

**NORTH PACIFIC MARINE SCIENCE ORGANIZATION  
(PICES)**

ANNUAL REPORT

TWENTY SECOND MEETING

NANAIMO, BC, CANADA

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## REPORT OF OPENING SESSION

### AGENDA ITEM 1

#### **Opening by the Chairman of PICES**

The Opening Session started at 09:00 hours on October 14, 2013. Dr. Laura Richards, Chairman of PICES, welcomed delegates, observers and researchers to Nanaimo and formally declared that the PICES Twenty-Second Annual Meeting (PICES-2013) was open. The session agenda is appended as *OP Endnote 1*.

### AGENDA ITEM 2

#### **Welcome address on behalf of the host country**

Ms. Susan Farlinger (Regional Director General, Pacific Region, Fisheries and Oceans Canada) welcomed participants on behalf of the host country (*OP Endnotes 2*).

### AGENDA ITEM 3

#### **Remarks by the Chairman of PICES**

Dr. Richards thanked Ms. Farlinger for her remarks, and addressed the participants on behalf of PICES (*OP Endnote 3*).

### AGENDA ITEM 4

#### **Wooster Award presentation ceremony**

Dr. Sinjae Yoo, Chairman of Science Board, and Dr. Richards conducted the Wooster Award presentation ceremony. Dr. Yoo introduced the award and announced that the 2013 award was being given to Prof. Vera Alexander (University of Alaska, Fairbanks, U.S.A.) for a career of sustained excellence in marine science that has spanned nearly 50 years. (*OP Endnote 4*). Reading of the Science Board citation was accompanied by a slide show dedicated to Dr. Alexander. A commemorative plaque was presented to Dr. Alexander (a permanent plaque identifying all Wooster Award recipients resides at the PICES Secretariat), who accepted the award with the following remarks of thanks:

*I was completely surprised and astonished to receive this prize and yet nothing could have pleased me more. PICES has been an incredibly important part of my life, and in developing the Organization under the wise leadership of Warren Wooster, I learned so much. Preparing for PICES seemed to take a long time, but once it was signed, the forward movement was amazing. Others, too numerous to mention, played important roles as well, but I particularly want to mention Dick Beamish and Bill Aron for introducing me to the world of fisheries science and international policy most effectively. I owe them and PICES a major debt. It would be negligent not to mention Alex Bychkov and his excellent staff; they are highly effective and a pleasure to work with. It is good to find that PICES is prospering and continuing to do good and timely work. I am humbled in receiving the Wooster Award, but also extremely grateful and happy for this recognition. Thank you very much.*

### AGENDA ITEM 5

#### **PICES Ocean Monitoring Service Award presentation ceremony**

Drs. Yoo and Richards also conducted the presentation ceremony of the PICES Ocean Monitoring Service Award (POMA). Dr. Yoo introduced the award and announced that the 2013 award was being given to the

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A-line Monitoring Program for its contributions to understanding the past and future oceanography of the North Pacific (*OP Endnote 5*). Reading of the Science Board citation was accompanied by a slide show dedicated to A-line Monitoring Program. A commemorative plaque (a permanent plaque identifying all POMA recipients resides at the PICES Secretariat) and a certificate were presented to Dr. Hiroshi Kuroda (Hokkaido National Fisheries Research Institute, Fisheries Research Agency, Japan). Dr. Kuroda provided the following remarks of appreciation:

*Thank you very much for this award. I am the newest participant of the A-line monitoring, but I do not have a strong constitution against seasickness. Whenever I feel seasick on a ship, I am always mindful of the conditions that crew and researchers must work under. I respect and am very proud of all of the participants and contributors, particularly, captains, officers and crew of Research Vessels Hokko-maru and Wakataka-maru. This award will encourage us – all the participants and contributors. I would like to thank PICES deeply.*

### AGENDA ITEM 6

#### **PICES “Year-in-Review” 2013**

Dr. Yoo reviewed PICES’ scientific accomplishments since the Twenty-First Annual Meeting (PICES-2012) in Hiroshima, Japan. An article on the state of PICES science for 2013 will be published in the 2014 winter issue of PICES Press (Vol. 22, No. 1).

The 2013 keynote lecture entitled “*Canada’s changing Pacific marine ecosystems: Forecasts, uncertainties, potential consequences, and communication*” was given by Dr. R. Ian Perry (Fisheries and Oceans Canada, Pacific Biological Station) as part of the Science Board Symposium on “*Communicating forecasts, uncertainty and consequences of ecosystem change*”. The abstract of this talk is appended to the report as *OP Endnote 6*.

### AGENDA ITEM 7

#### **Closing remarks and announcements**

The session was adjourned at 10:00 a.m., after announcements related to the logistics of the Annual Meeting made by Dr. Stewart (Skip) McKinnell, Deputy Executive Secretary of PICES.

**OP Endnote 1****Opening Session agenda**

1. Opening by Dr. Laura Richards, Chairman of PICES
2. Welcome address on behalf of the host country by Ms. Susan Farlinger (Regional Director General, Pacific Region, Fisheries and Oceans Canada)
3. Remarks by Dr. Laura Richards, Chairman of PICES
4. 2013 PICES Wooster Award presentation ceremony
5. 2013 PICES Ocean Monitoring Service Award presentation ceremony
6. *PICES "Year-in-Review" 2013* by Dr. Sinjae Yoo, Chairman of Science Board
7. Closing Remarks/Announcements

**OP Endnote 2****Welcome address**

**by Ms. Susan Farlinger (Regional Director General, Pacific Region, Fisheries and Oceans Canada)**

Good Morning. Welcome to Canada, and welcome to Nanaimo.

My name is Susan Farlinger, and I work for Fisheries and Oceans Canada (DFO) as the Director General of the Pacific Region, which of course includes Nanaimo. The Minister of Fisheries and Oceans Canada, the Honorable Gail Shea, sends her warmest greetings to all delegates to the Annual Meeting of the North Pacific Marine Science Organization, also known as PICES. The Minister is excited and pleased that the marine science community from our North Pacific Ocean neighbors, China, Japan, Korea, Russia and the United States, has again come to conduct this important international exchange in Canada.

In my opening remarks, I should have said welcome back to Canada and Nanaimo, as this rotational meeting was held six years ago in Victoria. It is a privilege to host PICES in Nanaimo again in 2013. The last time that the PICES Annual Meeting was held in Nanaimo was in 1996 (the 5<sup>th</sup> Annual Meeting). That meeting had about 235 participants, compared to the almost 400 participants that are expected this week. PICES outgrew Nanaimo, and we had to wait for the completion of this beautiful new Conference Centre before we were able welcome all of you back to this city.

Many of you will know that Nanaimo is home to one of our key centres for marine research in western Canada. Not far from here is the Pacific Biological Station. It is one of our largest research centres in the country and has been in continuous operation for over 100 years now. Of course, not far from here either, in Sidney, is the Institute of Oceans Sciences, which is another DFO research facility. This is the home as well of the PICES Secretariat, led by Executive Director, Dr. Alexander Bychkov and his staff. These two facilities form the backbone of the Canadian government's capacity on the Pacific Coast, and provide a base from which we can readily and regularly work with the universities and other science-based organizations that collectively conduct marine research in Canada.

I should also note that this is the first Annual Meeting of PICES where Dr. Laura Richards will serve as Chairperson. Laura has had a stellar career at DFO and a long association with PICES. I will congratulate her here again on her election as Chairperson at your last meeting. I want you to know that your organization is in good hands.

PICES members know well that the North Pacific Ocean and its regional seas are a shared resource. Recent events have again shown us that, and it is clear that the broad oceanic processes at play are well suited to collaborative study. One such event was the arrival of debris on the Pacific coast of Canada and the United States. Many organisms were attached to this debris, generated by the tsunami from the great 2011 Great East Japan Earthquake. The organisms were identified with the aid of the Atlas of Nonindigenous Marine and Estuarine Species in the North Pacific developed by one of PICES working groups.

PICES is the key organization for the North Pacific with regard to scientific collaboration and learning in marine matters. We all share a need for science knowledge to underpin oceans management and policy. To that end, the current scientific focus of PICES is the FUTURE science program - *Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems*. This type of initiative is critical for Canada. The exhaustive Cohen Commission of Inquiry into the Decline of Sockeye Salmon in the Fraser River was a response to the difficulty and importance of understanding our key resources well enough to make reasonable predictions, at a time when the ecosystems of which those resources make part are themselves changing.

Of course, the theme of this year's conference, "Communicating forecasts, uncertainty and consequences of ecosystem change", is well-aligned with the direction of FUTURE. Ecosystem change is becoming the underlying concept of our times. Like Canada, a number of scientists from PICES member countries would have contributed to the recent International Panel on Climate Change report. That exercise and the PICES Annual Meeting here this week feature a vital characteristic in common – Communication. As we deal with our respective pressures and challenges related to oceans, especially in this context, the Pacific, it is vital that we work together to understand our common problems and develop common solutions. PICES represents an incredible opportunity to communicate amongst experts in different countries; amongst experts in different disciplines; amongst scientists and "clients" – fisheries and oceans managers, policy makers, industries, First Nations, the public. All of these people have a thirst for this information, but a limited capability to deal with all the details and technicalities.

These are challenging times for many countries – not all of the PICES member economies are as strong as they recently were, and we recognize that. In some ways, this makes the operation of an organization like PICES more challenging. But collaboration is an inherently efficient approach, and the benefits of strong international cooperation of common science issues become even more compelling in times like these.

So, on behalf of the Government of Canada and Minister Shea, I wish well in your 2013 Annual Conference and associated meetings that I know are scheduled for this week. I also know that the local organizing committee headed by Ms. Brenda Fair has designed a schedule of other diversions during the week that will allow you to experience a bit of the great Nanaimo area.

I wish you every success in your Annual Meeting.

### **OP Endnote 3**

#### **Welcome address by Dr. Laura Richards (Chairman of PICES)**

On behalf of PICES, I would like to thank Fisheries and Oceans Canada for hosting this meeting, working in conjunction with the PICES Secretariat. In particular, as Ms. Farlinger already mentioned, I would like to thank Ms. Brenda Fair as Chair of the Local Organizing Committee.

It is a special privilege for me to open PICES Annual Meeting for the first time as the Chair in my home town of Nanaimo. I would also like to acknowledge that this meeting is being held on the traditional territory of the Snuneymuxw First Nation.

Today is a special day. It is a holiday in Canada where traditionally we give thanks for the year's harvest. In modern times, the holiday is celebrated as a time for families to get together and share a dinner of stuffed turkey and cranberry sauce with pumpkin pie for dessert. I would like to thank and acknowledge those Canadians who have chosen to give up their family dinner and to spend this Thanksgiving here with PICES. Perhaps some of you visiting Canada this week will have an opportunity today to try a traditional Canadian Thanksgiving dinner for the first time.



Thanksgiving is also a good time for us to get together and celebrate the PICES family. We have achieved a great deal in the 22 years since PICES was formally established in 1992 and the 18 years since PICES was last held in Nanaimo in 1996. As Ms. Farlinger mentioned, at the previous Nanaimo meeting, we had 235 participants and the meeting was held in the Coast Bastion Hotel down the street where some of you may be staying. Today, we are expecting about 400 participants to PICES-2013. In 1996, PICES had 14 official expert groups or committees involving 210 individuals, while today we have 24 groups involving 285 individuals. PICES has outgrown our former meeting space in Nanaimo, but we have a new conference centre which I hope will be a perfect size for our meeting.

Of course, progress does not come without challenges. PICES has an ambitious Strategic Plan, as do each of the scientific committees. We have much to still accomplish within these strategic plans as well as on our main science program FUTURE. You will hear more about that and about the work of PICES over the past year when the Chairman of the Science Board gives his report. In particular, you will hear about preparations for the FUTURE Open Science Meeting next April in Hawaii.

The work of PICES is built on solid scientific cooperation. For PICES to progress and succeed as an organization, we must all continue to work as a team. I know that for some of you that means you must sometimes take on your less-than-favorite committee tasks for the overall good, and your efforts are truly appreciated. Because we all come from different backgrounds, we may sometimes use different words or expressions to say the same thing. You must be willing to hear other points of view and sometimes agree to compromise in order to move ahead. But in the process, you will meet wonderful people who share your enthusiasm for scientific progress.

In this spirit of scientific cooperation, I would like to pose three challenges to each of you here today for you to accomplish by Friday.

The first challenge is to attend a scientific presentation in a field of study which is different from your own. For example, if you are a physical oceanographer, then you could attend a presentation in a session sponsored by the Fishery Science Committee. Similarly, a fishery biologist could attend a presentation in a session sponsored by the Physical Oceanography Committee. I do not expect that you will find this challenge very difficult because many of the sessions are jointly sponsored by different committees.

The second challenge is to attend at least one scientific presentation by a scientist from each of the six nations within PICES.

The third challenge is to meet new people and to get to know one scientist from each of the six nations within PICES, ideally a scientist that you had not previously met.

Before I close, I would like to make some announcements. Dr. Skip McKinnell, the PICES Deputy Executive Secretary, has decided to retire in early 2014. Skip has been Deputy Executive Secretary since 1999 and has been very active at PICES meetings, providing support to the science program. I would like to acknowledge his contribution and say thanks on behalf of PICES.

Over the summer, the Executive Secretary led a staffing process for a new Deputy Executive Secretary. I am pleased to announce today that the next Deputy will be Dr. Hal Batchelder. I am sure that Dr. Batchelder is very well known to many of you. He has had many leadership roles, including Co-Chairman of the Climate Change and Carrying Capacity Program and a member of Science Board from 2001–2009 and a member of Governing Council since 2012. I would like to offer a warm welcome to Dr. Batchelder who will start his new position on March 1, 2014.

Unfortunately, PICES lost a close friend a few days ago. Professor Mingyaun Zhu from China's State Oceanic Administration passed away tragically on Friday, October 11, in Nanaimo. Professor Zhu was a long-time member of the Biological Oceanography Committee and a member of the Section on Harmful Algal Blooms

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since its establishment in 2003. On behalf of PICES, I would like to offer our most heartfelt condolences to Professor Zhu's family, friends and colleagues. PICES has placed a sympathy book at the Registration Desk which I would encourage you to sign and write messages to Prof. Zhu's family.

I would also like to take a moment to acknowledge another two of our former colleagues who passed away during 2013. Dr. C.S. Wong (Canada) was a long-time member of the PICES Physical Oceanography and Climate Committee and Co-Chairman of the Advisory Panel on Iron Fertilization Experiment between 1998–2007. Dr. Yutaka Nagata (Japan) was deeply involved in PICES from the beginning. He was the first chairman of the Physical Oceanography and Climate Committee, Co-Chairman of the Climate Change and Carrying Capacity Program, and member of Working Group 1 on Okhotsk Sea, along with an important role in the formation of the Technical Committee on Data Exchange. He received the PICES Wooster Award in 2002.

In honour of Professor Zhu, Dr. Wong and Dr. Nagata, we will now hold one minute of silence.

### OP Endnote 4

#### Science Board citation for the 2013 Wooster Award

The Wooster Award is the highest recognition of individual scientific achievement offered by PICES. Its name honors the first Chairman of PICES, Prof. Warren S. Wooster. The award is given to an individual who has made significant contributions to North Pacific marine science, especially to understanding and predicting how humans and climate affect marine ecosystems. In making its decision, the PICES Science Board looks for sustained excellence in research, teaching, and administration of marine science. It is my great pleasure to announce that Prof. Vera Alexander of the University of Alaska, Fairbanks (UAF) is the recipient of the 2013 Wooster Award for a career of sustained excellence in marine science that has spanned nearly 50 years.

Vera was born in Budapest, Hungary, but left with her family to England just before the start of World War II. There she developed a love for music and became an accomplished pianist. Early in life, she also developed an interest in agriculture and a love for the outdoors. Her family moved to the U.S. east coast, but Vera kept going west to attend the University of Wisconsin where she earned a bachelor degree in 1955. In 1965, she became the first woman to receive a Ph.D. at the University of Alaska. She became an associate professor at the new Institute of Marine Science on the Fairbanks campus.

Vera was a scientific pioneer. She was among the first to use the N-15 isotope to study nitrogen fixation in lakes. At the time, everyone thought that bacteria were the primary source of fixed nitrogen, but Vera found that most of it was fixed in lakes by blue green algae. Since this groundbreaking effort, this same process has been found in other environments including tundra terrestrial ecosystems, where lichens fix nitrogen.

Vera is also known worldwide for her pioneering research on the role of sea ice in the Bering Sea, by discovering that the ice was a critical factor determining spring productivity in the arctic region. The importance of Vera's work on Arctic phytoplankton and sea ice algae cannot be overstated. Many of her studies, such as heterotrophy of sea ice algae, or developing appropriate techniques to measure ice algal activity, were firsts in marine science. She and her colleagues, helped to lay a foundation for the current US Bering Sea Ecosystem Program that is further developing our understanding of biological processes in polar seas. Vera has published more than 70 papers in the refereed literature, most of which are recognized for scientific excellence with many having more than 50 citations.

Vera is known internationally and deeply appreciated for her administration of many regional, national, and international marine science programs. In 1980, she became the director of the Institute of Marine Science where she was instrumental in bringing fisheries scientists and oceanographers together. When the School of Fisheries and Ocean Sciences was formed at the University of Alaska in 1987, Vera became its first dean and served in that role for nearly 20 years.

A crowning achievement in Vera's career was the construction and launch of the 261-foot research vessel (R/V) *Sikuliaq*, one of the most advanced research vessels in the world. The *Sikuliaq*, owned by the US National Science Foundation and operated by the University of Alaska Fairbanks, is the first ice-strengthened research vessel in the U.S. academic fleet. She and Bob Elsner were involved with the planning and development of this ship for several decades. Vera's vision and involvement was recognized when she was invited to christen the ship at its launching in 2012. Vera and Bob's initials have been welded into a steel plate that is affixed to its keel.

In the course of her illustrious career, Vera Alexander has received numerous honors, including election as Fellow of the American Association for the Advancement of Science, to the Arctic Institute of North America, the Explorers Club, and was given the Walter and Ermalee Hickel Lifetime Achievement Award from the Alaska Marine Leadership Council. Vera was honored recently by the naming of the Vera Alexander Learning Center, which is the most technologically advanced classroom on the UAF campus.

Her service to science spans many organizations, including, 16 years as a commissioner on the United States Marine Mammal Commission, 10 years on the Science Panel of the North Pacific Research Board, and 12 years on the International Scientific Steering Committee (SSC) of the Census of Marine Life (COML). She also received an honorary Doctorate of Laws degree from Hokkaido University in recognition of her work in promoting international scientific cooperation.

Vera is a founder of PICES where she served as U.S. Delegate from 1992–2002, before becoming Vice-Chairman from 1998–2002, and Chairman from 2002–2006. Her dedication and contributions to PICES are deeply appreciated by all of us.

Ladies and Gentlemen, please join me in congratulating Dr. Vera Alexander as the 2013 recipient of the Wooster Award.

## **OP Endnote 5**

### **Science Board citation for the 2013 PICES Ocean Monitoring Service Award**

The Oyashio is a cold western boundary current flowing southward from the Kurile Islands to Hokkaido, Japan. "Oya" in Japanese means "parents" or "source" and "shio" means "current". Thus, Oyashio means "a current that provides rich marine products". This area is known as a good fishery ground for Japanese sardine, walleye pollock and other species. Because of its high productivity, Oyashio has fascinated biological oceanographers, fisheries scientists, and physical oceanographers. Not so long ago, there was relatively little information about its physical properties, ecosystem structure and mechanisms for maintaining its high productivity. It was clear that a continuous ocean monitoring system was needed to begin to understand fisheries oceanography in Oyashio area.

Twenty-six years ago in 1987, the first of many A-line observations was made by scientists at the Hokkaido National Fisheries Research Institute, led by Dr. Makoto Kashiwai (the second Science Board Chairman of PICES). The 3-year project on "Oyashio water" focused on its physical oceanography. The "A" in A-line is taken from the first letter of Akkeshi Bay, near the first station of the A-line. This project ended in 1990, but the enthusiasm of a new group of scientists expanded A-line monitoring to include physical, chemical and biological properties of the Oyashio ecosystem and the search for key factors associated with its high productivity. In 2002, the Tohoku National Fisheries Research Institute joined the effort and has been conducting 5-7 cruises per year up to the present. During that time, A-line monitoring program has made outstanding achievements related to understanding the Oyashio and its ecosystem.

An important characteristic of the A-line monitoring program is the close cooperation among scientists of different disciplines. It inspired the development of ecosystem models by the MODEL Task Team in PICES. The NEMURO model and its daughter models are now used in marine sciences all over the world. The A-line

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was also the site of iron fertilization experiments coordinated by the PICES Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific Ocean*. They found that iron controlled the productivity of the North Pacific and found east-west differences in iron concentration and iron species composition. Repeated monitoring in the A-line region discovered that the Sea of Okhotsk is an important source of iron in the western subarctic Pacific. Long-term observations have helped to clarify relationships between the physical environment and living marine resources, and revealed the mechanisms for long term variation of ocean ecosystems of the western North Pacific in relation to the global warming and/or Pacific Decadal Oscillation.

A-line Monitoring Program has fostered oceanography and fisheries science in the western North Pacific, with many papers presented annually at PICES Annual Meetings and symposia and workshops sponsored by PICES. A-line monitoring will continue to provide important data to understand the future ecosystem change related to the global change and contribute to the development of ocean science of the North Pacific.

PICES Science Board is honouring the A-line Monitoring Program with the 2013 PICES Ocean Monitoring Service Award for its contributions to understanding the past and future oceanography of the North Pacific. Congratulations!

### OP Endnote 6

#### *“Canada’s changing Pacific marine ecosystems: Forecasts, uncertainties, potential consequences, and communication”*

(Abstract of the keynote lecture by Dr. R. Ian Perry, Fisheries and Oceans Canada, Pacific Biological Station)

The theme for this 2013 PICES Annual Meeting is “communicating forecasts, uncertainty and consequences of ecosystem change”. This theme was chosen to feature the PICES integrating program *Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems* (FUTURE), and in particular to highlight its central question of “What is the future of the North Pacific given current and expected pressures?” The goal of this presentation is to propose how PICES may move forward with this theme and these issues, using examples largely (but not exclusively) from Canada and the NE Pacific.

Canadian marine waters provide good examples of these issues, since its marine ecosystems are different now than they were 50, even 25, years ago. This presentation illustrates how Canadian marine systems have changed, and discusses potential drivers for these changes including climate and human influences. Linking drivers and pressures to specific changes can be difficult, although approaches such as the Driver-Pressure-State-Impact-Response, pathways of effects, and Bayesian Network models show promise including, for some approaches, the explicit consideration of uncertainties. These approaches, along with statistical and simulation models and constructing alternative scenarios, can be used to project the drivers, pressures and ecosystem states into the future, from which the human and ecosystem consequences and implications can be evaluated and different management actions explored. Ultimately, these findings need to be communicated to inform scientific, policy, and public discussions of the decisions and trade-offs that will be required to attain desirable, or avoid undesirable, potential futures.

Communicating scientific findings is a core element of this meeting theme and of the FUTURE program. PICES has been very effective at communicating scientific knowledge and advances to other scientists, but perhaps less effective at communicating these advances to decision-makers and the public. Much has been learned recently about the psychology of communicating science, in particular from the issue of climate change. Key questions include communicating what, why, how, and to whom. But the first requirement is to ‘know your message’. Knowing your message includes understanding current conditions, how these may change in the future (forecasts), their uncertainties, and the potential consequences of current and future conditions. The Canadian Science Advisory process provides one example of how Canada develops scientific knowledge on marine issues and then integrates that knowledge into public discussions and decision-making. The ultimate goal of these Canadian activities, and of the PICES FUTURE program, is to ensure a North Pacific that is productive and resilient to the pressures and uncertainties of a changing world.

## Report of the Finance and Administration Committee

The Finance and Administration (hereafter F&A) Committee met from 09:00–13:30 hours on October 16, 2013, and from 09:00 to 11:30 on October 17, 2013, under the chairmanship of Dr. John Stein.

### AGENDA ITEM 1

#### **Opening remarks**

The Chairman called the meeting to order, welcomed the participants and requested an introduction of members for each delegation. All Contracting Parties, except the United States, were present at the meeting (*F&A Endnote 1*). The US members could not attend because of the partial US federal government shutdown.

### AGENDA ITEM 2

#### **Adoption of agenda**

The Committee reviewed and approved the provisional agenda without modification (*F&A Endnote 2*). Canada suggested having preliminary discussion on PICES Staff Rule 39, and it was added to the Agenda Item 14.

### AGENDA ITEM 3

#### **Audited accounts for FY 2011**

Following Council's Decision 2012/A/1(ii), a 3-year contract was signed with Chartered Accountants *Hale & Hughesman* (formerly *Flader, Hale & Hughesman*) for performing the external audits for FYs 2012–2014.

The FY 2012 financial statements were submitted to the auditor on March 26, 2012. The report (*F&A Endnote 3*) was electronically circulated to all Contracting Parties on April 30, 2013. In the auditor's opinion, "*the financial statements present fairly, in all material respects, the financial position of the North Pacific Marine Science Organization as at December 31, 2012, and the results of its operations and changes in fund balances for the year then ended*". The Committee noted that the auditing process was in line with the PICES Financial Regulations (*Regulation 11(ii)* and *Regulation 13*) and recommended that the Auditor's Report be approved by Governing Council (hereafter Council).

### AGENDA ITEM 4

#### **Annual contributions**

As stated in *Regulation 5(ii)* of the PICES Financial Regulations, all national contributions to PICES "*shall be considered due as of the first day of the financial year (January 1) to which they relate*". A request for payment of the 2013 annual fees was sent to all Contracting Parties on November 1, 2012. Council directed (Decision 2012/A/2(ii)) the Executive Secretary to send a letter to the Contracting Parties about the need for timely payment of annual contributions, which was sent on November 30, 2012. The Executive Secretary reported that all Contracting Parties had met their financial obligation for FY 2013. Japan and the United States paid prior to, and Canada immediately after, the due date. The Russian contribution arrived in mid-April, the Korean contribution was received in mid-May, and the Chinese contribution on October 11 (*F&A Endnote 4*). The Committee recommends that Council re-iterate the importance for all Contracting Parties to pay the Annual Fee by the January 1 deadline.

An historical analysis of annual contributions indicates that the total General Fund continues to grow faster than these contributions. In the 18 years from 1996 (when the number of Contracting Parties increased to the current six) to 2013, annual contributions have increased by approximately 44.8%. At the same time, the total

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General Fund has increased by about 67.1% because additional income has allowed a significant transfer from the Working Capital Fund to the General Fund every year since 1999. The practice of transferring surpluses from the Working Capital Fund [*Regulation 6(v)*] is a viable approach to balance accounts, although the Organization has come to depend on this additional income. However, the F&A Committee recommends that Council consider an increase in the annual fee to keep pace with the increase in PICES science activities, such as the the PICES integrative science program, FUTURE (*Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems*). To inform this consideration the Committee recommends that Council instruct the F&A Chairman and Executive Secretary to develop and present at PICES-2014 appropriate metrics to characterize the growth in science activities, as well as the formula for determining the size of the increase in annual contributions and to develop alternative approaches (incremental or one time) for the increase.

The Committee confirmed its previous recommendation that for planning purposes, Contracting Parties should continue to use the guideline generally accepted at PICES-1999 (Decision 1999/A/2(ii)), which states that “*the annual contributions will increase at the rate of inflation in Canada*”. This should assist Contracting Parties in preparing timely funding requests to cover annual contributions, and assist the Executive Secretary in developing future budgets. As the Committee discussed and recommended in 2011, the method for computing the Consumer Price Index (CPI) is to use the average of the monthly values from July of the previous year to June of the current year for determining the rate of increase in the future.

### AGENDA ITEM 5

#### **Fund-raising activities**

Annual contributions increasing only at the rate of inflation in Canada can impede improvement and development of the Organization. Therefore, fund-raising continues to be an important component of PICES activities. All types of contributions, monetary and “in-kind”, are equally valuable to PICES.

The Executive Secretary reported on fund-raising efforts for the period since PICES-2012 (*F&A Endnote 5*).

With respect to the North Pacific Continuous Plankton Recorder (NP CPR) survey, it was noted that the *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) and Japan Society for Promotion of Science (JSPS) extended their participation in the PICES CPR Consortium until 2016, with the same level of funding as for 2009–2013. The next critical renewals are those of Canada’s Department of Fisheries and Oceans (DFO) and the North Pacific Research Board (NPRB). The DFO, a member of the consortium since 2008, provided \$50,000 for the period from April 1, 2013 to March 31, 2014. A contribution at this same level is expected to continue for several more years. The PICES pre-proposal for the NP CPR survey was selected as one of six pre-proposals to go forward as full proposals for the Long-Term Monitoring Program to be funded by NPRB for the period 2014–2018.

At PICES-2010, the F&A Committee recommended that an annual report on the NP CPR survey be presented so that the achievements and benefits of the program would be more apparent to Contracting Parties as they seek to obtain continued funding for this activity. Dr. Nick Owens, Director of the Sir Alister Hardy Foundation for Ocean Science (SAHFOS), reported on progress of the program, initiatives for expanding or improving the CPR network, and the status of fund raising to encourage involvement of Contracting Parties who are not currently supporting the project.

The level of external funding to PICES has increased significantly over the last several years. For 2010–2012, the amount of funds from voluntary contributions, grants and partnerships for various activities initiated or sponsored by PICES exceeded the total annual contribution by Contracting Parties, indicating the Organization’s large dependence on outside funding offers, most of which have specific product and service requirements. However, the level of external funding in 2013 is expected to be more than 50% less than in

2012. This reflects the volatility in external funding and the risk to the Organization of being too dependent on this type of income to support PICES scientific activities and operations.

The Executive Secretary summarized voluntary contributions and grants provided for various activities of PICES by ministries, agencies and organizations of Contracting Parties for the period from 2002–2013. The Committee discussed certain patterns in fund-raising evident from a country-based or project-based summary. Several of the Contracting Parties expressed interest in specific fund raising. China is looking for an opportunity to support the 2014 FUTURE OSM and 2017 PICES/ICES Early Career Scientist Conference; Korea is planning to redirect the funds (approximately \$20,000) currently supporting the Administrative Assistant for the Science Board Chairman to other important activities in PICES; and Canada is exploring mechanisms for providing support for the incoming Science Board Chairman.

#### AGENDA ITEM 6

##### **Encumbered funds**

The Executive Secretary provided information on the amount of funds in the Working Capital Fund restricted for specific purposes (encumbered funds) at the beginning of *FY* 2013, and the estimated amount of the encumbered funds for the fiscal year end.

#### AGENDA ITEM 7

##### **Financing of high priority PICES projects**

The F&A Committee reviewed activities proposed under high priority PICES initiatives for 2014 and had some discussion about the financial needs of FUTURE. Considering the number of activities identified by the FUTURE roadmap and that will likely emerge from the FUTURE Open Science Meeting (OSM) to be held next year, the Committee recommends that funds available from the completed projects in the Working Capital Fund as of December 31, 2013, be allocated for this Program.

In February-March 2013, following the request by Council (Decision 2012/S/1(ii)), the Executive Secretary sent letters to all Contracting Parties providing information on planned activities for FUTURE and requesting contributions to these activities, and particularly for the 2014 FUTURE OSM. The only response came from China confirming that the State Oceanic Administration will provide \$15,000 for the meeting. The Committee commended China, and recommends that Council instruct the Executive Secretary to send a new letter to the Contracting Parties requesting contributions to FUTURE.

Capacity-building activities that might require funding support for 2014 were mentioned. In addition, the Committee reviewed the current status of the Intern Program. Korea indicated that they may not be able to contribute to the Intern Program in 2013 because of their commitment to hosting PICES-2014. The Committee recommends that Council request the Executive Secretary to invite Contracting Parties to provide voluntary contributions to the Trust Fund to support the Intern Program in 2014 and beyond.

#### AGENDA ITEM 8

##### **PICES Visiting Scientist Program**

At PICES-2001, Council approved the PICES Visiting Scientist Program (Decision 2001/A/6), expecting that the Program will allow national agencies and other international science organizations to contribute “in-kind” toward achieving PICES goals, and will be an alternative way to enhance the ability of the Organization and the Secretariat to support the high priority projects and increasing work demand. However, the Program has been inactive since its inception.

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Following instructions from Council (Decision 2011/A/9(i)), the F&A Committee reviewed and revised the description of the Program, reflecting mostly the possibility of providing additional resources for developing FUTURE products and having scientists participate “virtually” by performing the work at their home institution/agency. At PICES-2012, Council approved the revised description of the [PICES Visiting Scientist Program](#) and instructed the Executive Secretary to send a letter to the Contracting Parties, requesting their proposals for contributions to the Program (Decision 2012/A/6). It was also expected that Science Board will suggest potential tasks for a visiting scientist.

In 2013, the Secretariat did not receive proposals from any national institution/agency or from other international science organization to second their experts for the Program, nor did the Secretariat receive recommendations from Science Board on important tasks for these experts. The F&A Committee further discussed the apparent lack of interest in the Visiting Program and determined that the description should be revised by adding a junior scientist category. Therefore, the Committee recommends that Council approve the following revision of the Program’s description. The Qualifications section would be adjusted by labelling the existing paragraph under Qualifications as ‘Senior Scientist:---‘. This would be followed by “Junior Scientist: *The scientist should be an early career Ph.D. scientist or a master’s level scientist with at least 2 years of experience and in either case has demonstrated scientific writing and oral communications skills in English. The particular qualifications will depend on tasks outlined for the collaborative project.*” The Committee also recommends that Council instruct the Science Board Chairman to review the Visiting Scientist Program at the 2014 inter-sessional Science Board meeting to insure that all Science Board members are aware of the Program and will work to identify tasks and potential candidate visiting scientists.

### AGENDA ITEM 9

#### **Schedule, structure and financing of future Annual Meetings**

The Executive Secretary reported that on May 25, 2013, Korea confirmed its willingness to host PICES-2014. The Korean delegation confirmed that planning is on track for hosting this Annual Meeting. The Committee recommends that Council accept the offer of Korea to host PICES-2014 from October 17–26, 2014, in Yeosu, and approve Korea’s request for \$40,000 to partially cover costs for this meeting.

The Chinese delegation suggested that China is hoping to host PICES-2015, but formal negotiations among the agencies involved are not completed. The Committee recommends that Council request an answer from China by December 1, 2013, regarding its ability to host PICES-2015. If China is unable to host PICES-2015 or provides no response by the due date, the Annual Meeting will be held at the seat of the Organization in Victoria, Canada (Article VI.3 of the PICES Convention).

In keeping with the 6-year rotation cycle (Decision 1994/A/6), the United States (US) is expected to host the Annual Meeting in 2016. Earlier, the United States has indicated their intention to host PICES-2016; however, because the US delegate could not be present at the F&A Committee meeting due to the partial shutdown of the US federal government no update on the status of planning was available. The Executive Secretary should request the United States to confirm by March 31, 2014 that they will host PICES-2016.

The Committee reviewed various approaches to financing future PICES Annual Meetings, and recommends that Council task the F&A Chairman and Executive Secretary to present at PICES-2014 a comparison of the existing approach with an alternate approach to financing the annual meetings through annual contributions by each Contracting Party. In addition, a hybrid approach in which each Contracting Party could choose either the current approach or alternate annual contribution approach should be considered.

At PICES-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 2001/A/4(iv)). The Committee discussed the current registration fee structure and recommends keeping the same structure for PICES-2014 as for PICES-2010 through PICES-2013:



Type of registration fee	CDN \$
Regular	275
Early	200
Student	50
Spousal	50

At PICES-2009, Council adopted (Decision 2009/A/6(i)) the final report of the Study Group on *Restructuring of the PICES Annual Meeting* (SG-RAM). PICES-2012 and PICES-2013 were the first two meetings conducted in accordance with the entire suite of SG-RAM recommendations. The Committee recommends that Council discuss the effectiveness of the approved changes at this Annual Meeting.

At PICES-2005, 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 confirmed these views in 2013. Science Board has already indicated the importance of having an inter-sessional meeting in 2014, to be held immediately after the FUTURE Open Science Meeting. The Committee supports this request and recommends it to Council for approval.

#### AGENDA ITEM 10

##### **The structure and staffing of the PICES Secretariat**

According to Goal 10 of the [PICES Strategic Plan](#), “An effective Secretariat that supports the mission and goals of the Organization is essential to its success”. At PICES-2012, Council agreed to consider a complex of issues related to the structure and staffing of the Secretariat at PICES-2013 and, in preparation for this discussion, directed the F&A Chairman to work with the Executive Secretary to (1) prepare position descriptions for both the Executive Secretary and the Deputy Executive Secretary, (2) develop the process and timeline for staffing the Deputy Executive Secretary position, and (3) review the organizational structure and salary budget of the Secretariat (Decision 2012/A/12(ii)). As a preview to the F&A Chairman’s presentation of his report to Council it was presented to the Committee.

#### AGENDA ITEM 11

##### **Preparations for the Twenty-Fifth Anniversary of PICES**

At PICES-2012, Council approved the formation of a planning committee for the 25<sup>th</sup> anniversary of PICES (Decision 2012/A/5) consisting of the F&A Chairman, Science Board Chairman and Vice-Chairman, Executive Secretary, and a representative from each of the Contracting Parties. The planning committee, except for the F&A Chairman, met at PICES-2013 to discuss the development of the anniversary program, budget and fund-raising for this program and additional potential activities, such as dedicated surveys with research vessels arriving at the location of the Annual Meeting while the meeting is in progress. The F&A Committee recommends that Council consider and approve as guidance that each Contracting Party raises at least \$25,000 for the 25<sup>th</sup> Anniversary. Fund raising can be incremental and spread over the time between now and 2015. All Contracting Parties are encouraged to commence fund raising activities as early as possible. The Secretariat will create a separate encumbered fund for the 25<sup>th</sup> Anniversary to track contributions.

#### AGENDA ITEM 12

##### **Financial issues related to the Pension Plan for PICES employees**

At PICES-2010, the Committee received a report from the Executive Secretary about the deficiency in the pension funds for PICES employees and the recommendations of the International Fisheries Commissions

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(IFC) Pension Society for addressing these, and agreed that additional employer contributions to the IFC Pension Plan in 2010 and beyond be made in advance in order to reduce future payments. The Committee recommends that Council approve: (1) a lump sum employer contribution of \$20,000 to the IFC Pension Plan be made from the *FY* 2014 budget to pay down unfunded liabilities and (2) an additional lump sum payment (up to \$25,000) be paid to the IFC Pension Plan, if there is a *FY* 2013 surplus in the General Fund as determined by the Auditor's Report for 2013.

### AGENDA ITEM 13

#### **Budget**

##### Estimated accounts for *FY* 2013 (Agenda Item 13a)

The Committee reviewed the estimated accounts for *FY* 2013 and recommends their acceptance by Council, noting that the expenses for "foreign exchange loss/gain" are only estimates at this time.

##### Interest and other income (Agenda Item 13b)

In *FY* 2012, the total income was \$917,553. This amount includes \$688,185 in voluntary contributions and grants (\$652,130 credited to the Working Capital Fund, \$32,097 credited to the Trust Fund and \$3,958 credited to the Megrey Student Fund).

In *FY* 2013, the estimated total income is \$470,117. This amount includes \$256,195 in voluntary contributions and grants (\$193,364 credited to the Working Capital Fund and \$59,731 credited to the Trust Fund).

##### Relocation and Home Leave Fund (Agenda Item 13c)

At PICES-2007, Council approved the recommendation that the level of the Relocation and Home Leave Fund be allowed to fluctuate between \$90,000 and \$110,000, to minimize the need for small transfers between funds (Decision 2007/A/3(iii)). The F&A Committee recommends that Council approve a transfer from the Working Capital Fund to the Relocation and Home Leave Fund in order to bring the Relocation and Home Leave Fund to \$110,000.

##### Trust Fund (Agenda Item 13d)

In *FY* 2013, the total Trust Fund income is estimated at \$63,554 and estimated expenses are \$85,655. The Committee recommended that Council approve a transfer from the Working Capital Fund to the Trust Fund to recover the 2013 expenses and restore the Trust Fund to the level of \$110,000.

##### Japanese Trust Fund (Agenda Item 13e)

The Executive Secretary presented the report on the 2012–2017 PICES/MAFF project on "*Marine ecosystem health and human well-being*". The progress report and the financial report for *Year 1* (April 1, 2012 – March 31, 2013) were submitted to the Fisheries Agency of Japan (JFA) on July 22, 2013. The set of documents requesting funding for *Year 2* (April 1, 2013 – March 31, 2014) was directed to the Consulate General of Japan in Vancouver (Canada) on July 23, 2013, and, following instructions from JFA, the revised version of the document titled "*Year 2 workplan and budget*" was re-sent on August 8, 2013. Funds in the amount of \$130,036 were transferred to the PICES/MAFF bank account on September 20.

The status of the MAFF account, for the period from April 1 to December 31, 2012, was assessed during the regular PICES audit for *FY* 2012. The financial statements for the rest of *Year 1* of the MAFF project (January 1 to March 31, 2013) and for the part of *Year 2* (from April 1 to December 31, 2013) will be evaluated during the regular PICES audit for *FY* 2013.

##### Working Capital Fund (Agenda Item 13f)

After all approved inter-fund transfers, the amount of funds available in the Working Capital Fund (WCF) on January 1, 2013, was \$934,749. This included \$581,213 in encumbered funds and \$353,536 in "operating"

funds. In *FY* 2013, the total WCF income and expenses are estimated at a level of \$404,963 (\$193,364 are in extra-budgetary contributions and grants) and \$535,625, respectively. After the recommended inter-fund transfers, the amount of funds available in WCF at the fiscal year end is estimated at \$650,986. This includes \$281,881 in encumbered funds, and \$369,105 in “reserve operating” funds.

Budget for *FY* 2014 and forecast budget for *FY* 2015 (Agenda Item 13g)

The Committee reviewed the proposed *FY* 2014 budget of \$875,000 (*F&A Endnote 6*) and recommends its approval by Council. The amount of \$131,000 will be transferred from the Working Capital Fund to balance the budget, setting the total annual contribution at \$744,000, and the 2014 annual fee at \$124,000 per Contracting Party. The annual fee increase is a 0.96% increase from the *FY* 2013 level and the increase is based on the monthly average CPI from July 2012 to June 2013 reported by Statistics of Canada.

The Executive Secretary presented the forecast *FY* 2015 budget of \$887,000 and noted that this budget is prepared based on preliminary information available as of August 15, 2012, and is approximately 2.0% higher than the *FY* 2013 budget.

AGENDA ITEM 14

**PICES Rules of Procedure, Financial Regulations and Chairman’s Handbook**

The circumstances of the partial US federal government shutdown highlighted the need to review the section on the F&A Committee in the PICES Rules of Procedure, because there is currently no option for appointing an interim F&A Chairman if the sitting Chairman cannot attend an Annual Meeting. To rectify this situation the Committee recommends that Council approve the following revision to *Rule 19(iii)*. Preceding the last sentence of 19(iii) add the following: “*If the Chairman of the Finance and Administration Committee cannot attend an annual meeting, for any reason, then the Chairman of the Council will appoint an alternate to serve as interim Chairman of the Finance and Administration Committee.*”

AGENDA ITEM 15

**F&A Committee Action Plan**

The [PICES Strategic Plan](#) approved at PICES-2011 (Decision 2011/A/4(i)) mandates the preparation of 3-year Action Plans not only by Scientific and Technical Committees, but also by Executive Committees (F&A Committee and Science Board). These Action Plans are to describe specific actions and tasks needed to achieve the goals identified in the Strategic Plan. The Committee reviewed the [F&A Committee Action Plan for 2012–2015](#) approved at PICES-2012, and determined that the plan does not need to be revised.

AGENDA ITEM 16

**Administrative matters**

The Committee discussed the progress on the status of negotiations regarding the possibility of obtaining an *ex gratia grant* from the British Columbia government to PICES equal to the amount of the provincial personal income taxes remitted, and encouraged the Executive Secretary to continue his efforts to request this tax rebate. The Executive Secretary requested assistance from Canadian members of Council to facilitate the process for the coming year.

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) hosts the PICES Secretariat at the Institute of Ocean Sciences (IOS) in Sidney, British Columbia, Canada. The Executive Secretary provided a report on current arrangements between PICES and DFO/IOS and local companies on general administrative services. There appears to be no change in the arrangements at this time.

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### AGENDA ITEM 17

#### **Other business**

There were no additional matters requiring the attention of the F&A Committee.

### AGENDA ITEM 18

#### **Adoption of the F&A report and recommendations to Governing Council**

A set of recommendations was circulated and approved by all F&A members. The F&A report was brought forward by Dr. Stein at the first session of Council on October 19, 2013.

**F&A Endnote 1****2013 F&A participation list**Canada

Robin Brown (F&amp;A member)

Darlene Smith (advisor)

Japan

Hiroyuki Shimada (F&amp;A member)

Akihiko Yatsu (advisor)

People's Republic of China

Ying Jing (advisor)

Jilong Li (alternate)

Gongke Tan (advisor)

Rui Zheng (alternate)

Republic of Korea

Chul Park (F&amp;A member)

Naesun Park (advisor)

Gidong Yeo (advisor)

Russian Federation

Igor Shevchenko (F&amp;A member)

U.S.A.

None

Other

John Stein (F&amp;A Chairman)

Laura Richards (PICES Chairman)

Alexander Bychkov (Executive Secretary)

Sonia Batten (SAHFOS) – for Agenda Item 5 only

Nick Owens (SAHFOS) – for Agenda Item 5 only

**F&A Endnote 2****2013 F&A Committee meeting agenda**

1. Welcome and opening remarks
2. Adoption of agenda and meeting procedures
3. Audited accounts for *FY* 2012
4. Annual contributions
5. Fund-raising activities
6. Encumbered funds for PICES activities
7. Financing of PICES high priority activities
8. PICES Visiting Scientist Program
9. Schedule, structure and financing of future Annual Meetings
10. The structure and staffing of the PICES Secretariat
  - a. Structure and salary budget of the Secretariat
  - b. Staffing of the Deputy Executive Secretary position
  - c. Process and timeline for staffing the Executive Secretary position
11. Report and recommendations of the Planning Committee for the 25<sup>th</sup> Anniversary of PICES
12. Financial issues related to the Pension Plan for PICES employees
13. Budget
  - a. Estimated accounts for *FY* 2013
  - b. Interest and other income
  - c. Relocation and Home Leave Fund
  - d. Trust Fund
  - e. Japanese Trust Fund
  - f. Working Capital Fund
  - g. Proposed budget for *FY* 2014 and forecast budget estimates for *FY* 2015
14. PICES Rules of Procedure, Financial Regulations and Chairman's Handbook
15. F&A Action Plan
16. Administrative matters
17. Other business
18. 2013 F&A report and recommendations to Governing Council

## F&amp;A Endnote 4

Payment schedule of annual fees, 2005–2013<sup>1</sup>

	<i>Canada</i>	<i>China</i>	<i>Japan</i>	<i>Korea</i>	<i>Russia</i>	<i>USA</i>
2005	Dec. 24, 04	<b>Sept. 22, 05<sup>2</sup></b>	Mar. 2, 05	Mar. 30, 05	<b>Mar. 31, 05<sup>3</sup></b>	Jan. 10, 05
2006	Dec. 28, 05	<b>Aug. 1, 06</b>	Dec. 15, 05	Feb. 8, 06	Feb. 28, 06	Jan. 30, 06
2007	Jan. 23, 07	<b>July 3, 07</b>	Dec. 5, 06	Apr. 3, 07	Feb. 13, 07	Jan. 10, 07
2008	Jan. 16, 08	<b>May 15, 08</b>	Dec. 20, 07	Feb. 15, 08	Feb. 13, 08	<b>Jan. 7, 08<sup>4</sup></b>
2009	Jan. 5, 09	<b>June 3, 09</b>	Dec. 11, 08	Apr. 1, 09	Mar. 27, 09	Dec. 24, 08
2010	Apr. 1, 10	<b>Aug. 5, 10</b>	Dec. 14, 09	Mar. 2, 10	Mar. 26, 10	Dec. 11, 09
2011	Feb. 8, 11	<b>June 30, 11</b>	Dec. 3, 10	<b>Mar. 25, 11<sup>5</sup></b>	Feb. 9, 11	Dec. 7, 10
2012	Jan. 3, 12	<b>Aug. 31, 12</b>	Nov. 22, 11	<b>Oct. 11, 12</b>	Mar. 29, 12	Nov. 16, 11
2013	Jan. 7, 13	<b>Oct. 11, 13</b>	Nov. 21, 12	<b>May 14, 13</b>	<b>Apr. 12, 13</b>	Dec. 17, 12

<sup>1</sup> Late (after March 31) or partial payments are indicated in bold

<sup>2</sup> Partial (86%) payment, remainder paid December 30, 2005

<sup>3</sup> Partial (96.6%) payment, remainder paid April 25, 2005

<sup>4</sup> Partial (92.3%) payment, remainder paid on May 22, 2009

<sup>5</sup> Partial (88.1%) payment, remainder paid on September 20, 2011

## F&amp;A Endnote 5

## External funding and voluntary contributions received since PICES-2011

For the period since PICES-2012, the following external funding and voluntary contributions were provided or committed for various activities of the Organization:

Special projects

- In December 2011, the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan (JFA), approved funding for a 5-year (April 1, 2012 – March 31, 2017) PICES project on “*Marine ecosystem health and human well-being*”. The goal of this project is to identify the relationships between sustainable human communities and productive marine ecosystems in the North Pacific, under the concept of fishery social-ecological systems. The budget allocated for *Year 2* (April 1, 2013 – March 31, 2014) of the project is \$130,036.
- Recognizing the Continuous Plankton Recorder (CPR) data as the only long-term biological indicator of global change on the scale of the North Pacific, PICES has endorsed the North Pacific CPR (NP CPR) survey in 1999 and, since 2008, manages the funding consortium that supports this regional activity. PICES also maintains, under its Technical Committee on Monitoring (MONITOR), an Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* (AP-CPR) comprising scientists representing each Contracting Party (Dr. Sonia Batten, project PI, is an *ex-officio* member of the Panel representing SAHFOS). The Panel meets annually to contribute advice and oversee the project; AP-CPR reports are available at [http://www.pices.int/members/advisory\\_panels/cpr.aspx](http://www.pices.int/members/advisory_panels/cpr.aspx). The following 5 agencies have committed their resources for the project:
  - The Department of Fisheries and Oceans (Canada), a member of the consortium since 2008, provided \$50,000 for the period from April 1, 2013 to March 31, 2014. The contribution at the same level is expected to continue for several more years.
  - The North Pacific Research Board (USA) joined the consortium in 2009 and committed \$50,000 US per year for 5 years (until May 31, 2014) to support operations of the project. A pre-proposal titled “*The North Pacific Continuous Plankton Recorder Survey*” has been submitted for the Long-term

Monitoring Program to be funded by NPRB in 2014–2018. On September 30, PICES was invited (among 6 of 36 proponents) to submit a full proposal by February 14, 2014.

- The Exxon Valdez Oil Spill Trustee Council (EVOSTC) provided \$188,600 US for operations of the NP CPR project in 2010–2012, and report writing in 2013 (project on “*Measuring inter-annual variability in the herring’s forage base from the Gulf of Alaska*”). A new project on “*Long-term monitoring of zooplankton populations on the Alaskan Shelf and Gulf of Alaska using Continuous Plankton Recorders*” was approved as a part of a Long Term Monitoring Program of EVOSTC for 2013–2016, with the amount of \$61,300 US for 2013. Funding in subsequent years will be incremented slightly for cost of living increases.
- The Japanese Society for Promotion of Science (JSPS) awarded a grant (2009–2017) for CPR work to Dr. Sanae Chiba (JAMSTEC). While funds are not passed to the PICES consortium, this project provides in-kind support by taking over the analysis of samples from the western Pacific and is equivalent to a financial contribution of about \$37,500 US per year.
- The CPR parent organization, the Sir Alister Hardy Foundation for Ocean Science (SAHFOS, UK), contributes the remaining funds required to operate the survey at its current level.

#### Symposia/sessions/workshops

- The State Oceanic Administration (China) hosted the workshop on “*Radionuclide science and environmental quality of radiation in the North Pacific*” (March 14–15, 2013, Xiamen, China) and covered on-site expenses (accommodation and meals) for all members of the Study Group on *Radionuclide Science in the North Pacific Ocean*.
- The Federal Agency for Fisheries and Pacific Research Institute of Fisheries and Oceanography (Russia) hosted the inter-session Science Board meeting (May 20–21, 2013, St. Petersburg, Russia).
- ICES provided \$5,068 for the FUTURE-related workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” (May 22–24, 2013, St. Petersburg, Russia).
- Several international and national organizations/programs were invited, and subsequently agreed, to co-sponsor (by covering travel of additional invited speakers and/or convenors for these events) the following scientific sessions and workshops to be held at PICES-2013 (October 11–20, 2013, Nanaimo, Canada): “*The changing carbon cycle of North Pacific continental shelves and marginal seas*” (SOLAS), “*Marine ecosystem services and the contribution from marine ecosystems to the economy and human well-being*” (IMBER), “*Banking on recruitment curves; returns on intellectual investment*” (ISC), “*Comparison of size-based and species based ecosystem models*” and “*Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future*” (ICES), and “*Tools, approaches and challenges for accessing and integrating distributed datasets*” (IODE).
- The State Oceanic Administration (China) committed \$15,000 for the 2014 FUTURE Open Science Meeting (April 14–18, 2014, Kohala Coast, Hawaii, USA).

#### Capacity building

- Several contributions were received/committed for the Trust Fund in support of the PICES Intern Program:
  - Department of Fisheries and Oceans, Canada – \$10,000;
  - Korea Institute of Ocean Science and Technology, Korea – \$5,000 US;
  - National Marine Fisheries Service of NOAA, USA – \$23,219 (\$11,219 from the 2012/2013 grant and \$12,200 from the 2013/2014 grant);
- The following organizations/programs provided funding for the 2013 PICES Summer School on “*Ocean observing systems and ecosystem monitoring*” (August 19–23, 2013, Newport, Oregon, USA):
  - National Science Foundation (USA) ~ \$33,500 US (a grant to the US national delegate through the Oregon State University)
  - Ocean Observatories Initiatives and Hatfield Marine Science Center ~\$11,000 US (through the Oregon State University)
  - North Pacific Research Board (USA) –\$5,000 US;
  - Scientific Committee on Oceanic Research (SCOR) – \$4,900 US
  - Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) – \$2,850 US
  - Surface Ocean Lower Atmosphere Study (SOLAS) – \$2,800 US;

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- SCOR provided a grant of \$5,000 US to support participation of scientists from countries with “economies in transition” in SCOR-relevant sessions and/or workshops at PICES-2013.

### Operations of the PICES Secretariat

- The Korea Institute of Ocean Science and Technology contributed \$20,000 US to support a part-time contract position at the PICES Secretariat to assist the Science Board Chairman.
- An overhead of \$16,905 of the *Year 2* budget for the PICES/MAFF project on “*Marine ecosystem health and human well-being*” was retained to offset expenses related to the Secretariat’s involvement in the project.
- An overhead of \$25,194 of the US contribution related to the World Ocean Assessment was retained to offset expenses related to the Secretariat’s involvement in the project.



F&A Endnote 6

PROPOSED FY 2014 BUDGET

Sources for General Fund (GNF)		Amount
National contributions		744,000
Transfer from Working Capital Fund	(\$124,000 per Contracting Party)	131,000
<b>Total</b>		<b>875,000</b>

Category	GNF Allotment	WCF Allotments
Personnel Services	570,000	benefit adjustments and additional contribution to the IFC Pension Plan
Annual Meeting	40,000	registration fee revenue as needed/available
Special Meetings/Travel	180,000	encumbered funds as needed/available
Publications/Communications	58,000	
Office/Administrative	27,000	encumbered funds as needed/available
Projects		
<b>Total</b>	<b>875,000</b>	

Estimated interest and other income		169,000
Net income tax levies		70,000
Tax (GST, PST) rebate		10,000
Interest		10,000
Registration fees for PICES-2014		65,000
Overhead from the PICES/MAFF project		14,000

## **GC Appendix A**

### **2013 Governing Council decisions**

#### **2013/A/1: Auditor**

Council accepted the audited accounts for *FY* 2012.

#### **2013/A/2: Annual contributions**

- i. Council re-iterated that for planning of their funding requests for annual contributions, Contracting Parties should continue to use the guideline generally accepted at PICES-1999 (Decision 1999/A/2(ii)), which states that the annual contributions will increase at the rate of inflation in Canada.
- ii. Council instructed the Executive Secretary to send a letter to the Contracting Parties indicating the need for timely payment of the annual contribution and describing the difficulties that late and/or partial payment causes the Organization.
- iii. Council requested the F&A Chairman and Executive Secretary to develop and present at PICES-2014 appropriate metrics to characterize the increase in science activities of the Organization, as well as the formula for determining the size of the potential increase in annual contributions and to develop alternative approaches (incremental or one time) for the increase.

#### **2013/A/3: Budgetary considerations**

- i. Council accepted the estimated accounts for *FY* 2013, noting that the expenses for “foreign exchange loss” are only estimated at this time.
- ii. Council approved the *FY* 2014 budget of \$875,000. The amount of \$131,000 will be transferred from the Working Capital Fund to balance the budget, setting the total annual contribution at \$744,000, and the 2014 annual contribution at \$124,000 per Contracting Party.
- iii. Council approved a transfer from the Working Capital Fund to the Relocation and Home Leave Fund in order to bring the balance of the Relocation and Home Leave Fund to \$110,000.
- iv. Council approved a transfer from the Working Capital Fund to the Trust Fund to recover the 2013 expenses and restore the Trust Fund to the level of \$110,000.
- v. Council agreed to allocate funds available from the completed projects in the Working Capital Fund as of December 31, 2013, for the development of the PICES integrative science program “*Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems*” (FUTURE). Council also instructed the Executive Secretary to send a letter to the Contracting Parties providing information on planned activities for FUTURE and requesting contributions to these activities, particularly to the 2014 FUTURE Open Science Meeting (OSM). This letter should include a comment encouraging Council members to participate in the OSM and follow-up inter-sessional Science Board meeting.
- vi. Council approved a lump sum employer contribution of \$20,000 from the *FY* 2013 budget to the International Fisheries Commission (IFC) Pension Plan to pay down unfunded liabilities. An additional lump sum payment (up to \$25,000) will be paid to the IFC Pension Plan, if there is a *FY* 2013 surplus in the General Fund as determined by the Auditor’s Report for 2013.

#### **2013/A/4: Future PICES Annual Meetings and 2014 inter-sessional Science Board meeting**

- i. Council accepted the offer of Korea to host PICES-2014 from October 17–26, 2014, in Yeosu, and approved Korea’s request for \$40,000 to partially cover costs for this meeting. The theme for PICES-2014 will be “*Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*”.
- ii. Council requested an answer from China by December 1, 2013, regarding its ability to host PICES-2015. If China is unable to host PICES-2015 or provides no response by the due date, the Annual Meeting will be held at the seat of the Organization in Victoria, Canada, as directed by Article VI.3 of the PICES Convention.
- iii. Council requested the United States to confirm by March 31, 2014 their intention to host PICES-2016.
- iv. Council tasked the F&A Chairman and Executive Secretary to present at PICES-2014 a comparison of the existing approach with an alternate approach to financing the Annual Meetings through supplemental

annual contributions by each Contracting Party. In addition, a hybrid approach in which each Contracting Party could choose either the current approach or supplemental annual contributions should be considered.

- v. Council agreed to keep the same registration fee structure for PICES-2014 as for PICES-2010 through PICES-2013:

Type of registration fee	CDN \$
Regular	275
Early	200
Student	50
Spousal/guest	50

- vi. Council approved an inter-sessional Science Board meeting (ISB-2014) to be held immediately after the FUTURE Open Science Meeting (April 14–18, Kohala Coast, Big Island, Hawaii, U.S.A.).

#### **2013/A/5: Twenty-Fifth Anniversary of PICES**

- i. Council approved as guidance that each Contracting Party raise at least \$25,000 for the 25<sup>th</sup> Anniversary of the Organization. Fund raising can be incremental and spread over the time between now and 2015. All Contracting Parties are encouraged to commence fund raising activities as early as possible. The Executive Secretary was instructed to create a separate encumbered fund for the 25<sup>th</sup> Anniversary to track contributions.
- ii. Council requested Canada to appoint a member to the Anniversary Planning Committee.

#### **2013/A/6: PICES Visiting Scientist Program**

- i. Council approved revision of the description of the Visiting Scientist Program to include two categories (junior and senior) of visiting scientist (see *GC Appendix B*).
- ii. Council instructed the Science Board Chairman to review the Visiting Scientist Program at ISB-2014 to insure all Science Board members are aware of the Program and will work to identify tasks and potential candidate visiting scientists.

#### **2013/A/7: PICES Intern Program**

- i. Considering funding currently available for the Intern Program and stated intentions for contributions by Contracting Parties, Council agreed to initiate the process to obtain the 2014 intern, with the understanding that the intern's term will start in June 2014. Following the existing rotation cycle, Russia was requested to nominate the intern by December 31, 2013.
- ii. Council instructed the Executive Secretary to invite Contracting Parties to provide voluntary contributions to the Trust Fund to support the Intern Program in 2014 and beyond.
- iii. Council tasked the Executive Secretary to present at PICES-2014 a summary report on the implementation of the Intern Program since its inception in 2000, including information on the current status of former interns as a measure of the Program value.

#### **2013/A/8: Amendment to Rules of Procedure**

- i. Council approved the revision to Rule 19 (iii). Preceding the last sentence of 19(iii) add the following: "If the Chairman of the Finance and Administration Committee cannot attend an annual meeting, for any reason, then the Chairman of the Council will appoint an alternate to serve as interim Chairman of the Finance and Administration Committee."
- ii. Council approved the revision to Definition of Terms related to *ex-officio* members: "An *ex-officio* member is a person from a non-Contracting Party or an international organization formally appointed annually to a group by the Council on the basis of their expertise."

#### **2013/A/9: Improvement of participation in PICES activities**

- i. In order to better assess problems existing in Contracting Parties with the participation of their scientists in the activities of the Standing Committees and their subsidiary bodies, and in the Annual Meetings of the Organization, Council requested the Executive Secretary to continue regularly preparing and circulating to Contracting Parties information on participation of their scientists in the Annual Meetings.

- ii. Council re-iterated the necessity for Contracting Parties to: (1) regularly review their national membership, and to provide the updated national membership list to the Secretariat by the first day of the calendar year (January 1), and (2) follow up on *Rule 1(ii)* of the PICES Rules of Procedure in providing the national delegation list for Annual Meetings.

#### **2013/A/10: World Ocean Assessment (UN Regular Process for Global Reporting and Assessment of the State of the Marine Environment)**

Council re-iterated the importance of facilitating the conduct of the World Ocean Assessment and instructed the Executive Secretary to send a request to Contracting Parties to ensure that appropriate experts are nominated to the *Pool of Experts*, the body from which the *Group of Experts* will select authors and reviewers of the first World Ocean Assessment.

#### **2013/A/11: Arctic-based activities**

Council requested Contracting Parties to send comments on PICES participation in Arctic-based activities to the Executive Secretary by December 31, 2013, to allow a more informed discussion on this issue at PICES-2014.

#### **2013/A/12: Staffing the PICES Executive Secretary position**

- i. Council approved the position announcement for the PICES Executive Secretary (*GC Appendix B*);
- ii. Council agreed to form a committee with one member from each Contracting Party to participate in staffing the PICES Executive Secretary position. The PICES Chairman will retain overall responsibility for the process, but committee members will: (a) provide advice to the Chairman at each stage of the staffing process, (b) participate in selecting a short list of candidates to be interviewed, and (3) participate in the interviews with candidates on the short list to be scheduled in Yeosu, Korea, just prior to the opening of PICES-2014.

#### **2013/S/1: 2014 PICES Annual Meeting**

- i. The following scientific sessions are to be convened at PICES-2014:
  - ¾-day Science Board Symposium on “*Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*”;
  - ½-day BIO Contributed Paper Session;
  - ½-day BIO Topic Session on “*Strengths and limitations of habitat modeling: Techniques, data sources, and predictive capabilities*”;
  - 1-day BIO/MEQ Topic Session on “*Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystems*”;
  - ½-day BIO/MONITOR/TCODE Topic Session on “*Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries*”;
  - ½-day FIS Contributed Paper Session;
  - ½-day FIS Topic Session on “*Ecosystem considerations in fishery management of cod and other important demersal species*”;
  - ½-day FIS/FUTURE Topic Session on “*Climate change impacts on spatial distributions of marine fish and shellfish*”;
  - 1-day FIS/TCODE/FUTURE Topic Session on “*Recent assessments of climate change impacts on marine ecosystems*”;
  - ½-day MEQ Contributed Paper Session;
  - ½-day MEQ Topic Session on “*Marine debris in the Pacific Ocean: Source, transport, fate and effects of macro- and micro-plastics*”;
  - ½-day POC Contributed Paper Session;
  - 1-day POC/MONITOR Topic Session on “*Variability in advection and its biological consequences for Subarctic and Arctic ecosystems*”;
  - 1-day POC/TCODE/FUTURE Topic Session on “*Regional climate modeling in the North Pacific*”;
  - ½-day MarWeb Topic Session on “*Ecological and human social analyses and issues relating to Integrated Multi Trophic Aquaculture*”.

- ii. The following workshops are to be convened at PICES-2014:
- 2-day FIS Workshop on “*Dynamics of pelagic fish in the North Pacific under climate change*” (co-sponsored by ISC);
  - 1-day FIS Workshop on “*Towards improved understanding of linkages between Pacific salmon and their marine ecosystems*” (co-sponsored by NPAFC);
  - 1-day MEQ Workshop on “*Mitigation of harmful algal blooms: Novel approaches to a decades long problem affecting the viability of natural and aquaculture fisheries*”;
  - 1½-day MONITOR Workshop on “*Networking ocean observatories around the North Pacific Ocean*” (co-sponsored by Ocean Network Canada and U.S. CLIVAR);
  - ½-day POC Workshop on “*SOLAS into the Future: Designing the next phase of the Surface Ocean-Lower Atmosphere Study within the context of the Future Earth Program*” (co-sponsored by SOLAS);
  - 1-day TCODE Workshop on “*Tools, approaches and challenges for accessing and integrating distributed datasets*”;
  - 1-day Science Board Workshop on “*Marine ecosystem services*” (this workshop might be held inter-sessionally with support from the State Oceanic Administration, China).
- iii. The following business meetings are to be held at PICES-2014:
- ¼-day Science Board (SB) meeting (October 19) and 1½-day SB meeting (October 25 afternoon and October 26);
  - 1½-hour overture meetings (October 19 evening) and ½-day meetings (October 22 afternoon) of Scientific and Technical Committees;
  - 1½-hour overture meeting (October 19 evening) and ½-day meeting (October 22 afternoon) of the SB Section on *Human Dimensions of Marine Systems (S-HD)*;
  - ½-day meeting of the BIO/FIS/POC Section on *Climate Change Effects on Marine Ecosystems (S-CCME)*;
  - 1-day meeting of the MEQ Section on *Ecology of Harmful Algal Blooms in the North Pacific (S-HAB)*;
  - ½-day meeting of the POC/BIO Section on *Carbon and Climate (S-CC)*;
  - 1-day meeting of the POC Working Group on *North Pacific Climate Variability and Change (WG 27)*;
  - 2-day meeting of the MEQ/BIO Working Group on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors (WG 28)*;
  - 1-day meeting of the POC Working Group on *Regional Climate Modeling (WG 29)*;
  - 1½-day meeting of the MEQ Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific (WG 30)*;
  - 1-day meeting of the MEQ Working Group on *Emerging Topics on Marine Pollution (WG 31)*;
  - 1-day meeting of the BIO Advisory Panel on *Marine Birds and Mammals (AP-MBM)*;
  - ½-day meeting of the POC/MONITOR Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas (AP-CREAMS)*;
  - ½-day meeting of the MONITOR Advisory Panel on the *Continuous Plankton Recorder Survey in the North Pacific (AP-CPR)*;
  - 1-day meeting of the SB Study Group on *Socio-Ecological-Environmental Systems (SG-SEES)*;
  - 1-day meeting of the SB Study Group on *Biodiversity Conservation (SG-BC)*;
  - ¼-day concurrent meetings of the FUTURE Advisory Panels on *Anthropogenic Influences on Coastal Ecosystems (AP-AICE)*, *Climate, Oceanographic Variability and Ecosystems (AP-COVE)* and *Status, Outlooks, Forecasts, and Engagement (AP-SOFE)*, preceded by a ¾-day joint meeting of these Panels.

### **2013/S/2: Inter-sessional symposia/sessions/workshops/meetings**

The following inter-sessional events are to be convened/co-sponsored in 2014 and beyond:

- i. Symposia/conferences:
- FUTURE Open Science Meeting, April 14–18, 2014, Kohala Coast, Hawaii, U.S.A. (approved in 2012);
  - 29<sup>th</sup> Lowell Wakefield Fishery Symposium on “*Fisheries bycatch: Global issues and creative solutions*”, May 13–16, 2014, Anchorage, U.S.A. (co-sponsored by PICES);
  - ICES/PICES Symposium on “*Ecological basis of risk analysis for marine ecosystems*”, June 2–4, 2014, Porvoo, Finland (approved in 2012);

- 3<sup>rd</sup> PICES/ICES/IOC Symposium on “*Effects of climate change on the world’s oceans*”, March 23–27, 2015, Santos, Brazil (approved in 2012).
  - ii. Joint Theme Sessions:
    - IMBER/PICES Theme Session on “*Responses of society to marine and global changes as a core mandate for IMBER: ways forward*” at the IMBER Open Science Conference, June 23–28, 2014, Bergen, Norway;
    - ICES/PICES Theme Sessions on “*Gelatinous zooplankton on global perspective: Interactions with fisheries and consequences for socio-economics*” (Session A), “*The increasing importance of biofouling for marine invasions: An ecosystem altering mechanism*” (Session I), and “*Physical and biological consequences of North Atlantic circulation patterns*” (Session Q) at the 2014 ICES Annual Science Conference, September 15–19, 2014, A Coruña, Spain.
  - iii. Workshops and meetings:
    - 1-day meeting of the Project Science Team for the PICES/MAFF project on “*Marine ecosystem health and human well-being*”, April 13, 2014, Kohala Coast, Hawaii, U.S.A.;
    - 2-day inter-sessional Science Board meeting, April 19–20, 2014, Kohala Coast, Hawaii, U.S.A.;
    - 2-day meeting of the Evaluation Team to assess progress of FUTURE, April 19–20, 2014, Kohala Coast, Hawaii, U.S.A.;
    - ½-day joint meeting of the Evaluation Team and Science Board, April 21, 2014, Kohala Coast, Hawaii, U.S.A.;
    - ½-day PICES/ICES meeting to discuss joint activities of the two Organizations and progress made within the PICES/ICES framework for scientific cooperation endorsed in 2011, September 2014, A Coruña, Spain (in conjunction with the 2014 ICES Annual Science Conference).
  - iv. Capacity development events:
    - IMBER ClimECO4 Summer School on “*Delineating the issues of climate change and impacts to marine ecosystems: Bridging the gap between research, assessment, policy and management*”, August 4–9, 2014, in Shanghai, China (co-sponsored by PICES);
    - 2014 PICES Summer School on “*Ecological modeling for marine resources management and research*”, August 26–29, 2014, Seoul, Korea (approved in 2012);
    - 3-day PICES/MAFF training course to develop and set-up pond experiments (PICES/MAFF project on “*Marine ecosystem health and human well-being*”), February or March 2014, Indonesia.

**2013/S/3: Travel and representation at the meetings of other organizations/programs**

- i. FUTURE Open Science Meeting:
  - Invited speakers for Topic Sessions, with the normal allocation of approximately \$5,000 per session; additional requests are subject to fund availability;
  - One invited speaker for each of the approved workshops;
  - Members of the Evaluation Team to assess progress of FUTURE.
- ii. 2014 PICES Annual Meeting:
  - Invited speakers for Science Board Symposium and Topic Sessions, with the normal allocation of approximately \$5,000 per Committee/Program; additional requests are subject to fund availability;
  - One invited speaker for each of the approved workshops (see 2013/S/1(ii)).
- iii. Inter-sessional events:
  - PICES associate member of SCOR WG 140 on *Biogeochemical Exchange Processes at the Sea-Ice Interfaces* to attend the WG 140 meeting (March 16, 2014, Hobart, Australia);
  - PICES representative to attend the NPAFC Annual Meeting (May 12–16, 2014, Portland, U.S.A.);
  - PICES convenor and invited speaker to participate in the 29<sup>th</sup> Lowell Wakefield Fishery Symposium on “*Fisheries bycatch: Global issues and creative solutions*” (May 13–16, 2014, Anchorage, U.S.A.);
  - PICES convenor to participate in the ICES/PICES Symposium on “*Ecological basis of risk analysis for marine ecosystems*” (June 2–4, 2014, Porvoo, Finland);
  - PICES convenor and keynote speaker for the joint IMBER/PICES Theme Session on “*Responses of society to marine and global changes as a core mandate for IMBER: ways forward*” at the IMBER Open Science Conference (June 23–28, 2014, Bergen, Norway);

- PICES representative to participate in the 47<sup>th</sup> Session of IOC (Intergovernmental Oceanographic Commission of UNESCO) Executive Council (June 30–July 3, 2014, Paris, France);
- PICES representative to attend the 1<sup>st</sup> Pan-CLIVAR meeting (July 17–18, 2014, The Hague, The Netherlands);
- PICES representatives and convenors for the joint Theme Sessions to participate in the ICES Annual Science Conference (September 15–19, 2014, A Coruña, Spain);
- PICES representative to attend the SCOR (Scientific Committee on Oceanic Research) Executive General Meeting (fall 2014, Bremerhaven, Germany);
- PICES representative to participate in the 19<sup>th</sup> NOWPAP (Northwest Pacific Action Plan) Intergovernmental Meeting (December 2014, TBD).

#### 2013/S/4: Publications

- i. The following publications are to be produced in or submitted to primary journals in 2014:
  - Special issue of *Progress in Oceanography*, dedicated to Dr. Bernard Megrey, on modeling and observational approaches to understanding marine ecosystem dynamics (Guest Editors: E. Curchitser, S.I. Ito, M. Kishi, M. Peck and K. Rose) to be published electronically in late 2014 and hard copy in early 2015;
  - Special issue of *Progress in Oceanography* based on selected papers from the 2012 Topic Session on “*Advances in understanding the North Pacific Subtropical Frontal Zone ecosystem*” (Guest Editors: T. Ichii, S. McKinnell and M. Seki) to be submitted in 2014;
  - Special issue of *ICES Journal of Marine Science* based on selected papers from the 2013 PICES/ICES workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” and the ICES/PICES Theme Session on “*Responses of living marine resources to climate change and variability*” at the 2013 ICES Annual Science Conference (Lead: A. Hollowed) to be published in late 2014–early 2015;
  - Review paper based on findings from the 2013 PICES/ICES/GEOHAB workshop on “*Harmful algal blooms in a changing world*” (Lead Author: M. Wells) to be published in *Harmful Algae*.
- ii. The following publications are to be produced in the PICES Scientific Report series in 2014:
  - Report of the 2012 GLOBEC/PICES/ICES Workshop on “*Forecasting ecosystem indicators with process-based models*” (Editors: E. Di Lorenzo, A. Miller and S. Minobe);
  - Final report of the Study Group on *Marine Pollutants* (Editor: P. Ross);
  - Final Report of the Working Group 21 on *Non-indigenous Aquatic Species* (Editors: D. Smith and T. Theriault);
  - Final Report of the Working Group 26 on *Jellyfish Blooms around the North Pacific Rim: Causes and Consequences* (Editors: R. Brodeur and S-I. Uye);
  - Report, jointly with NOWPAP, on “*Economic and social impacts of HABs on aquaculture and fisheries*” (Editors: S. Itakura, V. Trainer and T. Yoshida);
  - Report on “*Oceanography of the Yellow and East China Seas (EAST-II region)*” (Editors: J. Ishizaka, T. Matsuno, J. Zhang, J-H. Lee, S. Kim, D. Xu, Y. Fei, S.-M. Liu and V. Lobanov);
  - Report on “*The legal and regulatory foundations of fisheries management in PICES member countries*” (Editors: K. Criddle and M. Makino).
- iii. Other publications to be produced in 2014 include:
  - Brochures on 6 themes from the PICES/ICES workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” (May 22–24, 2013, St. Petersburg, Russia);
  - Announcement and poster for PICES-2014 (October 17–26, 2014, Yeosu, Korea);
  - Books of Abstracts for the FUTURE Open Science Meeting and PICES-2014 to be published on the website and distributed electronically;
  - Two regular issues of PICES Press to be published on the website and distributed electronically in winter (Vol. 22, No. 1) and summer (Vol. 22, No. 2) of 2014.
- iv. Korea and Japan will meet bilaterally to attempt to resolve the publication of the supplementary chapter for the second North Pacific Ecosystem Status Report developed by the Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas, and report back to Council at PICES-2014.

#### **2013/S/5: Future of current PICES expert groups**

- i. The following expert groups completed their terms of reference and will be disbanded prior to PICES-2014 after submitting their final reports:
  - MEQ Study Group on *Marine Pollutants* (SG-MP);
  - MEQ Working Group on *Non-indigenous Aquatic Species* (WG 21);
  - BIO Working Group on *Jellyfish Blooms around the North Pacific Rim: Causes and Consequences* (WG 26).
- ii. To allow some additional time for processing the output of the IPCC climate models used in the last assessment (AR5) and preparing contributions for the 3<sup>rd</sup> PICES/ICES/IOC Symposium on “*Effects of climate change on the world’s oceans*”, with the goal of showcasing some of the advances made within the FUTURE key research themes, the life span of the POC Working Group on *North Pacific Climate Variability and Change* (WG 27) and the POC/BIO Working Group on *Regional Climate Modeling* (WG 29) was extended for 1 year (until October 2015).

#### **2013/S/6: New PICES expert groups**

- i. The MEQ Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (WG 30), with terms of reference as described in *GC Appendix B*, was established in the interim period.
- ii. The following expert groups, with terms of reference as described in *GC Appendix B*, were established at PICES-2013:
  - MEQ Working Group on *Emerging Topics in Marine Pollution* (WG 31);
  - SB Study Group on *Socio-Ecological-Environmental Systems* (SG-SEES);
  - SB Study Group on Biodiversity Conservation (SG-BC).

#### **2013/S/7: Chairmanship and membership for Science Board, Standing Committees and expert groups**

- i. Dr. Thomas Therriault (Canada) started his term as the Chairman of Science Board. Dr. Hiroaki Saito (Japan) was unanimously elected as the Vice-Chairman of Science Board.
- ii. The following reflects changes in Chairmanship and Vice-Chairmanship for Standing Committees and expert groups:
  - Dr. Angelica Peña (Canada) was elected as the Chairman of the Biological Oceanography Committee to replace Dr. Atsushi Tsuda (Japan);
  - Dr. Atsushi Tsuda (Japan) was elected as the Vice-Chairman of the Biological Oceanography Committee to replace Dr. Michael Dagg (U.S.A.);
  - Dr. Jennifer Boldt (Canada) was elected as the Chairman of the Technical Committee on Monitoring to replace Dr. Hiroya Sugisaki (Japan);
  - Dr. Sanae Chiba (Japan) was elected as the Vice-Chairman of the Technical Committee on Monitoring to replace Dr. Phillip Mundy (U.S.A.);
  - Dr. Steven Bograd (U.S.A.) was approved as the Chairman of the FUTURE Advisory Panel on *Anthropogenic Influences on Coastal Ecosystems* to replace Dr. Thomas Therriault (Canada);
  - Dr. Shigeru Itakura (Japan) was approved (inter-sessionally) as the Chairman of the Section on *Ecology of Harmful Algal Blooms in the North Pacific* to replace Dr. Changkyu Lee (Korea);
  - Drs. Kathryn A. Higley (U.S.A.) and Yusheng Zhang (China) were approved as the Co-Chairmen of the Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific*.
- iii. Council agreed that the Chairman of PICES will send a letter of thanks to outgoing Committee Chairmen.

#### **2013/S/8: Relations with other organizations and programs**

- i. Council approved the revised *Standing List of International and Regional Organizations and Programs* and agreed with the identified priorities for interaction in 2013–2014 (see *GC Appendix B*).
- ii. The joint NPAFC-PICES Study Group on *Scientific Cooperation in the North Pacific Ocean* (SG-SC-NP), with terms of reference as described in *GC Appendix B*, was established in the interim period.
- iii. Council instructed the Executive Secretary to explore the *SCOR Visiting Scholars Program* and *POGO-SCOR Fellowship Program* and provide options for decision at PICES-2014.



## **GC Appendix B**

### **Visiting Scientist Program** (approved October 19, 2013)

#### Rationale

Scientific activities sponsored and/or conducted by PICES have increased significantly since its inception in 1992, as has its production of scholarly works. Growth was achieved by making efficient use of national contributions and by attracting external funding for PICES activities. In addition, the new PICES FUTURE Scientific Program, which began in 2009, will require a great deal of scientific involvement, oversight, and collaboration in order to be successful. This will involve the need to deliver timely, high quality scientific products to the PICES community and beyond. PICES is seeking ways to enhance the ability of the Organization and the Secretariat to support the increasing demand. Establishing a PICES Visiting Scientist Program will allow national agencies and/or other international science organizations to contribute “in kind” toward achieving PICES goals, and improve the way the Organization functions.

#### Objectives of the program

- to provide for and enhance collaborative projects among PICES member countries;
- to strengthen the capacity of the Organization to develop and implement projects that have high priority for PICES and member countries, particularly those linked to integrative science programs of PICES;
- to provide professional development of marine scientists and managers from PICES member countries.

#### Nature of the program

Each visiting scientist (expert) will be made available to PICES through secondments from national agencies and/or other international science organizations. He/she will be given a specific task that is important to PICES and is also in the interests of his/her agency/organization. The secondment should be governed by a mutual agreement developed between PICES and the seconding agency/organization. The agreement spells out the terms of reference for the tasks, responsibilities, duration, as well as the legal terms.

The expert will perform the given task either at the PICES Secretariat, at their home institution, or at an institution of another PICES country that has agreed to host the expert, while the expert remains on the payroll of his/her agency/organization. The expert’s agency/organization shall pay the salary, allowances, and expenses incurred in travel to and from the place of residence and the location of the secondment. Since the expert will continue to be an employee of his agency/organization while working on their collaborative project, his/her expenses relating to taxes, medical and life insurance coverage, and any other benefits to which the expert is entitled, will remain the responsibility of his/her agency/organization.

PICES or the hosting institution shall provide appropriate facilities, including office space and administrative services. Travel expenses associated with the expert's work under the collaborative project will be shared by PICES or the hosting agency and the expert’s agency/organization as agreed upon in the MOU.

#### Qualification

*Senior Scientist:* The expert should be an experienced individual (Ph.D. or master’s level scientist with over 5 years of post-master’s degree experience) with good scientific writing and oral communication skills in English. The particular qualifications will depend on the tasks outlined for the collaborative project.

*Junior Scientist:* The scientist should be an early career Ph.D. scientist or a master’s level scientist with at least 2 years of experience, and in either case has demonstrated scientific writing and oral communications skills in English. The particular qualifications will depend on tasks outlined for the collaborative project.

#### Duration and starting date

The program will be implemented following approval by the Governing Council and identification of potential tasks by the Science Board. The expert’s term will start after approval of the specific MOU. Duration of the term will depend on the specific task. The expert may be onsite for as little as two weeks to as long as visa requirements allow. Applicants may identify a host institution or PICES will help identify hosts.

#### Information required from potential host institutions

Institutions interested in hosting a PICES Visiting Scientist should provide the following information, in a short proposal describing the visiting scientist's term at the host institution:

- Help requested: mentoring in research, technology assistance, teaching, *etc.*
  - Term of service desired, including specific dates
  - Local subsistence provided
  - Language abilities desired
  - Plans by the host institution to build on the training received or assistance provided.
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### **Executive Secretary Position**

Applications are invited for a five-year appointment to the position of Executive Secretary of the North Pacific Marine Science Organization (PICES), based in Sidney, British Columbia, Canada. PICES is an international scientific organization, established by an inter-governmental [Convention](#) in 1992. The mission of PICES is to promote and coordinate marine scientific research in order to advance scientific knowledge of the temperate and sub-Arctic region of the North Pacific Ocean and its adjacent seas and of its living resources. The [PICES Strategic Plan](#) is built upon five central themes: advance scientific knowledge; apply scientific knowledge; foster partnerships; develop capacity; and ensure a progressive organization. The governments of Canada, China, Japan, Korea, Russia, and United States are the Parties to the convention. The Organization consists of the Governing Council and Science Board as well as the Finance and Administration Committee, permanent Scientific and Technical Committees, and *ad hoc* expert groups established by the Council, which meet at least once a year at the Annual Meeting. Hosting the Annual Meeting rotates among the Contracting Parties. English is the official language of the Organization.

#### Duties

The Executive Secretary is the Organization's chief administrative officer and must be impartial in promoting and coordinating the interests of all Contracting Parties. The Executive Secretary is responsible for the management of the Organization's office, staff, and budget, which is presently near CND\$2 million, including CND\$700,000 contributed equally as dues by the Contracting Parties; conducts business on behalf of the Organization; arranges meetings of the Organization and its constituent bodies and committees; prepares annual budget statements, estimates and forecasts; raises funds for priority activities of the Organization; invests funds that are surplus to immediate needs; manages the Intern Program; prepares annual financial statements, and other documents as required; handles correspondence; provides secretarial services to meetings, symposia, and conferences approved by Governing Council, prepares minutes of Governing Council and Finance and Administration Committee; prepares an annual report of the Organization for distribution to the Contracting Parties; coordinates the Organization's publication program; and supports the Organization's science program. The Executive Secretary anticipates the future needs of the Organization and prepares an analysis of options for decision by Governing Council. The successful candidate must be self-motivated and be responsible for the administration and staff of the Organization, working collaboratively with the Chairman of Council, Science Board, Scientific Committees, Working Groups, and other bodies.

The Executive Secretary is aided by a Deputy Executive Secretary, a Deputy of Administration, a Database and Web Administrator, and other staff on temporary basis.

The term of office is for five years, subject to demonstrated performance during the first two years of the term (probationary period). The term of office may be renewed at the discretion of Council. The probationary period is applicable only to the first term of office.

#### Principal qualifications required

At a minimum, the successful applicant will have:

Citizenship:

- Citizenship of a PICES Contracting Party at the time of assuming the position.

Education:

- A Ph.D. in a discipline of marine or fishery science from a recognized university or demonstrated equivalent experience.

Language

- Fluency in both spoken and written English, including the ability to draft English text quickly and concisely; fluency in another language of a PICES Contracting Party would be an asset.

Experience:

- Demonstrated leadership in conducting and/or managing marine scientific research, preferably with international marine scientific programs and with marine scientists from a number of countries;
- Experience in or detailed knowledge of the operations of intergovernmental organizations;
- Significant experience in the preparation of financial budgets and management of funds;
- Significant experience in managing technical and/or administrative staff;
- Experience in the organization of large scientific conferences or symposia.

Other skills and/or abilities:

- Ability to work with all individuals equally and diplomatically and to deal appropriately and effectively with scientists from different countries, backgrounds and disciplines;
- Ability to negotiate and promote consensus in complex situations requiring tact and diplomacy while recognizing cultural differences of Contracting Parties;
- Ability to anticipate future needs of the Organization and to identify solutions, alternatives, and consequences;
- Ability to maintain sound judgment and decision making in demanding or stressful situations;
- Willingness and ability to travel internationally, as needed, but at least once a year for the PICES Annual Meeting.

Salary and Benefits

The annual salary and benefits are guided by but not limited to the host state (Canada) public service salaries for equivalent responsibilities. The current salary range is CND \$117,300 – \$137,900 plus a lump sum annual performance award of up to 12% of base salary. Starting salary will be commensurate with qualifications and experience. The salary is subject to the equivalent of Canadian income tax. The duty station for the Deputy Executive Secretary is the PICES Secretariat located at the Institute of Ocean Sciences, Sidney, British Columbia, Canada.

The Organization participates in:

1. Group Pension Plan with spouse and survivor benefits,
2. Canada Pension Plan,
3. Employment Insurance Plan,
4. British Columbia Medical Plan,
5. Group Extended Health Benefits Plan,
6. Group Dental Insurance Plan,
7. Group Long-Term Disability Plan, and
8. Group Term-Life Insurance Plan.

Non-Canadian applicants can be exempt from membership in some of the plans depending on circumstances. Cost to the successful applicant would vary depending on the exemptions.

Payment will be made for moving expenses for the employee and family to the PICES headquarters at the start of employment and return at the end of employment, in accordance with the host state public service guidelines.

Each year annual vacation leave and holidays traditionally celebrated by the host state public service, and sick leave are provided. Internationally recruited staff and their dependents are entitled to two paid calendar weeks home leave every two years.

Application Procedure

For more information about PICES, please contact the Executive Director, Dr. Alexander Bychkov, or consult the PICES website (<http://www.pices.int>).

Applications should include the following:

- Curriculum Vitae;
- A brief statement written by the applicant explaining why he/she considers him/herself to be suitable for the post;
- Copies of academic certificates or diploma;
- At least three letters of reference from individuals with a recent knowledge of the applicant's character, qualifications and experience. At least one reference is preferred from a country other than that of the applicant.

The applicant should indicate in their letter a suitable starting date; however, the starting date can be **no later than xxx**.

Applications and letters of reference must be in English, and marked "Personal and Confidential". Applications must be transmitted electronically to Dr. Laura Richards, PICES Chairman at XXX@pices.int, and received **no later than xxx**.

In-person interviews will be conducted during or just prior to the 2014 PICES Annual Meeting in Yeosu, Korea.

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**Working Group on Assessment of Marine Environmental Quality of Radiation around the North Pacific**  
(approved August 13, 2013)

Parent Committee: Marine Environmental Quality Committee

Duration: 3 years

Terms of Reference

1. Determine and compare radiological doses to North Pacific marine organisms, where data are available, from natural and anthropogenic radionuclides using existing data bases, newly acquired post-Fukushima monitoring results, and state-of-the-art dosimetric approaches.
  2. Examine the utility of applying natural and artificial (Fukushima and other sources) radionuclides as tracers of circulation, ecological transfers, biogeochemical cycling and consequences of climate change in the North Pacific, including the downstream interconnectivity.
  3. Determine the state of the science relative to assessment and mitigation of radiological impacts to marine organisms from natural and anthropogenic releases of radionuclides into the North Pacific marine environment, including a summary of peer reviewed literature and an overview of major sources and types of radiological releases into the marine environment.
  4. Foster collaboration with other expert groups, especially physical oceanographers and climate modellers, to achieve goals in items 1–3.
  5. Identify priority research requirements for knowledge gaps in items 1–3, the impacts on the marine environment from the planned expansion of nuclear facilities, other emerging nuclear issues and other sources of radionuclides in the PICES region.
  6. Promote collaboration in oceanographic studies using radio-tracer distributions and exchanging available information on environmental radioactivity, and encourage joint surveys/research among PICES member countries and international organizations.
  7. Contribute to FUTURE by producing a report on whether radioactive pollution is an additional stressor to the marine ecosystem in the North Pacific Ocean.
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**Working Group on Emerging Topics in Marine Pollution**  
(approved October 20, 2013)

Parent Committee: Marine Environmental Quality Committee

Duration: 3 years

Terms of Reference

1. Document and profile emerging marine pollution issues in the North Pacific Ocean within the PICES community by:
  - a. Convening special topic sessions and workshops on new and emerging pollutants and pollution issues;
  - b. Coordinating a series of special issues of international peer-reviewed journals based on topic sessions.

2. Compile data in support of pollution indicators describing spatial and temporal status, trends and impacts in the North Pacific Ocean in support of a contribution to the 3<sup>rd</sup> Edition of the PICES North Pacific Status Report.
  3. Strengthen partnerships to deliver special topic sessions / workshops and to publish special issues with:
    - a. Other PICES expert groups, especially those identified in the FUTURE Science Plan;
    - b. Other international organizations, including the International Council for the Exploration of the Sea (ICES), the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), and the North West Pacific Action Plan (NOWPAP).
  4. Contribute to FUTURE by publishing a final report summarizing results of Working Group deliberations.
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**Study Group on Socio-Ecological-Environmental Systems**  
(approved October 20, 2013)

Parent Committee: Science Board

Duration: 1 year

Terms of Reference

1. Assemble a team of experts for all the components that make up a Social-Ecological-Environmental System (SEES) and initiate a tighter communication among the experts to understand the challenges of conducting integrated science that include the climate, marine ecosystem and human dimensions explicitly.
  2. Develop an integrated model of SEES case study for hypoxia and acidification in the coastal ocean and select a suitable focus region.
  3. Conduct a meeting at the FUTURE Open Science Meeting (April 2014) and implement the steps needed to initiate the development of the integrated model.
  4. Conduct a meeting at the PICES Annual Meeting (October 2014) to finalize a report with recommendations for how the Organization can advance in this field of coupled SEES modeling in the near future.
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**Study Group on Biodiversity Conservation**  
(approved October 20, 2013)

Parent Committee: Science Board

Duration: 1 year

Terms of Reference

1. Review the scope of key drivers of biodiversity change in the North Pacific Ocean, including, but not limited to: non-indigenous marine species, climate change, fishing, and eutrophication.
  2. Identify potential mechanisms to advance biodiversity-based scientific research and/or conservation related to drivers of biodiversity change in the North Pacific Ocean.
  3. Review the research activities, past and present, undertaken by PICES and other international organizations on biodiversity in the North Pacific Ocean.
  4. Identify opportunities for collaboration, new research opportunities for PICES, and the potential to provide science-based advice that could be used to inform decisions related to the conservation and management of biodiversity in the North Pacific Ocean.
  5. Prepare a final report that includes an assessment of the merits of establishing an expert group focused on biodiversity science within PICES, and provide recommendations on the role(s) of such a group.
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**NPAFC-PICES Study Group on Scientific Cooperation in the North Pacific Ocean**  
(approved June 18, 2013)

Parent Committee: Science Board

Duration: 1 year

Statement of Purpose

The purpose of a joint Study Group is to develop a framework of enhanced collaboration between the two organizations to achieve better and/or more rapid understanding of natural and anthropogenic variability in

marine ecosystems. The Study Group will review each organization's scientific needs and identify where similar key questions or scientific issues might be explored jointly by both organizations.

#### Terms of Reference

1. Review existing and planned scientific activities of each organization.
2. Develop a list potential areas of cooperation.
3. Convene a meeting/workshop for the following purposes:
  - a. improve understanding of the science activities of each organization;
  - b. review scientific topics from TOR (1) to identify areas of common interest;
  - c. develop a framework for cooperation between NPAFC and PICES that lists categories of joint activities and the rationale for each, including the benefits to each organization from the joint activity, and identify priorities for joint activities within categories;
  - d. recommend processes for implementing TOR (3c);
  - e. recommend approaches to develop a strategic plan for cooperation and mechanisms to periodically update that plan.
4. The Co-Chairpersons will prepare a final Study Group report for distribution by the NPAFC-PICES Secretariats by spring 2014.

#### Membership

To keep costs to a minimum and to foster rapid communication, formal membership on the Study Group will be restricted to a small equal number of key participants (4 members) from each organization. Members recommended from PICES include: Elizabeth Logerwell (FIS Committee Chairman), Hiroaki Saito (FUTURE/COVE Advisory Panel Chairman), Thomas Therriault (Science Board Chairman-elect), Skip McKinnell (PICES Deputy Executive Secretary). Members nominated by NPAFC include: Shigehiko Urawa (Science Sub-Committee Chairman), Jim Irvine (Stock Assessment Working Group Chairman), Alexander Zavolokin (Science Sub-Committee member), and Nancy Davis (NPAFC Deputy Director). The proposed chairmanship of the Study Group is shared equally by Dr. Logerwell (PICES) and Dr. Irvine (NPAFC).

