NORTH PACIFIC MARINE SCIENCE ORGANIZATION (PICES)

ANNUAL REPORT

EIGHTEENTH MEETING

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REPORT OF OPENING SESSION

AGENDA ITEM 1
Opening by the Chairman of PICES

The Opening Session started at 09:00 hours on October 26, 2009. Dr. Tokio Wada, Chairman of PICES, welcomed delegates, observers and researchers to Jeju and formally declared that the PICES Eighteenth Annual Meeting (PICES-2009) was open. The session agenda is appended as *OP Endnote 1*.

AGENDA ITEM 2
Welcome addresses by representatives of the federal government and local government of the host country

Mr. Jong-Hwan Chung (Minister, Ministry of Land, Transport, and Maritime Affairs, Republic of Korea) welcomed participants on behalf of the host country (*OP Endnote 2*). Mr. Tae-Hwan Kim (Governor, Jeju Special Self-Governing Province, Republic of Korea) and Dr. Jung-Keuk Kang (President, Korea Ocean Research and Development Institute) addressed the session on behalf of the local government (*OP Endnote 3*), and the host organization (*OP Endnote 4*), respectively.

AGENDA ITEM 3
Remarks by the Chairman of PICES

Dr. Wada thanked Mr. Jong-Hwan Chung, Mr. Tae-Hwan Kim and Dr. Jung-Keuk Kang for their remarks, and addressed the participants on behalf of PICES. His comments are appended as *OP Endnote 5*.

AGENDA ITEM 4
Wooster Award presentation ceremony

Dr. Wada and Dr. John Stein, PICES Science Board Chairman, conducted the 2009 Wooster Award presentation ceremony. Dr. Wada introduced the award, and Dr. Stein announced the 2009 award recipient to be Professor Kuh Kim (Republic of Korea), a nationally and internationally distinguished physical oceanographer (*OP Endnote 6*). Reading of the Science Board citation of the 2009 Wooster Award was accompanied by a slide show dedicated to Dr. Kim.

A commemorative plaque was presented to Dr. Kim (a permanent plaque identifying all Wooster Award recipients resides at the PICES Secretariat), who accepted the award with the following remarks of thanks:

It is a great honor for me to receive the 2009 Wooster Award.

I would like to thank all of you who nominated me for this award, and the Science Board for selecting me. As I was on the Science Board as a member and later as its Chairman, I know well that very significant scientific contributions to the North Pacific and its marginal seas in research, education, and/or administration are required to receive this award. I am afraid that my record is short of meeting these criteria, as previous recipients of this award have left far-reaching footprints. So my guess is that this time the PICES Science Board probably decided to send a message that we oceanographers should continue to explore the sea as often as possible for more data to understand the oceans better and deeper as I did as a theoretician. We have a relatively good understanding on processes in the surface layer of the oceans, as large amounts of data are available from various platforms such as satellites, drifters and moorings. However, data from the deep ocean are very limited in space and time, and so is our understanding, despite the fact that it occupies most of the

oceans. For example, the understanding of climate change requires data from the whole water column of the oceans in time. Our approach should be multi-disciplinary and comprehensive. I like to emphasize that international collaboration is essential to make any progress in understanding the world ocean.

Without any exception, all my works are the results of collaborations at sea and in the laboratory with graduate students of the Ocean Circulation Laboratory at Seoul National University, and with friends and colleagues from PICES member countries for the last 30 years. My students had sleepless nights. I had selfless support from colleagues like Howard Freeland who helped me to start the Argo program in Korea. I would like to take this opportunity to thank great teachers like Henry Stommel and Peter Rhines, who taught me how to intertwine fluid dynamics and sea-going oceanography, and Kyung-Ryul Kim and Masaki Takematsu for their solid commitment and encouragement for science. Seoul National University has never had a research vessel, and I am deeply indebted to captains and crew of so many vessels ranging from a small chartered fishing boat, which lost its engine power and drifted for hours off the southern coast of Korea, to a Russian research vessel which had a serious CTD winch problem soon after sailing from Pusan Port for the first expedition of CREAMS in 1993, but where a replacement for its slip-ring was miraculously found. The first data of CREAMS were collected successfully on board this vessel, leading to the discovery of new water masses and changes in the thermohaline circulation in the Japan/East Sea. I am extremely lucky and fortunate to have met so many wonderful and dedicated people. I thank everyone who ever worked with me to reach the unknown.

I am proud of being part of PICES. Thank you again.

AGENDA ITEM 5
PICES Ocean Monitoring Service Award presentation ceremony

Drs. Wada and Stein also conducted the presentation ceremony of the PICES Ocean Monitoring Service Award (POMA). Dr. Wada introduced the award, and Dr. Stein announced that the 2009 award be given to Dr. Bernard A. Megrey of NOAA-Fisheries' Alaska Fisheries Science Center and Mr. S. Allen Macklin of NOAA's Pacific Marine Environmental Laboratory for their sustained efforts, vision, and leadership in building an inventory of biophysical data for the North Pacific, and creating the PICES Marine Metadata Federation (*OP Endnote 7*). Reading of the Science Board citation of POMA-2009 was accompanied by a slide show dedicated to all experts involved in the project. A commemorative plaque (a permanent plaque identifying all POMA recipients resides at the PICES Secretariat) and a certificate were presented to Dr. Megrey, who accepted the award with the following remarks of appreciation:

I want to thank PICES and the TCODE and MONITOR committees for selecting the PICES Metadata Federation Project for this year's PICES Ocean Monitoring Service Award. My colleague, Allen Macklin, could not be here today as he recently retired and is living the good life. I know he would want me to extend his thanks for this very special recognition.

The PICES Metadata Federation Project was not accomplished by two people. Rather, it is the product of the collective effort of many individuals representing national contributions coordinated and solidly supported by TCODE and PICES. The names and pictures of the individuals making up each national team are being displayed for you right now. It is gratifying to see emphasis given to data management activities within PICES. PICES scientists strive to answer difficult questions, especially as we begin a new science program. I am confident that the metadata tools provided by the project will help move the FUTURE scientific program forward in significant ways. This is your resource. Please use it and contribute to it.

Now I would like to invite my collaborators to join me on the stage if they are in the audience. I believe I see Robin Brown from Canada, Igor Shevchenko from Russia, Toru Suzuki from Japan, Ruguang Yin from China, and Kyu-Kui Jung from Korea. Please join me in accepting this award on behalf of the PICES Metadata Federation Project.

Certificates were also given to representatives of all national teams that participated in the Metadata Federation.

After the Annual Meeting, Dr. Macklin sent the following note to the PICES Secretariat:

I am sorry that I was unable to be with you to accept this award personally. Through the voice of my colleague, Bern Megrey, I expressed my thanks and appreciation to the Science Board and the TCODE and MONITOR committees of PICES for recognizing the value of this contribution to marine science.

Information management is a basic and unstated underpinning of the Scientific Method. As scientists we pose questions about the world, seek background knowledge, develop ideas about how things work, test those ideas through observation, analyze data from such tests, validate our ideas, and communicate the results. Clearly, the more information available at any step of the process should increase the overall advance of science. In this modern era, it is imperative that the information be well managed, valid and discoverable.

This project began with the intent to reveal more information about the Bering Sea. With the support of PICES and cooperation of its member countries, the PICES Metadata Federation Project now addresses a much wider geographic area, serves a greater user community and is a tool for international cooperation in guiding our understanding and use of marine areas. I urge you to use and contribute to this tool to continue its development and increase its value.

Finally, I wish for you know how rewarding and exciting working with PICES was to my career. It truly brought a new scope and understanding of the international world of science and our responsibility to guard our planet. To my many friends, Kom Bei!

AGENDA ITEM 6
PICES "Year-in-Review" 2009

Dr. Stein reviewed PICES' scientific accomplishments since the Seventeenth Annual Meeting (PICES-2008) in Dalian, People's Republic of China. An article on the state of PICES science for 2009 will be published in the next issue of PICES Press in January 2010 (Vol. 18, No. 1).

The 2009 keynote lecture entitled "*Ecosystem-based fisheries assessment and management: A step towards FUTURE implementation of ecosystem approaches to management (EAM)*" was given by Dr. Chang Ik Zhang (Pukyong National University) as a part of the Science Board Symposium on "*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*". The abstract of his presentation is appended to the report as *OP Endnote 8*.

AGENDA ITEM 7
Closing remarks and announcements

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

OP Endnote 1

Opening Session agenda

1. Opening by the Chairman of PICES, Dr. Tokio Wada
2. Welcome addresses by representatives of the federal government and local government of the host country
   - Mr. Jong-Hwan Chung (Minister, Ministry of Land, Transport, and Maritime Affairs, Republic of Korea)
   - Mr. Tae-Hwan Kim (Governor, Jeju Special Self-Governing Province, Republic of Korea)
   - Mr. Jung-Keuk Kang (President, Korea Ocean Research and Development Institute)
3. Remarks by the Chairman of PICES, Dr. Tokio Wada
4. 2009 PICES Wooster Award presentation ceremony
5. 2009 PICES Ocean Monitoring Service Award presentation ceremony
6. PICES "Year-in-Review" 2009 by the Chairman of Science Board, Dr. John Stein
7. Closing Remarks/Announcements

OP Endnote 2

Welcome address on behalf of the federal government of the host country by Mr. Jong-Hwan Chung (Minister, Ministry of Land, Transport and Maritime Affairs, Republic of Korea)

Honorable Chairman Tokio Wada, Science Board Chairman John Stein, Executive Secretary Alexander Bychkov, and marine scientists from overseas including Canada, China, Japan, Russia, and the United States! I welcome you to Korea.

Governor Tae-Hwan Kim of Jeju, President Jung-Keuk Kang of the Korea Ocean Research and Development Institute, and distinguished guests from Korea! Thank you for joining us despite your busy schedule.

I would like to congratulate you on the opening of the 2009 PICES Annual Meeting. I am especially delighted to be with world-renowned experts in this beautiful island of Jeju, one of UNESCO's world heritages.

Since its foundation in 1992, PICES improved research on climate change and the ocean ecosystem of the Pacific, especially above 30 degrees north latitude, and facilitated international cooperation in marine science. In particular, between 1996 and 2006, you have successfully conducted the Climate Change and Carrying Capacity Program. Moreover, the FUTURE science program to be implemented over the next decade is very timely and meaningful. It will become a significant opportunity for PICES to make another leap forward.

Distinguished guests! Global warming is becoming a greater threat to the survival of humankind every day. Under the circumstances, the importance of marine science is increasing. In this regard, the Ministry of Land, Transport and Maritime Affairs is utilizing the ocean to develop zero-carbon energy and CO_2 storage technologies. We are also studying marine plants as a new source of bio-energy. In addition, the Ministry is leading efforts to fight climate change by observing the ocean. In this sense, I hope this event provides a venue for active exchange between Korean and overseas marine experts.

Before closing my remarks, I would like to thank our organizers, including the PICES Secretariat, Jeju Province, the Korea Ocean Research and Development Institute, and the National Fisheries Research and Development Institute, for your preparation and support.

Once again, I would like to thank the participants who have come so far to join the Annual Meeting. I wish for your health and luck. Thank you.

OP Endnote 3

Welcome address on behalf of the local government of the host country by Mr. Tae-Hwan Kim (Governor, Jeju Special Self-Governing Province, Republic of Korea)

Honorable Chairman Tokio Wada, Minister Chung Jong-Hwan of Land, Transport and Maritime Affairs, government representatives, and marine scientists! I welcome you to Jeju Island, one of UNESCO's world heritages.

Your proactive support and participation has led to the successful opening of the 2009 PICES Annual Meeting, and I am very pleased to see this. I and the Jeju residents have keen interest in this event being held under the theme "*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*". This is because Jeju Island, which is surrounded by the sea, is focusing on the ocean for the future and is to realize our vision.

During your stay, if you are lucky, you will be able to listen to a sound that cannot be heard anywhere else on earth. The sound is called "Sumbi sound". Korean female divers gather seafood underwater, keeping their breath. As soon as they come out of the water, they exhale. And this is the Sumbi sound. As such, Jeju's ocean is very unique. The Jeju Special Self-Governing Province is making a challenge to turn the ocean into an ocean full of hope. However, Jeju is not free from the change in the marine ecosystem due to global warming. Compared to the 1930s, Jeju's average temperature has increased by 1.5 degrees. The sea level is also rising 0.5 centimeters yearly. As a result, the promenade in Yongmeori, Seoguipo-city, is now submerged during high tide. Jeju is one of the North Pacific regions that shows clear changes in the sea level and the marine ecosystem. In response, Jeju signed a convention to become the showcase city for climate change response with the central government, in line with the global trend for sustainable green growth.

Distinguished guests, you are the most prominent experts in marine science. Your research will greatly contribute to preserving the marine ecosystem of Jeju and the world. Right now, Jeju is in its most beautiful season, autumn. During your stay, I hope you can feel the warm hospitality of Jeju residents, and make many good memories. Moreover, I wish for the development of PICES, and your health and success. Thank you.

OP Endnote 4

Welcome address on behalf of the host organization by Dr. Jung-Keuk Kang (President, Korea Ocean Research and Development Institute)

Distinguished Dr. Tokio Wada, Chairman of PICES, Dr. John Stein, PICES Science Board Chairman, Mr. Jong-Hwan Chung, the Minister of Land, Transport and Maritime Affairs, Mr. Tae-Hwan Kim, the Governor of Jeju Special Province and honored guests, ladies and gentlemen. On behalf of the Korea Ocean Research and Development Institute, I would like to welcome all the participants to the Eighteenth Annual Meeting of PICES (PICES-2009), and especially welcome participants from abroad who, in many cases, must have travelled quite a long distance to come to Jeju Island.

We are very pleased and proud to host this Annual Meeting where FUTURE, the new science program of PICES, will be officially inaugurated. The anticipated global changes threaten the future of humanity and call for large-scale studies of ocean ecosystems. In this direction, PICES has been preparing a new science program during the past years and now we are about to witness its beginning. Aiming to understand and to make predictions of the ecosystem changes in the North Pacific, the FUTURE program will be one of the leading marine science programs of the world. The theme for this Annual Meeting of PICES, "*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*", addresses two of the fundamental issues of FUTURE. The issues you are going to discuss and debate in this Jeju meeting will set the direction of the FUTURE program and therefore, will be very critical for the success of FUTURE. I wish you all luck.

I would like to add that Jeju is not only the most popular tourist destination, but also a UNESCO World Natural Heritage Site. Therefore, I suggest that you take the opportunity to enjoy the beautiful scenery of the southern island of Korea.

Once again, I sincerely express my warmest welcome to all the participants, and wish you a very pleasant stay here on Jeju Island. Thank you.

OP Endnote 5

Welcome address by Dr. Tokio Wada (Chairman of PICES)

Mr. Jong-Hwan Chung, Mr. Tae-Hwan Kim, Dr. Jung-Keuk Kang, distinguished delegates, guests, ladies and gentlemen, welcome to the 2009 Annual Meeting of our Organization.

First of all, on behalf of PICES and all the participants, I would like to express our sincere thanks to the Ministry of Land, Transport, and Maritime Affairs of Korea, the Jeju Special Self-Governing Province, the Korea Ocean Research and Development Institute, and the National Fisheries Research and Development Institute, for their warm-hearted hospitality and hard work in organizing this Annual Meeting at such a wonderful venue.

From early times, we have received various benefits from the ocean, especially from its ecosystems. Food and raw materials from marine bio-resources are essential ecosystem services of the ocean, and these are indispensable for human life. CO_2 absorption and water purification through bio-chemical processes are also significant functions of the ocean ecosystems. On the other hand, anthropogenic effects on the ocean ecosystems have increased with the recent enhancement of our socioeconomic activities in the ocean. Climate change is also a big factor affecting the structure and functions of the ocean ecosystems. Therefore, under the current situation, to keep the structure and functions of the ocean ecosystems, and to sustain their services, is an urgent issue for the world beyond the North Pacific Ocean.

Since 2004, PICES has been developing a new integrative scientific program called FUTURE, an acronym for *Forecasting and Understanding of Trends, Uncertainty and Responses of North Pacific Marine Ecosystems*. Its Science Plan was adopted by Governing Council in 2008, and the Implement Plan was approved last June. At this Annual Meeting, we will make an actual start on the FUTURE program. FUTURE is quite a comprehensive program, including a variety of PICES scientific activities ranging from physical oceanography to fish biology, as well as socioeconomic studies on ecosystem-based management. Its ultimate goal is to provide the scientific knowledge for sustainable use of the ecosystem services of the North Pacific Ocean which will be requested by policy makers, interested parties and the public of the Contracting Parties. A tight collaboration among the standing committees and the expert groups of PICES, and the integration of their products, are key elements of the implementation of FUTURE. Furthermore, promoting collaboration with other international organizations and programs, and intensifying communication with the Contracting Parties are also important factors for the success of FUTURE. The overall theme of this Annual Meeting, "*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*", is a very timely one for the beginning of the FUTURE program.

Finally, I expect that this meeting will achieve many fruitful results, and will be a memorable event in the history of PICES. Thank you very much.

OP Endnote 6

2009 Wooster Award

Introduction of the Wooster Award (Dr. Tokio Wada)

In 2000, PICES established an annual award for scientists who have made significant contributions to North Pacific marine science; have achieved sustained excellence in research, teaching, administration, or a combination of these in the area of the North Pacific; have worked to integrate the various disciplines of the marine sciences; and preferably, all of these in association with PICES. The award was named in honor of Professor Warren S. Wooster, a principal founder and the first Chairman of PICES, a world-renowned researcher of climate variability and fisheries production. Prior recipients of the Wooster Award were Michael Mullin (2001), Yutaka Nagata (2002), William Pearcy (2003), Paul LeBlond (2004), Daniel Ware (2005), Makoto Kashiwai (2006), Kenneth Denman (2007), and Charles Miller (2008).

To our deep regret Professor Wooster passed away last October. He was not only a distinguished scientist, but also an ambassador of international scientific cooperation. We will no longer be able to see him among the participants at the Annual Meetings. However, his spirit will be living in our minds through this Award.

Science Board citation for 2009 Wooster Award (Dr. John Stein)

Today, it is a great pleasure to present to you Professor Kuh Kim, the recipient of the 2009 Wooster Award. Professor Kim has been active in PICES, serving first as a member of the Physical Oceanography and Climate (or POC) Committee since 1996, as Chairman of this Committee from 2001 to 2004, and as Chairman of the PICES Science Board from 2004 to 2007.

In addition to Professor Kim's international scientific leadership in PICES, his collaborative research in the western Pacific was pivotal in the initiation and success of the regional program on "Circulation Research in East Asian Marginal Seas" (CREAMS). The scientific foundation for CREAMS arose from his landmark papers entitled "*Characteristics of physical properties in the Ulleung Basin*" and "*Identification of water masses in the Yellow Sea and the East China Sea by cluster analysis*". CREAMS is now in its third phase. The PICES Science Board endorsed the CREAMS/PICES Program at the 2004 Annual Meeting as one of the key POC and PICES activities, and following this endorsement, the Korean government initiated the Korean CREAMS/PICES Program in 2006, which was the product of significant efforts by Professor Kim and his colleagues, and it is anticipated that the CREAMS/PICES Program will continue to be one of the regional projects of PICES' new integrative science program, FUTURE.

CREAMS is but one international program that Professor Kim has been a key participant of. Korea is an important contributor to the global Argo array, and this is largely through the efforts and initiative of Prof. Kim. He represented Korea on the Argo Steering Team from the moment it was created until 2008, and was the one who helped to make the free and open data policy work. Without the free and open data policy, Argo would have had a short history.

Professor Kim's international leadership is matched, if not exceeded, by his scientific achievements and development of the next generation of physical oceanographers and marine scientists. He has mentored many students and colleagues who have gone on to productive careers, and he has published more than 70 scientific papers, including a contribution to the 4th Assessment Report of the Intergovernmental Panel on Climate Change.

Professor Kim's accomplishments are many, and he continues to be strongly involved with his science career. Recently, he has moved from Seoul National University to Pohang University of Science and Technology to lead the establishment of a world-class graduate school of oceanography. This will be the last challenge in his exemplary research and education career. But given his stellar record as a scientist and educator, and his enthusiasm, there is little doubt that he will be successful.

OS-2009

Please join me in congratulating my predecessor as Science Board Chairman, Professor Kuh Kim, as the 2009 Wooster Award recipient.

OP Endnote 7

2009 PICES Ocean Monitoring Service Award

Introduction of the PICES Ocean Monitoring Service Award (Dr. Tokio Wada)

Progress in many aspects of marine science is based on ocean observations, monitoring, and management and dissemination of data provided by these activities. However, these activities are often behind the scenes and so inconspicuous that they are seldom evaluated appropriately. To remedy this, a PICES Ocean Monitoring Service Award (POMA) was established in 2007 to recognize the sustained accomplishments of those engaged in monitoring, data management, and communication. This award aims to acknowledge organizations, groups and outstanding individuals who have contributed significantly to the advancement of marine science in the North Pacific through long-term ocean monitoring and data management. The first award was presented in 2008 to the training ship T/S *Oshoro-maru* of Hokkaido University, Japan, for her long-term ecological monitoring activities in the northern North Pacific.

Science Board citation for 2009 PICES Ocean Monitoring Service Award (Dr. John Stein)

Researchers studying marine ecosystems need access to information on multiple ecosystem processes spanning everything from the seabed to the atmosphere. Metadata, or data describing what, when and how data were collected, help researchers choose information relevant to their project without acquiring the actual data. Metadata make data "discoverable". Even if data collectors provide metadata, there is no centralized repository of metadata contributed from different sources.

For the past 5 years, Dr. Bernard A. Megrey of NOAA-Fisheries' Alaska Fisheries Science Center and Mr. S. Allen Macklin of NOAA's Pacific Marine Environmental Laboratory led an initiative within PICES to federate marine metadata collections from all member countries into one integrated resource, the PICES Marine Metadata Federation. With this tool, a user has the ability to search for data catalogued by any and all participating countries with a single search request. Using modern data management standards and techniques to cross-search separate metadatabases has the advantages of shared metadata without compromising national ownership, data integrity, or the security of national metadata products. This task was accomplished by interacting with a large collaborative team consisting of data users and experts within PICES, practicing scientists trying to solve multi-national problems within the Pacific Rim, data providers and computer IT staff at international laboratories in Japan, China, Russia, Korea and Canada. Over the course of the project, separate meetings were held with each international team in the United States, and then the U.S. team visited the cooperating laboratory to meet their staff and leadership.

Bernard and Allen actively wrote proposals to secure funding, coordinated the expansion of the Federation by locating new partners, visited international laboratories, contacted participants, promoted the Federation within the PICES community, served as a point of contact, and supplied technical support on issues related to establishing a federated metadata node. They also provided capacity building within PICES by organizing training workshops and metadata training.

All nodes of the PICES Marine Metadata Federation offer English metadata records in a standard format through a standard communication protocol. Access to the portal is through a metadata clearinghouse that supplies search and delivery functions to the user who does not have to worry about which country or institution collected the data. In the process of developing the project, a PICES Technical Report was written providing instructions to each country regarding how to establish a node. Numerous PICES Press articles and over 15 oral presentations were given at PICES scientific meetings, Standing Committee and Working Group meetings.

This was NOT an easy job. Although many people and agencies had long recognized the 'need', there were no good models of exactly how to satisfy this need. Bern and Allen led the team which showed PICES how to do this and then made it happen! The success of the project required support from members of the PICES Technical Committee on Data Exchange (TCODE), Kimberly Bahl, and close international collaborations with Kyu-Kui Jung and Hae-Seok Kang (Korean Oceanographic Data Center), Toru Suzuki (Marine Information Research Center, Japan Hydrographic Association), Ruguang Yin and Jixiang Chen (National Marine Data and Information Service, State Oceanic Administration of the People's Republic of China), Igor Shevchenko, Olga Vasik and Igor Burango (TINRO-Centre, Russia) and Robin Brown and John Holmes (Fisheries and Oceans Canada). Throughout the long development and implementation period, Bern and Allen provided important leadership and vision, in addition to acquiring the resources to complete the job.

I am very pleased to announce that the PICES Ocean Monitoring Service Award for 2009 is given to Dr. Bernard A. Megrey and Mr. S. Allen Macklin for their sustained efforts, vision, and leadership in building an inventory of biophysical data for the North Pacific and creating the PICES Marine Metadata Federation.

OP Endnote 8

"Ecosystem-based fisheries assessment and management: A step towards FUTURE implementation of ecosystem approaches to management (EAM)"

Abstract of the keynote lecture by Dr. Chang Ik Zhang (Pukyong National University, Republic of Korea)

North Pacific marine ecosystems in the PICES region have been utilized in a variety of ways. In the western North Pacific, large coastal populations, with a long history of full exploitation of most harvestable renewable resources, are confronted with overfishing and habitat degradation. In the eastern North Pacific, coastal population growth and economic development have proceeded at a much slower pace, exerting less pressure on fishery resources. Marine living resources exploited by fisheries are part of complex marine ecosystems where many species interact. Ecosystem-based management is becoming a global theme of marine science in the 21st century. The World Summit on Sustainable Development (WSSD) recommended the implementation of the ecosystem approach by 2010. This holistic approach should consider fisheries resources and their associated habitats by examining ecological interactions of target species with predators, competitors, and prey species, interactions between fishes and their habitats, and the effects of fishing on these processes. A pragmatic ecosystem-based approach has been developed for the assessment of fisheries resources involving four management objectives: maintaining sustainability, biodiversity, habitat quality, and socio-economic benefits. It is a two-tier analytical system. Tier 1 is designed for situations where sufficient information is available to allow for a quantitative evaluation of the status of the system, whereas Tier 2 is designed for situations where only a semi-quantitative or qualitative assessment is possible. A number of indicators are used to assess ecosystem status. Target and limit reference points were chosen for each indicator to assess the status of species, fisheries and ecosystems. The approach was applied to several ecosystems, and found to be useful in comparing the status of species, fisheries and ecosystems spatially and temporally using an ecosystem perspective. A forecasting version of this approach is in the process of development with an aim to forecast the impacts of fishing activities and climate changes on the ecosystem. PICES has undertaken a new science program, FUTURE, with a goal to develop an understanding of the responses of marine ecosystems in the North Pacific to climate change and human activities, and to forecast ecosystem status based on an understanding of ecosystem functions. Implementation of the FUTURE program will enhance the limited understanding of ecosystem structure and function, and improve the ability to forecast the impacts of human activities and climate on marine ecosystems.

REPORT OF THE FINANCE AND ADMINISTRATION COMMITTEE

The Finance and Administration Committee (hereafter F&A) met from 09:00–13:30 hours on October 28, 2009, under the chairmanship of Ms. Patricia Livingston.

AGENDA ITEM 1
Opening remarks

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

AGENDA ITEM 2
Adoption of agenda
The Committee reviewed and approved the draft agenda without modification (*F&A Endnote 2*).

AGENDA ITEM 3
Audited accounts for *FY* 2008

The *FY* 2008 financial statements were submitted to *Flader, Hale & Hughesman* (formerly *Flader and Hale*, PICES external auditor for 2009–2011) on March 30, 2009, and the Auditor's Report was completed on April 17, 2009. The report (*F&A Endnote 3*) was electronically circulated to all Contracting Parties on April 22, 2009, and hard copies were sent to members of the F&A Committee by mail. In the auditor's opinion, the financial statements are an accurate representation of the financial position of the Organization as of December 31, 2008, and the results of its operations and changes in the fund balances are in accordance with the Canadian generally accepted accounting principles. The auditing process was in line with the PICES Financial Regulations (see *Regulation 11(ii)* and *Regulation 13*). The Committee reviewed the Auditor's Report and recommended it for approval by Council.

AGENDA ITEM 4
Annual contributions

As stated in *Regulation 5(ii)* of the PICES Financial Regulations, all national contributions to PICES "*shall be considered due as of the first day of the financial year (January 1) to which they relate*". The Executive Secretary reported on the 2009 annual fee payment dates, and provided information on the payment of national contributions from 2004 to 209 (*Endnote 4*).

The Committee noted that all Contracting Parties met their financial obligations for *FY* 2009. Even though only Japan, the United States and Canada paid prior to, or immediately after, the due date (January 1, 2009), the timeliness of payment from other Contracting Parties is stable. The Committee again recommended that Council instruct the Executive Secretary to send a letter to Contracting Parties commending their performance in submitting annual contributions for *FY* 2009.

The Committee confirmed its previous recommendation that for planning purposes, Contracting Parties should continue to use the guideline generally accepted at PICES-1999 (Decision 99/A/2(ii)), which states that "*the annual contributions will increase at the rate of inflation in Canada*". This should assist Contracting Parties in preparing timely funding requests to cover annual contributions, and assist the Executive Secretary in developing future budgets.

AGENDA ITEM 5
Fund-raising activities

As current funding constraints from an increase in annual contributions only at the rate of inflation in Canada can impede improvement and development of the Organization, fund-raising continues to be an important component of PICES activities. The level of external funding has increased significantly over the last several years, and a substantial part of the current operational budget is now supported by voluntary contributions, grants and partnerships (30–80% of the total annual contribution by Contracting Parties for the period from 2004 to 2009). All types of contributions are equally valuable to PICES.

The Executive Secretary reported on fund-raising efforts for the period since PICES-2008 (*F&A Endnote 5*) and provided information on the amount of funds in the Working Capital Fund restricted for specific purposes (encumbered funds) for the beginning of *FY* 2009, and the estimated amount of the encumbered funds for the fiscal year end. In reviewing the status of external funding, he put special emphasis on fund raising for the North Pacific Continuous Plankton Recorder (CPR) program, the 2010 PICES/ICES/FAO Symposium on "*Climate change effects on fish and fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies*", capacity building activities (such as the PICES Intern Program and the 2009 Summer School on "*Satellite oceanography*"), and on the voluntary contribution from the Japanese Ministry of Agriculture, Forestry and Fisheries for the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*". It was noted that even though funding of the CPR program has significantly improved in the last 2 years, there is still a shortfall in meeting the target funding level of $250,000 for the project. It was recommended that Council direct the Executive Secretary to write letters soliciting new members for the North Pacific CPR Consortium.

AGENDA ITEM 6
Financing of high priority projects

At PICES-2007, the Committee discussed the use of the encumbered funds designated for high-priority PICES projects and suggested that $40,000 be earmarked for the development of the new PICES integrative scientific program, FUTURE (***F****orecasting and* ***U****nderstanding* ***T****rends,* ***U****ncertainty and* ***R****esponses of North Pacific Marine* ***E****cosystems*), and the remainder ($103,092) be assigned for the preparation of the next North Pacific Ecosystem Status Report (Decision 07/A/3(v)). In 2008, additional funds for both these activities became available. Given current plans, the North Pacific Ecosystem Status Report appears to have sufficient financial support. However, the balance remaining for the development of FUTURE activities is small ($18,872). There was some discussion about the financial needs of FUTURE. Canada suggested that it would be useful for member countries to receive a short list of desired activities for FUTURE that may require funding. Because these activities have not yet been defined by Science Board, the Committee recommended that the surplus funds ($21,105) remaining from the 2008 symposium on "*Effects of climate change on the world's oceans*" be allocated to the general "high priority PICES projects" category. The Committee also recommended that Council direct the Executive Secretary to send a letter to the Contracting Parties which contains information on planned FUTURE activities and a request to make contributions to these activities.

AGENDA ITEM 7
PICES Intern Program

The Executive Secretary informed the Committee that Ms. Tatiana Semenova (Pacific Research Fisheries Centre, Russia) was selected as the 2010/2011 PICES intern.

The Committee reviewed the current status of the Intern Program. It is estimated that at the end of *FY* 2009, the Organization will be holding about $10,000 for the Intern Program. With the current stipend level of $2,000 per month (Decision 07/A/6(iii)), this amount is sufficient to maintain the Program for only 4 months in

2010. Contracting Parties were invited to provide voluntary contributions to support the Intern Program in 2010. In response to this request, the United States, Canada, and Korea committed to contribute US$15,000, CND$10,000, and US$10,000, respectively, to the Trust Fund for the Intern Program. These contributions are sufficient to maintain the Program for a full year without using the registration fee revenue (see Decision 01/A/4(iv)). Given the expected level of funding, the Committee recommended that Council keep the stipend at $2,000 per month and that Ms. Semenova be offered a 12-month term to start as soon as possible after March 1, 2010.

The Committee also recommended that Council instruct the Executive Secretary to invite the Contracting Parties to provide voluntary contributions to support the Intern Program for 2010 and beyond.

AGENDA ITEM 8
Schedule, structure and financing of future Annual Meetings

PICES-2010 will be held from October 22–31, 2010, in Portland, Oregon, U.S.A. The U.S. delegation confirmed that they will not require any funds from the Organization to help offset the costs for the meeting.

The Russian Federation presented the status of planning for PICES-2011. Khabarovsk is the site presently under consideration, which the Executive Secretary will visit in spring of 2010. Some logistical issues with this site were discussed relating to the multiple venues, poster session matters, and the visa application process. The Committee recommended that consideration be given to holding this meeting from October 14–22, 2011, which would be a return to the more traditional time frame of the Annual Meeting.

The Committee recommended that, in keeping with the 6-year rotation cycle (Decision 94/A/6), Council invite Japan to explore the possibility of hosting PICES-2012, and inform the Secretariat on this matter by March 31, 2010.

At PICES-2001 (Victoria, Canada), Council approved the charging of a registration fee for future Annual Meetings of the Organization and indicated that the registration fee structure should be reviewed annually (Decision 01/A/4(iv)). It was agreed that the fees have to be collected by the Secretariat and used to support high priority projects and the Intern Program, and to cover costs associated with Annual Meetings; the allocation among these three purposes should be flexible and decided by the Executive Secretary (Decision 04/A/5(iv)). The Committee reviewed the current registration fee structure that has been unchanged since 2004 and recommended that Council approve a $50 increase in the Regular and Early registration categories but no increase in the Student and Spousal categories.

Type of registration fee	2009 CDN $	2010 CDN $
Regular	225	275
Early	150	200
Student	50	50
Spousal	50	50

At PICES-2005 (Vladivostok, Russia), Council re-iterated its support for the concept of inter-sessional Science Board meetings with the participation of Council members, but suggested that the need for such a meeting should be evaluated each year and that, given meeting costs (including time commitment of the members), an inter-sessional meeting should be held only if the agenda is substantive. The Committee confirmed these views in 2009.

Science Board has already indicated the importance of having an inter-sessional meeting in 2010, to be held in conjunction with the PICES/ICES/FAO symposium on "*Climate change effects on fish and fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies*" to be convened April 26–29, 2010, in Sendai, Japan. The Committee supported this request and recommended that Council approve the 2-day inter-sessional Science Board meeting to be held immediately prior to the symposium.

Japan indicated that it is prepared to host ISB-2010, and Korea noted that it will investigate the possibility of hosting a FUTURE program inter-sessional event in 2010 or 2011.

The Committee was briefed by Dr. Tokio Wada, Chairman of PICES, on the recommendations of the Study Group on *Restructuring of the PICES Annual Meeting*. A slight revision to the wording of recommendation 5.3(b) was suggested for the sake of clarity to read: "*Scientific/Technical Committee Chairmen should circulate to members of the committee a description of the key issues and topics to be covered at the overture and formal meetings, prior to the Annual Meeting*." The Committee also discussed the recommendation 5.4(b) which states that Science Board refrain from converting topic sessions to workshops in the days before the Regular Meeting, and clarified that this recommendation does not preclude high priority workshops be held in the days before the Regular Meeting. The Committee noted that there did not appear to be any negative financial or administrative implications related to the recommendations of this Study Group. It was concluded that the Study Group has completed its assigned task and has developed sufficient alternatives for Council decision with respect to the restructuring of the Annual Meeting. The Committee recommended that Council adopt the final report of the Study Group on *Restructuring the PICES Annual Meeting* and implement recommended changes in the format of the Annual Meeting starting with PICES-2011.

AGENDA ITEM 9
Budget

Estimated accounts for *FY* 2009 (Agenda Item 9a)

The Committee reviewed the estimated accounts for *FY* 2009 and recommended their acceptance by Council, noting that the expenses for "foreign exchange loss" are unknown at this time.

Interest and other income (Agenda Item 9b)

In *FY* 2008, the total income was $540,128. This amount includes $212,703 in voluntary contributions and grants ($173,975 credited to the Working Capital Fund and $38,630 credited to the Trust Fund).

In *FY* 2009, the estimated total income is $576,449. This amount includes $388,048 in voluntary contributions and grants ($350,548 credited to the Working Capital Fund and $37,500 credited to the Trust Fund).

The Committee was informed of the reduction in the amount of interest earned in 2009, which is approximately $18,000 less than that in *FY* 2008.

Relocation and Home Leave Fund (Agenda Item 9c)

At PICES-2007, Council approved the F&A Committee recommendation that the level of the Relocation and Home Leave Fund (RHLF) be allowed to fluctuate between $90,000 and $110,000 to minimize the need for small transfers between funds (Decision 07/A/3(iii)). Given the estimated fund balance of $101,492 on December 31, 2009, no action is required.

Trust Fund (Agenda Item 9d)

In *FY* 2009, the total Trust Fund (TRF) income is estimated at $37,950 ($37,500 in voluntary contributions and grants) and estimated expenses are $69,800. The Committee recommended that Council approve a transfer from the Working Capital Fund to recover the 2009 expenses and restore the Trust Fund to the level of $110,000.

Japanese Trust Fund (Agenda Item 9e)

The Committee reviewed the financial report for *Year 2* (April 1, 2008 to March 31, 2009) of the project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" supported by the voluntary contribution from the Ministry of Agriculture, Forestry and Fisheries (MAFF). This report was submitted to the Fisheries Agency of Japan on July 21, 2009, and the notice on report acceptance was received on August 3.

The status of the MAFF account, for the period from April 1 to December 31, 2008, was assessed during the regular PICES audit for *FY* 2008. In the auditor's opinion, the financial statements are an accurate representation of the financial position of the Organization as of December 31, 2008, and the results of its operations and changes in the fund balances are in accordance with the Canadian generally accepted accounting principles. The financial statements for the rest of *Year 2* of the MAFF project will be evaluated during the regular PICES audit for *FY 2009*.

Working Capital Fund (Agenda Item 9f)

After all approved inter-fund transfers, the amount of funds available in the Working Capital Fund (WCF) on January 1, 2009, was $465,021. This includes $303,830 in encumbered funds and $161,191 in "reserve operating" funds. In *FY* 2009, the total WCF income and expenses are estimated at a level of $546,394 ($350,548 are in voluntary contributions and grants) and $282,965, respectively. After the recommended inter-fund transfers, the amount of funds available in WCF at the fiscal year end will be $586,600. This includes $458,413 in encumbered funds, and $128,187 in "reserve operating" funds.

Budget for *FY* 2010 and forecast budget for *FY* 2011 (Agenda Item 9g)

The Committee reviewed the proposed *FY* 2010 budget of $797,000 (*F&A Endnote 6*) and recommended its approval by Council. The Committee also recommended a transfer of $110,000 from the Working Capital Fund to balance the budget, setting the total annual contribution at $687,000, and the 2010 fees at $114,500 per Contracting Party. These are unchanged from the *FY* 2009 levels.

A 1.5% increase in the annual fees in 2010 had been proposed in order to compensate for the mandatory salary increases that were projected to occur, even though the forecast for the rate of inflation in Canada was close to 0%. There was no agreement among Committee members to recommend the approval of the proposed annual dues increase because it was not consistent with the guideline generally accepted at PICES-1999 (Decision 99/A/2(ii)), stating that "*the annual contribution will increase at the rate of inflation in Canada*". It was also noted that this is the second time in PICES history that the WCF transfer has reached the $110,000 level, and this may continue if mandatory salary increases continue while annual fees remain constant.

The Executive Secretary presented the forecast *FY* 2011 budget of $814,000 and noted that this budget is prepared based on preliminary information available as of September 1, 2009, and is 2.13% higher than the *FY* 2010 budget.

AGENDA ITEM 10
Changes in PICES Rules of Procedure

The Committee reviewed the suggested changes in the PICES Rules of Procedure and recommended that Council approve the changes as proposed to bring the Rules into line with the approved structure for the new PICES integrative science program, FUTURE.

AGENDA ITEM 11
Report on PICES Publication Program Action Plan

The Committee reviewed the progress on implementing the Action Plan for the PICES Publication Program and indicated the notable progress being made on the Plan, especially with respect to PICES branding on the article level in special issues of primary journals. The Committee looks forward to seeing further progress in the coming year.

AGENDA ITEM 12
Administrative matters

The Committee reviewed the status of negotiations for implementing the income tax levy practice for all personnel at the PICES Secretariat and directed the Executive Secretary to continue communications with the British Columbia government on the possibility for an *exgratia grant* equal to the amount of the provincial personal income taxes remitted, which will be paid back to the Organization at the end of each fiscal year.

AGENDA ITEM 13
Space, facilities and services for the PICES Secretariat office

PICES has a Headquarters Agreement with the Government of Canada that entered into force on December 15, 1993. In accordance with this agreement, Fisheries and Oceans Canada (DFO) hosts the PICES Secretariat at the Institute of Ocean Sciences (IOS) in Sidney, British Columbia, Canada. The Executive Secretary provided a report on current arrangements between PICES and DFO/IOS and local companies on general administrative services.

AGENDA ITEM 14
Other business

There was no other business.

AGENDA ITEM 15
Adoption of the F&A report and recommendations to Governing Council

The draft report was circulated and approved by all F&A members. All recommendations to Council were brought forward by Ms. Livingston at the first session of Council on October 31, 2009.

F&A Endnote 1

F&A participation list

Canada
Sylvain Paradis (F&A member)
Laura Richards (F&A member)

Japan
Yukimasa Ishida (advisor)
Harumi Yamada (F&A member)

People's Republic of China
Yingren Li (alternate F&A member)

Republic of Korea
Jeonghwa Kim (advisor)
Chul Park (F&A member)

Russian Federation
Anastasia Mednikova (advisor)
Igor Shevchenko (F&A member)

U.S.A.
Stephen DeVincent (alternate F&A member)

Other
Patricia Livingston (F&A Chairman)
Tokio Wada (PICES Chairman)
Alexander Bychkov (Executive Secretary)

F&A Endnote 2

F&A Committee meeting agenda

1. Welcome and opening remarks
2. Adoption of agenda and meeting procedures
3. Audited accounts for *FY* 2008
4. Annual contributions
5. Fund-raising activities
6. Financing of PICES high priority projects
7. PICES Intern Program
8. Schedule, structure and financing of future Annual Meetings (including review of the report of the Study Group on *Restructuring of the PICES Annual Meeting*)
9. Budget
   a. Estimated accounts for *FY* 2009
   b. Interest and other income
   c. Relocation and Home Leave Fund
   d. Trust Fund
   e. Japanese Trust Fund
   f. Working Capital Fund
   g. Proposed budget for *FY* 2010 and forecast budget for *FY* 2011
10. Changes in PICES Rules of Procedure
11. Progress report on implementation of the PICES Publication Program Action Plan
12. Administrative matters
13. Space, facilities and services for the Secretariat office
14. Other business
15. 2009 F&A report and recommendations to Governing Council

F&A Endnote 3

Audited Accounts for *FY* 2008

FLADER HALE HUGHESMAN
CHARTERED ACCOUNTANTS AND BUSINESS ADVISORS

A PARTNERSHIP:
RICHARD B. FLADER LTD.
SCOTT A. HALE LTD.
ELAINE V. HUGHESMAN LTD.

PROVIDING SOLUTIONS THAT FIT

AUDITORS' REPORT

To the Council of the
North Pacific Marine Science Organization

We have audited the statement of financial position of the North Pacific Marine Science Organization as at December 31, 2008 and the statement of operations and changes in fund balances for the year then ended. These financial statements are the responsibility of the Organization's management. Our responsibility is to express an opinion on these financial statements based on our audit.

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

In our opinion, these financial statements present fairly, in all material respects. The financial position of the Organization as at December 31, 2008 and the results of its operations and changes in fund balances for the year then ended are in accordance with Canadian generally accepted accounting principles.

Flader Hale Hughesman
CHARTERED ACCOUNTANTS

Sidney, B.C.
April 20, 2009

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NORTH PACIFIC MARINE SCIENCE ORGANIZATION
STATEMENT OF FINANCIAL POSITION
AS AT DECEMBER 31, 2008

ASSETS

	2008	2007
CURRENT ASSETS		
Cash and short term deposits (note 4)	$ 1,109,880	$ 939,641
Accounts receivable	7,034	29,264
Prepaid expenses	2,734	2,455
Accrued interest receivable	-	1,393
	$ 1,119,648	$ 972,753

LIABILITIES

CURRENT LIABILITIES		
Accounts payable	$ 38,899	$ 38,588
Funds held for Contracting Parties (note 3)	229,000	111,000
	267,899	149,588

FUND BALANCES

WORKING CAPITAL FUND (note 4)	563,021	450,519
TRUST FUND	110,000	110,000
RELOCATION AND HOME LEAVE FUND	100,862	108,577
MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES FUND	77,866	154,069
	851,749	823,165
	$ 1,119,648	$ 972,753

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
STATEMENT OF OPERATIONS AND CHANGES IN FUND BALANCES
FOR THE YEAR ENDED DECEMBER 31, 2008

	General Fund	Working Capital Fund	Trust Fund	Relocation and Home Leave Fund	Ministry of Agriculture, Forestry and Fisheries Fund	2008 Total	2007 Total
FUND BALANCES, beginning of year	$ -	$ 450,519	$ 110,000	$ 108,577	$ 154,069	$ 823,165	$ 629,670
SOURCES OF FUNDS							
Contributions from Contracting Parties	657,475	-	-	-	-	657,475	651,000
Budgeted transfer to General Fund (note 5)	96,000	(96,000)	-	-	-	-	-
Additional transfer to General Fund (note 5)	8,525	(8,525)	-	-	-	-	-
Voluntary contributions and grants (note 6)	-	173,975	38,728	-	161,466	374,169	435,698
Interest and other income (note 7)	-	321,567	3,102	2,756	1,746	329,171	342,599
Foreign exchange gain (note 10)	28,831	-	-	-	-	28,831	-
	790,831	391,017	41,830	2,756	163,212	1,389,646	1,429,297
FUND BALANCES, before expenditures	790,831	841,536	151,830	111,333	317,281	2,212,811	2,058,967
EXPENDITURES							
Personnel services	500,080	-	-	-	-	500,080	495,688
Annual Meeting	40,000	11,991	-	-	-	51,991	115,049
Special meetings/travel	118,136	38,023	35,751	-	-	191,910	426,916
Publications	54,489	-	-	-	-	54,489	68,432
Communication	25,927	-	-	-	-	25,927	51,992
Office and administration	18,206	-	-	-	-	18,206	19,041
Projects (note 8)	-	237,575	-	-	-	237,575	17,187
Intern program	-	-	30,998	-	-	30,998	27,153
Relocation	-	-	-	10,471	-	10,471	-
MAFF Fund expenditures (note 9)	-	-	-	-	239,415	239,415	-
Foreign exchange loss (note 10)	-	-	-	-	-	-	14,344
	756,838	287,589	66,749	10,471	239,415	1,361,062	1,235,802
NET FUNDS AVAILABLE	33,993	553,947	85,081	100,862	77,866	851,749	823,165
TRANSFER TO							
WORKING CAPITAL FUND (note 4)	(33,993)	33,993	-	-	-	-	-
INTERFUND TRANSFERS (note 5)	-	(24,919)	24,919	-	-	-	-
FUND BALANCES, end of year	$ -	$ 563,021	$ 110,000	$ 100,862	$ 77,866	$ 851,749	$ 823,165

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 2008

PURPOSE OF ORGANIZATION

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

ACCOUNTING POLICIES

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

(a) Fund Accounting

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

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

The Relocation and Home Leave Fund was established in 1995 to pay relocation and home leave expenses of new employees and their dependents to the seat of the Secretariat and removal after period of employment has ended, and to provide home leave for international staff. The fund balance must be maintained between $90,000 and $110,000.

The Ministry of Agriculture, Forestry and Fisheries Fund was established in 2007. The Ministry of Agriculture, Forestry and Fisheries of Japan, through the Fisheries Agency has provided voluntary contributions for a project dedicated to the development of the prevention systems for harmful organisms in the Pacific Rim.

(b) Capital Assets

Capital assets acquired by the Organization are expensed in the year of acquisition. During the current year the Organization purchased $4,997 of capital assets.

(c) Contributions

Contributions from Contracting Parties are recorded in the year in which they relate to. All other contributions and grants are recorded in the year received. Refer to Note 4 for contributions restricted for specific designated projects.

(d) Income Tax

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

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 2008

(e) Foreign Exchange

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

(f) Financial Instruments

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

(g) Use of Estimates

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

3. FUNDS HELD FOR CONTRACTING PARTIES

The funds held for Contracting Parties are advance contributions from Japan in the amount of $114,500 and U.S.A. in the amount of $114,500.

4. WORKING CAPITAL FUND

Of the total amount in the Working Capital Fund, $303,830 of cash and short term deposits is restricted for specific designated projects.

Pursuant to decision 08/A/3(ii) of the Governing Council, $98,000 of the funds held in the Working Capital Fund will be transferred to the General Fund at the beginning of the 2009 fiscal year to balance the budget, setting the total annual contribution at $687,000, and the 2009 annual fee at $114,500 per Contracting Party.

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

5. INTERFUND TRANSFERS

The Governing Council approved the transfer of $96,000 at the beginning of 2008 from the Working Capital Fund to the General Fund (Decision 07/A/3/ii) to balance the budget, setting the total annual contribution at $666,000, and the 2008 annual fee at $111,000 per Contracting Party.

All Contracting Parties met their financial obligations in 2008, except the United States. An additional transfer of $8,525 was transferred to the General Fund from the Working Capital Fund to compensate for the arrears payment.

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 2008

5. INTERFUND TRANSFERS, continued

The Governing Council approved the transfer of funds from the Working Capital Fund to restore the Trust Fund to $110,000 by the end of 2008 (Decision 08/A/3/iv). The amount of the transfer was $24,919.

6. VOLUNTARY CONTRIBUTIONS AND GRANTS

	Working Capital Fund	Trust Fund
Contributions for the North Pacific Ecosystem Status Report:		
KORDI (Korea)	$ 40,508	$ -
NPRB (U.S.A.)	53,123	-
NMFS (U.S.A.) contribution for the development of FUTURE	23,724	-
NOAA (U.S.A.) contribution for the Climate Change Symposium	52,720	-
SAHFOS (UK) contributions for the North Pacific CPR Project	500	-
SCOR contribution for PICES Special Publication No. 3	3,400	-
Contributions for the Intern Program:		
KORDI (Korea)	-	10,127
NMFS (U.S.A.)	-	15,816
SCOR travel grant for the Climate Change Symposium	-	7,493
SCOR travel grant for PICES XVII	-	5,292
	$ 173,975	$ 38,728

7. INTEREST AND OTHER INCOME

	Working Capital Fund	Trust Fund	Relocation and Home Leave Fund	Ministry of Agriculture, Forestry and Fisheries Fund
Interest income	$ 17,927	$ 3,102	$ 2,756	$ 1,746
Income tax levies	66,819	-	-	-
GST, PST & WCB rebates	5,449	-	-	-
Overhead from MAFF project	18,500	-	-	-
Registration Fees:				
PICES XVII	57,488	-	-	-
Climate Change Symposium	155,335	-	-	-
Other income	49	-	-	-
	$ 321,567	$ 3,102	$ 2,756	$ 1,746

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 2008

8. PROJECTS

The expenditures in the Working Capital Fund for projects were funded by voluntary contributions designated for the respective projects.

2008 Climate Change Symposium	$ 197,013
Development of FUTURE	24,337
North Pacific CPR Project	500
North Pacific Ecosystem Status Report	8,846
Publications (2006 CCCC Symposium special issue)	6,879
	$ 237,575

9. MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES FUND EXPENDITURES

Special meetings	$ 65,817
Contractual services	105,832
Equipment	49,108
Overhead to PICES	18,500
Miscellaneous	158
	$ 239,415

10. FOREIGN EXCHANGE GAIN / LOSS

At year end all funds held in foreign currency (US $84,773) are converted to Canadian dollars using the December 31st exchange rate. A foreign exchange gain has been reported on the current year financial statements; this amount is an unbudgeted item which has been caused by the ongoing fluctuations in the US dollar (2008 = 1.2246, 2007 = 0.9881), and not by the actual purchase or sale of any foreign currencies.

11. UNFUNDED PENSION LIABILITY

The Organization holds a pension plan for its employees with the International Fisheries Commissions Pension Society. An actuarial valuation report was prepared as at January 31, 2008 and showed an unfunded pension liability for PICES of $208,000. This liability is being paid in monthly instalments over a period of 15 years. The total amount payable in each of the next five years is $25,200.

12. COMPARATIVE FIGURES

Certain balances of the preceding period have been reclassified, where applicable, to conform to the presentation used in the current year. The changes do not affect prior year earnings.

NORTH PACIFIC MARINE SCIENCE ORGANIZATION
NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 2008

13. FINANCIAL STATEMENTS

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

F&A Endnote 4
Payment schedule of annual contributions, 2004 to 2009[1]

	Canada	*China*	*Japan*	*Korea*	*Russia*	*U.S.A.*
2004	Jan. 5, 04	**Aug. 10, 04**	Dec. 26, 03	Mar. 24, 04	Mar. 2, 04	**Feb. 9, 04**[2]
2005	Dec. 24, 04	**Sept. 22, 05**[3]	Mar. 2, 05	Mar. 30, 05	**Mar. 31, 05**[4]	Jan. 10, 05
2006	Dec. 28, 05	**Aug. 1, 06**	Dec. 15, 05	Feb. 8, 06	Feb. 28, 06	Jan. 30, 06
2007	Jan. 23, 07	**July 3, 07**	Dec. 5, 06	Apr. 3, 07	Feb. 13, 07	Jan. 10, 07
2008	Jan. 16, 08	**May 15, 08**	Dec. 20, 07	Feb. 15, 08	Feb. 13, 08	**Jan. 7, 08**[5]
2009	Jan. 5, 09	**June 3, 09**	Dec. 11, 08	Apr. 1, 09	Mar. 27, 09	Dec. 24, 08

[1] payments made later than in the first quarter of the PICES fiscal year or partial payments are indicated in bold
[2] partial (50%) payment, remainder paid September 8, 2004
[3] partial (86%) payment, remainder paid December 30, 2005
[4] partial (96.6%) payment, remainder paid April 25, 2005
[5] partial (92.3%) payment, remainder paid on May 22, 2009

F&A Endnote 5
External funding and voluntary contributions received since PICES-2008

Special projects

- The Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan, contributed CDN$187,505 for Year 3 (from April 1, 2009–March 31, 2010) of the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*". The anticipated duration of the project is 5 years (from April 1, 2007 to March 31, 2012), with a total funding at the level of approximately $900,000.
- Several organizations contributed to the North Pacific Continuous Plankton Recorder (NP CPR) project (for full usage of the information available in the data funding at the level of $250,000 per year is required):
  - Fisheries and Oceans Canada (DFO) provided CDN$75,000 for operations of the NP CPR project in 2008–2009. This support is intended to continue into the future at the level of $50,000 per year.
  - The North Pacific Research Board (NPRB, U.S.A.) provided US$50,000 for operations of the NP CPR project in 2009. This support is intended to continue at the same level for the next 5 years.
  - The *Exxon Valdez* Oil Spill Trustee Council (EVOSTC) approved funding in the amount of US$205,600 for operations of the NP CPR project in 2009–2012 (Project on "*Measuring interannual variability in the herring's forage base from the Gulf of Alaska*"). The amount for 2009–2010 is US$61,900, and progress on the project has to be assessed prior to the next fiscal year.
  - The Sir Alister Hardy Foundation for Ocean Science (SAHFOS, UK) agreed to cover 2009 salaries for a Principle Investigator and a technician for the North Pacific CPR project.
  - The Japanese Society for Promotion of Science (JSPS) provided a 5-year (2009–2013) grant equal to about US$400,000 to analyze samples collected by the North Pacific CPR project for the western Pacific.
- The Korea Ocean Research and Development Institute (KORDI) and the National Fisheries Research and Development Institute of Korea (NFRDI) hosted and provided additional support for the workshop on "*Status and trends in East Asian Marginal Seas*" held April 21–22, 2009, as a part of the development of the next PICES North Pacific Ecosystem Status Report.

Symposia/sessions/workshops

- Several organizations/institutions provided or committed financial support for the PICES/ICES/FAO Symposium on "*Climate change effects on fish and fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies*" to be held April 26–29, 2010, in Sendai, Japan (funds marked by * will go through PICES accounts):

- Fisheries and Oceans Canada (DFO) – CDN$20,000* (to be paid in early 2010)
- Fisheries Research Agency of Japan (JFA) – JPY 1,500,000
- Food and Agriculture Organization of the United Nations (FAO) – US$10,000
- Hokkaido University Global Center of Excellence Program on "Establishment of Center for Integrated Field Environmental Science" (HUGCOE) – JPY 1,500,000
- International Pacific Halibut Commission (IPHC) – US$6,000*
- Intergovernmental Oceanographic Commission of UNESCO (IOC) – US$10,000
- Korea Ocean Research and Development Institute (KORDI) – KRW 3,000,000*
- National Institute of Environmental Studies of Japan (NIES) – US$7,000
- National Marine Fisheries Service of NOAA (NMFS) – US$50,000*
- North Pacific Anadromous Fish Commission (NPAFC) – CDN$6,000*
- North Pacific Research Board (NPRB) – US$30,000*
- Pacific Salmon Foundation (PSF) – CDN$5,000*
- Scientific Committee on Oceanic Research (SCOR) – US$5,000* (to be paid in early 2010)
- Sendai Tourism and Convention Bureau (STCB) – US$8,000
- University of Hamburg Integrated Climate System Analysis and Prediction (CLiSAP) – €4,000
- The World Bank (WB) – US$10,000

- The U.S. National Marine Fisheries Service (NMFS) and U.S. Department of State provided US$50,000 (CDN$55,000) and US$51,000 (CDN$55,354), respectively, for PICES-2010 to be held October 22–31, 2010, in Portland, Oregon, U.S.A.
- Argo (International Program for Deployment of Profiling Floats), CLIVAR (Climate Variability and Predictability Program), GOOS (Global Ocean Observing System), ICES (International Council for the Exploration of the Sea), IMBER (Integrated Marine Biogeochemistry and Ecosystem Research), ESSAS (Ecosystem Study of Sub-Arctic Seas), NOWPAP (Northwest Pacific Action Plan), and SOLAS (Surface Ocean Low Atmosphere Study) accepted PICES' invitation to co-sponsor (by covering travel of additional invited speakers and/or convenors) relevant sessions/workshops held at PICES-2009.

Capacity building

- DFO (Canada) and NMFS (U.S.A.) contributed CDN$10,000 and US$15,000 (CDN$16,500), respectively, to the Trust Fund to support the PICES Intern Program.
- SCOR provided a grant of US$10,000 to support participation of scientists from countries with "economies in transition" in the 2009 PICES Summer School on "*Satellite oceanography in the marine environment*" (August 25–28, 2009, Seoul, Korea) and in SCOR-relevant sessions and/or workshops at PICES-2009.
- Several Korean organizations/programs (East Asian Seas Time Series-1 Program, Brain Korea 21 Program, Seoul National University, Ministry of Land, Transport and Maritime Affairs, Korea Ocean Research and Development Institute, Korea Meteorological Administration, and National Fisheries Research and Development Institute) provided major funding for the 2009 PICES Summer School on "*Satellite oceanography in the marine environment*". Additional support was committed by the Special Monitoring and Coastal Environmental Assessment Regional Activity Centre of the Northwest Pacific Action Plan (CEARAC/NOWPAP).

Operations of the PICES Secretariat

- A 10% overhead ($16,147) of the *Year 2* budget ($161,466) and 13% overhead ($24,375) of the *Year 3* budget ($187,505) for the PICES project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" was retained to offset expenses related to the Secretariat's involvement in the project.

F&A Endnote 6

Proposed *FY* 2010 budget

Sources for General Fund (GNF)	
Contributions from six Contracting Parties	687,000 (2010 Annual fee for each Contracting Party is $114,500)
Transfer from Working Capital Fund	110,000
Total	**797,000**

Category	**GNF Allotment**	**WCF Allotments**
Personnel Services	525,000	
Annual Meeting	20,000	encumbered funds as needed/available
Special Meetings/Travel	125,000	encumbered funds as needed/available
Publications	70,000	
Communications	33,000	encumbered funds as needed/available
Office/Administrative Expenses	24,000	
Projects		encumbered funds as needed/available
Total	**797,000**	

REPORT OF SCIENCE BOARD

The Science Board (*SB Endnote 1*) met from 1230–1430 h on October 25, 2009 in Jeju, Korea, a to review the first part of its meeting agenda (*SB Endnote 2*) and to discuss items concerning the upcoming scientific sessions, awards, and the Closing Session at the Annual Meeting. Science Board met again October 31 from 900–1730 h to discuss the remainder of the agenda. Chairman, Dr. John Stein, welcomed guests and members and called the meeting to order. The agenda was discussed and adopted as presented.

Skip McKinnell, Mikhail Stepanenko, Gongke Tan, Glen Jamieson, Sinjae Yoo, Harold (Hal) Batchelder, John Stein, Michael Dagg, Hiroya Sugisaki, Michael Foreman, Hiroaki Saito, Mitsutaku Makino, Bernard Megrey

October 25, 2009

AGENDA ITEM 2
Review of procedures for Science Board Symposium, Topic Session awards, and Closing Session

Past practices were reviewed and it was agreed that the format of the previous year would be used in judging oral and poster presentations for the Science Board Symposium and topic sessions. Where topic sessions were co-sponsored by one or more Committees, the Chairman gave responsibility for judging to one of the Committees.

AGENDA ITEM 3
Relations with specific international programs/organizations

Drs. Wolfgang Fennel, President, and Ed Urban, Executive Director, of SCOR, were unable to attend the Science Board meeting, but conveyed the following by email:

- SCOR appreciates the contributions of PICES to SCOR activities and looks forward to continued interaction.
- SCOR has approved US$5000 for the PICES symposium on climate and fisheries and another $5000 for SCOR-related sessions at the PICES-2010 Annual Meeting for travel of scientists from developing countries, Russia, and Eastern Europe to these meetings.

- PICES is welcome to co-sponsor SCOR working groups, if it is willing and able to contribute appropriate funding for groups that are global in scope.
- SCOR has created a Working Group on *Patterns of Phytoplankton Dynamics in Coastal Ecosystems: Comparative Analysis of Time Series Observations*, and welcomed the offer from PICES to support an Associate Member of the group.

Science Board unanimously supported SCOR's Working Group and unanimously decided to have Science Board Vice-Chairman, Dr. Sinjae Yoo, serve as an Associate Member in the Working Group.

ICES observer, Dr. Michael Sinclair, emphasized that ICES has a keen interest in continued collaboration with PICES. He discussed the idea of holding another joint ICES/PICES Early Career Scientist Conference with ICES, which Science Board unanimously endorsed. Each Committee Chairman was asked to nominate three Early Career Scientists to serve on its SSC before the next Science Board meeting on October 31.

AGENDA ITEM 4
Implementation of Science Board recommendations and Governing Council decisions

Science Board accepted the report on decisions and recommendations that were of relevance from PICES-2008 (see *GC Appendix A*) and the 2009 inter-sessional Science Board meeting.

AGENDA ITEM 5
Update on Study Group on *Restructuring of the PICES Annual Meeting*

Dr. Stein instructed Science Board members to review the October 8, 2009 version of the report prepared by the Study Group on *Restructuring of the PICES Annual Meeting* and be prepared to discuss recommendations at the next Science Board meeting.

October 31, 2009

AGENDA ITEM 5
Update on Study Group on *Restructuring of the PICES Annual Meeting* (continued)

Science Board reviewed the report prepared by the Study Group on *Restructuring of the PICES Annual Meeting* and had no substantive comments on its recommendations.

AGENDA ITEM 6
Report on Elections in Committees and other expert groups

Dr. Glen Jamieson, Chairman of the MEQ Committee, did not seek a second term. Dr. Steve Rumrill (U.S.A.) was elected to succeed Dr. Jamieson and Dr. Mitsutaku Makino (Japan) was elected as Vice-Chairman. The following is a list of changes of Chairman/Vice-Chairman for other Scientific and Technical Committees and expert groups:

- Dr. Thomas Therriault nominated by Science Board to act a Chairman of the FUTURE Advisory Panel on *Anthropogenic Influences on Coastal Ecosystems*
- Dr. Hiroaki Saito nominated by Science Board to act a Chairman of the FUTURE Advisory Panel on *Climate, Oceanographic Variability and Ecosystems*;
- Mr. Robin Brown nominated by Science Board to act a Chairman of the FUTURE Advisory Panel on *Status, Outlooks, Forecasts, and Engagement*.

