List of posters

Howard J. Freeland and the Argo Steering Team
Argo – An ocean observing system for the 21st century

Kenneth F. Drinkwater and George L. Hunt, Jr.
Ecosystem Studies of sub-Arctic Seas (ESSAS)

Clarence Pautzke, W. Wiseman and F. Wiese
North Pacific Research Board and National Science Foundation partner in comprehensive study of eastern Bering Sea ecosystem

George L. Hunt, Jr. and K. David Hyrenbach
The Bering Sea Ecosystem Study (BEST): A new program for the estern Bering Sea

BIO Workshop (W1)
Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data

Co-Convenors: Evgeny A. Pakhomov (Canada) and Orio Yamamura (Japan).

Background

Micronekton is one of the important but largely understudied components of marine ecosystems functionally linking small zooplankton and higher trophic levels. Recent advances in acoustic devices and efforts to standardize sampling gears undertaken by both PICES and ICES communities have made the sampling of micronekton more precise. Nevertheless, the issue of inter-calibrating the growing number of micronektonic gears is still unresolved. The PICES Advisory Panel on *Micronekton Sampling Inter-calibration Experiment* (MIE-AP) organized two field experiments (off Hawaii in 2004 and off Japan in 2005) to collect comparative data for several micronekton sampling gears and a wealth of acoustic information. The main objective of this workshop was: (1) to finalize the analysis and to compare MIE-1 and MIE-2 data sets; (2) to present and discuss acoustic data sets from both cruises; (3) to compare ICES and PICES inter-calibration experiments; and finally (4) to discuss new developments in the field of micronekton quantitative techniques.

Summary of presentations

Two contributions on the analysis of acoustic data described attempts to compare acoustic data with the densities of micronekton estimated by trawling during MIE-1 and MIE-2 cruises. The main conclusion was that the acoustic data represented an important technique to quantify micronekton. While showing some significant progress, both failed to reconcile the acoustic and trawl data. The main problems were associated with:

- additional noise induced by other acoustic systems during the MIE-1 experiment;
- absence of target strength measurements for the micronekton species (particularly for MIE-1); and
- undersampling the micronekton due to net avoidance or loss of gelatinous zooplankton (both MIE-1 and MIE-2).

J-Quest technology for observing and quantifying micronekton using acoustics and video appeared to be very advantageous for resolving some outstanding issues between acoustic and trawl density assessments, although it still has some difficulties in species identification of micronekton. AP-MIE concluded that using acoustics in a diverse community (*e.g.* MIE-1) requires numerous measurements of the individual species target strengths. The absence of such measurements translates into large discrepancies between acoustic and trawl density estimates. At the same time, when only a few species dominate the micronekton community (*e.g.* MIE-2), it is possible to achieve reasonable agreement between acoustic and trawl density estimates. It was concluded that a newly developed MOHT net appears to be consistently the best sampling

gear for micronekton and perhaps should be recommended as a standard gear for use by PICES nations to collect micronekton.

After looking at the intercomparison of gears used during the MIE-1 and MIE-2 cruises, MIE-AP concluded that when a small number of species (or a single species) was dominant in micronekton community, the intercalibration between gear types appeared to be a relatively straight forward exercise. The catchability ratios between gear types produced comparable densities. However, in a highly diverse community, as it was during MIE-1, only the size composition data of large taxonomic groups lumped into 10-mm size intervals can be compared quantitatively with any success. This approach allowed the calculation of intercalibration coefficients between three gear types used during MIE-1 and yielded relatively accurate (within 12–30%) intercomparison of micronekton densities obtained by different gears.

List of papers

Oral presentations

Réka Domokos, Evgeny A. Pakhomov, Michael P. Seki and Jeffrey J. Polovina (Invited)
Acoustic characterization of the mesopelagic community off the Leeward coast of Oahu, Hawaii

Hiroki Yasuma, Kazushi Miyashita and Orio Yamamura
Acoustic monitoring of a lanternfish *Diaphus theta* in the northwestern Pacific

Evgeny A. Pakhomov, M.P. Seki, A.V. Suntov, R.D. Brodeur and K.R. Owen
Inter-comparison of three sampling gears during the first Micronekton Intercalibration Experiment (MIE-1): Size composition approach

Hiroya Sugisaki and Koichi Sawada (Invited)
Introduction to J-QUEST research project: Quantification of micronekton using an integrated system of echosounder and stereo TV cameras

FIS Workshop (W2)
Methods for standardizing trawl surveys to ensure constant catchability

Co-Convenors: David A. Somerton (U.S.A.), Jin-Yeong Kim (Korea) and Greg Workman (Canada)

Background

Standardization in the gear and methodology used to conduct pelagic and bottom trawl surveys is essential for a correct interpretation of catch per unit effort as a measure of relative abundance. In the United States, standardization problems stemming from inaccurate measurement of the towing warps on a NOAA survey vessel resulted in a thorough review of standardization methodology and the development of the National Bottom Trawl Survey Protocols (http://spo.nmfs.noaa.gov/tm/tm65.pdf) governing the operation of all NOAA-sponsored surveys. Subsequently, ICES formed the Study Group on *Trawl Survey Standardization* to examine the same issue for ICES-sponsored multinational surveys, and to formulate a similar set of standardized operating protocols expected to be published in the fall of 2007. The proposed workshop will review the various pelagic and bottom trawl surveys conducted by PICES member countries, with a focus on the operational protocols used to ensure that survey catchability remains constant over time. Topics to be discussed likely would include a consideration of various instruments to monitor trawl performance, such as acoustic trawl measurement systems, bottom contact sensors and speed through water sensors, as well as trawl design and operation procedures that allow trawl catchability to be robust to environmental variation.

Summary of presentations

The workshop had 27 participants representing all PICES countries. Initial talks described the efforts by the U.S. (David Somerton) and ICES (David Reid) to standardize trawl design and trawling procedures to minimize changes in catchability over time and differences in catchability between vessels. This was followed by descriptions of the standardization protocols used by various surveys conducted around the Pacific, including: California to Washington (Aimee Keller), Canada (Greg Workman), Alaska coastal (Dan Urban), Alaska offshore (Kenneth Weinberg), Russia (Mikhail Stepanenko) and Korea (Jung Hwa Choi). This was followed by talks describing ongoing research intended to reveal additional methods for trawl survey standardization including statically analyses of trawl performance (Stan Kotwicki), experiments on the affect of scope ratio on footrope contact (Yasuzumi Fujimori) and methodology to estimate relative catchability of alternate survey fishing gear (Yamamura).

The discussion following these talks focused on the need to ensure sampling consistency over time and the advantages of standardization in multinational surveys. The experience of ICES in its support of several international surveys was considered, especially with respect to the difficulty to control the tendency of individual nations to differ in their interpretation of trawl construction plans and sampling methodology. Such divergence in national style has led to divergence in the catchabilities of the various vessels employed and greater variance in the relative abundance estimates produced from the survey data. It was emphasized that, if PICES countries developed cooperative surveys in the future, attention to standardization at the outset would lead to better consistency and might eliminate the need for extensive and expensive inter-vessel calibration experiments.

The subject of the workshop then turned to the estimation of survey catchability so that swept area estimates of relative abundance can be used as estimates of absolute abundance. Examples were provided for flatfishes in Alaska (Somerton) and monkfish in Scotland (Reid). Discussion was focused on the issue that catchability estimation is important in situations when either the survey time series is short or when the commercial catch data is too poor to support catch-at-age models, both of which are common in the North Pacific.

Several participants expressed interest in continuing a dialogue on issues related to surveys and fishing gear. One possibility is the formation of a working/study group patterned after the ICES Working Group on *Fishing Technology and Fish Behaviour*, which focuses on issues such as bycatch reduction and size selection in commercial fishing operations, and the impacts of fishing gear on the bottom, as well as stock assessment, surveys. It was recommended that the Fishery Science Committee should consider options about how the theme of fishing gear research and survey technology can be continued by PICES in the future.

List of papers

Oral presentations

Dan Urban, Nicholas Sagalkin and Kally Spalinger
Alaska Department of Fish and Game trawl surveys in the Gulf of Alaska and eastern Aleutian Islands

M.A. Mizyurkin (presented by Mikhail A. Stepanenko)**, A.I. Shevchenko and S.E. Astafyev**
Approach of research trawl surveys certification

Orio Yamamura
Catch efficiency of a small-sized Danish seine

Yasuzumi Fujimori, Kazushi Miyashita and Satoshi Honda
Consideration of bottom contact effect on the catch of demersal species in a trawl survey in Japan

Greg Workman, Norm Olsen and Rick Stanley
Development of a standardized Fisheries Independent bottom trawl Survey program (FIS) off the west coast of Canada

David A. Somerton
Development of the NOAA national bottom trawl survey protocols

D.G. Reid, R.J. Kynoch, I. Penny and K. Peach
Estimation of catch efficiency in a new angler fish survey trawl

Jung Hwa Choi, Hui Chun An and Bong Jin Cha
Introduction of Korean survey bottom-trawl and catchability method

Aimee Keller, Victor Simon and Beth Horness
Methods for standardizing the U.S. west coast groundfish trawl survey

Kenneth L. Weinberg
Protocols for conducting Alaska Fisheries Science Center bottom trawl surveys

Dave Reid (Invited)
Survey trawl standardization

Stan Kotwicki and Michael H. Martin
The effects of improving accuracy and precision of area swept estimates on relative biomass estimation and stock assessment

David A. Somerton, Peter T. Munro and Kenneth L. Weinberg
Whole-gear efficiency of a benthic survey trawl for flatfish

FIS/MEQ Workshop (W3)

Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation

Co-Convenors: Glen Jamieson (Canada), Patricia Livingston (U.S.A.) and Chang-Ik Zhang (Korea)

Background

An ecosystem-based approach to management (EBM) is an integrated approach to management of land, water, and living resources that promotes conservation and sustainable use over a broad range of human activities in an ecosystem. Implementation of an EBM for marine ecosystems in the North Pacific Ocean requires a number of steps and activities. An explicit framework that outlines the objectives, legal mandates, and institutional roles and responsibilities is essential. Data requirements and analytical tools need to be developed. This workshop invited papers to: 1) highlight existing national and international frameworks for implementation of an ecosystem approach to management; 2) outline the data requirements for such an approach; 3) describe the analytical tools being developed; 4) show the progress in communicating results of EBM activities; and 5) discuss outstanding research gaps for making progress. The workshop was organized to allow time for keynote summaries of PICES Working Group 19 results, invited contributions from other PICES groups, insights by other organizations involved in providing integrated ecosystem advice, talks on governance issues and difficulties, socioeconomic issues, *etc*. During a discussion period, participants were welcomed to advise the convenors on the desirability of publishing the results of the workshop in a leading primary scientific journal.