#### Timelines

**April 2013** – *NPAFC* – Seek endorsement by the Committee on Scientific Research and Statistics (CSRS) at its 2013 meeting to establish a joint Study Group with PICES according to terms of reference set out in this document.

**May 2013** – *PICES* – Seek endorsement by Science Board at its 2013 inter-sessional meeting to establish a joint Study Group with NPAFC according to the terms of reference described herein.

**July 2013** – Establish the Study Group by correspondence (consensus of the Contracting Parties is needed to establish any new expert groups in PICES).

**October 2013** – Convene a formal Study Group meeting in association with PICES-2013 (although Study Group members could work initially by correspondence during the summer). If NPAFC cannot formally establish a Study Group until their November 2013 Annual Meeting, meeting at PICES-2013 could be considered as an informal meeting of potential members.

**November 2013** – *NPAFC* – Approve recommendation by CSRS to establish the Study Group at its Annual Meeting.

**Spring 2014 deadline** – *SG* – Complete the text of the framework prior to the NPAFC and PICES spring meetings.

**Spring 2014** – *PICES* – Endorse the final text of the framework at the 2014 inter-sessional Science Board meeting and recommend it for approval by Governing Council at its 2014 Annual Meeting.

**Spring 2014** – *NPAFC* – Endorse the final text of the framework at the CSRS meeting and approve it by the Commission at its 2014 Annual Meeting.

**Fall 2014** – *PICES* – Approval the final text of the framework at its Annual Meeting.

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#### **2013-2014 Standing List of International and Regional Organizations and Programs**

AMAP	Arctic Monitoring and Assessment Program
AOOS	Alaska Ocean Observing System
APEC-MRC	Marine Resources Conservation Working Group, Asia Pacific Economic Cooperation

APEC-FWG	Fisheries Working Group, Asia Pacific Economic Cooperation
APFIC	Asia-Pacific Fishery Commission
APN	Asia Pacific Network for Global Change Research
Argo*	International Program for deployment of profiling floats
BEST-BSIERP*	Bering Sea Ecosystem Study
CeNCOOS	Central and Northern California Ocean Observing System
CERF	Coastal and Estuarine Research Federation
CLIVAR*	Climate Variability and Predictability Program
ESSAS*	Ecosystem Studies of Sub-Arctic Seas
EVOSTC*	<i>Exxon Valdez</i> Oilspill Trustee Council
FUTURE EARTH	Research Initiative for Global Sustainability
FAO	Food and Agriculture Organization
GESAMP*	Group of Experts on Scientific Aspects of Marine Pollution
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
IMBER*	Integrated Marine Biogeochemistry and Ecosystems Research
IMO	International Maritime Organization
IOC*	Intergovernmental Oceanographic Commission
IOCCP*	International Ocean Carbon Coordinated Project
IODE	International Oceanographic Data and Information Exchange
IPCC*	Intergovernmental Panel on Climate Change
IPHC	International Pacific Halibut Commission
ISC*	International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
IWC	International Whaling Commission
NAFO	Northwest Atlantic Fisheries Organization
NANOOS	Northwest Association of Networked Ocean Observing Systems System
NEAR-GOOS	North East Asian Regional Global Ocean Observing System
NOWPAP*	Northwest Pacific Action Plan
NPAFC*	North Pacific Anadromous Fish Commission
NPFC	North Pacific Fisheries Commission
NPFMC	North Pacific Fishery Management Council
NPRB*	North Pacific Research Board
PaCOOS	Pacific Coast Observing System
PAG	Pacific Arctic Group
POGO	Partnership for Observing the Global Oceans
PSC	Pacific Salmon Commission
PSG	Pacific Seabird Group
SAHFOS*	Sir Alister Hardy Foundation for Ocean Science
SAON	Sustaining Arctic Observing Networks
SCCOOS	Southern California Coastal Ocean Observing System
SCOPE	Scientific Committee on Problems of the Environment
SCOR*	Scientific Committee on Oceanic Research
SOLAS*	Surface Ocean Low Atmosphere Study
SPC	South Pacific Commission
START	South Asian Regional Committee for the System for Analysis, Research and Training
WCPFC	Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
WCRP	World Climate Research Programme
WESTPAC*	Cooperative Study of the Western Pacific, IOC Sub Committee for the Western Pacific
WPFMC	Western Pacific Fishery Management Council

## Inter-sessional Science Board 2013 Report

Science Board met for two full days from May 20–21, 2013, in St. Petersburg, Russia, prior to the PICES/ICES Workshop on Global assessment of the implications of climate change on the spatial distribution of fish and fisheries”. Science Board Chairman, Dr. Sinjae Yoo, welcomed members and guests and introductions were made around the table (*ISB Endnote 1*). The agenda was reviewed and adopted without changes (*ISB Endnote 2*).



Science Board members and guests. Back (left to right) Igor Shevchenko (Science Board, representing Russia), Gongke Tan, Thomas Therriault (AP-AICE Chairman, Science Board Chairman-elect), Kyung-Il Chang (POC Chairman), Yusheng Zhang (China), Elizabeth Logerwell (FIS Chairman), Phillip Mundy (AP-SOFE Chairman), Alexander Bychkov (PICES Secretariat), Atsushi Tsuda (BIO Chairman), Chuanlin Huo (MEQ Chairman), Hiroyuki Shimada (Japan), Dongho Youm (Korea). Front (left to right) Hiroya Sugisaki (MONITOR Chairman), Hiroaki Saito (AP-COVE Chairman), Jinqiu Du (China), Robin Brown (Governing Council member, Canada), Laura Richards (PICES Chairman), Sinjae Yoo (Science Board Chairman), John Stein (Governing Council member, USA), Toru Suzuki (TCODE Chairman), Skip McKinnell (PICES Secretariat), Naesun Park (Korea), and Heejin Kim (Korea)

*Monday, May 20, 2013*

### AGENDA ITEM 2

#### **Interactions with other organizations, including NPAFC Study Group**

A number of joint activities PICES conducts with other international organizations and programs were reviewed, and major highlights and recommendations given below.

#### **ICES**

ICES and PICES are the two major marine science organizations in the Northern Hemisphere, with each focusing on different oceans. Both organizations face many common marine scientific issues which has motivated them to establish a common framework for scientific cooperation (a report prepared by the joint P/ICES Study Group on *Developing a Framework for Scientific Cooperation in Northern Hemisphere Science* in 2011) to look at joint topics and activities of interest. Dr. Yoo mentioned that 3 years after the framework has been in place may be a good time to conduct a formal assessment of PICES/ICES cooperation.



## ISB-2013

### SCOR

Science Board reviewed a proposal by SCOR for a joint SCOR/ICES/PICES working group on “Zooplankton Production Measurement Methodologies and their Application” and strongly agreed this was a worthwhile endeavour. However, ten other SCOR proposals were made available recently for consideration, and Dr. Yoo will email them to Science Board members for assessment. If the zooplankton working group is not one of the two annually selected by SCOR, it was suggested that this group could still be proposed by PICES and ICES at their respective Annual Meetings, with SCOR making a funding contribution.

**Action:** Dr. Yoo to send 10 SCOR proposals for working groups to Science Board with responses by end of July.

### GEOHAB

GEOHAB completed its Phase I workshop on “*HABs in a changing world*” March 18–22, in Friday Harbor, USA, and presented its summary report. Phase II proposes a GEOHAB Open Science Meeting in 2014 or 2015.

**Action:** Science Board Chair to direct S-HAB to review and provide its opinion for Phase II at PICES-2013.

### NOWPAP

NOWPAP is currently involved in capacity building activities (NOWPAP/PICES training course on “*Remote sensing data analysis*”, October 21–25, 2013, Qingdao, China) and MEQ-related issues with PICES. Historically, Japan has set up a trust fund for NOWPAP’s operation budget, but more money is needed to continue functioning.

**Action:** Dr. Gongke Tan to verify if China (SOA) is also setting up a trust fund to support NOWPAP.

### CLIVAR

The main area of cooperation between the Climate Variability and Predictability Program and PICES is the impact of climate variability and change on marine ecosystems. By expanding its scope to include ecosystems, CLIVAR’s data will be valuable for PICES to use for its marine ecosystem/human dimension focus. CLIVAR co-sponsored a topic session with ICES at PICES-2012 in Hiroshima, Japan, and POC is co-sponsoring a theme session with CLIVAR at the 2<sup>nd</sup> International Symposium on “*Boundary current dynamics*” (July 8–13, 2013, Lijiang, China). Dr. Shoshiro Minobe, WG 27 member, and a CLIVAR member, will attend the session.

**Action:** POC Chairman to ask Dr. Minobe for feedback to report at PICES-2013.

### NPAFC

The North Pacific Anadromous Fish Commission and PICES have been working on problems of mutual interest in the North Pacific for several years. NPAFC has the same contracting parties, except for China, as PICES. Science Board reviewed and agreed to support a proposal for a joint Study Group on *Scientific Cooperation in the North Pacific Ocean* which will develop a framework of enhance collaboration between the two organizations to better understand and/or have more rapid understanding of natural and anthropogenic variability in marine ecosystems. NPAFC has already reviewed the proposal and supported it. Science Board recommended Dr. Elizabeth Logerwell to co-chair the Study Group. Governing Council will finalize the PICES Chair and membership by correspondence.

**Recommendation:** Science Board recommends Dr. Logerwell as Co-Chair of the proposed Study Group.

### **Convention on Biological Diversity**

Dr. Thomas Therriault represented PICES at a regional North Pacific workshop to “*Facilitate the description of ecologically or biologically significant marine areas*” February 25–March 1, 2013, in Moscow, Russia. The workshop was run by the United Nations Conference of Parties to the Convention on Biological Diversity. In his overview of PICES’ mandate and activities, Dr. Therriault had the opportunity to showcase the North Pacific Ecosystem Status Report which could be of value to the CBD process. As this is the first round in a series of events for CBD, Dr. Therriault recommended having a package of EBSA information prepared for the next iteration at the next CBD meeting. PICES already has experience in identifying and describing ecologically and biologically important areas in the North Pacific, but the mechanism to carry this out has not yet been established. It could entail forming a 1-year Study Group two years in advance to pull information together to have in place for the next UN procedure. Dr. Therriault suggested either the Secretariat maintain communication with the CBD Secretariat to anticipate the next iteration process or do the activity now and have it ready; in the meantime the information would be useful for PICES. It was also suggested that Council look at this as a UN Process to see what role PICES will play in it. PICES Chairman, Dr. Laura Richards, and Dr. Therriault offered to write a proposal to establish a means of identifying and describing EBSAs which Science Board will review.

**Action:** Drs. Richards and Therriault to prepare a proposal for gathering EBSA information to be reviewed by Council one month before PICES-2013 before being given to Science Board for comments at PICES-2013.

### **UNRP**

A brief announcement by F&A member, Ms. Elizabeth Tirpak, at the UNRP meeting in New York in April that a PICES workshop focusing on the human dimension aspect of marine ecosystems in the North Pacific will take place June 13–15, 2013 in Honolulu was well received, as one aspect of WOA is human dimensions. A number of experts from the PICES-MAFF project on “Marine ecosystem health and well-being” meeting in Honolulu (June 10–12, 2013) has agreed to stay on to attend the human dimensions workshop. The output from the workshop will be a valuable contribution to the next version of the North Pacific Marine Ecosystem Status Report as well as benefitting the WOA of the UN Regular Process.

### AGENDA ITEM 3

#### **Status of planning for PICES-2013**

Executive Secretary, Dr. Alexander Bychkov, informed Science Board that local arrangements for the next PICES Annual Meeting in Nanaimo, Canada, were in hand and that Canada did not require any funds from PICES to host the meeting. Visa applications were needed for China and Russia, and Dr. Bychkov urged those delegations to determine their prospective participants so they could start applying for visas as soon as possible, as Canada’s policies for visa requirements were changing. Deputy Executive Secretary, Dr. Skip McKinnell, announced a field for invited speakers for proposed topic sessions and workshops had been added to the on-line submission system.

### AGENDA ITEM 4

#### **Report from Study Group on *Radionuclide Science and Environmental Quality of Radiation in the North Pacific***

SG-RS Chairman, Dr. Yusheng Zhang, presented a report on the Study Group’s workshop on “*Radionuclide science and environmental quality of radiation in the North Pacific*” held March 14–15, 2013, in Xiamen, China. He stated that the widespread application of nuclear science and technology can potentially lead, and has led (in the case of a recent nuclear power plant accident), to increasing amounts of radionuclides being released directly or indirectly into the ocean. Therefore, it was important to monitor radiation exposure levels and to take action in case negative effects are produced in marine ecosystems in the North Pacific. To do this, SG-RS actively discussed and refined the terms of reference, including relevance to FUTURE, and formulated a 3-year work plan for a proposed working group on “Assessment of Marine Environmental Quality of Radiation around the North Pacific”.

## ISB-2013

### AGENDA ITEM 5

#### **Proposal for the establishment of a Section on “Emerging Topics in Marine Pollution”**

MEQ Chairman, Mr. Chuanlin Huo, reported that the Committee had not seen the final report from Study Group on *Marine Pollution* (SG-MP) so there was no chance to assess it or to link its proposed expert group with that of radionuclide science. Science Board agreed that over recent years there has been a strong desire to deal with marine pollution, but now there is a push from many directions for MEQ deal with the issue, and suggested that the Board help MEQ by providing guidance so that the future of the two groups is not prolonged. There was also agreement that the terms of reference for a proposed section were very broad, and less advanced than those for radionuclide science. Whereas SG-RS has accomplished a lot in a very short time since its establishment by planning a workshop to refine terms of reference and developing a work plan for its proposed expert group, SG-MP has not had a workshop to scope out the issues. Science Board was unanimous in recommending that the proposal from SG-RS should move forward and that a decision on SG-MP's proposal should be postponed until its terms of reference for an expert group could be developed further.

**Recommendation:** Science Board recommends the establishment of a working group on radionuclide science.

#### **Action:**

- Science Board to provide TOR comments by end of first week in June;
- National delegates to nominate candidates by end of July;
- Science Board to nominate co-chairs by mid-August;
- Table discussion on SG-MP for PICES-2013.

### AGENDA ITEM 6

#### **Current status of the FUTURE APs and AP chair rotations**

AP-AICE Chairman, Dr. Therriault, will be stepping down after PICES-2013 to take up his position as Science Board Chairman. A couple of candidates to succeed him are under consideration and will be decided during elections at PICES-2013. Participation by email was still a problem even with changes/additions in membership, so it was difficult to provide advice based on review of *e.g.*, Committee Actions Plans where only one comment was received. Almost all AP-COVE members support Dr. Hiroaki Saito to remain Chairman for another term but he requested Science Board to wait for a final decision on COVE chairmanship by September. COVE participation was healthy and all members have reviewed the Action Plans and made comments. Dr. Phillip Mundy, who replaced Mr. Robin Brown as Chairman of AP-SOFE at PICES-2012, reported that member participation was good, and although some members never attend the meetings, he had a good core to work with. It was suggested that it might be time for Science Board to review how the Advisory Panel structure model for FUTURE is providing results, and perhaps look for options, based on its setup.

### AGENDA ITEMS 7 AND 8

#### **Status of FUTURE OSM 2014 and venue and date for ISB-2014**

An announcement advertising a 4-day FUTURE Open Science Meeting in 2014 in Kohala Coast, Hawaii, was sent to the PICES community in April. Topics, times and expert groups to convene sessions are in place, but topic session abstracts and names of convenors to chair the sessions have been very slow to arrive. Science Board reviewed the following submissions and made the adjustments to fit the session framework:

(1) ½-day Topic Session on “*Natural and Anthropogenic Drivers of Jellyfish Blooms in Coastal Ecosystems: Correlation, Causation, and Prediction*” to be integrate into (2) WG 28 ½-day Workshop on “*Communicating and Presenting Indicators of Ecosystem Responses to Multiple Stressors in North Pacific Marine Systems*”.

Move (2) and (3) ½-day Workshop on “*Top predators as indicators of climate change: statistical techniques, challenges and opportunities*” to Day 3

(4) 1-day Workshop on “*Bridging the divide between models and decision-making: The role of uncertainty in the uptake of forecasts by decision makers*” standalone.

(5) 1-day S-CCME/FIS Workshop on “*Climate change and ecosystem-based management of living marine resources: Appraising and advancing key modeling tools*”

(6) 1-day Topic Session on “*Interactions of ecosystem status and fishery policy and management*” – encourage to work with (4)

(7) Topic Session on “*How do natural and human perturbations cascade through ecosystems?*”

(8) Topic Session on “*How are biological communities responding to stressors?*”

The Secretariat was tasked by Governing Council to send letters to Contracting parties informing them on planned activities for FUTURE and asking them for contributions, especially for the FUTURE OSM. So far, China is the only country to commit money. China also requested that Dr. Fangli Qiao (POC, WG 29 member) be added to the OSM Scientific Steering Committee, as it is hoped that this will encourage more Chinese scientists to be involved in FUTURE. Dr. Igor Shevchenko will request his government to provide a Russian representative on the SSC, and will also encourage more Russian participation in general. Since there will be eight or nine sessions, with an equal number of invited speakers, the Secretariat can allocate 5k for full support of one speaker, or 5k to the session with the convenor deciding on full support for one speaker or partial support for two speakers.

**Action:**

- Science Board to add Dr. Fangli Qiao (China) to the FUTURE SSC,
- Dr. Shevchenko to provide a Russian nomination to the FUTURE SSC.

AGENDA ITEM 8

**Venue and date for ISB-2014**

ISB-2014 will be held in conjunction with the FUTURE OSM. It will take place after the OSM, on Kohala Coast, from April 19–20, and will be followed by an OSM Evaluation Team meeting. Science Board agreed that the Team should be composed of both external and internal experts. Ideally, it should be made up of people who are familiar with PICES, but are at arm’s length from the Organization. Science Board’s selection consisted of: two FUTURE Advisory Panel Chairs (Phillip Mundy, SOFE; Hiroaki Saito, COVE), two members of the FUTURE Implementation Plan Writing Team (James, Overland; Vyacheslav Lobanov) and two externals, to be decided. Several names were suggested, and Dr. Yoo will contact them.

**Action:** Dr. Yoo to contact external reviewers recommended by Science Board.

AGENDA ITEM 9

**Status of Special Session at IMBER OSM 2014**

Dr. Therriault informed Science Board that PICES’ contribution of a Topic Session on “*The impacts of ecosystem responses to multiple stressors and climate variability: how will human societies respond and adapt?*” to the IMBER OSM to take place June 23–27, 2014, in Bergen, Norway, was accepted by the IMBER SSC [but was later merged with IMBER’s HD WG session to become a joint IMBER/PICES session renamed as “*Responses of society to marine and global changes as a core mandate for IMBER: ways forward*”]. PICES will provide travel support for one convenor (Dr. Therriault) and one invited speaker from the North Pacific.

**Action:** Dr. Therriault to confirm an invited speaker from the North Pacific by PICES-2013 (tentatively).

## ISB-2013

Tuesday, May 21, 2013

### AGENDA ITEM 10

#### **Climate Change Symposium in 2015**

Co-convenors are in place for the other two major co-sponsors, ICES and IOC. Science Board selected Dr. Jacquelynne King to represent PICES as convenor at the 3<sup>rd</sup> international symposium on the “*Effects of climate change on the world’s oceans*” to take place March 23–27, 2015 in Santos City, Brazil. From a short list of potential SSC members, Science Board recommended two western Pacific scientists, Drs. Shoshiro Minobe, Fangli Qiao (physical oceanography) and one eastern Pacific scientist, Dr. Angelica Peña (biological oceanography) to represent PICES. Once the selected SSC nominations agree to be part of the Committee, the Secretariat will check with ICES and IOC to ensure there is balanced representation.

**Action:** Secretariat to contact Drs. King, Minobe, Qiao and Peña.

### AGENDA ITEM 11

#### **PICES-sponsored conference/symposia in 2014 and beyond**

The United States will be unable to host the PICES/ICES 6<sup>th</sup> International Zooplankton Production Symposium to take place in 2016, as had been suggested at the last Symposium in Pucón, Chile (March 14–18, 2011). PICES and ICES suggested the venue revert to Europe, and Norway (Institute of Marine Research, Bergen) has agreed to be the next host, upon approval by Science Board.

**Decision:** Science Board approves Norway hosting the next Zooplankton Production Symposium.

### AGENDA ITEM 13

#### **Status of PICES-2014**

Dr. Naesun Park (invited guest, KIOST) announced that Korea’s federal departments have just undergone restructuring, and that the new Minister of Oceans and Fisheries confirmed May 17 that Korea is prepared to host PICES-2014, but is waiting for China to confirm its intentions. If Korea is to move forward, a venue and theme will need to be determined. The Korean government would prefer to hold the meeting in Yeosu, to take advantage of the infrastructure built for Expo-2012, but would consider Gyeongju, north of Busan. Dr. Kyung-Il Chang is preparing a theme, but is also open to ideas/key words from Science Board. A formal letter from the Korean government has been sent to PICES confirming it will be prepared to act as host.

**Action:**

- Dr. Chang to circulate theme draft to Science Board for review by June 10.
- Science Board to finalize theme by June 28.

### AGENDA ITEM 12

#### **Wooster and POMA awards**

Science Board met *in camera* to select a recipient for the 2013 Wooster Award and PICES Ocean Monitoring Service Award (POMA). Each award had two nominations, with one each rolled over from 2012. Science Board agreed to do away with rollovers in the future but encouraged the unselected nominations to be resubmitted. In addition, Science Board discussed the need to broaden the definition of “long-term monitoring” for POMA to sustain the award since there is a finite source of long-term candidates.

**Action:** Secretariat to revise the Wooster Award description and Drs. Yoo, Therriault, and MONITOR to revise the POMA description for review at PICES-2013.

## AGENDA ITEM 14

**Capacity building/plan for PICES summer schools***Early Career Scientist Conference*

The next PICES/ICES Early Career Scientist Conference will be held in 2017. Interest was expressed by Japan and Korea, but nothing firm has been established. Dr. Yoo noted the timeline for determining the host is 2½ years from present, so a firm commitment must be made by PICES-2014, but it would be useful to know before then, *i.e.*, at ISB-2014 so preparations can start before the Annual Meeting. Dr. Gongke Tan (alternate national delegate, China) offered to discuss the conference with his government. Regarding a question on costs to the host country to organize such a conference, Dr. Skip McKinnell (PICES Deputy Executive Secretary) explained that, based on the last two conferences, 60% is budgeted for by PICES and ICES, with the rest being taken care of through funding raising. Any contributions from the host would be minor, and the local organizers would also take care of local arrangements.

**Action:** Science Board to discuss progress on venue for ECS Conference at PICES-2013.

*Summer Schools*

Dr. McKinnell announced that the 4<sup>th</sup> PICES Summer School on “*Ocean observing systems and ecosystem monitoring*”, will be held August 19–23 in Corvallis, USA. The SSC received almost 90 applicants from which 37 were selected, with PICES member countries being given priority. Every person who was contacted has accepted (6 each from Canada, China, Korea, and the U.S.; 4 each from Japan and Russia, and 5 from outside of PICES).

The next PICES Summer School on “*Ecosystem modelling for marine resources management and research*” (proposed by AP-CREAMS and approved by Science Board at PICES-2012) will take place in Seoul, Korea in 2014. Dr. Kyung-Il Chang informed Science Board that 30 rooms have been blocked for the event and that Korea will cover accommodation and meals. He requested travel expenses for 5 to 6 students and for Science Board to recommend possible lecturers. Science Board supported setting up a SSC in principle, from which a selection committee (SC) would be chosen to review applications. Dr. Chang recommended Professor Chung-Il Lee (Gangneung-Wonju National University, Korea), and FIS Chair, Dr. Logerwell, to be part of the SSC, but she declined. However, Dr. Logerwell will contact Dr. Chang with recommendations for a more suitable replacement. End-to-end modellers were also requested, and it was suggested that they could be selected from POC and relevant working groups. Dr. Chang will email Science Board regarding SC nominations. Details on the SSC and SC and lecturers will be fixed at PICES-2013. The SSC will need to fix students and lectures by April/May 2014. Preliminary details of the Summer School can be found in *ISB-2013 Endnote 3*.

**Action:** Dr. Chang to email Science Board requesting SC nominations from Science Board.

*Summer Schools co-sponsored by PICES*

Dr. Bychkov informed Science Board that 6k was budgeted for students from PICES member countries to attend the 6<sup>th</sup> International SOLAS Summer School to be held August 23 to September 2, 2013 in Xiamen, China. One student each from Japan, Russia and the U.S. will attend.

No formal proposal has been received for next IMBER summer school but a proposal may be coming after IMBER’s SSC meeting in June.

*Training Courses*

The second NOWPAP/PICES Training Course on “*Remote sensing data analysis*” will take place October 21–25, 2013, in Qingdao, China. As recommended by Science Board at PICES-2012, PICES will provide support

## ISB-2013

for one student from a PICES member country to attend the course and one lecturer, Dr. Young Je Park (KIOST), an ocean colour specialist responsible for Korean Ocean Color Satellite.

**Action:** Science Board to provide ideas for the next PICES Summer School after 2014.

### AGENDA ITEM 15

#### **PICES' 25<sup>th</sup> anniversary**

Dr. Bychkov informed Science Board on planning progress to celebrate accomplishments of PICES at its 25<sup>th</sup> anniversary in 2016. The anniversary will fall on the U.S.'s turn to host the Annual Meeting. The PICES 25<sup>th</sup> Anniversary Planning Committee, established at PICES-2012 by Governing Council, has been active. A PICES 25<sup>th</sup> Anniversary draft logo (3 versions) was shown to Science Board for review, and an electronic album of past Annual Meeting photos is being made. Science Board was requested to discuss the scientific activities of PICES. Suggestions included producing a special journal issue, a lecture series related to PICES science, and/or having special topic sessions at PICES-2016. In addition, Science Board was to consider what it would like to do during that year. As to communicating with the public, Dr. Bychkov related that for PICES' 10<sup>th</sup> anniversary, it was done at the Committee level, *e.g.*, a former Chair was tasked with highlighting the accomplishments of that Committee and the current Chair described where they intended to focus.

Dr. Logerwell presented a number of suggestions from FIS such as 1) a publication summarizing 25 years of activities and posing three questions: what was successful, what was unsuccessful, and what was intended for the future; 2) producing a book or pamphlet; 3) following an example of ICES' "ICES takes stock" on "investigating our role" for their 20<sup>th</sup> anniversary. The Bevan lecture series that Alaska Fisheries/NWFSC co-sponsored with the University of Washington could be another way of communicating with the public, if they were willing to co-sponsor a series with PICES.

The mechanisms for communications, besides standard ones, could be through social media like YouTube or Facebook; and could be in other languages besides English.

Other suggestions included looking at the achievements of PICES, CCCC, and FUTURE, and looking at the activities in member countries, *i.e.*, workshops, lectures, some other event. It was also important to inform other organizations of the anniversary so they could 'book their calendar'. A common whiteboard could be used to facilitate messages or ideas between Committees, and it was suggested that the Anniversary Committee look into how to set one up. Further ideas can be discussed at PICES-2013, especially at the FUTURE Advisory Panel meetings (early), and can be captured by the Anniversary Committee (later in the meeting).

**Action:** Science Board to consider scientific content, national activities, target audiences, video events in each country (outside the Annual Meeting) to be discussed at PICES-2013.

### AGENDA ITEM 16

#### **Mid-year reports from Scientific and Technical Committees**

Brief highlights of Committee and expert group activities since PICES-2012, and any requests, are provided below.

##### *Biological Oceanography Committee (BIO)*

BIO Chairman, Dr. Atsushi Tsuda, announced that the Section on *Carbon and Climate's* (S-CC) PACIFICA data sets and data products were now open on the public domain. The accompanying data report (NDP\_092) will be published soon. S-CC is preparing papers for a special issue in a peer-reviewed journal.

The Advisory Panel on *Marine Birds and Mammals* has produced a special publication resulting from the 2011 joint PICES/ICES Topic Session (S2: BIO/POC Topic Session entitled “*Mechanisms of physical-biological coupling forcing biological “hotspots”*” which will appear as a Theme Session in the journal *Marine Ecology of Progress Series* (6 papers and 3 potential: invited editors, Elliott Hazen, Rob Suryan, Jarrod Santora, Yutaka Watanuke, and Rory Wilson, Steven Bograd). Dr. Yutaka Watanuki organized a Marine Spatial Ecology Symposium at the Bio-logging Society’s Annual Meeting at Hokkaido University, Hakodate, Japan, in 2012 where Dr. Suryan gave plenary talk on “*Many lessons learned from long-term tracking studies of albatrosses*”. The Bio-logging Society agreed to share its seabird tracking data for AP-MBM’s spatial ecology project.

The 4<sup>th</sup> International Jellyfish Bloom Symposium will be held in Hiroshima, Japan, from June 5–7, 2013, and is being co-organized by Working Group on *Jellyfish Blooms around the North Pacific Rim: Causes and Consequences* (WG 26) Co-Chairman, Dr. Shin-ichi Uye. PICES has given travel support for 2 invited speakers. The call for papers was very successful with about 140 abstracts submitted, of which 56 will be included as oral presentations, which will make it the largest meeting ever to examine jellyfish blooms. A WG 26 inter-session meeting will be held in advance of the symposium to take advantage of the expertise coming to the meeting, including present WG members to discuss plans for the final report. WG 26 proposed a ½-day Topic Session on “*Natural and anthropogenic drivers of jellyfish blooms in coastal ecosystems: Correlation, causation, and prediction*” to be co-convened by WG members Drs. Uye, Ric Brodeur and Lucas Brotz and held at the FUTURE Open Science Meeting in 2014. [This has now been combined with WG 28’s proposal for a workshop – see Agenda Item 7.]

Several new members, especially from China, have been added to Working Group on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* (WG 28) since PICES-2012. Mr. Vladimir Kulik participated on behalf of WG 28 at a workshop on “*Marine Biodiversity Conservation and Marine Protected Areas in the Northwest Pacific*”, convened by NOWPAP in Toyama, Japan (March 13–14, 2013). The objective of this workshop was to share information on methodologies for marine environment assessment and the current status of Marine Protected Areas in member states; PICES WG 28 was invited to discuss its work on ecosystem indicators for multiple stressors. Several WG 28 members are participating at the PICES/ICES Workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” following the ISB-2013 meeting in St. Petersburg (May 22–24, 2013). WG 28 proposed a ½-day Workshop on “*Communicating and presenting indicators of ecosystem responses to multiple stressors in North Pacific marine systems*” to be co-convened by WG members Drs. Ian Perry, Motomitsu Takahashi, Vladimir Kulik, and Jameal Samhour and held at the FUTURE Open Science Meeting in 2014. There is still large uncertainty about the ability for all members to participate in the meetings and work of WG 28 at the Annual Meeting in the fall.

Dr. Tsuda will be stepping down as BIO Chairman at the end of PICES-2013. The proposed Chair to take his place is Dr. Angelica Peña (Canada), who will be formally elected at the Meeting.

#### *Fishery Science Committee (FIS)*

FIS Chair, Dr. Libby Logerwell, reported that Dr. Jaebong Lee (Korea) is a new member of FIS, replacing Dr. Jinyeong Kim; Prof. Kazushi Miyashita and Dr. Motomitsu Takahashi (Japan) are the new members of FIS, replacing Drs. Toyomitsu Horii and Yasuzumi Fujimori; Prof. Masahide Kaeriyama (Japan) stepped down from AP-AICE. Dr. Anya Dunham (Canada) will now serve as FIS representative on this Advisory Panel.

Dr. Logerwell and Dr. Dunham agreed to review two sections of the final report of the Working Group on *Environmental Interactions of Marine Aquaculture* (WG 24) before signing off on it for publication in the PICES Scientific Report series.

FIS worked with the North Pacific Anadromous Fish Commission to develop a proposal for a joint Study Group on *Scientific Cooperation in the North Pacific Ocean* (see Agenda Item 2, NPAFC).



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An ICES/PICES Symposium on “*Forage fish interactions: Creating tools for ecosystem-based management of marine resources*” (endorsed by Council in 2011) was held November 12–14, 2012 in Nantes, France. Topic session descriptions, convenors, and invited speakers were finalized for six FIS co-sponsored sessions to be held at PICES-2013.

### *Marine Environmental Quality Committee (MEQ)*

MEQ Chairman, Mr. Chuanlin Huo, thanked Science Board for its patience and understanding, as the Committee has been in a state of transition since early 2012 [when its former chairman unexpectedly stepped down] and as he becomes familiar with the duties of an MEQ chairman. Any direction or advice from Science Board and/or FUTURE would be welcomed as the Committee finds its direction.

Mr. Huo briefly explained that since FUTURE was established in 2009, every Standing Committee, except MEQ, has aligned its Action Plan with the program’s objectives. After being elected at PICES-2012, he organized a special MEQ task team to work on the Action Plan, integrating the issues/focus areas into a first draft. After a number of iterations, including the recent incorporation of tasks from the SG-RS workshop, Mr. Huo presented the final version for Science Board review.

Mr. Huo presented a short overview of Study Group on *Radionuclide Science in the North Pacific* achievements (see also Agenda Item 2), mentioning that SG (and newly formed WG 30) member, Dr. Gi-Hoon Hong (Korea) was also a member of the London Convention Protocol.

No final report was submitted by Study Group on *Marine Pollutants* because MEQ has just finished revising its Action Plan. Similarly, the Section on the *Ecology of Harmful Algal Blooms* (S-HAB) and Working Group on *Non-indigenous Aquatic Species* (WG 21) can only finish revising their terms of reference once MEQ’s Action Plan has been endorsed by Science Board.

### *Physical Oceanography and Climate Committee (POC)*

POC Committee Chairman, Dr. Kyung-Il Chang, announced that the ½-day joint PICES/CLIVAR Theme Session on “*Biophysical interactions*” at the 2nd International Symposium on “*Boundary current dynamics: Its connection with open-ocean, coastal processes, biophysical interactions and responses to global climate change*” will take place July 8–9, 2013, in Li Jiang, China. The key question to be answered in this session is “What are the roles of boundary currents in biogeochemical cycles and marine ecosystems?” Session convenors are Drs. Shoshiro Minobe (WG 27 member) and Hiroaki Saito (AP-COVE Chairman; BIO, SG-SC-NP member). PICES is supporting two invited speakers for the session.

A 2<sup>nd</sup> (WG 29) Regional Climate Modeling Workshop will take place September 10–12, 2013, in Busan, Korea. The workshop will involve 4 sessions: downscaling, submesoscale processes, North Pacific variability, and other climate-related issues. Session convenors from PICES are Drs. Chang (POC Chairman; WG 29, AP-CREAMS member), Enrique Curchitser (POC, WG 27 member, WG 29 Co-Chairman), and Chan Joo Jang (WG 29 Co-Chairman; POC, WG 27 member). Among the invited speakers are: Drs. Curchitser, Michael Foreman (POC Vice-Chairman, WG 27 Co-Chairman; WG 29, S-CCME member) and Shoshiro Minobe (WG 27 member).

The Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (AP-CREAMS) held its inter-sessional meeting April 26, 2013, in Hangzhou, China, where national reports were presented. A NOWPAP/PICES joint training course on “*Remote sensing data analysis*” will take place October 21–25, 2013, in Qingdao, China; a 6<sup>th</sup> China-Japan-Korea IMBER symposium on “*Ocean ecosystem dynamics and integrated marine biogeochemistry and ecosystem research*” will take place October 2–3, 2013, in Tokyo, Japan. The Scientific Organizing Committee includes Drs. Hiroaki Saito (AP-COVE), Jing Zhang (AP-CREAMS), Se-Jong Ju (BIO), Jinjae Yoo (Science Board Chairman), and Sumei Liu (AP-CREAMS). A

PICES Summer School on “*Ecological modelling for marine resources management and research*”, proposed by AP-CREAMS in 2012, is scheduled for August 26–29, 2014.

The 20<sup>th</sup> anniversary of CREAMS expeditions will take place in August in Seoul, Korea. AP-CREAMS will publish (tentatively a book) on the oceanography of the EAST-II region (*i.e.*, Yellow Sea and East China Sea). The first chapter will deal with climate and physical oceanography and will include circulation, tides, water masses, ocean mixing, air–sea interactions, and long-term variations. It was suggested that the chapter could be a product in FUTURE’s roadmap.

#### *Technical Committee on Monitoring (MONITOR)*

MONITOR Chairman, Dr. Hiroya Sugisaki, requested Science Board to ask the Secretariat to send a letter on behalf of the Advisory Panel on *Continuous Plankton Recorder* (AP-CPR) to the key agencies (NPRB, DFO, SAHFOS) of the consortium that has supported AP-CPR’s work in the past to continue funding to keep AP-CPR’s sampling program running. Funding by NPRB, DFO and SAHFOS will run out between the end of 2013 to mid-2014. Funding by Japan and EVOS is secure until the end of 2016.

The Global Alliance of Continuous Plankton Recorder Surveys (GACS) will hold its 2013 Board of Governance Meeting from September 25–26 in Plymouth, UK. GACS meetings for its Database Working Group and Standards and Methodologies Working Group will be held there also, on September 24. The Global Marine Ecological Status Report: results from the global CPR survey 2010/2011 authored by M. Edwards, P. Helaouet, D.G. Johns, S. Batten, G. Beaugrand, S. Chiba, M. Flavell, E. Head, G. Hosie, A.J. Richardson, K. Takahashi, H.M. Verheye, P. Ward P, and M. Wootton was published in 2012 as SAHFOS Technical Report 9: 1–40. The paper on “Inter-annual variations and regional differences in the developmental timing of mesozooplankton in the western North Pacific Ocean based on Continuous Plankton Recorder data from 2001 to 2009” authored by T. Yoshiki, S. Chiba, H. Sugisaki, K. Sasaoka, T. Ono and S. Batten has been accepted in the *Journal of Plankton Research*. Dr. Song Sun (AP-CPR member) has joined GACS.

**Action:** Secretariat to send a letter to NPRB, DFO and SAHFOS requesting funding for the AP-CPR sampling program.

MONITOR continues to maintain relations to the GOOS groups of ICES, and is informed of their meetings and activities. Dr. Sugisaki briefly described the 2013 PICES Summer School on “*Ocean observing systems and ecosystem monitoring*” (see Agenda Item 14).

Dr. Sugisaki announced that two nominations were submitted to MONITOR for evaluation, with one being rolled over from 2012 (see also Agenda Item 12). MONITOR expressed concern that the nominations for POMA were dwindling with each year, and that China is the only member country that has not yet submitted any names.

New items in MONITOR’s Action Plan are to foster the relationships between international and local organizations for ocean observation (*e.g.*, SAON, GACS, and the OOSs), and to link to FUTURE (especially AP-SOFE) and S-HD in order to advance scientific knowledge on the relationship between marine ecosystems and human activities.

#### *Technical Committee on Data Exchange (TCODE)*

TCODE Chairman, Dr. Toru Suzuki, informed Science Board that Dr. Ling Tong (China) stepped down as a member of TCODE. No replacement has been made.

TCODE is co-sponsoring three Topic Sessions and co-sponsoring one workshop with IODE on “*Tools, approaches and challenges for accessing and integrating distributed datasets*” at PICES-2013. A

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convenor/speaker from IODE is still to be decided. TCODE supported the 2013 PICES Summer School on “*Ocean observing systems and ecosystem monitoring*” (August 19–23, Corvallis, USA) with Dr. Suzuki being one of the members of the SSC/SC.

An IODE GE-BICH Workshop was held February 27–29 in Oostende, Belgium. Dr. Hernan Garcia (Co-Chairman of GE-BICH) and Dr. Suzuki attended. Discussions revolved around a Quality Flag Scheme proposal for the exchange of oceanographic and marine meteorological data, which was accepted by the Ocean Data Standards Pilot Project and published as UNESCO Manual and Guide 54, Vol. 3 in April 2013.

IODE-XXII was held March 11–15, 2013 in Ensenada, Mexico. Four TCODE members attended: Drs. Suzuki, Garcia, Joon-Soo Lee, and Ms. Lynn deWitt. A poster on the TCODE GeoNetwork Portal was presented at the meeting.

Dr. Yukihiro Nojiri, past Co-Chairman of Working Group (WG 13) on *Carbon Dioxide in the North Pacific* and Working Group (WG 17) on *Biogeochemical Data Integration and Synthesis* has proposed a Japan-Canada cooperative program for ocean surface nutrients monitoring. As part of TCODE’s Action Plan Goal 4, the Committee and S-CC support this program and will propose a Topic Session for PICES-2014. As part of Action Plan Goals 4 and 5, Dr. Suzuki submitted the PACIFICA (**PACIF**ic **Ocean Interior CARbon**) document to CDIAC (Carbon Dioxide Information Analysis Center) which published it as NDP-092 in May and is available online at <http://cdiac.ornl.gov/oceans/PACIFICA/>. The PICES website <http://pacific.pices.jp/> is the primary source for the PACIFICA document.

As part of TCODE’s outreach activities for 2012–2014 (see 2012 TCODE report, Agenda Item 8, [https://www.pices.int/publications/annual\\_reports/Ann\\_Rpt\\_12/2012-TCODE.pdf](https://www.pices.int/publications/annual_reports/Ann_Rpt_12/2012-TCODE.pdf)), an interactive website has been established for the Section on *Climate Change Effects on Marine Ecosystems* (S-CCME), using Google sites, <http://sites.google.com/site/picesscme>. Access to it is free of charge and is open to the public, but only members can edit the Section’s documents.

TCODE is continuing to maintain and promote PICES TCODE GeoSpatial Portal, promote the use of shared information tools, and help in the preparation of the North Pacific Ecosystem Status Report (Action Plan Goal 5).

### AGENDA ITEM 17

#### **Committee Action Plans**

All Committees have submitted their Action Plans for the next three years. Upon review, Dr. Yoo found different levels of detail and different connections to FUTURE. He explained that Action Plan contents could reflect FUTURE but not everything in an Action Plan had to be related to it. Drs. Therriault and Yoo will edit the Plans to have a common look and feel while maintaining the integrity of each Committee’s Plan.

**Action:** Science Board Chairman and Chairman-elect to edit Action Plans for commonality.

Although not on the agenda, the following topic was presented for discussion near the end of the meeting.

#### **FUTURE Progress – the next steps**

Dr. Therriault raised the question as to when Science Board (as FUTURE SSC) could expect to see FUTURE science being done. The FUTURE Advisory Panels had done their job in asking the SSC to advise them on how to proceed; now the Standing Committees needed to be involved to fix any gaps or issues prior to being appraised by the evaluation team of experts at the FUTURE OSM. FUTURE needs to know where to feed the elements (data) to, so how are the Committees going to get the work done? For instance, S-CCME has a paper in press, so how will the parent Committees of this group take the science from that paper and link it to other tasks of FUTURE? As another example, Dr. Therriault pointed out that specific tasks and components that will

go into the 2015 North Pacific Ecosystem Status Report need to be identified, and the experts who will identify the content need to be determined.

Another issue was to find a strategy to extend products beyond the working group term. Should working groups be staggered to identify different issues, or are there individuals/agencies who can extend/sustain the product? Also, certain products need to be combined or linked (*e.g.*, those of WG 28, 29, S-CCME). Unlike the previous program, which had task teams to address specific tasks, FUTURE is more integrated, so it is more challenging to determine the elements needed and gaps to be filled.

Dr. Therriault noted that when expert groups were established, the Advisory Panels rated them high/medium/low in identifying the questions related to the three overarching research themes. Now it was time for the Committees to bring back to the SSC how their expert groups addressed the specifics, and the Committees' responsibility to guide their expert groups as they finish up on what products are still needed. Therefore, a mechanism needs to be established to gather relevant information and glue it together, and to identify missing parts needed to fill the gaps before the expert group disbands. An individual/team is needed to identify and synthesize the products.

One method suggested for funnelling the information would be for each expert group to present a final report to its parent Committee and add a summary on how they addressed the questions of FUTURE, and how the products will be delivered.

It was agreed that the SSC needed to identify (1) the products and (2) mechanism to get the products done. The next step would be to identify the expert (either in the Committee/Advisory Panel, in an agency, or visiting scientist) to synthesize the product. The Committee would play two roles: that of acting as a filter and as a bridge between the FUTURE Advisory Panels and expert groups. The Committee would be responsible for looking at what has been done, what needs to be done, what is missing, and the expert would be charged with putting these items together. As a guide, the FUTURE Science Plan sub-questions of each overarching question could be used to do a self-evaluation.

Dr. Atsushi cautioned that in placing so much emphasis on FUTURE, some BIO members were hesitant to propose a new expert group or topic session not directly linked to FUTURE, so as not to take away from the goals of the program, and urged that some room be left open in PICES for other activities.

#### AGENDA ITEM 18

##### **Other business**

##### *Supplementary Chapter*

In response to the task set by Science Board to provide advice on the next steps for releasing the revised supplementary chapter of NPESR II, AP-SOFE circulated an email to Science Board (February 15, 2013) recommending that it be published as a special issue in a peer reviewed journal. At the inter-sessional meeting, SOFE Chairman, Dr. Phillip Mundy, confirmed that the authors should be contacted soon to determine if they would like to go ahead with publishing in this manner. If the authors agree to publish in a special issue, the matter will be taken up by Science Board as a matter for financial support.

**Action:** Dr. Yoo to request AP-CREAMS Co-Chairmen (who are also co-authors) to discuss with the rest of co-authors if they are agreeable to publishing a special issue.

*ISB Endnote 1*

**Science Board list of participants**

Members

Kyung-Il Chang (POC)  
Chuanlin Huo (MEQ)  
Elizabeth Logerwell (FIS)  
Phillip Mundy (SOFE-AP)  
Hiroaki Saito (COVE-AP)  
Igor Shevchenko (representing Russia)  
Hiroya Sugisaki (MONITOR)  
Toru Suzuki (TCODE)  
Tom Therriault (AICE-AP)  
Atsuki Tsuda (BIO)  
Sinjae Yoo (Chairman, Science Board)

Observers

Robin Brown (GC)  
Jinqiu Du (SG-RS)  
Heejin Kim (KIOST)  
Chul Park (GC, F&A)  
Neasun Park (KIOST)  
Hiroyuki Shimada (Japan)  
John Stein (GC)  
Gongke Tan (China)  
Dongho Youm (KIOST)  
Yusheng Zhang (SG-SR)

PICES

Alex Bychkov (PICES)  
Skip McKinnell (PICES)  
Laura Richards (PICES)

*ISB Endnote 2*

**Science Board meeting agenda**

1. Welcome and adoption of agenda (Yoo)
2. Interactions with other organizations including NPAFC Study Group (Yoo)  
*Decision 2.1:* Accept/reject/modify proposal for PICES to be part of a SCOR/ICES working group  
*Decision 2.2:* Accept/reject/modify proposal for joint study group with NPAFC
3. Status of planning for PICES-2013, Nanaimo, Canada (Secretariat)
4. Report from Study Group on Radionuclide Science and Environmental Quality of Radiation in the North Pacific  
*Decision 4.1:* Accept/reject/modify proposal for a working group on Marine Environmental Quality of Radiation in the NP Ocean
5. Proposal for the establishment of a Section on “Emerging Topics in Marine Pollution”  
*Decision 5.1:* Accept/reject/modify proposal for a section on Emerging Topics in Marine Pollution
6. Presentation and discussion of current status of the FUTURE APs and AP chair rotations (AP Chairs)
7. Status of FUTURE OSM 2014, Hawaii, theme and venue (Secretariat/Therriault)  
*Action 15.1:* Discuss/fill in gaps in the scientific program
8. Venue and date for ISB-2014 (Yoo)
9. Status of Special Session at IMBER OSM 2014, Bergen (Therriault)
10. The 3<sup>rd</sup> Climate Change Symposium in 2015, Brazil (Secretariat)  
*Decision 10.1:* Names for a PICES convenor and 2 PICES SSC members
11. Possible PICES-sponsored conference/symposia in 2014 and beyond
12. Wooster and POMA awards (All)  
*Decision 12.1:* Decide the recipients of the Wooster and POMA awards
13. Status of PICES-2014, theme and venue (Secretariat)
14. Capacity building/Plan for PICES summer schools (Yoo)  
*Action 14.1:* Discuss how to proceed with the next ECS conference  
*Action 14.2:* Discuss next potential summer school/training course to be sponsored by PICES
15. Preparation of PICES’ 25th anniversary (Secretariat)

- Action 15.1:* Science Board to provide additional ideas for tasks/activities
16. Mid-year reports from Scientific and Technical Committees (Committee Chairs)  
*Action 16.1:* Provide any highlights on progress of expert groups
17. Committee Action Plans (All)  
*Decision 17.1:* Accept/modify Science Board/Committee Action Plans
18. Other business

### **ISB Endnote 3**

#### **PICES International Summer School on “Ecological Modeling for Marine Resources Management and Research”**

August 26-29, 2014, Seoul, Korea, Seoul National University

**Purpose:** Ecological models have applications in a wide variety of disciplines, such as natural resource management, wildlife conservation and agriculture. These models are formed by combing known complicated ecological relations with field observation data, and are being used in order to make an understanding about the process in systems and predictions about the dynamics of the real ecosystem. The purpose of this Summer School is to review and present methods of modeling in ecological relations, and to show how these models (methods) can be applied to understand and predict change in ecosystem.

Date: 26-29 (Tuesday ~ Friday) August, 2014

Venue: Seoul National University (Republic of Korea)

Lecture & Workshop: Bd. 25-1/1st floor International Conference Room

Hands-on Exercise: Bd. 25-1/2nd floor Room 210 (SEES Computer Room)

Students: maximum 30

Lecturers: up to 10 (including 5 foreign lecturers)

Organizing committee: to be determined

Request for financial support from PICES: travel costs for five non-Korean students and five foreign lecturers.

### **1. Background**

An ocean ecological model and its application are representation of an ecological system which is ranging in scale from an individual population to an ecological community, or even an entire system. The real systems are quite complicated because they involves biotic and abiotic components all interacting over a large area and a long time span. Understanding and predicting the changes in marine ecosystem requires high quality observation and experiment data. The models are formed by combining known ecological relations (e.g. the relation of sunlight and water availability to photosynthetic rate, or the relation between predator and prey populations) with data gathered from field and laboratory experiments. Ecological models are useful tools to describe ecological conditions and have long been developed to understand ecosystem behavior mechanism and to predict changes in community composition and ecosystem functioning. In particular, there has been a rapid rise in the development of end-to end model dealing with the effects of climate change and human activity on the marine ecosystem through the food web. End-to-end models combine physicochemical oceanographic descriptors and organisms ranging from microbes to higher-trophic-level organisms. The demand for End-to End approaches including bottom-up and top-down control in food webs arises from the need for quantitative tools for ecosystem-based management. End-to-end models that can deal with bottom-up and top-down controls that operate simultaneously and vary in time and space and that are capable of handling the multiple impacts expected under climate change.

This summer school intends to help graduate students and early-career scientists as well as new comers by providing basic knowledge for advanced applications. The 4-day summer school will cover an introduction to marine ecosystems (e.g. concept of the ecosystem) and parameter optimization of marine ecosystem model and

## ISB-2013

its application. The courses will be composed of lectures, seminars, and hands-on training in parameter optimization and end-to-end model application. The official language of the school is English.

### 2. International Organizing Committee

Prof. Chung Il Lee

Department of Marine Bioscience, Gangneung-Wonju National University, Korea

leeci@gwnu.ac.kr

- To be determined

### 3. International Advisory Committee

- To be determined

### 4. Program (tentative plan)

Day	Time	Type	Title	Lecturer
Tuesday	08:30-09:30	Registration Address	Summer School Registration Welcome Address	
	09:30-12:30	Lecture	Introduction of Ecological Model	
	12:30-13:30		Lunch	
	13:30-18:00	Lecture Exercise	Principles and Application of Ecosystem-based Model (End-to-End Model) Introduction of End-to-End Model tools	
Wednesday	09:00-12:00	Lecture	Introduction of Food-web Model	
	12:00-13:00		Lunch	
	13:00	Lecture Exercise	Parameter for Food-web Model Food-web Model Simulation	
Thursday	09:00-12:00	Lecture	Time-dynamic Simulation for Ecosystem & Fisheries Management Evaluating Ecosystem Effects of Climate	
	12:00-13:00		Lunch	
	13:00-18:00	Lecture Exercise	Evaluating Ecosystem Effects of Fishing Fitting an Time-dynamic Module for Ecosystem & Fisheries Management	
Friday	09:00-12:00	Lecture	Change in biomass and trophic interactions in space Data needs and how to build an Model	
	12:00-13:00		Lunch	
	13:00-16:00	Exercise	How to use ecosystem-based model for addressing the issues of Ecosystem & Fisheries Management	
	16:00-17:00 18:00-20:00	Ceremony	Graduation Ceremony Farewell Dinner Party	

## Report of the Science Board Meeting

Science Board met in Nanaimo, Canada from 12:30-14:00 on October 13, 2013. Science Board Chairman, Dr. Sinjae Yoo, welcomed members and guests, Dr. Linda Stevenson (APN), Dr. Yutaka Michida (IOC/WESTPAC) and Dr. Nicholas Owens (SAHFOS) to the meeting (*SB Endnote 1*) and called it to order. The agenda was revised prior to the second meeting, held after the Closing Session, from 14:00–18:00 on October 18, to accommodate the schedules of invited guests, Dr. James Irvine (Co-Chairman SG SC-NP) and Dr. Keith Criddle (Co-Chairman S-HD) reporting on expert group activities, and Dr. Gordon Kruse (acting for FIS Chairman, Dr. Elizabeth Logerwell) reporting on FIS activities. A third, full-day, meeting was held from 9:00–19:00 on October 20. The revised meeting agenda times can be found in *SB Endnote 2*.



Participants of the PICES-2013 Science Board meeting (back row, from left): Atsushi Tsuda (BIO), Toru Suzuki (TCODE), Sinjae Yoo (Science Board Chairman), Hiroya Sugisaki (MONITOR), Hal Batchelder (representing AP-SOFE), Igor Shevchenko (representing Russia), (front row, from left): Thomas Therriault (AP-AICE and Science Board Chairman-elect), Hiroaki Saito (AP-COVE), Skip McKinnell (PICES Secretariat), Kyung-II Chang (POC). Absent in photo: Chuanlin Huo (MEQ).

*Sunday, October 13, 2013*

### AGENDA ITEM 2

#### **Procedures for Science Board Symposium, Session awards, and Closing**

Procedures for judging presentations by Early Career Scientists were briefly discussed. Any presentations made by early career scientists at workshops will not be considered in future Annual Meetings because they are held too far in advance of the main meeting when few Committee members are present to judge. Science Board agreed not to judge the small pool of posters in the Science Board Symposium at this meeting but instead, divide them among the MEQ- and MONITOR-sponsored topic sessions.

### AGENDA ITEM 3



**Relations with specific international programs/organizations**

*International Council for the Explorations of the Sea (ICES)*

ICES representative, Dr. Adolf Kellermann was unable to attend, but sent a list of 25 potential theme sessions for the ICES 2014 ASC for PICES to consider for co-sponsorship.

*International Oceanographic Commission of UNESCO and its Sub-commission for the Western Pacific (IOC/WESTPAC)*

Dr. Yutaka Michida, Vice-Chair of IOC, discussed past WESTPAC-PICES collaborative activities and informed Science Board that WESTPAC will be celebrating its 25th anniversary in 2014 by holding an International Scientific Symposium on “*A healthy ocean for prosperity in the Western Pacific: Scientific challenges and possible solutions*” April 22-25, 2014 in Nha Trang, Vietnam in which PICES was invited to participate. Deadline for abstract submission is November 30, 2013.

Science Board agreed that Drs. David Checkley (AP-CREAMS member) and Sanae Chiba (MONITOR, AP-CPR member) should represent PICES at the GOOS Biogeochemical Workshop to be held late fall in Townsville, Australia. It is anticipated that the workshop will lead to the formation of a new GOOS working group. MONITOR will provide guidance to them on PICES representation.

*Scientific Committee on Oceanic Research (SCOR)*

Committee Chairs were requested by the Science Board Chairman to review (1) a short list of SCOR working group proposals and (2) SCOR suggestions for joint capacity building activities at their Committee meetings before Science Board convened its second meeting. Once Science Board has finalized its selection for working group associate membership, Dr. Yoo will inform SCOR after the Annual Meeting. A document outlining PICES decisions on capacity building activities with SCOR will be prepared by Drs. Yoo, Thomas Theriault, and Harold (Hal) Batchelder. Dr. Batchelder, who is also a member of the SCOR capacity building team, will present it at the team meeting in November.

*Asia-Pacific Network (APN)*

Dr. Linda Stevenson, representing the Asia-Pacific Network, discussed APN activities in the Asia-Pacific area that could be linked with PICES. APN’s major activities for the next year are to fund regional research and capacity building projects. It is presently focusing on three activities, one being the Biodiversity and Ecosystem Services framework which APN would like to collaborate on with PICES and NOWPAP, although no formal proposal was presented.

*Sir Alister Hardy Foundation for Ocean Science (SAHFOS)*

Dr. Nicholas Owens, Director of SAHFOS, informed Science Board that SAHFOS has been making CPR surveys since 1931 and a goal is to fill in the gaps in surveys. This can be done because the samples have been archived, and the collected data are proving to be useful in policy making. A future objective is to have a full suite of oceanographic sensor instrumentation on every CPR body and to do molecular-level surveys. Since most of the world ocean is undersampled, there is lots of opportunity to sample along the Pacific. SAHFOS is interested in maintaining its current E-W transect collaboration with PICES but suggested there were opportunities to also do sampling along north-south transects along the North and South American continents and that a line to Hawaii could also be considered.

Friday, October 18, 2013

AGENDA ITEM 3, CONTINUED

**Relations with specific international programs/organizations**

*ICES (continued)*

Dr. Batchelder, acting for AP-SOFE Chairman, Dr. Phillip Mundy, who could not be present, made a brief report on ICES activities on behalf of Dr. Kellermann. ICES is developing a new strategic plan which will be launched in early 2014. The new plan is very similar to PICES' integrated science plan, FUTURE, and will focus on providing integrated advice to clients. Once ICES SCICOM is in place, it will review the document for scientific cooperation between ICES and PICES that was prepared by the joint P/ICES Study Group on *Developing a Framework for Scientific Cooperation in Northern Hemisphere Science* formed in 2009.

Science Board reviewed the list of ICES theme sessions that were chosen for PICES to co-sponsor by the Standing Committees at their Committee meetings on Wednesday, October 16. The selections are listed under Science Board recommendations in Agenda Item 5.

AGENDA ITEM 4

**Reports from expert groups under Science Board**

Section on *Human Dimensions of Marine Systems*

S-HD Co-Chairman, Dr. Keith Criddle, presented the activities, of the Section in the last half year, and what the group expected to achieve in its 2014 workplan. S-HD convened a workshop in Hawaii (June 13–16, 2013) to select indicator time series observations to feed into an HD chapter in the next version of NPESR. Workshop participants committed to provide preliminary data (or web links) at the S-HD meeting on October 16, 2013. A white paper on the legal and regulatory foundations of fisheries management in PICES member countries is anticipated as a PICES Scientific report in 2014, pending data received from Korea.

Plans are to hold a topic session at the FUTURE Open Science Meeting in Hawaii (April 15-18, 2014) on "*Human dimension indicators of the status of the North Pacific ecosystem*" and a 1-2 day meeting to review the first draft of the human dimension time series observations indicator data tables and assign responsibilities for drafting sections of an HD chapter for the next version of NPESR. The Section expects to review the draft chapter during the S-HD meeting at PICES-2014. Dr. Criddle reported that no FUTURE Advisory Panels have communicated with the Section, and that advice would be welcomed. The Section is considering holding a symposium between 2015 and 2017 and requests guidance from Science Board.

S-HD proposed a Study Group on Marine Ecosystem Services which would be kicked off as a workshop on the "*Development of marine ecosystem service indicators for the North Pacific region*" to take place March 2014, in Qingdao, China. The workshop would attempt to reach consensus on MES indicators for each PICES country and a commitment to conduct analyses needed to develop estimates of the value of MES for inclusion in the NPESR chapter on human dimensions. Science Board agreed that a workshop be held, first at PICES-2014, but inter-sessionally if funding can be arranged by China.

**Action:** FUTURE Advisory Panels to communicate with S-HD.

**Recommendation:** Science Board recommends S-HD hold a 1-day workshop on marine ecosystem indicators.

Study Group on *Scientific Cooperation in the North Pacific Ocean*

SG SC-NP Co-Chairman, Dr. James Irvine, presented a brief update since the Study Group's formation in June 2013. He noted that the main reason for establishing a joint NPAFC/PICES Study Group was to form a

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bottom-up approach to look at issues common to the two organizations. A final framework of enhanced collaboration to achieve better and/or more rapid understanding of natural and anthropogenic variability in marine ecosystems related to anadromous fish stocks will be developed in the spring of 2014. PICES-NPAFC expertise will be used to try to address a number of questions of mutual interest. In 2015 NPAFC will be hosting an NPAFC symposium which would be an ideal mechanism for the two organizations to address at least one of these questions.

*Saturday, October 19, 2013*

### AGENDA ITEM 3 (CONTINUED)

#### **Relations with specific organizations**

##### *SCOR (continued)*

Out of a list of 11 SCOR working group proposals that were reviewed by the Standing Committees after ISB-2013, three were chosen by Science Board for further discussion, based on the criterion of at least 2/3 of the Committees approving a proposal. All Committees subsequently supported the selection of:

1. Standard protocols for the development of an atlas of marine plankton biogeography;
2. Zooplankton production measurement methodologies and their application;
3. Studying ocean acidification effects on continental margin ecosystems.

Science Board agreed with SCOR's suggestions for strengthening cooperation through additional approaches besides those that are already maintained. Drs. Yoo and Batchelder will attend the SCOR Annual Meeting in November to discuss further means of SCOR-PICES collaboration.

#### **Action:**

- Dr. Yoo to submit the proposals to SCOR, and request to include Pacific representation if #3 is selected by SCOR);
- Dr. Batchelder to provide outcome of SCOR-PICES discussions from SCOR Annual Meeting.

##### *International Indian Ocean Expedition (IIOE-II)*

Science Board agreed that participating in updating Indian Ocean observations with the new technology now available would be interesting but the new initiative did not have direct relevance to PICES' interests at this time, although PICES would be interested to see a dipole connection between the Indian Ocean and western Pacific and/or ITF. Science Board would also be interested in tracking the progress of IIOE plans and agreed it would be worthwhile to send a local PICES representative to the IIOE-II planning meeting in Qingdao, China, November 20–21, 2013.

**Action:** Dr. Yoo to ask Dr. Fangli Qiao to attend IIOE-II planning meeting and provide Science Board with a report.

##### *Convention on Biological Diversity (CBD)*

In response to CBD's request from PICES for more information on identifying ecologically or biologically significant areas in the North Pacific (proposed at the CBD workshop to develop EBSAs in the North Pacific in Moscow, February 25– 1, 2013), Dr. Therriault and PICES Chairman, Dr. Laura Richards, prepared a draft terms of reference for a study group to identify the types of scientific activities currently under way or being planned for the North Pacific and any gaps where PICES might make a significant contribution. The proposal will be presented to Governing Council for review at PICES-2013 before being given to Science Board for comments. The top-down approach through Council versus the bottom-up approach through Committee expert groups for gathering EBSA information was briefly debated. Science Board recommended first to review

MEQ's proposal for a new expert group on biodiversity to see if it could do the work advocated in the CBD (see *SB Endnote 4*).

Science Board reviewed the 2012–2013 standing list of international and regional organizations and programs PICES identifies for interaction and agreed with the Secretariat's decision to delete:

- Arctic Climate Impact Assessment Program (ACIA of AMAP),
- American Fisheries Society Program on Climate and Aquatic Resources (AFSCAR),
- International Geosphere-Biosphere Program (IGBP),
- International Human Dimensions Program on Global Environmental Change (IHDP),
- South Asian Regional Committee for the System for Analysis, Research and Training (START),
- United Nations Environment Program (UNEP),

and to add the North Pacific Fisheries Commission to the standing list. Science Board requested the addition of Future Earth to the list (see GC Appendix B in the Report of Governing Council for the standing list elsewhere in the 2013 Annual report).

#### AGENDA ITEM 5

### Reports from Scientific and Technical Committees

#### *Science Board recommendations*

#### **Changes in chairmanship**

- Dr. Thomas Therriault replaces Dr. Sinjae Yoo as Science Board Chairman;
- Dr. Hiroaki Saito was elected Science Board Vice-Chairman;
- Dr. Angelica Peña (Canada) replaces Dr. Atsushi Tsuda (Japan) as BIO Chair;
- Dr. Atsushi Tsuda (Japan) replaces Dr. Michael Dagg (USA) as BIO Vice-Chairman;
- Dr. Jennifer Boldt (Canada) replaces Dr. Hiroya Sugisaki (Japan) as MONITOR Chair;
- Dr. Sanae Chiba (Japan) replaces Dr. Phillip Mundy (USA) as MONITOR Vice-Chair;
- Dr. Steven Bograd (USA) replaces Dr. Thomas Therriault (Canada) as AP-AICE Chairman.

#### **Membership changes/additions**

- Dr. Anya Dunham (Canada) to be FIS representative to AP-AICE;
- Dr. Young Jae Ro (MONITOR) be taken off the list of AP-AICE membership;
- BIO member to be appointed to S-CCME.

#### **Proposed new expert groups**

- Study Group on *Socio-Ecological-Environmental Systems* (SG-SEES; *SB Endnote 3*);
- Study Group on Biodiversity Conservation (SG-BC; *SB Endnote 4*);
- Working Group on *Emerging Topics in Marine Pollution* (WG 31; *SG-MP Endnote 2*).

#### **Expert groups to be disbanded upon completion of their final report**

- Study Group (SG-MP) on *Marine Pollutants*;
- Working Group (21) on *Non-indigenous Aquatic Species*;
- Working Group (26) on *Jellyfish Blooms around the North Pacific Rim*.

#### **Extension of existing expert groups**

- Working Group (WG 27) on *North Pacific Climate Variability and Change*;
- Working Group (WG 29) on *Regional Climate Modeling*.

#### **Expert groups to undergo progress review**

- Section on *Carbon and Climate*;
- Section on *Ecology of Harmful Algal Blooms in the North Pacific*.

**Joint theme sessions at the ICES 2014 Annual Science Conference in A Coruña, Spain**

- *Ecological consequences of reduced body size of organisms in the future ocean* (theme session M) [later withdrawn for PICES co-sponsorship];
- *Gelatinous zooplankton on a global perspective: interactions with fisheries and consequences for socio-economics* (theme session A);
- *The increasing importance of biofouling for marine invasions: an ecosystem altering mechanism* (theme session I);
- *Physical and biological consequences of exchanges between the Atlantic\* Subarctic and the Arctic* [\*PICES requested “North Pacific” to be added to the title; (theme session Q). Subsequently, the request could not be implemented in the title (later renamed as “*Physical and biological consequences of North Atlantic circulation patterns*”) but was referenced in the abstract description.];
- *Pelagic ecosystem dynamics from integrated monitoring surveys* [not accepted for co-sponsorship by Governing Council];
- *The big (ocean) data journey – All aboard?* [not accepted for co-sponsorship by Governing Council]

**Inter-sessional symposia/sessions/workshops/meetings**

- 2-day inter-sessional Science Board meeting, April 19–20, 2014, Kohala Coast, Hawaii, USA;
- 2-day meeting of the Evaluation Team to assess progress of FUTURE, April 19–20, 2014, Kohala Coast, Hawaii, USA;
- ½-day joint meeting of the Evaluation Team and Science Board, April 21, 2014, Kohala Coast, Hawaii, USA.;
- 29<sup>th</sup> Lowell Wakefield Fishery Symposium on “*Fisheries bycatch: Global issues and creative solutions*”, May 13–16, 2014, Anchorage, U.S.A. (co-sponsored by PICES).

**Capacity building**

- IMBER ClimECO4 Summer School on “*Delineating the issues of climate change and impacts to marine ecosystems: Bridging the gap between research, assessment, policy and management*”, August 4–9, 2014, in Shanghai, China (co-sponsored by PICES);
- 2014 PICES Summer School on “*Ecological modeling for marine resources management and research*” [now named “*End-to-end models for marine resources management and research*”], August 26–29, 2014, Seoul, Korea (approved in 2012).

**Priority items with funding implications**

*Inter-sessional events*

- PICES associate member (Dr. Lisa Miller) of SCOR WG 140 on *Biogeochemical Exchange Processes at the Sea-Ice Interfaces* to attend the WG 140 meeting (March 16, 2014, Hobart, Australia);
- PICES convenor and invited speaker (Dr. Heui Chun An, Korea) to participate in the 29<sup>th</sup> Lowell Wakefield Fishery Symposium on “*Fisheries bycatch: Global issues and creative solutions*” (May 13–16, 2014, Anchorage, USA);
- PICES convenor (Dr. Thomas Therriault) for the joint IMBER/PICES Theme Session on “*Responses of society to marine and global changes as a core mandate for IMBER: ways forward*” at the IMBER Open Science Conference (June 23–28, 2014, Bergen, Norway);
- PICES representative (Dr. Shoshiro Minobe) to attend the 1st Pan-CLIVAR meeting (July 17–18, 2014, The Hague, The Netherlands);
- PICES representatives and convenors for the joint Theme Sessions to participate in the ICES Annual Science Conference (September 15–19, 2014, A Coruña, Spain).

*Facilities*

- Renew rent of remote server for PICES TCODE geo-spatial portal site.

### Publications

#### Special issues of primary journals (2014-2015)

- Review paper based on findings from the 2013 PICES/ICES/GEOHAB workshop on “*Harmful algal blooms in a changing world*” (Lead Author: M. Wells) to be published in *Harmful Algae*.
- Special issue of *Progress in Oceanography* based on selected papers from the 2012 Topic Session on “*Advances in understanding the North Pacific Subtropical Frontal Zone ecosystem*” (Guest Editors: T. Ichii, S. McKinnell and M. Seki) to be submitted in 2014;
- Special issue of *ICES Journal of Marine Science* based on selected papers from the 2013 PICES/ICES workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” and the ICES/PICES Theme Session on “*Responses of living marine resources to climate change and variability*” at the 2013 ICES Annual Science Conference (Lead: A. Hollowed) to be published in late 2014–early 2015;
- Special issue of *Progress in Oceanography*, dedicated to Dr. Bernard Megrey, on modeling and observational approaches to understanding marine ecosystem dynamics (Guest Editors: E. Curchitser, S.I. Ito, M. Kishi, M. Peck and K. Rose) to be published electronically in late 2014 and hard copy in early 2015.

#### PICES Scientific reports

- Final report of Working Group (WG 21) on *Non-indigenous Aquatic Species*
- Final Report of Working Group (WG 26) on *Jellyfish Blooms around the North Pacific Rim: Causes and Consequences*;
- Final Report of Study Group (SG-MP) on *Marine Pollutants*
- S-HAB report on “*Economic and Social impacts of HABs on aquaculture and fisheries*”
- AP-CREAMS EAST-II project on “*Oceanography of Yellow and East China Sea*”
- Report of the 2012 GLOBEC/PICES/ICES Workshop on “*Forecasting ecosystem indicators with process-based models*”;
- S-HD white paper report on legal and regulatory foundations of fisheries management in PICES member countries.

#### Other

- Brochures on 6 themes from the PICES/ICES workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” (May 22–24, 2013, St. Petersburg, Russia)

Brief highlights of Committee activities and plans are provided below. High priority items from Committees are listed under relevant categories above. Detailed reports of each Committee can be found elsewhere in the [2013 Annual Report](#).

### BIO

BIO Committee Chairman, Dr. Atsushi Tsuda, reported that he will step down as Chairman of BIO but will take up the elected position of Vice-Chairman. Dr. Angelica Peña was elected as Chair. The final reports of Working Group (WG 22) on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific* and Working Group (WG 23) on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* were published July 2013.

The Committee agreed with the format of a joint FUTURE meeting being held first at this Annual Meeting followed by separate FUTURE Advisory Panel meetings.

BIO agreed with the new direction being proposed in the reporting process for the North Pacific Ecosystem Status Report (NPESR) but felt the schedule was not realistic. Since Status Reports are one of the top priorities of PICES, BIO felt the planning of such products must be done carefully and fully, and involve as many PICES members as possible. In this regard, BIO regarded the open NPESR meeting held half an hour

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prior to the scheduled Wednesday Committee meetings too short and would have liked SOFE to plan for a more complete presentation to all Committees and allow for more open discussion.

BIO agreed with AP-MBM's request to continue sending Dr. Hirohito Kato as a PICES representative to IWC meetings. BIO requested a BIO member be added to S-CCME to enhance tighter cooperation. BIO agreed in principle with the Section on *Carbon and Climate*'s development of its next workplan to focus on acidification and hypoxia and coastal carbon cycles.

### FIS

FIS member, Dr. Gordon Kruse, acting for the FIS Chair, Dr. Elizabeth Logerwell, who could not be present, presented the Committee report. A convention was signed to establish a new Regional Fishery Management Organization called the North Pacific Fisheries Commission (NPFC). Its scope includes high seas fishery resources, except those covered by other organizations, and includes important fishery resources such as Pacific saury and cephalopods. FIS recommended that PICES establish linkages to the new organization starting in 2014 when an NPFC scientific working group is established.

FIS recommended that PICES support ICES theme session "*Gelatinous zooplankton on a global perspective: interactions with fisheries and consequences for socio-economics*". The Committee felt there were other topics that would be relevant to FIS' Action Plan, but did not have the information needed to make a decision at PICES-2013, and requested that ICES provide further details and FIS be allowed to vote on the sessions via email. FIS ranked PICES Topic Sessions for PICES-2014 and suggested that the proposal on "*Recent assessments of climate change impacts on marine ecosystems*" be a Science Board sponsored topic session. Alternatively, in lieu of a topic session, two keynote speakers could headline the Science Board symposium to present comprehensive overviews on the topic.

FIS requested that "fisheries" be added to a list of keywords for the development of topic sessions for the proposed international Symposium on the "*Effects of climate change on the world's oceans*" to be held in Santos, Brazil, March 25–27, 2015. It was also noted that most climate change forecasts are based on single-species projections, so moving beyond single species to communities is more desirable, and therefore, a second area for a topic session could be "climate-driven ecological changes".

FIS requested travel support for Dr. Heui Chun An (Korea) to attend the Lowell Wakefield fisheries symposium on "*Fisheries bycatch: Global issues and creative solutions*" in Anchorage, Alaska (May 13–16, 2014). Dr. An is serving as a PICES SSC member and would serve as a co-convenor and invited speaker.

FIS agreed in principle with SOFE's plenary on the process for NPESR, but raised questions about whether all countries will agree to provide data, and what will happen if some countries do not agree to do so. FIS supported the new process but only if there are data sharing agreements between all PICES member countries. FIS also requested clarification on the financial costs of developing and maintaining databases and servers; how differences would be dealt with between the proposed process and the first two NPESRs; what type of information the website would host.

### MEQ

MEQ Chairman, Mr. Chuanlin Huo, reviewed the main achievements of the Committee over the past year, including the establishment of the Working Group (WG 30) on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* and the publication of the final report of Working Group (WG 24) on *Environmental Interactions of Marine Aquaculture* in August 2013. The Study Group on *Marine Pollution* submitted its final report to MEQ and requested the establishment of a section or working group on emerging topics on marine pollutants.

- WG 28 requested a 2-day business meeting at PICES-2014;
- WG 28 requested \$1500 support for 2 invited speakers (from Western and Eastern Pacific)

- WG 21 requested \$3000 travel support for speaker/convenor for a joint ICES/PICES theme session on “*The increasing importance of biofouling for marine invasions: an ecosystem altering mechanism*” at ICES ASC 2014;
- SG-MP requested \$2000 travel support for 2 invited speakers (from Western and Eastern Pacific) for topic session on “*Marine debris in the Pacific Ocean: Source, transport, fate and effects of macro- and micro-plastics*” at PICES-2014
- S-HAB requested \$3000 travel support for a “Climate and HABs” SSC member to attend an IPHAB meeting in April;
- S-HAB requested \$1500 travel support for 2 invited speakers for ½-day topic session and 1-day workshop at PICES-2014
- WG 30 requested a 1½-day business meeting at PICES-2014
- WG 21 requested the establishment of a section on biodiversity conservation including NIS

**Action:** MEQ to instruct S-HAB to prepare a progress report for its tri-annual review by Science Board.

MEQ supported the new approach to publishing NPESR, but had concerns as to how the datasets would be identified, how quality control would be ensured, and how analysis would be conducted. The Committee also felt that SOFE’s suggested timeline of 20 months was too ambitious.

#### POC

POC Chairman, Dr. Kyung-Il Chang, was re-elected as Chairman for another term. POC supported the request of WG 27 member, Dr. Shoshiro Minobe, to attend the first Pan-CLIVAR meeting in July 17–18, 2014 in the Hague, The Netherlands, to look for ways to strengthen PICES-CLIVAR collaboration. Dr. Lisa Miller, representing SOLAS, reported that the 6<sup>th</sup> international SOLAS Summer School in Xiamen, China (August 23–September 2, 2013) was a success, with 36% of the participants from PICES member countries, and PICES supporting 3 students. As IGBP sponsorship of SOLAS will be winding down, SOLAS will transition to the Future Earth initiative, which has a large human dimensions component. SOLAS has a number of research themes it would like to address under the new initiative, and welcomes comments and suggestions from PICES by November 2013. Dr. Miller is seeking travel support to attend the SCOR WG 140 (Biogeochemical Exchange Processes at the Sea-Ice Interfaces II) in Hobart in March 2014.

AP-CREAMS recommended the supplementary chapter to the second version of NPESR be published without further delay. In the case of any delay, AP-CREAMS will initiate efforts to publish outside of PICES, possibly as a book. However, the publication is not intended to act as a replacement for the supplementary chapter, and PICES should continue efforts for completing it before the third version of NPESR. AP-CREAMS requested support for 5 lecturers and 5 students for 2014 PICES Summer School on “*Ecological modeling for marine resources management and research*”, August 26–29, 2014, Seoul, Korea.

Working Group (WG 29) on *Regional Climate Modeling* began discussions on the final WG report. FUTURE products will include scientific papers, an inventory of modeling efforts, analysis of CMIP5 output, derived quantities (e.g., MLD), and model data, if possible, but there are still gaps to fill, especially for ecosystems. Since RCMs are complex and take time to develop and since there is little expertise in modeling human activity, WG 29 requested a 1-year extension, in part, to examine the latest available models from the CMIP5 effort. The WG suggested better communication between the expert groups, e.g., S-CCME, S-HD to understand what and how to achieve those products. WG 29 also requested clarification from Science Board/TCODE as to how the model data might be served.

**Action:** FUTURE Advisory Panels to promote communication between WG 29 and other expert groups.

Working Group (WG 27) on *North Pacific Climate Variability and Change* FUTURE products will include a final report, website repository for archiving data of ocean circulation anomalies from regional models and from IPCC outputs. Suggestions to filling identified gaps included entraining more climate modelers, developing critical datasets, sharing information among expert groups, continuing to be connected to large



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programs/organizations (e.g., CLIVAR, ICES), and improving communication with other expert groups (e.g., S-HD). WG 27 requested a 1-year extension, in part, to examine the latest available models from the CMIP5, analyze further FUTURE gaps, and organize contributions for the 3<sup>rd</sup> international symposium on the “*Effect of climate change on the world’s oceans*” in 2015. WG 27 proposed a new Study Group on *Socio-Ecological-Environmental Systems* to look at developing an integrated model that would allow the study of dynamics between climate, marine ecosystems and the human dimension, and the exploration of sensitivity of the integrated systems to perturbation in key controls.

POC recommended that Science Board support the 1-year extensions of WG 27 and WG 29, and the proposal for a new Study Group on *Socio-Ecological-Environmental Systems*.

The Section on Carbon and Climate (S-CC) will prepare a document on accomplishments and future activities to be reviewed by BIO and POC, at PICES-2014, in accordance with the PICES Rules of Procedures in which parent Committees will review their Sections every 3 years. S-CC was last reviewed in 2010. The Section objectives will re-focus around acidification and de-oxygenation issues in support of FUTURE. The PACIFICA data synthesis is complete, but not yet published.

POC proposes to offer more physics-focused topic sessions at future Annual Meetings to encourage more early career scientists majoring in physical oceanography to attend and be involved in PICES Annual Meetings.

POC approved the new process for NPESR in principle, but would like to know more details, especially the level of commitment and engagement of the PICES community to make it achievable.

### MONITOR

MONITOR Chairman, Dr. Hiroya Sugisaki, reported that PICES members, Drs. Sonia Batten (AP-CPR) and Sanae Chiba (MONITOR, AP-CPR) attended the second GACS (Global Alliance of Continuous Plankton Recorder Surveys) in Paris, France, in September. Dr. Batten is also Vice-Chair of GACS. Contributions by all members of the CPR consortium for the North Pacific CPR survey is stable until mid-2014.

Dr. Chiba accepted the request to represent PICES at the First Technical Expert Workshop for the GOOS Biology and Ecosystem, and GOOS Biogeochemistry Panels in November 2013 in Townville, Australia. MONITOR will provide her with information on PICES monitoring activities.

MONITOR agreed in principle with SOFE’s proposal for the new process of producing NPESR, but the Committee needed more time to consider mechanisms and timelines for reporting.

### TCODE

TCODE Chairman, Dr. Toru Suzuki, reported that the TCODE-sponsored Workshop (W4) on “Tools, approaches and challenges for accessing and integrating distributed datasets” was cancelled due to the lack of US representation due to the US government shutdown that coincided with the Annual Meeting. TCODE recommends holding the same workshop at PICES-2014. TCODE asked guidance on the benefits of *ex officio* TCODE membership with the IODE Associate Data Unit (ADU) if all TCODE can share are data that are readily available on other platforms.

TCODE agreed with the new process of producing NPESR and will assist in the data management aspect, but had concerns regarding such items as the amount of time it will take to update time series, metadata and provide interpretation, the cost breakdown of the report, and where the data will reside.

## AGENDA ITEM 6

**PICES-2014, Yeosu, Korea**

The theme for PICES-2014 is “*Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*” and the Annual Meeting will be held from October 17–26, 2014, in Yeosu, Korea. The following topic sessions and workshops were recommended by Science Board:

¾-day Science Board Symposium

*Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*

½-day BIO Contributed Paper Session

½-day BIO Topic Session

*Strengths and limitations of habitat modeling: techniques, data sources, and predictive capabilities*

1-day BIO/MEQ Topic Session

*Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystems*

½-day BIO/TCODE/MONITOR Topic Session

*Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries*

½-day FIS Contributed Paper Session

½-day FIS Topic Session [to be co-sponsored by ICES]

*Ecosystem considerations in fishery management of cod and other important demersal species*

½-day FIS/FUTURE Topic Session [to be co-sponsored by ICES]

*Climate change impacts on spatial distributions of marine fish and shellfish*

1-day FIS/TCODE/FUTURE Topic Session [to be co-sponsored by ICES]

*Recent assessments of climate change impacts on marine ecosystems*

2-day FIS Workshop [to be co-sponsored by ISC]

*Dynamics of pelagic fish in the North Pacific under climate change*

½-day FIS Workshop [later changed to 1 day; to be co-sponsored by NPAFC]

*Towards improved understanding of linkages between Pacific salmon and their marine ecosystems [later renamed to Linkages between the winter distribution of Pacific salmon and their marine ecosystems and how this might be altered with climate change]*

½-day MEQ Contributed Paper Session

½-day MEQ Topic Session

*Marine debris in the Pacific Ocean: Source, transport, fate and effects of macro- and micro-plastics*

1-day MEQ Workshop [to be co-sponsored by ICES]

*Mitigation of harmful algal blooms: Novel approaches to a decades long problem affecting the viability of natural and aquaculture fisheries*

½-day POC Contributed Paper Session

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1-day POC/MONITOR Topic Session [to be co-sponsored by ESSAS]  
*Variability in advection and its biological consequences for Subarctic and Arctic ecosystems*

1-day POC/TCODE/FUTURE Topic Session  
*Regional climate modeling in the North Pacific*

½-day POC Workshop [to be co-sponsored by SOLAS]  
*SOLAS into the Future: Designing the next phase of the Surface Ocean-Lower Atmosphere Study within the context of the FutureEarth Program*

1½-day MONITOR Workshop [to be co-sponsored by Ocean Networks Canada, U.S. CLIVAR]  
*Networking ocean observatories around the North Pacific Ocean*

1-day TCODE Workshop [to be co-sponsored by IODE]  
*Tools, approaches and challenges for assessing and integrating distributed datasets*

½-day MarWeb Topic Session  
*Ecological and human social analyses and issues relating Integrated Multi Trophic Aquaculture*

1-day Science Board Workshop  
*Marine Ecosystem Services*

Science Board was generally pleased with the process of submitting proposals for topic sessions and workshops, now in its second year of application. A couple of suggestions were presented for improvement of online ranking.

### Action:

- Secretariat delete third column (*i.e.*, Committee/Panel) of the summary table for submissions to avoid being mistaken as an endorsing group;
- Secretariat increase ranking scale from 3 to 4 levels (no, ok, good, very good).

### AGENDA ITEM 7

#### **3<sup>rd</sup> International Symposium on the “Effects of climate change on the world’s oceans”**

In response to the email request from symposium co-convenor, Dr. Jacquelynne King (representing PICES) just prior to PICES-2014, Committees provided the following session descriptions or list of key words for symposium topics.

- fisheries,
- session on “climate-driven ecological change”
- biodiversity,
- predator-prey relations
- oxygenation/de-oxygenation
- session on “climate change and eastern boundary currents: evidence for change”

The 3<sup>rd</sup> PICES/ICES/IOC Symposium will take place March 23-27, 2015 in Santos, Brazil.

### AGENDA ITEM 8

#### **Status of proposed inter-sessional workshops/symposia**

Science Board recommended supporting:

- Dr. Fangli Qiao (China) to represent PICES at the IIOE-II meeting in Qingdao, China (November 20–21, 2013) [later confirmed that Professor Dejun Dai, First institute of Oceanography, SOA would attend];
- Lowell Wakefield fisheries symposium on “*Fisheries bycatch: Global issues and creative solutions*” in Anchorage, Alaska (May 13–16, 2014);
- joint IMBER/PICES Theme Session on “*Responses of society to marine and global changes as a core mandate for IMBER: ways forward*” at the IMBER Open Science Conference in Bergen, Norway (June 23–28, 2014).

**Action:** Dr. Therriault to confirm invited speaker for IMBER/PICES theme session at IMBER OSM.

#### AGENDA ITEM 9

##### **Capacity building**

Science Board recommended co-sponsoring:

- IMBER ClimECO4 Summer School on “*Delineating the issues of climate change and impacts to marine ecosystems: Bridging the gap between research, assessment, policy and management*”, August 4–9, 2014, in Shanghai, China;
- 2014 PICES Summer School on “*Ecological modeling for marine resources management and research*”, August 26–29, 2014, Seoul, Korea. Science Board recommended travel support for 2 lecturers from the eastern Pacific and 5 students.

Science Board recommended not to support the Pacific Ecology and Evolution Conference (March 2014, Bamfield, British Columbia) because of its local focus on early career scientists from the eastern Pacific.

#### AGENDA ITEM 10

##### **Early Career Scientist Conference in 2017**

No formal proposal was issued on what Asian country will hold an Early Career Scientist Conference in 2017. China expressed interest but cannot make plans because it was reviewing its budget. However, it would be willing to provide support to any country undertaking the event. Korea also expressed interest, but no decision was forthcoming at the time of the Science Board meeting.

**Action:** PICES to discuss a contingency plan with ICES and make decision by ISB-2014.

#### AGENDA ITEM 11

##### **PICES 25<sup>th</sup> Anniversary activities**

Science Board briefly discussed activities to celebrate PICES’ 25<sup>th</sup> Anniversary in 2016. Potential considerations could be to conduct a pan-Pacific cruise to mark the building of a Korean research vessel (which will to be completed in 2016) or to inaugurate a PICES scientific journal. Dr. Yoo instructed the Committee Chairs to discuss other potential scientific activities with their members.

**Action:** Committee Chairs to provide feedback from their Committees on celebration activities at ISB-2014.

#### AGENDA ITEM 12

##### **Revision of Wooster/POMA awards description**

The PICES Ocean Monitoring Service Award (POMA) was revised by Drs. Sugisaki and Mundy to broaden the range of nominations. Both the Wooster award (revised for clarity by the Secretariat) and POMA changes were accepted by Science Board.

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### AGENDA ITEM 13

#### **Election of Science Board Vice-Chair**

Deputy Executive Secretary, Dr. Skip McKinnell, conducted elections to name the next Vice-Chairman of Science Board to replace Dr. Therriault, who will take up duties as Science Board Chairman after PICES-2014. Dr. Hiroaki Saito accepted the position of Vice-Chairman of Science Board after being nominated by MONITOR. Science Board unanimously approved the decision.

### AGENDA ITEM 14

#### **Review of Action Plans for Standing Committees and Science Board**

Due to lack of time, Committee Action Plans were not finalized. Dr. Yoo briefly referred to nominal changes he had made to the Plans to have a more consistent format, and to the more substantial action and tasks added to Goal 10 to emphasize the connection between Committees and FUTURE Advisory Panels, and asked that these changes be reviewed and any modifications made before sending the finalized Plans to the Secretariat for posting on the Committee webpages.

**Action:** Committee Chairs to review changes and make any adjustments before submitting final Action Plans to the Secretariat.

### AGENDA ITEM 15

#### **FUTURE OSM 2014**

The topic sessions and workshops, times and convenors were in place but national delegates needed to be contacted to provide a review of current national activities and future activities they would like to see in the FUTURE program.

Four out of six potential members of a FUTURE Evaluation Team who were contacted after ISB-2013 (St. Petersburg, Russia) agreed to be part of the Team. Two potential members, Dr. Vyacheslav Lobanov and Dr. James Overland (members of the former FUTURE Implementation Plan Writing Team) still needed to be approached. Alternate contacts will be made in case Dr. Lobanov and/or Dr. Overland are unable to accept. [Correspondence after the meeting resulted in Dr. Lobanov and alternates, Dr. Shin-ichi Ito and Jacquelynn King, tentatively accepting but were unable to commit due to internal institute restructuring or travel commitments.]

#### **Action:**

- Drs. Yoo and Therriault to draft a letter to PICES member countries regarding current and future role of national programs in FUTURE;
- Dr. Yoo to contact Dr. Lobanov and Overland to be part of the Evaluation Team.

### AGENDA ITEM 16

#### **Presentation and discussion of current status of FUTURE Advisory Panels**

##### *AP-AICE*

Participation by members continued to be an issue, as in previous years. AICE requested the removal of Dr. Young Jae Ro from membership on the PICES website to reflect his removal from the Panel in 2012. Active members representing BIO, FIS, S-CMME and S-HD needed to be identified and added to AICE membership.

AICE requested expert groups to start identifying specific products they are producing or have completed. AICE also requested expert groups to identify specific data products needed or desired from other expert groups. This will allow the FUTURE APs to determine connections between groups and provide a reliable means of communication and delivery of FUTURE products.

AICE recommended that the proposed Study Group on *Socio-Ecological-Environmental Systems* be allowed to develop a case study pilot for a specific region to test how an integrated team product can be delivered. In addition, it was suggested that intermediate products be developed to be used as a link between desired FUTURE products and actual products being made by expert groups. AICE recommended that expert groups identify linkages to Ecosystem Services to be used by the Section on *Human Dimension of Marine Systems*.

#### *AP-COVE*

Member representation at the AP-COVE meeting was good. Overall, the COVE-related expert groups, WG 27, WG 28, WG 29, S-CC and S-CCME are very active and have, or are, producing many products. WG 29, in particular, needs to know what type of products would be useful to deliver and requested the development of proper infrastructure to facilitate changes.

COVE recommended:

- FUTURE gaps be identified after the FUTURE Open Science Meeting (April 15–18, 2014) and determine the expert groups that are needed to cover these gaps;
- A tool be provided on the PICES website to track products;
- A close linkage between AP-CREAMS, AP-CPR, and AP-MBM to FUTURE-related expert groups;
- A formal expert groups/FUTURE session during the next Annual Meeting to exchange information and discuss how to advance FUTURE science.

AP-COVE, Chairman, Dr. Saito, requested that in future all Standing Committees convey to proponents of future expert groups that they:

1. Make clear in their proposal only those members appointed by their national delegates who will be eager to contribute to the proposed activity;
2. Describe what products will be the outcome of their group;
3. Provide a timeline when that product is expected to be produced.

#### *AP-SOFE*

SOFE reported that member participation was good at their business meeting. SOFE received positive feedback from the community on the proposed new process of presenting information for the next version of the NPESR but acknowledged there were still issues that needed to be resolved. In response to particular concerns raised by FIS, SOFE reported that a preliminary budget for starting up and maintaining the new reporting process was prepared but little feedback had been received so far on how realistic it was. To deal with the disparity between the previous two reports focusing on continental shelves and the new process on LMEs, it was noted that each PICES country typically has continental shelves and would put together their own LMEs and map their data for it. The finer details of data presentation on the web would be handled by datasets and graphics as well as identification by title and abstract; data integration and synthesis could also be done if Science Board chose this approach.

#### AGENDA ITEM 17

##### **Issues with FUTURE implementation**

Science Board agreed to wait until after the Evaluation Team meeting at the FUTURE Open Science Meeting to discuss remaining gaps in the FUTURE roadmap. In the meantime it was important to have synergy between expert groups so that linkages could be established and products defined by AICE, COVE and SOFE. It was agreed that in place of individual Advisory Panel meetings at the next Annual Meeting, a ½ day will be

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devoted to a joint FUTURE Advisory Panel and expert group meeting. [This was later revised to ¼-day concurrent meetings of the FUTURE Advisory Panels preceded by a ¾-day joint meeting of these Panels.]

**Action:** FUTURE SSC to discuss FUTURE products at PICES-2014.

### AGENDA ITEM 18

#### **Other FUTURE matters**

Science Board agreed with the concept of SOFE's proposal for a web-based approach for producing version 3 of the North Pacific Ecosystem Status Report and agreed to present it to Governing Council for review and feedback. SOFE will update the report in incremental stages similar to the second version of NPESR. Dr. Mundy thanked Science Board for their comments and suggestions.

### AGENDA ITEM 19

#### **Status of proposed publications**

This item was not discussed due to lack of time.