AGENDA ITEM 7
Election of Science Board Chairman

At the Science Board Chairman's discretion, an election was scheduled for PICES-2009 to appoint a Chairman-elect. No nominations were received by the deadline. Rule of Procedure Rule 17(i) stipulates that *qualified candidates nominated, or seeking, to be elected as Chairman of the Science Board shall submit their credentials (curriculum vitae and letter of justification) in writing to the Executive Secretary at least 60 days prior to the start of an annual meeting at which said election will occur*. After the deadline, representatives of the Government of the Republic of Korea nominated Science Board Vice-Chairman, Dr. Sinjae Yoo for the position of Science Board Chairman. Science Board voted unanimously to waive the 60-day requirement for nominations and unanimously endorsed Dr. Yoo as the Science Board Chairman-elect.

AGENDA ITEM 8
Relations with specific international programs/organizations (continued)

The Scientific Steering Committee of IMBER (Integrated Marine Biogeochemistry and Ecosystem Research) proposed a memorandum of understanding (MOU) between it and PICES, which would ensure FUTURE as a regional project. Science Board noted that PICES normally enters into MOUs on a peer-to-peer basis. Since IMBER is a project of SCOR, Science Board agreed that an MOU would not be appropriate at this time, but recommended that the Secretariat send a letter to IMBER stating that PICES would be willing to cooperate with it in areas of joint interest. Science Board recommended co-sponsoring IMBER IMBIZO II, to be held October 10–14, 2010 in Crete.

Dr. Jamieson, Chair of MEQ, requested *ex-officio* membership in HAB-S for a NOWPAP-CERAC member (Dr. Takifumi Yoshida) and for an ICES HAB Working Group member. Dr. Bern Megrey, Chair of TCODE, requested that Edward Vanden Berghe of OBIS (Ocean Biogeographic Information System) be appointed as an ex-officio member of TCODE.

AGENDA ITEM 9
Reports from FUTURE Advisory Panels

Science Board reviewed the reports of the FUTURE Advisory Panels on *Climate, Ocean Variability and Ecosystems* (COVE), *Anthropogenic Influences on Coastal Ecosystems* (AICE), and *Status, Outlooks, Forecasts and Engagements* (SOFE). On October 27, 2009 each group met separately for 2 hours to review their roles, Terms of Reference of expert groups relevant to their charge, to discus what might be the initial advice on the next steps of FUTURE, and to identify two candidates for AP Chair. The Advisory Panels then met jointly for 2½ hours to discuss their relationship to Science Board, what role they will play in providing advice on the priorities of FUTURE, and what processes and next steps to take, including:

- Meeting individually for 3½ hours and jointly for 1½ hours before an Annual Meeting;
- Provide advice to Committees on high priority topic sessions that will further the implementation of FUTURE. Topic sessions of high priority to FUTURE will be co-sponsored by a relevant Committee and FUTURE;
- AP Chairs working with their members to set terms of reference and to develop a work plan which will be reviewed by Science Board before the next inter-sessional Science Board meeting for conditional approval at the meeting;
- Developing operating procedures to describe a process for AP meetings, their interaction with expert groups, and how Science Board will operate as the SSC for FUTURE.

Science Board selected the following to chair the FUTURE Advisory Panels: Dr. Hiroaki Saito (COVE), Dr. Thomas Therriault (AICE), and Mr. Robin Brown (SOFE). Science Board recommended that the chairmen serve for a 3-year term, but that they would not rotate off at the same time. To do this initially, the chair of one AP would continue for 4 years, after which time the 3-year rotation would apply to everyone. In order for

modelling to have a higher visibility in FUTURE, Science Board recommended that the APs discuss and formulate recommendations for the role of modelling in PICES, and to recommend what type of expert group would be best for fitting the needs of modellers.

Science Board agreed that the name "FUTURE" would be added to any topic sessions or workshops that were co-sponsored by any of the FUTURE Advisory Panels.

Action:
FUTURE APs to make recommendations on how best to fit modelling expertise into FUTURE and what is the best type of expert group for modelling needs.

AGENDA ITEM 10
FUTURE SSC-Planning for 2010 Inter-sessional Science Board meeting

Science Board will meet from April 23–24, 2010 in Sendai, Japan, prior to the PICES/ICES/FAO Symposium on "*Forecasting climate change impacts on fish and shellfish*" (April 25–29). Because of Science Board's new role as SSC for FUTURE, at least one day will be devoted to activities related to FUTURE. Since it is usual for a host country of an Annual Meeting to be the host the inter-sessional Science Board meeting, Korean Delegates agreed that it was reasonable for Japan to hold the symposium and meeting at the same venue. In lieu of hosting the meeting, Dr. Yoo informed Science Board that Korea would support an activity related to FUTURE in 2010 in Korea.

AGENDA ITEM 11
High priority items for Science Board to Governing Council

Proposed new groups
A Study Group on *Human Dimensions* (SG-HD) was recommended by Science Board at ISB-2009 and was provisionally approved by Council once minor modifications were implemented. The proposed SG Chairman, Dr. Mitsutaku Makino, was invited by Science Board to describe its objectives (see *SB Endnote 3*). There was consensus among Science Board members that the Study Group will provide value to PICES by encouraging better understanding between social and natural scientists.

Science Board did not support a proposal by MEQ for the establishment of PULSE (PICES Understanding, Linking and Synthesis of Ecosystems) as an ongoing expert group at this time. It was recommended instead that SG-HD revise its terms of reference slightly to incorporate a social science linkage to ecosystem-based fisheries management.

The proposed PICES/ICES Study Group on *Strategic Planning* (later renamed to *Framework*) *for Scientific Cooperation in the Northern Hemisphere Marine Science* garnered approved in principle from Council. It will allow for enhanced cooperation between ICES and PICES and serve as a basis for linkages of their science plans and the longer-term planning by the two organizations. Science Board and the Secretariat will work with ICES to finalize the terms of reference, timelines and membership for the group (Decision 09/S/10(iii)) (*SB Endnote 4*).

For PICES to have a higher profile and improve its relevance to the scientific community, Science Board recommended that all appropriate Working Groups and other expert groups should amend their terms of reference to include the development of a product that would communicate their activities to a lay audience. It would be posted on the PICES website and Science Board could determine if it should be developed into a brochure. Because of budget implications involved with publication and translation into other languages, Dr. Dagg volunteered to approach NPRB for financial support to assist in producing a limited number of such documents. This would help PICES test the feasibility of brochures as an outreach tool.

Final reports by the Working Group on *Ecosystem-based Management and its Applications to the North Pacific* (WG 19) and Advisory Panel on *Micronekton Sampling Inter-calibration Experiment* (MIE-AP) were completed and approved by their parent Committees. The final report by the *Climate Forcing and Marine Ecosystem* Task Team is incomplete because some regional chapters have been received. Science Board recommended disbanding these three expert groups.

Action:
Dr. Dagg to write a proposal to NPRB to ask for financial support in producing a 2-page outreach document.

Sponsorship or co-sponsorship of inter-sessional meetings/workshops/symposia

- Second PICES Harmful Algal Bloom training course, February 10–19, 2010, Guatemala-City, Guatemala;
- POC/BIO Workshop on *Carbon data synthesis (II)*, June 2010, Japan or U.S.A.;
- IMBER Summer School on "*Oceans, marine ecosystems, and society facing climate change: A multidisciplinary approach*" (ClimECO2) sponsored by CNRS, Europole Mer., IRD, PICES and UBO, August 23–27, 2010, Brest, France;
- Meeting of the Study Group on *Human Dimensions*, June 2010, Japan
- CREAMS/PICES EAST-II (East Asian Seas Time Series) Workshop, September 11–12, 2010, Gangnueng, Korea;
- IMBER IMBIZO II on "*Integrating biogeochemistry and ecosystems in a changing ocean: Regional comparisons*", co-sponsored by PICES, October 10–14, 2010, Crete;
- 2 ICES/PICES theme sessions on *Impact of climate variability on marine ecosystems: Understanding functional responses to facilitate forecasting*" and "*Development and use of ocean observing and forecasting systems in coastal and marine management* at the ICES 2010 Annual Science Meeting, October 22-31, 2010, Nantes, France;
- Second ESSAS Open Science Meeting on "*Comparative studies of climate effects on polar and sub-polar ocean ecosystems: Progress in observation and prediction*", (organizational support by PICES) June 2011, Seattle, U.S.A.;
- PICES/ICES joint Strategic Planning Workshop (postponed);

High priority projects

No new high priority projects were proposed.

Attendance at inter-sessional meetings/workshops/symposia

- 1 MONITOR representative to attend a Sustained Arctic Ocean Network (SAON) meeting, March 16–19, 2010, Miami, U.S.A.;
- 1 MONITOR representative to attend an ICES/GOOS Working Group meeting, April 20–21, 2010, Woods Hole, U.S.A.;
- 1 WG 20 member to attend PICES/ICES/FAO Symposium on "*Climate change effects on fish and fisheries*", April 25-29, 2010, Sendai, Japan;
- 2 experts to attend the POC/BIO Workshop on *Carbon data synthesis (II)*, June 2010, Japan or U.S.A.;
- 6 early career scientists (1 from each member country) to attend the IMBER Summer School on "*Oceans, marine ecosystems, and society facing climate change: A multidisciplinary approach*" (ClimECO2) sponsored by CNRS, Europole Mer., IRD, PICES and UBO, August 23–27, 2010, Brest, France;
- 2 invited speakers to attend a CREAMS/PICES EAST-II Workshop, September 11–12, 2010, Gangnueng, Korea;
- 1 WG 20 member to attend the 2010 ESSAS Annual Science Meeting, September 2010, Reykjavik, Iceland;
- 3 PICES scientists to attend 2 ICES/PICES theme sessions on *Impact of climate variability on marine ecosystems: Understanding functional responses to facilitate forecasting*" and "*Development and use of*

ocean observing and forecasting systems in coastal and marine management at the ICES 2010 Annual Science Meeting, October 22-31, 2010, Nantes, France;
- 3 invited speakers to attend the second IMBER IMBIZO on "*Integrating biogeochemistry and ecosystems in a changing ocean: Regional comparisons*", October 10–14, 2010, Crete;
- 4 early career scientists to attend the second ESSAS Open Science Meeting on "*Comparative studies of climate effects on polar and sub-polar ocean ecosystems: Progress in observation and prediction*", June 2011, Seattle, U.S.A.;
- rental of an off-site AdHost server, to hold the federated metadata library and PICES publications, on an annual, rather than monthly basis. (Annual cost will be $2050 and the savings will be about 12%.)

Publications

No new publications were proposed for 2010. A Working Group on *Non-indigenous Aquatic Species* (WG 21) atlas on NIS (in CD format) is proposed for 2011.

AGENDA ITEM 12
PICES-2010, Portland, Oregon

Science Board agreed, in principle, with the proposed theme for PICES-2010, *North Pacific ecosystems today, and challenges in understanding and forecasting change,* to be held in Portland, Oregon, U.S.A. from October 22–31, 2010. The following sessions and workshops, in order of Committee, were recommended to be convened.

¾-day Science Board Symposium
North Pacific ecosystems today, and challenges in understanding and forecasting change

1-day BIO Topic Session (co-sponsored by IMBER)
Understanding the role of iron in regulating biogeochemical cycles and ecosystem structures in the North Pacific Ocean

½-day BIO Topic Session (co-sponsored by CoML)
The Practical Handbook at 50: A celebration of the life and career of Tim Parsons

½-day BIO Topic Session
Census of Marine Life: Exploring ocean life. Past, present and future

1-day BIO Contributed Paper Session

2-day BIO Workshop (co-sponsored by ESSAS)
Workshop on marine ecosystem inter-comparisons III

½-day FIS Topic Session
Oceanographic and demographic processes affecting the reproductive biology of exploited marine stocks

1-day FIS/BIO Topic Session
Observations of ecosystem mixing under climate change

1-day FIS/MEQ Topic Session (co-sponsored by NMFS)
Economic relation between marine aquaculture and wild capture fisheries

1-day FIS/POC/BIO Topic Session (co-sponsored by ICES)
Impact of climate variability on marine ecosystems: Understanding functional responses to facilitate forecasting

1-day FIS Contributed Paper Session

½-day FIS Workshop
Beyond Lagrangian: Modeling migratory fish behavior in GCMs

½-day MEQ Topic Session
Integrating non-indigenous species with other anthropogenic influences

½-day MEQ Topic Session
New and emerging technologies: Applications of genomics for marine ecosystem studies

½-day MEQ/FIS Topic Session
Identifying vulnerable marine ecosystems in the North Pacific

1-day MEQFUTURE Topic Session (co-sponsored by IMBER)
Characterization, understanding, and forecasting the influence of multiple stressors in coastal ecosystems (later renamed to *Anthropogenic forcing in the North Pacific coastal ecosystems: Understanding changes in the ecosystem structure and function*)

½-day MEQ/POC/FUTURE Topic Session
Marine renewable energy development in coastal and estuarine environments around the North Pacific

½-day MEQ Workshop and ½-day lab demonstration
New technologies and methods in HAB detection: I. HAB species detection

1-day MONITOR Topic Session (co-sponsored by ICES)
Development and use of ocean observing and forecasting systems in coastal and marine management

1-day POC/BIO/MONITOR/FUTURE Topic Session
Comparing the two major gyres of the subarctic North Pacific - Seasonal and interannual variability and its predictability

½-day POC/MEQ/FUTURE Topic Session
Comparing the two major gyres of the subarctic North Pacific – Seasonal and interannual variability and its predictability

1-day POC Contributed Paper Session

½-day POC Workshop
PICES Working Group on Evaluations of Climate Change Projections (Working Group 20): Progress and FUTURE

2-day POC/BIO Workshop
Carbon data synthesis (III)

TCODE E-Poster Session

Science Board recommended that proceedings from the 2010 Science Board Symposium and related papers from Topic Sessions be submitted to an Elsevier journal in time for publications to be referenced in the next IPCC AR5 slated for 2013.

AGENDA ITEM 13
Selection of PICES-2011, Theme

Science Board requested more time for further thought on refining the theme for PICES-2011 entitled "*Mechanisms of ecosystem reorganization in the North Pacific Ocean*" (*SB Endnote 5*) in order that Dr. Dagg could edit the theme. The venue for the Annual Meeting is tentatively Khabarovsk, Russia. Science Board discussed whether the city would be able to meet the needs of the meeting as the distance between venues would not allow participants to mover easily between sessions unless a form of transportation such as shuttle buses were used. It was agreed that the proposed venue needs further thought.

Action:
Dr. Dagg to edit PICES-2011 theme for clarity.

AGENDA ITEM 14
High priority PICES activities

Dr. Skip McKinnell, co-editor of the North Pacific Ecosystem Status Report (NPESR), informed Science Board that the NPESR will be composed of 9 regional chapters and a synthesis/overview. One regional chapter was still outstanding but the Lead Author had indicated that it would be completed. Members of the NPESR synthesis team (editors, lead authors and invited experts) will meet at a workshop from December 1–3, 2009 in Honolulu, U.S.A. to review the regional chapters and develop a draft synthesis of the results. It will also provide an opportunity for the chapters to be formally reviewed by the team. The final text and figures will be ready for publication by March 2010.

Dr. Sinjae Yoo reported on PICES's involvement in the IMBER summer school on "*Oceans, marine ecosystems, and society facing climate change: A multidisciplinary approach*" (ClimECO2) that will take place August 23–27, 2010 in Brest, France. By having PICES involved with IMBER in a usually Eurocentric event, it is hoped that the number of participating countries and scientific cultures will be broadened, thereby increasing PICES capacity building. Science Board recommended that PICES provide travel support for one early career scientist from each member country. Dr. Yoo will ask each member country to set up a review process for applicants. Science Board nominated early career scientists Hanna Na (Korea), Naoki Yoshie (Japan), and Bryan Black (U.S.A.), with Lu Guan (Canada) as an alternate, to be on the Scientific Steering Committee. It was also proposed that PICES/ICES consider and discuss having one or two members from the previous ECS Conference of 2007 held in Baltimore, U.S.A. to serve as mentors or advisors to the SSC.

AGENDA ITEM 15
PICES Strategic Plan/Committee Action Plans – Align with FUTURE

Since FUTURE is the next major scientific plan of PICES, and should be structured to appeal to all the science elements of the Organization, the PICES Strategic Plan will need to be revised. Accordingly, Committee Action Plans will also need to be revised to align with the Strategic Plan. A Study Group on *Updating the PICES Strategic Plan* was formed under Governing Council at PICES-2009. To help with the study, Science Board recommended establishing a subgroup from among the Committee members to review and decide how to align the Strategic Plan with the goals and objectives of FUTURE. The subgroup will be composed of Drs. Bern Megrey, John Stein and Sinjae Yoo who will provide comments that can be discussed by Science Board at the inter-sessional meeting in April 2010.

AGENDA ITEM 16
Next inter-sessional Science Board meeting

Science Board recommended that the next inter-sessional Science Board meeting take place in Sendai, Japan, two days prior to the Symposium on "*Climate change effects on fish and fisheries*". The meeting will run from April 23–24, 2010 so that one full day can be dedicated to presentation and discussion of FUTURE Advisory Panel workplans. It is usual for the country that hosted the previous Annual Meeting (PICES-2009 in Jeju, Korea) to also host the next inter-sessional Science Board meeting, but because Korea agreed that it was more expedient to hold the Symposium and meeting at the same venue, Korea agreed to commit funding that would have been used for the inter-sessional meeting to a FUTURE-related activity, if held in Korea.

AGENDA ITEM 17
Other Business

Because of the ongoing workload of Secretariat, Science Board recommended that the incoming intern, Ms. Tatiana Semenova, be assigned the task of transferring and linking the PICES digital library to the rented remote server, Adhost. Ms. Semenova will work closely with TCODE (Drs. Bern Megrey and Igor Schevchenko) to effect a seamless transition of data.

SB Endnote 1

Science Board participation list

Members

Harold Batchelder (Chairman,U.S.A.)
Michael J. Dagg (Chairman,BIO)
Michael Foreman (Chairman,POC)
Glen Jamieson (Chairman,MEQ)
Bernard Megrey (Chairman,TCODE)
John E. Stein (Chairman, Science Board)
Mikhail Stepanenko (Chairman,FIS)
Hiroya Sugisaki (Chairman,MONITOR)
Gongke Tan (representative of China)
Sinjae Yoo (representative of Republic of Korea, Science Board Vice-Chairman)

Invited Observers

Mitsutaku Makino (proposed Chairman for Study Group on *Human Dimensions*)
Hiroaki Saito (Chairman, COVE-AP)
Michael Sinclair (ICES)

PICES Secretariat

Skip McKinnell (Deputy Executive Secretary)

SB Endnote 2

Science Board Agenda

Sunday, October 25, 2009

1. Welcome and adoption of agenda
2. Review of procedures for Science Board Symposium and Session awards, and Closing Session
3. Relations with specific international programs/organizations
4. Implementation of Science Board recommendations and Governing Council decisions from PICES 2008 and the 2009 inter-sessional SB/GC meeting
5. Update on SG on Restructuring of the PICES Annual Meeting

Saturday, October 31, 2009

6. Report of election of MEQ Committee Chairmen

7. Election of Science Board Chair-elect/Science Board Vice-Chair
8. Relations with specific international programs/organizations (continued)
9. Reports from FUTURE Advisory Committees
10. FUTURE SSC – Planning for 2010 ISB Meeting
11. Recommendations for Part 1 - High Priority Items for SB Report to GC
12. PICES 2010, Portland, Oregon, Theme and description, draft schedule of scientific sessions and workshops
13. Selection of PICES-2011, Theme
14. High priority PICES activities
15. PICES Strategic Plan/Committee Action Plans – Align with FUTURE
16. Next inter-sessional Science Board meeting
17. Other business

SB Endnote 3

Study Group on Human Dimensions for FUTURE

The Implementation Plan for the FUTURE Science Program (2009) calls for PICES scientists to make the societal implications of their science more explicit and accessible. In particular, Objective 2 "Status Reports, Outlooks, Forecasts, and Engagement" states that long-term engagement and communication activities should be established in PICES.

In addition, as stated in Principle 1 of the Ecosystem Approach of the Convention on Biological Diversity, different sectors view ecosystems in terms of their own economic, cultural and societal needs, *i.e*., the objective of the ecosystem conservation is "a societal choice". Therefore, the social significance of predicted impacts induced by the climate or ecosystem changes, and the types of information, advice and guidance that might be requested of FUTURE might differ from country to country and sector to sector.

Therefore, based on sound social and economic science, FUTURE should first survey/assess the needs of a broad group of potential stakeholders for PICES-FUTURE products, and clarify differences in social objectives among stakeholders in different sectors and countries. In order to move toward accomplishing this task, this SG will review the social scientific tools and information on this purpose in PICES member countries, as follows.

Step 1. Review how social science has been used/applied globally and specifically in PICES nations in ecosystem-based management and the theoretical basis for this practice. This would be an inventory to define best practices. [Sessions 4 and 12 at the annual meeting in Dalian (PICES-2008) provide the initial basis for this work]. This builds upon the results of the WG-19 report on EBM in PICES.

Step 2. The suggestion by WG19 to establish a long-term group (Section?, referred to as PULSE (PICES Understanding, Linking and Synthesis of Ecosystems)) to synthesize regional and basin-wide ecosystem-based management (EBM) studies and initiatives (ecosystem health) will be considered and the TOR for such a group recommended (using as a basis the suggested TORs for PULSE in WG 19). A specific goal here would be to create a forum attractive to social-scientists so that their participation in PICES would be increased.

In order to fully utilize the limited time frame of the SG (one year) and the outcome of WG-19 report, this SG will mainly focus on ecosystem-based fisheries management (EBFM). Based on the outcome of this SG, and if Science Board approves, a group such as PULSE would be recommended to conduct a comparative study on Member Countries to synthesize differences in management objectives, which would include an assessment of 1) meaningful indicators for human dimensions, 2) social-scientific research needs for better information, and 3) linkages of social science with natural-scientific frameworks for better engagement. Along with the line of FUTURE, this group will expand the scope of analysis from the EBFM to incorporate other anthropogenic and

natural aspects such as hypoxia, ocean health, invasive species, etc (these are examples –exact topics should be decided by the discussion with other natural science groups of FUTURE). All these accomplishments would be reported to Science Board and to other relevant expert groups within PICES, especially the Status, Outlooks, Forecasts and Engagement (SOFE) advisory panel of FUTURE.

Tentative Timeline/ Process/ Products from SG
- PICES approves SG (October 2009)
- Members nominated (January 2010)
- SG composition confirmed (February 2010)
- SG meets after email exchange on Step 1
- Step 1 meeting finalizes paper on *Human Dimension Social Science* for EBM - June? 2010 (Inter-sessional Meeting)
- Step 1 meeting plans for process to draft Step 2 report
- SG meets to develop Step 2 report and to develop TOR for WG on Human Dimension
- Step 2 report discussed and finalized at PICES 2010 Meeting
- Final TOR for WG on *Human Dimension* set at PICES-2010

Proposed SG composition: Mitsutaku Makino, Japan and David Fluharty, U.S.A. (co-chairs), with membership: Masahito Hirota (Japan), Keith Criddle (U.S.A.), Ian Perry (Canada), Glen Jamieson (Canada), Dohoon Kim (Republic of Korea), Shang Chen (China), and Olga Lukyanova (Russia).

SB Endnote 4

Joint P/ICES Study Group on
Developing a Framework for Scientific Cooperation in Northern Hemisphere Marine Science

The two major international marine science organizations in the northern hemisphere, ICES (International Council for the Exploration of the Sea) and PICES (North Pacific Marine Science Organization), are focused on different oceans but have in common many scientific issues. In the past 10 years, there have been significant increases in reciprocal exchanges, cooperative sponsorships of scientific meetings and projects, and deeper linkages that have often developed on a case-by-case basis. The objective of this Study Group is to develop a formal framework for cooperation between ICES and PICES to serve as the basis for linkages of our science plans and longer-term strategic planning.

Terms of Reference

1. Study Group members will review their organization's existing and planned scientific activities to identify scientific themes that could potentially benefit from the other's involvement in these activities.
2. Lists of potential areas of cooperation will be exchanged by September 2010.
3. A meeting/workshop will be convened after documents are exchanged in spring 2011 to:
   a. Improve understanding of the science activities of each organization;
   b. Review scientific topics from TOR(1) to identify areas of common interest;
   c. As an example of recent cooperation, review progress of the joint Working Group on *Forecasting of Climate Change Impacts on Fish and Shellfish* (WG-FCCIFS) established in 2008;
   d. Develop a framework for cooperation between ICES and PICES that lists categories of joint activities and the rationale for each, including the benefits to each Organization from the joint activity; identify priorities for joint activities within categories;
   e. Recommend processes for implementing TOR(3d);
   f. Recommend approaches to develop a strategic plan for cooperation and mechanisms to periodically update that plan.
4. The Co-Chairmen will prepare a final Study Group report for distribution by the P/ICES Secretariats by August 2011.

SB-2009

Membership

PICES (4 members)
- Chairman of Science Board
- Deputy Executive Secretary
- Two Science Board members responsible for Climate and Fisheries & Aquaculture

ICES (4 Members)
- Chairman of Scientific Committee
- Head of Scientific Programme
- Two Scientific Committee members responsible for Climate and Fisheries & Aquaculture

SB Endnote 5

Theme for PICES-2011 (Russia)

Mechanisms of ecosystem reorganization in the North Pacific Ocean

In recent years, observed variations in marine ecosystems are often attributed to climatic or hydrological changes. Studies of this nature typically were able to demonstrate some correlation with indices of global warming or climatic oscillations of one kind or another. Changes in biological communities were described in terms of their relationships to variation in these large-scale indices. While these studies have produced interesting results, the processes responsible for changing ecosystems in general have not been found, particularly when it comes to understanding how populations, communities, and ecosystems are re-organized from time to time. Complexity masks our understanding of these processes, and it arises from the varying influences of biotic and abiotic factors on scales that vary from populations, to human scales, to the cosmophysical. As a consequence, it is not unusual to find that what has happened in the past can be explained but what will happen cannot because of an inadequate development of ecological theory for oceanic regions. Let us therefore focus a Science Board symposium on describing the mechanisms of ecosystem change and re-organization under the joint influence of factors operating at various frequencies and spatial scales. Applying intellectual energy in this direction will ultimately lead to a better understanding of factors that limit species abundances at various trophic levels. The symposium will lead to a better understanding of the ecological capacities of biotopes, ocean landscapes, and ecosystems.

REPORT OF BIOLOGICAL OCEANOGRAPHY COMMITTEE

The BIO Committee and interested participants (*BIO Endnote 1*) met under the chairmanship of Dr. Michael Dagg from 14:00-18:00 h on October 28, 2009 in Jeju, Korea. The agenda for the meeting can be found in *BIO Endnote 2*.

AGENDA ITEM 3
Reports from BIO subsidiary bodies

Advisory Panel on *Micronekton Sampling Intercalibration Experiment*

MIE-AP submitted its final report which summarized the activities and findings obtained from three cruises. Its title is "*Report on the Advisory Panel on the Micronekton Gear Intercalibration Experiment*", edited by Prof. Evgeny Pakhomov and Dr. Orio Yamamuro. A presentation summarizing the report was given by one of the contributing authors, Dr. Ric Brodeur. The Committee provisionally accepted the report, pending minor editing and a few additions and modifications that were discussed by BIO. It is anticipated that the final version will be completed within 2–3 months and sent to the PICES Secretariat to be published as a PICES Scientific Report.

Advisory Panel on *Marine Birds and Mammals*

A summary of recent activities by the Advisory Panel on Marine Birds and Mammals (MBM-AP) was presented by Dr. William Sydeman (See the AP-MBM report in the Annual Report for more details). A proposal for a 1-day workshop titled *"Location matters: Importance of spatial variability in physical-biological interactions to understanding, forecasting and managing marine ecosystems"* was presented to the Committee for discussion later in the meeting.

Section on *Carbon and Climate*

A report on the activity of the Carbon and Climate Section (CC-S), whose activities are jointly overseen with POC, was given by Dr. James Christian (see the CC-S elsewhere in the Annual Report). A data synthesis workshop, seen as a continuation of unfinished business from the 2009 workshop, was proposed for PICES-2010. CC-S will conclude its first 5-year term at PICES-2010 and is proposing to develop new Terms of Reference during the coming year, prior to their review by POC/BIO in 2010.

Joint PICES/ICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish*

A report on the Working Group on Forecasting Climate Change Impacts on Fish and Shellfish (WG-FCCIFS) was given by Dr. Anne Hollowed, summarizing the activity of this joint ICES-PICES Working Group. Of particular note are the activities proposed for the symposium entitled "*Climate change effects on fish and fisheries*" to be held in Sendai, Japan, from April 26–29, 2010.

FUTURE

A summary of the inaugural meetings of the three FUTURE Advisory Panels, distributed earlier in the day by Science Board Chairman, Dr. John Stein, was presented by the BIO Committee Chairman.

AGENDA ITEM 4
BIO Working Groups

Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22) is currently chaired by Drs. Shigenobu Takeda (Japan) and Fei Chai (U.S.A.). An activity report was

presented by Dr. William Crawford (See WG 22 report for more details). This is the last year for the Working Group and a final Topic Session was proposed for PICES-2010.

Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* (WG 23) is currently chaired by Drs. William Peterson (USA) and Song Sun (China). An activity report was presented by Ms. Tracy Shaw (See WG23 report for more detail). A workshop focusing on krill was proposed to be held at the Sendai symposium in April 2010. The title is "*Examining the linkages between physics and fish: how do zooplankton and krill data sets improve our understanding of the impacts of climate change on fisheries?"*

AGENDA ITEM 5
Topic sessions and workshops

Summaries of the topic sessions and workshops at PICES-2009 can be found in the Session Summaries chapter of this Annual Report.

Eight topic sessions and three workshops were proposed for sponsorship by the BIO Committee at PICES-2010. After discussion, the following list of BIO Committee priorities for topic sessions was developed:

1. BIO paper session;
2. "*Understanding the role of iron in regulating biogeochemical cycles and ecosystem structures in the North Pacific Ocean*" (see *BIO Endnote 3*);
3. "*The Practical Handbook at 50: a celebration of the life and career of Tim Parsons*" (*BIO Endnote 4*);
4. "*Impact of climate variability on marine ecosystems: understanding functional responses to facilitate forecasting*" (see *POC Endnote 5(4)*);
5. "*Census of marine life: Exploring ocean life. Past, present and future*" (*BIO Endnote 5*);
6. *"Comparing the two major gyres of the subarctic North Pacific - seasonal and interannual variability and its predictability*" (see *POC Endnote 5(2))*;
7. "*Observations of ecosystem mixing under climate change*" (see *FIS Endnote 5*);
8. "*Ecosystem models: Are they useful for management or forecasting biological response to climate change?*" (see *FIS Endnote 4*);
9. "*Location matters: Importance of spatial variability in physical-biological interactions to understanding, forecasting and managing marine ecosystems*" (see *AP-MBM Endnote 5*).

Workshops proposed by BIO for PICES-2010 (Both proposed workshops are of equally high priority for the Committee):

1. "*Marine Ecosystem Inter-Comparisons III*" (*BIO Endnote 6*);
2. Final CC-S data synthesis workshop (see *POC Endnote 4*).

AGENDA ITEM 6
Updates on symposia and meetings previously endorsed by BIO

The 5th International Zooplankton Production Symposium on "*Population connections, community dynamics and climate variability*" will be held during March 14-18, 2011, at Pucón, Chile. Dr. Julie Keister has been appointed as the PICES representative. A draft brochure for this meeting is attached (*BIO Endnote 7*).

Last year it was reported that the Expo 2012 Organizing Committee (Yeosu, Korea) expressed interest in hosting the 2nd International Symposium on "*Effects of climate changes on the world's oceans*" in the early spring of 2012. Dr. Sinjae Yoo reported that planning for this symposium is continuing.

AGENDA ITEM 7
Relationships with other international programs and organizations

Short presentations were given from representatives of the following programs:

Ecosystem Studies of Sub-Arctic Seas

Dr. George Hunt gave a presentation on the recent and planned activity of ESSAS, mentioning in particular the proposed ESSAS Open Science Meeting "*Comparative studies of climate effects on polar and sub-polar ocean ecosystems: progress in observation and prediction*" to be held in Seattle, USA in May 2011. He requested PICES financial support of $20,000 in order to bring early career scientists from PICES Asian countries to the meeting, and asked that a PICES member be appointed to the Steering Committee.

Integrated Marine Biogeochemistry and Ecosystem Research

Dr. Yoo gave a presentation on recent and proposed activities of IMBER. IMBER will contribute $2000–$3000 towards a WG 22 topic session at PICES-2010, should it be approved by Science Board. IMBER proposes to make FUTURE a contributing program. IMBER asked BIO to provide verbal support for an IMBER summer school in August 2010 titled "*Ocean dynamics and marine ecosystems in the context of climate change*", and the scientific meeting, "IMBIZO II", proposed for October 10–14, 2010 in Crete. These requests will be brought to Science Board.

Census of Marine Life

A presentation was given by Dr. Vera Alexander. CoML will have a final meeting in London, in October 2010.

North Pacific Research Board

A presentation was given by the Director of NPRB, Dr. Clarence Pautzke, summarizing some of the recent NPRB activities that are highly relevant to PICES, including the BSIERP-BEST program in the Bering Sea that is jointly supported by NPRB and the US National Science Foundation. It was noted by the BIO Chairman that NPRB has provided financial support for many PICES research activities in the past years.

AGENDA ITEM 9
Publications for upcoming year resulting from BIO sponsored activities were updated

Krill papers from the 4th International Zooplankton Symposium will be published as a special volume of *Deep-Sea Research II* (DSR II), edited by W. Peterson and S. Kawaguchi: Approximately 16 papers have been accepted and were sent to journal editor, John Milliman, in April.

The OECOS Special Volume (Drs. Atsushi Yamaguchi and Charles Miller, editors) is being prepared for publication in DSR II. About half the papers are complete and others are under final revision by authors.

The IFEP special volume on SEEDS II is in press with DSR II and should be published in November 2009.

A special section of the Journal of Oceanography (Vol 65, No 5, 2009) was recently published and contained three papers under the heading of "PICES North Pacific Carbon Synthesis"

AGENDA ITEM 10
North Pacific Ecosystem Status Report II – 2003–2008

A brief update on the status of this report was given by Dr. Dagg. Seven of the nine regional chapters are nearing completion and a synthesis workshop will be held in Hawaii in December 2009. Anticipated publication as a PICES Special Publication is March 2010.

AGENDA ITEM 11
BIO Action Plan

Not discussed.

AGENDA ITEM 12
FUTURE Implementation Plan

Not discussed.

AGENDA ITEM 13
Other items

It was noted that the next BIO Chairman is to be electedby Committee members in one year, with duties to begin after the end of the PICES-2010 in Portland, U.S.A.

Information on the proposed restructuring of the Annual Meeting was given. This will be further discussed at the Science Board meeting

The BIO Committee meeting adjourned by 17:55 h.

BIO Endnote 1

BIO participation list

Members

Michael J. Dagg (U.S.A.)
Angelica Peña (Canada)
Hiroaki Saito (Japan)
Michael Seki (U.S.A.)
Atsushi Tsuda (Japan)
Harumi Yamada (Japan)
Atsushi Yamaguchi (Japan)
Sinjae Yoo (Korea)

Observers

George Hunt Jr. (ESSAS)
Vera Alexander (CoML)
Ric Brodeur (U.S.A.)
Seok-Gwam Choi (Korea)
William Crawford (Canada)
Reila Domokos (U.S.A.)
Ian Dutton (NPRB)
Anne Hollowed (U.S.A.)
Young-Shil Kang (Korea)
Clarence Pautzke (NPRB)
C. Tracy Shaw (U.S.A.)
Yvette Spitz (U.S.A.)
William Sydeman (U.S.A.)
Yutaka Watanobi (Japan)
Xuelei Zhang (China)

BIO Endnote 2

BIO meeting agenda

1. Welcome and Introductions
2. Agenda additions and changes – approval of agenda
3. Reports from subsidiary bodies:
   - MIE-AP
   - MBM-AP
   - CC-S
4. Working group reports:

   - WG 22: *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean*. Shigenobu Takeda (Japan) and Fei Chai (USA).
   - WG 23: *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim*. William Peterson (USA) and Song Sun (China).
5. Topic sessions and workshops
   (a) completed
   (b) proposed for PICES-2010 – Portland, U.S.A.
   Theme sessions:
   - *The Practical Handbook at 50: a celebration of the life and career of Tim Parsons*
   - *Observations of Ecosystem Mixing under Climate Change*
   - *Ecosystem Models: Are they useful for management or forecasting biological response to climate change?*
   - *Natural Supplies of Iron to the North Pacific and Linkages Between Iron Supply and Ecosystem Responses*
   - *BIO paper session*

   Workshops:
   - *CC-S data synthesis workshop*
6. Updates on symposia and meetings endorsed by BIO
7. Relationships with other international programs and organizations.
   - ESSAS – Ecosystem Studies of SubArctic Seas- George Hunt
   - IMBER – Integrated Marine Biogeochemistry and Ecosystem Research - Sinjae Yoo
   - CoML – Census of Marine Life - Vera Alexander
   - NPRB – North Pacific research Board - Clarence Pautzke
   - WG-FCCIFS – Working Group on Forecasting Climate Change Impacts on Fish and Shellfish - Anne Hollowed
8. Financial requests
9. Publications for upcoming year
10. North Pacific Ecosystem Status Report – II
11. Discussion of BIO Action Plan
12. Discussion of FUTURE Implementation Plan and new Advisory Panels
13. Other items
14. Meeting adjourned

BIO Endnote 3

Proposal for a 1-day BIO Topic Session at PICES 2010 on *Understanding the role of iron in regulating biogeochemical cycles and ecosystem structures in the North Pacific Ocean*

Iron plays a key role in regulating the biogeochemical cycles of carbon and nitrogen, and pelagic ecosystem structures in the North Pacific Ocean, yet our understanding of these effects remains limited. External sources of iron, such as Asian dust, rivers, sediments, and volcanoes supply large amounts of iron to the North Pacific, while the physical processes of upwelling, meso-scale eddies, boundary currents, and tidal mixing transport deep waters with high iron concentration to the upper ocean. Biological uptake, zooplankton grazing, remineralization, and iron chemistry change the forms of iron and its distribution in the North Pacific Ocean. This session invites papers that address physical, biological and chemical processes controlling iron distribution and transformation, linkages between iron and ecosystem responses, and impacts on carbon and nitrogen cycles. We particularly invite papers that combine recent progress from field observations and modeling studies that relate iron cycling to ecosystem structures and carbon fluxes in the North Pacific Ocean.

Co-convenors: Mark Wells (U.S.A.), Angelica Pena (Canada), and Toshi Saino (Japan)

Potential invited speakers: Keith Moore (U.S.A.), Phoebe Lam (U.S.A.), Hajime Obata (Japan), One modeler outside PICES countries, who develops more detailed iron chemistry , Jay Cullen (Canada), Maurice Levasseur (Canada)

BIO Endnote 4

Proposal for a ½ day BIO Topic Session at PICES-2010 on
The Practical Handbook at 50: a celebration of the life and career of Tim Parsons

The importance of Strickland and Parsons' "*A practical handbook of seawater analysis*" to the development of oceanographic science is difficult to overstate. The first version of the manual, "*A manual of sea water analysis*", was published by the Fisheries Research Board of Canada in 1960. Half a century on, we are in a position to examine the role that this manual and its descendants have played in the development of biological and chemical oceanography. This session invites papers on the role that the development and standardization of analytical methods has played in the evolution of oceanography, and the evolution of our understanding of planktonic ecosystems that methodological innovation has catalyzed.

Convenor: James Christian (Canada)

Possible invited speakers: Timothy R. Parsons (Canada), R. Ian Perry (Canada), David M. Karl (U.S.A.)

BIO Endnote 5

Proposal for a ½ day BIO Topic Session at PICES-2010 on
"*Census of Marine Life: Exploring ocean life. Past, present and future*"

The Census of Marine Life (CoML) is a global scientific initiative to assess and explain the changing diversity, distribution and abundance of marine species in the past and present, and to build the capacity to project future diversity. CoML is a broad global initiative of unprecedented size and scope that has engaged more than 2000 scientists and ocean professionals from over 80 countries with a common mission towards improving the understanding of life in the ocean. This session at PICES will summarize the past 10 years of results from the global CoML program, highlighting specific products and how CoML products information and data can be used or applied. Contributors will discuss findings and discoveries with particular attention to the information released at the CoML Finale in London just a few weeks earlier. Discussions will look for additional ways to

apply the newly released CoML information to answer the growing global questions of ocean acidification and climate change, and the role of marine biodiversity information with managing through ecosystem approaches and marine spatial planning. The session will conclude with a discussion of lessons learned for CoML, exploring some of the most successful (and some not-so successful) aspects of the program in the context of developing any future coordinated marine biodiversity efforts.

Co-convenors: Michael Feldman (US CoML Program manager), Andrew Rosenburg (University of New Hampshire and Chairman of the US National Committee for CoML), and Clarence Pautzke (US National Committee for CoML and North Pacific Research Board).

BIO Endnote 6

Proposal for a 2-day BIO Workshop on "*Marine Ecosystem Inter-Comparisons III*"

The objective of the Marine Ecosystem Model Inter-comparison Project (MEMIP) is to compare the performance of various lower trophic level marine ecosystem simulation models at predicting the abundance and distribution of coastal zooplankton functional groups. Models with high performance will be used to examine the future state of the marine ecosystem to global climate change. This workshop builds upon the discussions and planning accomplished at the successful workshop held at the PICES 2009 meeting. The workshop will be technical, hands-on, and focus on parameterizing, executing and calibrating three test bed versions of a biogeochemical lower trophic level (LTL) marine ecosystem models. At each test bed 3-6 ecosystem models will be run. Specific ecosystem models (*i.e.*, NPZD, NEMURO and CoSINE) will be executed. Some models will be tuned to run in a specific region and others will be applied to areas different from where they were calibrated. Model skill assessment will be evaluated. The models will be used to identify important mechanisms that control secondary production, zooplankton biomass and variability, as well as bounding the levels of uncertainty in model predictions by calculating ensemble statistics. Comparisons at multiple locations will provide information on the spatial-temporal robustness of particular model structures and parameterizations. The products of the comparison will contribute to FUTURE by estimating the uncertainty and the limits of forecasting.

In order to maximize productivity during the workshop, we prefer participation be limited to the MEMIP working group members.

Conveners: Bernard A. Megrey (U.S.A.), Shin-ichi Ito (Japan), Hal Batchelder (U.S.A.), Yvette Spitz (U.S.A.), Guimei Liu (China)

Travel support is requested for one Asian and one North American scientist to attend the workshop.

BIO Endnote 7

Draft brochure of the 5th Zooplankton Production Symposium on *Population Connections, Community Dynamics, and Climate Variability*. Pucón, Chile, March 14-18, 2011

Symposium Scope

Zooplankton play a pivotal role in aquatic ecosystems and global biogeochemical cycles. They function as prey for economically important fish, grazers of primary production, and drivers of carbon and nutrient cycles. Their population and community dynamics including their growth, mortality, distribution, and diversity structure the ecosystem. At the same time, a changing environment influences their dynamics. Climate change is profoundly impacting marine ecosystems through changes in zooplankton. A combination of new technologies and techniques together with classical in situ and laboratory studies are needed to understand the changing ecosystems. In response to the need to understand zooplankton dynamics, their sensitivity to change,

and the resultant effects on ecosystems, ICES and PICES are holding the *5th International Symposium on Zooplankton Production* as an international forum to discuss zooplankton and their role in the global ecosystem.

Sessions

- Effects of climate variability on secondary production and community structure,
- Ecological interactions: links to upper and lower trophic levels,
- Zooplankton life histories: spatial connectivity, dormancy, and life cycle closure,
- Small scale processes and patterns,
- Zooplankton in upwelling and coastal systems,
- Zooplankton in polar ecosystems and extreme environments,
- Zooplankton physiology and bioenergetics,
- The role of zooplankton in biogeochemical cycles.

Workshops

- Zooplankton IBMs,
- Advances in genomic and molecular studies of zooplankton,
- Updates and comparisons of zooplankton time series,
- Impacts of ocean acidification,
- Automated visual plankton identification,
- New technologies.

Request input from the community for up to two more session topics or workshops.

Structure

A combination of sessions and workshops, with sessions as broad topics and workshops as focused topics (such as modeling, matching observations and models, measuring rates and production, comparative studies).

Talks

Plenary: Monday morning = 30–60 minutes each to introduce the themes of the conference/sessions. Friday afternoon wrap-up and beginning of each session = 30 minutes each.

Parallel sessions – 15 minutes per talk = 10 talks per session. At most, two parallel sessions (8–10 sessions depending on length of each. Some sessions could be full-day).

Daily schedule

The basic formula is a 0900 start, with 1030–1100 coffee breaks, 1.5 hrs for lunch, and afternoon coffee break, ending by 1730.

Socials

- Reception Monday evening.
- ½-day excursion Thurs afternoon/evening.
- Heavy hors d'oeuvre and drinks poster sessions Tuesday and Wednesday evenings, with posters starting at 0600, food and drinks at 1830, all ending at 2030.

Monday	Tuesday	Wednesday	Thursday	Friday
Plenary – Theme introductions	2 parallel sessions	Workshops	2 parallel sessions	2 parallel sessions
Lunch	Lunch	Lunch	Excursion	Lunch
2 parallel sessions	2 parallel sessions	Workshops		Poster session
				Plenary – big picture, wrap up talks
				Closing ceremony
Welcome Reception	Poster session	Poster session	Symposium Dinner	

Outcomes

A special issue of ICES Journal of Marine Science, scheduled for publication in 2012.

Symposium Convenors

- Rubén Escribano
- Julie Keister
- Delphine Bonnet

Scientific Steering Committee

- David Mackas
- Sanae Chiba
- Ángel López-Urrutia
- Catherine Johnson

REPORT OF FISHERY SCIENCE COMMITTEE

The meeting of the Fishery Science Committee (FIS) was held during 14:00–18:00 h on October 28, 2009. Chairman, Mikhail Stepanenko, and Vice-Chairman, Gordon Kruse, called the meeting to order and welcomed the participants. The agenda was reviewed and adopted with one addition to add a report on the North Pacific Anadromous Fisheries Commission by Dr. Yukimasa Ishida (*FIS Endnote 2*). The meeting was attended by 14 FIS members plus 18 observers (*FIS Endnote 1*). All PICES member countries were represented. Dr. Kruse served as rapporteur.

AGENDA ITEM 3
2009 FIS Best Oral Presentation and Poster awards

Volunteers were solicited to serve on the FIS awards sub-committee for PICES-2009. Drs. John Field and Sukgeun Jung agreed to select the Best FIS Oral Presentation by an early career scientist and Drs. Libby Logerwell and Laura Richards agreed to select the Best FIS Poster. Selections were chosen from Topic Sessions S2 and S3 and the FIS Paper Session. Best Oral Presentation award was given to Hyunjung Kang (NFRDI, Korea) for her talk on "Maturity and spawning of small yellow croaker, *Larimichthy polyactis*" (FIS Paper Session). Best Poster award was given to Tatiana Tunon (SOLV Consulting, Canada) for "*Using classification trees to capture a manager's interpretation of Bayesian projections*" (FIS Paper Session).

AGENDA ITEM 4
FIS Chairman's report: Implementation of PICES XVII decisions

PICES-2009 sessions

At PICES-2009, FIS sponsored:
- 1-day FIS Topic Session (Oct. 27) on "*Ecosystem based approaches for the assessment of fisheries under data-limited situations*" (S2),
- ½-day FIS/BIO Topic Session (Oct. 28) on "*Early life stages of marine resources as indicators of climate variability and ecosystem resilience*" (S3),
- 1 day MEQ/FIS Topic Session (Oct. 30) on "*Marine spatial planning in support of integrated management – tools, methods, and approaches*" (S6),
- 1-day FIS Contributed Paper Session (Oct. 29),
- 1-day FIS Workshop (Oct. 23) on "*Understanding the links between fishing technology, bycatch, marine ecosystems and ecosystem-based management*" (W5),
- 1-day MEQ/FIS Workshop (Oct. 24) on "*Interaction between aquaculture and marine ecosystems*" (W7).

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

International events

During 2009, FIS co-sponsored/will co-sponsor the following events:
- Theme session with ICES on "*Climate impact on marine fish: Discovering centennial patterns and disentangling current processes*" at the ICES 2009 Annual Science Conference in Berlin, Germany. The PICES Co-Convenor was Dr. Skip McKinnell.
- Symposium on the "*Rebuilding of depleted fish stocks – Biology, ecology, social science and management strategies*" (co-sponsored by ICES, PICES, UNCOVER) from November 3–6, 2009, in Warnemünde, Germany. The FIS vice-chairman Gordon Kruse (U.S.A.), Cornelius Hammer (Germany), Olav Kjesbu (Norway), Peter Shelton (Canada) were Co-Convenors. Dr. Toyomitsu Horii (Japan) is a member of the Scientific Steering Committee. The proceedings will be published in the *ICES Journal of Marine Science*.

- The 26th International Lowell Wakefield Fisheries Symposium, titled "*Ecosystem 2010: Global progress on ecosystem-based fisheries management*" will be held in Anchorage, U.S.A. from November 8–11, 2010. Dr. Kruse is a Chair of the Steering Committee on behalf of the University of Alaska and FIS member Dr. Chang-Ik Zhang is the designated PICES member of the Steering Committee. Co-sponsors include PICES, ICES, FAO, and regional sponsors. The proceedings will be published as an Alaska Sea Grant publication. The symposium website is: http://www.seagrant.uaf.edu/conferences/2010/wakefield-ecosystems/index.php

Publications

The following FIS-related PICES publications were either under preparation or have been published:

- Draft report of WG 19 on *Ecosystem-based management science and its application to the North Pacific*, edited by G. Jamieson, P. Livingston, C.-I. Zhang. The final FIS chairman's edits were provided;
- Selected papers from PICES/ICES/FAO Symposium on "*Effects of climate change on fish and fisheries*" ,convened by ICES/PICES Working Group (POC/FIS) on *Forecasting Climate Change Impacts on Fish and Shellfish* (WG-FCCIFC), edited by A. Hollowed, M. Barange, S.-I. Ito, S. Kim, H. Loeng, and M. Peck to be published in a special issue of ICES Journal of Marine Science;
- Special issue of Fisheries Research Vol. 100, Issue 1 on *Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks* edited by G. Kruse, Y. Ishida, R.I. Perry, V. Radchenko, and C.I. Zhang was published. This publication was a product of a FIS Topic Session at PICES XVI in Victoria, Canada. Electronic copies of the papers are available via a link on the PICES website: (http://www.pices.int/publications/primary_journals/default.aspx).

AGENDA ITEM 5
Reports of FIS-sponsored groups

MEQ/FIS Working Group on *Ecosystem-based Management Science and its Application to the North Pacific* (WG 19)

WG-19 Co-Chairman, Chang-Ik Zhang, reported on the activities of this Working Group. The Group has completed its work and a draft report has been submitted. Co-Chairman, Glen Jamieson, previously provided a summary of the draft final WG 19 report to FIS members by email. This report provides an emerging consensus on indicators of marine ecosystems, and makes recommendations applicable to North Pacific waters of PICES interest. In addition, it attempts to take a broader view of indicators for ecosystem-based management of marine systems rather than the narrower application to fisheries management (even though most research to date has focussed on this narrower application). Specific recommendations relating to indicators include: 1) PICES should explore the use of a consensus suite of indicators in each of its regions to develop a common set of indicators to be included in each iteration of the PICES Ecosystem Status Report; 2) PICES should use the WG 19 Ocean Management Activity reports and FIS and MEQ committee inputs to help identify region-specific drivers of change and pressure measurements in order to interpret relevant status indicators; 3) PICES should establish collaborations with social scientists to develop indicators which describe the coupled marine social-ecological system and expand the understanding of human behavior and responses to environmental forcing from the marine sector; and 4) PICES should recommend a research activity to explore the use of additional indicators for marine ecosystem-based management in each of its regions, building from those outlined here and elsewhere.

WG 19 considered that the issues it has addressed might evolve into a component of the PICES FUTURE program. Depending on the organization of FUTURE, WG 19 could become a task team, a section, or continue as a working group. In function, WG 19 suggested that the new expert group's emphasis be on developing an integrative, science-based, ecosystem-scale understanding of the human dimension (across a diversity of sectors) in FUTURE, and suggest it be called "*PICES Understanding, Linking and Synthesis of Ecosystems*" (PULSE). The Working Group submitted a proposal to FIS for a PULSE task team that included a background statement and Terms of Reference (*FIS Endnote 3*). The goal of PULSE would be to monitor

and synthesize regional and basin-wide ecosystem-based management (EBM) studies and initiatives (ecosystem health) and to provide a forum for the integration of FUTURE-related EBM practices and their implementation. FIS supported the proposal for PULSE as a task team.

Joint PICES/ICES Working Group (POC/FIS) on *Forecasting Climate Change Impacts on Fish and Shellfish* (WG-FCCIFC)

Co-Chairman, Dr. Suam Kim, provided a summary of the activities of WG-FCCIFS. The Working Group had met previously at the GLOBEC Open Science Meeting in Victoria, Canada (June 2009), and at the ICES Annual Science Conference in Berlin, Germany (September 2009). The third meeting of this Working Group took place in Jeju, Korea, during PICES-2009 and another will occur for 1½ days immediately after the International Symposium on "*Climate change effects on fish and fisheries*" in Sendai, Japan, April 26–29, 2010. The Working Group plans to develop web meetings.

WG-FCCIFS finalized the organization of the Sendai symposium, including scientific sessions, invited speakers list, expected results of the conference, finances, and other logistical issues. The Working Group noted that many of their Terms of Reference cannot be achieved until after the symposium. It will provide a forum for discussing frameworks and methodologies for forecasting impacts of climate change on the growth, distribution and abundance of marine life. Dr. Kim noted that the proceedings of the Sendai symposium will be published as a special issue of the ICES Journal of Marine Science. However, he noted the Working Group's desire to produce a second publication, likely to be a synthesis of the Sendai workshops. FIS discussed and supported this proposal. Finally, WG-FCCIFS proposed a Topic Session for PICES-2010 on *"Impact of climate variability on marine ecosystems: Understanding functional responses to facilitate forecasting."*

MEQ/FIS Working Group on *Environmental Interactions of Marine Aquaculture* (WG 24)

Dr. Stewart Johnson (Canada) provided WG 24's report to FIS. This Working Group began in 2008 and held its first meeting during PICES-2009 where the Group reviewed its Terms of Reference (ToR). One Working Group member will lead each of the three ToR – Drs. Katsuyuki Abo (ToR 1), Edward Black (ToR 2), and Kevin Amos (ToR 3). During PICES-2009, WG 24 held a 1-day workshop that featured 12 oral and 7 poster presentations, at least one presentation from each PICES member country. The Working Group meeting followed the day after the workshop.

WG 24 made the following decisions. First, all parties agreed to the ToR. Second, the members decided that they would not try to standardize risk assessment methods, but rather would strive to understand and compare them. WG 24 requested a 1½-day meeting to be held before PICES-2010. WG 24 also indicated its strong support for the proposal of a Topic Session, titled "*Economic relation between marine aquaculture and wild capture fisheries*". Primary issues raised by WG 24 are the need to standardize terminology, and concern about meeting the second ToR regarding risk assessment within 3-year timeframe. Finally, the WG 24 noted that, at present, there is no Japanese representative for aquatic animal health. FIS supported the Working Group's request for a 1½-day meeting at PICES-2010, as well as its request for one more Japanese scientist with expertise in animal health.

AGENDA ITEM 6
Relations with other programs and organizations

Dr. John Stein, Science Board Chairman, summarized the first meetings of the Advisory Panels of FUTURE, AICE (Anthropogenic Influences on Coastal Ecosystems), COVE (Climate, Oceanographic Variability and Ecosystems) and SOFE (Status, Outlooks, Forecasts, and Engagement). They met for first time at PICES-2009, first individually, then jointly. Each Advisory Panel was asked to nominate two potential candidates to serve as their chairman. Science Board is the Scientific Steering Committee for FUTURE. All Topic Sessions for PICES Annual Meetings proposed by the Advisory Panels will be vetted by the Committees, so the Panels

must meet before the Committees. The plan is to meet on the Sunday before the Opening Session; 3½ h individually, 1½ h together. It was also noted that, as some Working Groups end, it is important to keep track of them, as they may be doing activities important to FUTURE. Advisory Panel ToR are expected to be adopted at inter-sessional Science Board meeting in Sendai, Japan in April. There is a need to define how Science Board will function as an SSC of FUTURE.

Ms. Judith Amesbury (representing the Western Pacific Fishery Management Council, WPFMC) presented a report on the Pelagic Fish Research Program at the University of Hawaii and activities of the WPFMC. She summarized the fisheries of the region, which are largely focused on pelagic fishes. The Pelagic Fisheries Research Program funds research on pelagics to support WPFMC. She indicated that PICES members are welcome to attend the annual meeting of principal investigators to hear results and to propose new research. She offered the following ideas for collaboration with PICES: attend their meeting to help set priorities, co-sponsor meetings – current topics include catch shares, ecosystem-based approach, *etc*. Additional information is available at: www.soest.hawaii.edu/PFRP/ and www.wpcouncil.org/.

Dr. Juan Valero (representing the International Pacific Halibut Commission, IPHC) presented a report on IPHC research programs, and discussed opportunities to collaborate with PICES. IPHC has a long history of collaboration and welcomes opportunities to conduct joint research. IPHC's survey began in 1925. By 1980, many key areas were sampled, and by the late 1990s surveys covered distributions in the Gulf of Alaska and eastern Bering Sea. Current collaborations address the following topics: accurate catch accounting, collection of sablefish logbook information, halibut monitoring on NMFS surveys, electronic pop-up tags, rockfish monitoring off the U.S. west coast, oceanographic monitoring off Oregon, incidentally caught species on IPHC surveys, electronic monitoring instead of observers, pollutant contamination monitoring, and genetics research.

Dr. Yukimasa Ishida reported on the North Pacific Anadromous Fisheries Commission activities for 2008–2009. The BASIS Symposium was held from November 23–25, 2008 in Seattle, U.S.A. and a publication of papers presented is expected in December 2009. A long-term research and monitoring plan was developed to describe their vision for future research and monitoring. NPAFC contributed information on the status of salmon to the PICES North Pacific Ecosystem Status Report. NPAFC will organize a workshop on climate change and salmon during the Sendai Symposium in 2010. FIS discussed whether there were new areas for collaboration or any new requests of NPAFC by PICES. FIS agreed that NPAFC participation in the salmon workshop at the Sendai Symposium and preparation of the North Pacific Ecosystem Status Report remain top priorities for PICES–NPAFC collaborations for the next year. No new collaborations were identified.

Dr. George Hunt (representing ESSAS) presented a report on program activities. ESSAS started as a GLOBEC regional program, and it has now become an IMBER regional program. This past spring, ESSAS held its annual meeting in Seattle, U.S.A. The meeting included a gadid working group on gadoid-crustacean interactions. Also, the meeting examined the roles of advection on marine ecosystems.

Past and present ESSAS activities with PICES include: (1) co-sponsoring a modeling workshop at PICES XVII in Dalian, China, (2) supporting a modeling group to meet with Dr. Enrique Curchitser at Rutgers University, (3) co-sponsoring a workshop on model comparisons at PICES-2009, (4) hoping to co-sponsor at PICES 2010, and (5) making a big contribution for the North Pacific Ecosystem Status Report. ESSAS led the development of the Bering Sea chapter (~70 pages). George Hunt proposed an ESSAS Open Science Meeting in May/June of 2011 in Seattle, U.S.A. The meeting will have 9 or 10 sessions, including regional comparisons over more than one region, new observations on Bering Sea ecosystems (and Chukchi), modeling of marine ecosystem dynamics, contributions of endogenous remineralization of nutrient supplies, IPY studies, a gadoid-crustacean session, Arctic and Antarctic issues, ocean acidification, and hopefully, a session on socio-economics. ESSAS requests PICES funding for early career scientists to travel to the meeting from Asian countries. ESSAS is seeking $20 K, which may cover 2 early career scientists from each of the four PICES countries in the western north Pacific. FIS supported this proposal.

Reports by the North Pacific Research Board and FAO, by Drs. Clarence Pautzke and Yimin Ye, respectively, were scheduled but not provided.

AGENDA ITEM 7
Proposals for FIS Topic Sessions and workshops at PICES XIX

The following Topic Sessions were proposed for PICES-2010:
- *Ecosystem models: Are they useful for management or forecasting biological response to climate change* (½ day, FIS/BIO). (*FIS Endnote 4*)
- *Observations of ecosystem mixing under climate change (1-day FIS/BIO).* (*FIS Endnote 5*)
- *Economic relation between marine aquaculture and wild capture fisheries* (1 day, FIS/MEQ). (*FIS Endnote 6*)
- *Impact of climate variability on marine ecosystems: Understanding functional responses to facilitate forecasting* (1-day, FIS/POC/BIO). (FIS Endnote 7)
- *Oceanographic and demographic processes affecting the reproductive biology of exploited marine stocks* (½ or 1 day, FIS). (FIS Endnote 8)
- *Identifying vulnerable marine ecosystems in the North Pacific. (1/2-1 day, FIS/MEQ (possibly BIO). Co-convenors: four potential convenors from Canada were discussed.* (FIS Endnote 9)
- *New and emerging technologies: Applications of genomics and related technologies for marine ecosystem studies* (½ day, FIS/MEQ/others?). (FIS Endnote 10)
- FIS contributed Paper Session (1 day)

After discussion, FIS members agreed to the following topic session priorities from highest to lowest:
1. *Observations of ecosystem mixing under climate change* (see *FIS Endnote 5*).
2. *Oceanographic and demographic processes affecting the reproductive biology of exploited marine stocks* (see *FIS Endnote 8*).
3. FIS Paper contributed Paper Session
4. Merger of two proposals: *Ecosystem models: Are they useful for management or forecasting biological response to climate change* (see *FIS Endnote 4*) and *Impact of climate variability on marine ecosystems: understanding functional responses to facilitate forecasting* (FIS *Endnote 7*). In recommending this merger, FIS noted that both have some focus on prediction. Also, FIS noted that papers in the ecosystem modeling session would be suitable to the *Ecosystems 2010* symposium to be held in November 2010, which PICES is co-sponsoring.
5. *Economic relation between marine aquaculture and wild capture fisheries*. FIS feels that this is a high priority activity. It is supportive of FUTURE and the activities of WG 24 (see *FIS Endnote 6*). Also, the proponents are providing substantial travel funds to bring Asian scientists to the meeting. If there is inadequate space for this session as a Topic Session, then FIS recommends this as a workshop.

FIS also discussed two informal proposals. Dr. Field indicated a desire to develop a cephalopod Topic Session for PICES-2011 which FIS encouraged. An informal proposal was received from a Norwegian scientist about a rockfish/redfish Topic Session. However, no additional information was provided, so FIS took no action.

The following workshop was proposed:
- *Beyond Lagrangian: Modeling migratory fish behavior in GCMs* (½ day, FIS).

FIS members agreed to the following workshop priorities from highest to lowest:
1. *New and emerging technologies: Applications of genomics and related technologies for marine ecosystem studies* (moved from Topic Session to workshop).
2. *Beyond Lagrangian: Modeling migratory fish behavior in GCMs* (see *FIS Endnote 11*)

AGENDA ITEM 8
Proposals for new FIS-sponsored working groups and study groups

- MEQ/FIS Study Group on *Human Dimensions for FUTURE (Ecosystem-based Fisheries Management – EBFM)* presented by Dr. David Fluharty. Co-Chairmen: Mitsutaki Makino (Japan), David Fluharty (U.S.A.),

- MEQ/FIS Task Team on *PICES Understanding, Linking, and Synthesis of Ecosystems* (PULSE; *FIS Endnote 3*).