Summary of presentations

The workshop made progress in highlighting issues related to the implementation of EBM in PICES member countries. It was clear from the presentations that member countries are in different stages of implementation with respect to EBM. Some countries are still working on incorporating an ecosystem approach to fisheries management while others have national legislation that provides a mechanism for implementing a cross-sectoral approach to the management of marine activities to ensure environmental protection. The degree of advancement might be partly related to the nature of the different human pressures being exerted on the marine environment. Even where some countries appeared to be more advanced in their implementation, there were problems in actually making cross-sectoral management

work in marine ecosystems. The need for overarching legislation that requires action may be needed. It was clear that more than one agency was involved in EBM activities in each country and a challenge is to get agencies to work together in implementation. It was also noted that the main type of legislation that forced cross-sectoral implementation was species-at-risk legislation.

Data requirements for EBM were discussed to some extent. The Australian experience demonstrated that implementation could involve both highly quantitative approaches and models if data are available but the framework could also include methods to evaluate ecosystem status and potential impacts even in qualitative ways. The ICES experience demonstrated how highly evolved data gathering for EBM advice could be, although it was noted that highly evolved advice did not necessarily translate into the political will to follow such advice. The Technical Committee on Monitoring outlined some of the data requirements that would require its involvement along with the involvement of all the PICES committees. The workshop particularly noted the lack of socio-economic data to aid in decision-making in an EBM context.

Analytical tools are being developed to aid in establishing EBM frameworks. Highly structured risk assessment frameworks in Australia allow both quantitative and qualitative evaluation of risks and definitions of when actions are needed. The MODEL Task Team described a suite of modeling tools that might be used to understand impacts of climate variability on marine ecosystems. Models, such as Atlantis, to aid in the evaluation of management strategies seem to be important tools to help EBM decision-making.

Communicating the results of EBM activities is ongoing in member countries. Some are using highly structured reporting instruments such as ecosystem assessment documents. ICES advisory structure for communicating EBM advice in a tactical way is highly evolved although reporting its success in implementing EBM might not be so advanced. Reporting of ecosystem status is important but it was recognized that identification and reporting of ecosystem pressures and ecosystem responses to management are important pieces of communication of EBM progress. Communicating measures of human health was noted to be important in this regard. The PICES role in communicating EBM was seen to be more of a strategic one. There seemed to be a variety of scales that are potentially useful for reporting results.

A major outstanding research gap is the need for social science indicators and information. The advancement of risk assessment frameworks and tools seemed particularly important. Perhaps working groups on the human dimensions of implementing EBM or evaluation of risk assessment tools and frameworks might be important to consider in the future.

List of papers

Oral presentations

R. Ian Perry, William R. Crawford and Alan F. Sinclair
Comparative analysis of Canadian Pacific North Coast and Strait of Georgia marine ecosystems

Phil R. Mundy
Data requirements for implementing an ecosystem approach to management from a PICES perspective

Jake Rice
Ecosystem approaches to management – Where to start?

Mitsutaku Makino and Tatsu Kishida
Ecosystem-based management in Japan: Its status and challenges

Vladimir I. Radchenko
Ecosystem-based principles in the contemporary fisheries management on the Russian Far East

Jake Rice
ICES frameworks and processes for science advice in an ecosystem approach

Glen S. Jamieson
Integrated management in Canada's Pacific North Coast: Challenges in determining ecological objectives

Bernard A. Megrey, Michio J. Kishi, Shin-ichi Ito, Kenneth A. Rose, Francisco E. Werner and members of the MODEL Task Team and the NEMURO Mafia
Modeling multi-trophic level marine ecosystems using the NEMURO family of models: Climate change applications in the boreal North Pacific and scientific potential for ecosystem-based management

Chang Ik Zhang, Suam Kim, Donald Gunderson, Jae Bong Lee, Inja Yeon, Hee Won Park and Jong Hee Lee
Progress in the development of an ecosystem-based approach to assess and manage fisheries resources in Korea

David L. Fluharty
Realizing ecosystem based management through integrated ecosystem assessment and regional collaboration in the United States

Keith Sainsbury (Invited)
Sustainable use of marine ecosystems – The search for practical ways to support and implement ecosystem-based fisheries management and regional development

Inja Yeon, H.J. Whang, M.H. Shon, Y.J. Im, J.G. Myoung and WWF YSEPP project partners
Yellow Sea marine ecoregion for implementation of ecosystem-based management in marine capture fisheries

MEQ Workshop (W4)
Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophytes

Co-Convenors: Charles G. Trick (Canada) and Ichiro Imai (Japan)

Background

This workshop was the third of an annual series in which harmful algal bloom (HAB) species that impact all or most countries in the North Pacific were discussed in detail. In 2007, we focused on one species of raphidophytes, in particular, *Heterosigma akashiwo*. This species is distributed throughout the PICES region and has caused serious damage to finfish aquaculture, resulting in severe economic losses in PICES member countries. The integration of information from each country will advance our understanding of this organism. Topics included modes of toxicity, distribution, impact (differences between toxic and nontoxic strains), as well as physiology and ecology in each of the member countries. In particular, we wanted to identify additional studies needed specifically to define *H. akashiwo*'s mode of toxicity. Comparison with similar raphidophytes, namely *Chattonella* and *Fibrocapsa*, were also included. The workshop was preceded by a half-day laboratory demonstration on *Heterosigma* cell and toxin detection.

Summary of presentations

A summary of raphidophyte taxonomy helped to clarify some recent changes in nomeclature among the raphidophytes and will in future, assist with indentification of some morphologically similar species. This workshop featured primarily *Heterosigma* and *Chattonella*, species that are present in both the eastern and western Pacific. However, while *Heterosigma* is known to kill fish reared in aquaculture in both British Columbia and Washington State, no known fish mortalities have occurred in the western Pacific. The life cycles of *Heterosigma* and *Chattonella* were described, highlighting the possibility that some of the more toxic small *Heterosigma* cells observed in Washington State might be recently excysted cells.

The mechanism of raphidophyte toxicity was discussed and also whether *Heterosigma* and *Chattonella* are toxic by the same means. Toxicity may occur through synergistic effects of reactive oxygen species, nitric oxide, and a hemolytic toxin. The action of reactive oxygen species might affect the gill surface that discharges glycocalyx during a toxic event. The hemorrhagic toxin may be a porphyrin derivative. However, it is likely not involved in fish killing activity because ruptured *Chattonella* cells don't kill fish. The expression of hemolytic activity and exoprotease activity in *Heterosigma* appear to be linked.

Heterosigma's nutrient requirements were discussed, including that importance of iron availability on the level of exoenzyme (a possible toxin) release. The nitrogen requirements of *Heterosigma* may give it a competitive advantage over other phytoplankton in that this cell can grown well on ammonium sources. Hemolytic activity, peroxidase activity, grazer defense and anti-algal activity all appeared to be related to nutrient availability.

Sites in Washington State and British Columbia waters that are important in *Heterosigma* bloom initiation were described. Blooms in the Strait of Georgia and north Puget Sound are believed to be associated with their proximity to the Fraser River. Another initiation site is believed to be in central Puget Sound. In Japan, the use of the MPN (most probably number) method for cyst detection has been used as an important tool to determine potential initiation sites for raphidophyte blooms. This tool may be helpful in further pinpointing *Heterosigma* initiation sites in the eastern Pacific, leading to better forecasting of these harmful events.

Finally, remote detection of *Heterosigma* (and other harmful species) blooms is now possible using a moored observing system called the Environmental Sampling Platform (ESP). The ESP uses specific molecular probes to *Heterosigma* in a sandwich hybridization format for remote and sensitive detection of this organism. Use of this platform will allow for further warning of potential fish-killing blooms.

List of papers

Oral presentations

Jack E. Rensel and K. Bright
Bloom dynamics of *Heterosigma akashiwo* in Puget Sound and the Strait of Juan de Fuca

Jinhui Wang and Yutao Qin
Blooms of *Heterosigma akashiwo* and *Chattonella marina* in Chinese coastal waters

Desmond J. Johns and Patricia Glibert
Characterization of nitrogen uptake by *Heterosigma akashiwo* grown in turbidostat culture under two light intensities

Takashi Kamiyama
Effects of *Heterosigma akashiwo* blooms on planktonic food webs: Responses of microbial loop components

Charles G. Trick, M. Klein and C. Ling
Environmental parameters regulate exoenzyme and haemolysin production in *Heterosigma akashiwo*

Tatsuya Oda (Invited)
Generation of ROS (reactive oxygen species) by *Chattonella marina* as a possible factor responsible for the fish-killing mechanism

Ichiro Imai, Shigeru Itakura and Mineo Yamaguchi (Invited)
Life cycle strategies and occurrences of red tides of *Heterosigma akashiwo* and *Chattonella* spp. in temperate coastal sea

Carmelo R. Tomas
Microscopic observations and detailed analysis of raphidophyte taxonomy

Julian Herndon and William P. Cochlan
Nitrogen utilization by the raphidophyte *Heterosigma akashiwo*: Growth and uptake kinetics in unialgal cultures and natural assemblages of San Francisco Bay

Roman Marin III, Nilo Alvarado and Christopher A. Scholin
Rapid detection of *Heterosigma akashiwo* in natural samples using DNA probe based assay

Roman Marin III, Scott Jensen, Brent Roman, Eugene Massion, Christina Preston, Dianne Greenfield, William Jones, Gregory Doucette, Tina Mikulski, Kristen King, Mike Parker, Mark Brown and Chris Scholin
Routine rapid detection of *Heterosigma* in natural samples using DNA probes

Carmelo R. Tomas (Invited)
The Raphidophyceae: Enigmas in taxonomy, identification and morphology

Hakgyoon Kim, Samgeun Lee, Changkyu Lee, Kyongho An, Wolae Lim, Sookyang Kim, Youngtae Park and Yoon Lee
Two decadal changes of *Heterosigma akashiwo* blooms in Korean coastal waters

Poster

Li Zheng, Xiaotian Han, Xiuchun Guo, Ping Han, Zhiming Yu and Xiaoru Wang
Study on algicidal activity of marine bacteria to two HAB species *Heterosigma akashiwo* and *Prorocentrum micans*

MONITOR/BIO Workshop (W5)
Measuring and monitoring primary productivity in the North Pacific

Co-Convenors: Paul J. Harrison (Canada/Hong Kong) and Sei-Ichi Saitoh (Japan)

Background

Marine net primary productivity is a key metric of ecosystem health and carbon cycling and is commonly a function of plant biomass, incident solar flux, and a scaling parameter that accounts for variations in algal physiology. Net primary productivity is defined as the amount of photosynthetically fixed carbon available to the first heterotrophic level and is the relevant metric for addressing environmental questions ranging from trophic energy transfer to the influence of biological processes of carbon cycling. Long-term monitoring of primary productivity is a high priority for PICES nations because it is one of the essential parameters for the understanding of marine ecosystems and biogeochemistry. Recently, measurement technology of primary production has become extremely advanced through the application of fast repetition rate fluorometers, satellites, buoys, *etc*. However, inconsistencies between *in situ* measurements and satellites still exist and there are some differences between the values obtained with ^{13}C and ^{14}C isotopic methodology. This workshop discussed the state-of-the-art of primary productivity measurement technology and its application to understanding primary productivity in the North Pacific. Presentations at this workshop addressed techniques for measuring primary productivity, comparing *in situ* and satellite measurements of primary productivity, demonstrating the utility of long time series measurements in understanding ecosystem variability, and describing the application of primary productivity studies to marine ecosystems and biogeochemistry.

