

PICES Press



Newsletter of the North Pacific Marine Science Organization (Published semi-annually)



PICES science – 2006

Review of 2006

PICES aims to develop international collaborations by bridging scientists across disciplines, national boundaries and institutions through the organization of meetings and publications. This year is particularly notable in that the PICES community has met thirteen times at workshops and meetings around the world since the 2005 Annual Meeting in Vladivostok. Some of these include:

- In October 2005, an NPAFC/PICES symposium on “*The status of Pacific salmon and their role in North Pacific marine ecosystem*” was held in Jeju, Korea (see *PICES Press* Vol. 14(1));
- In November 2005, a workshop on “*Global comparison of sardine, anchovy and other small pelagics – building towards a multi-species model*” (sponsored by FRA, APN, IAL, PICES and GLOBEC) was held in Tokyo, Japan (*PICES Press* Vol. 14(1));
- In April 2006, a PICES/GLOBEC symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” was convened in Honolulu, U.S.A. (*PICES Press* Vol. 14(2));
- In June 2006, a PICES/NPRB workshop on “*Integration of ecological indicators for the North Pacific with emphasis on the Bering Sea*” was convened in Seattle, U.S.A. (*PICES Press* Vol. 14(2));
- In June 2006, an ESSAS workshop to develop comparative studies of the sub-Arctic seas (sponsored by GLOBEC, PICES and TINRO-Center) was held in St. Petersburg, Russia (*PICES Press* Vol. 14(2));
- In July 2006, a symposium on “*Time series of the Northeast Pacific Ocean*” (co-sponsored by DFO and PICES) was convened in Victoria, Canada, to mark the 50th anniversary of Line-P, which has been a backbone of time series observation programs in the northeastern Pacific (*PICES Press* Vol. 14(2));
- In August 2006, a CREAMS/PICES workshop on “*Model data inter-comparison for the Japan/East Sea*” (sponsored by SNU, KORDI, PKNU and PICES) was held in Busan, Korea (this issue of *PICES Press*);
- Close cooperation between PICES and ICES continued this year with two joint theme sessions on “*Large-scale changes in the migration of small pelagic fish and the factors modulating such changes*”, and on “*Operational oceanography*” organized at the ICES Annual Science Conference in September 2006, in Maastricht, Netherlands.

PICES has maintained excellence in its record of publications in 2006. Selected papers from two PICES XIII Topic Sessions on “*Mechanism that regulate North Pacific ecosystems: Bottom up, top down, or something else?*” and “*Hot spots and their use by migratory species*”



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|---|--|
| 1 PICES science – 2006 | 20 Photo highlights of the PICES Fifteenth Annual Meeting |
| 4 2006 Wooster Award | 22 Recent trends in waters of the subarctic NE Pacific: Cooler and fresher in summer of 2006 |
| 6 Thank you note from the Past-Chairman of PICES | 24 The state of the western North Pacific in the first half of 2006 |
| 7 A comparison of regional mechanisms for fish production: Ecosystem perspectives | 26 Latest and upcoming PICES publications |
| 10 2006 CREAMS/PICES international workshop and summer school | 27 A seven-year effort of the PICES CCC MODEL Task Team culminates in a dedicated issue of <i>Ecological Modelling</i> |
| 13 PICES Calendar | 30 Japan joins PICES Marine Metadata Federation |
| 14 2006 Harmful Algal Bloom Section annual workshop | 34 Argo: A 2006 status report |
| 16 2006 PICES Workshop on “ <i>Modeling iron biogeochemistry and ocean ecosystems</i> ” | 37 New Chairmen in PICES |
| 17 Strolling through the NEMURO ecosystem model | 40 PICES Interns |
| 18 Climate and marine birds and mammals in the North Pacific | |

and top predators in the North Pacific” were published as special issues in *Progress in Oceanography* (Vol. 68(2–4); Guest Editors: G. Hunt and S. McKinnell) and *Deep-Sea Research II* (Vol. 53(3–4); Guest Editors: W. Sydeman, R. Brodeur, A. Bychkov, C. Grimes and S. McKinnell), respectively. Results of the SERIES iron enrichment experiment in the eastern North Pacific were published in *Deep-Sea Research II* (Vol. 53 (20–22); Guest Editors: P. Harrison, P. Boyd, M. Levasseur, A. Tsuda, R. Rivkin, S. Roy and W. Miller). A set of papers on NEMURO and NEMURO.FISH models will appear soon in a dedicated issue of *Ecological Modelling* (Guest Editors: M. Kishi, B. Megrey, S.-I. Ito and F. Werner).

In addition to the special issues in peer-reviewed journals, three reports were published in the PICES Scientific Report Series. *PICES Scientific Report No. 31* (Editors: S. Takeda and C.S. Wong) is the proceedings of the 2004 workshop on “In situ iron enrichment experiments in the eastern and western subarctic Pacific”, and *PICES Scientific Report No. 32* (Editors: C. Miller and T. Ikeda) is the proceedings of the 2005 workshop on “Oceanic ecodynamics comparison in the subarctic Pacific”. Results of the PICES/NPRB Workshop on “Integration of ecological indicators of the North Pacific with emphasis on the Bering Sea” were published as *PICES Scientific Report No. 33* (Editors: G. Kruse, P. Livingston, J. Overland, G. Jamieson, S. McKinnell and R.I. Perry).

PICES Fifteenth Annual Meeting

PICES XV was held on October 12–22, 2006, at the Red Brick Warehouse No. 1 in Yokohama, Japan. This meeting was hosted by the Government of Japan, in cooperation with the Fisheries Research Agency, in coordination with the PICES Secretariat. A total of 447 participants from 19 countries attended the 10 sessions and 9 workshops as well as 24 business meetings. The theme of the Science Board Symposium was “Boundary current ecosystems”. The keynote lecture, “Biological production, animal migration and ecosystem regime shifts in the Kuroshio and Oyashio Currents: Perspective for sustainable use”, at the symposium was given by Dr. Akihiko Yatsu (Hokkaido National Fisheries Research Institute). He provided a broad review on climate and regime shifts affecting the population dynamics of species in the Kuroshio and the Oyashio currents region, and emphasized that proper understanding of ecosystem dynamics, linking both climate and human activities and taking into account ecosystem factors and uncertainties, are essential for wise management. The most plausible mechanisms for sardine/anchovy cycles in the Kuroshio/Oyashio system were presented to highlight the importance of these inter-connections. The keynote lecture was followed by five invited papers presented by Anthony Koslow (Australia), Ichiro Yasuda (Japan), Kenneth Drinkwater (Norway), William Peterson and Arthur Miller (U.S.A.).

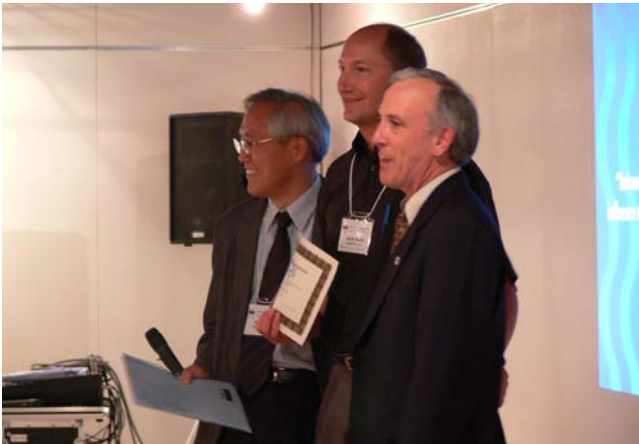
PICESians’ strong interests in the development of the next PICES science program to follow the current Climate Change and Carrying Capacity (CCCC) Program, were reflected by a room-packed attendance at the Open Forum on Future Integrative Science Program (FISP) held on the fourth day afternoon of the Annual Meeting. According to the terms of reference for the FISP Study Group, Dr. John Stein (Science Board Vice-Chairman) presented a preferred theme produced from an in-depth discussion at the 2006 inter-sessional Governing Council and Science Board Meeting under a tentative name “FUTURE”, which stands for “Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem”. The proposed theme aims “To understand and forecast responses of North Pacific marine ecosystems to climate change and human activities at basin-wide and regional scales, and to broadly communicate this scientific information to governments, resource managers and the general public”.



Great turnout at the FISP Open Forum.

In December 2006, a further step was taken towards the development of the new program, as a FISP work plan with associated timelines was approved by the Governing Council. A Writing Team was established with the responsibility of drafting the FISP Science Plan. The membership of the Writing Team includes 14 scientists representing all PICES member countries. The Writing Team will meet on February 16–17, 2007, in Seattle, U.S.A., to produce a detailed outline of the Science Plan. The FISP Workshop will be held in April 2007, in Yokohama, Japan, immediately prior to the inter-sessional Science Board/Governing Council meeting, to review the goals, objectives, organization and key elements of the Science Plan, define the key questions to be answered, and determine strategic approaches to answering the questions. The draft Science Plan will be discussed at an Open Forum and a 1-day workshop during PICES XVI in Victoria, Canada, and revised following comments from the PICES scientific community and from peer-reviews. It is expected that the final Science Plan will be submitted for approval by Council in April 2008. Information on FISP is available on the PICES website at <http://www.pices.int/members/FISP-WT.aspx>. It should be emphasized that the process to develop the next PICES science program is completely open, and excellent ideas and suggestions are always welcome to make an exciting program.

Congratulations are in order to winners of the Best Presentation Award at PICES XV. These awards are given to scientists, nominated by the Science Board and each PICES Scientific Committee and the CCCC Program, who gave the best presentation in a topic or paper session sponsored by the Board or Committee. Recipients for best oral presentations are: Jack A. Barth (Science Board Symposium), Andrew L. King (BIO), Min Ho Kang (FIS), Naoaki Tezuka/Masami Hamaguchi (MEQ), Ye Yuan (POC), and Muzzneena Ahmad Mustapha (CCCC); best poster presentations are Satoshi Kitajima (BIO), Atsushi Kawabata (FIS), Minkyu Choi (MEQ), Jong Jin Park (POC), and Yasuko Kamezawa (CCCC).



Jack Barth receives a Best Presentation Award from Science Board Chairman, Kuh Kim and Vice-Chairman, John Stein.

To facilitate the continuity of Science Board affairs, the Governing Council (at the 2006 inter-sessional meeting) established a Science Board Chairman-elect position to allow the election of the Science Board Chairman 1 year before the official change of the chairmanship. At PICES XV, Dr. John Stein (U.S.A.) was elected as the next Science Board Chairman for 2007–2010.

PICES capacity building

PICES' long-term interests in capacity building resulted in organizing the first PICES summer school on "*Ocean circulation and ecosystem modeling*" held August 23–25, 2006, in Busan (Korea). This school was co-sponsored by PICES, Seoul National University, the Korean Ocean Research and Development Institute, the National Fisheries Research and Development Institute, the Ministry of Maritime Affairs and Fisheries and the "Brain Korea 21" Program. Seven lecturers from Japan and U.S. taught a total of 37 participants from all 6 PICES member countries plus Chile and Indonesia (14 Ph.D. and 11 M.Sc. students, 7 early-career scientists, 4 undergraduate students, and 1 from a private company). Certificates were delivered to all participants on completion of the school. Details can be found in a separate article in this issue of PICES Press. Lecture notes and materials presented during the summer school can be downloaded from <http://www.pices.int/>

2006_CREAMS_PICES_school.aspx. PICES has already received a proposal from Japan to host the second summer school on "*Ecosystem-based management*" in September 2008, at Hokkaido University, in Hakodate.

It has taken three years for PICES and ICES to prepare an Early Career Scientists Conference on "*New frontiers in marine science*" to be hosted by the University of Maryland Center for Environmental Science from June 26–29, 2007, in Baltimore, U.S.A. Additional support for this event is provided by the North Pacific Research Board. The goal of the conference is to foster the development of contacts, collaborations, and associations among early career scientists that will persist for decades, and to establish personal and institutional networks that will help to advance our understanding of the marine environment. Approximately 100 young scientists from around the globe will be invited to share their interests in marine sciences. For detailed information about the conference please visit the PICES website.

Events in 2007 and beyond

Active participation of the PICES community is expected in the 5th International Conference on "*Marine bioinvasions*". This conference is co-sponsored by ICES, PICES and the U.S. National Sea Grant College Program, and will be convened in May 2007, in Cambridge, U.S.A. PICES, ICES and GLOBEC are co-sponsors of the 4th International Zooplankton Production Symposium on "*Human and climate forcing of zooplankton populations*" to be held on May 28–June 1, 2007, in Hiroshima (Japan). Three joint ICES/PICES Theme Sessions on "*Integrating observations and models to improve predictions of ecosystem response to physical variability*", "*Comparative marine ecosystem structure and function: Descriptors and characteristics*" and "*The ecosystem approach: What's the impact on marine science, science-based advice and management of marine ecosystems?*" will be convened during the ICES Annual Science Conference in September, in Helsinki, Finland. NAFO, PICES and ICES will organize the Symposium on "*Reproductive and recruitment processes in exploited marine fish stocks*" in early October 2007, in Lisbon, Portugal. PICES will co-sponsor, with ICES, IOC, SCOR and GLOBEC, the International Symposium on "*Effects of climate change on the world's ocean*" to be convened in May 2008, in Gijon, Spain.

The PICES Science Board has approved many exciting Topic Sessions and Workshops for PICES XVI to be held from October 26–November 5, 2007, in Victoria, Canada. The theme of this Annual Meeting is "*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*". We are also beginning to plan PICES XVII to be held in Dalian, China, in 2008.

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2006 Wooster Award



The Wooster Award presentation ceremony took place on October 16, 2006, during the Opening Session of the PICES Fifteenth Annual Meeting in Yokohama, Japan. Dr. Vera Alexander, PICES Chairman, and Dr. Kuh Kim, Science Board Chairman, conducted the ceremony. Dr. Kuh Kim announced that **Dr. Makoto Kashiwai (Japan)** was the recipient of the 2006 Wooster Award and quoted the following Science Board citation (reading of the Science Board citation was accompanied by a special slide show dedicated to Dr. Kashiwai):

In 2000, PICES established an award in honor of Dr. Warren S. Wooster, the principal founder and first Chairman of PICES, and world-renowned researcher and statesman in the area of climate variability and fisheries production. The award is to be given annually to an individual who has made significant scientific contributions to North Pacific marine science; has achieved sustained excellence in research, teaching, administration or a combination of these in the area of the North Pacific; has worked to integrate the various disciplines of the marine sciences; and preferably someone who is or had been actively involved in PICES activities.

Prior recipients of the Wooster Award are Prof. Michael M. Mullin (2001), Prof. Yutaka Nagata (2002), Prof. William Percy (2003), Prof. Paul H. LeBlond (2004), and Dr. Daniel Ware (2005). Today, it is with great pleasure that I announce the Warren S. Wooster Award winner for 2006. The Wooster Award for 2006 is being given to Dr. Makoto Kashiwai, a nationally and internationally distinguished interdisciplinary ocean scientist.

Dr. Kashiwai has authored or co-authored more than 20 primary journal articles, book chapters or review papers covering several disciplines that include fine-scale coastal hydrodynamics, biological production and fish population dynamics, and climate-scale ocean variability. His early career was with the Faculty of Fisheries at Kyoto University, where his research used hydraulic model experiments and theory to study tidal exchange, residual circulation and tidal vortices in Kumihama Bay. While in

Kyoto, he also investigated the formation of the anoxic layers of water in Kumihama Bay using field observations, and he contributed to the development of a continuous fish egg sampler, which was used in interdisciplinary studies of the microdistribution of fish eggs, larvae and plankton and its relation to ocean microstructure.

In 1986, Dr. Kashiwai moved to the Hokkaido National Fisheries Research Institute where he worked as the Head of the Physical Oceanography Section, and later as the Director of the Fisheries Oceanography Division until his retirement in 2001. During this period, he conducted a series of studies on the oceanographic structure and variability of the Oyashio region and its ecological influences. Among other observations obtained at this time, Dr. Kashiwai began routine physical and ecological observations of the Oyashio region along the "A-Line". This line is now an important time series, which continues today, and which has contributed greatly to the understanding of seasonal to decadal variability of the Oyashio Region. Dr. Kashiwai, with other colleagues, also initiated studies of the relationships between oceanographic variability and fish population dynamics of Japanese sardine and walleye pollock in the Oyashio. In 1989, he organized a special session at an international symposium on "The Okhotsk Sea and sea ice", where the results of the Oyashio project were presented. This symposium marked Makoto's first appearance on the international stage. At the symposium, he met Prof. Yutaka Nagata and Dr. Daniel Ware (both previous Wooster Award winners), and those meetings led him into ecosystem modeling in the Oyashio region and to PICES. Later, Makoto and his Japanese colleagues conducted comparative studies of the La Perouse, Oyashio and Labrador ecosystems under a Japan/Canada Science and Technology Exchange program with Canadian scientists from the Department of Fisheries and Oceans. As part of this work, ecosystem models were developed to compare the impact of interannual and decadal ocean climate variations on lower trophic levels and fish population dynamics between western and eastern boundary current regions.

Dr. Kashiwai has been generous in serving the ocean science community at both the national and international levels. He served as a member on several committees of the Japanese Society of Fisheries Oceanography, and later as the Vice-President of that society. OK, but what has he done for PICES, you wonder. Well, his service to PICES has been also extensive and in many roles. He was a member of PICES' Working Group 1 on the Okhotsk Sea and Oyashio Region. Japan offered to host the PICES Third Annual Meeting in Nemuro in 1994. Makoto was appointed the main local coordinator of the meeting. On October 5th, 10 days before the start of the Annual Meeting, an 8.1-magnitude earthquake occurred in the southern

Kurils and northern Hokkaido. The arranged venue for the PICES meeting was severely damaged and unusable. Makoto took the lead in arranging alternate facilities and preparing everything from scratch for the meeting, which was finally held primarily in the Nemuro-city library. At the same meeting, Dr. Kashiwai convened a PICES-GLOBEC workshop and was appointed the Co-Chairman of the PICES-GLOBEC initiative on Climate Change and Carrying Capacity (CCCC). He devoted significant time toward getting the CCCC Program up and running, establishing task teams, and contributing scientifically to the MODEL Task Team. At PICES IV in 1995, he succeeded his friend and colleague, Dr. Daniel Ware, as the Chairman of the Science Board of PICES. His term as the Science Board Chairman concluded in 1998, and that same year, the Japanese Government appointed him as national delegate to PICES. Thus, in a few short years, he had served as Co-Chairman of the first PICES scientific program, as Science Board Chairman, and as a national delegate on Governing Council. But, that apparently was not enough, for in 2000 he became again the Co-Chairman of the CCCC Program for another three years.

In his recent "retirement" years, Makoto has continued his study of the Oyashio ecosystem, he has coordinated a cooperative study of Nemuro-city and Sakhalino, Russia, on the larval transport of the Hanasaki crab, and he has been an adjunct professor at the Tokyo University of Agriculture, where he continues to teach fisheries oceanography of the subarctic Pacific to undergraduate and graduate students.

In conclusion, Dr. Makoto Kashiwai is an active leader in fisheries oceanography, on theoretical and observational studies of the structure and variability of the Oyashio, and has contributed greatly to the goal of international cooperation and collaboration on North Pacific Ocean research in general, and through PICES specifically. He is eminently qualified and a worthy recipient of the Wooster Award of PICES, and we are pleased to honor him today with this award.

Dr. Wooster was the Chairman of PICES during the first year when Dr. Kashiwai served as the Science Board Chairman, and they also co-chaired the PICES/GLOBEC CCCC Implementation Panel and developed a special working relationship. Dr. Alexander read the following tribute sent by Dr. Wooster:

It is an honor for me to participate in this award to Makoto Kashiwai, one of the early and most substantial contributors to the scientific programs of PICES. He first made his mark with development of the CCCC Program, Climate Change and Carrying Capacity. While the question was inspired by the threat of saturating the North Pacific with expatriate salmon, its broad scope became clear in Makoto's classic paper on the history of the carrying capacity concept. This demonstrated that

carrying capacity was not just an arbitrary and ill-defined constant in a theoretical productivity equation, but was an index of ecosystem productivity and a variable function of environmental change. It made evident, to me at least, that the carrying capacity for a specific population, for example that of Steller sea lions, could change with the climate as did the availability of suitable food. The development of this program, to which Makoto has made major contributions, has been fundamental towards achieving the scientific goals of PICES.

