

PICES Press



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



The 2007 inter-sessional Science Board and Governing Council meeting: A note from the Chairman

At the invitation of the Japanese Delegate, Dr. Hideki Nakano, the 5th inter-sessional joint meeting of the PICES Science Board and Governing Council was convened on April 19, 2007, at the "Work-pia Yokohama" in Yokohama, Japan. This was followed by a short meeting of the Governing Council in the morning of April 20. These events were preceded on April 16–18 by a workshop to develop a Future Integrative Science Program (FISP) of PICES. While the practice of holding inter-sessional meetings began only in 2003 in Victoria, Canada, it has now become an essential opportunity for mid-term reviews of scientific activities and in-depth discussions on administrative issues of the Organization.

The first order of business for the joint meeting was a systematic update on the activities of the various scientific bodies of PICES. The Chairmen of the Committees and the CCCC Program presented reports of their Action Plans, status of inter-sessional workshops and the progress of their publications, all of which were approved at previous Annual Meetings. The primary issue for this meeting, however, was the revision of the *North Pacific Ecosystem Status Report*. The first report was published in 2004, based largely on the scientific achievements of the CCCC Program. The report enhanced the reputation of PICES as an international scientific organization, not only in the academic community but also among policymakers in the Contracting Parties. Nevertheless, the ecosystems of the

North Pacific have continued to change, so periodic revisions of the report are highly expected.

The Governing Council established a Study Group on *Ecosystem Status Reporting* (SG-ESR) at PICES XV in Yokohama to develop options of principles and procedures and budgets for the next version. At the inter-sessional meeting, SG-ESR presented four options ranging from incremental improvements to fully integrated comparative ecosystem assessments. At PICES XVI in Victoria, the Governing Council will establish a strategic plan to revise the report, taking into consideration the amount of resources that the Organization can afford, as well as the high expectations from the Contracting Parties for an updated version.

The remainder of the joint meeting was devoted to reviewing upcoming PICES-sponsored activities and arrangements for PICES XVI in Victoria. A new PICES award for organizations or groups that have been steadily conducting ocean monitoring and data management in the North Pacific was also discussed. The proposal was supported by the Science Board and Governing Council, and the award was named the PICES Ocean Monitoring Service Award. The Science Board will develop the criteria and procedures for selection, with the first recipient(s) to be named in 2008, at PICES XVII in Dalian, People's Republic of China.



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|----|--|----|---|
| 1 | The 2007 inter-sessional Science Board and Governing Council meeting: A note from the Chairman | 21 | PICES Calendar |
| 3 | Getting to the "FUTURE" | 22 | The state of the western North Pacific in the second half of 2006 |
| 5 | The 4 th International Zooplankton Production Symposium: A review | 24 | The Bering Sea: Current status and recent event |
| 11 | Conference for Early Career Scientists: An unqualified success | 26 | Recent trends in the subarctic NE Pacific: Cooling of 2006 continues into 2007 |
| 14 | ESSAS meets in Hakodate, Japan | 28 | Mexican fisheries sciences and marine ecosystem modeling in La Paz, Mexico |
| 18 | Fifth International Conference on "Marine Bioinvasions" and a joint meeting of ICES, IOC, IMO and PICES working groups on invasive species | 30 | Two major prizes awarded to PICES/NEMURO family of ecosystem modelers |
| 19 | The CREAMS/PICES Advisory Panel meets in Qingdao, China | 32 | Strolling through end-to-end bioenergetic ecosystems: On-line comparison of NEMURO.FISH and APECOSM equations |
| 20 | Report of the CFAME workshop to develop a work plan for CCCC synthesis | | |



Science Board and Governing Council representatives. Front row from left: Kyoung-Jin Kim, Hideki Nakano, Gongke Tan, Laura Richards, Ig-Chan Pang, Tokio Wada, Vera Alexander, Samuel Pooley, Lev Bocharov, Skip McKinnell; back row from left: Sinjae Yoo, Oleg Katugin, Glen Jamieson, Michael Dagg, Harold Batchelder, John Stein, Michael Foreman, Kuh Kim, Gordon Kruse, Michio Kishi, Sei-Ichi Saitoh, Alexander Bychkov, Anna Karulina, Igor Shevchenko, Yuji Uozumi.

The main order of business for the Governing Council meeting was scientific cooperation between PICES and non-member countries. This issue was first discussed at PICES XIV in Vladivostok, and subsequently a Study Group on *Scientific Cooperation* (SG-SC) was established at PICES XV in Yokohama, under the chairmanship of Dr. Laura Richards. Its purpose was to identify options and propose mechanisms for cooperation with other countries at the 5th inter-sessional meeting. The Study Group was entirely negative to the idea of amending the Convention of the Organization to expand the “area concerned”. However, SG-SC recognized the scientific necessity and advantages of cooperating with non-member countries, and recommended that PICES introduce an affiliate member system. This type of arrangement was implemented some time ago in ICES to allow non-member countries to participate in its activities. After intensive discussions, the Governing Council accepted the conclusions of the Study Group, but felt that further discussion was needed before introducing the affiliate member system. SG-SC was asked to examine how such a system would influence the current structure and management of the Organization. The final report of SG-SC will be presented at PICES XVI, and we expect that an appropriate decision will be made for expanding the scientific cooperation.

Another important issue for consideration at the Governing Council meeting was a report by Dr. John Stein, Chairman-elect of the Science Board, on the outcome of the FISP Workshop, held immediately prior to the inter-sessional meeting. For SG-FISP to develop an actual science program, a Writing Team composed of experts of various scientific areas, from ocean climatology to ecosystem management, was established after PICES XV. The Team met for the first time in February 2007, in Seattle, and then in April 2007, in Yokohama, with a larger contingent of participants, and much progress was made during these meetings. The overarching scientific questions about the North Pacific Ocean were grouped initially according to

whether they dealt with “status”, “mechanisms”, and “consequences”. The participants also identified and discussed several key scientific questions under each overarching question. Work will continue in order to finalize a draft Science Plan at PICES XVI.

Unfortunately, the weather during the FISP workshop and the joint meeting was not good for enjoying the Japanese spring time because it was rainy and windy every day. However, the spirits of all participants were lifted by an invitation to a welcome party in the evening of April 16, hosted by Japan, and Japanese traditional foods and drinks were enjoyed by all.

With growing evidence of global warming, the conservation and sustainable use of ecosystems and bio-resources in the North Pacific has become an urgent issue for the Contacting Parties. There is a great expectation that PICES will provide scientific advice on these issues appropriately and promptly. The development and implementation of a new integrative science program and revision of the *North Pacific Ecosystem Status Report* are the top priorities of the Organization to meet these expectations. PICES will continue to develop its scientific abilities to gather knowledge and to provide advice. This is the reason why we are addressing cooperation with a broader range of scientific entities, including non-member countries, and involving early career scientists in the PICES activities, as well as reinforcing the functions of the Secretariat.



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Getting to the “FUTURE”

by John E. Stein

The PICES Study Group on *Future Integrative Scientific Program(s)* (SG-FISP) has established a work plan to develop a new science program that will replace the PICES-GLOBEC Climate Change and Carrying Capacity (CCCC) Program. The Writing Team of SG-FISP was formed following PICES XV, and held its first 2-day meeting on February 16–17, 2007, in Seattle (U.S.A.), followed by a 3-day FISP workshop from April 16–18, 2007, in Yokohama (Japan), in conjunction with a 5th inter-sessional joint meeting of the PICES Science Board and Governing Council.

The first step to develop the key questions that will be the foundation of the new science program named FUTURE (**F**orecasting and **U**nderstanding, **T**rends, **U**ncertainty and **R**esponses of **E**cosystems) was taken in Seattle. All participants presented their views on the major topics of concern, along with accompanying key questions that might be considered for FUTURE. An approach to classifying and evaluating the proposed questions was established, guided by principles shown in the box below. Once the list was complete, each member of the Writing Team was assigned a key question and asked to write a short description about the motivation for the question, and the benefits that might arise to PICES member countries by answering the question. This provided additional details to assist in prioritizing the candidate questions and to develop adequate justification for including the questions in the Science Plan. The principles helped us to identify important relevant questions without generating a long list.

PRINCIPLES

The new PICES science program should:

- be SCIENCE-focussed;
- be POLICY RELEVANT, but not tied to detailed management questions, and be broader than just resource management;
- build on the BEST of PICES’ past 10 years;
- INTEGRATE expertise across disciplines and countries;
- be NEW – not more of the same with a different name;
- be SPECIFIC enough that we do not say “Do everything”;
- focus on the things PICES has a high and unique capacity to add value to;
- focus on a FEW things we can do well and that unify us, not every question that is individually worth studying.

The motivations for, and the benefits of, answering the key questions in the draft Science Plan were written in a style that was intended to inform the decision makers in PICES member countries, who are expected to support the science

program, about the need for the work. This was a key step in preparing for the April workshop because it provided the FISP workshop attendees with important background information for making the next move to refine and focus on a set of questions that will be the basis of the science in FUTURE.



Oleg Katugin (Russia), Sinjae Yoo (Korea) and Hiroaki Saito (Japan) at the FISP Writing Team meeting in Seattle, February 2007.

The workshop was successful, in part because of the participation by Science Board and several members of Governing Council. We reached consensus on a set of key questions, developed an overall outline for the Science Plan, and identified the next steps to complete a full draft of the plan. Like all workshops where the objectives are not easily achieved (such as developing a 10-year international science plan), we took a step backward before taking two steps forward. In our case, the approach to classifying the questions that was developed in Seattle (grouping of overarching scientific questions according to whether they deal with “status”, “mechanisms”, and “consequences”) was not up to the task, and a new approach was needed.

In Yokohama, members of the Writing Team gave brief presentations on the motivation for, and expected benefits of, answering a question. This provided the opportunity for a group discussion of the question and an initial reaction of its importance and relative priority. Breakout groups then took the list of candidate questions, grouped them into common themes, and then identified a few overarching questions/issues that captured the general themes of the more specific questions. By dividing the participants into breakout groups and assigning each group the same task, it was possible to determine if there was consensus on the overarching questions for FUTURE.

There was a great deal of commonality in the overarching questions developed by the four breakout groups. As a result, the consolidation of a first draft was much easier.



FISP workshop in session, Yokohama, Japan, April 2007.

One overarching question captured a desire to add elements of forecasting changes in North Pacific ecosystems that might arise as a consequence of natural and anthropogenic forcing. We also developed three key questions to address the related issues of: physics/chemistry, ecology/biology at ecosystem scales, and the effects of humans at the intersections of land, the coast and the open ocean:

Given the current and expected forcings, what will be the future conditions in the North Pacific?

1. What are the mechanisms linking the important physical and chemical processes (and parameters) and ecosystem responses in the North Pacific Ocean?
 - a. In light of global climate change and other anthropogenic forces, how will these linkages change over seasonal–annual and decadal timescales and what will be the consequences?
 - b. To what extent can we forecast these changes, and with what level of accuracy?
2. How does ecosystem structure and function determine an ecosystem’s response to natural and anthropogenic forcing?
3. How do human activities impact coastal marine ecosystems and their interactions with offshore and terrestrial systems?

A subset of the Writing Team (those not on cruises or otherwise engaged) met in late June 2007, again in Seattle, to begin developing a full draft of the Science Plan. We hope to distribute the draft to SG-FISP for review in July, with comments returned by the end of August. By mid-September, the full draft will be sent to Science Board and Governing Council and will be made available on-line to the general scientific community for review and comments. On November 1, we intend to hold an Open Forum at this year’s PICES Annual Meeting in Victoria, where we can have a discussion with all of PICES on the draft Science Plan. Suggestions that can substantively improve the plan will be welcomed and will be reviewed at another FISP workshop to be convened on November 3.



Workshop participants enjoying a brew at the end of the day.

Are we getting to FUTURE? I think we are making very good progress. I was recently in La Paz, Mexico, at the first biannual meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society (AFS) to give a plenary lecture on PICES. In this presentation, I took the opportunity to discuss our progress in developing FUTURE and received many positive comments on its objectives and overall theme. Following the meeting in Mexico, I also gave a talk at the meeting of the North Pacific International Chapter of AFS, a local chapter of AFS for Washington and British Columbia, Canada. At this meeting the tenets of FUTURE were also warmly received. The positive reception at both meetings confirms for me that PICES is on the right track for its next integrative science program. In closing, I must acknowledge to the Study Group that we appreciate your efforts and look forward to your continued involvement when the draft plan is made available for review to all our ‘PICEans’—to quote a past PICES Science Board Chairman, Dr. Ian Perry.



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The 4th International Zooplankton Production Symposium: A review

by Michael Dagg, Roger Harris, Shin-ichi Uye and Luis Valdés

Zooplankton play a key role in the pelagic food web by controlling phytoplankton production and shaping pelagic ecosystems. In addition, because of their critical role as a food source for larval and juvenile fish, the dynamics of zooplankton populations have a significant influence on recruitment to fish stocks.

In 1961, ICES convened the 1st Zooplankton Production Symposium in Charlottenlund, Denmark. ICES also had a lead role in the 2nd Zooplankton Production Symposium on “*Zooplankton Production: Measurement and role in global ecosystem dynamics and biogeochemical cycles*”, held in Plymouth, UK, in 1994. The increasing importance of international programmes such as GLOBEC and the general concerns about global change and the changing role of zooplankton in ocean ecosystems were reflected in the development of this Symposium.



Organizers of the 2nd Zooplankton Production Symposium, Plymouth (UK), 1994. From left: Hein-Rune Skjoldal (Norway), Thomas Kiørboe (Denmark), Roger Harris (UK), David Griffiths (President, ICES) and Michael Reeve (U.S.A.).

This trend was further enhanced in the 3rd Zooplankton Production Symposium on “*The role of zooplankton in global ecosystem dynamics: Comparative studies from the world oceans*”, which was held in Gijón, Spain, in 2003. It was here that the Symposium was co-sponsored by ICES, PICES and GLOBEC for the first time. The Gijón Symposium attracted 333 participants from 38 countries from around the world.

The 4th International Zooplankton Production Symposium was held in Hiroshima, Japan, from May 28–June 1, 2007. This Symposium was the first of the series to be held outside Europe, and its focus was on “*Human and climate forcing of zooplankton populations*”.