Summary of presentations

The workshop had 2 invited speakers and 4 contributed speakers and 1 poster. Michael Behrenfeld (U.S.A.) gave an excellent overview of the uncertainties in converting chlorophyll to net primary productivity. Three environmental parameters influence the chl:C ratio: light, nutrients and temperature, and of these, light appears to be the most important factor. He raised a number of questions for future studies which are highlighted in the recommendations of the workshop, below.

Toshiro Saino (Japan) explained his new *in situ* ocean primary productivity profiling system that was developed to measure ocean primary productivity for real time validation of satellite-derived primary productivity estimations. The system uses fast repetition rate flourescence (frrf) installed on a profiling buoy tethered to an underwater winch. The frrf measurements of gross primary productivity were compared with the oxygen-17 anomaly in dissolved oxygen. It reflects the net primary productivity over time scales of weeks.

Sinjae Yoo (Korea) reported on the challenges of measuring chlorophyll and primary productivity in the very turbid Yellow Sea. He divided the Yellow Sea into different zones and seasons. In the center of the Yellow Sea in summer, estimates were more accurate than in winter when the Yellow Sea is very turbid due to wind mixing which produces a large over estimate of chlorophyll. Sei-Ichi Saitoh (Japan) showed that typhoons increase primary productivity several weeks after the passage of the typhoon. Slow passage of a typhoon and strongest winds give the highest primary productivity. The number of typhoons has increased in the last 15 years and average primary productivity has increased also. This increase may be related to the warming of the sea surface. Typhoons appear to be more frequent in warmer El Niño years. Akihiro Shiomoto (Japan) discussed primary productivity in the North Pacific. He reported that primary productivity in winter was 2 to 3 times lower at Station KNOT (NW Pacific) due to lower light, compared to Station P. The depth of the photic zone at Stn. P is deeper (80 m *vs* 55 m at Stn. KNOT). Primary productivity saturated at about 3 Ein m^{-2} d^{-1} at Stn. P and

around 18 Ein m^{-2} d^{-1} at Stn. KNOT. In summer, Stn. P has about 1.6 times greater primary productivity than Stn. KNOT. Paul Harrison reviewed the variability in chlorophyll and primary productivity in the NE Pacific. While chlorophyll appears to be relatively constant at about 0.4 μg/L over the annual cycle, small blooms greater than 1 μg/L have been observed in June and August/September and some of the blooms are sub-surface. Blooms of coccolithophores also occur and cause problems for remote sensing estimates of chlorophyll. While the NE Pacific appears to have a relatively constant chlorophyll and only a factor of 2 or 3 seasonal increase in primary productivity, larger episodic variations could be caused by eddies moving offshore and injections of iron from dust deposition and some vertical mixing.

Recommendations and research questions

1) The operational lifespan of SeaWiFS is uncertain. MODIS could take over from SeaWiFS if it fails, but beyond MODIS there are no other satellites planned with similar capabilities to SeaWiFS and MODIS. Therefore, there is a serious need to develop a satellite to continue the time series started in the 1980s with the coastal zone color scanner.
2) How good is the chlorophyll to net primary productivity conversion? Temperature should not be used as a proxy for the physiology of phytoplankton.
3) A carbon-based approach is needed. Is it possible to use back scattering to get the chl:C ratio.
4) How much variability is occurring under the clouds and during the long periods when there are no images?
5) Is it necessary to know remotely-sensed information of species/functional groups and their particle size to have a better understanding of the ecosystem?
6) Re-evaluating the utility of frrf measurements as a proxy for primary productivity measurements in required.
7) Time series measurements in the western and eastern Pacific are required since these data can provide valuable ground-truthing for satellites and observations of episodic events that may occur during cloud cover.

List of papers

Oral presentations

Michael Behrenfeld (Invited)
A satellite view of North Pacific primary production

Akihiro Shiomoto
Comparison of daily primary production between east and west in the subarctic North Pacific: A review from a new angle

Paul J. Harrison, Michael Lipsen and Adrian Marchetti
Phytoplankton biomass and primary productivity at Stn P and along Line P: Long-term variability over decades and during episodic events

Sinjae Yoo and Jisoo Park
Primary productivity of the Yellow Sea

Toshiro Saino (Invited)
Satellite monitoring and *in situ* validation of ocean primary productivity

Eko Siswanto, Joji Ishizaka, Mitsuhiro Toratani, Toru Hirawake and Sei-Ichi Saitoh
The effect of tropical cyclones on primary production enhancement – Some results from the W-PASS (Western Pacific Air-Sea interaction Study) project

Poster

Jeong-Min Shim, Suk-Hyun Yun, Jae-Dong Hwang, Hyun-Gook Jin, Yong-Hwa Lee, Young-Suk Kim and Un-Gi Hwang
Seasonal variability of picoplankton in the middle part of East/Japan Sea

POC/CCCC Workshop (W6)
Climate scenarios for ecosystem modeling

Co-Convenors: Jacquelynne R. King (Canada) and Michael G. Foreman (Canada)

Background

The objective of this workshop was to facilitate discussion between CFAME and Working Group on *Evaluations of Climate Change Projections* (WG 20) on potential future collaborative research on forecasting the impacts of climate change (as represented by IPCC projection scenarios) on regional ecosystems and species of the North Pacific. The workshop began with overviews of the Terms of Reference and workplans for CFAME and WG 20 by their Co-chairmen, Kerim Aydin (CFAME) and Michael Foreman (WG 20). The overviews provided the context for overlap in research foci between these two groups. CFAME has focused on three North Pacific ecosystems that represent different dominant physical processes: 1) California Current System (boundary current with upwelling); 2) Kuroshio/Oyashio Current System (boundary currents); 3) Yellow Sea/East China Sea Region (freshwater input). For each ecosystem, CFAME has developed conceptual models of the mechanisms relating climate forcing to the population dynamics of key species and to ecosystem processes. One of the goals of WG 20 is to facilitate analyses of climate effects on marine ecosystems and ecosystem feedbacks to climate by, for example, computing an ensemble of the IPCC model projections for the North Pacific and making these projections available to other PICES groups such as CFAME. The analyses could provide forecasts of regional parameters (such as sea surface temperature, sea ice cover, and river discharge) relevant to ecosystem processes identified within CFAME's conceptual models.

Summary of presentations

Thirteen talks were presented by CFAME and WG 20 members from Canada, Japan, Korea and the United States. Presentations were organized by the three ecosystems that CFAME has focused on. For each ecosystem a brief overview was presented by a CFAME member, providing a summary of the key processes that define the seasonal or temporal variability in physical parameters. In addition, each presentation quickly introduced some of the key species in the lower and higher trophic levels of each system.

CFAME members presented the conceptual models that they have developed for the mechanisms linking physical processes to population dynamics. Following these presentations, WG 20 members presented results of recent climate and oceanographic modelling efforts relevant to each of the three ecosystems. To wrap up the information portion of the workshop, a presentation on synthesis, and summary of the key climate and oceanographic factors required for ecosystem projections given climate change, was made, followed by a presentation on the uncertainties in climate model ensemble projections.

Discussion on the first day highlighted the need for CFAME to define geographic regions (*e.g.*, spawning areas, zone within an ecosystem) and to provide the important physical parameters that affect population dynamics (*e.g.*, stratification in the California Current System). Despite the broad definitions used in the ecosystem conceptual models, key processes were identified for each ecosystem. For the California Current System, temperature and its spatial variability, stratification, transition timing to upwelling, upwelling intensity, and eddies/meanders in the alongshore current. Characteristics of upwelling could be represented by upwelling favourable winds. Characteristics of currents will be a difficult feature to provide from existing climate/ocean modelling efforts because of their coarse resolution. In the Kuroshio/Oyashio System, key physical processes included temperature and its spatial variability, location of the southern branch of the Oyashio, location of the Kuroshio and its eddies/meanders. In addition, a key predator (Japanese common squid) is impacted

by temperature and salinity (*i.e.*, pycnocline) in the East China Sea. High resolution climate models have been developed for the Kuroshio/Oyashio System and these parameters, including characteristics in the Kuroshio (*i.e.*, extent of meanders), could be forecasted. The East China Sea is not well represented by climate models, mainly because of the dominant influence of freshwater input. Key processes identified for the Yellow Sea/East China Sea system included temperature and salinity. On the second day of the workshop CFAME and WG 20 met separately to discuss the previous days' discussion and to formulate workplans, and the outcomes are reported in the annual reports of each group.

List of papers

Oral presentations

Emanuele Di Lorenzo (WG 20 member, Invited) **and Niklas Schneider**
A North Pacific gyre-scale oscillation: Mechanisms of ocean's physical-biological response to climate forcing

Gordon McFarlane (CFAME member, Invited)
Conceptual mechanisms linking physical and biological oceanography to population dynamics of key species in the California Current System

Akihiko Yatsu, Yoshiro Watanabe (CFAME members, Invited)**, M. Kaeriyama, Y. Sakurai and A. Nishimura** (Presented by Jacquelynne King)
Conceptual mechanisms linking physical and biological oceanography to population dynamics of key species in the Kuroshio/Oyashio Current System

Yeong Hye Kim (Invited)
Conceptual mechanisms linking physical and biological oceanography to population dynamics of key species in the Yellow Sea/East China Sea

Jinhee Yoon, K.-I. Chang, Takashi T. Sakamoto, Hiroyasu Hasumi and Young Ho Kim
Effects of global warming on the East/Japan Sea heat balance using a global climate model (MIROC3.2-hires)

Enrique Curchitser (WG 20 member, Invited)
Embedding a high-resolution California Current climate model into the NCAR global climate model

Taketo Hashioka, Yasuhiro Yamanaka, Takashi T. Sakamoto and Maki N. Aita
Future projection with a 3-D high-resolution ecosystem model

Michael Foreman (WG20 member, Invited)
Future winds off the BC coast

Vera Agostini (CFAME member, Invited)
Overview of the California Current System

Akihiko Yatsu (CFAME member, Invited)**, Tsuneo Ono, Kazuaki Tadokoro** (CFAME member)**, Akira Nishimura, Shin-ichi Ito, Sanae Chiba and Yasunori Sakurai**
Overview of the Kuroshio/Oyahsio Current System

Young Shil Kang (CFAME Co-Chairman, Invited)
Overview of the Yellow Sea/East China Sea

James Overland (CFAME member, Invited)
Synthesis and summary of key climate and oceanographic factors identified by CFAME and required for ecosystem projections given climate change

Muyin Wang (W20 member, Invited)
Uncertainties in climate model ensemble projections

REPORT OF THE ICES/PICES CONFERENCE FOR EARLY CAREER SCIENTISTS

Background and objectives

Jointly sponsored by ICES and PICES, with generous support from the U.S. National Marine Fisheries Service and the North Pacific Research Board, the "*New frontiers in marine science*" Conference for Early Career Scientists was held from June 26–29, 2007, near Baltimore, Maryland, U.S.A. The objective of the conference was to encourage scientists who are at the beginning of their careers to share knowledge and to begin to build networks across disciplines and international borders.