Of course, as the Science Board makes clear in its citation, Makoto has been involved in most scientific activities of PICES, so perhaps that which I have emphasized is not the most significant. But it has certainly clarified the way I look at the effects of climate variations on marine ecosystems, so perhaps the education of this oceanographer at least is worth recognizing. In my view the case for presenting this award to Makoto Kashiwai is crystal clear.



Dr. Alexander presented a commemorative plaque to Dr. Kashiwai (a permanent plaque identifying Wooster Award winners resides at the PICES Secretariat in Sidney, British Columbia, Canada), who accepted the award with the following remarks:

Thank you, Vera. Thank you, Dr. Kim. This is the greatest honour of my life.

When I heard from my old PICES friends that they were planning to nominate me as a candidate for the PICES Wooster Award of this year, I felt a strong hesitation, because I do not feel that I am a great professor or excellent scientist as the previous recipients. But they told me that the major reason for my nomination is that I am one of the first generation PICES scientists that is brought up by PICES and helped to shape the Organization today. I could not deny that and so I accepted the nomination, which will be a strong encouragement for present and future PICES scientists, especially from non-English-speaking countries.

I can clearly remember the words of Dr. Warren Wooster, back in 1995, when I hesitated to accept the position of Science Board Chairman because of my insufficient English speaking ability. Warren said, "My expectation is not in your English speaking ability". I thought, at that time, that Warren might have found in me some possible capability to cope with the role of Science Board Chairman. Now I am sure that Warren meant nothing but my incapability in English itself. It was very important for PICES at that time, for any scientist from a non-English-speaking country to sit in a major driving seat of PICES, because, except for 2 member countries in North America, the rest of the 4 member countries on the western side of the Pacific are non-English-speaking countries.

My first project was to compose the Chairman's Handbook. The most important task for me was to incorporate the guideline "Use slow and clear English, not machine-gun talk", which was much help through my PICES days. This might be one of the expectations of Warren. This Handbook was not an instruction booklet made by the Secretariat, but a driving manual for new Chairmen of any subsidiary body of PICES, hoping that PICES can be an organization driven by scientists.

During my Science Board Chairmanship, both PICES and I benefited from the powerful participation of elder and younger colleagues, and it was a truly rich and enjoyable time. Thus, this award is a proof of the achievement by all the PICES scientists who shared my PICES days with me.

So, I would like to ask all of the PICES colleagues here to share this honour and happiness with me. Thank you.



Dr. Makoto Kashiwai is congratulated by family and friends at the Welcome Reception: daughter-in-law, son, Makoto, Dr. Vera Alexander, Dr. Tadashi Inada, Christina Chiu, Dr. Tokio Wada and Dr. Alexander Bychkov.

We are now soliciting nominations for the 2007 Wooster Award. Award description and selection criteria can be found on our website at http://www.pices.int/Wooster_Award/default.aspx. The closing date for nominations is April 15, 2007. The award will be presented during the Opening Session of PICES XVI on October 29, 2007, in Victoria, Canada.

Thank you note from the Past-Chairman of PICES



Dr. Vera Alexander has been involved in PICES since the first planning activities in the early 1980s, and served as one of the two national U.S. delegates during the first PICES decade. She was Vice-Chairman of PICES from 1998–2002 and chaired the Organization from 2002–2006. Her second term as PICES Chairman was completed at PICES XV in Yokohama, and she will continue to be on Governing Council as the Past Chairman. Vera's scientific background is in biological oceanography. Recently stepping down as Dean and Professor at the University of Alaska Fairbanks, she is now devoting her time to national and international marine science affairs. In addition to her work with PICES, she is serving as President of the Arctic Research Consortium of the United States and is on the Scientific Steering Committee and the U.S. National Committee for the Census of Marine Life. Vera requested to have the following note to the PICES scientific community in this issue of PICES Press.

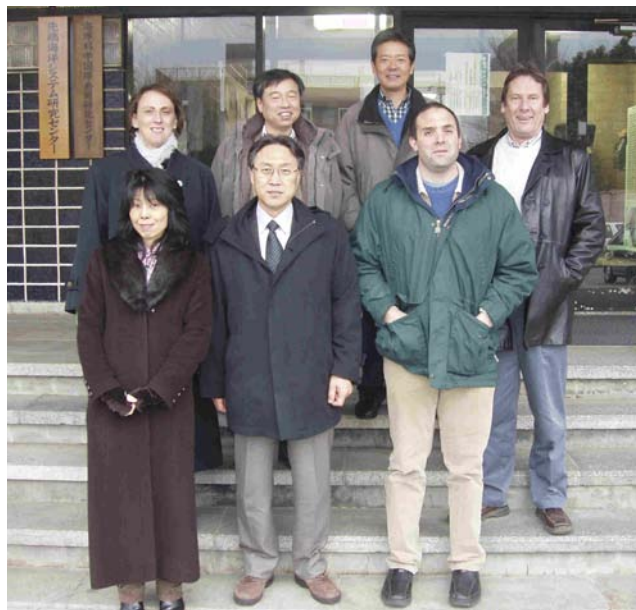
PICES XV was my last Annual Meeting as Chairman of the Governing Council. The past four years have been enjoyable, albeit at times stressful, but it has been a tremendous honor to serve this marvelous organization. PICES has made steady progress in contributing to and serving the member nations as well as the North Pacific Ocean science community, and its future is bright. The concept of addressing those scientific issues that can only be approached through multi-national cooperation is being implemented successfully. I was overwhelmed by the generosity of the PICES community in Yokohama. At the Closing Session, I was awarded a beautiful framed very special fossil fish. Also, at the Chairman's Reception I was showered with so many extraordinary gifts from delegations and from others that I was completely unable to thank everyone appropriately! So I am taking this avenue to let you know that I was extremely moved by your support and generosity, and to provide my heartfelt thanks.

A comparison of regional mechanisms for fish production: Ecosystem perspectives

By Akihiko Yatsu, Kerim Y. Aydin and Jacquelynne R. King

The Terms of Reference and the Action Plan of the Climate Forcing and Marine Ecosystem (CFAME) Task Team, outlines three main components: *Mechanisms*, *Ecosystems* and *Scenarios* (Aydin and Yatsu, 2005; *PICES Press* Volume 13, Number 2). The Task Team initiated their first action on *Mechanisms* with an inter-sessional workshop held January 12–13, 2006, at the Ocean Research Institute of the University of Tokyo, through the courtesy of Prof. Yoshiro Watanabe. The aims of this workshop were two-fold: 1) to develop regional and Pacific-wide conceptual models describing the mechanisms linking climate to fish production by focusing on comparative approaches of selected species; and 2) to revise the concept of carrying capacity based on the knowledge accumulated during the CCCC Program and other studies. Workshop participants (**Photo 1**) were Kerim Y. Aydin (CFAME Co-Chairman, U.S.A.), Akihiko Yatsu (CFAME Co-Chairman, Japan), Jacquelynne R. King (Canada), Gordon (Sandy) A. McFarlane (Canada), Sanae Chiba (Japan), Masahide Kaeriyama (Japan), Yoshiro Watanabe (Japan) and Skip McKinnell (PICES Secretariat).

At this workshop, species-specific production and recruitment trends in relation to climate forcing were reviewed for eight species which represent five life-history strategies (Table 1): Pacific sardine and Pacific herring (opportunistic strategists), pink and chum salmon (salmonic strategists), walleye pollock (intermediate strategist), sablefish and Pacific halibut (periodic strategists) and spiny dogfish (equilibrium strategist). Similarities and differences in the species' response to climatic regime shifts and underlying mechanisms were summarized. Mechanisms linking climate and production for each species in each region of the North Pacific were examined and compared for similarities and possible synchrony.



Participants in front of Ocean Research Institute, University of Tokyo (Back row: Jacquelynne King, Akihiko Yatsu, Yoshiro Watanabe and Sandy McFarlane. Front row: Sanae Chiba, Masahide Kaeriyama and Kerim Aydin. Photo by Skip McKinnell).

The carrying capacity concept was discussed at the species-level. An important point for discussion was how to measure changes in carrying capacity. In addition to traditional measures such as r and K , energy-based changes in the production rate (production/biomass ratio, P/B) or mortality (Z) were discussed with special reference to climatic and ecosystem regime shifts (**Fig. 1**). It was recommended that several different measures of carrying capacity be used for a number of key species and areas in the North Pacific. These multiple measures would integrate changes in component species to long-term variation in ecosystem carrying capacity.

Table 1 Comparison of expected responses to climatic regime shift (RS) by five life-history strategists.

Strategist	Species	Expected response to RS	Rationale	Remarks
Opportunistic	Pacific sardine; Pacific herring	Immediate and drastic	Short life-span and age at maturity	
Intermediate	Walleye pollock	Oscillatory	Juveniles are opportunistic, but good year-classes are followed by strong density-dependence	Cannibalism, especially in the eastern Bering Sea
Salmonic	Pink and chum salmon	Immediate and drastic but with two phases	Freshwater and marine life stages involve two phases for climate forcing	Need to account for artificial propagation
Periodic	Sablefish; Pacific halibut	Immediate year class impacts, but gradual and delayed population response	Low frequency variation in spawner biomass	Older ages of recruitment
Equilibrium	Spiny dogfish	Slight	Very low fecundity and stable early survival	Low population resilience to fishing impacts or habitat deterioration

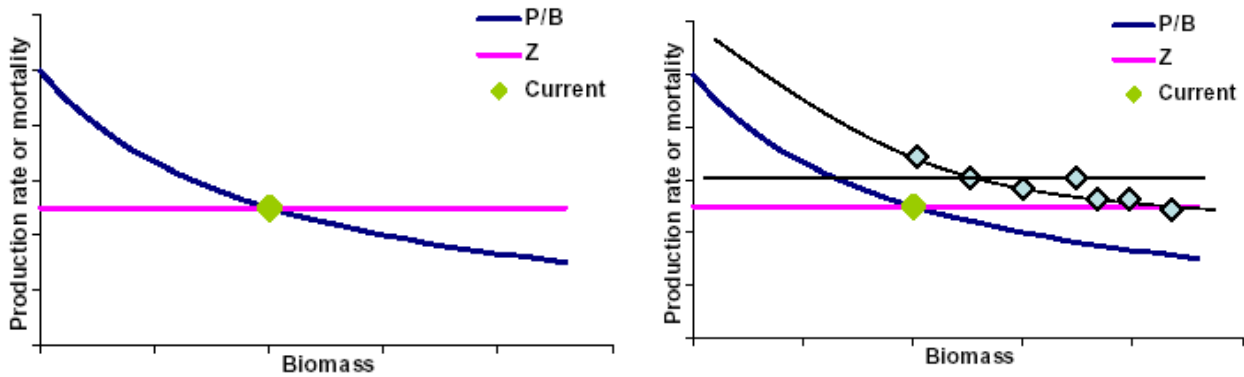


Fig. 1 Equilibrium condition of production rate (Production/Biomass) and mortality (Z) (left panel) and response of biomass, P/B and Z to a regime shift, resulting in gradual shift from “current” to a new equilibrium between thin curve and black horizontal line (right panel). P/B shape is due to local density dependence and age structure. Z “bends” but more slowly, approximated flat.

The results of the workshop were reported at the PICES/GLOBEC Symposium on “Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis” (April 19–21, 2006, Honolulu, U.S.A.). On behalf of the CFAME Task Team, Dr. Yatsu gave a talk on “Mechanistic linkages of fish population dynamics to climatic forcing: Comparative study on selected stocks representing five life-history strategies in the North Pacific”, and Dr. Aydin presented thoughts on the revision of the concept of carrying capacity (“Redefining carrying capacity ten years onward? CCCC research on a moving target”).

Initially, it was planned that the January workshop would include preliminary work on ecosystem comparisons. However, because of the truncation of the number of days that the workshop could be held and the absence of key researchers, it was recommended that a separate workshop on “Climate forcing and marine ecosystems of the North Pacific” be convened to initiate the second component of the CFAME Terms of Reference, *Ecosystems*.

This workshop was held on October 13, 2006, at PICES XV in Yokohama, Japan. The workshop was attended by 21 participants, from all PICES member countries, and included presentations from the United States, Russia, Korea and China. The workshop focused on three ecosystems of the North Pacific: the California Current System, the Sea of Okhotsk, and the Yellow Sea/East China Sea. Three invited speakers provided an overview of each of these key ecosystems, with the identification of conceptual models of climate forcing. Dr. Vera Agostini (U.S.A.) looked at the upwelling dynamics of the California Current System, summarized this system’s zooplankton community composition, and reviewed the biology and population dynamics of two key migratory pelagic fishes: Pacific sardine and Pacific hake. Dr. Victor Lapko (Russia) focused on the importance of sea ice to the physical oceanography of the Sea of Okhotsk, with subsequent impacts on dominant species such as walleye pollock. Dr. Young Shil Kang (Korea) presented

information on the Yellow Sea/East China Sea ecosystem, with emphasis on the impact of freshwater discharge from the Yantze River (East China Sea) on salinity changes. These changes, coupled with temperature variability, had impacts on zooplankton biomass and composition. Dr. Xiuren Ning (China) provided a contributed paper on the Bohai Sea ecosystem response to environmental changes, and highlighted the similarity to the Yellow Sea/East China Sea ecosystem with the dominance of freshwater discharge as a driver of ecosystem change. Overall, the three ecosystems selected captured different dominating features of climate forcing mechanisms: boundary current upwelling (California Current); sea ice (Sea of Okhotsk) and freshwater input (Yellow Sea/East China Sea). It was noted that freshwater discharge is also human regulated, which could confound climate forcing impacts. At the CFAME business meeting on October 15, 2006, the Kuroshio/Oyashio Current System was selected to be included in future CFAME work. Much of the species mechanism work conducted by CFAME is applicable to this system, and it represents a second boundary-dominated ecosystem which could simplify comparisons between ecosystems by selecting two with similar dominant characteristics (*i.e.*, to be compared to California Current System).

A second contributed paper in the workshop was presented by Dr. Sarah Gaichas on quantitative methods for comparative ecosystem analysis, which will be integral to the upcoming CFAME work on *Ecosystems*. Her presentation proved to be a good introduction to this area, and began a general discussion on ecosystem indicators (classifying ecosystems) and approaches to comparing ecosystems and their responses to perturbations. The underlying objective of CFAME work is predicting species response (whether singularly or aggregated, *i.e.*, ecosystem) to climate perturbations. The mechanisms of climate forcing will be species specific and ecosystem specific. Mechanisms of different species could interact, so integrated ecosystem indicators may be required. It was noted that ecosystem conceptual mechanisms need to

consider the seasonality of climate forcing. For example, there are different important parameters, or frequencies, that impact oceanography and biota for winter than for summer.

The dominant mode of climate-ocean coupling (e.g., boundary current upwelling, sea ice, freshwater input) could be one way of characterizing an ecosystem. These characterizations also encompass the overall regional indicators or climate model output products required (e.g., sea surface temperature, salinity, ice thickness or ice-free season, mixed layer depth, wind speed and direction, freshwater discharge). Ecosystems could also be classified by the overall dynamics of the food web (e.g., bottom-up, top-down, middle-trophic: wasp-waist or beer-belly). Generally, ecological indicators need to capture species composition, size distribution, trophic dynamics, and need to include low-trophic indicators (for bottom-up impacts) and top-trophic indicators (for top-down impacts). Irrespective of the method of ecosystem comparison,

general themes of comparison emerge: size spectra, food web structure, life history strategies, turnover rates or energy flow, and physical habitat structure. Workshop participants acknowledged that the ecological indicators selected, and the method of ecosystem comparison, will be determined by the available data. To that extent, future CFAME work on classifying and comparing ecosystems will be determined by the researchers involved. However, the generalities identified at the workshop for ecological indicators and for ecosystem comparison will need to be encompassed within each project.

The next phase for CFAME research will be linking species' *Mechanisms* and *Ecosystem* responses to climate forcing with climate forecasting *Scenarios*. This work will involve collaboration with PICES Working Group 20 on *Evaluations of Climate Change Projections*, and is anticipated to begin at PICES XVI in Victoria, Canada, in October 2007.



Dr. Akihiko Yatsu (yatsua@fra.affrc.go.jp) is the Director of the Subarctic Fisheries Division, Hokkaido National Fisheries Research Institute (HNFRI). He began his career in Shimizu from 1989–1999, studying the effects of squid driftnet fishing on the high seas ecosystems of the North Pacific, and the biology of neon flying squid. From 1999–2006, he worked in Yokohama, studying the population dynamics and regime shift issues of Japanese sardine and chub mackerel. His current work includes leading the stock assessment of major fisheries resources around Hokkaido, such as walleye pollock and common squid. He also conducts research exploring the linkages between marine ecosystems and environmental changes in the Northwest Pacific. Akihiko co-chaired PICES WG 16 on Climate Change, Shifts in Fish Production, and Fisheries Management and the PICES Climate Forcing and Marine Ecosystems (CFAME) Task Team from 2004–2006.

Dr. Kerim Y. Aydin (Kerim.Aydin@noaa.gov) is the Program Leader for the Resource Ecology and Ecosystem Modeling Program of the Alaska Fisheries Science Center (AFSC), NOAA Fisheries. Kerim received his Ph.D. in Fisheries from the University of Washington, in 2000, with a dissertation on the impacts of climate and prey variation on the ocean growth of Pacific salmon (Oncorhynchus spp.). He has been a Postdoctoral Research Associate and Fishery Research Biologist with AFSC since 2000. Kerim's main research focus has been on fish trophic interactions, bioenergetics, and ecosystem-scale predator/prey models. He has been an affiliate faculty member of the University of Washington School of Aquatic and Fishery Sciences since 2003, and is serving as Co-Chairman of the CFAME Task Team.

Dr. Jacquelynne R. King (KingJac@pac.dfo-mpo.gc.ca) is a Research Scientist in Groundfish Stock Assessment, at the Pacific Biological Station (Fisheries and Oceans Canada) in Nanaimo, Canada. Her research focuses on the impacts of climatic and oceanographic variability on marine fish population dynamics and the implications for fisheries management. She has published research on a suite of disciplines including marine fish life history strategies, statistical methodology, climate impacts on ecosystems, aging methodology, stock assessment, fish population dynamics and behavioural ecology. Jackie was a member of PICES WG 16 on Climate Change, Shifts in Fish Production, and Fisheries Management and chaired the PICES Study Group on Fisheries and Ecosystem Responses to Recent Regime Shifts (FERRRS). She is currently a member of the CFAME Task Team.

2006 CREAMS/PICES international workshop and summer school

By Kyung-Il Chang, Naoki Hirose, Shin-ichi Ito and Skip McKinnell

The second CREAMS/PICES international workshop entitled “*Model/data inter-comparison for the Japan/East Sea*” was held August 21–22, 2006, at Pukyong National University, in Busan, Korea, and followed by the first PICES summer school on “*Ocean circulation and ecosystem modeling*” at the National Fisheries Research and Development Institute (NFRDI), also in Busan. Both events were co-sponsored by PICES, Seoul National University, and the Korean Ocean Research and Development Institute (KORDI). Pukyong National University also sponsored the workshop, and the Ministry of Maritime Affairs and Fisheries (MOMAF), the “Brain Korea 21” Program (BK21), and NFRDI also sponsored the summer school. Convenors for both events were Kyung-Il Chang (Korea), Shin-ichi Ito (Japan), Sok-Kuh Kang (Korea), Kyung-Ryul Kim (Korea), Vyacheslav Lobanov (Russia), Christopher Mooers (U.S.A.), and Jong-Hwan Yoon (Japan). All workshop and summer school materials are posted on the PICES website at http://www.pices.int/2006_CREAMS_PICES_school.aspx.