### ***SB Endnote 1***

#### **Science Board participation list**

##### Members

Harold (Hal) Batchelder (representing AP-SOFE)  
Kyung-Il Chang (Korea)  
Chuanlin Huo (MEQ)  
Xianshi Jin (FIS Vice-Chairman, Oct. 13)  
Gordon Kruse (representing FIS, Oct. 18)  
Hiroaki Saito (AP-COVE)  
Igor Schevchenko (representing Russia)  
Hiroya Sugisaki (MONITOR)  
Toru Suzuki (TCODE)  
Thomas Therriault (AP-AICE, Chairman-elect)  
Atsushi Tsuda (BIO)  
Sinaje Yoo (Science Board Chairman)

##### PICES

Alexander Bychkov (Oct. 13)  
Skip McKinnell

##### Observers

Yutaka Michida (IOC/WESTPAC)  
Nicholas Owens (SAHFOS)  
Linda Stevenson (APN)  
James Irvine (Co-Chairman, SG SC-NP)  
Keith Criddle (Co-Chairman, S-HD)

**SB Endnote 2****Science Board agenda**

*Friday, October 18, 2013 (14:00 – 18:00) Nanaimo River Room A*

1. Welcome and adoption of agenda
2. Review of procedures for Science Board Symposium and Session awards, and Closing Session
3. Relations with specific international programs/organizations (Yoo, international organization representatives)

*Friday, October 18, 2013 (14:00 – 18:00) Nanaimo River Room A*

3. Relations with specific international programs/organizations, continued (Yoo, international organization representatives)
4. Reports from Expert Groups under Science Board

*Saturday, October 19, 2013 (09:00 – 18:00) Nanaimo River Room A*

3. Relations with specific international programs/organizations, continued (Yoo, international organization representatives)
5. Reports from Scientific and Technical Committees (Committee Chairs)
6. PICES-2014, Yeosu, Korea theme and description, draft schedule of scientific sessions and workshops
7. Preparation for 3rd International Symposium on the “*Effects of Climate Change on the world’s ocean*”
8. Status of proposed inter-sessional workshops/symposia (All)
9. Capacity building/Plan for PICES summer schools in 2013 and 2014 (Yoo and McKinnell)
10. Planning Early Career Scientist Conference in 2017
11. PICES 25th Anniversary activities
12. Revision of Wooster/POMA Awards description
13. Election of Science Board Vice-Chair
14. Review of Action Plans for Standing Committees and Science Board
15. FUTURE OSM 2014
16. Presentation and discussion of current status of the FUTURE APs (FUTURE SSC)
17. Issues with FUTURE implementation (FUTURE SSC)
18. Other FUTURE matters (AICE (Therriault), COVE (Saito), SOFE (Mundy))
19. Status of proposed publications
20. Other business

**SB Endnote 3****Study Group on Socio-Ecological-Environmental Systems**

Parent Committee: Science Board

Duration: 1 year

## Terms of Reference

1. Assemble a team of experts for all the components that make up a Social-Ecological-Environmental System (SEES) and initiate a tighter communication among the experts to understand the challenges of conducting integrated science that include the climate, marine ecosystem and human dimensions explicitly.
2. Develop an integrated model of SEES case study for hypoxia and acidification in the coastal ocean and select a suitable focus region.
3. Conduct a meeting at the FUTURE Open Science Meeting (April 2014) and implement the steps needed to initiate the development of the integrated model.



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4. Conduct a meeting at the PICES Annual Meeting (October 2014) to finalize a report with recommendations for how the Organization can advance in this field of coupled SEES modeling in the near future.

***SB Endnote 4***

**Study Group on *Biodiversity Conservation***

Parent Committee: Science Board

Duration: 1 year

Terms of Reference

1. Review the scope of key drivers of biodiversity change in the North Pacific Ocean, including, but not limited to: non-indigenous marine species, climate change, fishing, and eutrophication.
2. Identify potential mechanisms to advance biodiversity-based scientific research and/or conservation related to drivers of biodiversity change in the North Pacific Ocean.
3. Review the research activities, past and present, undertaken by PICES and other international organizations on biodiversity in the North Pacific Ocean.
4. Identify opportunities for collaboration, new research opportunities for PICES, and the potential to provide science-based advice that could be used to inform decisions related to the conservation and management of biodiversity in the North Pacific Ocean.
5. Prepare a final report that includes an assessment of the merits of establishing an expert group focused on biodiversity science within PICES, and provide recommendations on the role(s) of such a group.

## Report of the Biological Oceanography Committee

The Biological Oceanography Committee (BIO) held its meeting from 18:00–19:30 h on October 13 and 14:50–18:15 h on October 16, 2013 in Nanaimo, Canada. The Chairman, Dr. Atsushi Tsuda, called the meeting to order and welcomed the participants (*BIO Endnote 1*). The proposed agenda was reviewed and is provided in *BIO Endnote 2*.

### AGENDA ITEM 3

#### Annual review of BIO activities

The BIO Committee is parent to 6 subsidiary groups (S-CCME, S-CC, AP-MBM, WG 26, WG 28 and WG 29) whose aim are to understand the biological aspects of the North Pacific ecosystems. S-CC finalized a data base of physical and biogeochemical parameters (PACIFICA) last year, and they are preparing synthesis papers. AP-MBM renewed its activity plan in 2011, focusing on the spatial ecology of marine birds and mammals and actively working through Annual Meeting Workshops and Topic Sessions with other groups. WG 26 is in its final year and preparing its final report. The WG held an inter-sessional meeting in June in Hiroshima, Japan, during the 4<sup>th</sup> International Jellyfish Blooms there. WG 28 is in its 3<sup>rd</sup> year, and their progress is obvious through the proposed Topic Session on ecological indicators of multiple stressors for PICES-2014. The final reports of Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22) and Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* (WG 23) were published this year. Both reports include valuable data and synthesis on iron as a micro-nutrient and krill biology, respectively. The BIO Action Plan was discussed at the Committee meeting at PICES-2012 and was finalized at this year's Committee meeting.

### AGENDA ITEM 4

#### Oral and Poster Awards

Procedure to select the Awards for the Closing Session at PICES-2013 was confirmed as follows: Each Committee member was to list two top candidates for an oral presentation by an early career scientist in the BIO Paper Session and BIO-sponsored Topic Session S5, and provide the names to the BIO Chairman. For the Poster presentation (open eligibility), each Committee member was to list two top candidates and provide the names to the BIO Chairman by email. Rankings were compiled by the Chairman. The Best Presentation Award for a BIO-sponsored topic session was given to Dr. Jeffrey Dorman ([\*Modeling krill 'hotspots' in the central Californai Current: Results from variation in diel vertical migration schemes\*](#)) and BIO Best Poster Award to Mr. Daichi Arima ([\*Seasonal changes in the zooplankton community and number of generations per year of small copepods in Ishikari Bay, Sea of Japan\*](#)). Further details on award recipients can be found at the end of the Session Summaries section in the [2013 Annual Report](#).

### AGENDA ITEM 5

#### Report from FUTURE APs

Reports synthesizing the activities of AICE, COVE, and SOFE were summarized by Dr. Hiroaki Saito (BIO member and AP-COVE Chairman):

- a) The FUTURE road map was summarized and discussed.
- b) A summary of activities since last year was given.
- c) Communications between Committees and FUTURE still require some improvement.
- d) Planning for the FUTURE Ocean Science Meeting in Hawaii in 2014 was described.
- e) The procedure for development of NPESR III was briefly described by SOFE members in a plenary before the Committee meeting (see the report of AP-SOFE for details). BIO committee members felt that proposed

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idea and the procedure were immature at this stage to make a decision. The frequent updates from time-series observations in the North Pacific was a good idea but it could be difficult to carry out.

- f) Some ways to encourage early career scientists to be involved in FUTURE were presented; BIO representatives on FUTURE APs are: Hiroaki for COVE; William Peterson for SOFE, but no representative for AICE from BIO Committee. The BIO Chair will discuss a candidate for AICE with AP Chair. It was agreed that for FUTURE AP meetings, if the BIO representative cannot attend, someone else from BIO should go as replacement. It is also important for the AP to report back to the Committee, for good communication.

### AGENDA ITEM 6

#### Reports from subsidiary bodies

##### Section on *Climate Change Effects on Marine Ecosystems* (S-CCME)

S-CCME Co-Chairman, Dr. Suam Kim, gave a brief report on the Section's activities, including the outline and outcome from their workshop in St. Petersburg, Russia, in May 2013, which is part of a 9 year-program spread over three 3-year cycles. The full report can be found at [http://www.pices.int/publications/annual\\_reports/Ann\\_Rpt\\_13/ann\\_rep\\_2013.aspx](http://www.pices.int/publications/annual_reports/Ann_Rpt_13/ann_rep_2013.aspx).

##### Advisory Panel on *Marine Birds and Mammals* (AP-MBM)

A report summarizing the meeting of AP-MBM, held October 12, 2013, was presented by AP-MBM Co-Chairman, Dr. Yutaka Watanuki. An overview of topic session (*AP-MBM Endnote 7*) proposed for 2014 PICES Annual Meeting was presented. The end of the AP's project on Spatial Ecology and Conservation will end in 2015. New directions of AP-MBM from 2015–2017 were presented. Four possibilities for themes were suggested; continuing the same theme as this cycle could also be considered. The timeline for preparing this plan was discussed because BIO must evaluate AP-MBM's performance at the 2014 Annual Meeting.

##### Section on *Carbon and Climate* (S-CC)

A summary of activities was given by S-CC Co-Chairman, Dr. James Christian. A written report also will be submitted. S-CC is due to be reviewed by its parent Committees, BIO and POC, for another 3-year extension (Rule of Procedure 13(iii)(d)). A suggestion was made to request a 6 month extension to give S-CC time to prepare a workplan for reauthorization (*S-CC Endnote 4*).

##### Working Group on *Jellyfish Blooms around the North Pacific Rim: Causes and Consequences* (WG 26)

WG 26, chaired by Drs. Shin-ichi Uye and Richard Brodeur, has a 3-year term from 2010-2013. Unfortunately, the WG 26 meeting was cancelled during this 2013 Annual Meeting, but a summary of activities was presented in a document. WG 26 had an inter-sessional meeting in association with the 4<sup>th</sup> International Jellyfish Bloom Symposium in Hiroshima in June 2013. The final report will be prepared according to schedule.

##### Working Group on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* (WG 28)

WG 28, chaired by Drs. Motomitsu Takahashi and Ian Perry, has a 4-year term from 2011–2014. A summary of activities, including the outcome from the inter-sessional joint PICES-ICES workshop in St. Petersburg, Russia. The WG has prepared a Table of Contents for its final report and has assigned members to prepare each section with the goal to complete of the final version by mid-2015.

##### Working Group on *Regional Climate Modeling* (WG 29)

WG 29, chaired by Drs. Chan Joo Jang and Enrique Curchitser, has a 3-year term from 2011–2014, but has asked for an extension of 1 year to examine models appropriate to fill gaps in ecosystems in FUTURE. Dr. Angelica Peña summarized the activities of the WG 29, and the Committee discussed its commitment to this WG, of which the main focus is physical models on a regional scale.

## AGENDA ITEM 7

**International relationships***International Whaling Commission (IWC)*

Dr. Hidehiro Kato could not come to this meeting but he presented a written document to the Committee. A details is presented in MBM report (*AP-MBM Endnote 4*).

*BEST-BSIERP/NPRB (Bering Sea Project)*

Dr. Jeff Napp was not able to attend the Annual Meeting, but Dr. Franz Mueter was able to give a short summary. This program is now in its synthesis stage. A 1-day final meeting for summary talks will be held at the AGU/ASLO meeting in Hawaii in February 2014.

*Ecosystem Studies of Sub-Arctic Seas (ESSAS)*

Dr. Mueter briefly introduced ESSAS, an IMBER regional program. The Committee agreed that ESSAS is a valuable collaboration for BIO/PICES. The ESSAS and PICES meetings have sessions with similar themes, overlapping personnel, and other linkages.

*Surface Ocean – Lower Atmospheric Studies (SOLAS)*

Dr. Lisa Miller gave a brief summary of SOLAS and relations with BIO/PICES. SOLAS appreciates its special connection to PICES, especially for the financial support provided for the SOLAS summer school in Xiamen, China (August 23–September 2, 2013) in which 36% of the students were from PICES member countries and a best presentation award was given to a PICES-supported student. A workshop was proposed for PICES-2014 to solicit community support for the renewal of SOLAS under the FutureEarth umbrella. BIO members expressed some concern about whether this was a good theme for a PICES topic session.

*International Council for the Explorations of the Sea (ICES)*

The Committee members discussed the proposed theme sessions for the 2014 ICES ASC. BIO was supportive of #17 on gelatinous zooplankton, but neutral about the others.

*Scientific Committee on Oceanic Research (SCOR)*

BIO evaluated the SCOR working proposals and recommended three proposals on the PICES list, especially on “Studying Ocean Acidification Effects on Continental Margin Ecosystems” and “Production Measurement Methodologies and Their Applications”. Dr. Lisa Miller introduced the activities of SCOR WG140 on Sea-ice Biogeochemistry at the Interface.

## AGENDA ITEM 8

**Topic sessions and workshops completed at PICES-2013**

- S2 Are marine ecosystems of the North Pacific becoming more variable? (BIO/FIS/POC), Co-Convenors: Steven Bograd (USA), Elizabeth Logerwell (USA), William Sydeman (USA) and Yutaka Watanuki (Japan)
- S5 Marine ecosystem services and the contribution from marine ecosystems to the economy and human well-being (BIO/FIS), Co-Convenors: Shang Chen (China), Keith Criddle (USA), Ekaterina Golovashchenko (Russia), Mitsutaku Makino (Japan), Jungho Nam (Korea), Minling Pan (USA) and Ian Perry (Canada)
- S6 Recent trends and future projections of North Pacific climate and ecosystems (BIO/POC/TCODE/MONITOR/FUTURE), Co-Convenors: Jack Barth (USA), James Christian (Canada), Enrique Curchitser (USA), Chan Joo Jang (Korea) and Angelica Peña (Canada)
- S8 Ecosystem indicators to characterize ecosystem responses to multiple stressors in North Pacific marine ecosystems (BIO/FIS/MEQ/TCODE/FUTURE), Co-Convenors: Vladimir Kulik (Russia),

## BIO-2013

Chaolun Li (China), Ian Perry (Canada), Jameal Samhouri (USA), Peng Sun (China), Motomitsu Takahashi (Japan) and Chang-Ik Zhang (Korea)

- BIO Paper Session Co-Convenors: Michael Dagg (USA) and Atsushi Tsuda (Japan).
- W2 Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future. (POC/BIO/MONITOR/FUTURE) Co-Convenors: Jack Barth (USA), Emanuele Di Lorenzo (USA), Marc Hufnagl (Germany) Jacquelynne King (Canada), Arthur Miller (USA), Shoshiro Minobe (Japan), Ryan Rykaczewski (USA) and Kazuaki Tadokoro (Japan)
- W3 Marine bird and mammal spatial ecology. (BIO), Co-Convenors: Robert Suryan (USA), Rolf Ream (USA), William Sydeman (USA) and Yutaka Watanuki (Japan)

## AGENDA ITEM 9

### Proposed Workshop and Topic Sessions for PICES-2014

Proposals for topic sessions and workshops in the next year, including the 2014 PICES Annual Meeting were summarized. Topic sessions had previously been ranked by BIO Committee members but there was some proposed modification to the workshop list. BIO will recommend the rankings as they are unless anyone has strong recommendations later. There was some discussion about the new procedure which does not allow the committee to know what the proposed topic sessions are before the list is prepared for ranking. There was some dissatisfaction with this new system. Submitters should ask the committee first.

BIO rankings of proposed Topic Sessions for PICES-2014 is provided below.

Proposal ID	BIO Rating	Proposed by	Title
p-7	20	WG 28	<i>Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystems</i>
p-14	20	CREAMS	<i>Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries</i>
p-6	17	S-CCME	<i>Dynamics of pelagic fish in the North Pacific under climate change</i>
p-9	17	MEQ	<i>Marine debris in the Pacific Ocean: Source, transport, fate and effects of macro- and micro-plastics</i>
p-13	17	S-CCME	<i>Climate change impacts on spatial distributions of marine fish and shellfish</i>
p-4	16	AP-MBM	<i>Strengths and limitations of habitat modeling: techniques, data sources, and predictive capabilities</i>
p-5	16	WG 21 (AP-COVE, BIO)	<i>Ecosystem changes and driving factors in marginal seas of the Pacific Rim</i>
p-2	15	S-CCME	<i>Variability in advection and its biological consequences for Subarctic and Arctic ecosystems</i>
p-12	15	S-CCME	<i>Recent assessments of climate change impacts on marine ecosystems</i>
p-15	15	WG 29	<i>Regional climate modeling in the North Pacific</i>
p-3	14	FIS	<i>Ecosystem considerations in fishery management of cod and other important demersal species</i>
p-8	14	SG-SC-NP	<i>Towards improved understanding of linkages between Pacific salmon and their marine ecosystems</i>
p-10	13	S-HD	<i>Marine ecosystem services and economics of marine ecological resources</i>
p-11	11	S-HD	<i>Ecological and human social analyses and issues relating Integrated Multi Trophic Aquaculture</i>
p-1	10	S-HAB	<i>Emerging issues with lipophilic shellfish toxins</i>

AGENDA ITEM 10

**Additional financial requests**

None

AGENDA ITEM 11

**Revision of BIO Action Plan**

The BIO Action Plan has not been revised since 2007 and a new PICES Strategic Plan was presented after the establishment of the FUTURE program. The BIO Committee has discussed about the Action Plan for over an year. A new BIO Action Plan have finalized in the committee meeting this year.

AGENDA ITEM 12

**Election of new chairperson of BIO**

Explanation of rules given by Secretariat General . Dr. Angelica Pena was nominated by Atsushi Tsuda, and agreed to serve. Vice-Chair - Atsushi Tsuda nominated unopposed, and agreed to serve.

AGENDA ITEM 13

**Other items**

None

AGENDA ITEM 14

**Adjourn**

The meeting was adjourned at 18:15 hr.

***BIO Endnote 1***

**BIO participation list**

Members

Michael Dagg (USA, Vice-Chairman)  
 Se-Jong Ju (Korea)  
 Hyung-Ku Kang (Korea)  
 Boris Kotenev (Russia)  
 Alexei Orlov (Russia)  
 Angelica Peña (Canada)  
 Hiroaki Saito (Japan)  
 Atsushi Tsuda (Japan, Chairman)

Observers

Harold (Hal) P. Batchelder (USA)  
 James Christian (Canada, S-CC)  
 Masao Ishii (IOCCP)  
 Suam Kim (Korea, S-CCME)  
 Lisa Miller (SOLAS)  
 Franz Mueter (ESSAS)  
 Linda Stevenson (APN)  
 Motomitsu Takahashi (Japan, WG 28)  
 Yutaka Watanuki (Japan, AP-MBM)  
 Sinjae Yoo (Science Board Chairman)  
 Mikhail Zuev (Russia)

## **BIO-2013**

### ***BIO Endnote 2***

### **BIO meeting agenda**

1. Welcome, introductions
2. Meeting agenda
3. Annual review of BIO activities
4. Oral and Poster Awards
5. Report from FUTURE APs
6. Reports from subsidiary bodies
7. International relationships
8. Topic sessions and workshops (completed) at PICES-2013, and inter-sessional meeting
9. Proposed workshop and Topic Sessions for the 2014 PICES Annual Meeting in Korea
10. Additional financial requests
11. Revision of BIO Action Plan
12. Election of new chairperson of BIO
13. Other items
14. Adjourn

## Report of the Fishery Science Committee

The meeting of the Fishery Science Committee (FIS) was held during 18:00–18:40 on October 13, 2013, and 14:00–18:00 on 16 October 2013. Vice-Chairman Xianshi Jin called the meeting to order and welcomed the participants, who introduced themselves. At the request of Dr. Jin, and with the approval of FIS, Dr. Gordon Kruse chaired the 2013 FIS annual meeting. The meeting was attended by 10 FIS members plus 17 observers (*FIS Endnote 1*). Anya Dunham (October 13) and Laura Brown (October 16) served as rapporteurs.

The agenda was adopted with one modification (*FIS Endnote 2*). Dr. Chang-Ik Zhang provided an update on AP-SOFE (FUTURE Advisory Panel on *Status, Outlooks, Forecasts, and Engagement*) after Agenda Item 3 on October 13. In addition, FIS members were asked to attend a plenary briefing on SOFE during 14:00–14:30 on October 16.

### AGENDA ITEM 3

#### 2013 FIS Best Oral presentation and Poster Awards

Volunteers were sought to serve on subcommittees to select the FIS awards for Best Oral Presentation by an early career scientist and Best Poster presentation during PICES-2013. The Best Oral presentation subcommittee was comprised of Drs. Xianshi Jin, Gordon Kruse, Anya Dunham and Sukgeung Jung. The first three of these are co-conveners of the FIS Paper Session. The subcommittee for FIS Best Poster presentation was comprised of Drs. Jacquelynne King and Akihiko Yatsu. The FIS Committee appreciates the work of these subcommittee members. The PICES Best Oral Presentation award was given to Megan Stachura for her presentation, titled “*Linking recruitment synchrony to environmental variability*”. The PICES Best Poster Presentation award was given to Yang Liu for his presentation titled “*Development of the 3-D growth prediction model for Japanese scallop in Funka Bay, Japan*”. This year’s selections were chosen from topic session S2 and the FIS Paper session.

### AGENDA ITEM 4

#### FIS Chairman’s report: Implementation of PICES 2012 decisions

##### *PICES-2013 sessions*

At PICES-2013, FIS sponsored the following sessions:

- S1 Science Board Symposium (Oct. 14, ¾ day). *Communicating forecasts, uncertainty and consequences of ecosystem change*. Co-conveners: Sinjae Yoo (SB), Atsushi Tsuda (BIO), Elizabeth Logerwell (FIS), Chuanlin Huo (MEQ), Hiroya Sugisaki (MONITOR), Kyung-Il Chang (POC), Toru Suzuki (TCODE), Thomas Therriault (AP-AICE), Hiroaki Saito (AP-COVE), Phillip Mundy (AP-SOFE), and Igor Shevchenko (Russia);
- S2: BIO/FIS/POC Topic Session (Oct. 18, ½ day). *Are marine ecosystems of the North Pacific becoming more variable?* Co-conveners: Steven Bograd (USA), Elizabeth Logerwell (USA), William Sydeman (USA), and Yutaka Watanuki (Japan);
- S5: BIO/FIS Topic Session (Oct. 15, 1 day). *Marine ecosystem services and the contribution from marine ecosystems to the economy and human well-being*. Co-conveners: Shang Chen (China), Keith Criddle (USA), Ekaterina Golovashchenko (Russia), Mitsutaku Makino (Japan), Jungho Nam (Korea), Minling Pan (USA), and Ian Perry (Canada);
- S8: BIO/FIS/MEQ/TCODE/FUTURE Topic Session (Oct. 17–18, 1 day). *Ecosystem indicators to characterize ecosystem responses to multiple stressors in North Pacific marine ecosystems*. Co-conveners: Vladamir Kulik (Russia), Chaolun Li (China), Ian Perry (Canada), Jameal Samhoury (USA), Peng Sun (China), Motomitsu Takahashi (Japan), and Chang-Ik Zhang (Korea).



## FIS-2013

- S10: FIS/TCODE Topic Session (Oct. 17, 1 day). Co-sponsored by ISC. *Banking on recruitment curves: returns on intellectual investment*. Co-convenors: Anne Hollowed (USA), Skip McKinnell (PICES), Hiroshi Okamura (Japan), and Cisco Werner (ISC);
- FIS Contributed Paper Session (Oct. 15, 1 day). Co-convenors: Xianshi Jin (China), Gordon Kruse (USA), and Anya Dunham (Canada).

Summaries of these sessions and Symposium can be found in the [Session Summaries](#) section of the 2013 Annual Report.

### *PICES co-sponsorship at the ICES Annual Science Conference 2013*

PICES co-sponsored three theme sessions at the 2013 ICES ASC:

- *Marine litter* (Thomas Therriault, Canada);
- *Responses of living marine resources to climate change and variability: learning from the past and projecting the future* (William Cheung, Canada);
- *Do foodweb dynamics matter in fisheries management?* (Ian Perry, Canada).

### *International symposia (late 2012 and 2013):*

- ICES/PICES Symposium on “*Forage fish interactions: Creating the tools for ecosystem based management of marine resources*”, November 12–14, 2012, Nantes, France.

FIS members served as co-convenors and participants in the following joint international meetings:

- “*Responses of Arctic marine ecosystems to climate change*”, March 26–29, 2013, Anchorage, Alaska (Steering Committee member: Elizabeth Logerwell);
- PICES/ICES Workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*”, May 22–24, 2013, St. Petersburg, Russia.

### *FIS-related PICES publications*

None to report.

## AGENDA ITEM 5

### **Update on FUTURE activities and preview of FUTURE meeting**

Dr. Jacquelynn King (FIS and COVE-AP member) gave a progress report on FUTURE activities. FUTURE held its meeting on Sunday October 13, 2013. FUTURE continues to seek input from expert groups related to FUTURE and updates on relevant activities and products. Coordination could be improved, and one recommendation is that meetings with expert groups be held at Annual Meetings to provide updates on activities, products and future plans. Another recommendation is to host a single FUTURE website where all products are posted.

The FUTURE Open Science Meeting will be held April 15–18, 2014 in Hawaii. This falls at the mid-point in FUTURE timelines. Session themes are posted on the PICES website.

Anya Dunham (Canada) was nominated and agreed to serve as FIS representative on AP-AICE.

## AGENDA ITEM 6

### **Status reports of FIS-sanctioned groups**

#### a. PICES/ICES Section on *Climate Change Effects of Marine Ecosystems* (S-CCME)

Dr. Jacquelynn King reported on S-CCME activities. Progress was made in terms of the 3 Goals and 4 Objectives of S-CCME.

## Goals:

1. Define, coordinate and integrate the research activities needed to understand, assess and project climate change impacts on marine ecosystems with sufficient spatial and temporal resolution to plan strategies for sustaining the delivery of ecosystem goods and services, and when possible predictions should include quantifying estimations of uncertainty.
2. To build global ocean prediction frameworks, through international collaborations and research, building on ICES and PICES monitoring programs.
3. Define and quantify the vulnerability of marine ecosystems to climate change, including the cumulative impacts and synergetic effects of climate and marine resource use.

## Objectives:

1. Advancing the scientific capacity on the three main challenges identified above by engaging the PICES and ICES scientific community in focused workshops, theme/topic sessions and symposia that target key uncertainties and technical barriers that impact the predictive skill of ocean models used to project the impacts of climate change.
2. Effectively communicating this capacity to clients, Member Countries, stakeholders and the broader scientific community.
3. Facilitating an international effort to design data collection networks at the spatial and temporal scales needed to monitor, assess and project climate change impacts on marine ecosystems.
4. Facilitating international collaboration to design and implement comparative analysis of marine ecosystem responses to climate change through modelling and coordinated process studies.

There have been 16 activities related to Goal 1, 10 to Goal 2 and 4 to Goal 3. There have been 16 activities related to Objective 1, 6 to Objective 2, 9 to Objective 3 and 5 to Objective 4. This shows some gaps in S-CCME activities. In addition, it was reported that the Section needs to address the following issues:

- Link proposed research activities to strategies for sustainable delivery of ecosystem goods and services and biodiversity preservation,
- Build global prediction networks,
- Address how predictive skill of ocean models can be improved for projecting climate change impacts,
- Communicate results to clients and stakeholders, and develop new ways of doing so,
- Conduct comparative analyses in an international collaboration.

S-CCME produced two publications in 2013:

- *Projected impacts of climate change on marine fish and fisheries*. Hollowed *et al.* 2013. ICES J. Mar. Sci 70: 1023–30;
- Report on *Workshop on Global Assessment of the Implications of Climate Change on the Spatial Distribution of Fish and Fisheries*. 65 pp.
- S-CCME Chairs convened the PICES/ICES Workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*”, May 22–24, 2013, St. Petersburg, Russia. The report is available on the PICES website at [http://www.pices.int/publications/other/WKSICCME-Spatial13\\_140408\\_forPICESwebsite.pdf](http://www.pices.int/publications/other/WKSICCME-Spatial13_140408_forPICESwebsite.pdf). Manuscripts from the workshop will be published in a special volume of ICES Journal of Marine Science.

S-CCME participated in several theme sessions at the ICES 2013 ASC:

- Responses of living marine resources to climate change and variability: learning from the past and projecting the future;
- Physico–chemical aspects of ocean acidification in the ICES area;
- Hydrographic processes, circulation, and water mass formation in the polar and subpolar basins;
- Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future;
- The pelagic fish complexes in the North Atlantic Ocean: Distribution, productivity, and inter-specific competition during changing climate.

## FIS-2013

S-CCME members convened and/or participated in two workshops during PICES-2013:

- W1: *Comparison of size-based and species based ecosystem models*;
- W2: *Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future.*

Both workshops were co-sponsored by ICES.

S-CCME activities planned for 2014 include a theme session and workshop at the FUTURE OSM, one theme session at the ICES 2014 ASC, and three topic sessions at PICES-2014:

- PICES FUTURE OSM Theme Session S7, PICES FUTURE OSM: *Strategies for ecosystem management in a changing climate*. Co-conveners: M. Barange, A. Hollowed, S. Kim;
- PICES FUTURE OSM Workshop W3: *Climate change and ecosystem-based management of living marine resources: Appraising and advancing key modelling tools*. Co-conveners: M. Peck, A. Hollowed, T. Essington;
- ICES ASC Theme Session Q: *Physical and biological consequences of exchanges between the Atlantic Subarctic and the Arctic*. Session: Co-Conveners: Olafur S. Astthorsson, K. Drinkwater;
- PICES-2014 Topic Session S6: *Climate change impacts on spatial distributions of marine fish and shellfish*. Co-conveners: A. Hollowed, J. Hare, S. Kang (*FIS Endnote 3a*);
- PICES-2014 Topic Session S7: *Recent assessments of climate change impacts on marine ecosystems*. Co-conveners: A. Hollowed, S. Jung, H.-O. Pörtner, J. Rice (*FIS Endnote 3b*);
- PICES-2014 Topic Session S9: *Variability in advection and its biological consequences for Subarctic and Arctic ecosystems*. Co-conveners: F. Mueter, E. Curchitser, K. Drinkwater, S.T. Kim, H. Kuroda, S.I. Saitoh (see *POC Endnote 3*).

### b. PICES/NPAFC Study Group on *Scientific Cooperation in the North Pacific* (SG-SC-NP)

Dr. James Irvine reported on the joint PICES/NPAFC Study Group on *Scientific Cooperation in the North Pacific* (SG-SC-NP).

PICES members of the SG are Thomas Therriault (Chairman-elect, Science Board), Skip McKinnell (PICES Deputy Executive Secretary), Libby Logerwell (FIS Committee Chair), Hiroaki Saito (FUTURE/COVE Advisory Panel Chair). NPAFC members are Shigehiko Urawa (Science Sub-Committee Chair), Jim Irvine (Stock Assessment Working Group Chair), Alexander Zavolokin (Science Sub-Committee member), Nancy Davis (NPAFC Deputy Director).

The objective of the SG is to develop a framework of enhanced collaboration between the two organizations to achieve better and/or more rapid understanding of natural and anthropogenic variability in marine ecosystems.

NPAFC/Committee on Scientific Research and Statistics (CSRS) and PICES Science Board endorsed the formation of SG-SC-NP in May 2013. The SG met October 16, 2013 during the PICES 2013 Annual Meeting in Nanaimo, Canada. During spring 2014 SG members drafted the text of a framework describing scientific topics of joint interest and mechanisms for implementing collaboration. SG-SC-NP will seek feedback from PICES Science Board at the inter-sessional Science Board meeting in April 2014 and final PICES approval at the October 2014 Annual Meeting. The SG will seek approval from NPAFC at their May 2014 Annual Meeting.

The two major topics of joint interest to NPAFC and PICES in the framework are:

- Effects of climate change on the dynamics and production of Pacific salmon populations;
- Oceanographic properties and the growth and survival of Pacific salmon.

Focused research questions pertaining to each of these two topics are described in the framework.

The SG proposed a ½-day joint NPAFC/PICES Topic Session for PICES-2014 (see *SG-SC-NP Endnote 3*). Note: this proposal was accepted as a 1-day workshop (W2) and the title was changed from “*Towards improved understanding of linkages between Pacific salmon and their marine ecosystems*” to “*Linkages*”

*between the winter distribution of Pacific salmon and their marine ecosystems and how this might be altered with climate change*". The goal is to produce a collaborative manuscript from the workshop.

#### AGENDA ITEM 7

##### **Relations with other programs and organizations**

###### *a. Asia-Pacific Network for Global Change Research*

The representative of this organization, Dr. Linda Stevenson, was not present at the meeting but sent a poster describing the organization.

###### *b. Ecosystem Studies of Sub-Arctic Seas (ESSAS)*

Dr. Franz Mueter provided an update on the activities of Ecosystem Studies of Sub-Arctic Seas (ESSAS).

The ESSAS Annual Science Meeting was held January 7–9, 2013 in Hakodate, Japan. Sessions on Monday focused on Japanese Research and the "Green Network of Excellence (GRENE) Programs: Seeking comprehensive understanding of the rapid changes occurring in the climatic systems of the Arctic and its global effects". Sessions on Tuesday and Wednesday addressed topics such as Arctic-Subarctic interactions, human dimensions, bioenergetic modeling and spatial dynamics of subarctic and Arctic marine communities.

ESSAS was involved in several theme sessions during the ICES 2013 ASC in Reykjavik, Iceland, in September:

- Theme session B: *Responses of living marine resources to climate change and variability: Learning from the past and projecting the future*. Co-Convenors: M. Peck (Denmark), W. Cheung (Canada), V. Saba (USA), K. Drinkwater (Norway);
- Theme session C: *Modelling human behaviour as part of integrated models of marine ecosystems*. Co-Convenors: J.J. Poos (The Netherlands), O. Thebaud (Australia) and R. Groeneveld (The Netherlands);
- Theme session L: *Hydrographic processes, circulation, and water mass formation in the polar and subpolar basins*. Co-Convenors: S. Dye (UK) and H. Valdimarsson (Iceland), I. Yashayaev (Canada);
- Theme session M: *Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and "data dreams" for the future*. Co-Convenors: E. Di Lorenzo (USA), A. Miller (USA), M. Hufnagl (Denmark).

ESSAS was also involved in the 6<sup>th</sup> CJK IMBER Symposium, October 3–4, 2013, in Tokyo.

ESSAS was involved with several Workshops and Topic Sessions at PICES-2013 in Nanaimo:

- Topic Session S6: *Recent trends and future projections of North Pacific climate and ecosystems*. Co-Convenors: J. Christian (Canada), E. Curchitser (USA), C.J. Jang (Korea), A. Peña (Canada);
- Topic Session S8: *Ecosystem indicators to characterize ecosystem responses to multiple stressors in North Pacific marine ecosystems*. Co-Convenors: V. Kulik (Russia), C. Li (China), I. Perry (Canada), J. Samhuri (USA), M. Takahashi (Japan), C.-I. Zhang (Korea);
- Topic Session S10: *Banking on recruitment curves; returns on intellectual investment*. Co-chairs: A. Hollowed (USA), S. McKinnell (Canada), H. Okamura (Japan), C. Werner (USA);
- Workshop W2: *Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and "data dreams" for the future*. Co-Convenors: E. Di Lorenzo (USA), M. Hufnagl (Denmark), J. King (Canada), A. Miller (USA), S. Minobe (Japan), R. Rykaczewski (USA), K. Tadokoro (Japan).

The ESSAS Annual Science Meeting will be held in Copenhagen Denmark, April 1–9, 2014. There will be workshops on polar/Arctic cod and ice cod; human responses to regime shifts; and paleo-ecology of the sub-Arctic Sea.

ESSAS members will be convening a Topic Session at the *IMBER Open Science Conference Future Oceans*, June 23–27 2014, Bergen, Norway titled "*Changing ecosystems in Subarctic and Arctic regions*".

## FIS-2013

ESSAS proposed a Theme Session for the 2014 ICES Annual Science Conference, Sustainability in a changing ocean, A Coruna, Spain, September 15–19, titled “*Physical and biological consequences of North Atlantic circulation patterns*”. ESSAS also proposed a Topic Session for the PICES-2014 in Yeosu, Korea, titled “*Variability in advection and its biological consequences for Subarctic and Arctic ecosystems*” (see *POC Endnote 3*). Contributions from the Pacific and Atlantic would be welcome.

### *c. International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC)*

Dr. John Holmes provided an overview of the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC).

The ISC was established in 1995 as an inter-governmental body to answer tuna or tuna-like science questions, in areas north of the Equator. The ISC provides stock assessment results and research and undertakes scientific collaboration with the Inter-American Tropical Tuna Commission (IATTC). The mission of the ISC is to enhance science research for conservation and rational utilization and to establish scientific groundwork conservation. The member nations of ISC are: Canada, China, Chinese-Taiwan, Japan, Korea, Mexico, and USA. Non-voting members are the Food and Agriculture Organization (FAO), North Pacific Marine Science Organization (PICES), Secretariat of the Pacific Community (SPC), and Inter-American Tropical Tuna Commission (IATTC).

In 2013 the ISC conducted three stock assessments: bluefin tuna, blue marlin and blue shark. In 2014 the ISC plans assessments for albacore, bluefin tuna, striped marlin, swordfish and possibly blue shark.

ISC and PICES share research interests in the relation between spatio-temporal patterns of variability and environmental signals, future climate scenarios, and end-to-end modeling.

ISC-PICES dialogue in 2013 to 2014 is evidenced by mutual participation in several events:

- ISC co-sponsored a Topic Session S10 at PICES-2013: *Banking on recruitment curves: Returns on intellectual investment*. Co-convenor: C. Werner (USA and ISC); Invited speaker: Jon Brodziak (PIFSC, USA and ISC);
- A Seminar at ISC13 (Busan, Korea, July 2013) focused on Pacific Ocean ecosystems and tuna dynamics, including a presentation by a PICES scientist (C.I. Zhang, Korea) on “*Ecosystem-based assessment and management for sustainable fisheries*”;
- FUTURE Open Science meeting, Kohala Coast, Hawaii, April 15–18, 2014 – it is anticipated that ISC-affiliated scientists will participate in this forum;
- ISC (G. DiNardo, C. Werner) proposal for a workshop on “*Dynamics of pelagic fish in the North Pacific under climate change*” (W1) at PICES-2014 (Yeosu, Korea) was accepted by Science Board (*FIS Endnote 3c*).

In addition, ISC and PICES can interact through participation or *ex-officio* membership in appropriate committees and WGs, *e.g.*, PICES scientists in ISC Working Groups, *e.g.*, North Pacific Albacore, and/or of ISC scientists in PICES WGs.

Finally, the linkages between ISC and FUTURE were discussed:

- Tuna and tuna-like species are sentinels of open ocean environments. Increased understanding of climatic and anthropogenic impacts on tuna provides insight into responses of open ocean ecosystems, for which much less is known than coastal ecosystems; [addresses a gap]
- Tuna and tuna-like species are foundation of high-valued fisheries in most PICES member countries; there is demand from decision-makers, industry and the general public for products (*e.g.*, status reports, outlooks, forecasts) for these fisheries that clearly present risks and opportunities associated with climatic forcing and human activities.

For more information see [isc.ac.affrc.go.jp](http://isc.ac.affrc.go.jp)

*d. North Pacific Anadromous Fish Commission (NPAFC)*

A presentation on the NPAFC was prepared by Drs. Vladimir Radchenko and Nancy Davis. Dr. Radchenko made the presentation.

NPAFC was established under the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean in 1993. NPAFC is dedicated to the conservation of anadromous stocks in the Convention Area, where there is no directed fishing for anadromous stocks. Areas of potential collaboration between NPAFC and PICES lie in the fields of improved ecosystem models and practical applications; improved forecasting and monitoring; and outreach. The Bering-Aleutian Salmon International Survey (BASIS) is a coordinated program of cooperative research on Pacific salmon designed to clarify the mechanisms of biological response by salmon to climate change, and provides many opportunities for collaboration between PICES and NPAFC.

NPAFC activities of interest to PICES in 2013 include the publication of a Technical Report (#9) on the 3<sup>rd</sup> International Workshop on Migration and Survival Mechanisms of Juvenile Salmon and Steelhead in Ocean Ecosystems.

Upcoming activities of interest to PICES include the May 2015 NPAFC Symposium in Japan on “*Forecasting Pacific salmon production in ocean ecosystems under changing climate*”. In addition, NPAFC is examining the feasibility of developing an International Year of the Salmon, which would allow experts from all Pacific salmon producing countries to focus on identifying the mechanisms that regulate Pacific salmon abundance and to use this understanding to maximize economic opportunities in the future while ensuring responsible stewardship. The purpose is to show the major climate and ocean influences on Pacific salmon production and indicate the major changes in abundance trends in the future. It is anticipated that the prospectus for this initiative will be completed in May 2014.

*e. Pacific Salmon Commission (PSC)*

Dr. John Field described the activities of the Pacific Salmon Commission (PSC). PSC is a bi-lateral fisheries management organization of the USA and Canada. It was established by treaty and is part of more than one hundred years of cooperative management. The underlying philosophy is that stewardship and management of salmon stocks is responsibility of the two countries. This management is supported by research between two countries. Two borders are shared (Canada/Alaska and Canada/Washington State) and there are many stocks, rivers, and salmon populations. PSC is comprised of 8 commissioners from each country for a total of 16. Commissioners represent industry, conservation and fishery interests as well as provincial and federal interests. The Secretariat is based in Vancouver, BC.

One of the current issues facing PSC is that regional stocks of Chinook, coho and steelhead are still declining, particularly in the Salish Sea. In fact, many are listed as endangered under the USA Endangered Species Act. Other species are highly variable, *e.g.*, sockeye in 2010 showed a record high. PSC management regimes are robust and resilient but difficulties in forecasting exist.

PSC is funded through two Endowment Funds: Northern and Southern. There has been \$60M in research contributions since 2004. Dr. Field will present a poster on the Endowment fund proposal process.

PSC has identified a need to increase collaboration with PICES, NPAFC and the private sector. Dr. Mark Saunders (DFO, Canada) chairs the NPAFC Scientific Research and the PSC Scientific Cooperation Committee.

PSC is currently developing the PSC Science Agenda. For more information: [www.psc.org](http://www.psc.org)

*f. North Pacific Fisheries Commission (NPFC)*

Dr. Oleg Katugin indicated that a convention has been signed to establish a new Regional Fishery Management Organization, the North Pacific Fisheries Commission (NPFC). The applicable region is similar to that covered by the North Pacific Anadromous Fish Commission, except for the Sea of Okhotsk and Bering

## FIS-2013

Sea. The scope includes high seas fishery resources except those covered by other organizations (*e.g.*, not salmon). Several very important fishery resources will be addressed, such as Pacific saury and cephalopods.

**Recommendation:** FIS Committee recommends PICES establish linkages to this new organization, to be formed in 2014 when the NPRC Scientific Working Group is established.

### AGENDA ITEM 8

#### Status report on FIS topic sessions and workshops for PICES-2014

##### *PICES-2014 Topic Sessions*

FIS reviewed 15 Topic Session proposals. The rankings are summarized below, with points that each proposal scored.

FIS highest priority:

- (20 pts) #3 Kruse – *Ecosystem considerations in fishery management of cod and other important demersal species (FIS Endnote 3d)*;
- (20 pts) #12 Hollowed – *Recent assessments of climate change impacts on marine ecosystems*.

However, FIS recommends to Science Board that Topic Session proposal #12 could become a Science Board session. As an alternative, a couple of keynote speakers could headline the Science Board session to present comprehensive overviews on this topic. If Science Board does not accept either of these FIS recommendations, then FIS is very pleased to sponsor #12 as one of our top two priorities.

FIS third priority

- (18 pts) #13 Hollowed – *Climate change impacts on spatial distributions of marine fish and shellfish*.

FIS priorities (tied)

- (17 pts) #2 Mueter – *Variability in advection and its biological consequences for Subarctic and Arctic ecosystems*;
- (17 pts) #7 Martone – *Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystems*;
- (17 pts) #11 Hirota – *Ecological and human social analyses and issues relating to Integrated Multi Trophic Aquaculture*.

Note: FIS recommends moving proposal ID #6 Werner to be a workshop (it was mis-filed), as well as #6 Irvine and #5 Kang.

##### *PICES-2014 Workshops*

The FIS ranking of proposed workshops is:

1. #6 Werner – Dynamics of pelagic fish in the North Pacific under climate change;
2. #8 Irvine – Towards improved understanding of linkages between Pacific salmon and their marine ecosystems;
3. #1 Trainer – Mitigation of harmful algal blooms: Novel approaches to a decades long problem affecting the viability of natural and aquaculture fisheries;
4. #5 Kang – Ecosystem changes and driving factors in marginal seas of Pacific Rim.

##### *Inter-sessional Workshops*

FIS discussed the proposed inter-sessional workshop on “*Evaluating the significance of 2011 hydrologic regime on juvenile salmon recruitment and survival across North American stocks*” and felt this workshop was too regional in focus and did not support as proposed.

## AGENDA ITEM 9

**Proposals for new FIS working groups, study groups, and special projects**

The FIS Committee received no new proposals for working groups.

## AGENDA ITEM 10

**Proposals for new meetings/conferences with PICES as co-sponsor***a. ICES Annual Science Conference 2014*

The FIS Committee received a description of only one ICES ASC theme session: *Gelatinous zooplankton on a global perspective: interactions with fisheries and consequences for socio-economics*. This proposed theme session is well conceived, relevant to PICES interests, and received the top ranking by ICES. The FIS Committee recommends PICES co-sponsor this session. The FIS Committee very briefly examined other proposed theme sessions, however, available time was very short and there was no supplemental information. A number of proposed theme sessions appeared to be highly relevant to the FIS Committee's Action Plan. FIS would like to co-sponsor up to three more ICES theme sessions, but the Committee did not have information needed to make a decision at PICES-2013. FIS requests further information and wishes to vote via email.

*b. Session and workshop topics for the Third International Symposium on the "Effects of climate change on the world's oceans", March 25–27, 2015, Santos, Brazil*

Symposium Co-Convenor, Dr. Jacquelynne King, provided information on the planning for this symposium. She emphasized the need to convene sessions and workshops that will attract PICES experts to the symposium. The intention is to select session topics by November 2013. Dr. King provided the current list of keywords that were identified to motivate decisions about theme sessions. FIS noted that "fisheries" was a missing key word. Also, most climate change forecasts are based on single-species projections. However, it was noted that species do not react in isolation. Moving beyond single species to communities is desirable. Therefore, a second area for a theme session could be "climate-driven ecological changes".

*c. SCOR (Scientific Committee on Ocean Research) working group proposals*

The FIS Committee rankings of SCOR working group proposals are:

1. Studying ocean acidification effects on continental margin ecosystems;
2. Science and technology imperatives created by deep-ocean industrialization;
3. Response of marine biota to complex global environmental change: Co-ordination and harmonization of experimental approaches.

These three proposals were selected for their relevance to fishery science issues of interest to PICES.

*d. 29th Lowell Wakefield Fisheries Symposium: Fisheries bycatch: Global issues and creative solutions, May 13–16, 2014, Anchorage, Alaska, USA.*

Dr. Gordon Kruse provided an update on this international bycatch symposium. The goal of this symposium is to bring together fishery and social scientists, managers, fishermen, and other stakeholders from around the world to report on creative approaches to solving fishery bycatch issues. A Scientific Steering Committee has been formed, keynote and invited speakers have been invited, announcements have been distributed, and a website has been created: <http://seagrant.uaf.edu/conferences/2014/wakefield-bycatch/index.php>. The symposium proceedings will be peer-reviewed and published as an electronic and bound book. In summer 2014 the FIS Committee supported a request for PICES travel support for Dr. Heui Chun An (Korea) to attend the meeting. Dr. An would serve as a PICES member of the SSC and he would present an invited talk. Science Board is scheduled to take action on this request at its meeting at the end PICES-2013.

*e. Other proposals*

None



## **FIS-2013**

### AGENDA ITEM 11

#### **High priority projects and activities with financial/policy implications**

None.

### AGENDA ITEM 12

#### **Priority items with funding implications**

None.

### AGENDA ITEM 13

#### **Proposed publications**

A PICES/ICES workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” was held in St. Petersburg, Russia, in May 22–24, 2013. Manuscripts from Session B of this workshop are intended to be published in a special journal issue in the ICES Journal of Marine Science. Publication is at least one year away.

### AGENDA ITEM 14

#### **Inter-session activities and meetings, travel support requests**

None.

### AGENDA ITEM 15

#### **Other business**

FIS members heard a plenary report by AP-SOFE on the North Pacific Ecosystem Status Report. A new plan is proposed whereby each country would submit electronic data and a short data description rather than providing graphs and explanations as done in the first two reports. The FIS Committee raised questions about whether all PICES member countries will agree to provide data. Another question concerned what would happen if some countries do not agree to do so. Therefore, the support of FIS for this proposal is contingent on data-sharing agreements with all PICES member countries being accomplished. Additional questions raised:

- Financial costs of developing and maintaining databases, servers, *etc.* need to be considered.
- How do AP-SOFE and MONITOR propose to deal with differences between the proposed program and the two previous Ecosystem Status reports? For instance, there is a disparity between reports focused on continental shelves versus reports that are based on marine ecosystems.
- Some other details not clear. For instance, will the website host only just data and graphics? Will there be explanations? Integration? Synthesis? A website of datasets/graphics may be of value to scientists, but descriptions and explanations would be of broader interest, including non-scientists.

FIS seeks clarification on these questions.

***FIS Endnote 1*****FIS participation list**Members

Laura Brown (Canada)  
 Anya Dunham (Canada)  
 Xianshi Jin (Co-Chair, China)  
 Sukgeun Jung (Korea)  
 Jacquelynne King (Canada)  
 Gordon Kruse (USA)  
 Kazushi Miyashita (Japan)  
 Motomitsu Takahashi (Japan)  
 Akihiko Yatsu (Japan)  
 Chang-Ik Zhang (Korea)

Observers

Linsey Arnold (Oregon State University, USA)  
 Nancy Davis (NPAFC)  
 Andrew Edwards (Fisheries and Oceans Canada)  
 John Field (Pacific Salmon Commission)  
 Masahito Hirota (FRA, Japan)  
 John Holmes (Fisheries and Oceans Canada; ISC)  
 James Irvine (Fisheries and Oceans Canada; NPAFC)  
 Oleg Katugin (TINRO-Centre, Russia)  
 Skip McKinnell (PICES)  
 Jessica Miller (Oregon State University, USA)  
 Franz Mueter (ESSAS)  
 Vladimir Radchenko (NPAFC)  
 Nadezda A. Rastyagaeva (KamchatNIRO, Russia)  
 Chuanxin Qin (South China Sea Fisheries Research Institute, China)  
 Xianjuan Shan (Yellow Sea Fisheries Research Institute, China)  
 Shigehiko Urawa (FRA, Japan)  
 Nadezda Yavosh (KamchatNIRO, Russia)

***FIS Endnote 2*****FIS meeting agenda**

1. Welcome and introductions
2. Adoption of agenda
3. 2013 FIS Best Oral presentation and Poster awards
4. FIS Chairman's report: Implementation of PICES 2012 decisions
5. Update on FUTURE activities and preview of FUTURE meeting
6. Status reports of FIS-sanctioned groups
7. Relations with other programs and organizations
8. Status report on FIS topic sessions and workshops for PICES-2014
9. Proposals for new FIS working groups, study groups, and special projects
10. Proposals for new meetings/conferences with PICES as co-sponsor
11. High priority projects and activities with financial/policy implications
12. Priority items with funding implications
13. Proposed publications
14. Inter-session activities and meetings, travel support requests
15. Other business

**FIS Endnote 3**

**Proposals for FIS-sponsored Topic Sessions and Workshop at PICES-2014**

**a) *Climate change impacts on spatial distributions of marine fish and shellfish***

Proposed by S-CCME

Duration: 1 day

Conveners: Jon Hare (USA), Anne B. Hollowed (USA), Sukyung Kang (Korea)

Changes in fish and shellfish distributions are an important indicator of climate change and are being incorporated into national climate change assessment. Fishing, however, also affects fish and shellfish distributions and fishing effort is changing in many ecosystems. Changes in distributions will also affect fisheries, shifting the resource toward or away from fishing ports. We invite papers that examine the combined effect of climate change and fishing on fish and shellfish distributions and the impact of these changes on fisheries. Specifically, we encourage papers that 1) develop and use analytical approaches for separating the effect of fishing and climate, 2) evaluate life history and fishery traits that are associated with shifting distributions, and 3) examine the effect of shifting distributions on fisheries, fishing communities, resource economics, and international allocation.

**b) *Recent Assessments of Climate Change Impacts on Marine Ecosystems***

Proposed by S-CCME

Duration: 1 day

Conveners: Anne Hollowed (USA), Sukgeun Jung (Korea), Hans-O. Pörtner (Germany), Jake Rice (Canada)

Co-Sponsor: ICES

The Intergovernmental Panel on Climate Change expects to release the full reports of Working Groups 1, 2 and 3 electronically in January, August, and September of 2014, respectively. Other organizations have recently completed assessment reports that focus on specific geographic regions or fishing sectors (e.g., the U.S. National Climate Assessment or FAO's report on Priority adaptations to climate change for Pacific fisheries and Aquaculture: Reducing risks and capitalizing on opportunities). Collectively these reports will mark a major milestone by updating our knowledge of the observed and projected implications of climate change on the earth. Of particular interest to PICES and ICES will be the findings of the reports with respect to impacts on marine ecosystems. This session encourages presentations that summarize the key findings of the IPCC. It also encourages talks that provide guidance and insight on future directions for climate change research within the ICES and PICES communities.

**c) *Workshop on "Dynamics of pelagic fish in the North Pacific under climate change"***

[originally proposed as a Topic Session]

Proposed by S-CCME

Duration: 1 day

Conveners: Gerard DiNardo (USA), Suam Kim (Korea), Sei-Ichi Saitoh (Japan), Cisco Werner (USA)

Co-Sponsor: ISC

The goal of the workshop is to define a scientific framework to assess the dynamics of pelagic fish under climate/environmental variability. We will discuss the overlapping PICES and ISC science missions and outline a Science Plan for a multi-year collaborative effort. Climate variability affects pelagic fish distributions and migration, and ultimately pelagic fisheries, the level of impact depending on the persistence, direction, and magnitude of the variability. Survival and growth rates of pelagic fish are linked to oceanographic conditions, and changes to these conditions can have dramatic impacts on the composition of

species assemblages within pelagic ecosystems, as well as the persistence and magnitude of individual pelagic fish populations (PICES/ICES, 2013). Understanding the links between environment and pelagic fish behavior, growth, recruitment, and production are paramount to understanding the impacts of climate variability.

Pelagic fishes occupy surface waters of the North Pacific Ocean, from coastal shelf to open ocean ecosystems. Many of these species undertake large-scale feeding, spawning, and ontogenetic migrations linked to seasonal changes in water masses. For example, Pacific bluefin tuna use waters off Japan as a nursery habitat, undertaking an ontogenetic movement eastward to waters off North America where they remain as subadults for 2-3 years. Additionally, many pelagic species have environmental thresholds and preferences, which limit the spatial distribution of a species. The most important environmental factors include oxygen, salinity and temperature, and because these factors generally exhibit persistent spatiotemporal patterns, the general distribution of pelagic fishes is known. Knowledge of these relationships allows for the incorporation of climate change into stock assessments, which forms the basis for fisheries management.

**d) *Ecosystem considerations in fishery management of cod and other important demersal species***

Proposed by FIS

Duration: 1 day [later changed to ½ day]

Conveners: Gordon H. Kruse (USA), Sukgeun Jung (Korea), Alexei Orlov (Russia), Xianshi Jin (China), Jacquelynne King (Canada), Kenneth Drinkwater (Norway)

Co-Sponsor: ICES

Pacific cod (*Gadus macrocephalus*) sustain important commercial fisheries throughout the North Pacific Ocean and, historically, Atlantic cod (*Gadus morhua*) have supported some of the most valuable commercial fisheries in the North Atlantic Ocean. Their dynamics have been linked to fishing, climate and other commercially important demersal species. Cod are also extremely important ecologically. As predators, they have been implicated in the decline or lack of recovery of shrimp, king crab, capelin and herring. As prey, they are important forage for pinnipeds; some research implicates seal predation in the lack of recovery of some Atlantic cod stocks and other studies implicate Pacific cod in the lack of recovery of Steller sea lions in the western Gulf of Alaska and Aleutian Islands. Multispecies models demonstrate co-variation of cod with other important demersal species, as well as explicit tradeoffs in cod and forage fish populations with implications on the joint setting of catch quotas. Moreover, cod recruitment and spatial distribution can be strongly influenced by climate-driven changes in oceanography on decadal and shorter time scales, implying that catch levels must be adjusted for bottom-up changes in productivity. For these and other reasons, ecosystem considerations must be taken into account in cod fishery management. By drawing upon insights gained from different systems, as well as from studies of other important co-occurring demersal species (*e.g.*, walleye pollock, small yellow croaker), this session will deepen our understanding of the roles of cod in the marine ecosystem and their implications on fishery management. Contributions are sought that consider stock identification, stock assessment and population dynamics, effects of climatology and oceanography on recruitment and biomass, trophodynamics, movements and distribution with respect to oceanographic features, multispecies models and their implications on management strategies, and other ecosystem approaches to the management, including aquaculture alternatives. Presentations are welcome from marine ecosystems in the North Pacific and North Atlantic.

## Report of the Marine Environmental Quality Committee

The business meetings of the Marine Environmental Quality Committee (MEQ) were held on October 13 (18:00–19:30) and October 16 (14:50–19:10), 2013 in Nanaimo, Canada. All six PICES member countries sent members or alternatives to the meetings. Over 20 participants, including observers, attended (*MEQ Endnote 1*). MEQ Chair, Mr. Chuanlin Huo, called the meetings to order and welcomed all participants. MEQ members and observers were asked to give self-introduction and to provide a brief statement about their interests and expertise. The agenda was reviewed, modified with the addition of 3 new items (see Agenda Item 5), and accepted (*MEQ Endnote 2*).

*Sunday, October 13, 2013*

AGENDA ITEM 2

### Implementation of PICES-2013 decisions

MEQ has a wide range of interests spanning from regular research areas to emerging marine environmental issues. At PICES-2013 MEQ sponsored or co-sponsored the following topic sessions and workshops.

1. MEQ Paper Session: (Oct. 15, ½ day) Co-convenors: Chuanlin Huo (China), Elizabeth Logerwell (USA), Olga Lukyanova (Russia), Darlene Smith (Canada) and Lyman Thorsteinson (USA).  
According to the adjusted Scientific Program and schedule, MEQ/FIS/FUTURE Topic Session S7: *Science needs for offshore oil and gas development in the North Pacific* was cancelled, and its 4 submitted abstracts were moved to the Paper Session.
2. MEQ/FUTURE Topic Session S3, *Status, trends and effects in coastal ecosystem: Implication for wildlife and humans* (Oct. 16, ½ day). Co-convenors: Olga Lukyanova (Russia) and Won Joon Shim (Korea). Invited speakers: Sandra O'Neill (NVFSC, NOAA, USA) and Lorrie Rea (University of Alaska Fairbanks, USA).

AGENDA ITEM 3

### Review of the main achievements of MEQ-2013

Mr. Huo reviewed the main achievements of the Committee over the past year, including the establishment of the Working Group (WG 30) on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* and the submission of Study Group (SG-MP) on *Marine Pollution's* final report.

1. MEQ draft Action Plan: a first draft was finished in Jan. 2013; a third draft was submitted to FUTURE Advisory Panels and Science Board in May, revised by Science Board before the Annual Meeting. It is currently still being revised;
2. The Study Group (SG-RS) on *Radionuclide Science in the North Pacific Ocean* was established in January 2013;
3. A PICES Workshop on “*Radionuclide science and environmental quality of radiation in the North Pacific*” was held March 14–15, 2013 in Xiamen, China;
4. WG 30 was established in August 2013 (recommended by SG-RS).
5. MEQ expert groups: Working Group (WG 21) on *Non-indigenous Aquatic Species* was permitted an extension of one year by Science Board at the 2012 Annual Meeting. Work done by WG 21 in 2013 included analysis for comparing and contrasting bio-invasions, working towards the completion of its final report and developing recommendations for further work on marine non-indigenous species. Changes in their terms of reference were to be made by the Section on *Ecology of Harmful Algal Blooms in the North Pacific* (S-HAB) once MEQ's Action Plan has been revised. S-HAB has proposed various research projects for 2014 (see their report elsewhere in the 2013 Annual Reports). SG-MP submitted its final report to MEQ and requested the establishment of a section or working group on emerging topics on marine pollutants. The Working Group (WG 28) on the *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors*' work includes preparation of a draft final report.

## MEQ-2013

### AGENDA ITEM 4

#### **Relations with other groups/organizations**

Mr. Sangjin Lee (NOWPAP) and Dr. Takafumi Yoshida (NOWPAP/CEARAC) introduced the activities of their organizations especially on cooperation with PICES on marine environmental issues, such as Integrated Coastal and River Basin Management (ICARM), regular assessments of the state of the marine environment, climate change impacts, biodiversity conservation (including MIS), and pollution prevention and reduction.

### AGENDA ITEM 5

#### **Other business**

1. S-HAB – Dr. Shigeru Itakura (S-HAB Co-Chair) reviewed the Section’s work in 2013, and submitted a list of financial requests for MEQ to present at the Science Board meeting (see Agenda Item 8).
2. FUTURE priorities – AP-AICE Chairman, Dr. Thomas W. Therriault, reported on the priorities of AP-AICE and described the high priority topics for FUTURE, including linkages of committees with expert groups.
3. MEQ Action Plan – the Action Plan was emailed by Mr. Huo to members for feedback and suggestions prior to the MEQ meeting on October 16 (see Agenda Item 14).

*Wednesday, October 16, 2013*

### AGENDA ITEM 6

#### **Reports from MEQ expert groups**

All expert groups under MEQ attended the Committee meetings during the Annual Meeting. The following are brief reports and progress in 2013.

1. Working Group (WG 21) on *Non-indigenous Aquatic Species* (Co-Chair: Darlene Smith)  
Ms. Smith reported WG 21 work done in 2013 including:
  - analysis for comparing and contrasting bio-invasions,
  - completing and submitting final WG 21’s report,
  - Recommendation of a new section on ‘Marine Non-indigenous Species or on Marine Biodiversity Conservation’ (see *WG 21 Endnote 3*),
  - Proposal for a joint PICES-ICES Theme Session on “*The increasing importance of biofouling for marine invasions: an ecosystem altering mechanism*” at the ICES 2014 Annual Meeting.
2. Working Group (WG 28) on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* (Co-Chair: Ian Perry)  
Dr. Perry gave presentation on WG 28 TORs and proposed:
  - a Topic Session on “*Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystems*” (*WG 28 Endnote 6*) at PICES-2014 for sessions/workshops,
  - 2-day WG 28 meeting in PICES-2014.The WG is preparing to submit a draft of a final report by mid-2014.
3. Study Group (SG-MP) on *Marine Pollution* (Chair: Peter S. Ross)  
SG-MP member, Dr. Won Joon Shim, reported that a SG-MP final report has been submitted to MEQ for approval.
  - SG-MP recommends the formation of an expert group (section or working group) on ‘Emerging Topics in Marine Pollution’ (see *SG-MP Endnote 2*),
  - SG-MP proposed a 1-day Topic Session on “*Marine debris in the ocean: Sources, transport, fate and effects of macro- and micro-plastics*” (*SG-MP Endnote 3*) and support for 2 invited speakers at PICES-2014.

4. Section on *Ecology of Harmful Algal Blooms in the North Pacific* (Co-Chair: Shigeru Itakura)  
Dr. Shigeru Itakura gave presentation on S-HAB, reported work done in 2013.
- S-HAB proposed a ½-day Topic Session on “*Emerging issues with lipophilic shellfish toxins*” (*S-HAB Endnote 4*), funding for 1 invited speaker, and 1-day business meeting at PICES-2014,
  - Request 1 day workshop on “*Mitigation of harmful algal blooms: Novel approaches to a decades long problem affecting the viability of natural and aquaculture fisheries*” (*S-HAB Endnote 4*) at PICES-2014, and funding for 1 invited speaker,
  - Preparation on “Economic and Social Impacts of HABs” in a PICES Scientific Report series.

## AGENDA ITEM 7

**Introduction of WG-AMR (WG 30)**

The Study Group on *Radionuclide Science in the North Pacific Ocean* (SG-RS), under the direction of MEQ, was established at the beginning of 2013. During PICES-2013, Prof. Yusheng Zhang (China) introduced the work of the SG, including the Terms of Reference (TOR) and process leading to the formation of WG-AMR (WG 30).

1. After reviewing the work and recommendations of SG-RS, the establishment of Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (WG-AMR/WG 30), under the direction of MEQ, was recommended by Science Board and endorsed by Governing Council in August 2013.
2. 1½-day WG 30 business meeting prior to PICES-2014 meeting.

## AGENDA ITEM 8

**Items with financial implications for 2014**

Financial support from expert groups was discussed during the meeting. The Co-Chairs of each expert group presented their requirement for activities in 2014, and MEQ members were encouraged to vote on-line for ranking PICES-2014 sessions and workshops. Discussion results are listed below and will be presented to Science Board.

1. PICES-2014 requested financial support

WG S/W	Topic Sessions	Invited speaker (E/W Pacific)	Funding (US dollars)
WG 21	NONE		
WG 30	NONE		
WG 28	<i>Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystems</i>	E-1;W-1	2000
SG-MP	<i>Marine debris in the Pacific Ocean: Sources, transport, fate and effects of macro- and micro-plastics</i>	E-1;W-1; 3–5: from other resources	3000

Also recommended (but with no financial implications) were:

- ½-day MEQ Contributed Paper Session,
- 2-day WG 28 business meeting at PICES-2014,
- 1½-day WG 30 business meeting at PICES-2014,
- ½-day S-HAB business meeting at PICES-2014,

## MEQ-2013

### 2. Inter-sessional requested financial support

WG S/W	Topic	Funding (US dollars)
WG 21	Convenor or speaker to attend the joint ICES/PICES Theme Session on “ <i>The Increasing importance of biofouling for marine invasions: an ecosystem altering mechanism</i> ”	3000
WG 30	NONE	
WG 28	NONE	
SG-MP	NONE	
S-HAB	One SSC member to attend an IPHAB meeting on “Climate and HABs” in April	3000

#### AGENDA ITEM 9

##### **Discussion and suggestion of the Proposal for the Process of Producing of new generation NPESR**

MEQ members reviewed the proposal for the Process of Producing the North Pacific Ecosystem Status Report (NPESR) and discuss the actions requested by FUTURE SOFE and MONITOR. Members supported the new approach to publishing NPESR, and questions about how the datasets would be identified, how quality control would be ensured and how analysis would be conducted were discussed. USA and Canada are both concerned with the quality control and more modern approach.

#### AGENDA ITEM 10

##### **Proposals for new Expert Groups**

Based on review of the main achievements of MEQ-2013, proposals of establishing new expert groups were discussed. Following two proposals were approved by MEQ, and will be submitted to Science Board accordingly.

1. A section or working group on “Emerging Topics Marine Pollution” (see Agenda Item 6).
2. A Section either on NIS or on conservation focused on drivers of marine biodiversity (see Agenda Item 6).

#### AGENDA ITEM 11

##### **2014 FUTURE Open Science Meeting**

A FUTURE Open Science Meeting (OSM) will be held on April 15–18, 2014, Hawaii, USA. MEQ business and suggestions for the OSM were discussed. No comments or suggestions were received from the participants.

#### AGENDA ITEM 12

##### **MEQ Best Oral and Poster Presentation awards for PICES-2013**

1. MEQ was responsible for judging early career scientist oral presentations for the MEQ-Paper session, and S3 and S8 Topic Sessions. The award was given to Cathryn Clarke Murray (Canada) for her presentation titled: “[\*Assessing direct and indirect risk from human activities to significant ecosystem components in the Northeast Pacific\*](#)”.
2. The Best Poster (open eligibility) was awarded to Dr. Won Joon Shim (Korea) for his presentation titled: “[\*Ship paint as a new input source of floating microplastics in surface microlayer\*](#)”.



Further details on award recipients can be found at the end of the [Session Summaries](#) section in the 2013 Annual Report.

## AGENDA ITEM 13

**Relations with other groups/organizations (continued)**

Mr. Huo attended the NOWPAP Expert Meeting on Marine Biodiversity and Eutrophication in the Northwest Pacific Region as a PICES delegate on August 5–6, 2013 in Toyama, Japan. During the meeting, he shared details of activities in the PICES region on eutrophication, marine biodiversity, and seagrass/seaweed mapping. Through these activities, more skills and approaches were gained by PICES and NOWPAP. In the near future, these successful study modes and experiences can be used by PICES. Furthermore, we believe there will be more opportunities for cooperation between PICES and other organizations.

Dr. Peter Kershaw, representing GESAMP, gave a presentation on GESAMP's activities and potential collaboration between GESAMP and PICES.

## AGENDA ITEM 14

**Discussion and revision of Draft MEQ Action Plan**

Mr. Huo reported on the progress of drafting MEQ Action Plan (3rd draft), discussed how to incorporate comments and requests from the Science Board and FUTURE Advisory Panels including approaches to prioritize the action and task items, and steps needed to narrow the scope and number of tasks. Due to limited meeting time, members discussed only relevant topics, and did not give detailed suggestions or comments. A final draft will be completed before ISB-2014.

## AGENDA ITEM 15

**Other business**

None

***MEQ Endnote 1*****MEQ meeting participants**Members\*

Janelle Curtis (Canada)  
Chuanlin Huo (China, Chair)  
Ichiro Imai (Japan)  
Hideaki Maki (Japan)  
Won Joon Shim (Korea)  
Staci Simonich (USA)  
Mikhail Simonov (representing Russia)  
Darlene L. Smith (Canada)  
Thomas W. Therriault (Canada)

Observers

Karin Baba (Japan)  
Rongshuo Cai (China)  
Jinqiu Du (China)  
Shigeru Itakura (Japan, S-HAB Co-Chair, WG 28)  
Jung-Hoon Kang (Korea, WG 21, AP-COVE)  
Peter Kershaw (GESAMP)  
Sangjin Lee (NOWPAP)  
Sandra O'Neill (USA)  
R. Ian Perry (Canada, WG 28 Co-Chair)  
Lorrie Rea (USA)  
Peter S. Ross (Canada, SG-MP Chair)  
He Wu (China)  
Takafumi Yoshida (NOWPAP/CEARAC)  
Yusheng Zhang (China, WG 30)

\*Lyman Thorsteinson (USA) was unable to attend due to the U.S. government partial shutdown.

## MEQ-2013

### *MEQ Endnote 2*

### MEQ meeting agenda

*Sunday, October 13, 2013*

1. Welcome and adoption of agenda
2. Implementation of PICES-2013 decisions
3. Review of the main achievements of MEQ-2013
4. Relations with other groups/organizations (All)
5. Other business (All)
  - a. Requests to SB from S-HAB
  - b. Request of suggestion from elected-SB Chairman
  - c. Chairman Huo's request for feedback and suggestions to Action Plan

*Wednesday, October 16, 2013*

6. Reports from MEQ expert groups (WG 21, WG 28, SG-MP, S-HAB)
7. Introduction of the new WG-AMR (WG 30)
8. Items with financial implications for 2014 (Topic sessions, Workshops, *etc.*)
9. Discussion and suggestion of the Proposal for the Process of Producing of new generation NPESR
10. Proposals for new expert groups
11. Business of 2014 FUTURE Open Science Meeting
12. MEQ Best Oral and Poster Presentation awards for PICES-2013
13. Relations with other groups/organizations
14. Discussion and revision of draft MEQ Action Plan
15. Other business

## Report of the Physical Oceanography and Climate Committee

An overture meeting of the Physical Oceanography and Climate Committee (POC) took place in Nanaimo, Canada, from 18:00–19:30 h on October 12, 2013. POC Chairman, Dr. Kyung-Il Chang, called the meeting to order, circulated the draft agenda, and introduced key issues that needed in-depth discussion and decisions at the formal POC meeting on October 16, 2013. Judges for 2013 POC Best Presentation and Poster awards were nominated: Drs. Kyung-Il Chang (S4), Shin-ichi Ito (S4), Emanuele Di Lorenzo (W2), and Yury Zuenko (POC). The formal POC meeting was held from 13:00–18:00 h on October 16, 2013.

Dr. Chang called the meeting to order and welcomed members and observers (*POC Endnote 1*). Two new POC members were introduced: Drs. Charles Hannah representing Canada, and Fangli Qiao representing China to replace Dr. Zhenya Song. Dr. Qiao did not attend the meeting for either day due to the unexpected passing of his colleague, Dr. Mingyuan Zhu, while attending the PICES Annual Meeting. Dr. Michael Foreman, Vice-Chairman of POC, agreed to act as a rapporteur. Three items were added to the agenda that were reviewed and decided at the overture POC meeting: i) discussions on producing of the next generation NPESR, ii) proposals for new, and extensions of, POC expert groups, and iii) other business on how to encourage more participation in the POC Paper session. The agenda was adopted (*POC Endnote 2*).

### AGENDA ITEM 4

#### Completion of PICES-2013 decisions

The following items were listed on the agenda distributed prior to the meeting for POC members to review. They were not discussed at the meeting.

#### 1. PICES-2013 POC Paper/Topic Sessions and Workshop

Title	Convenors	Invited speakers	Duration (day)	Date	Committees (Sponsors)
POC Paper Session	Kyung-Il Chang (Korea) Michael Foreman (Canada)		0.5	Oct. 18 (Fri.)	POC
S2: Are marine ecosystems of the North Pacific becoming more variable	Steven Bograd (USA) Elizabeth Logerwell (USA) William Sydeman (USA) Yutaka Watanuki (Japan)	Emanuele Di Lorenzo (USA) Michael Litzow (Australia)	0.5	Oct. 18 9(Fri.)	BIO/FIS/POC
S4: The changing carbon cycle of North Pacific continental shelves and marginal seas	Minhan Dai (China) Sophia Johannessen (Canada) Don-Jin Kang (Korea)	Miguel Goni (USA) Kon-kee Liu (Chinese-Taipei)	1	Oct. 16–17 (Wed.–Thur.)	POC
S6: Recent trends and future projections of North Pacific climate and ecosystem	Jack Barth (USA) James Christian (Canada) Enrique Curchitser (USA) Chan Joo Jang (Korea) Angelica Peña (Canada)	Jason Holt (UK) William Merryfield (Canada)	1.5	Oct. 15–16 (Tue.–Wed.)	BIO/POC/ TCOCE/ MONITOR/ FUTURE
W2: Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future	Jack Barth (USA) Emanuele Di Lorenzo (USA) Marc Hufnagl (Germany) Jacquelyne King (Canada) Arthur Miller (USA) Shoshiro Minobe (Japan) Ryan Rykaczewski (USA) Kazuaki Tadokoro (Japan)	Jürgen Alheit (Germany) Bryan Black (USA) Carolina Parada (Chile) Hans-O. Pörtner (Germany)	1	Oct. 11 (Fri.)	POC/BIO/ MONITOR/ FUTURE (ICES)

## POC-2013

### 2. 2013 inter-sessional symposia/sessions/workshops/meetings

- PICES Workshop on “*Radionuclides science and environmental quality of radiation in the North Pacific*” (Xiamen, China, March 14–15, 2013)
- Inter-sessional Science Board Meeting, May 20–21, 2013, St. Petersburg, Russia
- PICES/ICES FUTURE Workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” (St. Petersburg, Russia, May 22–24, 2013): Anne Hollowed (S-CCME Co-Chair, PICES), Suam Kim (S-CCME Co-Chair, PICES)
- PICES Summer School on “*Ocean observing systems and ecosystem monitoring*” (Newport, USA, August 19–23, 2013)
- 6<sup>th</sup> International SOLAS Summer School (Xiamen, China, August 23–September 2, 2013)
- WG 29 RCM-II Workshop (Busan, Korea, September 10–12, 2013)
- 4 ICES/PICES Joint Theme Sessions at the 2013 ICES ASC (Reykjavik, Iceland, September 23–27, 2013)
  - ✓ Session B: Responses of living marine resources to climate change and variability: Learning from the past and projecting the future (Convenor: Anne Hollowed, S-CCME Co-Chair)
  - ✓ Session M: Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future (Convenor: Emanuele Di Lorenzo, WG 27 Co-Chair)
- NOWPAP/PICES Joint Training Course on “*Remote sensing data analysis*” (Qingdao, China, October 21–25, 2013)

### 3. Travel and representation at the meetings of other organizations/programs

- PICES convenors, Shoshiro Minobe (POC, WG 27 Co-Chair), Hiroaki Saito (AP-COVE Chair), for CLIVAR/PICES joint session on “*Biophysical interaction*” in WCRP/CLIVAR Second International Symposium on “*Boundary Current Dynamics*” (Lijiang, China, July 8–9, 2013):
- PICES representative, Shoshiro Minobe (POC, WG 27 co-chair), to attend CLIVAR SSG meeting (Kiel, Germany, May 6–9, 2013), CLIVAR Pacific panel meeting (Lijiang, China, July 8–13, 2013):

### 4. Publications (GC 2012/S/5 decisions)

- Special issue of Progress in Oceanography on modeling dedicated to Dr. Bernard Megrey (Guest Editors: Drs. Enrique Curchitser, Shin-ichi Ito, Kenneth Rose, Michio Kishi, Myron Peck) to be published in 2015. Submission deadline: November 15, 2013.
- Special issue of ICES Journal of Marine Science based on selected papers from 2012 2<sup>nd</sup> International Symposium on “*Effects of climate change on the world’s oceans*” to be published in 2013.
- Report of the 2012 GLOBEC/PICES/ICES Workshop on “*Forecasting ecosystem indicators with process-based models*” (Editors: Drs. Emanuele Di Lorenzo, Arthur Miller, Shoshiro Minobe)

## AGENDA ITEM 5

### Reports of POC active groups

#### Section on *Carbon and Climate* (S-CC)

Dr. James Christian, Co-Chairman of S-CC, reported on the Section’s 2013 activities and 2014 plans.

1. S-CC was created in the fall of 2005 to continue the work of the disbanded Working Groups 13 (*Carbon Dioxide in the North Pacific*) and 17 (*Biogeochemical Data Integration and Synthesis*). At completion of its first 5 years, S-CC submitted a report and was reauthorized at the 2010 Annual Meeting to continue for another 5 years from 2011 to 2015. S-CC submitted its report at the 2013 Annual Meeting (*S-CC Endnote 4*) in accordance with PICES Rules of Procedure (Rule 13) that Sections shall be reviewed every 3 years. As a parent committee of S-CC, POC supports S-CC’s continuation of its activities until 2016.
2. PACIFICA data synthesis was completed and publication of its results is ongoing.
3. S-CC is re-focusing its objectives more on ocean acidification and de-oxygenation in support of FUTURE

objectives. It will produce syntheses and data products to achieve its new goal, accommodating the needs of the FUTURE APs and other expert groups, including a membership turnover if requested.

#### Joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems* (S-CCME)

Dr. Michael Foreman, member of S-CCME, presented summarized the Section's 2013/2014 activities and future plans. S-CCME convened a FUTURE workshop together with ICES on "*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*", which was held in St. Petersburg, Russia from May 22–24, 2013. A report of the workshop is available on the PICES website at [http://www.pices.int/publications/pices\\_press/volume21/v21-n2/pp\\_5-8\\_WS-SCCME.pdf](http://www.pices.int/publications/pices_press/volume21/v21-n2/pp_5-8_WS-SCCME.pdf). S-CCME co-sponsored 2013 ICES ASC Theme Sessions (Session B and Session M, and Workshops in PICES-2013 with ICES (W1 and W2).

PICES current and former members authoring IPCC chapters were also introduced: Chapter 10 – Detection and Attribution of Climate Change (Dr. Jim Overland), Chapter 28 – Polar Regions (Dr. Anne Hollowed), Chapter 30 – Oceans (Dr. Sukgeun Jung), and Chapter 5 (Dr. Jake Rice).

Planned theme/topic sessions and workshops in 2014 include Sessions for PICES FUTURE Open Science Meeting (April 15-18, Hawaii), two topic sessions for PICES-2014, and a theme session for 2014 ICES ASC.

#### Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (AP-CREAMS)

Dr. Yury Zuenko, a member of AP-CREAMS, gave a brief report of the Panel on its activities in 2013 and plans for 2014 and beyond. During its business meeting, national reports were given by Dr. Dongfeng Yu (China) on results of current observations in the Yangtze River estuary and adjacent seas and on a new project on mesoscale processes of the shelf-break in the northern South China Sea. Dr. Kyung-Ryul Kim reported on the 20<sup>th</sup> Anniversary of the first CREAMS expedition in 1993 held in Seoul in August 2013, and introduced a plan for a Korea–Russia joint expedition in the Japan/East Sea using the R/V *Lavrentyev* during October–November, 2013. This joint cruise has been and will continue to be conducted regularly, and it is possible for other scientists from PICES member countries to participate in the cruises. Dr. Kim encouraged interested scientists to contact him if they are interested in having work done on future cruises.

Dr. Jae-Hak Lee presented preliminary results from surveys in the East China Sea in October 2012 and a surface mooring east of Jeju-do Island which has been in operation since May 2012. He also introduced a new proposal on physical and ecological function of the East China Sea submitted to Ministry of Ocean and Fisheries of Korea, which would be the Korea EAST-II project if the proposal is approved. Dr. Zuenko presented results from long-term monitoring in Amur Bay: long-term trends in temperature, hypoxia, and zooplankton.

A PICES Summer School on "*End-to-end models for marine resources management and research*" is planned for August 26–29, 2014, at Seoul National University. The Summer School can accommodate about 30 postgraduate students and early-career scientists. One of the organizers (Dr. Chung Il Lee) contacted 5 scientists to serve as instructors, and a tentative day-by-day program was introduced. AP-CREAMS requested PICES to support all 5 instructors and 5 non-Korean students.

A progress report on the publication of a volume on the Yellow and East China Seas was also introduced, including a tentative list of contents. AP-CREAMS requested PICES endorsement of the publication and technical editing support.

At the AP-CREAMS meeting, the following recommendations were agreed on pertaining to the Supplementary Chapter of NPESR: Marine Ecosystems of the North Pacific Ocean 2003–2008:

- PICES should initiate the publication of the supplementary chapter without further delay as Science Board has already endorsed it.
- If there are further delays, AP-CREAMS will initiate efforts to publish the prepared manuscript outside

## POC-2013

PICES, possibly as a book. However, this publication will not be a replacement of the missing chapter of the 2<sup>nd</sup> NPESR by any means. PICES should continue efforts for completing the 2<sup>nd</sup> NPESR and for the preparation of NPESR 3.

### Working Group on *North Pacific Climate Variability and Change* (WG 27)

Dr. Emanuele Di Lorenzo, Co-Chair of WG 27 (<http://wg27.pices.int>), gave a brief presentation on 2013 activities and future plans for the WG. Science products of WG 27, including a list of members' publications and reports of the ECOFOR 2012 workshop (<http://wg27.pices.int/ecofor/>), have been updated. At its 2013 Annual Meeting, the WG prepared a draft of a final report which will be further expanded in 2013–2014. WG 27 members agreed to complete the following two synthesis papers: i) Reduced complexity models to hindcast and forecast North Pacific climate, ii) Coherent changes in North Pacific climate and ecosystems. WG 27 also plans to assemble an ocean currents database based on outputs of regional model hindcasts and AR5 models.

Dr. Shoshiro Minobe, WG 27 Co-Chair, convened a PICES/CLIVAR joint session on “*Biophysical interaction*” during the WCRP/CLIVAR International Symposium on “*Boundary current dynamics*” held in Lijiang, China, July 8–9, 2013. Nine talks were presented, which mainly addressed physical control of nutrients such as vertical mixing, upwelling, and advection in the western North Pacific and its marginal seas. At its conclusion, the necessity of constructing nutrient budgets on various long-term timescales including mean climatology and interannual-to-decadal timescales, and how those budgets respond to climate change, was discussed.

Dr. Minobe, representing PICES, attended the CLIVAR SSG meeting held in Kiel, Germany, May 6–9, 2013. He joined the tiger team of one of the focused and integrated research opportunities of the 2<sup>nd</sup> phase CLIVAR activities on “Biophysical interactions and dynamics of upwelling system” led by Dr. Ken Drinkwater.

WG 27 requested an extension of its lifespan for one more year, until 2015, to analyze CMIP 5 results, to contribute to the 3<sup>rd</sup> International Symposium on the “*Effects of climate change on the world's oceans*” (March 23–27, 2015, Santos, Brasil), and to devote more efforts on, and to develop recommendations for, new expert groups, completing some of its TORs. Considering its important contributions to FUTURE program, POC agreed to support the extension.

Dr. Di Lorenzo also planned to propose a new integrated study group together with the Section on *Human Dimensions of Marine Systems*-, focusing on the development of integrated model of coastal hypoxia and acidification. POC agreed to support the new expert group.

### Working Group on *Regional Climate Modeling* (WG 29)

Dr. Enrique Curchiter, Co-Chair of WG 29, gave a brief summary of activities and plans of WG 29 followed by a review of its TORs and a brief description of downscaling and upscaling. He reported on the 2<sup>nd</sup> RCM workshop held in Busan, Korea from August 23–September 23, 2013. A total of 21 oral talks and 7 posters were presented during 3 scientific sessions: i) Processes in RCM (meso- and submesoscale motions), ii) Regional climate and ecosystem projections, and iii) Climate variability in the North Pacific. Based on discussions at the wrap-up session, the following issues in RCM were presented: i) How useful are idealized process models? ii) At what spatial resolution do results converge? iii) How important are sub-mesoscale processes for climate? iv) How much can be learned from one-way nesting? It was suggested that RCM-III could focus on physical–biological and ocean–atmosphere coupling.

Other activities of WG 29 included sponsoring topic sessions at PICES-2013 (S6: Recent trends and future projections of North Pacific climate and ecosystems) and FUTURE OSM (S2: Regional climate modeling in the North Pacific) in April 2014. WG 29 also plans to propose sessions including an RCM III workshop at the 3<sup>rd</sup> International Symposium on the “*Effects of climate change on the world's oceans*”.

WG 29 requested an extension of its lifespan for one more year, until 2015, to analyze CMIP 5 results and possibly to use them in regional models, to convene a workshop on RCM III (see above), and to propose a new

expert group to follow WG 29 activities without a gap in its crucial role in the FUTURE program. POC agreed to support the extension.

Summary of POC decisions regarding expert group important matters:

1. Approve the request for an extension of the lifespan for one year, for both WG 27 and WG 29.
2. Support a new expert group proposal for an integrated modeling approach prepared by WG 27.
3. Receive a 3-year progress report of S-CC, and approve its continued activity.

#### AGENDA ITEM 6

##### **Relations with other international organizations/programs**

1. Dr. Charles Hannah gave an update on the status of Argo on behalf of Dr. Howard Freeland. The one millionth Argo profile was delivered in November 2012, and the number of published research papers based on Argo data is 1409 since 1998. Float and sensor technology continue to improve, and the design of Argo is evolving towards more complete global coverage and regionally-enhanced resolution. National Argo programs, however, face tight resources, hence Argo must exploit continuing technology advances to become more efficient and cost-effective. Argo is progressing towards the future with two prioritized items: Implementing and sustaining the core global Argo mission, and the evolution of Argo with additional missions such as Deep Argo, Bio-Argo, and near-surface mission. Dr. Hannah demonstrated a new software, Global Marine Argo Atlas, which gives very easy access to data and simple software to produce various useful plots. The software also allows an easy and prompt update of Argo data. The software is available from the Argo Steering Team web site: [http://www-argo.ucsd.edu/Marine\\_Atlas.html](http://www-argo.ucsd.edu/Marine_Atlas.html).
2. Dr. Shoshiro Minobe introduced new CLIVAR structure and research opportunities. He became a member of one of the research opportunities “Marine biophysical interactions and dynamics of upwelling system”, which is led by Dr. Ken Drinkwater. (See the WG 27 report above for additional activities of Dr. Shoshiro Minobe related to CLIVAR.)
3. Dr. Hee-Dong Jeong, NEAR-GOOS Coordinating Committee member, gave a brief summary of NEAR-GOOS activities. NEAR-GOOS is one of 13 GOOS regional alliances in the North East Asian Region. A Coordinating Committee meeting was held in Busan, Korea in October 2013 to review and discuss the work plan and to cooperate with other regional projects and international programs. Dr. Jeong also introduced the status of each country’s database management, and the development of cooperative regional observing systems in the Japan/East Sea, Russia (POI) and Japan (JMA) monitoring section (former PM-line), and on-going and future plans of ferry boat monitoring.
4. Dr. Lisa Miller provided a summary of SOLAS organizational issues including an emerging topic on the impacts of ship plumes on atmospheric chemistry, climate and nutrient supply to the ocean. She also introduced three joint SOLAS–IMBER working groups. The 6<sup>th</sup> SOLAS Summer School was held in Xiamen, China, in August 23–September 2, 2013, with an appreciation of PICES support. Thirty-six percent of the students came from PICES member countries. The SOLAS synthesis publication, “Ocean-atmosphere interactions of gases and particles” (edited by Liss, P.S. and Johnson, M.T.) is in press, and the SOLAS Open Science Conference will be held in Kiel, Germany from September 7–11, 2015. SOLAS is transitioning towards the Future Earth program, and accordingly preparing themes of major importance for SOLAS research over the next decades. An early white paper draft version of eight themes as a consultation document is available on their web site. A workshop was proposed for PICES-2014 to solicit community input to those themes. Future Earth is an alliance of ICSU, ISSC, UNESCO, UNEP, UNU, WMO (as an observer) and the Belmont Forum (a high level group of major research funders). The Belmont Forum is an alliance of funders and has been set up to be a more useable tool for research funding. Future Earth has a large social science component. Dr. Miller also introduced activities of SCOR Working Group on Biogeochemical Exchange Processes at the Sea-Ice Interfaces (SCOR WG 140), as affiliate member representing PICES.

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5. POC reviewed theme session proposals for the 2014 ICES Annual Science Conference held in A Coruña Spain, and supported the proposal, “*Physical and biological consequences of exchanges between the Atlantic Subarctic and the Arctic*”, provided the Pacific be included in the title and abstract.

### AGENDA ITEM 7 FUTURE issues

The Chairman introduced the structure and scientific programs for the FUTURE Open Science Meeting to be held in Hawaii in April 15–18, 2014, and reminded members of the abstract submission deadline.

At the overture meeting on October 12, the Chairman asked the chairs of POC’s expert groups to answer the following questions about FUTURE-related issues when they present their groups’ activities at the POC business meeting on October 16:

- (1) What are the expected deliverables and/or products related to FUTURE?
- (2) What are the gaps/obstacles in making progress with the expected contribution; and what will be the necessary actions to overcome these gaps?
- (3) What kind of coordination is needed with other expert groups; How well are we communicating with Committees/FUTURE APs on FUTURE matters? The following is the response of each group to those questions.

*S-CC* – (1) data products related to ocean acidification and de-oxygenation, analysis and synthesis of historical data, analysis of climate model projections and evaluation against observations, observations and projections of changes in open ocean [O<sub>2</sub>] and [CO<sub>3</sub><sup>2-</sup>] to help separate local from large-scale influences;  
(2) natural variability in observations and models, downscaling (dynamical, statistical ?), coastal data (extend dynamic range of interrelationship among salinity, pH, [CO<sub>3</sub><sup>2-</sup>], *etc.*), benthic influences; refocusing S-CC objectives;  
(3) producing synthesis or data products according to the needs of the APs and other expert groups, membership turnover as requested by APs and other expert groups.

*S-CCME* – (1) scientific papers, reports, other synthesis products;  
(3) WG 29 doesn’t know what S-CCME wants.

WG 27 – (1) scientific papers, final report, website repository, data archive of ocean circulation anomalies from regional models and IPCC outputs;  
(2) entrain more climate modelers, develop critical datasets (ocean currents, physiological responses, *etc.*), share information, continue to connect to large-programs (*e.g.*, CLIVAR, ICES);  
(3) communication through website, proposing a new expert group to enhance communication with S-HD.

WG 29 – (1) inventory of regional physical and coupled physical-biological modeling efforts in PICES region, regional analysis of CMIP5 model output, CMIP5 derived quantities (*e.g.*, MLD);  
(2) limited available data (especially ecosystem variables), complexity of regional models and time-consuming modeling job, little expertise in modeling human activity; progress is being made slowly but surely;  
(3) a natural connection to WG 27, coordination with TCODE required to seek for an efficient way to serve data and model product; Don’t know what products others need, and would be great to get representatives from other expert groups to attend the annual WG 29 meetings for closer communication on FUTURE.

The POC meeting on October 16 adjourned for about half an hour to attend the presentation made by Dr. Harold Batchelder, on behalf of AP-SOFE, on the draft proposal of the process to produce the next generation North Pacific Ecosystem Status Report (NPESR) submitted to Science Board by AP-SOFE and MONITOR. After the presentation, the POC meeting resumed starting from the discussion about the new NPESR process followed by the Chairman’s summary of the major changes described in the draft proposal. POC approved the proposal in principle, considering the demands of the PICES community to update the ecosystem status in the



North Pacific more frequently. POC members, however, wanted to know more details on the production of the new NPESR. The Chairman mentioned that he will circulate the proposal to all Committee members to receive further comments.

Some comments raised at the POC meeting on the new NPESR process: (1) It is not clearly dictated in the proposal whether or not hard-copy publication be made the same as the previous NPESR reports in the form of PICES special publication. (2) Inclusion of numerical model time series, especially where observations are unavailable, and Argo and satellite altimetry by setting up links to websites. (3) Concerns if there are enough dedicated PICES people with sufficient time to do it, especially those who have another paying job. (4) It was questioned whether the naming issue of the Japan/East Sea can be avoided in the new NPESR.

AGENDA ITEM 8

**Election of new POC Chairman**

Dr. Kyung-Il Chang will stand again as the Chairman and Dr. Michael Foreman will remain as Vice-Chairman

AGENDA ITEM 9

**Planning for PICES-2014**

1. Six Topic Sessions which POC or its expert groups co-sponsor were proposed for PICES-2014 as well as POC Paper Session (*POC Endnote 3*). Ranking of the proposed sessions was made and allotment of POC money for selected sessions was decided as follows: “Regional climate modeling in the North Pacific” (\$3,000), “Variability in advection and its biological consequences for Subarctic and Arctic ecosystems” (\$1,000), and “POC Paper Session” (\$1,000).
2. Two Workshops that POC or its expert groups co-sponsor were proposed (*POC Endnote 3*).
3. Half-day business meetings for S-CC, S-CCME, AP-CREAMS, WG 27, and WG 29 were requested.