The University of Maryland Center for Environmental Science (UMCES) was host to nearly 100 early career scientists from 20 nations. Participation was by invitation only, based on criteria established by the Scientific Steering Committee (SSC). Lodging and meals were provided by the organizers at no cost to all participants. In addition, travel costs were covered for approximately 40 selected scientists.

PICES SSC members were Drs. Franz Mueter (U.S.A.), Julie Keister (U.S.A.) and Sukyung Kang (Korea), and ICES SSC members included Drs. Jens Floeter (Germany) Angel Lopez-Urrutia (Spain) and Elizabeth W. North (U.S.A.). Drs. Skip McKinnell (PICES Secretariat) and Adi Kellermann (ICES Secretariat) served as coordinators for the conference. Ms. Jane Hawkey (UMCES) was responsible for local logistics and designed the conference logo. Ms. Julia Yazvenko created and maintained the conference website and the database, communicated with potential participants and convenors, and prepared (with Jane Hawkey) the book of abstracts.

The conference featured six theme sessions, for a total of 65 talks and 33 posters. Presentations spanned all of the marine science disciplines on topics ranging from estuaries to the deep ocean, and from bacteria and phytoplankton to whales and humans. Reflecting the conference's international character, theme sessions were introduced by six keynote speakers from five nations from Europe, Asia and North America, with a mixture of senior scientists and accomplished early career scientists. The six "*New frontiers*" included:

- Biodiversity and productivity of marine organisms from pole to pole;
- Processes at ocean margins;
- The last frontier: Processes in the deep sea;
- The role of behavior in marine biological processes;
- The effect of climate on basin-scale processes and ecosystems;
- Humans and the marine environment.

In addition to the theme sessions, two workshops on "*Effective science communication*" and "*Integrated environmental assessment*" were led by staff from the UMCES Integration and Application Network. A mini-symposium on "*International and interdisciplinary collaboration*" included invitees from seven international oceanographic organizations and programs (ICES, PICES, SCOR, GLOBEC, IMBER, EUR-OCEANS, and EAST-1).

A brief summary of the conference was published in PICES Press (Vol. 15, No. 2, 2007). The conference was a success. Much new knowledge was gained from many excellent presentations, but the most immediate and long-lasting benefit for most participants was the development of personal and institutional contacts that will persist for decades.

Biodiversity and Productivity of Marine Organisms from Pole to Pole (Session 1)

Convenor: Sukyung Kang, National Fisheries Research and Development Institute, 424-1, Songhyun-ri, Sonyangmyeon, Yangyang, Gangwondo 215-821, Republic of Korea
Invited Speaker: Hyung-Chul Shin (Korea Polar Research Institute, Incheon, Republic of Korea)

Background

Marine biological diversity and productivity play a vital role in the global climate and carbon cycle, and provide much of the world's protein. Marine biodiversity also is recognized as an important source of medicines and raw materials. Understanding diversity and productivity is critical to the conservation and management of living marine resources. This session will address regional to large-scale patterns in diversity and productivity at all trophic levels from bacteria to marine mammals. Preference will be given to papers addressing (1) global patterns in diversity and productivity and the processes that give rise to them, (2) diversity in poorly sampled regions such as the deep sea and the polar seas, (3) effects of fisheries and climate change on marine biodiversity and ecosystem function, and (4) innovative theories, sampling techniques, indicators, and statistical models for assessing diversity and productivity.

Summary of presentations

Dr. Shin from the Korea Polar Research Institute gave a keynote speech. He highlighted the Antarctic marine ecosystem as a driver, detector, and depository of global changes by explaining the sensitivity of biological productivity and diversity to environmental changes in the Southern Ocean. A total of 10 oral and 6 poster presentations and heated discussions boosted the dynamic fever of the frontier spirits throughout the whole session. Session presentations covered not only the various niches of the ecosystem from the productivity and diversity of phytoplankton to those of sharks but also broad geographic diversities from Antarctica to Bering Sea and Chukchi Sea. The Session seemed to conclude that interdisciplinary collaboration of researches is the essence of the future construction to build a broad and deep marine science.

List of papers

Oral presentations

Hyoung Chul Shin (Invited**)**
Polar marine ecosystems; driver, detector and depository of global changes and their records

Mamoon M.D. Al-Rshaidat, Tracy A. Villareal, Heather Singler, Rob M. Sherrell and R. Michael L. McKay
Iron physiological autecology of the vertically migrating diatoms *Ethmodiscus* spp. and *Rhizosolenia* spp. in the Central North Pacific (CNP) gyre

A. Berenike S. Diekmann, Robert W. Campbell, Myron A. Peck and Michael A. St John
Significance of Algal Bloom Temporal Dynamics on Zooplankton Vital Rates – Variation in diatom biochemical composition during a simulated bloom and its effect on copepod reproduction

Susan M. Dippenaar
The diversity of symbiotic Siphonostomatoida (Copepoda) of marine fish from southern Africa

Yan Jiao
Modeling population dynamics of Hammerhead Shark complex using a hierarchical Bayesian production model

Anastasia M. Khrustaleva
Application of microsatellite analysis to the study of the population structure and population assignment of Asian sockeye salmon (*Oncorhynchus nerka*)

Hui Liu and Russell R. Hopcroft
Modeling copepod growth rates in the northern Gulf of Alaska

Kohei Mizobata and Jia Wang
Phytoplankton Dynamics fluctuated by the Ice-Ocean Circulation in the Chukchi and Beaufort Seas

Michelle J. Paddack
Functional diversity in coral reef herbivores and impact upon ecosystem structure

TaeKeun Rho, Sei-Ichi Saitoh and Terry E. Whitledge
Spatial and temporal variation of primary production in the southeastern Bering Sea shelf: Merging field data and satellite estimates

Sazlina Salleh and Andrew McMinn
Effect of temperature on photoinhibition of Antarctic benthic microalgae

Posters

Pedro R. Costa, Susana Garrido and Maria João Botelho
Harmful algal bloom events and detection of marine biotoxins in sardines (*Sardina pilchardus*)

Verena Häussermann and G. Försterra
A hotspot in the cold – outstanding biodiversity in the Chilean Patagonian fjord region

Angel Lopez-Urrutia, Elena San Martin, Roger P. Harris and Xabier Irigoien
Scaling the metabolic balance of the oceans

Sara E. Miller, James N. Ianelli and Terrance J. Quinn II
Estimation of movement in a spatially-explicit stock assessment of Eastern Bering Sea walleye pollock (*Theragra chalcogramma*)

Svetlana V. Piyanova and Andrey F. Petrov
The oogenesis characteristics of Antarctic tootfish *Dissostichus mawsoni* Norman 1937 (Perciformes Nototheniidae) caught by the bottom longline in the Ross Sea

Dace Zilniece, Maris Plikss, Danute Uzars, Didzis Ustups and Barbel Muller-Karulis
The structure and dynamics of fish communities in the coastal zone of the central-eastern Baltic Sea

Processes at Ocean Margins (Session 2)

Convenor: Julie Keister, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR, 97331 U.S.A.
Invited Speaker: John Simpson (School of Ocean Sciences, University of Wales, Bangor, UK)

Background

Ocean margins play a key role in the global ecosystem by supporting the majority of the world's fisheries, while being directly impacted by multiple human uses. These boundary areas are critical habitat for many species and are important in the transfer of energy and materials between oceans and continents. Ocean margins are areas where biological, physical, and chemical processes are tightly coupled and where multidisciplinary research is essential. This session aims to provide a forum for such interdisciplinary discussion and invites contributions covering all areas of nearshore and continental shelf research. Topics may include the effects of circulation on sediment transport, chemistry, and biology, interaction between estuaries and the nearshore environment, effects of river plumes on coastal oceans, characterization of the nearshore ecology and environment, ocean margin productivity, and the mechanisms of energy transfer between the nearshore and the deep ocean. Contributions may address processes that occur on scales from tens of meters to thousands of kilometers, from the very nearshore to the continental slope region. Especially encouraged are interdisciplinary contributions.

Summary of presentations

Dr. John Simpson of the University of Wales, Bangor (U.K.) kicked off the first session of the conference, "*Processes at Ocean Margins*" by challenging the early career scientists to continue some of his groundbreaking research on the dynamical processes that occur at the continental slope – the critical transition area between the shelf and the deep sea. The session continued with talks on physical and biological processes on mudflats, in estuaries, on rocky intertidal shores, in the transition area between the nearshore and the continental shelf, and over the shelf. Posters extended the domain seaward

to the continental slope and shoreward into embayments. A diversity of topics was addressed. Highlights included debunked paradigms and tests of long-standing hypotheses, demonstrating the enthusiasm, critical-thinking, and challenging nature of the conference participants.