At the 1st Zooplankton Symposium only four themes were represented: “*Methods at sea, Methods in the laboratory, Food and trophic relations, and Distribution*”. By the Plymouth meeting the number and variety of topics had increased to “*Biomass and production measurements (New sampling and analysis techniques, Production and grazing methodology), Regional interactions of physics and population dynamics (Quantitative aspects of life history patterns, Population dynamics models and production), Food chain control (Grazing, flux and microzooplankton, Predation and gelatinous zooplankton), Spatial/temporal variability and prediction (Time-series and their significance, Large-scale physical/biological coupled models), and GLOBEC International*”. This trend was further developed in Gijón with sessions on “*Physical variability and zooplankton population dynamics, Role of zooplankton in biogeochemical cycles, Climate influences: What are long-term zooplankton data sets telling us? New approaches to zooplankton modelling, Progress in molecular biology, and Application of new technologies*”. The 3rd Symposium also saw a number of associated workshops on “*Comparative life histories and life cycles of zooplankton populations within and between North Pacific and North Atlantic, Microzooplankton in the marine pelagial: Recent advances from molecules to ecosystems, Gelatinous zooplankton and fish: Predators, prey or nuisance, Meso- and bathy-pelagic zooplankton: Current status and future aspects, and Climate variability, zooplankton abundance and distribution: Comparative opportunities from the world’s oceans*”.

The trend of the previous three Zooplankton Symposia was also towards an increasing number of participants and an ever expanding number of countries represented. The Hiroshima Symposium was certainly a notable landmark in this progression. Similarly, as noted above, new scientific themes have developed over the years, indicating the evolution of the field of zooplankton research. It has already been mentioned that the 1961 Symposium had only four session themes. In the subsequent Symposia, new emphasis on physical–biological interactions, climate change effects, time-series, molecular biology and modeling, as well as greater emphasis on zooplankton groups, such as microzooplankton and gelatinous zooplankton, are obvious evidence that our field continues to develop and innovate.



Dr. Toshimasa Asahara, President of Hiroshima University, welcomes participants to Hiroshima and the Symposium.



Dr. Victoria Fabry giving one of the three keynote lectures on the first official day of the Symposium.



A full attendance at the plenary sessions.



A very attentive and enthusiastic audience (here represented by Dr. Mike Landry) active in a session discussion period.

International co-sponsors of the Hiroshima Symposium included: the North Pacific Marine Science Organization (PICES), the International Council for the Exploration of the Sea (ICES) and the Global Ocean Ecosystem Dynamics Program (GLOBEC). Local sponsors were the Japanese Society of Fisheries Oceanography, the Plankton Society of Japan and Hiroshima University. Dr. Shin-ichi Uye, the Chairman of the Local Organizing Committee, was very active in raising financial support for the meeting from many generous Japanese sources. In addition, SCOR (Scientific Committee on Oceanic Research) provided travel support to scientists from countries with “economies in transition”.

PICES member countries recognize the importance of bringing marine scientists together to provide better understanding and predictive capability for the world’s oceanic ecosystems. International meetings such as this symposium contribute greatly to these broad goals. This symposium not only provided a better knowledge of zooplankton production processes but also contributed to a deeper understanding of all marine ecosystems. Zooplanktologists from all PICES member countries and countries around the world met to address issues important to marine science and to society in this time of rapid and serious climate change. For this week-long symposium, 334 participants from 46 countries contributed 141 oral and 250 poster presentations. These demographics clearly indicate the international nature of zooplankton research.

On Monday (May 28), the day prior to the meeting, there were three full-day workshops:

- W1 – “*Temporal and regional responses of zooplankton to global warming: Phenology and poleward displacement*”, convener: Anthony J. Richardson (Australia) representing Wulf Greve (Germany) who was unable to attend;
- W2 – “*Zooplankton research in Asian countries: Current status and future prospects*”, convenors: Sun Song (P.R. China), Sanae Chiba (Japan) and Young-Shil Kang (Republic of Korea);
- W3 – “*Krill research: current status and its future*”, convenors: So Kawaguchi (Australia) and William T. Peterson (U.S.A.).

On Tuesday (May 29), the Symposium was officially opened with welcome addresses from the President of Hiroshima University, Dr. Toshimasa Asahara, and the Chairman of the Local Organizing Committee, Shin-ichi Uye. This was followed by brief presentations from symposium convenors representing ICES (Luis Valdés), PICES (Michael Dagg) and GLOBEC (Roger Harris).

The morning plenary session provided three excellent presentations on different aspects of the symposium theme:

- *Impacts of ocean acidification on marine zooplankton: Knowns and unknowns* by Victoria J. Fabry;

- *In hot water: Zooplankton communities now and in the future* by Anthony J. Richardson; and
- *The role of microzooplankton in a changing ocean* by Albert Calbet.

Parallel oral sessions followed in the afternoon and throughout the duration of the meeting. These were:

- S1 – “*Global comparisons of zooplankton time series*”, convenors: David L. Mackas (Canada) and Luis Valdés (Spain);
- S2 – “*Importance of zooplankton in biogeochemical cycles*”, convenors: Hiroaki Saito (Japan) and Deborah K. Steinberg (U.S.A.);
- S3 – “*The role of zooplankton in foodwebs: Changes related to impacts of climate variability and human perturbation*”, convenors: Hans G. Dam (U.S.A.) and Mike A. St. John (Germany);
- S4 – “*Mortality impacts on the ontogeny and productivity of zooplankton*”, convenors: Mark Ohman (U.S.A.), Serge Poulet (France) and Anthony Verschoor (The Netherlands);
- S5 – “*Zooplankton functional groups in ecosystems*”, convenors: Sanae Chiba (Japan) and Sun Song (P.R. China);
- S6 – “*Microbial loop vs classical short food chains: Implications for appraisal of foodweb efficiency and productivity*”, convenor: Ulf Bamstedt (Sweden);
- S7 – “*Environmental and other constraints on zooplankton behaviour, life histories and demography*”, convenors: Charles B. Miller (U.S.A.) and Atsushi Tsuda (Japan);
- S8 – “*Zooplankton biochemistry and physiology: Practical and potential biotechnology applications*”, convenors: Ann Bucklin (U.S.A.), Adrianna Ianora (Italy) and Kurt Tande (Norway);
- S9 – “*Advances in image technologies and the application of image analysis to count and identify plankton*”, convenors: Cabell Davis (U.S.A.) and Xabier Irigoien (Spain);
- S10 – “*Analysis and synthesis: Modelling zooplankton in aquatic ecosystems*”, convenors: Daniel Grunbaum (U.S.A.) and Michio Kishi (Japan).

The large number of symposium participants required extensive time for poster viewing, so on both Tuesday (May 29) and Wednesday (May 30) there were official poster sessions of 2 hours each. Refreshments and snacks, combined with the many interesting posters, made these sessions a forum for terrific scientific discussions.

With such a range of topics and such a large number of contributions, it is difficult to single out highlights of the Symposium. The standard throughout was very high and the level of interest and participation was great. Perhaps, looking to the future, the focus on topics, such as the characterization of zooplankton with novel approaches like bar-coding and image analysis, the increased emphasis on time-series analysis and large data sets, the range and

activity of modeling approaches, emerging functional group concepts and concerted international efforts on particular groups or species (such as krill and *Calanus*), will come to be recognized as particular achievements of the Hiroshima Symposium.



Numerous posters await to be displayed at the Poster Session.



A labyrinth of colourful and informative posters and interested viewers.



Participants hanging around the Registration Area during a coffee break.

Remarks by Teruaki Yoshida

I would like to thank Prof. Uye and the Symposium organizers for giving me the opportunity to speak in front of so many distinguished zooplanktologists.

I am currently a Ph.D. student at University Kebangsaan Malaysia. Today, I am happy to have the opportunity to stand here in the presence of my mentor, Prof. Othman Haji Ross. Going back a few years, I met Prof. Othman for the first time at Soka University in Tokyo, where I was doing my Master degree under the guidance of Prof. Toda, my other mentor. Both of them have a record of active collaborative research projects between Japan and Malaysia. Their collaborative efforts have borne fruit to 12 publications over the years, and there are more on the way. At that time, I had always wanted to go abroad to do a Ph.D., and I was happy when Prof. Othman kindly offered to take me under his wing. I have been working on zooplankton in Malaysia ever since.

As a participant from Malaysia, I had many fruitful discussions with scientists from all around the world, but I am especially happy to be able to meet participants from Asian countries as we exchanged opinions and formed mutual friendships as zooplanktologists from the same region. I found out that many of these countries faced similar challenges such as a lack of funding, expertise and facilities. Thus, I believe that it is important to form close networks with scientists for open exchanges and collaborative partnerships for major advances in the understanding of zooplankton.

40 years ago in Japan, nobody thought of studying plankton. Today, Japan has become a leading country in

zooplankton research. Malaysia would like to aim for that. Although zooplankton studies are still at an early stage in Malaysia, I am taking this experience back and sharing it with fellow researchers and the next generation of students. I hope more Asian researchers will be able to participate in the next zooplankton symposium. Until we meet again.

Thank you very much.



One emphasis of the Symposium was the encouragement and recognition of young scientists. To highlight the importance of this issue, travel support for more than 40 early career scientists was provided from the Symposium budget or directly by PICES and ICES. Many young scientists from Asian countries were also able to participate thanks to the special support arranged by Shin-ichi Uye. Recognition for the two best posters by young scientists was provided by the Symposium during the closing ceremony. The two best posters were:

- Yuichiro Nishibe (Japan) and T. Ikeda, “*Metabolism and elemental composition of four oncaeid copepods in the western subarctic Pacific*”;
- Jörn O. Schmidt (Germany), J. Renz and J. Dutz, “*Vertical distribution and diel vertical migration of main copepod species in the Bornholm Basin (Baltic Sea)*”.

On Thursday (May 31) afternoon, everyone took a break from the formal sessions and participated in a Symposium excursion to Miyajima Island, the location of the majestic Itsukushima Shrine, first built in 593, then rebuilt in 1168

on the same scale as seen today. The shrine was designated as a UNESCO World Heritage site in 1996. The evening’s banquet dinner of fine Japanese foods brought the day to a close.

The closing ceremony was held after the sessions on Friday (June 1). Ceremonies began with a short speech by Teruaki Yoshida, a Japanese student presently pursuing his Ph.D. in Malaysia (see the insert on this page). If he is representative of the future, then we will have no worries about zooplankton research in the coming years. Poster awards, described above, were presented by Luis Valdés. Recipients received some nice prizes including encouragement, in the form of a waived registration fee, to attend the meeting on “*Effects of climate change on the world’s oceans*” to be held in Gijón, in May 2008.

Closing scientific remarks were provided by Roger Harris, who gave a brief summary of the history of zooplankton research as represented by the three previous Symposia, and then pointed to the future, reflecting on some of the key themes of the Hiroshima Symposium. He concluded



Dr. Luis Valdés presenting the Best Poster Award to the winners, Yuichiro Nishibe (left) and Jörn O. Schmidt (right), at the Closing Ceremony.

by projecting ahead to the next Zooplankton Symposium and anticipating significant advances in topics, such as automated/semi-automated characterization of zooplankton spatial and temporal distribution on a global scale, coupling food-web models from phytoplankton to fish, coupling between physical and biological models, and assessments and prediction of climate change on marine resources and marine ecosystems. He observed that society was starting to demand a predictive capability regarding marine ecosystems, and that this would be a major challenge for the community. With developing new technologies, carefully posed new questions and hypotheses, and with new people entering the field, future progress will be assured. The quality of presentations and the enthusiastic participation by early career stage scientists had been outstanding and he concluded that their contribution to the Hiroshima Symposium provided real confidence for the future. Shin-ichi Uye then officially closed the Symposium.

Two special publications will result from this Symposium. Manuscripts based on papers and posters presented at the symposium will be considered for publication in a special issue of the *ICES Journal of Marine Science*. Publication is planned for the late summer of 2008, and approximately 35 to 40 papers are anticipated. All registered participants of the Symposium will receive a copy of the special issue following publication. There will also be a special issue of *Deep Sea Research II* on krill biology and ecology. This volume will be derived from papers and posters presented in the krill workshop (W3) and relevant papers and posters presented in the other sessions of the Symposium.



Participants are given a chance to explore the culture of Japan during an excursion to the famous Itsukushima Shrine on nearby Miyajima Island.



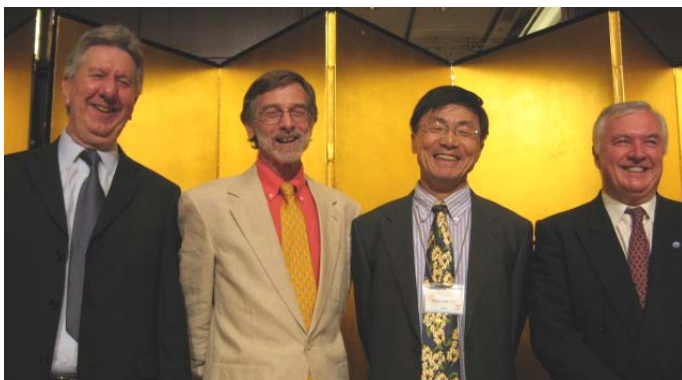
Participants are treated to an exquisite banquet after the pleasant outdoor excursion.

The PICES staff (Alexander Bychkov, Skip McKinnell, Christina Chiu and Julia Yazvenko) contributed greatly to the smooth running of the Symposium by their activity before and during the meeting. Additional assistance was provided by Dawn Ashby and Lotty Ireland from the GLOBEC office. Many Japanese students were of excellent assistance in running the registration desk and the audio-visual equipment used in all the sessions and workshops.

In summary, PICES, GLOBEC and ICES were privileged and pleased to have served as co-sponsors of the highly successful 4th International Zooplankton Production Symposium.



History in the making... Alexander Bychkov and Shin-ichi Uye asking Rubén Escribano, "Will the 5th Zooplankton Production Symposium be in Chile ...???"



The symposium convenors, Drs. Roger Harris, Michael Dagg, Shin-ichi Uye and Luis Valdés, express their feelings for the outcome of the Symposium by body language.