Workshop description

About 50 marine scientists participated in the workshop (**Photo 1**), which provided a forum to address: whether observational and modeling advances in the Japan/East Sea (JES) are interactive and comparable, what were the achievements and what are the remaining gaps, and how

the creation of a reliable regional model should be approached. Seventeen oral talks and seven posters were presented in four sessions: *Review of up-to-date observational results* (WS1), *Ocean circulation modeling and inter-comparison with data* (WS2), *Operational nowcast/forecast system* (WS3), and *Ecosystem modeling in the North Pacific region* (WS4). A panel discussion on the future of circulation and ecosystem modeling and forecast in the JES concluded the workshop.

Up-to-date observational results on basin- and meso-scale circulation and hydrography in the northern JES (Vyacheslav Lobanov) and in the southwestern JES (Kyung-Il Chang), and a variability of sea surface temperature on decadal timescales (Sang-Wook Yeh) were presented in WS1.

Circulation model results for research and operational purposes using seven different models were presented in WS2 and WS3 (Table 1). Model results were compared with observations obtained during CREAMS I and II periods from 1993 to 2001 (Christopher Mooers, Patrick Hogan, Young-Ho Kim), or with previously known circulation and hydrographic features (Jong-Hwan Yoon, Olga Trusenkova). One presentation was on the internal tide generation using a two-layer model (Sok-Kuh Kang). To improve future modeling in the JES, it was suggested:



Photo 1 Participants of the second CREAMS/PICES international workshop.

Table 1 Various ocean circulation models presented during the second CREAMS/PICES workshop.

Model (Presenter)	Horizontal Grid	Vertical Grid	Purpose
RIAMOM (Jong-Hwan Yoon)	1/12°, 1/36°	46 levels	Research
RIAMOM (Sergey Varlamov)	1/12°	46 levels	Operational
MHI model (Olga Trusenkova)	1/8°	12 layers	Research
LOM (Patrick Hogan)	1/8°, 1/16°, 1/32°, 1/64°	4 layers	Research
HYCOM (Patrick Hogan)	1/25°	20 layers	Research
NLOM, NCOM, HYCOM (Patrick Hogan)	NLOM - 1/32°, NCOM - 1/16°, HYCOM - 1/12°	NLOM - 4 layers NCOM - 40 levels	Operational
POM (Christopher Mooers)	1/10°	21 levels	Research
JCOPE (POM) (Shin-ichi Ito)	1/12°	45 layers	Operational
Kyoto Univ. (Yoichi Ishikawa)	1/6°(EW) × 1/8°(NS)	67 levels	Research
ESROM (MOM) (Young-Ho Kim)	1/16~1/10°	42 levels	Research

- to include a sea ice module into models to better reproduce the deep water formation;
- to use a higher (>1/36°) resolution model or sophisticated parameterization to reproduce the observed magnitude of deep flow;
- to use synoptic wind forcing, preferably hourly data, for the quantitative comparison with observations;
- to nest JES models into basin- or global-scale models to reproduce more realistic dynamic interactions between the JES and the North Pacific and the East China Sea; and
- to use coastal hydrographic data to refine the initial condition.

WS4 introduced regional coupled physical-biological models in North Pacific to encourage such efforts in the JES. Fei Chai discussed available ocean circulation models that can be coupled to ecosystem models, and suggested how to improve future ecosystem modeling. Michio Kishi compared four ecosystem models in North Pacific regions, and showed that NEMURO gives a satisfactory reproduction of the vertical flux of particulate organic matter in the northern North Pacific, while other NPZD (Nutrients-Phytoplankton-Zooplankton-Detritus) models simulate it rather poorly. Xuehai Liu presented a 3-D ecosystem model of the southern Yellow Sea coupled to the 3-D Princeton Ocean Model, and pointed out that tides, runoff and wave mixing are important factors affecting the ecosystem in the region considered. Naoki Yoshie introduced observational results during SERIES (Subarctic Ecosystem Response to Iron Enrichment Study), and the successful modeling of high concentration of silicic acid to nitrate uptake during SERIES using NEMURO.

As it was learned from the workshop, many more sensitivity and process studies are needed to establish the adequacy of model parameters, to validate model physics, and to verify model fields. Past and future observations must be organized to facilitate this modeling analysis. Accordingly, the panel discussion held after all presentations suggested that it is necessary to design and

conduct an international JES model-data comparison experiment for a specified period of time (rich in forcing, validation, and verification data) using either free-running or data assimilation models.

Summer school description

The main objective of the summer school was to teach and motivate postgraduate students, early-career scientists, and other professionals who will be the principal users of numerical models. The summer school summarized our present knowledge of ocean circulation and ecosystem modeling, and introduced numerical models that can be used and applied in various fields of oceanography. Participants also carried out computer exercises to gain modeling experience. Thirty-seven students from 8 countries (including all six PICES member countries) attended the summer school: 1 from Canada, 1 from Chile, 2 from China, 2 from Indonesia, 10 from Japan, 13 from Korea, 4 from Russia, and 4 from U.S.A. (**Photo 2**). Among those 37 participants, 25 were postgraduate students (14 Ph.D. students and 11 M.Sc. students), 7 early-career scientists, 4 undergraduate students, and 1 from a private company. The participants' major were either physical or biological oceanography.

The summer school consisted of two 1.5-day courses: *Ocean circulation modeling* (organized by Naoki Hirose from Kyushu University, Japan), and *Ecosystem modeling* (organized by Shin-ichi Ito from Tohoku National Fisheries Research Institute, Japan). Other lecturers in the *Ocean circulation modeling* course were Patrick Hogan from the Naval Research Laboratory (U.S.A.), Yoichi Ishikawa from Kyoto University (Japan), and Christopher Mooers from the University of Miami (U.S.A.). Other lecturers in the *Ecosystem modeling* course were Fei Chai from the University of Maine (U.S.A.) and Michio Kishi from Hokkaido University (Japan). Both courses involved lectures and practical exercises, and three assistants – Young-Ho Kim (Korea), Goh Onitsuka (Japan), Naoki Yoshie (Japan) – helped the lecturers and hands-on training.



Photo 2 Participants of the CREAMS/PICES summer school.

The *Ocean Circulation Modeling* course covered many aspects of numerical modeling as it was intended to present a variety of opportunities for students who are interested in, and so would like to start, ocean circulation modeling. The course introduced the overall concepts of ocean circulation modeling, basic finite differencing schemes, various models from simple 1-D/2-D models to the most sophisticated ocean general circulation models (OGCMS: RIAM Ocean Model, Princeton Ocean Model, HYbrid Code Ocean Model), and linear and non-linear data assimilation principles. Model formulation methods and issues were described with teaching hands-on model running. Sample Fortran codes on the spring-mass system, shallow water model, Kalman filter/smoothing, adjoint method, *etc.* were provided, to enable the students to play the sample Fortran programs again by changing the parameters, initial, and/or boundary conditions on their home computers. The students were also expected to deepen their understanding of numerical modeling by finding the recommended references which were provided in various presentations during the class. However, nothing much was done with the implementation of models for idealistic, let alone realistic, model space-time domains and forcing. It might have been a better idea to focus on the tutorial and demonstration of a single OGCM so that the students could be fully aware of the OGCM.

The *Ecosystem Modeling* class started with the introduction of ecosystem modeling, the philosophy and rationale of

modeling, examples related to ecosystem modeling studies, and a brief history of ecosystem modeling dating back to the pioneering work of Gordon A. Riley. Fei Chai concluded his lecture by asking the students to “think the bigger picture with your investigation; it will bring the excitement”. Introduction of the lower trophic level ecosystem model NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography), and the fish growth model coupled with NEMURO – NEMURO.FISH (NEMURO For Including Saury and Herring) – followed. Basic structures, governing equations, and the characteristics of each term of the equations were explained, with emphasis on the characteristics of quadratic terms for the mortality of plankton and the stability of NEMURO, and the importance of observational and experimental data in the construction of the model and determination of the parameters of NEMURO.FISH. Source codes of the box version of the two models were distributed to the students, and most of them ran the model successfully. The last lecture was on the automated parameter-tuning software PEST (Model-Independent Parameter Estimation), which is one of the data assimilation softwares that automatically finds the optimized parameters for the model. PEST calculates the error between the model outputs and observations, searches, and produces new parameter values. Source codes and PEST control files were distributed to the students, and they were asked to test several examples.

Certificates prepared by the PICES Secretariat and signed by the Chairman of the PICES Physical Oceanography and Climate Committee (Michael Foreman), organizing lecturers, and one of the convenors (Kyung-Ryul Kim) were given to all students at the end of the school day (**Photo 3**). A questionnaire for the purpose of improving the planning and implementation of a future summer school was distributed to all participants, and 29 of them were submitted. In general, students responded that the summer school was successful in that it was very well organized and executed, and provided an intense and productive learning experience. It was commented that holding the summer school in conjunction with the workshop helped them to attend the school courses. Apart from a variety of complaints ranging from accommodations, mosquitoes, air conditioning, sharing a bathroom to spicy Korean food, they also said that the contents were too diverse for the students to digest in such a tight time schedule. Apparently, the students faced a lot of new concepts and new words in the school. Some exercises could not be solved simply due to a lack of time, and some were too difficult for inexperienced students to solve even though there was enough time. The remedy for this problem in future schools would be either to select more specific topics or to have a longer schedule. Many students wanted to have a similar modeling school in the future. A recommendation from one of the school assistants, Young-Ho Kim, reflects this, “The same lectures should be repeated a couple of times in the future with a progressive revision of lecture materials to make this summer school more fruitful”. Another problem was that some students were not familiar with Fortran or the command-line operation in a UNIX-like window, and the

visualization software used during the course. The lecture time was too short for students to get used to the manipulation of the software, so it would be valuable to provide all tutorial materials well in advance for the students’ preparation.



Photo 3 Dr. Shin-ichi Ito, lecturer for the Ecosystem Modeling course, gives a certificate to student, Arnaud Laurent (Canada).

Nevertheless, the first CREAMS/PICES summer school was successful as it provided a valuable opportunity to young students and early-career scientists to have a feel for models and modeling, and it is a touchstone for future PICES capacity-building programs. It was suggested that provision should be made for a technical follow-up to measure the impact of the summer school on the students’ education and professional careers at several time horizons (they could form an “alumni group”). The preceding is associated with establishing expectations of students, instructors, and sponsors, and managing them well.

PICES Calendar

- Workshop to develop a Science Plan for the future integrative scientific program of PICES and inter-sessional Science Board/Governing Council meeting, April 16–19, 2007, Yokohama, Japan.
- 5th International Conference on “*Marine bioinvasions*”, (co-sponsored by ICES, PICES and the U.S. National Sea Grant College Program), May 21–24, 2007, Cambridge, U.S.A.
- Joint meeting of ICES WGITMO, ICES/IOC/IMO WGBOSV and PICES WG on *Non-indigenous aquatic species*, May 25–26, 2007, Cambridge, U.S.A.
- 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (co-sponsored by PICES, ICES and GLOBEC), May 28–June 1, 2007, Hiroshima, Japan.
- ESSAS/PICES Workshop on “*Identifying the best IPCC model or ensemble of models for subarctic regions*”, and on “*Role of sea ice in marine ecosystems*”, June 4–6, 2007, Hakodate, Japan.
- ICES/PICES Conference for Early Career Scientists on “*New frontiers in marine science*”, June 26–29, 2007, Baltimore, U.S.A.
- Workshop on “*Forecasting climate impacts on fish production*”, July 2007, Seattle, U.S.A.
- ICES/PICES theme sessions on “*Integrating observations and models to improve predictions of ecosystem response to physical variability*”, “*Comparative marine ecosystem structure and function: Descriptors and characteristics*” and “*The ecosystem approach: What’s the impact on marine science, science based advice and management of marine ecosystems*” at the ICES Annual Science Conference, September 17–21, 2007, Helsinki, Finland.
- PICES Sixteenth Annual Meeting, October 26–November 4, 2007, Victoria, Canada.
- International Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” (co-sponsored by NAFO, PICES and ICES), October 1–3, 2007, Lisbon, Portugal.
- International Symposium on “*Effects of climate change on the world’s oceans*” (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR and WCRP), May 19–23, 2008, Gijón, Spain.

2006 Harmful Algal Bloom Section annual workshop

By Charles G. Trick and Yasunori Watanabe

The Section on Harmful Algal Blooms (HAB-S) was established under the Marine Environmental Quality Committee (MEQ) at PICES XII in 2003, in Seoul (Korea). At PICES XIII in 2004, in Honolulu (U.S.A.), HAB-S recommended to MEQ to convene an annual series of workshops that “review selected harmful algae that impact all or most countries in the PICES region”. The first workshop of this series on *Pseudo-nitzschia* and *Alexandrium* spp., preceded by a laboratory demonstration on detection techniques for algal toxins, was held at PICES XIV in 2005, in Vladivostok (Russia). This year, at PICES XV in Yokohama (Japan), we had our second workshop on *Dinophysis* and *Cochlodinium* spp., also accompanied by a half-day laboratory demonstration on detection techniques for algal toxins.

The laboratory demonstration was organized by Drs. Yasunori Watanabe and Ichiro Imai and held on October 13 at the National Research Institute of Fisheries Science (NRIFS) of the Fisheries Research Agency (FRA). In total, 28 scientists from 7 nations (Canada-3, China-6, France-1, Japan-10, Russia-2, Spain-2, and U.S.A.-4) were in attendance. They gathered at the Red Brick Warehouse (venue of the Annual Meeting) and took lunch together at a Chinese restaurant after the registration for the meeting. Then they went to NRIFS by bus chartered by FRA. Two demonstrations were carried out. The first demonstration “Protein Phosphate 2A (PP2A) inhibition assay for okadaic acid and its analogs in shellfish” was conducted by Dr. Reiji Sekiguchi (sekiguchir@jfrl.or.jp), Ms. Natsuki Takahashi and Dr. Toshiyuki Suzuki (tsuzuki@affrc.go.jp) (Photo 1). They introduced a new toxin determination kit, based on the principle that okadaic acid and its analogs (OAs) strongly and specifically bind to PP2A and inhibit its dephosphorylation activity. If OAs is absent, PP2A hydrolyze a colorless substrate pNPP and produce a yellow product. But in the presence of OAs, the substrate remains colorless. Therefore, OAs concentration is determined by

measuring the intensity of the yellow color. This newly developed determination kit is expected to be used for on-site monitoring of OAs in shellfish.

The second demonstration on “Simple, rapid, specific and cost effective method for identifying *Alexandrium tamarense* and *A. catenella* using the LAMP method” was conducted by Drs. Shigeru Itakura (itakura@affrc.go.jp) and Satoshi Nagai (snagai@affrc.go.jp) (Photo 2). LAMP, which stands for **L**oop-mediated **I**sothermal **A**mplification, is a simple, rapid, specific and cost-effective nucleic acid amplification method solely developed by Eiken Chemical Co., Ltd., in Japan. Advantages of LAMP are:

- There is no need for a step to denature double stranded into a single stranded form;
- The whole amplification reaction takes place continuously under isothermal conditions (~65°C);
- The amplification efficiency is extremely high, with DNA being amplified 10^9 - 10^{10} times in 15-60 minutes;
- By designing 4 primers to recognize 6 distinct regions, the LAMP method is able to specifically amplify the target gene;
- The total cost can be reduced, as LAMP does not require special reagents or sophisticated equipment such as a thermo-cycler and other basic apparatus for molecular biological experiments; and
- The amplification can be checked by the naked eye through the presence of an amplified product (the turbidity of magnesium pyrophosphate, a by-product of the amplification reaction).

Drs. Itakura and Nagai, together with Dr. Yukihiko Matsuyama, have developed LAMP primers for detecting *A. tamarense* and *A. catenella*, and it is now possible to identify each species from a single cell within 1 hour (starting from isolation of the cell to the detection of the amplification). This method can be performed using standard equipment needed in other molecular biological



Photo 1 Dr. Reiji Sekiguchi pointing at a graph monitoring the PP2A reaction.



Photo 2 Dr. Shigeru Itakura sampling *Alexandrium tamarense* using a micropipette during the LAMP method demonstration.

experiments. Though the time schedule was tight (from 14:00–18:00 hours), the laboratory demonstration finished smoothly because of the help of Dr. Hiroshi Oikawa (NRIFS) and cooperation of all attendees. After the demonstration, participants returned to the Minato Mirai District and enjoyed a communal Japanese dinner.

The workshop entitled “Review of selected harmful algae in the PICES region: II. *Dinophysis* and *Cochlodinium*” was held on October 14 at the Red Brick Warehouse, and co-convened by Drs. Charles Trick (Canada) and Yasunori Watanabe (Japan). There were 22 scientists in attendance from 9 nations (Canada-2, China-1, France-1, Japan-8, Korea-1, Norway-1, Russia-1, Spain-2, and U.S.A.-5). Three experts were invited: Drs. Kazumi Matsuoka (University of Nagasaki, Japan), Patrick Gentien (IFREMER, France) and Beatriz Reguera (Instituto Español de Oceanografía, Spain). Travel expenses for these invited speakers were covered by PICES and FRA.

At the workshop, the ecology, physiology, taxonomy and toxicity of two exceptionally important harmful algal species, *Cochlodinium* and *Dinophysis* spp., were discussed and compared. Ideas regarding these common themes were summarized in the three invited talks on “Recent progress of the study on a harmful dinoflagellate – *Cochlodinium polykrikoides*” (by Dr. Matsuoka), “The rare marine protist *Dinophysis acuminata*” (by Dr. Gentien) and “What we know and what we do not know about *Dinophysis*” (by Dr. Reguera). These presentations resulted in considerable discussion among the participants. As PICES had hoped, much of the discussion focused on two major themes:

- (1) Why does the distribution and toxicity of these two genera reside in the PICES countries of the western North Pacific, and are not (as yet) detrimental HABs of the PICES countries in the eastern North Pacific (Canada and U.S.A.)?
- (2) What are the environmental situations that enhance or stimulate toxin production?

The invited lectures were complemented by a series of presentations concerning *Dinophysis* and *Cochlodinium* in

the individual PICES countries. Drs. Vera Trainer (U.S.A.) and Charles Trick reviewed the low levels of these two genera in waters adjacent to the North American shore. These levels are in stark contrast to the deep and profound negative impact of *Dinophysis* and *Cochlodinium* in waters of Korea (presented by Drs. Hak-Gyoon Kim and Chang-Kyu Lee), Japan (presented by Drs. Kazutaka Miyahara and Ichiro Imai) and China (presented by Dr. Jinhui Wang). More specific methodologies were also presented. Dr. Toshiyuki Suzuki described modern methods for the analysis of lipophilic toxins, and Dr. Takafumi Yoshida documented the activities of the Northwest Pacific Action Plan (NOWPAP) on developing a regional HABs database. The details of each topic were summarized in an “enthusiastic” hour-long summary discussion aimed at establishing a list of “what is known”, “what is unknown” and “what sort of information is required next”.

We, the conveners, would like to thank all of the participants for making our workshop a great success. Special thanks go to the PICES Secretariat, the Fisheries Agency of Japan and FRA, especially NRIFS, for their support and efforts in arranging the venue and logistics for the meeting. We also greatly appreciate suggestions given by the Co-Chairmen of HAB-S, Drs. Vera Trainer and Hak-Gyoon Kim, in the course of our preparation of the workshop.

The third workshop of this series will focus on *Heterosigma akashiwo* and other harmful raphidophytes, and will be held at PICES XVI in 2007, in Victoria (Canada), and co-convened by Drs. Charles Trick and Ichiro Imai (Japan), and will include a half-day laboratory demonstration on *Heterosigma* cell and toxin detection to be led by Drs. V. Trainer, C. Trick and Robin Brown.

It is expected that the results of the annual HAB workshops will be published as a PICES Scientific Report or other publication. A product from this series will also be a list of recommendations to help guide collaborative HAB research priorities in PICES member countries over the next five years.



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Dr. Yasunori Watanabe (ywat@affrc.go.jp) is the Director of the Harmful Algal Bloom Division at the National Research Institute of Fisheries and Environment of Inland Sea, Fisheries Research Agency of Japan. Dr. Watanabe puts his focus on the fisheries ground protection issue including HAB problems, based on the experience of his study of chemical oceanography. He is a member of the PICES Section on Harmful Algal Blooms.