FIS endorsed the formation of the Study Group, but commented that the ToR were vague and suggested that they be refined to make them achieveable in one year. FIS also endorsed the proposed PULSE Task Team.

AGENDA ITEM 9
Proposals for new meetings with PICES as co-sponsor

FIS considered ICES offers for PICES to co-sponsor some sessions and symposia:
- ICES Symposium on "*Carrying capacity: What does it mean in a changing ocean?*" will be held in Lisbon, Portugal in 2010. PICES was invited to be a co-convenor. FIS recommended that PICES support this symposium by providing a co-convenor.
- FIS supported the funding request of $20 K for travel by early career Asian scientists to the ESSAS Open Science Meeting in Seattle, U.S.A. in 2011.
- FIS approved the inter-sessional meeting of the joint PICES/ICES WG-FCIFC during the International Symposium on "*Climate change effects on fish and fisheries*" in 2010 in Sendai, Japan. Publication of the results will occur in 2011. A workshop for this working group at the GLOBEC Open Science Meeting, was also supported.

AGENDA ITEM 10
High priority projects: FUTURE

The key features of PICES' Future Integrative Science Plan (FISP, FUTURE) were reviewed very briefly to provide guidance for FIS priority setting concerning topic sessions, workshop, working groups and symposia. The FUTURE Science Plan includes key questions on system resilience and vulnerability to natural and anthropogenic forcing, on ecosystem responses and on evaluating how human activities affect coastal ecosystems and how societies are affected by ecosystem changes. FIS discussed how its decisions on working groups, topic sessions, and workshops could consider how well they match with FUTURE goals. It was pointed out that FIS activities are not entirely constrained by FUTURE. Other bottom-up activities that are not totally related to FUTURE could be approved. However, FIS agreed that high-priority, long-term activities such as working groups should be relevant to FUTURE.

At the recent inter-sessional Science Board meeting in Qingdao, China (April 28, 2009), the FUTURE Implementation Plan was approved. The FUTURE Science Plan and Implementation Plan are posted on the PICES main web page: http://www.pices.int/. FUTURE includes three Advisory Panels:
1. AICE (Anthropogenic Influences on Coastal Ecosystems) is focused primarily on human influences on coastal ecosystems, such as runoff, pollution, effects of fishing, existence of invasive species, and loss of habitat.
2. COVE (Climate, Oceanographic Variability and Ecosystems) is focused on regional (shelf) to basin scale ecosystem processes and Pacific teleconnections.
3. SOFE (Status Reports, Outreach, Forecast and Engagement) will identify major sources of uncertainty and impediments to improving the skill of assessments and forecasts, and suggest research areas for priority development.

PICES FUTURE Advisory Panel Chairman nominations from FIS:

AICE
- Masahide Kaeriyama, FIS, CFAME, IP-WT (Japan)
- Jae Bong Lee, WG 19 (Korea)
- Anne Hollowed, WG-FCCIFS, IP-WT, WG-25 Co-Chairman (U.S.A.)

COVE
- Jacquelynne King, CFAME, WG-FCCIFS (Canada)
- Akihiko Yatsu, FIS, CFAME, WG-FCCIFS (Japan)
- Sukyung Kang (Korea)

SOFE
- Sukgeun Jung, FIS (Korea)
- Oleg N. Katugin, CCCC, IP-WT (Russia)
- John Field, FIS (U.S.A.)

Science Board recommended, and Governing Council approved, the following FIS-nominated Advisory Panel memberships: Jackie King (COVE), Masahide Kaeriyama (AICE), and Oleg Katugin (SOFE).

AGENDA ITEM 11
Other priority items with funding implications

The Study Group on *Restructuring the Annual Meeting* (SG-RAM) reported its first draft to the 2009 inter-sessional Governing Council meeting in Qingdao (April 29, 2009) and made the following recommendations.

Options:
1. Increase of the number of concurrent scientific sessions and shorten the duration of Annual Meeting;
2. Reduce the number of meetings and workshops immediately prior to the Annual Meeting;
3. Use the Science Board inter-sessional meeting as an opportunity to decide on the scientific sessions of the Annual Meeting for the following year. This would be lighten the burden on Science Board during the Annual Meeting;
4. Science Board and Scientific/Technical Committees should explore the possibility of holding an inter-sessional conference using video and web systems among PICES member countries.

AGENDA ITEM 12
Proposed publications

The proceedings of the PICES/ICES Symposium on "*Climate change effects on fish and fisheries*" in Sendai, Japan, April 2010 is proposed for publication in 2011.

AGENDA ITEM 13
Inter-sessional activities, meetings and requests for travel support

No additional requests other than those already noted.

AGENDA ITEM 14
Review of FIS Action Plan

The FIS Action Plan has not been reviewed since 2007 and needs to be reviewed and updated to be more consistent with the FUTURE Science Program. However, FIS discussed the fact that the FIS Action Plan is based on the overall PICES Strategic Plan, which also needs to be revised. It was resolved that FIS should wait for the PICES Strategic Plan to be revised. In any case, time was much too limited to discuss the FIS Action Plan in detail during PICES 2009. Therefore, FIS will develop and consider revisions to its Action Plan by email during the year after the PICES Strategic Plan is revised.

AGENDA ITEM 15
Other business

None.

FIS Endnote 1

FIS participation list

Members

Elena Dulepova (Russia)
John Field (U.S.A.)
Gordon Kruse (U.S.A., Vice-Chairman)
Toyomitsu Horii (Japan)
Xianshi Jin (China)
Sukgeun Jung (Korea)
Masahide Kaeriyama (Japan)
Jin Yeong Kim (Korea)
Libby Logerwell (U.S.A.)
Laura Richards (Canada)
Mikhail Stepanenko (Russia, Chairman)
Akihiko Yatsu (Japan)
Chang-Ik Zhang (Korea)

Observers

Katsuyuki Abo (Japan)
Judith Amesbury (WPFMC)
Heui Chun An (Korea)
David Fluharty (U.S.A.)
Caihong Fu (Canada)
Graham Gillespie (Canada)
George Hunt (ESSAS)
Yukimasa Ishida (NPAFC)
Oleg Katugin (Russia)
Suam Kim (Korea)
Patricia Livingston (U.S.A.)
Skip McKinnell (PICES)
Minling Pan (U.S.A.)
Craig Rose (U.S.A.)
Hiroaki Saito (Japan)
Chang Seung (U.S.A.)
John Stein (PICES)
Tokio Wada (PICES)
Juan Valero (IPHC)

FIS Endnote 1

FIS meeting agenda

1. Welcome, attendance, rapporteur
2. Adoption of agenda
3. 2009 FIS Best Oral Presentation and Poster awards
4. FIS Chairman's Report: Implementation of PICES XVII decisions
5. Reports of FIS-sponsored groups
6. Relations with other programs and organizations
7. Proposals for FIS Topic Sessions and workshops at PICES XIX
8. Proposals for new FIS-sponsored working groups and study groups
9. Proposals for new meetings with PICES as co-sponsor
10. High priority projects: FUTURE
11. Other priority items with funding implications
12. Proposed publications
13. Inter-sessional activities, meetings and requests for travel support
14. Review of FIS Action Plan
15. Other business

FIS Endnote 3
Proposal for an MEQ/FIS Task Team on "PICES Understanding, Linking and Synthesis of Ecosystems" (PULSE)

Objective: To monitor and synthesize regional and basin-wide ecosystem-based management (EBM) studies and initiatives (ecosystem health) and to provide a forum for the integration of FUTURE-related EBM practices and their implementation.

Proposed Terms of Reference:

1. PULSE (PICES Understanding, Linking and Synthesis of Ecosystems) is the scientific body responsible for the promotion, coordination, integration and synthesis of research activities related to the implementation of EBM among PICES member nations. This goal would be accomplished by convening meetings, periodic scientific symposia or workshops, and by distributing information designed to foster cooperation and integration among existing or developing PICES programs, and possibly between and/or within member nations;
2. PULSE will provide the scientific body to identify and improve indicators to measure progress in the achievement of EBM. It will provide the forum to discuss the needs, impacts and responses of coastal communities in a changing marine environment, and to enhance the use of this information by governments and society at large. It will provide a forum for the connection of ecosystem monitoring and status reporting of both environmental and social indicators (through linkage with Monitor), and the subsequent implementation and adaptation of EBM;
3. Scientific collaboration and coordination with other international agencies, bodies and societies that are engaged in either EBM or human activities that are relevant to the achievement of EBM will be undertaken. This will engage expertise not previously active in PICES, such as social-scientists and policy makers;
4. PULSE will encourage establishment of other component activities, such as developing the basis for coupled human science-natural science models, and emerging approaches as needed to facilitate synthesis of the FUTURE Program.

Suggested members: We recommend a structure that will ensure core connection with the PICES committees, key expertise from the various disciplines involved in studying ecosystem approaches to management, and national representation. We advocate a nomination process that will closely connect PULSE to PICES Scientific Committees, such as ensuring that a member or designate from each of the Committees and perhaps from the current Communication Study Group is in PULSE. There is also merit in having member participation from different sectors besides fishing (*e.g.* mariculture, *etc.*,) and ecoregions.

FIS Endnote 4
Proposal for a ½-day FIS/BIO/ESSAS Topic Session at PICES-2010 on "*Ecosystem models: Are they useful for management or forecasting biological response to climate change*"

Recommendations to pursue ecosystem perspectives in marine resource management and research have been common for several years. In the beginning, there seemed to be a consensus that ecosystem approaches were a reasonable next step in managing our living marine resources and alleviating problems of fragmented sector-based management. However, marine science organizations around the world struggled to operationally define and implement ecosystem-based fishery management. Consequently, most case studies that claim to be implementing an ecosystem approach to management have done so by adopting tactical measures that address one or a few species. While the combination of many tactical measures may result in an ecosystem approach to management, scientists and managers seldom examine the efficacy of the strategy to achieve the goals of ecosystem management. We believe this trend is changing in response to a demand for a public deliberation of the costs and benefits of different approaches. Ecosystem models are beginning to be useful for management or forecasting biological response to climate change and fishing. In this session, we seek papers that demonstrate the utility of ecosystem models and ecosystem assessments as techniques to inform decision makers as to the impacts different management approaches under a changing climate. Specifically we seek

examples of techniques for assessment of the impacts of different strategies on the structure, function and variability of marine ecosystems. We anticipate that some case studies will demonstrate the utility of these models to assist decision makers to address a variety of issues including: defining and setting limited access privilege, establishing quota programs and catch shares, assisting with the regulatory process, and helping to settle stakeholder disputes for marine spatial planning.

Convenors: Bernard A. Megrey (U.S.A.), Anne Hollowed (U.S.A.), Jae-Bong Lee (Republic of Korea)

Potential invited speakers: Steve Mackinson (Ecosystem Applications Team Leader, CEFAS, UK), Villy Christensen (Associate Professor, UBC, Canada), and Beth Fulton (CSIRO, Tasmania, Australia)

FIS Endnote 5

A 1-day FIS/BIO Topic Session at PICES-2010 on
"*Observations of ecosystem mixing under climate change*"

As the ocean environment changes, we expect species to respond by changing their distribution. Species could expand into habitats newly made available to them and avoid or shrink their abundance in habitats that are no longer viable. Because species respond to these environmental changes at different rates, formally isolated species now interact. We coin the term "ecosystem mixing" to describe the pulling apart and re-mixing of ecosystems and species interactions in a changing environment. For example, Humboldt squid, for example, expanded their range northward along the west coast of North America in 2009, encountering new prey species, potentially including important stocks of juvenile salmon. In this topic session, we consider the consequences of ecosystem mixing. We invite papers which describe case studies of ecosystem mixing from a physical, biological and/or socio-economic perspective, especially as they impact the predators and/or prey of key species (such as those important for fishery harvests). Selected oral and poster presentations will be considered for publication in a peer-reviewed journal.

Suggested Convenors: Laura Richards (Canada), Franz Mueter (U.S.A.), Sanae Chiba (Japan), Jin-Yeong Kim (Korea)

FIS Endnote 6

Proposal for a 1-day FIS/MEQ Topic Session at PICES-2010 on
"*Economic relation between marine aquaculture and wild capture fisheries*"

Past activities of PICES have mainly focused on physical and biological sciences, such as ecology, ecosystems, fisheries, oceanography, and biogeochemistry, *etc*. Recognizing the importance of impacts from human activities/uses upon marine living resources, we are proposing a topic session on the fisheries economics at the 2010 PICES meeting. While humans are essential parts of marine ecosystems, it is important to consider economic and social science research within PICES. Indeed, the new FUTURE science program endeavors to provide a greater role for social and economic scientists in PICES. This proposed economics session is a direct response to this objective and is intended to be a step toward enhancing research and management of marine living resources from a socio-economic perspective.

We propose the first ever PICES topic session on marine aquaculture economics, because of the growing role of marine aquaculture in both seafood production and consumption, as well as the close relationship between marine aquaculture and wild ocean capture fisheries. The proposed topic session will focus on the relationships of marine aquaculture with capture fisheries with respect to economics, such as (1) marine aquaculture products as a substitute and/or complement for wild caught products owing to consumer preference, price, and availability; (2) the synergies between aquaculture and fishing (use of fish processing trimmings, resilient coastal communities and maintaining working waterfronts, and (3) economic considerations regarding potential environmental effects (positive and negative) interactions between captured fisheries and marine

aquaculture (*e.g*, feed inputs in marine aquaculture derived from captured fisheries, aquaculture stock enhancement, aquaculture structures as fish aggregating devices, *etc*.).
We believe that the PICES 2010 annual meeting in Portland is particularly well suited for this proposed topic session for multiple reasons. First, this topic is timely owing to the ongoing activities of WG-24 and the joint interests of FIS and MEQ, particularly in light of FUTURE. Second, we have secured funding from NOAA NMFS to support travel of key Asian experts to this topic session. This funding, coupled to easy access to Portland by economic and social scientists from the U.S. and Canada, should assure a very well attended and highly successful topic session. We seek to publish accepted papers or a special issue from this session in a peer-reviewed journal such as Aquaculture Economics and Management, Aquaculture, Reviews in Aquaculture, or Fishery Research.

Suggested Convenors: Minling Pan (U.S.A., committed); Ingrid Burgetz (Canada, tentative); Qingyin Wang (China, committed); Dohoon Kim (Korea, in contact)

Proposed invited speakers: Michael Rubino (Manager, Aquaculture Program, NOAA), James Anderson (Professor, The Department of Environmental and Natural Resource Economics University of Rhode Island, tentative), Ping Sun Leung (Professor, Natural Resources and Environmental Management, University of Hawaii at Manoa, tentative)

FIS Endnote 7

Proposal for a 1-day POC/FIS/BIO Topic Session at PICES-2010 on "*Impact of climate variability on marine ecosystems: Understanding functional responses to facilitate forecasting*"

Understanding the role of natural variability, occurring over a variety of temporal and spatial scales is essential for effective management of marine ecosystems in the wake of predicted global change. Evidence suggests that climate variability can trigger regime shifts in marine ecosystems. Regime shifts are characterized by a re-organization of marine communities, species dominance, and tropho-dynamic relationships. Often, synchronous shifts occur in aquatic ecosystems that are separated by thousands of kilometers. This finding suggests that atmospheric teleconnections are mediating regional system changes. We postulate that comparative studies of ecosystems that have experienced regime shifts will provide insights into the expected responses of marine organisms to climate change. We seek papers that go beyond simple pattern matching. Contributions to this Theme Session should provide statistical evidence of the functional responses and relationships that underlie regime shifts and statistical or modeling studies that successfully simulate observed shifts. The primary focus of this session will be on understanding shifts in the pelagic realm including phytoplankton, zooplankton and pelagic fishes such as herring, capelin, sardines anchovies, sprat, saury and gadids.

Co-sponsored by ICES

Co-convenors: Suam Kim, Jurgen Alheit, Harald Loeng, James Overland

FIS Endnote 8

A ½ (or full) day Topic Session at PICES-2010 on
"*Oceanographic and demographic processes affecting the reproductive biology of exploited marine stocks*"
[later changed to a ½-day Topic Session]

Recent research has demonstrated several complexities in the reproductive processes of marine fish. First, for some cod and rockfish stocks there is evidence of a maternal effect upon larval quality such that larval viability increases with spawner age. Second, some iteroparous stocks show evidence of skipped spawning (*i.e.*, not all mature fish spawn in each year) that is related to environmental conditions and the life-history of the stock. Third, temporal changes in age at reproduction have occurred for some exploited stocks, and researchers are attempting to attribute this pattern to some combination of 1) demographic changes in age and size structure; 2) plastic responses to a changing environment; or 3) evolutionary responses to selective pressures. These

complexities indicate that the production of reproductive output of marine stocks may be more complex than typically assumed in population models, and researchers are beginning to more fully incorporate reproductive biology in assessment procedures. The purpose of this symposium is to review field, laboratory, and modeling studies that may reveal how oceanographic variability, life-history pattern, and fishing pressure may affect the reproductive biology for North Pacific fish stocks, and consider how reproductive biology can best be incorporated into fishery assessment and management.

Suggested Convenors: Paul Spencer (U.S.A.), Chang Ik Zhang (Korea), Jin-Yeong Kim (Republic of Korea)

Proposed Keynote Speaker: Edward Trippel (Department of Fisheries and Oceans, New Brunswick, Canada). Dr. Trippel is an internationally recognized expert on the reproductive biology of commercially fished marine stocks, and in particular how environmental and anthropogenic factors can affect reproductive biology.

FIS Endnote 9

Proposal for a ½-day MEQ/FIS Topic Session at PICES-2010 on
"Identifying vulnerable marine ecosystems in the North Pacific"

The FAO and the Convention on Biological Diversity (CBD) have been encouraging the sustainable use of marine living resources by the identification of vulnerable marine ecosystems (VMEs) and ecologically and biological significant areas (EBSAs), in particular but not exclusively in international waters. The broad purpose for identifying such areas is to prevent significant adverse impacts and to protect the marine biodiversity that these ecosystems provide.

To achieve these objectives, researchers and managers must be able to identify areas where VMEs are known, or are likely, to occur. Outstanding questions related to VME identification include what characteristics should be used to classify these systems, how can current information on VMEs and EBSAs be consolidated, and how can predictive models be developed and tested. PICES member countries are beginning to identify VMEs that meet a variety of biological and socio-economic objectives. However, no comprehensive comparison the different methods or assessment of their performance against established ecological, social and economic objectives exists to provide guidance on the appropriate tools to be used. The proposed session will bring together researchers and managers engaged in ecosystem-based management to address three objectives: (1) to compare current approaches and datasets used to identify Vulnerable Marine Ecosystems/Ecologically and Biological Sensitive Areas by different member countries in order to develop a list of appropriate tools, (2) to attempt to reach consensus on broadly acceptable criteria for the identification of VME/EBSA-type areas or potential areas in the high-seas of the Northeast Pacific Ocean, and (3) to propose the locations of such areas and ecosystems. Both benthic/demersal and pelagic systems will be considered, as they may have different criteria. Presentations and methods developed for shelf and coastal waters are welcome to the extent that they provide guidance and case studies for open ocean situations. This review of international experiences with applying criteria to identify VMEs and EBSAs will contribute to the international discussion and evaluation of these issues, and to the application of measures to protect these significant regions.

Convenors: Canada, U.S.A., Korea, others?

Invited speaker: TBD. Approximate cost: ?

FIS Endnote 10

Proposal for a ½-day FIS/MEQ/others? Topic Session at PICES-2010 on "*New and Emerging Technologies: Applications of Genomics and Related Technologies for Marine Ecosystem Studies*"

The use of genomics, proteomics and metabolomics, either alone or in combination with each other and/or with more traditional methods, is rapidly transforming many areas of biological and biomedical research. Genomics is the study of all genes within an organism, and can be applied at the sequence (DNA) level, or the

transcribed (RNA) level. Proteomics and metabolomics are studies of all proteins or metabolites, respectively, within an organism, organ, cell, or system, at any given time, under selected conditions. These technologies have enabled the transition from sequential studies of single genes, proteins or metabolites by enabling the simultaneous study of many components and their interactions with the environment (from pathways, through cell tissues to whole organisms and communities). These technologies are now being used to address fundamental questions in areas such as ecology, biodiversity and evolution primarily in the terrestrial setting. With the exception of genomic and proteomic studies designed to address questions about the diversity and ecology of marine microbial and phytoplankton and fish communities to date, these technologies have not been broadly applied in marine ecosystems or fisheries research. The goal of this session will be to provide an introduction to these technologies, including information on how they have been applied, or could be applied to address questions of importance to marine and fisheries scientists and policy makers. Contributors will be invited to explore topics such as: the scientific value of these technologies to ecological and fisheries research; the factors that have limited their application; the importance of these technologies to our understanding of complex issues such as monitoring, managing and setting policy for marine biodiversity; and what is needed for marine and fisheries scientists to take advantage of these technologies? This session will stimulate discussion within the PICES and broader research community: encourage interactions between marine and fisheries scientists with research groups that routinely use these technologies in their fields of research; and start the process of development of multidisciplinary research teams that are so crucial for obtaining funding for large-scale marine-base research programs that utilize and, more importantly, integrate these fields.

Convenors: Laura Brown (Canada) and (TBD)

Suggested invited speakers: Salvatore Aricò (Program Specialist Biodiversity, Environmental Governance and Policy Responses, UNESCO, Paris) or Brian Bowen (University of Hawaii – research area: phylogeography and conservation genetics of marine vertebrates)

FIS Endnote 11

Proposal for a ½-day FIS Workshop at PICES-2010 on
"*Beyond Lagrangian: Modeling migratory fish behavior in Global Circulation Models*"

The advent of high resolution coupled atmosphere–ocean circulation models and the creation of repositories of high resolution 4-D ocean hindcasts and future scenarios has made it possible to contemplate adding virtual fish to an increasingly virtual ocean. The ability to study virtual fish in a virtual ocean has a potential to understand past phenomena and potentially, to predict future behavior. Recent developments in satellite data availability, in data assimilating physical models, and in tagging technologies for fishes, all increase the chance to improve our understanding of fish migration mechanism. However, fish behavior is complex. It is a consequence of genes, the physical, chemical and biological environment and their interaction, and perhaps even from learned behavior. This makes the modeling of fish behaviors potentially very complex, and this complexity suggests that a team approach to model building might be desirable. The purpose of this workshop is to understand the current state of development in modeling fish behaviour. Presentations are anticipated that discuss successes (and failures) in modeling migratory fish behavior. Presentations related to data availability to evaluate fish behavior models and laboratory experimental approaches to investigate fish behavior are also welcomed. Based on the results and opinions expressed at the workshop, the convenors would like to discuss the desirability of establishing a group that will focus its attention on developing and advancing the state of fish behavioral modeling.

Co-Convenors: Enrique Curchitser (U.S.A.), Shin-ichi Ito (Japan), Michio Kishi (Japan), Skip McKinnell (PICES)

Invited speaker: Geir Huse (Institute of Marine Research, Norway)

REPORT OF MARINE ENVIRONMENTAL QUALITY COMMITTEE

The meeting of the Marine Environmental Quality Committee (MEQ) was held at Jeju Island, Korea from 14:00–16:00 hours on October 28, 2009. The Chairman, Dr. Glen S. Jamieson, called the meeting to order and welcomed the participants and observers (*MEQ Endnote 1*). The Committee reviewed the draft agenda (*MEQ Endnote 2*) and it was adopted. Dr. Steve Rumrill (U.S.A.) served as rapporteur.

AGENDA ITEM 3
Implementation of PICES XVII decisions

There were no pressing issues for the Committee pending from last year's meeting, PICES XVII, in Dalian, China. The Chairman did not summarize the report of the inter-sessional Science Board meeting (April 28, 2009, Qingdao, China) as issues relative to it were largely focused on FUTURE, which was covered later in the agenda.

AGENDA ITEMS 4–7
Progress reports of MEQ subsidiary bodies

Section on Ecology of Harmful Algal Blooms in the North Pacific (HAB-S)

Dr. Hak-Gyoon Kim, HAB Section Co-Chairman, reported on the results of their workshop and laboratory demonstrations (W6) on "*Cyst-forming HAB species*"; MEQ Topic Session (S4) on "*Mitigation of harmful algal blooms*", and HAB-S business meeting convened at PICES-2009. Summaries of the workshop and session can be found in the Session Summaries chapter of this Annual Report.

HAB-S requested the following members be considered for replacement due to a lack of contribution and activity: Dr. Jennifer Martin (Canada) and Drs. Gennady Kantakov and Nina Klochkova (Russia). Potential alternatives for delegates to consider adding, based on their valuable contributions are: Drs. Hao Guo and Jinhui Wang (China). HAB-S requests that Canada provide an additional expert to the Section who can report on Canadian HAB data. HAB-S requests *ex-officio* membership for: Dr. Takafumi Yoshida (NOWPAP/CEARAC) and an ICES HAB Working Group member. The full report of HAB-S plans and activities can be found in the Report of the Section on *Ecology of Harmful Algal Blooms in the North Pacific* elsewhere in the PICES 2009 Annual Report.

Working Group on *Ecosystem-based Management Science and its Application to the North Pacific* (WG 19)

Dr. Glen Jamieson, WG 19 Co-Chairman, reported on the activities of the Working Group, and stated that the final report had been completed and had been sent to all MEQ and FIS Committee members for their evaluation. The Committee was asked to approve it, which it did unanimously. It was pointed out that WG members plan to produce a brochure of their report, which will be done with input from members from the FUTURE Advisory Panel, SOFE.

Working Group on *Non-indigenous Aquatic Species* (WG 21)

Ms. Darlene Smith, WG 21 Chairman, reported on the fourth meeting of the WG 21. As part of the MAFF project, WG 21 held a 4-day Rapid Assessment Survey (RAS) from October 19–22, with participation from Canada, Japan, Korea, Russia and United States, ICES WGITMO, and IOC WESTPAC. Collections analysed were taken from four locations (Busan, Ulsan, Masan and Jang Mok). There was also field sampling in Jeju Port and at Seongsan Beach, with laboratory analysis conducted at the Jeju Biodiversity Institute. The analysis is being finalized and will be entered into the NIS database. Special thanks are given to the local organizers and collaborators at KORDI, especially Dr. Junghoon Kang and Dr. Kyoungsoon Shin.

There were also presentations on surveys undertaken by Dr. Li Zheng in Qingdong and Qingdao, China, and by Dr. Hiroshi Kawai in Osaka Bay, Japan (note: collectors were also put out by Canada and United States but their analysis was not yet completed). Collector surveys are planned for 2010 in Japan, China, United States, and possibly other countries.

Two alternative locations (Tokyo Bay or Osaka Bay) were proposed by Dr. Kawai for a RAS demonstration workshop to be held in July 2010. WG 21 selected the Osaka Bay proposal based on considerations of cost, biodiversity, facilities and logistics.

Upgrades to the Nonindigenous Species Database included: ability to add images, ability to add pdf files, ability to output maps to a pdf file or to a printer, a bulk import utility, and a utility to produce speadsheets of information by species. Development is planned to be concluded by March 2010.

Finally, with respect to the summary of the marine bioinvasions in the North Pacific database, data entry is going slower than planned. The long-term plan is to produce an atlas of species with distribution maps and ecological characteristics as a PICES publication; a brochure with a CD and a pdf on the PICES website.

This was the fourth annual meeting of WG 21. There was participation by WG members from all PICES countries, including guests from IOC WESTPAC, ICES WGITMO, WG-24, and Oregon State University.

Concerning PICES-ICES collaboration, there was a joint meeting held in August with exchange of information on programs.

There is a possibility to present the WG 21 NIS database at a meeting at the WGBOSV meeting in Hamburg, Germany in March 2010. It is proposed that a third joint meeting be held in 2011, following a planned 7th Marine Bioinvasions Conference in Barcelona, Spain.

The Working Group is planning to hold a 4-day Rapid Assessment Survey prior to the next PICES Annual Meeting in Portland, U.S.A., and a 4- to 5-day demonstration RAS workshop in July in Japan.

A full report of WG 21 plans and activities can be found in its own report elsewhere in the PICES 2009 Annual Report.

Working Group on *Environmental Interactions of Marine Aquaculture (EIMA)* (WG 24)

At its inaugural meeting, all members present were in agreement that, at this time, the Terms of Reference are appropriate for the Working Group. They agreed that standardization of risk analysis methods was not what is desired. Understanding how different methods are used, and how they compare with each other is a more important goal. The Working Group requested a 1½-day meeting to be held in advance of PICES-2010. WG 24 requested another Japanese member to support Activity 3 (Aquatic Animal Health).

Discussions by WG 24 are summarised in its own report, which was also presented to the FIS Committee.

AGENDA ITEM 8
FUTURE: Roles for MEQ and respective member countries

The Committee again had a good discussion of the structure of the next PICES integrative science program. Members believe that the direction of FUTURE is aligned well with the objectives of MEQ. Objectives of the three new FUTURE Advisory Panels, AICE, COVE and SOFE, were described by Dr. Jamieson, who served as the Interim Chair of AICE. Scientists associated with MEQ by virtue of their being committee members or by serving on expert groups associated with MEQ were appointed, one to each Advisory Panel. Dr. Tom Therreault (Canada, WG 21) is the AICE member, Dr. Jung-Hoon Kang (Korea, MEQ Committee) is the

COVE member, and Dr. Chang-Ik Zhang (Korea, WG 19) is the SOFE member. There is a potential conflict with the last appointment as WG 19 has been disbanded and Prof. Zhang is a FIS Committee member. To achieve a balance of committee and national representation on all Advisory Panels, the above nominations were agreed to. These MEQ representatives to FUTURE Advisory Panels have been asked to report their Panel's activities at future MEQ Committee meetings.

Discussions were held on the planned scope of activities and the identification of expert groups relative to each Advisory Panel. AICE-AP is most relevant to MEQ, and Chairmen of all three Advisory Panels will be on the PICES Science Board. AICE-AP can make recommendations on its own as to desired research, expert groups, *etc.*, but all three Advisory Panels are expected to recommend specific activities for consideration by the Committees.

Dr. John Stein (U.S.A.) summarized the differences between FUTURE and the previous science program, CCCC (Climate Change and Carrying Capacity). PICES Science Board is the scientific steering committee for FUTURE (unlike the CCCC Program which had its own Science Steering Committee).

AGENDA ITEM 9
MEQ proposals for new subsidiary bodies

Dr. Mitsutaku Makino gave a presentation on a proposal for a study group focusing on human dimensions. Its initial focus was to be ecosystem-based fisheries management, with additional foci anticipated on other sectors (*i.e.*, transportation, tourism, *etc.*) at a later date. The Committee supported establishment of a PICES Study Group on *Indicators of Human Well-Being: Benefits and Health.*

WG 19 recommended establishment of an expert group (section or task team, to be titled PULSE (**P**ICES **U**nderstanding, **L**inking and **S**ynthesis of **E**cosystems)) to keep abreast of developments in EBM in PICES member countries. The relationship of PULSE (see MEQ *Endnote 3*) to other potential expert groups that may be established by FUTURE, and to the proposed Study Group, above, was discussed. WG 19 thought that a study group on human dimensions should be able to address some of the issues of concern to PULSE. The establishment of PULSE could be deferred for a year to await the study group's report. The MEQ Committee recommended that a Study Group on *Human Dimensions* be established with the understanding that it consider how best to achieve a longer-term EBM monitoring program as a component of FUTURE.

AGENDA ITEM 10
MEQ Best Presentation and Poster Awards

The MEQ Best Presentation award for 2009 was given to I Nyoman Radiarta for the paper entitled "*The impact of climate change on the development of marine aquaculture: A case study on Japanese scallop aquaculture in Funka Bay, Hokkaido, Japan*" (MEQ Topic Session S5).

The MEQ Best Poster award was given to Sang Rul Park for the paper entitled "Growth and photosynthetic characteristics of three *Zostera* spp. (*Z. japonica*, *Z. marina* and *Z. caespitosa*) along vertical gradient: Implications for seagrass zonation" (S5).

AGENDA ITEM 11
Proposals for Topic Sessions and workshops at PICES-2010

The Committee proposes that the following Topic Sessions, meetings and workshops to be convened at PICES-2010:

- a ½-day MEQ Topic Session on "*Conceptual and numerical models of HAB dynamics*" (*MEQ Endnote 4*);
- a 1-day MEQ workshop on "*New technologies and methods in HAB research and monitoring. I. HAB*

species detection" (*MEQ Endnote 4* footnote);
- a ½-day MEQ Topic Session on "*Join the club: Integrating non-indigenous species with other anthropogenic influences on coastal ecosystems*" [later renamed as "*Anthropogenic forcing in North Pacific coastal ecosystems: Understanding changes in ecosystem structure and function*"] (*MEQ Endnote 5*);
- a ½-day MEQ/FIS Topic Session on "*New and emerging technologies: Applications of genomics for marine ecosystem studies*" (*MEQ Endnote 6*);
- a ½-day MEQ/FIS Topic Session on "*Identifying vulnerable marine ecosystems in the North Pacific*" (*MEQ Endnote 7*);
- a ½-day POC/MEQ/FUTURE Topic Session on "*Marine renewable energy development in coastal and estuarine environments around the North Pacific*" (*MEQ Endnote 8*);
- a 1-day FIS/MEQ Topic Session on "*Economic relation between marine aquaculture and wild capture fisheries*" (*MEQ Endnote 9*);
- a ½-day MEQ/FUTURE Topic Session on "*Characterization, understanding, and forecasting the influence of multiple stressors in coastal ecosystems*" (*MEQ Endnote 10*);
- a 1-day HAB-S business meeting;
- a 2-day WG 21 business meeting;
- a 1½ -day WG 24 business meeting.

AGENDA ITEM 12
Relations with other international programs and organizations

HAB-S requested MEQ to recommend to Science Board for *ex-officio* membership for Dr. Takafumi Yoshida (NOWPAP CEARAC) and a HAB working group representative from ICES to attend PICES Annual Meetings. A member of this group was represented by Dr. Donald Anderson at PICES-2009.

MEQ proposed that one HAB-S member should attend ICES Annual Science Conferences (and *visa versa*).

AGENDA ITEM 13
Items with financial implications

Proposed inter-sessional meetings for 2010 and beyond

- WG 21 proposed a third joint meeting with ICES in 2011 following the 7th Marine Bioinvasions Conference that is currently being planned in Barcelona, Spain.

Proposed publications

The following publications, repeated from last year, are still proposed:
- final WG 19 report in the PICES Scientific Report series (2010);
- a WG 19 brochure on ecosystem-based management (2010 or 2011) in a format similar to the FERRRS Advisory Report.

AGENDA ITEM 14
Membership and chairmanship of MEQ

There continues to be an overall issue of having full participation in MEQ by all PICES member countries. At PICES-2009, China was not present, and only 60% of MEQ members were in attendance.

Terms of the MEQ Chairman and Vice-chairman expired following PICES-2009. Dr. Jamieson was renominated as MEQ Chairman by Dr. Rumrill, but declined to serve because he had retired from his Canadian government position. As a consequence, it would be difficult to receive travel support from Canada. Dr. Steven

Rumrill was then nominated by Darlene Smith. During the election, Dr. Rumrill was unanimously voted in as MEQ Chairman. Dr. Jamieson then nominated Dr. Mitsutaku Makino as Vice-Chairman, and this was also approved unanimously. Both Drs. Jamieson and Hak-Gyoon Kim were thanked for their efforts in chairing the MEQ Committee.

AGENDA ITEM 15
Other business

A 10 minute presentation was given by Dr. Peter Kershaw, representing the Group of Experts on Scientific Aspects of Marine Pollution (GESAMP).

The names of early career participants in MEQ activities were suggested as MEQ nominations for PICES Steering Committee representatives for the 2012 ICES/PICES Conference for Early Career Scientists that is being planned.

AGENDA ITEM 16
Suggested theme for PICES-2011

1. "FUTURE is now: Identification of ecosystem trends and responses to changing resilience in the North Pacific".
2. "Connections between the land and sea: Physical, biotic, and social-science links between and among coastal watersheds and North Pacific ecosystems"

MEQ Endnote 1

MEQ participation list

Members

Ik-Kyo Chung (Korea)
Glen Jamieson (Canada, Chairman)
Hak-Gyoon Kim (Korea)
Kunio Kohata (Japan)
Olga Lukyanova (Russia)
Mitsutaku Makino (Japan)
Darlene Smith (Canada)
Steve Rumrill (U.S.A.)
John Stein (U.S.A.)

Observers

Katsuyuki Abo (Japan)
Edward Black (Canada)
David Fluharty (U.S.A.)
Graham Gillespie (Canada)
Yoichiro Ishibashi(Japan)
Peter Kershaw (GESAMP)
Tsuyoshi Kitamoto (Japan)
Tatyana Semenova (Russia)
Peter Ross (Canada)
Gongke Tan (China)
Thomas Therriault (Canada)
Yasunori Watanabe (Japan)

MEQ Endnote 2

MEQ meeting agenda

1. Welcome and introductions
2. Approval of agenda
3. Implementation of PICES XVII decisions
4. Progress report of the MEQ Section on Ecology of Harmful Algal Blooms in the North Pacific and HAB activities related to "Development of the prevention system for harmful organisms' expansion in the Pacific Rim" supported by a special fund from the Government of Japan" (Trainer)
5. Progress report of MEQ/FIS WG 19 on *Ecosystem-based Management Science and its Application to the North Pacific* (Jamieson)
6. Progress report of MEQ WG 21 on *Non-indigenous Aquatic Species* and NIS activities related to "Development of the prevention system for harmful organism's expansion in the Pacific Rim" supported by a special fund from the Government of Japan" (Smith)
7. Progress report of MEQ WG 24 on "*Environmental Interactions of Marine Aquaculture*" (WGEIMA) (Amos)
8. Discussion of the next major PICES integrative scientific program, FUTURE: Roles for MEQ and respective member countries (Jamieson)
   - Brief Advisory Panel (AICE, COVE and SOFE) presentations by each of the three potential AP Chairs (20 min each)
9. Proposals for new subsidiary bodies (*e.g.*, Working Groups, *etc.*; requires Terms of Reference and list of potential members)
10. 2009 MEQ Best Presentation and Poster Awards
11. Proposals for Topic Sessions and workshops at PICES-2010 in Portland, U.S.A.
12. Relations with other international organizations/programs
13. Items with financial implications
    a) Proposed inter-sessional meetings for 2010 and beyond
    b) Proposed publications for 2010 and beyond
    c) Travel support requests
    d) Other items
14. Election of MEQ Chair and Vice-Chair
15. Other business
    - 10 min presentation by Dr. Peter Kershaw (representing the Group of Experts on Scientific Aspects of Marine Pollution)
    - Nomination for a PICES Steering Committee representative for a 2012 ICES/PICES Conference for Young Scientists (<35 y old)
16. Suggestions for the theme for PICES-2011 in Russia.
17. Adjourn at 18:00

MEQ Endnote 3

Proposal for a MEQ/FIS Task Team on
"PICES Understanding, Linking and Synthesis of Ecosystems" (PULSE)

Objective

To monitor and synthesize regional and basin-wide ecosystem-based management (EBM) studies and initiatives (ecosystem health) and to provide a forum for the integration of FUTURE-related EBM practices and their implementation.

Draft Terms of Reference

1. PULSE (PICES Understanding, Linking and Synthesis of Ecosystems) is the scientific body responsible for the promotion, coordination, integration and synthesis of research activities related to the implementation of EBM among PICES member nations. This goal would be accomplished by convening meetings, periodic scientific symposia or workshops, and by distributing information designed to foster cooperation and integration among existing or developing PICES programs, and possibly between and/or within member nations. PULSE will provide the scientific body to identify and improve indicators to measure progress in the achievement of EBM. It will provide the forum to discuss the needs, impacts and responses of coastal communities in a changing marine environment, and to enhance the use of this information by governments and society at large. It will provide a forum for the connection of ecosystem monitoring and status reporting of both environmental and social indicators (through linkage with Monitor), and the subsequent implementation and adaptation of EBM;
2. Scientific collaboration and coordination with other international agencies, bodies and societies that are engaged in either EBM or human activities that are relevant to the achievement of EBM will be undertaken. This will engage expertise not previously active in PICES, such as social-scientists and policy makers. PULSE will encourage establishment of other component activities, such as developing the basis for coupled human science-natural science models, and emerging approaches as needed to facilitate synthesis of the FUTURE Program.

Suggested members

We recommend a structure that will ensure core connection with the PICES committees, key expertise from the various disciplines involved in studying ecosystem approaches to management, and national representation. We advocate a nomination process that will closely connect PULSE to PICES Scientific Committees, such as ensuring that a member or designate from each of the Committees and perhaps from the current Communication Study Group is in PULSE. There is also merit in having member participation from different sectors besides fishing (*e.g.*, mariculture, *etc.*) and ecoregions.

MEQ Endnote 4

Proposal for a ½-day MEQ Topic Session at PICES-2010 on
"Conceptual and numerical models of HAB dynamics"

Each PICES member country has conceptual models of harmful algal bloom dynamics that link the physics, chemistry and biological aspects of bloom development and decay. The biology gives us information on ecosystem structure but also describes elements contributing to success of a particular species. The chemistry focuses on nutrient dynamics, ratios and preferences among species. Physical processes detail cell and nutrient delivery to the coast. While conceptual models are descriptions of HAB dynamics without numbers, numerical models include rate estimates. In theory, each of these would be supported with the same physical, chemical and ecological foundation, overlain with the unique considerations of different water types and second order ecosystem structure. However, these models vary widely between species and among countries. There has been no comprehensive intercomparisons among these conceptual and numerical models to identify their

similarities and differences. The focus of this session will be to seek commonalities among models and identify the unique second order aspects needed to describe the distribution and dynamics of HAB in different PICES regions. We encourage modelers and non-modelers alike to submit their papers.

Co-Conveners: Shigeru Itakura (Japan) and William Cochlan (U.S.A.)

Invited Speakers: Selected by co-convenors from the following: Donald Anderson, Patrick Gentien, Wolfgang Fennel, Robin Raine (conceptual model), Tamiji Yamamoto (numerical model on nutrient dynamics and *Alexandrium tamarense*)

***** Plus a 1-day lab demonstration on *"New technologies and methods in HAB research an monitoring. I. HAB species detection"*. This series will continue in the future with demonstrations on: automated nutrient samplers, modeling, remote sensing, *etc*. (see *HAB-S Endnote 3*)

MEQ Endnote 5

Proposal for a ½-day MEQ Topic Session at PICES-2010 on *"Join the club: Integrating non-indigenous species with other anthropogenic influences on coastal ecosystems"*

[later renamed as "*Anthropogenic forcing in North Pacific coastal ecosystems: Understanding changes in ecosystem structure and function*"]

When people think of anthropogenic forcing in coastal marine ecosystems, commercial fishing, aquaculture, pollution and urbanization usually come to mind. Another type of anthropogenic forcing, typically not classified as such, is the presence of non-indigenous species (NIS). While the occurrence and subsequent impacts of NIS in coastal ecosystems are usually not classified as anthropogenic, the mechanisms of their introductions are by definition anthropogenic.

The Anthropogenic Influences on Coastal Ecosystems (AICE) advisory panel under the auspices of FUTURE, identified NIS as an exemplary anthropogenic impact on coastal marine systems. Further, in order to begin addressing the three key questions identified as priorities for FUTURE research activities, AICE and COVE Advisory Panels made it a priority to either establish new PICES expert groups or build on and extend existing activities in PICES. Working Group 21 (Non-indigenous Aquatic Species) was one of the existing groups that were specifically suggested to "form an association with AICE". Therefore, we propose a PICES topic session dedicated to NIS as an anthropogenic influence on coastal ecosystems, which would facilitate the priorities set forth by the aforementioned advisory panels

If we wish to integrate NIS with other anthropogenic influences, we need a better understanding of ecosystem or regional impacts of NIS. Many if not most studies on the impacts of NIS in marine systems are done at small spatiotemporal scales, i.e., typically over small areas (1 m2) or under controlled circumstances with single species interactions. Conclusions from these studies are often scaled up and extrapolated to entire ecosystems or regions, but the extrapolations are limited by the fact that NIS consequences for whole ecosystems are not limited to single species interactions within homogeneous habitats. The dynamics of NIS impacts vary over space and time. Processes occurring over seasonal, annual and decadal time horizons interact in complex ways with habitat type, condition and availability, native species assemblages, trophic interactions, and food web dynamics. Understanding these complexities requires restructuring how we think about NIS invasions and their impacts on the health of coastal systems. Including and integrating NIS invasions with other anthropogenic influences would help advance our objective of getting a better understanding of the ecosystem and regional impacts of NIS introductions.

Problems arising from the existence of NIS in coastal systems should be addressed using an ecosystem based approach. Continuing to study and manage NIS invasions as single species problems must be replaced by examining NIS within the context of the systems in which they invade. For example, global climate change is expected to have clear consequences with regard to future NIS introductions, establishment, and range

expansion of currently established populations. Ignoring this complex interaction will only hinder efforts to control established populations and prevent new introductions. Integrating NIS invasions with existing anthropogenic stressors will facilitate a holistic approach to addressing the challenges facing our coastal marine ecosystems.

We believe that the PICES-2010 annual meeting in Portland is particularly well suited for this proposed topic session. First, since much of the research on the impacts of NIS on coastal marine systems occurs in North America, Portland would serve as a convenient hub for this special session. Second, The Center for Lakes and Reservoirs (CLR) at Portland State University (PSU) is an internationally renowned Center that focuses on NIS research and serves as a conduit for much of the NIS research that occurs on the West Coast of the United States.

Confirmed Convenors: Blake Feist (U.S.A.) and Hiroshi Kawai (Japan)

Suggested Invited Speakers: John J. Stachowicz, Department of Evolution and Ecology, University of California, Davis (tentative): Topic: "Ecosystem and regional consequences of marine NIS invasions in coastal systems"; Toshiyuki Yamaguchi, Department of Earth Science, Chiba University, Japan (tentative): Topic: "*Biogeography and impacts of recently introduced non-indigenous barnacles in Japan*".

MEQ Endnote 6

Proposal for a ½-day MEQ/FIS Topic Session at PICES-2010 on
"New and emerging technologies: Applications of genomics for marine ecosystem studies"

The use of genomics, proteomics and metabolomics, either alone or in combination with each other and/or with more traditional methods, is rapidly transforming many areas of biological and biomedical research. Genomics is the study of all genes within an organism, and can be applied at the sequence (DNA) level, or the transcribed (RNA) level. Proteomics and metabolomics are studies of all proteins or metabolites, respectively, within an organism, organ, cell, or system, at any given time, under selected conditions. These technologies have enabled the transition from sequential studies of single genes, proteins or metabolites by enabling the simultaneous study of many components and their interactions with the environment (from pathways, through cell tissues to whole organisms and communities). These technologies are now being used to address fundamental questions in areas such as ecology, biodiversity and evolution primarily in the terrestrial setting. With the exception of genomic and proteomic studies designed to address questions about the diversity and ecology of marine microbial and phytoplankton and fish communities to date, these technologies have not been broadly applied in marine ecosystems or fisheries research. The goal of this session will be to provide an introduction to these technologies, including information on how they have been applied, or could be applied to address questions of importance to marine and fisheries scientists and policy makers. Contributors will be invited to explore topics such as: the scientific value of these technologies to ecological and fisheries research; the factors that have limited their application; the importance of these technologies to our understanding of complex issues such as monitoring, managing and setting policy for marine biodiversity; and what is needed for marine and fisheries scientists to take advantage of these technologies? This session will stimulate discussion within the PICES and broader research community: encourage interactions between marine and fisheries scientists with research groups that routinely use these technologies in their fields of research; and start the process of development of multidisciplinary research teams that are so crucial for obtaining funding for large-scale marine-base research programs that utilize and, more importantly, integrate these fields.

Suggeted Co-Convenors: Laura Brown (Canada) and TBD

Suggested Invited Speaker: Salvatore Aricò, Division of Ecological Sciences, UNESCO, Paris. Approximate cost: $3000, or Brian Bowen, Hawaii Institute of Marine Biology, University of Hawaii; research area: Phylogeography and conservation genetics of marine vertebrates. Approximate cost: $2500.

MEQ Endnote 7

Proposal for a ½-day MEQ/FIS Topic Session at PICES 2010 on
"Identifying vulnerable marine ecosystems in the North Pacific"

The FAO and the Convention on Biological Diversity (CBD) have been encouraging the sustainable use of marine living resources by the identification of vulnerable marine ecosystems (VMEs) and ecologically and biological significant areas (EBSAs), in particular but not exclusively in international waters. The broad purpose for identifying such areas is to prevent significant adverse impacts and to protect the marine biodiversity that these ecosystems provide.

To achieve these objectives, researchers and managers must be able to identify areas where VMEs are known, or are likely, to occur. Outstanding questions related to VME identification include what characteristics should be used to classify these systems, how can current information on VMEs and EBSAs be consolidated, and how can predictive models be developed and tested. PICES member countries are beginning to identify VMEs that meet a variety of biological and socio-economic objectives. However, no comprehensive comparison the different methods or assessment of their performance against established ecological, social and economic objectives exists to provide guidance on the appropriate tools to be used. The proposed session will bring together researchers and managers engaged in ecosystem-based management to address three objectives: (1) to compare current approaches and datasets used to identify Vulnerable Marine Ecosystems/Ecologically and Biological Sensitive Areas by different member countries in order to develop a list of appropriate tools, (2) to attempt to reach consensus on broadly acceptable criteria for the identification of VME/EBSA-type areas or potential areas in the high-seas of the Northeast Pacific Ocean, and (3) to propose the locations of such areas and ecosystems. Both benthic/demersal and pelagic systems will be considered, as they may have different criteria. Presentations and methods developed for shelf and coastal waters are welcome to the extent that they provide guidance and case studies for open ocean situations. This review of international experiences with applying criteria to identify VMEs and EBSAs will contribute to the international discussion and evaluation of these issues, and to the application of measures to protect these significant regions.

Convenors: Canada, U.S.A., Korea, others?
Invited Speaker: TBD. Approximate cost: ?

MEQ Endnote 8

Proposal for a ½-day POC/MEQ/FUTURE Topic Session at PICES-2010 on *"Marine renewable energy development in coastal and estuarine environments around the North Pacific"*

Renewable energy projects are increasing worldwide, and many types involve the marine environment. Those under active development are typically designed to directly extract energy from waves, tides, currents, wind, or thermal gradients or indirectly from biomass energy. These novel technologies will require new emplacements, moorings, or other structures in marine and estuarine environments with attendant intrusions upon the environment, including acoustic signals, changes to mixing, and electromagnetic fields. Marine renewable energy sources are able to provide clean energy, but their effects on the physical and biological environment are not well understood. This session will examine the technologies under development in PICES nations and address the current state of our knowledge on how they will interact with estuarine, coastal, and offshore environments.
For this session we seek contributions that deal with any topics pertinent to marine renewable energy development, including:

- Status of marine renewable energy in PICES countries;
- Economic costs and benefits of different approaches;
- Marine spatial planning for renewable energy;
- Physical effects of marine renewable energy development (current flow, energy reduction, mixing, sediment transport);
- Ecological effects (larval transport, entrainment, entanglement, behavior, habitat changes, communities) on all trophic levels.

Convenors: George Boehlert (USA), Michael Foreman (Canada, POC), Kuh Kim (Korea), Glen Jamieson (Canada, MEQ)

Suggested Invited Speaker: Henry Jeffrey (UK). Estimated cost: $2500

MEQ Endnote 9

Proposal for a 1-day FIS/MEQ Topic Session at PICES-2010 on "*Economic relation between marine aquaculture and wild capture fisheries*"

Past activities of PICES have mainly focused on physical and biological sciences, such as ecology, ecosystems, fisheries, oceanography, and biogeochemistry, *etc*. Recognizing the importance of impacts from human activities/uses upon marine living resources, we are proposing a topic session on the fisheries economics at the 2010 PICES meeting. While humans are essential parts of marine ecosystems, it is important to consider economic and social science research within PICES. Indeed, the new FUTURE science program endeavors to provide a greater role for social and economic scientists in PICES. This proposed economics session is a direct response to this objective and is intended to be a step toward enhancing research and management of marine living resources from a socio-economic perspective.

We propose the first ever PICES topic session on marine aquaculture economics, because of the growing role of marine aquaculture in both seafood production and consumption, as well as the close relationship between marine aquaculture and wild ocean capture fisheries. The proposed topic session will focus on the relationships of marine aquaculture with capture fisheries with respect to economics, such as (1) marine aquaculture products as a substitute and/or complement for wild caught products owing to consumer preference, price, and availability; (2) the synergies between aquaculture and fishing (use of fish processing trimmings, resilient coastal communities and maintaining working waterfronts, and (3) economic considerations regarding potential environmental effects (positive and negative) interactions between captured fisheries and marine aquaculture (*e.g.*, feed inputs in marine aquaculture derived from captured fisheries, aquaculture stock enhancement, aquaculture structures as fish aggregating devices, *etc.*),

We believe that the PICES 2010 annual meeting in Portland is particularly well suited for this proposed topic session for multiple reasons. First, this topic is timely owing to the ongoing activities of WG 24 and the joint interests of FIS and MEQ, particularly in light of FUTURE. Second, we have secured funding from NOAA NMFS to support travel of key Asian experts to this topic session. This funding, coupled to easy access to Portland by economic and social scientists from the U.S. and Canada, should assure a very well attended and highly successful topic session. We seek to publish accepted papers or a special issue from this session in a peer-reviewed journal such as *Aquaculture Economics and Management*, *Aquaculture*, *Reviews in Aquaculture*, or *Fishery Research*.

Suggested Convenors: Minling Pan, U.S. Economist, NOAA, Pacific Islands Fisheries Science Center (committed), Ingrid Burgetz, Canada, Senior Science Advisor, Fisheries and Oceans Canada (tentative), Qingyin Wang, China, Director, Yellow Sea Fisheries Research Institute (committed), Dohoon Kim, Korea, Economist, Office of Fisheries Economics, National Fisheries Research & Development Institute (in contact).

Proposed Invited Speakers: Michael Rubino, Manager, Aquaculture Program, NOAA, James Anderson, Professor, The Department of Environmental and Natural Resource Economics University of Rhode Island (tentative), Ping Sun Leung, Professor, Natural Resources and Environmental Management, University of Hawaii at Manoa (tentative).

MEQ Endnote 10

Proposal for a ½-day MEQ/FUTURE Topic Session at PICES-2010 on
"Characterization, understanding, and forecasting the influence of multiple stressors in coastal ecosystems"

The North Pacific marine environment has provided a diverse and valuable series of ecosystem services to coastal communities for many thousands of years. Ocean and land-based anthropogenic activities are now widely recognized to have a strong influence on ecological processes throughout the North Pacific marine ecosystem. Anthropogenic influences are particularly strong in coastal waters where they impose a wide variety of multiple stressors that can impact fundamental ecosystem functions, critical processes, and marine biodiversity. Changes in the physical and biological environment perturb native communities, often resulting in disruption of species interactions and trophic relationships that can negatively impact productivity and diminish ecosystem resilience. For example, mariculture operations can change the physical environment while introduced species can negatively impact native biodiversity. Commercial shipping and recreational fishing activities can be a powerful vector for changes in the geographic distribution of marine and estuarine species. In addition, large scale processes such as regime shifts, ocean oscillations, and climate variability can alter nearshore processes. This session will explore the characterization, understanding, and forecasting of the influence of multiple anthropogenic stressors in North Pacific coastal ecosystems. Contributed papers will provide a higher-level overview of stressors (*e.g.*, overharvesting, urbanization, habitat loss, mariculture, HABs, pollution, introduced species, *etc*.) and the types of impacts that have been observed in northern marine ecosystems, especially those linked to changes in biodiversity and productivity (*e.g.*, extinctions, species interactions, trophic cascades). Authors of contributed papers will be encouraged to consider how larger-scale forecasts translate to lower-scale understanding. For example, determining how ocean models can be downscaled for regional predictions.

Co-conveners: Thomas Therriault (Canada, AICE), Steve Rumrill (U.S.A., MEQ)

Invited Speaker: TBD. Approximate cost: ?

REPORT OF PHYSICAL OCEANOGRAPHY AND CLIMATE COMMITTEE

The meeting of the Physical Oceanography and Climate Committee (POC) was held from 14:00–17:30 on October 28, 2009. The Chairman, Dr. Michael Foreman, called the meeting to order and welcomed members and observers (*POC Endnote 1*). Dr. Shin-ichi Ito agreed to act as rapporteur. Several changes were made to the draft agenda in order to accommodate new Topic Session and workshop proposals for PICES-2010 and to discuss planning for the next Early Career Scientists Conference (Agenda Item 12). The new draft agenda was adopted (*POC Endnote 2*).

AGENDA ITEM 3
Completion of PICES-2008 decisions

1. The proposed PICES/ICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish* was approved by Science Board and Governing Council, with POC and FIS as its parent committees.
2. The request for PICES to print and deliver the abstract volume for Third Argo Science Workshop in Hangzhou, China, March 25–26, 2009 was approved and carried out.
3. The travel support request for one WG20/POC member to attend the ESSAS workshop in Seattle, June 2009, was approved. Dr. Enrique Curchitser (WG 20) gave an invited presentation.
4. Travel support was approved for five non-Korean students and one foreign guest lecturer to attend the CREAMS/PICES summer school on "*Satellite oceanography*", Seoul National University, August 2009.
5. The proposed POC Topic Session *"Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales"* for PICES-2009 was switched to a 1½-day workshop and approved by Science Board.
6. The proposed POC/BIO topic session "*Mesoscale eddies and their roles in North Pacific ecosystems*" for PICES 2009 was also switched to a workshop and approved by Science Board.
7. The proposed POC/FUTURE Topic Session *"Future marine ecosystem predictions from an earth system science perspective"* for PICES-2009 was merged with another to become "*Outlooks and forecasts of marine ecosystems from an earth system science perspective: Challenges and opportunities*" and approved by Science Board.
8. The proposed CC-S Topic Session *"Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific"* was approved by Science Board for PICES-2009.
9. The POC Contributed Paper Session was approved by Science Board for PICES-2009.
10. The CCS workshop "Carbon Data Synthesis" was approved by Science Board for PICES 2009.

AGENDA ITEM 4
Reports of existing subsidiary bodies and plans for ones

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

Dr. James Christian, Co-Chairman of CC-S, briefly reported on its annual meeting and requests to be forwarded to Science Board. These included two carbon data synthesis workshops, one at PICES-2010 (see *POC Endnote 4*) and another to be held in June 2010 in either Japan or Seattle. The latter requests travel support for two members (see Agenda Item 10). The full CC-S annual report, including discussions on the fact that their 5-year term comes up for renewal at PICES-2010, can be found elsewhere in the PICES 2009 Annual Report.

Advisory Panel on *CREAMS/PICES Program in East Asian Marginal Seas* (CREAMS-AP)

Dr. Joji Ishizaka gave a brief report on the activities of the Panel in the past year, including meetings in Busan, Korea, on April 24 and in Jeju on October 25, a summer school at Seoul National University on August 25–29, a joint Russia–Korea cruise in July, two planned cruises in 2010, and a special session during the PEACE Meeting in September 2010. A full report of CREAMS-AP can be found elsewhere in the PICES 2009 Annual Report.

Working Group on *Evaluation of Climate Change Projections* (WG 20)

Dr. Foreman gave a brief report on the activities of this group over the last year. (More details can be found in the summary of the WG 20 business meeting found elsewhere in the PICES 2009 Annual Report). Highlights included: (1) a 1-year extension of the Working Group's lifetime to permit collaboration with the new ICES/PICES Working Group on *Forecasting Climate Change Impacts to Fish and Shellfish* (WG-FCCIFS), (2) contributions to the final CFAME report, (3) invited presentations at the ICES and ESSAS annual meetings, (4) co-convening a session at the Symposium on "*Climate change effects on fish and fisheries*" in Sendai, Japan, v) a business meeting on October 25 that proposed a final workshop/business meeting for PICES-2010, and that discussed the FUTURE Implementation Plan Advisory Panels and WG 20's final report.

PICES/ICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish* (WG-FCCIFS)

Dr. Shin-ichi Ito gave a brief report summarizing activities of this Group over the past year and an update on the status of the Group's upcoming Symposium on "*Climate change effects on fish and fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies*" in Sendai, Japan, April 26–29, 2010. More details can be found in the WG-FCCIFS report contained in the 2009 PICES Annual Report.

AGENDA ITEM 5
Relations with other international organizations

The following four brief presentations were given.

1. Dr. Howard Freeland reviewed the current status of the Argo program, the Third Argo Science Workshop in Hangzhou, China, March 25–26, 2009 and the OceanObs'09 meeting in Venice. He thanked PICES for producing and delivering the abstract volume for the Hangzhou meeting.
2. Hee-Dong Jeong gave a summary of NEAR-GOOS activities over the last year, including updates on both their regional near-time and delayed-mode databases and the development of new conventional observing systems and a ship-of-opportunity program using ferries and container ships.
3. Dr. William Crawford, a member of the CLIVAR Pacific Panel, gave a brief summary of their March 2009 meeting in Perth Australia, and relayed WCRP support for the 2012 symposium on "*Effects of climate change in the World's oceans*" (see *POC Endnote 3*).
4. Dr. George Hunt, Co-Chairman of the ESSAS Steering Committee, gave a brief summary of activities for the past year and those planned for 2010/11. He requested travel support for one WG 20/POC member to attend the 2010 ESSAS annual workshop in Iceland, and that PICES provide both logistical support to help organize, and $20K of funding to support the travel of young scientists from the western Pacific to, the 2011 ESSAS Open Science Meeting in Seattle, U.S.A.

AGENDA ITEM 6
Discussion of POC Action Plan

In light of numerous changes that are anticipated when the Terms of Reference for the three FUTURE Advisory Panels are ratified, the Chairman recommended that changes to the POC Action Plan be postponed for one year. The Committee agreed that this issue will be reviewed at PICES-2010.

AGENDA ITEM 7
Discussion of the FUTURE Implementation Plan and the new Advisory Panels

This item was moved to the beginning of the meeting so the Committee would be familiar with issues by the time the Chairman of Science Board, Dr. John Stein, came around to present a summary of the initial Advisory Panel meetings the previous evening. The Chairman gave a brief summary of the final FUTURE Implementation Plan, the objectives and membership of the three new Advisory Panels, and the revised structure of Science Board. He expressed the opinion that with four POC/WG20 members on these new panels, POC issues should be well represented. More details on the FUTURE Implementation Plan can be found on the PICES webpage (http://www.pices.int/members/scientific_programs/FUTURE/FUTURE-main.aspx) and in the 2009 PICES Annual Report.

AGENDA ITEM 8
Planning for PICES-2010

The Committee approved requests for: (1) a 2-day CC-S workshop (with two invited speakers) and (2) a combined ½-day WG 20 workshop and business meeting with no invited speakers (see *POC Endnote 4*).

In addition to a POC Paper Session, three Topic Sessions were proposed. See *POC Endnote 5*.

No possible invited speakers for the Science Board session were put forward but WG20 is discussing submitting at least one contributed talk to review activities and accomplishments over their lifetime.

AGENDA ITEM 9
PICES-2011 theme

The theme suggested by the Russia for PICES-2011 is "*Mechanisms of marine ecosystem reorganization in the North Pacific Ocean*".

AGENDA ITEM 10
Items with financial implications

Inter-sessional travel requests

POC agreed to put forward the following list of ranked requests for financial support to Science Board:

1. CREAMS-AP requests travel funds for 2 invited speakers in the special session on "*Plan for the international cooperation for CREAMS/PICES EAST-II*" at the PEACE Meeting in September 2010 in Gangnueng, Korea.
2. CC-S requests travel support for 2 scientists (non-CC-S members) to attend their 2nd Carbon Synthesis Workshop in either Japan or U.S.A., June 2010.
3. Funding to send 1 PICES scientist to Co-Chair and speak in a WG-FCCIFS co-sponsored session at the 2010 ICES ASC in Nantes, France.
4. WG 20 requests funding to send one of their members to the PICES/ICES/FAO Symposium on "*Climate change effects on fish and fisheries*" in Sendai, Japan, in April 2010.
5. WG 20 requests funding to send one of their members to the ESSAS Annual Meeting in Iceland, August/September 2010.
6. ESSAS requests PICES logistical support to help organize their 2011 Open Science Meeting (this may have already been granted) and $20K to support the travel of young scientists from Asian countries to this meeting.