ID	Title	Convenors	Duration (Day)	Committees (Sponsors)	Publication
	POC Paper Session		1	POC	
TS-2	Variability in advection and its biological consequences for Subarctic and Arctic ecosystems	Franz Mueter (USA) Ken Drinwater (Norway) Sei-Ichi Saitoh (Japan) Enrique Curchitser (USA)			
TS-6	Dynamics of pelagic fish in the North Pacific under climate change	Gerard DiNardo (USA) Suam Kim (Korea) Sei-Ichi Saitoh (Japan) Cisco Werner (USA)	1	S-CCME (ESSAS)	Yes
TS-12	Recent assessments of climate change impacts on marine ecosystems	Anne B. Hollowed (USA) Jake Rice (Canada) Sukgeun Jung (Korea) Hans-O. Pörtner (Germany)	0.5	S-CCME (ICES)	
TS-13	Climate change impacts on spatial distributions of marine fish and shellfish	Jonathan Hare (USA) Anne B. Hollowed (USA) Sukyung Kang (Korea)	1	S-CCME (ICES)	
TS-14	Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries	David Checkley (USA) Sanae Chiba (Japan)	0.5	AP-CREAMS	
TS-15	Regional climate modeling in the North Pacific	Chan Joo Jang (Korea) Enrique Curchitser (USA) Michael Foreman (Canada) Kyung-Il Chang (Korea) Shin-ichi Ito (Japan)	1	POC, WG 27, WG 29	Yes

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		Angelica Peña (Canada) Hyodae Seo (USA)			
WS-1	SOLAS into the future: Designing the next phase of the Surface Ocean–Lower Atmosphere Study within the context of the Future Earth program	Lisa Miller (Canada) Minhan Dai (China) Yukihiro Nojiri (Japan)	0.5	S-CC (SOLAS)	
WS-2	Networking ocean observatories around the North Pacific Ocean	Ken Denman (Canada) Jack Barth (USA) Jae Hak Lee (Korea) Robert Weller (USA) Hidekatsu Yamazaki (Japan)	1.5	(Oceans Networks Canada, US CLIVAR)	Yes

### AGENDA ITEM 10

#### Publication for 2014 and beyond

- AP-CREAMS submitted a proposal for publishing a book on “Oceanography of the Yellow and East China Seas” as the PICES special report. The book would be a review and textbook-style book of the area of about 300 pages long, and is expected to be published at the end of 2014. The Chairman introduced the a tentative list of contents of the book as was received from developed by AP-CREAMS (see *AP-CREAMS Endnote 3*). Mainly AP-CREAMS members will constitute the editorial board: Drs. Joji Ishizaka, T. Matsuno, T Jing Zhang, Jae-Hak Lee, JS. Kim, S., Dongfeng Xu, D., Yu Fei, Y., Sumei Liu, Vyacheslav Lobanov. AP-CREAMS requested PICES support of for technical editing and publication fee.
- S-CCME proposed a special volume in the ICES Journal of Marine Science for manuscripts given arising from presentations given in at the PICES/ICES Workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” held in St. Petersburg, Russia, from May 22–24, 2013 and from Theme Session B of 2013 ICES ASC.
- WG 27 proposed two synthesis papers (journals TBD): 1. Reduced complexity models to hindcast and forecast North Pacific climate (Cummins, Di Lorenzo, Davis, Yeh, Taguchi, Bograd), 2. Coherent changes in North Pacific climate and ecosystem (King, Ito, Minobe, Chiba, Davis, Ustinova, Zuenko, Di Lorenzo).

### AGENDA ITEM 11

#### Items with financial implications

1. Topic sessions for PICES-2014 (see Agenda Item 9)
2. Proposed inter-sessional meetings and capacity building programs for 2014 and beyond:
  - 1<sup>st</sup> Pan-CLIVAR meeting, The Hague, The Netherlands, July 17–18, 2014: Travel support for Dr. Minobe to attend the meeting to represent PICES and implement PICES/CLIVAR collaboration. POC approved the request.
  - PICES Summer School on “*End-to-end models for marine resources management and research*”, Seoul, Korea, August 26–29, 2014 (GC decision 2012/S/3): The Chairman introduced an updated plan from the principal organizer of the Summer School, Dr. Chung-Il Lee, at Gangneung-Wonju National University (*POC Endnote 4*). There were no specific comments on the updated program from POC members. AP-CREAMS requested travel support for 5 lecturers and 5 non-Korean students. POC approved the request.
  - BEPS-II (SCOR WG 140) meeting, Hobart, Australia, in March 2014: Travel support for Dr. Lisa Miller. POC approved the request.
  - 3<sup>rd</sup> PICES/ICES/IOC Symposium on “*Effects of climate change on the world’s oceans*”, Santos City, Brazil, March 23–27, 2015: Symposium convenor, Dr. Jacquelynne King, requested keywords or titles for topic sessions as soon as possible. PICES SSC members, Drs. Minobe, Qiao and Angelica Peña will decide the final topic sessions. WG 29 plans to propose a workshop which may be split into sub-sessions, possibly including RCM-III. Dr. Curchitser also plans to propose a topic session “*Modeling climate impacts across scales: from physics to ecosystems*” together with Drs. Jason Holt, Jerome

Fiechter, and Shin-ichi Ito. The session description was prepared and will be sent to Dr. Peña. Dr. Minobe plans to propose the following sessions: “*Impact of climate variability and change on nutrient distributions*” and “*Validation and utilization of Earth System models*”.

- PICES/ICES Early Career Scientist Conference proposal for 2017: The venue for the conference has not decided so far, although Korea and China have shown their intention to host the conference.

#### AGENDA ITEM 12

##### **POC Best Presentation and Poster awards**

Best presentation by an early career scientist for a POC-sponsored session was awarded to Colleen M. Petrick for her talk on “*How eastern Bering Sea climate variability affects the distribution of walleye pollock early life stages*” (W2) and best poster was awarded to Hiromichi Ueno for his presentation on “*Decadal variation of temperature inversions along Line P*” (POC Contributed Paper Session) See Session Summaries for more details ([http://www.pices.int/publications/annual\\_reports/Ann\\_Rpt\\_13/2013-Session-Summaries.pdf](http://www.pices.int/publications/annual_reports/Ann_Rpt_13/2013-Session-Summaries.pdf)).

#### AGENDA ITEM 13

##### **Documenting sessions and workshops**

The Chairman recalled the request from Science Board to complete and send documentation of topic session and workshop summaries convened by POC members for PICES-2013 to the Secretariat before the end of the Annual Meeting, and business meeting reports of POC and expert groups within one month after the Annual Meeting.

#### AGENDA ITEM 14

##### **Other business**

POC members discussed possible POC contributions to celebrate the 25<sup>th</sup> Anniversary of PICES in 2016. The following were suggested.

- If PICES considers a special journal issue, POC will contribute to it.
- A special POC session to highlight the accomplishments of POC, to summarize Working Groups that POC supported, and possibly to invite former POC Chairs.

A discussion on the declining number of papers submitted to the POC Paper Session and the declining participation of young physical oceanographers was made. The Chairman suggested that POC members should always contribute to the Paper Session, and that POC members also try to propose physics-dominated topic sessions. As part of this commitment, POC decided to allocate funds to POC Paper Session to invite a distinguished speaker presenting emerging issue(s) in physical oceanography.

#### AGENDA ITEM 15

##### **Adoption of report and recommendations to Science Board**

This POC report was circulated among, and approved by all POC members. All recommendations were brought by Dr. Kyung-Il Chang to the Science Board meeting on October 18–19, 2013.

## POC-2013

### *POC Endnote 1*

#### POC participation list

##### Members

Kyung-Il Chang (Korea, Chairman)  
James Christian (Canada)  
Enrique Curchitser (U.S.A.)  
Michael Foreman (Canada, Vice-Chairman, rapporteur)  
Shin-ichi Ito (Japan)  
Hee-Dong Jeong (Korea)  
Elena Ustinova (Russia)  
Yury Zuenko (Russia)

##### Observers

Emanuele Di Lorenzo (WG 27)  
Lisa Miller (SOLAS, SCOR WG 140)  
Shoshiro Minobe (WG 27)  
Vadim Navrotsky (POI, Russia)  
Dmitry Stepanov (POI, Russia)  
D.F. Xu (SIO/SOA, China)

### *POC Endnote 2*

#### POC meeting agenda

1. Welcome, introductions, opening remarks
2. Membership changes
3. Changes to, adoption of agenda and appointment of rapporteur
4. Completion of PICES-2012 decisions
5. Reports of POC expert groups
  - i) Section on *Carbon and Climate* (Dr. James Christian)
  - ii) Joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems* (Dr. Michael Foreman)
  - ii) Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (Dr. Yury Zuenko)
  - iii) Working Group on *North Pacific Climate Variability and Change* (Drs. Emanuele Di Lorenzo and Shoshiro Minobe)
  - iv) Working Group on *Regional Climate Modeling* (Dr. Enrique Curchitser)
6. Relations with other international organizations/programs
  - i) Argo (Dr. Charles Hannah)
  - ii) WCRP/CLIVAR (Dr. Shoshiro Minobe)
  - iii) NEAR-GOOS (Dr. Hee-Dong Jeong)
  - iv) SOLAS and BEPS II (Dr. Lisa Miller)
  - v) Review of 2014 ICES ASC theme session proposals (Dr. Kyung-Il Chang)
7. FUTURE issues
  - i) FUTURE Open Science Meeting in 2014
  - ii) Contribution/Gaps/Communication issues from expert groups
  - iii) Draft proposal on producing next generation NPESR
9. Planning for PICES-2014
  - i) Ranking and allotment for proposed six Topic Sessions
  - ii) Two Workshops proposed by POC or its active groups
  - iii) Business meetings of active groups
10. Publication for 2014 and beyond
11. Items with financial implications
  - i) Topic Sessions for PICES-2014
  - ii) Proposed inter-sessional meetings and capacity building programs for 2014 and beyond
  - iii) Requests for PICES support for inter-sessional meetings and 2014 Summer School
12. POC Best Presentation and Poster awards
13. Documenting sessions and workshops
14. Other business
15. Adoption of POC report and recommendations to Science Board

**POC Endnote 3****Proposals for POC-sponsored sessions and workshop at PICES-2014****POC Paper Session**

Duration: 1 day

Conveners: Kyung-Il Chang (Korea) and Michael Foreman (Canada)

Invited speakers: one

Papers are invited on all aspects of physical oceanography and climate in the North Pacific and its marginal seas.

**POC Topic Sessions****TS-2 *Variability in advection and its biological consequences for Subarctic and Arctic ecosystems***

Proposed by S-CCME

Co-sponsor: ESSAS

Duration: 1 day

Conveners: Franz Mueter (USA), Ken Drinkwater (Norway), Sei-Ichi Saitoh (Japan), Enrique Curchitser (USA)

The advection of water masses and their associated nutrients and plankton is critical to biological processes within the subarctic gyres and on the productive shelf regions bordering the gyre. Cross-shelf and along-shelf advection regulate the supply of nutrients and plankton to these shelves, thereby affecting the productivity and species composition of the prey organisms that support higher trophic levels. Moreover, the advection of larvae to suitable nursery areas affects the spatial and temporal overlap between larvae and their prey and predators (match-mismatch dynamics). Advective processes have been linked to the recruitment success of walleye pollock off Japan and in the Gulf of Alaska, which benefit from increased retention within certain nearshore regions, and to recruitment patterns of flatfishes and crab in the eastern Bering Sea, which benefit from increased advection towards suitable nursery areas. Interannual variability in advection has long been understood as an important source of biological variability, while variability at shorter time scales (days to weeks) has only recently received more attention due to the increased availability of high-frequency observations and the development of high-resolution models. The main goal of this session is to explore how variability in the advection of nutrients, zooplankton prey, and early life stages at all scales affects the recruitment, abundance and distribution of subarctic fish and invertebrate species, including the potential to extend their range into Arctic waters. We invite papers that explore past variability and potential future trends based on field observations, analyses of long-term data series, and biophysical models. Contributions from both the Pacific and Atlantic Subarctic are welcome.

**TS-6 *Dynamics of pelagic fish in the North Pacific under climate change* [later changed to a workshop]**

Proposed by S-CCME

Co-sponsor: ISC

Duration: 1 day

**Conveners:** Gerard DiNardo (USA), Suam Kim (Korea), Sei-Ichi Saitoh (Japan), Cisco Werner (USA)

The goal of the workshop is to define a scientific framework to assess the dynamics of pelagic fish under climate/environmental variability. We will discuss the overlapping PICES and ISC science missions and outline a Science Plan for a multi-year collaborative effort. Climate variability affects pelagic fish distributions and migration, and ultimately pelagic fisheries, the level of impact depending on the persistence, direction, and magnitude of the variability. Survival and growth rates of pelagic fish are linked to oceanographic conditions, and changes to these conditions can have dramatic impacts on the composition of species assemblages within pelagic ecosystems, as well as the persistence and magnitude of individual pelagic

## **POC-2013**

fish populations (PICES/ICES, 2013). Understanding the links between environment and pelagic fish behavior, growth, recruitment, and production are paramount to understanding the impacts of climate variability.

Pelagic fishes occupy surface waters of the North Pacific Ocean, from coastal shelf to open ocean ecosystems. Many of these species undertake large-scale feeding, spawning, and ontogenetic migrations linked to seasonal changes in water masses. For example, Pacific bluefin tuna use waters off Japan as a nursery habitat, undertaking an ontogenetic movement eastward to waters off North America where they remain as subadults for 2-3- years. Additionally, many pelagic species have environmental thresholds and preferences, which limit the spatial distribution of a species. The most important environmental factors include oxygen, salinity and temperature, and because these factors generally exhibit persistent spatiotemporal patterns, the general distribution of pelagic fishes is known. Knowledge of these relationships allows for the incorporation of climate change into stock assessments, which forms the basis for fisheries management.

PICES/ICES (2013) Report of the Workshop on Global Assessment of the Implications of Climate Change on the Spatial Distribution of Fish and Fisheries (WKSICCMESpatial), 22–24 May 2013. ICES CM 2013/SSGEF:11. 63 pp.

### ***TS-12 Recent assessments of climate change impacts on marine ecosystems***

Proposed by S-CCME

Co-sponsor: ICES

Duration: 0.5 day

Conveners: Anne B. Hollowed (USA), Jake Rice (Canada), Sukgeun Jung (Korea), Hans Pörtner (Germany)

The Intergovernmental Panel on Climate Change expects to release the full reports of Working Groups 1, 2 and 3 electronically in January, August, and September of 2014, respectively. Other organizations have recently completed assessment reports that focus on specific geographic regions or fishing sectors (e.g., the U.S. National Climate Assessment or FAO's report on *Priority adaptations to climate change for Pacific fisheries and Aquaculture: Reducing risks and capitalizing on opportunities*). Collectively these reports will mark a major milestone by updating our knowledge of the observed and projected implications of climate change on the earth. Of particular interest to PICES and ICES will be the findings of the reports with respect to impacts on marine ecosystems. This session encourages presentations that summarize the key findings of the IPCC. It also encourages talks that provide guidance and insight on future directions for climate change research within the ICES and PICES communities.

### ***TS-13 Climate change impacts on spatial distributions of marine fish and shellfish***

Proposed by S-CCME

Duration: 1 day

Conveners: Jon Hare (USA), Anne B. Hollowed (USA), Sukyung Kang (Korea)

Changes in fish and shellfish distributions are an important indicator of climate change and are being incorporated into national climate change assessment. Fishing, however, also affects fish and shellfish distributions and fishing effort is changing in many ecosystems. Changes in distributions will also affect fisheries, shifting the resource toward or away from fishing ports. We invite papers that examine the combined effect of climate change and fishing on fish and shellfish distributions and the impact of these changes on fisheries. Specifically, we encourage papers that 1) develop and use analytical approaches for separating the effect of fishing and climate, 2) evaluate life history and fishery traits that are associated with shifting distributions, and 3) examine the effect of shifting distributions on fisheries, fishing communities, resource economics, and international allocation.

**TS-14 *Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries***

Proposed by AP-CREAMS

Duration: 0.5 day

Conveners: David Checkley (USA), Sanae Chiba (Japan)

Plankton plays key roles in the pelagic ocean. Planktonic plants, invertebrates and the early developmental stages of vertebrates are important for trophic and population dynamics of many taxa, many of which are exploited and some are protected; the flux of energy and material, including carbon; and as indicators of ecosystem status. Phytoplankton has been both sampled in situ and observed remotely, from satellites. Zooplankton has been collected by nets. Increasingly, optics, acoustics, and 'omics' are used and developing. Sampling programs worldwide now span decades, often with ancillary data. From these, time series of plankton abundance have been created, with varying levels of taxonomic and geographic resolution. Often, such programs have been in support of fisheries management. Increasingly, however, they are also relevant to management and policy decisions affecting ecosystems and climate. In turn, such programs require justification for their continuation. Examples of such programs include the California Cooperative Oceanic Fisheries Investigations (CalCOFI), the Global Alliance of Continuous Plankton Recorder Surveys (GACS), and many other plankton sampling programs worldwide (many zooplankton programs are listed at <http://www.st.nmfs.noaa.gov/copepod/>). The objective of this session is to learn how time series of plankton have been, are being, and might be used to inform decisions in management and policy concerning climate, ecosystems, and fisheries. We invite presentations on both time-tested uses of plankton time series and on novel, untested uses.

**TS-15 *Regional climate modeling in the North Pacific***

Proposed by POC/WG27/WG29

Duration: 1 day

Conveners: Chan Joo Jang (Korea), Enrique Curchitser (USA), Michael Foreman (Canada), Kyung-Il Chang (Korea), Sin-ich Ito (Japan), Angelica Peña (Canada), Hyodae Seo (USA)

Regional climate models are a key scientific tool for understanding climate change on a regional scale which is essential for consideration of many socio-economic impacts of climate change and its adaptation. Despite their limitations including systematic errors in forcing fields given by global climate models and uncertainties in downscaling methods, it is recognized that regional models are necessary for understanding and projecting regional climate changes because of improved model resolution.

This session calls for papers addressing the recent efforts for regional climate modeling such as developing novel approaches for dynamic downscaling, comparison between regional and global climate model results, detection and evaluation of regional climate changes in the North Pacific Ocean simulated by regional and global climate models, assessment of their uncertainty, and coupling of regional climate models with biogeochemical models. This session aims to assemble and share existing expertise in recent efforts to regional climate models by providing a platform to discuss their limitations and reliability.

**POC Workshop**

***WS-1 SOLAS into the future: Designing the next phase of the Surface Ocean-Lower Atmosphere Study within the context of the Future Earth program***

Proposed by S-CC

Co-sponsor: SOLAS

Duration: 0.5-day

Conveners: Lisa Miller (Canada), Minhan Dai (Canada), Yukihiro Nojiri (Japan)

For more than a decade, the Surface Ocean-Lower Atmosphere Study (SOLAS) has fostered cutting-edge research in air-sea interactions, facilitating communication, coordinating and directing research, and advocating for new projects. The SOLAS program has facilitated major advances, changing fundamental understanding in a number of subjects, including the significance of ocean acidification, the roles of DMS and marine organic matter in atmospheric chemistry, and the importance of sea-ice biogeochemistry in controlling air-sea exchange. At the same time, the significance of earth system science to society has become increasingly apparent, and FutureEarth is replacing the International Geosphere-Biosphere Programme as a major SOLAS sponsor. Within this context, SOLAS is plotting a new course for the next 10 years. This discussion session is one of a number at various conferences that is soliciting community input into the future of SOLAS. In particular, we are asking the question: In a world where Earth system science is coming under increasing political and public scrutiny, what is and should be the contribution of SOLAS science to society? Ideas and conclusions from this and other, similar workshops will be incorporated into the new SOLAS science plan.

***POC Endnote 4***

**PICES Summer School on  
“End-to-End models for marine resources management and research”**

**1. Background**

An ocean ecological model and its application are representation of an ecological system which is ranging in scale from an individual population to an ecological community, or even an entire system. The real systems are quite complicated because they involves biotic and abiotic components all interacting over a large area and a long time span. Understanding and predicting the changes in marine ecosystem requires high quality observation and experiment data. The models are formed by combining known ecological relations (e.g. the relation of sunlight and water availability to photosynthetic rate, or the relation between predator and prey populations) with data gathered from field and laboratory experiments. Ecological models are useful tools to describe ecological conditions and have long been developed to understand ecosystem behavior mechanism and to predict changes in community composition and ecosystem functioning. In particular, there has been a rapid rise in the development of end-to end model dealing with the effects of climate change and human activity on the marine ecosystem through the food web. End-to-end models combine physicochemical oceanographic descriptors and organisms ranging from microbes to higher-trophic-level organisms. The demand for End-to End approaches including bottom-up and top-down control in food webs arises from the need for quantitative tools for ecosystem-based management. End-to-end models that can deal with bottom-up and top-down controls that operate simultaneously and vary in time and space and that are capable of handling the multiple impacts expected under climate change.

This summer school intends to help graduate students and early-career scientists as well as new comers by providing basic knowledge for advanced applications. The 4-day summer school will cover an introduction to marine ecosystems (e.g. concept of the ecosystem) and parameter optimization of marine ecosystem model and



its application. The courses will be composed of lectures, seminars, and hands-on training in parameter optimization and end-to-end model application.

The official language of the school is English.

## 2. Purpose

End-to-End Models have applications in a wide variety of disciplines, such as natural resource management, wildlife conservation and agriculture. These models are formed by combining known complicated ecological relations with field observation data, and are being used in order to make an understanding about the process in systems and predictions about the dynamics of the real ecosystem. The purpose of this Summer School is to review and present methods of modeling in ecological relations, and to show how these models (methods) can be applied to understand and predict change in ecosystem.

## 3. Dates and venue

Date: 26–29 (Tuesday ~ Friday) August, 2014

Venue: Seoul National University (Republic of Korea)

Lecture & Workshop: Bd. 25-1/1st floor International Conference Room

Hands-on Exercise: Bd. 25-1/2nd floor Room 210 (SEES Computer Room)

## 4. Number of students

Maximum 30

## 5. Steering Committee

Dr. Chris Harvey: National Marine Fisheries Service, NOAA

[chris.harvey@noaa.gov](mailto:chris.harvey@noaa.gov)

Dr. Chung Il Lee: Gangneung-Wonju National University (principal organizer)

[leeci@gwnu.ac.kr](mailto:leeci@gwnu.ac.kr)

Dr. Emanuele Di Lorenzo: Georgia Institute of Technology

[edl@gatech.edu](mailto:edl@gatech.edu)

Dr. Isaac Kaplan: National Marine Fisheries Service, NOAA

[isaac.kaplan@noaa.gov](mailto:isaac.kaplan@noaa.gov)

Dr. Kenneth A. Rose: Louisiana State University

[karose@lsu.edu](mailto:karose@lsu.edu)

Dr. Tae-Hee Na: Seoul National University

[thna@snu.ac.kr](mailto:thna@snu.ac.kr)

Dr. Yang-Ki Cho: Seoul National University

[choyk@snu.ac.kr](mailto:choyk@snu.ac.kr)

## 6. Lecturers

Dr. Chris Harvey: National Marine Fisheries Service, NOAA

[chris.harvey@noaa.gov](mailto:chris.harvey@noaa.gov)

Dr. Chung Il Lee: Gangneung-Wonju National University

[leeci@gwnu.ac.kr](mailto:leeci@gwnu.ac.kr)

Dr. Emanuele Di Lorenzo: Georgia Institute of Technology

[chris.harvey@noaa.gov](mailto:chris.harvey@noaa.gov)

Dr. Isaac Kaplan: National Marine Fisheries Service, NOAA

[isaac.kaplan@noaa.gov](mailto:isaac.kaplan@noaa.gov)

Dr. Kenneth A. Rose: Louisiana State University

[karose@lsu.edu](mailto:karose@lsu.edu)

Dr. Rubao Ji: Woods Hole Oceanography Institution  
[rji@whoi.edu](mailto:rji@whoi.edu)

## 7. Registration

The summer school can accommodate a maximum of approximately thirty participants. If there are more than thirty applicants, students will be selected by the organizing committee and lecturers. Participants will be notified of their selection by the end of June, 2014. Participants must complete a Student Summer School Application Form, and send it with supporting documents to [gwnu2008@gmail.com](mailto:gwnu2008@gmail.com) before May 31, 2014. The official language of the summer school is English.

## 8. Lecture Notes and Publication

Please download these electronic versions of lecture notes (<http://seoul.snu.ac.kr/pices2014/lecture/>, not prepared yet!) with lecturers' names ahead for yourself to prepare summer school courses. Color printing would be limited during the summer school period, so please prepare your own printed version if you think it is of help to you. Local conveners will provide you with a printed lecture note at the registration desk. Dr. Chung Il Lee will update the above site as soon as she receives additional materials from lecturers, so check the above site until you leave your country. If you have any problem with downloading these files, please contact Dr. Chung Il Lee ([gwnu2008@gmail.com](mailto:gwnu2008@gmail.com)).

## 9. Lecture Plan - Draft

### Day 1 - Tuesday (August 26): Introduction to End-to-End Modeling

*Topics: continuous and discrete differential eq. with example of NPZD (continuous), IBM (discrete, difference equation), time-stepping schemes (Euler Forward/Backward the stability, Runge-Kutta and numerical integration for non-linear equations, why do we build models (e.g. hypothesis testing, understanding, diagnosing, forecasting, what is an end-to-end model)*

#### Lectures:

1. **Why do we build models?**
2. **Introduction to End-to-End models** [e.g. definition = can handle climate as input (types of climate input). At least two species at each trophic (how to determine which species include). Fishing pressure is included (not a constant mortality) (how to model fishing pressure)].
3. **Continuous and discrete equations & dynamics** [NPZD equations, discretization and numerical schemes, example for IBM].
4. **Modeling Lab** [MATLAB Tutorial with a point model NPZD, sensitivity to quadratic mortality, closing with simple IBM].

### Day 2 - Wednesday (August 27): Food-Web Models

*Topics: theory, structure and application of several End-to-End models, including Ecopath, Ecopath with Ecosim (EwE), and IBMs*

#### Lectures:

1. **Representing growth mortality and reproduction** [how to account for these dynamics in models that include fish]
2. **Introduction of Food-web Model**
3. **Parameter for Food-web Model**
4. **Simulations with Food-web Model** (e.g. Ecospace)
5. **Modeling Lab** [EwE tutorial, use model to test scenario for future climate by running a small sensitivity analyses. Ecopath is a balanced time independent model, Ecosim has time]

**Day 3 - Thursday (August 28): Time dependent dynamic simulation (e.g. Ecosim)**

*Topics: Adding time dependent forcing in the ecosystem model (e.g. climate forcing and fishing pressure). How to model fishing pressure?*

Lectures:

1. **Including the effects of *climate* in ecosystem models**
2. **Including the effects of *fishing* in ecosystem models**
3. **Using time dependent information for fisheries management**
4. **Modeling Lab** [Tutorial to use a simple Ecosim and add fishing/climate]

**Day 4 - Friday (August 29): Space dependent dynamic simulation (e.g. IBM)**

*Topics: Overview of models that include space e.g. Atlantis, Multi-species IBM. Lagrangian particle dynamics, using physical models to implement particle tracking algorithm, adding behavior to particle to develop IBMs.*

Lectures:

1. **Overview of space dependent ecosystem models** (Ecosim, Ecospace, Atlantis, IBMs) (possible move to day 2), **Ecospace Model**
2. **Intro to IBM Models: Implicit and explicit approaches** (why and how to include space, implicit/averaging/closure problem and explicit/fully resolving)
3. **IBM Models: particle tracking and physical circulation** (overview of the physical model)
4. **IBM Models: Adding behavior** (e.g. theory of movement, implementing behaviors in particle tracking algorithms)
5. **Modeling Lab** (example of MATLAB Lagrangian/IBM: the case of a gradient/front structure in 2D with temperature as the cue for behavior, with some eddies at the front)

## The Technical Committee on Data Exchange

The meeting of the Technical Committee on Data Exchange (hereafter TCODE) was held on from 18:00 to 19:15 on October 13 and 15:00 to 18:00 on October 16, 2013. One member from China stepped down after the last TCODE meeting. Three observers attended (*TCODE Endnote 1*). Mr. Graham Gillespie was appointed a rapporteur by Dr. Toru Suzuki, TCODE Chairman. Several changes were made to the draft agenda and the revised agenda was adopted (*TCODE Endnote 2*).

### AGENDA ITEM 3

#### **Review of Workshop on “Tools, approaches and challenges for accessing and integrating distributed datasets” (W4)**

Dr. Suzuki, who was also one of the co-convenors of the workshop co-sponsored by TCODE and IODE, explained that it had been cancelled because the other co-convenor, one of the invited speakers and contributed speakers, affected by U.S. government shutdown, were not allowed to travel on government business to attend the PICES Annual Meeting. He proposed to reorganize the same workshop at PICES- 2014, and all members agreed.

### AGENDA ITEM 4

#### **Review of procedure for Best Presentation award**

Dr. Suzuki explained that the TCODE judges could choose a recipient for Best Oral Presentation among four early career scientists in the FIS/TCODE-sponsored Topic Session on “*Banking on recruitment curves; returns on intellectual investment*” (S10) on October 17, and requested that the judges report their ranking to him using a score sheet as soon as the session was over. He also explained that TCODE did not need to select a Best Poster Presentation because no posters were submitted to S10.

### AGENDA ITEM 5

#### **Status of proposed topic sessions/workshops of PICES 2014, Yeosu, Korea**

Dr. Suzuki expressed regret that several members did not rank the proposed topic sessions and workshops for PICES-2014 before the TCODE meeting, and said he would send an email reminder to those members again for their complete ranking. The members acknowledged Dr. Suzuki’s proposal to discuss this agenda item again at the Day 2 meeting.

### AGENDA ITEM 6

#### **2013 POMA**

Dr. Suzuki reported the results of the 2013 PICES Ocean Monitoring Service Award (POMA) selection at the inter-sessional Science Board meeting in St. Petersburg, Russia, in May and expressed regret that several members did not rank nominations for the POMA until the deadline. He encouraged the members to submit a new nomination for the POMA because just one nomination remained at present. Mr. Jingkun Yang (China) explained that it is difficult to provide nominates from China at present. Dr. Suzuki presented members with a POMA description revised by the PICES Secretariat. All members agreed with the revised description which Dr. Suzuki will report at the Science Board meeting.

## **TCODE-2013**

### AGENDA ITEM 7

#### **Status of FUTURE and NPESR**

Dr. Suzuki, also a member of AP-COVE, stated that he could not stay for the entire AP-COVE meeting because he had to report on several items at the Section on *Carbon and Climate* meeting which was held at the same time as the AP-COVE meeting. Mr. Robin Brown, member of AP-SOFE, reported the status of North Pacific Ecosystem Status Report (NPESR) and requested everyone to attend a plenary session concerning a NPESR proposal on October 17 prior to the TCODE meeting on Day 2. Dr. Igor Shevchenko, also a member of AP-AICE, noted that few in any Committees understand how to move FUTURE forward to develop and combine products in the context of FUTURE goals, so he proposed establishing a website to document FUTURE products. He also pointed out that the roles of working groups were unclear and several working groups that were established simultaneously required products from each other. Each TCODE member who was also a member of a FUTURE Advisory Panels confirmed to continue his membership: Dr. Shevchenko (AP-AICE), Dr. Suzuki (AP-COVE) and Mr. Robin Brown (AP-SOFE).

### AGENDA ITEM 8

#### **Review revised TCODE Action Plan 2012–015**

Dr. Suzuki reported that Committee Action Plans had already been submitted to Science Board for review (at ISB-2013) but further revisions of the Action Plans were made by the Science Board Chairman and returned to each Committee Chairs to discuss with their members. For the 2012–2015 TCODE Action Plan, Dr. Suzuki showed where a minor change had been made in the paragraph on strategy and under Theme E, Goal 10, Action 10.1, where Tasks 10.1.1, 10.1.2 and 10.1.3 were added to emphasize communication between Committees and FUTURE Advisory Panels. The members had no objections and accepted the revisions.

### AGENDA ITEM 9

#### **Relations with specific international organizations/programs**

Dr. Suzuki showed a list of international organizations and programs: AOOS, CenCOOS, IODE, NANOOS, NEAR-GOOS, SCCOOS which were suggested by PICES Secretariat and to be invited to attend the TCODE meeting. The members noted the list included programs proposed at previous meetings and included people who were also members in PICES. Dr. Suzuki, on behalf of IODE representatives, Mr. Tobias Spears and Dr. Sergey Belov, presented a brief summary of the IODE-XXII session held on March 11–15, 2013 in Ensenada, Mexico; and a WESTPAC-sponsored Symposium on “*A healthy ocean for prosperity in the Western Pacific: Scientific challenges and possible solutions*” will take place April 22–25, 2014, in Nha Trang, Vietnam. Dr. Suzuki explained the IODE Associate Data Unit (ADU) and IODE ADU application form which was forwarded to TCODE by the PICES Secretariat. Some members questioned cost implications for attendance at the IODE and related meetings, data exchange issues, benefits to join as ADU, and so on. The members agreed that more discussion was required before TCODE would join IODE as ADU; in the meantime, they will review ADU application form.

The meeting adjourned at 19:15 and resumed at 15:00 on October 16, just after the plenary meeting for NPESR.

### AGENDA ITEM 10

#### **Review of NPESR proposal**

TCODE members discussed NPESR following a plenary session outlining a proposal for a new process of reporting. TCODE was assured it would be called upon to comment on data management, not to develop the

NPESR. The members had a number of questions/comments regarding the proposal:

- What is the distinction between coastal and oceanic?
- There is a guideline for standard products of Ecosystem Time Series Observations which is modeled on Alaskan Ecosystems Considerations; lessons learned from the Alaskan standard will reduce time required to develop NPESR standard;
- time commitment to update time series, metadata and interpretation is underestimated;
- Annual cycle may be too frequent;
- Interpretation by contribution is as important as data;
- Will data be available for other processes or just for NPESR?
- Has F&A seen the budget proposal? The total cost of NPESR is larger than proposed budget when all inputs are considered, although costs for synthesis workshop and special publications are in the budget;
- Where will the data reside? – PICES does not have a data center; TCODE will need to provide advice;
- What are the roles of PICES Committees? The proposal is silent on expectations of the PICES Secretariat and their implications so there needs to be a better description;
- What is the process for nomination of time series? – A review of existing time series from previous NPESR (data sets, investigations/institutions/data centers), and additional nominations will likely come from various Committees, based on their familiarity with disciplines/regions;
- There are four options: reject proposal, make suggestions, request more detailed proposal that addresses concerns, or request more time to think about proposal;
  - Requesting clarification postpones the beginning of the project for at least one year;
  - Acknowledge shortfalls of the proposal, commit support to the process work through the details as the process unfolds;
  - Recommend general support for moving forward with the project: agreement in principal for the approach; recognition that further development of details is required inter-sessional. TCODE will have a role but this is not yet entirely clear, and there is some question surrounding utility of annual updates, but not serious enough to prevent recommendation to proceed.

The members recommend that TCODE would prefer to see an organization that focuses on large marine ecosystems as per NPESR II.

#### AGENDA ITEM 11

##### **Review of SCOR working group proposals**

The members discussed potential PICES member affiliation for three SCOR working group proposals: S-CC selection of a WG for Studying Ocean Acidification Effects on Continental Margin Ecosystem; BIO for a WG on Zooplankton Production Measurement Methodologies and Their Application and WG on standard protocols for the development of an atlas of marine plankton biogeography. The members also recognized that TCODE does not have an enough expertise for those proposed working groups.

#### AGENDA ITEM 12

##### **Review of ICES ASC 2014 theme sessions**

Top priority for TCODE co-sponsorship was the theme session “The big (ocean) data journey” followed by “HABs in aquaculture and fisheries ecosystems”. Some members questioned co-sponsoring the session “Arctic Biodiversity under climate change and other stressors” because the arctic is not in the PICES convention. Dr. Suzuki will request travel expenses if a TCODE co-convenor is required for either session.

## TCODE-2013

### AGENDA ITEM 13

#### Status of proposed topic sessions/workshops at PICES-2014, Yeosu, Korea

Dr. Suzuki announced that the top three scores ranked online by Committee members for topic sessions proposals at PICES-2014 were: “*Regional climate monitoring in the North Pacific*”, “*Recent assessments of climate change impacts on marine ecosystems*”, and “*Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries*”. Some members commented that the last two sessions were more closely aligned with TCODE’s mandate but all members agreed that TCODE should co-sponsor the three sessions. Dr. Suzuki recommended that \$5,000CDN travel support for invited speakers should be shared among the three sessions as needed. As discussed previously (see Agenda Item 3), the TCODE workshop that was cancelled at this Annual Meeting will be re-submitted for PICES 2014. Dr. Suzuki also agreed still act as co-convenor, and will confirm invited speakers for next year.

### AGENDA ITEM 14

#### Review progress of TCODE workplan 2012/2013

Below is a review of TCODE workplan (*TCODE Endnote 3*) accomplishments for 2012/2013

1. Support meetings, workshops, symposia and training course/education activities
  - 1-1 TCODE workshop (W4) cancelled.
  - 1-2 No topic session proposal but the cancelled workshop will be re-submitted for PICES-2014.
  - 1-3 Dr. Suzuki (SSC member) helped select attendees by March deadline for PICES-sponsored 2013 summer school on “*Ocean observing systems and ecosystem monitoring*”.
  - 1-4 Dr. Shevchenko reported that the current GeoSpatial Portal server has become unstable due to some problems so a clean installation will be required, and the service provider changed from AdHost. He pointed out that the current service provider don’t support any security services, back up or performance monitoring.
  - 1-5 There is no plan for supporting a training course or educational activities of international programmes/organizations.
2. Maintain a dialogue and collaborate with international organizations and scientific programs

Dr. Suzuki and Dr. Hernan Garcia attended a IODE GE-BICH workshop in February 2013 in Oostende, Belgium, and completed a proposal for a new quality flag scheme for oceanographic and marine meteorological data. Dr. Suzuki attended a NOWPAP DINRAC Focal Point Meeting in August 2013, in Beijing, China, as a PICES observer and provided comments for a biennial action plan and budget for DINRAC. Mr. Jinkun Yang reported on progress of ODINWESTPAC activities (see *TCODE Endnote 5*).
3. Strengthen communication and engagement with users of PICES scientific products

There was no new information for HAEDAT/S-HAB. S-CC is still maintaining PACIFICA. GLODAPv2, a global carbon data synthesis project, is being developed and PACIFICA will be included together with GLODAP, CARINA and new cruises into a global package. The PACIFICA website <http://cdiac.ornl.gov/oceans/PACIFICA/> is managed by CDIAAC and S-CC.
4. Maintain and promote PICES TCODE GeoSpatial Portal
  - 4-1 The technical report of GeoSpatial Portal has not been updated yet.
  - 4-2, 4-3, 4-4 No progress on registration of metadata of WG 21 database, WG 23 products, or scientific products of PICES scientific and technical committees and expert groups.
  - 4-5, 4-6 Remote server contract will be taken care of and Dr. Shevchenko will continue to administer it
5. Promote to use of shared information tools.

Dr. Shevchenko reported that there was no progress for promotion of information tools.
6. Prepare to produce the North Pacific Ecosystem Status Report

Dr. Shevchenko pointed out that this work should change with the new process of reporting the next NPESR and other FUTURE projects. He also discussed deleting the PICES Wiki page due to a perceived conflict of interest.

7. Maintain TCODE website

Dr. Shevchenko will continue to maintain the TCODE website using Google Site and back up PDF files of PICES scientific and technical reports to the TCODE website.

8. POMA 2013 nomination and rank

8-1, 8-2 There were no new nominations for POMA in 2013, and ranking of POMA 2013 nominations was completed.

AGENDA ITEM 15

**Discussion and adoption on TCODE workplan 2013/2014**

The members discussed TCODE workplan 2013/2014. Item 1-3 was revised to reflect opportunities to include metadata instruction units for PICES training courses and summer schools. Regarding collaboration with other data management groups, ICES DIG (Data and Information Group) replaced Dr. Georgiy Moiseenko with Dr. Suzuki, and new proposed SCOR working groups were added to item 2. Mr. Brown and Dr. Suzuki were added to collaborate with ocean surface nutrients monitoring by Canada–Japan. Item 6 changed to TCODE providing support on the development of the next NPESR. Responsibility for item 7 was changed from Dr. Shevchenko to all. After discussion the revised workplan was adopted (*TCODE Endnote 4*)

AGENDA ITEM 16

**Country reports**

Dr. Suzuki expressed regret to not have time for presentations due to the late start of the meeting, and requested representatives of member countries to send their reports to him to be included in the meeting report (*TCODE Endnote 5*).

AGENDA ITEM 17

**Election of chair and vice-chair**

Dr. Suzuki explained that the chair's and vice-chair's three-year term will expire after the meeting at PICES-2013 but they can be eligible for re-election for one consecutive term. Dr. Skip McKinnell, Deputy Executive Secretary, called the election. Dr. Suzuki was nominated, elected and accepted second term as Chairman and Dr. Garcia was nominated and elected for a second term as Vice-Chairman.

AGENDA ITEM 18

**Other business**

Dr. Suzuki showed a poster of the third international symposium on the “effects of climate change on the world's oceans” co-sponsored IOC/ICES/PICES. Dr. Tony Koslow requested to add de-oxygenation as one of key words for the symposium.

AGENDA ITEM 19

**Closing**

The meeting was closed at 18:00.



## TCODE-2013

### *TCODE Endnote 1*

#### **TCODE participation list**

##### Members

Robin Brown (Canada)  
Graham Gillespie (Canada)  
Tony Koslow (USA)  
Georgiy Moiseenko (Russia)  
Igor Shevchenko (Russia)  
Toru Suzuki (Japan, Chairman)  
Tomowo Watanabe (Japan)  
Jinkun Yang (China)

##### Observers

Yutaka Michida (IOC/WESTPAC, Day 1)  
Tom Royer (USA, past TCODE member, Day 2)  
Wu Shuangquan (China, Day 1)

### *TCODE Endnote 2*

#### **TCODE meeting agenda**

*Day 1: 18:00-19:30, Sunday, October 13 (PST)*

1. Welcome and introduction of members
2. Adoption of agenda
3. Review of Workshop on “Tools, approaches and challenges for accessing and integrating distributed datasets” (W4) on October 11 (Suzuki)
4. Review of procedure for Best Presentation Award (Suzuki)
5. Status of proposed topic sessions/workshops of PICES 2014, Yeosu, Korea (Suzuki)
6. Report of POMA 2013 (Suzuki)
7. Status of FUTURE and NPESR (Brown, Shevchenko, Suzuki)
8. Review revised TCODE Action Plan 2012-2015 (All)
9. Relations with specific international organizations/programs  
AOOS, CenCOOS, IODE (Appendix III), NANOOS, NEAR-GOOS, SCCOOS

*Day 2: 14:30-18:00, Wednesday, October 16 (PST)*

10. Review of NPESR proposal (All)
11. Review of three SCOR Working Group proposals (All)
12. Review of ICES ASC 2014 theme sessions (All)
13. Status of proposed topic sessions/workshops of PICES 2014, Yeosu, Korea (Suzuki)
14. Tea break
15. Review progress of TCODE workplan 2012/2013 (All)
16. Discussion and adoption on TCODE workplan 2013/2014 (All)
17. Presentation of country reports (representative of member countries)
18. Election of chairperson and vice-chair
19. Other business
20. Closing

*TCODE Endnote 3***TCODE Workplan 2012/2013**

1. Support meetings, workshops, symposia and training course/education activities (AP Goals 1, 2, 6, 7 and 8)
  - 1-1 Support and co-convene topic session and workshop of PICES 2013 annual meeting in Nanaimo, Canada  
Responsibility – All
  - 1-2 Propose topic session and workshop at upcoming PICES annual meeting  
Responsibility – All
  - 1-3 Support PICES 2013 Summer School on “Ocean Observing Systems and Ecosystem Monitoring” co-sponsoring BIO/POC/MONITOR  
Responsibility – T. Suzuki (as one of member of SSC)
  - 1-4 Propose workshop or training course for GeoSpatial Portal data/metadata management, *etc.*  
Responsibility – All
  - 1-5 Support training course/education activities of international programmes/organizations  
Responsibility – All
2. Maintain a dialogue and collaborate with international organizations and scientific programs (AP Goal 4)  
Responsibility – T. Suzuki/ICES DIG
  - H. Garcia and T. Suzuki/IODE
  - H. Garcia/GEBICH
  - T. Suzuki/ODP, OBIS
  - J. S. Lee/ODP
  - J. Yang/ODINWESTPAC
3. Strengthen communication and engagement with users of PICES scientific products (AP Goals 4 and 5)  
Responsibility – I. Shevchenko and R. Brown for HAEDAT/S-HAB
  - T. Suzuki for PACIFICA/S-CC
  - I. Shevchenko for WG 21 and 29
4. Maintain and promote PICES TCODE GeoSpatial Portal (Goal 5)
  - 4-1 Update technical report
  - 4-2 Support to register metadata of database of WG-21 “Non-indigenous Aquatic Species”
  - 4-3 Support to register metadata of products of WG-23 “Comparative ecology of Krill in coastal and oceanic waters around the Pacific Rim”
  - 4-4 Support to register scientific products of PICES scientific and technical committees and expert groups
  - 4-5 Renew remote server contract
  - 4-6 Continue to administer AdHost server  
Responsibility – I. Shevchenko
5. Promote to use of shared information tools (Goal 5)  
Responsibility – I. Shevchenko
6. Prepare to produce the North Pacific Ecosystem Status Report (Goal 5)  
Responsibility– R. Brown
7. Maintain TCODE website  
Responsibility – I. Shevchenko
8. POMA 2013 nomination and rank
  - 8-1 Propose a recommendation of new nomination until February 2013
  - 8-2 Rank nominations in April 2013  
Responsibility – All

*TCODE Endnote 4*

**TCODE Workplan 2013/2014**

1. Support meetings, workshops, symposia and training course/education activities (AP Goals 1, 2, 6, 7, 8 and 9)
  - 1-1 Support and co-convene topic session and workshop of PICES 2014 Annual Meeting in Yeosu, Korea  
Responsibility – All
  - 1-2 Propose topic sessions/workshops at PICES 2015 Annual Meeting  
Responsibility – All
  - 1-3 Propose workshop or training course for GeoNetwork, data/metadata management, *etc.*  
Responsibility – All
  - 1-4 Support training course/education activities of international programme/organizations  
Responsibility – All
2. Maintain a dialogue and collaborate with international organizations and scientific programs (AP Goal 4)  
Responsibility – H. Garcia and T. Suzuki/IODE, GEBICH  
– T. Suzuki and J.S. Lee/ODP  
– T. Suzuki/OBIS  
– J. Yang/ODINWESTPAC  
– All/new proposed SCOR WGs  
R. Brown and T. Suzuki/ocean surface nutrients monitoring
3. Strengthen communication and engagement with users of PICES scientific products (AP Goals 4 and 5)  
Responsibility – I. Shevchenko and R. Brown for HAEDAT/S-HAB  
– T. Suzuki for PACIFICA/S-CC  
– I. Shevchenko for WG 21 and 29
4. Maintain and promote PICES TCODE GeoSpatial Portal (AP Goals 4, 6, 7 and 8)
  - a. Update technical report
  - b. Support to register metadata of database of WG 21 on *Non-indigenous Aquatic Species*
  - c. Support to register metadata of products of WG 23 on *Comparative ecology of krill in coastal and oceanic waters around the Pacific Rim*
  - d. Support to register scientific products of PICES scientific and technical committees and expert groups
  - e. Renew remote server contract
  - f. Continue to administer AdHost server  
Responsibility – I. Shevchenko
5. Promote to use of shared information tools (AP Goals 4 and 6)
  - a. Update FUTURE Wikipedia  
Responsibility – I. Shevchenko
  - b. Maintain S-CCME website  
Responsibility – T. Suzuki
6. Provide support to development of next North Pacific Ecosystem Status Report (AP Goals 3, 5 and 10)  
Responsibility – R. Brown
7. Maintain TCODE website  
Responsibility – All
8. POMA 2014 nomination and rank
  - a. Propose a recommendation of new nomination until February 2014
  - b. Rank nominations in April 2014  
Responsibility – All

*TCODE Endnote 5***Country Report of China**

submitted by

Jinkun Yang, NMDIS/SOA

**1. Working Progress Related to TCODE “PICES Metadata Federation Project”**

Metadata records of former PICES-NMDIS node have been moved to the AdHost server, to become one metadata source of GeoNetwork portal. All the metadata records (see the table below for details) have already been submitted to the directory distributed for former PICES-NMDIS node on AdHost server; 21 metadata were updated during the past year, including 6 monthly sea level metadata for China oceanographic stations, 2 hourly sea level metadata, and 13 metadata for marine meteorology wave, temperature and salinity.

Metadata	Station	Time period	No. of records
Metadata of temperature and salinity data from China coastal stations	Laohutan, Tanggu, Qinhuangd, Yantai, Haikou, Dongfang, Beihai, Lianyungang	1959–1976 1988–2001	8
Metadata of ocean tide forecasting product	32 major coastal ports in Southeast Asian coastal areas	Monthly	32
	10 major ports along Chinese coastal line, such as Dalian, Qingdao, Wusong, Zhenhai, Xiamen, Guangzhou, Beihai, Haikou, and Gaoxiong.	Monthly	10
Metadata of monthly mean sea level from China oceanographic stations	Dalian, Kanmen, Lvsi, Zhapo, Nasha and Xisha.	2009–2013	6
Hourly sea level metadata from China coastal stations	Lianyungang and Dalian	2008–2012	2
Metadata of meteorological, wave, temperature and salinity data from 13 China coastal stations	Dalian, Xiaochangshan, Yantai, Xiaomaidao, Lianyungang, Lvsi, Shengshan, Zhenhai, Dachen, Nanji, Beishuang, Dongshan, and Zhelang	2012	13

**2. Data Exchange and Cooperation with Other Related International or Regional Programs****2.1 Ocean Data and Information Network for the Western Pacific Region (ODINWESTPAC)**

ODINWESTPAC is a regional project of WESTPAC initiated by IODE to primarily provide an effective capacity building framework, to promote regional collaboration in marine data and information and product sharing, to develop cooperation with other ODINs and international and regional projects/programs, and to provide data and information services mainly for the WESTPAC member states and other users. The project has 21 member states: Australia, China P. R., Fiji, France, Indonesia, Japan, Korea, D.P.R., Korea, R., Malaysia, New Zealand, Philippines, Russian Federation, Samoa, Singapore, Solomon Islands, Thailand, Tonga, United Kingdom, United States of America, and Vietnam.

NMDIS has been coordinating the ODINWESTPAC project since 2008. Through the collection, exchange, and share platform of marine data and information (ODINWESTPAC, hosted by NMDIS, website: <http://www.odinwestpac.org.cn/>), it maintains and operationally updates publicly released marine data and information of China and those collected from the international programs/projects, and promotes data and information exchange and collaboration between WESTPAC member states, and with other international and regional data projects.

Currently, multiple marine data and products are disseminated through the website:

- a. Chinese Coastal Station data which include:
  - Monthly mean sea level data of six Chinese coastal stations;
  - Real-time meteorological, wave, temperature and salinity data of 13 stations;
- b. Chinese section survey profile data which involve meteorology, temperature, salinity in areas of the South China Sea and the East China Sea.
- c. Other regional and international cooperation programs and projects data:
  - NEAR-GOOS data collected from Real-Time database and delay mode database of NEAR-GOOS;
  - Argo data includes Chinese deployed Argo data and data collected from Global Argo Data Centers;
  - GTSPP data have been collected in near real-time and delay mode from China joined GTSPP projects and will be collected continuously.
- d. Marine data products:
  - China has been providing marine hydrological data products of the northwestern Pacific Region, which includes temperature, salinity, one-degree square area air temperature, air pressure, wind, wave, etc., and monthly statistical analysis product between 1950 –2002;
  - China Marine Environment Quality Bulletin, China Marine Economic Statistics Bulletin, Sea Area Use Management Bulletin, China Marine Satellite Application Report, China Oceanic Hazards Bulletin, China Sea Level Bulletin, Marine Law Enforcement and Supervision Bulletin, Monthly Report on National Ocean Dumping Management, El Niño Monitoring and Prediction;
  - Global monthly-mean current distribution maps and the multiyear monthly-mean (1996–2013) current maps with two different resolutions (2 degrees and 5 degrees) at different depths (surface, 1000m, 1500m, and 2000m), derived from Argo trajectory data;
  - More marine data products will come from member states.

As the host center for ODINWESTPAC, NMDIS is planning to organize an WESTPAC-IODE workshop on “Mapping the Capacity Building Needs for Oceanographic Data & Information Management towards the Sustainability of Marine and Coastal Resources” in February 2014 Tianjin, China, together with the IOC WESTPAC Office.

To implement the IODE capacity development strategy and to review the present deficiencies of ODINWESTPAC, the objectives of this workshop are to:

- Further collect and understand the capacity building needs from WESTPAC member states and capacity building requirements for ODINWESTPAC cooperation at a regional level, and establish an effective implementation plan to satisfy these needs.

We are planning to acquire the information on:

- ✓ The capacity building efforts ongoing in each member state,
- ✓ The ever-growing demand of capacity building needs at national and regional levels.
- Map the capacity building needs for oceanographic data & information management and service, and develop a Framework for ODINWESTPAC Capacity Building, which will provide coordination and guidance for the future development of ODINWESTPAC project.

We will mainly discuss:

- ✓ How to collect and process oceanographic data,
- ✓ What kind of quality control procedure should be carried out,
- ✓ The needs for oceanographic data and information products,
- ✓ Scientific management and service,
- ✓ The future development of ODINWESTPAC.

## 2.2 JCOMM CMOC China node on the trial basis

The proposal for the establishment of WMO-IOC Centres for Marine Meteorological and Oceanographic Climate Data (CMOCs) was made at the Third Session of JCOMM ETMC (ETMC-III, Melbourne, Australia, 8–12 February 2010), and was approved at the Fourth Session of JCOMM (JCOMM-IV, Yeosu, Korea, 23–31 May 2012). CMOCs will endeavor to achieve the integrating collection, rescue, quality control, formatting, archiving, exchange, and access—for marine-meteorological and oceanographic real-time and delayed-mode data and associated metadata of known quality, and products that satisfy the needs of WMO and IOC applications. The National Marine Data and Information Service (NMDIS) of China had already submitted statements of capability and commitment to host CMOCs in Tianjin in February 2012. NMDIS committed to undertake the following tasks by:

- a. Strengthening and streamlining the former JCOMM/ODASMS and improving its operational services to achieve direct access to all global marine–meteorological and oceanographic climate data, metadata, and related products via the DACs, GDACs and CMOC network;
- b. Actively undertaking the standardization, and quality control of MCDS data;
- c. Actively participating in the research and development of oceanographic and marine–meteorological products, and their related services;
- d. Providing technical training, and carrying out capacity building activities for countries in the region at JCOMM-IV, the Commission decided that China could begin filling the role of CMOCs on a trial basis immediately. Currently, the establishment work is actively on-going. The CMOC China Steering Group had been set up with the Director-General of NMDIS as the Chairman to provide guidance and coordination of the CMOC China project with the center. The function of the former JCOMM ODAS Metadata Service will be incorporated in CMOC China. The official website of CMOC China ([www.cmoc-china.cn](http://www.cmoc-china.cn)) has been established to distribute domestic and international oceanographic and meteorological data and products, as well as release related information.

## Report of the Technical Committee on Monitoring

The Technical Committee on Monitoring (hereafter MONITOR) met from 18:00–19:30 hours on October 13, and from 14:00–18:30 hours on October 18, 2013, under the chairmanship of Dr. Hiroya Sugisaki. Nine committee members representing all PICES member countries were present, and a total of 16 observers were in attendance (*MONITOR Endnote 1*). The meeting agenda (*MONITOR Endnote 2*) was very full and business was conducted at a brisk pace.

### AGENDA ITEM 2

#### Advisory Panel reports

##### *Advisory Panel on Continuous Plankton Recorder Survey in the North Pacific (AP-CPR)*

Dr. Phillip Mundy, AP-CPR Chair, could not participate in the Annual Meeting so the AP-CPR meeting planned for October 12 was cancelled. Instead, Dr. Sonia Batten, AP-CPR member from Canada, reported on the annual activities of the Panel. The Pacific CPR currently has funding, but the Panel needs to continue looking for funds to sustain Pacific CPR activities. Research activity is going well and the Pacific CPR group has a good relationship with the Global Alliance of Continuous Plankton Recorder Surveys (GACS). Dr. Nicholas Owen, Director of SAHFOS, added information about the Foundation's activities.

##### *Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas (AP-CREAMS)*

Dr. Naoki Iguchi, AP-CREAMS member from Japan, presented a report on the status of the AP-CREAMS activities. AP-CREAMS requested that the EAST II project report be published as a PICES scientific report.

##### *FUTURE Advisory Panels*

Dr. Vladimir Kulik, representing MONITOR in AP-AICE, presented a report on AICE activities and Dr. Hiroya Sugisaki, on behalf of Dr. Vyacheslav Lobanov, representing MONITOR in AP-COVE, reported the COVE activities. MONITOR could not send a representative to AP-SOFE.

### AGENDA ITEM 3

#### PICES-2013

MONITOR was assigned the responsibility of judging the session on “Recent trends and future projections of North Pacific climate and ecosystems” (S6) and “Cost-effective, cooperative ocean monitoring” (S9). The Chairman thanked the volunteers for their service.

Dr. Youngji Joh received the MONITOR Best Presentation Award for her talk on “[\*An improvement of reproductibility of Pacific decadal oscillation in CMIPS\*](#)”, and Dr. Tomoko Yoshiki received the MONITOR Best Poster Award for her poster on “[\*Geographical shift of warm water species distribution in western subarctic North Pacific based on CPR sample during 2001-2010\*](#)”.

### AGENDA ITEM 4

#### National reports

The following Committee members from 4 nations made short presentations on national monitoring activities relevant to PICES; the Korean report was sent to the Committee Chair later:

- Canada: Dr. Jennifer Boldt reported on Canada's continuous monitoring activities, *e.g.*, Line-P, ecosystem process surveys, aquatic invasive surveys, and on the cabled undersea observatory networks (VENUS and NEPTUNE).
- China: In recent years, representatives of China did not attend the MONITOR meetings. Dr. Jilong Li agreed that China will resume communications with MONITOR.

## MONITOR-2013

- Japan: Drs. Sei-Ichi Saitoh and Sanae Chiba reported on the continuous monitoring activities and ocean observing activities conducted by universities and national institutes in Japan.
- Korea: Korean membership in MONITOR has changed this year. Dr. In-Seong Han agreed that Korea will resume communications with MONITOR.
- Russia: Dr. Kulik talked about continuous monitoring activities of TINRO-Centre in the Bering Sea, Okhotsk Sea, *etc.*
- USA: Dr. Barth spoke about U.S. ocean monitoring activities, including the U.S. ocean cable observatory, OOI's (Ocean Observatory Initiative) glider array observation, and NaNOOS.

Dr. Barth presented a report on the 2013 PICES summer school "*Ocean observing systems and ecosystem monitoring*". The 5-day summer school was held August 19–23, at Oregon State University's (OSU) Hatfield Marine Science Center, Newport, Oregon, USA. It was the first PICES summer school held on the eastern side of the Pacific. Thirty-three early career scientists attended this summer school to learn about in-water observing, and to work with multidisciplinary sensors and analyzers, *etc.* It was very successful.

### AGENDA ITEM 5

#### **Relations with international/national organizations and programs**

MONITOR agreed that the network between international organizations and PICES is very important and it is necessary to keep up good relationships with them. The representatives of the following organizations attended the committee meeting and reported their activities:

- AMAP (Arctic Monitoring and Assessment Programme): Dr. Robie Macdonald,
- PAG (Pacific Arctic Group): Dr. Bill Williams
- ESSAS (Ecosystem Studies of Sub-Arctic Seas): Dr. Sei-Ichi Saitoh
- NPRB (North Pacific Research Board): Dr. Carrie Eichens
- SCOOS (Southern California Coastal Ocean Observing System): Dr. Tony Koslow
- Argo (International program for deployment of profiling floats): Dr. Charles Hannah
- SAHFOS (Sir Alister Hardy Foundation for Ocean Science): Dr. Nicholas Owens (see Agenda Item 2)

#### *BIO-GOOS*

GOOS activities have begun to incorporate biological and biochemical research and a GOOS Biogeochemical Workshop will be held on November 13–15, 2013 in Townsville, Australia. Drs. Sanae Chiba (MONITOR member) and David Checkley (AP-CREAMS member) will represent PICES at the workshop. In preparation, MONITOR members will send information on PICES monitoring activities to them by e-mail.

#### *ICES ASC*

MONITOR discussed whether to support the proposed sessions at the 2014 ICES ASC. MONITOR agreed to support the session "*Pelagic ecosystem dynamics from integrated monitoring surveys*" and to send a co-convenor.

#### *SCOR*

Out of three short-listed SCOR proposals for working groups chosen by the Standing Committees, MONITOR strongly recommended:

- Zooplankton production measurement methodologies and their application,
- Studying ocean acidification effects on continental margin ecosystems.

### AGENDA ITEM 6

#### **Election of MONITOR Chair and Vice-Chair**

Dr. Jennifer Boldt (Canada) was elected Chair, and Dr. Sanae Chiba (Japan) was elected Vice-Chair, replacing Drs. Sugisaki and Mundy, respectively.



## AGENDA ITEM 7

**Proposals for PICES-2014 MONITOR workshops, special sessions, inter-sessional meetings**

MONITOR supported the following sessions and workshops at PICES-2014.

- Topic Session on “*Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries*” (co-convenor Sanae Chiba; *AP-CREAMS Endnote 4*);
- Topic Session on “*Variability in advection and its biological consequences for Subarctic and Arctic ecosystems*” (co-convenor Sei-ichi Saitoh; *POC Endnote 4*);
- Workshop on “*Networking ocean observatories around the North Pacific Ocean*” (co-convenor Jack Barth; *MONITOR Endnote 3*).

## AGENDA ITEM 8

**A proposal for the process of producing the North Pacific Ecosystem Status Report**

The Committee reviewed a proposal to automate the production of the NPESR, making it a web-based product to be updated on an annual or more frequent basis, with a variety of paper products such as brochures and reports produced less often. MONITOR agreed that the draft of the proposal by SOFE was well designed and well thought out but the Committee could not approve it yet because, as the NPESR is a high priority item, member countries need more time to consider it. AP-SOFE requested that a proposal for a new process of producing the next NPESR be sent to the Governing Council for endorsement if approved by Science Board.

## AGENDA ITEM 9

**Other business**

The Chair and Vice-Chair were asked by Science Board at ISB-2013 to revise the description the POMA to broaden the definition of long-term monitoring. Dr. Sugisaki discussed the draft description with MONITOR members and received no objections.

Dr. Sugisaki reviewed the Action Plan and requested any comments from the members and guests before finalization at the Science Board Meeting.

***MONITOR Endnote 1*****MONITOR participation list**Members

John A. Barth (USA)  
Jennifer Boldt (Canada)  
Sanae Chiba (Japan)  
In-Seong Han (Korea)  
Charles Hannah (Canada)  
Vladimir Kulik (Russia)  
Jilong Li (China)  
Sei-Ichi Saitoh (Japan)  
Hiroya Sugisaki (Japan, Chairman)

Observers

Sonia D. Batten (SAHFOS, AP-CPR, GACS)  
Wang Cuihua (China)  
Feiyan Du (China)  
Carrie Eischens (NPRB)  
Abigan Enghirst (NPRB)  
Jing Feng Fan (China)  
Hiromichi Igarashi (Japan)  
Naoki Iguchi (AP-CREAMS)  
Tony Koslow (SCCOOS)  
Robie Macdonald (AMAP)  
Nicholas Owens (SAHFOS)  
Kazuaki Tadokoro (Japan)  
Ellen Tyler (AOOS)  
Bill Williams (PAG)  
Jing Ying (China)  
Sinjae Yoo (Science Board Chairman)

## MONITOR-2013

### *MONITOR Endnote 2*

#### MONITOR meeting agenda

13 October 2013

1. Welcome, Introductions and Sign-in (All)
2. Advisory Panel reports
  - Status of Pacific CPR program and advisory panel and activities of SAHFOS and GACS (Mundy, Batten, Owens)
  - Status of CREAMS w. POC (TBD)
  - Report on the meetings on FUTURE (AICE: Kulik, COVE: Sugisaki, SOFE: Mundy)
3. Information and discussion for PICE-2013 annual meeting
  - Information for S6 (Barth) and S9 (Boldt)
  - Judge of the best presentation award and other information (Sugisaki)

16 October 2013

4. National reports of relevant monitor/observation activities
    - Canada (Boldt)
    - China (Li, Zhang, Zhao)
    - Japan (Chiba, Saitoh, Sugisaki)
    - Korea (Han, Kwon, Ro )
    - Russia (Kulik, Lobanov)
    - United States (+ report on summer school, NaNOOS, AOOS) (Barth, Tyler, Napp/Mundy)
  5. Relations with specific international organizations/programs
    - Arctic Council AMAP, SAON & PAME (Macdonald and Mundy)
    - CenCOOS (Bograd)
    - ESSAS (Saitoh)
    - EVOSTC (Boerner)
    - NEAR-GOOS (Jeong)
    - NPRB (Eischens)
    - SCCOOS (Koslow)
  6. Election of MONITOR Committee Chair and Vice-Chair (All)
  7. Proposals for PICES-2013 MONITOR workshops, special sessions, inter-sessional meetings (All)
  8. Discussion on “A Proposal for the Process of Producing of the North Pacific Ecosystem Status Report” by SOFE (All)
  9. Other business
    - Report on POMA (Sugisaki)
    - Action Plan
- Adjourn

### *MONITOR Endnote 3*

#### **Proposal for a 1½-day MONITOR Workshop on “Networking ocean observatories around the North Pacific Ocean” at PICES-2014**

Convenors: Kenneth Denman (Canada), Jack Barth (USA), Jae Hak Lee (Korea), Robert Weller (USA), Hidekatsu Yamazaki (Japan)

Co-sponsors: Ocean Networks Canada, U.S. CLIVAR

In the North Pacific Ocean, various cabled ocean observatories are operating or under development. In addition there exist several long term time series programmes, and the Argo drifter programme. It seems timely to hold a workshop with the following objectives:

- i) set up plans for coordinated data sharing, data standards, common sampling protocols, and open access on the Internet, and
- ii) set out a timeline for developing an integrated (nearly) real-time synthesis of observations in the N. Pacific, by linking coastal and open ocean observatories, and Argo.

- iii) define a specific science challenge/question that could be best addressed through a network of observing systems in the Pacific Ocean.

Most of these facilities are in the North Pacific, and are regional and coastal in scope, making PICES the ideal organization to host such a workshop. The need for such a network of observing facilities was articulated in the conference description of the recent Joint PICES/ICES Workshop on 'Global assessment of the implications of climate change on the spatial distribution of fish and fisheries' held in May 2013 in St. Petersburg, Russia: "... observations and model projections (are) needed to develop a global synthesis of the implications of climate change on fish and fisheries". In the past, correlations of sardine and anchovy long term changes have been established between populations off California, Chile and Japan, so it seems prudent to make the scope of such a workshop the whole Pacific Ocean. We propose the following format for the Workshop: a) a series of talks describing the capabilities of the various long term systematic ocean observing facilities in the Pacific Ocean, and b) a discussion in workshop format on setting up a group to develop a plan for achieving objective ii) above.

## Report of the Section on *Carbon and Climate*

The meeting of the Section on *Carbon and Climate* (S-CC) was held from 14:00–18:00 on October 13, 2013 at the PICES Annual Meeting in Nanaimo, BC, Canada. Dr. James Christian acted as meeting Chair. Seven members were present, representing Canada, China, Japan and Korea (*S-CC Endnote 1*). Some minor amendments were made to the meeting agenda (*S-CC Endnote 2*) which was then adopted unanimously.

### AGENDA ITEM 1

#### **Membership**

Membership rotation was discussed for the U.S. and Japanese delegations. The U.S. delegation was not present. Areas of expertise considered a priority for FUTURE objectives include ocean acidification and coastal oceans / marginal seas. It was noted that expertise in these areas has already been enhanced with addition of members Drs. Minhan Dai (China), Burke Hales (U.S.), Dong-Jin Kang (Korea), and Jeong Hee Shim (Korea) over last few years.

### AGENDA ITEM 2

#### **S-CC achievements in the past 12 months**

##### *PACIFICA data synthesis*

The PACIFICA data product was published May 2013 (<http://pacifica.pices.jp/>, <http://cdiac.ornl.gov/oceans/PACIFICA/>). Some errors were found after publication (NODC ship codes); there is a log of these on JODC but not necessarily on CDIAC. Planned tasks that were not completed were the second level quality control (2QC) of CFC and pH data, 2QC of the A-line time series data (which generally lack deeper data that are the basis for the crossover analysis method), and integration of the HOT time series data.

It was noted that GLODAP-2 may proceed with funding from European sources. Nicolas Gruber (ETH, Switzerland) has submitted an abstract to Ocean Sciences 2014 on this effort.

There was some discussion of extension of this process into the marginal seas. It was suggested that SOCAT data (which already include marginal seas) could be used as a point of reference (ground truth to surface instead of deep). Some marginal seas have stable deep composition; others do not. There are also legal issues of operating in some countries' exclusive economic zones that may affect our ability to include such data in a public domain data product.

It was agreed to abandon a planned special issue centred around analyses of PACIFICA data (see [S-CC Annual Report for 2012](#)), due to lack of author response. Publications describing the construction of the data product will nonetheless be completed.

### AGENDA ITEM 3

#### **Reports of collaborating organizations and agencies**

Reports were given on several international programs relevant to the mandate of S-CC, including SOCAT (Suzuki), SOLAS/IMBER (Miller, Dai), IOCCP (Ishii), CLIVAR/GO-SHIP (Murata, Ishii), NPOCE (Dai) and AMAP (R. MacDonald).

Dr. Toru Suzuki (Japan) gave a presentation on Volunteer Observing Ship (VOS) programs. Basic  $p\text{CO}_2$  observations by two VOSs in the Pacific are supported by the regular funding from NIES (National Institute for Environmental Studies, Japan). The NIES VOS program has also collected nutrient data since 1999. There has been discussion on the establishment of a Pacific network for surface nutrient sampling/data exchange/database preparation; S-CC supports such an initiative but its exact shape is not

yet known. SOCAT is also discussing inclusion of surface nutrient data within their database, and collaboration between SOCAT and the Pacific network is anticipated. Other new or expected developments include addition of Research Ships of Opportunity (e.g., Japan Fisheries Research Agency) and continuous underway measurement of nitrate using sensors. A poster on surface nutrient synthesis was presented (Yasunaka *et al.*, “*Monthly maps of sea surface nutrients in the North Pacific: Basin-wide distribution and seasonal to interannual variations*”) in Topic Session S6 on “*Recent trends and future projections of North Pacific climate and ecosystems*”.

SOLAS held a Summer School August 23–September 2, 2013 in Xiamen, China. This was the first time a SOLAS Summer School was held in a PICES member country (and the first outside of Europe). PICES supported travel for 3 students: one each from Japan, Russia and the U.S.; 36% of the students came from PICES member countries. There was further discussion on the renewal of SOLAS under the FutureEarth umbrella. A workshop has been proposed for PICES-2014 to solicit community input (*S-CC Endnote 3*).

Dr. Masao Ishii (Japan) (with input from Dr. Akihiko Murata who was not present) reviewed plans for CLIVAR/GO-SHIP cruises over the next few years. JAMSTEC will occupy P1 in July–August 2014, with occupation of Ocean Station Papa and crossovers with P02 and P16N, which American cruises will likely occupy in 2013 and 2014. JMA has just completed P3, and plans to occupy P10 in 2014. There was some discussion of the process for incorporating these data into the expected updated GLODAP data set.

Dr. Ishii also gave an update on IOCCP activities. The latest activities include organizing an international time-series methods workshop jointly with U.S. research project OCB (Ocean Carbon and Biogeochemistry; (<http://www.whoi.edu/website/TS-workshop/>), contributing toward developing the Global Ocean Acidification Observing Network ([http://www.pmel.noaa.gov/co2/GOA\\_ON/2013/](http://www.pmel.noaa.gov/co2/GOA_ON/2013/)), and having the first technical workshop for the GOOS Biogeochemistry Panel to nominate Essential Ocean Variables (<http://www.ioccp.org/slides/45-slide-3>). Several countries have new initiatives in terms of ocean observatories. China plans to deploy a cabled observatory in 2015. Supporting the activities of SOCAT and GLODAP-2, information exchange on surface and interior ocean observations and instruments, and data and information management are also continuing activities of IOCCP.

Prof. Minhan Dai (China) gave a brief presentation on NPOCE (Northwest Pacific Ocean Circulation and Climate Experiment), an international program with participants from (at least) China, the U.S. and Australia. The goals of NPOCE are to improve the understanding of northwest Pacific ocean circulation, and its role in warm pool maintenance, low-frequency variability, modulation of ENSO, the East Asian Monsoon variability, and tropical cyclones. Prof. Dai heads the biogeochemistry working group and is soliciting others to join this group.

Dr. Robie MacDonald (Canada) gave a presentation on the Arctic Monitoring and Assessment Program, which recently completed its Arctic Ocean Acidification Assessment. AMAP was tasked by the Arctic Council to evaluate the status of Arctic ocean acidification and its implications for future ecosystem impacts. Three PICES member countries are members of the Arctic Council, and the other three are observers. The recently completed assessment report is available at <http://www.amap.no/documents/doc/amap-assessment-2013-arctic-ocean-acidification/881>.

#### AGENDA ITEM 4

##### **Future goals and objectives**

##### *PACIFICA publications*

It was decided that a special issue on PACIFICA scientific analyses would not proceed (Dr. Lisa Miller had volunteered to act as a Guest Editor at the previous Annual Meeting in Hiroshima) due to lack of author interest. Several publications on the PACIFICA data products and methodology will nonetheless be completed. Drs. Christian, Ishii, and Suzuki will take primary responsibility for these.

*Topic sessions for 2014*

Topic Session S4 convened by Drs. Dai, Sophia Johannessen, and Dong-Jin Kang, entitled “*The changing carbon cycle of North Pacific continental shelves and marginal seas*” was very well subscribed, indicating substantial interest in this topic. Several S-CC members are involved in several workshop and topic session proposals, including a workshop for PICES-2014 (*S-CC Endnote 3*).

*Integration with FUTURE*

Plans for the coming years and integration of S-CC into FUTURE were discussed at length. (S-CC submitted a report for another 3-year extension for review by the BIO and POC parent committees for (*S-CC Endnote 4*)). Suggested activities include using SOCAT data to link the coastal and open ocean, and to extend the PACIFICA methodology into marginal seas where the assumption of constant deep water composition is not warranted, documenting procedures for second-level quality control (2QC) for the coastal ocean and marginal seas, doing a focused AMAP-type assessment on a specific target region that would be chosen to be of broad interest among scientists and policymakers from PICES countries, and a general synthesis of the state of knowledge of oxygen minimum zones and deoxygenation in the North Pacific. Membership renewal was discussed with respect to future activities, but as noted above the addition of Drs. Dai, Hales, Kang and Shim has already added substantial new expertise in the targeted areas. FUTURE related data products or syntheses will be developed over the next few years in consultation with the FUTURE APs and other expert groups.

***S-CC Endnote 1*****S-CC participation list**Members

James Christian (Canada, Co-Chair)  
 Minhan Dai (China)  
 Masao Ishii (Japan)  
 Dong-Jin Kang (Korea)  
 Lisa Miller (Canada)  
 Jeong Hee Shim (Korea)  
 Toru Suzuki (Japan)

Observers

Robie MacDonald (Canada)  
 Toshiya Nakano (Japan)  
 Boram Sim (Korea)

***S-CC Endnote 2*****S-CC meeting agenda**

1. Opening (Christian, Saino)
  - Review and adopt agenda
  - Membership: Saino, Watanabe to rotate off?
2. S-CC achievements in the past 12 months
  - PACIFICA Data Synthesis (Ishii, Suzuki)
3. Information Exchange
  - SOCAT (Suzuki)
  - SOLAS-IMBER (Miller, Dai)
  - CLIVAR/GO-SHIP (Murata)
  - IOCCP (Ishii)
  - AMAP (R. MacDonald)
  - Future goals and objectives: refocus section objectives around ocean acidification and its impacts?  
Integration with FUTURE
  - PACIFICA Publications
  - Topic sessions for 2014

**S-CC Endnote 3**

**Proposal for a ½-day POC Workshop on “SOLAS into the future: Designing the next phase of the Surface Ocean-Lower Atmosphere Study within the context of the Future Earth program” at PICES-2014**

Co-sponsor: SOLAS

Duration: 0.5-day

Convenors: Lisa Miller (Canada), Minhan Dai (Canada), Yukihiro Nojiri (Japan)

For more than a decade, the Surface Ocean-Lower Atmosphere Study (SOLAS) has fostered cutting-edge research in air-sea interactions, facilitating communication, coordinating and directing research, and advocating for new projects. The SOLAS program has facilitated major advances, changing fundamental understanding in a number of subjects, including the significance of ocean acidification, the roles of DMS and marine organic matter in atmospheric chemistry, and the importance of sea-ice biogeochemistry in controlling air-sea exchange. At the same time, the significance of earth system science to society has become increasingly apparent, and FutureEarth is replacing the International Geosphere-Biosphere Programme as a major SOLAS sponsor. Within this context, SOLAS is plotting a new course for the next 10 years. This discussion session is one of a number at various conferences that is soliciting community input into the future of SOLAS. In particular, we are asking the question: In a world where Earth system science is coming under increasing political and public scrutiny, what is and should be the contribution of SOLAS science to society? Ideas and conclusions from this and other, similar workshops will be incorporated into the new SOLAS science plan.

**S-CC Endnote 4**

**Report of the Section on *Carbon and Climate* for 2010–2013**

The Section on *Carbon and Climate* (S-CC) was created in the fall of 2005 at the PICES Annual Meeting in Vladivostok, Russia, following discussions to the effect that a more permanent body was needed to carry on the work of the disbanded Working Groups 13 (on *Carbon Dioxide in the North Pacific*) and 17 (on *Biogeochemical Data Integration and Synthesis*). At the 2010 Annual Meeting the Section was reauthorized for a further five years. Subsequent changes to the Rules of Procedure (Rule of Procedure 13(iii)(d)) reduced the reauthorization period to three years.

The S-CC has two parent committees, POC and BIO. Drs. James Christian (Canada) and Toshiro Saino (Japan) have chaired the Section since its inception.

**Membership**

S-CC has members from all PICES member countries, in addition to an *ex-officio* member representing IGBP (Prof. C.T.A. Chen). Current membership is 22; national complements range from 2 to 6 (see Annex 1).

**S-CC achievements in the past 3 years**

*Topic Sessions at PICES Annual Meetings*

At the 2012 Annual Meeting in Hiroshima, Japan, POC and TCODE co-sponsored a topic session called “*Changing ocean biogeochemistry and its ecosystem impacts*” (co-sponsored by ICES, IMBER and SOLAS). S-CC members Drs. Masao Ishii (Japan) and Chen (*ex-officio*) were convenors and S-CC member Dr. Akihiko Murata (Japan) was an invited speaker.

At the 2013 Annual Meeting in Nanaimo, Canada, POC sponsored a topic session called “*The changing carbon cycle of North Pacific continental shelves and marginal seas*” (co-sponsored by SOLAS). S-CC members Drs. Minhan Dai (China), Sophia Johannessen (Canada), and Dong-Jin Kang (Korea) were the convenors.

Both sessions drew large audiences and large numbers of presenters. This attests to widespread interest in carbon biogeochemistry at PICES Annual Meetings and the need for the continued presence of a formal body dedicated to these topic areas.

#### *PACIFICA data synthesis*

The most significant undertaking of S-CC is the data synthesis project known as PACIFICA (PACIFic ocean Interior Carbon) database. PACIFICA has collected biogeochemical data (DIC, TA, nutrients, oxygen, salinity) from more than 200 cruises in the Pacific and has implemented a set of algorithms for cross-over analysis that permits the construction of a basin-wide, consistently calibrated data set. The PACIFICA algorithms were adapted from CARINA and implemented by Dr. Toru Suzuki (Japan). The data product was published in early 2013 as NDP-092 (<http://cdiac.ornl.gov/oceans/PACIFICA/ndp092.html>).

#### *Contribution to RECCAP*

The REgional Carbon Cycle Assessment and Processes (RECCAP) project is an international effort to develop a global carbon budget, synthesizing ocean, terrestrial, and atmospheric carbon studies. S-CC members Masao Ishii and Richard Feely are leading the ocean carbon synthesis effort for the Pacific (<http://www.globalcarbonproject.org/reccap/syntheses.htm>). PACIFICA data played an important role in the Pacific ocean synthesis.

#### *Contribution to SOCAT*

Surface Ocean CO<sub>2</sub> ATlas (SOCAT) is “a collection of underway ocean CO<sub>2</sub> observations quality controlled by the science community” (<http://www.socat.info/about.html>). Eight S-CC members contributed to SOCAT as data contributors and/or participants in data quality control and the development of the data product (L. Chen, R. Feely, B. Hales, A. Kozyr, A. Murata, T. Ono, C. Sabine, T. Suzuki, <http://www.socat.info/credits.html>). (Dr. Sabine resigned from S-CC in early 2013 due to new responsibilities as Director of NOAA-PMEL.)

#### *Scientific publications*

Annex 2 provides a list of sample publications for the years 2011–2013, emphasizing those that involve multiple S-CC members from different PICES member countries (and a few that include multiple S-CC members within the same country but from different institutions). There are numerous additional publications not listed here that represent, for example, member collaborations with members of other PICES expert groups or with nonmember scientists in other PICES member countries. There are several additional publications that represent work conducted during this period but were not accepted in final form by 2013.

#### *Participation in international symposia*

At the second symposium on “*Effects of climate change on the world’s oceans*” (co-sponsored by PICES, ICES, and IOC) in Yeosu, Korea in May 2012, S-CC Co-Chair Dr. James Christian (Canada) was on the Scientific Steering Committee and co-chaired a theme session, “*Changes in the ocean carbon cycle*” with S-CC member Prof. Kitack Lee (Korea). S-CC member Dr. Masao Ishii (Japan) was an invited speaker. The third symposium on “*The ocean in a high-CO<sub>2</sub> world*” was held in September 2012 in Monterey, California. S-CC member Dr. Richard Feely (USA) was on the International Steering Committee. S-CC members Drs. Andrew Dickson, Hernan Garcia, Masao Ishii, Akihiko Murata, Jeong Hee Shim, and Toru Suzuki attended. Dr. James Christian (Canada) was an invited plenary speaker at the second ESSAS Open Science Meeting in Seattle, Washington (co-sponsored by PICES, ICES, IMBER, and GOOS).

#### **Future plans**

The FUTURE Science Plan notes that “natural and anthropogenic pressures are causing the oceans to acidify, while pollution, extirpations, invasive species, anoxia, habitat loss, and exploitation affect the coastal zones”, and suggests that “Region-specific assessments of topical issues (*e.g.*, harmful algal blooms, eutrophication, native and alien species range changes, anoxia, and ocean acidification)” will be one of the key “anticipated benefits and products” of FUTURE. It is clear that ocean acidification, deoxygenation and productivity will be key issues for FUTURE and for Pacific Ocean science over the



next 5–10 years. In PICES, much of the scientific expertise on these issues – particularly acidification – resides within S-CC. S-CC anticipates a shift in focus from carbon biogeochemistry toward biological impacts of ocean acidification; the Terms of Reference have already been revised (2008) to reflect this (see Annex 3). S-CC gives a presentation on S-CC activities and potential areas of cooperation at the FUTURE and AP-COVE meetings at each PICES Annual Meeting. At S-CC meetings at recent Annual Meetings, we have discussed potential data syntheses and data products to be developed in cooperation with the FUTURE APs and other related expert groups.

*Overall objectives for 2013–2016*

- 1) Complete publication of scientific analyses arising from PACIFICA data synthesis.
- 2) Develop data syntheses or products related to ocean acidification and deoxygenation and their biological and ecosystem impacts in support of FUTURE objectives, in consultation with FUTURE APs and other expert groups.
- 3) Develop strategy for assessment of the carbon cycle in coastal oceans and marginal seas of the North Pacific (data syntheses, data products, documentation of methods), in consultation with FUTURE APs and other expert groups.

**Annex 1: S-CC members**

Canada: Dr. James Christian (Co-Chair); Dr. Sophia Johannessen; Dr. Lisa Miller

China: Prof. Liqi Chen; Prof. Minhan Dai

Japan: Dr. Masao Ishii; Dr. Akihiko Murata; Dr. Tsuneo Ono; Dr. Toshiro Saino (Co-Chair); Dr. Toru Suzuki; Prof. Yutaka Watanabe

Korea: Dr. Dong-Jin Kang; Prof. Kitack Lee; Dr. Jeong Hee Shim

Russia: Dr. Andrey Andreev; Dr. Pavel Tishchenko

United States: Prof. Andrew Dickson; Dr. Richard Feely; Dr. Hernan Garcia; Prof. Burke Hales; Dr. Alexander Kozyr

*ex-officio*: Prof. Chen-Tung Arthur Chen

**Annex 2: Sample S-CC Publications**

**(S-CC authors in bold)**

Alin, S., R. **Feely**, A. **Dickson**, J. Hernandez-Ayon, L. Juranek, M. Ohman, and R. Goericke (2012), Robust empirical relationships for estimating the carbonate system in the southern California Current System and application to CalCOFI hydrographic cruise data (2005-2011), *Journal of Geophysical Research-Oceans*, 117, doi:10.1029/2011JC007511.

Barton, A., B. **Hales**, G. Waldbusser, C. Langdon, and R. **Feely** (2012), The Pacific oyster, *Crassostrea gigas*, shows negative correlation to naturally elevated carbon dioxide levels: Implications for near-term ocean acidification effects, *Limnology and Oceanography*, 57, 698–710.

**Feely**, R., C. **Sabine**, R. Byrne, F. Millero, A. **Dickson**, R. Wanninkhof, A. **Murata**, L. **Miller**, and D. Greeley (2012), Decadal changes in the aragonite and calcite saturation state of the Pacific Ocean, *Global Biogeochemical Cycles*, 26, doi:10.1029/2011GB004157.

**Hales**, B., P. Strutton, M. Saraceno, R. Letelier, T. Takahashi, R. **Feely**, C. **Sabine**, and F. Chavez (2012), Satellite-based prediction of pCO<sub>2</sub> in coastal waters of the eastern North Pacific, *Progress in Oceanography*, 103, 1–15.

Khatiwala, S., Tanhua, T., Mikaloff Fletcher, S., Gerber, M., Doney, S.C., Graven, H.D., Gruber, N., McKinley, G.A., **Murata**, A., Ríos, A.F. and **Sabine**, C.L. (2013), Global ocean storage of anthropogenic carbon, *Biogeosciences*, *10*, 2169–2191.

**Lee**, K., C. **Sabine**, T. Tanhua, T. Kim, R. **Feely**, and H. Kim (2011), Roles of marginal seas in absorbing and storing fossil fuel CO<sub>2</sub>, *Energy & Environmental Science*, *4*, 1133–1146.

Maiti, K., K.O. Buesseler, S.M. Pike, C. Benitez-Nelson, P.H. Cai, W.F. Chen, K. Cochran, M.H. **Dai**, F. Dehairs, B. Gasser, R.P. Kelly, P. Masque, L.A. **Miller**, J.C. Miquel, S.B. Moran, P.J. Morris, F. Peine, F. Planchon, A.A. Renfro, M.R. van der Loeff, P.H. Santschi, R. Turnewitsch, J.T. Waples, and C. Xu (2012), Intercalibration studies of short-lived thorium-234 in the water column and marine particles, *Limnology and Oceanography-Methods*, *10*, 631–644.

Midorikawa, T., H. Inoue, M. **Ishii**, D. Sasano, N. Kosugi, G. Hashida, S. Nakaoka, and T. **Suzuki** (2012), Decreasing pH trend estimated from 35-year time series of carbonate parameters in the Pacific sector of the Southern Ocean in summer, *Deep-Sea Research I*, *61*, 131–139.

Pfeil, B., A. Olsen, D.C.E. Bakker, S. Hankin, H. Koyuk, A. **Kozyr**, J. Malczyk, A. Manke, N. Metzl, C.L. **Sabine**, J. Akl, S.R. Alin, N. Bates, R.G.J. Bellerby, A. Borges, J. Boutin, P.J. Brown, W.-J. Cai, F.P. Chavez, A. **Chen**, C. Cosca, A.J. Fassbender, R.A. **Feely**, M. González-Dávila, C. Goyet, B. **Hales**, N. Hardman-Mountford, C. Heinze, M. Hood, M. Hoppema, C.W. Hunt, D. Hydes, M. **Ishii**, T. Johannessen, S.D. Jones, R.M. Key, A. Körtzinger, P. Landschützer, S.K. Lauvset, N. Lefèvre, A. Lenton, A. Lourantou, L. Merlivat, T. Midorikawa, L. Mintrop, C. Miyazaki, A. **Murata**, A. Nakadate, Y. Nakano, S. Nakaoka, Y. Nojiri, A.M. Omar, X.A. Padin, G.-H. Park, K. Paterson, F.F. Perez, D. Pierrot, A. Poisson, A.F. Ríos, J. Salisbury, J.M. Santana-Casiano, V.V.S.S. Sarma, R. Schlitzer, B. Schneider, U. Schuster, R. Sieger, I. Skjelvan, T. Steinhoff, T. **Suzuki**, T. Takahashi, K. Tedesco, M. Telszewski, H. Thomas, B. Tilbrook, J. Tjiputra, D. Vandemark, T. Veness, R. Wanninkhof, A.J. Watson, R. Weiss, C.S. Wong, and H. Yoshikawa-Inoue (2013), A uniform, quality controlled surface ocean CO<sub>2</sub> atlas (SOCAT). *Earth Syst. Sci. Data*, *5*, 125–143.

**Sabine**, C.L., S. Hankin, H. Koyuk, D.C.E. Bakker, B. Pfeil, A. Olsen, N. Metzl, A. **Kozyr**, A. Fassbender, A. Manke, J. Malczyk, J. Akl, S.R. Alin, R.G.J. Bellerby, A. Borges, J. Boutin, P.J. Brown, W.-J. Cai, F.P. Chavez, A. **Chen**, C. Cosca, R.A. **Feely**, M. González-Dávila, C. Goyet, N. Hardman-Mountford, C. Heinze, M. Hoppema, C.W. Hunt, D. Hydes, M. **Ishii**, T. Johannessen, R.M. Key, A. Körtzinger, P. Landschützer, S.K. Lauvset, N. Lefèvre, A. Lenton, A. Lourantou, L. Merlivat, T. Midorikawa, L. Mintrop, C. Miyazaki, A. **Murata**, A. Nakadate, Y. Nakano, S. Nakaoka, Y. Nojiri, A.M. Omar, X.A. Padin, G.-H. Park, K. Paterson, F.F. Perez, D. Pierrot, A. Poisson, A.F. Ríos, J. Salisbury, J.M. Santana-Casiano, V.V.S.S. Sarma, R. Schlitzer, B. Schneider, U. Schuster, R. Sieger, I. Skjelvan, T. Steinhoff, T. **Suzuki**, T. Takahashi, K. Tedesco, M. Telszewski, H. Thomas, B. Tilbrook, D. Vandemark, T. Veness, A.J. Watson, R. Weiss, C.S. Wong, and H. Yoshikawa-Inoue (2013), Surface ocean CO<sub>2</sub> atlas (SOCAT) gridded data products. *Earth Syst. Sci. Data*, *5*, 145–153.

**Tishchenko**, P., D. **Kang**, R. Chichkin, A. Lazaryuk, C. Wong, and W. Johnson (2011), Application of potentiometric method using a cell without liquid junction to underway pH measurements in surface seawater, *Deep-Sea Research Part I*, *58*, 778–786.

Turk, D., C. Zappa, C. Meinen, J. **Christian**, D. Ho, A. **Dickson**, and W. McGillis (2010), Rain impacts on CO<sub>2</sub> exchange in the western equatorial Pacific Ocean, *Geophysical Research Letters*, *37*, doi:10.1029/2010GL045520.

Wang, D., W. Lin, X. Yang, W. Zhai, M. **Dai**, and C. **Chen** (2012), Occurrences of dissolved trace metals (Cu, Cd, and Mn) in the Pearl River Estuary (China), a large river-groundwater-estuary system, *Continental Shelf Research*, *50–51*, 54–63.

**Annex 3: S-CC Terms of Reference**

**(bold indicates 2008 revisions)**

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 the coordination of ocean carbon studies, such as the International Ocean Carbon Coordination Project (IOCCP), CLIVAR/CO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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 symposia, workshops, or Annual Meeting sessions on **the carbon cycle, ocean acidification,** and climate studies in the North Pacific.

## Report of the Section on *Ecology of Harmful Algal Blooms in the North Pacific*

The Section on *Ecology of Harmful Algal Blooms in the North Pacific* (S-HAB) met under the chairpersonship of Drs. Vera Trainer and Shigeru Itakura on October 11, 2013, in Nanaimo, British Columbia, Canada. The meeting was attended by members from Canada, China, Japan, Korea, and Russia. Other visiting scientists attended the meeting under their respective countries (*S-HAB Endnote 1*). The proposed agenda for the meeting (*S-HAB Endnote 2*) was reviewed by the Section and approved. A new set of S-HAB terms of reference (*S-HAB Endnote 3*) was reviewed.

*Day 1, October 11, 2013*

AGENDA ITEM 2

### Country reports and HAE-DAT usage

*USA*

Dr. Jerry Borchert, Washington State Department of Health, sent a presentation to be given during the meeting. This presentation described an extreme year for paralytic shellfish poisoning (PSP) in 2012 with 9 cases of this illness reported from Puget Sound. The highest concentration of PSP toxins was 10,304 µg/100 g in mussels near Kingston. On the other hand, no concentrations of domoic acid in shellfish above the regulatory level of 20 ppm were observed either in Puget Sound or the outer Washington coast. Several closures due to diarrhetic shellfish toxins were observed in Washington State in 2012, the first year that formal monitoring occurred in the state. Of the 903 shellfish samples that were analyzed, 87 contained levels of toxins above the regulatory limit of 16 µg/100g. The highest concentration of 184 µg/100g was measured at Bellingham Bay in August 2012.

*Japan*

Dr. Shigeru Itakura reported that there were 270 cases of red tide in 2012, most of which were in the Seto Inland Sea and Kyushu area. For each of the red tides including those that produce toxins, the number of closures was as follows: PSP – 14 cases, DSP – 5 cases, red tides – 29 cases. A *Karenia mikimotoi* red tide was observed in 2012 from mid July to early August. An extensive survey was conducted to study the horizontal distribution of the winter (vegetative) population of *K. mikimotoi* in the water column of the Bungo-Suido, using the LAMP method. With the help of fish farmers, 82 stations were sampled on the West coast of Kyushu Island. On the East coast of Kyushu Island, 20 stations were sampled. Several positive samples were found in February on the West coast. In March, no positive samples were found. It is hypothesized that there may be a front in the area where resting cells are found. HAE-DAT 2009 data were presented showing the following for that year: red tide – 19 cases, PSP – 10 cases, DSP – 14 cases.

*China*

Prof. Mingyuan Zhu reported that 73 HAB events occurred, affecting 7971 km<sup>2</sup> in coastal waters of China in 2012. Most events occurred in the East China Sea (38 events). Professor Zhu showed a beautiful map of the distribution of HAB in China's coastal waters in 2012. *K. mikimotoi* was the main causative species (19 events). HABs caused by dinoflagellates appear to be increasing. More than 80% of HABs are now caused by dinoflagellates. He described abalone deaths and a macroalgae bloom in the Yellow Sea. This macroalgae bloom (green tide) has now occurred for the sixth consecutive year.

*Canada*

Dr. Nicky Haigh reported that fish killing HABs in Canada include *Dictyocha speculum* (April 2012), *Pseudopedinella pyriformis* (May 2012) and *Chattonella cf. marina* (Sept 2012). *Heterosigma akashiwo* (July 2012, August 2012, June 2013) occurred at 3 sites on the central coast followed by the west coast of

## S-HAB-2013

Vancouver Island. *Pseudochattonella* cf. *verruculosa* (Sept. 2013) was also seen recently. Losses to salmon aquaculture in 2012 were approximately \$6 million.

As for shellfish toxins, there were several PSP-related closures in 2012. Highest PSP concentrations occurred on the west coast of Vancouver Island. For DSP, low levels of dinophysistoxins were measured but no closures occurred in 2012 or 2013. Dr. Haigh gave a summary of the Haida Salmon Corporation's "ocean fertilization experiment", which consisted of iron dumping off Haida Gwaii. The goal of this experiment was to increase plankton in order to increase fish stocks with the theory that carbon credits would result in economic benefit to local first nation. Domoic acid was present in northern Haida Gwaii in fall–winter 2012–2013 in shellfish samples. Maximum DA was just below 20 ppm but has persisted. *Noctiluca* was found but was not causing problems.