2006 PICES Workshop on “Modeling iron biogeochemistry and ocean ecosystems”

By Jun Nishioka and Fei Chai

The synthesis of data obtained from three successful meso-scale iron enrichment experiments in the western (SEEDS-I & II) and eastern (SERIES) subarctic North Pacific has been underway. The key findings of these experiments were presented at the Topic Session on “*Synthesis of in situ iron enrichment experiments in the eastern and western subarctic Pacific*” held at PICES XV in Yokohama, Japan. To enhance communication between experimentalists and modelers who work on iron biogeochemistry and ecosystem responses, a workshop on “*Modeling iron biogeochemistry and ocean ecosystems*” was held on October 13, 2006, also at PICES XV. The workshop was developed by the Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific Ocean* (IFEP) and the MODEL Task Team of PICES, and co-sponsored by SOLAS (Surface Ocean-Low Atmosphere Study). The convenors were Jun Nishioka (Japan) and Fei Chai (U.S.A.).

The workshop aimed to examine the role of the iron cycle and complexity in regulating the biological productivity and structure of ocean ecosystems (**Photo 1**). Twenty-seven scientists from Canada, Japan, United States of America, Hong Kong, France, and New Zealand attended the workshop. There were seven oral presentations, two focusing on iron biogeochemistry based upon observations, and five using numerical models to address the impact of iron on ecosystem dynamics.



Photo 1 Workshop in session.

An invited speaker, Dr. Marie Boye from France (**Photo 2**), reviewed recent advances in understanding the marine iron cycle, and the role of organic ligand chemistry in the ocean. Data on dust-iron solubility in the seawater were presented by Atushi Ooki. Five of the talks examined several different approaches to treating the iron cycle in models. An ocean carbon cycle model indicated that it is important to have realistic iron distributions (Daisuke Tsumune). A couple of models tested iron fertilization and its impact on marine ecosystem structure (Masakiho Fujii and Fei Chai). One presentation compared simple with complex ocean ecosystem models, as well as models with an iron cycle

against the models without an iron cycle (Albert Hermann). An iron cycle module has been incorporated in the NEMURO ecosystem model, and some preliminary results were presented (Naoki Yoshie).

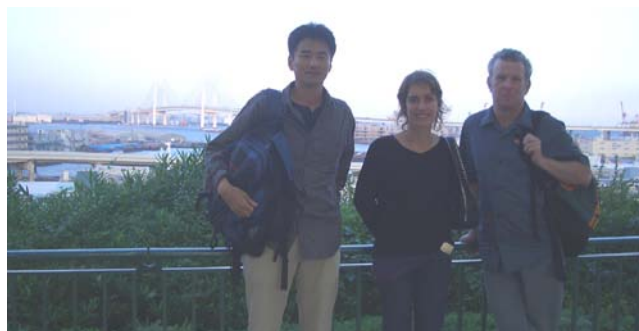


Photo 2 From left to right, Jun Nishioka (Japan), Marie Boye (France) and Philip Boyd (New Zealand) after the workshop in a park near the venue.

A dynamic discussion covered a number of topics and issues. The following are point-form summaries of the views of both experimentalists and modelers.

Suggestions from experimentalists:

- Dust size, solubility, and its retention time are important factors for estimating bioavailable iron in the surface layer, and these should be incorporated into models;
- Modelers should consider the significant differences in the concentrations of organic ligands among the ocean basins;
- Experiments are required on the bioavailability of organic iron species;
- Modelers should use the data that are currently available for organic iron, with the parameterizations provided by biogeochemists, to develop and improve iron cycle models;
- Models should take into account species-specific bioavailability of organic iron;
- A conceptual model focusing solely on iron chemistry should be established, and it should include remineralization and photochemical processes;
- Changes in the chemical forms of iron occur during remineralization and the scavenging process; these transformations should be considered in the models;
- There is a need to establish observational systems to collect long-term time series data.

Suggestions from modelers:

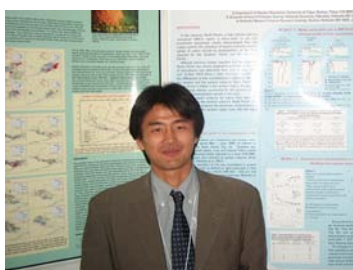
- Information on stoichiometry of phytoplankton is needed to improve iron distribution in the models;

- Iron dust deposition affects iron distribution, but current data are too sparse to quantify these relationships;
- Initial conditions (phytoplankton species, chemical and physical variables) are important factors for determining ocean ecosystem responses to iron enrichment;
- After iron enrichment in the equatorial Pacific, the ocean ecosystem needs about 60 to 90 days to return to the original state;
- More information is required on interaction between phytoplankton and zooplankton functional groups, especially due to iron perturbation;
- Based upon comparative studies of different NPZ (Nutrient–Phytoplankton–Zooplankton) models, it appears that multiple classes of phytoplankton models

with an iron cycle are needed to reproduce the basic characteristics of HNLC regions;

- There is a need for more information on organic-ligand chemistry and associated biogeochemistry from field observations in order to incorporate these processes into models;
- Long-term time series data are required for improving biogeochemical and ecosystem models.

The workshop participants agreed to continue the dialogue. A new PICES Working Group, consisting of both experimentalists and modelers, will be proposed next year in order to examine the iron cycle and its role in regulating ocean productivity and marine ecosystem dynamics. We, the workshop convenors, thank all the participants for the excellent presentations and lively discussion.



Dr. Jun Nishioka (nishioka@lowtem.hokudai.ac.jp) is an Associate Professor at the Institute of Low Temperature Science, Hokkaido University. His research focuses on biogeochemical cycles of iron, iron speciation and biological interactions in the ocean. Within PICES, he is a member of the Advisory Panel on Iron Fertilization Experiment in the Subarctic Pacific Ocean.

Dr. Fei Chai (fchai@maine.edu) is an Associate Professor of Oceanography at the University of Maine. By developing and using physical-biological models, Dr. Chai studies how physical and biological processes contribute to the carbon cycle and marine ecosystems. He has been involved in several PICES-organized workshops.

Strolling through the NEMURO ecosystem model

A collaboration between EUROCEANS NoE (*European Network of Excellence for Ocean Ecosystem Analysis*, www.eur-oceans.eu) and the PICES MODEL Task Team offers modellers, and process scientists alike, an on-line version of the recently published NEMURO pelagic ecosystem model (information on a special issue of *Ecological Modelling* can be found on pp. 27–29 in this PICES Press).

NEMURO model equations and parameters have been included in the Model Shopping Tool (MoST, www.eur-oceans.eu/models) developed within EUROCEANS NoE. MoST allows users to view concise model descriptions, search for specific biogeochemical processes or just walk through the equations of the virtual pelagic ecosystem they represent. Where relevant, the NEMURO process equations have also been compared to their equivalents in the carbon-based PISCES model (Aumont *et al.*, 2006).

The aim of MoST is to provide a platform for an end-to-end approach on pelagic ecosystem process research and modelling by making major pelagic ecosystem models more accessible so model developers and process scientists

can easily scrutinize the mathematical representation and parameterization of real biological processes. Where possible, the equations are also compared across modelling products. At present, MoST includes a searchable database for the process equations for the following model: PISCES (Monod, global biogeochemistry), PlankTOM (Monod, 10 Plankton Functional Types model based on PISCES), ERSEM-PELAGOS (Quota, global biogeochemistry), ECOSMO (Monod, North Sea biogeochemistry) and COHERENS (Quota, North Sea biogeochemistry).

In order to achieve the objective of providing ‘platform for an end-to-end approach on pelagic ecosystem process research and modelling’, modelling efforts focusing on upper trophic levels such as NEMURO.SAN and NEMURO.FISH are also planned to be included into the MoST database in the coming months.

For any queries and comments on model interfacing or to include your modelling effort into the database, please contact Ivo Grigorov (Project Officer for Model Interfacing within EUROCEANS NoE, ivo.grigorov@eur-oceans.eu).

Climate and marine birds and mammals in the North Pacific

By Yutaka Watanuki, Shoshiro Minobe and William J. Sydeman

A workshop on “Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing” was held on October 12, 2006, in conjunction with PICES XV in Yokohama, Japan. The workshop was developed by the PICES Advisory Panel on *Marine Birds and Mammals* and the Physical Oceanography and Climate Committee, and supported financially by PICES and the “Neo-science of natural history” Centre of Excellence (led by Prof. Hisatake Okada) at Hokkaido University, Sapporo, Japan (<http://nature.sci.hokudai.ac.jp/>). The workshop was convened by Drs. Yutaka Watanuki and Shoshiro Minobe (Japan), and William J. Sydeman (U.S.A.), and invited speakers included Drs. Sarah Wanless (U.K.), Arthur Miller and Julie Thayer (U.S.A.), and Shin-ichi Ito and Sei-ichi Saitoh (Japan) (**Photos 1 and 2**).



Photo 1 Front row: Workshop co-convenors, Yutaka Watanuki (left) and Shoshiro Minobe (right); back row: invited speaker, Sarah Wanless.



Photo 2 Front row: Workshop co-convenor, William Sydeman (left); second row: invited speaker, Julie Thayer; back row: invited speaker, Shin-ichi Ito (second from left).

Low-frequency climate variability often has profound effects on marine ecosystems, yet its influence on top predators, such as large fishes, seabirds and marine mammals, has not been adequately quantified, especially

for the North Pacific. In the North Atlantic, the breeding performance and population dynamics of many species are known to be related to changes in the North Atlantic Oscillation. The aim of this workshop was to examine responses by these types of fauna to interannual and interdecadal climate variability in the North Pacific. A secondary purpose was to facilitate collaboration between researchers working in disparate marine science disciplines (e.g., climatology to mammalogy). Various studies describing patterns and testing potential mechanisms of environmental forcing, from physics to prey to predators, were presented.

Approximately 25 scientists from the PICES community attended the workshop, and lively discussion followed each presentation. Using an elaborate modeling approach based on NEMURO.FISH, Shin-ichi Ito showed how growth of fishes (herring and saury) varies between regions of the North Pacific relative to ocean climate, suggesting that different physical or biological factors limit growth in the eastern and western Pacific. Regional differences in primary production (Sei-ichi Saitoh) and responses of marine birds (Sarah Wanless, Julie Thayer, Shoshiro Minobe and M. Ito) and mammals (Steller sea lion – Arthur Miller and Keiko Kato, northern fur seals – Andrew Trites and Shiroh Yonezaki, western grey whales – Hyun-Woo Kim) to variation in temperature and regime shifts were described. The potential mechanisms of responses (changes in food webs, diets, nutritional condition of prey, etc.) were also discussed. Dr. S. Minobe demonstrated how correlation analyses between sea temperature, sea level pressure, and breeding performance of marine birds may provide new insights toward specific mechanisms (**Fig. 1**). The relative importance of spatial variability in ocean climate, in addition to temporal variability, was a recurring theme of the workshop.

During general discussion, the following key points were elaborated:

- Collaboration between climatologists, oceanographers, and marine bird and mammal experts is essential to developing the science of climate change and climate effects on seabirds and marine mammals.
- Whereas marine bird and mammal specialists may offer local mechanistic hypotheses, climate scientists and oceanographers often provide a larger-scale physical context, and coupling these scales of analysis is likely to be critical to understanding the effects of climate change on these top predators.
- Marine birds and mammals should be considered in developing PICES ecosystem models, including NEMURO. Seabirds and marine mammals may exert “top-down” control of fish and zooplankton, and the effect of their consumption should be estimated.

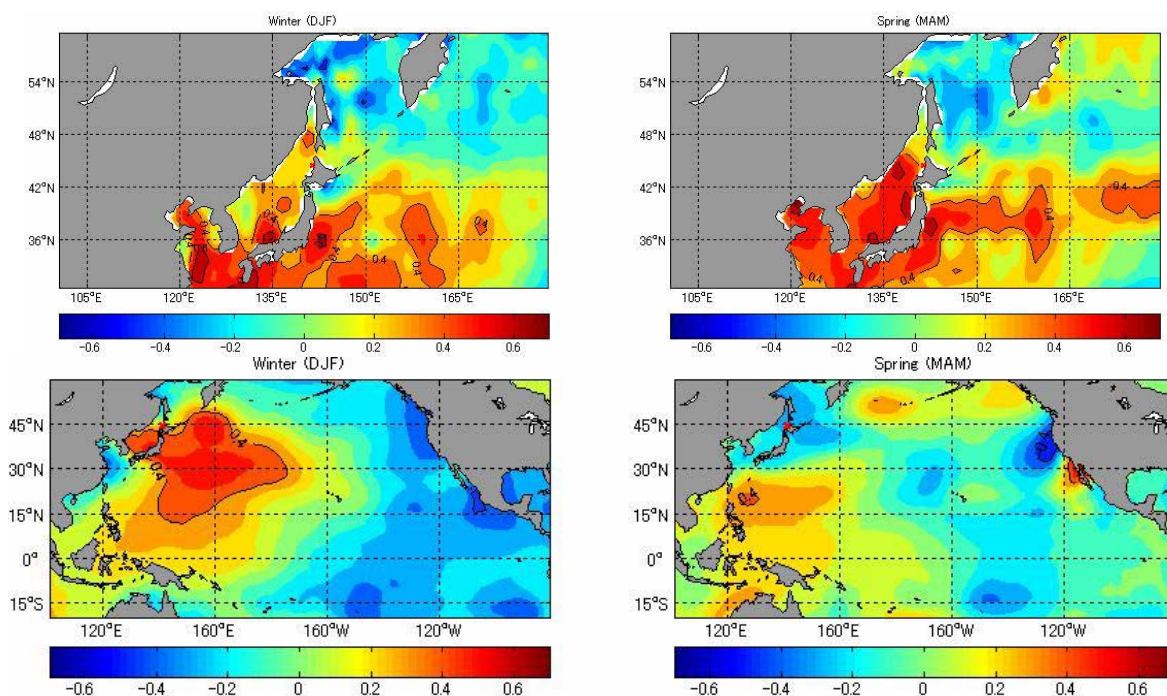


Fig. 1 Spatial correlation between physics – sea surface temperature, SST (top row) and sea level pressure, SLP (bottom row) – and the breeding success of Rhinoceros Auklets at Teuri Island on the west coast of Hokkaido, Japan (S. Minobe et al. unpublished). Winter SLP forces winter and spring SST, probably by changing winds, and the inflow of the Tsushima Warm Current to the Japan/East Sea. In turn, this affects the distribution of a primary prey (anchovy) for the auklet. Since winter SLP is measured 4–6 months prior to the completion of the auklet’s annual breeding cycle, this study suggests that predictions of reproductive success may be possible.

- Correlations between climate indices and the food habits, breeding success and population parameters of marine birds and mammals in the Atlantic and the Pacific are, in some cases, well known, but an understanding of the mechanisms driving correlative relationships is lacking. Until mechanisms are studied, established and modeled, our ability to predict effects of climate change on marine birds and mammals will be limited.
- Scale-dependent responses (spatial and temporal) and species-specific life history characteristics (*i.e.*, variation in trophic and foraging ecology and demographic strategies) must be considered in analyzing the relationships between climate variability and change and responses of marine birds and mammals. For example, species with narrow diets, restricted foraging ranges may be especially susceptible to climate induced changes to local food webs.
- Due to their visibility, and rapid and substantial responses, marine birds and mammals may be excellent indicators of marine ecosystem change. But, to use them fully, calibration of climate–predator responses is needed. Fortunately, many long-term research studies and datasets of PICES member nations and their academic communities are available for synthesis and analysis. The available information includes detailed data on food habits, movements and migration, and the demographic attributes (*e.g.*, fecundity, survival, recruitment) that drive abundance and biomass. Therefore, studies of marine birds and mammals are likely to contribute to a better understanding of climate change effects on marine ecosystems in the North Pacific.

Dr. Yutaka Watanuki (ywata@fish.hokudai.ac.jp) is an Associate Professor of the Graduate School of Fisheries Sciences at Hokkaido University, Hakodate. Dr. Watanuki studies the foraging behavior of seabirds using bio-loggers and telemetry, and conducts long-term studies of climate and seabirds at Teuri Island, Hokkaido, Japan. He is a member of the PICES Advisory Panel on Marine Birds and Mammals.

Dr. Shoshiro Minobe (minobe@ep.sci.hokudai.ac.jp) is a Professor of the Graduate School of Sciences at Hokkaido University, Sapporo. Dr. Minobe studies physical oceanography, with particular interest in coupling changes in the atmosphere and ocean, and in numerical simulations of oceanic variability.

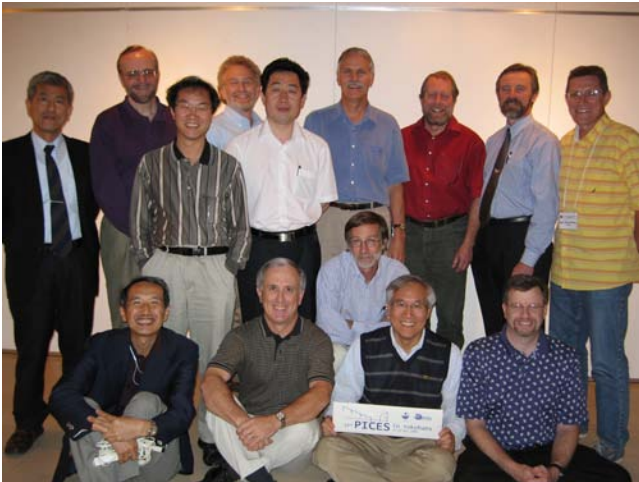
Dr. William J. Sydeman (wsydeman@prbo.org) is Director of the Marine Ecology Division at PRBO Conservation Science, in California. Dr. Sydeman studies climate effects on coastal and pelagic marine ecosystems in the eastern North Pacific, and conducts long-term studies of climate, seabirds and marine mammals at the Farallon Islands (California, U.S.A.). He co-chairs the PICES Advisory Panel on Marine Birds and Mammals.



Representatives on the Governing Council pose outside the Red Brick Warehouse beside a giant PICES XV poster stand.



Dr. Hideki Nakano briefing members of the Local Organizing Committee on the first day at the Red Brick Warehouse.



Representatives at the Science Board meeting: standing - Y. Ishida, G. Kruse, S. Kim, J. Napp, F.L. Qiao, M. Foreman, A. Kellermann (ICES), S. McKinnell, I. Shevchenko; front - M. Kishi, J. Stein, M. Dagg, K. Kim, H. Batchelder.



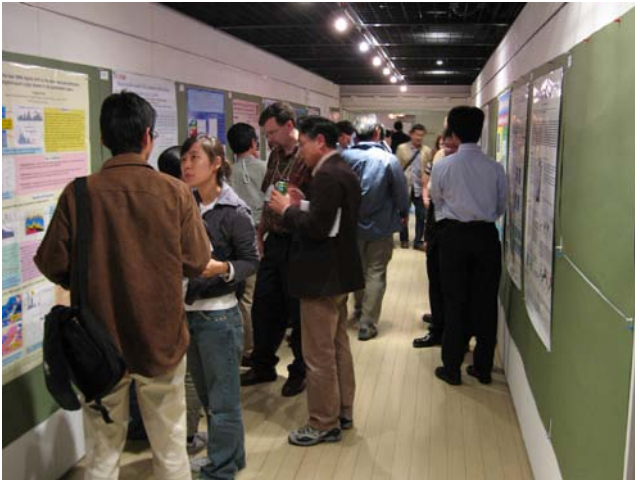
The TCODE Technical Committee Meeting in session.



Outgoing PICES Chairman, Dr. Vera Alexander, received special souvenirs from all Contracting Parties for her dedicated service to PICES during her chairmanship. She is seen here with the U.S. Delegates, Drs. George Boehlert and Samuel Pooley.



Soccer stars of tomorrow (or yesterday?!) at the PICES XV Soccer Match! PICES was represented by senior scientists, institute directors and organization/program heads from 4 continents, but, alas, lost to the young and energetic host team 1:3 and 2:5 in two friendly matches. The exciting matches were enjoyed immensely by everyone who played or watched.



Full and clever use of all the corridors was made to accommodate the many posters submitted at PICES XV.