Proposed publications for 2009 and beyond

1. CC-S had a special section in the *Journal of Oceanography* that was published in 2009 with papers arising from their Topic Session at PICES XVI in Victoria, Canada.
2. The special issue of *Continental Shelf Research* on "*Tides in marginal seas – A volume in memory of Prof. Alexei Nekrasov*" (eds. Alexander Rabinovich, Boris Kagan, Michael Foreman, and Josef Cherniawsky) received 21 manuscripts. To date, 14 have been accepted, 4 are still under review, and 3 have been rejected or withdrawn. The editors estimate 16 for final publication in 2010 and a volume size of about 200 pages.
3. Drs. Shoshiro Minobe and Emanuele Di Lorenzo, the co-conveners of the PICES 2009 workshop (W8) *"Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales",* are exploring the possibility of writing a review paper based on workshop presentations.

PICES-2010 travel support requests

Travel support is being requested for 1–2 invited speakers for each of the three POC co-sponsored topic sessions and 2 invited speakers for the CC-S workshop (see *POC Endnotes 4 and 5*).

AGENDA ITEM 11
POC Best Presentation and Poster awards

Drs. Ichiro Yasuda, Steven Bograd, and Elena Ustinova acted as judges for the best early career presenter and best poster in the POC Paper Session, S8, W8 and W10. The Best Presentation award was given to Xiaohui Tang for "*Influence of reducing weather noise on ENSO prediction*" (W8). The Best Poster award was given to Satoshi Osafune for his poster "*Numerical study of bidecadal water mass variations in the subarctic North Pacific related to the 18.6-year tidal cycle*" (POC Paper Session).

AGENDA ITEM 12
Other business

In light of the very successful Early Career Scientists Conferences held in 1999 and 2007, another is being planned for 2012 in southern Europe (Portugal, Spain, or Italy). A scientific steering committee of 6 young scientists (3 from PICES and 3 from ICES) needs to be identified and each of the PICES committees was requested to put forward one name. After considerable debate, the POC Committee decided that their nominee would be Hanna Na from Seoul National University.

AGENDA ITEM 13
Adoption of report and recommendations to Science Board

The POC report was circulated and approved by all Committee members. All recommendations to Science Board were brought forward by Dr. Foreman at their meeting on October 31, 2009.

POC Endnote 1

Participation List

Members

Steven Bograd (USA)
Kyung-Il Chang (Korea)
Dake Chen (China)
James Christian (Canada)
Michael Foreman (Canada, Chairman)
Shin-ichi Ito (Japan, rapporteur)
Hee-Dong Jeong (Korea)
Elena Ustinova (Russia)
Ichiro Yasuda (Japan, Vice-Chairman)
Yury Zuenko (Russia)

Observers

Jürgen Alheit (Germany)
William Crawford (CLIVAR)
Howard Freeland (Argo)
George Hunt (ESSAS)
Joji Ishizaka (Japan)
Vadim Navrotsky (Russia)
Gongke Tan (China)

POC Endnote 2

POC meeting agenda (revised)

1. Welcome, introductions, opening remarks
2. Changes to, adoption of, agenda and appointment of rapporteur
3. Completion of PICES-2008 decisions:
   i) New PICES/ICES Working Group "*Forecasting Climate Change Impacts on Fish and Shellfish*"
   ii) Request for PICES to print and send abstract volume for Third Argo Science Workshop in Hangzhou, China, March 25–26, 2009
   iii) Travel support request for WG20/POC member to ESSAS workshop, Seattle, June 2009
   iv) Travel support for five non-Korean students and one foreign lecturer to CREAMS/PICES summer school on "*Satellite oceanography*", August 2009
   v) Proposed POC topic session *"Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales"* at PICES-2009
   vi) Proposed POC/BIO topic session "*Mesoscale eddies and their roles in North Pacific ecosystems*" at PICES-2009
   vii) Proposed POC/FUTURE Topic Session *"Future marine ecosystem predictions from an earth system science perspective"* at PICES-2009
   viii) Proposed CC-S Topic Session *"Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific"* at PICES-2009
   ix) POC Contributed Paper Session at PICES-2009
   x) CCS workshop "Carbon Data Synthesis" at PICES-2009
4. Reports of existing and plans for new subsidiary bodies
   i) Progress report of the Section on *Carbon and Climate* (Christian/Saino)
   ii) Progress report of the Advisory Panel on *CREAMS/PICES Program in East Asian Marginal Seas* (Ishizaka/Lobanov/Kim)
   iii) Progress report of WG 20 on *Evaluation of Climate Change Projections* (Foreman/Yamanaka)
   iv) Progress report of ICES/PICES WG on *Forecasting Climate Change Impacts on Fish and Shellfish* (Ito)
5. Relations with other international organizations/programs:
   i) Argo (Howard Freeland)
   ii) NEAR-GOOS (Hee-dong Jeong)
   iii) WCRP/CLIVAR (Bill Crawford)
   iv) ESSAS (George Hunt)
   v) Other organizations/programs ?

6. Discussion of the POC Action Plan
7. Discussion of FUTURE Implementation Plan and the new Advisory Panels.
8. Planning for PICES-2010 "*North Pacific ecosystems today, and challenges in understanding and forecasting change*" in Portland, U.S.A.
   i) Topic/Paper Sessions
      a. Marine Renewable Energy Development in Coastal and Estuarine Environments around the North Pacific (POC, MEQ, FUTURE)
      b. POC paper session
      c. *Comparing the two major gyres of the subarctic North Pacific – Seasonal and interannual variability and its predictability* (POC/BIO/MONITOR/FUTURE)
      d. *Impact of climate variability on marine ecosystems: understanding functional responses to facilitate forecasting* (FIS/POC/BIO/FUTURE)
   ii) Workshops
      a. *Carbon data synthesis (III)* (POC/BIO)
      b. *Working Group 20: Progress and FUTURE*
   iii) Invited speakers for the Science Board Symposium
9. Theme for PICES-2011 in Russia "*Mechanisms of ecosystem reorganization in the North Pacific Ocean"*
10. Items with financial implications
   i) Proposed inter-sessional meetings for 2010 and beyond
      - WG-FCCIFS workshop on *Climate Change Effects on Fish and Fisheries*, Sendai Japan
      - Carbon data synthesis workshop, June 2010, Japan or Seattle
      - PEACE workshop, Special Session on "*Plan for the international cooperation for CREAMS/ PICES EAST-II*", September 2010, Gangnueng, Korea
      - ESSAS Open Science Meeting, May/June 2011, Seattle
   ii) Publications for 2009 and beyond
      - CC-S section in *Journal of Oceanography* from PICES XVI
      - CSR Special volume on "*Tides in marginal seas – A volume in memory of Prof. A. Nekrasov*"
   iii) Travel support requests
      - Sending 1 WG 20 member to the ESSAS Annual Meeting in Iceland
   iv) Other items
11. 2009 POC Best Presentation and Poster Award (Judges will be appointed early in week and give their recommendation at the Closing Session)
12. Other business
13. Adoption of POC report and recommendations to Science Board

POC Endnote 3

WCRP letter to William Crawford supporting the 2012 *Symposium* on *"Effects of climate change on the World's oceans"*

We would ask you to: 1) attend on our behalf, and 2) express our deep commitment to the Workshop. Our contribution to the Symposium will be:

- sharing the workload for workshop preparations, including not only "leg work" but also intellectual input;
- funding for travel of some scientists – the level to be agreed with other sponsors;
- reaching out to scientific community to attract best experts for the event;
- making available the climate projections for IPCC AR5, which are being coordinated by our WCRP CMIP5 project, openly available to all scientists (this contribution is not specific for the Workshop);
- providing additional guidance on how to use them for assessment of climate change impact on the oceans (that is a specific contribution);
- and any other contribution can be discussed between sponsors.

Best regards,

Dr.Vladimir Ryabinin
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POC Endnote 4

Proposals for workshops at PICES-2010

A 2-day POC/BIO Carbon data synthesis workshop*

The Carbon and Climate Section has as the major piece of unfinished business for the first 5 years of its existence (2005–2010) completion of synthesis of ship-based data sets including total dissolved inorganic carbon (DIC), alkalinity, nutrients and oxygen. Our goal is to create a consistently calibrated basin-wide data set, similar to what CARINA did for the Atlantic and compatible with earlier data sets such as GLODAP so that temporal trends can be detected. This is a key CC-S activity and very important to future PICES and FUTURE science. Collection of data and 1st-level QA/QC are complete; now we need to undertake 2nd-level QA/QC, which is a large and labour-intensive task.

* multiple small rooms, or a room that can be subdivided, and multiple computers and projectors are requested because parallel breakout groups will be examining different subsets of the data.

Co-Convenors: James Christian and Toshi Saino
Request travel support for 2 invited speakers.

A ½ day POC business meeting and workshop on "*Working Group 20: Progress and FUTURE*"

Presentations and discussions on:

- progress related to the WG 20 Terms of Reference
- status of, and future work on, the final report
- follow-up activities that conform to FUTURE objectives and needs.

Co-Convenors: Michael Foreman (Canada) and Yasuhiro Yamanaka (Japan)
No invited speakers.

POC Endnote 5

Proposals for Topic and Paper Sessions at PICES-2010

(1.) a 1-day POC Paper Session

Papers are invited on all aspects of physical oceanography and climate in the North Pacific and its marginal seas.

Co-convenors: Michael Foreman (Canada) and Ichiro Yasuda (U.S.A.)
No invited speakers.

(2.) a 1-day POC/BIO/MONITOR/FUTURE Topic Session on "*Comparing the two major gyres of the subarctic North Pacific - seasonal and interannual variability and its predictability*"

In the North Pacific, there are two major gyres; the western subarctic gyre and the Alaskan gyre. Although severe winter conditions have limited observational activity, recent progress in observational networks including satellites, drifters and Argo floats have improved our understandings of the two gyres. Both gyres are mainly driven by the subarctic wind field and are expected to be synchronized with each other. However, the real responses are not so simple. For example, the western subarctic gyre shows large seasonal variability in the western boundary current (Oyashio) while the Alaskan stream does not show large seasonal variability. In addition to these physical characteristics, chemical and biological characteristics are different. For example, iron supply is larger in the western subarctic gyre since the distance from the terrestrial sources is closer than in the Alaskan gyre. This in turn affects seasonal cycling and magnitudes of phytoplankton production and zooplankton production. Therefore ecosystems are also different in the two gyres. To achieve better understanding of the mechanisms of the subarctic response to atmospheric forcing, comparisons of the responses of the two gyres are essential. This session will focus on the comparison of the physical, chemical and biological characteristics of the two gyres, on all time scales. Presentations on predictability of the two gyres, or which address additional improvements of the subarctic observation network are also welcome.

Co-Convenors: Shin-ichi Ito (Japan), James Christian (Canada), Emanuele Di Lorenzo (U.S.A.), Vyacheslav B. Lobanov (Russia), David Mackas (Canada), Atsushi Tsuda (Japan, tentative)

Request funding for 2 invited speakers: Potential candidates are Robert Pickart (U.S.A.), Osamu Isoguchi (Japan), Joaquim Goes (U.S.A.)

(3.) a ½-day POC/MEQ/FUTURE Topic Session on "*Marine renewable energy development in coastal and estuarine environments around the North Pacific*"

Renewable energy projects are increasing worldwide, and many types involve the marine environment. Those under active development are typically designed to directly extract energy from waves, tides, currents, wind, or thermal gradients or indirectly from biomass energy. These novel technologies will require new emplacements, moorings, or other structures in marine and estuarine environments with attendant intrusions upon the environment, including acoustic signals, changes to mixing, and electromagnetic fields. Marine renewable energy sources are able to provide clean energy, but their effects on the physical and biological environment are not well understood. This session will examine the technologies under development in PICES nations and address the current state of our knowledge on how they will interact with estuarine, coastal, and offshore environments.

For this session we seek contributions that deal with any topics pertinent to marine renewable energy development, including:

- Status of marine renewable energy in PICES countries;
- Economic costs and benefits of different approaches;
- Marine spatial planning for renewable energy;
- Physical effects of marine renewable energy development (current flow, energy reduction, mixing, sediment transport);
- Ecological effects (larval transport, entrainment, entanglement, behavior, habitat changes, communities) on all trophic levels.

Convenors: George Boehlert (U.S.A.), Michael Foreman (Canada, POC), Kuh Kim (Korea), Glen Jamieson (Canada, MEQ)

Request travel support for one invited speaker, proposed to be Henry Jeffrey (UK). Estimated cost: $2500

(4.) a 1-day POC/FIS/BIO/FUTURE Topic Session on *"Impact of climate variability on marine ecosystems: understanding functional responses to facilitate forecasting"*
[sponsorship later changed to POC/FIS/BIO]

Understanding the role of natural variability, occurring over a variety of temporal and spatial scales is essential for effective management of marine ecosystems in the wake of predicted global change. Evidence suggests that climate variability can trigger regime shifts in marine ecosystems. Regime shifts are characterized by a re-organization of marine communities, species dominance, and tropho-dynamic relationships. Often, synchronous shifts occur in aquatic ecosystems that are separated by thousands of kilometers. This finding suggests that atmospheric teleconnections are mediating regional system changes. We postulate that comparative studies of ecosystems that have experienced regime shifts will provide insights into the expected responses of marine organisms to climate change. We seek papers that go beyond simple pattern matching. Contributions to this Theme Session should provide statistical evidence of the functional responses and relationships that underlie regime shifts and/or statistical or modeling studies that successfully simulate observed shifts. Studies that utilize these relationships to forecast of future climate change impacts are especially welcome. The primary focus of this session will be on understanding shifts in the pelagic realm including phytoplankton, zooplankton and pelagic species (for example, small pelagic fish, squids and gadids).

Co-Convenors: Suam Kim, Jurgen Alheit, Harald Loeng, James Overland, Yasunori Sakurai

Request funding for 2 invited speakers. (ICES will be asked to co-sponsor 1 speaker). Possible European candidates are Edwards/Gregory Beaugrand, Svein Sundby

REPORT OF TECHNICAL COMMITTEEON DATA EXCHANGE

The meeting of the Technical Committee on Data Exchange (hereafter TCODE) was held in Jeju, Korea from 14:00–18:00 h on October 28, 2009. The Chairman, Bernard A. Megrey and Co-Chairman Kyu-Kui Jung, called the meeting to order, welcomed the participants, and introductions were made. The meeting was attended by 10 TCODE members representing all PICES member countries (*TCODE Endnote 1*). Dr. Hernan Garcia served as the rapporteur. The Committee reviewed the provisional agenda. A suggestion to add a discussion on the North Pacific Ecosystem Status Report was accepted and placed under "New business", and the new agenda was adopted (*TCODE Endnote 2*).

Before the formal TCODE meeting started, Dr. John Stein (Science Board Chairman) presented a summary of the first meeting of the three FUTURE Advisory Panels (AICE, COVE, SOFE). He announced the appointment of the initial Chairs for each Advisory Panel, reviewed goals and objectives, and initiated discussion. As a group, the Panels discussed priorities and how to move forward within PICES. Each Panel will operate individually to advise Science Board, thus they will be a part of the decision-making process. Once permanent Chairs are selected, each Panel will formulate a workplan. The Science Board will review and adopt these terms of reference at the next Science Board meeting.

AGENDA ITEM 3
Review progress on items in the 2008/2009 work plan

a) Support HAB-S activities

Mr. Robin Brown reported that HAB-S continues to add metadata to the ICES/PICES/IOC HAE-DAT database. The process is moving forward steadily. The contents are not open for public access yet. A software application side of the database is under development. Possible connections to the PICES metadata federation were discussed. (Dr. Megrey placed this as an agenda item for next year's TCODE meeting.)

b) Cooperate with other data management groups outside PICES

ICES

Dr. Igor Shevchenko circulated the ICES metadata reports via email to TCODE members. A report from ICES WG on *Data and Information Management* (WGDIM) in 2009 was given by Dr. Georgiy Moiseenko. WGDIM terms of reference and data user needs were discussed. Activities for next year include focus on QC flags of ICES data. Dr. Moiseenko will attend the next WGDIM meeting at ICES headquarters, May 2010 and present a report at PICES-2010 in Portland. This item was added to next year's TCODE work plan.

Dr. Megrey met with Neil Holdsworth (ICES) and others in Helsinki, Finland, to discuss areas of cooperation. They wrote a proposal for future collaborative work to hold a joint session on "*Data for the Masses: Recent advances in the application of Marine Data and Information Managemen*t" at the 2010 ICES Annual Science Conference (ASC) in Nantes, France, to be convened by Bernard A. Megrey (PICES TCODE, USA), Neil Holdsworth (ICES Data Center, Denmark), and Edward Vanden Berghe (OBIS, USA). The ICES decision was made at the 2009 ICES ASC meeting in Berlin. After the TCODE meeting it was announced that the proposal was not accepted for the Nantes meeting. Dr. Megrey will work with the ICES convenors at the 2010 ASC to resubmit the proposal for reconsideration at the 2011 ICES ASC in Gdansk, Poland. This item was added to next year's TCODE work plan.

IODE-XX

Dr. Toru Suzuki presented a report of the IODE-XX meeting, including the IODE ocean data portal implementation, capacity building and education, and Ocean Biogeographic Information System (OBIS) as an IODE/IOC program. Dr. Megrey will post a copy of the report on the TCODE web site.

PICES will participate in IODE-XXI via their Japanese representative T. Suzuki, who is already an active member connecting IODE to TCODE. Dr. Suzuki will attend the IODE-XXI in March 2011 and present a report at PICES-2011 in Russia. This item was added to next year's TCODE work plan.

Group of Experts on Biological and Chemical Data Management and Exchange Practices

The IODE GE-BICH overlaps with TCODE with respect to terms of reference. No formal connection exists between PICES and GE-BICH. Dr. Hernan Garcia stressed the importance of international cooperation in GE-BICH and nominated Dr. Suzuki for membership as a short-term member of GE-BICH. It was agreed that TCODE should pursue further cooperation with IODE GE-BICH on behalf of PICES. This item was added to next year's TCODE work plan.

NOWPAP

It was reported that is difficult to harvest metadata from the NOWPAP server automatically since it offers limited machine to machine communication and searches. No common communication protocols exist. A possible potential connection to the IODE data portal was also discussed and will be explored.

c) PICES Metadata Federation Project

For the past 2 years, PICES has paid AdHost to rent a server on a monthly basis but if PICES enters into an annual contract, costs will be reduced by about 12%. TCODE agrees that using an annual contract seems a more practical alternative and it will be formally proposed to Science Board. This is an ongoing activity and it has been added to next year's TCODE work plan.

Drs. Shevchenko and Megrey administer the server. TCODE will continue this format. This item was added to next year's TCODE work plan.

TCODE planned to run an AdHost server performance experiment on accessing metadata from different locations and multiple users. This is intended to be part of formal performance test of multiple searches on the metadata server. No progress was made this year so this item was added to next year's TCODE work plan. Dr. Megrey will coordinate with national representatives.

One of the justifications for renting the AdHost server was to provide a platform for distributing the large collection of digital items in the PICES Digital library. There has been lack of progress in transferring large pdfs of presentations given at PICES Annual Meetings to the server because the Secretariat is understaffed and too busy to transfer the pdfs. Mr. Brown suggested that TCODE present this as an issue to the Science Board but Dr. Shevchenko suggested that TCODE solve this problem internally by requesting that the next PICES intern (Ms. Tatiana Semenova) be assigned this task early in her internship. Dr. Megrey will follow up with Dr. Shevchenko. This item was added to next year's PICES work plan.

Mr. Brown reported that no progress has been made on collecting Canadian metadata records to add to AdHost. Bernard Megrey reported that Japan and Korea's metadata records are also not on the rented server but that metadata from Russia, USA, and China are. It was suggested that Japan and Korea move their metadata to the rented server. This item was added to next year's TCODE work plan.

Dr. Shevchenko reported on the behalf of Dr. Olga Vasik (TINRO-Centre, Russia), who was not able to attend the meeting, that she has prepared scripts to monitor MDB use. Current usage statistics reveal relatively low

use of metadata records. When discussing the status of the PICES TCODE GeoNetwork Portal, Dr. Megrey suggested that the PICES community is not generally aware of this resource. The PICES web page does not prominently advertise the availability of the metadata federation server. The Committee suggested that a viable option would be to add a link to the metadata federation server (e.g., a visible access point) to the side bar on the PICES web page. The NPEM and KODC servers need to be removed from the NSDI clearinghouse site. Dr. Megrey will undertake this. This item was added to next year's TCODE work plan.

No progress has been made in adding FGDC-compliant Canadian metadata records as part of the metadata federation. This item was added to next year's TCODE work plan.

Promote the GeoNetwork Portal

Dr. Megrey proposed adding short sessions at future PICES summer schools to alert or make students aware of TCODE efforts. Unfortunately this was not possible in 2009. Thus it is proposed to do this task before summer 2010. Dr. Megrey will propose that at every summer session, participants at the schools should be made aware of TCODE activities. To accomplish this task, Dr. Megrey will prepare a short electronic presentation which could be given at various PICES venues. This item was added to next year's TCODE work plan.

Dr. Megrey will speak to Science Board to make sure the PICES GeoNetwork resource will be advertised at the Opening Sessions of PICES Annual Meetings. This item was added to next year's TCODE work plan.

TCODE plans to make a short presentation on the GeoNetwork resource at MONITOR Committee meeting (and other committee meetings). The start of the TCODE meeting will be delayed accordingly. Robin Brown suggested that TCODE prepare a short presentation about the GeoNetwork resource and what TCODE does. This item was added to next year's TCODE work plan.

Mr. Allan Macklin reported that updating the project page on the PICES home page was successfully completed.

Dr. Shevchenko reported that backups are done by Dr. Vasik. Exploring GeoNetwork Portal backup options was added to next year's TCODE work plan.

No progress was made this year on updating PICES Technical Report No. 1 (Metadata Federation of PICES Member Countries) to reflect GeoNetwork. This item was added to next year's TCODE work plan.

AGENDA ITEM 4
TCODE web pages

TCODE recognizes Dr. Shevchenko's efforts to maintain and update the TCODE page. This is an ongoing activity so this item was added to next year's TCODE work plan.

AGENDA ITEM 5
Update of WG 22 iron database and proposed collaboration with IODE/IOC

Mr. Brown reported that there has not been a major update of the Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22) iron database for the North Pacific. Mr. Brown was not able to attend the last WG 22 business meeting but he hopes to attend the upcoming meeting at PICES-2010. This item was added to next year's TCODE work plan.

AGENDA ITEM 6
Participation in FUTURE and FISP activities

Mr. Brown and Dr. Megrey reported successful completion of this item. TCODE has members on all new FUTURE Advisory Panels. Creation of a standardized presentation on TCODE activities was suggested as a way to alert the new FUTURE Advisory Panels of the existence of the TCODE metadata GeoNetwork Portal (See Agenda Item 3c). This item was added to next year's TCODE work plan.

AGENDA ITEM 7
Update TCODE Action Plan

Dr. Megrey presented a list of pending actions for next year's TCODE Action Plan. New items to include were: adding *ex-officio* members as needed (Megrey) and adding visibility to the metadata federation (Garcia). TCODE discussed the feasibility of recognizing metadata contributions via a small prize (*e.g*., t-shirt) or some sort of PICES recognition.

Mr. Brown proposed adding to the Action Plan an activity that would report on the performance by means of the metadata records in the North Pacific Ecosystem Status Report (NPSR) in order to identify availability (cataloguing) of metadata, identify metadata gaps, access needs, and most importantly, presence or absence of these metadata in the metadata federation. For instance, data time series by country (data available online, data products, *etc.*?). The report results would then be communicated to Science via an advisory panel. Time commitment and level of effort required to accomplish this task is difficult to assess. Dr. Megrey suggested that perhaps a scaled down approach at a regional level should be pursued. Dr. Megrey and Mr. Brown will talk to Dr. Skip McKinnell, Deputy Executive Secretary, about the matter. This item was added to next year's TCODE work plan.

AGENDA ITEM 8
Coordination with the Section on *Carbon and Climate*

Dr. Suzuki reported on a meeting of a subset of CC-S members that took place in Tokyo in March. Dr. Garcia is also a member of CC-S. An ocean carbon data set is being developed for the North Pacific. This is an ongoing activity and this item was added to next year's TCODE work plan.

AGENDA ITEM 9
Coordination of activities with MONITOR

Dr. Thomas Royer was not present at the meeting and did not send a report to TCODE. This is an ongoing activity and this item was added to next year's TCODE work plan.

AGENDA ITEM 10
Annual country reports

Dr. Megrey suggested that, in the interest of time, all country reports be sent to him by email so that they could be posted at the TCODE web page.

AGENDA ITEM 11
Topic Session proposals for PICES-2010

The floor was open for suggestions for session proposals for the next PICES Annual Meeting in Portland, U.S.A. Mr. Brown suggested an electronic poster session on "ocean observing systems for coastal and continental shelf ecosystems". Possible convenors (minimum two) included one from Russia (Oleg Kopelerich, Institute of Oceanology, Russian Academy of Sciences – to be confirmed) and one from the U.S.A. (temporarily, Bernard Megrey). Other possible U.S. convenors may include Jonathan Phinney (PACOOS) or Molly McCammon (AOOS). After the TCODE meeting, it was discovered that the suggested Russian convenor would not be able to attend the meeting. Dr. Megrey will follow up with Phinney and McCammon. This item was added to next year's TCODE work plan.

AGENDA ITEM 12
Relations with other international programs/organizations

In order to expand cooperation, PICES is allowing experts from non-PICES country members or international organizations to participate in PICES committees as "*ex-officio* members" pending approval by Science Board. This opens opportunities for TCODE to interact with other groups. TCODE members will send their suggestions to Dr. Megrey although Dr. Edward Vanden Berghe (OBIS, U.S.A.) was identified as a potential *ex-officio* member to TCODE. This item has been added to next year's TCODE work plan.

Action: Dr. Megrey to make this recommendation to Science Board.

AGENDA ITEM 13
PICES Ocean Monitoring Service Award nominations for 2010

TCODE has two pending nominations (one remaining from last year and a new nomination). The new nomination will be circulated to TCODE members for comment. Robin Brown suggested that in 2010, new POMA nominations should consider an Asian candidate. This item has been added to next year's TCODE work plan.

AGENDA ITEM 14
Summary of items with financial implications

There were no proposals for inter-sessional meetings for 2010 and beyond and no requests were made for travel support. TCODE recommends continuing the AdHost server for another year. This item has been added to next year's TCODE work plan.

Awarding prizes for metadata submissions was discussed. TCODE members will work on ideas to encourage metadata submissions and this item has been added to next year's TCODE work plan. To encourage documentation of PICES research, there was discussion about whether or not to recommend to Science Board that metadata submission be required with PICES Annual Meeting abstracts.

AGENDA ITEM 15
TCODE work plan for 2009/2010

Dr. Megrey will condense the 2010/2011 work plan (*TCODE Endnote 3*) and circulate it for comment to TCODE members before adopting it via email.

AGENDA ITEM 16
New business

The NPESR was discussed earlier (Agenda Item 7) at the suggestion of Mr. Brown.

TCODE also discussed the merits of using a Wiki page to collect and distribute TCODE documents such as Google Sites, which was suggested by Dr. Garcia. Further consideration of this idea was added to next year's TCODE work plan.

TCODE Endnote 1

TCODE participation list

Members

Robin Brown (Canada)
Sang-Hwa Choi (Korea)
Hernan Garcia (U.S.A.)
Kyu-Kui Jung (Korea, Vice-Chairman)
Bernard A. Megrey (U.S.A., Chairman)
Georgiy Moiseenko (Russia)
Igor Shevchenko (Russia)
Toru Suzuki (Japan)
Tomowo Watanabe (Japan)
Nignsheng Yang (CAFS, China, for Ling Tong)

TCODE Endnote 2

TCODE meeting agenda

1. Welcome and introduction of members
2. Adoption of agenda
3. Review progress on the items from the 2008/2009 work plan
   a) Continue to support HAB-S work (R. Brown)
   b) Cooperate with other data management groups outside PICES
      i) ICES WG on Data and Information Management ICES 2008 WGDIM Report, ICES 2009 WGDIM Report (B. Megrey, G. Moiseenko)
      2010 ICES Session Proposal: Data for the Masses: Recent advances in the application of Marine Data and Information Management (B. Megrey)
      Report on ICES and WGDIM meetings (G. Moiseenko)
      ii) IODE-XX (B. Megrey, T. Suzuki)
      iii) IODE GE-BICH (Group of Experts on Biological and Chemical Data Management and Exchange Practices) (B. Megrey, H. Garcia)
      iv) Develop plan to harvest metadata from the NOWPAP server (I. Shevchenko to organize with national representatives)
   c) PICES Metadata Federation Project
      Promote the GeoNetwork Portal.
4. Maintain TCODE web pages (I. Shevchenko)
5. Update of WG 22 iron database and proposed collaboration with IODE/IOC (R. Brown)
6. Participate in FUTUE and FISP activities (R. Brown and B. Megrey)
7. Update TCODE Action Plan Megrey, K.K. Jung)
8. Coordination with Section on *Carbon and Climate* (T. Suzuki and R. Brown)
9. Coordination of Activities with MONITOR (T. Royer)
10. Annual country reports
11. Topic Session proposals for PICES-2010
12. Relations with other international programs/organizations
13. PICES Ocean Monitoring Service Award nominations for 2010

14. Summary of items with financial implications:
15. Discussion and adoption of the TCODE Work Plan for 2009/2010 (B. Megrey, K.K. Jung)
16. New business (additional items added at the meeting)

TCODE Endnote 3

TCODE Work Plan for 2010/2011

1. Continue to support HAB-S work (R. Brown)
   a. Harmful Algal Blooms Section-evaluate how PICES can contribute to this effort and which national repository claims the ownership.
2. Cooperate with other data management groups outside PICES
   a. Megrey to follow up on the unsuccessful ICES proposal at the next WGDIM meeting in Nantes, France (B. Megrey)
   b. ICES WG on Data and Information Management
      Moiseenko to attend the next WGDIM meeting at ICES HQ, May 2010. He will present a report at the 2010 PICES meeting in Portland (B. Megrey, G. Moiseenko)
   c. IODE-XXI
      PICES will participate in IODE-XXI via their Japanese representative T. Suzuki, who is already an active member connecting IODE to TCODE. Suzuki will attend the IODE-XXI in March 2011 and present a report at the 2011 PICES meeting in Russia (T. Suzuki)
   d. IODE GE-BICH (Group of Experts on Biological and Chemical Data Management and Exchange Practices)
      Identify representatives from PICES to participate in a network of experts on biological and chemical data (H. Garcia and T. Suzuki)
3. PICES Metadata Federation Project
   a. Renew Remote server contract (B. Megrey and Shevchenko to organize with national representatives)
   b. Continue to administer AdHost server (B. Megrey and I. Shevchenko)
   c. Run the AdHost server performance experiment on accessing metadata from different locations and multiple users (B. Megrey to organize with national representatives)
   d. Brown and Holmes will gather some Canadian metadata records to establish a Canadian presence on the PICES Metadata server. Report on progress at next years TCODE meeting (R. Brown/J. Holmes)
   e. Request SB suggest to GC that next PICES intern (Tatiana Semenova) assist with the transfer of the PICES Digital Library to the rented server. Report on status of PICES Digital Library migration and Ecosystem Status Report web pages (B. Megrey and I. Shevchenko)
   f. Japan, Korea and Canada move their metadata records to the AdHost server (T. Suzuki, K-K. Jung, R. Brown/J. Holmes, I. Shevchenko)
   g. Remove NPEM and KODC servers from the NSDI clearinghouse site (B. Megrey)
   h. Update AdHost server to monitor MDB use (Olga Vasik)
   i. Promote the GeoNetwork Portal.
      i. Prepare short PowerPoint presentation on GeoNetwork portal (B. Megrey)
      ii. Request GeoNetwork resource be advertised at PICES Summer in Seoul (June 2010) and Winter school in Vladivostok (Feb. 2010). (B. Megrey, I. Shevchenko)
      iii. Request GeoNetwork resource be reported at next years opening session as part of PICES activities (B. Megrey)
      iv. Plan to have a short presentation on the GeoNetwork resource be given at the MONITOR meetings other committee's? (request at front of the agenda and delay start of TCODE). Prepare a presentation for SOFE, COVE and AICE. (B. Megrey, I. Shevchenko, R. Brown)
      v. Add the MDB server link on the sidebar of the PICES web page (B. Megrey)
   j. Explore GeoNetwork Portal backup options (I. Shevchenko)
   k. Update the Technical report to reflect GeoNetwork (I. Shevchenko and B. Megrey)
4. Maintain TCODE web pages (I. Shevchenko)

5. Participate in FUTUE and FISP activities. Work to facilitate preparation of the NPESR. Approach McKinnell to see what data was used to support the report, what data are accessible, what data are accompanied by metadata, what are the data characteristics and is the data discoverable and searchable. A simple analysis should be revealing. Focus on about 50-100 records as a place to start. Present report to SB and SOFE. (R. Brown, B. Megrey)
6. Update of WG22 iron database and proposed collaboration with IODE/IOC (R. Brown)
7. Update TCODE Action Plan (B. Megrey, K.-K. Jung)
    a. Use preparation of NPESR to examine participation of metadata reporting. Megrey and Brown will talk to McKinnel to discuss the possibility of carrying out this exercise. (B. Megrey, R. Brown)
8. Coordination with Section on Carbon and Climate (T. Suzuki, R. Brown)
9. Coordination of Activities with MONITOR
   Monitor TC Action Plan (T. Royer)
10. 2010 and 2011 Topic Session proposals (All)
11. Relationships with other international organizations
    TCODE will request the Science Board instruct the PICES Secretariat to invite Edward Vanden Berghe (OBIS, USA) to join TCODE as an *ex-officio* member. (B. Megrey)
12. POMA nomination
13. Prepare proposal to renew rented server for another year (B. Megrey)
14. Develop strategy to award and encourage metadata submission (All)
15. Add TCODE web site to collect and distribute TCODE documents (H. Garcia)

REPORT OF THE TECHNICAL COMMITTEE ON MONITORING

The Technical Committee on Monitoring (MONITOR) met from 14:00–18:00 h on October 28, 2009, under the chairmanship of Dr. Hiroya Sugisaki. Seven committee members were present and a total of 14 scientists from 6 PICES member countries were in attendance (*MONITOR Endnote 1*). The meeting agenda (*MONITOR Endnote 2*) was very full and business was conducted at a brisk pace.

AGENDA ITEM 2
Report on the meeting of FUTURE

Dr. John Stein, Chairman of Science Board briefed the Committee on the status of the new PICES scientific program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems), including a report on the FUTURE Advisory Panel meeting held the previous day, on October 27. Three MONITOR members, Drs. Young-Jae Ro (AICE, Anthropogenic Influences on Coastal Ecosystems) Vyacheslav Lobanov (COVE, Climate, Oceanographic Variability and Ecosystems), and Phillip Mundy (SOFE, Status, Outlooks, Forecasts, and Engagement) serve as members of the FUTURE Advisory Panels. They and Hiroya Sugisaki (interim Chairman of COVE) attended the FUTURE meeting.

Committee members agreed that monitoring activities are very important for the early stage of the FUTURE program and MONITOR can summarize existing observing systems, identify gaps in observations, and also identify monitoring programs at risk of being lost and the importance of these monitoring systems.

AGENDA ITEM 3
North Pacific Ecosystem Status Report

Dr. Sugisaki reported on the editing of NPESR II (North Pacific Ecosystem Status Report II). The editors of the report, Drs. Skip McKinnell and Michael Dagg, asked MONITOR to review the drafts of the chapters, and to attend a workshop for reviewing regional chapters and developing a draft synthesis of results in Honolulu, U.S.A. December 1–3, 2009. MONITOR recommended Drs. Young Jae Ro and Jeffrey Napp to participate in the workshop as representatives of the Committee. Dr. Sugisaki expressed appreciation to Committee members for their cooperation in editing NPESR II.

AGENDA ITEM 4
Reports corresponding to MONITOR

Dr. Jack Barth attended the *OceanObs '09 Conference* held September 21–25, 2009 in Venice, Italy as the representative of PICES and introduced a statement of PICES' background and activities. Dr. Barth could not attend the PICES-2009 meeting so his report was provided by the Chairman.

Dr. Sugisaki informed the Committee about the relationship with the ICES-GOOS Steering Group (IGSG). He attended the IGSG meeting held at Woods Hole, U.S.A. in March to introduce the activities of MONITOR. Based on the similarities in interests, MONITOR invited the IGSG to co-sponsor a Theme Session on "*Development and use of ocean observing and forecasting systems in coastal and marine management*" at PICES-2010. The session would likely focus on ocean observations in forecasting. The IGSG accepted the invitation.

IGSG invited members of MONITOR to an ICES-GOOS Working Group meeting in Woods Hole in April 2010. ICES-GOOS will be meeting jointly with the Working Group on the Northwest Atlantic Regional Sea (WGNARS). This is a new Working Group and one of their Terms of Reference is "*coordinated ocean*

observation systems to support integrated assessment of climate change ecosystem effects". The international interactions and the topic of the Working Group are relevant to PICES/MONITOR.

Dr. Sonia D. Batten reported on the scientific accomplishments and present status of the North Pacific Continuous Plankton Recorder (CPR) project. In spite of the difficult funding situation, the importance of CPR becomes greater. Sessions on CPR were held at the GLOBEC OSM in Victoria, Canada (June 2009) and at OceanObs '09 conference in Venice (September 2009). To encourage an interest in CPR in the western Pacific, a workshop on "*Continuous Plankton Recorder survey and long-term observations of plankton ecosystems in the North Pacific*" was hosted by Dr. Sugisaki in Yokohama (September 30–October 1). A joint research project between SAHFOS and Japanese scientists to analyze western Pacific CPR samples has begun.

Dr. Lobanov reported that NEAR-GOOS is operational. He also reported that a CREAMS/PICES workshop on "*Status and trends in East Asian marginal sea ecosystems*", relating to contributions to the North Pacific Ecosystem Status Report, was held in Busan, Korea, April 21–22, 2009.

Dr. John Calder, representing Sustaining Arctic Observing Networks (SAON), presented the background and activities of SAON to the Committee members and discussed common interests between MONITOR and SAON.

Dr. Sugisaki stressed to Committee members that MONITOR and PICES must communicate with other international organizations and programs to encourage joint international activities on ocean observations.

AGENDA ITEM 5
Report on POMA

Dr. Sugisaki briefly described the need for MONITOR to recommend a candidate(s) for the PICES Ocean Monitoring Service Award (POMA) to Science Board.

AGENDA ITEM 6
National reports

The following Committee members made short presentations on national monitoring activities relevant to PICES:

- Canada: Dr. David Mackas
- Japan: Dr. Sugisaki
- Korea: Drs. Ro and Kwang Soon Park
- Russia: Dr. Lobanov
- United States: Dr. Mundy

AGENDA ITEM 7
Best Presentation awards

MONITOR was assigned responsibility to assess oral and poster presentations for the MONITOR-sponsored Topic Session on "*State of the art of real-time monitoring and its implication for the FUTURE oceanographic study*" (S7). The Chairman thanked the volunteers in advance for their service.

The Best Presentation award was given by MONITOR to Dr. Kelly J. Benoit-Bird (Oregon State University, U.S.A.) for her paper on "*Trophic cascades in Hawaii's nearshore ecosystem: Using observing technology to understand ecological interactions*". Dr. Shin-ichi Ito (Tohoku National Fisheries Research Institute, Japan) received the MONITOR Best Poster award on "*A profiling mooring buoy to observe mixed layer formations*

in the western North Pacific and its combination with a deeper type underwater glider" (co-authored by Yugo Shimizu, Shigeho Kakehi, Fumitake Shido, Taku Wagawa, Kazuyuki Uehara, Toshiya Nakano and Masafumi Komachi).

AGENDA ITEM 8
Planning for PICES-2010 and inter-sessional meetings

MONITOR strongly supported the following two proposals for PICES-2010 (see *MONITOR Endnote 3*):

- Dr. Sugisaki proposed a 1-day joint PICES/ICES Topic Session entitled "*Development and use of ocean observing and forecasting systems in coastal and marine management*".
- Dr. Lobanov proposed a 1-day POC/BIO/MONITOR/FUTURE session entitled "*Comparing the two major gyres of the subarctic North Pacific- Seasonal and interannual variability and its predictability*".

Committee members agreed that MONITOR should recommend sending one attendee to the next GOOS Scientific Steering Committee meeting, and two attendees at CREAMS/PICES meeting.

AGENDA ITEM 9
Other business

MONITOR agreed with a request from TCODE on "a joint proposal to semi-permanently renew the contract for the PICES remote server".

At the request of Science Board, MONITOR to nominated PhD student, Hanna Na (Korea), to be a member of the Scientific Steering Committee for the second Early Career Scientists' Conference to be held in Majorca, Spain in 2012, and co-sponsored by PICES and ICES.

MONITOR Endnote 1

Participation list

Members	Observers
Vyacheslav Lobanov (Russia)	Sonia D. Batten (Canada, CPR-AP)
David L. Mackas (Canada)	John Calder (SAON)
Phillip R. Mundy (U.S.A., Vice-Chairman)	Sanae Chiba (Japan)
Kwang Soon Park (Korea)	Kuh Kim (Korea)
Young Jae Ro (Korea)	Tony Koslow (U.S.A)
Hiroya Sugisaki (Japan, Chairman)	Dong Young Lee (Korea)
Young Sang Suh (Korea)	John Stein (PICES)

MONITOR Endnote 2

MONITOR meeting agenda

1. Welcome, Introductions and sign-in (all)
2. Report on the meeting of FUTURE on 27th, Wednesday (member of FUTURE-AP)
3. NP Ecosystem Status Report current status
    1. Discussion about MONITOR's roles with NPESR-II
    2. Review the drafts of chapters of NPESR-II
    3. List up the suggestion and comments to the editors and authors

4. Reports on corresponding MONITOR technical committee
   1. MONITOR session overview (Young Jae Ro)
   2. Report on the membership of FUTURE-AP from MONITOR (Hiro Sugisaki)
   3. Report on Ocean Obs '09 meeting
   4. Report on ICES-GOOS Steering Group meeting (Sugisaki)
   5. Report on the CPR workshop in Japan (Sugisaki)
   6. Status of NEAR-GOOS activities (Slava Lobanov)
   7. Status of Pacific CPR program and advisory panel (Phil Mundy)
   8. Status of CREAMS w. POC & report on the NPESR workshop on status and trends on the East Asian Marginal Seas (Lobanov)
   9. Report on international activities relevant to MONITOR committee
      i) NEAR-GOOS (Lobanov, Dong Young Lee)
      ii) AOOS (Phil Mundy)
      iii) NaNOOS
      iv) SAON (John Calder)
      v) SAHFOS (Sonia Batten)
5. Report on POMA (Sugisaki)
6. National reports of relevant monitoring and observational activities (brief introduction of each member states' preparation activity for the PICES-FUTURE Program)
   Canada (Dave Mackas)
   China (Quan Wen, Xianyong Zhao)
   Japan (Sei ichi Saitoh, Sugisaki)
   Korea (Kwang-Soon Park, Ro, Young-Sang Suh)
   Russia (Elena Gritsay, Lobanov)
   U.S.A. (Mundy)
7. Judges for PICES-2009 Best Paper awards
8. Proposals for PICES-2010 MONITOR workshops, special sessions, inter-sessional meetings
9. Other business (if any)

MONITOR Endnote 3

Proposals for Topic Sessions at PICES-2010

1-day PICES/ICES Topic Session on "*Development and use of ocean observing and forecasting systems in coastal and marine management*"

The session will advance the objectives of the PICES Technical Committee on Monitoring, the PICES FUTURE program (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems) and the ICES-GOOS Steering Group. These groups have ToRs related to the coordination of Global Ocean Observing Systems, the development and evaluation of forecasting systems, and their application to ocean management. The theme session will focus on examples where ocean observations and forecasts have been used in PICES and ICES products. Methodological advances and issues will also be presented to promote the development of observing and forecasting capabilities. Finally, the theme session will serve as a forum to bring the ocean observing, ecological forecasting and resource management communities together to better link observing and forecasting efforts with the need to provide scientific advice for marine and coastal resource management.

Recommended Conveners: Hiroya Sugisaki (Japan), Phillip Mundy (U.S.A), Young Jae Ro (Korea), David Mackas (Canada) Vyacheslav Lobanov (Russia), and Jonathan Hare (IGSG, U.S.A).

1-day POC/BIO/MONITOR/FUTURE Topic Session on "*Comparing the two major gyres of the subarctic North Pacific - Seasonal and interannual variability and its predictability*"

The description of this session: In the North Pacific, there are two major gyres; the western subarctic gyre and the Alaskan gyre. Although severe winter conditions have limited observational activity, recent progress in observational networks, including satellites, drifters and Argo floats, have improved our understandings of the two gyres. Both gyres are mainly driven by the subarctic wind field and are expected to be synchronized with each other. However, the real responses are not so simple. For example, the western subarctic gyre shows large seasonal variability in the western boundary current (Oyashio), while the Alaskan stream does not show large seasonal variability. In addition to these physical characteristics, chemical and biological characteristics are different. For example, iron supply is larger in the western subarctic gyre since the distance from the terrestrial sources is closer than in the Alaskan gyre. This, in turn, affects seasonal cycling and magnitudes of phytoplankton and zooplankton production. Therefore ecosystems are also different in the two gyres. To achieve better understanding of the mechanisms of the subarctic response to atmospheric forcing, comparisons of the responses of the two gyres are essential. This session will focus on the comparison of the physical, chemical and biological characteristics of the two gyres, on all time scales. Presentations on predictability of the two gyres, or which address additional improvements of the subarctic observation network are also welcome.

Recommended Conveners: James Christian (Canada), Emanuele Di Lorenzo (U.S.A.), Shin-ichi Ito (Japan), David Mackas (Canada), Vyacheslav Lobanov (Russia) and Atsushi Tsuda (Japan)

REPORT OF THE SECTION ON *ECOLOGY OF HARMFUL ALGAL BLOOMS IN THE NORTH PACIFIC*

The Section on *Ecology of Harmful Algal Blooms in the North Pacific* (HAB-S) met from 9:00 to 18:00 h on October 26, 2009, in Jeju, Korea. The meeting was attended by 19 members and observers (*HAB-S Endnote 1*). HAB-S was represented by all PICES member countries. The proposed agenda for the meeting was reviewed and approved by the Section (*HAB-S Endnote 2*). Co-Chairman, Dr. Vera Trainer, gave a brief history of the origins of HAB-S and reviewed the Section's Terms of Reference.

AGENDA ITEM 3
Country reports

Canada

No report was available. Dr. Trainer strongly urged Canada to provide country reports in the future.

China

Dr. Mingyuan Zhu reported that eutrophication in China is mostly found in the Yangtze River estuary where the major pollutants are phosphate and DIN. The highest concentration of DIN was measured at Shanghai. The Yangtze River also discharges large amounts of nutrients, COD and oil, but in 2008 there was not as much nutrient discharge. HABs are found in the coastal regions of China; 68 HAB events were reported in 2008, affecting 13,000 km^2. Events are on the increase in the Yellow Sea, and the East China Sea has largest scale and 70% of total events. The HABs include Thalassiosira, Skeletonema, *Chaetoceros* sp., and *Prorocentrum* sp. *Prorocentrum* is main species found in the East China Sea, blooming every year since 2000. *Noctiluca* sp. blooms were found in June. HAB events decreased overall, but increased slightly in the Yellow Sea. Although there has been a general increase in HAB events since the 1980s, over the last 5 years HAB events have generally had a slight decrease. The East China Sea, which has been impacted the most by HAB events, has seen an increase over a 10-year period. May to September is the season for HABs. A movement to the north of Karenia mikimotoi has occurred over a 5- to 10-year period. Since 2000 most blooms have been dominated by dinoflagellates.

Dr. Zhu also discussed macroalgae blooms that occurred in the Yellow Sea in 2008 and 2009. A green tide occurred in Qiangdao 2 months before it was to host the regatta at the 2008 Olympics. One million tons of the macroalgae were physically removed before the event. In May 2008, small patches were observed off the coasts of Yancheng and Lianyungang, and 10 days later significantly expanded northward towards Qingdao, reaching the coast by the end of June. The source of the green tide remained speculative but investigation showed that *Enteromorpha* sp. was the cause of the bloom, although *Ulva* sp. was implicated as well, as the algae was found attached to ropes of aquaculture facilities. The Qingdao region was surveyed in the winter of 2008–2009, but very few patches were observed, so potentially it was not the source. The survey revealed that no patches were found before April 6, 2009, but after this date a floating biomass estimated at 1.35 tons was formed. By mid-April it increased, reaching about 40 tons by the end of the month. In early May it increased to 760 tons and moved to offshore. In late May the biomass increased to an estimated 116,000 tons and moved northward. By early June it increased to 175,000 tons, and in early July reached 262,000 tons and began moving north. In 2009, the algae didn't effect many coastal areas, most of it just sinking to bottom offshore. It is thought that environmental factors, such as rising air and sea temperatures, contribute to the bloom. Scientists are still not sure where the bloom originates, or what can be done to mitigate the green tides.

Dr. John Keesing (CSIRO) presented a report on "*Recurrent large-scale macroalgal blooms in the Yellow Sea*". In late June 2008, a green tide composed of *Entoromorpha* formed in the Yellow Sea off China. The algae is not a toxic species but it has a large economic impact to tourism and on the cost of cleaning it up. Ten

thousand people were involved in cleaning up of 1 million tons of the algae which covered 600 km^2 in Jiaozhou Bay, Qingdao. The cause was initially thought to be due to eutrophication, but bloom was novel event while eutrophication is not. In 2009 a linkage was found between *Porphyra* cultivation and *Enteromorpha* biomass accumulation. A recommendation has been made to modify the way rafts are cleaned to dispose of *Enteromorpha* on land. There also needs to be a better understanding of *Enteromorpha* biomass accumulation on rafts and in the sea.

Japan

Dr. Shigeru Itakura reported that paralytic shellfish poisoning (PSP) and diarrheic shellfish poisoning (DSP) in 2008 and 2009 were caused by *Chattonella antiqua.* In 2008 total PSP events overall were lower than in the previous 8 years, mainly in the JP04 and JP02 areas, and DSP occurrences were moderate. In Ariake Bay, southwestern Japan, the average depth is 20 m, with a range in tides of 5 m, a broad tidal flat. A *Chattonella* red tide occurred there in August 2000. A cyst survey conducted found dense concentrations of cysts. In 2009, another bloom occurred at the head of bay from July 17–23, then moved to the mouth of bay from July 24-31 during which there were strong winds from north and heavy rainfall which resulted in very low salinity and *Porphyra*. At the mouth of bay, finfish aquaculture sustained damage during that year.

Korea

Dr. Yang Soon Kang's HAB case report for 2008 and 2009 was given by Co-Chairman, Dr. Hak-Gyoon Kim. No fisheries damages in were reported in 2008 and 2009 (the largest fishery damage occurred in 1995), but *Cochlodinium polykrikoides* blooms were present in 2008. The species bloom started in Kamak Bay and lasted from July 30 to September 29, 2008. Small-scale blooms took place in 2008 due to very low rainfall, low nutrient levels and strong feeding pressure by zooplankton. No blooms of *C. polykrikoides* occurred in 2009 due to very high precipitation in July, which drove the salinity down. However, there was a *Chattonella* bloom on west coast from July 14 to 21, but no fish were killed. August and September were the peak months for HAB events in 2008 and 2009. Other HAB species blooms are *Alexandrium* sp., *Scrippsiella* sp., and *Gonyaulax* sp. In 2009 precipitation in July was very high, driving salinity down.

Russia

Dr. Tatiana Orlova reported that most HAB monitoring on Russian pacific coast is being conducted in Peter the Great Bay. A total of 28 bloom-forming species, mostly diatoms, were detected in 2009. Among them were potential DSP, ASP, PSP producers. July and August were the months when DSP was most prevalent. June to autumn is when amnesic shellfish poisoning (ASP) is common, although *Pseudo-nitzschia australis* is not one of the factors. During monitoring for epiphytes and benthic species, *Osterosis ovata* and *Siamensis* sp. were found, (typically tropical species), with concentrations up to 1460 cells/g of wet weight. HAB resting stages and cysts are also monitored. *P. multiseries* was shown to increase in toxicity in culture, possibly because of the change of bacteria composition of *Alteromonas*, shown to increase domoic acid (DA) production from previously low producer of DA (*P. multiseries*). The ELISA method used for DA detection showed that *P. pungens* and *P. calliantha* produced DA from Russian waters. ASP toxin was found in 96% of total samples (mollusks) ~60% for DSPs. A larger span time for monitoring has now been given because of the results from mollusks. PSP toxins have been detected as well in sediments and *Alexandrium tamarense* cells and cysts are present in the Kamchatka region. Mycotoxins (aflotoxins) are also measured in scallops and fungi (B1, G1, G2 toxins), with values 0.38–1.03 μg/kg.

U.S.A.

Dr. Trainer noted that in Alaska, Washington, Oregon and California, only PSP and ASP testing is done. No red tides are reported. No DSP testing is done, so fish killing toxins generally do not get reported. In Alaska in 2009, there were frequent PSP closures, but rarely ASP closures; 2008 saw many PSP closures, and no ASP closures. DA was detected in harbor seals. An Alaska phytoplankton monitoring program was started in 2008 by the University of Alaska in collaboration shellfish growers and volunteers who are trained to ID and test for toxins.

Washington State has mussel sentinel monitoring stations. Closures due to PSPs are frequent and common in Puget Sound, but are few on the coast. The Puget Sound Sound Toxins monitoring network for HAB cell detection is an early warning system that is made up of growers and volunteers who sample, identify and communicate the results to fish and shellfish farmers in the region and to the State. The first closures for DA in Puget Sound took place in 2005. DSP toxins found throughout Washington recently, but no monitoring program for these toxins has been set up yet. In 2009 there were no closures on the outer coast for ASP toxins. Closures on the coast for PSP were rare but concentrations were high, reaching 405 μg/100g. a Pacific Northwest Harmful Algal Blooms Forecasting Bulletin is a web-based information system that provides a comprehensive early warning information, such as winds, currents, upwelling index, cell abundance, drifters, river discharge, and weather for potential development of Washington coast HAB events. For example, an *Akashiwo sanguinea* bloom this year resulted in sea bird deaths, and the HAB Bulletin gave a risk level of red (high) during this occurence.

In Oregon there were PSP closures in bays along coast: DA closures, if any, were in the northern coastal region. In 2008 there were no DA closures. However, there is an annual stoppage of digging from May to October, regardless of monitoring results. Oregon issues weekly reports on HABs and toxins in its MOCHA (Monitoring the Oregon Coast for Harmful Algae) program.
California reported 2008 levels of PSP above 80 μg/100g. The State conducts an annual quarantine from May to October. There were no DA closures. Weekly biotoxin reports are made, giving abundance information on phytoplankton, including HABs.

AGENDA ITEM 4
FUTURE science program

Dr. John Stein, Science Board Chairman, informed HAB-S of PICES' new integrative science program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems). FUTURE is made up of three Advisory Panels on Climate, Ocean Variability and Ecosystems (COVE), Anthropogenic Influences on Coastal Ecosystems (AICE) and Status, Outlooks, Forecasts and Engagements (SOFE) who will play a role in providing advice on the priorities of FUTURE, including reviewing proposed expert groups in relation to FUTURE activities and recommending activities to be undertaken by existing expert groups. A joint meeting of the FUTURE Advisory Panels would be taking place on October 27 to, in part, to discuss working with existing PICES expert groups, and Dr. Stein encouraged the Section to attend.

AGENDA ITEM 5
Relations with international organizations

ICES

Dr. Donald Anderson (WHOI) gave a report on the ICES-IOC Working Group on Harmful Algal Bloom Dynamics (WGHABD), its background and method of doing science and discussed potential collaboration between WGHABD and PICES expert groups. WGHABD meets for 3–4 days during the ICES ASC and discusses HAEDAT maps, member country reports, and new findings (i.e., *Azadinium* is the causative organism of azasporacid toxins). (Dr. Anderson suggested that HAB-S do new findings instead of focusing on a demonstration/meeting (cysts, raphidophytes, *etc*.). It was suggested that HAB-S could undertake both new findings as well as lab demonstrations, since the latter is valuable to participants for the training aspect and transfer of knowledge.) WGHABD also reviews their Terms of Reference at each meeting and discusses specific topics and items that need to be done, such as new species, data collation, map generation, research report generation, *etc*. Special workshops and meetings are then organized separately on specific targeted topics and special reports produced. Dr. Anderson presented HAB-S with a number of opportunities to collaborate with ICES including:

- HAIS/HAEDAT submissions,
- workshops or intercalibration exercises,
- joint participation in special sessions,
- coop research reports on specific topics,
- exchange of "new findings" summaries.

HAB-S reviewed the suggestions and concluded that:
1. joint meetings with ICES might not be possible because of size restraints and time of year conflicts with the PICES Annual Meeting;
2. it might be possible for WGHABD member to attend a PICES workshop and *vice versa* for a HAB-S member, and that the member would make a summary report from the workshop;
3. more discussion was needed in HAB-S to decide what types of collaborations it wanted to undertake with ICES;
4. HAB-S should probably require PICES member countries to turn in written reports for their countries, not just slide presentations; HAB-S also discussed establishing a form sheet for each country to fill out.

NOWPAP CEARAC

Dr. Takafumi Yoshida (NOWPAP) informed HAB-S that NOWPAP has established a HAB Integrated Website to provide HAB-related information in the NOWPAP CEARAC region (http://www.cearac-project.org/HAB_ Integrated_Website/). The website includes links to:
- Publications – reports on HABs from working groups, national reports (Korea, Japan, Korea, Russia), special publications, case studies reports, other outputs;
- Database – HAB reference database (searchable), case studies, and HAB expert database;
- Topics – *Cochlodinium*, satellite remote sensing, and eutrophication events.

There were no limitations to sharing data through the PICES and ICES database systems.

IPHAB/IODE Task Team on the development of the Harmful Algal Information System (HAIS)

Dr. Monica Lion (IOC) provided an update on the joint work of the IPHAB/IODE Task Team on the development of the Harmful Algal Information System (HAIS). The objectives of such a database is to serve such groups as managers, scientists, policy administrators. The establishment of HAIS builds on the evolution over the past 15 years of a number of separate databases and products that have been developed in partnership between IOC, ICES, PICES and ISSHA. When HAIS is in place, users will have access to taxonomy, references and an expert directory; monitoring and management design with ICES (MONDAT); interface with Encyclopedia of Life. The Task Team is presently looking for funding to implement the plan.

AGENDA ITEM 6
PICES Seafood Safety Project

Dr. Charles Trick presented an update on the PICES Seafood Safety Project which began in 2007 with funding assistance from the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF). The purpose of the project is to build capabilities in non-PICES member countries in the Pacific Rim to monitor and test for HAB species and toxins for seafood safety. A tiered monitoring strategy is used – analysis of phytoplankton, then, if warranted, toxin content in phytoplankton and finally, if warranted, toxin content of shellfish. Efficiency and cost effectiveness is key to the project and is specific to each region. The first training class was held in the Philippines from January 15–23, 2009 and the agenda included rapid testing for toxin screening (ELISA, Jellet), database organization, phytoplankton identification and monitoring, coordination of data collection and submission. The criteria for selecting the next country of focus is that it be geographically distinct from the previous one; it have existing HAB problems resulting in fisheries losses; it have its government support of management needs; it have the potential for sustainable monitoring. Guatemala was visited in September 2009 to identify the level of training needed, and to discuss with managers and fishers what the HAB problems

were. It was noted that many of Guatemala's red tides were not health issues for human consumption, so fish farmers may be more open to having testing done.

AGENDA ITEM 7
GEOHAB Ocean Science Meeting on "*HABs and eutrophication*"

Dr. William Cochlan reported on the GEOHAB 2nd Open Science Meeting on "*HABs and eutrophication*" held in Beijing, China, on October 18–21, 2009. It was particularly appropriate that this meeting was held in China, as the rate of nutrient loading to coastal waters in China has increased rapidly over the past several decades with the rapid industrialization of this country, and eutrophication-related HAB events are now common along the Chinese coast. The meeting featured seven keynote presentations, ranging from reviews of the rapidly expanding HAB events and their impacts throughout Chinese waters in the past, to global estimates of the expanding distribution and impacts of *Nocticula scintillans*, to nutrient discharge from expanding aquaculture operations and their impacts. Participants also heard local reviews of eutrophication-related HAB events. Contributed talks described a broad range of topics, underscoring many aspects of the complexity of the relationships of HABs with nutrients. Unintentional message that eutrophication causes HABs, and thus can be controlled through control of nutrients, is not true for many areas. To further the dialogue and the sharing of information on this important topic, a special issue of the Chinese Journal of Oceanology and Limnology is being prepared to capture the highlights of this meeting.

AGENDA ITEM 8
***Ex-officio* membership in HAB-S**

The Executive Secretary of PICES, Dr. Alexander Bychkov informed HAB-S that scientific issues that PICES deals with are not limited to the North Pacific. Therefore, Council has looked for a legal framework to bring in experts from outside of PICES member countries to contribute and exchange scientific information at PICES standing committee and expert group meetings. Dr. Bychkov encouraged HAB-S to consider recommending an expert from an organization or program that the Section has relations with for *ex-officio* member status.

AGENDA ITEM 9
Workshops and meetings at PICES-2010

Proposals for meetings and workshops:
- A 1-day HAB-S meeting, including country reports for HAB events in 2007–2008 and discussion of HAEDAT use. Countries are requested to input HAB event data to HAEDAT for 2005–2006 directly to the online database;
- A 1-day Workshop and lab demo on the "*New technologies and methods in HAB detection I. HAB species detection*" co-convened by Dr. Ichiro Imai (Japan) and Dr. Vera Trainer (U.S.A.) (*HAB-S Endnote 3*);
- A ½-day Topic Session on "*Conceptual and numerical models of HAB dynamics*", organized by Dr. Shigeru Itakura (Japan) and Dr. William Cochlan (U.S.A.) (*HAB-S Endnote 4*).

AGENDA ITEM 10
Items with financial implications and recommendations

HAB-S requests travel funds for:
- 2 invited speakers for a ½-day Topic Session on "*Conceptual and numerical models of HAB dynamics*" at PICES-2010,
- 2 invited speakers for a 1-day Workshop and lab demo on the "*New technologies and methods in HAB detection I. HAB species detection*" at PICES-2010,
- a PICES member to attend ICES WGHABD meetings.

HAB-S requests *ex-officio* membership for:
- Dr. Takafumi Yoshida (NOWPAP CEARAC),
- an ICES HAB Working Group member.

HAB-S recommends that the following be considered for removal due to lack of contribution and activity:
- Canada – Dr. Jennifer Martin,
- Russia – Dr. Gennady Kantakov, Dr. Nina Klochkova.

HAB-S recommends that the following be considered by their countries to be added to HAB-S for their valuable contributions:
- China – Drs. Hao Guo, Jinhui Wang.

HAB-S requests that Canada provide an additional expert to the HAB-S who can report on Canadian HAB data and that Canada provide funds for travel for their HAB-S members to PICES Annual Meetings.

AGENDA ITEM 11
Summaries of the HAB-S Topic Session and Workshop at PICES-2009

Summaries of the MEQ Topic Session (S4) on "*Mitigation of HAB events*" and the MEQ Workshop and laboratory demonstration (W6) on " Review of selected harmful algae in the PICES region: V. *Cyst-forming HAB species*" can be found in the Session Summaries section of the PICES-2009 Annual Report.