### *Russia*

Dr. Tatiana Morozova reported the HAB monitoring program in Russia is in Peter the Great Bay in the western part of the Sea of Japan. Cyst surveys are done 2× per year with 3× per month HAB monitoring through much of the year. In 2012–2013, 12 bloom-forming species were observed. Most were diatoms. A bloom of *Noctiluca scintillans* was observed in 2012. A bloom of *H. akashiwo* occurred in June 2012. Three ribotypes of *Ostreopsis* were noted in Peter the Great Bay. Russian ribotypes are similar to those from Jeju Island and other areas of the Japan coast. DSP toxins exceeded the regulatory level of 16 µg/100g, with the primary toxin DTX-1.

### AGENDA ITEM 3

#### **Harmful Algal Event Database (HAE-DAT) report from the joint Harmful Algal Bloom Programme**

Dr. Henrik Enevoldsen could not attend the PICES meeting, but sent a presentation to be given at the S-HAB meeting on his behalf. HAE-DAT decadal maps for PICES member countries have now been created and have been posted on the IFREMER website. The goal of HAE-DAT decadal maps of HAB events is to provide a global and immediate view of harmful events around to whole world for the past decade. One dot per map is created for each toxin syndrome. The product was developed by IFREMER (France) with IOC using Google maps. All PICES member countries are currently adding events and the database should be updated to 2008 this year. This data set is now available on the web at

<http://envlit.ifremer.fr/var/envlit/storage/documents/parammaps/haedat/>

A number of questions relating to the presentation were posed by S-HAB members about the new web maps:

- Where are red tides with damage listed?
- Where are fish kills listed?
- Please send a list of entries for which you need area codes.
- Please add acknowledgement of PICES, add a PICES logo, and add agencies who contribute.
- How do we find the metadata?

### AGENDA ITEM 4

#### **Report on ICES meeting and joint workshop on HABs and climate**

Dr. Mark Wells was not able to attend the S-HAB meeting, so Dr. Charles Trick gave the report. A more rigorous assessment of purported links between anticipated climate-driven changes and HABs will be accomplished in two stages. Stage I is a 5-day international conference that was held in March 2013, co-organized by Drs. Mark Wells (PICES S-HAB) and Bengt Karlson (ICES/IOC-WGHABD) and jointly sponsored by PICES, IOC/SCOR, NOAA, GeoHAB (and ICES). A focused group (~15) of key individuals with different expertise that bears strongly on climate change/HAB linkages reviewed what is known and unknown about HAB/climate linkages. A seminal paper identifying the keystone parameters and research infrastructure needed to test these purported linkages is underway. Stage II will be an Open Science Conference

to define the organizational structure and Steering Committee for a broad open International Science Meeting on HABs and climate change that would be planned for 2015. This is tentatively proposed to be linked to the international Symposium on the “*Effects of climate change on the world’s oceans*” in Brazil in 2015.

During the Stage I workshop, three core questions were discussed:

1. What do we know about how the given parameter affects HAB species?
  2. What do we know of importance in terms of these parameters?
  3. Which of these unknowns are the most pressing questions and how should we go about addressing them?
- An important aspect of the group’s deliberations was consideration of how HAB science has progressed over the last few decades. It was agreed that there is a need for new research tools that help move science forward as well as a need for long-term collection of HAB relevant datasets across diverse geographical and oceanographic regimes. It was suggested that HAB “observer sites” be established.

#### AGENDA ITEM 5

##### **Report on new MAFF project on Marine Ecosystem Health and Well-Being**

Drs. Wells and Trainer on are the [project Science Team](#). The target countries and focus areas are: Indonesia (aquaculture), Guatemala (aquaculture and wild fisheries), Palau (wild fisheries). The project strategy will be a combination of workshops and social impacts studies. Workshops will be held 2–3 times at each site. A primary goal will be to conduct research on ecosystem health and human well-being. The project output will be the development of a manual for each site. Dr. Trainer, Trick and Makino will visit Guatemala in January 2014 for the initial scouting meeting.

#### AGENDA ITEM 6

##### **Review of the 2012 workshop, “*The contrasting cases of HABs in the eastern and western Pacific in 2007 and 2011*”**

Several countries have entered their relative intensity data for both toxin-producing and fish-killing HABs for representative outer coast and inland waters areas. These data have been made into “heat maps” which show the relative intensity of HAB occurrences from 2000–2012 and allow for country comparisons. Dr. Thomas Therriault (Science Board Chariman-elect) proposed that there might be a home for these data in FUTURE, perhaps as a collaboration with Working Group (WG 28) on the *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors*. In addition, Working Group (WG 27) on *North Pacific Climate Variability and Change* and (WG 29) on *Regional Climate Modeling* are all producing products related to ocean conditions. They will have the products that we need to link these “heat maps” of HAB relative abundance over the past decade to try to answer the environmental pressures that might influence the intensity of HABs.

*Day 2, October 12, 2013*

#### AGENDA ITEMS 9–13

##### **Special presentations**

Below are special presentations that were given on the second day of the S-HAB meeting.

Tatiana Morozova: “*Diarrhetic shellfish toxins (DSTs) in Primorye, Russian Federation*”

DSTs in molluscs in 2008 showed high levels around Vladivostok. The highest concentration was 108 µg/kg. In 2009, concentrations in June were 319 mg/g – some of the highest in mussels. Guidance level is 160 µg/kg. In 2012, *Crenomytilus grayanus* showed high DSTs with high numbers of *Dinophysis* present in July 2012. Pectenotoxin, yessotoxin and azaspiracid-2 were measured. The highest concentration of DSTs measured was

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430 µg/kg. Several *Dinophysis* species are present and the highest density measured is 12,000 cells per L.

Joo-Hwan Kim (Myung-Soo Han's student): "*Improvement of aPCR methods for quantification of H. akashiwo cysts*"

These cysts are very small and have similar morphology to other cells in the sediment. The previous quantification method is most probable number (MPN) method which has the potential to over or underestimate numbers of cysts in sediment. The qPCR method has unsolved problems – DNA debris in sediment and extracellular DNA debris. Kim *et al.* used the PowerSoil DNA isolation kit and found the presence of many clustered cysts. At 75°C, distilled water was most effective for removing DNA debris.

Satoshi Nagai: "*Easy detection of multiple HAB species by nucleic acid chromatography*"

This technology is from the Kaneka Corporation. Single cell PCR is possible. This method can detect target species from natural plankton assemblages, but some nonspecific bands occur. It is useful to distinguish among *Alexandrium* species and is essentially a detection chip for nucleic acid chromatography. It needs only 3 µl of PCR product. Five to six different genes can be detected per chip by multiplex PCR. No false positives are apparent.

Ichiro Imai: "*Prediction of toxic algal bloom occurrences and adaptation of scallop aquaculture industry to blooms for minimizing economic losses in Hokkaido, Japan*"

Scallop production in China is 1 million tons per year. The world's second biggest producer is Japan at 500,000 tons per year. Most scallops (80%) are produced in Hokkaido. However, PSP contamination closes this fishery. There is an urgent need for prediction of PSP in the Okhotsk Sea. In a PSP year, there is a weak Soya warm current and smaller difference in the water level along the coastline. Using knowledge of these environmental factors conducive to PSP, successful forecasting was possible in 2011 (no PSP!). Successful prediction of PSP in 2012 was possible using this method. There was high density of *A. tamarense* in early June. The local government issues these predictions which are used by local fishermen. Harvesting and shipping occurs from December–April, prior to the high PSP season (mitigation).

Vera Pospelov: "*Resting cysts of C. polykrikoides in surface sediments from aquaculture sites of southern S. Korea*"

*Cochlodinium* cyst abundance matched very well with sites where vegetative (swimming) cells have been found. She requested preserved cyst reference material or high quality images to assist with identification. On the northwestern side of Vancouver Island – many "strange" cysts were found. Dr. Nicky Haigh commented that the species of *Cochlodinium* in British Columbia, Canada, is *C. fulvescens*.

During the S-HAB meeting, two poster presenters gave brief talks:

Svetlana Esenkulova: "*Isolation of HAB species affecting aquaculture on west coast of Canada*"

Both water samples and sediment from bloom areas are collected for culture establishment.

Chang-Hoon Kim: "*Water quality improvement by polychaete rock worm in integrated culture with olive flounder*"

An integrated multi-trophic aquaculture approach to mitigating nutrient to coastal waters using the polychaete rock worm was described.

## AGENDA ITEMS 14 AND 15

### Proposals for the future

Our quick exchange of new findings was focused on the S-HAB contribution to FUTURE. For FUTURE to have any realistic hope of achieving meaningful predictions/forecasts of future ecosystem states, it is critical that the link between environmental conditions and the nature of primary production be characterized.

The more proactive climate/ecosystem models reduce primary producers into 2 or 3 “boxes”, based largely on size or specific function — it is critical that they now incorporate consideration of ecosystem disruptive primary producers, including:

- High biomass, monospecific blooms (phytoplankton, macroalgae, hypoxia),
- Toxic blooms (toxic diatoms, fish-killing species, toxic dinoflagellates),
- Food-web disruptive blooms (species that facilitate jellyfish blooms),
- Nutritionally-inadequate blooms (physiological or species driven changes in production of essential fatty acids).

We must go beyond the current focus on carbon processing/climate linkages to ecological/climate linkages — requiring an entirely new approach.

Effective modeling/forecasting of ecosystem changes associated with climate change will require establishing the “windows” of opportunity for ecosystem disruptive blooms. S-HAB will focus its efforts for FUTURE in the following areas:

- We cannot predict HABs or Ecosystem Disruptive blooms - We can only establish how these blooms may change temporally or geographically (aka. Environmental “Market” Reports).
- S-HAB is well positioned to provide key input to help define the edges of these “windows” which, when linked with appropriate physical and human dimension models, can provide “Market Forecast” outcomes.
- PICES S-HAB workshop and session outputs include characterizing the ecophysiology of key HAB species in the PICES region.
- HAE-DAT (Global database on HAB events) will provide valuable trend datasets.

#### AGENDA ITEM 16

##### **Topic Session and Workshop for PICES-2014**

In addition to a 1-day S-HAB meeting, a 1-day Workshop on “*Mitigation of Harmful Algal Blooms: Novel approaches to a decades long problem affecting the viability of natural and aquaculture fisheries*” and a ½ day Topic Session on “*Emerging issues with lipophilic shellfish toxins*” were proposed by S-HAB members for PICES-2014 (*S-HAB Endnote 4*). The S-HAB meeting will include member country reports for HAB events in 2008–2009 and a discussion on HAE-DAT use. Countries are requested to input HAB events data to HAEDAT for 2000–2009 directly to the online database.

#### AGENDA ITEM 17

##### **Proposals to the Science Board**

Funds are requested for:

- a. 1 invited speakers for the proposed Workshop on “Mitigation of HABs”.
- b. 1 expert speaker for the proposed Topic Session on “Lipophilic toxins”.
- c. PICES/NOWPAP sponsored PICES Scientific Publication on “Economic and social impacts of HABs on aquaculture and fisheries”.
- d. 1 S-HAB member to attend the annual IPHAB in Paris, France in April 2013 (Dr. Charles Trick).
- e. a “Climate and HABs” steering committee member to attend the IPHAB meeting in April 2013 (Mark Wells) and for the Open Science Meeting in 2015.
- f. S-HAB members on the task team to develop a period Global Harmful Algal Bloom Report: Vera Trainer (USA) and Shigeru Itakura (Japan) – it is not know when this task team will meet.
- g. Recommended PICES members of the Global HAB Scientific Steering Committee for the Global HAB Programme are Charles Trick (Canada) and Ichiro Imai (Japan). It is not known when this SSC will meet.



*We dedicate our participation at this conference and  
our continued work as members of the Section on  
Harmful Algae to the memory of our esteemed  
colleague, Professor Mingyuan Zhu.*

***S-HAB Endnote 1***

**S-HAB participant list**

Members

Chunjiang Guan (China)  
Hao Guo (China)  
Ichiro Imai (Japan)  
Shigeru Itakura (Japan, Co-Chairman)  
Satoshi Nagai (Japan)  
Tatiana Morozova (Russia)  
Vera Trainer (USA, Co-Chairman)  
Charles Trick (Canada)  
Takufumi Yoshia (Japan)  
Mingyuan Zhu (China)

Observers

Svetlana Esenkulova (Canada)  
Nicky Haigh (Canada)  
Myung-Soo Han (Korea)  
Chang-Hoon Kim (Korea)  
Jin Ho Kim (Korea)  
Joo-Hwan Kim (Korea)  
Vera Pospelova (Canada)  
Tamara Russell (Canada)  
Tom Therriault (Canada)

***S-HAB Endnote 2***

**S-HAB meeting agenda**

1. Welcome, goals of HAB Section meeting, review of terms of reference (Shigeru Itakura)
2. Country Reports (2012-13) and HAE-DAT (year 2009) reports  
Korea (Changkyu Lee) - CANCELLED  
USA (Jerry Borchert, Dr. Charles Trick, speaker)  
Japan (Shigeru Itakura)  
China (Ruixiang Li)  
Canada (Charles Trick)  
Russia (Tatiana Orlova & Tatiana Morozova)
3. The joint Harmful Algal Bloom Programme and International Oceanographic Data and Information Exchange Harmful Algae Information System: An update and country maps (Henrik Enevoldsen & Vera Trainer)
4. Report on ICES Meeting and Joint Workshop on HABs and Climate (Charles Trick)
5. Report on New MAFF project, Marine Ecosystem Health and Human Well Being (Charles Trick)
6. Review of Workshop, “*The contrasting cases of HABs in the eastern and western Pacific in 2007 and 2011*” (Charles Trick)
7. Assignments for the evening (ALL)
8. Welcome and review of previous day (Shigeru Itakura)
9. Diarrhetic shellfish toxins in Primorye, Russian Federation (Tatiana Morozova)
10. Improvement of previous qPCR method for quantification of Heterosigma akashiwo cyst (Joo-Hwan Kim)

11. Easy detection of multiple HAB species by nucleic acid chromatography (Satoshi Nagai)
12. Prediction of toxic algal bloom occurrences and adaptation of scallop aquaculture industry to blooms for minimizing economic losses in Hokkaido, Japan (Ichiro Imai)
13. Spatial distribution and identification of resting cysts of *Cochlodinium polykrikoides* in surface sediments from the aquaculture sites of southern South Korea (Vera Pospelov)
14. HOT Topics – short discussions of hot topics or novel, interesting findings (ALL)
15. Final discussion of Proposals for the Future and Review of assignments (ALL)
16. Discussion about Sessions and Workshops for 2014 (ALL)
17. Proposals to Science Board

### ***S-HAB Endnote 3***

#### **New Terms of Reference for the Section on *Ecology of Harmful Algal Blooms in the North Pacific***

##### Summary

There is a strong need to ascertain what currently is known about the environmental conditions that favor initiation and maintenance of different types of harmful algal bloom (HAB) events, and the natural vs. anthropogenic driving mechanisms that influence their prevalence. This critical assessment will serve as a springboard to focus attention on the research issues of greatest importance over the next decade. It also will help to proactively identify the fundamental parameters and research infrastructure needed to effectively hindcast current changing HAB distributions; the first step in gaining the capacity to forecast future HAB patterns in a changing climate.

- Continue PICES member country data entry into the joint ICES-PICES harmful algal event database to allow global comparison of changes in harmful algal bloom occurrences;
- Convene workshops and sessions including joint sessions with other international organizations to evaluate and compare results and maintain an awareness of state-of-the-art advances outside the PICES community;
- Convene a joint PICES/ ICES workshop to assess the purported links between climate change and HAB character, frequency and severity, and publish a comprehensive review paper that identifies the near- and long-term research priorities and the monitoring structures needed to effectively hindcast and forecast future HAB events;
- Produce and post on the PICES website papers that document the unanimous HAB Section opinion on timely subjects related to HABs, including topics related to FUTURE such as how human activities (increased cultural eutrophication and climate changes including temperature, changes in stratification and ocean acidification) might affect harmful algal bloom incidence and magnitude.

*S-HAB Endnote 4*

**Proposal for a 1-day MEQ/FUTURE Workshop on  
“Mitigation of Harmful Algal Blooms: Novel approaches to a decades long problem affecting  
the viability of natural and aquaculture fisheries” at PICES-2014**

Co-convenors: Mark L. Wells (USA), Charles Trick (Canada), Shigeru Itakura (Japan), Changkyu Lee (Korea)

Harmful Algal Blooms have substantial economic, societal, and human health impacts in coastal waters worldwide, from equatorial to high latitude environments. Our increasing reliance on the economic services of coastal waters is threatened by the apparent increasing frequency and severity of HABs globally. Currently, clay dispersal in Korean waters is the only pragmatic operational program for mitigating HAB effects on coastal aquaculture operations. The trade-off, namely smothering of benthos with rapid sedimentation of clays, is not acceptable in many nations, leaving them with any mitigation strategies. This full day workshop will open with presentations on current rules for testing and implementing mitigation strategies in PICES nations to set the stage for considering HAB mitigation. Participants then will deliberate on novel physical, chemical, and biological control strategies and research paths that have potential for minimizing or eliminating HAB effects without significant coincident impacts on ecosystem health. The aim of the workshop is to develop independent evaluation of mitigation strategies that are effective, transformative and sustainable for individual PICES nations, and to provide a framework to advance the scientific collaborations and funding strategies to move mitigation research into the 20 century.

**Proposal for a ½-day MEQ Topic Session on  
“Emerging Issues with Lipophilic Shellfish Toxins” at PICES-2014**

Co-convenors: William Cochlan (USA) and Ichiro Imai (Japan)

While primarily associated with blooms in Europe and some Asian coasts, lipophilic toxin events are increasingly shaping the phytoplankton communities in PICES nations. We anticipate that these toxins will be a FUTURE problem for all PICES member nations and threaten the sustainability of aquaculture. Tumor-promoting, mutagenic and immunosuppressive effects, shown in animals to be associated with lipophilic shellfish toxins, including okadaic acid (OA) and the dinophysistoxins (DTXs), have not yet been quantified in humans. However there is speculation that chronic exposure may increase the risk of gastrointestinal cancers. The lipophilic toxins in shellfish can be divided into four groups of toxins with different chemical structures and biological effects: OA and its derivatives, the DTXs; the pectenotoxins (PTXs); the yessotoxins (YTXs); and the azaspiracids (AZAs). These toxins can often be found in combination in shellfish. Some western Pacific nations have a long history of problems with some of the lipophilic toxins, but new toxins, such as azaspiracids, have recently appeared. In addition, the Salish Sea (US and Canada) has recent reports of illnesses due to DTXs. PICES member nations are initiating lipophilic toxin analysis as a more standard part of their seafood safety testing. We propose to consider research details that broaden our knowledge on the three primary ecological questions: how did these lipophilic toxin-producing species enter into PICES waters and what regulates toxin production? What factors have allowed these species to out compete natural phytoplankton populations? And will these lipophilic toxin-producing species remain in our coastal waters? These discussions will be guided by FUTURE science themes, with special attention to potential linkages to climatic and anthropogenic influences, to enable forecasting of these harmful events.

## Report of the Section on *Human Dimensions of Marine Systems*

The Section on *Human Dimensions of Marine Systems* (S-HD) held its second meeting on October 13, 2013, from 18:00–19:30 h and October 16, from 14:00–18:00 h in Nanaimo, Canada. Drs. Mitsutaku Makino and Keith Criddle acted as meeting Co-Chairs. The meeting began with brief self-introductions (S-HD Endnote 1) and the adoption of the meeting agenda (S-HD Endnote 2).

### AGENDA ITEM 2

#### **Introduction to the meeting**

Dr. Makino provided a succinct review of the formation and activities of the human dimension related studies in PICES, TORs of S-HD, and the past activities since the second S-HD meeting (June 13–16, 2013) in Honolulu. The objective for this third meeting was to review progress from the Honolulu meeting, in particular, regarding: a) planning for the UN-WOA and NPESR–HD Chapter (TOR-3); b) advances in the works for TORs; and c) developing the work plan for 2014.

### AGENDA ITEM 3

#### **Progress report of the Year 1**

The Co-Chairs reviewed the main outcomes from the S-HD's second (inter-sessional) meeting in Honolulu, *i.e.*, the Indicator studies in PICES member countries and the possible contributions of Human Dimension Chapters for the next North Pacific Ecosystem Status Report (the report of that meeting can be found in the products table on S-HD's [webpage](#)). Then, the main messages of the three articles from S-HD members in PICES Press articles (see also the products table at <http://www.pices.int/members/sections/S-HD.aspx>) were summarized.

The Co-Chairs reported on the status of a special issue of *Fisheries Science* that features papers presented at the PICES-2012 Session (S5) on “*Social-ecological systems on pollock under changing environment: an inter-disciplinary approach*” sponsored by SG-HD and at the 2012 Symposium of the Japanese Society of Fisheries Science. Publication is anticipated in 2014.

Dr. Juri Hori and Dr. Makino (Japan) presented the preliminary results of the Wellbeing Cube analyses conducted in Japan, Korea, and the USA. The presentation showed exciting results which clearly illustrated the differences in the perception of the “ideal marine ecosystem” and “ecosystem service needs” amongst three countries, which implied the differences in the types of scientific information needed to monitor changes in wellbeing in these three regions and suggests that it will be important to monitor unique factors in other regions as well.

Dr. Shang Chen (China) introduced the main objectives and the expected outcomes of the 1-day Topic Session (S5) on “*Marine ecosystem services and the contribution from marine ecosystems to the economy and human wellbeing*”, which was co-sponsored by IMBER. This session was a very good opportunity to summarize ecosystem service related studies in the North Pacific. We found that there are mainly three pillars in marine ecosystem service studies: 1) economic evaluation, 2) indicators, and 3) links to ecosystem functions and human wellbeing.

Representatives of each PICES member country provided an update of recent activities in support of the S-HD TOR and the assembly of time series of HD-Indicators for inclusion in the next NPESR. Dr. Ekaterina Golovashchenko (Russia) presented a literature review of ecosystem service studies in Russia. Dr. Ninsheng Yang (China) introduced the international co-research project of ecosystem service based on GIS analysis. Dr. Grant Murray (Canada) summarized social science research activities conducted by his students in Vancouver Island University. Also, Dr. Alida Bundy, representing the IMBER WG on Human Dimensions, presented their works “ADApT”, which is a good tool for comparative study on social-ecological responses against the global changes.

AGENDA ITEM 4

**Work plan for the Year 2 forward**

Development of time series observations (TSOs) of HD Indicators for the North Pacific ecosystem is one of the main activities of S-HD. The list of indicators was developed at the inter-sessional meeting in Hawaii (June 2013). China and Japan provided TSOs (as electronic files or webpage links) of all the indicators to the S-HD Co-Chairs in advance of PICES-2013. Russia provided sample observations of the principle indicators. Canada, Korea, and the U.S. committed to provide TSOs before the end of 2013. The Co-Chairs will organize the full set of TSOs, conduct preliminary trend analyses, and distribute the full data set and results of preliminary analyses to S-HD members in advance of the FUTURE OSM in Hawaii in April 2014. Based on review and discussion during the FUTURE OSM, S-HD members will agree on finalizing the TSOs of HD indicators and agree on undertaking additional analyses of the TSOs to develop a draft HD chapter for the NPESR. The draft chapter will be reviewed at the S-HD meeting during PICES-2014.

Human Well-Being Cube analysis is another major activity in S-HD; possible refinements of the analysis and work plans for Year 2 were discussed. Many constructive comments were made by the members. Also, because there are no psychologists other than Dr. Hori in this Section, it was recommended an academic article based on the initial project results be submitted to an appropriate international journal where the work will be subject to review by appropriate experts.

During 2014, the S-HD Co-Chairs will complete a draft white paper describing the legal and regulatory foundations of fisheries management in the PICES member countries. Short summaries of the legal and regulatory foundations of fisheries management in the U.S., Russia, and China have been received. It is anticipated that summaries for Canada, Korea, and Japan will be received before the end of 2013. This draft white paper will be reviewed during S-HD meetings during the FUTURE OSM or during PICES-2014. It is anticipated that the white paper will lead to a journal publication co-authored by members of S-HD who have contributed to the development of the six national summaries.

Proposals for two new study groups were discussed. Dr. Chen (China) summarized the importance of ecosystem service studies in S-HD, and its academic value to construct the inter-disciplinary framework for it as a new study group, *i.e.*, a Study Group on Marine Ecosystem Services. The six member countries unanimously supported his proposal. Dr. Emanuele Di Lorenzo (USA) proposed a new Study Group on Social-Ecological-Environmental systems (SG-SEES), which would conduct a one-year exploratory study to develop a conceptual model of a coastal hypoxia SEES in the California Current ecosystem.

Two proposals for topic sessions at PICES-2014 in Yeosu, Korea, were put forth for consideration. Dr. Masahito Hirota (Japan), as the lead co-convenor, proposed a Topic Session on the “*Ecological and human social analyses and issues relating Integrated Multi-Trophic Aquaculture*” (S-HD Endnote 3), which will be co-sponsored by MarWeB Project (funded by MAFF, Japan). Dr. Chen (China) proposed a Topic Session on “*Marine Ecosystem Services*” (S-HD Endnote 4) as a follow-up on session S5 (*Marine ecosystem services and the contribution from marine ecosystems to the economy and human well-being*) during PICES-2013.

S-HD has provided three contributions to PICES Press: articles by Drs. Makino, Criddle, and Felthoven and Kasperski (see Agenda Item 3). S-HD will provide two articles during 2014. Dr. Grant Murray (Canada) and Ms. Ekaterina Kurilova (Russia) have volunteered to write these articles.

***S-HD Endnote 1*****S-HD participation list**Members

Shang Chen (China)  
 Keith Criddle (USA, Co-Chair)  
 Emanuele Di Lorenzo (USA)  
 Feiyan Du (China)  
 Ekaterina V. Golovashchenko (Russia)  
 Masahito Hirota (Japan)  
 Juri Hori (Japan)  
 Ekaterina Kurilova (Russia)  
 Mitsutaku Makino (Japan, Co-Chair)

Grant Murray (Canada)  
 Naesun Park (Korea)  
 Ian Perry (Canada)  
 Tatiana Semenova (Russia)  
 Ningsheng Yang (China)

Observers

Alida Bundy (Canada, IMBER)  
 Cuihua Wang (China, WG 28)

***S-HD Endnote 2*****S-HD meeting agenda**

1. Adoption of the Agenda (Co-Chairs)
2. Introduction to the meeting (Co-Chairs)
3. Progress reports of the Year 1
  - Results of the S-HD 2nd Meeting in Hawaii (Co-Chair)
  - PICES Press (Co-Chair)
  - Well-being Cube (Hori)
  - Topic Session in PICES-2013 (Co-Chair)
  - Proposal of Topic Sessions for PICES-2014 (Sunny, Hirota, Mark)
  - Proposal of a new WG on Marine Ecosystems (Sunny)
  - Updates from each Member Countries
  - Other reports
4. Discussion for the work plan of the Year 2 forward (Co-Chairs)
  - Human well-being and ecosystem services in marine social-ecological systems (S-HD TOR1).
  - Social and economic impacts of climate-induced changes in marine ecosystems (S-HD TOR2 and FUTURE Key Question 3.4).
  - Human Dimension Chapters in the next NPESR (S-HD TOR 3) and contributions for the UN's First World Ocean Assessment (WOA).
  - Planning of the S-HD Symposium (S-HD TOR 4)
  - Others (PICES Press, *etc.*)
5. Concluding remarks (Co-Chairs)

***S-HD Endnote 3***

**Proposal for a 1-day MarWeb Topic Session on  
 “Ecological and human social analyses and issues relating Integrated Multi-Trophic Aquaculture”  
 at PICES-2014 [later changed to ½ day]**

Several recent studies and reports suggest that increased aquaculture production is essential if we are to meet the growing world demands for marine protein. However, the rapid current development of intensive fed aquaculture (*e.g.* finfish and shrimp), in both developed and developing countries, has generated concerns about the environmental impacts of these often monospecific practices. To help address such issues, Integrated Multi-Trophic Aquaculture (IMTA) has been attracting global attention as a means to conduct aquaculture activities, while at the same time improving/rehabilitating coastal environmental conditions and improving the well-being of the people living in coastal areas. By integrating fed aquaculture (finfish, shrimp) with inorganic and organic extractive aquaculture (seaweed and shellfish), the wastes of one resource become a resource (fertilizer or food) for the others. This “ecosystem-like” approach provides nutrient bioremediation capabilities, mutual benefits to the co-cultured organisms, economic diversification by production of other value-added marine products, and increased profitability and food security for the local community. This session seeks contributions and case studies of how to

implement and conduct integrated multi-trophic aquaculture activities, in particular that reduce negative impacts to the quality of the local environment and improve the well-being of the local human communities. Examples of activities in tropical and semi-tropical locations are particularly welcome, as well as examples of general methods and approaches that can be applied in many different environments. This session is a contribution of, and towards, the work of the PICES Project on Marine Ecosystem Health and Human Well-Being (MarWeB).

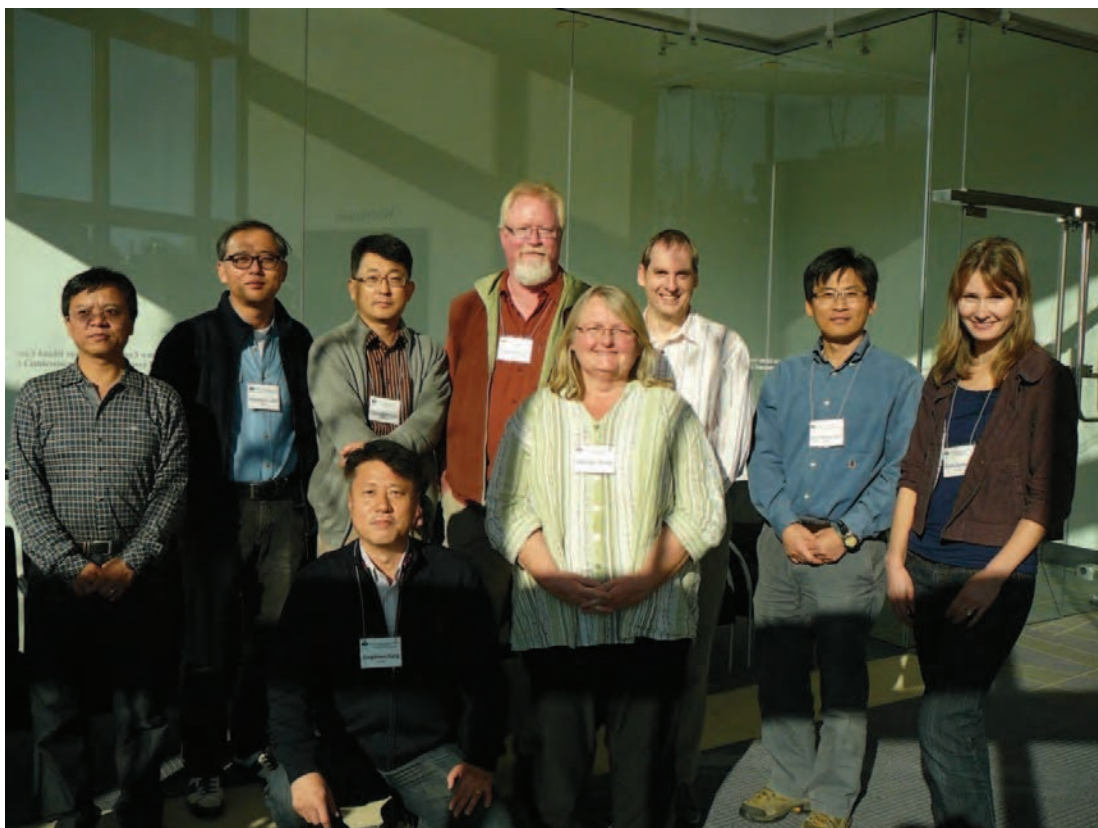
***S-HD Endnote 4***

**Proposal for a 1-day S-HD Topic Session on “*Marine Ecosystem Services*” at PICES-2014**

Marine ecosystem services (MES) are benefits people obtain from the seas and oceans. Marine ecosystems provide ecological products and services, such as seafood, regulation of climate, reducing storm disasters, waste purification, recreation and leisure, biodiversity maintenance and so on. Assessing the value of MES has become an emerging and somewhat challenging subject in the scientific world and is receiving increasing attention from politicians. The United Nations’ millennium ecosystem assessment reports published in 2005 focused on discovering changes in global ecosystem status and services. The ongoing World Ocean Assessment has urgent need for knowledge on marine ecosystem services. The United Nations Environmental Programme formed the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) in 2012. The IPBES aims to develop and use the knowledge on ecosystem services and biodiversity to improve national, regional, and global ecosystem management. The goals of this session are to provide marine scientists, economists, and ecologists with a platform to exchange results from research on marine ecosystem services, economics of marine ecological resources, and the contribution of marine environment to blue economy.

## Working Group on *Non-indigenous Aquatic Species*

The Working Group on *Non-indigenous Aquatic Species* (hereafter WG 21) held its eight meeting October 12, 2013 under the chairmanship of Ms. Darlene Smith who presented opening remarks and welcomed participants. WG 21 members from three PICES member countries (Canada, China and Korea) and observers from the Northwest Pacific Action Plan (NOWPAP) attended (*WG 21 Endnote 1*). The agenda for the meeting can be found in *WG 21 Endnote 2*.



Participants at the final meeting of WG 21 at PICES-2013 in Nanaimo, Canada. (Back, left to right) Hao Guo, Kyoungsoon Shin, Sangjin Lee, Graham Gillespie, Thomas Therriault, Keun-Hyung Choi, Anya Dunham. (Front) Jung-Hoon Kang, Darlene Smith.

### AGENDA ITEM 2

#### **Report on WG 21 related ICES activities**

The International Council for the Exploration of the Sea (ICES) has launched the Strategic Initiative on Biodiversity Advice and Science (SIBAS) which has a key focus on aquatic invasive species, but also deals with ecological and biologically sensitive areas and marine protected areas. Information on SIBAS can be found on the ICES website: <http://ices.dk/community/groups/Pages/SIBAS.aspx>.

There will be a joint ICES/PICES theme session on marine biofouling at the ICES Annual Science Conference in A Coruña, Spain (September 15–19, 2014). WG 21 member, Dr. Thomas Therriault, will chair the session.



## WG 21-2012

### AGENDA ITEM 3

#### **International Conference on Marine Bioinvasions**

The 8<sup>th</sup> International Conference on Marine Bioinvasions was held in Vancouver, British Columbia, from August 20–22, 2013, and was co-sponsored by PICES. The conference's theme was "*Biological invasions in changing waters: Envelopes, estuaries, and evolution*". Approximately 125 researchers, policy makers, and managers from 13 countries in North America, South America, Europe, Australia/New Zealand, and Asia exchanged ideas and discussed the latest findings and progress in the global effort to understand and reduce the delivery, establishment, and spread of marine invasive species. Additional information on the Conference can be found in the PICES Press article: [http://pices.int/publications/pices\\_press/volume22/v22-n1/pp\\_20-21\\_2013-MBIC.pdf](http://pices.int/publications/pices_press/volume22/v22-n1/pp_20-21_2013-MBIC.pdf).

Planning has begun for the 9<sup>th</sup> International Marine Bioinvasions Conference tentatively scheduled for January 2016 in Sydney, Australia, and the 10th International Marine Bioinvasions Conference tentatively scheduled for 2018 in Argentina.

### AGENDA ITEM 4

#### **NOWPAP Medium-Term Strategy**

The Northwest Pacific Action Plan (NOWPAP) has adopted a Medium-Term Strategy for 2012–2017. Under this Strategy NOWPAP activities will focus on five priority areas:

1. Integrated coastal and river basin management;
2. Regular assessments of the state of the marine environment;
3. Pollution prevention and reduction, including harmful substances, hazardous waste and marine litter;
4. Biodiversity conservation (including marine invasive species); and
5. Climate change impacts.

NOWPAP will publish an Atlas of Marine Invasive Species in 2014.

Given the overlap of interests and membership, WG 21 members recognized the benefits of cooperation on marine non-indigenous species between PICES and NOWPAP.

### AGENDA ITEM 5

#### **Review of final WG 21 report**

A draft of the final report was reviewed and suggestions made for completion.

### AGENDA ITEM 6

#### **Discussion and recommendations for future NIS activities in PICES**

Having completed its original mandate, WG 21 concluded that non-indigenous species (NIS) will continue to be an issue of significant concern for PICES member countries. Discussion considered various options for continuing work on NIS. Briefly, WG 21 recommends two options for continuing NIS activities:

1. Create a section focused entirely on marine non-indigenous species; or
2. Create a Section on Conservation Focused on Drivers of Change in Biodiversity.

Proposed terms of reference for the two recommended options can be found in *WG 21 Endnote 3*.

WG 21 also recommends that PICES organize and support the following workshop/special sessions:

- Support a joint PICES/ICES theme session on "*The Increasing importance of biofouling for marine invasions: an ecosystem altering mechanism*" at the 2014 ICES Annual Science Conference in Spain;

- Mitigation and control measures to reduce the impacts of NIS on biodiversity;
- Range expansion of indigenous and non-indigenous species vs. human-mediated introductions;
- FAO workshop on identification of VMEs in the North Pacific Ocean;
- NPFC SWG meetings on identification of VMEs and development of encounter protocols.

**WG 21 Endnote 1****WG 21 participation list**Members

Keun-Hyung Choi (Korea)  
 Graham Gillespie (Canada)  
 Hao Guo (China)  
 Jung-Hoon Kang (Korea)  
 Kyoungsoo Shin (Korea)  
 Darlene Smith (Canada, Co-Chairman)  
 Thomas Therriault (Canada)

Observers

Anya Dunham (Canada, FIS, AP-AICE)  
 Sangjin Lee (NOWPAP of UNEP)

**WG 21 Endnote 2****WG 21 meeting agenda**

1. Opening remarks and introductions (Darlene Smith)
2. Report on WG 21 related ICES activities (Thomas Therriault)
3. International Conference on Marine Bioinvasions (Thomas Therriault)
4. NOWPAP Medium-Term Strategy (Sangjin Lee)
5. Review of WG 21 final report (All)
6. Recommendations for future PICES Activities on marine NIS (All)

**WG 21 Endnote 3****Recommendations for future PICES activities on NIS**

WG 21 makes the recommendations to Science Board on the following two options for continuing activities related to marine nonindigenous species:

**Option 1** – Create a section focused entirely on marine non-indigenous species

## Terms of Reference

- Continue to share information and taxonomic expertise and update the database and atlas on new introductions to ecoregions.
- Evaluate how changes in patterns of trade affect pathways and vectors, and provide new species pools from donor regions (*e.g.*, in the potential opening of a north polar sea route, it is possible that NIS could spread between the North Atlantic and North Pacific).
- Develop a protocol for sampling non-indigenous aquatic species in PICES member countries, including a method for sampling on polar sea route ships.
- Develop a better understanding of changing distributions of NIS and vectors in the context of global climate change and its impacts on temperature, salinity, ocean acidification and deoxygenation.

## WG 21-2012

- Develop capacity for predicting changes in the distribution patterns of selected marine NIS among PICES member country ports over the next 100 years as global climate change leads to the opening of new pathways (e.g., shipping in the Arctic).
- Evaluate the risk of biofouling (hull fouling and tsunami debris) as a vector for the introduction of NIS. Additionally, evaluate the individual risks presented by species commonly encountered in biofouling vectors.
- Investigate why some species establish over broad areas while some only establish restricted distributions. Compare widely distributed species (e.g., green crab) with those of the same phyla with a narrow distribution. This information could be used in future risk assessments.
- Changing vectors (e.g., biofouling ships + tsunami debris (a novel vector) and understanding the risk of these species).
- Plan workshops/special sessions, for example:
  - Support a joint PICES/ICES theme session on “*The increasing importance of biofouling for marine invasions: an ecosystem altering mechanism*” at the 2014 ICES Annual Science Conference in Spain;
  - Propose a workshop/session on mitigation and control measures to reduce the impacts on NIS on the marine environment;
  - Propose a workshop session on the role of global climate change in species’ range expansion and human-mediated introductions.
- Work with NOWPAP and ICES to accomplish the Terms of Reference.
- Work with other PICES expert groups to accomplish the Terms of Reference.
- Prepare a final report on accomplishments.

### Option 2 – Create a Section on Conservation Focused on Drivers of Change in Biodiversity

#### Terms of Reference

#### Partnerships:

- Establish linkages with other intergovernmental organizations dealing with biodiversity issues (e.g., ICES, NOWPAP, WESTPAC, NPFC, CBD, FAO)
- Document and predict patterns in biodiversity:
  - Identify potential mechanisms to store and share information/data on biodiversity issues in the North Pacific (and beyond), e.g., PICES atlas on NIS, NPFC SWG to build and update databases of the past and current distributions of key commercial and non-commercial species, including database of NIS, at the scale of ecoregions.
  - Identify areas that support high, rare, or unique biodiversity, including VMEs and EBSAs in collaboration with international organizations including CBD, FAO, NPFC, NOWPAP using international criteria (e.g., CBD criteria for EBSA identification; FAO criteria for VME identification).

#### Understanding drivers of change in biodiversity:

- Identify major drivers of change in biodiversity in the North Pacific Ocean, including non-indigenous marine species, climate change, fishing, and eutrophication, and develop pathways of effects models for related activities that describe the mechanisms of change, including interactions among multiple stressors.
- Develop indicators to assess how drivers and biodiversity are changing over time and space (e.g., ecosystem status index).
- Develop models that relate changes in environmental (e.g., climate-related changes in temperature, salinity, pH and O<sub>2</sub>, human (e.g., changes in the distribution of fishing effort, discharge of effluents), and ecological variables (e.g., change in community structure) to changes in species distribution patterns, including changes in NIS distributions.
- Develop models and predictions of change in biodiversity under alternative scenarios of climate change, NIS introductions, fishing patterns, eutrophication, or other key threats.

- Investigate impacts of NIS, fishing, climate change, contaminants (and other key threats) in areas that support high, rare, unique or endangered biodiversity.
- Identify how human societies around the North Pacific value marine biodiversity and how they benefit from naturally diverse marine ecosystems.

Provision of science advice:

- Develop risk assessments for areas that support high, rare, unique or endangered biodiversity.
- Review mechanisms to conserve biodiversity in the North Pacific, including development/implementation of Ecologically and Biologically Significant Areas (EBSAs), identification of Vulnerable Marine Ecosystems (VMEs), Marine Protected Areas (MPAs), *etc.* and identify mechanisms to preserve endangered and threatened species in the North Pacific.
- Respond to emerging issues related to biodiversity.
- Prepare science advisory reports on key biodiversity issues.
- Work with other PICES expert groups to accomplish the Terms of Reference.
- Prepare a final report on accomplishments.

## **Working Group 26 on Jellyfish Blooms around the North Pacific Rim: Causes and Consequences**

The third meeting of PICES WG 26 (*Jellyfish Blooms around the North Pacific Rim: Causes and Consequence*) was held inter-sessionally in Hiroshima, Japan, (June 4, 2013) before the Fourth International Jellyfish Blooms Symposium in early June. The meeting was chaired by Dr. Shin-ichi Uye and Dr. Richard Brodeur. A new Korean WG member, Dr. Seungshic Yum, met with the group for the first time. All PICES member countries were represented at the WG meeting and several prominent jellyfish scientists from non-PICES nations also attended and provided useful comments and suggestions. A total of 11 members attended the WG meeting. PICES co-sponsorship of the Jellyfish Blooms Symposium was acknowledged which allowed for funding support for two invited speakers (Drs. Larry Madin and Rob Condon) to present at the meeting (*WG 26 Endnote 1*). The WG proposed a theme session to be held at the PICES FUTURE Open Science Meeting in Hawaii (April 15–18, 2014) entitled “*Natural and anthropogenic drivers of jellyfish blooms in coastal ecosystems: Correlation, causation, and prediction*” to be co-convened by WG members Uye, Brodeur and Lucas Brotz. The proposal was reviewed by Science Board and it was recommended that instead of being a separate session, this topic should be merged with another session on “*Identifying multiple pressures and system responses in North Pacific marine ecosystems*” led by Dr. Ian Perry. Discussions are underway with the organizers of that session to integrate jellyfish research into this theme section.

The remainder of the meeting consisted of discussions on the current state of writing for the WG report. Over the last twelve months, the WG members have been researching and writing their sections for the report and numerous emails have been exchanged among members. Progress by the different WG members was presented along with updates of the status of bloom conditions in several PICES regions. After brief discussions, the WG made slight modifications to the outline of the report, adding several new sections that were deemed useful to include. The major sections of the WG report are as follows:

- 1) Introduction and purpose,
- 2) Life history and population dynamics,
- 3) Sampling considerations,
- 4) Spatio-temporal variations of biomass and current bloom conditions in regional seas,
- 5) Physio-ecological properties,
- 6) Impacts on marine ecosystems and socio-economics,
- 7) Reducing jellyfish impacts, and
- 8) Conclusions and prioritized recommendations for future research.

Discussions were included on how this report may best address the goals and themes of the FUTURE program.

During the past summer, WG Co-Chair, Dr. Brodeur, worked with two ICES colleagues (Cornelia Jaspers of Denmark and José Luis Acuña of Spain) to put together a proposal for a joint ICES/PICES session on jellyfish at the next ICES Annual Meeting to be held in A Coruña, Spain, in September 2014 (see *WG 26 Endnote 2* for title and description). This is a followup to the very successful PICES/ICES collaborative session held at the 2012 PICES Annual Meeting in Hiroshima, Japan. In contrast to the one in 2012, this session would focus on the socio-economic impacts of blooms on humans, particularly related to fisheries. The other WG Co-Chair, Dr. Uye, was proposed as a keynote speaker for this session. ICES reviewed the proposal at their September annual meeting and ranked it as the top proposed session so it is likely to be approved for the next meeting. The WG will next request sponsorship by the BIO and FIS committees prior to moving forward to Science Board for consideration.

Finally, due to circumstances beyond their control, neither WG Co-Chair was able to attend the proposed WG business meeting at the 2013 PICES Annual Meeting in Nanaimo, Canada, so the meeting was cancelled. It was suggested instead that the WG members continue to write their reports and submit them to the WG Chairs.

WG 26-2013

**WG 26 Endnote 1**

***Report on International Jellyfish Blooms Symposium in PICES Press***

[https://www.pices.int/publications/pices\\_press/volume21/v21-n2/pp\\_14-15\\_Jellyfish-Symposium.pdf](https://www.pices.int/publications/pices_press/volume21/v21-n2/pp_14-15_Jellyfish-Symposium.pdf)

**WG 26 Endnote 2**

**Proposal for joint 1-day ICES/PICES Topic Session on**

***“Gelatinous zooplankton on a global perspective: interactions with fisheries and consequences for socio-economics”***

**Convenors:** José Luis Acuña (Spain, ICES), Richard Brodeur (USA, PICES), Cornelia Jaspers (Denmark, ICES)

**Proposed Invited speaker:** Shin-Ichi Uye (Japan)

Gelatinous zooplankton, such as ctenophores, jellyfish and pelagic tunicates, contain groups belonging to the fastest growing metazoans on Earth, contributing more to secondary production than crustacean zooplankton during periods in certain regions. Irrespectively, gelatinous zooplankton remain understudied and disregarded in most food web investigations and are largely viewed as a dead end in the food chain. Lately, evidence has accumulated that gelatinous zooplankton populations have increased and likely have benefitted from global change. Further, anthropogenic stressors such as eutrophication, bio-invasions and overfishing have been correlated with increased jellyfish and ctenophore abundances with documented changes in food web structure, functioning and productivity of many marine ecosystems around the world. Especially in the Mediterranean Sea, the Black Sea, the East Asian marginal seas, the Benguela Current, and fjord systems around northern Europe, bio-invasions and blooms of gelatinous zooplankton have gained public attention, with documented shifts in the food web structure, functioning and corresponding socio-economic consequences for fisheries and tourism. This theme session aims at addressing the role, position and importance of gelatinous zooplankton organisms for marine ecosystems and their impact on food web structure, functioning and overall productivity.

We encourage presentations on gelatinous zooplankton and their:

- spatial and temporal distribution patterns
- contributions to carbon cycling in pelagic & benthic ecosystems including higher trophic levels
- population dynamics or species interactions of native and invasive groups
- socio-economic impacts e.g. on fisheries, aquaculture and tourism
- potential as a fast growing, renewable resource

# PICES WG27 Report 2012-2013

## NORTH PACIFIC CLIMATE VARIABILITY & CHANGE

Emanuele Di Lorenzo  
Shoshiro Minobe  
Mike Foreman



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## Extending WG27 Terms to 2015

During the WG27 business meeting the group agreed that it would be useful to extend the lifetime of WG27 by 1-year. Below is a summary of the main motivations to request an extension (A,B,C and D).

### A. Analyze CMIP5

The output of the IPCC climate models used in the last assessment AR5 has just been released in 2013. WG27 would like to devote some additional time to process the output of these models in the context of TOR # 5

5. *Provide improved metrics to test the mechanisms of climate variability and change in IPCC models, and in coordination with other PICES working groups and FUTURE Advisory Panels, assist in evaluating those models and providing regional climate forecasts over the North Pacific.*

More specifically, we would like to use the CMIP5 to conduct analysis of the biogeochemistry and the changes in ocean circulation. Our efforts are aimed at developing a simple diagnostic of the ocean circulation (e.g. metric that test the realism of the patterns of circulation and of the dynamics that drive them). We will also extract the ocean current information and make it available to the PICES community as one of the **Science Products** of WG27

### B. Identify gaps between climate and ecosystem science

Although WG27 has made much progress on most TORs and a final report has been drafted, the members discussed the need of devoting more effort on completing TOR #6

6. *Understand and fill the gaps between what physical models can currently produce and what ecosystem scientists suggest are the important physical forcing factors required for predicting species and ecosystem responses to climate variability and change.*

We plan to conduct a conference calls in the Spring of 2014 to further brainstorm on TOR #6. We also plan to link the material of TOR 3 with the CFAME material that has not been published to report on TOR6.

- 3. In conjunction with ecosystem scientists, coordinate the development and implementation of process-based models, which include important processes in simple forms, to hindcast the variability of available long-term biological time series.*

Among the discussions that we plan to complete are identifying key oceanic forcing: upwelling strength and timing, stratification and mix later depth, temperature surface and subsurface, strength of the alongshore and cross-shore transport both surface and sub-surface, eddies and submesoscale fronts. Understanding the timing of the physical variability in relation to the timing of ecosystem processes. CFAME produced meta-diagram of the mechanism but without providing actual quantitative measures supporting the physical/biological links. WG27 can revise this for the mechanisms where links can be made and quantified.

### **C. Organize contributions to 3rd Climate Change Symposium**

WG27 will also work on preparing contributions for the 3rd international symposium on The effects of climate change on the world ocean, with the goal of showcasing some of the advances made by WG27 within the FUTURE key research themes.

### **D. Develop recommendations for new working groups**

During the last WG27 meeting there was consensus among the members that more work was needed in completing some of the TORs of WG27 before we could agree on recommendations for new experts groups.

## WG27 Science Products (progress update)

Below is a list of updates on the WG27 science products.

### A. WG27 Website and peer reviewed publications (78)

The working group maintains an active website (<http://wg27.pices.int>) where the scientific material that is produced by the members, which is relevant to the terms of reference of WG27, is posted. From the beginning of the WG27 the members have completed over 78 publications (see picture below). The website also gives access to reports and the outcome of workshops such as the ECOFOR 2012 in Friday Harbour. The WG27 is now in the process to synthesize the material for the WG27 Final Report.



The screenshot shows the website for PICES Working Group 27. The browser address bar displays "wg27.pices.int: public.aspx?publications.asp". The website header includes the PICES logo and the text "PICES WORKING GROUP 27". A navigation menu on the left lists: HOME, MEMBERS, TERMS, PUBLICATIONS, and ECOFOR WS. The main content area features a group photo of the working group members. Below the photo, the section is titled "PUBLICATIONS RELEVANT TO TERMS OF REFERENCE" and includes an "Add Record" button. A list of publications is shown, with the following entries:

- 78. Cummins, P.F. and D. Masson, 2013: Climatic variability and trends in the surface waters of coastal British Columbia. *Progress in Oceanography*, (accepted, pending minor revision). - | [Update](#) |
- 77. Sang-Wook Yeh, Won-Mo Kim, Young Ho Kim, Byung-Kwon Moon, Rokjin J. Park, and Chang-Keun Song, 2013: Changes in the variability of the North Pacific sea surface temperature caused by direct sulfate aerosol forcing in China in a coupled general circulation model. *JOURNAL OF GEOPHYSICAL RESEARCH: ATMOSPHERES*, VOL. 118, 1261–1270, doi:10.1029/2012JD017947 | [PDF](#) | - [Update](#)
- 76. MinHo Kwon, Sang-Wook Yeh, Young-Gyu Park, and Yoon-Kyoung Lee, 2013: Changes in the linear relationship of ENSO-PDO under the global warming. *INTERNATIONAL JOURNAL OF CLIMATOLOGY*, 33: 1121–1128 (2013) | [PDF](#) | - [Update](#)
- 75. Jae-Heung Park & Soon-Il An & Sang-Wook Yeh & Niklas Schneider, 2013: Quantitative assessment of the climate components driving the Pacific decadal oscillation in climate models. *Theor Appl Climatol*, 112:431–446 | [PDF](#) | - [Update](#)
- 74. Bo Young Yim + Yign Noh + Sang-Wook Yeh + Jong-Seong Kug + Hong Sik Min + Bo Qiu, 2013: Ocean mixed layer processes in the Pacific Decadal Oscillation in coupled general circulation

### B. Draft of the Final Report

During the business meeting at PICES 2013 the members agreed on the format and content of the Final Report. Action items have been developed and assigned to different members. A draft of the Final Report is now in place and will be expanded during the year 2013-2014. The scientific material that is produced by the members, which is relevant to the terms of reference of WG27.

## C. Synthesis Papers

WG27 members agreed that it would be important to complete two synthesis papers on that outline the progress done on the main terms of reference. After some discussions the group isolated the following:

### 1. Reduced complexity models to hindcast and forecast North Pacific Climate

(Cummins, Di Lorenzo, Davis, Yeh, Taguchi, Bograd)

Application of Auto-regressive multivariate models of order 1 to hindcast the physical variability of the North Pacific basin scale climate and of coastal environments. Examples for the Gulf of Alaska, CCS and KOE

### 2. Coherent changes in North Pacific climate and ecosystems

(King, Ito, Minobe, Chiba, Davis, Ustinova, Zuenko, Di Lorenzo)

Synthesis of how climate forcing drives coherent changes between the eastern and western boundaries of the North Pacific (1) climate framework, (2) lower-trophic framework, (3) higher trophic framework.

## D. Ocean Currents Database

Form the output of the PICES and ICES sessions and from the discussion within WG27 it is clear that information on how ocean currents are changing is critical to make advances in understanding the mechanism of how ecosystem response to climate forcing. For this reason a set WG27 members (e.g. Dr. Minobe, Dr. Curchister) offered to help in assembling a database with the output of regional scale model hindcast as well as the output of the AR5 models. Were this database will be hosted is still being discussed.

## Report on PICES CLIVAR Collaborations

### WCRP/CLIVAR 2nd Int. Symposium on Boundary Current Dynamics

(Li Jiang, China July 7-9, 2013).

In this symposium, a joint session between CLIVAR and PICES was held as a one of three sessions. The session is devoted to “biophysical interaction”, with the corresponding convenor, Shoshiro Minobe (Hokkaido University, Japan, WG 27 co-chair) and Hiroaki Saito (Fisheries Research Agency, Japan). The session has five invited and four contributed talks, which cover global paleo ecosystem modeling and ecosystem in the southern Indian Ocean, but majority of the presentations were devoted to the western North Pacific and its marginal seas. A topic commonly discussed in the latter papers is nutrient, and its physical controls including vertical mixing, upwellings, and advections, in association with the Kuroshio (Fig. 1). These studies clarify the large uncertainty of nutrient budget. As a session summary it is suggested that a holy grail may be three-dimensional budget of nutrient for mean climatology, climate variability on interannual and decadal timescales, and climate change. We appreciate travel supports from local organizing committee (especially Prof. Xiaopei Lin, Ocean University of China, China) for the conveners and one invited speaker and from PICES for two invited speakers, and science committee chair, Prof. Lixin Wu (Ocean University of China, China). Profs. Wu and Lin are WG27 members.

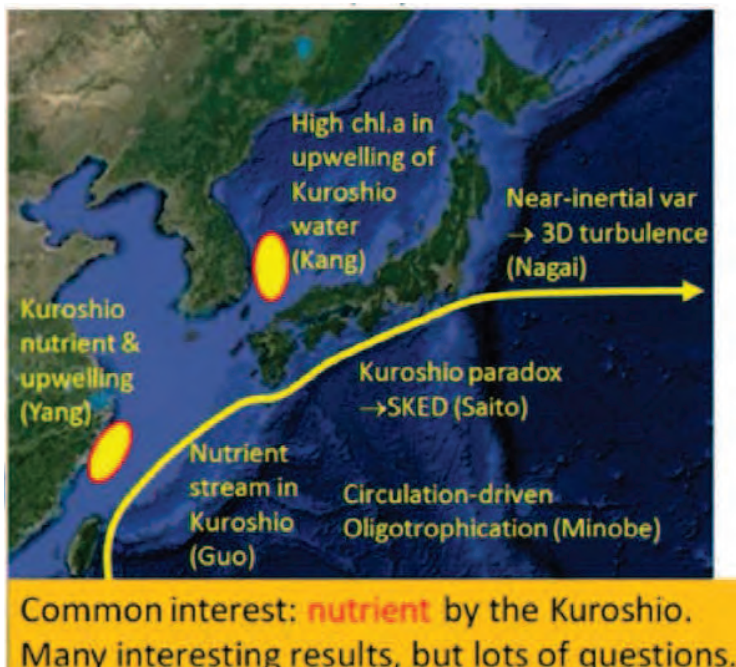


Fig. 1. Summary figure of biophysical interaction session of the symposium.

## Biophysical interaction and dynamics of upwelling systems

Shoshiro Minobe (Hokkaido University, Japan, WG27 co-chair) attended CLIVAR SSG meeting held in Kiel, Germany from 6 to 9 May, 2013 as a guest, representing PICES and Japan. This SSG meeting is an important one, because CLIVAR evolves to its second phase from 2014. Thus this SSG meeting is a place where CLIVAR determines its new structure and activities. In new CLIVAR, sciences will be conducted by “core panels” and “focused & integrated research opportunity”. Some research opportunities can be related to PICES, but the most important one should be “biophysical interactions and dynamics of upwelling systems”. In the SSG meeting, the leader of the tiger team for this research opportunity, Prof. Ken Drinkwater (University of Bergen, Norway), present a motivation and expected activities. In the last PICES meeting 2012, POC discussed about this research opportunity, and agreed that the phrase of the title “upwelling systems” is modified. This is because that this phrase sounds as if this research opportunity focuses on just upwellings in the eastern boundary regions, and excludes important upwellings, for example dynamical uplift in the western boundary currents. Following this POC’s suggestion, Minobe proposed in the SSG meeting that the title should be modified, for example the phrase “upwelling systems” may be changed into “upwellings”, but no decision was made about it. Through discussions with Drinkwater and co-chairs of CLIVAR, Minobe joined the tiger team.

As a relating activity, Minobe attended to the CLIVAR’s Pacific panel meeting held in Li Jiang in July. In this meeting, Minobe took care of a short session for this research opportunity, and written a suggestion document based on its discussion for title, major themes, specific activities, etc.

## ICES and PICES Joint Sessions in 2013

Following the ECOFOR workshop of 2012 on Forecasting Ecosystem Indicators with process based model, WG27 submitted two session proposals entitled “Identifying mechanisms linking physical climate and ecosystem change”. The proposals were identical and the goal was to collect input on this topic from both the ICES and PICES community. The session descriptions are introduced below along with a report and synthesis of the main findings from the sessions that are relevant to WG27 terms of reference.

### Workshop W2 at PICES Annual Meeting 2013 (Canada)

**Co-Convenors:** Jack Barth (USA), Emanuele Di Lorenzo (USA), Marc Hufnagl (Germany) Jacquelynne King (Canada), Arthur Miller (USA), Shoshiro Minobe (Japan), Ryan Rykaczewski (USA) and Kazuaki Tadokoro (Japan)

**Invited Speakers:** Jürgen Alheit (Leibniz Institute for Baltic Sea Research, Germany) Bryan Black (University of Texas, USA), Carolina Parada (Instituto de Investigación Pesquera, Chile) Hans-O. Pörtner (Alfred-Wegener-Institute, Germany)

#### Session description

Climate variability and change in the ocean is now recognized as a significant driver of marine ecosystem response, from primary production to zooplankton composition, and through the trophic chain to fish, marine mammals and other top predators. Past studies have often relied upon existing datasets to draw correlative conclusions (associated with indices and discovered time-lags in the system) regarding the possible mechanisms that may control these linkages. In this workshop, we seek to identify and model key processes that enable us to succinctly and quantifiably explain the mechanisms underlying the correlative relationships in physical-biological datasets, both in the North Pacific and North Atlantic. The description and modeling of these key processes may (a) involve few or several variables (but not full complexity), (b) use dynamical (e.g., eddy-resolving ocean models, NPZ, IBM, etc.) or statistically based methods (e.g., Bayesian, linear inverse models, etc.), (c) explain variability in low or high trophic levels (although we seek to emphasize secondary and higher producers), and (d) include uncertainty estimation. We also solicit ideas and hypotheses concerning new mechanisms of physical-biological linkages that can only be tested by establishing novel long-term observational strategies, where the harvest of understanding will eventually be reaped by future generations of ocean scientists, as well as by developing creative modeling datasets, where ecosystem complexities can be effectively unraveled. The workshop format will be a mixture of talks and group discussions that aim at enriching the exchange of ideas and concepts between physical and biological ocean scientists. The ultimate goal is to deliver: (1) a

set of new hypotheses of the mechanisms of marine ecosystem response to climate forcing, and (2) a description of the observational and modeling datasets required to test these hypotheses using process models.

## Theme Session M at ICES Annual Meeting 2013 (Iceland)

**Co-Convenors:** Emanuele Di Lorenzo (USA), Marc Hufnagl (Germany), Arthur Miller (USA)

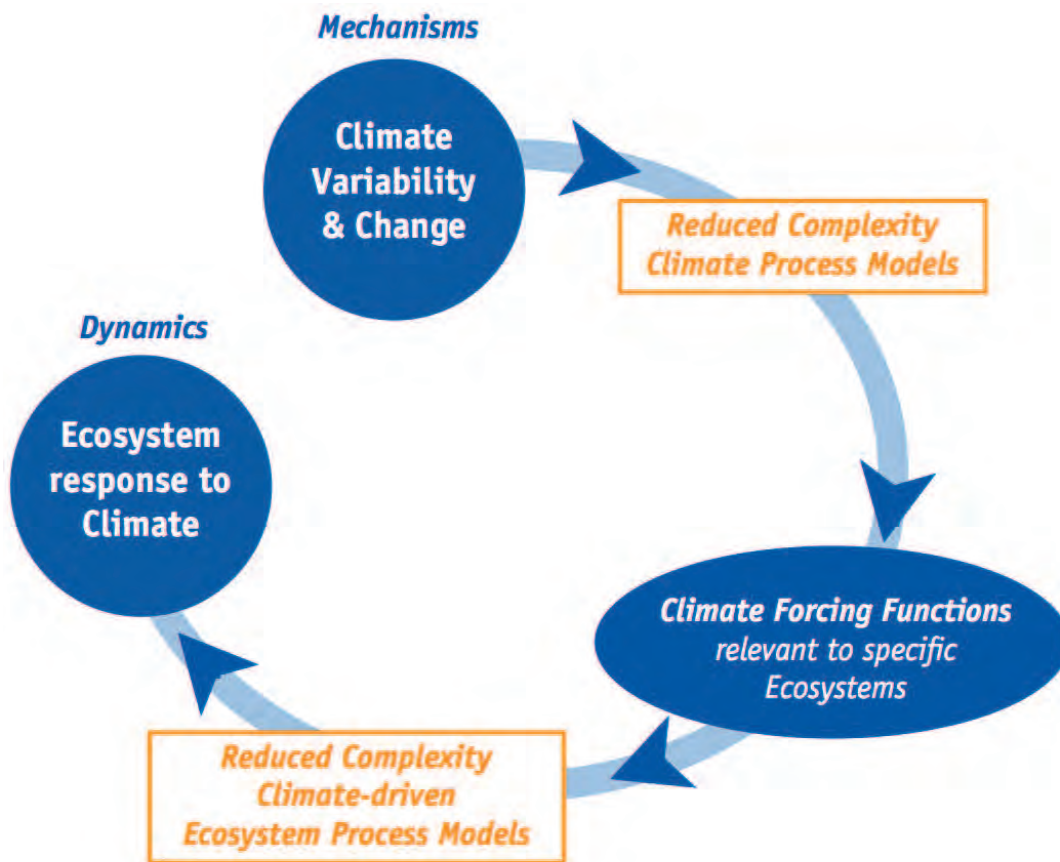
### Session description

Climate variability and change in the ocean is now recognized as a significant driver of marine ecosystem response, from primary production to zooplankton composition, and through the trophic chain to fish, marine mammals and other top predators. Past studies have often relied upon existing datasets to draw correlative conclusions (associated with indices and discovered time-lags in the system) regarding the possible mechanisms that may control these linkages. In this workshop, we seek to identify and model key processes that enable us to succinctly and quantifiably explain the mechanisms underlying the correlative relationships in physical-biological datasets, both in the North Pacific and North Atlantic. The description and modeling of these key processes may (a) involve few or several variables (but not full complexity), (b) use dynamical (e.g., eddy-resolving ocean models, NPZ, IBM, etc.) or statistically based methods (e.g., Bayesian, linear inverse models, etc.), (c) explain variability in low or high trophic levels (although we seek to emphasize secondary and higher producers), and (d) include uncertainty estimation. We also solicit ideas and hypotheses concerning new mechanisms of physical-biological linkages that can only be tested by establishing novel long-term observational strategies, where the harvest of understanding will eventually be reaped by future generations of ocean scientists, as well as by developing creative modeling datasets, where ecosystem complexities can be effectively unraveled. The workshop format will be a mixture of talks and group discussions that aim at enriching the exchange of ideas and concepts between physical and biological ocean scientists. The ultimate goal is to deliver: (1) a set of new hypotheses of the mechanisms of marine ecosystem response to climate forcing, and (2) a description of the observational and modeling datasets required to test these hypotheses using process models.

### Identifying Mechanisms of physical/biological interactions (report)

The main goal of the PICES/ICES sessions was to (1) identify mechanisms controlling the marine ecosystem response to climate forcing, (2) isolate the climate forcing functions that are relevant to the specific ecosystem that are studied, and (3) link these climate forcing functions to the dynamics of large and regional scale climate variability. Furthermore, in this session we were seeking talks that would allow to synthesize the complex interaction dynamics between climate and marine ecosystem by providing reduced complexity models or understanding of the dynamics. This concept is illustrated in the digram below.





Both the ICES and PICES session were very well attended with about 100-200 participants. Several talks were able to target different aspects of diagram 1 and provided important insight on the nature of the climate forcing to which ecosystem are sensitive too and the dynamics of ecosystem response to environmental perturbations. Below is a synthesis of the main findings.

### 1. Sensitivity of ecosystem to physical drivers changes with season

During different months of the season different physical drivers become important in driving ecosystem variability. Therefore using regional indices that tracks the seasonal sensitivity of the ecosystem leads to better predictions than using climate indices. In future studies it is critical to examine if IPCC class models can resolve the dynamics of the regional forcing functions.

### 2. Lower-trophic levels variability tracks regional and local physical forcing

Ecosystem properties of lower trophic level (e.g. nutrient fluxes and primary productivity) are typically sensitive to few environmental driver and often track indices of climate variability that are regional or locally defined. These regionally defined indices allow to capture both the local-scale environmental variability as well as the impacts of large-scale climate variability.

### 3. Higher-trophic levels integrate multiple forcing and track large-scale climate modes

Ecosystem functions of higher trophic levels (e.g. sardine) are typically sensitive to multiple stressors. Hence higher trophic levels have the ability to integrate multiple sources of environmental variability and exhibit the tendency to align their variability with that of the large-scale climate modes, which capture the shared low-frequency variance among the different environmental forcing.

### 4. Changes in large-scale and regional scale circulation play a dominant role in driving ecosystem variability

Changes in large-scale and regional scale circulation play a dominant role in driving ecosystem variability both at the lower and higher trophic levels. Resolving the circulation dynamics with regional climate model is key to allow a proper understanding of how coastal ecosystem respond to climate forcing. It will be important in the future to develop adequate data archives of ocean currents and advection pathways that can be used by ecosystem scientists to test hypothesis on the ecosystem response to environmental oceanic forcing. These data archives will likely be assemble using the output of regional scale model hindcast. It was also pointed out the resolving eddies at the regional scale is critical, but it also introduces a random component in the variability associated with the degree of intrinsic nature of the eddy-scale circulation. Future eddy resolving models will need to perform an ensemble hindcast in order to separate the fraction of variance that is deterministically forced vs. the internal variance.

### 5. Spatial dimension is key for understanding the links between physical variability and ecosystem response

As we develop reduced complexity models of the marine ecosystem response to climate forcing it will be critical to incorporate the spatial dimension (e.g. associated with fish distributions). This topic has already emerged from the section on Climate Change impacts on Marine Ecosystem (S-CCME) and is currently an important topics research/discussion. Although several talks showed example of how the spatial dimension plays an important role, no systematic approach was presented to incorporate the spatial dimension in reduced complexity models. During the discussion a Linear Inverse Model methodology was suggested as one approach to model the spatial dimension of fish distribution in the context of a changing climate.

## **Report of Working Group 28 on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors***

WG 28 met from 9:00 to 18:00 h on October 12, 2013 in Nanaimo, Canada, under the chairmanship of Drs. Motomitsu Takahashi (Japan) and Ian Perry (Canada). The meeting objective was to review activities during the 2<sup>nd</sup> year (2012–2013) of WG 28, plan for activities during the 3<sup>rd</sup> year (2013–2014), and discuss the contents of the final report. Note that reports from previous WG 28 meetings and sponsored sessions are on the WG 28 web page at [http://www.pices.int/members/working\\_groups/wg\\_28.aspx](http://www.pices.int/members/working_groups/wg_28.aspx).

The participants at this meeting are listed in *WG 28 Endnote 1*. The agenda for this meeting is presented in *WG 28 Endnote 2*. The members of WG 28 are listed in *WG 28 Endnote 3*.

### AGENDA ITEM 2

#### **Review of activities during the 2<sup>nd</sup> year of WG 28**

##### *a) Review of Terms of Reference:*

The terms of Reference for WG 28 (*WG 28 Endnote 4*) were reviewed and discussed. It was recognized they are very challenging and ambitious. WG 28 is making progress on addressing them, but may not be able to fully respond to all questions. Since this WG is connected to the FUTURE program, it was agreed that requesting an additional one or two years to the duration of WG 28's term is reasonable considering the complexities of the Terms of Reference and the contributions of WG 28 to this program.

WG 28 was requested by The FUTURE Advisory Panels to identify how it will link to the FUTURE. WG 28 will contribute directly to goals 1 and 3 of the FUTURE Science Plan and partially to goal 2:

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?

The responses of the Working Group to the additional questions posed by Science Board are:

- What is the progress with the expected contribution to FUTURE?
  - Good progress,
  - Habitat-stressor relationships and potential indicators have been identified,
  - Outline of the report has been developed,
  - About 6 months to get a draft together.
- What is the gap/obstacles in making progress?
  - Lack of full representation from all countries,
  - Data exchange,
  - Overuse of the same experts for similar surveys.
- What will be the necessary actions to overcome the gaps?
  - Members might need to be engaged by correspondence through written materials,
  - Bring to the Technical Committee on Data Exchange (TCODE),
  - Similar surveys – but there is no clearing house.
- What kind of coordination is needed with other expert groups?
  - Section on *Human Dimensions of Marine Systems*,
  - Advisory Panel on *Marine Birds and Mammals*,
  - Section on *Ecology of Harmful Algal Blooms in the North Pacific*,
  - WG 21 on *Non-indigenous Aquatic Species* (e.g., Manila clams).
- How well do you communicate with Committees/FUTURE APs on FUTURE matters?
  - Currently report annually with the Committees and FUTURE APs and welcome the opportunity to have additional communication.

*b) Report on participation and presentation by WG 28 in NOWPAP Workshop*

Purpose of this workshop was to discuss Marine Protected Areas and biodiversity issues in the East Asian Seas region. Goals included developing common language around these topics, and developing marine ecosystem indicators. See PICES Press July 2013 article for a discussion of the meeting and of the WG 28 presentation by Dr. Kulik: [http://www.pices.int/publications/pices\\_press/volume21/v21-n2/pp\\_28-29\\_NOWPAP-Wsh.pdf](http://www.pices.int/publications/pices_press/volume21/v21-n2/pp_28-29_NOWPAP-Wsh.pdf), and also the meeting report on WG28 web page: [http://www.pices.int/members/working\\_groups/materials/WG-28-2013-Report-from-NOWPAP-MPA-Workshop.pdf](http://www.pices.int/members/working_groups/materials/WG-28-2013-Report-from-NOWPAP-MPA-Workshop.pdf)

The HELCOM (Baltic Marine Environment Protection Commission – Helsinki Commission) presentation by Dr. Maria Laamanen is of interest to WG 28; see their website for their multi-layered core indicators report ([www.HELCOM.fi](http://www.HELCOM.fi)). One conclusion is that the main interactions among pressures are not additive.

In discussion, it was suggested that Chapter 3 of the WG 28 report might include a summary of main indicator webpages and compare/contrast indicators among ecosystems. For example, which indicators are common in a majority of lists produced by various organisations, and which are ‘unique’ to specific locations? Many indicators are status indicators, but WG 28 is looking for ecosystem response to multiple stressors; can we identify the dominant driver/stressor that is causing changes in an indicator from the observed ecosystem response? In addition, can WG 28 identify candidate early-warning indicators? See also websites for the health of the Salish Sea ecosystem ([www2.epa.gov/salish-sea](http://www2.epa.gov/salish-sea)), Baltic Sea ([www.HELCOM.fi](http://www.HELCOM.fi)), and [www.oceantippingpoints.org](http://www.oceantippingpoints.org).

Dr. Vladimir Kulik mentioned that another meeting on marine ecosystem indicators was held in early October in Russia. The interest here was to develop ecosystem indicators to assist decisions on Total Allowable Catches because often there is insufficient information to develop Virtual Population Analyses and other traditional stock assessments, but there is information on hydrological conditions and populations, *i.e.*, the use of ecosystem indicators to assist with fisheries management.

*c) Report on participation and presentation by WG 28 to the 2013 Inter-sessional Science Board meeting, and at the ICES/PICES workshop on “Climate Change Effects on Marine Ecosystems” (SICCME)*

These meetings took place in St. Petersburg, Russia, May 20–24, 2013; WG 28 was represented by Dr. Takahashi. For details on the workshop and presentation, please see the web site: <http://www.pices.int/publications/presentations/2013-S-CCME-Wsh/2013-SCCME-wsh-agenda.aspx>.

In discussion, it was noted that the vulnerability definitions adopted by the IPCC and expressed by Allison *et al.* (2009, *Fish and Fisheries* 10, 173–196), in which the vulnerability of a national economy (or any ecosystem) can be expressed as a function of exposure to pressures, sensitivity to those pressures, and the capacity to adapt to those pressures, may have some applicability to the work of WG 28, in particular at sub-national levels).

*d) Report on additional WG 28 session proposals*

At the FUTURE Open Science Meeting in Hawaii, April 14–18, 2014, WG 28 is supporting one scientific session and one workshop (*WG 28 Endnote 5*). The WG is also supporting a topic session at the 2014 PICES Annual Meeting in Yeosu, Korea (*WG 28 Endnote 6*).

*e) WG 28-sponsored topic session at PICES-2013*

WG 28 co-sponsored one topic session (S8) at this PICES Annual Meeting, titled “*Ecosystem indicators to characterise ecosystem responses to multiple stressors in North Pacific marine ecosystems*”. Details of this session can be found in the Session Summaries section of the 2013 Annual Report at [http://www.pices.int/publications/annual\\_reports/Ann\\_Rpt\\_13/2013-Session-Summaries.pdf](http://www.pices.int/publications/annual_reports/Ann_Rpt_13/2013-Session-Summaries.pdf).

*f) Report on project MEcoPAM*

The project “Sustainability of **M**arine **E**cosystem **P**roduction under Multiple stressors and **A**doptive **M**anagement” (MEcoPAM) focuses on the impact of multi-stressors on the sustainability of marine ecosystem production in China. It is a project under IMBER.

The sustainability of marine ecosystem production is impacted by multi-stressors, such as physical processes, eutrophication, over-fishing and aquaculture. The objectives of the MEcoPAM project are to identify and characterize the interactions of marine biogeochemical cycles and marine ecosystems, and to understand the response of typical marine ecosystem production to multi-stressors, thereby improving our knowledge of the impact of multi-stressors on the sustainability of marine ecosystem production. The research areas include several unique sub-ecosystems in the Bohai Sea, Yellow Sea, and East China Sea (*e.g.*, the hypoxia zone off the Changjiang Estuary, and aquaculture sites in the Shandong Peninsula). The major scientific questions to be addressed are:

- What is the impact of multi-stressors on biogeochemical cycles in coastal ecosystems (*e.g.*, hydrodynamic control of biogenic element cycles, coupling mechanism of primary production with biogeochemical processes)?
- How does ecosystem functioning in the hypoxia zone of the East China Sea respond to multi-stressors (*e.g.*, the role of metabolism and redox processes on element cycles, impact of hypoxia on the function and structure of marine ecosystem, impact of open ocean and atmosphere)?
- What are the adaptive strategies of coastal aquaculture ecosystems to deal with multi-stressors (*e.g.*, the supporting role of main biogeochemical processes in food production and food web trophodynamics of major biological functional groups, adaptive strategies to fishery management)?

In addition to field observations of the physical, chemical and biological properties of ecosystems in East China Sea, Changjiang Estuary and the coastal area of the Shandong Peninsula, historical data analysis, numerical modelling and microcosm experiments will be undertaken.

The program is structured around five sub-projects: (1) Biogeochemical Dynamics of Marine Ecosystems; (2) Nutrient Cycles and Response to Multi-stressors; (3) Hydrodynamic Response to Multi-stressors and its Impact on the Supply of Nutrients; (4) Microbial Loop and Coupling with Biogeochemical Cycles; and (5) Feedback Mechanisms of Ecosystem Structure and Function to Climate Change and Human Activities.

The project is scheduled for completion in 2015. The project web site is at <http://www.imber.info/index.php/Science/National-Network/CHINA/MEcoPAM-project-website>.

### AGENDA ITEM 3

#### **Progress on Terms of Reference, and brief country reports of activities of interest to WG 28**

##### *Canada*

Dr. Perry reported that an ecological risk assessment framework has been developed and a detailed case study application has been developed and reviewed – the report is in preparation. Indicators for the Salish Sea ecosystem (Strait of Georgia and Juan de Fuca Strait in Canada, and Puget Sound in the U.S.) have been updated and published (<http://www2.epa.gov/salish-sea>).

##### *Japan*

Dr. Takahashi stated that discussions have been ongoing with China regarding relevant work in the East China Sea. Work has also been ongoing to develop coupled pelagic-benthic biogeochemical models for the Mikawa Bay estuary (*e.g.*, see presentation on “*The pelagic and benthic coupled biogeochemical cycle model study for Mikawa Bay estuary*” in Session S8 by Dr. Kisaburo Nakata: S8-9005).

##### *Korea*

Dr. Jaebong Lee informed the WG that a primary ecosystem assessment framework is IFRAME; a current major goal is to identify reference points and conduct risk analyses. Korea has a new Fishery Act, but so far no methods for ecosystem-based management. IFRAME may be applicable to aquaculture as well to calculate total allowable aquaculture (TAA) and to assess the carrying capacity and risks of aquaculture to the ecosystem. This is a 3-year project. The project will start at the end of this year or early next year.

*Russia*

Dr. Kulik said that in Russia, damage to ecosystems is not part of the science program; therefore, there is difficulty in obtaining data. For example, estimates of the total biomass of targeted species can vary considerably because of the use of different base data (spring or fall surveys which target different life stages or species) and different geostatistical techniques (*e.g.*, GAMS, kriging, or other techniques). As a consequence, indicators show promise in providing alternative methods. Several indicators developed by IndiSeas have been explored, although there were issues with FAO designations of over- and moderately exploited species. General additive mixed models have been used to incorporate environmental indicators. Which values are included or excluded from indicators can affect indicator values/outputs. How data are selected or grouped also affects the results. In Russia, there is pressure from Industry on Science to lower the total allowable catch (TAC) because they have to catch 50% of TAC for the TAC to exist the next year. This could be viewed as precautionary since the TAC may not really reflect population status.

*United States (Martone)*

Dr. Rebecca Martone announced that significant efforts are being directed towards a Marine Monitoring Enterprise and a project on ocean tipping points: [www.oceantippingpoints.org](http://www.oceantippingpoints.org). This project is characterizing nonlinear responses in ecosystems, with the goal of developing early warning indicators and how these may be incorporated in oceans management. An example of an early warning indicator is the coefficient of variation, and how it may change as the system approaches a regime shift (*e.g.*, Lindegren *et al.*, 2012, PLoS One 7(7), e38410). Case study locations for this project include Hawaii, and Haida Gwaii in Canada.

AGENDA ITEM 4

**Report draft chapter outlines**

Draft outlines for the chapters of the WG 28 final report were presented and discussed. These form the basis for focused work for the next year. The updated chapter outlines (revised from those developed last year in Hiroshima) are presented in *WG 28 Endnote 7*.

It is anticipated that about 50% of the report will consist of a literature review, 30% the application of existing methods to data and information from the PICES region, and 20% of new analyses. The goal now is to create drafts of each of the core chapters, for presentation and discussion at the FUTURE Open Science Meeting in April and subsequently (expecting that not all members of WG 28 will be able to attend this meeting). The objective of these first drafts is to take stock of what we have in hand, and to understand where the gaps remain. These gaps will then become the focus for directed efforts in the remaining two years of the WG.

In discussion of the revised outline for Chapter 2, one gap that was suggested was whether the report should include a summary from each PICES member country of relevant work, using a common template – this is something to consider. There was also discussion about how best to include the open ocean/high seas areas. Some of this may rely on existing assessments. It may also be useful to identify limitations of existing approaches, *e.g.*, the Halpern model for regional level applications; what is important to capture at small spatial scales. We need to be clear that we are not planning on a comprehensive and exhaustive review of all stressors everywhere in the North Pacific. Instead, we could identify what can apply to areas not covered in our report, and their limitations; we need to focus on areas for which we have expertise. A relevant recent publication was noted (Knights *et al.*, 2013, *Ecological Applications* 23(4), 755–765) which conducted a network analysis on stressors.

In discussion of Chapter 3, it was noted there needs to be interaction between this chapter and the case studies, *i.e.*, perhaps including the trial of some of the indicators proposed in Chapter 3.

Chapter 4 should then take the recommendations from Chapters 2 and 3 to utilize and apply in case studies. It was also noted the terminology should be “indicators of ecosystem responses to multiple stressors” (not “indicators of multiple stressors”). It would be useful to include early warning indicators from the literature (*e.g.*, tipping points) where possible, although it was recognized this is a new and emerging field.

Reference points could also be included in Chapter 3: at least their importance should be discussed. They could be included in the Conclusions chapter under future work.

End of March 2014 was recommended as the due date for rough first drafts of Chapter 2 and 3, for circulation amongst WG members, to help prepare for the presentations at the FUTURE OSM, and to help identify remaining gaps which may need to be filled prior to completion of the report.

In broad discussion on the draft report outline, it was noted by Dr. Takafumi Yoshida (NOWPAP representative) that WG 28 appears to be focused on fisheries. Dr. Perry indicated that this WG does not have to be focused only on fisheries and, in fact, should include non-fisheries activities as well. It needs to be stated in the introduction that fisheries is just one example of an activity that may stress a marine ecosystem. Dr. Martone added that cumulative impacts work done to date elsewhere has included fishing, climate, land-based impacts (pollution and sedimentation); for some systems, land-based stressors are correlated with responses.

#### AGENDA ITEM 5

##### **Interactions with other PICES groups**

This item was largely covered by the discussions and responses of WG 28 to the questions posed by Science Board (see Agenda Item 2).

#### AGENDA ITEM 6

##### **Plans for primary publications resulting from the WG 28 report**

This item was deferred.

#### AGENDA ITEM 7

##### **Other business**

It was noted that the FUTURE OSM could be useful for informal discussions amongst WG members who are able to participate, as to the evolving chapter drafts. It was suggested that a good venue for a future meeting of the WG would be in China, as a way to engage Chinese representatives on the draft report.

The meeting adjourned at 18:00 h, with the next full meeting of the WG scheduled for the PICES 2014 Annual Meeting in Yeosu, Korea.

*WG 28 Endnote 1*

**WG 28 participation list**

Members

Jennifer L. Boldt (Canada)  
Sachihiko Itoh (Japan)  
Vladimir V. Kulik (Russia)  
Jaebong Lee (Korea)  
Rebecca Martone (USA)  
Ian Perry (Canada, Co-Chair)  
Motomitsu Takahashi (Japan, Co-Chair)  
Naoki Yoshie (Japan)

Observers

Karin Baba (Japan)  
Sunkil Lee (Korea)  
Vadim Navrotsky (Russia)  
Hiroaki Saito (Japan)  
Jeong Hee Shim (Korea)  
Sinjae Yoo (PICES)  
Takafumi Yoshida (NOWPAP)



WG 28 meeting participants at PICES-2013 in Nanaimo, Canada. Left to right, back: Jeong Hee Shim, Sunkil Lee, Vladimir Kulik, Hiroaki Saito, Motomitsu Takahashi, Jennifer Boldt. Left to right, front: Jaebong Lee, Naoki Yoshie, Rebecca Martone, Ian Perry, Sachihiko Itoh.

*WG 28 Endnote 2*

**WG 28 meeting agenda**

1. Welcome, Introduction and sign-in (all) – including introductions of new Working Group members (co-chairs; see *WG 28 Endnote 3* for list of WG members)
2. Review of activities during the 2<sup>nd</sup> year of WG 28
  - a) General review of Terms of Reference (see Appendix 3) plus discussion of expectations for the Working Group by PICES, and what we expect to be able to deliver (all)
  - b) Report on participation and presentation by WG28 in NOWPAP Workshop (Kulik); [see PICES Press July 2013 article: [http://www.pices.int/publications/pices\\_press/volume21/v21-n2/pp\\_28-29\\_NOWPAP-Wsh.pdf](http://www.pices.int/publications/pices_press/volume21/v21-n2/pp_28-29_NOWPAP-Wsh.pdf), also meeting report on WG28 web page: [http://www.pices.int/members/working\\_groups/materials/WG-28-2013-Report-from-NOWPAP-MPA-Workshop.pdf](http://www.pices.int/members/working_groups/materials/WG-28-2013-Report-from-NOWPAP-MPA-Workshop.pdf).



- c) Report on participation and presentation by WG28 to PICES Inter-sessional Science Board meeting, and at ICES/PICES workshop on Climate Change Effects on Marine Ecosystems (SICCME) (Takahashi)
  - d) Report on additional WG 28 session proposals, at 2014 PICES FUTURE Open Science Meeting (Perry), and submitted for 2014 PICES Annual Meeting (Martone/Samhouri)
  - e) Brief outline of WG 28-convened session at 2013 Annual Meeting later in the week (Session S8, titled “Ecosystem indicators to characterize ecosystem responses to multiple stressors in North Pacific marine ecosystems”)
  - f) Report on the project MEcoPAM, which focuses on the impact of multi-stressors on the sustainability of marine ecosystem production in China (discussion led by Takahashi, with input from Chinese WG members)
  - g) Other related WG28 activities?
3. Review of progress on Terms of Reference  
General discussion of how far we have progressed in addressing our ToR – which have we covered, which have we still to do? To include brief reports from each country of activities of importance to WG 28.
  4. Presentations on outlines for each of the draft report chapters, and plans for moving these ahead.  
Lead authors for the various chapters in our draft report outline are requested to present and lead a discussion of their proposed chapter outline, *i.e.*, contents, contributors and task assignments, timelines. Additional contributors (in particular among new WG members or those not able to participate in Hiroshima) are welcome:
    - a) Chapter 2 “Frameworks linking pressures to impacts and changes in North Pacific marine ecosystems”, and “Multiple pressures on North Pacific marine ecosystems” (discussion leads: Perry, Takahashi)
    - b) Chapter 3 “Ecosystem indicators” and “Indicators for ecosystem responses to multiple pressures” [discussion leads: Boldt, Samhouri, Itoh, Yoshie, Chung, others (?)]
    - c) Chapter 4 “Case study examples”:  
Inland seas, *e.g.*, Salish Sea (Strait of Georgia; Puget Sound), Seto Inland Sea (discussion leads: Samhouri, Perry, Takahashi)  
High latitude seas, *e.g.*, possibly Sea of Okhotsk, Bering Sea (discussion leads: Kullik, Zador, Lukyanova)
    - d) Re-look at proposed report chapter outline – are any topics missing (*e.g.*, reference points/tipping points – or could that be added to Chapter 3)?
    - e) Conclusions and recommendations – can we begin to identify any of these now? (discussion leads: co-chairs)
  5. Discussion of interactions with other PICES groups (co-chairs)
    - a) Relationships between WG28 and other Working Groups and Committees
    - b) Contributions to FUTURE
  6. Discussion of plans for primary publications resulting from the WG 28 report (Samhouri)
  7. Any other business

18:00 End

*WG 28 Endnote 3*

**WG 28 members as of September 2013**

Dr. Jennifer L. Boldt (Canada)	Prof. Ik Kyo Chung (Korea)
Dr. Ian Perry (Canada, WG 28 Co-Chairman)	Dr. Jaebong Lee (Korea)
Prof. Min Chao (China)	Prof. Chang-Ik Zhang (Korea)
Dr. Baisong Chen (China)	Dr. Vladimir V. Kulik (Russia)
Dr. Honghui Huang (China)	Dr. Olga N. Lukyanova (Russia)
Dr. Chaolun Li (China)	Dr. Rebecca G. Martone (USA)
Prof. Cuihua Wang (China)	Dr. Jameal F. Samhoury (USA)
Dr. Heng Zhang (China)	Dr. Stephani G. Zador (USA)
Dr. Shigeru Itakura (Japan)	
Dr. Sachihiko Itoh (Japan)	
Dr. Motomitsu Takahashi (Japan, WG 28 Co-Chairman)	
Dr. Naoki Yoshie (Japan)	

*WG 28 Endnote 4*

**Terms of Reference**

1. Identify and characterize the spatial (and temporal) extent of critical stressors in North Pacific ecosystems both coastal and offshore and identify locations where multiple stressors interact. Identify trends in these stressors if possible.
2. Review and identify categories of indicators needed to document status and trends of ecosystem change at the most appropriate spatial scale (e.g., coastal, regional, basin).
3. Using criteria agreed to at the 2011 PICES FUTURE Inter-sessional Workshop in Honolulu, determine the most appropriate weighting for indicators used for:
  - a. documenting status and trends
  - b. documenting extent of critical stressors
  - c. assessing ecosystem impacts/change
4. Review existing frameworks to link stressors to impacts/change, assessing their applicability to North Pacific ecosystems and identify the most appropriate for application to North Pacific ecosystems.
5. Determine if ecosystem indicators provide a mechanistic understanding of how ecosystems respond to multiple stressors and evaluate the potential to identify vulnerable ecosystem components.
6. For 1-2 case studies, identify and characterize how ecosystems respond to multiple stressors using indicators identified above. Are responses to stressors simply linear or are changes non-linear such that small additional stressors result in much larger ecosystem responses? Do different parts of the ecosystem respond differently (e.g., trophic level responses)? How do stressors interact?
7. Publish a final report summarizing results with special attention to FUTURE needs. This WG will focus primarily on delivery of FUTURE Questions 3 and 1 (outlined below).

**Linkages to the FUTURE Science Plan:**

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?

**WG 28 Endnote 5****WG 28-sponsored session at the FUTURE Open Science Meeting, Hawaii, April 2014*****Identifying multiple pressures and system responses in North Pacific marine ecosystems***

Co-convenors (alphabetically): Vladimir Kulik (Russia), Rebecca Martone (USA), Ian Perry (Canada), Jameal Samhouri (USA), Motomitsu Takahashi (Japan)

Coastal and offshore marine ecosystems of the North Pacific are impacted by increasing temperature, changing iron supply, harmful algal bloom events, invasive species, hypoxia/eutrophication and ocean acidification. These multiple pressures can act synergistically to change ecosystem structure, function and dynamics in unexpected ways that differ from single pressure responses. It is also likely that pressures and responses will vary geographically. A key objective of the FUTURE program is to identify and characterize these pressures in order to facilitate comparative studies of North Pacific ecosystem responses to multiple stressors and how these systems might change in the future. This session has two primary objectives: 1) to identify key stressors and pressures on North Pacific marine ecosystems, and to compare how these stressors/pressures may differ in importance in different systems and how they may be changing in time; and 2) to identify ecosystem responses to these multiple stressors and pressures, including gaining an understanding of how natural and human perturbations may cascade through ecosystems, and whether there may be amplifiers or buffers which modify the effects of perturbations on marine systems. Papers using conceptual, model-based, observation-based, or experimental-based approaches are welcome, as well as papers which evaluate approaches to linking pressures to ecosystem changes, such as pathways of effects or driver-pressure-state-impact-response models. The overall goal of this session is to obtain an overview of the pressures being experienced by North Pacific marine ecosystems, how these pressures may be changing with time, variation in these pressures (both singly and in combination) among regions, and the combined effects of pressures, both now and in the future, on the marine ecosystems of the North Pacific.

**WG 28-sponsored workshop at the FUTURE Open Science Meeting, Hawaii, April 2014*****Bridging the divide between models and decision-making: The role of uncertainty in the uptake of forecasts by decision makers***

Convenors: Harold Batchelder (USA), Kai Chan (Canada), Edward Gregr (Canada), Shin-ichi Ito (Japan), Vladimir Kulik (Russia), Naesun Park (Korea), Ian Perry (Canada), Jameal Samhouri (USA), Motomitsu Takahashi (Japan)

Uncertainty is a key theme of the FUTURE program. Scientific uncertainty extends beyond the outputs of oceanographic or ecosystem models and has significant consequences on human dimensions ranging from public and stakeholder perception to tactical and strategic decision making by managers and policy makers. The workshop will consider uncertainty along the entire path from data, through model design and implementation to communication and uptake of results by decision makers. Such end-to-end consideration of uncertainty is critical to improve the uptake of oceanographic model results by stakeholders and decision makers in all PICES member countries, particularly as the modeling community moves towards end-to-end models, and faces the challenges of managing multiple stressors. This workshop will thus bridge two central themes of the FUTURE Open Science Meeting: quantification and measurement of uncertainty in observations and projects, and communication and engagement in the development and dissemination of FUTURE products.