List of presentations

Oral presentations

John H. Simpson (Invited)
Transport and Mixing at the Shelf Edge: a key Challenge for Oceanographers

Melanie J. Bishop, Brendan P. Kelaher, Ralph Alquezar, Paul H. York, Peter J. Ralph and C. Greg Skilbeck
Cul-de-sacs of detritus-based food-webs: large gastropods, *Pyrazus ebeninus*, short-circuit trophic transfer

Sarah E. Dudas, Brian A. Grantham, Anthony K. Kirincich, Bruce A. Menge, Jane Lubchenco and Jack A. Barth
The influence of nearshore current reversals on intertidal invertebrate recruitment along the central Oregon coast

Stephanie A. Henson and Andrew C. Thomas
Physical-biological interactions in the coastal Gulf of Alaska

Yong Hoon Kim and George Voulgaris
Role of lateral circulation on suspended sediment transport in estuaries

Anthony R. Kirincich and John A. Barth
Spatial and temporal variability of inner-shelf circulation along the central Oregon coast during summer

Chaolun Li, Shiwei Wang, Song Sun and Bo Yang
Seasonal variations in reproduction of a planktonic copepod *Calanus sinicus* related to the physical and biological environments in the Yellow Sea, China

Cindy M. Palinkas and Andrea S. Ogston
Event-scale analysis of shelf sedimentary processes

Gil Rilov
Benthic-pelagic decoupling in the rocky intertidal by subtidal predators: The effect of seascape on species interactions and onshore recruitment

Ryan R. Rykaczewski and David M. Checkley Jr.
From physics to fish: Influence of wind-stress curl on Pacific sardine

Afonso Souza and Tamara K. Pease
Effect of organic enrichments on bacterial potential hydrolytic activity in organic-poor estuarine sediments

Michael S. Wetz and Hans W. Paerl
Impact of large storms (hurricanes, tropical disturbances) on phytoplankton and microzooplankton in a large estuarine ecosystem: a glimpse into the effects of a period of elevated hurricane activity

Juan P. Zwolinski, Paulo B. Oliveira, Alexandre Morais, Victor Quintino and Yorgos Stratoudakis
Sardine potential habitat and environmental forcing off western Portugal

Posters

Daisuke Goto and William G. Wallace
The importance of metal storage by prey and digestive processes in predators to metal trophic transfer in coastal benthic food chains

Alan F. Koropitan, Motoyoshi Ikeda, Ario Damar and Yasuhiro Yamanaka
Influences of physical processes on the ecosystem of Jakarta bay: a coupled hydrodynamic-ecosystem model experiment

Hyunju Seo, Suam Kim, Sukyung Kang, Kibeik Seong, Hideaki Kudo and Masahide Kaeriyama
Variability in growth and survival of chum salmon in relation to environmental changes in the western Pacific Ocean

Di Wu and Meng Zhou
Zooplankton offshore transport and population dynamics in California Current off Oregon in June 2002

The Last Frontier: The Deep Sea (Session 3)

Convenor: Angel Lopez-Urrutia, Centro Oceanográfico de Gijón, Instituto Español de Oceanografía, Avda. Príncipe de Asturias 70 bis, E-33212 Gijón, Asturias, Spain
Invited Speaker: S. Kim Juniper (University of Victoria, BC, Canada)

Background

The deep sea is regarded by many as the ultimate frontier for marine research. New organisms and geochemical processes are continuously being discovered at the deep seafloor and in extreme ocean environments. At the same time, there has been a rapid increase in deep sea trawling and hydrocarbon exploration in these largely unknown ecosystems, which are now believed to be much more dynamic and diverse than previously assumed. A better understanding of the geochemical processes, life forms, and community dynamics in these environments, from the continental rise to the abyssal zone, is urgently needed. Recent advances in submersibles (*e.g.*, smart sensors) and marine communication (*e.g.*, telemetry for remote exploration) have greatly improved our ability to sample and monitor extreme systems. We invite contributions on the geological, geochemical, biochemical, and biological processes that shape the deep sea environment. Examples include, but are not limited to, seismic and volcanic activities at mid-ocean ridges, chemosynthetic food webs at hydrothermal vents, adaptations of deep sea organisms, and unique microbial communities at cold vents and in subseafloor sediments.

Summary of presentations

It appears that the last of the new frontiers in marine science will remain for a while longer. The session attracted the fewest number of abstracts at the conference but the enthusiasm was high. Especially by Prof. Juniper, the invited speaker, who described a new world of cabled underwater ocean observing systems that are being deployed off the west coast of Canada. The VENUS project is focusing on two coastal loops while the larger project NEPTUNE will have undersea cables running off the continental shelf, down the slope, and into the deep ocean. New research opportunities in the last frontier are emerging in the northeastern Pacific.

List of papers

Oral presentations

S. Kim Juniper (Invited**)**
The Neptune Canada seafloor observatory project

Günter Försterra and V. Häussermann
Where the deep sea comes into reach – deep-water emergence in the Chilean fjord region

Tadanori Fujino, Kazushi Miyashita, Hiroki Yasuma, Tsuyoshi Shimura, Shunichi Shimoyama and Shinya Masuda
Seasonal change in distribution characteristics of mesopelagic fish in the Sea of Japan

Henry A. Ruhl and Kenneth L. Smith Jr.
Surface Climate and Megafauna Community Change in the Abyssal NE Pacific

The Role of Behavior in Marine Biological Processes (Session 4)

Convenor: Elizabeth W. North, Horn Point Laboratory, University of Maryland Center for Environmental Science, 2020 Horns Point Road, Cambridge, MD 21613 U.S.A.
Invited Speaker: Mark Baumgartner (Woods Hole Oceanographic Institution, Woods Hole, U.S.A.)

Background

From single-cell plants to marine mammals, behavior in response to physical, chemical and biological cues is a common trait whose significance is increasingly recognized. Behaviors as simple as vertical migration can cause differential transport and aggregations in frontal zones, with implications for predator-prey interactions and energy transfer in ocean ecosystems. Complex behaviors such as schooling and long-distance spawning migrations affect vulnerability to predation, exploitation, reproductive potential, stock structure, and an ability to recover from overharvest and habitat loss. Advances in *in-situ* measurement capabilities (*e.g.*, acoustics, tagging, laser and video optical methods, holography), coupled bio-physical and bio-geochemical numerical models, and otolith and genetic approaches provide insights into the complexity of behavior, its role in structuring populations and ecosystem processes, and its impact on survey design and sample variability. Contributions were sought to improve understanding of the role of behavior in marine biological processes with an emphasis on methods that apply recent advances in technology.

Summary of presentations

Mark Baumgartner began with an exciting plenary talk that demonstrated how new technologies can significantly advance our understanding of the interactions between physical conditions, whales and their prey. Not only did his lecture provide an excellent introduction to progress in behavior-related research, but it also provided valuable experience-based advice for early-career scientists.

A major theme of this session concerned the vertical distribution of organisms. Many techniques were presented for identifying factors that influence vertical distributions, such as innovative net designs, acoustics techniques, remotely operated vehicles, laboratory studies, video plankton recorders, pop-up satellite and implantable archival tags, and direct observations of the plankton. Participants heard how copepods use foray behavior, depth facilitates retention of siphonophores in fjords, lobster larvae remain above the 12°C isotherm, coral reef fish larvae regulate depth in response to pressure, sprat move vertically in response to temperature, temperature gradient, oxygen and light, and how bluefin tuna make vertical excursions that vary in depth according to changes in prey distributions. Numerical modeling studies were also used to gain insight on the role of behavior in marine processes, indicating that small differences in the depth of larval fish and oysters can result in large differences in dispersal, and that the timing and location of adult spawning can have a significant influence on larval dispersal and settlement.

Participants also described and discussed the implications of different horizontal distributions of organisms. Separate migration patterns of individual stocks were discovered (in a species previously considered to be of mixed stock composition) using elemental and isotopic signatures in fish otoliths. Otolith analysis was also used to demonstrate that the distribution of eels along a salinity gradient affected the degree of parasite infection. One of the highlights of the session was an appreciation of the fine-scale picture that Video Plankton Recorders produce of the correspondence between biological and physical features in frontal regions, despite the many challenges associated with image interpretation.

List of papers

Oral presentations

Mark Baumgartner (Invited)
Comparative studies of baleen whale foraging ecology

Anik Brind'Amour, Daniel Boisclair, Stéphane Dray and Pierre Legendre
Multi-scale assessment of the functional relationship between species traits and environmental conditions for littoral fish communities

Robert W. Campbell and Morten Holtegaard Nielsen
Meso- and small-scale distributions of plankton and marine snow in the southeastern north

Tomas Didrikas and Sture Hansson
Effects of light intensity on the vertical distribution and activity of pelagic fish–Studies with a seabed-mounted echo sounder

Karen P. Edwards, Jonathon A. Hare and Francisco E. Werner
Marine population connectivity and dispersal: The role of spawning behaviors, or why do parents know best?

Susana Garrido, Ana Marçalo, Juan Zwolinski and Carl D. van der Lingen
Laboratory investigations on the effect of prey size and concentration on the feeding behavior of *Sardina pilchardus*

Eva Jakob, Karsten Zumholz and Reinhold Hanel
Habitat dependent parasite infestations and virus infections of the European eel *Anguilla anguilla* (L.) in northern Germany

Sarah E. Kolesar, Kenneth A. Rose and Denise L. Breitburg
The effect of hypoxia on intraguild predation in an estuarine food web: An individual-based model of ctenophores, fish larvae, and copepods

Gareth L. Lawson, Andre M. Boustany, Andreas Walli, Steven L.H. Teo and Barbara A. Block
Distribution and movements of Atlantic bluefin tuna in the northwestern Atlantic studied using electronic tags

James J. Pierson, Bruce W. Frost and Andrew W. Leising
Foray foraging behavior in marine copepods

Daniel Stepputtis, Uwe Böttcher, Thomas Neumann and Jörn Schmidt
Distribution of Baltic sprat (*Sprattus sprattus* L.) – observations, models and consequences

Frode Vikebo, Trond Kristiansen, Gert Dingsor, Svein Sundby, Christian Jorgensen and Oyvind Fiksen
Drift, growth and distribution in northeast Arctic cod during the 1980s – predictions from a biological individual-based model embedded in a general circulation model

Benjamin D. Walther and Simon R. Thorrold
Marine migratory patterns of immature anadromous fish: An otolith chemistry approach

Posters

Eric R. Annis
In situ swimming behavior of lobster postlarvae: implications for transport and settlement

Aino Hosia and Ulf Båmstedt
Vertical distribution of physonect siphonophores in western Norwegian fjords

Klaus B. Huebert
Can pelagic coral reef fish larvae regulate their swimming depths via hydrostatic pressure cues?

Trond Kristiansen, Frode Vikebø, Svein Sundby, Geir Huse and Øyvind Fiksen
Growth and feeding of larval cod (*Gadus morhua*) in large-scale latitudinal environmental gradients

Joel K. Llopiz and Robert K. Cowen
Trophodynamics of larval billfishes and tunas: Are the constraints of the low-latitude open ocean actually constraining?