Science Board members busy trying to put together the scientific schedule for the next Annual Meeting.



Dr. Akihiko Yatsu giving the keynote lecture at the PICES XV Science Board Symposium.



Participants eat, drink and chat amidst a Japanese matsuri (festival) atmosphere at the Poster Session Reception.



Drs. Suam Kim, Sinjae Yoo and Hyung-Tack Huh pose with Japanese performers at the Chairman's Reception.



Dr. Shin-ichi Uye makes his presentation on jellyfish blooms to a well-attended S2 Session audience.

Recent trends in waters of the subarctic NE Pacific: Cooler and fresher in summer of 2006

By William Crawford and Peter Chandler

Shore station temperatures

Ocean waters cooled through the late summer and autumn of 2006 at almost all shore stations in western Canada. **Figure 1** presents a time series of temperature at Amphitrite Point on the west coast of Vancouver Island. Temperatures fell below normal at several periods in the first half of 2006, and remained below normal after mid-August.

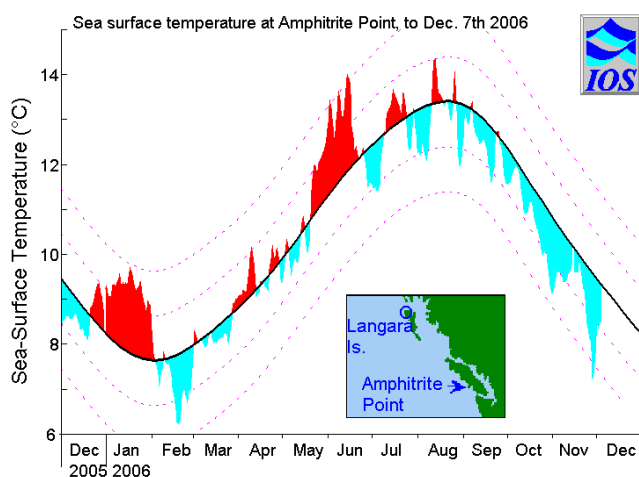


Fig. 1 Daily temperature at Amphitrite Point on the west coast of Vancouver Island. Black curve denotes the average annual cycle of temperature for the past 65 years; red and blue show measured temperatures above and below the annual cycle. (Figure provided by H. Freeland; updates are available at: http://www-sci.pac.dfo-mpo.gc.ca/osap/projects/sst/default_e.htm#)

The steepest declines in temperature were along the west coast of Vancouver Island and at stations on the inshore waters to the north. Declines were less significant in the Strait of Georgia, and at Langara Island at the northwest point of the Queen Charlotte Islands (see inset to **Fig. 1** for location).

Amphitrite Point and Langara Island are two of fourteen Canadian shore stations with daily samples of temperature and salinity. The longest time series began at the Pacific Biological Station in Nanaimo in 1912, with additional stations added in the 1930s and 1960s. Details and data can be found at http://www-sci.pac.dfo-mpo.gc.ca/osap/data/Search Tools/Searchlighthouse_e.htm.

Mid-ocean temperatures

Surface waters of the Gulf of Alaska turned cooler in the summer of 2006, following the very warm summers of 2004 and 2005. **Figure 2** reveals this return to normal through a sequence of plots of temperature anomalies at

10 metres depth for the summers of 2005 and 2006, plus the winter of 2006. Temperatures at 10-m depth were selected to enable a better comparison between ship-based and Argo measurements, and to avoid waters stirred at depths above 10 metres by vessels while on station.

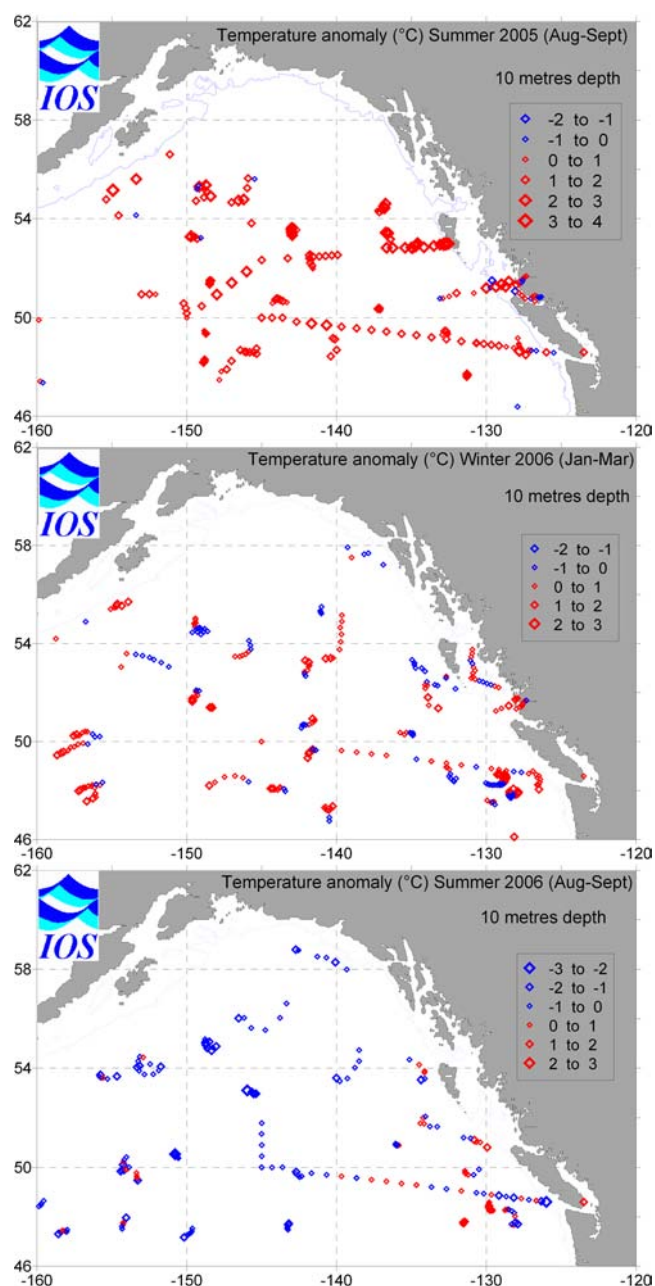


Fig. 2 Anomalies of temperature at 10 metres depth in the Gulf of Alaska from summer 2005 to the summer of 2006. Symbols denote negative (blue) or positive (red) anomalies in degrees Celsius. Each symbol represents a single profile from a research vessel, or by an Argo profiler.

Anomalies are computed relative to climatology of all observations in the U.S. and Canadian data archives. This climatology covers shelf, inshore and deep-sea regions of the Gulf of Alaska east of 160°W. Summer includes the two-month interval of August 1 to September 30, avoiding the month of July when surface temperatures are still warming through most of these regions. Winter extends through the three months of January 1 to March 31. Plots of temperature and salinity climatology are available online at http://www-sci.pac.dfo-mpo.gc.ca/osap/data/alaska/default_e.htm.

This decline in the warm anomalies began after the record-high temperatures observed in the gulf in previous summers. For example, temperatures measured between 10 and 50 m below surface along Line-P in the summers of 2004 and 2005 were two of the four warmest in almost 50 years of sampling along this line. (Line-P extends from the coast to Ocean Station Papa at 50°N, 145°W. It is evident in all three panels of **Figure 2**).

Salinity

Near-surface salinity in the summer of 2006 remained slightly below the long-term average through the Gulf of Alaska, as noted in **Figure 3**. Lowest salinities in the 10 to 50 m layer along Line-P were observed in both 1992 and 2003; highest salinity in the nearly 50-year-long record occurred in 1999. Between 1999 and 2003, salinity along Line-P declined by 0.4 psu, the steepest decline over the entire half-century record. A preliminary analysis of this decline attributes it to an increase in westerly winds from 1999 to 2002 that deflected the low salinity water of the Alaska Current toward the North American coast.

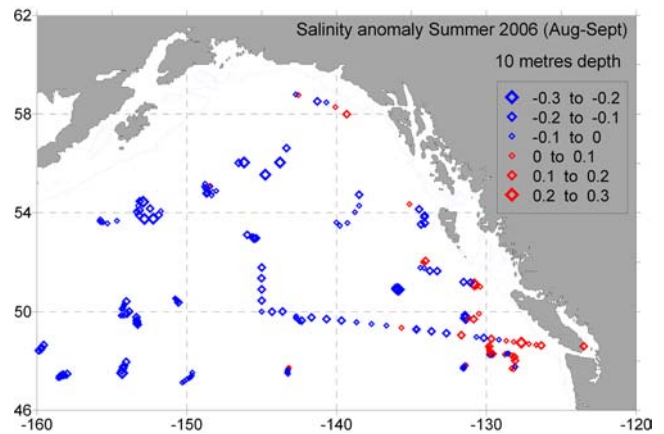


Fig. 3 Anomalies of salinity at 10 metres depth in the Gulf of Alaska for the summer of 2006. Symbols denote fresher (blue) or saltier (red) anomalies. Each symbol represents a single profile from a research vessel, or by an Argo profiler.

Salinity anomalies were slightly lower in offshore regions of the Gulf of Alaska than in waters near Vancouver Island in the summer of 2006, as can be seen in the distribution of positive and negative anomalies in **Figure 3**.

Salinities at shore stations along the west coast of Vancouver Island and to the north increased slightly through 2006. Three stations in the Strait of Georgia measured salinities well above normal in the summer, with anomalies of +3 to +4 psu from July to October. We expect these high values are due to the very low runoff of the Fraser River through these months, combined with a dry summer and early autumn.



Dr. William (Bill) Crawford (crawfordb@pac.dfo-mpo.gc.ca) works as a research scientist for Fisheries and Oceans Canada at the Institute of Ocean Sciences (IOS). Bill leads the State of the Ocean Section of IOS, researching the movement and impacts of moving water masses in the Gulf of Alaska and Canadian coastal waters. He co-chairs the Fisheries and Oceanography Working Group that prepares the annual “State of the Ocean Report” for Canada’s Pacific Region. Bill is a member of the PICES CFAME Task Team, serves as the Canadian member of the Pacific Panel of CLIVAR, and is one of two Canadian representatives on the International Association of Physical Oceanography.

Peter Chandler (chandlerp@pac.dfo-mpo.gc.ca) is a physical oceanographer with Fisheries and Oceans Canada, also at IOS. Peter manages the shore station program that records daily temperature and salinity at fourteen locations along the western coast of Canada.

The state of the western North Pacific in the first half of 2006

By Shiro Ishizaki

Sea surface temperature

Figure 1 shows monthly mean sea surface temperature (SST) anomalies in the western North Pacific from January to June 2006, computed with respect to JMA's (Japan Meteorological Agency) 1971–2000 climatology. Monthly SSTs are calculated from JMA's MGDSST (Merged satellite and *in-situ* data Global Daily SST), which is based on NOAA/AVHRR and microwave sensor (AQUA/AMSR-E) data, and *in situ* observations. Time series of 10-day mean SST anomalies are presented in **Figure 2** for 9 regions (indicated in the bottom panel).

During the entire period, SSTs were generally below normal north of 35°N (regions 1–4 in **Fig. 2**). In particular, negative SST anomalies exceeding -2°C were found east of the northern part of Japan. Negative SST anomalies detected in January around 25°N, 140°E were reduced in magnitude and turned to positive anomalies in May and June.

SSTs were above normal south of 20°N. While negative SST anomalies were sustained in the northern part of the

East China Sea (region 5 in **Fig. 2**), SSTs were above normal in the South China Sea throughout the period. Negative SST anomalies prevailed around 36°N, 165°E in June.

Kuroshio and Oyashio

Figure 3 shows the Kuroshio path for 10-day periods from January to June 2006. The Kuroshio took a small meandering path south of Kyushu Island (30°N, 132°E) in January, February and May. East of 133°E, several small perturbations propagated eastward along the Kuroshio during the entire period. Corresponding to the passage of each perturbation, the latitude of the Kuroshio axis over the Izu Ridge moved from north to south.

The subsurface temperature at the depth of 100 m east of Japan for February 2006 is presented in **Figure 4**. This chart is based on the numerical ocean data assimilation system (JMA's Ocean Comprehensive Analysis System).

The Oyashio cold water (defined as temperatures less than 5°C in **Fig. 4**) is known to extend southward in spring

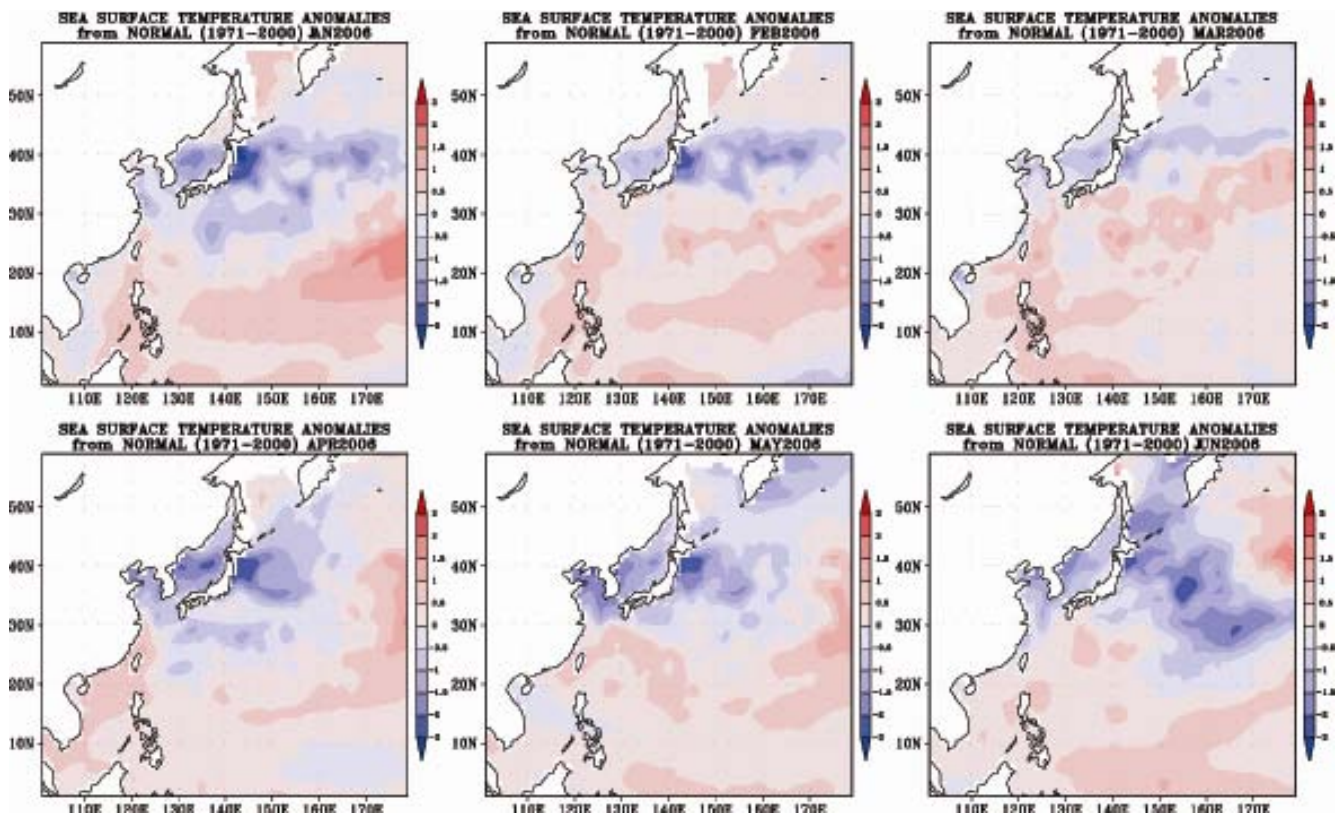


Fig. 1 Monthly mean sea surface temperature anomalies ($^{\circ}\text{C}$) from January to June 2006. Anomalies are deviations from JMA's 1971–2000 climatology.

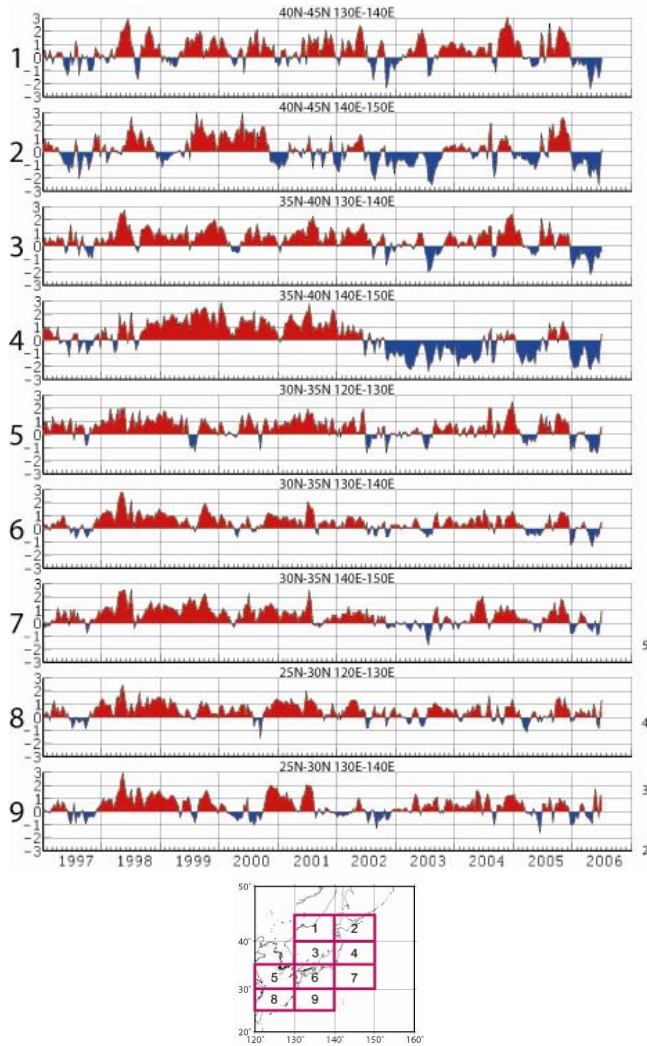


Fig. 2 Time series of the 10-day mean sea surface temperature anomalies ($^{\circ}\text{C}$) averaged for the areas shown in the bottom panel. Anomalies are deviations from JMA's 1971–2000 climatology.

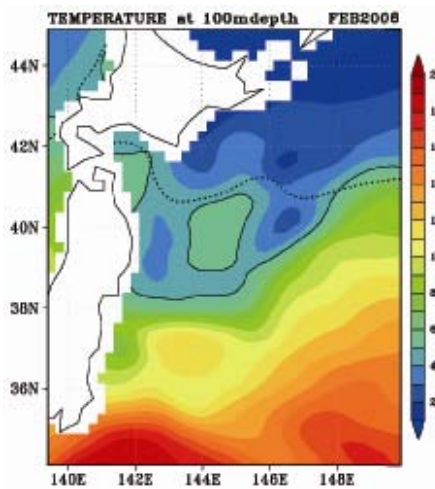


Fig. 4 Subsurface temperature ($^{\circ}\text{C}$) at the depth of 100 m east of Japan for February 2006. The solid line denotes the 5°C isotherm, and the dashed line that of the climatology (30-year averaged values from 1971 to 2000).

and return northward from summer to autumn (as indicated by the green line in Fig. 5). The coastal branch of the Oyashio cold water extended southward significantly in February 2006, while it returned to almost the same latitude as normal after May (Fig. 5). The southernmost point in February was 37.5°N , 142.0°E , which is 180 km south of the 30-year average.