Dr. Roger Harris (r.harris@pml.ac.uk) is a Senior Scientist at the Plymouth Marine Laboratory (UK). His main research interests are: the control of biological production by physical processes, the role of water column biology in global oceanic carbon flux and the ecology and physiology of calanoid copepods. Roger has considerable experience in international and interdisciplinary project management. He is the past Chairman of the IGBP/SCOR/IOC GLOBEC Scientific Steering Committee (SSC) and continues to serve on the GLOBEC SSC and leads the Focus 2 Process Studies Working Group. He is also the past Chairman of the ICES Working Group on Zooplankton Ecology and remains active in the Working Group. He is currently a member of the EUR-OCEANS Network of Excellence Executive Committee. He is involved in a number of editorial roles, principally as Strategic Editor of the Journal of Plankton Research.

Dr. Michael Dagg (mdagg@lumcon.edu) is a Professor at the Louisiana Universities Marine Consortium (U.S.A.). He divides his research efforts between studies of river plume–ocean interaction in the northern Gulf of Mexico and zooplankton feeding processes in the North Pacific Ocean. He has worked extensively with North Pacific copepods over the past 25 years. Mike received his undergraduate and graduate degrees in Canada and his Ph.D. from the University of Washington (U.S.A.). He is currently serving as the Chairman of the Biological Oceanography Committee of PICES, and is a member of the Science Advisory Panel of the North Pacific Research Board, U.S.A.

*Dr. Shin-ichi Uye (suye@hiroshima-u.ac.jp) is the Executive Vice-president of Hiroshima University (Japan), as well as a Professor of Biological Oceanography of the Graduate School of Biosphere Science at the same university. He was motivated to study zooplankton production ecology during a year's (1974–75) stay as a visiting student at the Scripps Institution of Oceanography. He had determined the specific growth rates (somata and eggs) of major copepod species, and has used them to estimate the production rates of the natural copepod populations in various Japanese coastal waters. His scientific interest has now shifted to megazooplankton, including the giant jellyfish (*Nemopilema nomurai*), which has been continuously blooming in the East Asian Marginal Seas since 2002. He is currently wearing two hats, one as a researcher investigating the causes for the recent jellyfish population explosions and their impact and another as a university administrator. He is also the President of the World Association of Copepodologists.*

Dr. Luis Valdés (luis.valdes@gi.ieo.es) is the Director of the Centro Oceanográfico de Gijón - Instituto Español de Oceanografía (CO Gijón-IEO), Spain. He has more than 25 years' experience in marine research and field studies related to zooplankton time series and climate change. In 1988, he started the Radiales project which has grown from one standard transect off Coruña to the present network of 20 fixed stations along the north and northwest coast of Spain. In 1998–2001, Luis was the coordinator of the IEO programme on Time Series and Ocean Observing Systems. He maintains an intense activity in the international arena serving as the Spanish Delegate to IOC-UNESCO and to ICES, where he is the current Chairman of the Oceanographic Committee. He has convened several international symposia and was also the local organizer of the 3rd International Zooplankton Production Symposium held in Gijón in 2003.

Conference for Early Career Scientists: An unqualified success

by Franz Mueter

Jointly sponsored by ICES and PICES, with generous support from NOAA/Fisheries and the North Pacific Research Board, the “*New Frontiers in Marine Science*” Conference for Early Career Scientists was held from June 26–29, 2007, near Baltimore, Maryland, U.S.A. Its objective was to encourage new scientists to share knowledge and to begin to build networks across disciplines and international borders. The University of Maryland Center for Environmental Science (UMCES) was host to nearly 100 early career scientists from 20 nations.

The conference featured six theme sessions, each with a keynote speaker, for a total of 65 oral and 33 poster presentations. Two workshops on “*Effective Science Communication*” and “*Integrated Environmental Assessment*” were led by staff from the UMCES Integration and Application Network. A mini-symposium on “*International and Interdisciplinary Collaboration*” included invitees from seven international oceanographic programs and organizations (SCOR, ICES, PICES, EUR-OCEANS, GLOBEC, IMBER, and EAST-1).

Presentations spanned all of the marine science disciplines in their consideration of ecosystem topics ranging from estuaries to the deep ocean, and from bacteria and phytoplankton to whales and humans. The six “New Frontiers” included (keynote speakers are shown in brackets):

- Biodiversity and productivity of marine organisms from pole to pole (Hyung Chul Shin);
- Processes at ocean margins (John H. Simpson);
- The last frontier: Processes in the deep sea (S. Kim Juniper);
- The role of behavior in marine biological processes (Mark Baumgartner);
- The effect of climate on basin-scale processes and ecosystems (Emanuele Di Lorenzo); and

- Humans and the marine environment (Philippe Cury).

Session descriptions and abstracts can be found at <http://www.pices.int/newfrontiers.aspx>.

Reflecting the conference’s international character, theme sessions were introduced by six keynote speakers from six nations, with a mixture of senior scientists and accomplished early career scientists. Speakers not only shared their perspectives and research relating to the topic at hand, but also peppered their presentations with practical advice for early career development based on personal experience, common sense, or a lifetime of mentoring. Useful bits of advice included: “Do (and publish) good work”, “Do it now (rather than waiting for more data, more analyses, improved models, *etc.*)”, “Take risks and be innovative”, and “Develop (and stick to) a well thought-out, long-term research plan”. While the latter is sound advice for any young scientist, personal anecdotes from participants in the mini-symposium suggested that the path to success is often circuitous and may be marked by a focused pursuit of research goals as well as chance events and opportunities that can lead to entirely new and unforeseen pursuits. One of the major “lessons” may thus be summed up as: *Define your goals and stay focused, but be prepared for the unexpected!*

Considering the diverse background of the participants and judging by the lively discussions in each session, as well as during breaks, at meal time, and in the pub, the next generation of marine scientists seems well positioned to achieve a strong integration of marine research across disciplines and across national boundaries. Although there was much new knowledge to be gained from many excellent presentations, the contacts and friendships that developed over the course of four packed days are likely the most immediate and long-lasting benefit for most participants.



Conference organizers, invited guests, and a new generation of marine scientists assembled for one last smile before heading into the future.



BALTIMORE 2007



Although the challenges facing early career scientists, not least the need to procure research funds, are undeniable, a sense of optimism and enthusiasm prevailed. Several speakers highlighted the progress achieved over the last several decades through integrated research programs. These accomplishments not only led to a greatly improved understanding of key ecosystem processes, but also to better integration and diversification of the marine research community itself. For example, several senior researchers noted a gender balance among the participants (~40% women) that did not exist in their early careers.



Participants engaged at the workshop on “Effective Science Communication”.



Scientific Steering Committee: Franz Mueter, Sukyung Kang, Julie Keister, Elizabeth North, Angel Lopez-Urrutia. Jens Floeter, who is missing from this photo, was unable to attend the conference.

Both the participants and organizers agreed that the conference was a resounding success! Together, we accomplished our goals and more. Contacts that will undoubtedly persist for decades were developed and the seeds of new personal and institutional networks were planted. The conference represents a small but significant step towards solving the many challenges faced by our blue planet and by those who will study it in the 21st century.

Acknowledgements: The Scientific Steering Committee thanks Drs. Skip M^cKinnell (PICES) and Adi Kellermann (ICES) for their efforts to bring this conference into existence. Without their guidance and dedication, it would not have been possible. Thanks also to Julia Yazvenko and all of the PICES and ICES staff members whose hard work behind the scenes to create web pages, maintain databases, and make financial arrangements was essential. Many thanks to Ms. Alexandra K. Curtis at the U.S. Department of State for helping participants with visa applications. Last, but certainly not least, we thank the multi-talented Jane Hawkey of UMCES/IAN for coordinating local logistics and designing the abstract book and the conference logo.



Dr. Franz Mueter (fmueter@alaska.net) is “relatively” early in his career, having received an M.S. in Biostatistics (1998) and a Ph.D. in Fisheries Oceanography (1999) from the University of Alaska Fairbanks (UAF). He works as a fisheries and statistical consultant in Fairbanks and lectures occasionally at UAF. His research is focused on applied problems in the emerging field of ‘ecosystem oceanography’, in particular the effect of oceanographic variability on fish populations, and the effects of fishing and other human activities on marine ecosystems.

ESSAS meets in Hakodate, Japan

by George L. Hunt, Jr., Egil Sakshaug, James E. Overland, and Bernard A. Megrey

Professor Yasunori Sakurai hosted the Second Annual Meeting of the GLOBEC regional program, *Ecosystem Studies of Sub-Arctic Seas* (ESSAS), from June 4–9, 2007, in Hakodate, Japan. The welcoming address by the Vice-Mayor of Hakodate, Mr. Toshiki Kudoh, was followed by opening remarks from Profs. Sakurai and George L. Hunt who introduced the co-convenors of a 2-day (June 4–5) workshop on “*The role of seasonal sea ice cover in marine ecosystems*”: Egil Sakshaug (Norway), Sei-ichi Saitoh (Japan) and John Bengtson (U.S.A.). A total of 67 people attended the workshop, including a number of graduate students from the Hokkaido University Graduate School of Fisheries Sciences.

The first day was dedicated to 15 invited talks by scientists from France, Japan, Korea, Norway and U.S.A., on sea ice,

physical oceanography, and ice-biota in sub-arctic seas. There was one overview by Louis Legendre, 3 talks on “monitoring and methodological progress”, 5 talks on “physical characteristics”, 4 talks on “phytoplankton, zooplankton”, one talk on “fish”, and 3 talks on “marine mammals and seabirds”. An important benefit of the workshop was the opportunity to learn about recent results from Japanese research in the Bering Sea and the Sea of Okhotsk.

A common denominator for the workshop was to clarify the underlying mechanisms that regulate fluctuations in productivity and biomass at different trophic levels, especially the role of changes in seasonal sea ice cover brought about by climate fluctuations. Furthermore, the workshop participants discussed the possibility of writing



Participants at the ESSAS Second Annual Meeting in Hakodate, Japan, June 4–9, 2007.

review papers for refereed journals, with the expressed goal of distilling new knowledge by synthesizing existing information from different seas. To this end, during the second day, the participants divided into two groups to discuss the possibility of writing two papers that will focus on “Hotspots” and “Thresholds of change”, respectively. Both groups emphasized the need to identify mechanisms to improve the models that are needed to assess the impact of climate change in the Arctic.

The **Hotspots** group suggested a paper tentatively titled “*Mechanisms of hotspot generation in subarctic seas – relationships with sea ice*”, with hotspots defined as areas of high productivity and/or biomass. The rationale was that hotspots are spatially and numerically limited and therefore tractable for observation, modeling, and hypothesis testing. Moreover, hotspots are important to food webs in SAS ecosystems overall, playing roles in the resilience of fisheries and the success of species at higher trophic levels. Among the hotspots under debate were Hudson Strait, the Kurile Islands, Unimak Pass, Shiretoko and the NOW Polynya, which offer examples of more or less different underlying mechanisms for high productivity and biomass. Also considered were “hotbands” (greenbelts), such as those along the western shelf break of the Barents Sea north to Fram Strait, across the Bering Sea, the Sea of Okhotsk and the Greenland slope/shelf, and moving fronts associated with the retreating ice edge, where the ice-edge bloom follows the retreating ice.

The **Thresholds for change** group suggested a paper tentatively titled “*Non-linear biological responses to sea ice [climate] change in Sub-Arctic seas*”, to focus on how non-linear biological responses in sea ice ecosystems may be triggered by climate change when certain thresholds are exceeded. Moreover, the group suggested initiation of a threshold information database for the Sub-Arctic seas. The topic of thresholds is important because there is a high probability of exceeding critically important biological thresholds in Sub-Arctic marine ecosystems during the next 50 years. The paper will define what the thresholds are and will discuss how statistical and dynamical climate models can be applied to estimate the probabilities of future changes in the thresholds. Thresholds can be evident by a failure or switch in annual production, or in altered population status through several years (*i.e.*, regime shift). Non-linear thresholds are evident, for example, in the relationship between sea ice and black guillemot nesting, certain species of fish and *Calanus* species, and the requirements of seals and polar bears for sea ice cover. A crucial question is how statistical and dynamic climate models can be applied to estimate the probabilities of future changes in thresholds.

On June 6, the ESSAS Working Group 1 on *Regional Climate Prediction* (WGRCP) held a 1-day workshop to provide quantitative estimates of the magnitude and

uncertainty of future climate change, and the frequency distribution of the large natural variability known to influence marginal seas in the ESSAS region of interest. A major resource for the development of these future climate scenarios is the recent output from 22 state-of-the-art coupled atmosphere–ocean climate models which are part of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4). The workshop provided background material on the IPCC AR4 process and results, investigated the state of the art in high resolution physical models of the ESSAS seas, and charted a path forward for WGRCP during the next 2 years.

During the workshop, Vladimir Kattsov, John Walsh, Tore Furevik (*in absentia*) and James Overland reported on the AR4. The process involved 450 lead authors, 130 countries, and represented 6 years of work. The physics was first published in February 2007, while direct results from the 22 climate models have been available for review over the last 2 years. A major AR4 conclusion is that most of the observed increase in global average temperature since the mid-20th century is very likely due to observed increase in anthropogenic greenhouse gas concentrations contributed by humans. Observed changes in high latitude regions over the last 45 years are shown in **Figure 1**.

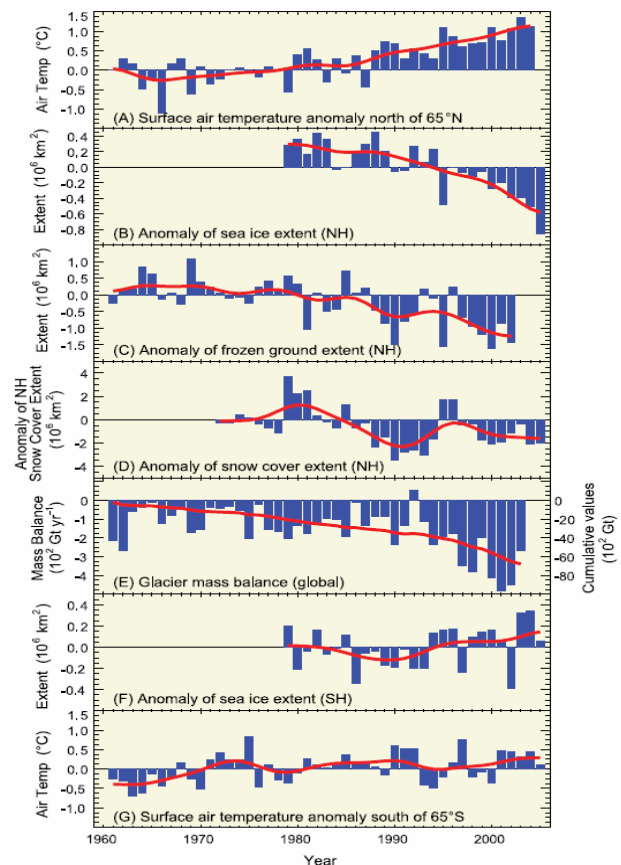


Fig. 1 IPCC summary of recent variations in polar temperatures and cryospheric variables. Note change of more than 1°C in temperature and 20% in ice loss in the North, but no systematic changes in the South.