Klas O. Moeller, Robert W. Campbell, Morten Holtegaard Nielsen and Michael A. St. John
In situ distribution and vertical migration of plankton in the North Sea (German bight)

Elizabeth W. North, Z. Schlag, R.R. Hood, M. Li, L. Zhong, T. Gross, and V.S. Kennedy
The influence of larval behavior on oyster larvae transport and settlement: A numerical approach

Susan E. Parks, Christopher W. Clarkm and Peter L. Tyack
Evidence for a long-term change in the acoustic behavior of the North Atlantic right whale (*Eublalena glacialis*) in response to noise

Didzis Ustups and Maris Plikss
The influence of environmental conditions on the year-class strength of the Eastern-Gotland flounder (*Platichthys flesus*) in the Baltic Sea

Yi Xu, Fei Chai, Lei Shi, Yi Chao, Kenneth Rose, Francisco Chavez, and Richard T. Barber
Seasonal cycle, interannual and decadal variability of Peruvian anchovy population dynamics: A model study

The Effect of Climate on Basin-scale Processes and Ecosystems (Session 5)

Convenor: Jens Floeter, Institute of Hydrobiology and Fisheries Science, Hamburg University, Olbersweg 24, D-22767 Hamburg, Germany, and
Julie Keister, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, OR 97331 U.S.A.
Invited Speaker: Emanuele Di Lorenzo (Georgia Institute of Technology, Atlanta, U.S.A.)

Background

Recent advances in earth monitoring systems and global climate models indicate that basin-scale phenomena profoundly influence physical, geochemical and biological systems in the world's oceans. Interacting processes between the oceans and the atmosphere, such as El Niños and decadal-scale oscillations, impact circulation patterns, nutrient cycling, and ecosystem structure and productivity within and across basins. In this session, we welcome contributions that apply global datasets and recent technological advances (*e.g.*, satellites, gliders and floats, and global climate models) to further our understanding of these basin- and global-scale processes. In particular, we invite papers that address effects of large-scale climate forcing on physical and chemical processes, mechanistic linkages between climate forcing and the dynamics of marine ecosystems, and advances in modeling and predictive capabilities for oceanic ecosystems at basin-wide scales.

Summary of presentations

The session was jump-started with a spirited keynote address by Emanuele DiLorenzo, an early career scientist himself. Dr. DiLorenzo culminated his talk with advice for the audience drawn from his own experiences transitioning from Ph.D. candidate to the head of an active research laboratory. Further talks and posters addressed climate controls on fisheries, zooplankton communities, food web dynamics, carbon cycling, harmful algal blooms, variability in SST, and circulation. Throughout the excellent presentations, the importance of climate on the processes explored was a strong connecting theme. The session accentuated the need for long time series of observations and realistic models to address the potential consequences of changing climate on the world's ecosystems.

List of papers

Oral presentations

Emanuele DiLorenzo (Invited)
Linking North Pacific ocean climate variability to ecosystem changes: The interplay between a gyre-scale mode and the Pacific Decadal Oscillation

Emmanuel Chassot, Sylvain Bonhommeau, Frédéric Mélin, Olivier Le Pape and Didier Gascuel
World fish catch driven by primary production

Dmitry D. Kaplunenko, Olga O. Trusenkova and Viacheslav B. Lobanov
Features of seasonal and intra-annual variability of Japan Sea SST from satellite data.

David G. Kimmel, W. David Miller, Lawrence W. Harding, Edward D. Houde and Michael R. Roman
Regional scale climate forcing of Chesapeake Bay ecosystem dynamics

Guimei Liu
A Three-Dimensional Physical-Biogeochemical Modeling Study on Productivity and Carbon Cycle in South China Sea

Stephanie K. Moore, Nathan J. Mantua, Vera L. Trainer and Barbara M. Hickey
Climate impacts on Puget Sound oceanography and harmful algal blooms

Olav A. Ormseth and Brenda L. Norcross
Latitude, temperature, and growth: Implications for life history strategies of cod in the Pacific and Atlantic Oceans

Mark D. Scheuerell and John G. Williams
Forecasting climate-induced shifts in the marine survival of Pacific salmon (*Oncorhynchus* spp.)

Robert M. Suryan
Environmental forcing of life history strategies: Multi-trophic level response at ocean basin scales

Posters

Hongsheng Bi, William T. Peterson, Jesse Lamb and Edmundo Casillas
Characterizing pelagic ocean habitat for juvenile salmon using generalized linear mixed model

Sukyung Kang and Suam Kim
Climate-induced variation in the distribution and abundance of mackerels in the Northwestern Pacific

Julie E. Keister, William T. Peterson, P. Ted Strub and Timothy J. Cowles
Climate effects on zooplankton biomass, species composition, and cross-shelf delivery of carbon in a coastal upwelling system.

Yong-Woo Lee, Bernard A. Megrey and S. Allen Macklin
Development of environment-based recruitment forecasting models and evaluation of forecast accuracy using a resampling strategy

Yulia N. Tananaeva and Marat A. Bogdanov
SST and ice conditions' variability, its influence on primary production and fishery resources of North West Pacific

Humans and the Marine Environment (Session 6)

Convenor: Franz J. Mueter, Sigma Plus Consulting, 697 Fordham Drive, Fairbanks, AK 99709 U.S.A.
Invited Speaker: Philippe Cury (Centre de Recherche Halieutique Méditerranéenne et Tropicale, IRD, Sète Cedex, France)

Background

The marine environment is subject to a variety of human impacts including the introduction of contaminants, habitat disturbance, species invasions, and effects of increasing CO_2 levels in the atmosphere. These impacts result from activities both on land and in the ocean such as increased coastal development, oil and gas exploration, fishing, and shipping. This session explored how people affect the oceans, how changes in the oceans affect the lives and livelihoods of people, and how these can be managed to ensure both healthy oceans and healthy human societies in the future. Papers were sought to: (1) quantify large-scale impacts of human activity on ocean ecosystems including novel ways to monitor and assess such impacts, (2) provide examples of how communities and societies are impacted by changes in the ocean, and (3) develop new approaches to support ecosystem-based management, including the development of ecosystem indicators and reference points.

Summary of presentations

A session on "*Humans and the marine environment*" set out to explore how people impact the oceans, how changes in the oceans impact the lives and livelihoods of people, and how these impacts can be managed to ensure both healthy oceans and healthy human societies in the future. While all presentations addressed impacts from human activities on the ocean, few presentations touched on the impacts of management or natural changes on coastal communities. This may simply reflect the fact that the marine sciences are dominated by environmental scientists, rather than social scientists. Nevertheless, the number of multi-author papers and the breadth of topics covered, with many speakers addressing new approaches to fisheries and ocean management, suggest that marine science in the 21st century is no longer aligned along traditional disciplines.

Reflecting this interdisciplinary approach, the wide-ranging and thought-provoking keynote address by Dr. Philippe Cury explored the scientific challenges of implementing an ecosystem approach to marine resources. These challenges range from basic ecological issues such as the processes that determine whether a community is dominated by bottom-up or top-down controls, over management challenges associated with developing suitable system-level reference points, to a need for ethical guidelines

(a "hippocratic oath") for marine scientists. Contributed papers and posters focused primarily on fisheries issues, but also documented the impacts of pollutants (in particular hydrocarbons), introduced species, coastal development, and climate change.

Human impacts from fishing on all components of the marine ecosystem appear to remain among the main concerns of the next generation of marine scientists. A variety of innovative approaches to measuring and modeling fishing impacts were presented, including the documentation of discarding practices, modeling of species interactions across multiple exploited systems, evaluation of single-species assessment and management strategies, development of novel system-level reference points, and a spatially explicit ecosystem model to explore the consequences of introducing marine protected areas.

Presentations highlighted the multitude of challenges faced by marine scientists and resource managers working at the interface between marine ecosystems and the humans that depend on these systems. If there was an over-arching message, it may be that the complexity of ecological interactions, the multiple levels at which humans interact with the marine environment, and the sometimes conflicting goals for marine stewardship require a cross-disciplinary perspective as well as a broad awareness of ecological, economic, and social science principles in order to define and achieve sustainable relationships with the marine environment.

List of papers

Oral presentations

Philippe Cury (Invited)
Scientific challenges to respond to a shared vision: the ecosystem approach to marine resources

Z. Teresa A'mar, A.E. Punt and M.W. Dorn
The Management Strategy Evaluation Approach and the Fishery for Walleye Pollock in the Gulf of Alaska

Andrey P. Chernyaev
Distribution of petroleum hydrocarbons in Ussuriyskiy Bay (Japan/East Sea)

Jason M. Cope and André E. Punt
Drawing the lines: Resolving fishery management units with simple fisheries data

Michelle L. Davis and Brian R. Murphy
Harvest Impacts on Population Dynamics of Sex-Changing Fishes

Paul. A. de Bruyn, M.H. Schleyer and C.L. Moloney
A novel application of Operational Management Procedures in the fisheries management of the oyster (*Striostrea margaritacea*) in KwaZulu-Natal, South Africa

Melissa A. Haltuch, Andre E. Punt and Martin Dorn
Evaluating alternative estimators for fisheries biomass reference points: How close are we?

Chih-hao Hsieh, Christian S. Reiss, Roger P. Hewitt and George Sugihara
Spatial analysis shows fishing enhances the climatic sensitivity of marine fishes

Hae-Cheol Kim, Xuyong Li, Charles L. Gallegos, Donald E. Weller, Thomas E. Jordan and Patrick J. Neale
Predicted ecological responses of subestuarine ecosystems to different watershed loadings in the Chesapeake Bay: A modeling study

Jae Bong Lee, Anne Hollowed and Chang-Ik Zhang
Comparing ecosystem variations between the eastern and western North Pacific using size-based indicators

Coilín Minto, Joanna Mills Flemming, Boris Worm and Ransom A. Myers
Meta-analytical approaches to understanding species interactions

Barbara Paterson, Coleen L. Moloney, Astrid Jarre, Tracy Fairweather, Carl van der Lingen, Lynne J. Shannon, and John G. Field
A fuzzy logic expert system for monitoring the implementation of an Ecosystem Approach to Fisheries in the Southern Benguela

John R. Peter and Victor M. Peddemors
Responses of Indian Ocean bottlenose dolphins to active acoustic devices (pingers) in South Africa

Jennifer N. Putland and Richard L. Iverson
Ecology of microzooplankton in a subtropical estuary and implications of river water diversion

Dawit Yemane, Yunne-J. Shin and John G. Field
Exploring the consequences of introducing Marine Protected Areas for the dynamics of fish communities in the southern Benguela ecosystem: an Individual Based Modelling approach

Posters

Svetlana A. Aleshko
Antioxidant defense system in fish and mussels from polluted areas of Peter the Great Bay (Japan/East Sea)

Susana Barbosa, Ana C. Fernandes, Laura Wise, Dina Silva and Graça Pestana
Fishing and discarding practices in the Portuguese trawl, longline and purse seine fleet

Claudia F. Bravo, Joseph Dietrich, Deborah Boylen, Bernadita Anulacion, Gina Ylitalo, Frank J. Loge, Tracy K. Collier and Mary R. Arkoosh
Transcriptional patterns in head kidney of polybrominated diphenyl ethers (PBDE) exposed fall Chinook salmon (*Oncorhynchus tshawytsha*) challenged with the marine pathogen *Listonella anguillarum*

Suchana Chavanich, Larry G. Harris, Jong-Geel Je and Rae-Seon Kang
Distribution pattern of the green alga *Codium fragile* in its native range, Korea: is it similar to invaded habitats?