The workshop will be centered on two themes. The first of them concerns input data, model structure, and parameterization, and will focus on how sources of uncertainty can be articulated and presented on a technical level. This theme challenges the modeling community to explain the credibility of their results, articulate their assumptions, and generally expose sources of uncertainty. Models of any topic including stock assessment, ecosystem dynamics, and cumulative effects are welcome. The second theme will consider decision analysis and decision making, including psychological insights into how people perceive, understand, and incorporate complex information into decision-making. Discussions will focus on:

(1) how FUTURE can best articulate uncertainty assessments, and develop a communication strategy to broaden the engagement of the public, communities, decision makers and other stakeholders in the results emerging from FUTURE; and (2) how FUTURE products can link to coastal communities, with an emphasis on how and to what degree these products are relevant to the communities whose decisions they presume to affect. This includes the fundamental challenge of how to scale FUTURE scientific outputs with impacts on human dimensions, generally considered at more local extents. This theme in particular will consider approaches to communicate the value of FUTURE products beyond the natural science community. Potential topics of additional discussion include outreach to other disciplines (e.g., psychologists and anthropologists) with the intent of developing more insightful and applicable interdisciplinary outputs and strategies for presenting FUTURE products to the broader, international stakeholder community. From this workshop, we plan a primary publication outlining how FUTURE products can be effectively communicated to the intended audiences.

**WG 28 Endnote 6**

**Proposal for a 1-day Topic Session on**

***“Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystem” at PICES-2014***

Co-sponsors: ICES, IMBER

Co-Convenors: Rebecca G. Martone (USA), Ian Perry (Canada), Jameal Samhouri (USA), Motomitsu Takahashi (Japan), Maciej Tomczak (Poland), Chang Ik Zhang (Korea)

Many coastal and marine ecosystems, ranging from reefs to estuaries to pelagic systems, are exposed to multiple stressors, which can lead to rapid changes with significant, long-term consequences that are often difficult to reverse. Changes in ocean climate, the abundance of key species, nutrients, and other factors drive these shifts, which affect ocean food webs, habitats, and ecosystem functions and people's livelihoods and well-being. Determining indicators of ecological changes due to multiple stressors and defining reference points for those indicators are key steps for managers to avoid ecological degradation and loss of key goods and services. Setting ecological reference points in ecological systems presents a challenge to resource managers because (a) reference points are often difficult to determine due to the complexity of natural systems, including the presence of thresholds, tipping points, and non-linearities; (b) the paucity of theoretical modeling and empirical understanding needed to address these complexities, identify ecological thresholds and develop early warning indicators means that managers must make decisions based on high levels of uncertainty; and, (c) many institutional and governance structures do not allow managers the necessary flexibility to take up this information and react within relevant timeframes. This session will address these pressing challenges, and explore promising approaches to tackling them with the goal of catalyzing new research and management innovation. In particular, we invite presentations that (i) define the conceptual basis for reference points and management objectives surrounding reference points; (ii) use theoretical, modeling and observational approaches to identify potential reference points for indicators of changes in marine ecosystems; (iii) incorporate risk and sources of error (measurement, model, process) in such analyses; (iv) discuss how reference points may be used in helping to manage marine ecosystems, specifically in relation to the decision-making process related to evaluating and deciding on acceptable levels of risk. These discussions will be guided by the FUTURE science themes, with special attention to examining climate and anthropogenic drivers of ecological change, and identifying early warning indicators to enable forecasting to avoid crossing ecological thresholds. The outcomes will contribute to the work of PICES Working Group 28 on Development of ecosystem indicators to characterize ecosystem responses to multiple stressors.

**WG 28 Endnote 7****Updated and revised (draft) outlines for each chapter of WG 28 final report**

(revised from the version originally developed at the WG 28 meeting at PICES-2012 in Hiroshima)

General Outline*Chapter 1. Introduction* (Co-Chairs: Takahashi/Perry)

- Background to the WG
- ToR/Objectives
- Brief overview of the issue of multiple activities/stressors on marine ecosystems
  - *e.g.*, use of the phrase “activities/stressors (or “pressures”) to indicate both natural and anthropogenic pressures, and that not all of these are always “bad” for the ecosystem. Define what is a “bad” ecosystem? – *e.g.*, different objectives for ecosystem states, what is “bad” varies for fishers vs conservationists. Perhaps recommend the broader concept of retaining the natural resilience of ecosystems?
  - Include definitions for “stressors”. Note the issue that information to construct indicators is often available at multiple but different time and space scales, *etc.*
  - Brief literature review of problems of multiple and cumulative stressors in marine systems – *e.g.*, the norm, but difficult to assess more than 2–3 stressors at one time
    - presentation by Dr. Coté in Session S8 later in this PICES meeting provides an excellent overview and access to key literature.
    - include reference to climate change and fishing issues (*e.g.*, age structures are truncated and this can create problems with resilience to climate change).
    - two general types of approaches:
      - mesocosm experiments,
      - whole ecosystem studies and statistical methods.
- Organization and guide to report contents

*Chapter 2. Multiple stressors on North Pacific marine ecosystems* (Perry, Takahashi, Samhour, Zhang, Lee, Martone, others welcome!)

- Frameworks linking pressures to impacts and changes in North Pacific marine ecosystems (*e.g.*, PICES Session S10 at 2012 Annual Meeting in Hiroshima)
  - brief review of potential frameworks that could be used to link activities and stressors to ecosystem responses,
  - assessment of their applicability to North Pacific marine ecosystems,
  - recommendations for applications.
  - *e.g.*,
    - Pathways of Effects
    - Driver-Pressure-States-Impact-Response models,
    - simulation and other analytical modeling approaches, *e.g.*, Ecopath with Ecosim,
    - probabilistic (Bayesian) networks,
    - Integrated Ecosystem Analyses,
    - IFRAME, INVEST,
    - others?
- Multiple pressures on North Pacific marine ecosystems
  - identification of the spatial (and temporal, where possible) extent of important activities and stressors in North Pacific marine ecosystems,
  - identify habitats and general locations (if possible) where multiple stressors overlap,
  - identify trends in these activities/stressors if possible,
  - use existing literature as a starting point, but also build on own analyses.
- Sub-sections of this chapter for each PICES country, preferably using a common approach (???), plus a synthesis section. Or perhaps these might be included in the case studies?

*Chapter 3 Ecosystem Indicators for multiple stressors (Boldt, Samhouri, Itoh, Yoshie, Chung, Martone, others?)*

- A. Chapter Introduction
  - Identify need to include indicators of multiple stressors when evaluating the state of marine ecosystems.
  - Purposes of chapter:
    - review existing indicators,
    - review potential sources of data available from national and international programs,
    - indicator-selection criteria, and
    - approaches for evaluating indicators.
- B. Review of indicators in literature
  - General definition of indicators
  - General categories of indicators:
    - Human, biological (including trophodynamics), environmental, socio-economic-political,
    - State and trend,
    - Fulton (2003): strong, intermediate, and weak indicators.
  - Examples of indicators:
    - PICES Scientific Report No. 37:
      - Relative biomass, *e.g.*, top predators,
      - Biomass ratios, *e.g.*, Piscivore:planktivore,
      - Habitat-forming taxa, *e.g.*, proportional area covered by epifauna,
      - Community size spectra slopes,
      - Taxonomic diversity (richness),
      - Total fishery removals,
      - Maximum (or mean) length of species in catch,
      - Size-at-maturity,
      - Trophic level or trophic spectrum of the catch,
      - Biophysical characteristics, *e.g.*, temperature, chlorophyll a.
    - IndiSeas1 (focused on effects of fishing):
      - Mean length,
      - Trophic level of landed catch,
      - Proportion under/ moderately exploited species,
      - Proportion predatory fish,
      - Mean life span,
      - 1/CV biomass,
      - Biomass of surveyed species,
      - 1/landings/biomass.
    - IndiSeas2 (in addition to IndiSeas1 indicators; expanded to include effects of environment and indicators of human dimensions)
    - Environmental indicators: SST, Chl-*a*, global and regional climate
    - Human dimensions indicators:
      - Effectiveness, efficiency and fairness of fisheries management and quality of governance,
      - Contribution of fisheries to food provision, economic and social well being,
      - Well being and resilience of fisher communities.
    - Biodiversity indicators:
      - Mean intrinsic vulnerability index of fish catch,
      - Trophic level of the community,
      - Mixed trophic index ( $TL \geq 3.25$ ),
      - Proportion of exploited species with declining biomass,
      - Relative abundance of flagship species,
      - Discards/landings.
- C. Indicator Selection Criteria
  - Rice and Rochet (2005) 8-step process for selecting a suite of ecosystem indicators:
    - Step 1 determine user needs,
    - Step 2 develop list of candidate indicators,
    - Step 3 determine screening criteria,
    - Step 4 score candidate indicators against screening criteria,

- Step 5 summarise scoring results,
- Step 6 decide how many indicators are needed,
- Step 7 make final selection,
- Step 8 report on chosen suite of indicators.
- PICES 2011 FUTURE workshop criteria (each criterion should be weighted for relevance to end user identified):
  - available regularly and in a timely manner,
  - available as a time series,
  - statistical properties are understood and provided,
  - related to attribute either empirically or theoretically,
  - specific to attribute,
  - spatial and temporal scales of indicator appropriate to attribute,
  - responsive (sensitive to perturbation),
  - relevant to objective,
  - understandable by target audience,
  - provides a basis for comparison between ecosystems.
- D. Indicators of ecosystem responses to multiple stressors
  - Approaches:
    - Halpern *et al.* (2007, 2008, 2009), Teck *et al.* (2010) – cumulative impact scores,
    - Samhuri and Levin (2012).
    - IndiSeas2 exploring approaches to integrating/combining indicators (Shin *et al.*, 2012):
      - scoring approach to aggregate all indicators into a single indicator,
      - multidimensional approach,
      - multi-criteria decision analysis.
  - Ban:
    - Data-based: Meta-analysis,
    - Expert-based elicitation,
    - Combined above, spatial: Regional mapping, GIS approaches,
    - Experimental,
    - Model-based.
  - Evaluation of indicators to identify vulnerable ecosystem components
    - despite pros and cons of each approach there is a need to use multiple approaches (expert elicitation, model-based simulation, and empirical analysis) to identify and evaluate critical multiple stressors of North Pacific marine ecosystems and indicators to assess their impacts.

#### Chapter 4. Case Studies

- Coastal systems (using Strait of Georgia, Canada, Puget Sound (US), Seto Inland Sea (Japan)
  - e.g., Perry *et al.* S8 presentation (but at the moment development of Indicators is lacking)
- Possibly: Sea of Okhotsk, Bering Sea (?Lukyanova, Kullik, Zador?)

#### Chapter 5. Conclusions and recommendations (drafted by Co-Chairs but developed by all WG 28 members)

#### Appendices

1. Terms of Reference
  2. Membership
  3. Reports of sessions held by WG 28
- etc.*

## Report of Working Group 29 on *Regional Climate Modeling*

The second business meeting of working group (WG 29) on Regional Climate Modeling (RCM) was held in Nanaimo, Canada, on October, 12, 2013 preceding the PICES Annual Meeting. With 17 members and observers in attendance (*WG 29 Endnote 1*), the meeting agenda included an introduction to WG 29 by Co-Chairmen, Drs. Enrique Curchitser and Chan Joo Jang's brief overview to each member nation Regional Climate Modeling (RCM) activity. After short presentations by the RCM working group members, the members discussed some emerging RCM issues, plans and schedule of future activity and preparation of the group's final report. Below are the agenda items (*WG 29 Endnote 2*) and the corresponding discussion of the meeting.

### AGENDA ITEM 1

#### **Welcome and self-introductions**

1. Pre-meeting social to allow members to interact.
2. Introduction to WG-29 activities by Drs. Jang, Curchitser, and Chang
3. Everyone introduced themselves (including new WG 29 members Drs. Panjun Du (China) and Young Ho Kim (Korea) (attendee sheet was circulated)

### AGENDA ITEM 2

#### **WG 29 activities**

Dr. Curchitser reviewed WG 29's terms of reference and first meeting in Hiroshima, Japan (2012) after which the group discussed emerging issues arising from that meeting.

#### *Regional Climate Modeling 2nd workshop*

Dr. Kyung-Il Chang reported on the second Regional Climate Modeling workshop held September 10–12, 2013 in Busan, Korea. Dr. Skip McKinnell has distributed a draft article of the workshop which will be published in the PICES Press newsletter (Vol. 22, No. 1, Winter 2014). The 3-day workshop was attended by more than 40 participants and comprised 9 mesoscale and sub-mesoscale presentations on Day 1, 9 RCM presentations on Day 2, 3 climate variability presentations on Day 3, and 7 posters.

Important discussions:

- At what resolution do models converge?
- How useful are idealized models?
- How important are sub-mesoscale processes for climate?
- What can be learned from 1-way nesting?
- RCM-3 could focus on physical-biological and ocean-atmosphere coupling.

#### *WG 29 proposals for 2014 FUTURE Open Science meeting and 2014 PICES Annual Meeting*

WG 29's proposal for a Topic Session on "*Regional climate modeling in the North Pacific*" to be convened by Drs. Curchitser and Jang, was accepted by the OSM SSC and will be held on Day 1 of the FUTURE Open Science Meeting (April 15–18, 2014, Kohala Coast, Hawaii). A proposal for a Topic Session (*WG 29 Endnote 3*) by the same name was submitted by Dr. Jang for PICES-2014 (October 17–26, 2014, Busan, Korea).



AGENDA ITEM 3

**Updates on national RCM activities**

1. **Panjun Du (China):** *Forecasting activities and issues in the East China Sea*

Dr. Du described the modeling activities relating to the East China Sea and the issues relating to forecasting there. In particular he described:

- Storm surge and wave forecasting carried out by six regional divisions,
- Data availability from buoy and coastal observing systems,
- Regional ocean model applications using FVCOM:
  - mari-culture application; tide and sandbar forecasting,
  - Shanghai – saltwater intrusion into Yangtse River in the dry season,
  - Storm surges around Zhou Shan Island – high resolution unstructured grid,
  - Temperature rise in Xiangshan harbour (power stations),
  - Future work and improvements.

2. **Hiroshi Kuroda (Japan):** *regional ocean model forecasting and hindcasting around Japan*

Dr. Kuroda described the modeling activities with the FRA implementation of the ROMS model. Specifically he described:

- ½ and 1/10 degree resolution implementations for the western Pacific; some finer 1/50 degree (sub-mesoscale) for Kuroshio and Hokkaido, 3DVar and scale-selective data assimilation – spectral nudging (for spatial scales > 100 km) for large domain model,
- The various models are also being applied for fisheries science.

3. **Shin-ichi Ito (Japan):** *Water temperature forecasts for cultured scallops in Mutsu Bay, Japan*

Dr. Ito spoke about water temperature forecasts for cultured scallops in Mutsu Bay.

- In 2010 record high temperatures resulted in high scallop mortality,
- Anti-estuary circulation due to anomalous winds was responsible for the mortality,
- A ROMS nested model was implemented down to 1/160 and 1/240 degrees and used to identify conditions that resulted in the anti-estuarine circulation.

4. **Chan Joo (Korea):** *RCM development around Korea and CMIP5 analysis*

Dr. Joo discussed the following topics in his presentation:

- Large resource (personnel and computing) requirements are required,
- Coupled atmosphere-ocean model used for NW Pacific; NPZD model for EJS,
- MLD analyses: CanESM2, RCP4.5 so far but more models to come,
- Multi-bias analysis suggests no improvement with CMIP5.

5. **Young Ho Kim (Korea):** *climate and regional ocean reanalysis from data assimilation system of KIOST*

- Ensemble optimal interpolation is used for DA (computational demands not as high as other approaches),
- Compared with global climatology, SST in Nino3.4 region, TS cross-sections along 160° and 180°E,
- New open boundary conditions for their model, MOMp1,
- Plan to set up regional ocean forecasting system.

6. **Jerome Fiechter (USA):** *Role of Eastern Boundary Current regions in global carbon cycles*

Dr. Fiechter presented results from recent work with a coupled bio-physical regional model for the California Current System. His presentation focused on the model implementation and some early results from that work that included:

- California Current System: ROMS + NEMURO,
- Effect of different horizontal resolutions,
- OCMIP air–sea CO<sub>2</sub> exchange,
- Shelf vs offshore regions,
- More detailed talk on Wednesday (S4),

- Sees daily variability,
- Outgassing in upwelling zone,
- 30km resolution bad, 10km ok, 3km good,
- Map of outgassing vs equilibrium,
- Coastal representation (capes) and bathymetry important,
- Differences in northern and southern CCS for carbon budget,

7. **Dimitry Stepanov (Russia): Numerical study of low frequency variability in JES circulation**

- Ocean model used is INMOM,
- Showed mean circulation at 500m and 1500m; relative vorticity.

8. **Michael Foreman (Canada): Regional ocean climate model projection for the British Columbia continental shelf**

Dr. Foreman discussed the results from two papers that were accepted in Atmosphere-Ocean which focus on regional projections for the British Columbia coast.

9. **Kyung-Il Chang (Korea): WG 29 FUTURE contributions**

- 4 (Julie Hall, Manuel Barange, Phillip Mundy, Hiroaki Saito) out of 6 potential members were in place for the FUTURE Evaluation Team that will meet immediately after the Open Science Meeting to evaluate FUTURE's progress.
- FUTURE products are important, so:
  - How to link WG 29 products to other expert groups?
  - How to identify gaps in FUTURE beyond 2014?
  - In WG 29 final report, need to add summary on how we addressed FUTURE questions.
  - Can we prepare database of future projections (same scenario?):
    - ✓ Perhaps for California Current region (Curchitser), Korea (Jang and/or Chang), Japan (Ito and Kuroda), BC (Foreman)
    - ✓ Need to talk to TCODE (Shevchenko)

The 3<sup>rd</sup> international symposium on "Effects of climate change on the world's oceans" will take place March 23–27, 2015, in Santos, Brazil. The deadline for symposium theme session and topic suggestions is October 2013. ICES currently has proposed over a dozen topics. Dr. Shoshiro Minobe suggested two topics on:

- impact of climate variability and change on nutrient distributions,
- validation and utilization of earth system models to RCMs.

It was also suggested that a third RCM workshop ( RCM3) be held in conjunction with the symposium (jointly with ICES).

AGENDA ITEM 4

**WG 29 final report**

Dr. Joo presented ideas for a final WG report and along with specific section assignments, will email them to the members. Also discussed was the strategy for data archiving model results that would be available to PICES users:

- What would it entail? Could it be hosted by PICES/TCODE?
- Produce monthly average 3D T, S, velocity, contemporary and future fields? (FUTURE outlooks)
- Do we adopt a unified format and create scripts to facilitate export (would require a lot of work, who?), or do we re-direct users to portals (Japanese, Korean, etc.) for each set of output?
- Important parameters (MLD, nutrients) can come from CMIP5 (Chan Joo Jang, Shoshiro Minobe, Jim Christian already producing), RCM values.

## WG 29-2013

### AGENDA ITEM 5

#### WG 29 term extension

The last item proposed by the Co-Chairs and discussed by the group was whether to request a one-year extension to the Working Group. The main reason for the extension is to be able to participate in the upcoming PICES/ICES/IOC symposium in Brazil, where a session on regional modeling was proposed. With the group's agreement, the Co-Chairs agreed to present the request in the POC Committee meeting.



WG 29 meeting participants (left to right): Hiroshi Kuroda, Arthur Miller, Emanuele Di Lorenzo, Shin-ichi Ito, Young Ho Kim, Xingrong Chen, Panjun Du, Angelica Peña, Enrique Curchitser, Elena Ustinova, Kyung-II Chang, Dmitry Stepanov, Chan Joo Jang, Michael Foreman, Hal Batchelder, and Jerome Fiechter.

#### *WG 29 Endnote 1*

#### WG 29 participation list

##### Members

Chan Joo Jang (Korea, Co-Chairman)  
Enrique Curchitser (USA, Co-Chairman)  
Dmitry V. Stepanov (Russia)  
Jerome Fiechter (USA)  
Shin-ichi Ito (Japan)  
Hiroshi Kuroda (Japan)  
Kyung-II Chang (Korea)  
Elena Ustinova (Russia)  
Angelica Peña (Canada)  
James Christian (Canada)  
Michael Foreman (Canada)  
Young Ho Kim (Korea)  
Panjun Du (China)

##### Observers

Harold (Hal) Batchelder (USA)  
Xingrong Chen (China)  
Emanuele Di Lorenzo (USA)  
Arthur Miller (USA)

**WG 29 Endnote 2****WG 29 meeting agenda**

1. Welcome and self-introductions including introduction of new WG 29 members (Drs. Panjun Du (China) and Young Ho Kim (Korea)) (Co-chairs)
2. Introduction to WG 29 activity (Jang, Curchitser, Chang)
  - a. Brief introduction of WG 29 including Terms of Reference (Jang)
  - b. Review of the first meeting of WG-29 in Hiroshima, Japan (Curchitser)
  - c. Report on the Regional Climate Modeling 2nd workshop in Busan, Korea (Chang)
  - d. Report on WG29 workshop proposals for 2014 Open Science meeting and for 2014 PICES Annual Meeting (Jang)
3. Short update by each member of their nation RCM activity (WG 29 members)
4. Discussion on preparation and timeline of WG 29 final report, and specific plans and schedule (Co-Chairs)
5. WG 29 term extension

**WG 29 Endnote 3**

**Proposal for a 1-day Topic Session on  
 “Regional climate modeling in the North Pacific” at PICES-2014**

Regional climate models are a key scientific tool for understanding climate change at regional to local scale, which is highly relevant to considerations for many socio-economic impacts. Despite the apparent limitations associated with errors in forcing fields and uncertainties in downscaling techniques, regional climate models continue to provide critical information for regional climate change by filling the gap between projections by global climate models and demand for developing adaptation and mitigation strategies at highly resolved scales. This session calls for papers addressing the recent efforts for regional climate modeling such as developing novel approaches for dynamic downscaling, comparison between regional and global climate model results, detection and evaluation of regional climate changes in the North Pacific Ocean simulated by regional and global climate models, assessment of their uncertainty, and coupling of regional climate models with other Earth system model components such as biogeochemical and ecological models. The session aims to assemble and share existing expertise in recent efforts to regional climate models by providing a platform to discuss their limitations and reliability.

Sponsoring Committees/Program: POC/TCODE/FUTURE

Convenors: ChanJoo Jang (Korea), Enrique Curchitser (USA), Michael Foreman (Canada), Kyung-II Chang (Korea), Shin-ichi Ito (Japan), Angelica Peña (Canada), Hyodae Seo (USA)

## **Report of the Working Group on Assessment of Marine Environmental Quality of Radiation around the North Pacific**

The first business meeting of Working Group (WG 30) on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (AMR) was held in Nanaimo, Canada, on October 13, 2013. Interim Chairman, Dr. Yusheng Zhang (ys.zhang@163.com), welcomed 18 members and observers (*WG 30 Endnote 1*) and formally declared the first meeting of WG 30 was opened (at 18:00). The agenda (*WG 30 Endnote 2*) included an introduction to the establishment and objectives of WG 30 by Dr. Yusheng Zhang. Participants gave a brief overview of their activities. Discussion then moved to selecting co-chairmen and plans and schedule of future activities.

### AGENDA ITEM 1

#### **Establishment of WG 30**

The Chairman noted that WG 30 was formally established on August 14, 2013, for a three-year term after being approved by Governing Council. The proposal to set up the WG was made by the People's Republic of China during the PICES-2012 in Hiroshima, Japan.

### AGENDA ITEM 2

#### **Working Group members**

Dr. Yusheng Zhang noted that WG members from five member countries including Canada, People's Republic of China, Japan, Republic of Korea and the United States of America were present, as were observers from PICES secretariat and member countries. The Chair of WG 30's parent Committee (MEQ), Mr. Chuanlin Huo, was also in attendance.

### AGENDA ITEM 3

#### **Recommendation of Co-Chairs**

The recommendation of co-chairs for the WG was discussed and Drs. Yusheng Zhang (China) and Kathryn Higley (USA, Kathryn.Higley@oregonstate.edu) were recommended by the WG members.

### AGENDA ITEM 4

#### **Review of Work Plan**

WG members were invited to review the Work Plan through brief presentations given by each member country. After discussion, the members agreed to revise the Work Plan according to the Terms of Reference (*WG 30 Endnote 3*) in the coming months.

### AGENDA ITEM 5

#### **Goals for the coming year**

Members discussed several goals which needed to be met by WG 30 during the next year. They agreed that the next WG 30 business meeting should take place in advance of PICES-2014 in Yeosu, Korea. They also agreed that this WG meeting should be at least of 1.5 days duration and occur at the location of the 2014 meeting. The purpose of the meeting will be for members to share data, compile results, and begin preparation of draft reports required under the Work Plan. In addition, the WG members will revisit the Work Plan to

## **WG 30-2013**

assess compliance with goals of the Plan and the Terms of Reference. WG 30 members want to be given the opportunity to present data at the Annual Meeting. The Co-Chairs will remind members, several months before the meeting, of the need to submit abstracts for the 2014 meeting, most likely within the MEQ paper session. A decision whether or not to hold a workshop or topic session at PICES-2015 will be determined through correspondence between WG members prior to PICES-2014. Members agreed to establish a means to share data during the next year – through email or a web-based method. This will be determined in the next three months. Members also agreed to provide a description of their organization's research activities that relate to the Work Plan. This information will be shared between all WG members during the next year. Finally, WG 30 will discuss the Work Plan via email during the next 6 months and identify any issues or concerns that need to be addressed with the PICES Secretariat.

### **AGENDA ITEM 6**

#### **Actions requested of MEQ/Science Board**

The Co-Chairs request support for a meeting of WG 30 at PICES-2014 of 1.5 days (total) to be scheduled right before the 2014 meeting (Friday/Saturday)

### **AGENDA ITEM 7**

#### **Closing remarks and announcements**

The meeting was recessed at 18:30 on October 13, 2013, and reconvened at 18:00 on October 15, 2013. It was adjourned at 19:00 on October 15, 2013 by the Co-Chairs after announcements related to logistics of the next WG 30 meeting were made.

*WG 30 Endnote 1***WG 30 participation list**Members

Kathryn Higley (USA, Co-Chairman)  
 Suk Hyun Kim (Korea)  
 John N. Smith (Canada)  
 Tomowo Watanabe (Japan)  
 Yusheng Zhang (China, Co-Chairman)

Observers

Keyseok Choe (PICES Secretariat)  
 Jinqiu Du (China)  
 In-Seong Han (Korea)  
 Chuanlin Huo (China, MEQ Chairman)  
 Dong-Woon Hwang (Korea)  
 Shigeru Itakura (Japan)  
 Peter J. Kershaw (UK)  
 Jung-No Kwon (Korea)  
 Wu Men (China)  
 Delvan Neville (USA)  
 Hiroyuki Shimada (Japan)  
 Atsushi Tsuda (Japan)  
 He Wu (China)



Participants at WG 30's first meeting, at PICES-2013 in Nanaimo, Canada. Front row (left to right): Peter J. Kershaw, Tomowo Watanabe, Yusheng Zhang, Kathryn A. Higley, Suk Hyun Kim, John Smith; back row (left to right): In-Seong Han, Hiroyuki Shimada, Jinqiu Du, Wu Men, Delvan Neville.

*WG 30 Endnote 2***WG 30 meeting agenda**

1. Establishment of WG 30
2. Working Group members
3. Recommendation of Co-Chairs
4. Review of Work Plan
5. Goals for the coming year
6. Actions requested of MEQ/Science Board by WG 30
7. Closing remarks and announcements

**Terms of Reference**

1. Determine and compare radiological doses to North Pacific marine organisms, where data are available, from natural and anthropogenic radionuclides using existing data bases, newly acquired post-Fukushima monitoring results, and state of the art dosimetric approaches.
2. Examine the utility of applying natural and artificial (Fukushima and other sources) radionuclides as tracers of circulation, ecological transfers, biogeochemical cycling and consequences of climate change in the North Pacific, including the downstream interconnectivity, with establishing link to POC or WG 29 *etc.*
3. Determine the state of the science relative to assessment and mitigation of radiological impacts to marine organisms from natural and anthropogenic releases of radionuclides into the North Pacific marine environment, including a summary of peer reviewed literature and an overview of major sources and types of radiological releases into the marine environment.
4. Foster collaboration with other expert groups, especially physical oceanographers and climate modellers, to achieve the item 1-3 goals.
5. Identify priority research requirements for knowledge gap identified in item 1-3, the impacts on marine environment from the planned expansion of nuclear facilities, other emerging nuclear issues and other sources of radionuclides in the PICES region.
6. Promote collaboration in oceanographic studies using radio-tracer distribution and exchanging available information on environmental radioactivity, and encourage joint surveys/research among PICES member countries and international organizations.
7. Contribute to FUTURE by producing report on whether radioactive pollution is an additional stressor to marine ecosystem in North Pacific Ocean.



## **Report of the NPAFC–PICES Study Group on *Scientific Cooperation in the North Pacific Ocean***

The Joint NPAFC–PICES Study Group on *Scientific Cooperation in the North Pacific Ocean* (SG-SC-NP) was endorsed by PICES Science Board at the May 2013 Inter-sessional Science Board Meeting in St. Petersburg, Russia, and was subsequently unanimously approved by PICES Member Countries. The SG-SC-NP was also endorsed by the NPAFC Committee on Scientific Research and Statistics (CSRS) at their April 2013 meeting in Honolulu. NPAFC (North Pacific Anadromous Fish Commission) is an international inter-governmental organization established to promote the conservation of anadromous stocks primarily in international waters of the North Pacific Ocean and its adjacent seas. The purpose of the Study Group is to develop a framework of enhanced collaboration between the two organizations to achieve better and/or more rapid understanding of natural and anthropogenic variability in marine ecosystems. The Study Group will review each organization's scientific needs and identify where similar key questions or scientific issues might be explored jointly by both organizations. Chairing the Study Group are Libby Logerwell (PICES, FIS Committee Chair) and Jim Irvine (NPAFC, Stock Assessment Working Group Chair, Science Sub-Committee). PICES members are: Thomas Therriault (Chairman-elect, Science Board), Skip McKinnell (PICES Secretariat), and Hiroaki Saito (FUTURE/COVE Advisory Panel Chair). NPAFC members are: Shigehiko Urawa (Science Sub-Com Chair), Alex Zavolokin (Science Sub-Committee), and Nancy Davis (NPAFC Secretariat) (*SG-SC-NP Endnote 1*).

SG-SC-NP met on October 16 during the PICES 2013 Annual Meeting in Nanaimo, Canada, under the chairmanship of Dr. James Irvine. Brief overviews of PICES and NPAFC organizational structures and scientific missions were given (*SG-SC-NP Endnote 2*).

AGENDA ITEMS 2 and 4b

### **Proposal for topic session at PICES-2014**

An SG-SC-NP Topic Session titled “*Towards improved understanding of linkages between Pacific salmon and their marine ecosystems*” and co-sponsored with FIS was submitted to FIS for approval for PICES-2014 in Yeosu, Korea. FIS approved the topic but recommended it as a workshop (*SG-SC-NP Endnote 3*). The goal of this workshop will be to focus on one (or more) questions(s) of mutual interest, such as: Where do Asian chum salmon spend their winters and why; and how is it likely to be affected by climate change? A publication may result from the workshop.

AGENDA ITEMS 3

### **Scientific needs and overlapping issues**

Scientific needs and overlapping issues that might be explored jointly by both organizations were discussed. Possible questions of mutual interest are: Where do salmon go in the winter and why; and how might this be affected by climate change? How can we improve our ability to forecast salmon production? What determines salmon carrying capacity and how might this be affected by climate change?

AGENDA ITEM 5

### **Next steps to complete framework report**

The outcome of the SG-SC-NP will be a report describing a framework for scientific cooperation between the two organizations, to be completed in the spring of 2014. Next steps towards this report are to define and refine key questions of mutual interest and to describe implementation procedures. This work will be conducted by email among Study Group members and led by the Co-Chairs.

*SG-SC-NP Endnote 1*

**SG-SC-NP participation list**

Members

Thomas Therriault (PICES/Canada)  
Skip McKinnell (PICES/Secretariat)  
Hiroaki Saito (PICES/Japan)  
Shigehiko Urawa (NPAFC/Japan)  
Nancy D. Davis (NPAFC/Secretariat)  
James R. Irvine (NPAFC/Canada, Chairman)

Observers

Vladimir Radchenko (NPAFC)

*SG-SC-NP Endnote 2*

**SG-SC-NP meeting agenda**

1. Briefly review SG purpose which is: by spring 2014, to develop a framework of enhanced collaboration between the two organizations to achieve better and/or more rapid understanding of natural and anthropogenic variability in marine ecosystems.
2. Briefly review proposal for topic session at PICES-2014 (e.g. invited speakers, publication).
3. Review scientific needs and overlapping issues that might be explored jointly by both organizations including, but not limited to, the following:
  - a. Where do salmon go in the winter and why and how might this be affected by climate change?
  - b. Are episodic injections of iron and other nutrients to the surface ocean responsible for occasional returns of high abundances of sockeye salmon and pink salmon?
  - c. How to improve our ability to forecast salmon production? Role of density-independent (hard-to-predict, low frequency, high impact) and density dependent events.
  - d. What determines salmon carrying capacity and how might this be affected by climate change?
4. Review approaches to deal with these overlapping issues. For example:
  - a. Joint (modelling?) working group with regular meetings
  - b. Joint symposia/topic sessions
  - c. Joint surveys
  - d. Collaborative publications
  - e. Roles and responsibilities of individual SG members
5. Next steps to complete framework report by spring 2014
6. Other items

*SG-SC-NP Endnote 3*

**Proposal for a 1-day FIS Topic Session [later changed to a Workshop] on “Towards improved understanding of linkages between Pacific salmon and their marine ecosystems”  
(co-sponsored by NPAFC) at PICES-2014**

Pacific salmon (genus *Oncorhynchus*) are an important ecological and economic species complex widely distributed throughout the North Pacific Ocean. In recent years, there have been large, often unanticipated, fluctuations in abundance and survival that may be climate-change related. Understanding the causes of variable salmon production will be critical to predicting future abundance levels and harvest opportunities. This has been a major concern for the North Pacific Anadromous Fish Commission (NPAFC), which has responsibility for scientific research and enforcement for conserving anadromous salmon and steelhead trout in the North Pacific Ocean.

This workshop is intended to build on recommendations from a report prepared by the NPAFC/PICES Study Group in the spring of 2014. The workshop will bring together researchers in fisheries and oceanography to

improve understanding of the mechanistic linkages between salmon and their ecosystem. Of the many topics of overlapping interest between the two organizations, it is envisaged that this workshop will focus on one question: *Where do Asian chum salmon go in the winter and why, and how might this be affected by climate change?* Prior to the workshop, salmon researchers will assemble information on where chum salmon are thought to live during the winter including depth, temperature and salinity. Oceanographers and climate specialists will be provided these data prior to the workshop so that they can do preliminary work on the extent of the habitats suitable for chum salmon, both currently and subsequently based on various scenarios of climate change.

## Report of the Study Group on *Marine Pollutants*

The Study Group on *Marine Pollutants* (SG-MP; 2011–2013) met for its final business meeting under the chairmanship of Dr. Peter Ross in Nanaimo, Canada, on Saturday, October 12, 2013 (see *SG-MP Endnote 1* for list of participants). This ½-day meeting followed the workshop (W7) on “*Traditional seafoods of the Snuneymux’w First Nation in Nanaimo, BC: Insight into food, social and ceremonial uses*”.

At the meeting participants reviewed past activities of SG-MP and

- i) made changes to complete the SG-MP final report for submission to MEQ for approval;
- ii) made changes to the proposal for a new Section on *Emerging Topics in Marine Pollution* (later recommended as a Working Group by Science Board; *SG-MP Endnote 2*). Included in the list of plans for the proposed Section were Topic Sessions and workshops, which will lead to special journal issues and a contribution to the 3<sup>rd</sup> PICES North Pacific Status Report during the period 2014–2016;
- iii) finalized a proposal for a Topic Session on “*Marine debris in the ocean: Sources, transport, fate and effects of macro- and micro-plastics*” (*SG-MP Endnote 3*) for PICES-2014 in Yeosu, Korea (to be co-sponsored by NOWPAP, GESAMP and ICES).

### *SG-MP Endnote 1*

#### SG-MP participation list

##### Members

Peter S. Ross (Canada, Chairman)  
 Shigeru Itakura (Japan)  
 Won Joon Shim (Korea)  
 Staci Simonich (USA)  
 Mikhail Simokon (Russia)  
 Zijun Xu (China)

##### Observers

Hideaki Maki (Japan)  
 Karin Baba (Japan)

### *SG-MP Endnote 2*

#### Proposal for a Section on *Emerging Topics in Marine Pollution (S-ETMP)*

##### *General objectives*

Pollution can adversely affect the health and abundance of marine biota, especially in densely-populated coastal areas. The downstream socio-economic consequences can be significant, with numerous examples of consumption advisories, commercial fishery closures, commercial trade interdictions and diminished aboriginal access to food resources around the North Pacific Ocean. The protection of ecosystem health and services requires an ability to detect emerging pollutant issues before serious adverse impacts arise. Regulations, policies and other management actions resulting from marine pollution research in the past have led to dramatic declines in environmental concentrations of a number of harmful pollutants, subsequently improving the health of marine biota.

This proposed Section will provide leadership on emerging pollution issues to the PICES community, reporting through the MEQ Committee. The S-ETMP will convene a series of timely Topics Sessions and workshops, and coordinate special issues in international peer-reviewed journals. The Section will ensure the continued availability of expertise on marine pollutants within PICES, and deliver guidance to the FUTURE Advisory Panels (notably AICE and SOFE). The Section will collaborate with other PICES expert groups in

## SG-MP-2013

co-convening activities or compiling data. Importantly, the Section will address the question identified in the FUTURE Science Plan “*How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?*”

### *Terms of Reference*

1. Document and profile emerging marine pollution issues in the North Pacific Ocean within the PICES community by:
  - a. Convening Topic Sessions and workshops on new and emerging pollutants and pollution issues;
  - b. Coordinating a series of special issues in international peer-reviewed journals based on topic sessions; and
  - c. Contributing to the next edition of the PICES North Pacific Ecosystem Status Report by compiling data describing spatial and temporal trends for pollution indicators in the North Pacific Ocean.
2. Strengthen partnerships to deliver Topic Sessions/workshops and to publish special issues with:
  - a. Other PICES expert groups, especially those identified in the FUTURE Science Plan.
  - b. Other multilateral organizations, including the International Council for the Exploration of the Sea (ICES), the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), and the Northwest Pacific Action Plan (NOWPAP).

### *Proposed activities 2014–2019 (3 yr + 3 yr)*

The Section on *Emerging Topics in Marine Pollution* will engage in specific activities that will identify contaminants of emerging concern, prioritize pollutants from the many sources, and assess the relative importance of pollutants among other natural and anthropogenic stressors. Members will contribute to discussions and strategic planning with the MEQ Committee as well as through other PICES expert groups. The S-ETMP will build on the success of a number of activities carried out by the SG-MP, including two workshops (2011, Khabarovsk: *Pollutants in a changing ocean: Refining indicator approaches in support of coastal management* and 2013, Nanaimo: *Traditional seafoods of coastal aboriginal communities in the North Pacific: Insight into food, social and ceremonial uses at Snuneymux’w First Nation in Nanaimo, British Columbia*) and two Topic Sessions (2012, Hiroshima: *Environmental contaminants in marine ecosystems: Seabirds and marine mammals as sentinels of ecosystem health*; 2013, Nanaimo: *Status, trends and effects of pollutants in coastal ecosystems: Implications for wildlife and humans*). The proposal for establishing a S-ETMP will benefit from the current support of ICES and GESAMP.

### *Topic Sessions at PICES Annual Meetings*

- 2014: *Marine debris in the North Pacific Ocean: source, transport, fate and effects of macro- and micro-plastics* (solicit expert input from WG 29 on the role of ocean currents in shaping marine debris transport and fate; co-sponsored by NOWPAP, GESAMP and ICES);
- 2015: *Indicators of emerging marine pollution issues in the North Pacific Ocean* (co-convene a session with WG 28 on multiple stressors, WG 30 on radiation, and S-HD, and with support of AP-SOFE, AP-AICE and AP-MBM);
- 2016: *Sources, transport and fate of hydrocarbons in the marine environment*, including oil spills, vessel emissions, long-range transport (co-convene a session with partners to be determined, and with support of AP-AICE);
- 2017: *Climate influences on pollutant transport, fate and effects in the North Pacific Ocean* (co-convene a session with S-CCME on climate variability and change, and with support of AP-COVE);
- 2018: *Seafood safety in the Pacific Ocean: Risks vs benefits* (co-convene a session with WG 30 on radiation, S-HAB on natural toxins, and S-HD, and with support of AP-AICE).

### *Meetings/Workshops*

- 2014: S-ETMP meeting, data compilation;

- 2015: *Indicators of emerging marine pollution issues in the North Pacific Ocean* (co-convene a data compilation workshop with WG 28, and with support of AP-MBM);
- 2016: *Oil spill monitoring and characterization* (co-convene a workshop with the Korean Institute of Ocean Science and Technology (KIOST), and with support of AP-AICE);
- 2017: *Status and trend of marine pollution in the coasts of North Pacific rim* (co-convene a data compilation workshop with NOWPAP, and with support of AP-MBM);
- 2018: *Monitoring and assessment of marine pollution in the coasts of North Pacific rim* (co-convene a data compilation workshop with NOWPAP, and with support of AP-MBM).

#### *Special journal issues*

- 2015: Marine debris in the North Pacific;
- 2016: North Pacific pollution indicators;
- 2017: Source, transport and fate of hydrocarbons in the North Pacific;
- 2018: Climate-pollutant interactions in the North Pacific;
- 2019: Seafood safety in the North Pacific.

#### *Compilation of data for marine pollution*

Compiled data for marine pollution indicators and findings will be delivered to multiple PICES expert groups and in particular to AP-SOFE in support of the PICES North Pacific Ecosystem Status Report ~2016/17.

The S-ETMP will directly address the following questions of FUTURE program:

#### *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?
  - By characterizing emerging pollution priorities in the North Pacific Ocean.
- 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?
  - By documenting the impacts of emerging pollutants in the North Pacific Ocean, especially in coastal environments, and in a changing ocean environment.
- 3.3. How do multiple anthropogenic stressors interact to alter the structure and function of the systems, and what are the cumulative effects?
  - By collaborating with other expert groups to document importance of marine pollution relative to multiple stressors.
- 3.4. What will be the consequences of projected coastal ecosystem changes and what is the predictability and uncertainty of forecasted changes?
  - By developing approaches to pollutant indicators that account for climate variability and change.
  - By characterizing changing pollution risks as climate 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?
  - By prioritizing pollutant sources and types in support of source control, regulations and best practices.
  - By translating compiled data and findings through the PICES North Pacific Status Report to formats that are understandable to the general public and a wider audience.

***Proposed membership\****

Recommended Co-Chairmen: Olga Lukyanova (Russia), Peter S. Ross (Canada), Won Joon Shim (Korea), Staci Simonich (USA)

Proposed members:

John Elliott (Canada)

Zhengguo Cui (China)

Zijun Xu (China)

Ziwei Yao (China)

Shigeru Itakura (Japan)

Hideaki Maki (Japan)

Sang Hee Hong (Korea)

Hyo-Bang Moon (Korea)

Mikhail Simokon (Russia)

Joel Baker (USA)

Gina Ylitalo (USA)

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\*The additional members for the proposed Section on *Emerging Topics in Marine Pollution* will be designated by each PICES member country based on their expertise related to the Section topics.

***SG-MP Endnote 3***

**Proposal for a 1-day MEQ Topic Session on  
“Marine debris in the Ocean: Sources, transport, fate and effects of macro- and micro-plastics”  
at PICES-2014**

Co-Convenors: Won Joon Shim (Korea), Peter S. Ross (Canada), Olga Lukyanova (Russia), Sangjin Lee (NOWPAP), Peter Kershaw (GESAMP), Jesus Manuel Gago Piñeiro (Spain)

Marine debris is increasingly recognized as a threat to biota in the ocean, which can have a range of socio-economic impacts from coastal areas to the open ocean. The majority of marine debris consists of synthetic polymers, or 'plastics', which readily float on the ocean surface or are suspended in the water column. Microplastics may be attributed to the intentional manufacture of commercial products or the fragmentation of plastic products. They can increase the bioavailable fraction of marine litter and act as a vector for the delivery of intrinsic or adsorbed toxic chemicals to exposed biota. Floating, submerged and beached debris have been documented in marginal seas and the adjacent coastal zone of the North Pacific Ocean. In addition, the North Pacific Ocean Gyre is known to accumulate floating debris in what has become known as the “Great Pacific Garbage Patch”. Marine debris represents trans-boundary pollution which can also deliver associated chemicals and invasive organisms to regions far removed from source. The objective of this session is to present status and trend information for marine plastic debris pollution and its environmental consequences in the PICES region. Papers are invited that assess macro- or micro-plastic debris 1) hotspots in the PICES region, 2) source and input pathways, 3) long-range transport, 4) role as sink or source of associated toxic chemicals, and 5) biological and ecological effects. Recommendations on how to address growing problems associated with marine debris will be also considered.

## **The Advisory Panel for a *CREAMS/PICES Program* in *East Asian Marginal Seas***

The meeting of the Advisory Panel for a *Circulation Research in East Asian Marginal Seas* (AP-CREAMS) was held on October, 13, 2013 in Nanaimo, Canada. Eight Panel members and four observers, from China, Japan, Korea, Russia and USA attended the meeting (*AP-CREAMS Endnote 1*).

### AGENDA ITEM 1

#### **Opening remarks**

Dr. Kyung-Ryul Kim, Co-Chairman of AP-CREAMS, opened the meeting at 14:30 h and, after greeting participants, reviewed the agenda (*AP-CREAMS Endnote 2*). Dr. Kim stated that at least one member from all participating countries was in attendance and that the meeting could be an official AP-CREAMS meeting, and all participants agreed. He thanked all the participants and asked Dr. David Checkley to serve as the Rapporteur of the meeting.

### AGENDA ITEM 2

#### **National reports on activities and plans related to CREAMS/PICES Program**

##### *China*

Dr. Dongfeng Xu discussed the residual current observed by a Mooring Station and its importance to the Yangtze River Estuary and Adjacent Seas was explained. Studies including ship-based and mooring observations and models were used to investigate the currents. A new project has been applied to study mesoscale processes of the shelf-break in the Northern South China Sea.

##### *Japan*

No Report was presented at the meeting.

##### *Korea*

Dr. Kim reported activities associated with the Korea EAST-I project:

- To celebrate the 20<sup>th</sup> anniversary of first CREAMS expedition in 1993 an international workshop was held August 22–23, 2013 at Seoul National University.
- The R/V *Lavrentyev* Expedition will take place October 25 to November 9, 2013. Scientists will include 13 from Korea and ~ 23 from Russia. Stations will be within 37–43°N and 130–136°E.

Dr. Jae-Hak Lee reported activities associated with KIOST:

- Repeat cruises with line surveys (including T, S, DO, and chlorophyll) have taken place since October 2012 at 2-week intervals. A surface mooring has been operational since May 2012 east of Jeju-do Island (including wind, T, S, currents, DO, and chlorophyll). Surface-deep shears have been observed, with a deep southward countercurrent flow (a new finding) below the Tsushima Warm Current.
- A new program proposal has been submitted to the Ministry of Oceans and Fisheries to study physical/ecological functions in the East China Sea using time series measurements from a fixed surface buoy, repeated observations at 2-week intervals, seasonal synoptic observations, and process studies, *e.g.*, of stratification.

##### *Russia*

Dr. Yury Zuenko reported that monthly cruises have been conducted regularly in the coastal waters of Peter the Great Bay in May–October since 2007. Long-term monitoring in Amur Bay has shown a warming trend in the surface layer. Other layers show no warming or cooling trends. The Amur Bay surface is becoming warmer and saltier, but the bottom is not. Hypoxia in late summer is occurring less, perhaps due to lower productivity or upwelling. Most zooplankton is of local origin but changing, with oceanic taxa increasing in abundance. Three decades of general results exist for the coastal zone.





Participants at the AP-CREAMS/PICES workshop, held at Seoul National University, August 2013, celebrating the 20th anniversary of the CREAMS first expedition.

#### AGENDA ITEM 3

##### **Capacity building activities in 2014 and later**

The 2014 PICES International Summer School on “*End-to-End models for marine resources management and research*” is planned for August 26–29, 2014, at Seoul National University. Participating students will be both high undergraduate and graduate levels. Main course components will be an introduction to End-to-End modeling (day 1), Food-Web Models (day 2), time-dependent dynamic simulations (day 3), and space-dependent dynamic simulations (day 4). The hope is that PICES will support proposed all instructors; if not, Korea will need to find funds to supplement those recommended by PICES. This summer school was already been approved by the PICES Governing Council in 2012 but the exact number of teachers had not been decided at the time of our meeting.

No other courses planned or considered were presented at the meeting.

#### AGENDA ITEM 4

##### **Status report on international cooperation**

Dr. Kim gave a status report of Korea–Russia cooperative research (See also Agenda Item 2 above regarding the 2014 cruise of the R/V *Lavrentyev* with Korea and Russia). The expedition will consist of 20 days in the fall immediately following PICES-2013. There will be no participation from Japan or China. The hope is to conduct this cruise every year; two years of continuing funding now exist. Thus, participation of China and Japan may be possible in future years. Next year’s cruise is already being planned, with possibly 17–18 non-Russian foreign scientists participating. Dr. Kim requested Panel members to contact him if anyone was interested in participating or having work done on future cruises. He noted that approvals from Russia are necessary for each activity, thus advance planning is necessary.

It is too early to provide any information on the possible uses, including collaboration in the Japan/East Sea, for Japan’s newly built R/V *Shinsei Maru*. It was commissioned in less than 10 months of the Fukushima event for post-tsunami work but will also be used for general oceanography.

## AGENDA ITEM 5

**Progress on EAST-II Program**

Publication of a volume on the Yellow Sea and East China Sea was discussed. Dr. Lee presented a progress report associated with this project. Details are appended as *AP-CREAMS Endnote 3*. A proposal for a textbook style publication will be submitted to Science Board for approval and/or support, *i.e.*, a PICES Scientific Report or a commercial publication. No geological component currently exists. Ocean acidification was added as a topic under chemistry.

## AGENDA ITEM 6

**Current Status of NPESR supplementary chapter Japan/East Sea for Marine Ecosystems of the North Pacific Ocean 2003–2008**

Dr. Kim presented a detailed account of events to date and led the discussion on possible future steps to take. It was agreed that the prepared manuscript be published without further delay.

The following recommendations were agreed upon:

- PICES should initiate the publication of the supplementary chapter without further delay as Science Board already endorsed.
- In case of further delay, AP-CREAMS will initiate efforts to publish the prepared manuscript outside PICES, possibly as a book. However, this publication will not be a replacement of the missing chapter of the 2<sup>nd</sup> North Pacific Ecosystem Status Report by any means. PICES should continue efforts for completing the second version of NPERS before the preparation of NPESR 3.

Some steps to achieve above recommendation were further discussed, which include publication of the entire report as a book without the PICES affiliation (*e.g.*, no PICES logo), and possible revision of its present Executive Summary to be compatible with other sections of the second version of NPESR for publication by PICES.

## AGENDA ITEM 7

**Next AP-CREAMS meeting in spring 2014**

Qingdao or Hangzhou was suggested as a possible venue for the next AP-CREAMS meeting but the Panel also suggested that the date and place for the meeting may need to be more carefully considered in view of the FUTURE Open Science Meeting, which will be held in Hawaii, USA, April 14–18, 2014.

## AGENDA ITEM 8

**Miscellaneous items**

AP-CREAMS recommended a Topic Session on the “*Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries*” at PICES-2014, in Yeosu, Korea (*AP-CREAMS Endnote 4*).

Without further items, the meeting was adjourned at 5:00 pm.

*AP-CREAMS Endnote 1*

**AP-CREAMS participation list**

Members

Kyung-Il Chang (Korea)  
David Checkley (USA)  
Naoki Iguchi (Japan)  
Hee-Dong Jeong (Korea)  
Kyung-Ryul Kim (Korea, Co-Chairman)  
Jae-Hak Lee (Korea)  
Dongfeng Xu (China)  
Yury Zuenko (Russia)

Observers

Tae Hee Na (Korea)  
Jae-Hun Park (Korea)  
Naesun Park (Korea)  
Hiroyuki Shimada (Japan)



Some AP-CREAM members at PICES-2013 in Nanaimo, Canada (left to right): Kyung-Il Chang, Kyung-Ryul Kim, Yury Zuenko, and Dongfeng Xu.

*AP-CREAMS Endnote 2*

**AP-CREAMS meeting agenda**

1. Opening remarks
2. Brief national report on activities and plans related to CREAMS/PICES Program
- 2.1 China
- 2.2 Japan
- 2.3 Korea
  - 2.3.1 Activities associated with Korea EAST-I project
  - 2.3.2 Activities associated with KIOST
- 2.4 Russia
3. Discussion on capacity building activities in 2014 and later
4. Status report and discussion on international cooperation
  - 4.1 R/V *Lavrentyev* cruise in 2014
  - 4.2 Possible other cruises in 2014 and later
5. Progress on EAST-II Program
6. Current Status on Status Report on supplementary chapter Japan/East Sea for Marine Ecosystems of the North Pacific Ocean 2003–2008
7. Next AP-CREAMS meeting in spring 2014
8. Miscellaneous items
9. Closing

**AP-CREAMS Endnote 3****Proposal for a publication of the EAST-II project**

Tentative Title: Oceanography of Yellow and East China Sea

Type of Publication: PICES report

Time for Publication: End of 2014 (tentative)

Editorial: J. Ishizaka, T. Matsuno, J. Zhang, J.H. Lee, S. Kim, D. Xu, Y. Fei, S.M. Liu, V. Lobanov

Pages: 300 pp.

Contents of Publication: Review and textbook-style book of this area

Support from PICES: Comments and suggestions for Editing of English and Contents and publication fee

**Table of Contents (Possible authors, not confirmed)**

Chapter 1. Climate and Physical Oceanography (author(s) TBD)

1.1. Circulation (including current and influence of wind) (Heung-Jae Lie)

1.2. Tides (China)

1.3. Water masses (China)

1.4. Ocean mixing (T. Matsuno)

1.5. Air-sea interaction in the East China Sea (frontal structure or influence of typhoon) (Isobe)

1.6. Long term variations (Jae-Hak Lee?)

Chapter 2. Chemistry (J. Zhang, S.M. Liu)

2.1. Nutrients

2.2. Anoxic Water

2.3. Suspended Sediment

2.4. Ocean acidification

Chapter 3. Biology (J. Ishizaka, S. Kim)

3.1. Bacteria (?)

3.2. Phytoplankton (J. Ishizaka)

3.3. Seaweed and Seagrass (?)

3.4. Zooplankton (Including Giant Jellyfish) (Iguchi)

3.5. Benthic Community (?)

3.6. Fish and Invertebrate Fisheries (Chinese)

3.7. Marine Birds and Mammals (?)

**AP-CREAMS Endnote 4****Proposal for a ½-day MONITOR/BIO/TCODE Topic Session on**

***“Use of long time series of plankton to inform decisions in management and policy concerning climate, ecosystems and fisheries” at PICES-2014***

Convenors: David Checkley (USA) and Sanae Chiba (Japan)

Plankton plays key roles in the pelagic ocean. Planktonic plants, invertebrates and the early developmental stages of vertebrates are important for trophic and population dynamics of exploited protected species; the flux of energy and material, including carbon; and as indicators of ecosystem status. Phytoplankton has been both sampled *in situ* and observed remotely, from satellites. Zooplankton has been collected by nets. Increasingly, optics, acoustics, and ‘omics’ are used. Sampling programs worldwide now span decades, often with ancillary data. From these, time series of plankton abundance have been created, with varying levels of taxonomic and geographic resolution. Often, such programs have been in support of fisheries management. Increasingly, however, they are also relevant to management and policy decisions affecting ecosystems and climate. In turn, such programs require justification for their continuation. Examples include the California Cooperative Oceanic Fisheries

## **AP-CREAMS-2013**

Investigations (CalCOFI), the Global Alliance of Continuous Plankton Recorder Surveys (GACS), and many other plankton sampling programs worldwide. The objective of this session is to learn how time series of plankton have been, are being, and might be used to inform decisions in management and policy concerning climate, ecosystems, and fisheries. Presentations are invited on both time-tested uses of plankton time series and on novel, untested uses.

## Report of the Advisory Panel on *Marine Birds and Mammals*

The meeting of the Advisory Panel for Marine Birds and Mammals (AP-MBM; under the auspices of BIO Committee) was held from 09:30–17:00 hours on October 12, 2013 in Nanaimo, Canada. The business meeting focused on the current activities of AP-MBM at the Annual Meeting, on preparations for holding a 1-day session necessary to complete the objectives of the Activity Plan adopted during the 2011 Annual Meeting, and potential for new projects to start in 2015.

### AGENDA ITEM 1

#### **Welcome**

Dr. Yutaka Watanuki (Japan), Co-Chair of AP-MBM, called the meeting to order and welcomed members and observers (*AP-MBM Endnote 1*). AP-MBM members representing Canada, Japan and USA, and were present. Unfortunately, the U.S. Co-Chair, Dr. Rolf Ream, was not able to attend. AP-MBM has new members appointed from China and Korea, but they, as well as any Russian members, were not able to attend.

### AGENDA ITEM 2

#### **Adoption of agenda**

The agenda was reviewed and modified (*AP-MBM Endnote 2*) to orient new AP-MBM members and observers with reviews of FUTURE, Terms of References and the AP-MBM Spatial Ecology project. The Terms of Reference and project plan were approved. Members agreed that AP-MBM should be involved in FUTURE and that AP-MBM should have active “responsibilities” in support of FUTURE goals (*AP-MBM Endnote 3*).

### AGENDA ITEM 3

#### **Reports from participants**

Dr. Robert Suryan (USA) reported on the publication resulting from the BIO/POC Topic Session (S2, co-sponsored by ICES) at PICES-2011 entitled “*Mechanisms of physical-biological coupling forcing biological hotspots*”. The Advisory Panel agreed that a pdf of this publication should be shared with the PICES Committee chairs and other interested parties (<http://www.int-res.com/articles/theme/m487p177.pdf>; see also [http://www.pices.int/members/advisory\\_panels/MBM.aspx](http://www.pices.int/members/advisory_panels/MBM.aspx)).

Dr. Suryan reported on the BIO workshop (W3) on “*Marine bird and mammal spatial ecology*” held on October 11. The workshop was well attended (25 attendees) from Canada, Japan, and the U.S. Workshop discussion continued on October 13 (19 attendees; *AP-MBM Endnote 4*; for a summary of the workshop, see [http://www.pices.int/publications/annual\\_reports/Ann\\_Rpt\\_13/2013-Session-summaries.pdf](http://www.pices.int/publications/annual_reports/Ann_Rpt_13/2013-Session-summaries.pdf)).

Dr. William Sydeman (USA) introduced the BIO/FIS/POC Topic Session (S2), entitled “*Are marine ecosystems of the North Pacific becoming more variable?*” to be held October 18, 2013. Two invited and 6 contributed papers will be presented.

Dr. Tsutomu Tamura (Japan) reported on Dr. Hidehiro Kato’s activities as the PICES liaison to the International Whaling Commission (IWC; *AP-MBM Endnote 5*). The Advisory Panel thanked Dr. Kato for his efforts to integrate PICES science in the IWC science-policy arena, and recommends to BIO that Dr. Kato remain as the PICES liaison. The Panel also continues to recommend to BIO that seabird observers be added in the IWC “POWER” cruise.

## AP-MBM-2013

Dr. Watanuki (Japan) introduced his paper for MEQ/FUTURE Topic Session (S3) entitled “*Status, trends and effects of pollutants in coastal ecosystems*”. The Panel agreed to note to BIO the value of seabirds and mammals as sentinels of pollution and that AP-MBM can easily contribute to this aspect of the FUTURE program (AICE).

### AGENDA ITEM 4

#### Discussions

Dr. Elliot Hazen (USA) introduced the ½-day workshop entitled, “*Top predators as indicators of climate change*” (Hazen *et al.*) to be held at the FUTURE Open Science Meeting in Kohala Coast, Hawaii (April 15–18, 2013; *AP-MBM Endnote 6*). All AP members have an interest in this session and suggest that an announcement for this workshop should be distributed widely.

Dr. Hazen introduced a 1-day Topic Session proposal for PICES 2014, entitled, “*Strengths and Limitations of Habitat Modeling*” (*AP-MBM Endnote 7*) and agreed to bring the proposal to the BIO Committee. Early career scientists who might become long-term PICES participants were suggested as potential speakers. Needs of better communication to the public, lead time for arranging support from agency managers, and outreach to mammal researchers were also suggested.

Lastly, Dr. Watanuki reviewed AP-MBM activities in 2011–2012 (*AP-MBM Endnote 8*) and noted that the Spatial Ecology and Conservation project ends in 2015. Other potential topics for AP-MBM projects were discussed, and included “Climate Change Impacts, Indicators of Pollutants, and Prey Consumption” (diets, food web dynamics). After deep discussion, it is likely that a project related to prey consumption (led by AP-MBM member, Dr. Andrew Trites, with Martin Renner and Rob Suryan) will be the next focus of AP-MBM science. This will be reviewed and decided at the 2014 business meeting (to be held in Yeosu, Korea).

### *AP-MBM Endnote 1*

#### AP-MBM participation list

##### Members

Kaoru Hattori (Japan)  
Ken Morgan (Canada)  
Patrick O’Hara (Canada)  
William Sydeman (USA)  
Andrew Trites (Canada)  
Tsutomu Tamura, representing Hidehiro Kato (Japan)  
Yutaka Watanuki (Japan)

##### Observers

Elliot Hazen (USA)  
George Hunt (USA)  
Trevor Joyce (USA)  
Oleg Katugin (Russia)  
Martin Renner (USA)  
Jarrod Santora (USA)  
Robert Suryan (USA)  
Atsushi Tsuda (Japan)

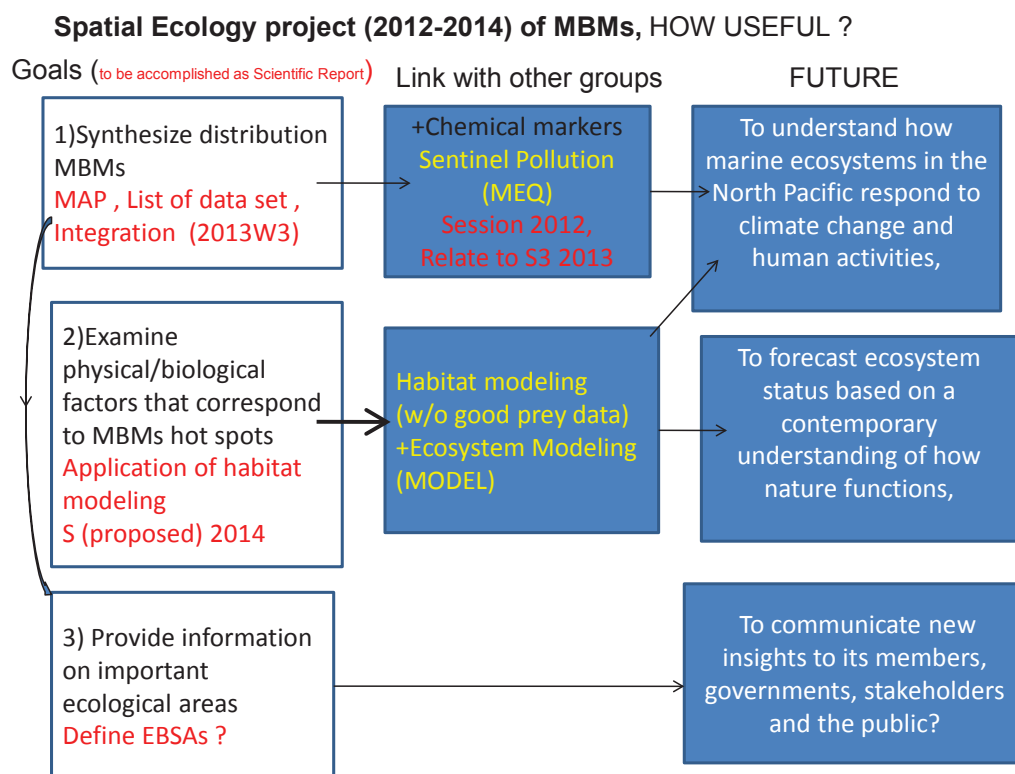
### *AP-MBM Endnote 2*

#### AP-MBM meeting agenda

1. Call to order – Review agenda (modify as needed)
2. Introductions - meeting participants, new members of PICES community
3. Review FUTURE, AP-MBM Terms of reference, AP Spatial Ecology Project plan
4. Reports from participants
  - a. Publication of the Hot Spot symposium 2011 (R. Suryan)
  - b. Report of W3 (R. Suryan)
  - c. Introduction of S2 2013 (W. Sydeman)

- d. IWC (T. Tamura)
- e. Link with other groups (MEQ session, Y. Watanuki, many others?)
- 5. Discussions
  - b. Review 2014 April Inter-sessional Workshop in Hawaii (E. Hazen)
  - c. Review 2014 session proposal and identify possible participants and speakers (Y. Watanuki)
  - d. Long term strategic plan; link with FUTURE, other committees, potential workshop, session
  - e. Ideas of the next 3-year project starting in 2015
  - f. Data integration and strategy to complete PICES report on AP-MBM 3-year project "SPATIAL ECOLOGY" (lead by R. Suryan)

*AP-MBM Endnote 3*





*AP-MBM Endnote 4*

PICES Workshop W3  
Marine Bird and Mammal Spatial Ecology

“Approaches to Integrate Individual Tracking and Vessel-based Survey Data”\*

PICES-2013, Nanaimo, Canada

Co-Convenors

Robert Suryan  
Oregon State University, USA

William Sydeman  
Farallon Institute for Advance Ecosystem Research, USA

Yutaka Watanuki  
Graduate School of Fisheries Sciences, Hokkaido University, Japan,

Rolf Ream  
National Marine Fisheries Service, USA

11-12 October 2013

Nanaimo, BC Canada

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See [Session Summaries](#) for a full report of the workshop

### *Marine Bird and Mammal Spatial Ecology*

#### **Objectives**

1. The primary goal of this workshop was to assess techniques to compile and integrate vessel-based marine bird and mammal surveys with individual tracking data sets.
2. The secondary goal was to catalogue and assess avenues for integrating various data sets. Once primary databases are identified and/or compiled and integrated, the subsequent objectives will include:
  - Synthesize distribution data of marine birds and mammals (MBMs) and assess changes over time
  - Examine physical and biological factors that correspond to high use “hot spots”
  - Map and provide information on important ecological areas in the PICES regions.
3. Outline and coordinate our efforts in producing the final results

#### **Background**

Marine birds and mammals (MBMs) are highly mobile, yet relatively easily observed and tracked to determine their spatial distribution throughout the North Pacific Ocean. They are important marine top predators that consume substantial amounts of zooplankton and fish, and are susceptible to changes in marine food web structure, productivity, and to a variety of anthropogenic impacts. Therefore, MBMs are highly visible sentinels of ecosystem health and its change. To incorporate these roles and characteristics of MBMs into ecosystem based management and meet objectives of FUTURE, the PICES MBM Advisory Panel (MBM AP) proposed to focus on MBM spatial ecology and conservation as a priority topic for their 2012-2014 activities.

Over the past several decades, a wide variety of research programs have collected observational and tracking data of MBMs throughout the North Pacific. Portions of these data have been compiled into large databases, such as the North Pacific Pelagic Seabird Database (NPPSD). Other data sets, however, still need to be integrated for more complete coverage of the PICES regions. Holding the proposed workshop is an important first step to compiling and integrating these massive datasets. In February 2012, we held discussions with several of the main data holders/contributors and they expressed broad support for this effort. Workshop invitees were contacted over the past year and included data holders, spatial analysis experts, and end product users.

#### **Appendix 1** Workshop attendees

Sonia Batten	Canada	Corinne Pomerleau	Canada
Douglas Bertram	Canada	Martin Renner	USA
Bryan Black	USA	Tamara Russell	Canada
Carrie Eischens	USA	Ryan Rykaczewski	USA
Jerome Fiechter	USA	Hiroaki Saito	Japan
Marisol Garcia-Reyes	USA	Jarrood Santora	USA
Tracee Geernaert	USA	Hiroko Sasaki	Japan
Kaoru Hattori	Japan	Huamei Shao	Japan
Elliott L. Hazen	USA	Melanie Smith	USA
George Hunt	USA	William Sydeman	USA
Trevor Joyce	USA	Tsutomu Tamura	Japan
Ken Morgan	Canada	Andrew Trites	Canada
Chad Nordstrom	Canada	Atsushi Tsuda	Japan
Patrick O’Hara	Canada	Yutaka Watanuki	Japan
Mayuko Otsuki	Japan		

Appendix 2 Workshop Schedule

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Friday, 11 October:	09:00 – 18:00	W3
Saturday, 12 October:	09:30 – 12:30	AP-MBM
	14:00 – 15:00	W3 continued discussion
	15:45 – 17:30	Strategy to complete PICES report

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*Friday, 11 October*

<b>Datasets</b>	
9:00 – 9:15	<b>Suryan:</b> <i>Overview and discussion of goals of workshop</i>
9:15 – 9:30	<b>Piatt et al. (presented by Martin Renner):</b> <i>The North Pacific Pelagic Seabird Database (NPPSD) Version 2: Expanding spatial and temporal ranges and identifying data gaps</i>
9:30 – 9:45	<b>Geernaert et al.:</b> <i>Trends in seabird occurrence on Pacific halibut assessment surveys (2002-2012)</i>
9:45 – 10:00	<b>Ballance, Barlow, and Joyce:</b> <i>At sea marine mammal, seabird, and ecosystem assessment surveys in the eastern Pacific: an overview of Southwest Fisheries Science Center's 23-year time series</i>
10:00 – 10:15	<b>Morgan et al.:</b> <i>Vessel-based marine bird and mammal surveys in BC Canada.</i>  <b>Zerbini et al.:</b> <i>An overview of vessel-based cetacean surveys and satellite telemetry studies conducted by the National Marine Mammal Laboratory in the North Pacific Ocean, the Bering Sea and adjacent waters (cancelled)</i>
10:15 – 10:45	Break
10:45 – 11:15	<i>Discussion: Data gaps, accessibility, and needs</i>
<b>Applications</b>	
11:15 – 11:30	<b>Tamura et al.:</b> <i>Geographical and temporal distribution of common minke, sei and Bryde's whales in the western North Pacific in relation to prey availability</i>
11:30 – 11:45	<b>Hazen et al.:</b> <i>Understanding spatial overlap of human impacts and marine predator distributions</i>
11:45 – 12:00	<b>Sasaki et al.:</b> <i>Seasonal shift of Bryde's and sei whale habitat in the western North Pacific</i>
12:00 – 12:15	<b>Bertram et al.:</b> <i>Interannual variation in zooplankton prey distribution determines marine breeding distributions of Cassin's Auklet in the proposed Scott Islands National Marine Wildlife Area in Canada</i>
12:15 – 1:30	Lunch
1:30 – 2:00	<i>Discussion: How would integrated datasets be used and who/what would benefit from these.</i>
<b>Integration</b>	
2:00 – 2:30	<b>Renner (invited):</b> <i>Combining tracking and transect data - issues and possible solutions</i>
2:30 – 2:45	<b>Watanuki et al.:</b> <i>Distribution of short-tailed shearwaters in the northern North Pacific: a comparison between geolocator-based tracking of individuals and boat-based surveys</i>

2:45 – 3:00	<b>Santora et al.:</b> <i>Comparative habitat use and spatial overlap of sooty shearwaters using shipboard surveys and satellite-tracking</i>
3:00 – 3:15	Bailey, <b>Bograd et al. (presented by Elliott Hazen):</b> <i>Integrating blue whale satellite telemetry and oceanographic data to develop habitat models for conservation management</i>
3:15 – 3:45	Break
3:45 – 6:00	<i>Discussion &amp; Simulations: Integrating tracking and survey data. Synthesis and next steps (to be continued Saturday afternoon, if needed)</i>

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**Saturday, 12 October**

9:30 – 12:30	Marine Bird & Mammal Advisory Panel Meeting
2:00 – 3:00	W3 discussion of end product users needs from data, including modelling and FUTURE
3:15 – 3:45	Break
3:45 – 17:30	Strategy to complete PICES report

**AP-MBM Endnote 5**

**PICES Observer Report on the 2013 IWC Scientific Committee Meeting**

Hidehiro Kato

*Tokyo University of Marine Science and Technology, Tokyo 104-8477, Japan*

The 65<sup>th</sup> scientific committee meeting (SC) of the International Whaling Commission (IWC) was held at Jeju, Republic of Korea from June 3–15, 2013. A total of 96 participants from 27 contracting governments, in addition to 46 invited experts and 4 observers from 4 international organizations (CCAMLR, IUCN, PICES, SPAW), participated this year's annual meeting. PICES was especially welcomed by the IWC/SC. For the management of cetacean stocks, which is the most important task for the committee, the SC explored improvement of management methods for cetacean stocks after enforcement of the commercial whaling moratorium in 1985, and had already agreed with the scientific basis of RMP (Revised Management Procedure) in 1996 through long time endeavors by many scientists. The IWC/SC is now continuing work on checking the performance and implementation trial of the RMP for the stocks after completion of their comprehensive assessments.

Under the IWC/SC, following six sub-committees and nine working groups have been established:

- Sub-committee on Revised Management Procedure (RMP),
- Sub-committee on Bowhead, Right and Gray Whales (BRG),
- Sub-committee on In-Depth Assessments (IA),
- Sub-committee on Other Southern Hemisphere Whale Stocks (SH),
- Standing Sub-committee on Small Cetaceans (SM),
- Sub-committee on Whale Watching (WW);
- Working Group on Western North Pacific common minke whales (NPM)

## AP-MBM-2013

- Standing Working Group Aboriginal Subsistence Whaling Management Procedure (AWMP),
- Working Group on Stock Definition (SD),
- Working Group on Non-Deliberate Human-Induced Mortality of Large Whales,
- Standing Working Group on Environmental concerns (E),
- Working Group to Address Multi-species and Ecosystem Modelling Approaches (EM),
- Working Group on DNA (DNA),
- Working Group on National Progress Reports
- Working Group on Scientific Permits (SP).

Every substantial issue is discussed once at the sub-committees or the working group and then goes to plenary of the committee. After completion of its business at its annual meeting, the IWC/SC makes scientific advice and recommendations to the IWC commission. However, according to resolution adopted in last year's commission meeting, the commission meeting which is usually held immediately after the scientific committee meeting, was held biennially and no commission meeting was held this year.

This year the following topics were noted in discussions from the 2013 annual meeting:

### 1. RMP implementation

For the RMP implementation, the IWC/SC has focused on the North Pacific common minke whale, and completed the implementation review and made some recommendations though the implementation review will be still continued. In addition, the implementation trials for the North Atlantic fin whale, North Atlantic common minke whale are ready to start, and for the western North Pacific stock, Bryde's whales will start in 2016.

### 2. Comprehensive assessment, etc.

Under the comprehensive assessments through IA, SH and BRG sub-committees, this year the IWC/SC continued on review of stock status of blue and humpback whales in the southern hemisphere; also North Pacific sei whales and sperm whales in the southern hemisphere are to be discussed priorities in next year's meeting. For the Antarctic minke whale stocks, there was some progress in VPA type analyses (Statistical catch-at-age models) and further discussion on the comparison of population abundance estimates between the second and the third circumpolar surveys. For conservation of western North Pacific gray whale stock, which is a highly depleted one, the IWC/SC originated the GWAP (Western Gray Whale Advisory Panel) in cooperation with IUCN.

### 3. Management of aboriginal and subsistence whaling

The IWC/SC has managed ongoing aboriginal and subsistence whaling with using AWMP (Aboriginal and subsistence whaling management scheme): including Bowhead whale stocks in the Arctic region, fin whale, minke whale and humpback whale stocks of west Greenland and humpback whale off St. Vincent and Grenadines and Eastern stock of gray whales of Chukotka. Through examinations of updated scientific information the IWC/SC concluded the present catch levels for respective stocks would not harm the stocks.

### 4. Scientific permit

Under the SP sub-committee to review the scientific permit program (based on Article VIII of the international convention for regulation of whaling), the report from the Icelandic scientific permit workshop and research results and plans for Japanese scientific permits were reviewed.

### 5. Environment issues and ecosystem modeling

For environment issues around cetacean stock management, the SC has two working groups (E, Environmental concern; EM, ecosystem modeling) and discussed a number of matters related to environmental factors that affect cetaceans.

This year, the following issues were reviewed in looking at the progress of the respective issues of E Working Group:

- 1) Status of the cetacean Environment Report
- 2) Review progress in planning for POLLUTION 2000+, Phase II
- 3) Review oil spill impact
- 4) Review activities by working group of CERD (cetacean emerging and resurging disease)
- 5) Review anthropogenic sounds related issues
- 6) Review activities related Climate Change issue

For ecosystem modeling, EM Working Group dedicated its time to three general tasks: (1) reviewing ecosystem models and modeling approaches that were developed outside of the IWC/SC, especially CCMLR's ecosystem monitoring and management programme; (2) explore how ecosystem models can contribute to developing scenarios for simulation testing of the RMP; (3) review of issues relevant to ecosystem modeling within the SC, focusing on changes in blubber thickness of the Antarctic minke whales in conjunction with environmental changes used in the analyses based on JARPA II (Japanese scientific permit sampling) and GADGET model in some analyses by the Icelandic special permit.

#### 6. North Pacific Sighting survey cruise (IWC/PWER)

IWC sponsored an international cetacean sighting survey program, started in 2010, in cooperation with Japan, Korea and United States. The project includes line transect sighting for estimating population abundance and biopsy skin-sampling and photo ID for stock structure on major large cetaceans. The programme was renamed POWER (North Pacific Ocean whales and ecosystem research project) in 2011, and this year the SC received the 2012 cruise report conducted in waters surrounding 40°N–60°N and 134°W–150°W, which made 169 fin and 151 sei whale sightings, etc. during 2,126 nm effective searching distance. It was planned to conduct a 2013 POWER cruise in waters surrounding 30°N–40°N and 134°W–160°W. Kato requested that PICES' AP-MBM conduct a piggyback sea-bird census on the research vessel; however, it was not accepted by the SC due to logistical reasons, mainly the limitation in accommodations for researchers.

#### 7. Other issues

The SC also covers relevant issues to small cetaceans, whale watching, by-catch and humane deduced mortality, etc., as in previous years.

Next year's annual meeting of the IWC/SC will be held in the alpine town of Bled, Slovenia, from May 12–24, 2014. The IWC commission meeting is planned to be held in the next year, but details of place and date are not yet known.

*AP-MBM Endnote 6*

**Proposal for a ½-day Workshop on “Top predators as indicators of climate change: statistical techniques, challenges and opportunities” at the 2014 FUTURE Open Science Meeting**

Sponsoring Committees: POC/WG 27; BIO will seek co-sponsorship from the IMBER 10-year regional program CLIOTOP

Co-conveners: E. Hazen (lead), M. García-Reyes, M. Litzow, J. Santora, I. Schroeder, S. Bograd (proponent POC/WG27), Y. Watanuki (proponent BIO/ AP-MBM)

Top predators such as fish, turtles, marine mammals, and seabirds can serve to integrate multiple lower trophic level processes and can provide top-down control of marine food webs. Climate variability and changes affect the timing and strength of productivity at the base of pelagic ecosystems, which are integrated by top predator life histories. This could result in changes in breeding patterns, migration strategies and dietary switching, and ultimately in the fitness and reproductive success of the animal. There is a suite of information from top predators around the Pacific, including survey data, tracking data, diet data, and reproductive data, as well as extensive environmental and climate data that can be synthesized to examine differential ecosystem responses spatially as a function of climate variability and change. There are suites of statistical tools used to analyze climate change effects and part of our discussion would be to identify techniques and synthetic approaches for a potential pan-Pacific meta-analysis. Spatial patterns in species response We propose a half-day workshop, and invite topics addressing (1) oceanographic and top predator datasets that can be used to examine responses to climate variability and change, (2) statistical techniques that can be used in differentiating top predator responses to climate variability and climate change, (3) identification of sentinel species that respond directly to climate effects and can be used as leading indicators of ecosystem state, and (4) synthetic approaches to understanding how climate variability and change is incorporated in top predator distribution, abundance, or foraging datasets. From this workshop, we will plan a pan-Pacific meta-analysis and review paper examining this subject.

Potential invited presentations:

- Streaked shearwaters and environmental variability in the Western Pacific (Takashi Yamamoto, Japan)
- Large-scale climate variability, climate change, and predictability in the N. Pacific (M. DiLorenzo / N. Mantua / R. Rykaczewski, USA)
- Seabird responses to climate variability and change in the N. Pacific (W.J. Sydeman, USA)
- Climate change effects in the North Pacific and potential effects on marine predators (J. Polovina, USA)

*AP-MBM Endnote 7***Proposal for a 1-day Topic Session on “Strengths and limitations of habitat modeling: Techniques, data sources, and predictive capabilities” at PICES-2014 [later changed to ½-day]**

Sponsoring Committee: BIO

Co-conveners: Elliot Hazen (NOAA affiliate, Elliott.hazen@noaa.gov), Sei-ich Saito (MONITOR.), William Sydeman (MBM-AP, wsydeman@ucsd.edu), Enyuan Fan (MBM-AP.), Rob Suryan (MBM-AP.), Yutaka Watanuki (MBM-AP, lead)\*

Habitat modeling has been a powerful tool to find key factors affecting distribution of marine organism and its mechanisms, to predict optimal fishing grounds, to evaluate human impacts on ecosystems, and to project distribution shifts in the face of climate change. Thus evaluation of the strengths and weakness of various modeling approaches is increasingly important. Environmental data are derived from satellite, shipboard surveys, or ocean models and include SST, SST gradient, SSH, Chl-a, and their variation across time, etc and geographic features such as shelf breaks as these are available proxies for prey. While distribution data is based on various sources, ship based line transect survey, animal tracking, fisheries activities (log data, satellite-based fishing light distribution) and hence contains inevitable biases including the selection of the survey line and season, tagging location of tracked animals, the number of sample animals, type of the fishing activities. Biases are also depend on the models; Generalized linear and additive models (GLMs and GAMs), Random Forests, boosted regression approaches, Maximum Entropy modeling (MaxEnt). The session will examine factors causing biases, identify direction of biases, discuss techniques for mitigating or accounting for biases, and create a best-practice guide for using habitat modeling approaches to predict distribution of marine organism in dynamic marine environments.

Support requested for 2 invited speakers

Potential speakers:

M. Renner (Contractor with USFW in Alaska), Ensemble modeling of seabirds at sea.

H. Murase (Fisheries Agency, Japan), Habitat modeling of whales using different techniques.

I. Alabia (Department of Fisheries Sciences, Hokkaido University), Comparison of predictive power of various habitat modeling using fisheries data.



*AP-MBM Endnote 8*

**Time schedule of the Spatial Ecology project**

**2012**

PICES Annual Meeting (Hiroshima, Japan): Start of project

- BIO/MEQ Topic Session (S6): *Environmental contaminants in marine ecosystems: Seabirds and marine mammals as sentinels of ecosystem health* (Y. Watanuki, lead),
- BIO Workshop (W3): *The feasibility of updating prey consumption by marine birds, marine mammals, and large predatory fish in the PICES regions* (G. Hunt, lead).

**2013**

PICES Annual Meeting (Nanaimo, Canada)

- BIO/FIS/POC Topic Session (S2): *Are marine ecosystems of the North Pacific becoming more variable?* (W. Sydeman, lead),
- BIO Workshop (W3): *Marine bird and mammal spatial ecology* (R. Suryan, lead).

**2014**

Inter-sessional Meeting (14 April 15–18, 2014, Kohala Coast, Hawaii)

- BIO/POC Workshop (W1): *Top predators as indicators of climate change: Statistical techniques, challenges and opportunities* (E. Hazen, lead).

PICES Annual Meeting (Yeosu, Korea): End of project

- BIO Topic Session (S2): *Strengths and limitations of habitat modeling: Techniques, data sources, and predictive capabilities* (Y. Watanuki, lead),
- Business meeting (request 1 day): Bring draft for Science report.

**2015~2017**

Next potential 3-year project starting in 2015:

- “Marine climate impacts on MBMs through food web” (Potential leader: William Sydeman, USA),
- “Marine mammals and seabirds as indicators of temporal and spatial variations of pollutants”,
- “MBMs as a predictive indicator of forage fish”,
- “MBMs as consumers” will be probably the focus of the next science project/plan (Potential leader: Andrew Trites, Canada) and will be integrated with spatial data and ecosystem modeling.

At a related Workshop at PICES-2012 (“The feasibility of updating prey consumption by marine birds, marine mammals, and large predatory fish in the PICES regions (Co-Convenors: G.L. Hunt, H. Kato, M. Seki)), participants agreed that it is important to update information on prey consumption by marine birds and mammals, and to include a select group of large predatory fishes.

## **Report of the Advisory Panel on *Continuous Plankton Recorder* in the North Pacific**

The Advisory Panel on *Continuous Plankton Recorder in the North Pacific* (MONITOR) was scheduled to meet from 14:00–16:30 on October 12, 2013, in Nanaimo, British Columbia, Canada. The regularly scheduled meeting was replaced by a later, less formal gathering due to circumstances related to the absence of the Chair (Dr. Phillip R. Mundy) from the PICES Nanaimo meetings. Members and guests of the Panel were assembled later that evening by Dr. Sonia Batten at the SAHFOS Nanaimo office for a combination meeting and social event. Contact information for members and guests and the agenda for the regularly scheduled meeting are found in *AP-CPR Endnotes 1* and *2*.

### **Advice**

The North Pacific CPR continues to build a unique set of observations on zooplankton species composition that is invaluable for understanding the extent and effects of global climate change in the North Pacific. Information from NP CPR is made available in a timely manner and it supporting a growing legacy of scientific publications. NP CPR exemplifies the benefits derived from PICES' fostering of cooperation and communication among nations in North Pacific marine science.

### **Updates**

Ms. Moira Galbraith (Canada) has replaced Dr. David Mackas, who has retired.

The Advisory Panel was honored to have Prof. Nicholas Owens, the Director of SAHFOS, attend the meeting. Dr. Owens also attended other parts of the PICES Annual Meeting. He presented information on CPR, including costs and applications, to the Science Board meeting (October 13) and the F&A Committee (October 16) meeting. Dr. Owens' efforts to stimulate interest in CPR and to otherwise encourage further involvement of the PICES community are greatly appreciated by the AP.

### **Report on CPR activities in 2012 – 2013**

An overview of sampling in 2013 was presented by Dr. Batten at the subsequent MONITOR Committee meeting (October 16).

### **Overview of funding for CPR activities (Batten)**

The current funding is reasonably secure, being supported by Canada (Department of Fisheries and Oceans, DFO), Japan (Japan Society for the Promotion of Science, JSPS), the United States (North Pacific Research Board, NPRB, and Exxon Valdez Oil Spill Trustee Council, EVOSTC) and the Sir Alister Hardy Foundation for Ocean Science (SAHFOS). Canadian funding from DFO is expected to continue at the same level through March 2014, when it is expected to be approved for renewal. Funding from Japan JSPS is secure up to FY2017, with the bulk of the anticipated funding being devoted to the personnel who do the analyses, rather than to collecting new observations. In the United States, the NPRB has invited the SAHFOS consortium to submit a proposal to its long-term monitoring request for proposals, RFP. Current NPRB funding is secure through mid-2014, and the timing of the long-term monitoring RFP makes possible continuation of support in the summer of 2014 without interruption. Additional funding from the U.S. is provided by the EVOSTC Gulf Watch program. Gulf Watch is committed to support CPR through 2016 with the possibility of renewal for an additional five years, dependent on performance. NOAA's National Marine Fisheries Service will continue to support NP CPR through its positions on the boards of directors of NPRB and EVOSTC.

## AP-CPR-2013

### Presentations at PICES-2013

- MONITOR Topic Session (S9) on *Cost-effective, cooperative ocean monitoring*: Sonia Batten (Invited), Ship of opportunity sampling of lower trophic levels
- MONITOR Topic Session (S9) on *Cost-effective, cooperative ocean monitoring*: Tomoko M. Yoshiki, Sanae Chiba, Tadafumi Ichikawa, Hiroya Sugisaki and Sonia Batten, P2: Geographical shift of warm water species distribution in western subarctic North Pacific based on CPR sample during 2001-2010
- BIO/POC/TCODE/MONITOR/FUTURE Topic Session (S6) on *Recent trends and future projections of North Pacific climate and ecosystems*: Sanae Chiba, Sonia Batten, Tomoko M. Yoshiki, Tadafumi Ichikawa and Hiroya Sugisaki, Climate induced variation in the basin scale zooplankton community structure in the North Pacific
- POC Topic Session (S4) on *The changing carbon cycle of North Pacific continental shelves and marginal seas*: Sonia Batten, Abigail McQuatters-Gollop and Dionysios Raitos Exarchopoulos, Variability in lower trophic levels on the Alaskan Shelf (S4-8906)
- BIO Contributed Paper Session: Moira Galbraith and Sonia Batten, P5: Interannual variability in the abundance of *Pseudocalanus* spp.

### AP-CPR Endnote 1

#### AP-CPR participation list

##### Members

Sonia Batten (SAHFOS)  
Sanae Chiba (Japan)  
Feiyan Du (China)  
Moira Galbraith (Canada)  
Hyung-Ku Kang (Korea)  
Takashige Sugimoto (Japan)  
Song Sun (China)  
Anatoly F. Volkov (Russia)  
Zhimeng Zhuang (China)

##### Observers

Catherine W. Boerner (USA)  
Jennifer Boldt (Canada)  
Alexander Bychkov (PICES)  
Carrie Eischens (NPRB)  
Abigail Enghirst (NPRB)  
Hee-Dong Jeong (Korea)  
Tony Koslow (USA)  
Jan Newton (USA)  
Nicholas Owens (SAHFOS)  
Hiroya Sugisaki (Japan)  
Ellen Tyler (AOOS)

### AP-CPR Endnote 2

#### AP-CPR meeting agenda

1. Welcome and introductions (Mundy)
2. Additions and modifications to agenda
3. North Pacific CPR Consortium update and solicitation (Mundy and Batten)
4. Overview of CPR activities in 2012–2013 (Batten)
5. Update on Global Alliance of Continuous Plankton Recorder (CPR) Surveys (Chiba and Batten)
6. Reports and comments of national representatives and guests (All)
7. Receive suggestions for 2012–2013 CPR AP Annual Report (Mundy)
8. New business
9. Adjourn

**Web links to explore**

PICES AP-CPR

[http://www.pices.int/members/advisory\\_panels/CPR.aspx](http://www.pices.int/members/advisory_panels/CPR.aspx)

PICES CPR projects

<http://www.pices.int/projects/tcprsotnp/default.aspx/#data>

Global Alliance of CPR Surveys

<http://www.globalcpr.org/>

North Pacific CPR Survey

<http://www.globalcpr.org/about-gacs/north-pacific-cpr-survey.aspx>

## **Report of the FUTURE Advisory Panel on *Anthropogenic Influences on Coastal Ecosystems***

AP-AICE Chairman, Dr. Thomas Therriault, welcomed members and guests (*AP-AICE Endnote 1*) and guests to the fifth meeting of the FUTURE Advisory Panel on *Anthropogenic Influences on Coastal Ecosystems* on October 13, 2013, in Nanaimo, Canada, and self introductions were made.

### AGENDA ITEM 2

#### **Review and agenda adoption**

It agreed during the review of the agenda (*AP-AICE Endnote 2*) that for logistical reasons Dr. Ian Perry's presentation on behalf of Working Group on *Ecosystem Responses to Multiple Stressors* (WG 28) would be the first order of business following introductions.

Additional issues raised at the joint AP Meeting were added to the Agenda as priority items for discussion including:

- Recommend theme sessions for PICES-2014 to Committees,
- Recommend PICES co-sponsorship of ICES ASC 2014 theme sessions,
- Discuss collaborations with SCOR and evaluate SCOR WG proposals via Committees.

Low participation continued to be an issue for AP-AICE but external participants at this year's meeting helped advance discussions. At this meeting three countries (China, Korea, and USA) and three Committees (BIO, FIS and POC) were not represented officially. Given the structure of the FUTURE program and the reliance on Country/Committee contributions to APs, it is essential this issue be resolved. The lack of participation by BIO clearly was unforeseen (see (*AP-AICE Endnote 1*)) and an alternate will need to be identified. The AP previously had requested additional membership, including a representative of the Section on *Human Dimensions of Marine Systems* (S-HD) but this was not realized for this meeting. As noted in Hiroshima, AP-AICE participation has been so low it has been limiting and a critical mass must be generated to fully address AP-AICE's goals and Terms of Reference. This will be essential as the AP starts to map expert group products and identify linkages to advance FUTURE in its next work plan (see below).

**Action:** The PICES website does not reflect the removal of Dr. Young-Jae Ro (Korea) at PICES-2012 and should be updated. BIO will need to identify a replacement for Prof. Zhu. FIS and S-HD need to identify an active participant for AP-AICE to ensure Committee representation and connection with the FUTURE program. AP-AICE could benefit from representation from S-CCME as well.

### AGENDA ITEM 3

#### **Potential Topic Sessions for PICES-2014 and utility of online submission system**

In general, AP-AICE was happy with the online system and felt the slight modifications made since last year were an improvement. Most AP members used the online system to rank proposed sessions and workshops and outputs of the online ranking were reviewed at the meeting.

AICE-AP briefly discussed each of the proposed topic sessions and looked for linkages to AICE and the FUTURE program.

**Action:** AP-AICE supported the results generated via the online ranking system without modification as AICE- or FUTURE-related proposals were ranked high by AP-AICE members.

## AP-AICE-2013

### AGENDA ITEM 4

#### **Review and discuss expert group activities relevant to AICE**

At the joint AP Meeting all expert groups relevant to FUTURE made presentations. This allowed all AP members to hear the same message about progress, issues, results, *etc.* Due to the strong linkages between WG 28 and AP-AICE, this Working Group provided a more detailed presentation to AP-AICE during its breakout meeting.

A brief re-cap of WG 28's presentation is captured here:

- This WG is not looking at all stressors in all areas;
- Ecosystem indicators are being developed and will be applied to case studies;
- Marine pollution and HABs are two stressors that WG 28 is not explicitly considering although there are other expert groups within PICES that could provide this information;
- So far a list of "candidate" indicators has been identified and the WG is now looking to validate and apply these;
- Proposed comparisons include both coastal (Seto Inland Sea vs. Salish Sea) and oceanic (Bering Sea vs. Sea of Okhotsk);
- An issue raised by WG 28 was data availability and suggested TCODE might be able to help.

There continues to be some uncertainty as to specific FUTURE products and how these will be generated. Although the FUTURE roadmap is a big improvement, there continues to be questions about the final product and driving directions to reach it.

**Recommendation:** AICE suggests a dedicated FUTURE website be implemented as soon as possible. Ideally this would include "open" pages to allow all to see specific FUTURE products as they are completed and "restricted access" pages that would allow internal communication of developing products.

#### **Action:**

- AP-AICE requests that all PICES expert groups provide a detailed list of specific products being developed. Further, AICE would like to have expert groups identify specific data/products/information that are desired or needed from other expert groups. Together this information will allow the APs to identify important connections and provide a mechanism to ensure improved communication and delivery of FUTURE products.
- AP-AICE requests additional details of the HAB indicator being developed by S-HAB based on the HAE-DAT database.
- AICE should review the Study Group on Marine Pollution final report to identify potential pollution indicators.

AP-AICE agreed that it is relatively easy for expert groups to identify linkages to FUTURE questions in the Science Plan but that it is much more complex and difficult to identify solutions to these FUTURE questions that require inputs from multiple expert groups and higher level synthesis.