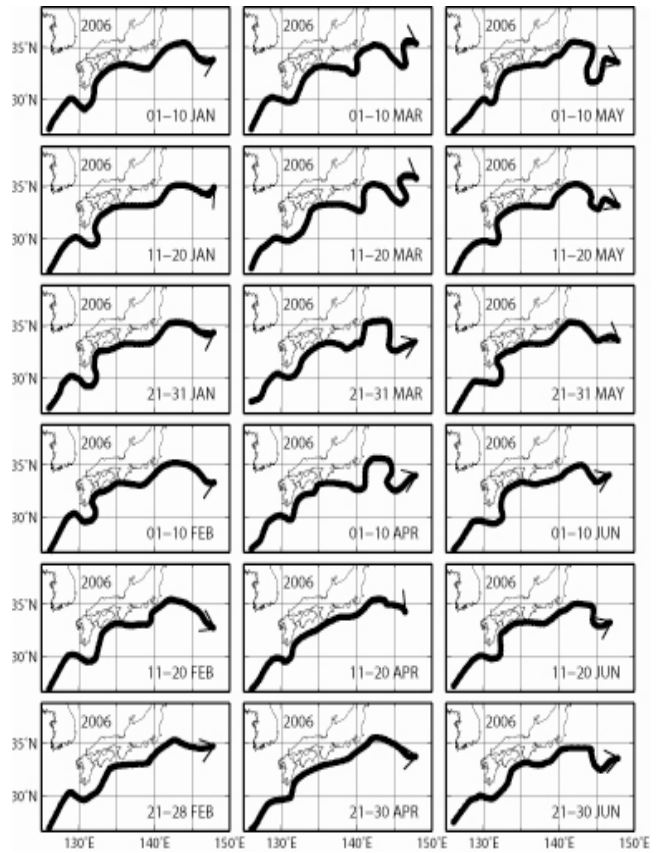


Fig. 3 Location of the Kuroshio path from January to June 2006.

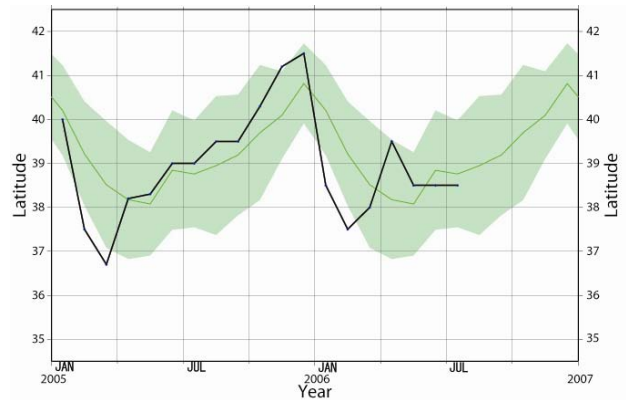


Fig. 5 The southernmost position of the coastal branch of the Oyashio cold water from January 2005 to July 2006 (black line), and the 30-year averaged values (green line), with the range of one standard deviation (green shade) from 1971 to 2000.

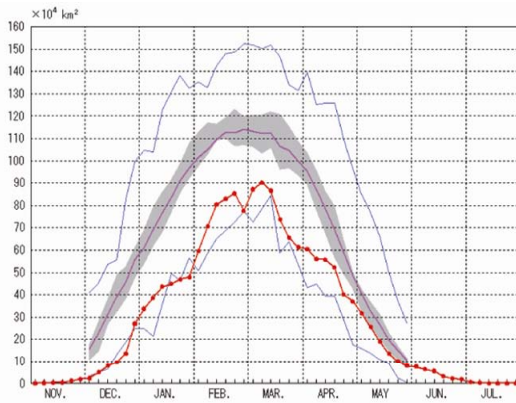


Fig. 6 Time series of sea ice extent in the Sea of Okhotsk from November 2005 to July 2006 (pink line – JMA’s 1971–2000 climatology; red line – 2005–2006 analysis; blue lines – maximum/minimum of sea ice extent since 1971; grey area – within the normal range).

Sea ice in the Sea of Okhotsk

The extent of the sea ice in the Sea of Okhotsk was below normal (30-year averaged values from 1971 to 2000) throughout the period from December 2005 to May 2006 (Fig. 6). The sea ice area reached its seasonal maximum of $90.38 \times 10^4 \text{ km}^2$ on March 10, which was the second lowest value since 1971 (the lowest value was $85.81 \times 10^4 \text{ km}^2$ in 1984). The accumulated sea ice extent, defined as the sum of the 5-day sea ice areas from December to May, was 1651.7 km^2 , which was the smallest since 1971 (normal value is 2574.3 km^2).



Shiro Ishizaki (s_ishizaki@met.kishou.go.jp) is a scientific officer of the Office of Marine Prediction at the Japan Meteorological Agency (JMA). He is working as a member of a group in charge of oceanic information in the western North Pacific. Using the data assimilation system named “Ocean Comprehensive Analysis System”, this group provides an operational surface current prognosis (for the upcoming month) as well as seawater temperature and an analysis of currents with a 0.25×0.25 degree resolution for waters adjacent to Japan. He is now involved in developing a new analysis system for temperature, salinity, and currents that will be altered with the Ocean Comprehensive Analysis System.

Latest and upcoming PICES publications

PICES Scientific Report Series, 2006-2007

- Takeda, S. and Wong, C.S. (Eds.) 2006. Proceedings of the 2004 Workshop on *In Situ* Iron Enrichment Experiments in the Eastern and Western Subarctic Pacific. *PICES Sci. Rep.* No. 31.
- Miller, C.B. and Ikeda, T. (Eds.) 2006. Report of the 2005 Workshop on Oceanic Ecodynamics Comparison in the Subarctic Pacific. *PICES Sci. Rep.* No. 32.
- Kruse, G.H., Livingston, P., Overland, J.E., Jamieson, G.S., McKinnell, S. and Perry, R.I. 2006. Report of the PICES/NPRB Workshop on Integration of Ecological Indicators of the North Pacific with Emphasis on the Bering Sea. *PICES Sci. Rep.* No. 33.
- Dickson, A.G. (Ed.) 2007. Guide to Best Practices for Oceanic CO₂ Measurements and Data Reporting. *PICES Sci. Rep.* No. 34.

PICES Technical Report Series, 2007

- Megrey, B.A., Macklin, S.A., Bahl, K. and Klawitter, P.D. (Eds.) 2007. Metadata Federation of PICES Member Countries. *PICES Tech. Rep.* No. 1.

Special issues of primary journals, 2006-2008

- Marine ecosystem structure and dynamics (Guest Editors: G.L. Hunt, Jr. and S. McKinnell) – *Prog. Oceanogr.*, 2006, Vol. 68, Nos. 2–4, pp. 115–342.
- Top predator “hot spots” in the North Pacific (Guest Editors: W.J. Sydeman, A. Bychkov, R. Brodeur, C. Grimes and S. McKinnell) – *Deep-Sea Res. II*, 2006,

Vol. 53, Nos. 3–4, 247–479.

- Canadian SOLAS: Subarctic Ecosystem Response to Iron Enrichment (SERIES) (Guest Editors: P.J. Harrison, P.W. Boyd, M. Lvasseur, A. Tsuda, R.B. Rivkin, S.O. Roy and W.L. Miller) – *Deep-Sea Res. II*, 2006, Vol. 53, Nos. 20–22, 2005–2454.
- Selected papers on NEMURO and NEMURO.FISH models (Guest Editors: M.J. Kishi, B.A. Megrey, S.I. Ito and F.E. Werner) – *Ecol. Modelling* (2007).
- Selected papers from the symposium on “Climate variability and sub-arctic marine ecosystems” (Guest Editors: K. Drinkwater, G.L. Hunt, D.L. Mackas and S. McKinnell) – *Deep-Sea Res. II* (2007).
- Selected papers from the symposium on “Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P” (Guest Editors: A. Peña, A. Bychkov and S. Bograd) – *Prog. Oceanogr.* (2007).
- Selected papers from the symposium on “Climate variability and ecosystem impacts on the North Pacific” (Guest Editors: H. Batchelder and S. Kim) – *Prog. Oceanogr.* (2007–2008).
- Selected papers from the PICES XV Topic Session on “The human dimension of jellyfish blooms” (Guest Editor: H. Iizumi) – *Plankton and Benthos Res.* (2007–2008).
- Selected papers from the 2006 CREAMS/PICES workshop on “Model-data inter-comparison for the Japan/East Sea” (Guest Editors: K.-I. Chang, S. McKinnell and C. Mooers) – *J. Mar. Systems* (2008).

A seven-year effort of the PICES CCCC MODEL Task Team culminates in a dedicated issue of *Ecological Modelling*

By Bernard A. Megrey, Francisco E. Werner, Michio J. Kishi and Shin-ichi Ito

A seven-year effort of the PICES CCCC MODEL Task Team including planning, organizing, funding, and conducting 10 international workshops, will soon culminate in the publication of 19 peer-reviewed scientific papers on NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography) and NEMURO.FISH (NEMURO For Including Saury and Herring) in a dedicated issue of *Ecological Modelling*. These contributions represent a rich set of case studies and in-depth modeling studies using the NEMURO family of models focused on the North Pacific that address: oceanic biogeochemistry, regional and seasonal variability of phytoplankton and zooplankton, reconstruction of 40-50 years of plankton dynamics, effects of climate on herring and saury growth and population dynamics, the feasibility of automatic calibration methods, the sensitivity of the model to parameter values, and projections of future states of the ecosystem under scenarios of climate change.

NEMURO is a nutrient-phytoplankton-zooplankton (NPZ) model of the lower trophic level of the marine ecosystem dynamically coupled to a fish bioenergetics model (NEMURO.FISH). It was originally developed for Pacific saury and Pacific herring to study climate change impacts on important commercial species in the North Pacific basin. The model was named after the City of Nemuro (Japan) that generously hosted the first model-buildup workshop in 2000. Under a separate project funded by PICES, Intra-American Institute (IAI), GLOBEC and the Asian Pacific Network (APN), NEMURO.FISH is now being extended to include species-to-species interactions via an implementation of sardine and anchovy populations (NEMURO.SAN) for regions that support important populations of small pelagic fish (California Current, Humboldt Current, Benguela Current, Oyashio/Kuroshio). NEMURO and NEMURO.FISH are among the few models that span and couple the processes from physics to populations of fish, include density-dependent ecosystem feedbacks, and potentially can be used to investigate the effects of climate change on populations of small pelagic fish.

Through the workshop process, the structure of NEMURO was developed in the course of discussions within a broad group of researchers from different fields including physics, biology and fisheries. Formulations and parameterizations were a result of a collective effort that engaged everyone equally. We believe that had smaller groups taken on similar tasks, it is likely that different formulations would have resulted, rather than the common single NEMURO and NEMURO.FISH formulations used in these papers. Similarly, once the formulations were agreed to, the implementation and application of the common model to

different regions and different times was done with the benefit of the collective understanding gained through the joint “bottom-up” effort of the researchers involved. In other words, through the team effort, everyone’s cross-disciplinary awareness of the different issues and limitations was increased. The resulting contributions, even at the level of the individual papers, provide a broader perspective and integration of the results than would otherwise have occurred by groups working in isolation. It is safe to say that the effort resulting in the papers in the special *Ecological Modelling* issue is greater than the sum of its parts, and even goes beyond the scientific content of the papers and how the scientists involved will approach new problems in the future.

To achieve a long-term goal of a true common ecosystem model, the community of researchers needs to come to agreement on unique expressions of key biological traits. A grand challenge is to define unique empirical equations for marine ecosystems. For example, scientists working in one region of the ocean will formulate the temperature dependence of target organisms using the data from that region, while scientists at other sites will likely derive a different formulation. The MODEL Task Team’s effort in implementing NEMURO required the compilation of data from several locations in the North Pacific in order to set the model parameters. To make the data uniform and to be able to compare across sites, conversions needed to be applied. However, the factors themselves varied across sites and varied seasonally. The goal of constructing a “simple” ecosystem model for the North Pacific clearly showed that one of the most basic and important elements that can result from sustained international collaborations is the unification of observational methods, measurements and their interpretation. Such uniformity in approach will greatly help the definition of unique empirical equations for ecosystem modeling in general, and for their inclusion in a common NEMURO-like model.

Support from PICES and other agencies

Carrying out such ambitious objectives, among individuals coming from different countries and scientific cultures and backgrounds, was made difficult given that the work was conducted without the sustained support of a large well-funded international program. Fortunately, PICES provided a different approach. Working with PICES, the four Co-Chairmen of the MODEL Task Team (who rotated over a seven-year period) realized this difficulty and were able to secure funding from various sources [The Japan International Science and Technology Exchange Center (JISTEC, US\$ 70,000), PICES (US\$ 12,000), the City of Nemuro (US\$ 40,000), Japan’s Fisheries Research Agency

(FRA, US\$ 60,000), the Heiwa-Nakajima Foundation of Japan (US\$ 30,000), GLOBEC (US\$ 6,000), the Asian Pacific Network (APN, US\$ 45,000), and the Asian Pacific Network Capacity Building/Enhancement for Sustainable Development in Developing Countries Program (APN CAPaBLE, US\$ 10,500)] to help fund the workshops that fostered model development.

PICES contributed significantly to the collaborative environment that was necessary to build our team by providing opportunities to meet at inter-session meetings and workshops, and by sponsoring special sessions at PICES Annual Meetings. This latter contribution helped keep the PICES community up-to-date on model developments as progress was reported, and basically kept the project on track. PICES generously provided funding to help support new emerging scientists. It is important to note the capacity building component of this effort whereby many students were afforded the opportunity to be trained through the workshop process, with the tangible result that several papers in the *Ecological Modelling* volume resulted from M.Sc. and Ph.D. theses (including those by M. Fujii, D. Mukai, T. Hashioka and N. Yoshie). It bears re-iterating that the success of these efforts would not have been possible without the encouragement, support, coordination and funding enabled by PICES' commitment to the project.

Now that NEMURO and NEMURO.FISH have been tested and scrutinized by an international community, we thank PICES and the other agencies mentioned above for their support, and we are pleased to publish the *Ecological Modelling* special issue which contains the latest papers describing the present status of NEMURO and/or NEMURO.FISH, as well as specific applications (the list of titles and authorship of papers appearing in the special issue can be found on the PICES MODEL Task Team web page at http://www.pices.int/members/task_teams/MODEL.aspx).

Personal aspects of an international collaboration

During the period of model development, numerous investigators freely contributed untold amounts of energy, disciplinary perspective, and intellect towards the creation, testing and application of these models. This often required working extra hours planning for a workshop, traveling long hours criss-crossing the international dateline, writing computer code in hotel rooms or while riding buses and trains, gathering in the lobby of a hotel after a late dinner to continue pursuing an interesting line of scientific thought, and then polishing these thoughts by working at home after the workshop. We are proud to report that the work was done in a truly international team setting of cooperation and in a highly collegial manner of open scientific sharing. The code for the NEMURO and NEMURO.FISH soon will be posted on the PICES website.

The inter-personal collaborative aspect of the group's endeavor was as important as its scientific contributions. One outcome has been the growth of deep personal friendships among the participants and, in many situations, opportunities to exchange visits to each others houses and for families to meet each other. The photographs at the end of this article were taken during one such meeting in Seattle.

Summary

NEMURO was developed as a common ecosystem model for the North Pacific. However, ecosystem models are different from general ocean circulation models. Circulation models are derived from first principles, together with constraints imposed by temperature, salinity and mass conservation equations. Ecosystem models rely much more on empirical relations and the judgment of the developers as to what to include and what to ignore. Hence, developing a generalized ecosystem model involves additional challenges.

NEMURO is only one milestone in a long process toward achieving a common ecosystem formulation for use in the North Pacific. The framework offered by the NEMURO model and its extensions provide the opportunity to examine the dynamics and variability of the North Pacific marine ecosystem. Although the complexity of the system demands significant idealizations and approximations, important contributions resulted in several areas ranging from methodological, such as techniques for coupling across trophic levels and better parameter estimation, to process studies that provided better understanding of the factors controlling marine ecosystems. The next steps should include increased resolution (not just computational, but in the processes included) with the aim of providing projections of future states. There will continue to be a need for additional hindcast studies, but these will always be data-limited to some extent. It is important that models be used to identify where additional data need to be collected so that maximum advantage is taken of available resources, and so that the data are collected optimally for integration with the models.

As we better quantify the observed variability in marine ecosystems and our predictive capacity increases, we will move closer to our goal of providing stewardship of our marine ecosystems. While our approaches so far are relatively simple, they represent important steps towards the integration of our understanding of climate variability and the responses of lower trophic levels and fish populations. As such, we have reason to be optimistic about models providing information needed to manage our oceanic resources. However, efforts of the magnitude required to take the next steps in the development of future marine ecosystem models cannot happen without sustained resources to train the next generation of scientists who will lead this charge.

Dedication

We acknowledge the important contributions to NEMURO and NEMURO.FISH made by our colleague, mentor and friend Dr. Daniel Ware who sadly passed away in 2005. Dan's many insights and encyclopedic knowledge into the workings of marine ecosystems and detailed knowledge

about fish biology and population dynamics greatly enhanced NEMURO and NEMURO.FISH. All of the MODEL Task Team members who collaborated with Dan feel privileged to have worked with him. In recognition of Dan's contribution, we dedicated the special issue of *Ecological Modelling* to him.



Dr. Bernard Megrey (bern.megrey@noaa.gov) is a Research Fisheries Biologist with NOAA's Alaska Fisheries Science Center where he has worked since 1982. As the lead investigator for recruitment modeling studies for FOCI (Fisheries-Oceanography Coordinated Investigations), he has over 20 years of experience studying dynamics of exploited North Pacific fish populations, relationships of environment to recruitment variability, and application of computer technology to fisheries research and natural resource management. His recent research has focused on developing indices of ecosystems status and health, building simulation models of marine ecosystems, and performing comparative analyses of system-level characteristics of similar marine ecosystems. Dr. Megrey is a member and former Co-Chairman of the PICES MODEL Task Team, Co-Editor of the NEMURO Ecological Modelling volume, and an Editor for the ICES Journal of Marine Science.

Dr. Francisco Werner (cisco@unc.edu) is the George and Alice Welsh Professor and Chairman of the Marine Sciences Department at the University of North Carolina at Chapel Hill, U.S.A., and also chairs the GLOBEC Scientific Steering Committee. Originally from Venezuela, Cisco completed his graduate work in Physical Oceanography at the University of Washington in Seattle. His research includes the development of circulation coastal ocean models and their coupling to trophodynamic individual-based models of planktonic and early life stages of marine organisms. He is a former Co-Chairman of the PICES MODEL Task Team, a Co-Editor of the NEMURO Ecological Modelling volume and Co-Editor-in-Chief of Progress in Oceanography.

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Dr. Shin-ichi Ito (goito@affrc.go.jp) is a Chief Scientist of the Physical Oceanography Section in FRA's (Fisheries Research Agency of Japan) Tohoku National Fisheries Research Institute. Shin-ichi completed his graduate work in Theoretical Physical Oceanography at Hokkaido University and converted to an observational physical oceanographer in FRA. He was a project office secretary of Subarctic Gyre Experiment (SAGE) and a lead investigator of VENFISH (Comprehensive study of the Variation of the Oceanic Environment and Fish populations in the North-western Pacific). He is a former Co-Chairman of the PICES MODEL Task Team, a member of POC, and Co-Editor of the NEMURO Ecological Modelling volume.

Japan joins PICES Marine Metadata Federation

By Bernard A. Megrey, S. Allen Macklin and Toru Suzuki

Summary

Significant progress has been made over the past year to connect PICES member nations' metadatabase systems into one integrated resource. With this new scientific resource, a user of any one metadata inventory will have the ability to search for data catalogued by any and all other system participants with a single search request. Using modern data management techniques to cross-search separate metadatabases provides the advantages of shared metadata without compromising national ownership, data integrity, or security of national metadata products.

The PICES Marine Metadata Federation, originally formed by the North Pacific Ecosystem Metadatabase (NPEM) and the Korean Oceanographic Data Center (KODC), has been expanded to include registered nodes from Korea's National Fisheries Research and Development Institute (NFRDI), Japan's Marine Information Research Center (MIRC) of the Japan Hydrographic Association (JHA) and Russia's TINRO-Center (**Fig. 1**). The Korean nodes now serve more than 700 Korean metadata records; NPEM serves more than 3000 records; the Russian and Japanese nodes serve a small but growing number of records. All nodes have established English-language XML metadata records in Federal Geographic Data Committee (FGDC) standard format and provide those records using the Z39.50 communications protocol. Access is through a metadata clearinghouse that supplies search and delivery scripts to the user (**Fig. 2**). Presently, the federation uses FGDC's National Spatial Data Infrastructure (NSDI) Clearinghouse (<http://www.fgdc.gov/clearinghouse/clearinghouse.html>). The ultimate goal of this project is to federate the marine metadata holdings of all PICES member countries.