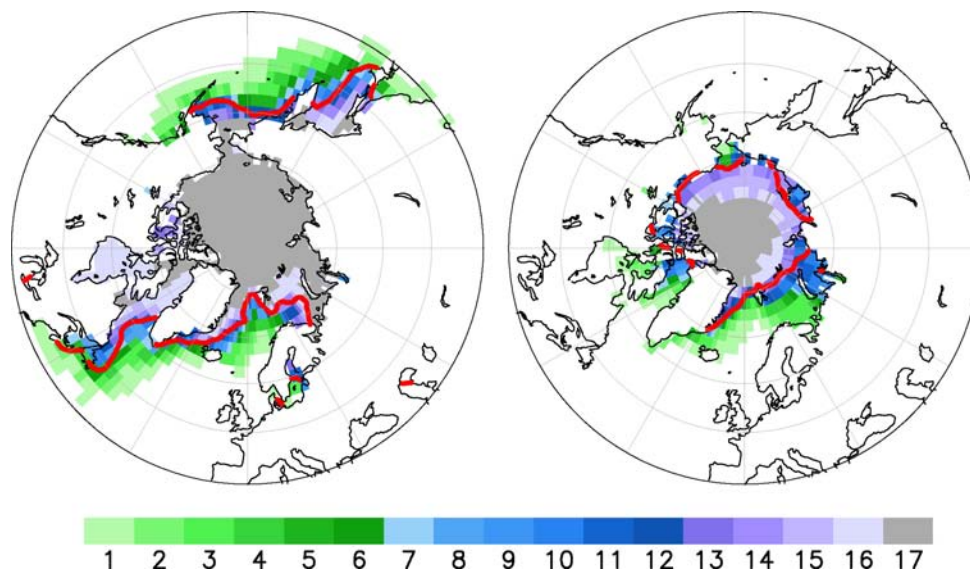


Fig. 2 Sea ice in 17 IPCC AR4 models compared to recent data (red line) for March (left) and September (right). The colors indicate how many models have ice this far south. Note that about 5 of the models have too much ice in the Pacific and the western Atlantic in winter. The Barents Sea has a large percentage of models that have too much ice in both seasons.

The AR4 forecast models appear to be much improved from the Third Assessment Report of 6 years ago in terms of spatial resolution, better ice parameterization and ocean physics. Because of a lag effect, climate projections to 2050 depend more on known CO₂ concentration increases than differences in economic or conservation scenarios. Thus, the largest uncertainties in future climate projections are from model-to-model differences. Models that are run several times with slightly different starting conditions (termed ensembles) seem to capture some of the natural variability in climate when the models are compared to 20th century data. **Figure 2** shows that the models vary in terms of how much ice they produce relative to recent observations.

The first conclusion from the workshop was that, while there are still problems with the details of some of the variables, there is utility for ESSAS in the temperature, sea ice, and perhaps ocean stratification projections from a subset of the IPCC AR4 models. This conclusion was based on model improvements compared to previous IPCC reports, comparisons with data, the large community involvement in AR4, and the modeling of key processes, such as greenhouse warming and ice–albedo feedback.

The second conclusion was that there are a number of outliers among the group of models compared to 20th century data, and that a carefully crafted set of rules for the selection of appropriate models would be helpful to constrain the uncertainty in future climate projections. There were several approaches suggested to address this issue, such as the use of a single indicator versus multivariate statistical fitting, and seeking region-specific output versus inter-regional consistency in output. Exploration of these rules and their statistical rigor is a challenge for WGRCP for the next year.

Paul Budgetell, Hisashi Nakamura and Junlin Zhang discussed high resolution modeling of the Barents Sea/North Atlantic, waters near Japan, and the Bering Sea, respectively. The Barents Sea ROMS (**R**egional **O**cean **M**odel **S**ystem) model is nested down to a 4-km resolution. Hindcasts of ice variability are handled well by the model, given good meteorological forcing. The difficulty with downscaling the IPCC results to the Barents Sea model is associated with the selection rules mentioned above. Most IPCC models over-predict the extent of cold temperatures. Models of Japanese waters predict an intensification of the Kuroshio with global warming; realistic simulations require an eddy resolving model (0.1° × 0.1°). The Bering Sea model has a multi-category sea ice thickness, tides, and a POP (**P**arallel **O**cean **P**rogram) ocean model. It is able to describe some of the basic features of sea ice advance and retreat, ocean circulation, and SST. These regional models are areas of ongoing research. The third conclusion of the workshop was that further refinement of these models should be encouraged to couple (downscale) these models to the range of variability shown by the IPCC models.

Muyin Wang, George Hunt and Kenneth Drinkwater (*in absentia*) discussed the climatology of the ESSAS regions and how the physics may be coupled to the biology. In the example of cod (*Gadus morhua*) in the Atlantic, climate shifts at the extreme southern and northern ranges show the most biological sensitivity. Thus, identifying particular climate thresholds for different species may be a more relevant approach than requiring overall high accuracy from the models. It was pointed out that it is important for the modeling group to learn from the biologists where, when, what variable(s) and why (species and impact) potential ecosystem stress points may occur.



ESSAS Science Steering Committee linking research activities in the Sub-Arctic seas.

The priorities for WGRCP are to: 1) pursue and evaluate a range of IPCC AR4 model selection rules for ESSAS regions; 2) work with other ESSAS Working Groups on matching potential biological impacts from climate change to the limits of credible projections from IPCC; and 3) explore the general area of downscaling, particularly in the context of high resolution ocean models. Strong collaboration with the PICES Working Group 20 on *Evaluations of Climate Change Projections* is anticipated.

ESSAS Working Group 3 on *Modeling Ecosystem Response* (WGMER) convened a ½-day workshop on June 7, led by Bernard Megrey, Sei-Ichi Ito and Kenneth Rose, to develop a strategy for WG 3. They reviewed recent efforts to model marine ecosystems and to compare ecosystems using models of ecosystem function. One presentation concerned the status of the MENU (Marine Ecosystems of Norway and the US) program, one focused on collaborative opportunities with ESSAS Working Groups 1 and 2, one discussed a JGOFS model comparison experiment, and the final presentation reviewed some NEMURO applications, comparison of models from the NEMURO family of models, and the EUROCEANS “model shopping” web page (http://www.eur-oceans.eu/WP3.1/shopping_tool/index.php?mode=fromEuroceans). The remainder of the plenary covered topics such as the draft terms of reference, preparing a proposal to create an IOC/SCOR Working Group on *High Latitude Ecosystems*, membership suggestions, and developing an Action Plan.

The final 1½ days were devoted to the ESSAS Science Steering Committee meeting to evaluate activities to date and to formulate plans for the future. Of immediate interest to the PICES community is the plan to have the next ESSAS Annual Meeting from September 15–19, 2008, in Halifax, Nova Scotia, Canada. The main purpose for this meeting is to revisit progress on the threshold and hotspot syntheses papers, and to focus on the roles of advection in Sub-Arctic seas. Since advective processes

are important in all of the Sub-Arctic seas and in a number of additional PICES regions as well, it is hoped that PICES members will join ESSAS in Halifax.

The Hakodate experience was enlivened by a fine reception and by a visit to a hot springs spa followed by a traditional Japanese dinner. On Saturday, Professor Sakurai guided a lucky group to a fishermen’s festival in a small fishing port where we were invited to sample numerous seafood delicacies barbecued along the wharves of the village. Professor Sakurai then took us to visit a hot springs spa near Oonuma Lake National Park and, after a refreshing soak, we walked some of the many footpaths around the lake.



*Traditional Japanese dinner after bathing in the hot springs of Hakodate.
Photo by Muyin Wang.*

The meeting participants greatly appreciated the generous hospitality of Japanese colleagues at the Hokkaido University Graduate School of Fisheries Sciences. Support for the meeting was provided by the GLOBEC IPO, the city of Hakodate, the North Pacific Research Board, the NOAA Alaska Fisheries Science Center, and PICES. The ESSAS SSC is grateful for this vital support of our scientific activities.

Fifth International Conference on “*Marine Bioinvasions*” and a joint meeting of ICES, IOC, IMO and PICES working groups on invasive species

by Graham Gillespie

The 5th International Conference on “*Marine Bioinvasions*” was held May 21–24, 2007, at the Massachusetts Institute of Technology (MIT) in Cambridge, Massachusetts, U.S.A., with more than 180 participants from 22 countries. The event was co-sponsored by the International Council for the Exploration of the Sea (ICES), the North Pacific Marine Science Organization (PICES), the U.S. National Sea Grant Program and MIT Sea Grant College Program, with additional support from NOAA. The purpose of the conference was to examine marine bioinvasion vectors, patterns, distribution, ecological and evolutionary consequences, economic impacts, biosecurity approaches, and natural and invasion impacts on biodiversity.

Each day of the conference opened with an excellent plenary talk. Dr. Jeb Byers, University of New Hampshire, spoke on “upstream” dispersal of invasive species in advective environments. Dr. Janice Lawrence, University of New Brunswick, greatly expanded the awareness of the role of viruses in plankton dynamics. Dr. James Carlton, Williams College, gave an eloquent and entertaining presentation on the challenges associated with assessing the impacts of marine bioinvasions on ecological diversity, and thus the evolution, structure and functioning of natural communities. There were 22 topic sessions that ranged in subject matter from *Patterns in Time and Space*, *Impacts (Ecological, Economic, Risk Assessment, Strategies and Management Options)*, to *Shipping (Biofouling and Ballast Water)*, and *Phenotypic Responses, Molecular Tools and Information Management*.

While there were many papers documenting progress on invasive species issues, *e.g.*, models to identify potential invasive species, predict species dispersal and describe the

possible range of introduced species, it was clear that there is yet much work to be done. In particular, general understanding and quantification of ecological and economic impacts need further development, as does the use of risk assessment principles to determine species with high potential to invade, to prioritize and direct research, and to identify high-risk vectors to management agencies.

The conference was followed by a joint meeting of the ICES Working Group on *Introductions and Transfers of Marine Organisms* (WGITMO), the ICES/IOC/IMO Working Group on *Ballast and Other Shipping Vectors* (WGBOSV), and PICES Working Group 21 on *Non-indigenous Aquatic Species*. It was convened by the Chairmen of the respective groups: Judith Pederson (MIT Sea Grant College Program, U.S.A., WGITMO), Anders Jelmert (IMR, Norway, WGBOSV), Darlene Smith (DFO, Canada, WG 21) and Vasily Radashevsky (Russian Academy of Sciences, WG 21). The participants briefly reviewed mandates and functions of each working group, then moved on to discuss issues of joint interest and how we might work together in the future.

Potential activities were discussed for the new PICES project on “*Development of the prevention systems for harmful organisms’ expansion in the Pacific Rim*”, funded by the Government of Japan. A general lack of taxonomic expertise was cited as a limiting factor in exchange of information between the member nations of both ICES and PICES. Discussion focussed on a database that would bring together taxonomic information and a registry of taxonomic experts from PICES member countries, similar to DAISIE (**D**elivering **A**lien **I**nvasive **S**pecies **I**nventories for **E**urope).



Participants of a joint meeting of ICES, IOC (Intergovernmental Oceanographic Commission), IMO (International Maritime Organization), and PICES working groups on invasive species.

(continued on page 31)

The CREAMS/PICES Advisory Panel meets in Qingdao, China

by Yasunori Sakurai

The Advisory Panel for a CREAMS/PICES Program in East Asian marginal seas (CREAMS-AP) was established in 2005, and met twice during 2006. The first meeting was convened on April 11–12, in Seoul, Korea, hosted by the Seoul National University. The second meeting was held on October 15 at PICES XV in Yokohama, Japan. Recommendations from these meetings were:

- R1 To support continuation and development of existing national observational programs and, when possible, their coordination, including exchange information on cruise schedules, and data, samples, personnel and equipment sharing;
- R2 To continue Russian–Korean observations along the repeated north–south sections in the Japan/East Sea (JES), and to start (beginning 2007) Korean–Japanese observations along the repeated west–east sections in the southern part of JES; more ecological parameters should be added to the observational programs;
- R3 To implement a comprehensive international basin-scale survey of JES and adjacent areas in summer 2009; the survey should include hydrographic, chemical and biological observations, sampling for trace elements (as a part of the Asian GEOTRACERS program), and observations carried out under regional national programs;
- R4 To develop a CREAMS/PICES Capacity Building Program that will provide on-site training through international research at educational laboratories, training camps, inter-calibration centers, *etc.*, and to organize summer and winter schools for students and young researchers;
- R5 To collaborate with NEAR-GOOS on the development of an observing system, expansion of observational parameters and data sources (*e.g.*, more satellite data), and improvement of international data exchange in the region;
- R6 To strongly support PICES activities related to the development of the GOOS component for the North Pacific;
- R7 To provide frequent updates on progress of the CREAMS/PICES Program via the PICES website, and to publish in 2006 brief information on the program in a special issue of *Oceanography* (by TOS).

The third CREAMS-AP meeting was held on May 18, 2007, in Qingdao, China, hosted by the First Institute of Oceanography of the State Oceanic Administration (SOA). Six members of the Advisory Panel, representing China, Japan, Korea and Russia, and three observers, were in attendance. National reports on activities and plans related to the CREAMS/PICES Program were presented, followed by discussion focused on the implementation of the above recommendations. The following is a brief summary of the outcomes from the meeting.