Robert Enever, A. Revill and A. Grant
Discarding around the UK - New information and analyses: English Channel, Western Approaches, Celtic & Irish Sea (ICES subarea VII)

Kathleen R. Murphy, Gregory M. Ruiz, W.T.D. Dunsmuir and T. David Waite
Verification of mid-ocean ballast water exchange using fluorescence spectroscopy

Michael J. Wilberg and James R. Bence
Use of Bayesian model selection to improve stock assessment advice

Effective Science Communication (Workshop 1)

Instructor: Tim Carruthers (UMCES, Cambridge, MD, U.S.A.)

To have an impact, even excellent science needs to be effectively communicated. This workshop dealt with how to incorporate visual elements into print and electronic media-to expand on traditional peer reviewed journal formats-and more effectively communicate to managers, the general public, as well as fellow scientists. Participants were introduced to conceptual diagrams, one of the key tools used to synthesize information and therefore facilitate effective communication.

Integrated Environmental Assessment (Workshop 2)

Instructor: Bill Dennison (UMCES, Cambridge, MD, U.S.A.)

In our current scientific climate of mass data collection and a large and productive scientific community, the challenge is how to synthesize a mass of diverse information to answer apparently simple questions such as “how healthy is a system?” and “is the system getting better or worse?”' This workshop considered tools for syntheses and provided examples of where these approaches have been effective. Such issues as how to choose metrics, how to determine thresholds and how to combine metrics were discussed and presented in practical exercises.

International and Interdisciplinary Collaboration (Overview and Panel Discussion)

Moderator: Franz Mueter (Sigma Plus Consulting, Fairbanks, AK, U.S.A.)
Panel Members: Kyung-Il Chang (EAST-1), Philippe Cury (EUR-OCEANS), Elizabeth Gross (SCOR), Adi Kellerman (ICES), Skip McKinnell (PICES), Michael Roman (IMBER), Susan Weiler (invited speaker), Franciso E. Werner (GLOBEC)

International oceanographic organizations and research programs play an important role in coordinating marine research activities, sharing information, knowledge, and technology, and setting research priorities for collaborative research across borders and disciplines. This mini-symposium features speakers from various regional or global organizations to provide a very brief overview over their goals and activities. More importantly, speakers will discuss how their organization can help early career scientists get involved in collaborative research, provide suggestions on what new investigators can do to get involved, and share their personal insights and advice on effective international collaborations. Individual presentations will be followed by a panel discussion on the challenges of successful collaborative research and on approaches to overcoming these challenges.

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BIO	Biological Oceanography Committee
CCCC-IP/EC	Executive Committee of the Climate Change and Carrying Capacity Program Implementation Panel
CC-S	Section on *Carbon and Climate*
CFAME (TT)	Climate Forcing and Marine Ecosystem Response Task Team (Oct. 2004 –)
CPR-AP	Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific*
CREAMS-AP	Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas*
F&A	Finance and Administration Committee
FERRRS	Study Group on *Fisheries and Ecosystem Responses to Recent Regime Shifts* (Oct. 2003 – Oct. 2004)
FIS	Fishery Science Committee
FUTURE	Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem
GC	Governing Council
HAB-S	Section on *Harmful Algal Blooms*
IFEP-AP	Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific*
MBM-AP	Advisory Panel on *Marine Birds and Mammals*
MEQ	Marine Environmental Quality Committee
MIE-AP	Advisory Panel on *Micronekton Inter-calibration Experiment*
MODEL (TT)	Conceptual/Theoretical and Modeling Studies Task Team (Oct. 1995 –)
MONITOR	Formerly Task Team on Monitoring (Oct. 1997 – Oct. 2004), renamed to Technical Committee on Monitoring (Oct. 2004 –)
NEMURO	North Pacific Ecosystem Model for Understanding Regional Oceanography
NEMURO.FISH	NEMURO For Including Saury and Herring
NEMURO.SAN	NEMURO for Sardine and Anchovy populations
NEXT (TT)	NEMURO Experimental Plan Task Team (Oct. 2002 – Oct. 2003)
NPDB-AP	*North Pacific Data Buoy* Advisory Panel (Oct. 2001 – Oct. 2006)
NPESR	Working Group on *North Pacific Ecosystem Status Report* (Oct. 2002 – Oct. 2004)
PICES	North Pacific Marine Science Organization
POC	Physical Oceanography and Climate Committee
REX (TT)	Regional Experiments Task Team (Oct. 1996 – Oct. 2004)
RHLF	Relocation and Home Leave Fund
SB	Science Board
SG-CB	Study Group on *PICES Capacity Building* (Oct. 2002 – Oct. 2003)
SG-COM	Study Group on *PICES Communication* (Oct. 2007 –)
SG-EBM	Study Group on *Ecosystem-based Management Science and its Application to the North Pacific* (Oct. 2003 – Oct. 2004)
SG-ESR	Study Group on *Ecosystem Status Reporting* (Oct. 2006 –)
SG-FISP	Study Group on *Future Integrative Scientific Program(s)* (May 2005 –)
SG-GOOS	Study Group to develop a strategy for *GOOS* (Oct. 2006 –)
SG-MAR	Study Group on *Marine Aquaculture and Ranching in the PICES Region* (Oct. 2006 – 2007)
SG-RPFR	Study Group on *PICES Rules of Procedure and Financial Regulations* (Oct. 2004 – Oct. 2006)
SG-SC	Study Group on *Scientific Cooperation between PICES and Non-member Countries* (Oct. 2006 –)

SISG	Study Group on *PICES Strategic Plan* (Oct. 2003 – Oct. 2004)
TCODE	Technical Committee on Data Exchange
TRF	Trust Fund
WCF	Working Capital Fund
WG-1	Working Group on *Okhotsk Sea and Oyashio Region* (Oct.1992 – Oct. 1993)
WG-2	Working Group on *Development of Common Assessment Methodology for Marine Pollution* (Oct.1992 – Oct. 1994)
WG-3	Working Group on *Dynamics of Small Pelagics in Coastal Ecosystems* (Oct.1992 – Oct. 1995)
WG-4	Working Group on *Data Collection and Quality Control* (Oct.1992 – Oct. 1994)
WG-5	Working Group on *Bering Sea* (Oct.1992 – Oct. 1996)
WG-6	Working Group on *Subarctic Gyre* (Oct. 1992 – Oct. 1994)
WG-7	Working Group on *Modeling of the Subarctic North Pacific Circulation* (Oct. 1993 – Oct. 1995)
WG-8	Working Group on *Practical Assessment Methodology* (Oct. 1994 – Oct. 2000)
WG-9	Working Group on *Subarctic Pacific Monitoring* (Oct. 1994 – Oct. 1997)
WG-10	Working Group on *Circulation and Ventilation in the Japan/East Sea* (Oct. 1995 – Oct. 1999)
WG-11	Working Group on *Consumption of Marine Resources by Marine Birds and Mammals* (Oct. 1995 – Oct. 1999)
WG-12	Working Group on *Crabs and Shrimps* (Oct. 1995 – Oct. 2001)
WG-13	Working Group on *Carbon Dioxide in the North Pacific* (Oct. 1997 – Oct. 2002)
WG-14	Working Group on *Effective Sampling of Micronekton to Estimate Ecosystem Carrying Capacity* (Oct. 1997 – Oct. 2004)
WG-15	Working Group on *Ecology of Harmful Algal Blooms (HABs) in the North Pacific* (Oct. 1999 – Oct. 2003)
WG-16	Working Group on *Climate Change, Shifts in Fish Production, and Fisheries Management* (Oct. 1999 – Oct. 2005)
WG-17	Working Group on *Biogeochemical Data Integration and Synthesis* (Oct. 2001 – Oct. 2005)
WG-18	Working Group on *Mariculture in the 21st Century – The Intersection between Ecology, Socio-economics and Production* (Oct. 2003 – Oct. 2006)
WG-19	Working Group on *Ecosystem-based Management Science and its Application to the North Pacific* (Oct. 2004 –)
WG-20	Working Group on *Evaluations of Climate Change Projections* (Oct. 2005 –)
WG-21	Working Group on *Non-indigenous Aquatic Species* (Oct. 2005 –)
WG-22	Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (Oct. 2007 –)
WG-23	Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* (Oct. 2007 –)

ACRONYMS

AFS	American Fisheries Society
AFSC	Alaska Fisheries Science Center
AIS	Aquatic Invasive Species
ALOS	Advanced Land Observing System
AOOS	Alaska Ocean Observing System
APEC	Asia Pacific Economic Cooperation
ASC	Annual Science Conference, ICES
ASP	Amnesic shellfish poisoning
BASIS	Bering-Aleutian Salmon International Survey, NPAFC
BCLME	Benguela Current Large Marine Ecosystem programme
BEST	Bering Ecosystem Study
BSIERP	Bering Sea Integrated Ecosystem Research Program
CA	Comprehensive Assessment
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CAISN	Canadian Aquatic Invasive Species Network
CAMEO	Comparative Analysis of Marine Ecosystem Organization, NOAA
CARBO-OCEAN	Marine carbon sources and sinks assessment
CARINA	Carbon in the North Atlantic project
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCE-LTER	California Current Ecosystem – Long-Term Ecological Research
CCHDO	CLIVAR and Carbon Hydrographic Data Office
CCRS	Center for Climate System Research, University of Tokyo
CCS	California Current System
CDIAC	Carbon Dioxide Information and Analysis Center
CDN	Canadian dollar
CEOHAB	Chinese Ecology and Oceanography on Harmful Algal Blooms program
CFC	Chloro-fluorocarbons
CIBNOR	Centro de Investigaciones Biológicas del Noroeste
CITES	Convention on International Trade in Endangered Species
CLIOTOP	Climate Impacts on Oceanic Top Predators
CLIVAR	Climate Variability and Predictability Program
ChloroGIN	Chlorophyll Ocean Globally Integrated Network
CMS	Convention on Migratory Species
COCO-NEMURO	CCSR Ocean Component Model-NEMURO
CREST	Core Research for Evolutional Science and Technology
DFO	Department of Fisheries and Oceans, Canada
DIC	Dissolved Inorganic Carbon
DMAS	Data Management and Archival System
DMCR	Department of Marine and Coastal Resources, Thailand
DOC	Dissolved Organic Carbon
DSP	Diarrheic Shellfish Poisoning
EAM	Ecosystem Approach to Management
EAST-I, -II	East Asian Seas Time-Series-I, -II
EBM	Ecosystem-Based Management
ECCO	Estimating the Circulation and Climate of the Ocean
Ecopath/Ecosim	Ecological/Ecosystem modeling software
ECS	East China Sea