The status of the PICES nodes can be found at <http://registry.fgdc.gov/serverstatus/>, and the nodes can be searched by going to <http://clearinghouse3.fgdc.gov/>.

From then until now – The Federation history

In 2002 and 2003, informal discussions between KODC and NPEM took place with the goal to connect the two metadatabase systems into one integrated resource. Drs. Hee-Dong Jeong (KODC/NFRDI) and Hae-Seok Kang (KORDI) agreed to contribute Korean metadata. At the 2004 PICES Annual Meeting, the Technical Committee on Data Exchange (TCODE) adopted a pilot KODC-NPEM Marine Metadata Federation project as part of its 2005 work plan, and the first PICES node (PICES-NPEM) was registered with the U.S. NSDI clearinghouse. Using partial support from PICES, KODC and NPEM, Drs. Hae-Seok Kang and Kyu-Kui Jung, along with NPEM personnel, developed the first Korean node, with major

progress coming from joint meetings held in August (Seattle, U.S.A.) and October 2005 (Busan, Korea). The KODC node (PICES-KODC) came on-line during the Busan meeting. KODC is expanding the information that it serves through prioritized translation of metadata records from Korean to English and their subsequent conversion to the FGDC standard. Recently Korea added a second node for NFRDI called PICES-NFRDI KODC. See *PICES Press* 2006, Vol. 14(1): 8–11 for more details.

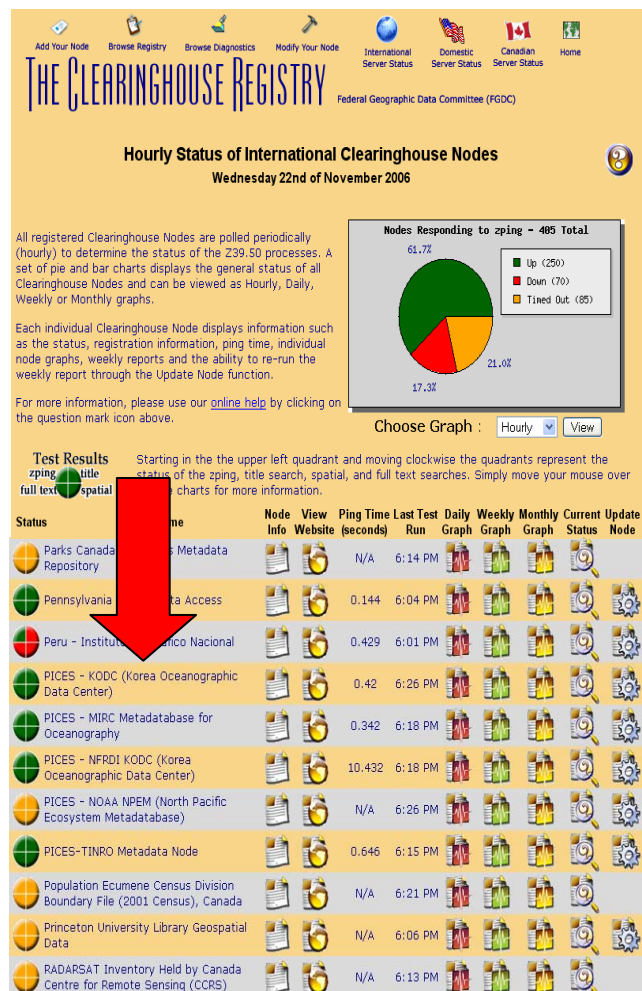


Fig. 1 The arrow points to the current PICES nodes (KODC, MIRC, NFRDI, NPEM and TINRO) of the Clearinghouse Registry. The symbols describe connectivity statistics for all registered sites. At this time, there were 405 sites participating in the clearinghouse (not all shown).

At previous TCODE meetings, Japan expressed an interest to join the Federation. In 2005, in collaboration with Dr. Toru Suzuki (MIRC), TCODE submitted, for partial support by PICES, a Phase II Metadata Federation proposal to expand the Federation to include Japan. Dr. Bernard Megrey and Mr. Allen Macklin also prepared a successful companion proposal ("North Pacific Ecosystem Metadata

Federation: Japan Component”, US\$ 20,000) to the 2006 NSDI Cooperative Agreements Program (CAP). The objective of the NSDI CAP program is to fund innovative projects in the geospatial data community to build the infrastructure necessary to effectively discover, access, share, manage, and use digital geographic data. Monies were used to fund two MIRC/JODC-NPEM workshops that took place in August (Seattle) and October 2006 (Tokyo) and discussed required technical details and technical hurdles, and the means to address and solve problems associated with federating with the Japan Oceanographic Data Center (JODC) and MIRC.

These initiatives take considerable resources. The original KODC-NPEM activity was supported directly at the level of US\$ 4,000 from PICES, US\$ 6,000 from NPEM, and US\$ 6,000 from KODC. Both NPEM and KODC contributed approximately US\$ 35,000 in matching monies. The MIRC-NPEM project was directly funded at the level of US\$ 4,000 from PICES and US\$ 20,000 from NSDI-CAP, with about US\$ 38,700 being contributed in matching monies.

The demonstrated success with these two projects indicates that efforts with other PICES countries should easily scale up with a nominal investment of time and planning.

MIRC-NPEM collaboration

Dr. Suzuki traveled to Seattle in August 2006 for the first MIRC-NPEM planning meeting (Figs. 3–4). The meeting began with an overview of NPEM, Isite (an application of the Z39.50 protocol) and a history of the NPEM and PICES Federation project. The overview was based on a presentation given at the 2005 PICES Annual Meeting in Vladivostok. An overview of MIRC’s data holding and metadata needs followed. Dr. Suzuki informed participants of the hierarchical structure of MIRC, JODC and JHA. He then reviewed the varied types of data holdings available through JODC. JODC’s data holdings are extremely valuable to scientists working in the North Pacific. They maintain data from several million stations dating back to the early 1800s. JODC Cruise Summary Reports (CSRs) provide information for each observational cruise including date/time, research area, abstract, purpose, and contact information. Therefore, the CSRs contain much of the core metadata elements that will serve as the basic source of the PICES-MIRC metadata base.

The first requirement for the Federation is to produce FGDC-compliant metadata. Kimberly Bahl, who received training from FGDC last spring, introduced the FGDC metadata content standard and its sections and elements. This gave Dr. Suzuki the rules to write FGDC-compliant metadata records from MIRC information. Ms. Bahl also demonstrated two open-source metadata creation and validation tools, Metavist 2005 and Metadata Parser (MP).

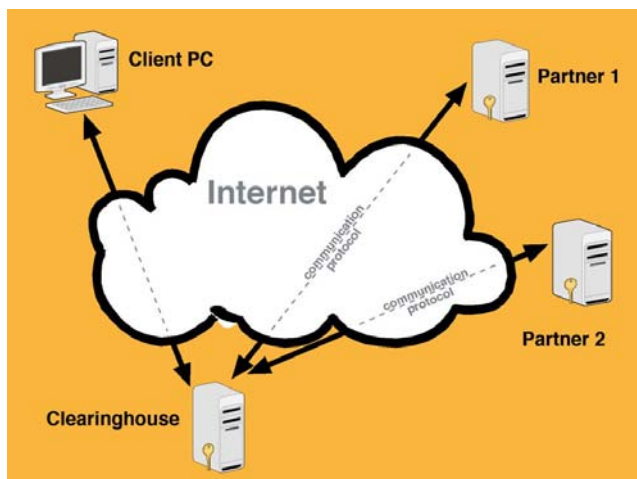


Fig. 2 An Internet metadata federation requires a clearinghouse and partners sharing a communication protocol and serving metadata using the same standard.

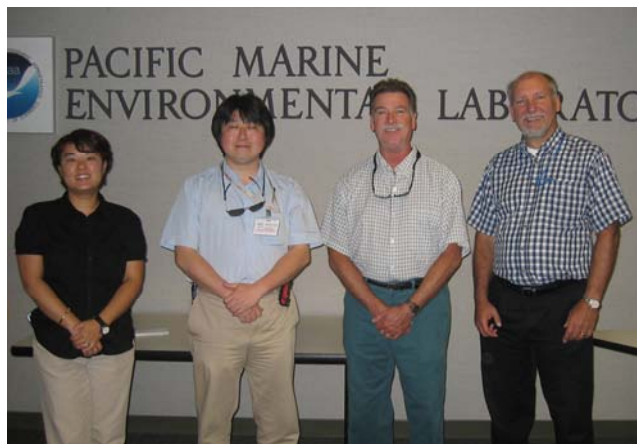


Fig. 3 The MIRC-NPEM Federation Team inside the Pacific Marine Environmental Laboratory, (August 2006, Seattle); left to right: Kimberly Bahl, Toru Suzuki, Allen Macklin and Bernard Megrey.



Fig. 4 MIRC and NPEM representatives working at the Alaska Fisheries Science Center (August 2006, Seattle); left to right: Bernard Megrey, Kimberly Bahl, Toru Suzuki and Allen Macklin.

These tools allow easy creation of individual metadata records in XML file format (required for any clearinghouse node) and validation that they are FGDC-compliant. Participants used Metavist and MP to create and validate an XML metadata record from a JODC CSR.

The second requirement for the Federation is to supply a common communication protocol: Z39.50. Ms. Bahl provided specific instructions on how to install and configure the Isite application that allows the use of the Z39.50 protocol. The Isite software suite is a free, open-source application available from the FGDC website.

The remainder of the meeting was spent discussing strategies for implementing a Japanese clearinghouse node and dealing with the problems and challenges of locating on-going funding for the PICES Federation. PICES has been very supportive but has limited resources. At present, funding from within NOAA is unlikely. Despite numerous efforts, attracting money from international funding organizations has not been successful. There is a possibility that NOWPAP (Northwest Pacific Action Plan) may be able to provide support. This year, MIRC will submit proposals for three-year projects to the Nippon Foundation to begin in April 2007. Participants of this meeting will work with Dr. Suzuki to develop a MIRC proposal. The proposal will provide support for on-going MIRC participation in the PICES Federation, primarily through development of a MIRC metadatabase. The meeting ended with presentation of MIRC plans to develop a demonstration site using Isite and the XML record created at this meeting, and to register the node at the clearinghouse.

Japanese node comes on-line

The second planning meeting was held in Japan in October 2006, in conjunction with the PICES Fifteenth Annual Meeting. It started at the Red Brick Warehouse in Yokohama and continued at the MIRC office in Tokyo (Fig. 5). Mr. Norio Baba of NOWPAP also joined the discussions.

Participants reviewed the advantages of promoting the metadatabase in NOWPAP DINRAC (Data and Information Network Activity Center), discussed the relationship between TCODE and DINRAC activities and new opportunities for capacity building, and investigated the utility of an Asian-side metadatabase mirror server. Mr. Baba said that NOWPAP has worked on metadata capacity building and might be able to invite a specialist from NPEM to collaborate. Dr. Suzuki suggested that representatives from Korea and Japan may also assist the DINRAC activity.

Dr. Suzuki reported that Isite had been installed on MIRC's server, and the site was registered with the NSDI Clearinghouse as "PICES-MIRC metadatabase" on October 18. He reported that some small problems were encountered during the installation and configuration of the site. Technical issues related to resolving these problems were discussed.

Participants reviewed the progress on the Seattle meeting action plan and amended the plan based on the Japan meeting discussions. Dr. Suzuki submitted the aforementioned proposal to the Nippon Foundation for metadata translation on October 23, 2006.



Fig. 5 Top: Working session at MIRC headquarters (October 2006, Tokyo); left to right: Allen Macklin, Toru Suzuki, Norio Baba and Bernard Megrey. Bottom: Group photo; left to right: Toru Suzuki, Norio Baba, Kimberly Bahl, Allen Macklin and Bernard Megrey.

Emerging standards

The standards upon which the clearinghouse functionality relies are in a state of change. The present NSDI Clearinghouse legacy search gateway will soon be replaced. This legacy gateway is built with proprietary software that is no longer maintained and supported by the vendor, Blue Angel Software. The legacy interface eventually will be replaced with GeoNetwork, a user-maintained, open-source solution with similar and enhanced capabilities compared to the legacy interface. The GeoNetwork gateway (a beta version of the new search gateway is in development) will be implemented in six months to a year. Both the legacy interface and the new GeoNetwork interface rely on the proven Z39.50 communication protocol.

The final change concerns the way metadata are described. The old method used FGDC standards. While proven and well known, this standard has difficulty with biological data. A new international metadata standard, ISO 19115, is emerging, which was built to be compatible with FGDC and to address the deficiencies in describing biological data. Translators that convert from FGDC to ISO 19115 should be easily available.

These and probably other changes will lead to modifications in PICES Metadata Clearinghouse interface standards and will require changes for existing and future clearinghouse servers.

Future work

A new PICES Technical Report “Federation of PICES member countries metadata” has recently been uploaded to the PICES web site in PDF format. This report provides up-to-date information on the emerging changes expected to take place in the clearinghouse interface, as well as specific technical guidance and instructions for anyone wishing to become a partner.

Future plans include the participation of PICES member countries not already federated (*i.e.*, Canada and China) into a PICES Metadata Federation. Such activity may be supported through future 2007 NSDI-CAP funding possibilities. At the 2006 TCODE meeting, a request for Phase III funding (\$4K) to bring China or Canada into the Federation (pending successful funding application elsewhere) was submitted.

With the move of the U.S. Metadata Clearinghouse interface from proprietary to open-source software, the potential exists for PICES to adopt the open-source standard, federate its metadata internally and sever its direct relationship with the U.S. Clearinghouse nodes. Related costs, consequences, benefits and recommendations were discussed at the recent TCODE meeting.

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Mr. Allen Macklin (allen.macklin@noaa.gov) also co-directs the North Pacific Ecosystem Metadatabase and co-chairs the Data Management and Communications Committee for the Alaska Ocean Observing System. Allen is a Meteorologist with the Pacific Marine Environmental Laboratory. He is Coordinator for Ecosystems & Fisheries-Oceanography Coordinated Investigations (EcoFOCI), a NOAA research program to sustain fishery resources in the Gulf of Alaska and Bering Sea while maintaining healthy ecosystems. Allen has 30 years’ experience studying Alaskan marine ecosystems and managing associated scientific information.

Dr. Toru Suzuki (suzuki@mirc.jha.jp) is General Manager of the Research Division at the Marine Information Research Center (MIRC), Japan Hydrographic Association. His scientific background is physical oceanography in coastal regions, and his current work includes integration of oceanographic data and information, and the development of quality-control procedures. Toru is a member of the PICES Section on Carbon and Climate and serves on the IMBER Data Management Committee.

Argo: A 2006 status report

By Howard Freeland

For the last several years, I have written a report at about this time of year on the current status of Argo and the prospects for the future. The report has, in the past, been circulated within Canada, but this year, I was asked to reproduce a version for PICES Press. This note accompanied the release of Argonautics-8, the 8th issue of the Argo newsletter (see <http://www.pac.dfo-mpo.gc.ca/sci/osap/projects/argo/documents/Argonautics08.pdf>).

Internationally, Argo is extremely successful. In 2001, when I was the annual tour lecturer for the Canadian Meteorological and Oceanographic Society (CMOS), Argo was just starting, but I advertised our short-term objective to have 3000 floats operating in the oceans of the world by some time in 2007. Well, 2007 is here, so we must be getting close, and **Figure 1** shows where the project is right now. I think the one message to take home from this diagram is that, perhaps we have not yet achieved the target of 3000 floats, but we have a global array of profiling floats. All floats are reporting in near real-time (with a few notable exceptions which we are endeavouring to fix), and the data from this array are available to anyone in the world who has a broadband internet connection.

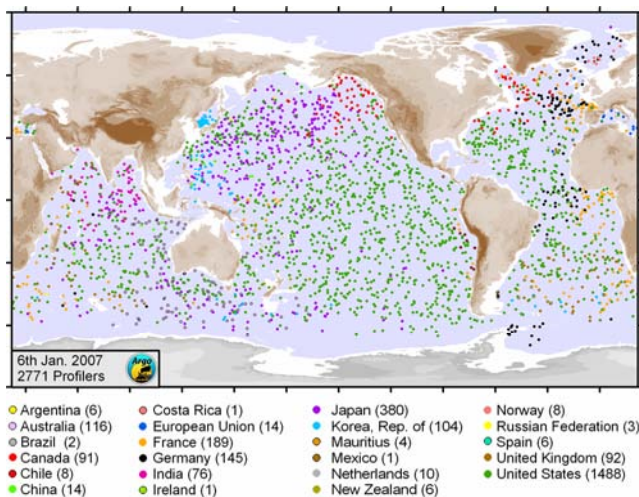


Fig. 1 A plot of the recent distribution of Argo floats, colour-coded by country that launched the float.

The Argo team aims to supply an array with even coverage everywhere. If we count the number of floats per unit area and divide it by the number there would be with a nearest-neighbour separation of 300 km, we get a density map as seen in **Figure 2**. The object then is to turn the whole map red, but we will never actually achieve this. Even in areas that are easy to reach, gaps will open up, but the large gaps now have mostly disappeared. We have a global array, and the problem now is one of maintenance until we have

demonstrated the value of the array for ocean climate prediction.

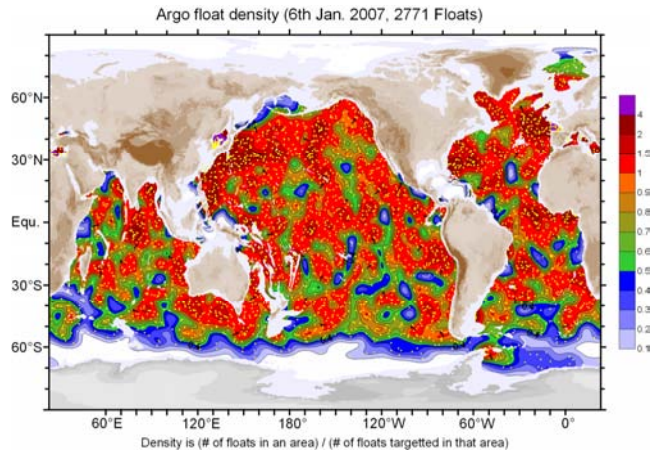


Fig. 2 A plot of the density of Argo floats (January 6, 2007, 2771 floats), normalized by the target density.

I would like to give a few examples to show how big Argo really is:

- Between 1990 and 1996, the countries of the world collaborated for a one-time survey of the climatic status of the global oceans, called World Ocean Circulation Experiment (WOCE). During that period 25 ship-years were used to gather about 20,000 CTD stations. Data were not released in real-time, rather they were protected so that the Principal Investigator had an inside-track on publications.
- In 2005, the global XBT surveys collected data from 30,000 stations. Generally, the data were made available in real-time, but these data are of limited value as the XBTs do not measure salinity, temperature is good to only $\pm 0.1^\circ\text{C}$, and pressure is not measured, rather, it is inferred from a fall-rate equation.
- In December 2006, Argo floats gathered 8715 profiles that is equivalent to almost 103,000 profiles *per year*. Argo has a lower accuracy than the WOCE datasets had with ± 0.002 in temperature or salinity, but the data are of systematically high quality, available in real-time without constraint and with a uniform quality control.

I am frequently asked when Argo will actually achieve the target we set back in 2001 of having 3000 floats operating at one time. I have tried fitting a simple population dynamic model to the array, and this suggests that we will have 3000 operating floats around the beginning of September 2007.

Not everything went right in 2006. During this last year, the Argo Program Director, John Gould, retired without replacement. This derives from a perennial problem that not enough countries are able to contribute funds to the Argo infrastructure. The IOC (Intergovernmental Oceanographic Commission) resolution XX-6 forces us to run an Argo Program Office with an Argo Technical Coordinator, and we (the Argo Steering Team) also feel a need to have an overall Program Director. At the moment, only five countries (Australia, Canada, France, UK and U.S.A.) contribute funds to the infrastructure, and so we were no longer able to pay the salary of the Program Director. If anyone has an innovative solution to this dilemma then please contact me, quickly.