- The participants agreed on the need to carry out the cooperative physical–biological coupled study related to the recruitment process of pelagic fish and squid in the East China Sea, Yellow Sea, Bohai Sea and JES under the CREAMS/PICES Program. [R1]
- A joint Russian–Korean survey along 132°E will be organized by the Pacific Oceanological Institute and Seoul National University from May 4–22, 2007, aboard the R/V *Professor Gagarinsky*. [R2]
- Three joint Japanese–Korean cruises with sampling for trace elements (as a part of the Asian GEOTRACERS program), aboard the R/Vs *Hakuho Maru*, *Tansei Maru* and *Nagasaki Maru*, will cover the major part of JES and the East China Sea in 2008/2009. [R1–R3]
- A joint Chinese–Korean study of the water circulation dynamics and its effects on the marine environment of the Yellow Sea will be proposed to advance our knowledge on this Large Marine Ecosystem and to further cooperative research between the two countries. [R1]
- The first PICES summer school on “*Ocean circulation and ecosystem modeling*” (co-sponsored by the Seoul National University, the Korean Ocean and Research Development Institute, the Korean Ministry of Maritime Affairs and Fisheries, the National Fisheries Research and Development Institute, and the Brain Korea 21 (BK 21) Program of the Korean Ministry of Education and Human Resources) was held in August 2006, in Busan, Korea, in conjunction with the CREAMS/PICES workshop on “*Model-data inter-comparison for the Japan/East Sea*”. Following this very successful endeavor, Japan will organize a second PICES summer school on “*Ecosystem-based management and ecosystem approach*” to be held in late August or early September 2008, at Hokkaido University, in Hakodate. Potential sponsors include: the Hokkaido University Sustainable Government Project, the Japanese Society for Promotion of Science and the Asia Pacific Network. [R4]
- In order to get financial support for the CREAMS/PICES international research and the CREAMS/PICES Capacity Building Program, a joint Japanese–Korean–Chinese project entitled “*Marine ecosystem response related to climate change in East Asian marginal seas*” will be proposed under the A3 Foresight Program (August 2007–July 2010) to the Japanese Society for the Promotion of Science, the Korean Science and Engineering Foundation and the National Science Foundation of China. [R1–R4]

The next CREAMS-AP meeting will be held in October 2007 at PICES XVI in Victoria, Canada. The 2008 inter-sessional meeting is planned for spring, in Vladivostok, Russia.

Report of the CFAME workshop to develop a work plan for CCCC synthesis

by Kerim Aydin

A workshop entitled “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*” was held by the PICES CFAME (Climate Forcing and Marine Ecosystem Response) Task Team on May 21–23, 2007, in Seattle, U.S.A. In attendance were 10 scientists from Canada, Japan, the Republic of Korea, and the United States (**Photo 1**). The CFAME Task Team was formed with the objective of synthesizing regional and basin-wide studies of the PICES–GLOBEC Climate Change and Carrying Capacity (CCCC) interdisciplinary program.

The goal of the workshop was to finalize working hypotheses of mechanisms linking climate to key species and ecosystem processes in three major marine ecosystems: the California Current, the Yellow/East China Sea, and the Oyashio/Kuroshio Current regions, and to link climate variability to changes in ecosystem productivity, structure, and function. This finalized set of hypotheses will form the basis for collaboration with the PICES Physical Oceanography Committee (POC) to extract necessary climate variables from modeled scenarios for future climate reported by the Intergovernmental Panel on Climate Change (IPCC). The first stage of this collaboration will occur at the POC/CCCC workshop on “*Climate scenarios for ecosystem modeling*” to be convened on October 26–27, 2007, at PICES XVI in Victoria, Canada.

The workshop began with review presentations on each of the selected ecosystems given by Akihiko Yatsu (Oyashio/Kuroshio), Seok Hyun Youn (Yellow/East China Sea), and

Jacquelynn King (California Current). Following the review, a method of comparison was designed which involved selecting a subset of **controlling climate variables**, and ranking the importance of these drivers for each ecosystem (**Table 1**).

To refine these general controlling factors into specific information requests from IPCC models from which to forecast local conditions, a subset of dominant species was chosen for each ecosystem, and an interaction matrix was created for each species in each ecosystem. These interaction matrices link the climate variables in Table 1 to the following five life history traits for each selected species: range, recruitment (spawning success and juvenile survival), spawning behavior, feeding and growth, and adult survival. This linking was performed for one example species in each ecosystem, with the tables for all species to be completed by CFAME members and colleagues between the inter-sessional workshop and the workshop at PICES XVI.

After the development of these tables as a method for comparing species and ecosystem processes, the workshop participants discussed the overall challenge of predicting the future of marine environments undergoing long-term climate change. In particular, while the relative predictive units of concern to society were considered to be “fish stocks and the assemblage of stocks in an ecosystem”, it was important to stress that absolute productivity (*e.g.*, “carrying capacity”) of marine species would be difficult or impossible to forecast given our current knowledge.



Photo 1 Participants of the 2007 CFAME inter-sessional workshop; left to right, back row: William Crawford (Canada), Gordon (Sandy) McFarlane (Canada), James Overland (U.S.A.), Seok Hyun Youn (Korea), Brenda Norcross (U.S.A.), George Hunt (U.S.A.); front row: Jacquelynn King (Canada), Kerim Aydin (CFAME Co-Chairman, U.S.A.), Christopher Harvey (U.S.A.) and Akihiko Yatsu (CFAME Co-Chairman, Japan).

Table 1 Preliminary ranking of relative importance of climate drivers in three selected ecosystems, with ranking ranges from 0 (unimportant) to 3 (highly important).

Climate variable	Oyashio/Kuroshio	Yellow/East China Sea	Californina Current
Stratification	3	1	3
Temperature	3	3	3
River discharge	0	3	1
Currents	3	2	3
Current-carried nutrients/outside production	1 (from Sea of Okhotsk)	1	3 (Subarctic Current)
Air input (dust)	2	3	0
Eddies/meanders	3	0	3
Winds – turbulence	3	2	3
Winds – upwelling	3 coastal, otherwise 0	0	3
Winds – deep mixing	0	0	0
Tidal mixing	0	3	3 near Juan de Fuca Strait, otherwise 0

To this end, a focus on comparative processes was recommended. For example, rather than predicting absolute recruitment or biomass, it was suggested that the mechanism tables be used for predicting shifts in overall ecosystem structure, especially with regard to the control of production. Under what climate scenarios could an ecosystem shift from “bottom-up” to “top-down” production, and how would such a shift impact the overall

structure of the ecosystems? Types of possible shifts were drawn from the history of CCCC research, particularly from past symposia/sessions on recruitment and ecosystem control. The summarizing of predicted changes in controlling mechanisms in an ecosystem context, as forecast from IPCC scenarios, was thought to represent an excellent final synthesis of CCCC/CFAME activities as they might lead to future integrated programs within PICES.



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.

PICES Calendar

- 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.
- 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.
- PICES Sixteenth Annual Meeting, October 26–November 4, 2007, Victoria, Canada.
- 1st CLIOTOP Symposium on “*Climate impacts on oceanic top predators*” (co-sponsored by GLOBEC, IMBER, SCOR, PICES, EUR-OCEANS, NOAA, IRD, CLS, PFRP, CIBNOR, CICIMAR), December 3–7, 2007, La Paz, Mexico.
- 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.
- International Symposium on “*Coping with global change in marine social–ecological systems*” (co-sponsored by GLOBEC, EUR-OCEANS, FAO, IRD, PICES, SCOR, IMBER), July 8–11, 2008, Rome, Italy.
- PICES Seventeenth Annual Meeting, October 23–November 2, 2008, Dalian, China.

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

by Shiro Ishizaki

Sea surface temperature

Figure 1 shows the monthly mean sea surface temperature (SST) anomalies in the western North Pacific from July to December 2006, computed with respect to JMA's (Japan Meteorological Agency) 1971–2000 climatology. Monthly mean SSTs are calculated from JMA's MGDSST (Merged satellite and *in-situ* data Global Daily SST), which is based on NOAA/AVHRR data, 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.

SSTs were generally above normal in the seas adjacent to Japan from August to December, except east of Honshu in October (**Figs. 1** and **2**). Positive SST anomalies exceeding +2°C prevailed west of Hokkaido from August to December. These anomalies correspond to positive anomalies for Region 1 in **Figure 2**. Positive SST anomalies exceeding +1°C were also found in the East China Sea from August to December. These anomalies are confirmed in **Figure 2** (Regions 5 and 8). In July, negative SST anomalies existed in a broad area except south of Honshu. Around the Philippines, negative SST anomalies

dominated from July to October. After that, positive SST anomalies appeared from November to December.

Kuroshio path

Figure 3 shows time series of the location of the Kuroshio path for this period. The Kuroshio took a small meandering path at the south end of Kyushu Island (30°N, 132°E) in July, October and December. East of 133°E, several small perturbations propagated eastward along the Kuroshio during the whole period. Corresponding to the passage of each perturbation, the latitude of the Kuroshio axis over the Izu Ridge moved from north to south.

Carbon dioxide

JMA has been conducting observations for carbon dioxide (CO₂) in the surface ocean and atmosphere in the western North Pacific, on board the R/V *Ryofu Maru* and the R/V *Keifu Maru*. **Figure 4** illustrates the distribution of the difference in CO₂ partial pressure ($p\text{CO}_2$) between the surface seawater and the overlying air (denoted as $\Delta p\text{CO}_2$) observed in the western North Pacific Ocean in each

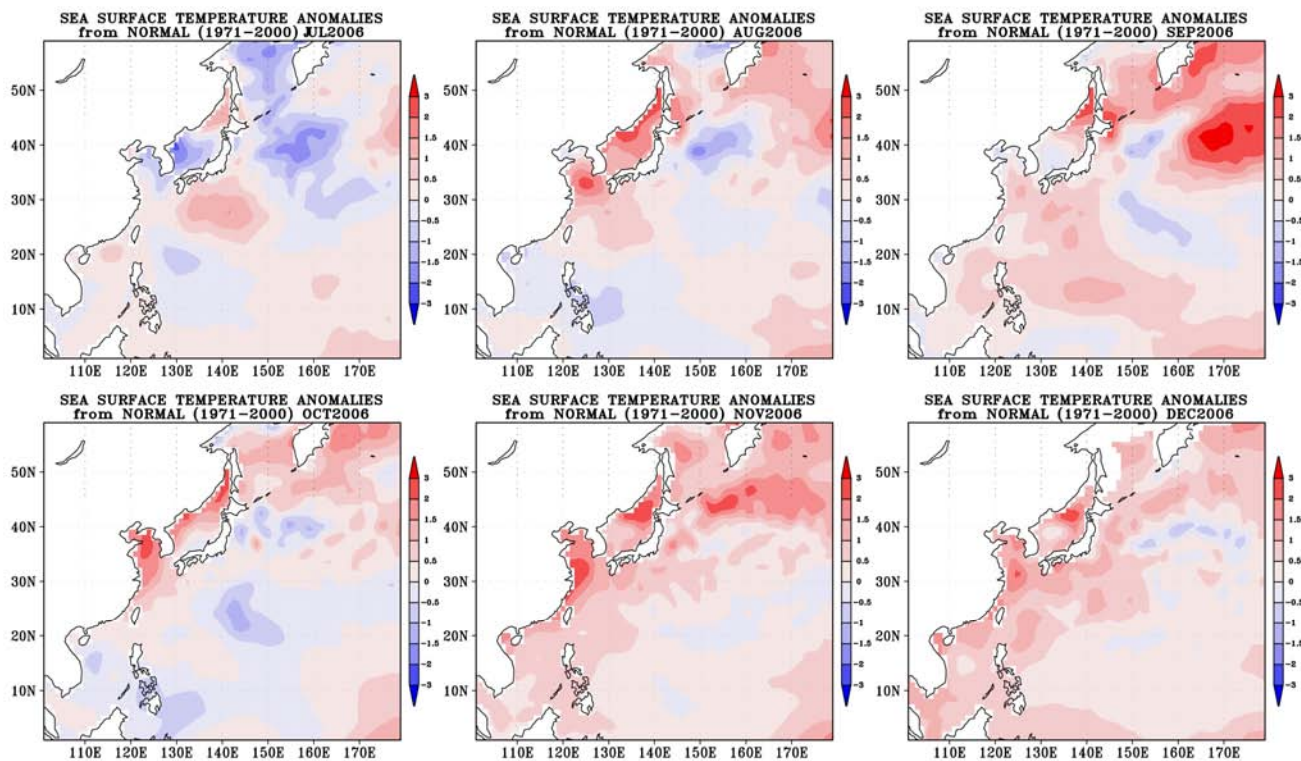
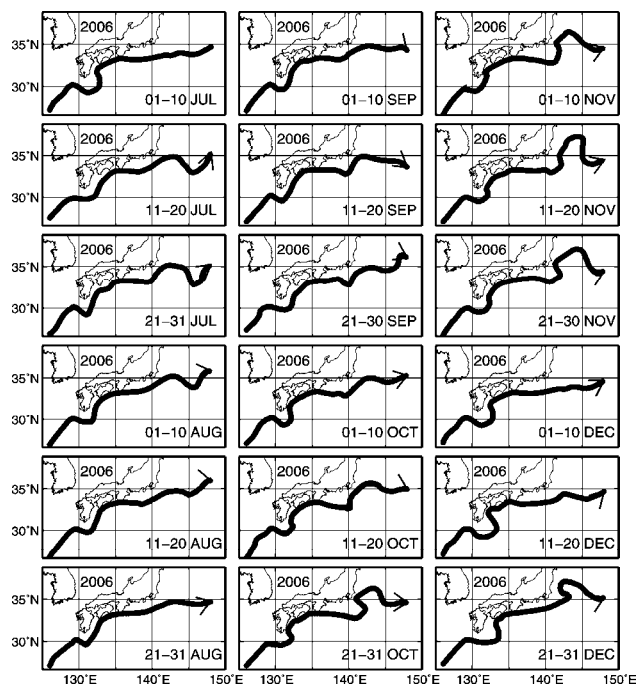
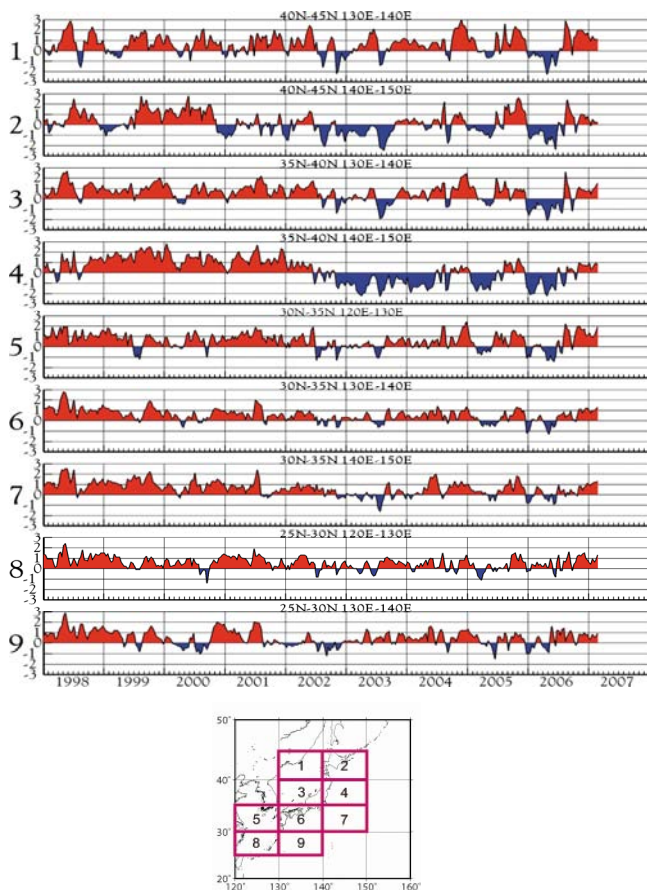


Fig. 1 Monthly mean sea surface temperature anomalies (°C) from July to December 2006. Anomalies are deviations from JMA's 1971–2000 climatology.