HAB-S Endnote 1

HAB-S participation List

Members	Observers
William Cochlan (U.S.A.)	Donald Anderson (U.S.A.)
Shigeru Itakura (Japan)	Robin Brown (Canada)
Hak-Gyoon Kim (Korea, Co-Chairman)	Alexander Bychkov (PICES)
Weol-Ae Lim (Korea)	Rongshuo Cai (China)
Olga Lukyanova (Russia)	Hao Guo (China)
Tatiana Morozova (Russia)	John Keesing (Australia)
Tatiana Orlova (Russia)	Ruixiang Li (China)
Michail Simokon (Russia)	Monica Lion (IOC)
Vera Trainer (U.S.A., Co-Chairman)	Takafumi Yoshida (NOWPAP CEARAC)
Charles Trick (Canada)	
Yasunori Watanabe (Japan)	
Mark Wells (U.S.A.)	
Mingyan Zhu (China)	

HAB-S Endnote 2

HAB-S meeting agenda

1. Introduction
2. Approval of agenda
3. Country reports
4. FUTURE science program
5. Relations with international organizations

6. PICES Seafood Safety Project
7. GEOHAB Ocean Science Meeting on "*HABs and eutrophication*"
8. *Ex-officio* membership in HAB-S
9. Workshops and meetings at PICES-2010
10. Items with financial implications and recommendations
11. Summaries of the HAB-S Topic Session and Workshop at PICES-2009

HAB-S Endnote 3

Proposal for a 1-day MEQ Workshop and lab demonstration on
"*New technologies and methods in HAB research and monitoring I. HAB species detection*"
at PICES-2010

Here we begin a series of workshops and lab demonstrations focusing on new technologies in harmful algal bloom (HAB) research and monitoring. The first workshop in this series will include demonistrations of new methods in organism detection with concentrated information on HAB species. This workshop and integrated demonstrations will include demonstrations and lectures describing equipment and methods from the following list: environmental sampling platform (ESP), FloCam, sandwich hybridization assay (SHA), qPCR, FISH, and in situ sensors including gliders. This series will continue in the future with demonstrations on automated nutrient samplers, modeling, remote sensing, and other techniques.

Co-conveners: Ichiro Imai (Japan) and Vera Trainer (U.S.A.)

Proposed invited speakers to be selected from the following: Chris Scholin, MBARI; Harry Nelson, Fluid Imaging; and Nicole Poulton, Bigelow Labs.

HAB-S Endnote 4

Proposal for a ½-day MEQ Topic Session on
"*Conceptual and numerical models of HAB dynamics*" at PICES-2010

Each PICES member country has conceptual models of harmful algal bloom dynamics that link the physics, chemistry and biological aspects of bloom development and decay. The biology gives us information on ecosystem structure but also describes elements contributing to success of a particular species. The chemistry focuses on nutrient dynamics, ratios and preferences among species. Physical processes detail cell and nutrient delivery to the coast. While conceptual models are descriptions of HAB dynamics without numbers, numerical models include rate estimates. In theory, each of these would be supported with the same physical, chemical and ecological foundation, overlain with the unique considerations of different water types and second order ecosystem structure. However, these models vary widely between species and among countries. There has been no comprehensive intercomparisons among these conceptual and numerical models to identify their similarities and differences. The focus of this session will be to seek commonalities among models and identify the unique second order aspects needed to describe the distribution and dynamics of HAB in different PICES regions. We encourage modelers and non-modelers alike to submit their papers.

Co-convenors: Dr. Itakura (Japan) and Dr. Cochlan (U.S.A.)

Proposed invited speakers to be selected from the following: Don Anderson, Patrick Gentien, Wolfgang Fennel, Robin Raine (conceptual model), Tamiji Yamamoto (numerical model on nutrient dynamics and *Alexandrium tamarense*)

REPORT OF THE SECTION ON *CARBON AND CLIMATE*

The meeting of the Section on *Carbon and Climate* (CC-S) was held from 14:00–18:00 on October 24, 2007 during PICES-2009 in Jeju, Korea. The meeting was chaired by Drs. James Christian (Canada) and Toshiro Saino (Japan) (*CC-S Endnote 1*). The agenda was adopted unanimously (*CC-S Endnote 2*).

AGENDA ITEM 2
Membership

In early 2009, Dr. Xiuren Ning, CC-S member from China, tragically passed away as a result of a traffic accident. Possible appointment of new members from China was discussed, and it was recommended to invite Dr. Minhan Dai of Xiamen University. Dr. Dai subsequently accepted the invitation and his formal appointment is in process.

The appointment of Dr. C.T. Arthur Chen as an *ex-officio* member representing IGBP was also proposed. Dr. Chen has since agreed and his appointment was approved by PICES and IGBP. Dr. Chen is a member as of December 2009.

AGENDA ITEM 3
CC-S achievements in the past 12 months

Pacific Carbon Data Synthesis

Substantial progress was made on the data synthesis in 2009. A subset of CC-S members met in Tokyo in March, and made several important decisions regarding the data synthesis process. It was decided that CARINA methodologies and software would be largely adopted, and that Dr. Toru Suzuki (JODC) would be principally responsible for implementing the algorithms and developing a web-base interactive database. The main deviation from CARINA methods is that pH would be expressed on the total scale rather than the seawater scale.

Subsequent developments prior to PICES-2009 are the completion and unveiling by Dr. Suzuki of his web database, and the completion of the CARINA database (published at CDIAC as NDP-091). Papers describing the CARINA data synthesis process are now in review at Earth System Science Data.

At PICES-2009, a carbon data synthesis workshop (W10), which was chaired by Dr. Masao Ishii (Japan) and Dr. Robert Key (U.S.A.), was held in the 1½ days prior to the CC-S meeting. A detailed summary of this workshop is included in the Session Summaries section of the Annual Report.

Topic Session in Jeju and future publication

A POC/BIO Topic Session (S6) was held on October 26 on the "*Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific*" chaired by Drs. Christian and Saino. The invited speaker was Dr. Richard Zeebe (U.S.A.). The session was well attended (80 recorded attendees) and inspired significant discussion. Plans for publication of the proceedings in the *Journal of Oceanography* were announced; guest editors will be Drs. Kitack Lee, Tsuneo Ono, and Chris Sabine, with Dr. Saino overseeing the process as Editor-in-Chief.

Publication of Journal of Oceanography Special Section

Publication of the proceedings of the previous BIO/POC-sponsored Topic Session on "*Decadal changes in carbon biogeochemistry in the North Pacific*" (S2) convened by CC-S at PICES-2007 in Victoria, Canada, was completed with the release of the special section in the *Journal of Oceanography* in 2009.

AGENDA ITEM 4
Reports of collaborating organizations and agencies

Reports were given on several national and international programs relevant to the mandate of CC-S, including IOCCP (Sabine), SOCAT (Nojiri), and CarboOcean (Key, Kozyr). Drs. Saino and Ishii reported on recent activities at JAMSTEC and JMA, respectively. Dr. Yukihiro Nojiri also reported on a pCO_2 system intercomparison held February 2009 at the National Research Institute of Fisheries Engineering, Japan; a poster presentation on this experiment was submitted to the Topic Session on "*Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific*" at PICES-2009 October 27.

AGENDA ITEM 5
Data synthesis

The data synthesis effort was the topic of a 1½-day workshop prior to the CC-S meeting (see Agenda Item 3), so little additional discussion was required. The full report of the workshop is described in the Session Summaries section of the Annual Report.

Requests to the BIO and POC parent committees were formalized, including an additional 2-day workshop at PICES-2010 and a request for travel expenses for two scientists. The workshop to be held at PICES-2010 is intended to be the final stage in the process, and will require multiple breakout groups working in parallel on different subsets of the data.

At the data synthesis workshop it was decided that the project and the dataset must have a name, and that the decision should be made soon so that interim *ad hoc* names do not get onto many files and documents. Subsequent to the meeting a vote of the membership was help via email and the name PACIFICA ("PACIFIc CArbon") was chosen.

AGENDA ITEM 6
Future meetings and activities

At PICES-2010, CC-S will have existed for 5 years and will present an interim report to its parent committees detailing its accomplishments and providing justification for reauthorization. Activities over the next 5 years will likely center around analysis of surface pCO_2 datasets and examination of ocean acidification impacts on biota.

CC-S Endnote 1

CC-S meeting participation list

Members

James Christian (Canada, Co-Chairman)
Richard Feely (U.S.A.)
Masao Ishii (Japan)
Alex Kozyr (U.S.A.)
Kitack Lee (Korea)
Tongsup Lee (Korea)
Akihiko Murata (Japan)
Tsuneo Ono (Japan)
Chris Sabine (U.S.A.)
Toshiro Saino (Japan, Co-Chairman)
Toru Suzuki (Japan)

Observers

Robert Key (U.S.A.)
Chihiro Miyazaki (Japan)
Toshiya Nakano (Japan)
Yukihiro Nojiri (Japan)
Ken'ichi Sasaki (Japan)
Masahide Wakita (Japan)

CC-S Endnote 2

CC-S meeting agenda

1. Review and adopt agenda, aims of the workshop
2. Discussion of CC-S membership
3. CC-S activity report: integrated dataset, topic session, JO special volume
4. Information exchange: IOCCP/GCP, SOLAS, JP-GEOTRACES, CarboOcean, JMA repeat hydrography activities, new JAMSTEC activities
5. Further activities relating to Data Synthesis
6. Discussion of future meetings and activities

REPORT OF WORKING GROUP 20 ON *EVALUATIONS OF CLIMATE CHANGE PROJECTIONS*

A Working Group 20 meeting was held in Jeju, Korea on October 25, 14:00–18:00 hours. After introductory formalities by the Co-Chairmen, Drs. Michael Foreman (Canada) and Yasuhiro Yamanaki (Japan), and Dr. James Christian (Canada) agreeing to act as rapporteur, the meeting of participants (*WG 20 Endnote 1*) began according to the agenda (*WG 20 Endnote 2*) with a recap of the Terms of Reference (*WG 20 Endnote 3*).

AGENDA ITEM 3
Updates on work related to Terms of Reference

Dr. Foreman stated that the CFAME final report was nearing completion and had received input from WG 20 members Yasuhiro Yamanaka, Emanuele Di Lorenzo, Muyin Wang, Michael Foreman and Dr. Wang's collaborators, James Overland and Nicholas Bond. The report will include chapters, each on the California Current, Kuroshio/Oyashio, and Yellow/East China Seas ecosystems. It was also noted that WG 20's request for a one-year extension of its lifetime to collaborate with the new PICES/ICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish* (WG-FCCIFS) was endorsed by Science Board.

AGENDA ITEM 4
Update on FUTURE and its new Advisory Panels

A discussion of FUTURE was moved to the top of the agenda, and Dr. Foreman gave a brief introduction to them and discussed outstanding issues about their structure and function. He gave a brief summary of the final version of the FUTURE Implementation Plan and the roles of its three new Advisory Panels. As Dr. Lorenzo was named a member of COVE (Advisory Panel on *Climate, Ocean Variaibility, and Ecosystems*) and POC members Drs. Steven Bograd, Shin-ichi Ito, Vyacheslav Labonov and Zhanggui Wang were named to AICE (Advisory Panel on *Anthropogenic Influences on Coastal Ecosystems*) and SOFE (Advisory Panel on *Status, Outlooks, Forecasts and Engagement*), it was felt that physical/geochemical oceanographic and climate issues would be well represented in FUTURE.

AGENDA ITEM 3, CONTINUED
Updates on work related to Terms of Reference

Brief updates on research progress relevant to the Terms of Reference were given by Drs. Elena Ustinova, Vadim Navrotsky, Enrique Curchitser, and Yamanaka, Christian, Lorenzo and Foreman. Dr. Muyin Wang had given an update of her work the preceding day in Workshop 8 on "*Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales*". It was felt that these summaries demonstrated good progress against the first four Terms of Reference.

Dr. Foreman outlined the status of collaborations of WG 20 with WG-FCCIFS. They included his being named a Working Group member and his co-chairing (with Dr. Jason Holt of the Proudman Oceanographic Laboratory, Liverpool, UK) the Theme Session "*Downscaling variables from global models*" at the WG-FCCIFS workshop [later changed to an International Symposium] on "*Climate change Effects on Fish and Fisheries: Forecasting impacts, assessing ecosystem responses, and evaluating management strategies*" planned for Sendai, Japan in April 2010. Dr. Muyin Wang has agreed to give an invited presentation in this session. Given the relevance of both this session and another entitled "*Contemporary and next generation climate and oceanographic models, technical advances and new approaches*" to the WG 20 objectives, other Working Group members were encouraged to attend the Sendai workshop. An informal Working Group meeting might be convened there if there are enough members present.

AGENDA ITEM 5
WG 20 final report

Given that WG 20 will end after PICES-2010, discussions on the structure and content of its final report were initiated. The following rough outline of possible chapters was put forward:

1. Introduction, TOR, overview of progress and relevance to FUTURE,
2. Contributions to CFAME and WG-FCCIFS,
3. Wang/Overland/Bond: statistical downscaling in NEP, PDO representation,
4. Curchitser: dynamical downscaling,
5. Di Lorenzo and Miller: NPGO and ENSO representations and projections in GCMs, …
6. Foreman *et al.*: BC statistical and dynamical downscaling,
7. Yamanaka *et al.*: Kuroshio/Oyashio dynamical downscaling and ecosystem modeling,
8. Korean work?
9. Chinese work: Fan Wang will summarize various national efforts,
10. Russian work: Elena Ustinova and Vadim Navrotsky will contribute with help from Yury Zuenko,
11. Recommendations for FUTURE work.

Dr. Foreman agreed to send out emails in 1–2 months requesting more complete outlines of respective chapters from individual members. Though this report need not be finished by PICES-2010, it was agreed that there was no desire to continue much beyond that date.

AGENDA ITEMS 6 AND 7
Future WG 20 workshops/meetings

It was decided that WG 20 would propose a workshop entitled "PICES *Working Group on Evaluations of Climate Change (WG 20): Progress and FUTURE*" for PICES-2010. No invited speakers would be requested and presentations and discussions would concentrate on:

- progress related to the WG 20 Terms of Reference,
- status of, and future work on, the final report,
- follow-up activities that conform to FUTURE objectives and needs.

The possibility of submitting at least one oral presentation summarizing WG 20 activities to the Science Board Symposium at PICES-2010 was also discussed, and will be finalized via email as the deadline abstract submissions for that meeting comes closer.

AGENDA ITEM 8
Other business

No other business was discussed and the meeting was adjourned at about 17:30 hours.

WG 20 Endnote 1

WG 20 participation list

Members

James Christian (Canada)
Enrique Curshitser (U.S.A.)
Emanuele Di Lorenzo (U.S.A.)
Michael G. Foreman (Co-Chairman, Canada)
Arthur Miller (U.S.A.)
Vadim Navrotsky (Russia)
Elena Ustinova (Russia)
Fan Wang (China)
Muyin Wang (U.S.A.)
Yasuhiro Yamanaka (Co-Chairman, Japan)

Observers

Heui Chun An (Korea)
Stewart (Skip) McKinnell (PICES)
John E. Stein (PICES)
Yury Zuenko (Russia)

WG 20 Endnote 2

WG 20 meeting agenda

1. Welcome, introductions, opening remarks
2. Changes to, adoption of, agenda and appointment of rapporteur
3. Updates on work related to WG Terms of Reference
   a. Brief individual research summaries
   b. CFAME final report
   c. Collaboration with WG-FCCIFS:
      i. Sendai workshop, April 26–29, 2010
   d. Individual research summaries (Curchitser, *etc*.)
   e. other
4. Update on FUTURE and its new Advisory Panels:
   a. Discussion on roles for WG20 & possible successor WG(s)
5. WG 20 final report:
   a. organization and content
   b. chapter assignments
6. Future WG 20 workshops/meetings
   a. Informal meeting at Sendai workshop?
   b. Final meeting and/or workshop/session at PICES 19, Portland, October 2010
   c. Other?
7. Items with financial implications
   a. Travel support requests
   b. Other items
8. Other business
9. Adoption of report for presentation at POC committee meeting

WG 20 Endnote 3

Terms of Reference

1. To analyze and evaluate climate change projections for the North Pacific and its marginal seas based on predictions from the latest global and regional models submitted to the Inter-governmental Panel on Climate Change (IPCC) for their 4th assessment report;
2. To facilitate analyses of climate effects on marine ecosystems and ecosystem feedbacks to climate by, for example computing an ensemble of the IPCC model projections for the North Pacific and making these projections available to other PICES groups such as CFAME;
3. To facilitate the development of higher-resolution regional ocean and coupled atmosphere-ocean models that are forced by, and take their boundary conditions from, IPCC global or regional models;
4. To facilitate the development of local and regional data sets (*e.g.*, SST, river flow, sea ice cover) incorporating information from climate model projections as well as observations and historical re-analyses;
5. To ensure effective two-way communication with CLIVAR;
6. To convene workshops/sessions to evaluate and compare results;
7. To publish a final report summarizing results.

REPORT OF WG 21 ON *NON-INDIGENOUS AQUATIC SPECIES*

The 4th annual meeting of the Working Group on *Non-Indigenous Aquatic Species* (hereafter WG 21) was held under the co-chairmanship of Ms. Darlene L. Smith from October 23–24, 2009. There was participation from all PICES countries and guests from ICES WGITMO, IOC WESTPAC and NOWPAP. Twenty-five WG-21 members and guests attended the meeting (*WG 21 Endnote 1*). meeting agenda can be found in *WG 21 Endnote 2*.

AGENDA ITEM 2
2009 inter-sessional highlights

WG 21 was active throughout the year planning working group activities and interacting with other multilateral organizations. The following are the highlights of these activities:

- Dr. Thomas Therriault, the Principle Investigator of the Ministry of Agriculture, Forestry and Fisheries of Japan (MAFF) funded Taxonomy Initiative visited Busan and Jeju Island, Korea, in March 2009 to plan a collector plate and Rapid Assess Survey (RAS). This ultimately resulted in a very successful RAS in Jeju (see PICES Press Vol. 18, No. 1, pp. 38–40). WG 21 conducted a 4-day (October 19–22, 2009) RAS in Jeju prior to the PICES Annual Meeting. Participants were from 5 PICES member countries (Canada, Japan, Korea, Russia and United States) as well as from ICES WGITMO and IOC WESTPAC. Collectors from 4 locations (Busan, Ulsan, Masan and Jang Mok) analyzed the samples at the Jeju Biodiversity Institute. Field sampling was conducted at Seongsan Beach. Analysis is being finalized and will be entered into the database. Working Group members, Drs. Junghoon Kang and Kyoungsoon Shin of KORDI, were instrumental in the success of this exercise and WG 21 thanks them.
- Ms. Darlene Smith was invited to give a presentation on WG 21's activities at an IOC WESTPAC workshop on "*Marine invasive species and management in the western Pacific region*" in Bangkok, Thailand (June 4–5, 2009). This resulted in a formal invitation and acceptance for IOC WESTPAC to attend the WG 21 meeting as an observer at PICES-2009. It is also likely that IOC WESTPAC representatives will participate in the demonstration workshop on "*An introduction to rapid assessment survey methodologies for application in developing countries*" to be hosted by Japan in July 2010.
- PICES co-sponsored the 6th International Conference on Marine Bioinvasions held in Portland, Oregon, from August 24–29, 2009. This financial support enabled a number of WG 21 members to attend the Conference. The meeting was attended by all the Chairs and Co-Chairs of the working groups and a numbers of members. The working groups' activities were shared. This resulted in an invitation to WG 21 to present the Non-indigenous Species database at the WGBOSV meeting in Hamburg, Germany in March 2010. It was also agreed that the PICES and ICES Working Groups would meet again following the 7th Marine Bioinvasions Conference to be held in Barcelona, Spain in 2011.

AGENDA ITEM 3
Taxonomy initiative

The Rapid Assessment Survey (RAS), as part of the taxonomic initiative under the MNIS sub-project which is part of the project entitled "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" is funded by a voluntary contribution to PICES from the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan. The project is anticipated to run for 5 years (from April 1, 2007 to March 31, 2012).

In addition to the RAS conducted in Jeju, Korea, collector surveys were undertaken in China and Japan. Dr. Li Zheng presented results from Qingdong and Qingdao, China. Collectors were also put out by Canada and United States but analysis not yet complete.

Two proposals (Tokyo Bay and Osaka Bay) for a demonstration RAS workshop were presented by Dr. Hiroshi Kawai. WG-21 selected the Osaka Bay proposal based on the following criteria: Cost, Biodiversity, Facilities and Logistics. The demonstration RAS workshop will be held in July 2010 with the precise date to de determined shortly. IOC WESTPAC will be invited to participate and will conducting its own RAS later in the fall 2010.

AGENDA ITEM 4
Marine non-indigenous species database initiative

The marine non-indigenous species database is the other MNIS sub-project funded by MAFF. Ms. Deborah Reusser and Dr. Henry Lee II reported on the following upgrades to the database:

a. Ability to add images,
b. Ability to add pdf files,
c. Ability to output maps to pdf or to a printer,
d. Bulk import utility,
e. Utility to produce spreadsheets of information by species.

The latest version of the database was installed on Working Group members' laptops at the meeting. Development of the database will be finished March 31, 2010. WG 21 members agreed to submit data quarterly to Dr. Lee for wrap-up. However, they were not able to resolve the question of a web-based application or long-term maintenance of the database.

AGENDA ITEM 5
Glossary of terms and definitions

A draft of a glossary was completed by Mr. Graham Gillespie. WG 21 members will review the glossary and add terms that are missing. Mr. Gillespie will then sort and compare the entries and prepare a final version by October 2010.

AGENDA ITEM 6
Compilation of databases of NIS experts including taxonomists

Dr. Blake Feist prepared a draft compilation. WG 21 members will review the draft and Dr. Feist will produce a final version by January 2010 to be posted on the Working Group's webpage.

AGENDA ITEM 7
Summary of marine bioinvasions in the North Pacific

Dr. Lee reported on progress on the marine bioinvasions database. Data entry is slower than planned. WG 21 members agreed to supply data in a timely manner as discussed above. They also agreed that an atlas of NIS species, with distribution maps and ecological characteristics, would be the best way to communicate a summary of marine bioinvasions in the North Pacific. The atlas would be a PICES publication and brochure, with a CD, and pdf file posted on the PICES website. The atlas will be completed October 2010 with publication in 2011.

AGENDA ITEM 8
Korean port environmental risk assessment technology

Dr. Kang presented Korea's efforts to develop environmental risk assessment technologies for ports. This includes monitoring and risk assessment.

AGENDA ITEM 9
ICES Code of Practice on Introductions and Transfers of Marine Organisms

Dr. Judith Pederson, Chair of ICES WGITMO, presented a summary of the ICES Code of Practice on Introductions and Transfers of Marine Organisms. A number of ICES member countries, including Canada, use this code as a basis for their approvals of transfers of marine organisms in their aquaculture industries. This summary will be included in WG-21's final report in 2012.

AGENDA ITEM 10
International Maritime Organization Ballast Water Standards

Dr. Lee presented a summary of IMO Ballast Water Standards. To date, no PICES member countries have ratified the IMO convention on ballast water. Dr. Lee's summary will be included in WG-21's final report in 2012.

AGENDA ITEM 11
Topic Session proposal

WG 21 recommends a ½-day Topic Session on "Join the club: Integrating non-indigenous species with other anthropogenic influences on coastal ecosystems" at PICES-2010 (*WG 21 Endnote 3*). We believe that the PICES 2010 annual meeting in Portland is particularly well suited for this proposed topic session. First, since much of the research on the impacts of NIS on coastal marine systems occurs in North America, Portland would serve as a convenient hub for this special session. Second, The Center for Lakes and Reservoirs (CLR) at Portland State University (PSU) is an internationally renowned Center that focuses on NIS research and serves as a conduit for much of the NIS research that occurs on the West Coast of the United States.

Proposed budget: $3,500 to cover travel of 2 keynote speakers.

AGENDA ITEM 11
Recommendations to MEQ

The Working Group recommends that the MEQ Committee approve:

a. Holding a 4-5 day demonstration RAS workshop in Japan (MAFF funding),
b. Holding a 4-day Rapid Assessment Survey in Oregon (MAFF funding),
c. Holding a 2-day working group meeting at PICES-2010,
d. Advising Science Board that WG 21 intends to publish an atlas of non- indigenous species in the North Pacific in 2010,
e. Approving a ½-day Topic Session at PICES-2010 in Portland, Oregon, and travel support for 2 keynote speakers.

WG 21 Endnote 1

Participation list

Members

Evgenyi Barabanshchikov (Russia)
Blake E. Feist (U.S.A.)
Graham Gillespie (Canada)
Hao Guo (China)
Junghoon Kang (Korea)
Hiroshi Kawai (Japan)
Henry Lee II (U.S.A.)
Deborah Reusser (U.S.A.)
Kyoungsoon Shin (Korea)
Darlene Smith (Canada, Co-Chairman)
Thomas Therriault (Canada)
Hisashi Yokoyama (Japan)
Li Zheng (China)

Observers

Judith Pederson (ICES)

and others

WG 21 Endnote 2

WG 21 meeting agenda

1. Opening remarks and introductions
2. 2009 inter-sessional highlights
3. Taxonomy initiative (funded by MAFF)
4. Marine non-indigenous species database initiative (funded by MAFF)
5. Glossary of terms and definitions
6. Compilation of databases of NIS experts including taxonomists
7. Summary of marine bioinvasions in the North Pacific
8. Korean port environment risk assessment technology
9. ICES Code of Practice on Introductions and Transfers of Marine Organisms
10. International Maritime Organization Ballast Water Standards
11. Topic Session proposal
12. WG 21 recommendations to MEQ

WG 21 Endnote 3

Proposal for a ½-day Topic Session on
"*Join the club: Integrating non-indigenous species with other anthropogenic influences on coastal ecosystems*" at PICES-2010

When people think of anthropogenic forcing in coastal marine ecosystems, commercial fishing, aquaculture, pollution and urbanization usually come to mind. Another type of anthropogenic forcing, typically not classified as such, is the presence of non-indigenous species (NIS). While the occurrence and subsequent impacts of NIS in coastal ecosystems are usually not classified as anthropogenic, the mechanisms of their introductions are, by definition, anthropogenic.

The Advisory Panel on Anthropogenic Influences on Coastal Ecosystems (AICE-AP), under the auspices of FUTURE, identified NIS as an exemplary anthropogenic impact on coastal marine systems. Further, in order to begin addressing the three key questions identified as priorities for FUTURE research activities, AICE and COVE (Climate, Oceanographic Variability and Ecosystems) Advisory Panels made it a priority to either establish new PICES expert groups or to build on and extend existing activities in PICES. Working Group 21

(*Non-indigenous Aquatic Species*) was one of the existing expert groups that was specifically suggested to "form an association with AICE". Therefore, we propose a PICES Topic Session dedicated to NIS as an anthropogenic influence on coastal ecosystems, which would facilitate the priorities set forth by the aforementioned advisory panels

If we wish to integrate NIS with other anthropogenic influences, we need a better understanding of ecosystem or regional impacts of NIS. Many, if not most, studies on the impacts of NIS in marine systems are done at small spatiotemporal scales, *i.e.*, typically over small areas (1 m^2) or under controlled circumstances with single species interactions. Conclusions from these studies are often scaled up and extrapolated to entire ecosystems or regions, but the extrapolations are limited by the fact that NIS consequences for whole ecosystems are not limited to single species interactions within homogeneous habitats. The dynamics of NIS impacts vary over space and time. Processes occurring over seasonal, annual and decadal time horizons interact in complex ways with habitat type, condition and availability, native species assemblages, trophic interactions, and food web dynamics. Understanding these complexities requires restructuring how we think about NIS invasions and their impacts on the health of coastal systems. Including and integrating NIS invasions with other anthropogenic influences would help advance our objective of getting a better understanding of the ecosystem and regional impacts of NIS introductions.

Problems arising from the existence of NIS in coastal systems should be addressed using an ecosystem based approach. Continuing to study and manage NIS invasions as single species problems must be replaced by examining NIS within the context of the systems in which they invade. For example, global climate change is expected to have clear consequences with regard to future NIS introductions, establishment, and range expansion of currently established populations. Ignoring this complex interaction will only hinder efforts to control established populations and prevent new introductions. Integrating NIS invasions with existing anthropogenic stressors will facilitate a holistic approach to addressing the challenges facing our coastal marine ecosystems.

Recommended Convenors: Blake Feist (USA) and Hiroshi Kawai (Japan)

Suggested invited speakers:

- John J. Stachowicz, Professor, Department of Evolution and Ecology, University of California, Davis (tentative) to speak on ecosystem and regional consequences of marine NIS invasions in coastal systems;
- Toshiyuki Yamaguchi, Professor, Department of Earth Science, Chiba University, Japan (tentative) to speak on Biogeography and impacts of recently introduced non-indigenous barnacles in Japan.

REPORT OF WORKING GROUP 22 ON IRON SUPPLY AND ITS IMPACT ON BIOGEOCHEMISTRY AND ECOSYSTEMS IN THE NORTH PACIFIC OCEAN

The Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22) held its second meeting on October 25, 2009 from 14:00 to 18:00 under the co-chairmanship of Drs. Fei Chai and Shigenobu Takeda who welcomed the participants and called the meeting to order. Members who attended the meeting are listed in *WG 22 Endnote 1*.

Unfortunately, the Working Group lost one of its members, Prof. Xiuren Ning, from China, who died from an automobile accident in France. At the beginning of the meeting, members and observers held one minute of silence to pay tribute to Prof. Ning.

Drs. Chai and Takeda reviewed its Terms of Reference, and reported on the progress and activities of the Working Group during the past year. Dr. Takeda talked about the SCOR working group on synthesizing ocean iron fertilization data and future modeling activities (WG 131 on The Legacy of in situ Iron Enrichment: Data Compilation and Modeling). Dr. Chai presented the U.S. position statement on large-scale iron fertilization experiments. Both Co-Chairmen reported on the London Convention Scientific Working Group and IOC *ad hoc* committee activities on ocean fertilization. Dr. Maurice Levasseur (member from Canada) was unable to attend the meeting, but prepared a document calling for international research collaboration on iron-dust deposition in the HNLC regions considering a pH decrease in the ocean. The Working Group reviewed the 1-day workshop (W1) on "*Natural supplies of iron to the North Pacific and linkages between iron supply and ecosystem responses*" held October 25, 2009 and co-sponsored by BIO and SOLAS (see list of participants and workshop summary on page **Error! Bookmark not defined.**).

A proposal for a Topic Session on "*Understanding the role of iron in regulating biogeochemical cycles and ecosystem structures in the North Pacific Ocean*" was put forth for PICES-2010 in Portland, U.S.A. (*WG 22 Endnote 2*). The Topic Session will be co-sponsored by SOLAS. Convenors have been selected and invited speakers have been proposed, but not yet confirmed. Travel support for two invited speakers is requested from PICES.

WG 22 Endnote 1

WG 22 participation list

Members

Fei Chai (USA, Co-Chairman)
William Crawford (Canada)
Jun Nishioka (Japan)
Hiroaki Saito (Japan)
Vladimir Shulkin (Russia)
Shigenobu Takeda (Japan, Co-Chairman)
Mark Wells (USA)

Observers

Kenneth Bruland (USA)
Stephanie Dutkiewicz (USA)
Masahiko Fujii (Japan)
Ai Hattori-Saito (Japan)
Guimei Liu (China)
Tsuneo Ono (Japan)
Hiroshi Sumata (Japan)
Toru Suzuki (Japan)
Keisuke Uchimoto (Japan)
Atsushi Tsuda (Japan

WG 22 Endnote 2

Proposal of a 1-day Topic Session on
"*Understanding the role of iron in regulating biogeochemical cycles and ecosystem structures in the North Pacific Ocean*" at PICES-2010

Iron plays a key role in regulating the biogeochemical cycles of carbon and nitrogen, and pelagic ecosystem structures in the North Pacific Ocean, yet our understanding of these effects remains limited. External sources of iron, such as Asian dust, rivers, sediments, and volcanoes supply large amounts of iron to the North Pacific, while the physical processes of upwelling, meso-scale eddies, boundary currents, and tidal mixing transport deep waters with high iron concentration to the upper ocean. Biological uptake, zooplankton grazing, remineralization, and iron chemistry change the forms of iron and its distribution in the North Pacific Ocean. This session invites papers that address physical, biological and chemical processes controlling iron distribution and transformation, linkages between iron and ecosystem responses, and impacts on carbon and nitrogen cycles. We particularly invite papers that combine recent progress from field observations and modeling studies that relate iron cycling to ecosystem structures and carbon fluxes in the North Pacific Ocean.

Co-convenors: Mark Wells (USA), Angelica Peña (Canada), and Toshi Saino (Japan)

Suggested invited speakers:
Keith Moore (USA)
Phoebe Lam (USA)
Hajime Obata (Japan)
One modeler outside PICES countries, who develops more detailed iron chemistry
Jay Cullen (Canada)
Maurice Levasseur (Canada)

REPORT OF WORKING GROUP 23 ON *COMPARATIVE ECOLOGY OF KRILL IN COASTAL AND OCEANIC WATERS AROUND THE PACIFIC RIM*

The meeting of Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* (WG 23) held its second meeting on October 23, 2009 in Jeju, Korea. A list of participants and the meeting agenda can be found in *WG 23 Endnotes 1* and *2*. The meeting was chaired by Ms. Tracy Shaw, as the Co-chairs, Drs. Song Sun and William Peterson, were unable to attend.

AGENDA ITEM 2
Presentation on status of krill research in each PICES member country

The meeting started with presentations on the status of krill research in each PICES member country that had a representative in attendance: Canada (Mackas), Japan (Okazaki), Korea (Ju), U.S.A. (Shaw). These presentations were based on the Working Group's Term of Reference #6 (Convene a krill workshop at the GLOBEC Open Science Meeting in May 2009). This led to discussion of what topic to address in the first synthesis paper and what data to collect to enhance the available data set. Brood sizes of *Euphausia pacifica* were a likely candidate as scientists in China and Japan have recently conducted such experiments and there is a possibility that scientists from Canada and Korea will be able to conduct brood size experiments during their research cruises next year. Collection of such data is ongoing in Dr. Peterson's lab at the Northwest Fisheries Science Center (NOAA) and there is a hope to recruit other scientists working on the California Current.

AGENDA ITEM 3
Specific terms of reference (TOR)

The other main topic of discussion (TOR #1) was on assembling lists of existing data that will contribute to an analysis and comparison of the life histories of *E. pacifica* and *Thysanoessa*. Egg production, development times, growth rates, distribution and abundance, migration, biomass, hot spots, seasonality of spawning in relation to phytoplankton blooms, role of krill as grazers, vertical flux of carbon in fecal pellets (and moults?) had been discussed previously and to this list krill strandings were added. The latter are reported regularly and, although there are many theories as to why they occur, they are not well understood.

The translation into English of papers which would facilitate a comparative ecological analysis is another goal of this Working Group. Noting that translation of entire papers is a tremendous project, the Group considered translating only parts of each paper (such as the abstract and conclusions) and expanding the figure captions to include more detail. It is possible that this could be done cooperatively by members of the Working Group. Upon completion, the documents could be made available via the PICES website.

AGENDA ITEM 4
Research during PICES/ICES/FAO symposium

WG 23 members discussed the possibility of "hands-on" research in association with the PICES/ICES/FAO Symposium on "*Climate change Effects on Fish and Fisheries*" in Sendai, Japan, from April 26–29, 2009. Dr. Yuji Okazaki will look into the possibility of a visit to his lab at the Tohoku National Fisheries Research Institute in Shiogama, Japan. The Peterson lab at Oregon State University, U.S.A. has been invited to participate on a Korean research cruise in 2010. These two activities are in accordance with TORs #2 (Prepare a research plan to help fill gaps in our understanding, and aid regional collaborative research efforts. Explore ways and means of facilitating exchange of scientists between laboratories and on research cruises) and #3

(Convene "hands-on" practical workshops with krill biologists (including students and established scientists) from PICES member countries to help them initiate and carry out krill research programs. These workshops could be convened before each PICES Annual Meeting, or at other times as appropriate. Protocols for experimental work have been already published on the PICES website at http://www.pices.int/projects/Euphasiid/PICES%20Protocols%20COMPLETE.pdf).

AGENDA ITEM 5
Attendance at Workshop W4 on "*Marine ecosystem model inter-comparisons*" at PICES-2009

WG 23 discussed collaboration with PICES modelers (TOR #5; Work with modelers to better parameterize euphausiids in the NEMURO model and other models so as to explore their role in coastal and oceanic food chains). Specifically, that euphausiid modeling should incorporate the differing characteristics of different life stages, *i.e.*, in a model, early larval stages behave similarly to a copepod but older life stages behave quite differently from copepods. Dr. David Mackas reported on the modeling efforts of Dr. David Preikshot at the University of British Columbia, Canada. He is using ECOPATH to model different life stages of euphausiids and is including gelatinous zooplankton, with approximately monthly time steps.

WG 23 Endnote 1

WG 23 participation list

Members	Observers
Michael J. Dagg (U.S.A.)	Harold Batchelder (U.S.A.)
Se-jong Ju (Korea)	Hye-Seon Kim (Korea)
Hyung-ku Kang (Korea)	
Michio J. Kishi (Japan)	
David L. Mackas (Canada)	
Yuji Okazaki (Japan)	
C. Tracy Shaw (U.S.A.)	

WG 23 Endnote 2

WG 23 meeting agenda

1. Welcome and introductions
2. Presentation on status of krill research in each PICES member country
3. Discuss specific terms of reference
4. "Hands-on" research during PICES/ICES/FAO symposium on "Climate change effects on fish and fisheries"
5. Attendance at WS 4 on "*Marine ecosystem model inter-comparisons*" at PICES-2009

REPORT OF WORKING GROUP 24 ON *ENVIRONMENTAL INTERACTIONS OF MARINE AQUACULTURE*

The Working Group on *Environmental Interactions of Marine Aquaculture* (hereafter WG 24) held its inaugural meeting from 9:00–12:00 h on October 25, 2009, under the co-chairmanship of Mr. Kevin Amos, Dr. Katsuyuki Obo and Dr. Stewart Johnson (for Ms. Ingrid Burgetz). A list of participants and the meeting's agenda can be found in *WG 24 Endnotes 1* and *2*.

AGENDA ITEM 4
Review of Terms of Reference and reports by activity

Review of Terms of Reference

Dr. Abo provided a brief review of the Terms of Reference (TOR) for WG 24. Working Group members were asked to review them to ensure that they are relevant to all of the PICES member countries. Dr. Glen Jamieson mentioned that the FUTURE Advisory Panel on *Anthropogenic Influences on Coastal Ecosystems* (AICE-AP) will continue to examine and adjust the TOR over time. Dr. Steve Rumrill questioned whether the specific areas outlined in the TOR would be all explored by WG 24 in the future. There was a short discussion on this issue as well as the timing for addressing these specific areas.

Decision: All parties present agreed that the TOR are appropriate for the Working Group at this time. Specific issues to be addressed by the Working Group will be develop before the next Annual Meeting.

Reports of Activity Leaders

Prior to the meeting, PICES member countries were asked to provide information in the following areas as they relate to aquaculture:
1) species of interest and production methods,
2) risk assessment and
3) diseases of aquaculture including potential interactions between wild and farmed marine animals.

The responses received from member countries in response to questions for the three activity areas were reviewed by the Activity Leaders.

Activity 1: Species of interest and production methods (K. Abo)

Dr. Abo received responses from all countries for this activity, which were summarized and presented. During review of these data several areas requiring revision were identified. Dr. Abo will revise his summary to incorporate information provided during the meeting. He will then send this revised version to all Working Group members for a final review and comment.

Action: Dr. Abo will produce a finalized document that will be made available to all Working Group members. This document will provide definition for the various culture methods that are used.

Due to the diversity of species under culture in the various member countries, it was suggested by Dr. Stewart Johnson that the Group consider the use of functional groups rather than individual species. Dr. Jamieson noted that with respect to examining environmental impacts, then this may be a relevant way to proceed. Dr. Brett Dumbauld supported this view.

It was suggested using the information received for Activity 1 that three or four general themes suitable for more detailed study should be identified. Dr. Rumrill suggested that the Group should focus on helping producers understand interactions rather than focusing on differences in production techniques.

Activity 2: Risk Assessment (E. Black)

Dr. Edward Black reviewed the reference terms of relevance to Activity 2 and then provided a brief summary of the responses he received. The TOR were considered in their broadest sense. It was questioned if AICE-AP was most interested in "thresholds of resistance". Dr. Jamieson stated that it was not the only component of risk analysis that the AICE-AP considers important.

Based on his experience, Dr. Black pointed out the long period of time that is required to develop and conduct risk assessments. He suggested that it will be difficult, if not impossible, to meet some of the TOR (especially the TOR #2) within the 3-year time frame of the Working Group. The great amount of information that was received from the member countries is an important first step in the process of risk assessment.

The Group discussed whether TOR #3 could be achieved. It was questioned whether the goal should be to standardize risk assessment methods or to understand the relationships between the different methods used within member countries. If the latter is the case then rewording of the TOR will be required.

There was further discussion on whether the groups should focus on risk assessment for single species, for a specific site or at the ecosystem level. Most responses to the questionnaire focused on studies of single species rather than specific sites or ecosystems.

Mr. Graham Gillespie asked, that since PICES has no official way of providing advice to national governments, whether standardization of risk assessment is a reasonable goal for the Group to try to achieve. He also noted the necessity to standardize terms within the Working Group. He suggested that the Group possibly compile a list of assessment methodologies used in the different countries.

Dr. Gary Wikfors questioned whether standardization of risk assessment methods between countries was possible. He briefly discussed the differences between intercalibration and standardization and suggested that intercalibration of methods should be the way that the Group should proceed. It was suggested that this could be achieved by supplying member countries with a data set that they would analyze using their respective methods/standards. The results of the different analyses then could be compared to understand differences between approaches.

Dr. Galina Gavrilova noted that participation in Activity 2 will be difficult for Russian participants as there is not a lot of aquaculture development or the legislation to support risk assessment activities in Russia.

Decision: WG 24 will not work towards standardization of risk assessment methods. Understanding the different methods used in the member countries and how these methods compare to each other is a more important goal.

Action Items:

- Dr. Black will produce a spreadsheet similar to Activity 1 to summarize the data that were received and circulate it to Working Group members.
- Dr. Black will confirm by email interest of Working Group members in Activity 2.
- Dr. Black will provide a list of risk analysis terms and their definitions to Working Group members, with the ultimate goal of working towards an agreement of which terms to use.
- WG 24 will work towards defining its focus with respect to scale (species, sites or ecosystems).

Activity 3: Report on aquatic animal health (K. Amos)

Mr. Amos reviewed the TOR for Activity 3 and provided a brief summary of the reports received from PICES member countries. In general, most member countries have a good understanding of diseases in cultured animals but limited information or research activities related to the understanding disease in wild populations. He noted that from the U.S. perspective, a major question was whether pathogens shed from aquaculture have

negative impacts on wild hosts and the ecosystem. He proposed that the Office International des Épizooties (OIE) guidelines related to aquatic animal health be used as a starting point for the Group. It was questioned whether all member countries subscribed to, or were members of, the OIE. Several group members were unfamiliar with the OIE. However, examination of the OIE website revealed that all member countries are part of the OIE. Dr. Abo noted that participation in the OIE was very important to Japan. He felt that the limited number of responses from Japan was, in part, due to scientists feeling that the information requested for Japan by the Working Group could be accessed through the OIE. Dr. Johnson noted that not all diseases are listed under the OIE and that there may important diseases WG 24 should consider which are not covered.

It was noted that PICES member countries have different interests with respect to diseases of concern and host species. Countries also vary widely in their research and diagnostic capacity, and the magnitude of disease monitoring in both cultured and wild populations. For example, Dr. Gavrilova stated that other than information on parasites of wild fish and bacterial pathogens of sea cucumbers, Russia has limited data on disease. This is in comparison to several other countries which have regional or national programs in Aquatic Animal Health. Dr. Johnson suggested taking a more ecosystem-based approach, possibly focusing on model pathogens for study. Mr. Gillespie suggested that the Group should consider following the earlier suggestion of studying functional groups (*e.g.*, specific types of pathogens such as gram negative bacteria) rather than specific species. There was also a suggestion that the WG 24 needed to better understand bilateral agreements between PICES member countries that are related to the Working Group's mandate. This would help to develop and refine the TOR.

Actions:
- Mr. Amos will forward the URL for the OIE website and confirm with members whether they agree that this is a good starting point for the Group.
- Mr. Amos will send a request to Working Group members to provide information on pathogens of concern that they feel would be suitable for study. These could be of concern for either farmed or wild hosts or both.

Ex-officio membership

Dr. Bychkov provided the group with information on membership within working groups. He noted that many issues facing the Pacific Ocean are not unique to the Pacific and the expertise of importance to PICES activities may be found outside of member countries. He explained *ex-officio* membership on committees and the procedures that need to be followed to bring in *ex-officio* members. As of April 2009 there will be an option to have *ex-officio* members from non-member countries or international organizations. He also mentioned that scientists from member countries can be asked to sit as observers by the working group.

AGENDA ITEM 5
Next Steps

Concern was expressed that there had not been sufficient time set aside for the first meeting of this Working Group. Following discussion of the length of time for the next Working Group meeting, the following was decided upon.

Decision: To request a 1½-day Working Group business meeting to be held in advance of the PICES 2010 Annual Meeting.

WG 24 also discussed the possibility and logistics of a field trip for members after the next Working Group business meeting.

Action: Co-chairs will examine the possibility of a field trip for the Working Group to be held before or after the next WG 24 meeting at PICES-2010. Sources of funding to support a field trip will have to be explored.

AGENDA ITEM 6
Relationship with international organizations

WG 24 discussed possible relationships with ICES working groups. There was also some discussion of a possible of a joint meeting with ICES working groups to be held after the next world aquaculture meeting. Due to the short time frame it was decided that the group would not attempt to develop a joint meeting.

Action: Dr. Black (a member of ICES) will provide information on ICES activities related to Activity 2.

AGENDA ITEM 7
Proposal for a workshop/Topic Session at PICES-2010

The Group discussed the possibility of a workshop and/or session for the next PICES Annual Meeting in Portland, U.S.A., and felt that it was premature to propose a workshop or Topic Session.

AGENDA ITEM 8
Other business

Following a series of discussions the following action items and decisions were agreed upon.

Actions:
- Dr. Johnson will circulate a copy of the minutes of the working group members for comments. Corrected minutes will be circulated to the working group members.
- Mr. Amos will send a reminder to all members responsible for action items within 2 weeks after the end of meeting.
- All members to provide extra information and comments via email to the activity leaders (as soon as possible) but welcome throughout the year.

Decision: WG 24 agreed to support a workshop entitled "*Economic relation between marine aquaculture and wild capture fisheries*" at PICES-2010.

WG 24 Endnote 1

WG 24 participation list

Members

Katsuyuki Abo (Japan, Co-Chariman)
Kevin Amos (U.S.A., Co-Chairman)
Edward Black (Canada)
Brett Dumbauld (U.S.A.)
Galina Gavrilova (Russia)
Graham Gillespie (Canada)
Toyomitsu Horii (Japan)
Stewart Johnson (Canada, representing Co-Chairman, Ingrid Burgetz)
Hyun-Jeong Lim (Korea)
Tamiji Yamamoto (Japan)
Xuelei Zhang (China)

Observers

Alexander Bychkov (PICES)
Ik-Kyo Chung (Korea)
Glen Jamieson (Canada, Chairman MEQ)
Steve Rumrill (U.S.A.)
Mikhail Stepanenko (Russia)
Gary Wikfors (U.S.A.)

WG 24 Endnote 2

WG 24 meeting agenda

1. Welcome by WG 24 Co-Chairs (K. Abo, K. Amos, E. Black and S. Johnson – for Ingrid Burgetz)
2. Introductions by WG 24 members
3. Approval or edits to the agenda
4. Review of terms of reference and reports by activity leaders
   a) Activity 1 – report by Katsuyuki Abo
   b) Activity 2 – report by Edward Black
   c) Activity 3 – report by Kevin Amos
5. Discussion on next steps for each activity
6. Discussion on coordination of potential activities with ICES
7. Proposal for a workshop/Topic Session at PICES-2010 in Portland, Oregon
8. Other work group business
9. Adjourn at 12:00 pm

Afternoon – Field trip to aquaculture facilities hosted by Dr. Hyun-Jeong Lim

REPORT OF THE ADVISORY PANEL ON *CONTINUOUS PLANKTON RECORDER SURVEY IN THE NORTH PACIFIC*

The Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* (CPR-AP) met from 18:00–20:00 h on October 28, 2009 under the chairmanship of Dr. Phillip R. Mundy. The list of participants and agenda are found in *CPR-AP Endnotes 1 and 2*.

AGENDA ITEM 2
Report on CPR activities in 2008–2009

Advice

The CPR continues to be an excellent international marine monitoring program that produces biological and physical data sets which are unique in time and space, and from which information is made available in a timely manner to support a growing legacy of scientific publications. CPR exemplifies how PICES fosters cooperation and communication among nations in North Pacific marine science. Financial and in-kind support from Canada, Japan, the United States and CPR's originating agency, the Sir Alister Hardy Foundation for Ocean Sciences, is sufficient to permit operation of the transects in 2010–2012. However, more support is desirable for processing samples. CPR-AP continues to pursue funding from the U.S. National Science Foundation and other national sources with the support of the Science Board and the efforts of the Secretariat. The Panel requests, through MONITOR, that the Science Board continue to support the Executive Secretary's annual letter of information to selected agencies that are potential partners in the CPR Consortium.

Sampling 2009 – Dr. Sonia Batten reported that sampling was close to desirable levels in 2009. In a normal year the east to west (E–W) transect is sampled three times (April, June and October) and the north to south (N–S) transect is sampled six times (March to September). In 2009 the E–W transect was sampled three times: April/May, June/July, August/September and the N–S transect was sampled five times: March, April, May, June, August. Based on 25% of samples processed in the southern and eastern portions of the transects, biomass in May 2009 was about at the average of 2000–2008, and substantially higher than in May 2008. Nevertheless, zooplankton biomass in late 2008 was unusually high (see Hamme *et al.* below).

Sampling 2010 – If the U.S. NSF proposal is not funded, funds currently committed may permit about 75% of the desired level of sampling to be conducted. The Panel was asked to provide advice on how to approach the possibility of reduced capacity to process samples in 2010. The basic trade-off presented between processing all samples at a lower rate, and focusing on fully processing some geographic regions while archiving other regions without processing. The Panel was asked to offer perspectives to Dr. Batten.

Publications and presentations

There were three scientific presentations at PICES-2009 based on CPR results. Hamme *et al.* on "*Natural volcanic iron fertilization of the Subarctic North Pacific*" (W1-5905). Zooplankton biomass in the late summer of 2008 was unusually high due to high numbers (1.5 to 8 times previous years) of large copepods (*C. pacificus* and *N. cristatus*). Does this fit the pattern of cool temperatures favoring large copepods, or are there other explanations such as changing vertical distribution of large zooplankton in response to food availability? Batten *et al.*'s presentation on "*Ship-of-opportunity observations of mesoscale eddies*" (W9-5819) examined the number of taxa and zooplankton biomass associated with mesoscales eddies in the Gulf of Alaska with different geographic origins. The third presentation was Mackas *et al.*'s on "*Perspectives on a decade of change in the Alaska Gyre: A comparison of three Northeast Pacific zooplankton time series*" (BIO-P-5937) which confirmed consistency of the CPR.

Funding

Dr. Batten reported substantial progress in securing funding for the PICES CPR program. The CPR Funding Consortium had two contributing members in 2008–2009: Department Fisheries and Oceans Canada (DFO) and the North Pacific Research Board NPRB (U.S.A.). In order to reach the level of support required to sample adequately, it was necessary for SAHFOS to provide additional funds. Two additional funding sources were added in 2009. Dr. Sanae Chiba (Japan) obtained funding for the processing of western Pacific samples in Japan. In preparation, Japanese scientists traveled to SAHFOS in Plymouth, England to understand CPR sample processing conventions and a workshop on "*Continuous Plankton Recorder survey and long-term observations of plankton ecosystems in the North Pacific*" in Yokohama (September 30–October 1) was hosted by Dr. Hiroya Sugisaki. Also in 2009, the Exxon Valdez Oil Spill Trustee Council approved financial multi-year support that will conclude in 2013. As of now, direct funding from DFO, NPRB and EVOSTC are at approximately 70% of full costs for operating two transects (E–W and N–S), including processing samples. Current funding, when supplemented by sample processing support from Japan and continued input from SAHFOS, is expected to keep the two transects in place; however, it permits fewer samples than desirable to be processed.

There is one immediate prospect for additional funding. A proposal to the U.S. National Science Foundation with participation by Dr. Russell Hopcroft, University of Alaska Fairbanks, has been submitted. If funded it would permit processing of a substantial number of Gulf of Alaska samples in 2010.

AGENDA ITEM 3
Reports from national representatives

Canada

Dr. David Mackas reported that Canadian scientists continue to be active in analyzing CPR data and using them to make inferences on the status of North Pacific ecosystems, for example, see the Batten and Mackas publication on "Shortened duration of the annual *Neocalanus plumchrus* biomass peak in the Northeast Pacific" (2009, MEPS 393: 189–198; http://www.int-res.com/abstracts/meps/v393/).

Japan

Dr. Sugisaki reported on Japan's efforts to secure funding for analysis in Japan of the CPR samples taken to the west of 170°E. Funding from JSPS Kakenhi (Kiban-A) FY-2009 to 2013 is approximately $400,000 for the five years. He also asked for funds from the Japan–UK research collaboration fund. Leading scientists are Drs. Sanae Chiba (JAMSTEC, CPR sample analysis), Kosei Sasaoka (physical-chemical data analysis), Hiroya Sugisaki (FRA; MONITOR Chairman), Tsuneo Ono (HFRI, physical-chemical data analysis). Japan is adding value to CPR data by investigating the use of stable isotopes as a proxy for mapping nitrate depletion along the CPR transect.

Russia

Dr. Igor Shevchenko reported that TINRO is exploring the possibility of establishing CPR in Peter the Great Bay and in deep water using a ferry that sails to Vladivostok (Russia), Donghee (South Korea) and Sakaiminato (Japan). International collaboration is appreciated. Dr. Shevchenko has received information from Dr. Batten on the CPR regarding the kinds of data that may be acquired by it and the costs of acquisition and sample processing. Dr. Batten has offered further assistance to Dr. Shevchenko in this inquiry.

U.S.A.

The Alaska Ocean Observing System (AOOS) has been level funded so it is not expected to be a source funding for the CPR Consortium in 2010. AOOS is part of the national system of regional observing systems for which funding legislation has been pending. Additional U.S. sources being pursued for the Consortium are the NOAA Program Office for the Integrated Ocean Observing System and the NOAA Fisheries Office of

Science and Technology. To assist in this regard, a renewal of the information sent to potential Consortium members in 2008 was requested by the U.S. representative and endorsed by CPR-AP.
NOAA Fisheries' Pacific Islands Fisheries Center (Hawaii) plans to tow a CPR between Honolulu and Mariana Islands in January 2010 although it is not yet certain how sample analysis will proceed. It is a feasibility study to determine what kinds of information CPR may provide on this region.

AGENDA ITEM 4
New business

Panel members were encouraged to visit the CPR page on Wikipedia to edit and offer contributions.

CPR-AP Endnote 1

CPR-AP participation list

Members	Observers
Sonia D. Batten (Canada, SAHFOS)	Alexander Bychkov (PICES)
Hyung-Ku Kang (Korea)	Skip McKinnell (PICES)
David L. Mackas (Canada)	Tsuneo Ono (Japan)
Phillip R. Mundy (U.S.A., Chairman)	Igor Shevchenko (Russia)
	Hiroya Sugisaki (Japan, MONITOR Chairman)

CPR-AP Endnote 2

CPR-AP meeting agenda

1. Welcome (Mundy)
2. Report on CPR activities in 2008 – 2009 (Batten)
3. Reports from national representatives on status of CPR (all) - Proposal from Japan (Sugisaki)
4. New business - Request from Russia for information on CPR, CPR on Wikipedia
5. Receive comments on 2008 – 2009 CPR draft annual report (Mundy)
6. Adjourn

REPORT OF THE ADVISORY PANEL FOR A *CREAMS/PICES PROGRAM IN EAST ASIAN MARGINAL SEAS*

A formal meeting of the Advisory Panel for a *CREAM/PICES Program in East Asian Marginal Seas* (CREAMS-AP) took place on October 25, 2009 during PICES-2009 in Jeju, Korea. Seven members and 6 observers from Korea, Japan, Russia and the U.S. attended the meeting (*CREAMS-AP Endnote 1*). Dr. Kyung-Ryul Kim, Co-Chairman of CREAMS-AP, opened the meeting at 18:10 h with self-introductions of each participant. Dr. Kim mentioned that this was a formal meeting after the informal one that took place in Busan, Korea in April. The meeting agenda can be found in *CREAMS-AP Endnote 2*. He also mentioned that Dr. Fang Wang was attending on behalf of one of the Panel members, Dr. Fei Yu, who could not be at the meeting.

AGENDA ITEM 2
Summary of informal Advisory Panel meeting in Busan

Dr. K.-R. Kim showed a summary report of the informal CREAMS-AP meeting that was held in Busan, Korea on April 24, 2009 and briefly explained its content (*CREAMS-AP Endnote 3*). It was held in conjunction with the 15th PAMS meeting (see Agenda Item 5).

AGENDA ITEM 3
Report on capacity building activities in 2009

Dr. Dong Jin Kang, on behalf of Dr. Kyung Ae Park, Seoul National University, reported that the PICES 2009 Summer School on "*Satellite oceanography for the earth environment*" was successfully held from August 25–29 at Seoul National University, coinciding with the launch of Korea's first geostationary ocean color satellite.

AGENDA ITEM 4
Report on North Pacific Ecosystem Status Report (NPESR)

CREAMS-AP Co-Chairman, Dr. Vyacheslav Lobanov, reported that the North Pacific Ecosystem Status Report is nearing completion. The drafts of some regional chapters have already been submitted to lead editors of the NPESR and the rest must be finished by November 2009. A synthesis workshop will be held in December 2009. A special PICES workshop on "*Status and trends in East Asian marginal sea ecosystems*" was held from April 21–22, 2009 in Busan, Korea, which contributed largely to the contents of the report. Dr. K.-R. Kim requested Dr. Lobanov to circulate the draft for input from CREAMS-AP members and related scientists.

AGENDA ITEM 5
Report on international cooperation

Russia-Korea cooperation in 2009

Drs. Lobanov and D.-J. Kang reported that a Russia-Korea cooperative cruise was successfully implemented in July 2009 with 33 scientists, including 15 Koreans, on the Russian research vessel *Akademik M.A. Lavrentyev*.

Hakuho-Maru cruise in 2010

Dr. Kang reported on behalf of Drs. Toshitaka Gamo (Univeristy of Tokyo) and Jing Zhang (Toyama University) about planning for a 43-day cruise of R/V *Hakuho-maru* cruise during June–July 2010.

GLOBEC Open Science Meeting

Dr. Yasunori Sakurai (Seoul National University) reported that a workshop on "*Climate impact on ecosystem dynamics of marginal seas*" was held during the GLOBEC Open Science Meeting in June 2009 in Victoria, Canada. Summaries are available in the PICES (PICES Press, July 2009, Vol. 17, No. 2, pp. 24–25; http://www.pices.int/publications/pices_press/volume17/v17_n2/pp_24-25%20Marginal%20seas%20workshop_f.pdf) and GLOBEC newsletters.

China-Japan-Korea GLOBEC Symposium

Drs. Sakurai and CREAMS-AP Co-Chairman, Joji Ishizaka, reported that the China-Japan-Korea GLOBEC Symposium that was originally planned for December 2009 in Korea was postponed to 2010.

PAMS meeting

Drs. Kyung-Il Chang and Jae-Hak Lee reported that the 15th PAMS Meeting was successfully held in Busan, Korea from April 23–25, 2009. A special report will be published in Progress in Oceanography with Dr. Lee acting as Guest Editor. The next PAMS Meeting will be in Taiwan in 2011.

AGENDA ITEM 6
Activities of CREAMS-AP after 2009

Continuation of EAST-I

Dr. K.-R. Kim reported that continuation of the EAST-I program was already approved and members agreed to enhance the activities.

EAST-II (Yellow Sea, East China Sea)

a) Summary of Chinese research activities
Dr. Fan Wang reported that a buoy array system was established in the Yellow Sea and East China Sea, operated by the Institute of Oceanology, Chinese Academy of Sciences (IOCAS). Test operations began in June 2009 for physical, meteorological, chemical, geological and biological measurements. These will be a potential Chinese contribution to EAST-II. Initial surveys have been carried out 1–2 times per year since 2005 by IOCAS and the frequency will increase to 4 cruises per year within a couple of years. The exchange of ship time between participating nations of the EAST-II program would be very helpful for EAST-II implementation.

b) Summary of Japanese research activities
Dr. Ishizaka reported that planning for a *Nagasaki-maru* cruise in late July 2010 south of Jeju Island (Korean EEZ) in collaboration with Korean scientists can be a good activity of EAST-II. He also invited participation to the cruise by scientists from other member countries. Dr. Ishizaka reported on the activities of the Seika National Fisheries Institute. Dr. Takeshi Matsuno (Kyushu University) reported on a project called "*Establishment of cooperative sea under the common understanding on the marine environment of the East China Sea*" and suggested the need for a virtual consortium to discuss cooperation and the possibility of CREAMS-AP as the function.

c) Summary of Korean research activities
Dr. Lee reported on buoy systems, including IEODO, Gageocho, Yellow Sea, a new buoy near Changjiang estuary, and KOOS as an extension of NEAR-GOOS. He also mentioned that the first stage of the Yellow Sea Large Marine Ecosystem project ends June 2010 and that a second stage is expected.

d) Action Plan for the near future
Drs. Lee and Ishizaka suggested convening a special session of EAST-II during the 5th PEACE Meeting in Kangnung, Korea, in September 2010. Panel members agreed to the proposal and to requesting travel funds through the POC/MONITOR Committees.

They also suggested that the *Nagasaki-maru* cruise for July 2010 be considered as an activity of EAST-II. Members agreed.

Dr. Jiang Zhang from East China Normal University was suggested as a candidate for an additional Advisory Panel member and a possible Co-Chair from China. Dr. K.-R. Kim will contact him to see if he is interested.

AGENDA ITEM 7
Next Advisory Panel meeting

It was tentatively decided to hold the next inter-sessional CREAMS-AP meeting in Qingdao, China in spring 2010. Dr. Wang will discuss the possibility with Dr. Fei Yu, and they will circulate the results to the Panel members.

AGENDA ITEM 8
Miscellaneous Items

A summary of this meeting will be reported by Drs. Ishizaka and Lobanov at the POC and MONITOR committee meetings on October 28.

The replacement of Dr. Suam Kim by Dr. Kyung-Il Chang as a member of CREAMS-AP will be confirmed by the Korean delegation.

AGENDA ITEM 9
Closing

Co-Chairman, Dr. K.-R. Kim closed the meeting at 21:00 h, October 25, 2009.

CREAMS-AP Endnote 1

CREAMS-AP participation list

Members

Kyung-Il Chang (Korea)
David M. Checkley, Jr. (U.S.A.)
Joji Ishizaka (Japan, Co-Chairman)
Kyung-Ryul Kim (Korea, Co-Chairman)
Jae-Hak Lee (Korea)
Vyacheslav Lobanov (Russia, Co-Chairman)
Fan Wang (China, on behalf of Fei Yu)
Yury Zuenko (Russia)

Observers

Dong-Jin Kang (Korea)
Chang-Keun Kang (Korea)
Jin-Yeong Kim (Korea)
Yasunori Sakurai (Japan)
Takeshi Matsuno (Japan)

CREAMS-AP Endnote 2

CREAMS-AP meeting agenda

1. Opening remarks
2. Summary of informal Advisory Panel meeting in Busan
3. Report on capacity building activities in 2009
4. Report on North Pacific Ecosystem Status Report (NPESR)
5. Report on international co-operation
   - 5.1 Russia-Korea Cooperation in 2009
   - 5.2 *Hakuho-Maru* Cruise in 2010
   - 5.3 GLOBEC Open Science Meeting
   - 5.4 China-Japan-Korea GLOBEC Symposium
   - 5.5 PAMS meeting
6. Activities of CREAMS/PICES AP after 2009
   - 6.1 Continuation of EAST-I
   - 6.2 EAST-II (Yellow Sea, East China Sea)
     - a. Summary of Chinese research activities
     - b. Summary of Japanese research activities
     - c. Summary of Korean research activities
     - d. Action Plan for near future
7. Next Advisory Panel meeting
8. Miscellaneous items
9. Closing

CREAMS-AP Endnote 3

Informal CREAMS/PICES Advisory Panel Meeting

An informal meeting of the CREAMS-AP took place on April 24, 2009 at the Novotel Ambassador Hotel, Busan, Korea, during the 15th Pacific Asian Marginal Seas (PAMS) meeting. Five members of the CREAMS-AP and four observers from Korea and Japan attended the meeting as did the Deputy Executive Secretary of PICES, Dr. Skip McKinnell.