ECYS	East China/Yellow Seas
EDRR	Early Detection and Rapid Response
EEZ.	Exclusive Economic Zone
EPA	Environmental Protection Agency, U.S.
ERAIMA	Environmental Risk Assessment and Interactions of Marine Aquaculture
ESMF	Earth Systems Modeling Framework
ESR	Ecosystem Status Report
ESSAR	Ecosystem Studies of Subarctic and Arctic Regions
ESSAS	Ecosystem Studies of the Sub-Arctic Seas
Eur-OCEANS	European Network of Excellence for Ocean Ecosystems Analysis
FDGC	Federal Geographic Data Committee, U.S.A.
FVCOM	Finite Volume Coastal Ocean Model
EVOSTC	Exxon Valdez Oil Spill Trustee Council
FAO	Food and Agriculture Organization, UN
FAO-COFI	FAO's Committee on Fisheries International
FEIS	Fisheries and Environment of Inland Sea, Japan
FERHRI	Far Eastern Regional Hydrometeorological Research Institute
FERRRS	Fisheries and Ecosystem Responses to Recent Regime Shifts
FGDC	Federal Geographic Data Committee, U.S.A.
FRA	Fisheries Research Agency of Japan
FTP	File Transfer Protocol
FUTURE	Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems
FVCOM	Finite Volume Coastal Ocean Model
F&WS	Fish and Wildlife Service, U.S.
GCP	Global Carbon Project
GEOHAB	Global Ecology and Oceanography of Harmful Algal Blooms
GEO	Group on Earth Observations, Geneva
GEOSS	Global Earth Observing System of Systems, NOAA
GLOBEC	Global Ocean Ecosystem Dynamics Programme
GLODAP	Global Ocean Data Analysis Project
GODAR-WESTPAC	Global Oceanographic Data Archaeology and Rescue project in the Western Pacific region
GRA	GOOS Regional Alliance
GRAND	GOOS Regional Alliance Network Development Project
GSSC	GOOS Scientific Steering Committee
GTS	Global Telecommunications System
GTSPP	Global Temperature–Salinity Pilot Project
HAB(s)	Harmful Algal Bloom(s)
HACCP	Hazard Analysis of Critical Control Point
HAE-DAT	ICES-IOC Harmful Algal Event Database
HAIS	Harmful Algae Information System
HAMP	Harmful Algae Monitoring Program
HNFRI	Hokkaido National Fisheries Research Institute
HNLC	High nutrients–low chorophyll
HPLC	High Performance Liquid Chromatography
HTL	Higher Trophic Level
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
ICES-IOC WGHABD	Working Group on Harmful Algal Bloom Dynamics

IGO	Inter-Governmental Organization
IGOOS	Intergovernmental Committee for GOOS
IKMT	Isaacs–Kid Midwater Trawl
IMBER	Integrated Marine Biogeochemistry and Ecosystems Research
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission, UNESCO
IOC-ANCA	IOC HAB working group for Central America and Caribbean Sea
IOC-FANSA	IOC HAB working group for South America
IOCCP	International Ocean Carbon Coordinated Project
IODE	International Oceanographic Data Information Excahnge, IOC
IOOS	Integrated Ocean Observing System
IOS	Institute of Ocean Sciences, Canada
IPCC	Intergovernmental Panel on Climate Change
IPHC	International Pacific Halibut Commission
IPY	International Polar Year
ISO	International Organization for Standardization
IWC	International Whaling Commission
JARPA	Joint Aquatic Resources Permit Application
JCOMM	Joint WMO–IOC Technical Commission for Oceanography and Marine Meteorology
JCOPE	Japan Coastal Ocean Predictability Experiment
JES	Japan/East Sea
JFA	Japan Fisheries Agency
JHA	Japan Hydrographic Association
JMA	Japan Meteorological Agency
JNCC	Joint Nature Conservation Committee
JODC	Japanese Oceanographic Data Center
J-QUEST	Japan Quantitative Echo-sounder and Stereo TV-camera system
JSPS	Japanese Society for Promotion of Science
KO	Kurashio/Oyashio currents
KODC	Korea Oceanographic Data Center
KORDI	Korea Ocean Research and Development Institute
KOSEF	Korean Science and Engineering Foundation
LME	Large Marine Ecosystem
LTL	Lower Trophic Level
MAFF	Ministry of Agriculture, Forestry and Fisheries, Japan
MEOW	Marine Ecosystems of the World
MIRC	Marine Information Research Center, Japan
MIROC	Model for Interdisciplinary Research on Climate
MIS	Marine/Estuarine Invasive Species
MLR	Multiple Linear Regression
MNRE	Ministry of Natural Resources and Environment, Thailand
MOHT	Matuda-Oozeki-Hu Trawl
MOMAF	Ministry of Maritime Affairs and Fisheries, Republic of Korea
MOU	Memoranda of Understanding
MPA	Marine Protected Area
NAFO	Northwest Atlantic Fisheries Organization
NAMMCO	North Atlantic Marine Mammal Commission
NANOOS-IOOS	Northwest Association of Networked Ocean Observing Systems – Integrated Ocean Observing System
NASCO	North Atlantic Salmon Conservation Organization
NCAR	National Center for Atmospheric Research

NEAR-GOOS	North East Asian Regional Global Ocean Observing System
NEMURO	North Pacific Ecosystem Model for Understanding Regional Oceanography
NEMURO.FISH	NEMURO For Including Saury and Herring
NEMURO.SAN	NEMURO for simulating Sardine and ANchovy
NEP	North East Pacific
NEPTUNE	North-east Pacific Time-series Undersea Network Experiments
NFRDI	National Fisheries Research and Development Institute, Korea
NGO	Non-Governmental Organization
NISBASE	Non-Indigenous Species Database
NMDIS	National Marine Data and Information Service, P.R. China
NMEFC	National Marine Environmental Forecasting Center, P.R. China
NMFS	National Marine Fisheries Service, NOAA
NOAA	National Oceanographic and Atmospheric Administration, U.S.A.
NOWPAP	Northwest Pacific Action Plan
NPAFC	North Pacific Anadromous Fish Commission
NPESR	North Pacific Ecosystem Status Report
NPRB	North Pacific Research Board, U.S.A.
NPZD	Nutrients-phytoplankton-zooplankton-detritus
NSDI	National Spatial Data Infrastructure
NSF	National Science Foundation, China; National Science Foundation, U.S.A.,
NWFSC	Northwest Fisheries Science Center, NOAA
ODE	Ordinary Differential Equation
ODIN-WESTPAC	Ocean Data and Information Network for the Western Pacific
OECOS	Oceanic Ecodynamics Comparison in the Subarctic Pacific
OSPAR	Commission for the Protection of the Marine Environment of the North East Atlantic
PaCOOS	Pacific Coast Ocean Observing System
PAG	Pacific Arctic Group
pCO_2	Partial pressure of carbon dioxide in surface sea water
PCEIS	Pacific Coast Ecosystem Information System
PEST	Parameter Estimation software for automated calibration and data interpretation of models
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
PICES	North Pacific Marine Science Organization
PIRE	Partnership for International Research and Education program, U.S.A.
POI	V.I. Il'ichev Pacific Oceanological Institute, Russia
POMA	PICES Ocean Monitoring Service Award
PORSEC	Pacific Ocean Remote Sensing Conference
PRBO	Point Reyes Bird Observatory
PSA	Pacific Science Association
PSC	Pacific Salmon Commission
PSG	Pacific Seabird Group
PSP	Paralytic Shellfish Poisoning
PSU	Portland State University, U.S.A.
QA/QC	Quality Assurance/Quality Control
RAC-SPA	Regional Activity Centre for Specially Protected Areas
RDMDB	Regional Delayed-Mode Database
RFP	Request for Proposal
RMP	Revised Management Procedure
RMT	Rectangular Midwater Trawl
ROMS	Regional Ocean Modeling System
RRTDB	Regional Real-Time Database

RTDB	Real-Time Database
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SCOPE	Scientific Committee on Problems of the Environment
SCOR	Scientific Committee on Oceanic Research
SCUBA	Self-Contained Underwater Breathing Apparatus
SEEDS	Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study
SEA-GOOS	Southeast Asia-GOOS
SERIES	Subarctic Ecosystem Response to Iron Enrichment Study
SIO	Scripps Institution of Oceanography, U.S.A.
SOA	State Oceanic Administration, China
SOCER	State of the Cetacean Environment Report
SO-GLOBEC	Southern Ocean Global Ocean Ecosystem Dynamics Programme
SOLAS	Surface Ocean–Low Atmosphere Study
SPAW	Specially Protected Areas and Wildlife
SOWS	Southern Ocean Whale Sanctuary
SPC	South Pacific Commission
SPREP	South Pacific Regional Environmental Program
SSC	Scientific Steering Committee
SSG-GOOS	GOOS Scientific Steering Committee
SST	Sea surface temperature
START	South Asian Regional Committee for the System for Analysis, Research and Training
STRATOGEM	Strait of Georgia Ecosystem Modelling
TAC	Total Allowance Catch
TBD	To Be Determined
TINRO-Centre	Pacific Scientific Research Fisheries Centre, Russia
TMA	Technology and Management for Aquaculture
TNFRI	Tohoku National Fisheries Research Institute
TOR	Terms of Reference
TOS	The Oceanography Society
UMCES	University of Maryland Center for Environmental Science
UN	United Nations
UNEP	United Nations Environmental Programme
URL	Uniform Resource Locator
USGS	U.S. Geological Survey
US-OCB	U.S.-Ocean Carbon and Biogeochemistry
VENUS	Victoria Experimental Network Under the Sea, Canada
WCRP	World Climate Research Program
WDCGG	World Data Centre for Greenhouse Gases
WESTPAC	IOC Sub-Commission for the Western Pacific
WHP	WOCE Hydrographic Program
WGBOSV	Working Group on *Ballast and Other Ship Vectors*, ICES/IOC/IMO
WGDIM	Working Group on *Data and Information Management*
WGECO	Working Group on *Ecosystem Effects of Fishing Activities*, ICES
WGITMO	Working Group on *Introductions and Transfers of Marine Organisms*, ICES
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
YOOS	Yellow Sea Ocean Observing System
YSLME	Yellow Sea Large Marine Ecosystem