**Recommendation:** AICE requests Science Board to consider developing a case study to pilot final FUTURE product development. This case study would attempt to solve a very specific FUTURE problem through an interdisciplinary PICES team. Lessons learned from this exercise would provide increased understanding/clarity that could then be applied more broadly to complete FUTURE.

**Consideration:** Should this approach prove beneficial PICES will need to consider how broad expertise within PICES can be mobilized to produce final (or even intermediate) FUTURE products.

Similarly, AICE discussed that as a Strategic Science Program, FUTURE is very idealistic which makes identification of a specific path to reach the end product much more complicated (likely because there are many). Currently it is hard to say what the final FUTURE "puzzle" looks like but different expert groups are

working on different elements, perhaps without the same vision. For example, if we are building a palace are we all working on the same wall or different ones and if different, will they all meet the same roofline? Intermediate products and identification of specific outputs and needs will help ensure a solid final product.

**Recommendation:** AICE thinks that development of specific, clear intermediate products could be an important mechanism to bridge the gap between the specific outputs of expert groups and the idealistic FUTURE products. Hosting a topic session or workshop could be an effective way to identify and/or develop these intermediate products.

It was noted in the presentation by S-HD that there would be value in having PICES expert groups identify specific linkages to Ecosystem Services (outlined in the Millennium Assessment) which, in turn, could be linked to human well-being. The intent is sustainable ecosystems under changing anthropogenic pressures, including climate change.

**Recommendation:** AICE would like PICES expert groups to identify linkages with Ecosystem Services and foster collaborations with S-HD to determine how to link ecosystem services to human well-being.

#### AGENDA ITEM 5

##### **Discussion of the FUTURE roadmap**

Although specifics of the roadmap were not discussed at this meeting, given considerable time spent on this agenda item at the last AP meeting in Hiroshima, there was constant reference to it under the previous item.

The roadmap outlines some of the expected FUTURE products and how elements will be advanced with current or proposed expert groups. However, as noted above there remains some uncertainty as to the final FUTURE product(s) and the next step should be to provide PICES with some driving directions to navigate the roadmap.

**Action:** AICE will need to develop a new Work Plan that will provide the AP with specific actions to be undertaken over the next few years as FUTURE enters its mid-life. Key elements of this plan would include, but not limited to, review of specific expert group products, identify specific linkages between multiple expert group products and FUTURE key questions, explore links to Ecosystem Services and ultimately human well-being, identify new areas of research to advance FUTURE (see Agenda Item 9).

#### AGENDA ITEM 6

##### **FUTURE Open Science Meeting**

AP-AICE recognizes this OSM will help solidify the implementation of FUTURE. It will highlight recent advancements and potential gaps. The planned review should clarify direction to the finish line.

**Action:** It will be imperative for AICE (and other APs) to thoroughly review products presented at the OSM and identify “missing” products before current FUTURE-based expert groups expire.

#### AGENDA ITEM 7

##### **Develop/review AICE Action Plan**

It is now clear that this was not required and no further action needs to be taken. The role of the Advisory Panel is to advise Science Board on FUTURE implementation.

## **AP-AICE-2013**

### AGENDA ITEM 8

#### **Identification of high priority topics for FUTURE**

AP-AICE discussed the need for additional membership to better advance AP discussions/issues/recommendations (see Agenda Item 2).

The AP suggested that there is considerable work still required to make the FUTURE roadmap operational. Thus, continuing to establish connections/linkages within the roadmap should be a priority. The development of a new Work Plan should help focus AP activities but there remains some questions as to how final products will be delivered.

### AGENDA ITEM 9

#### **Linkages to other FUTURE-APs, committees and PICES researchers**

This year's joint AP Meeting highlighted the advancement of several expert groups providing products but also identified the continued need to improve communication within FUTURE. Additional participation from expert group/Committee members at the joint AP Meeting would strengthen this relationship.

AP-AICE briefly discussed the role of National Programs in the delivery of FUTURE Science. It was noted these are the primary sources of data for PICES but, as noted by WG 28 data acquisition, issues still exist.

**Recommendation:** FUTURE APs should review data/products provided or derived from National Programs and identify potential data requirements these programs could fill. It was felt AP-COVE may be more impacted by this and a dialogue should be established.

### AGENDA ITEM 10

#### **Implementing FUTURE, developing a plan for AP-AICE**

A specific Work Plan will need to be developed as noted above.

**Action:** Develop a new AP-AICE Work Plan.

### AGENDA ITEM 11

#### **Membership, rotation of FUTURE AP Chairs**

At PICES-2009 it was recommended that the three FUTURE AP chairs should not be replaced at once but rather on a rotational basis. It was decided at ISB-2012 that the SOFE Chairman, Mr. Robin Brown, would be replaced in 2012 at the Annual Meeting in Hiroshima. AP-AICE Chairman, Dr. Therriault, will need to step down following PICES-2013 to assume duties as Science Board Chairman. Thus, AP-AICE must identify a new chairman. Discussions on a potential replacement were initiated following ISB-2013 in St. Petersburg, Russia, in May.

**Recommendation:** AICE recommended the next chairman to be Dr. Steven Bograd (POC) who confirmed he would be willing to take on these duties if selected.



*AP-AICE Endnote 1***AP-AICE participation list**Members

Thomas Therriault (Canada, Chairman; MEQ)  
 Igor Shevchenko (Russia; TCODE)  
 Vladimir Kulik (Russia; MONITOR)  
 Ichiro Imai (Japan; MEQ)

Observers

Ian Perry (Canada)  
 Karin Baba (Japan)  
 Won Joon Shim (Korea)  
 Hideaki Maki (Japan)  
 Qin Chuanxin (China)

Absent

Steven J. Bograd (USA) <sup>1</sup>  
 Mingyuan Zhu (China) <sup>2</sup>

<sup>1</sup> Notified in advance due to U.S. government shutdown.

<sup>2</sup> Passed away suddenly in Nanaimo.

*AP-AICE Endnote 2***AP-AICE meeting agenda**

1. Welcome, introductions, opening remarks
2. Review and adopt Agenda
3. Potential topic sessions at PICES-2014, Korea, and proposed inter-sessional workshops/symposia
4. Review and discuss expert group activities relevant to AICE
  - a. WG 28
  - b. S-CCME
  - c. S-HD
  - d. others
5. Discussion of implementation of FUTURE roadmap from Busan ISB Meeting (extension from joint FUTURE AP Meeting), including next iteration of “North Pacific Ecosystem Status Report”
6. FUTURE Open Science Meeting in 2014
7. Review of AICE Action Plan (tentative)
8. Identification of high priority topics for FUTURE and potential mechanisms to address these (AP activities, national programs, symposia, new Expert Groups, *etc.*)
9. Linkages to other FUTURE APs, committees, national programs and PICES researchers
10. Implementing FUTURE, developing a plan for AP-AICE
11. Membership, rotation of FUTURE AP Chairs and election of new AP-AICE Chair
12. Other issues (Roundtable)

## **Report of the FUTURE Advisory Panel on *Climate, Oceanographic Variability and Ecosystems***

The FUTURE Advisory Panel on *Climate, Oceanographic Variability and Ecosystems* (AP-COVE) held its fifth meeting from 14:00 to 17:50 on October 13, 2013 in Nanaimo. AP-COVE chairman, Dr. Hiroaki Saito, welcomed the 4 members, 2 representative from China and MONITOR (*AP-COVE Endnote 1*) and guests to the meeting. The draft agenda (*AP-COVE Endnote 2*) was reviewed and agreed upon.

### AGENDA ITEM 2

#### **Changes to, adoption of, agenda**

The agenda was adopted without changes.

### AGENDA ITEM 3

#### **Review and discussion of COVE-related expert group activity**

Chairs or representatives of AP-COVE-related expert groups attended the meeting and presented their activities, products, workplans and remaining issues.

##### a. Working Group (WG 27) on *North Pacific Climate Variability and Change*

The following results obtained from WG 27 activities in 2012–2013 are as follows:

- lower-trophic level variability tracks regional and locally defined physical forcing; higher-trophic levels integrate multiple forcing and track large-scale climate modes; changes in large-scale and regional-scale ocean circulation play a dominant role in driving ecosystem variability; spatial dimension is key for understanding the links between physical variability and ecosystem response.
- WG 27 has published >70 papers and is planning 2 synthesis papers: (1) Reduced complexity models to hindcast and forecast North Pacific climate, (2) Coherent changes in North Pacific climate and ecosystems.

Request:

- WG 27 requested an extension to its the life span to (1) analyze CMIP5, (2) further analyze the gaps, (3) organize contributions to the international Symposium on “*Effects of Climate Change in World’s Oceans*” (March 23-27, 2015, Santos, Brazil), and (4) create a possible vision and plan for new expert groups.

Suggestions for improving integrated science and exchanges with Section on *Human Dimensions*:

- (1) WG 27 Co-Chair to join S-HD and (2) establish a target interdisciplinary study group on social-ecological-environmental systems (SG-SEES) to foster examples of integrated science in the coastal ocean.

##### b. Working Group (WG 29) on *Regional Climate Modeling*

WG 29 held the 2nd Regional Climate Modeling (RCM 2) Workshop in Busan, Korea (September 10–12, 2013), including sessions on mesoscale and submesoscale, regional climate and ecosystem projections, climate variability in the North Pacific, is preparing a PICES Press article, and is planning for RCM 3. WG 29 needs to know what type of products would be useful to deliver, and clarification on developing the proper infrastructure to facilitate exchanges. COVE encourages other expert groups to send specific request to WG 29. Reviewing the WG’s TORs and objectives shows that downscaling and upscaling of models are essential activities to be done to reach the goal.

##### c. Section (S-CCME) on *Climate Change Effects on Marine Ecosystems*

S-CCME has published synthesis papers that will be cited in IPCC AR5 report. S-CCME needs to cover gaps such as building global prediction networks and communicating results to clients and stakeholders.

AP-COVE pointed out to S-CCME that it needs to provide better communication to the PICES community, e.g., provide a clearer roadmap of S-CCME goals, how PICES scientists can contribute to S-CCME. S-CCME requested future PICES events be better planned so that sessions not to overlap with AP meetings.

d. Section (S-CC) on *Climate Change Effects on Marine Ecosystems*

S-CC completed its PACIFICA data synthesis. Data was cross-validated with existing long-term time series and cross-calibrated with spatial data. S-CC objectives will refocus around ocean acidification and deoxygenation in support of FUTURE, but the Section needs/requests input from Advisory Panels and other expert groups. New members will be needed for specific analyses (e.g., subsurface circulation and hypoxia) that align with S-CC objectives or AP suggestions.

e. Joint NPAFC-PICES Study Group (SG-SC-NP) on *Scientific Cooperation in the North Pacific Ocean*

The purpose and timeline of the SG were explained.

f. Working Group (WG 28) on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors*

WG 28 proposed FUTURE OSM Sessions on: (1) “*Identifying multiple pressures and system responses in North Pacific marine ecosystems*”, and (2) “*Bridging the divide between models and decision-making: The role of uncertainty in the uptake of forecasts by decision makers*”. WG 28 proposed a Topic Session on “*Tipping points: defining reference points for ecological indicators of multiple stressors in coastal and marine ecosystems*” at PICES-2014. A draft of the WG’s final report is set for March 2014. A table of content and assignments and case study are being prepared.

AP-COVE Recommendations:

- After the FUTURE OSM, identify the gaps and recommend the WGs and experts groups that are needed to cover these gaps;
- Establish a tool on the PICES website to track products (papers, reports, etc., e.g., WG 27 published more than 70 review papers, S-CCME published synthesis papers which will be cited in IPCC AR5 reports).
- A closer linkage between APs external to FUTURE (i.e., AP-MBM, AP-CPR, AP-CREAMS) and FUTURE-related expert groups need to be established;
- Have a formal session during PICES Annual Meetings to gather expert groups and AP Chairs and members to exchange information and discuss how to proceed on FUTURE science. AP-COVE considers this to be an essential activity to produce synergy between expert groups and APs, and to reach the goals of FUTURE.

AGENDA ITEM 4

**Review and discussion of COVE-related national/regional projects**

AP-COVE compiled a list of relevant national projects (*AP-COVE Endnote 3*). Dr. Saito will ask SOFE or PICES secretariat to put the table of COVE related national projects on the PICES website. Dr. Zhan reported on new Chinese projects on greenhouse gases in the Arctic.

AGENDA ITEM 5

**Identify potential for new Expert Groups to address AP-COVE priorities**

Since AP-COVE related expert groups are doing well to address their TORs, and AP-COVE can expect important products from each group to reach the goals of FUTURE, this issue will be discussed after reviewing the products.

## AGENDA ITEM 6

**Discussion of the FUTURE roadmap**

This issue was discussed in the Joint FUTURE AP meeting.

## AGENDA ITEM 7

**FUTURE-related sessions at PICES-2013**

Dr. Saito noted the FUTURE related sessions (MEQ/FUTURE Topic Session (S3) on “*Status, trends and effects of pollutants in coastal ecosystems: Implications for wildlife and humans*”, BIO/POC/TCODE/MONITOR/FUTURE Topic Session (S6) on “*Recent trends and future projections of North Pacific climate and ecosystems*”, BIO/FIS/MEQ/TCODE/FUTURE Topic Session (S8) on “*Ecosystem indicators to characterize ecosystem responses to multiple stressors in North Pacific marine ecosystems*”, and POC/BIO/MONITOR/FUTURE Workshop (W2) on “*Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future*” and recommended all AP members to attend these sessions.

## AGENDA ITEM 8

**FUTURE OSM in 2014**

This issue was discussed in the Joint AP Meeting. Dr. Saito encouraged COVE members to attend the OSM (to take place April 15-18, 2014 at Kohala Coast, Hawaii).

## AGENDA ITEM 9

**Develop/review COVE Work Plan**

Dr. Saito explained the revised Work Plan, which was slightly modified from the previous one. All the members agreed on the proposed Work Plan (*AP-COVE Endnote 4*).

## AGENDA ITEM 10

**Linkages to AICE and SOFE, Committees and PICES scientists**

AP-COVE recommended that expert group Chairs meet and exchange information during the PICES Annual Meeting in order to improve the synergy in the research that targets FUTURE’s goals.

## AGENDA ITEM 11

**Membership**

Dr. Saito appreciated AP-COVE members’ continuous input of ideas and comments to COVE activities. Each member agreed to be a member in the next term and to continue to support COVE activity. All members endorsed Dr. Saito’s chairmanship for the next term.

## AGENDA ITEM 12

**Other issues**

AP-COVE members agreed that the selection of proposed session/workshops for PICES-2014 is to be followed by the ranking the proposals by the members.

Dr. King introduced the 3rd international symposium on the “Effects of climate change on the world’s oceans” in Brazil (March 23–27, 2015) and encouraged the members to attend.

The meeting ended at 17:50.

***AP-COVE Endnote 1***

**AP-COVE participation list**

Members

Emanuele Di Lorenzo (USA)  
Jung-Hoon Kang (Korea)  
Jacquelynne King (Canada; FIS)  
Hiroaki Saito (Japan, Chairman; BIO)  
Toru Suzuki (Japan; TCODE)

Guests

Chairs of COVE related ExGs  
Motomitsu Takahashi (WG 28)  
Enrique Curchster (WG 29)  
Jim Christian (S-CC)  
Suam Kim (S-CCME)

Representatives

Liyang Zhang (China)  
Hiroya Sugisaki (MONITOR)

Observers

Jing Ying (China)  
Wang Cuihua (China)  
Sinjae Yoo (Science Board)

***AP-COVE Endnote 2***

**AP-COVE meeting agenda**

1. Welcome, introductions, opening remarks
2. Changes to, adoption of, agenda
3. Review and discussion of COVE-related ExGs activity
  - a. WG 27 – North Pacific Climate Variability and Change
  - b. WG 29 – Regional Climate Modeling
  - c. S-CCME – Climate Change Effects on Marine Ecosystems
  - d. S-CC – Carbon and Climate
  - e. SG-SC-NP – Joint NPAFC-PICES Study Group on Scientific Cooperation in the North Pacific Ocean
  - f. WG 28 – Ecosystem Responses to Multiple Stressors
4. Review and discussion of COVE related national/regional projects
5. Identify potential for new Expert Groups to address AP-COVE priorities
6. Discussion of FUTURE roadmap from Busan ISB Meeting
7. FUTURE related session at PICES-2013 (Nanaimo)
8. FUTURE OSM in 2014
9. Develop/review COVE Work Plan
10. Linkages to AICE and SOFE, committees and PICES scientists
11. Membership
12. Other issues

## AP-COVE Endnote 3

## FUTURE's AP-COVE Related National/Regional Projects

Project	Funding agency/country	Duration	Contact	Purpose	Web
ACCASP (Aquatic Climate Change and Adaptation Services Program)	DFO, Canada		R. Brown	Annually funded projects that investigate climate change impacts to maritime sectors and fisheries, sustainable ecosystems, and safe and secure waters	<a href="http://www.dfo-mpo.gc.ca/science/oceanography-oceanographie/accasp/index-eng.html">http://www.dfo-mpo.gc.ca/science/oceanography-oceanographie/accasp/index-eng.html</a>
NEPTUNE Canada	UVic, Canada		Kim Juniper, K. Moran	Continental shelf and offshore cabled observatory system	<a href="http://www.neptunecanada.com/">http://www.neptunecanada.com/</a>
Nereus	Nippon Foundation Japan/UBC, Canada	2010-2019	V. Christensen	Simulating the future ocean - develop scientifically credible simulations of future fish populations and policy options for the world oceans; developing research capacity and international cooperation, raising public awareness of the state of the oceans	<a href="http://www.nereusprogram.org/content/about-nf-ubc-nereus-%E2%80%93-predicting-future-ocean">http://www.nereusprogram.org/content/about-nf-ubc-nereus-%E2%80%93-predicting-future-ocean</a>
Assessment of the climate impact on the South Sea ecosystem	China	2008-2013	J. Zhang, J.G. Fang, T. Xiao, D.J. Huang, S.M. Liu	Understanding the effects of climate/marine environment changes (global warming, acidification) and predicting the future changes on ecosystem structure and function	
Chinese Polar Environment Comprehensive Investigation & Assessment Programmes	SOA, China	2011-2015	L. Zhan, L. Chen (GCMAC, SOA)	Budgets of N <sub>2</sub> O and CH <sub>4</sub> in Polar and Subpolar marine systems	
Sustainability of Marine Ecosystem Production under Multi-stressors and Adaptive Management	Korea	2011-2015		Impact of external forcings (Multi-stressors) from climate change and anthropogenic perturbations on the marine ecosystems. Responses of marine ecosystem and change in function and services	
POSEIDON (Northwestern Pacific Ocean Study on Environment & Interactions bw Deep Ocean & marginal seas)	Korea	2006-2015		To suggest the best scenario for 2030 in association with the climatic impacts by examining and configuring the correlation between the Northwestern Pacific and the marginal seas	<a href="http://east-1.snu.ac.kr/intro/index.php">http://east-1.snu.ac.kr/intro/index.php</a>
YES Cold Water (The study on the impact of the Yellow Sea Bottom Cold Water Mass to the	KIOST, KOREA	2012-2014	Woong-Seo Kim, Seok Lee, Se-Jong Ju, Jung-Hoon Kang	To better understand effects of cold water mass on the ecosystem by investigating temporal and spatial variation in structure and dynamics of planktonic trophic components	

ecosystem)				in the Yellow Sea Bottom Cold Water	
KOREA EAST-1 (East Asian Seas Time Series)	Korea	2006-2015	K.-I. Chang, T. Lee, C. K. Kang, K.-R. Kim	Identify, quantify, and model the dynamic processes governing the climate variability and their linkage to changes in marine ecosystems	<a href="http://east-1.snu.ac.kr/intro/index.php">http://east-1.snu.ac.kr/intro/index.php</a>
SKED (The study of Kuroshio Ecosystem Dynamics for Sustainable Fisheries)	MEXT, Japan	2011-2021	H. Saito (FRA)	Understanding the mechanisms of high fisheries productivity from oligotrophic Kuroshio ecosystem	<a href="http://tnfri.fra.affrc.go.jp/kaiyo/sked/english/index.html">http://tnfri.fra.affrc.go.jp/kaiyo/sked/english/index.html</a>
NEOPS (New Ocean Paradigm on its Biogeochemistry, Ecosystem and Sustainable Use)	MEXT, Japan	2012-2017	K. Furuya (U. Tokyo)	Developing new ocean provinces based on BGC and ecosystem studies for sustainable use of marine ecosystem services. Half natural sciences, half social	<a href="http://ocean.fs.a.u-tokyo.ac.jp/index-e.html">http://ocean.fs.a.u-tokyo.ac.jp/index-e.html</a>
“Hot spot” in the climate system	MEXT, Japan	2010-2015	H. Nakamjura (U. Tokyo)	Extra-tropical air-sea interaction under the East Asian monsoon system	
Tohoku Ecosystem-Associated Marine Science	MEXT, Japan	2011-2020	Akihiro Kijima, Kazuhiro Kogure, Hiroshi Kitazato	Understanding the perturbation damage by 3.11 Tsunami in the coastal ecosystems in Tohoku, Japan. (AICE related project)	<a href="http://www.i-teams.jp/">http://www.i-teams.jp/</a>
NEOPS <i>Hakuho-Maru</i> cruise	various funding	2013-2014	K. Furuya, H. Ogawa (U. of Tokyo)	Meridional transect cruise of North and South Pacific (170°W) on BGC and Ecosystem	
Evaluation, Adaptation and Mitigation of Global Warming in Agriculture, Forestry and Fisheries	MAFF, Japan	2010-2015	H. Kidokoro (FRA)	Forecasting and mitigation of the impact of global warming on marine ecosystems	
Comprehensive Study of the Far Eastern Seas of Russia and Northern Pacific	Ministry of Economic Development and Russian Academy of Sciences, Russia	2011-2013	V. Lobanov (POI FEB RAS)	Comprehensive study of properties and dynamics of water, atmosphere and lithosphere, their interactions, including process in coastal zone, to understand their influence on climate and formation of biological, mineral and energetic resources and increase effectiveness of marine activity and protect environment of the Far Eastern Seas and Northwestern Pacific	
Integrated investigations of ecosystems and biological	Committee on Fisheries, Russia	2012-2016	O. Katugin (TINRO)	To understand status and variability of fisheries resources of the northwestern Pacific and its marginal seas and make	

resources of the Far Eastern Seas of Russia				assessment for sustainable fishery	
CIMEC (The Cooperative Institute for Marine Ecosystems and Climate)	NOAA, USA		D. Checkeleley	To better serve the Nation's needs through observing and understanding the marine ecosystems and climate in the California Current System, Eastern Tropical Pacific, Southern Ocean, and globally	<a href="http://cimec.ucsd.edu/index.html">http://cimec.ucsd.edu/index.html</a>
POBEX (Pacific Ocean Boundary Ecosystems)	NSF/NOAA, USA		E. Di Lorenzo	Investigating the mechanisms of climate-related variability in three Pacific boundary ecosystems: Gulf of Alaska, California Current System, the Humboldt or Peru-Chile Current System, the Kuroshio-Oyashio Extension (KOE) region	<a href="http://www.pobex.org">http://www.pobex.org</a>
Understanding the spatial and temporal variability of dissolved oxygen through a hierarchy of models	NSF, USA	2009-2013	C. Deutsch, T. Ito	Developing a hierarchy of models to understand observed variability of oxygen in the North Pacific and its relation to physical and biogeochemical processes	
The history and future of coastal upwelling in the California Current	NSF, USA	2012-2012	W. Sydeman, S. Bograd	Using historical time series and climate models to evaluate changes in the intensity and timing of upwelling in the California Current System	
Multi-Scale Modeling	NSF, USA		E. Curchitser	Assessing the role of eastern boundary upwelling regions and their ecosystems on climate variability using a fully coupled model	
BEST Synthesis	NSF, USA		E. Curchitser	The variable transport of pollock eggs and larvae over the Bering shelf: A marriage of physics and biology	
Ocean Observatories Initiative	NSF, USA		T. Cowles	Ocean Observatories Initiative (OOI) will encompass an integrated, global network of ocean sensors providing near-real time data that will transform the study of interrelated ocean processes on coastal, regional, and global spatial scales.	<a href="http://oceanobservatories.org/">http://oceanobservatories.org/</a>



**AP-COVE Endnote 4**

**AP-COVE Workplan and timeline from PICES-2012 in Hiroshima to PICES-2013 in Nanaimo**

*Mission of FUTURE COVE*

The Advisory Panel on *Climate, Oceanographic Variability and Ecosystems* (AP-COVE) is focused on regional (shelf) to basin scale ecosystem processes and Pacific basin teleconnections. Even though AP-COVE will keep all FUTURE key questions in mind while pursuing its activities, the purview of COVE is mainly the key questions (2) How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future? and (1) What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?

*COVE-associated expert groups (2013):*

On-going expert groups

- WG 27: Working Group on *North Pacific Climate Variability and Change* (2011–2014)
- WG 29: Working Group on *Regional Climate Modeling* (Oct. 2011–2014)
- S-CC: Section on *Carbon and Climate* (2005–2013)
- S-CCME: Section on *Climate Change Effects on Marine Ecosystems* (2011–2020)
- WG 28: Working Group on *Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* (June 2011 –2014). Mainly associated with AP-AICE.
- AP-MBM: Advisory Panel on *Marine Birds and Mammals* (1999–2014)
- SG-SC-NP: Joint NPAFC-PICES Study Group on *Scientific Cooperation in the North Pacific Ocean*

Disbanded expert groups

- WG 20: Working Group on *Evaluation of Climate Change Projections*
- WG 22: Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific*
- WG 23: Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim*

*Workplan 2013–2014*

1. Review the activities of on-going AP-COVE related expert groups.  
*At PICES-2013*
2. Advice on revising the ToR for the AP-COVE related expert groups with the term beyond 2013 as needed.  
*PICES-2013–ISB-2014*
3. Work with Committee chairs to develop new WGs.  
*PICES-2013–PICES-2014*
4. Developing a plan of FUTURE OSM in 2014 with AP-AICE, AP-SOFE and Committees.  
*PICES-2013 – April 2014*
5. Review the progress of AP-COVE work plans and update as needed.  
*PICES-2013–ISB-2014*
6. Confirm the membership of AP-COVE.  
*At PICES-2013*
7. Initiate reviews and synthesis of information to address FUTURE goals.  
*PICES-2013–PICES-2014*

## **Report of the FUTURE Advisory Panel on *Status, Outlooks, Forecasts and Engagement***

The Advisory Panel on *Status, Outlooks, Forecasts and Engagement Advisory Panel* (AP-SOFE) met on October 13, 2013 from 14:00 to 18:00 hours, following the joint FUTURE meeting, in Nanaimo, Canada. Past Chairman, Mr. Robin Brown, welcomed members and observers (*AP-SOFE Endnote 1*), as SOFE Chairman, Dr. Phillip Mundy, was unable to attend the meeting. Several changes were made to the draft agenda and the revised agenda was adopted (*AP-SOFE Endnote 2*). Terms of Reference are provided in *AP-SOFE Endnote 3*.

### AGENDA ITEM 3

#### **FUTURE Open Science meeting session update and discussion**

AP-SOFE members received an update on the status of planning for the SOFE-sponsored theme session (S3) entitled, “*Overcoming challenges in communicating science and engaging the public: Ways and means of developing and disseminating FUTURE products*” (*AP-SOFE Endnote 4*) to be held at the FUTURE Open Science Meeting (April 15–18, 2014, Kohala Coast, Hawaii, USA). Members were asked to review it and submit comments by e-mail.

### AGENDA ITEM 4

#### **Discussion and agreement on proposed advice to FUTURE regarding NPESR production**

Dr. Hal Batchelder led a discussion among members and observers to develop the advice relevant to Term of Reference 5 (*AP-SOFE Endnote 3*) based on the draft document entitled, “*A proposal for the process of producing of the North Pacific Ecosystem Status Report, 2009 – 2013*” (Draft, August 13, 2013; *AP-SOFE Endnote 5*). The proposal was circulated to past editors of NPESR (Drs. Skip McKinnell and Michael Dagg) and SOFE members on the date of issue and subsequently it was circulated to the Chairs of PICES standing committees.

Although the proposed advice was accepted in principle, it could not be adopted by SOFE as written. The first recommendation for how to reach consensus advice on which SOFE could agree was to hold a briefing for all PICES committees at which further comments could be received. (This meeting was held later in the week, October 16, and the results were reported at the Science Board meeting on October 19 by Dr. Batchelder, who led the all-committee briefing.) It was also recommended to send the proposal to Governing Council to allow Council to understand the level of commitment that leadership might be willing to bring to the report production approach outlined in the proposal.

The plenary session allowed a number of specific recommendations on approaches to improving the proposed advice to be captured, should SOFE be encouraged by Science Board and Council to do so. SOFE members were also invited to submit written comments and suggestions for improvements should it be necessary to continue the process of developing the proposed advice into 2015.

### AGENDA ITEM 5

#### **Other business**

SOFE members reviewed the Workplan for 2013–2014 and had no revisions (*AP-SOFE Endnote 6*).

## AP-SOFE-2013

### *AP-SOFE Endnote 1*

#### **AP-SOFE participation list**

##### Members

Harold (Hal) Batchelder (USA)  
Robin Brown (Canada, past Chair)  
Shin-ichi Ito (Japan)  
Oleg Katugin (Russia)  
William Peterson (USA)

### *AP-SOFE Endnote 2*

#### **AP-SOFE meeting agenda**

1. Welcome, introductions, opening remarks
2. Review and adopt agenda
3. FUTURE Open Science meeting session update and discussion
4. Discussion and agreement on advice to FUTURE regarding NPESR production
5. Other business

### *AP-SOFE Endnote 3*

#### **AP-SOFE Terms of Reference**

1. Establish a list of specific FUTURE priority topics, activities and products for review by the Science Board;
2. Work with the existing expert groups associated with FUTURE to review and revise, if needed, their Terms of Reference;
3. Work with the Scientific and Technical Committees and the PICES community to identify gaps in the priorities and activities of the expert groups and to provide recommendations to the Science Board;
4. Coordinate with the Scientific and Technical Committees in developing Terms of Reference for new expert groups to be part of FUTURE;
5. Coordinate with the Editors of the next version of the North Pacific Ecosystem Status Report and advise on how the Report should be updated in the future.
6. Recommend expert groups to identify major sources of uncertainty and impediments to improving the skill of assessments and forecasts, suggest research areas for priority development, and provide coordination of potential PICES products.
7. Provide for a PICES final peer review on information and interpretations

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Note: Terms of Reference 1–4 are common to all FUTURE Advisory Panels; Terms of Reference 5 – 7 are specific to AP-SOFE only.

*AP-SOFE Endnote 4*

**FUTURE Open Science Meeting**  
Kohala Coast, Big Island, HI, USA, April 15–18, 2014  
Draft Session Day 1

**S3: Overcoming challenges in communicating science and engaging the public: Ways and means of developing and disseminating FUTURE products**

Co-Conveners: Phillip Mundy (lead), Harold (Hal) Batchelder (USA) **confirmed**, Robin Brown (Canada), Shin-ichi Ito (Japan), Oleg Katugin (Russia) **confirmed**, Chang-Ik Zhang (Korea) **confirmed**, William Peterson (USA) **confirmed**

Plenary Speaker (tentative): Stephanie Hampton, National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara, Santa Barbara, CA [hampton@nceas.ucsb.edu](mailto:hampton@nceas.ucsb.edu)

Invited speaker: William Peterson (confirmed)

Communicating scientific findings to the public has never been more important and challenging than in the present era of global climate change unfolding against the backdrop of rapidly accelerating human population growth. Engaging the public in factually based dialogs about climate change and its impacts on the ecosystems on which we all depend is increasingly challenging. The compelling existential nature of the discussion has attracted people of many different professions and cultures who speak a wide variety of mutually unintelligible jargons and many different national languages. As members of the international marine scientific community served by PICES, as we are mindful that the first language of most participants is not English, we also need to be mindful that those from outside our area of specialization do not necessarily share our professional lexicon. As we get to know the public, we come to realize that it is us.

FUTURE is remarkable as a marine scientific program that explicitly addresses the area of public education and outreach within the broader scientific context of identifying major sources of uncertainty and impediments to improving the skill of assessments and forecasts, suggesting research areas for priority development, and providing coordination of potential PICES products through the FUTURE Advisory Panel on *Status, Outlooks, Forecasts, and Engagement* (SOFE).

Building on expertise and information in workshops that precede the session, a series of papers will address challenges presented by uncertainty in the uptake of forecasts by decision makers within the context of communication challenges presented by the diversity of disciplines and languages necessary to address global climate change.

*AP-SOFE Endnote 5*

**Cover page and Table of Contents for the draft advice document considered at the SOFE meeting**

*Author's Note October 12, 2013: The content of the draft below was distributed to the PICES Secretariat, FUTURE and Science Board leadership, including all Committee Chairs, all AP-SOFE members, and to MEQ by Chair, Mr. Chuanlin Huo, in August and September, 2013. Comments were received from Skip McKinnell, Ian Perry, Michael Dagg, Lyman Thorsteinson (MEQ on behalf of Mr. Huo, MEQ Chair), and others, and the author expresses appreciation for these ideas. This draft of October 12 does not respond to the comments due to problems relating to the shutdown of the author's agency (NOAA) by the U.S. Congress on October 1, 2013. Although the draft advice document contains a fair amount of detail, there are key items that would benefit from discussions in Nanaimo. Accordingly, the new draft contains a synopsis of key points for discussion at PICES-2013 by FUTURE, AP-SOFE, and Science Board, and it has a new title more appropriate to its role in the NPESR production process.*

Advice to FUTURE on the Process of Producing of the North Pacific Ecosystem Status Report  
2009 - 2013  
**DRAFT October 12, 2013**

Submitted to the  
Science Board  
North Pacific Marine Science Organization, PICES  
On behalf of  
FUTURE AP-SOFE  
and  
MONITOR  
October 12, 2013

Please send comments and recommendations to: [phil.mundy@noaa.gov](mailto:phil.mundy@noaa.gov)

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**AP-SOFE Endnote 6**

**AP-SOFE Workplan for 2013–2014**

1. Clearly identify all SOFE-related output products from Expert Groups, based on the Roadmap. This should include details on the output product (What is it?), timing for production and format (Scientific Report; Special Publication; Brochure; presentation; Database). Any potential issues regarding access or storage should be coordinated with TCODE.
2. With this information in hand, develop a simple spreadsheet or database to track progress of FUTURE products.
3. Assist in the planning and development of the FUTURE Open Science Meeting.
4. Plan for publication and outreach components of FUTURE products, as identified above.
5. Work with the Section on *Human Dimensions* (S-HD) on the identification of clients or target groups for FUTURE products in each PICES nations.  
It may be possible to get assistance from Governing Council member in this area. Many agencies will have lists of key client groups that they use to direct national outreach/engagement/consultation activities.
6. (With MONITOR and other Expert Groups) Refine/design the next version of the North Pacific Ecosystem Status Report. In particular, this will require consultation with S-HD on socio-economic indicators and WG 28 on ecosystem indicators).

7. Review requirement for a brochure summarizing the results of Working Group 20 – Climate Projections, drawn from the final report. Produce brochure if deemed valuable.
8. (With Expert Groups) Review Terms of Reference for these groups with the goal of embedding requirements for outreach/engagement products in these ToRs, as appropriate. Update Chairman's handbook to reflect this new requirement for all Expert Groups.
9. Assist host country in arrangements for a public lecture at PICES-2013.

## Summary of Scientific Sessions and Workshops and List of Best Presentations

### Science Board Symposium (S1)

#### *Mechanisms of Marine Ecosystem Reorganization in the North Pacific Ocean*

Co-Convenors: *Sinjaee Yoo (SB), Atsushi Tsuda (BIO), Elizabeth Logerwell (FIS)\*, Chuanlin Huo (MEQ), Hiroya Sugisaki (MONITOR), Kyung-Il Chang (POC), Toru Suzuki (TCODE), Thomas Therriault (AICE), Hiroaki Saito (COVE), Phillip Mundy (SOFE) and Igor Shevchenko (Russia)*

\* Elizabeth Logerwell was unable to attend PICES-2013.

#### Invited Speakers:

*Richard Beamish (Fisheries and Oceans Canada, retired)*  
*Alida Bundy (Bedford Institute of Oceanography, DFO, Canada)*  
*Brian Helmuth (Northeastern University, USA)*  
*Mitsutaku Makino (Fisheries Research Agency, Japan)*  
*Muyin Wang (University of Washington, Seattle, WA, USA)*

#### Background

The PICES FUTURE program aims to improve our capability to convey how North Pacific marine ecosystems may change due to natural and anthropogenic stressors, including climate change, and ultimately how societies will be affected by these changes. This will require advances in scientific communication which is a relatively new area for PICES and so to facilitate advancement of this topic this Symposium will focus on four focal areas of communication: Products, Communicating Uncertainty, Decision Support Tools, and Human Dimensions. In addition, this Symposium discussed the scientific basis of FUTURE products.

#### Summary of presentations

The Science Board Symposium was held on Monday, October 14, 2013 and was launched with a keynote address by Ian Perry and included five invited presentations: Richard Beamish (Fisheries and Oceans Canada, retired), Alida Bundy (Fisheries and Oceans Canada, Canada), Brian Helmuth (Northeastern University, USA), Mitsutaku Makino (Fisheries Research Agency, Japan), and Muyin Wang (University of Washington, USA). In addition, there were nine contributed oral presentations and two poster presentations.

The keynote address was given by Ian Perry (Fisheries and Oceans Canada, Pacific Biological Station, Canada) who used a local example of ecosystem change to highlight a central question of FUTURE: “What is the future of the North Pacific given current and expected pressures?”. Dr. Perry highlighted the linkages between Products, Tools, Uncertainty, and Human Dimensions as he illustrated how Canadian marine ecosystems have changed in response to potential drivers, including climate change and human influences. Specifically, within the Strait of Georgia, he showed how environmental indicators like temperature have increased and salinity decreased while biological indicators such as seals have increased while Fraser River sockeye have decreased. These products have been communicated to managers via various reports and publications. Linking drivers to change can be difficult but Dr. Perry showed how different modeling approaches, ecological risk assessment frameworks, and simulation models like Ecopath can be useful. However, he also highlighted how any forecast of the “future” has elements of uncertainty that also must be communicated when providing scientific advice to decision makers. Ultimately, the goal of communicating these findings and uncertainty is to allow decision makers to evaluate the trade-offs that will be required to attain a desirable state, likely one that will impact human societies as little as possible. Dr. Perry was clear that when communicating it is essential to “know your message” and be clear on what, why, how, and to whom scientific information is being communicated. This will be essential as the PICES FUTURE program moves forward.

## Session Summaries-2013

How does marine science become sustainable? Dr. Richard Beamish suggested this could be accomplished by having an informed public by being clear on what scientists know, what they don't know, and what they need to know using the coho salmon fishery in the Strait of Georgia as a case study. In the late 1980s the sport and commercial fisheries were booming but had collapsed by the mid-1990s due to changes in survival and migration patterns. With recreational fishermen, hatchery managers, and scientists all ready and willing to figure out what is happening, a community science team, the Strait of Georgia Coho Study Team, was created to conduct regional science and publicize the results. Dr. Beamish suggested PICES could consider a similar mechanism and the potential creation of a PICES Public Press to reach more general audiences.

Brian Helmuth touched on a different issue when communicating uncertainty and that is: When is it important to provide details? In many cases generalizations of species distributional responses to climate change have been useful but there is growing evidence that these simplifications might not be enough and a more detailed understanding of how organisms respond to their environment might be required to actually forecast change. Approaches like coupled biophysical-energetic models that build on a mechanistic understanding of how coastal organisms interact with their environment have the potential to provide spatially explicit estimates of where, when, and with what magnitude climate-induced impacts might occur. This will allow consideration of cumulative stress impacts, including sublethal effects, as shown here for *Mytilus*. Dr. Helmuth indicated it will be important to embrace variability early in an attempt to avoid potential "surprises" down the road as scientists continue to struggle to predict exact detailed impacts of climate change with a high degree of certainty.

Mitsutaku Makino highlighted why Human Dimensions are needed, especially for the FUTURE program. Dr. Makino showed how good science is sometimes not implemented by managers because of the perceived socio-economic or cultural costs and how inclusion of social science can be useful for setting objectives for social-ecological systems (SES). Further, he introduced the PICES community to the human well-being cube. This is one method that can be used to link ecosystems and human well-being through ecological services. Dr. Makino also showcased how the PICES Section on *Human Dimensions* is addressing key elements of the FUTURE science program and how human dimension indicators are being developed for use by the PICES community.

Science products can be directed at international experts, resource managers, and the general public. Alida Bundy provided an overview of the Indicators for the Seas (IndiSeas) program and showed how an empirical suite of indicators can be used to provide an interdisciplinary assessment or compare changes across ecosystems. In the first cycle, IndiSeas focused on developing ecological indicators that could be communicated to the public in an easy to understand way. Issues of climate change and human dimensions were identified as gaps and the second iteration of IndiSeas has now expanded to include these metrics. Dr. Bundy also introduced the IMBER-ADApT (Assessment based on Description, Responses and Appraisal for a Typology) decision support tool as humans are both drivers and recipients of ecosystem change. This tool allows users to build on knowledge gained from past experiences to inform future decision making, and is a tool that could be useful for implementing parts of the FUTURE program.

Muyin Wang presented results from the Coupled Model Intercomparison Project, phase 5 (CMIP5), especially how these models perform with respect to sea ice. Using observational constraints it was possible to eliminate some outlier models but many still performed relatively poorly with respect to simulated sea ice extent, significantly underestimating it. Despite some uncertainty, models predicted the Arctic will have a 2- to 3-month ice free period by the middle of the 21<sup>st</sup> century and a 5-month ice free period by the end of the 21<sup>st</sup> century. Clearly this will impact not only future climate but will have significant social, ecological, and economic consequences.

The remainder of the symposium included a variety of presentations related to the symposium theme. For example, Harold (Hal) Batchelder introduced the Future Ocean Alliance (FOA) and showed how coupling of natural and human systems will be essential to transfer knowledge to those that need it for sustainable ocean development. Ed Gregr showed how model complexity does not necessarily equate to uptake by managers



using a case study of otters, urchins, and kelp. Further, by not being explicit with respect to uncertainty there can be an overconfidence in models and with no clear endpoint, it can be difficult to determine when models are sufficient (generally when decisions would be unchanged). Carrie Holt showed how limit reference points or benchmarks can be applied to data-limited salmon stocks and highlighted how declines in productivity can be a concern for these data-limited stocks and that this uncertainty needs to be communicated to resource managers. Bill Sydeman presented a meta-analysis as a method to simplify and integrate information that can provide a synthetic view of an ecosystem that could be very useful in FUTURE. Hans Pörtner discussed multiple stressors such as increased sea surface temperature, ocean acidification, eutrophication, *etc.* and how they can impact different life history stages differently. For example, seasonal shifts in thermal windows can have significant large-scale impacts. Using chinook salmon in the Yukon River as an example, Ellen Tyler showed how outlooks and forecasts using real time data can be used for management purposes. Similarly, Sue Grant highlighted how making future predictions based on the past can be problematic when in the realm of “never seen before”. Here, Bayesian methods were used to include uncertainty in forecasts. Shin-ichi Ito spoke about extreme hot events that resulted in very high scallop mortality, even in deep water of Mutsu Bay. Models using the salinity budget were used to identify conditions that resulted in anti-estuarine circulation responsible for this high mortality and this information was used to inform management when this situation arose again. Marc Trudel discussed lessons learned from a juvenile salmon program, including the predictive power of forecasting models, the reality of shifting baselines, and the role of regime shifts: all of which contribute to uncertainty.

#### List of papers

##### *Oral presentations*

**Ian Perry** (Keynote)

Canada’s changing Pacific marine ecosystems: Forecasts, uncertainties, potential consequences, and communication

**Richard J. Beamish** (Invited)

Sustaining Marine Science

**Brian Helmuth** (Invited)

Communicating uncertainty in the era of climate change: When do ‘the details’ matter?

**Harold (Hal) P. Batchelder, Isabel Torres de Noronha, Oran Young, Suzanne Lawrence, Peter Fox, J. Luis Valdes, David Vousden, Ruben Zondervan, Robin Mahon, Leopoldo C. Gerhardinger, Heidi Schuttenberg and Marion Glaser**

Future Ocean Alliance (FOA): Enhancing ocean sustainability challenges through knowledge-based governance and decision-making

**Mitsutaku Makino and Keith R. Criddle** (Invited)

Why do we need Human Dimensions for the FUTURE Program?

**Alida Bundy** (Invited)

Communication is a two-way process: Bringing science to the people and people to the science

**Edward J. Gregg, Kai M.A. Chan and Villy Christensen**

When are models good enough? Assumptions and uncertainty in forecasts of ecosystem state and service supply

**Carrie A. Holt**

Evaluating benchmarks of biological status for data-limited populations of Pacific salmon: Impacts of climate-driven changes in productivity

**William J. Sydeman, Marisol Garcia-Reyes, David S. Schoeman, Ryan R. Rykaczewski, Bryan A. Black, Sarah Ann Thompson and Steven J. Bograd**

Meta-analysis: A tool for communicating complexity to informed general audiences

**Muyin Wang and James E. Overland** (Invited)

Arctic sea ice projections and uncertainties – An update from CMIP5 models

**Hans-O. Pörtner**

An integrated view of climate sensitivity in marine organisms: The need for proxies indicating molecular to ecosystem-level changes

**Phillip R. Mundy, Will Koeppen, Stephanie N. Schmidt, Ellen Tyler, Eric J. Newland, Bryce Mecum, Kathrine Howard, Darcy Dugan and Brian Stone**

Operational outlook and forecast in support of the management of a climate-driven fishery

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### **Sue C.H. Grant and Bronwyn L. MacDonald**

Fraser River Sockeye pre-season run size forecasts: Methods, indicators, and uncertainty

### **Shin-ichi Ito, Masaki Seito, Tooru Yoshida, Kazuhiro Takeuchi, Shigeo Kakehi, Taku Wagawa, Yutaka Isoda and Hiroshi Kawamura**

Water temperature forecasts to decrease megadeath of aquacultured scallops in Mutsu Bay, Japan

### **Marc Trudel**

Using ocean conditions to forecast salmon runs: Lessons learned from a decade of sampling juvenile salmon at sea

### *Poster presentations*

### **Gakushi Ishimura, Keita Abe, Kento Ito, Hiroki Nakano and Bolorchimeg Byamba**

Post-Tsunami Recovery Strategies: Issues and challenges for group operations by Kesenuma off-shore longline fisheries in Kesenuma, Japan

### **Tuula E. Hollmén and Suresh A. Sethi**

Development of conceptual ecological models to support the Gulf Watch Alaska long-term monitoring program

## **BIO/FIS/POC Topic Session (S2)**

### ***Are marine ecosystems of the North Pacific becoming more variable?***

Co-Convenors: *Steven Bograd (USA), Elizabeth Logerwell (USA), William Sydeman (USA) and Yutaka Watanuki (Japan)*

### Invited Speakers:

*Emanuele Di Lorenzo (Georgia Institute of Technology, USA)*

*Michael Litzow (University of Tasmania, Australia)*

### Background

It is well-known from fundamentals of population biology that demographic variability (*i.e.*, variability/variance in offspring production, survival, and recruitment) is a key attribute of population stability and sustainability (Caswell, 2001). This concept has important implications for fish and fisheries management, marine wildlife (seabirds and marine mammals), and marine ecosystem ecology and conservation, especially in light of ongoing and future climate change. Indeed, based on projections from recently updated Global Climate Models (GCMs; Solomon *et al.*, 2007, IPCC, 2013) as well as observations (*e.g.*, Hansen *et al.*, 2012, but see Huntingford *et al.*, 2013), a likely outcome of global warming is increasing variance in physical environmental characteristics. If marine environments generally become more variable, with more extremes in currents, temperatures, winds, or precipitation, there could be substantial impacts to populations and ecosystems with potentially severe socio-economic consequences. Increasing spatial and temporal variance in populations has also been hypothesized to be a precursor to low-frequency marine ecosystem “regime shifts” (Scheffer *et al.*, 2009) and fisheries collapses (Litzow *et al.*, 2013).

### Summary of presentations

With this background, the convenors (Steven Bograd, Elizabeth Logerwell, William Sydeman, and Yutaka Watanuki) convened a topic session for the 20<sup>th</sup> PICES Annual Meeting asking what we considered, at the time, to be a basic and simple question: Are marine ecosystems of the North Pacific becoming more variable? Papers were invited that tested hypotheses of increasing marine ecosystem variability relative to global climate change. The topic session was held in Nanaimo, British Columbia, Canada, on 18 October 2013. Due to the U.S. government shutdown, as well as other personal circumstances, only four presentations were made. The talks included a) invited speaker, Emanuele Di Lorenzo, who spoke on changes in characteristics of North Pacific climate variability and ecosystem responses, b) Michael Litzow *et al.*, who discussed non-linear change in the variability of North Pacific climate – and the response of biological systems, c) Marisol García-Reyes *et*

*al.*, who investigated the hypothesis of increasing variance in the California Current upwelling ecosystem using IPCC-class AR5 GCM, and d) Jay Peterson *et al.*, who addressed the hypothesis of increasing ecosystem variability based on an array of ecological indicators from the northern California Current. Two other presentations, Seokjin Yoon *et al.*, who discussed chum salmon (*Oncorhynchus keta*) habitat in the Western Arctic using coupled models, and Sen Tok Kim, who presented on demersal fish biomass within the East Sakhalin Current area of the Sea of Okhotsk, were made but these talks did not directly address the primary question of the topic session.

Di Lorenzo examined the drivers of coupled climate–ocean variability in the North Pacific and considered whether variance in time series for the Aleutian Low (AL) and North Pacific Oscillation (NPO), as primary drivers of the PDO and NPGO, respectively, have changed over the past six decades. Updating the work of Sydeman *et al.* (2013), Di Lorenzo demonstrated significant changes in the driver (NPO) of the NPGO, but no change in the variance structure of the AL and corresponding PDO. Di Lorenzo then considered whether changes in variance in the NPO could be attributed to climate change, finding that no definitive answer could yet be provided. Thereafter, Litzow *et al.* examined long-term observations of SST using the HadISST data set (20°N to 60°N) and biological populations (copepods in the western Pacific off Japan, ichthyoplankton and euphausiids off southern California, and fish [salmon, flatfish] and mammal [fur seal] production time series from Alaska), and conducted a statistical assessment of trends in variance using 11-year running standard deviations as the response variable. At the basin scale, Litzow *et al.* showed an 18% increase in SST variability from the mid 1950s to the late 1980s, but overall an 18% decrease in SST variance, contra Hansen *et al.* (2012), from the mid 1950s to 2010. However, Litzow and colleagues also showed substantial spatial variability in SST variance trends in Large Marine Ecosystems (LME) of the North Pacific. While SST increased across all LME (with varying slopes), variance in SST only increased substantially for two LME and it decreased in one. SST variability appeared to increase in the Aleutian Islands–Bering Sea and in central Pacific oligotrophic waters. In accordance with SST variance, change in population variance was found for the Bering Sea/Gulf of Alaska ( $p < 0.01$ ), but no associations were illuminated in the western Pacific or California Current. Litzow *et al.* concluded that while the question of increasing variability is exceedingly important and warrants additional attention, it would be most fruitful if investigated at the regional or LME scale of observation. Next, García-Reyes *et al.* investigated changes in the variance structure upwelling-favorable winds of the California Current. Based on her previous work on upwelling and ecosystems responses in this system (García-Reyes *et al.*, 2013), winter was selected as the season of interest. García-Reyes *et al.* tested the hypothesis that variance in winter upwelling would increase using IPCC GCM output (38 outputs from 21 models) made available recently on the CMIP5 website. As upwelling is a local process, the low resolution of most GCMs prevented direct analysis of coastal winds. Instead, they tested this hypothesis by examining the distribution and amplitude of the North Pacific High (NPH) as a proxy for winter upwelling in this system (Schroeder *et al.*, 2013). Using this approach, they found no systematic change in amplitude or positioning of the NPH, and that an equal number of models showed no change, increasing variance, and decreasing variance. García-Reyes *et al.* concluded that variability among the GCMs is too high to be able to assess changes in the variance of upwelling-favorable winds in the California Current. Last, Peterson *et al.* investigated changes in ecosystem variance using 18 years of observations of mesozooplankton abundance off central Oregon. Peterson and colleagues showed substantial seasonal and interannual variability in the zooplankton (copepod) community structure and how variability in both “southern” and “northern” copepod communities related well to variability in the PDO, on seasonal and annual temporal scales. While time series from this region are relatively short, if anything it appears that variance in the abundance of copepods has decreased, not increased, in recent years.

Overall, the topic session produced a number of interesting and surprising results. First, contrary to expectations, based on both observations and numerical experiments, it is unclear whether variance in the physical attributes of North Pacific marine ecosystems has or will increase or decrease. Observations and models support both interpretations. Second, while some population data appear to be tracking changes in environmental variance (in SST in this case), most population/ecosystem data sets are too short to provide strong inference regarding trends in variance and relationships to environmental variance. It seems probable

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though that some populations of the North Pacific are experiencing increasing variability in demographic attributes that could lead to reduced population viability with impacts on sustainability

The fact that findings were few, and contradictory to expectations, indicates that this fascinating question should be reconsidered at a future date by the PICES community, with greater attention paid to regional variation and novel methods and ideas to circumvent the limitations of data and models.

### Literature cited

- Caswell H (2001) Matrix Population Models: Construction, Analysis, and Interpretation, Vol. Sinauer Associates, Sunderland, Massachusetts
- García-Reyes M, Sydeman WJ, Thompson SA, Black BA, Rykaczewski RR, Thayer JA, Bograd SJ (2013) Integrated assessment of wind effects on Central California's pelagic ecosystem. *Ecosystems* 16:722-735
- Hansen J, Sato M, Ruedy R (2012) Perception of climate change. *Proceedings of the National Academy of Sciences* 109:E2415-E2423
- Huntingford C, Jones PD, Livina V, Lenton TM, Cox PM (2013) No increase in global temperature variability despite changing regional patterns. *Nature* 500:327-331
- IPCC (2013) Summary for policymakers. In: Stocker TF, Qin D, Plattner G-K, Tignor M, Allen SK, Boschung J, Nauels A, Xia Y, Bex V, Midgley PM (eds) *Climate change 2013: The physical science basis Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, p 27
- Litzow MA, Mueter FJ, Urban JD (2013) Rising catch variability preceded historical fisheries collapses in Alaska. *Ecological Applications* 23:1475-1487
- Scheffer M, Bascompte J, Brock WA, Brovkin V, Carpenter SR, Dakos V, Held H, van Nes EH, Rietkerk M, Sugihara G (2009) Early-warning signals for critical transitions. *Nature* 461:53-59
- Schroeder ID, Hazen EL, Black BA, Bograd SJ, Sydeman WJ, Santora JA, Wells BK (2013) Deconstructing the North Pacific High. *Geophysical Research Letters* 40:541-546
- Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL (2007) *Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK and New York, USA
- Sydeman WJ, Santora JA, Thompson SA, Marinovic B, Di Lorenzo E (2013) Increasing variance in North Pacific climate relates to unprecedented ecosystem variability off California. *Global Change Biology* 19:1662-1675

### List of papers

#### *Oral presentations*

**Emanuele Di Lorenzo** (Invited)

Changes in character of North Pacific variability and ecosystem implications

**Michael Litzow, William J. Sydeman, David S. Schoeman, Sanae Chiba, Marisol García-Reyes, Michael Malick, Hiroya Sugisaki and Sarah Ann Thompson** (Invited)

Nonlinear change in the variability of North Pacific climate – Are biological systems responding?

**Marisol García-Reyes, William J. Sydeman, Ryan R. Rykaczewski, Allison R. Wiener, Isaac D. Schroeder and Steven J. Bograd**

What do Global Climate Models say about increasing variance in the California Current upwelling ecosystem?

**Jay O. Peterson, William T. Peterson and Jennifer L. Fisher**

Assessing ecosystem variability from an array of indicators relevant to the northern California Current

**Seokjin Yoon, Eiji Watanabe, Hiromichi Ueno and Michio J. Kishi**

Estimating potential habitat for chum salmon (*Oncorhynchus keta*) in the Western Arctic using a bioenergetics model coupled with a three-dimensional lower trophic ecosystem model

**Sen Tok Kim**

Spatial distribution and long-term dynamics of demersal fish biomass within East Sakhalin Current area, Sea of Okhotsk

**MEQ/FUTURE Topic Session (S3)*****Status, trends and effects of pollutants in coastal ecosystems: Implications for wildlife and humans***

Co-Convenors: *Olga Lukyanova (Russia) and Won Joon Shim (Korea)*

## Invited Speakers:

*Sandra O'Neill (NWFSC, NOAA, USA)*

*Lorrie Rea (University of Alaska Fairbanks, USA)*

Background

Marine pollutants can impact the quality and/or abundance of invertebrates, fish, and wildlife. In addition, the contamination of seafood can diminish the viability of commercial species and/or deliver potentially harmful contaminants to human consumers. While pollutant topics vary geographically, a number of priority pollutants are common throughout the northern hemisphere. This session highlighted a number of practical approaches to assessing the status, trends and effects of emerging and/or priority pollutants in the PICES region, as well as examples from other parts of the world. Some of these approaches are presently being used as indicators of marine environmental quality in some jurisdictions. Examples include the 'Mussel Watch' program for monitoring metals and persistent organic pollutants (POPs), spatial and temporal trends in POPs in seabird eggs, and effects of POPs and hydrocarbons on the health of marine biota. Some of these efforts have proven very useful in revealing improvements to marine ecosystem health subsequent to the implementation of regulations, including the dramatic declines in PCB, DDT, dioxin and organotin levels and associated effects. Nevertheless, a number of pollutant concerns are emerging, such as replacement flame retardants, pharmaceuticals, and current use pesticides. Characterizing the status, trends and effects of marine pollutants in coastal ecosystem components can provide cost-effective means to guide regulations, source control and/or remediation strategies that will ultimately protect ecosystem health and services.

Summary of presentations

Session S3 was held on Wednesday, October 16, 2013 (half day). It was launched with two invited speakers, Sandra O'Neill (Washington Department of Fish and Wildlife, USA) and Lorrie Rea (University of Alaska Fairbanks, USA) and included other 6 oral presentations, 14 posters, and time for discussion. Approximately 30 to 40 people, including marine and geochemists, marine biologists, and bird and mammal researchers attended the session and provided useful comments.

The session covered a wide spectrum of pollutants (persistent organic pollutants, polycyclic aromatic hydrocarbons, tributyltin, mercury, arsenic, microplastics and infective human enteric virus) in the Pacific region from all six PICES member countries. There are on-going marine chemical pollution issues which affect salmon and stellar sea lion populations. O'Neill *et al.* found that the tissue residue levels and composition of persistent organic pollutants were distinctly different among five Pacific salmon species, depending their dwelling region, migratory route and diet. Rea *et al.* showed that Steller sea lions in the western Aleutian Islands had an apparent elevation in mercury and discussed its possible relationship with population decline in specific region. Simokon *et al.* reported on arsenic pollution originating from land-based activity in the coastal ecosystems of Far Eastern Seas. Polycyclic aromatic hydrocarbons contamination and their possible source and input pathways after the great tsunami in Japan were presented by Maki *et al.* Effective reduction of tributyltin levels in water and biota as well as its effects on marine organism was evaluated by Shim *et al.* after the implementation of total ban on tributyltin based antifouling paints in Korea. It could be a good example of proper management of marine chemical pollutants. A new emerging pollutant, microplastics in the marine environment in coastal British Columbia, was revealed by Desforges *et al.* An abundance of floating microplastics showed an obvious gradient from the coast to the open ocean. Watanuki *et al.* presented on a monitoring technique using feathers of tracked seabirds for investigating the spatial pattern of marine pollution was presented. Fan (Fan and Ming) discussed infective human enteric virus contamination and its risk assessment in surface seawater of Bohai Bay, China, and demonstrated that it is required to manage

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pathogen pollution. Poster presentations included microplastic pollution and its biological effects, spatiotemporal distribution of persistent organic pollutants and heavy metals. Through this session, presenters and audience agreed that there is still a variety of marine pollution issues to be dealt with in the Pacific region. Legacy and emerging persistent organic pollutants and heavy metals and marine debris including microplastics are high priority issues and topics in the Pacific. There is a growing need to address these pollution issues in the North Pacific region through an expert group. Based on the proposal of the Study Group of *Marine Pollutants* (SG-MP), a new Working Group on *Emerging Topics in Marine Pollution* (WG-ETMP/WG 31) was established under the direction of the Marine Environmental Quality Committee during the Annual Meeting.

### List of papers

#### *Oral presentations*

**Sandra O'Neill, Gina Ylitalo, David Herman and James West** (Invited)

Persistent organic pollutant fingerprints in five Pacific salmon species (*Oncorhynchus* spp.): Evidence of distinct contaminant sources associated with their marine distribution and feeding

**Lorrie D. Rea, J. Margaret Castellini, Lucero Correa, Brian S. Fadely, Vladimir N. Burkanov and Todd M. O'Hara** (Invited)

Some maternal Steller sea lion diets elevate fetal mercury concentrations in the western Aleutian Island area of population decline

**Yutaka Watanuki, Ai Yamashita, Mayumi Ishizuka, Yoshinori Ikenaka, Shouta M.M. Nakayama, Chihiro Ishii, Takashi Yamamoto, Motohiro Ito, Tomohiro Kuwae and Philip N. Trathan**

Feathers of tracked seabirds reveal a spatial pattern of marine pollution

**Mikhail V. Simokon, Lidia T. Kovekovdova and Denis P. Kiku**

Arsenic in the coastal ecosystems of Far Eastern Seas

**Won Joon Shim, Nam Sook Kim, Sang Hee Hong, Gi Myung Han and Sung Yong Ha**

An almost successful story of TBT regulation to protect the coastal environments of Korea

**Hideaki Maki, Gen Kanaya, Shin-Ichi Fukuchi, Kazuki Miura, Hisao Sasaki, Nobuyuki Tanaka, Nobuo Chiba and Osamu Nishimura**

Petrogenic and pyrogenic PAHs contamination in the sediments in Tohoku coastal seas, Japan by the great tsunami on 3.11.2011

**Jean-Pierre Desforges, Moira Galbraith, Neil Dangerfield and Peter Ross**

Microplastics in the marine environment in coastal British Columbia

**Jingfeng Fan and Hongxia Ming**

The contamination and risk assessment of infective human enteric viruses in surface seawater from Bohai Bay, China

#### *Poster presentations*

**Sangjin Lee**

NOWPAP activities addressing marine litter

**Young Kyoung Song, Won Joon Shim, Mi Jang, Sang Hee Hong and Gi Myung Han**

Ship paint as a new input source of floating microplastics in surface microlayer

**Chunjiang Guan, Fengao Lin and Jingfeng Fan**

A public questionnaire survey of oil spill in 7.16 Dalian New Port

**Dong-Woon Hwang, Pyoung-Joong Kim, Minkyu Choi, In-Seok Lee, Sook-Yang Kim and Hee-Gu Choi**

Temporal trend and spatial distribution of trace metals in coastal sediment of Korean peninsula

**Jung-Hoon Kang, Oh-Youn Kwon, Kyun-Woo Lee and Won Joon Shim**

Marine floating microplastics around Geoje Bay in the Southern Sea of Korea

**Kyun-Woo Lee, Jung-Hoon Kang and Won Joon Shim**

Toxicity of micro polystyrene particle for marine copepod *Tigriopus japonicus*

**Yanin Limpanont, Kwang-Sik Choi, Hyun-Ki Hong and Chang-Keun Kang**

Histopathology of Manila clams *Ruditapes philippinarum* surveyed in Korean waters

**Guangshui Na, Zihao Lu, Wanru Zhang, Hui Gao, Jinqiu Du, Zhen Wang, Yaqi Cai, Ziwei Yao and Chuanlin Huo**

Occurrence and distribution of five types of antibiotics and antibiotic-resistant *Escherichia coli* in Liao River estuary, China

**Jianguo Du, Zhao Jiayi and Chen Bin**

Assessing ecological risks of heavy metals to marine organisms by species sensitivity distributions

**POC Topic Session (S4)**

***The changing carbon cycle of North Pacific continental shelves and marginal seas***

Co-sponsored by SOLAS

Co-Convenors: *Minhan Dai (China), Sophia Johannessen (Canada) and Dong-Jin Kang (Korea)*

Invited Speakers:

*Miguel Goni (Oregon State University, USA)*

*Kon-kee Liu (Institute of Hydrological and Oceanic Sciences, National Central University, Chinese-Taipei)*

Background

Coastal waters link the atmosphere, the land and the open ocean, both dynamically and biogeochemically. Consequently, the carbon cycle of the continental shelves and marginal seas that ring the North Pacific is particularly complex and prone to rapid changes induced by global climatic and regional anthropogenic forcing. Among others, these drivers include increasing temperature, ocean acidification, eutrophication, and deoxygenation of seawater. Such changes represent a potential for great harm to the ecosystems and fisheries that rely on these highly productive waters. This session invites presentations on ocean acidification, hypoxia, eutrophication and other topics related to the biogeochemistry of organic and inorganic carbon in Pacific continental shelves and marginal seas.

Summary of presentations

Session S4 (co-sponsored by SOLAS) took place over two days (morning sessions of October 16 and 17), as well as posters. The session was well subscribed, with a total of 22 abstracts representing all six PICES member countries. Invited speakers were Prof. Miguel Goni (USA) and Prof. K.K. Liu (China-Taipei).

Prof. Goni reviewed the role of terrestrial sources of carbon along the northwest coast of North America, noting that these are likely to change substantially in the future due to both climate and other anthropogenic forcing. Prof. Liu addressed changes on the other side of the Pacific, noting that the western North Pacific continental margin is the most densely populated in the world, and that both eutrophication of river waters and its impounding and diversion for irrigation affect productivity in the coastal zone and that this, in turn, affects the course of ocean acidification.

Other talks addressed air–sea fluxes of CO<sub>2</sub>, hypoxia impacts on zooplankton and fish, interdecadal changes in carbon flux and zooplankton abundance, and regions including the California Current, East/Japan Sea, East China Sea, Strait of Georgia, and Prince William Sound.

List of papers

*Oral presentations*

**Miguel A. Goni** (Invited)

Land-ocean conductivity in the carbon cycle of the Pacific Northwest margin

**Vadim Navrotsky, Valeriy Liapidevskii, Vyacheslav Lobanov and Elena Pavlova**

On small- and meso-scale dynamic processes responsible for long-term fluctuations of biological parameters of continental shelves and marginal seas

**Dong-Jin Kang, Jae-Yeon Kim, Tongsup Lee, Pavel Tischchenko and Kyung-Ryul Kim**

An application of TrOCA to the East/Japan Sea

**Minhan Dai, Jinwen Liu, Wenping Jing, Hongjie Wang, Xianghui Guo and Guizhi Wang**

Multiple stressors in the coastal ocean ecosystem

**Zhong-yong Gao, Heng Sun and Liqi Chen**

Distributions of pCO<sub>2</sub> and their decadal changes in the Bering Sea

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**Jerome Fiechter, Enrique Curchitser, Christopher Edwards, Fei Chai, Nicole Goebel and Francisco Chavez**

Spatiotemporal variability of air-sea CO<sub>2</sub> exchange in the California Current

**Liyang Zhan, Liqi Chen, Jiexia Zhang and Yuhong Li**

Implication of different Nitrous oxide distribution patterns between Canadian and Greenland Basin on Global Deep Ocean water nitrous oxide Production

**Guimei Liu, Xuanliang Ji, Shan Gao and Hui Wang**

Temporal and spatial variability of carbon cycle in the Northwestern Pacific: A 3D physical-biogeochemical modeling study

**Kon-Ke Liu** (Invited)

Anthropogenic impacts on the carbon cycle and related biogeochemical processes of western North Pacific continental margins

**John A. Barth, Oscar Pizarro, Kate Adams and Nadin Ramirez**

Comparing hypoxia over the continental shelves off central Oregon, USA, and Concepción, Chile

**Sophia Johannessen, Diane Masson and Robie Macdonald**

Why the Strait of Georgia is not a dead zone

**Sonia Batten, Abigail McQuatters-Gollop and Dionysios Raitsos Exarchopoulos**

Variability in lower trophic levels on the Alaskan Shelf

**Julie E. Keister, Anna McLaskey, Lisa Raatikainen, Amanda Winans and Bethellee Herrmann**

Species diversity in zooplankton responses to hypoxia and elevated pCO<sub>2</sub>

**Rui Yin and Atsushi Ishimatsu**

Effects of ocean acidification on the physiological profile of the Japanese pearl oyster *Pinctada fucata*

**Andrew M. Edwards, Holly E. Neate, Rowan Haigh, Carrie A. Holt and Debby Ianson**

Vulnerability of Canadian Pacific fisheries to ocean acidification

**Burke Hales, Katherine Harris, Wiley Evans and George Waldbusser**

Winter conditions in Oregon coastal waters as refugia from ocean acidification

### *Poster presentations*

**Yusuke Takatani, Atsushi Kojima, Kazutaka Enyo, Yosuke Iida, Toshiya Nakano, Masao Ishii, Daisuke Sasano, Naohiro Kosugi, Takashi Midorikawa and Toru Suzuki**

New empirical equations for total alkalinity in surface waters over the Pacific Ocean from the PACIFICA database

**Boram Sim, Dong-Jin Kang, Cho-Rong Moon, Young Gyu Park and Kyung-Ryul Kim**

Basin-to-basin comparison of radiocarbon in the East/Japan Sea

**Masao Ishii, Toru Suzuki, Daisuke Sasano, Naohiro Kosugi, Yusuke Takatani, Masahide Wakita, Akihiko Murata, Lisa Miller and Robert M. Key**

PACIFICA carbon data 2nd-level quality control

**Jae-Yeon Kim, Dong-Jin Kang, Tonsup Lee, Kyung-Ryul Kim, JeongHee Shim and Hee- Dong Jeong**

fCO<sub>2</sub> characteristics in the surface of marginal seas around Korea (East/Japan Sea and East China Sea)

## **BIO/FIS Topic Session (S5)**

*Marine ecosystem services and the contribution from marine ecosystems to the economy and human well-being*

Co-sponsored by *IMBER*

Co-Convenors: *Shang Chen (China), Keith Criddle (USA), Ekaterina Golovashchenko (Russia), Mitsutaku Makino (Japan), Jungho Nam (Korea), Minling Pan (USA) and Ian Perry (Canada)*

Invited Speakers:

*Leif Anderson (NOAA Fisheries, Northwest Fisheries Science Center, USA)\**

*Kai Chan (University of British Columbia, Canada)*

*Shang Chen (First Institute of Oceanography, SOA, PR China)*

*Dan Lew (NOAA Fisheries, Alaska Fisheries Science Center, USA)\**

\* Leif Anderson and Dan Lew were unable to attend PICES-2013.



## Background

Marine ecosystem services are the benefits people obtain from the sea and ocean. Since the UN Millennium Ecosystem Assessment reports were published in 2005, the concept of ecosystem services has been broadly accepted by politicians, scientists, developers and the public. When politicians make policy decisions, they should know the value of the marine ecosystem services involved, and how much economic development and human well-being the marine ecosystem may support. As scientists, we have the responsibility to give the answers or the best estimates to these questions. The goals of this session are to provide scientists with a platform to exchange results from research on marine ecosystem services and to show how they contribute to the economy and human well-being. In turn, these research activities will be a demonstration of the contributions and significance of the work being done on this topic within PICES communities, including marine-related research institutes, universities, and management agencies, to marine science and national economies.

## Summary of presentations

This session was well-attended, with strong participation and questions. It was developed and led by members of PICES' Section on *Human Dimensions of Marine Systems*. Unfortunately, not all U.S. participants and invited speakers were able to attend. Kai Chan spoke about Integrating Ecological Considerations and Cultural Values into Decision-Making. He noted several prevailing assumptions regarding ecosystem services: we can identify what matters *a priori*; cultural and provisioning services are independent; values are commensurate; and change in ecosystem services is a function of ecological change. He proceeded to demonstrate that all four of these prevailing assumptions are false; that intangibles often drive success or failure of management; that key conditions for success include engaging interdisciplinary research teams; decision-makers/practitioners with resources are needed for long term partnerships; and a need to consider the planning/campaign horizon and its insulation from political pressures. He concluded by noting that integrating ecological considerations and cultural values into decision-making is not easy, but it is not an impossible quagmire. Shang Chen discussed marine ecological capital assessments in China. He noted that in the coastal waters of Shandong Province, each \$1 of living resources supports \$8 of service outputs, whereas in a particular location such as Dongshan Bay, each \$1 of living resources supports \$95 of service outputs. He concluded that: the value of ecosystem services shows decreasing trends from onshore to offshore; mariculture and recreational activities make major contributions to the value of ecosystem services; assessment methods developed for China appear to be valid to evaluate ecosystem services; and this approach can be used to assess ecosystem compensation values. Linda D'Anna spoke about the social values of marine ecosystem services and human well-being. In particular, she noted that well-being engages with the heterogeneity among stakeholders to inform decision-making. She described a case study for a specific marine social-ecological system in coastal British Columbia, asking how shellfish aquaculture might enhance or interrupt the flow of benefits supplied by ecosystem services, and how these changes may affect the well-being of the Baynes Sound social-ecological system (which produces one-half of all the shellfish cultured in B.C. Using a variety of techniques, including social surveys, she concluded that: changes in the flow of ecosystem services have several effects on social well-being, *e.g.*, on the environment, economy, and experience; perceptions about what matters about the effects of these changes are variable; and that changes like aquaculture that modify the delivery of ecosystem services are experienced and valued differently. The variability of the subjective component of social well-being can be a tool for discovering the spectrum of values affected by changes that modify the flow of ecosystem services. Ling Huang and colleagues evaluated the impact of sector management on the productivity of New England groundfish fisheries. They noted that these are considered as common pool resources in which management adopts a Sector rights-based approach. They concluded that joining sectors would increase productivity by 5.3% on average, and that sectors have different technical efficiencies which can change over time. Michio Kishi and colleagues described an ecosystem approach for management of artificial release of chum salmon from Japan coupled with the NEMURO and NEMURO.FISH ecosystem models. The purpose of their study was to examine how to maximize the income of Japanese fishermen by catching chum salmon, and therefore, how many chum salmon should be released from Japan and how this may change with future global warming. They calculated the suitable release number under present conditions and under conditions as they are expected

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to evolve due to global warming. Results indicate that present release numbers are optimal under current conditions. Jianshi Jin and colleagues examined fisheries and stock enhancement in the Bohai Sea, China. He noted that large-sized demersal species have been replaced by low-valued and small-sized pelagic fish, that the community structure has changed considerably, with rapid species shifts, lower trophic levels, and a simpler food web. He noted that rebuilding or restocking of this ecosystem is needed, and that sea ranching and stock enhancement have been regarded since the 1980s as important measures to rebuild the depleted stocks. He concluded that control of intensive fishing is a key requirement, that restocking of depleted fishery stocks needs more input of both manpower and financing, and that an ecosystem based management approach is required. In a contributed presentation, Kai Chan and colleagues discussed the importance of considering ecosystem services in the presence of trophic cascades, using sea otters, kelp forests, and coastal communities on the west coast of Vancouver Island as their case study. They assessed the many ecological changes associated with otters and kelp forests, including 'nutrient subsidies' from kelp forests to adjacent and distant ecosystems and boosts to tourism, and how these can be represented in a spatial model that depicts the effects of various human interventions on ecosystems. Michael Melnychuk and colleagues generated much discussion by their examination of the potential consequences of overfishing and underfishing for food security and economic value in U.S. fisheries. Food security is threatened by overfishing in some cases, but by underfishing in others, and that overfishing and underfishing both result in less long-term catch than if populations were fished at their maximum sustainable yields. They reasoned that primary reasons for underfishing losses in the eastern Bering Sea include ecosystem catch limits and poor market conditions, whereas overfishing losses are incurred primarily by the slow recovery of some rebuilding stocks. They concluded that guards against overfishing are important, but analysis of trade-offs should also involve consequences of underfishing on food security. "Traditional" fisheries scientists expressed concern about the degree to which our understanding of and control over precise management controls might lead to excesses in either over- or under-fishing. Patricia MacDonald and colleagues concluded the session with their presentation on capturing social values in the seafood sector. They used the "Q Method" to examine an individual's subjective understanding of his/her world. They concluded that not everyone in each fishery-related sector holds the same views of the environment. Instead, they identified 5 cross-cutting groups: collaborative pragmatists; local guardians; science and innovation champions; cautious traditionalists; and prosperity promoters. This was a satisfying presentation to conclude with as it underscored the diversity of attitudes and approaches that make evaluations of ecosystem services such a complex issue.

### List of papers

#### *Oral presentations*

**Kai M.A. Chan, Anne Guerry, Patricia Balvanera, Sarah Klain, Terre Satterfield *et al.*** (Invited)

Not impossible: Integrating ecological considerations and cultural values into decision-making

**Shang Chen and Tao Xia** (Invited)

Marine ecological capital assessment: Methods and application in China seas

**Linda D'Anna, Grant Murray and Sarah Dudas**

Social value of marine ecosystem services: Insights from multi-dimensional subjective well-being

**Ling Huang, Subhash Ray, Kathleen Segerson and John Walden**

Evaluating the impact of sector management on the productivity of New England groundfish

**Michio J. Kishi, Kenta Awa, Takeshi Miwa, Seokjin Yoon and Toru Nagasawa**

Ecosystem approach for management of artificial release of chum salmon from Japan coupled with NEMURO and NEMURO.FISH

**Xianshi Jin, Xiu-Juan Shan, Jun Wang, Yunzhong Wang, Zhenliang Zhao, Shengrao Qiu and Jing Dong**

Fisheries and stock enhancement in the Bohai Sea, China

**Kai M.A. Chan, Russell Markel, Rebecca G. Martone, Jessica Clasen, Jordan Levine, Brock Ramshaw, Gerald G. Singh, *et al.***

Sea otters, kelp forests, and coastal communities: Ecosystem services amongst trophic cascades

**Ekaterina V. Golovashchenko and Andrey I. Solomin**

Bioeconomic modelling of the marine resource — Towards stable exploitation in the western Bering Sea marine ecosystem

**Michael C. Melnychuk, Jeannette A. Banobi and Ray Hilborn**

Overfishing and underfishing consequences for food security and economic value in U.S. fisheries

**Patricia MacDonald, Michele Patterson and Grant Murray**

Capturing social values in the seafood sector: New tools for new times

*Poster presentations*

**Tatiana N. Semenova**

Ecotourism — An effective means of contributing to the economy and human well-being

**Ryotaro Okazaki and Yasunori Sakurai**

Influence of SST and PDO on the catches of walleye pollock, pink salmon and Japanese common squids in Rausu, Shiretoko World Natural Heritage, Japan

**BIO/POC/TCODE/MONITOR/FUTURE Topic Session (S6)**

***Recent trends and future projections of North Pacific climate and ecosystems***

Co-Convenors: *Jack Barth (USA), James Christian (Canada), Enrique Curchitser (USA), Chan Joo Jang (Korea) and Angelica Peña (Canada)*

Invited Speakers:

*Jason Holt (National Oceanography Centre, UK)*

*William Merryfield (Canadian Centre for Climate Modelling and Analysis, Environment Canada)*

Background

The North Pacific Ocean experiences change on a range of timescales, and is among the most difficult regions of the world ocean in which to detect secular climate trends associated with anthropogenic forcing against the background of natural variability. Understanding impacts on ecosystems and the human communities dependent on them requires understanding of the magnitudes of climate variability and change. Sustained observations of past and present states, modeling of future states with global climate models (GCMs), and downscaling of GCM projections to the regional scale are all key components of the scientific effort to understand impacts and inform adaptation efforts. Downscaling efforts are likely to include a variety of methods, both statistical and dynamical, including high-resolution regional ocean circulation models with embedded ecosystem/biogeochemical models, statistical models relating local population statistics to climate forcing or climate indices, and multi-species models forced by temperature or oxygen anomalies from regional or global models. This session dealt with papers on time-series of observations of the North Pacific Ocean in the context of recent climate variability and change, and future projections of changes including statistical and dynamical downscaling.

Summary of presentations

Overall the session was extremely well subscribed and well attended, and the quality of the science was very good. An S6 presenter, Dr. Youngji Joh (Korea), received the MONITOR Best Oral Presentation award for a MONITOR-sponsored Topic Session (for more details, see the last page of this document). There was good representation from almost all of the PICES countries (two presenters from China withdrew in August due competing commitments). At most times there were in excess of 50 people present. The session was extended from a full day to an additional half day to accommodate all of the presenters.

Dr. Jason Holt (National Oceanography Centre, UK) started off the session with an invited talk about how to downscale global climate model predictions to the scale of shelf seas in order to get the shelf ecosystem response right. He reviewed how shelf seas differ from the deep ocean in their response to climate change projections, including that shallow shelf seas are more in thermal equilibrium with the atmosphere than is the

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deep ocean and that horizontal fluxes are particularly important in shelf seas, especially those contributing to ocean–shelf exchange. Dr. Holt pointed out that isolated seas are vulnerable to single drivers and concluded by reinforcing the need to compare the model results with long time series that are available from the European shelf seas.

Two speakers reviewed the use of regional climate models for both the western (Dr. Chul Min Ko, Korea) and eastern (Dr. Michael Foreman, Canada) North Pacific. They both pointed out that global climate models don't get the regional dynamics right and that downscaling was necessary. They both used the "pseudo global warming" technique where future-minus-contemporary anomalies were added to the initial and forcing fields of their regional models. Dr. Foreman pointed out that summertime winds off the British Columbia coast are not projected to be very different in the future and that global models do not resolve the California Undercurrent, which carries nutrient-rich, oxygen-poor waters from the south.

Dr. Ryan Rykaczewski (USA) used a suite of IPCC models to examine the Bakun (1990) hypothesis that winds off the U.S. west coast should become stronger with global warming. He found no evidence for this in the models and noted that the atmospheric pressure gradient between ocean and land does not increase as hypothesized by Bakun. Dr. William Crawford (Canada) showed how subsurface dissolved oxygen concentrations across the eastern North Pacific exhibit coherent interdecadal variation, with increases from the 1950s to the 1980s and a decline after the 1980s.

Two speakers demonstrated the importance of getting the details of the regional circulation correct in order to understand interannual and interdecadal variability in the Japan/East Sea. Dr. Dmitry Stepanov (Russia) focused on the deep circulation in the Japan Basin as influenced by the basin geography and Dr. Yuri Oh (Korea) described how nutrient fluxes through the Korea Strait influenced productivity in the southern Japan/East Sea (JES). Dr. Joo-Eun Yoon (Korea) further addressed this topic later in the day with an analysis of the mechanisms controlling interannual variability of primary production in the JES over 1998–2007 and the importance of Tsushima Current transport.

The second invited speaker, Dr. William Merryfield (Canada) reviewed the (very new) science of seasonal-to-interannual and decadal climate prediction, the areas of North Pacific climate that are amenable to prediction, and the particular challenges encountered in the North Pacific relative to other ocean areas. Dr. Youngji Joh (Korea) reviewed the ability of CMIP5 models to simulate the PDO, ENSO, and mechanisms underlying tropical-extratropical teleconnections, and found them substantially improved over CMIP3. Dr. James Christian (Canada) discussed the challenge of detecting an anthropogenic signal in ocean biogeochemical data, illustrated by sampling CMIP5 model simulations. Dr. Vera Pospelova (Canada) showed how dinoflagellate cysts can be used as an index of past primary productivity, using data mostly from the California Current region. Dr. Sanae Chiba (Japan) discussed the effects of climate variability on the mean size of the copepod community using over 10 years of CPR data, noting that there is a size dependence of the efficiency of trophic transfer to higher trophic levels. The copepod community showed significant interannual-to-interdecadal variability over this period, which was different in the eastern and western North Pacific.

The second day was equally well attended and again featured speakers from most of the PICES countries. Dr. Taeki An (Korea) discussed seasonal shifts of ecosystem structure in the JES, which show coherent fluctuations across trophic levels from phytoplankton to fish. Dr. Neil Banas (USA) considered similar shifts of ecosystem structure in the Bering Sea, and suggested that future climates will likely be unfavourable for pollock due to reduced production of large copepods. Dr. Andrei Krovnin (Russia) considered the effect of climate variability on pollock and pink salmon recruitment and noted that North Pacific climate variability may also be related to the Arctic and North Atlantic oscillations. Dr. Hae Kun Jung (Korea) considered records of a variety of fisheries around Korea in relation to multiple climate indices over 1960–2010, concluding that there are multiple 'cold' and 'warm' periods that are relatively, but not entirely, consistent across indices and in their effects on fisheries. Dr. Tony Koslow (USA) examined CalCOFI ichthyoplankton survey data from 1950–2010, and found that mesopelagic fishes have coherent fluctuations across ecotypes that are correlated with subsurface oxygen concentration. He further noted that advection (California Current transport) and water mass structure are important factors in climate control of fish and plankton assemblages.

List of papers

*Oral presentations*

**Jason Holt, Icarus Allen, Yuri Artioli, Laurent Bopp, Momme Butenschon, Heather Cannaby, Ute Daewel, Bettina Fach, James Harle, Dhanya Pushpadas, Baris Salihoglu, Corinna Schrum and Sarah Wakelin** (Invited)

Physical processes mediating climate impacts in shelf sea ecosystems

**Chul Min Ko, Chan Joo Jang, Chun Yong Jung and Cheol-Ho Kim**

A Regional Climate Coupled Model for the western North Pacific: Assessment of a present climate simulation

**Michael Foreman, Wendy Callendar, Diane Masson, John Morrison and Isaak Fain**

Regional ocean climate model projections for the British Columbia continental shelf

**Ryan R. Rykaczewski, John Dunne, Charles A. Stock, William J. Sydeman, Marisol García-Reyes, Bryan A. Black and Steven J. Bograd**

Investigating the upwelling intensification hypothesis using climate-change simulations

**William Crawford and Angelica Peña**

Decadal changes in dissolved oxygen concentration in the thermocline of the Northeast Pacific

**Dmitry V. Stepanov, Victoria I. Stepanova and Nikolay A. Diansky**

Interdecadal variability of circulation in the northern Japan/East Sea based on numerical simulations

**Yuri Oh, Chan Joo Jang, Sinjae Yoo and Chul Min Ko**

Effects of nutrient transport through the Korea Strait on the seasonal and interannual variability in the East Sea (Japan Sea) ecosystem

**William Merryfield** (Invited)

How predictable is the North Pacific?

**Youngji Joh, Chan Joo Jang, Minho Kwon, Ho-Jeong Shin and Taewook Park**

An improvement of reproducibility of Pacific decadal oscillation in CMIP5

**James R. Christian**

Detection of anthropogenic influences on ocean biogeochemistry in the North Pacific

**Vera Pospelova**

Environmental and primary productivity change in coastal waters of the eastern North Pacific revealed from the sedimentary phytoplankton record

**Joo-Eun Yoon, Young Baek Son and Sinjae Yoo**

Primary productivity and its interannual variability in the East Sea, 1998-2007

**Sanae Chiba, Sonia Batten, Tomoko M. Yoshiki, Tadafumi Ichikawa and Hiroya Sugisaki**

Climate induced variation in the basin scale zooplankton community structure in the North Pacific

**William T. Peterson and Jennifer L. Fisher**

The influence of ten El Niño events on pelagic ecosystem structure in the northern California Current

**Hiroshi Kuroda, Taku Wagawa, Yugo Shimizu, Shin-ichi Ito, Shigeho Kakehi, Takeshi Okunishi, Sosuke Ohno, Hiromi Kasai and Akira Kusaka**

Interdecadal decreasing trend of the Oyashio on the continental slope off the southeastern coast of Hokkaido, Japan

**Taeki An, Hyun Je Park, Jung Hyun Kwak, Chung Il Lee, Hae Won Lee, Kangseok Hwang, Jung Hwa Choi and Chang-Keun Kang**

Seasonal shift of ecosystem structure around the Ulleung Basin of the East/Japan Sea

**Elena I. Ustinova and Yury D. Sorokin**

Recent trends of air and water temperature and ice cover in the Far-Eastern Seas

**Neil S. Banas, Robert G. Campbell, Carin Ashjian, Evelyn Lessard, Alexei Pinchuk, Evelyn Sherr, Barry Sherr and Jinlun Zhang**

Linking sea-ice retreat and increasing water temperature to plankton community structure and function in the eastern Bering Sea

**Andrei Krovnin, Boris Kotenev and George Moury**

Climatic variability in the Northwest Pacific: Regimes, mechanisms, trends, impact on commercial fish populations

**Hae Kun Jung, Chang-Keun Kang and Chung Il Lee**

Regional differences in the response of ocean environment and fisheries resources in Korean waters to the North Pacific regime shift and possible mechanisms

**J. Anthony Koslow, Peter Davison, Ana Lara-Lopez and Mark D. Ohman**

Epipelagic and mesopelagic fishes in the southern California Current System: Ecological interactions and oceanographic influences on their abundance

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### *Poster presentations*

**Sayaka Yasunaka, Yukihiro Nojiri, Tsuneo Ono, Shin-ichiro Nakaoka and Frank A. Whitney**

Monthly maps of sea surface nutrients in the North Pacific: Basin-wide distribution and seasonal to interannual variations

**Minwoo Kim, Cheol-Ho Kim and Chan Joo Jang**

Effects of grid refinement in the global ocean circulation experiments

**Cheol-Ho Kim, Chan Joo Jang and Minwoo Kim**

Sea level projection of the North Pacific Ocean using a non-Boussinesq ocean-sea ice model in the SRES A1B scenario

**Olga Trusenkova and Dmitry Kaplunenko**

Patterns of interannual to decadal sea level variability in the Japan/East Sea

**SM M. Rahman, Chung Il Lee and Chang-Keun Kang**

Regional differences in oceanic and fisheries variability in the East/Japan Sea related to north Pacific climate-ocean variability

**Allison R. Wiener, Marisol García-Reyes, Ryan R. Rykaczewski, Steven J. Bograd and William J. Sydeman**

Statistical downscaling of an ensemble of Global Climate Models output for the California upwelling region

**Wu Shuangquan, Gao Zhigang, Yang Jinkun and Yu Ting**

Numerical simulation of ocean ecological dynamics in Taiwan Strait

### **BIO/FIS/MEQ/TCODE/FUTURE Topic Session (S8)**

***Ecosystem indicators to characterise ecosystem responses to multiple stressors in North Pacific marine ecosystems***

Co-Convenors: *Vladimir Kulik (Russia), Chaolun Li (China), Ian Perry (Canada), Jameal Samhouri (USA)\*, Peng Sun (China), Motomitsu Takahashi (Japan) and Chang-Ik Zhang (Korea)*

\* Jameal Samhouri was unable to attend PICES-2013.

### Invited Speakers:

*Isabelle Côté (Simon Fraser University, Canada)*

*Yunne-Jai Shin (Institut de Recherche pour le Développement, France)*

*Mingyuan Zhu (First Institute of Oceanography, SOA, PR China)*

### Background

Multiple natural and human stressors on marine ecosystems are common throughout the North Pacific, and may act synergistically to change ecosystem structure, function and dynamics in unexpected ways that can differ from responses to single stressors. These stressors can be expected to vary by region, and over time. Understanding the impacts of multiple stressors, and developing indicators which capture their behaviours and changes, are major challenges for an ecosystem approach to the North Pacific and for the PICES FUTURE project. The objective of this session was to present potential indicators of ecosystem responses to multiple stressors in the North Pacific (with the focus on multiple, rather than single, stressors). One goal of the session was to determine if these proposed ecosystem indicators can provide a mechanistic understanding of how ecosystems respond to multiple stressors. For example, 1) are responses to stressors simply linear or are changes non-linear such that small additional stressors result in much larger ecosystem responses; 2) do different parts of the ecosystem respond differently (*e.g.*, across trophic levels); 3) how do stressors interact and can these interactions be adequately captured by the proposed indicators? Conceptual, empirical and model-based analyses are welcome. The results of this session contribute to the work of PICES Working Group 28 on *Ecosystem indicators for multiple stressors on the North Pacific*.

The session was deeply saddened by the untimely death of Dr. Mingyuan Zhu, and a moment of silence was held in his honour. He was a very important scientist for PICES.

Summary of presentations

The session was well-attended, and with strong participation in questions and discussions. All of the presenters were congratulated for leaving time for questions after their presentations. The session introduced much new information and new ideas, all of which are relevant for the work of Working Group 28. A number of presentations proposed ecologically-based indicator sets and/or methods to evaluate the efficacy of the indicators. A number of talks also discussed how multiple stressors can interact. One important finding from a meta-analysis was that 35% of studies examined found that multiple stressors interacted synergistically, and that antagonistic interactions occurred in 42% of the studies examined. The conclusion from this analysis was that interactions were not additive in the majority of analyses studied, which is usually the default assumption in frameworks examining the impacts of multiple interacting stressors. An important implication of these results is that management actions may not produce the intended result because such actions may alter the interactions among multiple stressors, in particular if the interactions are antagonistic. Overall, discussions questioned how well existing indicators can address temporal scaling issues and the interactions of processes at larger (and smaller) temporal and spatial scales. The issue of sub-lethal stressors and their effects was also discussed, with the potential for indirect stressors to interact with direct stressors. It was recognised that many indicators can be proposed; when developing indicators of human actions and responses an inclusive process is needed. Overall, the consensus was that a good job is being done currently of beginning to model and evaluate responses of indicators to observed and modelled ecosystem changes, although questions remain as to whether these models can adequately address the three types of stressor interactions (additive, synergistic, antagonistic). Participants felt the current state of the art was doing a better job simulating fishing and climate interactions in models. Participants also concluded that no single indicator will be adequate and the use of multiple models was recommended to reduce model-based uncertainties. But an important question was raised: how, and whether, multiple indicators can be combined into smaller sets of summary indicators. At present, it seems the most common way to assess the impacts of more than two stressors is via expert opinion, and sometimes modelling. These techniques have their own important limitations and biases.

List of papers*Oral presentations*

**Isabelle M. Côté and Emily S. Darling** (Invited)

Testing and predicting synergy between multiple stressors

**Stephen Ban**

Expert elicitation of a Bayesian Belief Network for climate change effects on the Great Barrier Reef

**Helen J. Gurney-Smith, Catherine A. Thomson, Dan S. Sanderson, Jennifer Kimball and Stewart C. Johnson**

A functional genomics approach to assessing ecosystem health and resilience in keystone bioindicator species

**Andrew Day, Thomas A. Okey, Micha Prins and Stephanie King**

Developing social-ecological indicators for Canada's Pacific Marine regions: Steps, methods, results and lessons

**Joanna Smith, Charlie Short, Steve Diggon, John Bones, Matthew Justice, Andrew Day and Stephanie King**

Ecosystem-based management indicators for a marine planning process in BC's north coast- Marine Planning Partnership (MaPP)

**Cathryn Clarke Murray, Megan E. Mach, Rebecca G. Martone, Gerald G. Singh, Kai M.A. Chan and Miriam O**

Assessing direct and indirect risk from human activities to significant ecosystem components in the Northeast Pacific

**Rebecca G. Martone, Melissa M. Foley, Megan E. Mach, Corina I. Marks, Carrie V. Kappel, Kimberly A. Selkoe and Benjamin S. Halpern**

Groundtruthing cumulative impact models in nearshore ecosystems of the California Current

**Yunne-Jai Shin, Jennifer Houle, Alida Bundy, Marta Coll, Penny Johnson, Chris Lynam, Lynne Shannon and Laure Velez** (Invited)

A multi-model evaluation of ecosystem indicators' performance

**Caihong Fu and Yunne-Jai Shin**

Exploring ecological indicators to evaluate fishing and environmental impacts on ecosystem attributes

**Vladimir V. Kulik**

Comparing environmental changes over the past 10 years with the states and trends of the ecosystem indicators proposed by IndiSeas in the Sea of Okhotsk

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**Kirstin K. Holsman and Stephani Zador**

Methods to characterize risk of Alaskan marine habitats to multiple stressors and establish ecosystem reference points

**Stephen B. Brandt and Cynthia Sellinger**

Growth rate potential as a quantitative ecosystem indicator of habitat quality

**Doug Hav, Jake Schweigert, Jennifer L. Boldt, Jaclyn Cleary, Thomas A. Greiner and Kyle Hebert**

Decadal change in eastern Pacific herring size-at-age and gonad size: A climate connection?