Membership changes

Dr. Kyung-Ryul Kim, Co-Chairman of CREAMS-AP opened the meeting at 18:40 h on April 24, 2009. After self-introductions of each participant, Dr. Kim introduced a new prospective member of CREAMS-AP, Dr. Joji Ishizaka (Nagoya University, Japan). Dr. Ishizaka will replace Dr. Yasunori Sakurai (Hokkaido University, Japan) who has served as a Co-Chairman for last two years. Dr. Ishizaka is prepared to serve as a Co-Chairman as well. Dr. K.-R. Kim also reminded the participants that Dr. Vyacheslav Lobanov (Pacific Oceanological Institute, Russia) was recommended to serve as a new Co-Chairmen of CREAMS-AP during the 2008 PICES Annual Meeting in Dalian, China.

Dr. Kyung-Il Chang (Seoul National University, Korea) was also recommended to replace Dr. Suam Kim (Pukyung National University, Korea) who served for last two years as a member and who expressed a desire to step down at the 2008 PICES Annual Meeting. Dr. Skip McKinnell reminded the participants of the formal procedures for changes to PICES memberships that must be undertaken by Governing Council Delegates.

Previous meeting

Dr. K.-R. Kim reviewed the results of the previous CREAMS-AP meeting during the PICES 2008 Annual Meeting in Dalian, China, and briefly explained the results of that meeting.

Discussion on the East Asian Seas Time-series II
The CREAMS-AP members agreed that it would be desirable to expect more activities for CREAMS-AP from China, especially for the possible initiation of proposed new EAST-II program on the East China Sea and Yellow Sea. It was recommended that it might be desirable to search for more members from China. If necessary, Dr. Ishizaka and Dr. J.-H. Lee will seek possible candidates that can be recommended to a Chinese Delegate by the AP.

Members agreed that a report about the EAST-II program must be prepared for the PICES POC Committee for discussion at PICES-2009 in Jeju, Korea. Prof. J. Ishizaka, Dr. Jae-Hak Lee, (and a scientist from China) will initiate preparation of the report.

Report on the *Hakuho-maru* cruise in 2010
Dr. Jin Zhang (University of Toyama, Japan) participated in the AP meeting in lieu of Dr. Toshitaka Gamo (University of Tokyo) and reported on the current status of the proposed cruise of the *Hakuho-maru* in 2010. The duration of the cruise is 43 days, consisting of three separate legs. The first leg will start from a Japanese port on June 11, 2010. Discussions about permission for entry into Korean and Russian EEZs were done among all participants. The CREAMS-AP proposed that Dr. Zhang circulate the cruise plan to all CREAMS-AP members in time for cooperation.

Next meeting
It was decided to hold the next CREAMS-AP meeting during PICES-2009 in Jeju, Korea, in October 2009.

Closing
Dr. K.-R. Kim closed the meeting at 21:30 h, April 24, 2009.

REPORT OF THE ADVISORY PANEL ON *MARINE BIRDS AND MAMMALS*

The ninth meeting of the Advisory Panel on *Marine Birds and Mammals* (MBM-AP; under the auspices of BIO Committee) was held from 18:00–20:15 hours on October 27, 2009 in Jeju, Korea. The business meeting focused on current activities of the Panel and other relevant matters, including discussion of possible future workshops and topic sessions, and the role of MBM-AP in the new PICES Science Program, FUTURE. Panel members and observers discussed the general need for MBM-AP within the PICES community, concluding that it has served PICES well and has been active in coordinating and facilitating multi-disciplinary investigations, symposia, and workshops for PICES.

AGENDA ITEMS 1 AND 2
Welcome and adoption of agenda

Drs. William Sydeman and Hidehiro Kato, the Co-Chairmen of MBM-AP, called the meeting to order and welcomed the members and observers (*MBM- AP Endnote 1*). The revised Terms of Reference were reviewed (*MBM- AP Endnote 2*). The agenda was reviewed and approved by MBM-AP members (*AP-MBM Endnote 3*).

AGENDA ITEM 3
Review of workshop at PICES-2009

Under the leadership of Dr. Sydeman and Dr. Kato, MBM-AP convened a workshop (W3) entitled "*Integrating marine mammal populations and rates of prey consumption in models and forecasts of climate change-ecosystem change in the North Pacific and North Atlantic Oceans"*. This was a collaboration between ICES and PICES, with Co-Convenor, Dr. Begoña Santos, representing ICES. A report of this workshop can be found in the Session Summaries section of the Annual Report.

AGENDA ITEM 4
Reports on sessional and inter-sessional activities

Dr. Sydeman reported that a special volume based on Topic Session S11, convened by MBM-AP at PICES XVI in Victoria, Canada, on marine ecosystems, climate change, and phenology: impacts on top predators is slated to appear online in *Marine Ecology Progress Series* (MEPS) near the end of October. A total of 10 papers will be published. The Panel thanked Dr. Sydeman for taking this project to completion.

Dr. Kato reported on his activities as the PICES liaison to the International Whaling Commission (IWC) (*See MBM-AP Endnote 4*). Dr. Kato attends IWC meetings as a representative of PICES. This meeting in 2009 was held in Italy. Dr. Kato provided a written and verbal report to the group, and presented an overview of a new 10-year program to survey cetaceans of the central North Pacific. The Panel thanked Dr. Kato for his continuing efforts to integrate PICES science in the IWC science-policy arena. MBM-AP supports Dr. Kato's continued involvement in the IWC on behalf of PICES and asks BIO to endorse his participation.

Dr. Choi (Korea) reported on surveys for marine mammals in Korean waters of the Yellow Sea, and population studies of endangered spotted seal. Numbers of seals have declined substantially, from about 1000 to 500 animals. Marine mammal populations in Korean waters are of concern. MBM-AP supports continued efforts by Dr. Choi and his colleagues to work towards the conservation of marine mammals and seabirds in Korea.

AGENDA ITEMS 5 AND 6
Discussions

Workshop and topic session ideas

MBM-AP members and observers discussed what topics to put forth as proposals for workshops or topic sessions at future PICES Annual Meetings, including PICES-2010 in Portland, U.S.A. Some ideas for workshops and/or topic sessions included:

1. marine birds and mammals as indicators of ecosystem change,
2. an update on the importance of spatial variability in ecosystem productivity to marine bird and mammal foraging ecology and consequences to demography,
3. models of marine bird and mammal prey consumption and "top-down" food web controls.

A consensus developed that, despite the late date, a request would be made to BIO to hold a workshop on the topic of variability and importance of certain locations and regions, *i.e.*, spatial variability in the ecology of ecosystems, and its importance to top predators, seabirds and marine mammals, and predatory fishes. Dr. Sydeman was tasked with preparing a blurb for consideration by BIO (*AP-MBM-AP Endnote 5*). Co-Conveners will be Drs. Sydeman, Yutaka Watanuki, and Rolf Ream, and a physical oceanographer from the West.

Role of MBM-AP in PICES/FUTURE

As was done last year, MBM-AP reviewed aspects of the new PICES Science Program, FUTURE. The Panel and observers considered how to best contribute to this program, which is focused on: (1) understanding climate change and anthropogenic impacts on marine ecosystems in the PICES region, (2) forecasting future ecosystem change, and (3) better communications with society. The panel reiterated its primary mission to provide advice to the PICES community about the role of marine birds and mammals in marine ecosystems, and secondly to ensure that seabirds and marine mammals are included in PICES-related ecosystem research and communications, including FUTURE.

The Panel discussed how many long-term datasets on marine birds and mammals could and should be used in the analysis and models of marine ecosystem change. Marine birds and mammals are excellent indicators of marine ecosystem structure and functions and could be used in this capacity. Multi-decadal information on abundance, population variability, diet, prey consumption, and demographic attributes are available from numerous sites in the North Pacific for analysis. Changes in bird and mammal populations will also have an impact on the ocean as these predators consume large quantities of prey and may exert "top-down" control of food webs. The Advisory Panel and observers agreed that models of hypothetical or measured changes mammal populations and rates of consumption based on either increasing or decreasing abundance would be revealing, with implications for future ecosystem dynamics and fisheries. In this manner, MBM-AP could play a role in the forecasting goals of FUTURE.

The focal points for MBM-AP were thus defined as follows:

- Spatial ecology of predators in marine ecosystems,
- Models of prey consumption of top predators,
- Marine birds and mammals as indicators of ecosystem change,
- Marine mammals as autonomous oceanographic sampling devices,
- Providing advice to the PICES community.

Participation in MBM-AP

There has been good participation over the years from Canada, Japan, Korea, and Russia, and the USA. in MBM-AP. Korea provided one scientist (Dr. Choi) on behalf of its member, Dr. Zang-Geun Kim, while no Russian delegates were in attendance. The Advisory Panel members were satisfied with participation at this meeting.

Participation in CPR survey

MBM-AP confirmed a desire to continue to integrate observations of marine birds and mammals with the North Pacific Continuous Plankton Recorder program. Dr. Sydeman will continue to investigate new funding opportunities for this activity. A 6-year dataset (June 2002–March 2007) could be augmented, and would be valuable to understanding ecosystem dynamics in the North Pacific on the macro-(basin) scale.

MBM-AP Endnote 1

MBM-AP participation list

Members	Observers
Hidehiro Kato (Japan, Co-Chairman)	Seok-Gwan Choi (Korea)
William Sydeman (U.S.A., Co-Chairman)	George Hunt (U.S.A.)
Rolf Ream (U.S.A.)	Hiroto Murase (Japan)
Andew Trites (Canada)	Hiroshi Okamura (Japan)
Yutaka Watanuki (Japan)	Jarrod Santora (U.S.A.)

MBM-AP Endnote 2

Terms of Reference

1. Provide information and scientific expertise to BIO and the FUTURE Program, and, when necessary, to other scientific and technical committees with regard to the biology and ecological roles of marine mammals and seabirds in the PICES region;
2. Identify important problems, scientific questions, and knowledge gaps in assessing the roles of marine mammals and seabirds in marine ecosystems;
3. Assemble relevant information on the biology of marine mammals and seabirds and disseminate it to the PICES community through scientific reports and symposia;
4. Develop strategies to improve collaborative, interdisciplinary research with marine mammal and seabird researchers and the PICES scientific community.

MBM-AP Endnote 3

MBM-AP meeting agenda

1. Call to order – review agenda (modify as needed)
2. Introductions from member nations, meeting participants
3. Review of workshop (W3) at PICES-2009 – plan for special volume and/or review paper?
4. Report from participants
   a. PICES XVI/S11 publication on marine ecosystems, climate change and phenology – impacts on top predators in *Marine Ecology Progress Series* (Sydeman); to be released the week of October 26.
   b. liaison with International Whaling Commission (Kato)
   c. new IWC/Japan/U.S. central Pacific (10y project) (Kato)
   d. others (group)?
5. Discussions
   a. MBM-AP and FUTURE (new PICES Science Program) – how can/should MBMAP contribute? Goals of FUTURE:
      i. Understanding climate change, anthropogenic effects and ecosystem dynamics
      ii. Forecasting and forecasting tool development
      iii. Communicating

6. MBM-AP and PICES-2010 (Portland), PICES-2011 (Russia)
   a. Workshop suggestions?
   b. Ecosystem indicators?
   c. Theme session suggestions?
   d. Others ideas?
7. Wrap-up

MBM-AP Endnote 4

PICES Observer Report on the 61st IWC Scientific Committee Meeting

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The 61st Scientific Committee (SC) meeting of the International Whaling Commission (IWC) was held at Madeira, Portugal from May 31 to June 12, 2009. A total 199 participants, including 134 national delegates from 29 countries, 50 invited experts, 1 local scientist, 9 observers from international organizations (CCAMLR, ACCOBAMS, IUCN, NAMMCO and PICES) and 5 from the IWC Secretariat, participated the annual meeting. PICES was especially welcomed by the IWC/SC.

Under the SC, 6 sub-committees (revised management procedure; bowhead, right and gray whales; in-depth assessment; Southern Hemisphere whales; small cetaceans; whale watching) and 7 working groups (Aboriginal whaling management procedure; stock definition; by-catch and other human-induced mortality; environmental concerns; ecosystem modeling; DNA testing; IA-North Pacific minke whales). Every substantial issue was discussed at the sub-committees or the working group level and then forwarded to plenary of the committee. The SC has worked mainly on Comprehensive Assessments (CA) of whale stocks, Implementation trials of Revised Management Procedure (RMP) after cessation of commercial whaling, and agreed with the scientific basis of RMP at their 1993 meeting, subsequently endorsed by the Commission at the 1994 meeting.

The SC continued work on general RMP issues, including work towards finalizing the guidelines and requirement for implementing the RMP. This year, the SC focused especially on the review of stock status and abundance trends of Antarctic minke whales, North Pacific common minke whales, and Southern blue and humpback whales under the CA. In addition, current population status of North Atlantic right whales and Western North Pacific gray whales were reviewed and their endangered statuses were of special concern. Regarding Japanese scientific permit programs, the SC received a report from the dedicated specialists' review meeting on the western North Pacific program (JARPN II) which was held January 2009.

For environmental issues, the SC discussed a number of matters related to environmental factors that affect cetaceans, such as the POLLUTION 2000+ programme, SOCER (State of the Cetacean Environment Report), CERD (Cetacean Emerging and Resurging Disease) workshop, and ecosystem modeling including a CCAMLR-IWC workshop. In addition, the SC received a report from the Climate Change Workshop which was held at Italy in February 2009 and identified the following items: (1) identifying existing long-term cetacean environmental datasets that can be analyzed and included in models in relation to climate change variables; (2) determining patterns that may be attributable to climate change via analyses of these datasets; (3) modeling mechanisms to consider cause and effect relationships, provide predictions and identify data gaps that, if filled, would improve our understanding of the effects of climate change on cetaceans; and (4) providing timely advice related to cetacean research, conservation and management via peer reviewed publications. Furthermore, the SC recommended that IWC member countries and relevant organizations:

1. Take the potential effects of climate change on cetaceans seriously and include these considerations in relevant climate-related and conservation management initiatives, including implementation of emission controls;
2. Support the research recommendations given in SC/61/Rep4.

For next year's meeting, the following items will be prioritized in regard to environmental issues:

1. Review progress on work from the three sub-groups of the 2nd Climate Change Workshop;
2. Review the results of the inter-sessional workshop and complete POLLUTION 2000+ phase II planning (carried over from last year);
3. Anthropogenic sound (focus on shipping noise);
4. Review progress of the cetacean emerging and resurging disease (CERD);
5. Ecosystem modeling;

It was also noted that a (large scale) North Pacific Cetacean Sighting Survey was proposed under the IWC international research project, and it is expected that the first cruise will take place in midsummer 2010 under the joint venture of Japan and IWC. The overall research area will cover a latitudinal zone between 30°N and 50°N, which almost agrees with the PICES region. The project has the potential to provide an opportunity to collect a wide range of data sets of marine mammals and birds.

The next year's annual meeting of IWC/SC will be held in Agadir, Morocco, from May 30 to June 11, 2010.

MBM-AP Endnote 5

Proposal for a 1-day BIO/FUTURE Workshop at PICES-2010 on
"*Location matters: Importance of spatial variability in physical–biological interactions to understanding, forecasting, and managing marine ecosystems*"

Integrated multi-disciplinary science on the large marine ecosystems (LME) scale of organization is required to build novel insights into ecosystem structure and functions and the services (fisheries) provided to humanity due this period of rapid climate change. However, within large marine ecosystems, physical and biological properties vary spatially. Spatial variability, from localized 'hotspots' to regional centers of biological productivity (or hypoxic 'dead' zones), coupled with within-system transport mechanisms, can play a substantial role in determining overall ecological productivity and interactions with humans. Understanding and forecasting change in marine ecosystems as well as implementing ecosystem-based approaches to management, such as protected area design, is dependent on developing a better understanding of the spatial organization of marine ecosystems and how physical–biological interactions integrate across vast spatial scales. Building on a previous PICES topic session on ecological 'hotspots', this BIO/FUTURE workshop will focus on the spatial ecology of marine ecosystems across multiple spatio-temporal scales. Papers are sought describing local to regional spatial ecology, the importance of spatial variability to ecosystem productivity, and the implications of spatial variability to societal interactions with the marine environment. In particular, papers dealing with the spatial distribution fisheries relative to the distribution of target species, and papers presenting models of spatially-explicit ecosystem interactions are desired. The session will be organized as a workshop with 2–3 presentations, followed by discussion. The workshop products may be a special volume of contributed papers in a peer-reviewed journal, or a group-authored review paper on spatial ecology as a key topic for understanding marine ecosystems.

Convenors: William Sydeman (U.S.A.), Yutaka Watanuki (Japan), Rolf Ream (U.S.A.), physical oceanographer (west), Ian Perry (Canada)?

Potential Invited Speakers:
Ben Halpern (U.S.A.) – spatial ecology and ecosystem services
David Schneider (Canada) – integrating spatial scales and scale-dependent relationships
Shoshiro Minobe (Japan) – climate and spatial ecology of marine ecosystems
Muyin Wang (U.S.A.) – regionalizing climate models for North Pacific marine ecosystems
Fei Chai (U.S.A.) – spatially explicit ecosystem models

REPORT OF STUDY GROUP ON *COMMUNICATIONS*

Introduction

PICES formed a Study Group on *Communications* (SG-COM) in 2007, with a 2-year lifespan ending in November 2009 (see Appendix 1). A Study Group was constituted with membership from all Contracting Parties (see Appendix 2). The terms of reference for SG-COM were as follows.

Terms of reference

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

Approach

SG-COM had its first meeting at PICES-2008 in Dalian, China, on October 31, 2008. A contingent of its members also met in conjunction with the inter-sessional Science Board meeting in Qingdao, China, in April 2009. A final SG-COM meeting was held at PICES-2009 in Jeju, Korea, on October 25, 2009 (see Appendix 3 for meeting agendas). In addition, SG-COM, through its Chairman and a few other members, was involved with the development of the communications aspects of PICES' new integrative science program, **F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems (FUTURE). In fact, SG-COM had a rapidly moving target to advise when it came to this program where communication is integral (see Appendix 4 for details). In part, the SG-COM recommendations provide advice on how to implement this important initiative for PICES.

SG-COM benefited from the work of Mr. Brian Voss (NOAA Seattle Library and IAMSLIC) and Ms. Janet Webster (Oregon State University Libraries and IAMSLIC) in their preparation of the 2007 Review of PICES Publication Program (see http://www.pices.int/publications/annual_reports/Ann_Rpt_07/2007%20PICES%20Publication%20Report_f.pdf). At PICES-2008 Brian Voss, Janet Webster, and PICES intern, Mr. Keyseok Choe, provided an update on the implementation of an Action Plan for PICES Publications Program (see Appendix 5). While it was not a requirement, some member countries provided short reports on communications at the SG-COM meeting (see Appendix 6).

SG-COM endorses the progress being made to implement the valuable advice from the 2007 PICES Publication Program Review. We encourage the PICES Secretariat to continue to implement the advice as time and resources permit. In the long term, we encourage PICES to find the means to increase professional communications staff. We believe a dedicated position is essential for PICES to live up to its potential as a provider of high quality scientific research to multiple audiences.

The SG-COM has determined that the PICES communication priority audiences are:
- PICES members,
- The scientific community at large,

- Targeted new scientific disciplines which can contribute to the main interests of PICES and new users of scientific results,

The promotion of broad scientific literacy in PICES member countries is essential.

The Study Group was gratified to learn of voluntary efforts by at least four member countries to have an informal electronic communications network for PICES members. We believe this strengthens the communication capabilities of PICES in each member country, and that this mechanism might be used to broaden the PICES communication at the country level.

The deliberations of SG-COM at the PICES-2009 produced a series of recommendations for PICES to consider as it increases its roles in scientific communication. These recommendations are not necessarily direct responses to all of the terms of reference. The key reasons for this lack of direct response relate to limits on the resources SG-COM could devote to the task. More importantly, SG-COM did not envision ways to address some aspects of the terms of reference given the lack of identifiable financial resources to cover the costs of advancing in certain directions.

SG-COM developed its recommendations with the caveat that they should be practical, *i.e.* (1) directly tied to PICES Standing Committees (MONITOR, TCODE, *etc.*) and FUTURE; (2) implementable without significant new resources; (3) utilize electronic media rather than print media to reduce costs and maximize distribution; and (4) produce measurable results (ability to track web traffic, downloads of PDFs). To this end SG-COM recommended, with respect to communication of scientific reports, that PICES implement an experimental pilot communications program.

Recommendation 1

- Use the completion of the second PICES North Pacific Ecosystem Status Report (NPESR, PICES Special Publication No. 4, 2010) to develop a pilot news media strategy to publicize reports and to highlight significant publications by:
  1. Developing an electronic brochure with "highlights" of the status and trends for the North Pacific;
  2. Preparing a press release with key messages from NPESR;
  3. Having the PICES Secretariat ensure widespread electronic dissemination of the report and press releases which could include video clips of scientists discussing the report, fact sheets, *etc*.

The idea proposed by SG-COM is that of a pilot news media strategy would be for the PICES Secretariat to target one or a few PICES meetings/products/activities to test the techniques and to stay within limited resources. Ideally, specific messages should be crafted for different audiences: scientists, managers, policy/decision makers, the general public, and stakeholders, translated into either electronic or print media in PICES member country languages to ensure broad distribution. But this stresses the capacity of the PICES Secretariat. We do not conceive of a mechanism for how to do this without additional funding unless each member country agrees to take responsibility to disseminate scientific key findings to relevant audiences in an accessible language.

Recommendation 2

- Use the PICES/ICES/FAO Symposium on "*Climate change effects on fish and fisheries*" scheduled for April 2010, in Sendai, Japan, as a pilot for involving news media, and seek volunteers from the Local Organizing Committee to perform the following functions: develop a press release with key issues; organize a press conference with PICES scientists, and invite science writers and journalism/science writing students.

If this pilot works well, use it as a prototype for the 2010 PICES Annual Meeting in Portland, U.S.A.

Recommendation 3

- Instruct each expert group to (1) commit to increasing internal PICES communication for better information and integration, (2) include a task of preparing a short "electronic brochure" for communicating highlights of meetings or final reports as part of its terms of reference and (3) identify a point person(s) to interact with the PICES Secretariat to annually communicate the developments of the group.

The Secretariat will develop a pilot electronic reporting format for a brief final report of an expert group in non-technical language – what was done, what was learned and what are the implications for society, management and further research.

Recommendation 4

- Use PICES' ability to appoint an intern in the near term to assist Secretariat website staff in increasing electronic communications capacity (see next recommendation).

Recommendation 5

- Enhance the PICES website by developing a part of the website for the general public (highlight PICES science results – content to be derived from brief reports mentioned in Recommendation 3);
- Develop a web link for involving new scientists as PICES members or as participants in PICES activities: "How to get involved in PICES";
- Develop the ability to search PICES publications for metadata/geo-referenced information (using the TCODE method);
- Increase the web links to PICES with key websites of ocean interests (member nominations);
- Monitor PICES website visitation data from current baseline to assess how these recommendations work;
- Experiment with Wikipedia and other networking sites (will need volunteers to translate and maintain in all PICES member languages).

Recommendation 6

- Consider creating an on-going Communications *ad hoc* committee consisting of professionals with experience in science communications (including forecasts and risk/uncertainty) within member countries. This committee would plan and implement specific PICES communications under a designated PICES structure.

SG-COM notes that FUTURE, through its Advisory Panels on *Anthropogenic Influences on Coastal Ecosystems* (AICE), *Climate, Oceanographic Variability and Ecosystems* (COVE) and *Status, Outlooks, Forecasts and Engagement* (SOFE), has a strong commitment to communication consistent with other components of PICES, *e.g.*, Status and Trends reports. However, PICES faces new challenges with communicating Outlooks and Forecasts. These represent an order of magnitude greater degree of communication sophistication than even the complex ecosystem status reports. These tasks should not be underestimated. **SG-COM believes that technical advice and capacity building in PICES is necessary.**

Conclusion

The members of SG-COM thank PICES for the opportunity to be of service and to provide ideas for using communications to advance the broader understanding of PICES science, the implementation of FUTURE, and the ongoing success of PICES and its members. If we can provide further advice, please do not hesitate to contact us.

Appendix 1 PICES deliberations on setting up a Study Group on *Communications*

2006 Annual Report

PICES Fifteenth Annual Meeting
Yokohama, Japan
October 13–22, 2006

PICES communications (SB-IM Agenda Item 17)

Dr. Batchelder suggested that the PICES website should be designed as a dynamic site rather than an archive, as it now stood, but that he did not have time to devote attention to this issue. Dr. Gordon H. Kruse, FIS Committee Chairman, recommended that Ms. Julia Yavzenko, PICES Web and Database Administrator, contact all the Committee/Program Chairmen to encourage feedback and suggestions. Dr. Sei-Ichi Saitoh, MONITOR Vice-Chairman, volunteered to be on the Web Committee.

2007 Annual Report

PICES Sixteenth Annual Meeting
Victoria, Canada
October 26–November 5, 2007

Other business (GC Agenda Item 16)

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

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

GC Endnote 7

Study Group on *PICES Communications*

Background

All scientific organizations have a responsibility to communicate their results widely. In the PICES Strategic Plan, the mission calls for: i) synthesizing scientific information regarding the regions, and making the results widely available, and ii) informing interested parties and the public about marine ecosystem issues. The strategies to achieve this mission include Goal 8 (“Make the scientific products of PICES accessible”), which

focuses on communicating the results of PICES scientific activities broadly, explicitly mentioning high quality publications, the PICES website, and production and dissemination of educational materials. The plan does not explicitly identify the audiences that should receive this information. Scientific communication has many dimensions, and the approaches to be taken are dependent upon the audiences one hopes to reach. Audiences may include the scientific community, management agencies, governments, and the general public. Scientists traditionally involved in PICES lack the expertise and, often, the will, to communicate beyond the scientific community. The FUTURE Science Plan has identified the need to improve communications, particularly to science to policy makers and managers. A discussion of the FUTURE Science Plan concluded that the issues and communication challenges apply across the entire PICES community. In addition, a recent review of PICES Publication Program by representatives of the International Association of Marine Science Libraries and Information Centers (IAMSLIC) made recommendations in certain areas of communication. Thus, it is timely to convene a Study Group, which will address communication in PICES and make recommendations for actions. PICES is extremely strong in its core capacities, *i.e.*, exchange of ideas and collaboration among scientists in the North Pacific. The evidence for this is seen in the sustained high levels of participation in PICES meetings and expert groups. Publications by North Pacific scientists are reaching major international peer review journals, books and other media. Many of these publications show multiple authors from more than one country, demonstrating evidence of increasing collaboration and communication. The communication of scientific information to policy makers, managers and society is an increasing priority for PICES because member countries are being asked to explain more about what is happening in the sea? Little is known, systematically, about how scientific information from PICES is delivered on a national and sub national basis to policy makers and managers. Preliminary information indicates that the delivery pathways differ among PICES member countries. Relatively little attention is given to distributing PICES results to the general public. An important area that PICES needs to understand is the different cultural views about marine ecosystems across the Pacific Basin. Different attitudes about the importance of marine ecosystems exist on opposite sides of the Pacific and perhaps within countries based on the specification of the objectives.

We are at an early stage in the development of ecosystem based management and can benefit from the pursuit of alternative approaches toward defining ecosystem-based management and national objectives. PICES communications should work to improve the understanding of those attitudes, furthering our ability to collaborate as scientists and as societies. The overall goal of the Study Group is to identify the target audiences for outputs from PICES activities and to propose mechanisms to communicate with them.

Terms of reference

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

Membership

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

Term and schedule

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

Appendix 2 Membership of Study Group on *Communications* (SG-COM)

CANADA

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Appendix 3 SG-COM participation lists and meeting agendas at PICES Annual Meetings

PICES XVII, Dalian, China, October 31, 2008

SG-COM participation list

Members

David L. Fluharty (U.S.A., Chairman)
Marsha Gear (U.S.A.)
Sik Huh (Korea)
Kyu-Kui Jung (Korea)
Igor Schevchenko (Russia)
Darlene Smith (representing Canada)
Gongke Tan (China)
Harumi Yamada (Japan)
Julia Yazvenko (PICES, *ex-officio*)

Observers

Brian Voss (IAMSLIC)
George Boehlert (U.S.A.)
Jake Rice (Canada)
Glen Jamieson (Canada)

SG-COM meeting agenda

1. Opening remarks by Chair
2. Introduction of Study Group on Communications members
3. Discussion of Terms of Reference for Study Group
4. Presentation of PICES Survey results Brian Voss and Keyseok Choe
5. Discussion of PICES Survey results
6. Presentation of country experience with PICES Communications (approx. 5 min. each)
   - Canada
   - China
   - Japan
   - Korea
   - Russia
   - United States
   - Other examples
7. Preliminary response to terms of reference questions
   - Principal audiences and products
   - PICES role in educating diverse audiences
   - Options for PICES products-partnerships
   - Relationship between communications and PICES Strategic Plan, Action Plans of Standing Committees, and FUTURE
   - Draft recommendations
   - Development of SG-COM Final Report

PICES-2009, Jeju, Korea, October 25, 2009

SG-COM participation list

Members	Observer
David L. Fluharty (U.S.A., Chairman)	Tatyana Semenova (Russia)
Marsha Gear (U.S.A.)	
Sik Huh (Korea)	
Igor Schevchenko (Russia)	
Darlene Smith (representing Canada)	
Yukimasa Ishida (representing Japan)	
Julia Yazvenko (PICES, *ex-officio*)	
Gongke Tan (China)	

SG-COM meeting agenda

1. Introductions
2. Review and approval of agenda
3. Review of progress from Dalian PICES Annual Meeting and Qingdao PICES inter-sessional Meeting
   Key Element – Communication in FUTURE
4. Updates and comments by PICES SG-COM members
5. Discussion of draft report
6. Preliminary recommendations
7. Planning for completion of Final Report

Appendix 4 FUTURE and implementation of FUTURE re: Communication

The following paragraphs are excerpts [direct quotes] from the FUTURE Science and FUTURE Implementation Plan that embrace the general oversight SG-COM has to participate in planning. This emphasis should not be confused with the need for communications through standing Committees and expert groups of PICES. [The role of communication is bolded.]

FUTURE vision
To *understand* and *forecast* responses of North Pacific marine ecosystems to climate change and human activities at basin and regional scales, and to broadly ***communicate*** this scientific information to members, governments, resource managers, stakeholders and the public.

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

FUTURE research
Related to all three research themes is the goal of improving our capability to convey in a clear and effective way how societies will be affected by a changing North Pacific marine environment. The following question captures the goal of improved **communication** of the science from FUTURE. *"How can forecasts, uncertainty and consequences of ecosystem change be* ***communicated*** *effectively to society?"*

Science priorities are risk-based ecological assessments within a policy/management framework to **communicate** future states of nature, their implications, and uncertainties to decision makers and the public.

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

FUTURE will improve these estimates and communicate them effectively so that science can better support policy. This view has led to the identification of an overarching question for FUTURE.

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

All is done with the FUTURE perspectives of understanding, forecasting and **Communicating.**

Implementation strategy

The ultimate goal of FUTURE is *to understand and* ***communicate*** *the future of North Pacific ecosystems and the potential impacts from human use.* Implementation of FUTURE has two objectives:

- To increase understanding of climatic and anthropogenic impacts and consequences on marine ecosystems, with continued leadership at the frontiers of marine science;
- To develop activities that include the interpretation, clarity of presentation, peer review, dissemination, and evaluation of ecosystem products (*e.g.*, status reports, outlooks, forecasts) and establish a process for engaging interested institutions and other recipients.

Implementation of Objective 2 requires the establishment of a third FUTURE Advisory Panel on ***S**tatus, **O**utlooks, **F**orecasts, and **E**ngagement* (SOFE). SOFE will recommend expert groups to identify major sources of uncertainty and impediments to improving the skill of assessments and forecasts, suggest research areas for priority development, and provide coordination of potential PICES products. SOFE will provide for a PICES final peer review on information and interpretations, and work with the PICES Study Groups on *Communications* and on *Human Dimensions* on how to engage potential users of North Pacific ecosystem and climate information, including the quality of information and uncertainty.

Objective 2 of FUTURE comprises a new activity for PICES. The current Study Groups on ***Communication*** and on *Human Dimensions* will provide guidance and recommendations on engagement activities for FUTURE. It is too early in the FUTURE implementation process to fully interact with "stakeholders" that would benefit from and be targeted for FUTURE products. Instead, based on recommendations from the two Study Groups, long-term engagement and **communication** activities should be established in PICES. Initially user characteristics should be reviewed from existing sources. This review should be a basis for developing a matrix of potential applications for ecosystem status/forecasting, as well as an inventory of potential recipients and their **communication** requirements. These will be used to establish future contacts, assess status/forecast priorities of greatest interest to potential recipients, and the forms in which information and forecasts of marine ecosystems would be most useful. It should be noted that approaches and recipients often will be tailored differently for stakeholders in different North Pacific regions or Contracting Parties. This activity will collaborate with the PICES Secretariat to enhance web delivery of education and outreach. Besides the web, possible mechanisms of outreach could include research highlights, news briefs or press releases, and/or brochures.

This activity encourages individual scientists, and PICES as a whole, to be more involved in educating non-scientists. Initiating a dialog between the scientific community, the public, and the private sector can lead to new ideas and new directions for research. This can be carried out by maintaining a website and facilitating **communication** products beyond the PICES community.

First year of FUTURE (SOFE-AP only)

Coordinate with the editors of the next version of the North Pacific Ecosystem Status Report on how the Report should be updated in the future. Work with the **Communication** Study Group and the Study Group on Human Dimensions of Environmental Change to commence the review of user characteristics for FUTURE products.

Expert groups

The main activities of FUTURE are carried out by expert groups recommended by the Scientific and Technical Committees and initiated by the Science Board following existing procedures. Current relevant expert groups are Sections on *Harmful Algal Blooms* and on *Carbon and Climate*, Working Groups from WG-20 through WG-FCCIFS, and Study Groups on ***Communications*** and on *Human Dimensions*.

Communications among FUTURE and PICES scientists

Communications among FUTURE and PICES scientists will be facilitated by:

- Convening inter-sessional symposia to review progress and to stimulate the exchange of ideas among the multi-disciplinary teams working in different components of the program;
- Co-sponsoring activities with like-minded programs of other international organizations;
- Convening workshops to address important scientific questions;
- Convening topic and poster sessions at PICES Annual Meetings;
- Publishing workshop results in PICES Scientific Report Series;
- Publishing regularly articles in PICES Press on FUTURE scientific activities and progress;
- Publishing significant contributions in peer-reviewed scientific journals, and
- Maintaining a FUTURE website.

Appendix 5 Progress report on Action Plan for PICES Publications Program

PICES Seventeenth Annual Meeting
Dalian, China
October 29, 2008

Brian Voss, NOAA Libraries & IAMSLIC
Keyseok Choe, PICES Secretariat
Janet Webster, Oregon State University Libraries & IAMSLIC

Description of activities since October 2007

In the Finance and Administration Committee meeting at the 2007 PICES Annual Meeting, Janet Webster and Brian Voss presented the PICES Publication Program Review along with a concise Action Plan based on the recommendations in the Review. The Review was well received by the Committee and the Action Plan was approved with a request that the Secretariat prioritize the items as well as provide a cost estimate for each. In other sessions at that Annual Meeting, a Study Group on Communication (SG-COM) was initiated as well as the FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific **E**cosystems) Program, both of which have implications for the PICES Publications Program as well as the Review and Action Plan.

In early 2008, Mr. Keyseok Choe arrived from KORDI in Korea to begin his one-year assignment as an intern at the PICES Secretariat. A portion of his time over the year was to be dedicated to implementation of the Action Plan. The significant events in the year were:

- March: Keyseok, Janet and Brian met at the Cyamus (West Coast of North America and Hawaiian Regional Group of IAMSLIC) meeting in Friday Harbor, WA to formally initiate the collaboration on the Action Plan, provide an update to the group and ask for group input on various issues.
- April: Keyseok traveled to Seattle in conjunction with the Inter-sessional Science Board meeting and Workshop held there. At that meeting, Keyseok tested a survey exploring use of scientific literature and PICES publications on the members present. This was expanded to an online survey distributed to all individuals on the PICES publications distribution list.
- July: Keyseok again traveled to Seattle to work with Brian on the details of implementing the Action Plan. This culminated with a conference call with Janet to further discuss the way forward.

Between meetings, Janet, Brian and Keyseok worked individually and in conjunction with the Secretariat and other parties identified in the Review to accomplish individual goals within the Action Plan.

Progress on Action Plan items

Ideally, each of the goals in the Action Plan was to be completed or near completion by the 2008 PICES Annual Meeting. Several factors have slowed progress toward that ideal, including the amount of time needed to familiarize the PICES intern with the project combined with time available between the PICES Secretariat, Janet and Brian to simultaneously collaborate to achieve goals in the Action Plan. To a degree, this was foreseen in the review and reflected in the first recommendation to establish a position within the Secretariat dedicated solely to Publications, if only for this time of transition. Much progress has been made however, and continues to proceed. Notably,

- Janet has strengthened the relationship with PICES and ASFA (Aquatic Sciences and Fisheries Abstracts) to insure more timely and complete indexing of publications.
- Brian has enhanced OCLC WorldCat records to more comprehensively reflect PICES' online presence. OCLC (Online Computer Library Center) WorldCat (http://www.worldcat.org/) is a library catalog shared

by over 41,000 international member libraries which supports the development of local catalogs as well as interlibrary loan among member libraries.

- Keyseok has added a majority of the existing online publications to Aquatic Commons. Aquatic Commons is the OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting http://www.openarchives.org/) compliant digital repository managed by IAMSLIC (International Association of Aquatic and Marine Science Libraries and Information Centers).

New and recurring issues

Finances

One goal of the F&A Committee is to recover money through the transition to online-only distribution. Cost savings may not be realized, however, unless financial and administrative support can be transferred from the mailing and print based burdens to the new costs incurred under online-only distribution mechanisms. Among the new costs assumed in online-only distribution are ongoing tasks to be overseen if not completed by the Secretariat. These include maintaining currency in the digital repository, commercial indexes and library catalog records as new publications are released.

Access

Access to PICES publications through a robust web site, a digital archive and stable library partners continues to emerge as a workable strategy. As suggested by a colleague at the Cyamus meeting, Brian contacted the Pacific Rim Digital Library Alliance (http://prdla.ucmercedlibrary.info/), "a consortium of academic libraries joined together to facilitate improved access to scholarly research materials throughout the Pacific Rim" to gain more insight on what is already being done in this arena specifically across the Pacific region. Among their other efforts, the Alliance recently initiated pilot programs to explore international interlibrary loan (ILL) issues. In those programs, they learned that that the need for ILL across national borders was nominal and that existing ILL procedures, especially those within the OCLC system, readily met operational needs. In fact, the special arrangements within the pilot created overhead that reduced the efficacy of the standard systems (correspondence with R Bruce Miller, Secretariat Chair, Pacific Rim Digital Library Alliance). Consequently, we do not recommend PICES engaging in any direct library activities, but rather to continue to partner with IAMSLIC. As is detailed further below, two surveys exploring issues of access and usage of scientific literature among PICES Publications recipients were recommended in the 2007 review. We hope to work closely with the Study Group on Communication to not only utilize the data that has been gathered, but also assist in gathering the remaining data.

Communication

"The Journey to PICES" indicates that many of the issues we are facing differ little from those that emerged during the formation of PICES and its first years of existence. With regard to communications, lack of technology access, language barriers, and limited funding to support consistent, sustained participation by scientists in PICES initiatives were noted in the book. Also, developments in the year since the Action Plan was adopted, including the PICES new integrative scientific program, FUTURE, and the Study Group on Communications, will surely affect the existing publication program. Both may require new types of publications directed at audiences beyond the North Pacific science community. For example, one of the goals may be to increase civil society's exposure to PICES and ocean issues in the North Pacific. This will require having experts available for conversations with the media and writers that can translate science into plain language.

Recommendations

The Action Plan is a first step and completes the foundation from which to make more significant changes in the Publications Program, while neither disrupting or upsetting current users nor overwhelming the current Secretariat staff with new users. We have several recommendations to PICES. Two could be implemented immediately resulting in some minor cost savings. The others represent a sustained commitment to transitioning the Publications Program to be more online, more accessible and more connected with other PICES efforts.

- **Discontinue printing of annual report and distribute electronically:** We found in our survey of current users of PICES publications that few use the annual report with any regularity and even fewer used it in print.
- **Update the distribution list:** Through our survey work, we will identify email addresses for all current recipients of PICES Publications. If this data is added to their distribution database records, distribution could switch to electronic more seamlessly. Further surveys of individual recipients could capture distribution preferences for individual publication series. Those preferences could then be saved in the distribution database as well.
- **Continue to work on the items described in the Action Plan:** While we have made progress, there is still work to do. This includes completing changes to the web site, completing agreements with publishers and authors, and integrating new processes into the existing workflow.
- **Commit to depositing PICES Publications into the Aquatic Commons:** Key-Seok Choe has deposited many PICES publications into the Aquatic Commons, a stable, digital repository sponsored by IAMSLIC. This mechanism provides a backup to the PICES web site, a permanent URL for publications in case the PICES web site changes servers, a searchable venue, and a means for some indexers to more readily integrate PICES publications into their products. All lead to more usage and visibility of PICES publications.
- **Work with the Communications Study Group and other groups in PICES:** Others have an interest in publications as a means of promoting PICES science to a broader audience. Cooperation among these groups will be valuable.

We have appreciated working with Keyseok. He has provided valuable insight as well as hard work in implementing the Action Plan. As part of his work, he has learned how to deposit digital materials into the Aquatic Commons, making PICES one of the first international organizations to do so. He also has assisted in developing and conducting various surveys of PICES scientists as well as libraries and institutions receiving PICES publications. His presence made it possible to accomplish much of what we have to date. We anticipate continuing to work with the PICES Secretariat on this valuable project.

The following is a detailed description of progress on each item in the Action Plan.

Action Plan for the PICES Publications Program

A. Managing the publication workflow

1. Establish a new position (if only temporary) to assist with carrying out recommended actions and to consolidate and manage the whole publications workflow.
   This is not feasible given the current budget and staffing of the Secretariat. The Secretariat will continue to balance the cost and utility of using outside contractors with hiring another staff person.

2. Post the PICES Style Manual (Instructions to Authors and Editors) to the PICES website. Add similar information to print publications as appropriate.
   The PICES Style Manual of each publication will be posted on the PICES website by the end of 2008. These have been identified and simply need reformatting to pdf or html as appropriate and posting.

B. Increasing recognition of PICES as a publisher

1. Include recommended citation formats and summaries of publications on additional series as appropriate.
   The suggested citation format, the publication's website URL and series descriptions were first printed on each issue the scientific report series in 2004 and in the annual report series in 2007. The series descriptions were revised in 2008. This revision and additional information should continue to be included in these series and added to all PICES publications in a format that is fitting for the publication. The books should retain the "About PICES" section while including the above in an appropriate style.

   The following are the recommended citation formats for each type of PICES publication:

   Scientific Report
   Brodeur, R. and Yamamura, O. (Eds.) 2005. Micronekton of the North Pacific. PICES Scientific Report. No. 30, 115 pp.

   Haltuch, M. 2008. "Northern California Current (U.S.) groundfish production." pp.33-34 In: Forecasting Climate Impacts on Future Production of Commercially Exploited Fish and Shellfish. PICES Scientific Report. No.34.

   Book
   Hayes, D. 2001. Historical Atlas of the North Pacific Ocean: Maps of discovery and scientific exploration, 1500-2000. Seattle: Published under the auspices of North Pacific Marine Science Organization [by] Sasquatch Books.

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

   PICES. 2004. Marine ecosystems of the North Pacific. PICES Special Publication 1, 280 pp.

   Special Issue of Journal
   Ladd, C., Stabeno, P. & Cokelet, E.D. 2005. "A note on cross-shelf exchange in the northern Gulf of Alaska." In: Linkages between coastal and open ocean ecosystems, S.M. McKinnell & G.A. McFarlane (eds). Deep-Sea Research II 52 (5-6): 667-679.

   PICES Press
   Napp, J.M. 2008. "The Bering Sea: Current Status and Recent Events". PICES Press 16 (2): 30-31.

   Annual Report
   PICES. 2008. Annual report. North Pacific Marine Science Organization (Sixteenth Meeting, Victoria, Canada). 419 pp.

   PICES. 2008. "Report of Governing Council." pp.15-64 In: Annual Report. North Pacific Marine Science Organization (Sixteenth Meeting, Victoria, Canada).

2. Investigate possibilities of branding PICES at the article level in the journal special issues.
   Beginning in 2005, PICES established issue level branding on the cover or inside cover page of PICES special issues, and in 2007 began establishing article level branding in the Acknowledgments Section at the end of each article in special issues. Though seemingly redundant, article level branding is necessitated by the frequency with which users directly access an article or only obtain a single article in an online environment and never see the cover or prologue. There are two main ways of improving the branding of PICES at the article level. One is a small logo at the top of the article and the other is moving

the credit line from the Acknowledgement section into the Abstract. We continue to work with editors and publishers on these and other possibilities.

3. Add information on the PICES publications introductory web page for ordering publications as well as more specific contact information for publications.
   One of the core missions of PICES is to facilitate and deliver information to its member countries. Over the long-term, the least labor intensive system for ordering publications would be a fully-automated purchase and payment system like a shopping mall. This takes a lot of initial effort and cost to establish. The second-best choice would be a web-ordering form. Like the first choice, this also has complications: it is hard to set an international pattern for ordering PICES Publications because of the variables in shipping and transactions among countries. Thus far, given these variables, PICES has handled requests individually, determining charges on a cost recovery as well as ability to pay basis. PICES has decided to designate one contact person to be in charge of publication orders, and will post that name on the website. The contact information still needs to be added to the Publications page.

C. Enhancing access through library and indexer cooperation

1. Enhance existing OCLC catalog records with links to current digital versions of PICES publications.
   OCLC WorldCat library catalog records are all updated as of spring 2008. Periodic monitoring will be needed for new records. As mentioned above these records are the source from which thousands of libraries populate their local catalogs as well as provide interlibrary loan services. Though this catalog is recently free to search online via http://www.worldcat.org/, it is historically more of a librarian's tool. Therefore, presently the catalog is still heavily used by librarian's and less so by researchers.

2. Establish agreements with select libraries for ongoing print archiving, following surveys under Part D.
   Archiving agreements will be discussed after the completion of the PICES survey at the end of 2008. We hope to provide the Study Group on Communication with useful data from these surveys and engage them in a discussion on all aspects of implementing not only these agreements but also changes to the distribution of publications to individuals receiving PICES publications.

3. Establish agreements with commercial indexers that insure indexing of all PICES publications to the article level.
   Conversations were held with two Indexing Companies, ProQuest (ASFA) and NISC (Fish and Fisheries Worldwide). Both index PICES publications as received. ProQuest stopped receiving PICES publications, so indexing lapsed. NISC collects the indexing from library at the South African Institute for Aquatic Biodiversity (formerly the J.L. B. Smith Institute of Ichthyology. The name change in the 2003 may have hampered delivery of publications and their consequent indexing.

   Aquatic Sciences and Fisheries Abstracts through ProQuest:
   ProQuest editor, Vicki Soto, oversees the production of Aquatic Sciences and Fisheries Abstracts. Much of the content is entered by international centers coordinated by the ASFA Secretariat located at FAO in Rome. ProQuest contracts with the Secretariat to enhance the database with additional content. ProQuest provides the user interface and web accessible platform. Typically, Ms. Soto gathers publication information from mainstream publishers leaving small publishers such as PICES to be picked up by the ASFA input center in their respective countries. As PICES is an international organization, the Canadian input center does not track and input PICES publications. Consequently, we need to develop a better and more consistent process to ensure indexing of PICES publications in ASFA.

   Fish and Fisheries Worldwide through NISC:
   Input to this database is gathered from multiple sources including the collection of the South African Institute for Aquatic Biodiversity. SAISB scientists decide which publications and content are worthy of inclusion, and consequently index this. In general, PICES publications are well covered including the

PICES Press. Gaps in coverage are probably due to non-delivery of issues, selective indexing decisions, and changes in indexers.

Several mechanisms should be pursued:

- Add Ms. Soto to the distribution list so ProQuest has PICES publications available for indexing. There may still be a lag, but this would be a cost-effective, straight-forward approach. They would accept electronic copies.
- Continue to enter PICES publications into the Aquatic Commons. Ms. Soto believes this will be an efficient way for ProQuest to capture the metadata to add to ASFA. If this process continues, ProQuest may no longer need to receive print or electronic copies.
- Make sure the correct mailing address is in the Distribution List. SAIAB Library (Margaret Smith Library, SAIAB, Private Bag 1015, Grahamstown, 6140, SOUTH AFRICA).

4. Add all publications to a searchable digital repository following pilot project in Part E.
   IAMSLIC's Aquatic Commons (AC) digital repository can be an "article level" index without creating single records for each article in an issue, by using a contents field that is visible to web search engines. AC is also a tool to index new publications more quickly than Aquatic Sciences and Fisheries Abstracts (ASFA). ASFA will look to both AC and the PICES website to stay aware of new publications. AC is also important as a free resource and an OAI-PMH harvestable resource that is currently being harvested by the Avano repository at Ifremer. In essence, Avano, regularly and automatically copies and archives metadata (and in some cases the data files/pdfs as well) from Aquatic Commons and any other OAI-PMH compliant repository that is registered with them with no human intervention. ASFA, in contrast, is a fee resource usually purchased by libraries at an institutional rate and is not OAI-PMH compliant. Worldcat is more of a book title and journal title level database that is mainly useful to identify libraries with print copies of publications. While it (and ASFA) may link to online versions they do not maintain or control access to those versions. Therefore access is dependent on websites staying consistent and/or readers having paid subscription access to those pdfs. The digital repository aspect of AC also means that the pdf version of the publication is always immediately linked and freely accessible via the metadata record. At present, sixty-eight items from PICES Press, Annual Reports, Scientific Reports, Special Publications and Technical Reports have been added into the Aquatic Commons.

D. Improving distribution efficiencies

1. Review and enhance data on distribution lists.
   They will be updated after the institution/library survey responses are received.

2. Create and conduct surveys of each of the three groups of PICES distribution recipients and Contracting Parties.
   The PICES Secretariat maintains three distinct lists for distributing new publications to each group. One list contains names and addresses of individual researchers in the PICES community. The second contains library names and addresses and the third contains institution names and addresses. These libraries and institutions may be universities, government agencies, non-governmental agencies. One survey of individuals was completed in the spring of 2008. A report of those results will be presented to the Communications Study Group. The libraries and institutions survey is ready to implement and will also be discussed by the Communications Study Group before doing so.

3. Add RSS (Really Simple Syndication) functionality to website.
   This was determined to not be worth the effort due to the low rate of change on the publications web page. Still, there may be opportunities to improve the website, including an RSS feed on the PICES main page so those interested can easily stay informed of new developments at PICES with little sustained effort on the part of the Secretariat.

E. Increasing visibility and ensuring perpetuity through a digital repository

1. Establish a pilot project to develop a collection of PICES Publications in the IAMSLIC digital repository 'Aquatic Commons'
   Adding the Annual Reports, PICES Press and Scientific Reports to the Aquatic Commons has been accomplished as noted earlier.

2. Retrospectively scan items to complete the collection of digital publications.
   Missing electronic copies of two Scientific Reports were located and uploaded to the PICES web page as well as deposited in the Aquatic Commons. PICES has posted earlier editions of some Annual Reports. Digitization of the older annual reports is under consideration.

3. Negotiate with publishers for the right to deposit appropriate versions of journal articles into the repository and/or on the PICES website.
   Little progress has been made on direct negotiations. The two main publishers PICES special journal issues are Elsevier and Oxford. According to the SHERPA/RoMEO database (http://www.sherpa.ac.uk/romeo.php), both allow posting of post-prints or authors' proof copies to an institutional repository, though Oxford imposes a 12-month waiting period after which an author can archive a post-print. In either case, there are additional restrictions, that currently prevent PICES or special issue authors from posting articles "as is" from the publisher website. Consequently, it may be more expeditious to work with PICES authors to get their permission to post these articles or encourage them to do so.

4. Develop a copyright agreement between PICES and all authors that grants PICES rights to archive and provide access to digital content.
   An agreement needs to cover all PICES publications. Of those individuals surveyed, 75% indicated a willingness to give PICES the right to post publications online. An example of such an agreement would include a non-exclusive right to archive and provide online access to the author's work. It would be predicated on the author having the right to do so, e.g. having retained this right at the time of publishing with a publisher other than PICES. We suggest that PICES encourage all authors, when submitting to a commercial publisher, include the SPARC Author's Addendum provided by the Science Commons (http://scholars.sciencecommons.org/). This is a straightforward way to retain certain rights in regards to the author's work. The authors could in turn grant these rights to PICES as the archive and point of open access.

5. Review all PICES-related efforts related to metadata creation and online publication. Propose workflows that capitalize on OAI-PMH compliance with Aquatic Commons and federated metadata searching through T-Code's North Pacific Ecosystems Metadata site.
   Accomplishing this Action Item concerns direction and policy for PICES communications. So, it will require substantive discussion with the F&A Committee, the PICES Secretariat, TCODE, the FUTURE, the Communications Study Group and the Governing Council. The PICES website could be a primary portal to science information and data on the North Pacific. But given limitations of staffing, careful consideration must be given to priorities and possibilities. This will be discussed as part of the presentation to the Communications Study Group in Dalian.

   In the near term, links should be made from the PICES publications page to all PICES information and data. This reflects an understanding of how various efforts within PICES complement each other.
   Some examples include:
   - The North Pacific ecosystem Metadatabase (http://www.pmel.noaa.gov/np/mdb/)
   - The Aquatic Commons (http://aquacomm.fcla.edu/) Euphasid

Appendix 6 Member country written contributions at PICES XVII, Dalian, China, October 31, 2008

PICES communications – Canada

In Canada, a Science Outreach Strategy has been completed and a Knowledge Translation Strategy is being developed by the federal government. The four target audiences or pillars identified for both are: internal (our own employees), external audiences (including the general public), science partners (including universities and associated industries) and government (parliamentarians and other departments including granting agencies).

The implementation of these strategies provide an opportunity to ensure our audiences are made aware of the projects that we are taking on that move the FUTURE initiative ahead. For instance the Eco-system Research Initiative on the west coast is providing a wonderful opportunity to look at an eco-system aligned with the PICES geographic region. This Canadian initiative and others like it from other countries could be used to give some profile to PICES.

On this note, the audiences that PICES wants to reach is unclear....are we looking for people to become engaged in the organization in order to better partner on issues of importance to the PICES eco-system or are we looking to inform a broader public about the work that PICES is undertaken. I would suggest the first target might be more appropriate initially. Reaching those interested scientists is a segment that is, in a sense, easier to reach.

Currently, I believe that the community of members, an educated public, is paying a fair amount of attention to PICES and the work of PICES member countries. When we look at the attention paid through our federal government library system, we know that publications that are in hard copy are available in most of our facilities and are being used and that those available electronically are accessed regularly.

PICES annual publications are housed in most of the Fisheries and Oceans libraries across the country. The libraries are accessible to all DFO scientists and are open to the public in each region. In addition, the Departmental libraries subscribe to ELSEVIER and receive publications that are of interest to Departmental employees. Each year, the number of usages of electronic documents is reviewed to determine which publications should be retained and which should be deleted from our lists. It remains difficult to know the exact impact of the publications.

As we look toward the future, we should promote the PICES publications as they become available. It would also be appropriate to determine if our partner universities are receiving the PICES publications and encourage them to subscribe.

The study done through PICES provides information about the audiences and their usage but is incomplete. It is clear more work needs to be done on those issues and perhaps some of that can be done through member countries.

Increasing the membership by launching a membership drive, would mean that more individuals taking advantage of the PICES infrastructure, research, partnerships and publications. This could be done through the existing communications committee members working through PICES headquarters.

A general public website would assist member countries in identifying issues that could be expanded upon in their own countries, however. I would think a general public site might be useful.

A communications strategy and associated work plan definitely should be developed. These documents should clearly define actions....those to be done by PICES headquarters and those to be done by member countries. Without the work plan, actions to move FUTURE ahead may not be undertaken.

We in Canada would be pleased to assist in this activity.

PICES Communications – Japan[1]

Harumi Yamada (Fisheries Agency of Japan)
and
Yukimasa Ishida (Fisheries Research Agency)

In this paper, the examples of PICES scientific products communicated and used in Japan are introduced. There is a liaison meeting among the ministries to make marine policies and to raise several funds for scientific studies. An E-Mailing List for Japanese PICES members is utilized to quickly share and strongly promote PICES activities, including scientific programs in Japan. The website and scientific journals in the Japanese language are useful tools to connect other Japanese scientists to PICES scientific products. PICES should make more social contributions. For the general public, the citizen learning is important. We should take account of the approaches to general public using the local language and the common words, because the general public is expected to produce public opinion, which is influential in making policies for the government.

Liaison meeting among the ministries

There are 12 ministries in Japan. We have a liaison meeting among four ministries of Foreign Affairs (MOFA), Education, Culture, Sports, Science and Technology (MEXT), Land, Infrastructure, Transport and Tourism (MILT), Japan Meteorological Agency of MILT, Japan Oceanographic Data Center of Japan Coast Guard, MILT (JODC), the Environment (MOEN) and Fisheries Agency of Japan. The meeting is frequently held before and after the Annual Meeting and also inter-sessional Meeting, and also by e-mail if necessary.

The meeting plays a role in giving and sharing scientific information from PICES for the making government policies, including promoting the scientific activities to the PICES. Scientific information from this meeting helps the government policy makers to appropriately evaluate the scientific study plans in the North Pacific proposed from scientists.

This small meeting consists with one or two persons in each ministry and agency, so that deeper understanding of the outputs from PICES are expected among the members. Then, in the Fisheries Agencies, the scientific information from the meeting is also shared among all four departments. The system is followed in raising the MAFF Fund as well as several funds for summer school and for the workshops in MEXT.

E-mail list for Japanese PICES members

We have an e-mail list that includes a total of 51 Japanese scientists involved in all the PICES Standing Committees and expert groups as well as Governing Council and Finance & Administration. We are utilizing this e-mail list to share scientific information in PICES quickly and simultaneously, and to promote the studies in each Standing Committee and expert group.

Website and scientific journals

A website has been established by the Fisheries Research Agency (FRA) (http://pices.job.affrc.go.jp/picesindex.htm), targeting an audience of scientists and NGOs outside of the current PICES members. The website introduces mainly the PICES events in Japan and the activities of Japanese scientists in the PICES using the Japanese language, with linking to the original PICES website. This website plays a role of promoting, contributing and motivating the scientific studies through the PICES for the Japanese scientists.
Japanese PICES members frequently make announces and/or reports of PICES events to the Japanese science communities using their journal and their e-mailing list, such as the Japanese Society of Fisheries Science, the

[1] This paper was submitted to the PICES SG-COM meeting in Oct. 31, 2008 in Dalian, China. Paper not to be cited without the authors' permissions.

Oceanographic Society of Japan and the Plankton Society of Japan. These communications are expected to make Japanese scientists and/or NGOs closely aware of PICES activities.

Citizen learning

FRA holds citizen learning for the general public. Citizen learning with the theme "To marine scientists in future" from PICES was held during the PICES XV Annual Meeting in Yokohama in 2006. Both Drs. Jacquelynne King (Canada) and Richard Brodeur (USA) made presentations with us to students of a junior high school and elementary school. We should have another plan for understanding the North Pacific ecosystem on the basis of PICES products because citizen learning is expected to make public opinion, which is influential in making policies for the government.

Discussion

It is successful for PICES to communicate with other similar organizations, NGOs and scientists interested in marine ecosystem. PICES produces significant results from scientific studies with collaboration among PICES member and/or other communities, and scientific information on the understanding of the North Pacific ecosystem. In fact, a new Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish* will be established jointly with ICES.

PICES should have more communication with government and/or marine policy makers, with NGOs, and the general public, who are expected to shape public opinion. We believe that PICES has more social contributions through PICES products.

To increase inroads of PICES activities, including scientific advice to any audience, it is very important to make messages through the local language, especially for countries not using English as an official language. It might be proposed that one of the first steps could be the development of additional local language pages, such as Chinese, Korean, Russian and Japanese, into the current website.

Mass media is one of the most influential approaches to the general public, at least in Japan. They tend to be eager to know of environmental issues from any scientific communities by the local language. To deliver to the general public, we should pay more attention to the use of common words instead of scientific or technical terms.

However, we should consider both of the limited Secretariat resources and the different situations of PICES member countries, so we should not rely on the current Secretariat or newly internal structures to resolve any language barriers, as well education for the general public. Each country should keep paying for this effort on a voluntary basis.

Printed matter can also be useful for people, including government officials, because they may lack the expertise to access and collect on-line information in the same way as scientists.

1. Sylvain Paradis (Canada) noticed that the group did not identify all PICES objectives for communications.
2. He also proposed to take clips of interviews with leading marine scientists and make them available on the Internet. (So, as we discussed, to reach a broader audience, PICES needs to communicate not only texts but multimedia stuff as well.)
3. George Boehlert (USA) informed that people who train science writers will be invited to participate at the PICES Annual Meeting in Portland, USA, in 2010.
4. Tokio Wada recommended circulating the report to all Standing Committees.
5. After preparing the final report by the end of November, SG-COM will be disbanded. Governing Council will make a decision on how to treat PICES communication issues in the future, probably in Sendai.

Darlene Smith and Yukimasa Ishida participated in the GC meeting and can provide additional comments.

SUMMARY OF SCIENTIFIC SESSIONS AND WORKSHOPS

Science Board Symposium (S1)
Understanding ecosystem dynamics and pursuing ecosystem approaches to management

Co-Convenors: John E. Stein (SB), Michael J. Dagg (BIO), Mikhail Stepanenko (FIS), Glen Jamieson (MEQ), Hiroya Sugisaki (MONITOR), Michael G. Foreman (POC), Bernard A. Megrey (TCODE), Harold P. Batchelder (CCCC), Michio J. Kishi (CCCC), Fangli Qiao (China) and Sinjae Yoo (Korea)

Background

PICES undertakes a new science program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems), to understand the responses of marine ecosystems in the North Pacific to climate change and human activities, having the major questions: 1) How does ecosystem structure and function determine an ecosystem's response to natural and anthropogenic forcing? 2) How do physical and chemical processes respond to natural and anthropogenic forcing and how are ecosystems likely to respond to these changes in abiotic processes? 3) How do human activities impact coastal marine ecosystems and their interactions with offshore and terrestrial systems. We have only a limited ability to forecast how marine ecosystems will be affected by the changing global climate. Consequently, we still have limited knowledge on the assessment and management of marine ecosystems. Under this situation, it is necessary to improve our understanding of ecosystem structure and function, ecosystem stability and resilience, and to understand and quantify the impacts of human activities and climate on marine ecosystems. It is urgent that we develop and adopt a comprehensive ecosystem-based approach which will be required to manage depleted and deteriorated marine ecosystems. To this end, breakthroughs have to be made in many areas, including evaluation of ecosystem status.

List of papers

Oral presentations

Chang Ik Zhang (Keynote)
Ecosystem-based fisheries assessment and management: A step towards FUTURE implementation of ecosystem approaches to management

John K. Pinnegar, Steven Mackinson, Kathryn Keeble and Georg H. Engelhard
How does ecosystem structure and function determine the response to natural and anthropogenic forcing?

Suam Kim, Ana L. Rosa, Sang-Wook Yeh, Chung I. Lee, Sukyung Kang, Sinjae Yoo, Hyunwoo Kang and Yasunori Sakurai (Invited)
Effects of atmospheric and oceanographic variability on the common squid (*Todarodes pacificus*) in Korean and Japanese waters during the last 30 years

William Crawford and James Irvine
A group approach to understanding ecosystem dynamics in the northeast Pacific

William J. Sydeman, Jarrod A. Santora, Stephen Ralston, Nandita Sarkar, Steven J. Bograd, and Robert M. Suryan
Krill of the California Current: Predictive habitat modeling for ecosystem protection?