Left column:

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

Right column:

Fig. 3 Location of the Kuroshio path from July to December 2006.

season of 2006. The sign of $\Delta p\text{CO}_2$ determines the direction of CO_2 gas exchange across the air–sea interface, indicating that the ocean is a source (or sink) for atmospheric CO_2 in the case of positive (or negative) values of $\Delta p\text{CO}_2$. A strong CO_2 source region was found in the equatorial Pacific between 158°E and 166°E in the winter of 2006 (in the Northern Hemisphere). As this season was during the La Niña event continued from the autumn of 2005 to the spring of 2006, the eastern CO_2 -rich surface water might have moved to the west in response to the change of zonal wind. This equatorial region returned to a weak CO_2 source and/or sink region in the summer of 2006, when the equatorial region was under normal conditions. CO_2 sink regions were found in summer between 10°N and 30°N . This condition is greatly different from that in the summer of 2005 when the entire region between 10°N and 30°N acted as a CO_2 source.

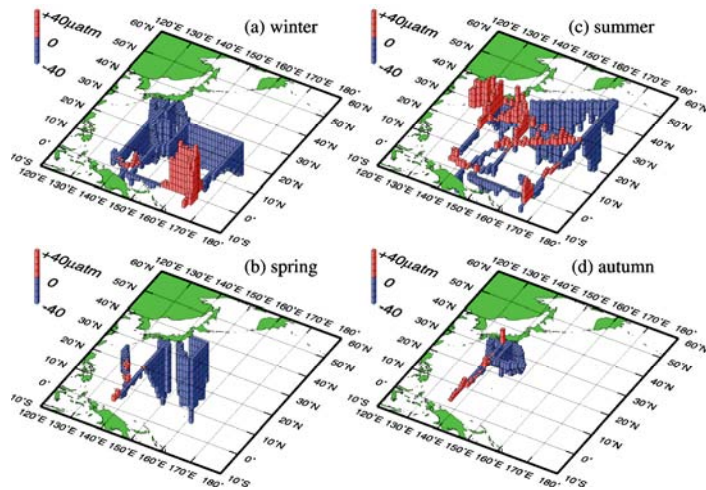
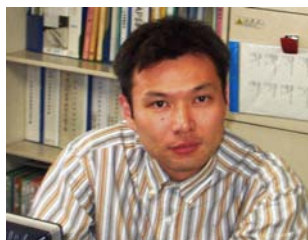


Fig. 4 Difference in CO_2 partial pressure between the ocean and atmosphere in the western North Pacific in 2006. Red/blue pillars show that oceanic $p\text{CO}_2$ is higher/lower than atmospheric $p\text{CO}_2$. Seasons are for the Northern Hemisphere.



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 works 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. Shiro is now involved in developing a new analysis system for temperature, salinity, and currents that will be altered with the Ocean Comprehensive Analysis System.

The Bering Sea: Current status and recent events

by Jeffrey M. Napp

Current status of the Bering Sea ecosystem

Do you believe in string theory? No, not the model of fundamental physics that replaces zero-dimensional point particles with one-dimensional extended objects (strings), but the statistical relationship observed in the Bering Sea where cold years occur sequentially like beads on a string. The winter of 2005/2006 was cold, with significantly more sea ice than had been observed in several previous years, although much less than during the 1970s (**Fig. 1**). It is noteworthy that the 2005/2006 event followed a familiar atmospheric pattern associated with cold winters: a negative Arctic Oscillation Index combined with La Niña conditions on the equator. This past winter (2006/2007) was characterized by a positive Arctic Oscillation Index and mild El Niño on the equator, but the weather was colder, with significantly more ice farther south than in the previous year. During late April, winds were still blowing from the northeast and air temperatures were -29°C (with wind chill). Cold waters in the eastern Bering Sea this year were facilitated by conditioning of the water column the previous year. Recent studies by James Overland and Phyllis Stabeno (NOAA-PMEL) to downscale IPCC climate predictions concluded that such cooling periods with large interannual variability will soon disappear, and the global warming signal will become predominant (<http://www.alaskamarinescience.org/2007/bsai.htm>).

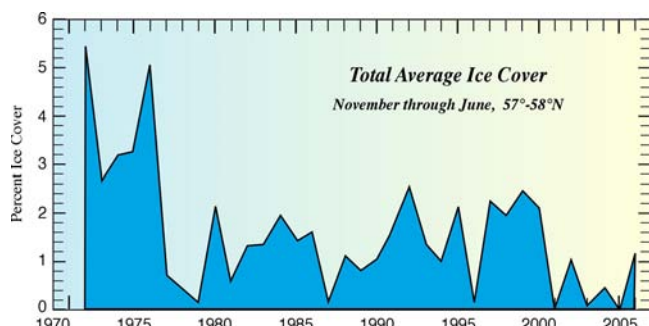


Fig. 1 The annual percentage of ice cover in a one degree (57° – 58°N) box stretching from the Alaskan coast to shelf break from November through May. This box is just north of NOAA mooring M2. Figure courtesy of P. Stabeno, NOAA-PMEL.

Spring survey of the eastern Bering Sea

The spring 2007 research cruise by the Coast Guard icebreaker USCGC *Healy* (**Fig. 2**) was the first one funded by the Bering Ecosystem Study (BEST), a program sponsored by the U.S. National Science Foundation. A group of researchers from Columbia University, Princeton University, University of Alaska at Fairbanks, University of Washington, Western Washington University, National Oceanic and Atmospheric Administration, and the Fish and Wildlife Service conducted a multi-disciplinary cruise in

both ice-covered and ice-free areas. Overviews of the expedition can be found at two web sites: <http://www.polartrec.com/best-cruise/> overview and <http://www.pmel.noaa.gov/foci/ice07>. The expedition was a significant advancement over other recent cruises because it was able to sample within the ice-covered areas. The scientific expertise of almost 50 investigators on board included: ocean physics and chemistry (macronutrients, iron, gases), phytoplankton species, physiology and production, zooplankton community composition, abundance and distribution, benthic community composition, production, nutrient generation, fisheries hydroacoustics, seabird and marine mammal abundance and distribution, and pinniped satellite tracking.



Fig. 2 The 128-m Coast Guard icebreaker USCGC *Healy* in the ice of the eastern Bering Sea viewed from a support helicopter. The ship is named for Captain Michael “Hell-Raising” Healy, a rough and tumble captain of U.S. revenue cutters in Alaska in the 1880s. Photo by D. Forcucci, Scientific Liaison for the ship.

The cruise started with a transect along the 70 m isobath from mooring M2 in the southeast to St. Lawrence Island in the north (**Fig. 3**). This transect has been sampled in three consecutive springs (2005–2007) that correspond to warm, cool, and cold years. The data obtained provide important information regarding interannual variation along the front that separates the southern and northern communities of the eastern Bering Sea. After defining along-shelf distributions of physics, chemistry, plankton,

fish, birds and mammals, the expedition focused on documenting cross-shelf patterns from north to south, moving in and out of ice-covered and ice-free areas with ease. The polynyas of St. Lawrence and St. Matthew Islands were of special interest, as ice was forming in the St. Lawrence polynya during our short time there. Brief stops at St. George and St. Paul Islands allowed scientists to visit local schools to explain the purpose of the expedition to the residents. Some local teachers and high-school students were able to visit the vessel and learn more about the research.

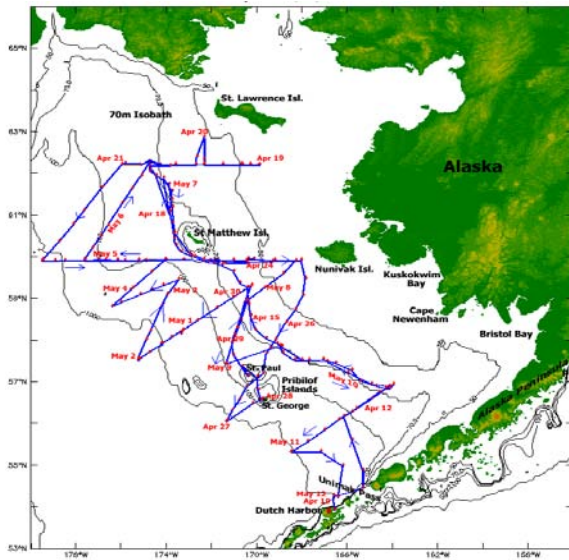


Fig. 3 Cruise track of the USCGC Healy (April 10 to May 12, 2007).

Of particular interest to many was the investigation of primary production under the ice. On numerous occasions, scientists were lowered over the side of the *Healy* to sample ice and ice algae (Fig. 4). In addition to samples of the ice, and determining nutrient concentrations of the brine, primary production was measured by monitoring the evolution of oxygen. Casual observations of the ice broken and overturned by the ship indicated considerable spatial variability in the amounts of under-ice phytoplankton. Nevertheless, when it was present it seemed like it was pervasive (Fig. 5).

Bering Sea Integrated Ecosystem Program

As this column is being written, the National Science Foundation (NSF) Polar Programs Division and the North

Pacific Research Board (NPRB) are meeting to determine the next round of proposals for integrated research in the eastern Bering Sea. Scientists who responded to calls for proposals the previous winter will soon learn whether or not they were funded to participate. NSF's BEST Program plans to conduct at least three more spring cruises with an icebreaker and perhaps some summer cruises with NPRB investigators to understand how climate variability and the loss of sea ice will affect the ecosystem.



Fig. 4 Scientists were lowered to the ice in a "basket of adventure". The Rescue Swimmer is in the yellow dry suit and a crew member with rifle (our Bear Watch) is seen at the top of the picture. Photo by J. Napp.



Fig. 5 A close-up of ice with associated algae. Color of overturned and broken ice behind the ship reveals the extent of a coating of under-ice algae. Photo by J. Napp.

Acknowledgements: Many thanks to Drs. Phyllis Stabeno and James Overland (NOAA-PMEL), and Dr. Nancy Kachel (UW) who helped to create this report.



Dr. Jeffrey (Jeff) Napp is a Biological/Fisheries Oceanographer at the Alaska Fisheries Science Center of NOAA-Fisheries. He is Head of the Recruitment Processes Program at the Center and co-leader (with Dr. Phyllis Stabeno) of NOAA's Fisheries Oceanography Coordinated Investigations (FOCI). His own research is focused on physical and biological processes at lower trophic levels that affect recruitment variability in fish populations. He was active as Principal Investigator in both Bering Sea (NOAA's Bering Sea FOCI, Southeast Bering Sea Carrying Capacity) and Gulf of Alaska (FOCI, GLOBEC) Programs, and currently serves on a Science Steering Committee to implement a U.S. science initiative for the Bering Sea (BEST: Bering Ecosystem Study). Jeff is the Chairman of the PICES Monitor Technical Committee.

Recent trends in the subarctic NE Pacific: Cooling of 2006 continues into 2007

by William Crawford and Patrick Cummins

Ocean temperatures at 10 m depth in the eastern Gulf of Alaska cooled by several degrees from winter 2006 to winter 2007, with coastal waters of the NE gulf cooling the most. This decline followed a period of extremely high temperatures in the region in the summers of 2004 and 2005. Above-normal temperatures appeared to persist into 2007 only in the Strait of Georgia in the SE region of **Figure 1**.