**Kisaburo Nakata**

The pelagic and benthic coupled biogeochemical cycle model study for Mikawa Bay estuary

**Kyung-Su Kim, JeongHee Shim and Suam Kim**

The combined effects of elevated CO<sub>2</sub> and temperature on the survival, growth and skeletal formation of olive flounder larvae *Paralichthys olivaceus*

**Skip McKinnell**

A quantitative method for assessing the interactions of multiple stressors; How I learned to compare apples and oranges

**Motomitsu Takahashi and Mingyuan Zhu**

Ecosystem responses to anthropogenic activities and natural stressors in the East China and Yellow Seas

**R. Ian Perry, Jameal F. Samhoury and Motomitsu Takahashi**

Developing indicators for ecosystem responses to multiple pressures: Case studies between the eastern and western North Pacific

**Sarah Ann Thompson, William J. Sydeman, Heather Renner and John F. Piatt**

Regionalizing seabirds as indicators of forage fish in Alaska

**Yuxue Qin, Yuichi Shimizu and Masahide Kaeriyama**

Risk management for recovering chum salmon populations in the Iwate coastal ecosystem after the Tohoku catastrophic earthquake and tsunami

**Yongjun Tian**

Interannual-decadal variability in the large predatory fish assemblage in the Tsushima Warm Current regime of the Japan Sea with an emphasis on the impacts of climate regime shifts

*Poster presentations*

**R. Ian Perry and Diane Masson**

A statistical approach to the development of ecosystem indicators for multiple pressures in the Strait of Georgia, Canada

**Peng Sun, Zhenlin Liang, Yang Yu, Yanli Tang, Fenfang Zhao and Liuyi Huang**

Trawl selectivity induced evolutionary effects on age structure and size at age of hairtail (*Trichiurus lepturus*) in East China Sea, China

**Guanqiong Ye, Jie Liu and Loke M. Chou**

Designing a network of coral reef marine protected areas in Hainan Island, South China



## **MONITOR Topic Session (S9)**

### ***Cost-effective, cooperative ocean monitoring***

Co-convenors: *Steven J. Barbeaux (USA)\*, Jennifer Boldt (Canada), Martin Dorn (USA)\* and Jaebong Lee (Korea)*

#### Invited Speakers:

*Sonia Batten (Sir Alister Hardy Foundation for Ocean Science, UK/Canada)*

*Chris Rooper (NMFS-Alaska Fishery Science Center, USA)\**

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\* Steven J. Barbeaux, Martin Dorn and Chris Rooper were unable to attend PICES-2013.

### Background

Long-term monitoring is a key component of an ecosystem-based approach to fisheries management. Data time series enable the examination of changes in oceanographic and community metrics. In addition to costly ocean monitoring systems with sensor arrays and autonomous vehicles, low cost cooperative monitoring efforts would enhance our understanding of marine ecosystems, as well as help insure their long-term viability. An important consideration for sustainable long-term ocean monitoring is the development of affordable solutions to deploying and retrieving sensors. Sustainable long-term ocean monitoring is successfully being implemented at regional scales with low-cost options as presented in the 2012 PICES Annual Meeting session entitled "Monitoring on a small budget: Cooperative research and the use of commercial and recreational vessels as sampling platforms for biological and oceanographic monitoring". Researchers from many nations are now working with other ocean going stakeholders such as fishers and mariners to collect oceanographic and fisheries data for little to no deployment and retrieval costs. This session provided a forum for researchers to present the development and results of cooperative monitoring projects world-wide.

### Summary of presentations

This session was well attended, despite several presentation cancellations. There were four oral presentations in this session; all presentations included excellent examples of cooperative observation programs. Each presentation was followed by a discussion regarding successes, challenges encountered, and lessons learned in cooperative monitoring programs. Successes common to all presentations included the cooperation of people associated with ships and equipment of opportunities, as well as the successful collection of data. Challenges included that data collection is not the main priority for shared sampling platforms. Also, there were some technical difficulties in some sensors due to conditions of opportunistic sampling. Regardless of these challenges, lessons learned indicate that cooperative programs can successfully provide low-cost monitoring of ecosystem attributes.

Dr. Sonia Batten was an invited speaker for this session and provided information on the Continuous Plankton Recorder (CPR) program in the North Pacific. CPRs have been deployed from vessels of opportunity on their regular routes of passage for multiple decades and in several of the world's oceans. These surveys generate spatially and temporally referenced quantitative data on the abundance and distribution of many zooplankton and larger phytoplankton taxa, providing insights into the base of the marine food chain and lower trophic level responses to hydroclimatic variability. Benefits and limitations of the approach were discussed. In more recent years, the CPR has itself become a sampling platform with instrumentation added to the towed body which autonomously collects physical data (T, S, D) and chlorophyll fluorescence, or microplankton via a self-contained water sampler. The North Pacific CPR survey has also, in the past, made use of marine bird and mammal observers onboard the vessel. There is thus the potential to develop large-scale, multi-trophic level monitoring programs with some supplemental physical data. While microscopic processing of all CPR survey data can take several months to complete, a more recently a near-real-time approach has been adopted along

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some transects with data available within 60 days. The CPR program has contributed significantly to oceanographic monitoring.

Dr. Kyung-Il Chang described a cooperative monitoring project that makes use of snow crab traps as sampling platforms for deep sea monitoring in the East/Japan Sea. A system was devised to monitor the deep sea environment and acquire full-depth profiles of water properties regularly, like an Argo float, using snow crab fishing boats. The Korean snow crab fishing activities are widespread in the southwestern East Sea at about 40 locations in a depth range between 500 and 1500m. The deployment and recovery of traps take place regularly approximately once a week if the sea state permits. The system consists of a Microcat with dissolved oxygen sensor and a data logger. The Microcat, attached to a trap, profiles CTD and dissolved oxygen while the trap is deployed and recovered. It records water properties for about a week while it stays near the seabed with the trap. Once the trap is on the vessel's deck, data inside the Microcat are automatically transferred to the compact logger set in the bridge of the boat, and then transferred to the lab via any available communication system.

Dr. Tony Koslow presented a model for cooperative observation programs as the basis for ecosystem-based management, ocean climate research and assessment of ecosystem change. A meta-analysis of Pacific Ocean observation programs indicated that while the physics is generally well-monitored, biological monitoring remains inconsistent, fragmented, *ad hoc*, and with critical data access issues still unresolved. He proposed the CalCOFI program as a model for cooperative monitoring between government fisheries and ocean agencies and academic oceanographic institutions which can provide the basis for fisheries stock assessment within the context of the physical and biological oceanographic environment. This partnership enhances ecosystem-based management and the development of robust ocean climate and ecosystem research that is able to provide time series for the ocean environment 'from winds to whales'.

The final presentation was given by Dr. Francis Juanes. The project described was aimed at understanding the marine soundscape off Vancouver Island by exploring passive acoustic data from the NEPTUNE Canada cabled ocean observing system in the Northeast Pacific Ocean. Elevated anthropogenic noise in marine soundscapes and their potential to decrease communication efficacy of marine organisms is of increasing global concern. The deep sea soundscape is particularly vulnerable to increasing anthropogenic noise while at the same time the ecosystem is being subjected to increasing pressures from resource users. Using passively-collected acoustic data collected at two sites over a one-year period, the levels of ambient noise were quantified, including vessel traffic, and biological sounds, including potential fish sound production. Complications due to extensive self-generated instrument noise were discussed.

In addition to the four oral presentations, three posters were presented as part of this session. Hisashi Yamaguchi and co-authors utilized satellite remote sensing data to examine the seasonal variation of chlorophyll *a*, which might be an index of the growth of cultured scallop in Mutsu Bay. Tomoko Yoshiki and co-authors examined the spatial and temporal variation of the copepod community structure, abundance and biodiversity in the western subarctic North Pacific during 2001–2010, using Continuous Plankton Recorder (CPR) data. The final poster stated that the tsunami caused by the Great East Japan Earthquake on 11 March 2011 destroyed monitoring systems important for aquaculture operations in Japan's Iwate Prefecture. Shin-ichi Ito and co-authors showed that monitoring systems at two ports (Kamaishi and Noda) were reconstructed, and there are plans to reconstruct four other systems.

### List of papers

#### *Oral presentations*

**Sonia Batten** (Invited)

Ship of opportunity sampling of lower trophic levels

**Kyung-Il Chang, Ki-Wan Kim and Sang-Uk Lee**

Use of snow crab traps as sampling platforms for deep sea monitoring in the East/Japan Sea

**J. Anthony Koslow and Jennifer Couture**

Are current ocean observation networks adequate? A model for cooperative observation programs as the basis for ecosystem-based management, ocean climate research and assessment of ecosystem change

**Carrie C. Wall, Rodney A. Rountre and Francis Juanes**

Understanding the marine soundscape off Vancouver Island: An exploration of passive acoustic data from the NEPTUNE Canada ocean observing system

*Poster presentations*

**Hisashi Yamaguchi, Hiroshi Murakami, Xu Yongjiu, Takayuki Kusunoki and Masahito Ebina.**

Understanding the estimated error of the satellite chlorophyll a in Mutsu Bay

**Tomoko M. Yoshiki, Sanae Chiba, Tadafumi Ichikawa, Hiroya Sugisaki and Sonia Batten**

Geographical shift of warm water species distribution in western subarctic North Pacific based on CPR sample during 2001-2010

**Shin-ichi Ito, Kazushi Tanaka, Yuki Endoh, Takeshi Yamanome, Shinnosuke Kaga, Taku Wagawa and Shigeo Kakehi**

Reconstruction of coastal sea water temperature monitoring systems and real-time broadcast to fishermen in Iwate Prefecture

**FIS/TCODE Topic Session (S10):**

***Banking on recruitment curves; returns on intellectual investment***

Co-sponsored by ISC (*International Scientific Committee on Tunas and Tuna-like Species*)

Co-Convenors: *Anne Hollowed (USA)\*, Skip McKinnell (PICES), Hiroshi Okamura (Japan), Cisco Werner (ISC)*

Invited Speakers: *Louis Botsford (University of California at Davis, USA), Jon Brodziak (NOAA/PIFSC, USA)\**

\* Anne Hollowed and Jon Brodziak were unable to attend PICES-2013.

Background

During the first half of the 20th century, one of the fundamental issues in the then nascent discipline of fisheries science was determining how many individuals could be removed from a fish population without affecting its ability to keep producing fish for a fishery. In the 1950s, theoretical solutions to this problem were discovered in mathematical formulations that emerged from the work of Ricker, Beverton, Holt and others. These closed-form solutions led to widespread adoption as electronic computing technology became widely available in fisheries labs in the 1960s. Concepts that emerged from their equations underpin current estimation of biological reference points used to set harvest strategies for many of the world's fisheries. Spawner-recruitment (S-R) curves serve as the foundation for what of a fish population remains to be conserved. With so much at stake, it is surprising that their application in contemporary fisheries is taken for granted. This session will delve into the good, the bad, and the ugly consequences of using recruitment curves, with an idea of determining whether an intellectual course correction is needed for the next 50 years. This topic session seeks papers that introduce new approaches to modeling the relationship between spawners and recruitment including: (1) incorporating predator prey interactions in S-R models, (2) use of coupled bio-physical models in identifying mechanisms linking spawners and recruitment, (3) consideration of the role of cohort resonance, (4) techniques for incorporating environmental variability into S-R functions, (5) stage-based S-R approaches, (6) comparative studies testing the performance of different methods relative to observations, and (7) decision rules regarding how to utilize knowledge of S-R relationships in formulating harvest advice. Enthusiasm for this topic session will be used to seek publication in a Special Issue in a primary journal.

Summary of presentations

The 22<sup>nd</sup> Annual Meeting of PICES was unique in many ways, but the greatest of the anomalies was the shutdown of the United States government which prevented NOAA employees from attending. Jon Brodziak

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of the NOAA/Pacific Islands Fisheries Science Center was nominated as the ISC invited speaker, but was unable to attend to present his views (with Mark Mangel) on “*Understanding and predicting population resilience via steepness*”. Nevertheless, the session was quite successful, especially due to the efforts of several early career scientists. Only the contributed talk by Ron Heintz and Edward V. Farley, Jr. was withdrawn because of the shutdown. Perhaps the most disappointing aspect of the session was the lack of enthusiasm to publish the results in a primary journal.

Louis Botsford, invited speaker from the University of California, Davis, focused on cohort resonance which refers to the greater spectral sensitivity of populations to slowly changing environmental variability and to variability on generational time scales. He and his colleagues described how populations have greater sensitivity to lower frequencies and generational frequencies. Overall variance and sensitivity increases with fishing although populations tend to be stable about an equilibrium on the compensatory part of a stock-recruitment curve. This may provide an explanation for cycles in sockeye salmon. The effect is just as strong in populations with hatcheries. Specific spectral sensitivity also appears in marine birds, where low (high) frequency of ENSO increases (decreases) population variance.

Some good collaborations among Japanese oceanographers, modelers and fishery biologists are producing useful tools for understanding Pacific saury migrations in the western North Pacific Ocean. Michio Kishi gave a nice presentation on the Pacific saury migration model and its relation to stock and recruitment and future climate change. Cheryl Harrison, David Siegel, and Satoshi Mitarai revisited the tattered curtain hypothesis that coastal jets limit cross-shelf benthic larval transport. Model results indicated that the upwelling jet along the U.S. West Coast partially retains material released over the shelf, broken up by filaments, that strong upwelling winds tear this jet, moving material offshore in complex patterns, and that the response of the jet to wind is nonlinear, making predictability limited in this high energy region. La Treese Denson, David Sampson, and Andi Stephens used environmental data to inform assumptions of spatial stock assessments (of a *Sebastes*-like fish) with Stock Synthesis. Preliminary results suggest that under some conditions, environmental data may help to describe the distribution of recruits and improve the estimation of reference points. Accounting for abrupt environmental change seemed to provide the greatest benefit to stock assessments that included environmental change. Increased intensity of environmental influence on recruitment may provide more information for the estimation process. Kirstin Holsman, Kerim Aydin and Jim Ianelli pooled their effort to examine the use of multi-species food-web and assessment models to evaluate climate change impacts on fisheries. Multi-species models (MSM) can provide annual estimates of natural mortality, and can be used to derive multi-species Biological Reference Points (BRP). BRPs are highly variable and depend on control rules. Climatic variability introduces some differences but they are less than what is introduced by control rules, at least for walleye pollock. For species with low predation, they found that MSM models were approximately equivalent to single species assessment models. Gordon Kruse presented Jonathan Richar’s work, in collaboration with Albert J. Hermann and Enrique Curchitser on the effects of shifting population demographics, oceanography, and predation on apparent stock-recruitment relationships for Tanner crab in the Eastern Bering Sea. They estimated stock-recruit relationships for Tanner crabs in the eastern Bering Sea, and estimated potential relationships between recruitment and groundfish predators in the eastern Bering Sea. One interpretation of results was that Tanner crab had a strong density-dependent relationship. Potential mechanisms included cannibalism. In abundant years, female distribution expands to the outer shelf and to the northwest. ROMS modeling suggests larvae from these regions are vagrants. An alternative interpretation was that recruitment is environmentally driven with autocorrelated variability with periodicity about twice the mean generation time. Evidence for a predation effect is weak or mixed. A positive relationship with cod is contrary to expectations from top-down control, no relationship with yellowfin sole suggests no effect, and a dome-shaped relationship with flathead sole could suggest prey switching behavior. Finer-scale spatial models may be necessary owing to interannual shifts in distributions.

After the lunch break, the theme switched briefly to Pacific salmon. Catherine Michielsens, Mike Lapointe and Carl Walters explored density dependence, delayed density dependence and time varying productivity to explain a decrease in productivity of Fraser River sockeye salmon. Kalman filter or recursive Ricker models are excellent for evaluating productivity trends over time across a wide range of stocks but may not be the

most appropriate for particular stocks, *e.g.*, those displaying cyclic dominance. They found that the Kalman filter or recursive Ricker model will attribute the low recruits per spawner on the dominant cycle as lower overall productivity. Recursive versions of alternative models may be more appropriate, *e.g.*, recursive Larkin model. It is easy to derive benchmarks based on recursive Ricker models but difficult to do the same for recursive Larkin models. Using recursive Ricker models to derive benchmarks may not be appropriate for some of the stocks.

Skip McKinnell went back to the drawing board with a simple polynomial model framework for assessing salmon production and setting escapement targets that avoided the use of Ricker or Beverton-Holt type production models. Using examples from multiple populations of Fraser River sockeye salmon, he found no significant evidence of curvature (density-dependent survival) in spawner-return data in most stocks, and inferred that optimum spawner abundance is unknown in them. Fishing prevents knowing optimum yield because spawner abundance is never high enough often enough, so most stocks are on ~linear part of the production curve. He suggested that current spawner abundance optimum arises from the types of curves that are used routinely, and perhaps OLS fitting, rather than the production data. Production and conservation goals might be achieved jointly by increasing spawner abundance, but the current generation of fishers won't benefit. Only the Chilko L. stock had statistically significant evidence of curvature.

Robyn E. Forrest (and co-authors Murdoch McAllister, Steven Martell and Carl Walters) received a Best Presentation award in a TCODE-sponsored Topic Session for her talk on “*Modelling the effects of density-dependent mortality in juvenile red snapper caught as bycatch in Gulf of Mexico shrimp fisheries: Implications for management*” (see the list of recipients at the end of these summaries). She asked what was needed to assess status of a fish stock and predict its response to fishing. They found that failure to account for density-dependent mortality occurring simultaneously with bycatch can lead to biased fishery reference points, underestimation of impacts of directed fishery, and overestimation of impacts of bycatch. They concluded that management plans cannot rely solely on bycatch reduction and should include directed fishery. Finally, that the definition of reference points is problematic in the presence of numerous sources of mortality affecting different demographic components of population.

The two final talks of the session were presented by Cody S. Szuwalski. The first was work with Katyana Vert-Pre, Andre Punt, Trevor Branch and Ray Hilborn, examining common assumptions about recruitment using the RAM Legacy Stock Assessment Database to understand whether the environment drives recruitment dynamics for most marine fisheries. Their advice to management was to “play to the mean” using proxies for FMSY and BMSY and change expectations for recruitment based on the regime state. Instead of target biomasses, they suggested using target fishing mortalities. Proxies for F could be based on life history, and risk analysis for target biomass. As Anne Hollowed was unable to attend, Cody also presented her talk on setting biological reference points under a changing climate. She concluded that the first step is to set goals and objectives for future fisheries management and identify strategies to achieve goals and objectives. These strategies should then be evaluated relative to achieving goals and identify trade-offs of changes in harvest strategies. She felt that it is necessary to acknowledge that management systems will continue to evolve, but develop suites of tests to identify shifts in dynamics – focus on quantifying holistic risk (and reward) using one-way trips to peer into the future. She asked, “Are we at the mercy of climate change?” How can we set a target for something for which we have never seen?” Developing suites of tests to identify when and how dynamics are changing is important.

### List of papers

#### *Oral presentations*

**Louis W. Botsford, J. Wilson White, Alan Hastings, Lauren Yamane, Flora Cordoleani, Patrick Kilduff and Allison Dedrick** (Invited)

Stock-recruitment and population variability in a changing, uncertain world

**Michio J. Kishi, Seokjin Yoon, Takeshi Terui, Satoshi Suyama, Masayasu Nakagami and Shin-ichi Ito**

A Lagrangian modeling approach for Pacific saury migrations

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### **Cheryl S. Harrison and David A. Siegel**

The tattered curtain hypothesis revisited: Coastal jets limit cross-shelf benthic larval transport

### **La Treese S. Denson and David B. Sampson**

Using environmental data to inform spatial stock assessments with Stock Synthesis

### **Jonathan I. Richar, Gordon H. Kruse, Albert J. Hermann and Enrique Curchitser**

Effects of shifting population demographics, oceanography, and predation on apparent stock-recruit relationships for Tanner crabs in the eastern Bering Sea

### **Catherine J.G. Michielsens, Mike Lapointe and Carl J. Walters**

Exploring density dependence, delayed density dependence and time varying productivity to explain decreased productivity of Fraser River sockeye salmon

### **Kirstin K. Holsman, Kerim Aydin and Jim Ianelli**

Using multi-species food-web and assessment models to evaluate climate change impacts on fisheries

### **Skip McKinnell**

A simple model framework for assessing salmon production and setting escapement targets

### **Robyn E. Forrest, Murdoch K. McAllister, Steven J.D. Martell and Carl J. Walters**

Modelling the effects of density-dependent mortality in juvenile red snapper caught as bycatch in Gulf of Mexico shrimp fisheries: Implications for management

### **Cody S. Szuwalski, Katyana A. Vert-Pre, Andre E. Punt, Trevor A. Branch and Ray**

Environment drives recruitment dynamics for most marine fisheries

### **Anne B. Hollowed and Cody S. Szuwalski**

Setting biological reference points under a changing climate

## BIO Paper Session

Co-Convenors: *Atsushi Tsuda (Japan) and Michael Dagg (USA)*

### Background

The Biological Oceanography Committee (BIO) has a wide range of interests spanning from molecular to global scales. BIO targets all organisms living in the marine environment including bacteria, phytoplankton, zooplankton, micronekton, benthos and marine birds and mammals. In this session, we welcome all papers on biological aspects of marine science in the PICES region. Contributions from the early career scientists are especially encouraged.

### Summary of presentations

The BIO Paper Session at PICES-2013 had high participation, with a total of 16 oral presentations and 10 poster presentations (2 cancellations). Oral sessions were divided over two days and were well attended (over 40 participants). Presentations spanned a wide range of biological issues focusing around phytoplankton (1), zooplankton (8), forage fish (1), marine birds and mammals (5), and other issues (1). Similarly, poster presentations covered a broad spectrum of biological topics. The convenors recognized that this regular session provides important opportunities for PICES scientists to present their results and for early career scientists to participate in PICES activities.

### List of papers

#### *Oral presentations*

### **Huamei Shao, Yuka Morita, Shiori Sonoki, Kenji Minami, Norishige Yotsukura, Masahiro Nakaoka and Kazushi Miyashita**

Spatiotemporal analysis of kelp forest distribution characteristics in sea desertification areas using acoustic and direct sensing methods

**Angelica Peña and Nina Nemcek**

Phytoplankton and nutrient dynamics along Line P in the NE subarctic Pacific

**Woo Yul Yi, Hyung-Ku Kang, Bome Song and Joong Ki Choi**

Egg production rate and hatching success in relation to feeding rate of the planktonic copepod *Paracalanusparvuss.l.* at a fixed station, southeastern coast of Korea

**Rui Saito, Atsushi Yamaguchi, Hiromichi Ueno, Hiromu Ishiyama, Hiroji Onishi, Ichiro Imai and Ichiro Yasuda**

Influence of Aleutian eddies on calanoid copepods south of the western Aleutian Islands during summer

**Corinne Pomerleau, Brian P.V. Hunt, R. John Nelson, Akash Sastri and William J. Williams**

Spatial patterns in zooplankton communities and stable isotope ratios ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ) in relation to oceanographic conditions in the sub-Arctic Pacific and Western Arctic regions during the summer of 2008

**Yoshiyuki Abe, Masafumi Natsuike, Kohei Matsuno, Takeshi Terui, Atsushi Yamaguchi, Michio J. Kishi and Ichiro Imai**

Variation in assimilation efficiencies of dominant *Neocalanus* and *Eucalanus* copepods in the subarctic Pacific: Consequences for population structure models

**Ah-Ra Ko and Se-Jong Ju**

Seasonal and spatial variations of food sources of krill *Euphausia pacifica* in Yellow Sea using fatty acids analysis

**Jeffrey G. Dorman, Ramona L. Zeno, Jarrod A. Santora and William J. Sydeman**

Modeling krill 'hotspots' in the central California Current: Results from variation in diel vertical migration schemes

**C. Tracy Shaw, Leah R. Feinberg and William T. Peterson**

A tale of two krill: Who, when, where, and how many? The euphausiids *Euphausia pacifica* and *Thysanoessa spinifera* in the coastal upwelling zone off the Oregon Coast, USA

**Se-Jong Ju, Ah-Ra Ko, E.J. Yang, William T. Peterson and C. Tracy Shaw**

Understanding the food selectivity of *Euphausia pacifica* in Yellow Sea: *in-situ* live feeding experiment with natural food assemblages

**Jessica A. Miller, William T. Peterson, Louise Copeman, Marisa N.C. Litz, Angela L. Sremba and Laurelyn Perry**

Is the growth of larval and early juvenile northern anchovy (*Engraulismordax*) related to the biochemical climatology of the Northern California Current?

**Strahan Tucker, Mark Hipfner, John R. Candy, Colin Wallace, Terry D. Beacham and Marc Trudel**

Stock-specific and condition based predation of juvenile pink, chum and sockeye by rhinoceros auklets (*Cerorhinca monocerata*)

**Jarrod A. Santora, Isaac D. Schroeder, John C. Field, Brian K. Wells and William J. Sydeman**

Melding space and time: Mesoscale structuring of predator-prey relationships off central California

**Mayuko Otsuki, Kazuo Amakasu, Minoru Kitamura, Shigeto Nishino, Takashi Kikuchi, Yoko Mitani and Kazushi Miyashita**

The presence of fin whale vocalizations is correlated with zooplankton abundance in the southern Chukchi Sea

**Szymon Surma**

Ecological interactions between forage fish, rorquals, and fisheries in Haida Gwaii

**Trevor W. Joyce and Lisa T. Ballance**

Effects of El Niño/La Niña–Southern Oscillation oceanographic variation on the at-sea distribution and foraging ecology of piscivorous seabirds in the oceanic eastern tropical Pacific

*Poster presentations*

**Daichi Arima, Atsushi Yamaguchi, Yoshiyuki Abe, Kohei Matsuno, Rui Saito, Hiroki Asami, Hiroshi Shimada and Ichiro Imai**

Seasonal changes in the zooplankton community and number of generations per year of small copepods in Ishikari Bay, Sea of Japan

**Wen-Tseng Lo, Shwu-Feng Yu and Hung-Yen Hsieh**

Epipelagic siphonophores associated with summer mesoscale hydrographic features in the waters around Taiwan, western North Pacific Ocean

**Maira Galbraith and Sonia Batten**

Interannual variability in the abundance of *Pseudocalanus* spp.

**Kyoungsoo Shin, Bonggil Hyun, Keun-Hyung Choi, Pung-Guk Jang, Min-Chul Jang and Woo-Jin Lee**

Effects of increased CO<sub>2</sub> and temperature on the growth of diatoms in laboratory experiments

**Bonggil Hyun, Kyoungsoo Shin, Keun-Hyung Choi, Woo-Jin Lee, Pung-Guk Jang, Min-Chul Jang and Chang-Ho Moon**

Changes in coastal phytoplankton community structure under future climate conditions: A mesocosm study

**Seokjin Yoon, Michio J. Kishi, Satoshi Nakada, Yoichi Ishikawa, Tomonori Isada and Sei-Ichi Saitoh**

Estimating carrying capacity for scallop aquaculture using a bioenergetics model

## Session Summaries-2013

### **Erin J. Fedewa, Jessica A. Miller and Thomas P. Hurst**

Interannual variation in pre- and post-settlement processes of northern rock sole (*Lepidopsetta polyxystra*) in relation to temperature variability in the Gulf of Alaska

### **Oleg N. Katugin, Mikhail A. Zuev and Gennady A. Shevtsov**

Distribution patterns of *Gonatus onyx*, *G. pyros* and *G. berryi* (Gonatidae, Teuthida) in the northwestern Pacific Ocean and adjacent marginal seas

### **German Novomodny**

Is unexpected 2013 flood on the Amur River an evidence of future probable drastic, unprecedented changes in the Amur bioresources state?

## FIS Paper Session

Co-Convenors: *Xianshi Jin (China) and Elizabeth Logerwell (USA)*

### Background

This session invited papers addressing general topics in fishery science and fisheries oceanography in the North Pacific and its marginal seas, except those covered by FIS-sponsored Topic Sessions.

\* Elizabeth Logerwell was unable to attend PICES-2013.

### List of papers

#### *Oral presentations*

#### **Nadezhda V. Yarosh and Victor F. Bugaev**

Seasonal growth of juvenile coho salmon *Oncorhynchus kisutch* scales in the Bolshaya River, West Kamchatka

#### **Cameron Freshwater, Marc Trudel and Francis Juanes**

Effects of body size, marine entry timing, and marine growth on the migration of juvenile sockeye salmon

#### **Beverly A. Agler, Gregory T. Ruggerson, Lorna Wilson and Edward V. Farley, Jr.**

Size-selective mortality of Kvichak River, Bristol Bay, Alaska sockeye smolts in relation to smolt characteristics, ocean conditions, and sockeye productivity

#### **Gregory T. Ruggerson and Brendan M. Connors**

Are there too many pink salmon in the ocean? The productivity and life history of Fraser River sockeye in relation to pink and sockeye salmon abundance across the North Pacific

#### **Eric Hertz, Marc Trudel, Strahan Tucker, Terry D. Beacham, Chuck Parken and Asit Mazumder**

Implications of the interannual variability in the feeding ecology of juvenile Chinook salmon

#### **Marisa N.C. Litz, Robert L. Emmett, Andrew M. Claiborne, Jessica A. Miller and David J. Teel**

Seasonal variability in juvenile fish and invertebrate prey available to Columbia River salmon entering the ocean

#### **Christine C. Stawitz, Timothy E. Essington, Anne B. Hollowed, Trevor A. Branch, Melissa A. Haltuch, Paul D. Spencer and Nathan Mantua**

Can we predict synchronous production dynamics? Applications to somatic growth

#### **Megan M. Stachura, Timothy E. Essington, Nathan J. Mantua, Anne B. Hollowed, Melissa A. Haltuch, Paul D. Spencer, Trevor A. Branch and Miriam J. Doyle**

Linking recruitment synchrony to environmental variability

#### **Kiva L. Oken and Timothy E. Essington**

Using surplus production models to study predation in age-structured populations

#### **Osamu Tamaru, Go Takayama, Hideo Takahara and Toshihiro Watanabe**

Constructing a 3-D simulation model of squid schooling behavior at jigging operations with the Boids Algorithm

#### **Irene D. Alabia, Sei-Ichi Saitoh, Hiromichi Igarashi, Yoichi Ishikawa, Norihisa Usui, Masafumi Kamachi, Toshiyuki Awaji and Masaki Seito**

Persistent summer pelagic hotspots of neon flying squid (*Ommastrephes bartramii*) in the western North Pacific

#### **Haruka Nishikawa, Yoichi Ishikawa, Takahiro Toyoda, Shuhei Masuda, Yuji Sasaki, Mitsuo Sakai and Toshiyuki Awaji**

Impact of climate variability on the neon flying squid (*Ommastrephes bartramii*) winter-spring cohort stock



**Chen-Yi Tu, Yongjun Tian and Chih-hao Hsieh**

Climate effects on spatial-temporal variation of the demersal fish assemblage in the Tsushima Warm Current region of the Japan Sea

**Chiuyuki Sassa, Motomitsu Takahashi and Youichi Tsukamoto**

Distribution, growth, and mortality of larval *Benthosema pterotum* (Pisces: Myctophidae) in the shelf region of the East China Sea

**Jennifer L. Boldt, Jake Schweigert, Jaclyn Cleary, Linnea Flostrand, Vanessa Hodes, Gordon McFarlane, Stephane Gauthier, Moira Galbraith and Dave Mackas**

Potential for competitive interactions between Pacific sardine and Pacific herring in British Columbia, Canada

**Tetsuichiro Funamoto, Lorenzo Ciannelli and Kazushi Miyashita**

Non-stationary effects of environmental conditions on walleye pollock larval distribution

*Poster presentations*

**Mikhail A. Stepanenko and Elena V. Gritsay**

Annual variability of pollock resources, distribution, reproduction and environment in the Bering Sea

**Xiu-Juan Shan, Peng-Fei Sun, Qiang Wu, Yun-Long Chen and Xianshi Jin**

Seasonal variations in fish community structure in Laizhou Bay and the Yellow River Estuary, China

**Chiuyuki Sassa, Yoshinobu Konishi and Youichi Tsukamoto**

Late winter larval fish assemblage in the southern East China Sea, with emphasis on spatial relations between mesopelagic and commercial pelagic fish larvae

**Ah Reum Kim, Ho Jin Bae and Chul-Woong Oh**

Age and growth of filefish *Thamnaconus modestus* off the Jeju Island

**Yang Liu, Sei-Ichi Saitoh, Yu Ihara, Toru Hirawake, Katsuhisa Baba and Kanamori Makoto**

Development of the 3-D growth prediction model for Japanese scallop in Funaka Bay, Japan

**Lyse Godbout, Carrie A. Holt, Peter Tchaplinski, Don Mcubbing, James Irvine and Marc Trudel**

Climate change, emigration timing to sea and salmon marine survival

**Hiroko Sasaki, Irene D. Alabia, Koji Matsuoka, Hiromichi Igarashi, Yoichi Ishikawa, Norihisa Usui, Masafumi Kamachi, Toshiyuki Awaji, Masaki Seito and Sei-Ichi Saitoh**

Potential habitat overlap between neon flying squid (*Ommastrephes bartramii*) and marine mammals in the western North Pacific: Possible trophic linkages

**Xun Zhang, Sei-Ichi Saitoh, Toru Hirawake, Satoshi Nakada, Koji Koyamada, Toshiyuki Awaji, Yoichi Ishikawa and Hiromichi Igarashi**

Potential fishing zone prediction map of Japanese common squid in the coastal water, southwestern Hokkaido, Japan

**David G. Stormer and Francis Juanes**

Overwintering ability of juvenile ocean-type Chinook salmon: Effect of water temperature and food deprivation on growth, energetics and survival

**Nadezhda L. Aseeva**

Some features of *Lycodes soldatovi* biology and parasitology in the Okhotsk Sea

**PilSoo Kim, Jae Bong Lee and Jin-Woo Bae**

Metagenomic analysis of the fish gut microbiota

**Nadezhda A. Rastvagaeva**

Some results of salmon origin identification and of figuring out the age structure of identified stocks by different methods

**A. Jason Phillips, Lorenzo Ciannelli, Richard D. Brodeur, William G. Percy and John Childers**

Spatio-temporal associations of albacore catches in the Northeastern Pacific with regional and climate environmental variables

**Sunkil Lee, Jae Bong Lee, Dae-Soo Chang and Jong-Bin Kim**

Comparisons of trophic level in ecosystem by effects of fishing in Korean waters

## Session Summaries-2013

### MEQ-Paper Session

Co-Convenors: *Chuanlin Huo (China) and Darlene Smith (Canada)*

Other Co-Convenors, Elizabeth Logerwell (USA), Olga Lukyanova (Russia) and Lyman Thorsteinson (USA) were absent at PICES-2013.

Invited Speaker: *Stanley (Jeep) Rice (retired, NOAA)*

#### Background

The Marine Environmental Quality Committee (MEQ) has a wide range of interests spanning from traditional research areas to emerging marine environmental issues. Papers were invited on all aspects of marine environmental quality research in the North Pacific and its marginal seas, except those covered by MEQ-sponsored Topic Sessions. According to the adjusted Scientific Program and schedule, MEQ/FIS/FUTURE Topic Session (S7: Science needs for offshore oil and gas development in the North Pacific) was cancelled, and 4 submitted abstracts were moved to this MEQ Paper Session.

A total of 12 papers were approved and scheduled in this session before the Annual Meeting, in which 8 papers were about the assessment of marine radioactivity around the North Pacific (NP), 4 papers were about science needs for offshore oil and gas development in the NP. However, 2 presentations (Leslie Holland-Bartels and Lyman Thorsteinson: “*An evaluation of science needs to inform decisions on outer continental shelf energy development in the Chukchi and Beaufort seas, Alaska*”; Dee Williams: “*Monitoring effects related to offshore petroleum development in Coastal Alaska*”) were cancelled, as the speakers were unable to attend the Annual Meeting due to the U.S. government partial shutdown.

Furthermore, since the Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (WG 30) was approved by the Governing Council and launched on August 1, 2013, scientists and potential WG 30 members from PICES member countries were encouraged to submit papers and to attend PICES-2013. Scientists from five PICES member countries attended this session and gave oral presentations relevant to radioactivity. The scientist from the Russia, who submitted an abstract, was not able to attend the Annual Meeting.

#### Summary of presentations

The MEQ Paper Session at PICES-2013 had good participation and was well attended, with a total of 8 oral presentations in a half-day. Oral presentations were given during the afternoon of October 15. Before the coffee break there was only one talk on the science needs for the oil development in the Arctic given by invited speaker (Dr. Stanley Rice, U.S. retired NOAA). Since the other two speakers were not able to attend, Dr. Rice gave a detailed presentation followed by many questions from an appreciative audience.

The second half of the Paper Session consisted of 6 talks, all on the radioactivity, which covered a wide variety from methodology to the assessment of the radioactivity distribution in seawater, sediment and organisms. Two talks from the USA dealt with relating radiation dose to effect, and with bio-magnification of radiocesium in jellyfish. From China, one talk was on the characteristics of radionuclides in the sediment, and another talk was the combination of two papers, one on the measured distribution of seawater radioactivity, and one about the radioactivity of marine cephalopoda and fish species in the Northwest Pacific Ocean from/after Fukushima Dai-ichi nuclear power plant accident. Following these two talks was a presentation from a Japanese scientist on the estimation of river discharges and fluxes of suspended substances to the North Pacific after the Fukushima Dai-ichi nuclear power plant accident. The last presentation was from Dr. John N. Smith, Canada, on the detection of radioactivity from the 2011 Fukushima accident in the Eastern North Pacific and Arctic Oceans, which was another presentation relating Arctic Oceans. This, and Dr. Rice’s presentation, stressed concern about the marine environment of Arctic from different aspects of artificial activities, marine oil exploration and the emerging disaster.

The convenors acknowledged that the MEQ Paper Session was able to provide important opportunities for PICES scientists to present their studies not only on known areas, but on emerging marine environmental issues, and for early career scientists to participate in PICES activities. They also recognized that all the participants showed the interest and concern about the marine environmental impact of the Fukushima Dai-ichi nuclear power plant accident.

#### List of papers

##### *Oral presentations*

**Stanley D. Rice** (Invited)

Oil development in the Arctic: What are the science needs?

**Kathryn Higley, Elizabeth Ruedig, Emily Caffrey, Mario Gomez-Fernandez, Michelle Comolli and Delvan Neville**

Relating radiation dose to effect: The importance of accurate dosimetry in assessing the impact of radioactivity on marine organisms

**Jinqiu Du, Ziwei Yao, Hui Gao, Guangshui Na and Chuanlin Huo**

Characteristics of radionuclides in sediment samples from coastal waters of Dalian Bay and Liaodong Bay

**Delvan Neville, Kathryn Higley and Richard D. Brodeur**

Radiocesium and jellyfish: Where's the biomagnification?

**Wen Yu, Men Wu, Jianhua He, Yusheng Zhang and Tao Yu**

Measured distribution of seawater radioactivity from Fukushima Daiichi Nuclear Power Plant in North Pacific

**Jianhua He, Wen Yu, Men Wu, Tao Yu and Yusheng Zhang**

Radioactivity of marine cephalopoda and fish species after 2011 Fukushima Daiichi Nuclear Power Plant accident in the Northwest Pacific

**Shin-ichi Ito, Hiroshi Kutsukake, Kazuhiro Takeuchi, Hideki Kaeriyama, Masashi Kodama, Shigeho Kakehi, Kazuhiro Aoki, Hiroshi Kuroda, Hiroshi Yagi, Ambe Daisuke and Tsuneo Ono**

Estimation of river discharges and fluxes of suspended substances to the North Pacific after the Fukushima Dai-ichi nuclear power plant accident

**Vyacheslav Lobanov, Vladimir Goryachev, Aleksandr Sergeev, Dmitry Kaplunenko, Natalia Shlyk, Natalia Treshcheva, Sergei Prants and Maksim Budyansky**

Fukushima 2011 derived radionuclides in the Japan and Okhotsk seas and subarctic front region of the Northwestern Pacific, one year later

**John N. Smith, Robin Brown, Marie Robert, Bill Williams and Richard Nelson**

Detection of radioactivity from the 2011 Fukushima accident in the Eastern North Pacific and Arctic Oceans

#### **POC Paper Session**

Co-Convenors: *Kyung-Il Chang (Korea), Michael G. Foreman (Canada)*

#### Background

Papers were invited on all aspects of physical and biogeochemical oceanography and climate in the North Pacific and marginal seas.

#### Summary of presentations

The session consisted of 6 oral presentations and 5 posters. Dr. Kyung-Il Chang chaired the ½-day oral presentation period.

The session began with Dr. Rong-shuo Cai presenting a study that found the East Asian Monsoon experienced a climatic jump in 1976/1977, weakening after 1976, and this shift in atmospheric forcing influenced the marine environmental changes of physical properties of seawater, major currents, and coastal sea level. Dr. Kirill Kivva presented observational evidence of coastal upwelling in the Bering Sea based on CTD and chemical data, and estimated that the observed coastal upwelling accounts for about 20% of the primary

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production in the region. Mr. Seung-Tae Yoon calculated bi-monthly heat contents for 35 years in the upper 500 m in the southwestern Japan/East Sea, and highlighted a decreasing trend of the heat content in the lower layer from 100 m to 500 m while the upper heat content changed little or increased slightly. This decrease in the lower layer heat content is due to a persistent negative anomaly since 2000. Dr. Jae-Hun Park talked about the seasonal variation of semi-diurnal internal tides in the Japan/East Sea based on numerical model results. He showed that the barotropic–baroclinic energy conversion is high in summer, and the internal tides propagate far to the north in summer, due to changes in stratification and wavelength. Dr. Young-Gyu Park investigated internal tides based on observations and their possible role in vertical mixing by calculating the Thorpe scale in the southwestern Japan/East Sea. Although he and colleagues observed strong internal tide signals, their contribution to vertical mixing is weak. Dr. Viktor Kuzin presented results of the Arctic Ocean climate simulations of present and future periods focusing on ice-cover and circulation using a 3-dimensional ocean circulation model coupled with a sea ice model. The simulated ocean condition is shown to be linked with NAO index, and model results predicted that the Arctic Ocean will be partially covered by ice until 2050 although its coverage will be reduced.

### List of papers

#### *Oral presentations*

**Rong-shuo Cai and Jun-pen Zhang**

The role of the East Asian monsoon in the responses of the marine environment in the East China Sea to the East Asian climatic jump around 1976/77

**Kirill Kivva and Denis Chulchekov**

Evidence of local upwellings in the north-western Bering Sea in 2012

**Seung-Tae Yoon and Kyung-II Chang**

Heat content variations in the southwestern East/Japan Sea

**Chanhyung Jeon, Jae-Hun Park, Sergey Varlamov, Jong-Hwan Yoon, Young-Gyu Park, Young Ho Kim, Seong Bong Seo, Hong Sik Min and Jae-Hak Lee**

Seasonal effects on generation and propagation of semi-diurnal internal tides in the East/Japan Sea

**Seong Bong Seo, Young-Gyu Park, Jae-Hun Park, Chang-Woong Shin and Chanhyung Jeon**

Properties of internal tides observed in the southwestern part of the East Sea

**Viktor Kuzin, Elena Golubeva and Gennady Platov**

Some results from the use of the numerical model in the Arctic Ocean climate simulation

#### *Poster presentations*

**Hiromichi Ueno**

Decadal variation of temperature inversions along Line P

**Kyung-Jae Lee and Kyung-II Chang**

Mesoscale eddies in the East/Japan Sea: Detection algorithms and characteristics of eddy properties

**Qing-hua Qi and Rong-shuo Cai**

Spatial-temporal evolution of SSTA in the South China Sea (SCS): An implication for the SCS summer monsoon outbreaks

**Chang-Woong Shin and Dong Guk Kim**

Trends of the coastal upwelling index along the southeastern coast of Korea

**Tsuyoshi Wakamatsu, Yusuke Tanaka and Yoichi Ishikawa**

Detection of attracting Lagrangian coherent structures in the Oyashio and the Oyashio-Kuroshio transition zones using the ocean data assimilation system

## Workshop (W1)

### *Comparison of size-based and species based ecosystem models*

Co-sponsored by ICES

Co-Convenors: *Jeffrey Polovina (USA)\*, Anne Hollowed (USA)\*, Shin-ichi Ito (Japan) and Myron Peck (Germany)*

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\* Jeffrey Polovina and Anne Hollowed were unable to attend PICES-2013.

Invited Speakers: *Julia Blanchard (University of Sheffield, UK), Julia K. Baum (University of Victoria, Canada), Villy Christensen (University of British Columbia, Canada)*

### Background

Size-based and species-specific ecosystem models are two different approaches to ecosystem modeling, based on different assumptions and designed to address somewhat different questions. In recent years considerable development of size-based models has occurred within the ICES community while the PICES community has typically focused on species-specific models for its applications. The objective of this workshop was to bring together the two communities of modelers to: (1) advance our understanding of the advantages and limitations of these two modeling approaches, especially in the context of modeling climate impacts on ecosystems, (2) make direct comparisons of the predictions of ecosystem structure and dynamics, both top-down and bottom-up, from both these model types applied to the same regional ecosystem, where possible under climate change forcing, and (3) discuss the benefits and feasibility of developing hybrid size-based and species-specific models. The workshop was structured with a series of talks to kick off discussion on these 3 topics.

### Summary of the workshop

Since the U.S. government was partly closed, scientists from NOAA, including co-convenors, Jeffrey Polovina and Anne Hollowed, could not attend the workshop. Another co-convenor, Myron Peck, also could not attend. Skip McKinnell kindly accepted to act as a co-convenor with Shin-ichi Ito.

About 40 persons attended and seven presentations were made. The session started with a brief introduction of the session: needs of comparison of two different ecosystem modeling approaches, size-based and species-specific ecosystem models.

An invited talk by Villy Christensen reviewed the brief history of the Ecopath with Ecosim modelling (EwE) and introduced the newest version of Ecospace model, which includes temporal and spatial dynamics bridging environmental factors to marine ecosystems through the food web. James Watson showed an example of a global simulation of fish biomass distribution using a simple size-based food web model coupled to simulations of global ocean physics and biogeochemistry and the result revealed the importance of fish movement dynamics to predict the fish distribution. The second invited speaker, Julia Blanchard, made her presentation through internet connection and showed several examples of model comparisons between size- and species-based food web models. There are many different types of food web and multispecies models from species- to size-based models (some of them are mixture of both models). She emphasized the importance of model comparison for improvement of our process-based understanding. The third invited speaker, Julia Baum, showed that trophic pyramids and size spectra are, in fact, interchangeable representations of the same information and mentioned a potential of size spectra as a central concept in ecosystem ecology to understand baseline expectations of community structure. Marc Hufnagl made a presentation in place of Myron Peck regarding the influence of size spectrum slope of prey sizes on fish early life stages. Shin-ichi Ito made the presentation for Nis Sand Jacobsen and colleagues on the comparison of ecosystem models under different fisheries managements. The results showed importance of multi-model approaches for fisheries management, especially for multi-species fisheries. Guimei Liu showed an example of species-specific model for jellyfish in

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the Northwestern Pacific. Three papers from NOAA employees were cancelled due to the U.S. government shutdown.

After these oral presentations, the afternoon session consisted of a group discussion focused on three objectives of the workshop; (1) advance our understanding of the advantages and limitations of these two modeling approaches, especially in the context of modeling climate impacts on ecosystems, (2) make direct comparisons of the predictions of ecosystem structure and dynamics, both top-down and bottom-up, from both these model types applied to the same regional ecosystem, where possible under climate change forcing, and (3) discuss the benefits and feasibility of developing hybrid size-based and species-specific models. Thirteen participants contributed to the group discussion (Table 1).

Table 1 Participants of afternoon discussion.

Name	Affiliation
Julia Baum	University of Victoria, Canada
Alida Bundy	Fisheries and Oceans Canada, Canada
Villy Christensen	University of British Columbia, Canada
Andrew Edwards	Fisheries and Oceans Canada, Canada
Cheryl Harrison	Oregon State University, USA
Marc Hufnagl	University of Hamburg, Germany
Shin-ichi Ito	FRA, Japan
Sukyung Kang	National Fisheries Research and Development Institute, Korea
Skip McKinnell	PICES Secretariat, Canada
Colleen Petrik	University of Alaska Fairbanks, USA
James Robinson	University of Victoria, Canada
Yunne-Jai Shin	IRD, France and UCT, South Africa
James Watson	Princeton University, USA

*(1) Advance our understanding of the advantages and limitations of these two modeling approaches, especially in the context of modeling climate impacts on ecosystems.*

Advantages and limitations of size-based and species-specific ecosystem models were discussed. First, it was recognized that a purely body-sized model and purely species-based model are the extremes and there are many models in the middle that contain both dimensions. Many different structures and assumptions are used in those models. Therefore, it was difficult to simply list up the advantages and limitations of both types of models although several points were listed (Tables 2 and 3). Andrew Edwards presented methods to estimate size spectrum slope and showed risk of simply fitting straight lines to log-log histograms. Likelihood methods were recommended. Adding to the advantages and limitations, the following opinions and questions were pointed out;

- Continuum of models between species-based and size-based. Distinguishing of model is difficult since recent model developments tend to incorporate both dimensions;
- Embracing trait-based models of which size is only one dimension;
- Sampling bias at large/small size affects size spectra;
- Do inverted trophic pyramids exist?
- Changing primary productivity changes size-spectrum and the extent depends on migration characteristics;
- Spatial resolutions of marine ecosystem models have been increased. Is advection of size spectrum meaningful in high-resolution models?

- Need to model how climate change and anthropogenic forces affect species interactions to a greater extent than food web effects.
- Climate change affects species interactions. Would size-based models be a better reflection of the changes?

Table 2 Advantages and limitations of size-based model.

Advantages	Limitation
Coverage of ecosystem is greater since size-based models can represent continuous distribution of biota from small phytoplankton to large top predator fish.	Core of many size-based models is metabolic theory (allometric scaling) and cannot resolve detail biological processes.
Species interactions are emergent (large species prey upon small ones).	Interactions defined by differences and overlap in body size and specific strong interactions between species may not be included.
Climate impacts are possible to be incorporated.	Climate impacts on primary productivity is imitated by intercept change of the size spectrum line.
Useful for global assessment of climate change impacts on marine ecosystems since size-based models are able to be applied without local species composition.	<ul style="list-style-type: none"> <li>- Representation of regional ecosystems may be limited.</li> <li>- Adaptation of species may be difficult to reveal.</li> </ul>

Table 3 Advantages and limitations of species-specific model.

advantages	limitation
Suited to focused interests in certain species.	Species interactions pre-defined by species/model group pairs and species that do not interact will not interact in a model.
Species interactions determined by functional response settings.	Cannot resolve size-based processes (large predate on small).
<ul style="list-style-type: none"> <li>- Climate impacts are possible to be incorporated.</li> <li>- Adaptation effects may be possible to be incorporated with high computational cost.</li> </ul>	<ul style="list-style-type: none"> <li>- Changing primary production changes are represented by change in functional phytoplankton groups.</li> <li>- Size and space are implicit in species-based models with diet information.</li> </ul>
Useful for global assessment of specific species regarding spatial distribution and biomass change.	Representation of global ecosystems may be impossible.

(2) *Make direct comparisons of the predictions of ecosystem structure and dynamics, both top-down and bottom-up, from both these model types applied to the same regional ecosystem, where possible under climate change forcing.*

A lot of effort has been devoted for comparisons of marine ecosystem models. The presentation of Julia Blanchard made a theoretical comparison between size-based and species-specific models. It also compared population and community responses to fisheries using multispecies size spectrum models in which growth and predation mortality processes are different. The presentation of Nis Sand Jacobson compared the responses of fish species to the fisheries using EwE and a size- and trait-based model. The two presentations gave the audiences the difficulties of the comparisons. During the afternoon discussion, the following points were suggested:

- Comparisons need multiple ecosystem models and multiple marine ecosystems;
- Comparisons should focus on specific questions and/or scenarios (*e.g.*, Steller sea lion – what caused the decline);

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- Comparisons need initial tunings of models to test the climate impacts;
- Theoretical comparisons are needed before applying to a specific question;
- It is possible to get similar answers from different models for very different reasons. We need to understand these differences before applying them to policy questions;
- Density-dependence is one of the most important factors for species-specific models. It is needed to explore how density-dependence is implemented in each model.

### *(3) Benefits and feasibility of developing hybrid size-based and species-specific models.*

There is a variety of marine ecosystem models and continuum of models between species-based and size-based. Some of them are hybrid size-based and species-specific models. Depending on scientific focus, it is feasible to apply different type of models.

At the end of the workshop, workshops of PICES FUTURE Open Science Meeting were introduced. Call for papers to Progress in Oceanography special volume on “Modeling and observational approaches to understanding marine dynamics” was announced. Finally, participants agreed to contribute to the workshop report.

### List of papers

#### *Oral presentations*

**Villy Christensen, Jeroen Steenbeek, Joe Buszowski, Marta Coll and Carl J. Walters** (Invited)

Modeling food web dynamics and spatial-temporal environmental variability

**James R. Watson, Charles A. Stock and Jorge L. Sarmiento**

The role of movement in determining the global distribution of marine biomass

**Julia Blanchard** (Invited)

Contrasting size- and species-based food web model responses to fishing and environmental change

**Rowan Trebilco, Julia K. Baum, Anne Salomon and Nick Dulvy** (Invited)

Size-based constraints on the pyramids of life

**Myron A. Peck, Klaus B. Huebert, Markus Kreis and Johannes Pätsch**

Examining the trophodynamic consequences of climate variability on the growth and survival of North Sea fish larvae: A coupled model approach utilizing size spectrum theory

**Nis Sand Jacobsen, Tim Essington and Ken Haste Andersen**

Comparing ecosystem models in fisheries management

**Xuanliang Ji, Guimei Liu and Shan Gao**

Parameter sensitivity study of the ecosystem model in the Northwestern Pacific

### **POC/BIO/MONITOR/FUTURE Workshop (W2)**

***Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future***

Co-conveners: *Jack Barth (USA), Emanuele Di Lorenzo (USA), Marc Hufnagl (Germany) Jacquelynne King (Canada), Arthur Miller (USA), Shoshiro Minobe (Japan), Ryan Rykaczewski (USA) and Kazuaki Tadokoro (Japan)*

Invited Speakers: *Jürgen Alheit (Leibniz Institute for Baltic Sea Research, Germany) Bryan Black (University of Texas, USA), Carolina Parada (Instituto de Investigación Pesquera, Chile) Hans-O. Pörtner (Alfred-Wegener-Institute, Germany)*

### Background

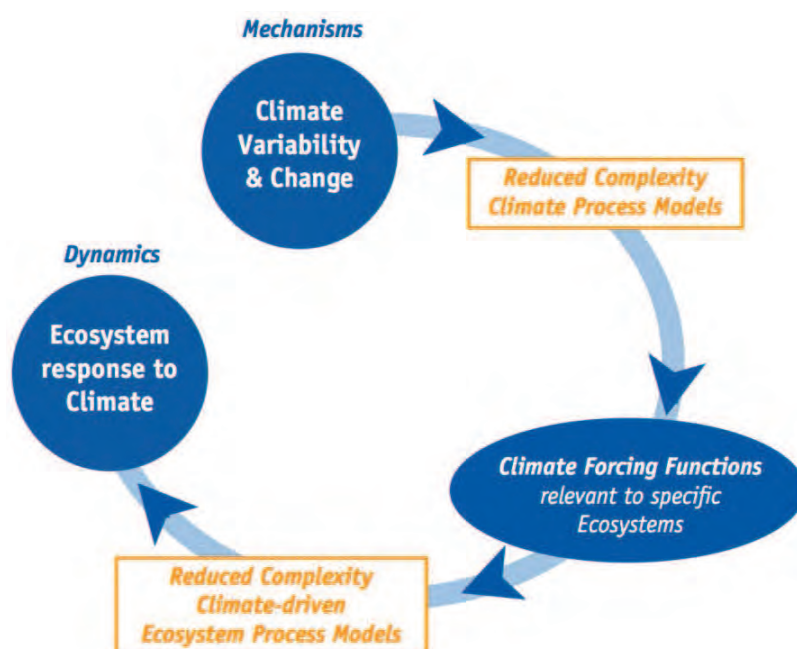
Climate variability and change in the ocean is now recognized as a significant driver of marine ecosystem response, from primary production to zooplankton composition, and through the trophic chain



to fish, marine mammals and other top predators. Past studies have often relied upon existing datasets to draw correlative conclusions (associated with indices and discovered time-lags in the system) regarding the possible mechanisms that may control these linkages. In this workshop, we seek to identify and model key processes that enable us to succinctly and quantifiably explain the mechanisms underlying the correlative relationships in physical-biological datasets, both in the North Pacific and North Atlantic. The description and modeling of these key processes may (a) involve few or several variables (but not full complexity), (b) use dynamical (*e.g.*, eddy-resolving ocean models, NPZ, IBM, etc.) or statistically based methods (*e.g.*, Bayesian, linear inverse models, *etc.*), (c) explain variability in low or high tropic levels (although we seek to emphasize secondary and higher producers), and (d) include uncertainty estimation. We also solicit ideas and hypotheses concerning new mechanisms of physical-biological linkages that can only be tested by establishing novel long-term observational strategies, where the harvest of understanding will eventually be reaped by future generations of ocean scientists, as well as by developing creative modeling datasets, where ecosystem complexities can be effectively unraveled. The workshop format will be a mixture of talks and group discussions that aim at enriching the exchange of ideas and concepts between physical and biological ocean scientists. The ultimate goal is to deliver: (1) a set of new hypotheses of the mechanisms of marine ecosystem response to climate forcing, and (2) a description of the observational and modeling datasets required to test these hypotheses using process models.

Summary of the workshop

The main goal of the PICES/ICES session was to (1) identify mechanisms controlling the marine ecosystem response to climate forcing, (2) isolate the climate forcing functions that are relevant to the specific ecosystem being studied, and (3) link these climate forcing functions to the dynamics of large- and regional scale climate variability. Furthermore, in this session we were seeking talks that would allow us to synthesize the complex interaction dynamics between climate and marine ecosystem by providing reduced complexity models or understanding of the dynamics. This concept is illustrated in the diagram below.



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The workshop was very well attended with about 100–200 participants. Several talks were able to target different aspects of the above diagram and provided important insight on the nature of climate forcing to which ecosystems are sensitive to, and the dynamics of ecosystem response to environmental perturbations. Below is a synthesis of the main findings.

### *1. Sensitivity of ecosystem to physical drivers changes with season*

During different months of the season different physical drivers become important in driving ecosystem variability. Therefore, using regional indices that track the seasonal sensitivity of the ecosystem leads to better predictions than using climate indices. In future studies it is critical to examine if IPCC class models can resolve the dynamics of the regional forcing functions.

### *2. Lower-trophic levels variability tracks regional and local physical forcing*

Ecosystem properties of lower trophic level (*e.g.*, nutrient fluxes and primary productivity) are typically sensitive to few environmental drivers and often track indices of climate variability that are regional or locally defined. These regionally defined indices allow the capture of both the local-scale environmental variability as well as the impacts of large-scale climate variability.

### *3. Higher-trophic levels integrate multiple forcing and track large-scale climate modes*

Ecosystem functions of higher trophic levels (*e.g.*, sardine) are typically sensitive to multiple stressors. Hence higher trophic levels have the ability to integrate multiple sources of environmental variability and exhibit the tendency to align their variability with that of the large-scale climate modes, which capture the shared low-frequency variance among the different environmental forcing.

### *4. Changes in large-scale and regional scale circulation play a dominant role in driving ecosystem variability*

Changes in large-scale and regional scale circulation play a dominant role in driving ecosystem variability both at the lower and higher trophic levels. Resolving the circulation dynamics with a regional climate model is key to allowing a proper understanding of how coastal ecosystems respond to climate forcing. It will be important in the future to develop adequate data archives of ocean currents and advection pathways that can be used by ecosystem scientists to test hypothesis on the ecosystem response to environmental oceanic forcing. These data archives will likely be assembled using the output of regional scale model hindcast. Resolving eddies at the regional scale is critical, but it also introduces a random component in the variability associated with the degree of intrinsic nature of the eddy-scale circulation. Future eddy resolving models will need to perform an ensemble hindcast in order to separate the fraction of variance that is deterministically forced *vs.* the internal variance.

### *5. Spatial dimension is key for understanding the links between physical variability and ecosystem response*

As we develop reduced complexity models of the marine ecosystem response to climate forcing, it will be critical to incorporate the spatial dimension (*e.g.*, associated with fish distributions). This topic has already emerged in the Section on *Climate Change Impacts on Marine Ecosystems* (S-CCME) and is currently an important topic for research/discussion. Although several talks showed examples of how the spatial dimension plays an important role, no systematic approach was presented to incorporate the spatial dimension in reduced complexity models. During the discussion a Linear Inverse Model methodology was suggested as one approach to model the spatial dimension of fish distribution in the context of a changing climate.

List of papers

*Oral presentations*

**Bryan A. Black** (Invited)

From the trees to the seas: Multi-species perspectives on long-term climatic and ecological variability

**Emanuele Di Lorenzo, Mark D. Ohman and Salvador Lluch-Cota**

A filtering hypothesis to explain climate synchrony in fish populations

**Kenneth Denman**

Modelling the changing structure of marine ecosystems in response to changes in the physical climate

**Jürgen Alheit** (Invited)

How the coupled ocean-atmosphere system of the North Atlantic impacts on dynamics of small pelagic fish populations and ecosystem regime shifts in the eastern North and Central Atlantic by modulating multi-decadal climate variability

**Colleen M. Petrik, Janet T. Duffy-Anderson, Franz Mueter, Katherine Hedstrom, Seth Danielson and Enrique Curchitser**

How eastern Bering Sea climate variability affects the distribution of walleye pollock early life stages

**Carolina Parada** (Invited)

Biophysical gauntlet regulating young walleye pollock survival in the Gulf of Alaska: Emphasis on meso and submesoscale eddies

**Hans-O. Pörtner** (Invited)

An integrated view of climate sensitivity in marine organisms: The need for proxies indicating molecular to ecosystem-level changes

**Jennifer L. Fisher and William T. Peterson**

Listen while the copepods speak: How different copepod indices respond to environmental indices in the northeast Pacific (Newport, Oregon, USA)

**Cheryl S. Harrison and David A. Siegel**

Coastal retention in upwelling currents: Mechanisms and sensitivity to wind forcing

**Kazuaki Tadokoro, Shigeo Kakehi, Akinori Takasuka, Kiyotaka Hidaka, Tadafumi Ichikawa, Yuichi Hirota, Haruyuki Morimoto, Takahiko Kameda, Satoshi Kitajima, Kou Nishiuchi and Hiroya Sugisaki**

Geographical and temporal variations in mesozooplankton biomass around Japan, western North Pacific

**Albert J. Hermann**

A rapid multivariate method for estimating regional forecast uncertainty

**Shoshiro Minobe**

Some changes of marine ecosystem in the 21st century in model projections

**Yury Zuenko, Vladimir Rachkov and Victoria Nadtochy**

Coastal ecosystem response to climate change in Peter the Great Bay (Japan Sea): Advances and failures of long-term monitoring

**Frank A. Whitney**

Some implications of ocean deoxygenation in the subarctic Pacific

*Poster presentations*

**David Timothy and Robie Macdonald**

Climatology and long-term trends of sediment flux and composition in the subarctic Northeast Pacific Ocean

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### BIO Workshop (W3)

#### Marine bird and mammal spatial ecology

Co-Convenors: *Robert Suryan (USA), William Sydeman (USA), Yutaka Watanuki (Japan) and Rolf Ream (USA)\**

\* Rolf Ream was unable to attend PICES-2013.

Invited Speaker: *Martin Renner (Tern Again Consulting, USA)*

#### Background

Marine birds and mammals (MBMs) are highly mobile, yet relatively easily observed and tracked to determine their spatial distribution throughout the North Pacific Ocean. They are important marine top predators that consume substantial amounts of zooplankton and fish, and are susceptible to changes in marine food web structure, productivity, and a variety of anthropogenic impacts. Therefore, MBMs are highly visible sentinels of ecosystem health and its change. To incorporate MBMs into ecosystem based management and meet objectives of FUTURE, the PICES Advisory Panel on MBM (AP-MBM) proposed to focus on MBM spatial ecology and conservation as a priority topic for their 2012–2014 activities.

Over the past several decades, a wide variety of research programs have collected observational and tracking data of MBMs throughout the North Pacific. Portions of these data have been compiled into large databases, such as the North Pacific Pelagic Seabird Database (NPPSD). Other data sets, however, still need to be integrated for more complete coverage of the PICES regions. Holding the proposed workshop is an important first step to compiling and integrating these massive datasets. In February 2012, we held discussions with several of the main data holders/contributors and they expressed broad support for this effort. Workshop invitees were contacted over the past year which included data holders, spatial analysis experts, and end product users.

#### Summary of the workshop

There were 29 attendees at the workshop (Table 1). The structure of the workshop was organized to address three main objectives: 1) Datasets, 2) Applications, and 3) Integration.

##### *1. Datasets*

The first four presentations highlighted examples of existing databases that include data representing large spatial scales (100,000s km<sup>2</sup>) spanning multiple decades. Examples of these large databases include the NPPSD that contains over 370,571 records (3 km transect segments) covering 282,035 km<sup>2</sup> spanning 1974–2012. Total counts of organisms include over 17 million seabirds and 241 thousand marine mammals. Spatial coverage from this dataset is best within or adjacent to the Exclusive Economic Zones of Pacific Rim countries where the majority of cruises have occurred. Other datasets include additional regions such as the Eastern Tropical Pacific. Regions of limited vessel survey coverage include the low to mid latitude central and Western Pacific. Individual tracking data from marine birds and mammals will help to fill some of these gaps, as well as provide greater temporal coverage in some instances, for example during winter.

##### *2. Applications*

Three presentations provided examples of individual studies describing how distributional patterns of birds (Cassin's auklets) and whales (minke, sei, and Bryde's) can change over time, affecting the types of prey that they consume or in response to changing prey distribution and abundance. A fourth presentation used a larger animal tracking dataset from the Tagging of Pacific Predators (TOPP) program and a cumulative human impact assessment to identify areas of highest cumulative impact. Interestingly, they found that marine sanctuaries were hotspots for use and risk. It was also discussed that birds and mammals do not always co-occur in the areas of greatest prey abundance since their relationship with prey is typically non-linear, only requiring enough to satisfy their immediate needs.

### 3. Integration

Three of the four presentations described regional studies in the Western Pacific, Bering Sea, and California Current where both vessel-based survey data and individual tracking data exist for a model species. One study where only a single vessel cruise through a region in a given year showed how restrictive vessel survey data can be relative to individual tracking. At the broad scale, there was some coherence in distribution where the ship and bird tracks overlapped. However, habitat models from vessel- and tracking-based data were quite different. In other regions, longer time series of repeated vessel-based surveys demonstrate how powerful these datasets are relative to the often shorter-duration tracking datasets. Presenters agreed that survey and tracking data are very different, yet highly complementary, especially for filling data gaps in perceived species habitat use and seasonal occurrence. A fourth presentation described an approach using tracking and environmental data to model habitat use, producing a density grid that shows similar patterns to density estimates from vessel surveys in regions where vessel and tracking data overlap.

#### Decisions from the workshop

##### 1. Datasets

Compiling all available vessel survey and tracking data into single databases for each data type is much needed. This is, however, an enormous undertaking. The NPPSD represents one such effort occurring over many years, yet does not include tracking data. Although there are still many datasets that have yet to be included in this database, the database is extremely comprehensive and represents the best single data source for many species of marine birds and mammals in the North Pacific. The most comprehensive database for individual tracking data is the Tagging of Pacific Predators, but this database does not include data from multiple independent programs over many years, like the NPPSD. It was agreed that our group's effort moving forward should be focused on compiling a list of existing datasets, their temporal and spatial extent, and contact information for the data holder. This could be used in future efforts to secure much needed funding for integrating these data into central databases and proposing additional studies to fill the spatial or temporal gaps in the data.

##### 2. Applications

Comprehensive distribution and abundance maps for the North Pacific are extremely valuable for many scientific and conservation efforts. In addition, it was noted that such accurate and comprehensive species abundance and distribution maps for marine birds and mammals are unique among marine organisms owing to the relative ease of collecting these data. Furthermore, because broad scale distribution of micronekton is poorly understood, the distribution and intensity of MBM aggregations may be valuable indicators of key micronekton. From the AP-MBM perspective, the first application of these data layers is to revisit prey consumption estimates for North Pacific marine birds and mammals (*e.g.*, Hunt *et al.*) With more comprehensive distribution and diet information, the spatially explicit prey consumption estimates will be greatly improved over previous efforts, which have received wide usage to date, indicating the value and demand for these efforts.

Additional uses for comprehensive marine bird and mammal distribution data include calibrating outputs from regional and basin scale ocean models and projecting future impacts of changing marine ecosystems. This is particularly relevant for identifying conservation hotspots and spatial distribution of contaminants in upper trophic level consumers (*e.g.*, Ross, Watanuki *et al.*).

An important consideration is to produce distribution data layers in metrics that are most relevant to modelers and other end product users, especially within the PICES community (*e.g.*, FUTURE).

##### 3. Integration

The group was unanimous in the conclusion that the two types of data are highly complementary, but for various sampling and empirical reasons it is not prudent to integrate vessel survey and tracking data outright, either quantitatively or qualitatively. Instead, the two types of data should first be used independently to create habitat use models, then secondarily combined in habitat use models to create a single predicted distribution (or density) layer from the two datasets.

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### Report outline and section leads:

The report documenting MBM AP's three year "spatial ecology" effort will follow the outline of the workshop with the respective section leads.

Introduction: R. Suryan (lead), B. Sydeman, R. Ream, Y. Watanuki

Chapter 1: Datasets, R. Ream (lead), R. Suryan, with contributions from many others

Chapter 2: Integration, R. Suryan (lead), Y. Watanuki, E. Hazen, M. Renner

Chapter 3: Habitat Modeling, Y. Watanuki (lead), J. Santora, R. Suryan, E. Hazen, M. Renner

Chapter 4: Uses, W. Sydeman (lead), A. Trites

Acknowledgements: We thank the presenters for taking the time to summarize their data for presentation, travel to attend the workshop, and contribute to a fruitful discussion. We would especially like to thank those individuals who contributed additional time to analyze new datasets specifically for this workshop. We thank BIO, Science Board and the PICES Secretariat for supporting the workshop and for providing travel for our invited speaker.

Table 1 Workshop W3 attendees.

Sonia Batten	Canada
Douglas Bertram	Canada
Bryan Black	USA
Carrie Eischens	USA
Jerome Fiechter	USA
Marisol Garcia-Reyes	USA
Tracee Geernaert	USA
Kaoru Hattori	Japan
Elliott L Hazen	USA
George Hunt	USA
Trevor Joyce	USA
Ken Morgan	Canada
Chad Nordstrom	Canada
Patrick O'Hara	Canada
Mayuko Otsuki	Japan
Corinne Pomerleau	Canada
Martin Renner	USA
Tamara Russell	Canada
Ryan Rykaczewski	USA
Hiroaki Saito	Japan
Jarrold Santora	USA
Hiroko Sasaki	Japan
Melanie Smith	USA
Huamei Shao	Japan
William Sydeman	USA
Tsutomu Tamura	Japan
Andrew Trites	Canada
Atsushi Tsuda	Japan
Yutaka Watanuki	Japan

List of papers

*Oral presentations*

**Tracee O. Geernaert**

Trends in seabird occurrence on Pacific halibut assessment surveys (2002-2012)

**Lisa T. Ballance, Jay P. Barlow and Trevor W. Joyce**

At sea marine mammal, seabird, and ecosystem assessment surveys in the eastern Pacific: An overview of Southwest Fisheries Science Center's 23-year time series

**Tsutomu Tamura, Kenji Konishi, Koji Matsuoka and Takashi Hakamada**

Geographical and temporal distribution of common minke, sei and Bryde's whales in the western North Pacific in relation to prey availability

**Sara M. Maxwell, Elliott L. Hazen, Steven J. Bograd, Benjamin S. Halpern, Greg A. Breed, Barry Nickel, Nicole M. Teutschel, Larry B. Crowder, Scott Benson, Peter H. Dutton, Helen Bailey, Michelle A., Carey E. Kuhn, Michael J. Weise, Bruce Mate, Scott A. Shaffer, Jason L. Hassrick, Robert W. Henry, Ladd Irvine, Birgitte I. McDonald, Patrick W. Robinson, Barbara A. Block and Daniel P. Costa**

Understanding spatial overlap of human impacts and marine predator distributions

**Hiroko Sasaki, Hiroto Murase, Koji Matsuoka, Yoko Mitani and Sei-Ichi Saitoh**

Seasonal shift of Bryde's and sei whale habitat in the western North Pacific

**D.F. Bertram, Dave Mackas, D.W. Welch, W.S. Boyd, J.L. Ryder and A. Hedd**

Interannual variation in zooplankton prey distribution determines marine breeding distributions of Cassin's Auklet in the proposed Scott Islands National Marine Wildlife Area in Canada

**Martin Renner** (Invited)

Combining tracking and transect data - Issues and possible solutions

**Yutaka Watanuki, Bungo Nishizawa, Takashi Yamamoto, Elizabeth Labunski, Kathy Kuletz, Catherine Meathrel and R.A. Phillips**

Distribution of short-tailed shearwaters in the northern North Pacific: A comparison between geolocator-based tracking of individuals and boat-based surveys

**Jarrod A. Santora, Josh Adams, Bill Henry, K. David Hyrenbach, Jim T. Harvey and David G. Ainley**

Comparative habitat use and spatial overlap of sooty shearwaters using shipboard surveys and satellite-tracking

**Helen Bailey, Steven J. Bograd, Elliott L. Hazen, Bruce Mate, Ladd Irvine, Daniel M. Palacios, Karin A. Forney and Evan Howell**

Whale Watch: Integrating blue whale satellite telemetry and oceanographic data to develop habitat models for conservation management

MEQ Workshop (W6)

***Economic impacts of HABs on fisheries and aquaculture***

Co-Convenors: Vera Trainer (USA), Chang Hoon Kim (Korea)

Invited speaker: *Daniel Huppert (University of Washington, USA)*

There were 20 scientists in attendance:

Background

Harmful algal blooms (HABs) have adverse economic and social impacts on the aquaculture industry, human health, coastal economies, and wild fisheries. HABs have prompted routine closures of both commercial and recreational shellfish harvesting as well as contributing to the death of aquaculture finfish resulting in financial losses in coastal communities. But the economic impacts generated by these events extend far beyond the industry itself. Obtaining more realistic estimates of HAB economic impacts, and the costs of preventing and managing them, calls for an integrated assessment approach that comprises the following: the economic impact of HABs on the aquaculture industry, the secondary integrated industries, and consumers, on both local and regional scales; some valuation of the costs and benefits of taking any recognized steps to lessen the HAB problem (*e.g.*, reducing coastal pollution and

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other human-related activities); and weighing the costs and benefits of enhanced monitoring and surveillance that potentially reduces the magnitude of the impacts (e.g., by limiting shellfish harvesting closure windows or alteration in the timing of finfish harvesting). This workshop comprised 2 parts, with the first being a presentation of what is known about the economic and social impacts of HABs in the eastern and western Pacific, by both HAB researchers and invited speakers who could inform on cutting edge approaches and methodologies for assessment of HAB and other marine economic impacts (e.g., oil spills). In Part 2 participants identified specific steps for developing improved and more comprehensive economic impact assessments of HABs on fisheries and aquaculture in the North Pacific.

### Summary of the workshop

The primary goal of the session was to provide PICES scientists with a better understanding of the economic and social impacts of both toxin-producing and high biomass blooms in PICES member countries. It was proposed, due to the quality of presentations and the novel information that they contained, that they be consolidated into a PICES Scientific Report entitled “Economic impacts of HABs on fisheries and aquaculture in PICES member nations”.

The scheduled session consisted of six oral presentations and one poster, representing authorship from five PICES member countries: Canada, Japan, Korea, Russia, and the United States. There were three last minute cancellations primarily due to the U.S. government shutdown. Attendance at the ½-day session was good, with approximately 20 participants. The workshop entailed lively discussions and questions among participants.

Invited speaker, Dr. Dan Huppert (University of Washington, USA) talked about the regional economic impacts of razor clam beach closures on Washington State’s Pacific beaches. Closures occur when the risk of ASP and PSP is high. Washington has short razor clamming seasons on the weekends. Dr. Huppert’s work assessed the impacts of HABs from fall 2007 to fall 2008. Research questions were: 1. How much do clambers spend in the coastal region? 2. How does spending change when razor clam beaches are closed? 3. How does change in spending impact local income and employment? A total of 450 surveys were distributed by the Washington Department of Fish and Wildlife and 240 were returned by mail. Total expenditures were added including hotel, camping, restaurant, groceries, gas, ferry, other items. The average expenditure per clammer day was \$100. Almost \$25 million in total estimated expenditures was estimated for 2007–2008 clamming season. Reaction to closures included: Only 14% would have stayed at the beach and 67% would go home if there was a closure. If more closures occur in the future, 52% would go to the same beach less frequently. The total expenditure for a 1-day opening at all 4 coastal beaches was ~\$4,500. An Input-Output (I-O) model was used to estimate income and employment impacts with calculation of direct and indirect impacts. An example of a direct impact is: a clammer spends money and changes local income. An example of an indirect impact is: local community members spend less because they have less income. The local economic impact of a 1-year beach closure (all beaches) = \$11.36 million. Reduced employment is ~364 jobs. The net benefit of the clam fishery to the coastal community would be calculated differently.

The group discussed how to assess the cultural and social impacts of fisheries closed due to HABs and how to assess true benefit of monitoring. Dr. Takfumi Yoshida (NOWPAP) discussed HABs in NOWPAP region. An integrated report on HABs for the NOWPAP region was published in 2011. It provides information on HAB monitoring and HAB occurrences. The negative impacts of HABs are on fisheries/aquaculture, human health, and tourism. Total economic loss in fisheries from 2006–2012 was US \$94 million for Korea, Japan, and China. In the Yatsushiro Sea in 2009 and 2010, there were huge economic losses incurred by blooms of *Chattonella antiqua*. The losses were US \$3.3 billion in 2009 and \$4 billion in 2010. In 2013 in South Gyeongsang Province, Korea, US \$28 million was lost by October 2013. The green tide in China has cost US \$30 million for cleanup and \$100 million in fisheries losses. To mitigate HAB damage, China is conducting regular monitoring to detect red tide in the early stage. This program has reduced economic loss by \$14.7 million in 2002 (J.People.com). In Japan, the fisheries cooperative, university, and local fishery agency contribute to a portal website. The result is a reduction in economic loss of \$US 35,000 per year to no dollars lost, and the number of early red tide detections has increased from 71 to 181. The operational cost of this website is \$4,500 per year.



Dr. Nicky Haigh (Vancouver Island University, Canada) reviewed the economic losses to the British Columbia salmon aquaculture industry due to HABs 2009–2012. Salmon is the largest agricultural export in British Columbia at an \$800 million dollar value. There are 130 farm leases with 75–80 usually in operation. Fish killing HAB species include raphidophytes (*Heterosigma akashiwo*, *Chattonella cf. marina*), dictyochophytes (*Dictyocha speculum*, *Dictyocha fibula*, *Pseudochattonella cf. verruculosa*), diatoms (*Chaetoceros*), Dinoflagellates (*Cochlodinium fulvescens*, *Alexandrium catenella*), Haptophytes (*Chrysochromulina* spp.). The relative economic loss is characterized in the following categories:

- Low: 10s of fish killed
- Mod: 100s of fish killed
- Hi: tons of fish killed.

Hi losses are usually due to *Heterosigma* or *Chattonella*.

- Losses due to HABs \$2.6 million CAN (2009), \$1.9, 3.1, 6.4 million (2012).
- Total direct losses ~CAD \$16 million (primarily *Heterosigma*, *Chaetoceros*, *Chattonella marina*)

Other losses are due to mitigation including:

- Lost production – withholding feed during blooms which results in less growth
- Mitigation – barrier curtains and upwelling or bubbling equipment, compressors, fuel (Costs \$1-2 million CAD annually per company)

Future needs are to:

- clearly identify HAB species,
- elucidate toxins and toxicity. What makes them toxic?
- understand the effects of environmental factors on HAB species prevalence
- understand the effects of climate change (warming, acidification) on different HAB species
- use better monitoring methods – especially for small species like *Chrysochromulina*. Some species are harmful at low levels, *i.e.*, *Chattonella cf. marina*

Dr. Meg Chadsey (University of Washington, USA) presented on cooperation of science and management for HABs. The Washington State razor clam fishery has 250,000 digger trips to the coast every year. The tribal clam harvest is estimated at \$7 million per year. The conceptual framework for environmental management includes community, scientists, and managers who, through institutional arrangements, seek to mitigate environmental problems. The standard method of management was to collect and analyze shellfish. This method resulted in emergency closures. The Quileute tribe contacted the University of Washington in 1995 to ask for assistance with the HAB problem. This resulted in convening of a stakeholder meeting in 2000 that resulted in the establishment of the Olympic Region Harmful Algal Bloom (ORHAB) partnership. ORHAB objectives were to study bloom dynamics, build credibility for funding, and assess economic impacts of HABs on the State's coastal economies. The overall goal was to develop local capacity and affordable tools for DA monitoring. ORHAB brought agencies together and helped to coordinate information regarding seafood safety. In 2003, a tax to shellfish license fees allowed the project to be transitioned to State funding. The funding request was \$150k which now is not enough to support all ORHAB costs. "Use inspired basic research" resulted in scientific papers responsive to management needs.

Dr. Hao Guo (Dalian Maritime University, China) examined the economic cost of HABs in China from 2008–2012. China's coastline is 32,000 km long of which the continental coastline is 18,000 km. China has 144 monitoring agencies. A national HAB monitoring system was established in 2002 and monitoring zones are focused in aquaculture areas as well as in ecologically protected areas. Financial losses due to the frequency and scale of red tides reached a high level during 2003–2006. Over the past 20 years, the occurrence of red tides and affected areas is basically stable. Approximately 57% of HABs are in the East China Sea, and large-scale HABs occur near the Yangtze River. The majority of HABs occur in May and June. The total economic loss from HABs in China during the years 2008–2012 was \$364 million USD. The East China Sea has suffered the largest direct economic effect (91%) in the last 5 years. *Noctiluca scintillans* has caused disasters through high levels of ammonium resulting in mass mortalities of cultivated shellfish. *Prorocentrum donghaiense*, common in the East China Sea, has resulted in problems with reproduction, survival and hatching rate in fish and scallops. Recurrent blooms of *Karenia mikimotoi* have been associated with massive

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deaths of fish and shellfish. In 2012, these blooms caused massive damage to abalone, causing a direct economic loss of more than \$330 million USD. In 2010, *Mesodinium rubrum* spread to a 20 km<sup>2</sup> area, causing great economic loss. *Cochlodinium geminatum* produced ichthyotoxins causing major losses in fisheries and shellfisheries. Approximately \$500,000 million US was lost in August 2011 due to this organism. From 2009–2012, the *Aureococcus anophagefferens* brown tide caused damage to scallop culture in Hebei Province by causing loss of feeding. A total of \$364 million US was lost due to HAB occurrences encompassing a total area of 53,000 km<sup>2</sup> from 2008–2012. The worst hit species were cultivated abalone and fish.

Shigeru Itakura explored the economic impacts of HABs on fisheries and aquaculture in western Japan. The Ministry of Agriculture Forestry and Fisheries (MAFF) collects economic impact data in Japan for both toxic blooms and red tides. Extensive damage has been caused by HABs in Japan. From 1972 to the present there have been many HABs including *Chattonella*, *Karenia*, *Heterocapsa*, *Cochlodinium*, and diatoms which affect yellowtail, red sea bream, pearl oyster, oyster, and porphyra. *Chattonella* is the most harmful alga in Japan. *Chattonella* was responsible for causing the most damage to fisheries in Seto Inland Sea from 1980–2008. *Heterocapsa* and *Cochlodinium* became problem NABs starting in 1995, and diatoms became a problem after 1990. The amount of fisheries damage on the Kyushu coast increased up to 1999, then appeared to decrease. *Cochlodinium* damage appears to be on the decrease in recent years. The economic loss due to toxic red tides is difficult to quantify but includes such factors as:

1. unrecognized financial losses,
2. halts in hiring,
3. damage of wild aquatic resources,
4. reluctance to buy fisheries products due to rumors,
5. the cost of countermeasures and mitigation.

### List of papers

#### *Oral presentations*

**Karen Dyson and Daniel D. Huppert (Invited)**

Regional economic impacts of razor clam beach closures due to Harmful Algal Blooms (HABs) on the Pacific coast of Washington

**Takafumi Yoshida and Hiroshi Ono**

Economic impacts of Harmful Algal Blooms in the NOWPAP region

**Nicola Haigh and Svetlana Esenkulova**

Economic losses to the British Columbia salmon aquaculture industry due to Harmful Algal Blooms 2009–2012

**Hao Guo, Dewen Ding and Chunjiang Guan**

The economic cost of Harmful Algal Blooms in China from 2008-2012

**Meg Chadsey, Vera L. Trainer and Thomas Leschine**

Cooperation of science and management for Harmful Algal Blooms: Domoic acid and the Washington Coast razor clam fishery

**Shigeru Itakura and Ichiro Imai**

Economic impacts of Harmful Algal Blooms on fisheries and aquaculture in the western Japan – An overview of interannual variability and interspecies comparison

### **MEQ Workshop (W7)**

#### ***Traditional seafoods of coastal aboriginal communities in the North Pacific: Insight into food, social and ceremonial uses at Snuneymux'w First Nation in Nanaimo, British Columbia***

*Co-Convenors: Peter Ross (Canada) and local community members*

#### Background

Seafoods are integral part of the nutritional, social and cultural fabric of many aboriginal communities inhabiting coastal regions of the North Pacific Ocean. The Snuneymux'w First Nation in Nanaimo, BC, is home to 1,200 residents who have relied heavily on seafoods for thousands of years. Despite now living in an urban environment with ready access to supermarket foods, it has been recently estimated that the average individual from this aboriginal community consumes 12 to 15 times as much seafood as the average Canadian. Much of this is harvested locally by native fishers. Community members routinely express concerns about the quality and quantity of their local seafoods. It is becoming increasingly evident that the availability of nutritious and uncontaminated seafoods is important for food, social and ceremonial purposes in this other coastal communities in BC.

#### Summary of workshop

A one-day PICES workshop (W7) on indigenous seafoods was held in the traditional territory of the Snuneymux'w First Nation near Nanaimo, British Columbia (BC), on Friday October 11, 2013. The workshop touched on aspects of marine stewardship, marine resource management, seafoods, and local aboriginal culture. Seafoods are an integral part of the nutritional, social and cultural fabric of aboriginal communities inhabiting coastal regions of the North Pacific Ocean. The Snuneymux'w First Nation in Nanaimo is home to 1,200 residents who have relied heavily on seafoods for thousands of years. Despite now living in an urban environment with ready access to supermarket foods, it has been recently estimated that the average individual from this aboriginal community consumes 12 to 15 times as much seafood as the average Canadian. Much of this is harvested locally by native fishers. Community members routinely express concerns about the quality and quantity of their local seafoods. It is becoming increasingly evident that the availability of nutritious and uncontaminated seafoods is important for food, social and ceremonial purposes in this other coastal communities in BC.

The morning session took place at the Vancouver Island University First Nations *Shq'aqpthut* ('Gathering Place'; <http://www.viu.ca/gatheringplace/gallery.aspx>). This session featured an opening prayer and song by Geraldine Manson, the Vancouver Island University elder-in-residence from Snuneymux'w. Geraldine described the importance of seafoods to her community, and recounted stories told by her parents and grandparents on topics of harvesting, cooking and stewardship. Geraldine then introduced Gary Manson, also an elder from Snuneymux'w. Gary described the historical importance of the Nanaimo River estuary for shellfish, crab and chum salmon harvesting. He also described the annual journey by canoe over the Strait of Georgia to the Fraser River for sockeye salmon harvesting. The importance of Gary's role as elder 'knowledge keeper' for the Snuneymux'w was evident in the afternoon when he led workshop participants on a tribal canoe journey over to salmon petroglyphs at Jack Point across the estuary.

John Rampanen, "naas-a-thluk", then described his family history in the Nuu-chah-nulth Nation - Ahousaht and Tla-o-qui-aht territories. John is an advocate for traditional foods and medicine. He combines traditional ecological knowledge with contemporary approaches and is dedicated to providing a strong sense of traditionally-oriented understanding and knowledge amongst First Nations youth and non-Native community partners. With a background in traditional medicinal practices, healthcare, counseling and indigenous foods, John has redeveloped a presence on his traditional territory (located on the western coast of Vancouver Island) where he now lives with his growing family.

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After the tribal canoe journey, some workshop members feasted on tasty smoked and barbecued chum salmon at Snuneymux'w beach hosted by Paul Wyse-Seward and Chris Good. The success of the workshop was due to the kind assistance of Vancouver Island University (Geraldine Manson, Michele Patterson, Grant Murray, Cathy Fee and students), Snuneymux'w First Nation (Gary Manson, Chris Good, Paul Wyse-Seward and Theodore Barker), and the entire staff of the PICES Secretariat.



*A one-day workshop on traditional seafoods was held at the PICES-2013 in Nanaimo. Clockwise from top left: Geraldine Manson, a Snuneymux'w Elder-in-Residence at Vancouver Island University opened the workshop with heartfelt prayer, song and stories; a visit to nearby petroglyphs highlighted the historical importance of chum salmon to the Snuneymux'w; John Rampanen described the strong inter-relationship between marine life and his communities on the west coast of Vancouver Island; some workshop participants got some exercise paddling a tribal canoe from downtown Nanaimo to Jack Point, where Gary Manson described the cultural importance of the 'salmon ceremony' at this site; a visit to a local smokehouse poignantly underscored the importance of chum salmon to the Snuneymux'w. Photo credits: Cathy Fee and Peter S. Ross.*

## Best Presentations for Committee/Program-sponsored Topic Sessions or Workshops at PICES-2013

### *Science Board Best Oral Presentation*

**Hans-O. Pörtner** (Alfred-Wegener-Institute, Bremerhaven, Germany) on “An integrated view of climate sensitivity in marine organisms: The need for proxies indicating molecular to ecosystem-level changes”

### *Best Oral Presentation by an early career scientist for the BIO-sponsored Contributed Paper Session*

**Jeffrey G. Dorman** (University of California, Berkeley, USA) on “Modeling krill ‘hotspots’ in the central California Current: Results from variation in diel vertical migration schemes” co-authored with Ramona L. Zeno, Jarrod A. Santora and William J. Sydeman

### *Best Poster for the BIO-sponsored Contributed Paper Session*

**Daichi Arima** (Hokkaido University, Hakodate, Japan) on “Seasonal changes in the zooplankton community and number of generations per year of small copepods in Ishikari Bay, Sea of Japan” co-authored with Atsushi Yamaguchi, Yoshiyuki Abe, Kohei Matsuno, Rui Saito, Hiroki Asami, Hiroshi Shimada and Ichiro Imai

### *Best Oral Presentation by an early career scientist for the FIS-sponsored Contributed Paper Session*

**Megan M. Stachura** (University of Washington, Seattle, USA) on “Linking recruitment synchrony to environmental variability” co-authored with Timothy E. Essington, Nathan J. Mantua, Anne B. Hollowed, Melissa A. Haltuch, Paul D. Spencer, Trevor A. Branch and Miriam J. Doyle

### *Best Poster for the FIS-sponsored Contributed Paper Session*

**Yang Liu** (Hokkaido University, Hakodate, Japan) on “Development of the 3-D growth prediction model for Japanese scallop in Funka Bay, Japan” co-authored with Sei-Ichi Saitoh, Yu Ihara, Toru Hirawake, Katsuhisa Baba and Kanamori Makoto

### *Best Oral Presentation by an early career scientist for the MEQ-sponsored BIO/FIS/MEQ/TCODE/FUTURE Topic Session (S8) on “Ecosystem indicators to characterize ecosystem responses to multiple stressors in North Pacific marine ecosystems”*

**Cathryn Clarke Murray** (WWF Canada, Vancouver, Canada) on “Assessing direct and indirect risk from human activities to significant ecosystem components in the Northeast Pacific” co-authored with Megan E. Mach, Rebecca G. Martone, Gerald G. Singh, Kai M.A. Chan and Miriam O

### *Best Poster for the MEQ-sponsored MEQ/FUTURE Topic Session (S3) on “Status, trends and effects of pollutants in coastal ecosystems: Implications for wildlife and humans”*

**Won Joon Shim** (Korea Institute of Ocean Science and Technology, Geoje, Korea) on “Ship paint as a new input source of floating microplastics in surface microlayer” co-authored with Young Kyoung Song, Mi Jang, Sang Hee Hong and Gi Myung Han

### *Best Oral Presentation by an early career scientist for the POC-sponsored POC/BIO/MONITOR/FUTURE Workshop (W2) on “Identifying mechanisms linking physical climate and ecosystem change: Observed indices, hypothesized processes, and “data dreams” for the future”*

**Colleen M. Petrik** (University of Alaska Fairbanks, AFSC NOAA, Seattle, USA) on “How eastern Bering Sea climate variability affects the distribution of walleye pollock early life stages” co-authored with Janet T. Duffy-Anderson, Franz Mueter, Katherine Hedstrom, Seth Danielson and Enrique Curchitser

### *Best Poster for the POC-sponsored Contributed Paper Session*

**Hieromichi Ueno** (Hokkaido University, Sapporo, Japan) on “Decadal variation of temperature inversions along Line P”

### *Best Oral Presentation by an early career scientist for the MONITOR-sponsored BIO/POC/TCODE/MONITOR/FUTURE Topic Session (S6) on “Recent trends and future projections of North Pacific climate and ecosystems”*

Youngji **Joh** (Korea Institute of Ocean Science and Technology, Ansan, Korea) on “An improvement of reproducibility of Pacific decadal oscillation in CMIP5” co-authored with Chan Joo Jang, Minho Kwon, Ho-Jeong Shin and Taewook Park

### *Best Poster for the MONITOR-sponsored Topic Session (S9) on “Cost-effective, cooperative ocean monitoring”*

**Tomoko M. Yoshiki** (National Research Institute of Fisheries Science, Yokohama, Japan) on “Geographical shift of warm water species distribution in western subarctic North Pacific based on CPR sample during 2001-2010” co-authored with Sanae Chiba, Tadafumi Ichikawa, Hiroya Sugisaki and Sonia Batten

### *Best Oral Presentation by an early career scientist for the TCODE-sponsored Topic Session (S10) on “Banking on recruitment curves; Returns on intellectual investment”*

**Robyn E. Forrest** (Fisheries and Oceans Canada, Nanaimo, Canada) on “Modelling the effects of density-dependent mortality in juvenile red snapper caught as bycatch in Gulf of Mexico shrimp fisheries: Implications for management” co-authored with Murdoch K. McAllister, Steven J.D. Martell and Carl J. Walters

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