Mitsutaku Makino, Chikako Watanabe, Masahito Hirota and Takumi Mitani (Invited)
Understanding the interactions between ecosystem structure and fisheries structure: The case of the sardine, anchovy, chub mackerel, and purse seine fisheries in Japan

Franz J. Mueter and Michael A. Litzow (Invited)
The spatial footprint of biological re-organization in a demersal community

Hiroshige Tanaka, Seiji Ohshimo and Yoshiaki Hiyama
Long-term fluctuations in the biomass of sardine *Sardinops melanostictus* in the western Japanese waters (Sea of Japan and East China Sea) from 1953 to 2008, in relation to climate variability

Chang Ik Zhang, Jennifer Boldt, Angie Greig, Anne B. Hollowed and Patricia Livingston
An assessment of fisheries management strategies in Alaska relative to the goals of ecosystem approaches to management

Michael Sinclair (Invited)
Ecosystem approach to management: The Scotian Shelf example

Erlend Moksness
Major human activities affecting Norwegian coastal marine ecosystems: Present status and challenges

Tony Smith, Beth Fulton and David Smith (Invited)
Ecosystem approaches to managing marine systems – the human dimension

Wei Zheng, Zongling Wang and Min gyuan Zhu
Impact of human activities on marine ecosystem services

Peter S. Ross
The pulse of the Pacific: Can science respond effectively to a changing ocean?

Posters

Lidia T. Kovekovdova and Mikhail V. Simokon
Environmental assessment of the rivers of Peter the Great Bay basin (Japan/East Sea)

Mayuko Tomida, Nobuyuki Miyazaki and Masahide Kaeriyama
Biotransport of POPs by salmonids in the North Pacific

Olga N. Lukyanova, Andrey P. Chernyaev, Nikolay V. Kolpakov and Anna S. Vazhova
Environmental impact assessment in the estuarine ecosystems of Peter the Great Bay (Japan/East Sea)

Sanae Chiba, Kazuaki Tadokoro, Akira Kuwata and Hiroya Sugisaki
Bottom-up control of multi-decadal variation of the western North Pacific ecosystem revealed by stable isotope ratio analysis

Shan Gao, Hui Wang, Guimei Liu and Liyin Wan
Temporal and spatial distribution of marine primary production in the South China Sea (SCS)

Hai Li, Jing Yang and Qin-Zheng Liu
Numerical simulation study on primary production in the Bohai Sea in summer, 2006

Hui Wang, Guimei Liu, Shan Gao and Hua Jiang
Response of marine primary production to monsoon variations in the South China Sea

Hyunju Seo, Hideaki Kudo and Masahide Kaeriyama
Causal linkage among growth, survival, and intra-population interactions of Hokkaido chum salmon related to climate changes in 1945-2005

Vladimir Krapivin and Ferdenant Mkrtchyan
An adaptive technology for Nature/Society System biocomplexity assessments

An-Yi Tsai, Kuo-Ping Chiang, Ciou-Jyu Wang and Gwo-Ching Gong
The impact of the Changjiang River plume extension on the nanoflagellate community in the East China Sea

Felipe Hurtado-Ferro
The role of uncertainty in hypothetical top predator culling programs

Pavel A. Salyuk, Oleg A. Bukin, Alexander Yu. Mayor, Andrey N. Pavlov and Konstantin A. Shmirko
Atmosphere aerosol and marine ecosystems after Sarychev Peak volcano eruption of June 2009

Joong Ki Choi, Jae Hoon Noh, Sung Hwan Cho, Seung Yoon Park and Youngju Lee
Long term change of phytoplankton ecology in the eastern part of the Yellow Sea

Seok-Hyun Youn, Yu-Mi Jun, Jae-Dong Hwang, Yong-Hwa Lee, Hyun-Gook Jin, Jung-Min Shim, Young-Suk Kim and Ki-Young Kwon
Egg production of copepod *Acartia omorii* in the coastal waters of Korea

Young-Sang Suh, Ki-Tack Seong, Jae-Dong Hwang, and Yeong Gong
Mixed layer depth in the high production region off Korea

Jae Bong Lee, Dong Woo Lee, Yeong Min Choi, Chang Ik Zhang, Myoung Ho Sohn, Sung Il Lee, Young Il Seo, Sang Chul Yoon, Yoo Jung Kwon, Jong Hee Lee, Hee Won Park, Young Jae Shin, Do Hoon Kim, In-Ja Yeon, Heui Chun An and Dae Soo Chang
A comparative study on the ecosystem risk indices of Korean waters

FIS Topic Session (S2)
Ecosystem-based approaches for the assessment of fisheries under data-limited situations

Co-Convenors**:** Yukimasa Ishida (Japan), Gordon H. Kruse (U.S.A.), Patricia Livingston (U.S.A.), Laura Richards (Canada), Mikhail Stepanenko (Russia) and Chang Ik Zhang (Korea)

Background

The World Summit on the Sustainable Development recommended implementation of the ecosystem-based management by 2010. Achievement of this goal will require holistic assessment and management of fisheries resources and their associated habitat and ecosystems. Therefore, consideration must be given to ecological interactions of target species with predators, competitors, and prey species, bycatch species, interactions between fishes and their habitat, and the effects of fishing on fish stocks and their ecosystems. The challenge associated with implementation of ecosystem-based management is the design of an approach that is capable of capturing the complexity of the system, while at the same time dealing with the varying quality and quantity of available information. The Ecological Risk Assessment for the Effects of Fishing (ERAEF) approach developed by Australia and the Marine Stewardship Council's Fisheries Assessment Methodology provide two examples of pragmatic approaches. This session encouraged contributions that: 1) describe the data and/or information requirements for the application of ecosystem-based assessments, 2) review existing and emerging ecosystem-based assessment methodologies, 3) describe indicators and reference points for these assessments, 4) identify research activities needed for developing an integrated framework for assessments, and 5) discuss indices for evaluating and assessing the ecosystem status and management. Selected oral and poster presentations from this session were to be considered for publication in a peer-reviewed journal.

Summary of presentations

During this session, 16 oral presentations were given and three posters were presented. Pursuant to the solicitation of papers, two presentations addressed data and/or information requirements for the application of ecosystem-based assessments, five papers addressed existing and emerging ecosystem-based assessment methodologies, four presentations described indicators and reference points for these assessments, four presentations identified research activities needed for developing an integrated framework for assessments, three presentations discussed indices for evaluating and assessing the ecosystem status and management, and one other presentation was given.

Invited speaker Tony Smith provided a pragmatic approach to conducting ecological risk assessments based on available information levels. A scale intensity consequences analysis (SICA) provided an approach for qualitative assessments for information-poor situations. For situations with somewhat more information, a productivity susceptibility analysis (PSA) provides a semi-quantitative approach. For situations with higher levels of information, a variety of approaches are available including SAFE, which is a quantitative version of PSA. A second invited speaker, Yimin Ye, discussed the justification for the ecosystem approach to fisheries and applied examples to two data-limited situations – the Gulf of Thailand and South China Sea.

Inja Yeon applied the IFRAME approach to the trammel net fishery for blue crabs in Korea. Jung Hyun Lim developed a size-based approach to assess the sustainability for IFRAME. In this approach, new size-based indicators were developed and applied to the Jacopever rockfish in a marine ranching area in Korea. Bern Megrey also provided an approach toward length-based assessments for data-limited situations, as reported by Zhang and Megrey (2006).

Anne Hollowed reported on the application of the PSA (introduced by Tony Smith) to U.S. fisheries, with particular application to Alaska. Vulnerability was assessed as a combination of productivity and susceptibility. Jae Bong Lee reported on an integrated ecosystem-based fishery management system and conducted a risk assessment of yellow goosefish, skate ray, and mackerel.

Dohoon Kim gave a presentation on the development of socioeconomic indicators for fisheries, such as Maximum Economic Yield, income per person, profit per sale, employment rate and others. Chang Seung reported on a multi-attribute utility function approach to developing socio-economic indicators for fisheries in Alaska. These presentations represent significant developments on incorporation of socio-economics into ecosystem-based fishery management, and area requiring further research.

A presentation by Yukimasa Ishida described ecolabelling of fishery products in Japan, with a specific case study of the Kyoto Danish seine fishery. Masahi Nishimura presented additional information on the marine ecolabel program in Japan, which was launched in December 2007. This approach has only been applied to wild fisheries in Japan so far. It is similar to the Marine Stewardship Council's approach and has been applied thus far to a freshwater clam, red snow crab, and a shrimp fishery.

In her presentation, Laura Richards asked the question whether necessary data were being collected for ecosystem-based fishery management, and provided case studies from Canada, including Fraser River sockeye salmon, in which a change in behavior in the late (fall) run to earlier returns was observed, which was surprising, given higher mortality rates during in-river migrations during higher late summer temperatures. As another example, chronic overforecast of summer run returns was particularly acute in 2009. The record low marine survival was unexpected and followed record high freshwater survival.

Jon Schnute gave a thought-provoking talk on models, perceived reality, and real systems, as well as perspectives on approaches on the role of models and how we should understand and apply them in the future.

The role of climate and fisheries was examined in three studies. Yongjun Tian examined the role of climate changes and trawling effects in the Sea of Japan. Climate appeared to be responsible for primary effects, and trawling effects varied by climate regime. Sukgeun Jung examined climate-driven ecosystem shifts in Korean coastal waters fisheries, which target species, such as hairtail, mackerel, saury, croaker and anchovy. Finally, Reka Domokos presented an analysis of the effects of seasonal monsoons in Borneo on the set-up of coastal upwelling and the south equatorial counter current (SECC). This upwelling-derived current occurs in winter, and is manifested in the EEZ off American Samoa in spring (about 3 months later). CPUE of albacore tuna in the American Samoan EEZ was closely related to the intensity of the SECC.

In summary, this session attracted a good attendance of PICES participants during this full-day session. Papers presented covered a diverse array of topics related to the development of indicators, risk assessments, and case studies, including analyses of climate versus fishing effects.

List of papers

Oral presentations

Tony Smith, Alistair Hobday, Shijie Zhou, David Johnson and Keith Sainsbury (Invited)
Ecological risk assessment for fisheries: Applications in Australia and in the Marine Stewardship Council

Kozo Ishii, Atsushi Yamasaki and Yukimasa Ishida
First Marine Stewardship Council (MSC) ecolabelling of fishery products from marine capture fisheries in Japan

Inja Yeon, Chang Ik Zhang, M.H. Shon, H.J. Whang, Kwangho Choi, J.H. Lee and Yang-Jae Im
Ecosystem–based approach for blue crab stock assessment and management strategies in the West Sea of Korea

Masahi Nishimura, Ken Kobayashi and Yukimasa Ishida
Marine Ecolabel Japan (MEL Japan): New ecolabelling of fishery products from marine capture fisheries in Japan

Jung Hyun Lim, Jae Bong Lee and Chang Ik Zhang
Using size-based indicators to assess the sustainability for IFRAME

Laura Richards
Research requirements for ecosystem-based assessments

Jong Hee Lee, Jae Bong Lee, Chang Ik Zhang, Dong Woo Lee and Dae Soo Chang
Determining indicators and compatible reference points to assess coastal marine ecosystem risks

Chang Ik Zhang and Bernard A. Megrey
A length-based stock assessment framework for data-deficient situations

Kevern Cochrane and Yimin Ye (Invited)
Using ecological indicators in the context of an ecosystem approach to fisheries for data-limited fisheries

Paul Spencer, Olav Ormseth, Anne B. Hollowed and Patricia Livingston
Analyzing the vulnerability of fish stocks in the North Pacific Ocean

Jon Schnute *et al.*
Ecosystem models: Can we trust ourselves?

Chang Seung and Chang Ik Zhang
Multi-attribute utility function approach to developing socio-economic indicators for Alaska fisheries

Yongjun Tian, Hideaki Kidokoro and Tadanori Fujino
Interannual-decadal variability of demersal fish community in the Japan Sea: Impacts of climate regime shifts and trawl fishing with recommendations for ecosystem-based management

Sukgeun Jung, Young Shil Kang, Dong-woo Lee, Young-Sang Suh, Sukyung Kang and Yeong Gong
Climate-driven ecosystem shifts indicated in fishery catch statistics from Korean coastal waters over 1968-2008

Dohoon Kim and Chang Ik Zhang
Developing socioeconomic indicators for an ecosystem-based fisheries approach

Vladimir B. Darnitskiy
Seamount ecosystems – oceanographic environment

Posters

Saang Yoon Hyun and Rishi Sharma
Integrated forecasts of fall Chinook salmon returns to the Columbia River

Hyeok Chan Kwon, Sang Chul Yoon, Sung Il Lee, Young Yull Chun, Jong Bin Kim and Chang Ik Zhang
An ecosystem-based fisheries resource assessment for the gillnet fishery of the Uljin marine ranch ecosystem in Korean waters

Young Jae Shin, Jae Bong Lee and Chang Ik Zhang
A systematic approach for estimating potential fishery yields of data-deficient, small-scale coastal fisheries in Korea

FIS/BIO Topic Session (S3)
Early life stages of marine resources as indicators of climate variability and ecosystem resilience

Co-sponsored by ICES
Co-Convenors: Richard Brodeur (U.S.A.), Mark Dickey-Collas (The Netherlands), Douglas E. Hay (Canada), Suam Kim (Korea), Gordon Kruse (U.S.A.) Vladimir Radchenko (Russia) and Yoshiro Watanabe (Japan)

Background

As management strategies become more ecosystem-based and climate-driven, there is a need for more information on the role of species interactions and oceanographic variability in regulating fisheries resources. The early life stage of fish and invertebrates has been shown to be critical in determining year-class success and subsequent recruitment to the fisheries. This session examined changes in the abundance, distribution, and ecological relationships of early life stages (eggs to juveniles) of important fish and invertebrate species in relation to climate fluctuations. Studies examining these stages in relation to adult recruitment and their use as indicators of ecosystem stress or variability were invited. Examples of the uses of ichthyoplankton or juvenile surveys in the assessment or management of stocks and in forecasting future trends in fisheries were highly encouraged. The session was especially interested in papers that examined the role of early life stage work relative to ecosystem structure and vulnerability of ecosystems to climate change, with particular reference to the processes of recruitment.

Summary of presentations

The papers presented in this session represented a broad geographical and topical spectrum of the work that is being done in the PICES area related to understanding recruitment variability and using larval indices to inform management decisions. The first invited talk gave examples from both sides of the North Atlantic (ICES area) on when early life history studies contributed to our understanding of recruitment dynamics. Despite a concerted effort over several decades, we only have a good understanding on just a few key species, and continual monitoring is necessary as relationships may change with climate variability. The second invited talk took a life history approach to understanding mechanisms related to recruitment variation. Additional talks took a comparative approach, using contrasting species, years, or even decades to illustrate linkages to physical forcing. In some examples, life stages from egg to juveniles showed good correlations with subsequent recruitment indices for different species. In our final invited talk, differing growth rates between species and years helped to explain why anchovies and sardines show inverse production regimes. In summary, much progress has been made in utilizing early life history information in the management of marine fish species but more progress needs to be made in transferring these data to managers.

NOTE: All papers were presented as in schedule except the one by Zhigalov *et al*.

List of papers

Oral presentations

Mark Dickey-Collas and Jonathan A. Hare (Invited)
Ichthyoplankton surveys, great for assessment and day to day management but are they so relevant for understanding the future?

Miriam J. Doyle (Invited)
Responding to the call for Ecosystem Based Management of marine fisheries: Perspectives from fish early life history studies in the Northeast Pacific Ocean

Elizabeth A. Logerwell, Janet Duffy-Anderson, Matt Wilson and Denise McKelvey
Processes affecting the productivity of capelin and pollock in the Gulf of Alaska

Sukgeun Jung, Dong-woo Lee, Yeonghye Kim, Hyung Kee Cha, Hak-jin Hwang and Jeongyong Lee
Contrasting recruitment of two gadoid species (*Gadus macrocephalus* vs. *Theragra chalcogramma*) to Korean coastal waters in relation to climate change

Lu Guan, John Dower and Skip McKinnell
Quantifying long-term variability in composition of the Strait of Georgia ichthyoplankton community

Andrey Suntsov and Tony Koslow
Nearshore ichthyoplankton communities off southern and central California

Richard D. Brodeur, Toby Auth, Elizabeth A. Daly and William T. Peterson
Ichthyoplankton as indicators of climate change and recruitment variability of marine fishes and salmon along the northwest coast of the US

Jun Shoji, Yasuhiro Kamimura, Ken-ichiro Mizuno and Shun-ichi Toshito
Fish production in seagrass habitat under global warming: Effects of temperature on early growth and production of a dominant species, black rockfish, in temperate waters of the western North Pacific

John C. Field, Stephen Ralston and Keith Sakuma
Rockfish (***Sebastes***) recruitment and ecosystem indicators for the Southern California Current

Chiyuki Sassa and Youichi Tsukamoto
Distribution and growth of chub mackerel *Scomber japonicus* and spotted mackerel *S. australasicus* larvae in the southern East China Sea (ECS) in response to oceanographic conditions

David Checkley, Yoshioki Oozeki, Sam McClatchie, and Akinori Takasuka
Comparison of spawning habitats of anchovy and sardine in the Pacific Ocean off Japan and North America

Motomitsu Takahashi (Invited)
Contrasting responses in growth rates between anchovy and sardine to changes in water structures in the eastern and western North Pacific

Masahide Kaeriyama, Hideaki Kudo, and Hyunju Seo
Global warming effects on the early ocean life of Hokkaido chum salmon

Igor Zhigalov, Alexander Figurkin and Svetlana Ovsyannikova
Oceanographic conditions and the distribution of walleye pollock eggs in the southern Kuril Islands region during March – April of 2006 and 2007

Yoshiro Watanabe
Linear response of growth rates to ambient temperature in larval round herring *Etrumeus teres* in the Pacific coastal waters off southern Japan

Nam-Il Won, Tomohiko Kawamura, Hideki Takami and Yoshiro Watanabe
Food web structures in crustose coralline algae bed during early life stages of abalone *Haliotis discus hannai* in relation with recruitment process

Tadanori Fujino, Hideaki Kidokoro, Tsuneo Goto and Yongjun Tian
Effect of the oceanographic condition on the abundance of mesopelagic fish: *Maurolicus japonicus* in the Japan Sea

Posters

Mikhail A. Zuev
Distribution and abundance of juvenile long armed gonatid squid (*Gonatus madokai*) in the northern Sea of Okhotsk

Chen-Yi Tu, Yu-heng Tseng, Tai-sheng Chiu and Chih-Hao Hsieh
Use particle tracking simulation in hydrodynamic model to investigate spawning migration of Japanese anchovy *Engraulis japonicus* from the East China Sea to Taiwan

Alexander A. Antonov, Irina Yu. Bragina and Elena M. Latkovskaya
Nutrients transport, forage base and survival of juvenile pink salmon in Aniva Bay (south of Sakhalin Island)

Ana L. Rosa, J. Yamamoto and Yasunori Sakurai
Effects of environmental variability on the spawning areas, catch and recruitment of the Japanese common squid, *Todarodes pacificus*

Heeyong Kim, D.H. Kim, Hakjin Hwang and Y.I. Seo
Effect of Siberian High on the catch fluctuation of pacific cod, *Gadus macrocephalus*, in the Yellow Sea

Yuji Okazaki, Hiroshi Kubota, Kaori Takagi, Hiroshi Itoh and Nobuhiro Saito
Feeding ecology of larval and juvenile sardine (*Sardinops melanostictus*) and anchovy (*Engraulis japonicus*) in the western North Pacific

MEQ Topic Session (S4)
Mitigation of harmful algal blooms

Co-Convenors: Hak-Gyoon Kim (Korea) and Mark L. Wells (U.S.A.)

Background

Mitigation includes any method that can reduce the impact or severity of harmful algal blooms (HABs). These methods involve both physical means, such as dispersal of clay to cause flocculation of cells from surface waters, and preventative means, such as better monitoring of coastal waters, allowing selective closures of shellfish beds (in contrast to coast-wide closures). The capability for mitigation and the choice of mitigative tools depend upon the bloom-forming species, the severity of the event, and the frequency and intensity of monitoring in a region. Presentations represented the comprehensive nature of HAB mitigation within the Pacific Rim nations.

List of papers

Oral presentations

J.E. Jack Rensel and Nicola Haigh (Invited)
Fish aquaculture and Harmful Algal Bloom mitigation in marine waters of North America

Hak-Gyoon Kim, Heon-Meen Bae, Chang-Kyu Lee, Yang-Soon Kang, Young-Tae Park, Wol-Ae Lim, Sook-Yang Kim, Jeong-Min Shim, Chang-Su Jung and Kyoung-Ho An (Invited)
Recent approaches on the feasible mitigation and clay dispersal

Ichiro Imai
Promising prevention strategies for harmful algal blooms by utilization of seaweed- and seagrassbeds as huge sources of algicidal bacteria

Donald M. Anderson
Suppression and control of harmful algal blooms: The slow pace of progress in an important area of HAB science

Eunhye Kim, Daeuk Kim, Hyungbeen Lee, Jungyul Na, Jee Woong Choi and Donhyug Kang
A feasibility study on the acoustic monitoring of *Cochlodinium Polykrikoides* blooms and mitigation by ship-mounted cavitation generating system

Young Baek Son, Joji Ishizaka and Young-Sang Suh
The spectral discrimination of surface harmful algal bloom in complicated coastal water conditions

Bum Soo Park, Rose Ann Cattolico, Seung Ho Baek, Jang Seu Ki, Yang Ho Yoon and Myung-Soo Han
Improvement of quantitative real-time PCR assay based on SYBR green for Raphydophytes: A field applicability test

Goh Onitsuka, Naoki Hirose, Kazutaka Miyahara, Shuyo Watanabe, Hitoshi Semura, Reiko Hori and Tetsuya Nishikawa
Monitoring and modeling of *Cochlodinium polykrikoides* bloom in the southwestern Sea of Japan

Takafumi Yoshida and Hidemasa Yamamoto
HAB Integrated Website demonstration

Dongyan Liu, John K. Keesing, Zhijun Dong, Yu Zhen, Baoping Di, Yajun Shi and Ping Shi
Coastal *Porphyra* aquaculture as a nursery for large scale green tide events in the Yellow Sea

Posters

Marina S. Selina, Tatiana V. Morozova and Tatiana Yu. Orlova
Species composition and seasonal changes in epiphytic dinoflagellates in Russian coastal waters of the Sea of Japan

Chunjiang Guan, Fengao Lin and Xiutang Yuan
Causes of 2008 green tide bloom in Yellow Sea and estimation for the absorption of C, N and H

MEQ Topic Session (S5)
The role of submerged aquatic vegetation in the context of climate change

Co-Convenors: Ik-Kyo Chung (Korea) and Hiroshi Kawai (Japan)

Background

This session focused on the practical measures utilizing submerged aquatic vegetation (SAV) such as seaweeds and sea grasses in coping with climate change in coastal regions. The intent was to discuss immediate and practical SAV measures that mitigate and adapt against global warming and sea level rise. Participants presented work highlighting their ideas on such practical measures against climate change and global warming as well as on other pertinent subjects.

Summary of presentations

The Covenors welcomed participants with a brief introduction on 'blue carbon, carbon captured by marine living organisms.' This session included presentations that described:

- emphasis of the role of submerged aquatic vegetations (SAV), seaweeds and seagrasses as blue carbon, and their ecosystem services;
- seaweed (red algae) pulp and paper as a practical mitigation measure, by reducing deforestation and producing bio-ethanol from the by-product of pulping;
- the estimation of carbon sequestration by seaweed beds and development of a pilot seaweed Clean Development Mechanisms;
- the construction of a seaweed farm on artificial reefs with bioslag as a mitigation and adaptation measures in the context of climate change;
- the assessment of climate impacts in aquaculture activities and development of managing tools using modeling techniques;

- research on the basic knowledge of SAV such as their productivities, seasonal variation, grazing, *etc*.;
- the introduction of the Asian Network for Using Algae as a CO_2 Sink, a working group of the Asian Pacific Phycological Association;
- an introduction of draft strategies for climate change adaptation in Korea.

List of papers

Oral presentations

Xuelei Zhang, X.J. Zhang and J.W. Wang
Restoration of seagrass/algal beds as a measure to abate climate change

Kwang-Seok Park, Hyung-Suek Kim, Heon-Woo Park, Gun-Mok Sohn and Hyeon Park
Climate change adaptation using seaweed beds of BioSlag in marine environment

I Nyoman Radiarta, Sei-Ichi Saitoh and Toru Hirawake
The impact of climate change on the development of marine aquaculture: a case study on Japanese scallop aquaculture in Funka Bay, Hokkaido, Japan

Seokjin Yoon and Michio J. Kishi
Estimation of the role of eelgrass and associated epiphytic algae on the carbon cycle in Akkeshi Lake, Japan

Taehee Na, Ik-Kyo Chung and Tongsup Lee
Estimation of carbon sequestration by seaweed beds

Hack-Churl You, Munho Sohn and Grevo Gerung
Red-algae pulp and paper, bio-ethanol

Sang Yong Lee and Yong-Gun Gong
Seasonal variation in $\delta^{13}C$ and $\delta^{15}N$ values for the temperate seagrass *Zostera marina* and its relation to leaf production

Tatyana N. Krupnova, Vladimir A. Pavlyuchkov, and Vera V. Agarkova
Resource management of sea urchins *Strongylocentrotus intermedius* on the basis of its biotic relations with brown alga *Laminaria Japonica*

Posters

Jin Ae Lee, Jung Hyun Oak and Siew-Moi Phang
The Asian Network for Using Algae as a CO_2 Sink of the Asian Pacific Phycological Association

Sang Rul Park and Kun-Seop Lee
Growth and photosynthetic characteristics of three *Zostera* spp. (*Z. japonica*, *Z. marina* and *Z. caespitosa*) along vertical gradient: implications for seagrass zonation

Ik Kyo Chung, Kwang-Seok Park, Hyung-Suek Kim, Jin-Hwan Hwang, Jae-Young Lee and Jung Hyun Oak
Research and development roadmap for climate change adaptation and CO_2 mitigation in the Korean maritime & fisheries sector

Miryang Kim, Jeong Chan Kang, Jong Chul Lee and Myung Sook Kim
Subtidal macroalgal species diversity during wintertime in Jeju Island, Korea

Seong Cheol Kim, Mi Sook Hwang, Jae Min Baek, Seock Jung Han, Nack Joong Choi, Mi kyung Choe, and Moon Ho Yang
Management of artificial coastal CO_2 removal belt in Korea

Yoon seok Choi, Choonkoo Jung and Min-woo Park
The effect of geochemical characteristics and environmental factors on the growth of cultured Ark shell *Scapharca broughtonii* at several shellfish-farming bays on the south coast of Korea

MEQ/FIS Topic Session (S6)
Marine spatial planning in support of integrated management – tools, methods, and approaches

Co-Conveners: Glen Jamieson (Canada), Vladimir Shulkin (NOWPAP, Russia) and Chang-Ik Zhang (Korea)

Marine spatial planning (MSP) is being used in an increasing number of jurisdictions as part of a strategic approach to achieving sustainable development in the marine environment. While the concepts of integrated management (IM) and MSP are now often included in marine policy, it is still unclear how they will be practically implemented and to what end. Conservation, conflict resolution to address multiple human uses,

and implementation of an ecosystem approach to oceans management are all important drivers for MSP. The most obvious elements of MSP include marine protected or spatially regulated areas designed to meet one or more objectives of IM, and assessment of the interactions between multiple sectors. PICES science has a role to play in the development of methods to support MSP.

This session explored developments in MSP under three topics: the role of MSP in achieving IM objectives, criteria foridentifying, mapping and assessing cumulative impacts of multiple human activities, and guidelines for the planning of MPAs to meet cross-sectorial IM objectives, using case studies to describe recent experiences of MSP.

A number of presentations in this session identified the importance of a defined set of objectives to guide the planning process. It was generally recognised that ecosystem objectives (also referred to as environmental or conservation objectives) and their associated reference levels to ensure ecosystem sustainability should be determined by scientists and should be non-negotiable, while determination of socio-economic objectives will require significant input and consultation to address the competing interests of different stakeholders. The need to evaluate multiple and potentially conflicting objectives, and the role that society will play in the resolution of these interactions, will involve the increased use of interactive web-based tools to communicate to a wider community.

Identifying the appropriate ecosystem components for conservation can be a challenging task. In Norway, particularly valuable areas are identified based on their importance to biological production, biodiversity or as key habitats to threatened or vulnerable species. Use of risk assessments to identify priority activities and components for management action was also highlighted.

Another approach was the use of spatial tools and analysis to investigate the response of species and habitats to both human and natural disturbance and to explore concepts of sensitivity, vulnerability, and recoverability. For example, models incorporating spatially defined marine parameters such as depth, substrate type, and bottom temperature were used to characterize benthic habitats and predict the sensitivity of these habitats to human disturbance (including potential rates of recovery). These types of tools are now being used to identify priority areas for conservation, and may have future application elsewhere. Spatial tools can also be used to help maximize ecosystem benefits (i.e. maintain ecosystem function or goods and services) while minimising societal costs, thereby optimising the provision of relevant management measures.

While much of the session focussed on the use of spatial planning to address fisheries impacts and issues, spatial considerations were also demonstrated for aquaculture, eutrophication, ocean ranching, and other coastal management concerns. The integration of information from a broad range of human pressures is essential for successful cumulative effects assessment. Several talks provided examples of the different types of management tools that can be applied within the marine environment, including area-based and seasonal closures, as well as gear-based technical measures applicable for mobile species with no fixed spatial location. The extensive use of geo-referenced data to produce maps, develop models and tools, and identify and assess habitats and/or sectoral interactions is now common, and will become increasingly important as plans become more multisectoral and complex.

The development of MPA networks continues to be a key focus for many scientists and technical experts. While MPA network design and evaluation (*e.g.*, determining the degree of connectivity, representativity, or coherence of sites) remains an ongoing challenge, a number of case studies and approaches (*e.g.*, site-selection algorithms such as MARXAN) demonstrated significant progress. However, site-selection algorithms such as MARXAN and related software can generate multiple solutions to the same set of objectives, and it is important to clarify objectives and related input criteria at the start of the process. Rather than being used in a prescriptive manner, these tools can also be used to generate discussion among stakeholders regarding the costs and benefits of various management options, leading to more informed decision-making.

Examples of how MSP has worked in different regional seas or national waters highlighted the importance of clarifying its purpose, and to get acceptance of the process from all key stakeholder groups. Although the focus of the session was marine ecosystems, it was noted that land-use plans that manage important watersheds must also be accounted for when developing marine plans, particularly in coastal areas. There was a general feeling that integrated planning in both terrestrial and marine ecosystems is increasingly necessary in many nearshore areas in particular, and that the necessary datasets, tools and approaches to allow this are in place. Required next steps must be political and legislative support, and broader stakeholder engagement.

Conclusions

This session was the first opportunity in PICES to discuss integrated, multi-sectoral issues in the context of marine planning. As expected from this largely ICES audience, many of the presentations explored the interaction between the ecosystem and fishing. As the single largest impact in many of our regional seas, this is understandable and the emphasis is to be expected. In the future, however, PICES will increasingly be required to assess ecosystem impacts of many competing sectors simultaneously; the implications for how science addresses these issues are considerable.

List of papers

Oral presentations

Erik Olsen and Fanny Douvere (Invited)
Marine spatial planning: A practical approach to ecosystem-based management

Michio J. Kishi, Ayaka Sakamoto and Kenta Awa
Basic idea on ecosystem based management for aquaculture and artificially released chum salmon

Brett R. Dumbauld
Managing estuarine resources at the landscape scale in Willapa Bay, Washington and similar U.S. West Coast estuaries

Jong-Deuk Bang, Jung-Pyo Hong, Sang Un Park, Jung-Yeong Lee, Jae-Yeong Lee, Im-Gi Jeon and Jong-Hun Na
Marine enhancement program in Korean Peninsula: Introduction of marine ranching programs

Hidemasa Yamamoto
Procedures for assessment of eutrophication status developed by NOWPAP CEARAC

Ivan S. Arzamastsev
Zoning of Far Eastern Seas for integrated nature management

Blake E. Feist, Carolina Parada, Kevin E. See and David A. Armstrong
Using ROMS ocean circulation models to predict the range expansion of non-indigenous European green crab (*Carcinus maenas*) along the west coast of North America

Anatoly Kachur (Invited)
Marine spatial planning in support of integrated management in North West Pacific Region – tools, methods, and approaches

David Nicolson, Natalie Ban, Julie Beaumont, Karin Bodtker, Christopher Bos, Tanya Bryan, Andrew Day, Glen Jamieson, Lynn Lee, Greg MacMillan, Glen Rasmussen, Charlie Short, Bruce Turris and Karen Topelko
Generating information to support integrated marine planning: Advantages and challenges of a collaborative approach

Ian M. Dutton, Kerrie Wilson and Hedley Grantham
Making marine spatial planning real: Bridging the gap from planning to action

Robinson Mugo, Sei-Ichi Saitoh, Akira Nihira and Tadaaki Kuroyama
Spatial prediction of skipjack tuna catch rates from remote sensing and geo-statistical approaches: Some tools for fisheries spatial planning and management in the western North Pacific

Vladimir Shulkin
Spatial zoning of the sea coastal areas by the land-based influences as a part of ICARM

Ning Lin, Nanyan Huang, Wenbin Xu and Qian Wang
Evaluation of marine function zoning: Research and practice in China

Li-Feng Lu, Yasumasa Miyazawa, Kazuo Nadaoka, Sergey M. Varlamov and Aditya R. Kartadikaria
Responses of surface current and temperature to the local wind and tidal forcing within Sekisei Lagoon, Japan and their application to the regional coral reef connectivity

Erik Olsen
Marine spatial planning in Norway: Lessons learned from developing and implementing integrated management plans for the Norwegian and Barents seas

MONITOR Topic Session (S7)
State of the art of real-time monitoring and its implication for the FUTURE oceanographic study

Co-Convenors: Jack Barth (U.S.A.), Dake Chen (China), David L. Mackas (Canada), Vyacheslav Lobanov (Russia), Young Jae Ro (Korea) and Hiroya Sugisaki (Japan)

Background

As the technology for the Ocean Sciences and Engineering is advanced rapidly, the real-time data production will revolutionize the field investigation and laboratory analysis in many ways which will have the impact over the entire oceanographic paradigm in the end. This session reviewed the state of art technology for the ocean investigation on a real-time and/or near real-time basis and discussed the impact on the research and educational horizons made possible by it. Each PICES member country demonstrated its ocean monitoring network and application. Exhibits from ocean monitoring companies were set up in conjunction with this session.

Summary of presentations

The morning session began with an invited presentation by Howard Freeland (S7-5645) who described the current status of the Argo program, ongoing since October 1999. The total number of floats are exceeding 3300 and 90% of profiles are available in near real-time. He discussed the experiences of success and failure from over the last decade. The Japanese monitoring experiences were introduced by Tsuyoshi Kitamoto (S7-5765) to address the concerns of pollutants around Japan in the deep marine waters down to 4000 m and 100 miles offshore. His and co-authors' results showed the concentrations of dioxins in coastal sediments are higher near big cities than in offshore areas. Elena Shtraikhert (S7-5593) spoke about the seasonal variation of chlorophyll-*a* concentrations in Peter-the-Great Bay by using satellite imageries. Springtime maxima were found and wind-induced upwelling caused the increase at the northeastern part of the bay. Young Baek Son (S7-5665) introduced a method for classification of water type and red tide in complex coastal water conditions using MODIS remote sensing data which was successfully applied to the South Sea of Korea where *Cochlodinium polykrikoides* blooms and there are various water types.

The second half of the morning session began with an invited presentation by Kelly Benoit-Bird (S7-5649), who described intense trophic and spatial interactions among phytoplankton and zooplankton thin layers, and migratory micronekton (myctophids) and top predators (dolphins), as revealed by a diverse and sophisticated array of acoustic moorings and profilers. This talk was very lively and interesting, stimulated many audience questions, and was later voted as the 2009 "best presentation" for a topic session sponsored by MONITOR. Hiro Sugisaki (S7-5611) next described integration of a profiling echosounder with a stereo video system (J-QUEST), and the utility of this combined system for adding species composition to the biomass distribution data provided by acoustics. The color spectrum for the video light source is an important engineering choice in this and other underwater video applications. Dmitry Strobykin (S7-5740) spoke on a multiplex send-receive acoustic array, and how inverse analysis of acoustic travel times can be used to reconstruct variability of temperature stratification and internal waves in coastal environments. The final talk of the morning session was by Natheer Alabsi (S7-5929). This lab study described new ways to monitor the swimming behavior of Alfonsino (*Beryx splendens* - a seamount-resident fish very vulnerable to intense fishing pressure). Acceleration data was from miniaturized data-loggers attached to the fish, and provided good estimates of diel variability of swimming rate and body orientation.

The afternoon session was opened with an invited presentation by Tomowo Watanabe (S7-5932) who, on behalf of his co-authors, introduced an ocean monitoring system operated by fisheries institutes of Japan. It is based on the ocean forecast model FRA-JCOPE, developed in cooperation with JAMSTEC, with capability to assimilate real-time oceanographic data obtained by fisheries institutes, which is especially important for coastal areas where Argo drifters and satellite data are not available. The next was a talk by John Calder (who was a replacement for the canceled presentation by John Barth *et al.* (S7-5949)). He described the concept of

the regional ocean observing system for the Arctic Ocean and the challenges for its implementation. The system would cover not only physical and biogeochemical aspects of the ocean but could be expanded to include human dimensions. Tomoharu Senjyu (S7-5894) spoke on joint Japanese-Korean research on monitoring Changjiang Diluted Water around Jeju and Tsushima Straits using fisheries trap-nets. In spite of a rather simple approach, it was possible to trace transport of this water, which has a lower salinity signal and affects primary production through effects on light and nutrients and its entering through the Tsushima Strait and distribution in the Japan Sea. Kwang-Soon Park (S7-5992) spoke on the development of a real-time ocean observing system in Korea which included quite an extensive coastal monitoring network (89 real-time monitoring systems) integrated with remote sensing data and numerical modeling. KORDI implemented this 10-year plan in 2009 through the partnership with other governmental agencies. One of key points of the project is a development and installation of comprehensive ocean observing platforms and buoys in the East-China, Japan and Yellow Seas.

Co-convener's Report: Phil Mundy for Jack Barth (U.S.A.)

The second half of the afternnon session opened with the invited presentation of Dong-Young Lee (S7-5984) who described the concept of the regional ocean observing system and the challenges for its implementation. Data exchange across national boundaries presents a challenge that is to be overcome in implementing the regional GOOS. Shin-ichi Ito (S7-5808) spoke on behalf of his research team regarding a novel application of mooring and glider technologies for collecting observations of the mixed layer formation in the Transition Region Mode Water (TRMW) at a time of year when observation from vessels is very difficult. Yasumasa Miyazawa (S7-5729) spoke on behalf of his research team about the substantial improvements in eddy-resolving reanalysis made possible by assimilation of observations from Japanese fishery research agency sources. David Foley (S7-5953) spoke on behalf of his co-authors on the use of real-time ocean observations off California to forecast the locations and densities of multiple species of marine mammals. Marine mammal forecasts allow naval operations to minimize risk of harm to protected species. Chang S. Kim provided a special presentation on behalf of his research team regarding implementation of the ocean observing system on the recently completed Saemangeum dike and land reclamation area. Extensive ocean and atmospheric observations support model forecasting of ocean conditions to guide management of the reclamation area.

Table 1 Number of presentations by participating nations.

Member courntry	# of orals
Japan	7
Korea	4
USA	3
Russia	2
Canada	1
China	0
Sum	17

Table 1 shows the number of presentations by participating member countries. Table 2 catagorizes the authors with their titles according to suject.

Table 2 List of titles and authors for S7 presentations.

Name	Title	Subject
Elena A. Shtraikhert	Some features of chlorophyll-a concentration distribution in the north-western part of Sea of Japan on the near real-time data	analysis
Young Baek Son	Detecting of *Cochlodinium polykrikoides* blooms using spectral classification at the South Sea of Korea (SSK)	analysis
Kelly J. Benoit-Bird	Trophic cascades in Hawaii's nearshore ecosystem: Using observing technology to understand ecological interactions	analysis
Tomoharu Senjyu	Monitoring of the Changjiang diluted water around the Jeju and Tsushima Straits using fisheries trap-nets	analysis
Yasumasa Miyazawa	Roles of in-situ profile data obtained by Japanese fishery research agencies in quality of the eddy-resolving ocean reanalysis data: FRA-JCOPE2	analysis
Howard J. Freeland	The state of the art of real-time monitoring – The Argo experience	monitor
Tsuyoshi Kitamoto	Has pollution of the sea around Japan become better?: A discussion based on more than 10 years of monitoring at depths up to 4000m.	monitor
Hiroya Sugisaki	Real-time monitoring for mesopelagic fish abundance using J-QUEST integrated system of echosounder and stereo TV cameras	monitor
Dmitry S. Strobykin	Acoustic monitoring of hydrophysical processes in ocean shelf zones	monitor
Tomowo Watanabe	Ocean monitoring system operated by fisheries institutes at waters around Japan	monitor
John A. Calder	Sustaining Arctic Observing Networks - An international process to follow the International Polar Year prototype trials in the Sea of Okhotsk	program
K.S. Park	Development of real-time coastal monitoring network and operational oceanographic system in Korea	program
Dong-Young Lee	Status of real-time data exchange and strategy for the development of regional GOOS	program
Shin-Ichi Ito	A profiling mooring buoy to observe mixed layer formations in the western North Pacific and its combination with a deeper type underwater glider.	program
Chang S.Kim	Long-term monitoring and prediction system for Saemangeum coastal waters in Korea	program
D.G. Foley	Integrating ocean observing data to enhance protected species spatial decision support systems	service
Natheer M. Alabsi	Measurement of swimming behavior of alfonsino Beryx splendens in experimental tank using micro-data logger	Lab Exp.

The MONITOR-sponsored session had a total of 17 oral and 9 poster presentations. We did not receive any submission from China. This needs to be changed in future MONITOR activity. Ten presentations were categorized in MONITOR/Program and 5 presentations were devoted to the analysis of the monitoring activities (Table 2).

1) Most of the presentations (10 out of 17) were devoted to describing and/or addressing on-going monitoring programs in regions of interest spanning from basin to near-shore area. Two presentations (Kim, Park) introduced state-of-art real-time monitoring activities in Korea.
2) Invited presentations of particular interest were made by Kelly Benoit-Bird and Dong-Young Lee. Dr. Benoit introduced state-of-the-art instrumentation for monitoring the ecosystem over the Hawaiian sea-mount where she monitored micro-necton and plankton abundance along with the physical structure such

as density discontinuity and/or layer formation. Dr. Lee introduced recent Near-GOOS activity in which he explained the current status of data exchange among nations and its obstacles before future improvement can be made.

3) David Foley's (NOAA, USA) presentation was a new one for our session. It dealt with decision support systems based on a wide range of information from climatology, remote sensing imagery and numerical model products to predicting or giving advice for public services such as courses of action and asset allocation. This kind of approach seems plausible and is worth looking into to complement our MONITOR session.
4) Another interesting presentation was made by Natheer Alabsi who performed lab experiments to study fishbehavior.

List of papers

Oral presentations

Howard J. Freeland (Invited)
The state of the art of real-time monitoring – The Argo experience

Tsuyoshi Kitamoto, Hirotaka Hamanaka, Asako Toyozumi, Satoshi Tanaka, Hiroko Arataki, Yoichiro Ishibashi, Yukio Kishimoto, Hideaki Nakata, Satoru Futatsumachi, Joji Ishizaka, Hideaki Maki, Shuhei Nishida, Yukihiro Nojiri, Haruo Ogi, Yoshihisa Shirayama and Shinsuke Tanabe
Has pollution of the sea around Japan become better? A discussion based on more than 10 years of monitoring at depths up to 4000m

Elena A. Shtraikhert, Sergey P. Zakharkov and Tatyana N. Gordeychuk
Some features of the distribution chlorophyll *a* in the north-western part of the Sea of Japan based on near real-time data

Young Baek Son, Joji Ishizaka and Young-Sang Suh
Detection of *Cochlodinium polykrikoides* blooms using spectral classification in the South Sea of Korea (SSK)

Kelly J. Benoit-Bird (Invited)
Trophic cascades in Hawaii's nearshore ecosystem: Using observing technology to understand ecological interactions

Hiroya Sugisaki and K. Sawada
Real-time monitoring for mesopelagic fish abundance using J-QUEST integrated system of echosounder and stereo TV cameras

Yury N. Morgunov, Yury A. Polovinka and Dmitry S. Strobykin
Acoustic monitoring of hydrophysical processes in ocean shelf zones

Natheer M. Alabsi, Hideaki Tanoue, Teruhisa Komatsu, Isamu Mitani, Mitsuhiro Kato, Toyomitsu Horii, Ichiro Aoki and Nobuyuki Miyazaki
Measurement of swimming behavior of alfonsino *Beryx splendens* in experimental tank using micro-data logger

Tomowo Watanabe, Manabu Shimizu, Takashi Setou, Hiroshi Kuroda, Masachika Masujima and Makoto Okazaki (Invited)
Ocean monitoring system operated by fisheries institutes at waters around Japan

John A. Barth, Justin Brodersen, Francis Chan, Anatoli Y. Erofeev, Murray D. Levine, Kim Page-Albins, Stephen D. Pierce, Craig Risien, Laura Rubiano-Gomez, R. Kipp Shearman and B. Walton Waldorf
An expanding observatory to monitor hypoxia off the Oregon (U.S.A.) coast

Tomoharu Senjyu, Takeshi Matsuno, Sang-Hyun Kim and Ig-Chang Pang
Monitoring of the Changjiang Diluted Water around the Jeju and Tsushima Straits using fisheries trap-nets

Kwang-Soon Park, Dong-Young Lee, Jae-Il Kwon, Kwan Chang Lim, Sang-Ik Kim and Ki-Chun Jun
Development of real-time coastal monitoring network and operational oceanographic system in Korea

Dong-Young Lee (Invited)
Status of real-time data exchange and strategy for the development of regional GOOS

Gennady A. Kantakov, Viktor S. Tambovsky, Alexey O. Bobkov and Evgeny G. Lunev
Surface currents new data collected during 2008-2009 Argo's ice/ocean drifters. Prototype trials in the Sea of Okhotsk

Yasumasa Miyazawa, Ruo Chao Zhang, Sergey M. Varlamov, Takashi Setou, Daisuke Ambe and Tomowo Watanabe
Roles of *in situ* profile data obtained by Japanese fishery research agencies in quality of the eddyresolving ocean reanalysis data: FRA-JCOPE2

David G. Foley, Elizabeth A. Becker and Karin Forney
Integrating ocean observing data to enhance protected species spatial decision support systems

Posters

Sirajuddin M. Horaginamani and M. Ravichandran
A study on impacts of anthropogenic CO_2 on oceans

Howard J. Freeland and the Argo Steering Team
Argo – An ocean observing system for the 21st century

Xiutang Yuan, Aihua Chen, Yibing Zhou, Haiying Liu and Dazuo Yang
The influence of cadmium on the antioxidant enzyme activities in polychaete *Perinereis aibuhitensis* Grube (Annelida: Polychaeta)

Jingfeng Fan and Hongxia Ming
Fecal coliform and typical enteric virus in representative bathing beaches of China

Zhen Wang, Zhengxian Yang, Dongmei Zhao and Ziwei Yao
Sources and deposition of heavy metals, nutrients and PAHs in the atmosphere of the North Yellow Sea

Shin-ichi Ito, Yugo Shimizu, Shigeho Kakehi, Fumitake Shido, Taku Wagawa, Kazuyuki Uehara, Toshiya Nakano and Masafumi Kamachi
A profiling mooring buoy to observe mixed layer formations in the western North Pacific and its combination with a deeper type underwater glider

Koji Kakinoki, Tatsuro Watanabe, Katsumi Takayama and Osamu Katoh
Behavior of the cold water area off the Sado Island in the Japan Sea detected from satellite altimeter data

Hisashi Yamaguchi, Young Baek Son, Eko Siswanto, Joji Ishizaka, Sinjae Yoo, Yu-Hwan Ahn, Sang-Woo Kim, Junwu Tang, Hiroshi Kawamura and Yoko Kiyomoto
Development and validation of a new satellite chlorophyll *a* algorithm in the Yellow and East China Seas with relation to suspended sediment concentration

Yoshiyuki Nakano, Tetsuichi Fujiki and Shuichi Watanabe
Development of compact drifting buoy for sea surface pCO_2 monitoring

POC/BIO Topic Session (S8)
Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific

Co-Convenors: James Christian (Canada) and Toshiro Saino (Japan)

Background

Accumulation of anthropogenic carbon and associated changes in ocean chemistry ("ocean acidification") affect all of the world's oceans. Anthropogenic CO_2 has multiple feedbacks to ocean chemistry and biology, such as reduction of calcification, shifts in phytoplankton species composition, and dissolution of particulate or sedimentary carbonates. The carbon system can also be affected by other anthropogenic factors such as changes in river flow and aeolian dust deposition. Carbon and nutrient biogeochemistry will be affected both directly and indirectly by ocean acidification. This session invites papers that address the biogeochemistry of anthropogenic carbon (processes controlling its distribution, processes by which it alters ocean chemistry), other anthropogenic impacts on carbon and nutrient cycles, acidification impacts on marine biota, and feedbacks among these.

Summary of presentations

Topic session S8 was held at the Jeju International Conference Center, Jeju, Korea on October 27, 2009. There were 12 oral presentations and 7 posters. The oral session was extremely well attended (80 people signed the attendance sheets) and generated stimulating discussion. A special section of the *Journal of Oceanography* based on the session is planned and a call for papers was issued, with a submission deadline of January 31, 2010.

Topics ranged from estimating the rate of ocean uptake and accumulation of anthropogenic CO_2 to ocean acidification effects on abalone. Dr. Richard Zeebe (U.S.A.) was the invited speaker and gave an excellent

introduction to ocean carbon chemistry and ocean acidification that provided context for subsequent presentations. Many of the presenters referred back to this talk for context and background, giving them more time to talk about their own specific results. Dr. Richard Feely (U.S.A.) reported on upwelling of 'corrosive' CO_2-rich waters onto the North American continental shelf and methods for estimating carbonate saturation states indirectly from temperature, salinity, and oxygen, greatly enlarging the number of cruises and profiles for which these parameters can be estimated. Dr. Shu Saito (Japan) reported on changes in saturation states in the northwestern Pacific since WOCE, and Dr. Tae-Wook Kim (Korea) examined historical trends in the saturation state of the Japan/East Sea. Drs. Jim Christian (Canada) and Keith Rodgers (U.S.A.) looked at future trends in ocean CO_2 uptake and saturation state using global climate models. Dr. Steve Rumrill (U.S.A.) reported on monitoring programs in U.S. estuaries, and the particular vulnerabilities of estuarine organisms. The final block of talks focused on biological topics including impacts on abalone (Dr. Ryu Kimura, Japan), interactions between photosynthesis and calcification in coccolithophorids (Dr. Yoshihiro Shiraiwa, Japan), and effects on ocean acidification on phytoplankton community structure (Dr. Takeo Hama, Japan).

Overall, there was a variety of topics and excellent interactions among presenters of diverse interests including biologists and geochemists, modelers and observationalists. This session lays the groundwork for productive interactions in the FUTURE, between scientists interested in the climatic and biogeochemical processes underlying ocean acidification and those focused on the biological impacts.

List of papers

Oral presentations

Richard E. Zeebe (Invited)
The future ocean: More acid, less calcifying, and more transparent to sound?

Shu Saito and Akihiko Murata
Decadal changes in $CaCO_3$ saturation state along 179°E in the Pacific Ocean

Christopher L. Sabine, Richard A. Feely, François M.M. Morel, Eric S. Egleston and Dana Greeley
Past and present trends in ocean carbon uptake and storage in the North Pacific

Andrey G. Andreev
Inorganic carbon parameters change in the surface waters of the subarctic North Pacific

Tsuneo Ono and A-line monitoring team
Interannual variation of DIC in the Oyashio region along the A-line transect

Lauren W. Juranek, Richard A. Feely, William T. Peterson, Simone R. Alin, Jay Peterson, Kitack Lee, Christopher L. Sabine and Burke Hales
A novel method for determining seasonal variations in aragonite saturation state in the eastern North Pacific continental shelf using multi-parameter analysis

James R. Christian
The future ocean carbon cycle: Projections with the Canadian Earth System Model CanESM1

Keith B. Rodgers, Laurent Bopp, Olivier Aumont, Daniele Iudicone, Jorge L. Sarmiento, Anand Gnanadesikan and John Dunne
Changes in North Pacific ΔpCO_2 and air-sea CO_2 fluxes over the 21st century in coupled models

Steven S. Rumrill, Alicia R. Helms and Adam S. DeMarzo
Long-term pH shift in a Pacific Northwest estuary: Potential relationship between ocean acidification and alkalinity within the South Slough (Coos Bay, Oregon, USA)

Tae-Wook Kim, Kitack Lee, Richard A. Feely, Christopher L. Sabine, Hae Jin Jeong and Kwang Young Kim
Prediction of East/Japan Sea acidification over the past 40 years using a multiple-parameter regression model

Ryo Kimura, Hideki Takami, Tsuneo Ono, Toshihiro Onitsuka and Yukihiro Nojiri
Effects of elevated $\boldsymbol{p}CO_2$ on early development of the Ezo abalone *Haliotis discus hannai*

Shinya Fukuda, Iwane Suzuki, Takeo Hama and Yoshihiro Shiraiwa
Control of seawater pH by the coccolithophorid, *Emiliania huxleyi* (Haptophyceae)

Takeo Hama, Shoko Kawashima, Yuhi Satoh, Koich Shimotori, Yuko Omori, Taiki Adachi, Shun Hasegawa, Hiroko Endoh, Takeshi Nakayama, Isao Inoue, Takashi Midorikawa, Masao Ishii, Shu Saitoh and Daisuke Sasano
Experimental study on the effect of ocean acidification on microbial structure and bioelemental cycles

Posters

Jae Hoon Noh, Dong Han Choi, Charity Lee and E.J. Carpenter
Spatio-temporal variations of N_2 fixation rates and abundance of N_2-fixers in the northwestern Pacific

Guimei Liu, Fei Chai, Huijie Xue and Lei Shi
Primary productivity and *p*CO2 variations in the China seas during 1990-2004: A three-dimensional physical-biogeochemical modeling study

Zhongyong Gao, Liqi Chen and Heng Sun
Transport of the Bering Slope Current and its effects on the carbon cycle in the Bering Sea and the western Arctic Ocean

Toshiya Nakano, Kazuhiko Hayashi, Yuichi Sasaki, Masao Ishii and Takashi Midorikawa
Estimation of the dissolved inorganic carbon inventory in the western North Pacific

Jeong-Hee Shim, Dong-Jin Kang, Chun Ok Jo, Young-Keun Jin, Pavel Ya. Tishchenko, Anatoly Obzhirov and Kyung-Ryul Kim
Distribution of surface pCO_2 and its controlling factors at the eastern shelf of the Sakhalin Island in the Sea of Okhotsk

Hyung Chul Kim, Yiming Wang, Seong Heo and Pyoung Joong Kim
Long-term variations and autumn distribution of inorganic nutrients in the Yellow Sea

Yukihiro Nojiri, Shin-ichiro Nakaoka, Chihiro Miyazaki, Andrew G. Dickson and Inter-comparison Participants
Indoor seawater pool inter-comparison of ocean surface *p*CO2 systems developed for underway and buoy operation

POC/FUTURE Topic Session (S9)

Outlooks and forecasts of marine ecosystems from an earth system science perspective: challenges and opportunities.

Co-sponsored by IMBER
Co-Convenors: Harold P. Batchelder (U.S.A.), Michael Foreman (Canada), Anne B. Hollowed (U.S.A) and Hiroaki Saito (Japan)

Background

The prediction of responses of marine ecosystems to future climate scenarios is an important objective of PICES' new science program, FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems). However, the marine ecosystem is part of the earth system and its prediction needs integrated knowledge from physical, chemical, and biological perspectives. Earth system science is an interdisciplinary approach that integrates anthropology, atmospheric science, biology, oceanography, geophysics and policy to provide predictions of ecosystem response to climate change. The earth system is complex with non-linear feedbacks, threshold responses, and, in some cases, irreversible change. Understanding the mechanisms controlling these system properties is critical to accurately forecasting future states of nature in a changing climate. Moreover, conducting large-scale experiments on the earth system is impossible. Therefore, regional marine ecosystem models should include the earth system science links that are essential for producing better predictions of marine ecosystem response to future climate scenarios. This session focused on multidisciplinary coupled models and theoretical, observational and experimental studies designed to provide outlooks and/or forecasts of marine ecosystems. Outlooks and forecasts differ in that outlooks are qualitative with (often) unbounded uncertainties, while forecasts are often quantitative, but must have bounded certainties. Presentations that focus on both long-term and short-term predictions, and that link two or more disciplines (such as physical oceanography, climate, ecosystem dynamics, marine resource management, or socio-economic systems), were welcome, especially presentations that explore what additional information or data are needed to provide outlooks andforecasts, and especially to transition from providing outlooks to providing forecasts.

Summary of presentations

The session consisted of 17 oral presentations distributed over two days from scientists in 5 countries. This was the first session at a PICES Annual Meeting that was formally considered a FUTURE topic session. The

intent of the session was to focus on multi-disciplinary models and observational studies designed to provide outlooks and forecasts—two types of forward-looking predictions. Topics varied from relatively small-scale investigations of coastal lagoons to global-scale data synthesis, and included socioeconomic impacts of climate change and other anthropogenic forcing at local (Chesapeake Bay) to global scales. Four presentations were invited (Okunishi, Murtugudde, Barange, Dalton).

Several presentations described the results of coupled biophysical models. In an invited talk, Takeshi Okunishi described the results of simulation models of small pelagic fish in the western North Pacific and found that the agreement between observations and models was best when predation by skipjack tuna was included in the dynamics of the small pelagics. Fei Chai and colleagues were able to link physical, lower trophic level ecosystem and IBM models of anchovy off Peru to provide 9-month forecasts arising from NCEP-predicted atmospheric conditions that had some skill at capturing larger-scale responses of anchovy to large forcing (El Niño, La Niña). Enrique Curchitser described some progress and challenges encountered in expanding lower trophic level biophysical modeling frameworks to not only fish, but fishing fleet behaviors. Keiji Kiyomatsu described the use of OFES ocean hindcasts of SST and velocities to estimate transport, growth and survival of Japanese sardine into the Kuroshio extension region.

Several presentations discussed reanalysis or new analyses of historical data sets. Yury Zuenko examined climate and ocean conditions in relation to productivity and transfer of production to higher trophic levels in the Japan/East Sea. V.S. Labay documented the evolution of benthic species in small Sakhalin coastal lagoons, and found bio-invasions from the sea. When lagoon openings became seasonal or restricted, this led to changed benthos structure, and to a prevalence of species having warmer affinities.

Masahiko Fujii and colleagues used projected temperatures from the MIROC IPCC climate scenario (global warming) model of the 21st century to examine temperature related bleaching of coral reef systems near Japan. Though the northward extent of coral habitat was projected to extend northward by about 200 km, bleaching events were forecast to occur nearly every year during the decade beginning 2060 compared to no events in the decade beginning in 2000.

Hiroaki Saito reported on the importance of composition and ballasting of particles for the vertical export of organic matter from the euphotic zone. Compositional changes can strongly influence the sinking rate and rate of remineralization, complicating simple vertical export models.

In an invited talk, Raghu Murtugudde described an end-to-end Earth system model of the Chesapeake Bay (East Coast of USA) system. The model is used to provide nowcasts and forecasts at daily to decadal time scales. Oxygen conditions, harmful algal blooms and sea nettle blooms are skillfully predicted at short time scales (few days) and with quantified levels of uncertainty. In another invited talk, Manuel Barange described the Quest-Fish project which is using global climate models to estimate primary production through trophic relationships and assumptions of fish production. The model framework also considers other anthropogenic stressors, including economic policies and variable geographic and temporal exploitation. The focus is on shelf-sea systems, and on the consequences of the stressors on market based fish commodities.

Anne Hollowed described a framework for downscaling Bering Sea climate indices applied to the walleye pollock and flatfish, with designs for constructing a management strategy evaluation (MSE) for some key species. Akihiko Yatsu described the results of a CCCC-CFAME Task Team exploration of the possible climate and global warming effects from IPCC scenarios on several key species (chum salmon, walleye pollock, sardine, anchovy, saury, squid) in the Kuroshio-Oyashio region. Information on the species biology (lifespan, prey types) and expected changes from IPCC scenarios were used to construct outlooks for several of these species.

In an invited talk, Michael Dalton described a population-environment-technology (PET) model applied to 9 regions worldwide. PET is multisector, multiregional and includes five production sectors and four types of consumer goods (energy, food, transport, other). The value of such models is that by being based on market information, it allows the model to span spatial scales.

Harold (Hal) Batchelder described approaches to, and results of, quantitative skill assessments of earlier and later implementations of ROMS physical models to the California Current and northern Gulf of Alaska regions. The results showed sensitivity of the stratification to the controlling influence (temperature in the south; salinity in the north) in the earlier model, and greater robustness/fidelity of the later model to observed temperature and salinity. Highly skillful physical models are useful as the basis for ecosystem models; models lacking physical skill should not be the basis for coupled ecosystem models. Jie Shi used a Princeton Ocean Model and coupled ecosystem and kelp models to examine the production of kelp and its control by nutrient fluxes from outer Sungo Bay, China. The model suggests that reduced kelp density at the mouth of the bay would increase yield significantly in the whole bay, since greater nutrient fluxes would be supplied to the inner region.

The recently released version of the World Ocean Atlas 2009 and World Ocean Database 2009 were described by Hernan Garcia. WOA-2009 and WOD-2009 are the largest quality controlled collections of ocean profile data available online. Steve Bograd documented strong correlations between retrospective analysis of climate records, growth chronologies of rockfish and seabird egg laying and fledging data. Good years for rockfish and seabirds were associated with strong high pressure systems, strong upwelling and cooler SSTs. Correlations of the biological metrics were seasonally highest with winter (JFM) conditions, indicating the importance of wintertime ocean conditions for ecosystem productivity.

Overall, this rather diverse collection of talks was well attended, and presented a number of different approaches that might be used for creating outlooks and forecasts within the Advisory Panel on *Status, Outlooks, Forecasts and Engagement* (SOFE-AP) of the new PICES scientific program, **F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems (FUTURE). It was an auspicious beginning to FUTURE topic sessions.

List of papers

Oral presentations

Takeshi Okunishi, Shin-ichi Ito, Atsushi Kawabata, Hiroshi Kubota, Taketo Hashioka, Hiroshi Sumata and Yasuhiro Yamanaka (Invited)
A multi-trophic level ecosystem model for understanding mechanisms of small pelagic fish species alternation

Fei Chai, Francisco Chavez, Yi Chao, Lei Shi, Hongchun Zhang and Richard Barber
Using remote sensing and modeling in operational forecasting of fisheries

Keiji Kiyomatsu, Takuji Waseda and Yasumasa Miyazawa
Reconstruction of high-resolution historical February SST in the northwestern Pacific and its application to larval dispersion

Yury I. Zuenko
How trends, shifts, and interdecadal fluctuations in climate reconstruct the ecosystem of the Japan/East Sea

Raghu Murtugudde (Invited)
Marine ecosystem forecasting with an Earth System Prediction model

V.S. Labay
Evolution of a benthos of coastal lagoons of Sakhalin Island: Causes and consequences

Yumiko Yara, Masahiko Fujii, Yasuhiro Yamanaka, Naosuke Okada, Hiroya Yamano and Kazuhiro Oshima
Projected effects of global warming on coral reefs in seas close to Japan

Hiroaki Saito
Modeling of organic matter dynamics in the mesopelagic zone: A perspective on modeling and ecosystem studies

Enrique N. Curchitser, Kenneth A. Rose, Kate Hedstrom, Jerome Fiechter, Shin-ichi Ito, Salvador Lluch-Cota and Bernard A. Megrey
Development of a climate-to-fish-to-fishers model: Progress, issues, and some solutions

Manuel Barange, Icarus Allen, Eddie Allison, Marie-Caroline Badjeck, Julia Blanchard, James Harle, Robert Holmes, Jason Holt, Simon Jennings, Gorka Merino, Christian Mullon and Emma Tompkins (Invited)
Predicting the impacts and socio-economic consequences of climate change on global marine ecosystems and fisheries: The QUEST_Fish framework

Anne B. Hollowed, Nicholas A. Bond, James E. Overland and Thomas Wilderbuer
Future conditions in the Bering Sea: Applications to walleye pollock and flatfish

Akihiko Yatsu, Sanae Chiba, Yasuhiro Yamanaka, Shin-ichi Ito, Yugo Shimizu, Masahide Kaeriyama and Yoshiro Watanabe
Future of Kuroshio/Oyashio ecosystems: An outcome of the CFAME Task Team and WG20

Michael Dalton (Invited)
Climate change and marine ecosystems: Demographic and economic implications under IPCC scenarios

Harold P. Batchelder, Enrique N. Curchitser and Kate Hedstrom
Modeling physical processes in the Northeast Pacific: model-data comparisons for assessing when model skill is sufficient as a basis for ecosystem simulation

Jie Shi, Hao Wei and Liang Zhao
Numerical study of the aquaculture carrying capacity in a typical raft culture bay of China

Hernan Garcia, Sydney Levitus, Tim Boyer, Ricardo Locarnini, John Antonov, Daphne Johnson, Olga Baranova, Alexey Mishonov, Dan Seidov, Igor Smolyar, Melisa Zweng and Evgeney Yarosh
The World Ocean Database and Atlas 2009

Steven J. Bograd, Bryan A. Black, William J. Sydeman, Isaac Schroeder and Peter Lawson
Wintertime ocean conditions synchronize rockfish growth and seabird reproduction in the California Current

Posters

Licheng Feng, Baochao Liu, Yi Cai, Zhanggui Wang, Jiping Chao and Jianping Li
Numerical simulation of the Changjiang estuary ecosystem

BIO Paper Session

Co-Convenors: Michael J. Dagg (U.S.A.) and Sinjae Yoo (Korea)

Background

The theme of PICES-2009 is "*Understanding ecosystem dynamics and pursuing ecosystem approaches to management"*. In this session, we welcomed papers on biological aspects of the PICES-2009 theme as well as papers on other aspects of biological oceanography in the North Pacific and its marginal seas (except S3 and S8 topics). Early career scientists were especially encouraged to submit papers to this session.