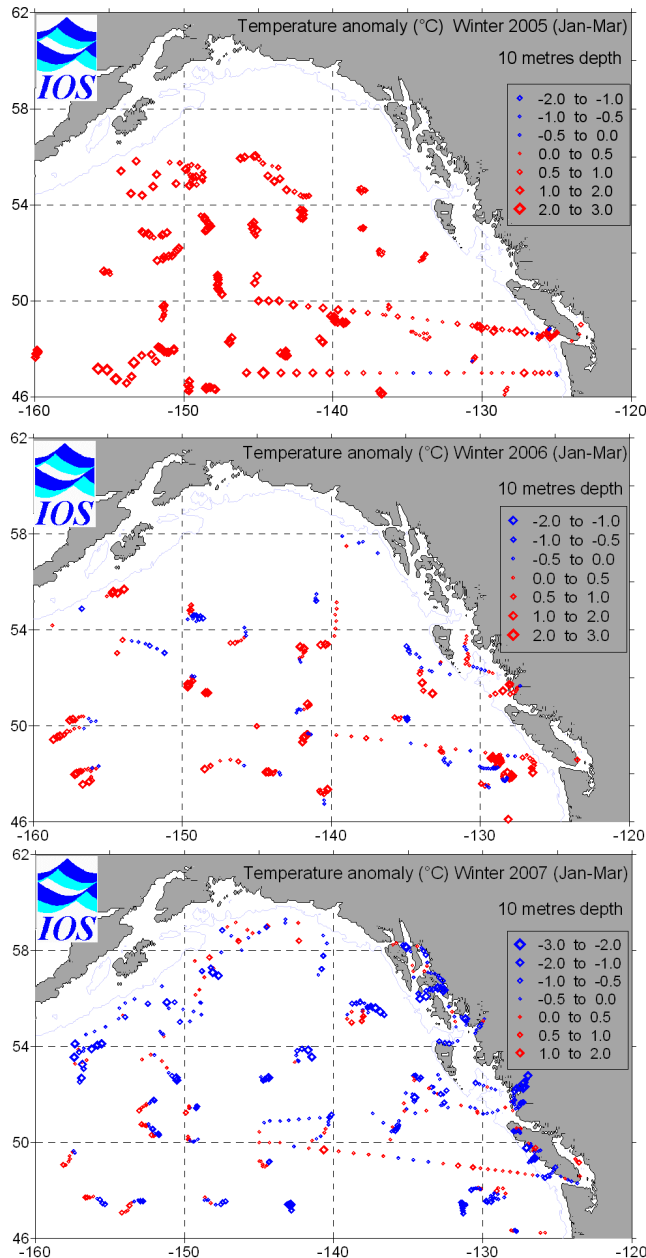


Fig. 1 Anomalies of winter temperature at 10 m depth in the Gulf of Alaska in 2005 (top), 2006 (middle) and 2007 (bottom). Symbols denote negative (blue) and positive (red) anomalies in degrees Celsius. Each symbol represents a single observation from a research vessel, or an Argo profiler.

Temperatures there often lag those in oceanic waters by several months to a year. Much of the cooling from Oregon to British Columbia might be attributed to major storms and southerly storm tracks of late 2006 that cooled oceanic surface waters. Cooling earlier in 2006 is believed to be associated with a shift in atmospheric circulation patterns. Impacts of continuing cooling in late 2006 and into 2007 are pointed out in a recent overview (DFO Ocean Status Report 2007/001; <http://sci.info.pac.dfo.ca/PSARC/OSR's/OSR.htm>). It notes that cooling in the last half of 2006 along the West Coast was accompanied by more boreal copepods on the Oregon continental shelf. Dr. William Peterson of the U.S. National Marine Fisheries Service reports that preliminary indications from samples collected in the winter and early spring of 2007 are that the copepod community is dominated by cool water species, *Pseudocalanus mimus* and *Calanus marshallae*. *Neocalanus plumchrus/flemingerii* also appeared to be unusually abundant in the spring of 2007.

Sea surface temperatures (SSTs) at Amphitrite Point on the west coast of Vancouver Island were 1 to 2°C below the long-term average from May to early June 2007 (**Fig. 2**), and boreal copepods were abundant in the region in May 2007, evidence of the continuing impact of this cool ocean.

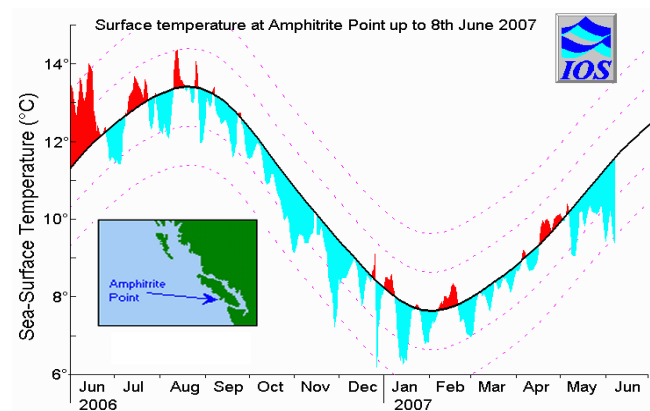


Fig. 2 Sea surface temperature at Amphitrite Point on the west coast of Vancouver Island. The solid black curve denotes the long-term annual cycle; red and blue show measured temperatures above and below the annual cycle. (Image provided by H. Freeland. Updates are available at http://www-sci.pac.dfo-mpo.gc.ca/osap/projects/sst/default_e.htm#)

Sea surface height (SSH) anomalies measured by satellite altimetry over the NE Pacific registered changes in the upper ocean. These anomalies provide a vertically integrated measure of upper ocean variability with greater "inertia" than rapidly fluctuating SSTs. Contour plots of SSH anomalies averaged at quarterly intervals (**Fig. 3**) indicate that between the first and second quarters of 2006 (winter to spring), SSH in the NE Pacific was dominated by a pattern that is related to the cold phase of the Pacific Decadal Oscillation (PDO). It consists of below-average

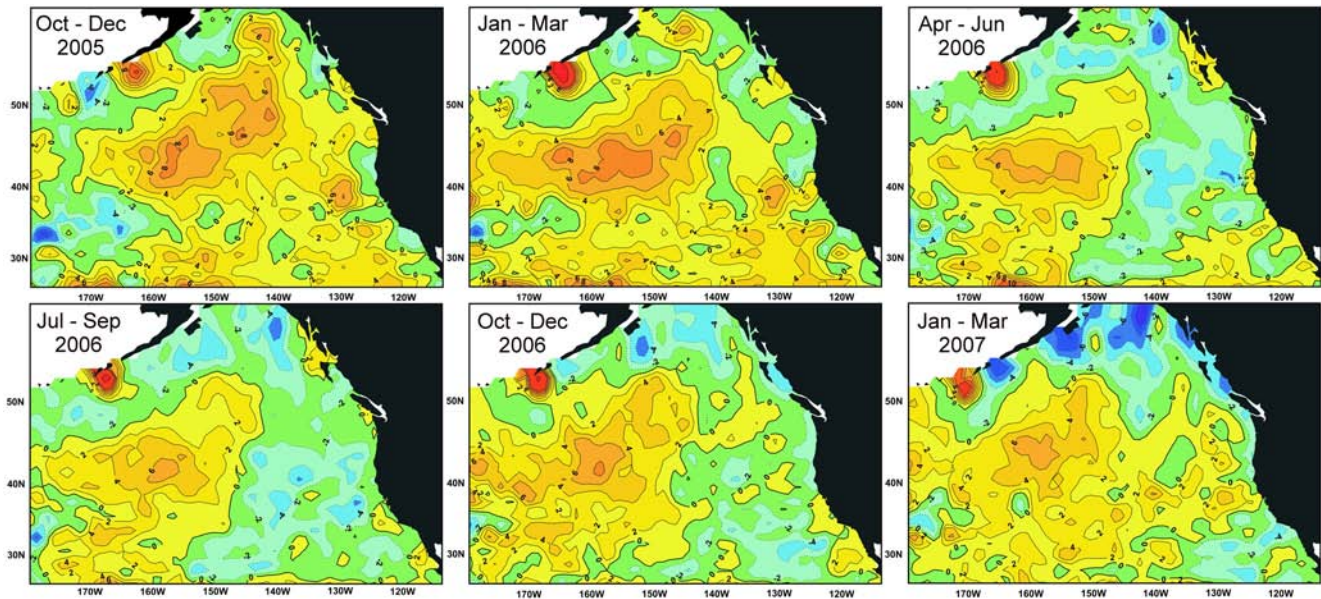


Fig. 3 Sea surface height (SSH) anomalies at 3-month intervals. Contour interval is 2 cm, with yellow-orange-red denoting positive values and blue-green denoting negative values. The anomalies in SSH were constructed by removing monthly means computed from 14 years of satellite altimeter data (TOPEX/Poseidon and Jason-1, 1993–2006), gridded at a resolution of 1 degree.

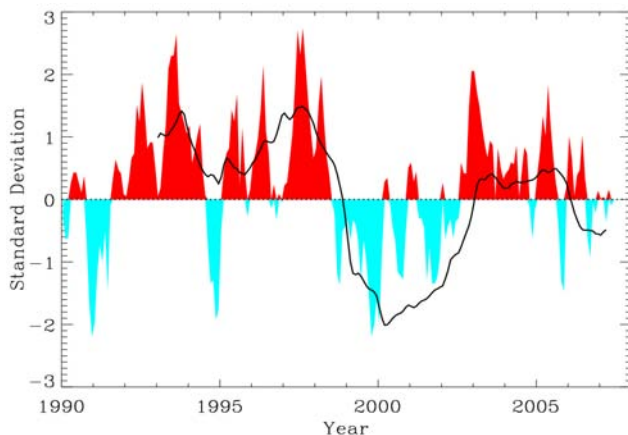
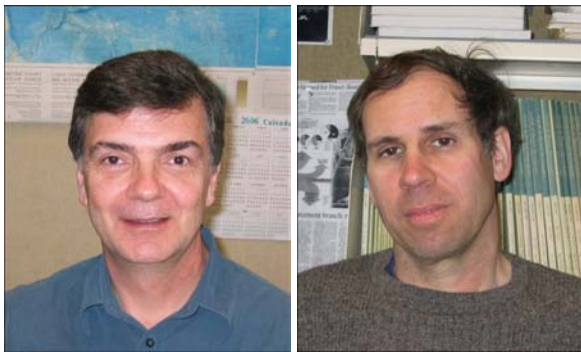


Fig. 4 The solid red/blue curve gives the recent history of the PDO index (obtained from <http://jisao.washington.edu/pdo/PDO.latest>). The solid black line is the first principal component of SSH over the NE Pacific.

sea level in a broad horseshoe-shaped pattern around the perimeter of the Gulf of Alaska, and extending into the central Pacific out to 205°E (155°W). The pattern in **Figure 3** is similar to a period of 4 years of La Niña-like anomalies that occurred in 1999–2002. While the pattern has persisted through the fourth quarter of 2006, it may be starting to break down in the first quarter of 2007 (**Fig. 3**, last panel). An index based on the first principal component of SSH over the NE Pacific (Cummins *et al.*, *Geophys. Res. Lett.*, 2005, 32, L17607) shifted to negative values in 2006. This change was similar to, but not as strong as, the shift that occurred in 1999 (**Fig. 4**). SSH anomalies in the winter of 2007 (**Fig. 3**, last panel) were especially low in the northern Gulf of Alaska, usually an indicator of less heat in the water column. The large, slowly propagating positive SSH anomaly located directly south of the Aleutian Island chain (**Fig. 3**) is likely associated with a mesoscale eddy in the Alaskan Stream.



Drs. William (Bill) Crawford (left) and Patrick Cummins (right) are research scientists for Fisheries and Oceans Canada at the Institute of Ocean Sciences.

Bill (crawfordb@pac.dfo-mpo.gc.ca) conducts research into the movement water masses in the Gulf of Alaska and their impacts on marine biota. 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 the senior Canadian delegate to the International Association of Physical Sciences of the Ocean. He also serves as the Canadian member of the Pacific Panel of CLIVAR and the PICES CFAME Task Team.

Patrick (cumminsp@dfo-mpo.gc.ca) has developed relatively simple models to interpret ocean change as revealed by satellite altimeter data. Of particular interest to him is an understanding of the influence of the Pacific Decadal Oscillation over the NE Pacific and developing indices that may be useful to monitor climatic changes. Patrick is co-editor of *Atmosphere–Ocean*, the research journal of the Canadian Meteorological and Oceanographic Society (CMOS).

Mexican fisheries sciences and marine ecosystem modeling in La Paz, Mexico

by Salvador E. Lluch-Cota, Bernard A. Megrey and John E. Stein

After adopting its formal constitution in 2006, the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society held their first biannual meeting from May 2–4, 2007, in La Paz, B.C.S., Mexico (**Photo 1**). Six plenary invited talks were featured after the Opening Ceremony, including one by Dr. John E. Stein, PICES Science Board Chairman-elect. He described the general activities and structure of the Organization, and highlighted the development of a new integrative science program in PICES: *Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem* (FUTURE). Likewise, this meeting was an opportunity for PICES colleagues to understand the main activities of the Mexican Fisheries Society. This was an important exchange of information because ways are being explored to use the Mexican Fisheries Society as a conduit to greater cooperation and interaction between marine scientists in Mexico and PICES.

A total of 97 oral and 42 poster presentations covered diverse aspects of marine and freshwater fisheries in four concurrent sessions. The program was particularly rich in papers on top predators biology, ecology and fisheries oceanography, coastal and benthic fisheries, modeling, management, and socioeconomic aspects. During the meeting, three side activities were hosted:

- the Fifteenth Annual Meeting of the Small Pelagics Technical Committee (CTPM), with over 20 presentations on sardine and anchovy fisheries science;
- a round table session on the concept of fishing down marine food webs as applied to the Gulf of California;
- a half-day workshop on fisheries legislation, particularly the recently approved fisheries and aquaculture law in Mexico.

Other activities included: a meeting with American Fisheries Society officers to discuss a bid to host their 2011 annual meeting in Mazatlán, Mexico; communications with several institutions in Mexico to explore the formation of sections within the society; and a proposal for a new fisheries journal oriented to Latin American scientists.

Besides the academic sessions, a marine sciences book show coordinated by Ana María Talamantes, a professional librarian and Chapter member, was hosted. Participation included several national institutions, the American Fisheries Society, and a collection of selected volumes kindly donated by the PICES Secretariat. Art was also exhibited, thanks to a very successful contest where the winning painting, called *El pescador dichoso* (The happy fisherman) will be used as the central image of the next biannual meeting in 2009.

Prior to the Mexican Fisheries Society meeting, Dr. Bernard A. Megrey held a 3-day training workshop (on April 26–28,) on “*Techniques for building multi-trophic level marine ecosystem models, with special emphasis on NEMURO and NEMURO.FISH*” at the Centro de Investigaciones Biológicas del Noroeste (CIBNOR) laboratory. The workshop was directly or indirectly sponsored by the International Fisheries Section of the American Fisheries Society, the Mexican Chapter of the Western Division of the American Fisheries Society, PICES, NOAA-Fisheries, and several members of PICES’ CCCC MODEL Task Team. The workshop was attended by seven Ph.D.-level scientists representing marine laboratories in La Paz, Mazatlán and Guaymas, Mexico (**Photo 2**).