Following a bad period in 2003, we have succeeded in improving the typical longevity of a float. There will always be floats that fail prematurely, but it should be possible for floats to complete 200 profiles with standard Argo profiling that would give a longevity of more than 5 years. Canada presently has two very old floats (known by their WMO IDs 4900073 and 4900074) that are still operating. They were launched 1 day apart in 2002, and if they continue to provide profiles, they will celebrate their 5th birthdays in February 2007. One of these (4900073) is near exhaustion and is behaving erratically, but the other (4900074) still has lots of power left in its batteries and appears likely to continue for a lot longer than 5 years. In the future, I anticipate that a large fraction of deployed floats will achieve this kind of longevity.

In March 2006, the second Argo Science workshop took place. Imagine the surprise as we were arriving in Venice for the workshop when a float was seen to emerge and deliver a profile of water properties in the Grand Canal (**Photo 1**)! This was an exciting meeting and was very well attended. However, Argo is just a global tool for the study of ocean climate, and I look forward to the day when Argo Science workshops no longer take place. Meteorologists do not have “Barometer workshops” and oceanographers do not have “CTD workshops”; these are just tools, and Argo is no more than that. It is a very new tool, and for now there is some value to the workshops still as scientists learn how to make optimal use of the data.

Currently, 80% of the floats have their data published within 24 hours of reporting. The data are subjected first to real-time quality control, and floats which have known problems are corrected in real-time. Canada now has 92 floats in the water. We are tracking 16 floats which report oxygen, and 7 floats with the capability of reporting a first profile within 24 hours after their launching. In November 2006, Anh Tran (Marine Environmental Data Services, MEDS) participated in the 7th Argo data management meeting. The meeting was very well attended. In the upcoming years, the data management group will streamline the quality control tests and will move forward in publishing Argo data in BUFR format.



Photo 1 A profiling float delivering a profile of water properties in the Grand Canal.

During the summer of 2006, Japan launched an Argo float close to the North Pole, and this can be seen just north of Spitsbergen on **Figure 1**. Since an Argo float cannot transmit data to a satellite through the Arctic sea ice, this is a modified system that has the float riding up and down a cable attached to a buoy that has been frozen into the ice. Also on the same map you will see a group of German floats in the Weddell Sea. These are designed to survive under ice and save profiles for later transmission, should they be unsuccessful in finding open water.

Denis Gilbert continued to assume his role with respect to oxygen data processing and quality checking on our now 16 Canadian Argo floats equipped with oxygen sensors. He interacted with Arne Koertzing (Germany) at the March 2006 Argo Science workshop. In late September 2006, he welcomed Taiyo Kobayashi (Japan) for a 2-day visit at the Institut Maurice-Lamontagne, to compare the Japanese and Canadian at-sea calibration checks of oxygen floats with Winkler titrations. In October 2006, Denis also attended an Oxygen Minimum Systems workshop in Concepción, Chile. Keynote lectures focused on the physical and biogeochemical processes responsible for the establishment and maintenance of oxygen minimum zones, and how various life forms are adapted to low oxygen conditions. While in Concepción, he also visited the Chilean Argo group (Osvaldo Ulloa, Oscar Pizarro, Victor Villagran) to share experience and exchange ideas with regards to quality control of oxygen data from Argo floats. Denis and Anh Tran have continued their joint work on oxygen data from the Canadian floats. For 2007, they plan to introduce delayed mode quality-controlled oxygen data. Finally, Denis is part of a team of people writing a white paper whose aim is to promote a more intense deployment of oxygen floats within the international Argo program. This white paper will be available for public comments in early 2007.

The use of Argo for climate forecasting and evaluating the changing state of the ocean is rapidly expanding. I recently participated in an Argo Capacity Building workshop at the University of Ghana (**Photo 2**). This was attended by about 40 scientists from countries along the Atlantic coast of Africa.



Photo 2 Attendees at the Argo Capacity Building workshop at the University of Ghana, in East Legon, a suburb of Accra (photo by Howard Freeland).

The workshop was very successful, and participants were convinced that the data are truly available free of charge for the benefit of everyone.

Argo is a new tool, and we are trying to learn how to use it. It does allow a real-time look at the behaviour of the ocean, and I am preparing real-time assessments of changing conditions in the Gulf of Alaska. Maps of ocean properties, mixed layer properties, evolving circulation maps, conditions in the biologically-active areas of the Gulf of Alaska, and some derived quantities are available on my website devoted to Argo (http://www.pac.dfo-mpo.gc.ca/sci/osap/projects/argo/Gak_e.htm). **Figure 3** shows, for illustrative purposes, the surface circulation pattern averaged over all of the year 2006. The website also includes indicators of the changing circulation field, for example, one plot shows that in December 2006, the surface flow in the North Pacific Current was the largest it has been since 2002. The computations that produce those maps can now be done anywhere at all from the Southern Ocean to the Gulf of Guinea or Spitsbergen.

In 2007, I expect we will see an increase in the number of float-supplying nations. I note that Kenya, in December 2006, has 5 floats awaiting deployment in the Indian Ocean. It is also likely that South Africa will deploy floats

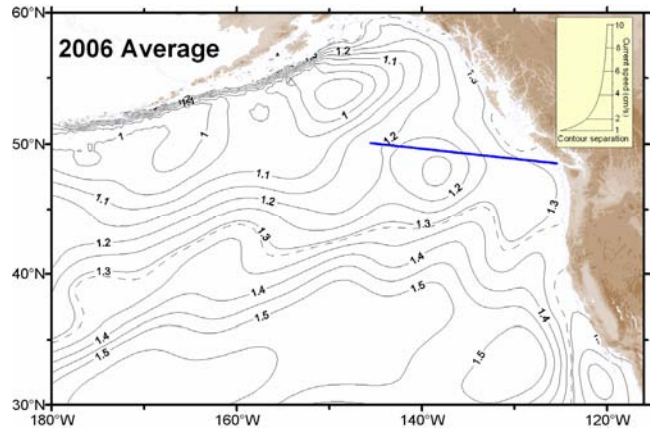


Fig. 3 The average surface circulation in the N.E. Pacific in 2006. The blue line shows Line-P and the dashed line shows the line separating water that ultimately flows north from that eventually heading south.

during 2007, and there are rumours that other nations may be joining the Argo club in 2007.

The technology in an Argo float is also likely to change in 2007. At long last, the manufacturers are ready to supply floats broadcasting on the Iridium global cell-phone system rather than the old Service Argos system. That will give Argo floats a large increase in flexibility. Webb Research may also be supplying floats with carbon-fibre hulls, instead of aluminium hulls. This change offers several advantages. First, the float will be lighter and so will be able to carry more batteries, thus increasing the potential lifetime of a float. Second, the hull will be slightly compressible, about 50% of the compressibility of water. This will allow the floats to make the vertical excursions between 2000 decibars and the surface with less power drain, again enhancing the potential float lifetimes.

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P.S. Download the Argo icosahedral net from <http://www.pac.dfo-mpo.gc.ca/sci/osap/projects/argo/images/icosa.jpg>, print it on a good colour printer, score it for easy folding, cut it out, fold it and stick it together (in that order) to make an unusual decoration.



Dr. Howard Freeland (FreelandHJ@pac.dfo-mpo.gc.ca) is a physical oceanographer conducting research on the circulation and dynamics of the N.E. Pacific and works for Fisheries and Oceans Canada at the Institute of Ocean Sciences. He was launching profiling floats before the Argo concept emerged. Since then Howard has been involved in every meeting of the International Argo Steering Team and Executive Committee and presently he co-chairs the International Argo Steering Team. Howard received his B.A. at the University of Essex (England) and his Ph.D. at Dalhousie University, in Halifax, Nova Scotia.

New Chairmen in PICES

Governing Council



Dr. Tokio Wada was elected Chairman of the Governing Council in October 2006, at PICES XV in Yokohama, Japan.

Dr. Wada was born in Maizuru, a small coastal town in the western Japan, in 1954. His father and uncles worked in the facilities of the coast guard and marine meteorological observatory, and sea and oceanography were familiar to him from his childhood. Entering Nagasaki University in 1973, he studied fisheries oceanography, marine ecology, and fisheries management. After graduating from university in 1977, he joined the Fisheries Agency of Japan and was assigned to the National Fisheries Research Institute in Kushiro, Hokkaido, as a junior scientist. In those days, the abundance of Japanese sardine was increasing, and a large fishing ground for sardine formed in the waters off Kushiro in every summer. Migration dynamics of the sardine and forecasts of the fishing ground formation were major subjects during his younger days, and became the themes of his doctoral thesis in 1986, supervised by Prof. Syoichi Tanaka, at the Ocean Research Institute of the University of Tokyo.

At the Hokkaido Institute, he also studied the mechanisms of biological production in the Oyashio region off Hokkaido with Dr. Makoto Kashiwai, the second Science Board Chairman of PICES and the recipient of the 2006 Wooster Award. This study expanded to include a comparative study of the ecological structure and trophodynamics of the Oyashio and La Perouse Bank regions, by collaborating with the late Dr. Daniel Ware of Canada, the first PICES Science Board Chairman and the recipient of the 2005 Wooster Award.

Dr. Wada began his career in PICES as a Japanese member of the Fisheries Science Committee (FIS) for the First Annual Meeting of the Organization in 1992, and he remained in this position until the Seventh Annual Meeting in 1998. While serving as a FIS member, he also participated in the Working Group on *Small pelagic fishes* (WG 3) and in the integrated PICES/GLOBEC program on Climate Change and Carrying Capacity of the North Pacific (CCCC Program).

In 1994, Dr. Wada moved to the National Institute of Fisheries Science in Yokohama, where he conducted studies on small pelagic fishes and their fisheries management from a nation-wide point of view. Thereafter he was transferred to the head office of the Fisheries Agency of Japan as a Research Coordinator in 1999. He returned to research briefly in 2002, but moved back to the Fisheries Agency as the Counselor for Research and Development in 2004. With those changes in his positions, his roles in PICES also changed from a player of scientific activities to a planner and/or coordinator of those. He has acted as an advisor for the Japanese delegates (1999–2003) and then as a Japanese National Delegate and Vice-Chairman of PICES (2004–2006). During this period, Dr. Wada emphasized the significance of coastal issues for the Organization because of increased concern for these issues in the member countries, and the importance of involving a wider spectrum of scientists in PICES activities.

His hobby, which most likely developed from the circumstances of his childhood, is to collect literature on ships and maritime history. The history of passenger liners and navigation companies in the first half of the 20th century and chronicles about vessels for scientific research and exploration are his favorite topics. Yokohama, which has been a major port of Japan and has many maritime heritages, is a good place for his hobby.

PICES has now become a well-known and respectable international organization, and its various activities, such as the CCCC Program and the North Pacific Ecosystem Status Report, have greatly contributed to the progress of North Pacific marine science. PICES has occupied a large part of Dr. Wada's career in the last 15 years. It is not too much to say that interchanges with many scientists through the various activities of the Organization have brought up his scientific ability. Therefore, he expects that PICES should not only be a center of marine science in the North Pacific, but also maintain its function as an international forum to foster the scientific experience and skills of young scientists.



Dr. Lev Bocharov was elected Vice-Chairman of the Governing Council in October 2006, at PICES XV in Yokohama, Japan.

Lev was born in 1950 in Crimea (USSR). After graduating from the Far Eastern State University in 1972, he worked at the Management Processes Department of this University. He completed his post-graduate study, supervised by Academician Yury Zolotov, and received his Ph.D. (in Mathematics) from the Far Eastern Branch of the USSR Academy of Sciences in 1978. In 1994, Lev defended his thesis on “The information technology of short-term field forecasting” and became a Doctor of Technical Science. In 1995, he was elected a Corresponding Member of the Russian Academy of Natural Sciences.

Dr. Bocharov is one of the founders and the leading expert of a new scientific direction of the complex analysis and forecasting of system pathology: “the environment – the marine biological objects”. Dr. Bocharov has already published more than 80 scientific papers and monographs covering a wide range of disciplines. His scientific

PICES/GLOBEC Climate Change and Carrying Capacity Program

Dr. Michio J. Kishi was appointed as Co-Chairman of the PICES Climate Change and Carrying Capacity (CCCC) Program in October 2006, at PICES XV in Yokohama, Japan. He has been active on the CCCC/MODEL Task Team since 1996, and served as its Co-Chairman from 1999 through 2002. Since 2001, he has also served as a Japanese representative on the Biological Oceanography Committee (BIO).

interests include the utilization of space and aircraft methods for oceanographic research, hydroacoustics, the development of information databases, marine system simulation and field forecasting for industrial fishery.

Dr. Bocharov has been associated with TINRO-Center for more than 25 years. He started as the Chief of the Mathematical Research Methods Laboratory in 1979, became the Deputy Director on scientific work in 1983, and has been the Director since 1997. Dr. Bocharov also serves as Chairman of the Board of Directors for the Association of Far Eastern Fisheries Scientific Organizations, and Vice-Chairman of the Far Eastern Scientific Production Council. For his achievements, Dr. Bocharov was honoured with the medal “300 Years of the Russian fleet” and “Russian Mark” from the National Fund.

Dr. Bocharov is keen to use his scientific authority and great management skills for the development of scientific cooperation in the North Pacific. He has been deeply involved in PICES since 1994, first representing Russia on the Working Group on *Data collection and quality control* (WG 4) and then on the Technical Committee on Data Exchange (TCODE). In June 1999, Dr. Bocharov was appointed the Head Russian National Delegate and became a member of Governing Council. TINRO-Center, led by Dr. Bocharov, hosted two very memorable PICES Annual Meetings in Vladivostok, PICES VIII in 1999 and PICES XIV in 2005.

Dr. Bocharov is well known as a subtle connoisseur of paintings and antiques. He owns one of the best private paintings and antique bronze collections in Vladivostok. Following the TINRO slogan “*A sound mind is a sound body*”, he is keen on sports, particularly basketball, and actively participates in friendly competitions between the TINRO-Center team and teams of domestic and foreign partners.

Lev enjoys the good fortune of true family happiness. His wife, Irina, is doing her best to protect him from routine problems of everyday life. They have a daughter, Ksenia, and look forward to every meeting with their beloved 3-year-old grandson, Gleb.

Kishi-san was born and raised in Tokyo, a son of a very famous businessman of Japan. Just after World War II, he spent his childhood without any economic difficulties. It was lucky for him that he had no need to earn money and could spend his time studying science! During junior high school and high school, he belonged to the Astronomy Club. Kishi-san received his B.Sc. in Electrical Engineering from Yokohama National University in 1983, his M.Sc. in Geophysics (physical oceanography) from the

University of Tokyo and his Ph.D. in Agriculture (fisheries oceanography), also from the University of Tokyo.

He worked for the Ocean Research Institute of the University of Tokyo from 1989 to 1997, where he was engaged in the study of fisheries oceanography for most of that time. Since September 1997, he has been a Professor in the Faculty of Fisheries Sciences of Hokkaido University. His many students are engaged in marine ecosystem modeling. His recent interest is to understand the structure and function of marine ecosystems and to predict their future states. He studies physical and biological processes in the ocean by using computer simulations of ocean circulation coupled to the dynamics of populations of various biota, ranging from phytoplankton to fish. Kishi-san has published many papers on ecosystem modelling, ranging in scale from coastal regions to the global scale. His role in leading the development and implementation of the ocean ecosystem model, NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography), is well-known among PICES scientists. He was the recipient of the 2005 Uda Prize from the Japanese Society of Fisheries Oceanography.

Kishi-san has also worked on the Council of the Oceanographic Society of Japan since 1995, has been an Officer of the Japanese Society of Fisheries Oceanography since 1994, and Vice-President of the International Society for Ecological Modelling from 1996 to 1998. He is a member of the editorial boards of *Ecological Modelling*, *Journal of Marine Systems* and *Journal of Plankton Research*.

Michio's hobby is still astronomy, especially watching the full solar eclipse. In Japan, people like Kishi-san are known as "eclipse addicts". He travels everywhere in the world to watch the eclipse, and he says, "To watch the full solar eclipse is a first priority for me (certainly much more important than attending PICES meetings!)".



Marine Environmental Quality Committee

Dr. Glen Jamieson was elected Chairman of the Marine Environmental Quality Committee (MEQ) in October 2006, at PICES XV in Yokohama, Japan. He was a member of WG 12 on *Crabs and shrimps*, and has represented Canada on the MEQ Committee since 2002. He co-chaired the Study Group on *Ecosystem-based management science and its application to the North Pacific* and is now Co-Chairman of WG 19 on *Ecosystem-based management science and its application to the North Pacific*.

Glen was born and raised in Montreal, Quebec, and was an undergraduate in Agriculture at McGill University (1963–1967) majoring in Entomology. His first exposure to marine science was as a technician of the Fisheries Research Board of Canada (now part of Fisheries and Oceans Canada) at a whaling station in Nova Scotia in 1966, where he collected biological data from harvested fin whales. This exposure led to his M.Sc. (1967–1970) on pinniped vision under Dr. Dean Fisher at the University of British Columbia (UBC). Recognizing that the ecological

sciences were developing rapidly, he undertook a Ph.D. also at UBC (1970–1973) in Ecological Modelling under Dr. Geoff Scudder, where he studied aquatic insects because of logistic considerations and for an opportunity to participate in UBC's Man and the Biosphere Marion Lake Study.

In 1974, Glen took a Killam Post-doctoral Fellowship at Dalhousie University to work on the population genetics of the American lobster. From 1975–1977, he was a consultant on a variety of marine issues (seaweed and mussel culture, nuclear power plant impacts) in the Maritimes, before joining Fisheries and Oceans Canada in 1977 to provide scientific advice on scallop stocks on Georges Bank, Bay of Fundy, Scotian Shelf and Northumberland Strait. In 1981, he moved to the Pacific Biological Station in Nanaimo (British Columbia), where he was Shellfish Section Head until 1993. During this time, he published on topics that included flying squid and tanner crab experimental fishing, mussel aquaculture, bivalve

zoogeography, larval crustacean dispersal, fishery-induced crab reproductive changes, and herring spawn-on-kelp harvesting. His focus, though, was the population dynamics and larval dispersal of crabs, particularly Dungeness crab. He chaired symposia on stock assessment and management of invertebrates in 1985 and 1995.

In 1994, he moved to the Conservation Biology Section, and since then, has focused his research on regional biogenic habitat, marine protected areas, identification of ecologically significant areas and species, invasive species, and initiatives to support the development of ecosystem approaches to integrated management.

He has published on community initiatives and challenges in balancing conservation with sustainable economic development. He is an avid gardener with the largest collection of tropical rhododendrons (vireyas) in Canada. Glen enjoys showing people the wonders of nature and increasing their awareness of the importance of sustaining a healthy natural environment. He actively encourages young people, in particular, to become involved and to study nature to the best of their abilities.



PICES Interns



PICES offers sincere thanks to **Mr. Pavel Vorobyov** (TINRO-Center, Vladivostok, Russia), the 2006 PICES intern, who completed his term at the Secretariat at the end of October 2006 at PICES XV, and has returned to Russia. We appreciate his dedicated efforts during this past year.

We are pleased to announce that **Mr. Xuewu Guo** from the Yellow Sea Fisheries Research Institute of the Chinese Academy of Fishery Sciences (Qingdao, People's Republic of China) will join the Secretariat in early February as the 2007 PICES Intern. You will have an opportunity to meet him this year at the ICES/PICES Conference for Early Career Scientists on "*New frontiers in marine science*" in Baltimore (U.S.A.), at the PICES Sixteenth Annual Meeting in Victoria (Canada), or at the PICES Secretariat office.

NEW PICES REPORT SERIES

In 2007, PICES started a new Technical Report Series to be published only electronically. The first report in this series entitled "*Metadata Federation of PICES Member Countries*" (Editors: Bernard A. Megrey, S. Allen Macklin, Kimberly Bahl and P. Daniel Klawitter) will be posted on the PICES website by mid-February. The main part of the report includes a detailed description of specific technical instructions and guidance for anyone wishing to join the Federation.

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