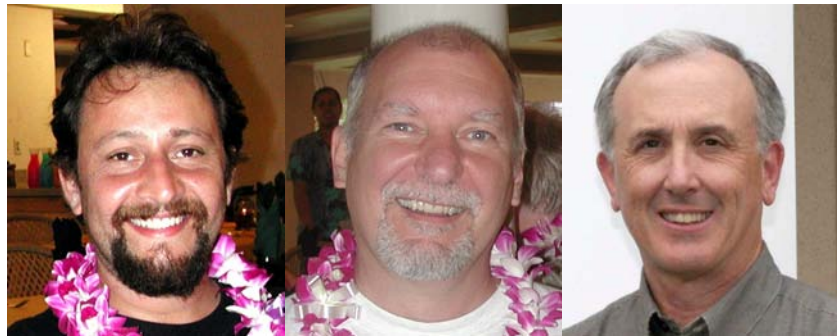
Photo 1 Participants of the first biannual meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society.

The workshop focused on general methods to simulate ecosystem mechanisms and processes, and specifically covered in detail the NEMURO lower trophic level ecosystem model process equations and the NEMURO extension called NEMURO.FISH, which links trophodynamically lower trophic-level zooplankton abundance to upper trophic-level fisheries bioenergetics and population dynamics models. The workshop, which was a mix of lectures and hands-on exercises, also included topics on model calibration, model validation and methods of sensitivity analysis. At the end of the workshop, part of one day was spent discussing ways to adapt NEMURO, which was built for sub-arctic North Pacific ecosystems, to the tropical and transitional zone ecosystems of Mexico. The workshop was a big success and plans are being developed to repeat it in La Paz, and possibly offer it at laboratories located in Mazatlán and Ensenada.

The next annual meeting of the Mexican Fisheries Society will take place in Ensenada in 2009, and then in Mazatlán in 2011.



Photo 2 Workshop participants outside the CIBNOR laboratory. From left to right, back: Carlos Pacheco (providing the lab's technical support), Salvador Lluch-Cota (local host), Felipe Amezcua (UNAM-Mazatlán), Verónica Morales-Zárate (CIBNOR), Alejandro Acevedo (Ph.D. student, Guaymas), Jesus Bautista (CIBNOR) and Bernard A. Megrey (trainer); front: Hugo Herrera and Alejandro Ramos (Ph.D. students, La Paz).



Dr. Salvador E. Lluch Cota (slluch@cibnor.mx) is a fisheries oceanographer working for the fisheries ecology program at CIBNOR. He has been involved in PICES activities for many years, including the hosting of the North Pacific Transitional Areas Symposium in 2002. Besides leading research projects and teaching, he currently serves as a GLOBEC SSC member, President of the Mexican Fisheries Society and Mexican Chapter of the American Fisheries Society, and is forming a group for the estimation of parameters for ecological modeling.

Dr. Bernard A. Megrey (bern.megrey@noaa.gov) is a fisheries research biologist with NOAA's Alaska Fisheries Science Center where he has worked since 1982. As the lead investigator for recruitment modeling studies for NOAA's Fisheries-Oceanography Coordinated Investigations (FOCI), he has nearly 25 years' 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. He is a member and former chairman of the PICES CCCC MODEL Task Team and also serves as a member of the PICES Technical Committee on Data Exchange (TCODE).

Dr. John E. Stein (john.e.stein@noaa.gov) is Deputy Science Director of the NOAA's Northwest Fisheries Science Center and Co-Director for NOAA's West Coast Center for Oceans and Human and Health. His science and scientific leadership has primarily focused on the impacts of anthropogenic and natural toxic compounds on fishery resources and protected marine species, and bringing science to the support efforts on recovery of endangered and threatened Pacific salmon. Recently, he has become more involved in the emerging area of scientific investigations on the connections between state of the ocean ecosystem and risk and benefits to human health. John was Chairman of the PICES Marine Environmental Quality Committee (MEQ) for many years and is now serving as Chairman-elect of the PICES Science Board. He will assume the chairmanship following the close of the PICES Sixteenth Annual Meeting in November 2007.

Two major prizes awarded to PICES/NEMURO family of ecosystem modelers

by Shin-ichi Ito

Two major awards were presented this year to two members of the PICES community. Professor Michio J. Kishi of Hokkaido University received this year's JOS Prize, the Prize of the Oceanographic Society of Japan (JOS), for his contributions to marine ecosystem modeling, education and outreach activities, and for his work on the NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography) and NEMURO.FISH (NEMURO For Including Saury and Herring) models. This award is the Society's highest prize in oceanography in Japan, and only one award is given annually to a scientist who has made outstanding contributions to the progress of oceanography. The first winner of the JOS Prize was Dr. Michitaka Uda, the principal founder and the first president of the Japanese Society of Fisheries Oceanography.

Professor Kishi's modeling work has contributed significantly to the efforts of PICES, and much of his recent scientific research was done in collaboration with members of PICES' CCCC MODEL Task Team. He is a member and former Chairman of this Task Team, and now serves as the Co-Chairman of the CCCC (Climate Change and Carrying Capacity) Program. The MODEL Task Team and PICES are both pleased to be acknowledged in this honor.

The Prize presentation ceremony took place on March 25, 2007, during the spring meeting of JOS in Tokyo. Dr. Satoru Taguchi, Chairman of the JOS Award Committee, conducted the ceremony. Dr. Taguchi announced that Dr. Michio J. Kishi was the recipient of the 2007 JOS Prize, and read the following JOS Award Committee citation:

“Dr. Michio J. Kishi has been one of the leaders in the modeling of marine ecosystems and has had a great influence on a world-wide research trend. His early success was in the reproduction, for the first time, of the chlorophyll distribution in Mikawa Bay, using carefully selected parameters to run a physical–biological coupled model. At that time ecosystem modeling was still at the earliest stage, and his success in ecosystem simulations with a state-of-the-art model greatly encouraged domestic and foreign researchers. His posture in evaluating model uncertainties with careful parameter sensitivity analysis is the exemplary style of younger generation of ecosystem modelers. Dr. Kishi extended his modeling skills to offshore ecosystems and showed the importance of the upwelling caused by the interaction of mesoscale eddies. He also became absorbed with the issue of plankton species composition on material recycling or ecosystem structure. As a member of PICES' MODEL Task Team,

Dr. Kishi played a central role in developing the ecosystem model NEMURO, which is composed of several functioning planktonic species. NEMURO is now widely distributed in the world, and a lot of scientific contributions based on NEMURO are expected in the future not only domestically but also from abroad. Besides these modeling activities, he has also been engaged in the education of young scientists and outreach to promote oceanography to the public. These past and ongoing contributions make him a deserving candidate for the JOS Prize.”



Professor Michio Kishi gives remarks at the JOS Prize presentation ceremony (March 25, 2007). Photo courtesy of JOS.



Professor Kishi presents a special issue of *Ecological Modelling* dedicated to the NEMURO and NEMURO.FISH model to the mayor of Nemuro-city.

Last year, Professor Kishi was also awarded the Uda Prize from the Japanese Society of Fisheries Oceanography. He is the first scientist to have been awarded both prizes.

The Uda Prize, established in 1995 by the Japanese Society of Fisheries Oceanography (JSFO), in honor of Dr. Michitaka Uda, a pioneer of fisheries oceanography in Japan, is given annually to an individual who has made significant scientific contributions to fisheries oceanography. Many scientists who have been active in PICES are among the winners of this prize (see *PICES Press*, Vol. 14(2) for a list of previous Uda Prize recipients).

The 2006 Uda Prize was awarded to Dr. Yoshioki Oozeki of the Fisheries Research Agency in recognition of his research on early life stages of small pelagic fishes and for his contribution that led to the parameterization of a Pacific saury version of NEMURO.FISH. The Prize presentation ceremony took place on March 26, 2007, in Tokyo, during the spring symposium of JSFO. Dr. Yoshiro Watanabe, President of JSFO, and Dr. Yoh Yamashita, Chairman of the JSFO Award Committee, conducted the ceremony. Dr. Yamashita announced that Dr. Yoshioki Oozeki was the recipient of the 2006 Uda Prize, and read the following JSFO Award Committee citation:

“Dr. Yoshioki Oozeki was responsible for introducing an experimental method to the early stage ecological study of fish at a time when field research was dominant in Japan. Dr. Oozeki is credited for leading achievements on larval growth and survival of pelagic fish. In the field, he established a method of quantitative collection of a target species (e.g., MOHT net). Dr. Oozeki estimated various biological parameters of pelagic fish larvae and juveniles, and that research has greatly contributed to the elucidation of pelagic fish responses to climate change through the application of NEMURO.FISH. Moreover, his interests have extended to various fields, including the establishment of the Japan Fisheries Oceanography Database and the realization of marine high-speed internet communication using satellite communication technology, among other endeavors. Dr. Oozeki has taken a leading role in fisheries oceanography in Japan. Besides these research activities, he has also been engaged in the administration of JSFO activities as the Chairman of the Business Committee and the Chief Editor of Suisan Kaiyo Kenkyu. These past and ongoing contributions make him a deserving candidate for the Uda Prize.”

PICES extends sincere congratulations to both these top scientists.

(continued from page 18)

The participants discussed the development of an invasive species database similar to DAISIE or the Pacific Coast Estuarine Information System to collate information on alien invasive species (AIS) from PICES member countries. The database would be similar to the U.S. NISBASE (Non-indigenous Species Database) and would contribute to the development of a global invasive species network. Database formats will be developed and tested on bivalve molluscs and reviewed at PICES XVI.

The group also discussed the importance of ballast water and biofouling as potential vectors for the introduction of invasive species. WGBOSV has nearly completed their ballast water sampling guidelines, and these will be distributed. The group proposed the presentation of member country reviews of ballast water issues and

discussion of critical issues related to ballast water for a joint ICES/PICES meeting during PICES XVI. Several other topics included hull fouling and its role in introducing new species, identifying what is being done to prevent hull fouling, examining the ornamental fish trade as a potential source of introductions, and documenting the socio-economic impacts of non-indigenous species.

The final item of discussion was the role of ICES and PICES in advancing Early Detection and Rapid Response (EDRR) by governments, agencies and organizations to implement eradication or control measures for AIS. The group suggested documenting impacts, costs, successes and failures from world-wide examples, with the intent of providing evidence that success is possible, and examining the roles of governments and citizens in EDRR.



Graham Gillespie (gillespieg@pac.dfo-mpo.gc.ca) is a research biologist with Fisheries and Oceans Canada at the Pacific Biological Station in Nanaimo. His work is associated with inter-tidal bivalve fisheries and the dispersal and distribution of invasive species in the intertidal zone in British Columbia. He is a member of PICES' WG 21 on Non-indigenous Aquatic Species.

Strolling through end-to-end bioenergetic ecosystems: On-line comparison of NEMURO.FISH and APECOSM equations

by Ivo Grigorov

With the reaffirmed role of anthropogenic contribution to global climate change (4th IPCC Assessment Report, 2007), the development of predictive capability of marine ecosystem models end-to-end has found even greater context. In order to capture the essence of the combined impacts of climate forcing and overfishing on the dynamics of marine ecosystems, two recent bioenergetic models have attempted to bridge the two ends of the trophic chain.

NEMURO.FISH (NEMURO For Including Saury and Herring; Megrey *et al.*, *Ecological Modelling*, 2007, 202: 144–165) and APECOSM (Apex Predators ECOSystem Model; Maury *et al.*, *Progress in Oceanography* 2007, doi:10.1016/j.pocean.2007.05.002) are both upper trophic-level bioenergetic models expressing energy flow through individuals in terms of gain as consumption and losses due to respiration, excretion, and reproductive output. The two approaches are, however, quite different.

The former follows the rhomboid approach proposed by de Young *et al.* (*Science*, 2004, 304: 1463–1466), whereby a maximum functional complexity is used at a targeted trophic level (in this case Pacific herring), with increasing degree of simplification at the trophic levels below (food) and above (predators) acting as closure terms. The exception with NEMURO.FISH is the dynamic coupling to the nitrogen-based biogeochemical model (NEMURO) that supplies the prey for the model-targeted species. While the dynamic coupling NEMURO–NEMURO.FISH provides a more realistic closure term for Pacific herring and a high level of functional complexity at three separate trophic levels, the coupling of multiple trophic-level-centered

models can become increasingly complex if the ecosystem is to be represented in an end-to-end manner.

An alternative approach is proposed for the APECOSM model. As with NEMURO.FISH, the energy fluxes through individuals are expressed as a function of their physiological processes, but APECOSM treats all processes in the trophic chain as size-dependent, thus avoiding the limitation of the rhomboid approach and being capable of representing all trophic levels based on size allometry. As with NEMURO.FISH, APECOSM will be coupled on-line to the PISCES (Pelagic Interaction Scheme for Carbon and Ecosystem Studies) biogeochemical model to be linked to the primary producers.

The model equations behind the formulation of these two bioenergetic upper trophic-level models are now available on-line (<http://www.eur-oceans.eu/models>) through the Model Shopping Tool (MoST) database, a product of the EUROpean Network of Excellence for OCEan Ecosystem ANalysisS (EUR-OCEANS, <http://www.eur-oceans.eu>). The aim of MoST is to provide a quick method of model equation inter-comparison for recent and mature pelagic ecosystem models. The database allows process scientists and non-ecosystem modelers an easy access to the inner detail of pelagic ecosystem models. NEMURO.FISH and APECOSM can be compared rapidly through this on-line tool, at the equation level, and based on individual processes (where available, the individual parameter values and sources are included). MoST also provides the model equations for the biogeochemistry models, NEMURO and PISCES, coupled to NEMURO.FISH and APECOSM.

Ivo Grigorov (ivo.grigorov@eur-oceans.eu) is a Project Officer for Model Interfacing within the EUR-OCEANS Network of Excellence (<http://www.eur-oceans.eu>), and is responsible for developing and maintaining the Model Shopping Tool (MoST) database (<http://www.eur-oceans.eu/models>) for pelagic ecosystem model descriptions and equations. This tool aims to allow process scientists and non-ecosystem modelers to step into marine ecosystem models and compare the multiple modeling approaches used, from the philosophy down to the individual parameter values. Ivo can be contacted for any queries and comments on MoST or to include your modeling effort into the database.

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” (Eds. Bernard A. Megrey, S. Allen Macklin, Kimberly Bahl and P. Daniel Klawitter) is posted on the PICES website at http://www.pices.int/publications/tech_reports/tech_rep_1/tech_rep_1.aspx. The report includes specific technical instructions and guidance for anyone wishing to join the Federation.

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