Summary of presentations

This session received a large number of applications (approximately 65) for oral and poster presentations and it ended with a full day of talks (19 total) and 42 posters. Presentations were given by members of all PICES countries, and 8 of the 19 oral presentations were given by early career scientists. As indicated in the Book of Abstracts, topics ranged widely and all were of interest to the PICES community of Biological Oceanographers. Both morning and afternoon sessions were well attended. Bryan Black received the BIO award for best presentation by an early career scientist for his talk in this session titled, "*Growth-increment chronologies reflect ecosystem responses to climate variability in the northeastern Pacific*".

List of papers

Oral presentations

David Mackas, Sonia Batten, Ken Coyle and Russ Hopcroft
Perspectives on a decade of change in the Alaska Gyre: A comparison of three Northeast Pacific zooplankton time series

Bryan A. Black
Growth-increment chronologies reflect ecosystem responses to climate variability in the northeastern Pacific

Seung-Hyun Son, Meng-Hua Wang and Jae Hoon Noh
Satellite-observed chlorophyll *a* data in the dump site of the Yellow Sea

Shinji Shimode and Atsushi Tsuda
Geographical distribution and ontogenetic migration of *Eucalanus californicus* (Johnson) in the western North Pacific Ocean

Mi Hee Chung and Won Duk Yoon
Variation of the epiphytic community and biomass on *Zostera marina* (eelgrass) related to the host plant and environmental factors

Tatyana N. Krupnova and Yury I. Zuenko
Development *Laminaria japonica* early stages in the coastal waters of Primorye caused by climate change

Hongyan Bao, Ying Wu, Lixin Tian, Jing Zhang and Guiling Zhang
Sources and distributions of terrigenous organic matter in a mangrove-dominant small tropical estuary, South China

Evgenia E. Vekhova, Michael I. Kusaykin and Konstantin V. Kiselev
The phytoplankton contribution to the common mussel diet (Bivalvia: Mytilidae) of the Sea of Japan

Anastasia Dolganova
Modern condition of fauna of Polychaeta in the Amur Bay (Peter the Great Bay, Sea of Japan)

Toru Kobari, Haruko Mori and Hitomi Tokushige
Nucleic acid and protein contents of ontogenetically migrating copepods in the subarctic Pacific Ocean as influenced by development stage and depth

Young-Ok Kim, Pung-Guk Jang, Eun-Jin Yang, Seung-Won Jeong and Kyoungsoon Shin
Tintinnid species as biological sensors for monitoring the Kuroshio Extension in Korean coastal waters

Yuichiro Nishibe, Shuhei Nishida and Atsushi Yamaguchi
Vertical distribution, population dynamics and lipid storage of the cyclopoid copepod *Oithona similis* in the Oyashio region, western subarctic Pacific

Julie E. Keister, Emanuele Di Lorenzo, Cheryl A. Morgan, William T. Peterson, Vincent Combes and Neri Mariani
Zooplankton species composition is linked to ocean transport in the Northern California Current

Elena Dulepova and Anatoly Volkov
East-west contrasts in production of zooplankton communities in the Bering Sea

Naoki Tojo, Ryuichi Matsukura, Hiroki Yasuma, Kenji Minami, Akira Nishmura, Orio Yamamura, Tetsuichiro Funamoto, Satoshi Honda and Kazushi Miyashita
Environmentally driven seasonal distribution of zooplankton along the Pacific coast off eastern Hokkaido, Japan

Yugo Shimizu, Kazutaka Takahashi, Shin-ichi Ito, Shigeho Kakehi, Hiroaki Tatebe, Ichiro Yasuda, Akira Kusaka and Tomoharu Nakayama
Transport of large subarctic copepods from the Oyashio area to the mixed water region by the coastal Oyashio intrusion

C. Tracy Shaw, Leah R. Feinberg and William T. Peterson
Population dynamics of the euphausiids *Euphausia pacifica* and *Thysanoessa spinifera* off Newport, OR, USA in relation to environmental conditions

Andrey Suntsov, Richard D. Brodeur and Jason Phillips
Interannual variability and spatio-temporal characteristics in populations of three dominant myctophid species in the northern California Current System

Olga Yu. Tyurneva, Yuri M. Yakovlev and Vladimir V. Vertyankin
Photographic identification of the Korean-Okhotsk gray whale (*Eschrichtius Robustus*) offshore northeast Sakhalin Island and southeast Kamchatka Peninsula (Russia), 2008

Tabitha C.Y. Hui, Rowenna Flinn, Edward J. Gregr, Ruth Joy and Andrew W. Trites
Are Steller sea lions (*Eumetopias jubatus*) affected by prey availability in the western Gulf of Alaska and Aleutian Islands?

Posters

Andrey P. Chernyaev and Alexandra S. Petrova
Determination of n-nonylphenol in the coastal waters of Vladivostok

Chun-Yi Chang, Pei-Chi Ho, Akash R. Sastri and Chih-Hao Hsieh
Development and application of an automatic mesozooplankton image classification system in the East China Sea, a region of complicated hydrography

Evgeniya A. Tikhomirova
Distribution of biogenic substances in waters of Amursky Bay (Peter the Great Bay, Japan/East Sea)

You-Ree Jun, Akash R. Sastri and Chih-Hao Hsieh
Field estimates of size-based ingestion rate of zooplankton using FlowCAM in the subtropical western Pacific

Wei-Hsuan Teng, Akash R. Sastri and Chih-Hao Hsieh
Investigation of size-trophic level relationships of zooplankton in different ocean environments - A stable isotope approach

Atsushi Tsuda, Hiroaki Saito and Hiromi Kasai
Vertical distribution of large suspension feeding copepods in the Oyashio region during the growing period

Atsushi Yamaguchi and Yoshimi Matsumoto
Life history and production of the chaetognath *Eukrohnia hamata* in the Oyashio region, western subarctic Pacific

Guo Ying Du and Ik Kyo Chung
Estimating areal production of intertidal microphytobenthos based on spatio-temporalcommunity dynamics and laboratory measurements

Seung Ho Baek, Kyoungsoon Shin, Shinji Shimode, Myung-Soo Han and Tomohiko Kikuchi
The role of vertical migration and cell division on dinoflagellates *Ceratium furca* and *C. fusus*

Hong-Bo Li and Fengao Lin
Relationships between bacterioplankton and virioplankton in coastal areas of Hebei, China

Min-Chul Jang, Kyoungsoon Shin, Woo-Jin Lee and Ok-Myung Hwang
Grazing impact of calanoid copepods on phytoplankton size-fractions in Jangmok Bay, South Coast Korea

Pung-Guk Jang, Kyoungsoon Shin, Min-Chul Jang, Woo-Jin Lee and Hyun-Su Kim
The succession of phytoplankton assemblage by nutrient property on summer in the coastal area

Masato Minowa, Toru Kobari, Hiroyasu Akamatsu and Toshihiro Ichikawa
Impacts of small copepods on sinking particles in a semi-enclosed and deep embayment

Evgeniy A. Sigida, Svetlana S. Musko, Lidia I. Titova and Alexandra A. Dvornik
Sakhalin's shelf pelagic marine bacteria *Pseudoalteromonas* sp. and *Pseudomonas* sp**.** as prospective destructors of ocean oil pollution

Bonggil Hyun, Kyoungsoon Shin, Min-Chul Jang, Woo-Jin Lee, Jeongmi Song and Seung Ho Baek
The survival possibility of introducing phytoplankton via ships ballast water

Yulia V. Zavertanova, Larisa E. Vasilyeva, Olesya A. Sharova and Vladimir A. Rakov
Species composition of ichthyoplankton in Alekseeva Bay (Peter the Great Bay, Japanese Sea) in 2006 – 2009

Bo-Bae Lee, Jae-Suk Choi, Yu-Mi Ha, Kee Hun Do and In Soon Choi
Inhibitory effects of seaweed extracts on *Helicobacter pylori* growth and urease activity

Yu-Mi Ha, Jae-Suk Choi, Kee Hun Do, Bo-Bae Lee, Su Hwa Shin and In Soon Choi
Inhibitory effects of *Sargassum sagamianum* extracts on the growth of several oral pathogens and collagenase activity

Zhisong Cui, Li Zheng, Li Tian, Ping Han, Xiaoying Zhang, Qian Liu, Xiaoru Wang and Frank S.C. Lee
Characterization of polycyclic aromatic hydrocarbons-degrading *Cycloclasticus* strains isolated from Yellow Sea sediment of China and their syntrophic effects with crude oil degraders *Alcanivorax* strains

Goh Onitsuka, Masatoshi Moku, Toru Kobari, Tetsutaro Takikawa, Akihiko Morimoto, Atsushi Watanabe, Yutaka Yoshikawa and Tetsuo Yanagi
Distribution of nutrients and plankton around the lee eddy of the Tsushima Islands

Li Zheng, Baijuan Yang, Junhui Chen, Jiaye Zang and Xiaoru Wang
Primary source identification of the invasive *Enteromorpha prolifera* in Qingdao based on hierarchical cluster analysis of fatty acids

Takeshi Terui and Michio J. Kishi
A Lagrangian ensemble model of Copepoda (*Neocalanus cristatus*) in the northwestern subarctic Pacific

Seung-Hyun Son and Meng-Hua Wang
Marine environmental responses to the Saemangeum Reclamation Project in South Korea

Seung-Hyun Son and Meng-Hua Wang
Temporal and spatial variability of water turbidity derived from satellite ocean color in the Yellow Sea and East China Sea

Natalia P. Fadeeva, Marina S. Selina, Elena V. Smirnova and Inna L. Stonik
Communities of sandy beaches: What factors influence their diversity and zonation patterns in shallow subtidal environments of the northwestern part of the Sea of Japan?

Kanako Toge, Masaaki Fukuwaka, Orio Yamamura and Yutaka Watanuki
Biennial change of pink salmon biomass and the body condition of a pelagic shearwater: Evidence of competition between fish and bird

Hiroshi Koshikawa, Hironori Higashi, Masanobu Kawachi, Toru Hasegawa, Kazumaro Okamura, Yoko Kiyomoto, Kou Nishiuchi, Hideki Akiyama, Kunio Kohata and Shogo Murakami
Dominance of the dinoflagellate *Prorocentrum dentatum* on the central continental shelf of the East China Sea in early summer, 2007

Yuji Okazaki and Kazuaki Tadokoro
Comparison of sampling gear (MOHT *vs.* BONGO net): Implication for euphausiid abundance

Evgeniya A. Tikhomirova
Spatial and temporal variability of primary production in Amursky and Ussuriysky Bays (Japan/East Sea) from modelling results

Tetsuichi Fujiki, Kazuhiko Matsumoto, Shuichi Watanabe, Takuji Hosaka and Toshiro Saino
Time-series observation of phytoplankton productivity in the western subarctic gyre of the North Pacific

Keiko Yamada, Sang-Woo Kim and Ji-Suk Ahn
Interannual variability of primary production in the East/Japan Sea estimated by satellite data, in consideration of influence of atmospheric aerosol

Yuya Yamamoto, Yasuyuki Kishi, Hirotada Moki and Kisaburo Nakata
A model study to predict zooplankton biomass in intermediate and deep water

Jiyeon Kim, Chaewoo Ma and Wongyu Park
Spatio-temporal variability of epifaunal distributions caused by the Hebei Spirit oil spill in the surf zone on the Hakampo beach on the west coast of Korea

Toshikazu Suzuki, Hisako Mori and Daisuke Nakatsugawa
Spatial distribution of filamentous cyanobacteria, *Trichodesmium* spp., in spring in the East China Sea

Hye Seon Kim, Ah-Ra Ko and Se-Jong Ju
A comparative study of the lipid dynamics of the euphausiid, *Euphausia pacifica*, from Korean seas (East/Japan Sea, South Sea, and Yellow Sea)

In Joon Hwang and Hea Ja Baek
Acute exposure of waterborne polycyclic aromatic hydrocarbon, benzo[a]pyrene during ovarian recrudescence in a marine fish, *Chasmichthys dolichognathus*

Oh Youn Kwon, Jung-Hoon Kang, Yong Hwan Cha and Man Chang
Environmental factors affecting dynamics of the phytoplankton community in port baseline surveys in Korea

Joji Ishizaka, Hisashi Yamaguchi, Sarat Tripathy, Takashi Makino, Takeshi Matsuno and Takahiro Endoh
Short term variability of primary production in the Changjiang River Plume in the East China Sea observed in summer 2008

Soo-Jung Chang, Donghyun Lim, Won Duk Yoon and Suam Kim
A phylogenetic study of Medusozoa (Scyphozoa, Hydrozoa) in Korean waters

Young Shil Kang, Weol Ae Lim, Young Sik Lee and Yang-Soon Kang
Ecosystem consequence of a *Noctiluca scintillans* bloom in the southern coast of the Korean Peninsula

Ji-Woong Ko, M. Sidharthan, Sung Hwan Cho, Seock Jung Han and Hyun Woung Shin
Climate change triggered fecundity of the solitary ascidian, *Herdmania momus* in the Jeju coast, Korea: Implications for benthic community structure and artificial reef function

FIS Paper Session

Co-Convenors: Gordon H. Kruse (U.S.A.) and Mikhail Stepanenko (Russia)

Background

Papers addressing general topics in fishery science and fisheries oceanography in the North Pacific and its marginal seas were invited (except S2, S3 and S6 topics).

List of papers

Posters

Victor F. Bugaev, A.V. Bugaev and V.A. Dubynin
Biological characteristics of commercial stocks of sockeye salmon *Oncorhynchus nerka* in East Kamchatka, Koryak Plateau and some adjacent areas

Elena V. Gritsay
Seasonal and interannual variations in the age structure of walleye pollock in commercial catches in the western Bering Sea

Tetsuichiro Funamoto
Effects of spawning stock biomass and environmental conditions on walleye pollock (*Theragra chalcogramma*) recruitment in the northern Japan Sea

Margarita D. Boyarova and Olga N. Lukyanova
Organochlorine pesticides in marine and freshwater organisms from the Russian Far East

Réka Domokos
Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone

Kevin Thompson, Grant Thompson and OSU Qualitative Analysis Group
Precautionary management may destabilize a fishery: Examples using loop analysis

Liudmila S. Dolmatova and Olga A. Zaika
Seasonal- and age-dependent activities of antioxidant enzymes in holothurian *Eupentacta fraudatrix*

Yugo Shimizu and Yoji Narimatsu
Relationship in temporal variability between temperature and recruitment of Pacific cod (*Gadus macrocephalus*) off the northeast coast of Japan

Alexei M. Orlov, Eugeny F. Kulish, Alexander O. Shubin and Ilyas N. Mukhametov
New data on age and growth of spiny dogfish *Squalus acanthias* in the northwestern Pacific Ocean

Galina S. Borisenko
The artificial radionuclides Sr-90 and Cs-137 in commercial fishes and sea water of Japan Sea

Chul-Woong Oh and Jong-Hun Na
Population biology of Korean pomfret *Pampus echinogaster* (Basilewsky, 1855) (Perciformes: Stromateidae) on the Western Coast of Korea, Yellow Sea

Alexei M. Orlov, Vadim F. Savinykh, Dmitry V. Pelenev and Eugeny F. Kulish
Distribution and size composition of spiny dogfish in the North Pacific

Naoki Tojo, Akira Nishmura, Tetsuichiro Funamoto, Orio Yamamura, Hiroki Yasuma and Kazushi Miyashita
Ecologically driven spatial dynamics in pre-wintering juvenile walleye pollock (*Theragra charcogramma*) in the coastal sea off northeastern Hokkaido, Japan

Svetlana A. Ireykina
Biotransformation and oxidative stress biomarkers as useful tools in assessment of pollution effects in estuaries of Peter the Great Bay (Japan/East Sea)

Seock-Woo Jang, Seong-Gil Kim, Ok-In Choi, Seong-Soo Kim and Zang-Geun Kim
Concentration of trace metals in the tissues of common dolphins (*Delphinus delphis*) on the east coast of Korea

Nadezhda L. Aseeva
Myxozoa parasites in fishes of the northwest Japan Sea

Wongyu Park, Chaewoo Ma, Miyoung Song, Myoung-Ho Sohn, Hakjin Hwang, Jong-Bin Kim, Kwangho Choi and In-Ja Yeon
Seasonal occurrence and distribution of Japanese mantis shrimp *Oratosquilla oratoria* larvae off Yeonpyeong-do near the Korean coast in the Yellow Sea

Myoung-Ho Sohn, Miyoung Song, Hakjin Hwang, Yang-Jae Im, In-Ja Yeon, Wongyu Park, Chaewoo Ma and Jae-Won Kim
Larval occurrence and distribution of swimming crab *Charybdis japonica* (Milne Edwards, 1860) off Yeonpyeong-do near Korean coast in the Yellow Sea

Jong Hee Lee, Jae Bong Lee, Jung Nyun Kim, Dong Woo Lee and Dae Soo Chang
Seasonal species composition of marine organisms collected by a shrimp beam trawl in the Nakdong River estuary, Korea

Hyoungsum Han, Chaewoo Ma and Wongyu Park
Differences of growth and density in *Ruditapes philippinarum* in the intertidal area in Tae-an on the west coast of South Korea

Hae-Won Lee, Byung-Kyu Hong, Young-Min Choi and Dong-Woo Lee
Gonadal maturation and spawning in the Pacific herring, *Clupea pallasii*, in the East/Japan Sea of Korea

Tatiana Tunon and Gottfried Pestal
Using classification trees to capture a manager's interpretation of Bayesian projections

Jung Hwa Choi, Bong Jun Sung, Jung Nyun Kim, Taeg-Yun Oh, Dae Soo Chang and Hyung Kee Cha
Feeding habits of yellow goosefish, *Lophius litulon*, and John Dory, *Zeus faber* in the northern part of the East China Sea

Wen-Bin Huang
Comparisons of spatiotemporal variations in abundance and size composition of Pacific saury between the high-seas and coastal fishing grounds in the Northwestern Pacific

POC Paper Session

Co-Convenors: Michael Foreman (Canada) and Ichiro Yasuda (Japan)

Background

Papers were invited on all aspects of physical and biogeochemical oceanography and climate in the North Pacific and its marginal seas (except S8 and S9 topics).

Summary of presentations

The session consisted of 19 oral presentations and 32 posters covering a wide range of physical and biogeochemical oceanographic research. Ichiro Yasuda, Yury Zuenko, and Steven Bograd, and Michael Foreman chaired sub-sessions over the 1-day presentation period. The morning portion included interesting talks related to: 1) Indo-Pacific climate variability and Indonesian Through Flow impacts (Chen, Ro), 2) climate variability teleconnections and ecosystem impacts in the Northern Hemisphere (Alheit), 3) North Pacific mixed layer depth projections from IPCC models (Jang), 4) steric contributions to sea level rise as computed from Argo data (Freeland), 5) fully coupled dynamical climate model downscaling in the Northeast Pacific (Curchitser), 6) warm intrusions in the Yellow Sea (Wang), 7) interannual variability of Korea Strait bottom cold water (Na), and 8) variability in the Japan/East Sea (Trusenkova, Kaplunenko).

The afternoon session started with a series of Arctic presentations: John Calder described a synthesis of recent data assembled by the Pacific Arctic Group, Victor Kuzin described dissolved methane in Arctic waters, and Eduard Spivak described observations from a September 2006 cruise in the Laptev Sea. Humio Musidera then described the dynamics behind the cold water belt along the Soya Warm Current, and Jinhee Yoon described the Kuroshio Extension response to an El Niño. In the final sub-session, Michael Foreman described the dynamics behind salinity variations in Knight Inlet, Anastasiya Abrosimova described dynamics in the Amur River estuary, Hitoshi Kaneko described turbulence measurements along 155°E, and Elena Vilyanskaya described water temperature changes in Aniva Bay.

The best POC-related poster was awarded to Satoshi Osafune for "*Numerical study of bidecadal water mass variations in the subarctic North Pacific related to the 18.6-year tidal cycle*" and the best early career scientist presenter award was given to Xiaohui Tang for "*Influence of reducing weather noise on ENSO prediction*".

List of papers

Oral presentations

Dake Chen and Tao Lian
A theoretical framework for tropical Indo-Pacific climate variability

Jürgen Alheit
Impact of climate variability on northern hemisphere marine ecosystems: Regime shifts and teleconnection patterns

Chan Joo Jang
North Pacific mixed layer depth projections from IPCC AR4 models

Howard J. Freeland and Denis Gilbert
A new estimate of the steric contribution to global sea-level rise

Enrique N. Curchitser, William Large, Kate Hedstrom and Jon Wolf
Downscaling climate simulations in the North Pacific Ocean using a fully coupled multi-scale model

Young Jae Ro
Impact of the Indonesian Through Flow on the water characteristics in western Pacific marginal seas

Fan Wang and Chuanyu Liu
A warm tongue intrusion into the Yellow Sea in winter and its inter-annual variability

Olga O. Trusenkova, Timofei Gulenko, Dmitry D. Kaplunenko and Vyacheslav B. Lobanov
Large-scale patterns of the Japan/East Sea sea level and its dynamic forcings

Dmitry D. Kaplunenko, Vyacheslav B. Lobanov and Olga O. Trusenkova
Effects of variability 'separation' for the northern Japan/East Sea obtained from satellite data

Hanna Na, Kwang-Yul Kim, Kyung-Il Chang and Kuh Kim
Relationship between the interannual variability of the Korea Strait Bottom Cold Water, upper water temperatures and surface heat fluxes in the East Sea

John Calder and Jackie Grebmeier
Synthesis of recent ocean data from the Pacific sector of the Arctic by the Pacific Arctic Group

Victor Kuzin, Valentina Malakhova and Elena Golubeva
Dissolved methane transport in the Arctic water: Observed data and simulation

Eduard A. Spivak, Nina I. Savelieva and Anatoly N. Salyuk
Summer hydrography of the southeastern part of the Laptev Sea – Results from the Pacific Oceanological Institute expedition in September 2006

Humio Mitsudera, Keisuke Uchimoto and Tomohiro Nakamura
Mechanisms of the cold water belt formation off the Soya Warm Current

Jinhee Yoon, Sang-Wook Yeh, Young Ho Kim and Jong-Seoung Kug
The characteristic response of the Kuroshio Extension region to a warm pool El Niño

Michael Foreman, Piotr Czajko and Dario Stucchi
Simulating spring–neap salinity variations in Knight Inlet, Canada

Anastasiya A. Abrosimova and Igor A. Zhabin
Interaction of sea and river waters in the estuary of the Amur River

Hitoshi Kaneko, Ichiro Yasuda and Sachihiko Itoh
Direct measurement of turbulence mixing along a meridional transect in the western North Pacific

Elena A. Vilyanskaya, G.V. Shevchenko, O. Kusaylo and A. Kato
Water temperature changes in the nearshore zone of Aniva Bay from mooring observations

Posters

Svetlana P. Shkorba
Research on the influence of the thermal regime of water on ice cover in the Japan Sea

Nadezda M. Vakulskaya
Analysis of spatio-temporal distribution typizations of ice areas and ice volumes according to ice thicknesses in the Bering Sea

Ekaterina Potalova
Estimation of wind stress curl on Far-Eastern seas from tropical cyclone movements

Valentina V. Moroz
The thermohaline structure and temperature anomaly dynamics in the Kuril Islands area

Talgat R. Kilmatov and Elena Dmitrieva
The climatic trend of non-homogeneous SSTs in the northern Pacific Ocean and stability of the Kuroshio Extension jet

Yury I. Zuenko
One-dimensional model of water productivity changes because of convective regime reconstruction

Elena Dmitrieva, Vladimir Ponomarev and Nina I. Savelieva
Classification of the meteorological–hydrological time series of the Asian-Pacific region using cluster analysis

Galina A. Vlasova, Svetlana U. Glebova and Gleb S. Vlasov
Seasonal variability of the water circulation in the Sea of Okhotsk under the influence of synoptic processes in 2003-2004

Galina A. Vlasova, Bui Hong Long, Antonina M. Polyakova, Nguyen Ba Xuan, Gennady I. Yurasov and Le Dinh Mau
Preliminary results of the seasonal variability of water circulation in the South China Sea under the influence of the synoptic processes

Antonina M. Polyakova
Destructive tsunamis near the coast of Primorye

Antonina M. Polyakova
Atmospheric circulation over the South China Sea

Gennady I. Yurasov
Upwelling and its influence on ice conditions in Peter the Great Bay

Vladimir B. Darnitskiy and Maxim A. Ishchenko
On the differentiation of thermohaline processes in the Sea of Japan to the south of the Subarctic Front: Part I

Vladimir B. Darnitskiy and Maxim A. Ishchenko
On the differentiation of thermohaline processes in the Sea of Japan to the south of the Subarctic Front: Part II

Cai Yi, Zhanggui Wang and Licheng Feng
The Numerical Simulation of the effects of global warming on ocean ecosystems in Bohai Sea

Boris S. Dyakov
Large-scale fluctuations in the salinity of the Tsusima Current in the second half of the 20th century

Fedor Khrapchenkov and Nadezda Dulova
Influence of eddies and tides on the vertical structure of acoustic speed field on the east coast of Kamchatka and the Kuriles

Fedor Khrapchenkov
Dynamics of the runoff lenses of the Amur River in summer of 2005–2008

Liying Wan, Hui Wang and Jiang Zhu
A "Dressed" Ensemble Kalman Filter method using different seasonal ensembles in the Pacific

Kwang Young Jung and Young Jae Ro
Stratification induced by Nam-Gang Dam water releases based on a numerical model in the Kangjin Bay, South Sea, Korea

Vladimir B. Darnitskiy and Maxim A. Ishchenko
Synoptic and long-term dynamics of water in the vicinity of the junction of Hawaii and the Imperial submarine ridges

Larissa A. Gayko
Variability of water and air temperature in the coastal zone of the northwestern Sea of Japan

Valentina V. Moroz
Thermohaline structure peculiarities in the South Kuril Straits zone

Vladimir Ponomarev, Vera Petrova and Elena Dmitrieva
Changing climate and linkages of surface heat fluxes in the North Pacific

Vladimir B. Darnitskiy and Maxim A. Ishchenko
Long-term thermohaline dynamics in the region of the northwestern Hawaiian Ridge Seamounts

Tatsuro Watanabe, Daisuke Simizu, Kou Nishiuchi, Toru Hasegawa and Osamu Katoh
Surface current structure and its variability in the southwestern Japan Sea derived by satellite tracked surface drifters

Satoshi Osafune and Ichiro Yasuda
Numerical study of bidecadal water mass variations in the subarctic North Pacific related to the 18.6-year tidal cycle

Hironori Higashi, Hiroshi Koshikawa, Kunio Kohata, Shogo Murakami and Motoyuki Mizuochi
Relationship between water quality trend and climate change in Ise Bay, Japan

Takeshi Matsuno, Takahiro Endoh, Eisuke Tsutsumi, Ken-ichi Fukudome, Joji Ishizaka, Hisashi Yamaguchi, Sarat Tripathy, In-Seong Han, Jae-Hak Lee, Sang-Tae Jang and Sang-Hyun Kim
Vertical transport of subsurface nutrients in the East China Sea shelf for primary production

Oleg A. Bukin, Alexey V. Bulanov, Alexey A. Ilin, Sergey S. Golik and Ekaterina B. Sokolova
Femtosecond laser-induced breakdown spectroscopy for the detection of marine water and elemental composition of phytoplankton cells

Joon-Soo Lee, Hye-Hyun Lee, Won Duk Yoon, Joon-Yong Yang, and Sang Ok Chung
Analysis of the long-term temporal variations in the Yellow Sea using the cluster method

Vladimir V. Plotnikov
Estimation of ice cover conditions in the Japan Sea

Hui-wang Gao, Gu Ming, Ren-lei Wang and Yu-huan Xue
Characteristics of atmospheric turbulence of the marine–atmospheric boundary layer over the north Yellow Sea

BIO Workshop (W1)

Natural supplies of iron to the North Pacific and linkages between iron supply and ecosystem responses

Co-sponsored by SOLAS
Co-Convenors: Fei Chai (U.S.A.), William R. Crawford (Canada) and Shigenobu Takeda (Japan)

Background

In the subarctic North Pacific Ocean, iron plays a central role in regulating phytoplankton productivity and pelagic ecosystem structure. There are several processes that supply iron from land, shelf sediment and deep waters to pelagic ecosystem. The goal of this workshop was to examine the relative importance of these iron

supply processes that includes atmospheric deposition of mineral aerosols and combustion substances, lateral transport of coastal iron-enriched waters by eddies and boundary currents, and deep vertical mixing during winter or by strong tidal current at narrow strait. Such knowledge will be used to identify key biogeochemical pathway that should be introduced into the ecosystem models and to plan international scientific programs for better understandings of marine ecosystem responses to changing iron supplies in the North Pacific.

Summary of Presentations

The workshop, sponsored by the BIO Committee, was the first workshop organized by the Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22). The 1-day workshop was held on October 25, and consisted of two parts. The first part included a total of 9 oral presentations and one poster, and it lasted from 9:00 to 15:30 h. The second part was WG 22's first business meeting, which was conducted from 16:00 to 18:00 h. The workshop had more than 30 participants representing all PICES member countries. Six talks in the morning focused on the field studies that related to iron sources, distribution, and iron impacts on phytoplankton dynamics in both the eastern and western subarctic Pacific. Three modeling presentations summarized the latest development of iron and biogeochemical modeling at regional and global scales.

Discussion following these talks focused on the gaps and issues related to experimental and modeling activities on iron biogeochemistry and its impact on ecosystem structures and carbon cycle. Here are some highlights of our discussion: 1) atmospheric dust input and Fe solubility associated with different types of dusts, including volcanic Fe input; 2) the role of eddies and coastal currents in transporting Fe, and sedimentary sources of different forms of Fe; 3) both dissolved Fe and leachable particulate Fe are important, residence time of particulate Fe; 4) improving model parameterizations of iron supplies from various sources, treatment of Fe removal and recycling in models; 5) physiological response of phytoplankton groups to Fe, and community structure changes to Fe supplies. Most of presenters had submitted an extended abstract before the workshop, so their key findings and recommendations on iron biogeochemistry research will be summarized in the WG 22 final scientific report.

List of papers

Oral presentations

Kenneth W. Bruland (Invited)
Reactive iron in the subarctic North Pacific; natural iron enrichments

Jun Nishioka, Tsuneo Ono, Hiroaki Saito, Takeshi Nakatsuka, Shigenobu Takeda, Wm. K. Johnson and C.S. Wong
Comparison of iron distribution between the western and the eastern subarctic Pacific

Eric Roy, Mark Wells and Fei Chai
The role of Haida eddies in iron transport to the eastern subarctic Pacific Ocean

Hiroaki Saito, Kazutaka Takahashi, Yoshiko Kondo, Jun Nishioka, Tomonori Isada, Akira Kuwata, Miwa Nakamachi, Yuji Okazaki, Yugo Shimizu and Koji Suzuki
Factors controlling the spatial variability of spring bloom dynamics in the Oyashio Region

Roberta C. Hamme, Sonia Batten, William Crawford, Kathleen Dohan, Steven Emerson, Karina Giesbrecht, Jim Gower, Maria Kavanaugh, Deirdre Lockwood, Christopher L. Sabine and Frank Whitney
Natural volcanic iron fertilization of the Subarctic North Pacific

Ai Hattori-Saito, Tomonori Isada, Natsuko Komazaki, Hiroshi Hattori, Kenshi Kuma, R. Michael L. McKay, Tsutomu Ikeda and Koji Suzuki
Fe nutrition in micro-sized diatoms in the Oyashio region of the NW subarctic Pacific during spring

Keisuke Uchimoto, Tomohiro Nakamura, Jun Nishioka, Humio Mitsudera, Michiyo Yamamoto-Kawai, Kazuhiro Misumi and Daisuke Tsumune
A simulation of chlorofluorocarbons in the Sea of Okhotsk

Kazuhiro Misumi, Daisuke Tsumune, Yoshikatsu Yoshida, Takeshi Yoshimura, Keisuke Uchimoto, Tomohiro Nakamura, Jun Nishioka, Humio Mitsudera, Frank O. Bryan, Keith Lindsay, J. Keith Moore and Scott C. Doney
Numerical simulation of iron export from the Sea of Okhotsk to the North Pacific

Yasuhiro Yamanaka, S. Lan Smith, Hiroshi Sumata, Naoki Yoshie, Taketo Hashioka, Takeshi Okunishi, Masahiko Shigemitsu, Maki N. Noguchi and Naosuke Okada (Invited)
New NEMURO-based model incorporating the iron cycle

Stephanie Dutkiewicz, Fanny Monteiro and Mick Follows (Invited)
Interplay between ecosystem structures and iron availability in a global marine ecosystem model

Poster
Youngju Lee and Joong Ki Choi
Effect of Asian dust on the picophytoplankton growth rate and cell cycle

BIO Workshop (W2)

Standardizing methods for estimating jellyfish concentration and development of an international monitoring network

Co-Convenors: Hideki Akiyama (Japan), Richard Brodeur (U.S.A.) and Young-Shil Kang (Korea)

Background

Large high-density jellyfish blooms are becoming increasingly common in many marginal seas in the North Pacific and in other regions of the world's oceans, and may be important regulators of marine ecosystems. These blooms may have direct effects on fish recruitment through predation on vulnerable early life stages of marine fishes, or indirect effects competing for limited food resources with exploited species. In addition, high concentrations of jellyfish influence humans in other ways like economic losses in tourism through beach closures, impeding commercial fishing through net clogging, and loss of energy production through clogging of power plant intakes. If jellyfish populations continue to increase in the coming decades, their impacts on human populations are also likely to increase. However, our understanding of these blooms is hindered by a lack of standardization in sampling and insufficient monitoring. The goals of this workshop were to 1) understand the problems and develop techniques for estimating concentrations of jellyfish, 2) evaluate the status of national monitoring systems, 3) emphasize why standard methods and international monitoring are needed, and 4) develop an implementation plan and schedule for improving abundance and distribution information on jellyfish blooms.

Summary of presentations

The session consisted of 1 invited and 9 contributed oral presentations. The invited talk specifically focused on the advantages and deficiencies of the various methods that have been used to estimate the abundance of gelatinous zooplankton in a number of systems around the world. These included using by-catch in fishery surveys, acoustics, aerial surveys, underwater cameras, shore-based surveys, ships of opportunity, and predictive modeling. For non-quantitative patterns of spatial and temporal abundance, these large-scale methods can effectively be used to monitor jellyfish populations but each has its own bias. To measure ecological effects we also need to: 1) calibrate large-scale methods against quantitative methods, 2) determine numbers and biomass, and 3) estimate trophic importance. Also discussed was how physiological parameters such as respiration rates can be used to measure trophic impacts of jellyfish populations.

Many of the contributed papers discussed particular case studies in different regions of the world, with a substantial emphasis on the giant jellyfish that has been appearing in East Asian waters in the last decade. Two contributed talks discussed acoustic methods (echo counting) and compared these estimates from other methods. Another talk focused on using regularly scheduled ferries between Japan and China to estimate jellyfish abundance visible from the deck. Three talks used video surveys to examine vertical and spatial distribution of smaller medusae off Japan and the west coast of the U.S. in comparison to trawl or sighting surveys. The latter also included using models to predict habitat and interannual catches of jellyfish. One talk used a sonar (DIDSON) system to examine the finer-scale distribution of jellyfish and provided density

estimates three times as high as net sampling. The last talk used numerical particle-tracking models to predict the arrival time of giant jellyfish to Japanese waters. Numerical circulation models were shown to be effective means of examining jellyfish dispersal in coastal waters but best results were obtained if vertical migration was incorporated into the modes. It became apparent that many novel techniques have been applied and some effort has gone into the efficacy of the different systems for estimating jellyfish abundance.

The final part of the workshop focused specifically on the jellyfish problem confronting the Asian east marginal seas with the yearly occurrence of the giant jellyfish blooms. The scale of the problem requires a substantial dedication of resources that may be beyond the ability of one laboratory or even one country to provide and it was broadly accepted that an international effort, coordinated by PICES, should be implemented. One way to accomplish this may be to assemble an international team of experts familiar with different sampling methods to participate on a PICES cruise to intercalibrate these methods to choose the best standard sampling to implement in all regions. Ship time would have to be contributed by the affected countries, but PICES could assist in coordinating research and help to disseminate results by sponsoring followup workshops. In the following years, cruises using multiple sampling gears and methods could be conducted in other jellyfish bloom 'hotspots'. The participants felt strongly that monitoring efforts in place now, including using ships of opportunity, should be continued and expanded where possible, and information on the magnitude and movement of on-going blooms should be expeditiously disseminated to all countries that may potentially be affected.

List of papers

Oral presentations

Jennifer E. Purcell (Invited)
Broad-scale research on jellyfish

Kazuhiro Sadayasu, Yoshimi Takao and Ryuichi Matsukura
Echo trace counting method for estimating the giant jellyfish *Nemopilema nomurai* density and distribution using a quantitative echosounder

Kyoung-Hoon Lee, Soo-Jeong Jang, Won Duk Yoon, Chang-Doo Park and Seong-Wook Park
Density estimates of ***Nemopilema nomurai*** jellyfish in Yellow Sea during 2006-2009

Hideki Ikeda, Hiroko Okawachi, Atsushi Yoshida, Miwa Hayashi and Shin-ichi Uye
Spatio-temporal distribution of the giant jellyfish *Nemopilema nomurai* in East Asian waters by sighting survey from a ferry

Haruto Ishii, Yasuyuki Nogata and Noriaki Endo
Horizontal and vertical distribution of jellyfish, *Aurelia aurita* medusae, and estimation of its abundance with underwater video system in Tokyo Bay

Richard D. Brodeur, Cynthia L. Suchman, Elizabeth A. Daly and Lanaya N. Fitzgerald
Habitat and ecology of large medusa in the northern California Current: An overview of recent studies

Naoki Fujii, Shinya Magome, Atsushi Kaneda and Hidetaka Takeoka
Monitoring method for moon jellyfish abundance in the western Seto Inland Sea, Japan

Hao-Hsien Chang, Chang-Yu Lai, and Wen-Tseng Lo
A study on the ecological significance of the box jellyfish, *Carybdea rastonii* Haacke (Cnidaria: Cubozoa), from the east coast of Taiwan

Chang-Hoon Han and Shin-ichi Uye
Quantification of the abundance and distribution of the common jellyfish *Aurelia aurita* s.l. with a Dual-frequency IDentification SONar (DIDSON)

Akira Okuno, Tatsuro Watanabe, Naoto Honda and Katsumi Takayama
Jellyfish transport simulation taking the diurnal vertical migration into account

BIO Workshop (W3)

Integrating marine mammal populations and rates of prey consumption in models and forecasts of climate change-ecosystem change in the North Pacific and North Atlantic Oceans

Co-sponsored by ICES
Co-Convenors: Hidehiro Kato (Japan), Begoña Santos (Spain/ICES) and William Sydeman (U.S.A.)

Background

Marine mammals are showing considerable changes in abundance. In general, cetaceans, recovering from historical exploitation, are increasing, whereas some pinniped species are declining regionally while others are increasing. Models of marine mammal prey consumption indicate that ~20–60% of secondary production may be taken by these top consumers. Mammals may exert top-down control on food webs, as well as function as competitors to fish, seabirds, and humans for mid-trophic level food resources. One of the goals of PICES and ICES science is to enhance forecasts of ecosystem change attributable to climate and anthropogenic forcings. Given this goal, the workshop reviewed and assessed rates of marine mammal population and prey consumption changes in the North Pacific and North Atlantic. Discussion focused on how to best integrate this information into models of ecosystem dynamics, with and without climate change and fishing impacts.

Summary of presentations

A total of 9 oral presentations and 10 poster presentations were made covering diverse topics from marine mammal population trends to diet and estimates of prey consumption to models of trophic impact in disparate ecosystems. A total of 50 participants from all disciplines represented (physical and biological oceanographers, modelers, marine bird and mammal specialists). A number challenges are currently limiting the accuracy and utility of models of marine mammal prey consumption and ecosystem impacts. These include variation in life histories, foraging distribution, physiology, regional variation in population trends, macro-scale movements between ecosystems, stock and genetic structure, and variability in prey quality and characteristics such as size. These variables and others will be to be incorporated into ecosystem models of trophic impact. Understanding climate impacts on marine ecosystems is made more difficult by the partial recovery of marine mammals from prior over-exploitation and their trophic interactions. It is therefore, of importance to further develop methods and models to estimate ecosystem change brought about by new fluctuations in marine mammal populations.

List of papers

Oral presentations

Andrew W. Trites (Invited)
Marine mammals in multi-species models: Assumptions, limitations and theoretical considerations

Frank A. Parrish
Top-down pressure of foraging monk seals on subphotic fish communities; a possible symptom of a marine mammal population at carrying capacity

Rolf Ream and Lowell Fritz
Pinniped population changes in the North Pacific: Recent trends in northern fur seal and Steller sea lion abundance

M. Begoña Santos and Graham J. Pierce (Invited)
Integrating marine mammal populations and rates of prey consumption in models and forecasts of climate change-ecosystem change in the North Atlantic Ocean

Hiroshi Okamura, Hiroshi Nagashima, and Shiroh Yonezaki (Invited)
Quantitative assessment of impacts on the sandlance population by consumption of minke whales

Hiroto Murase, Tsutomu Tamura, Tatsuya Isoda, Ryosuke Okamoto, Hidehiro Kato, Shiroh Yonezaki, Hikaru Watanabe, Naoki Tojo, Ryuichi Matsukura, Kazushi Miyashita, Hiroshi Kiwada, Koji Matsuoka, Sigetoshi Nishiwaki, Denzo Inagake, Makoto Okazaki, Hiroshi Okamura, Yoshihiro Fujise and Shigeyuki Kawahara
Prey preferences of common minke (*Balaenoptera acutorostrata*), Bryde's (*B. edeni*) and sei (*B. borealis*) whales in the western North Pacific

Jarrod A. Santora, William J. Sydeman and Christian S. Reiss
Of whales and krill: Investigating the patch dynamics between foraging whales and krill

Valeriy I. Fadeev
Benthos and food supply studies in feeding grounds of the Okhotsk-Korean gray whale population off the northeast coast of Sakhalin Island (Russia), 2004-2008

Kyung-Jun Song, Zang Geun Kim, Seok-Gwan Choi, Yong-Rock An and Chang Ik Zhang
Stomach contents of bycaught minke whales (*Balaenoptera acutorostrata*) in Korean waters

Posters

Sergey I. Kiyashko, Svetlana A. Rodkina, Vladimir I. Kharlamenko and Valeriy I. Fadeev
Macrobenthos trophic relationships in western grey whale feeding areas (northeast coast of Sakhalin Island, Okhotsk Sea)

Natalia L. Demchenko and Valeriy I. Fadeev
Quantitative distribution and species composition of amphipods from the feeding ground of western gray whales on the seashore near the Chayvo Bay (northeastern coast of Sakhalin Island, Okhotsk Sea)

Kenji Konishi, Hiroshi Kiwada, Koji Matsuoka, Toshihide Kitakado, Takashi Hakamada and Tsutomu Tamura
Modeling prediction of temporal and spatial distribution of Bryde's whales in the western North Pacific

Elena Ieno, M. Begoña Santos, Alex Edridge, Paul M. Thompson and Graham J. Pierce
Long-term variation in seal diet and relationships with fish abundance

Hyun Woo Kim, Zang Geun Kim, Seok-Gwan Choi and Yong-Rock An
Estimating the population size of Indo-Pacific bottlenose dolphins, Tursiops aduncus, in coastal waters off Jeju Island

Ah-Ra Ko, Zang Geun Kim, Seok-Gwan Choi, Kyung-Hoon Shin and Se-Jong Ju
Understanding the feeding ecology of minke whales, *Balaenoptera acutorostrata*, in Korean Seas using trophic lipid markers

Kristen Ampela
The diet of gray seals (*Halichoerus grypus*) in United States waters, estimated from hard remains and blubber fatty acids

Hyun Woo Kim, Zang Geun Kim, Seok-Gwan Choi and Yong-Rock An
First record of the Indo-Pacific bottlenose dolphins, *Tursiops aduncus*, in Korean waters, by means of skull morphometry and external morphology

Kyum Joon Park, Seok-Gwan Choi, Yong-Rock An, Zang Geun Kim, Ji Eun Park, Hyun Woo Kim, Tae-Geon Park, Young Ran Lee and Dae-Yeon Moon
Abundance estimation of minke whales (*Balanoptera acutorostrata*) in the East Sea, using the sighting survey in 2009

Valeriy A. Vladimirov, Sergey P. Starodymov, Alexey G. Afanasyev-Grigoryev and Vladimir V. Vertyankin
Distribution and abundance of western gray whales off the northeast coast of Sakhalin Island, Russia, 2008

BIO Workshop (W4)
Marine ecosystem model intercomparisons (II)

Co-sponsored with ESSAS
Co-Convenors: Harold Batchelder (U.S.A.), Shin-ichi Ito (Japan) and Bernard Megrey (U.S.A.)

Background

The objective of the Marine Ecosystem Model Inter-comparison Project (MEMIP) is to compare the performance of various lower trophic level marine ecosystem simulation models at predicting the abundance and distribution of zooplankton functional groups. Models with high performance and broad generality will be priority candidates for examining the state of marine ecosystem's response to future global climate change. This workshop will be technical, "hands-on", and focus on beginning to parameterize, execute and calibrate various 1-D versions of biogeochemical lower trophic level (LTL) marine ecosystem models. Multiple ecosystem models will be configured to three Pacific Ocean "location testbeds". The 1-D physical forcing for each site will be fixed (*e.g.*, to enforce a common physical environment) so that differences observed among simulations at a single site are due only to differences in ecosystem models. The three testbeds will be selected based on the availability of data sets suitable for this exercise-data for multiple years, good seasonal coverage, and breadth of state variables spanning inorganic nutrients, chlorophyll (or preferably phytoplankton carbon or nitrogen), and zooplankton biomass measures are needed. We plan to apply LTL models to Oyashio locations

such as stations along Japan's A line, the middle shelf of the eastern Bering Sea (*i.e.*, at mooring M2), and a shelf station on the Newport line to represent the California Current upwelling system. The models will be used to identify mechanisms that are important controls on the level and variability of secondary production and to bound the levels of uncertainty in model predictions by calculating ensemble statistics. Comparisons of identical ecosystem model formulations (*e.g.*, not tuned to each specific location) at multiple locations will provide information on the spatial-temporal robustness of particular model structures and parameterizations.

Summary of presentations

The MEMIP Working Group met for 2 days on October 24 and 25. Twenty-six participants attended the meeting. The first day consisted of invited presentations by Yvette Spitz (U.S.A.), Angelica Peña (Canada), and Nakoi Yoshi (Japan). Yasuhiro Yamanaka (Japan) presented an update on the goals and progress of the MAREMIP project, which is an ecosystem model intercomparison focusing on hindcasting phytoplankton as measured by the ocean color sensors SeaWiFS and MODIS. This goal seemed complementary (and not redundant or duplicative) of the planned MEMIP investigations. Presentations were also made on the physical and biological characteristics and availability of data for the three coastal test bed locations, the A-line off Hokkaido Island, Japan, the Seward or GAK line off of Alaska and the Newport line off the coast of Oregon.

Lengthy discussions took place with regard to procedures to conduct controlled execution of the ecological models at the 3 test bed locations and issues related to configuring the 2-dimensional ROMS model for each location. We also discussed what would be the goal of MEMIP, and concluded that an assessment and comparison of the generality (portability) of several state-of-the-art ecosystem models would constitute a significant contribution to the goals of FUTURE, and to marine pelagic ecology more generally.

There are several unique aspects of the MEMIP project. These include specifically looking at coastal regions of the North Pacific; using zooplankton abundance and distribution as the metric of model skill – providing a direct food-web link to upper trophic levels and using model investigations as a strong focus on evaluation of the ability of the various models to hindcast biomasses and distributions of zooplankton, in addition to nutrients and phytoplankton chlorophyll. The products of the comparison will contribute to estimation of the uncertainty and the limits of forecasting. In this meaning, MEMIP will contribute to FUTURE. A current version of the ROMS model code was retrieved from the ROMS distribution site and 6 marine ecosystem models of varying complexity were selected for the comparison. A list of tasks was prepared and 7 individuals agreed to take responsibility for the various identified tasks. A timeline was established for the completion of specific tasks and to maintain progress toward achieving the goal of MEMIP. Work will progress inter-sessionally. A proposal was prepared to hold a follow-up 2-day workshop immediately priot to the PICES-2010 meeting in Portland, U.S.A., which was submitted to the BIO Committee for their consideration.

List of papers

Oral presentations

Yvette H. Spitz (Invited)
Considerations and challenges inherent to the intercomparison of pelagic ecosystem models

Naoki Yoshie, Shin-ichi Ito, Kosei Komatsu, Takahiko Kameda, Tsuneo Ono, Kiyotaka Hidaka, Toru Hasegawa, Akira Kuwata, Miwa Nakamachi, Yuji Okazaki, Takeshi Okunishi, Kazuaki Tadokoro, Hiroaki Saito and Yasuhiro Yamanaka (Invited)
Comparison of two marine ecosystem models NEMRUO and eNEMURO in the western North Pacific

Angelica Peña (Invited)
Comparing the responses of simple plankton ecosystem models to alternate formulations and increasing complexity

FIS Workshop (W5)
Understanding the links between fishing technology, bycatch, marine ecosystems and ecosystem-based management

Co-Convenors: Heuni Chun An (Korea), Kaoru Fujita (Japan) and Craig Rose (U.S.A.)

Background

The methods and gears used to capture fish affect unintended mortalities (bycatch, discards and unobserved mortalities) and damage to other ecosystem components. Bycatch and discards significantly impede the sustainable use of living marine resources that are captured by commercial fisheries. To minimize unintended impacts on the environment, commercial fisheries should strive to improve selectivity to reduce the bycatch and discards of non-target species, as well as undersized commercial species. Research is exploring other effects of fishing gears on ecosystems such as habitat damage and ghost fishing of derelict fishing gear, and developing new technologies to minimize such unintended impacts. This workshop focused on the linkages between fishing technologies, ecosystems and ecosystem based management, as well as on recent technologies to reduce unintended effects of fishing. Particular emphasis was placed on studies that have changed commercial fishing practices.

Summary of presentations

The workshop met on Friday, October 23 and received 7 oral presentations and one poster presentation. One scheduled presentation (Maria Rebecca Campos) was not given. The initial presentation, from the invited speaker (Tatsuro Matsuoka) provided an extensive orientation to the issues of unwanted mortality of aquatic organisms resulting from fishing operations, including bycatch and discard research and the study of derelict gear and ghost fishing mortality. It also proposed a model for estimating mortalities from ghost fishing of derelict gear.

As a workshop on the interaction of fishing and marine ecosystems, the remaining presentations divided into two broad categories: how fishing affects ecosystems, particularly finding ways to reduce those effects, and how ecosystem states affect fishing. The later category included a presentation (Jong-Hun Na) of the variation of shrimp trawl catches due to seasonal and tidal effects and consideration of this information in risk analyses. Environmental effects were shown to affect the inter-annual and spatial variability of albacore catches in the American Samoa EEZ through oceanographic influences on forage density (Réka Domokos). Finally, in the environment effects fishing group, a poster (Ji Hyun Lee) examined how benthic different communities developed on artificial reefs placed to aggregate fish.

Four presentations demonstrated that fishing technology and methods can be altered to reduce fishing's unintended effects on ecosystem components. A review of three studies (Craig Rose) described trawl modifications to reduce salmon bycatch in pollock fisheries, changes to herding devices for flatfish trawls to reduce damage to sessile epifauna and estimation of mortality rates for crabs that encounter trawls but are not captured (unaccounted mortality). Mesh size and mouth openings of conger eel traps were shown (Seong Hun Kim) to determine selectivity and catch rates for these devices and studies responding to harvester feedback identified specifications that both reduced bycatch and allowed effective harvest. The importance of the interaction of fish behavior and fishing gear characteristics was highlighted in a study (Yonghae Kim) of the effect of twine visibility in codends on whether fish escape through available openings. High contrast twines inhibited escape because the fish saw and oriented to the netting; a difference that disappeared at light levels too low for effective vision. The importance in the adoption of new gears of balancing bycatch reduction while retaining effective capture of wanted fish was highlighted in a presentation (Kaoru Fujita) describing a trawl using multiple devices to separate components of a multi-species fishery and a high-opening trawl to selectively harvest off-bottom species.

The variety of studies and methods in this workshop demonstrated that, while the application of methods and designs must be specific to any study, the field would benefit from better communication of such tools within the region. The workshop agreed with the recommendation of the 2007 survey standardization workshop that the FIS Committee should consider options for continuing communication on fishing gear research. Fishing technology research can improve understanding across many critical fields, including bycatch reduction, discard assessments, survey standardization, reduction of habitat effects, understanding of the relationships of catch and effort, and energy savings. Wider representation and participation should be sought in developing proposals for further PICES activities in this area.

List of papers

Oral presentations

Tatsuro Matsuoka (Invited)
Negative impacts in capture fisheries: Bycatch, discards, derelict fishing gear, and ghost fishing

Craig S. Rose
Fishing gear technology to reduce bycatch and other ecosystem effects of Alaska trawl fisheries: Cooperative research with the fishing industry

Jong-Hun Na, Chul-Woong Oh and Sung-Tae Kim
Variations in species composition, biomass, and density in shrimp trawl bycatch across seasons and tidal phases in southern Korean waters: Developing a fisheries risk management approach

Heui Chun An, Bong Jin Cha, Seong Hun Kim, Chang-Doo Park, Kyoung-Hoon Lee, Seong-Wook Park and Jong Keun Shin
Modification of white-spotted conger eel *Conger myriaster* net trap for reducing bycatch of nontarget species

Réka Domokos
Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone

Yonghae Kim and Daesung Whang
The effect of netting twine contrast on escape of juvenile sea bream in model trawl cod-ends

Kaoru Fujita, Yoshiki Matsushita and Seizo Hasegawa
Development of bycatch reduction trawl nets to have benefits for fishermen

Poster

Ji Hyun Lee, Wan Ki Kim, M. Sidharthan, Sang Mok Jung, Hyun Woung Shin and Chae Sung Lee
Comparison of benthic assemblages and associated fish communities on two artificial reef types deployed along the Pohang coast, South Korea

MEQ Workshop and a Laboratory Demonstration (W6)
Review of selected harmful algae in the PICES Region: V. Cyst forming HAB species and HAB-S Meeting

Co-Convenors: Changkyu Lee (Korea) and Charles Trick (Canada)

Background

Analogous to the seeds of terrestrial plants, phytoplankton cysts are the hardy resting forms that allow phytoplankton (usually flagellates) to survive during extreme environmental conditions. These cysts fall out of the water column into sediments often after large blooms, thereby forming seed beds. Characterization of the distribution of seed beds in coastal waters can assist with forecasting the intensity of HAB events. However, proper identification is often difficult as many cysts can look alike. This workshop focused on new methods for identification of cysts as well as findings on their ecology and physiology. Presentations were encouraged on known distributions of cysts in coastal waters (cyst mapping), and studies on their ecophysiology.

List of papers

Oral presentations

Kazumi Matsuoka (Invited)
Modern dinoflagellate cyst study

Ruixiang Li, Jun Pan, Yan Li and Ping Sun
Distribution of dinoflagellate cysts in surface sediments in the Yellow Sea in autumn

Tatiana V. Morozova and Tatiana Yu. Orlova
Resting stages of HAB species in recent marine sediments from Peter the Great Bay, Sea of Japan (East Sea)

Hyeon Ho Shin, Yang Ho Yoon and Kazumi Matsuoka
Dinoflagellate cyst assemblages as an indicator of changed nutrient levels in Korean and Japanese coastal areas

Donald M. Anderson, B.A. Keafer, K. Norton, D.J. McGillicuddy, R. He, C.H. Pilskaln, D. Couture and J. Martin
Toxic blooms of *Alexandrium fundyense* in the Gulf of Maine: The role of cysts in population dynamics and long-term patterns of shellfish toxicity

Ichiro Imai, Shigeru Itakura and Mineo Yamaguchi
Cyst dynamics and occurrences of red tides of *Heterosigma akashiwo* and *Chattonella* spp. in temperate coastal waters

Ken-ichiro Ishii, Mitsunori Iwataki, Kazumi Matsuoka and Ichiro Imai
Species identification of resting spores of *Chaetoceros* (Bacillariophyceae)

Vera Trainer and Hak-Gyoon Kim
Welcome, goals of HAB Section meeting

Country Reports (2008-09) and HAE-DAT (year 2004) reports
Korea (Yangsoon Kang)
Japan (Shigeru Itakura)
China (Jinhui Wang)
Canada (Charles Trick)
U.S.A. (Vera L. Trainer)

Tatiana Yu. Orlova
Current situation and perspective for HABs monitoring on the Russian Pacific coast

Mingyuan Zhu and Zongling Wang
The study on the occurrence of green tide in Yellow Sea in 2009

Donald Anderson
Report on ICES HAB working group and potential areas of collaboration
Discussion of future workshops, special sessions, special PICES report on HAB species

Takafumi Yoshida
Integrated harmful algal bloom website demonstration

Monica Lion
The joint Harmful Algal Bloom Programme and International Oceanographic Data and Information Exchange Harmful Algae Information System: An update

Vera L. Trainer
PICES Seafood Safety Project

William P. Cochlan
Report on GEOHAB Open Science Meeting on HABs and Eutrophication

John K. Keesing, Dongyan Liu, Qianguo Xing, Ping Shi and Peter Fearns
Recurrent large scale macroalgal blooms in the Yellow Sea

MEQ/FIS Workshop (W7)
Interactions between aquaculture and marine eco-systems

Co-Convenors: Katsuyuki Abo (Japan), Kevin Amos (U.S.A.), Galina Gavrilova (Russia) and Hyun Jeong Lim (Korea)

Background

Open-water marine aquaculture has ongoing interactions with its surrounding environment. Some of these interactions have the potential to cause negative and positive effects on the other. For example, pathogens may be transmitted from wild reservoirs to cultured animals and *vice versa*, with the consequence of disease and mortality. Another example is the dispersal of nutrients from a farm site which in some instances negatively impacts the benthos while in other areas may enhance a nutrient-deficient marine zone or contribute to the culture of another aquatic species. Also, changing marine environments, including those impacted by global warming and ocean acidification, have the potential to affect these ecosystem interactions so as to investigate the culture of new farmed species - species that may perform better in altered environments. The PICES Working Group on *Environmental Interactions of Marine Aquaculture* (WG-EIMA; WG 24) has been charged with evaluating existing and potentially new interactions and to develop models that assess the risk of these interactions to include escapes of farmed marine animals (considerations for genetics, competition, and pathogen transfer), discharge of effluent from culture facilities, use of non-native species in culture, and the exchange of pathogens between farmed and wild aquatic animals. Major goals of this workshop included: 1) discussion of tools and models currently used by member countries to assess types of interactions and risks posed by them; 2) developing consensus on aquaculture technologies and indicators of interactions that will be used in completing the terms of reference and preparing the final report of WG-EIMA to include species and methods of culture; and 3) identifying the process by which the work will be carried out under the terms of reference.

List of papers

Oral presentations

Dario Stucchi, Michael Foreman, Ming Guo and Piotr Czajko (Invited)
A coupled biophysical sea lice model for the Broughton Archipelago

Tamiji Yamamoto, Hajime Maeda, Osamu Matsuda and Toshiya Hashimoto (Invited)
Effects of culture density on the growth and fecal production of oyster *Crassostrea gigas*

Xuelei Zhang
Challenges and opportunities of environmental issues faced by coastal aquaculture in China

Galina S. Gavrilova
Some ecological aspects of invertebrate mariculture in semi-closed bights

Jill B. Rolland and Lori L. Gustafson
A model to exclude endemic pathogens from semi-open or open aquaculture facilities: Utilizing compartmentalization to promote epidemiologic separation in shellfish hatcheries

Lori L. Gustafson and Jill B. Rolland
Marine reservoirs for infectious salmon anemia virus in pen-reared Atlantic salmon: Do they play a role in the U.S.?

Kevin H. Amos
A review of infective doses of viral and bacterial pathogens for modeling interactions between marine pen-reared salmon and wild cohorts

J.E. Jack Rensel, Dale A. Kiefer and Frank O'Brien (Invited)
Aquaculture modeling using a GIS-integrated simulation model

Katsuyuki Abo and Toshinori Takashi
Assessing nutrient environments of Nori (*Porphyra*) aquaculture area by using numerical model

Brett R. Dumbauld and Jennifer L. Ruesink
Evaluating the effects of bivalve shellfish aquaculture and its ecological role in the estuarine environment in the United States

Edward A. Black
Aquaculture risk assessments and ecosystem-based management

Motoyuki Hara and Toyomitsu Horii
Evaluation of the impacts of seedlings on abalone reproduction by genetic approach

Qtae Jo, Su-Kyoung Kim, Chae Sung Lee, Jin Yeong Kim and Victor D. Dzizyurov
Production of healthier *Patinopecten yessoensis* seeds for aquaculture on the Korean and Russian coasts of the East Sea

Posters

Larissa A. Gayko
The long-term physical-statistical method for the forecast of mollusks' yield at marine farms in Primorye (Sea of Japan)

Larissa A. Gayko
Interrelation between hydrometeorological and biological parameters of marine farms in Primorye (Sea of Japan)

Arthur A. Kos'yanenko
The distribution of commercially important species of sea squirts (Ascidians) in Alekseeva Bay of Peter the Great Bay

Liping Jiao, Gene J. Zheng, Tu Binh Minh, Liqi Chen and Paul K.S. Lam
Persistent toxic substances in remote lake and coastal sediments from Svalbard, Norwegian Arctic: Levels, sources and fluxes

Valeria E. Terekhova
Effect of the prophylactic antibacterial treatment on the intestinal microflora of cultivated sea cucumber, *Apostichopus japonicus*

Gary H. Wikfors
Flow-cytometric applications for bivalve hemocytes: Tools for assessing mollusc/ecosystem interactions

April N. Croxton, Gary H. Wikfors and Richard D. Gragg, III
An evaluation of hemocyte profiles from oyster populations located in two Florida bays

POC Workshop (W8)

Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales

Co-sponsored by CLIVAR
Co-Convenors: Emanuele Di Lorenzo (U.S.A.) and Shoshiro Minobe (Japan)

Background

Understanding the dynamics that control climate variability in the Pacific basin is essential for exploring the degree of predictability of the ocean-atmosphere and sea-ice climate systems of the North Pacific. The goal of this workshop was to improve the conceptual and quantitative frameworks used by the PICES community to interpret low-frequency climate variability in the Pacific basin, ranging from interannual to multi-decadal timescales. Contributions were invited on a broad range of topics including: (1) studies that link regional to basin scale dynamics; (2) investigations of "regime shift", specifically the extent to which sharp transitions in the climate system are predictable and connected with low-frequency variations in the ocean-atmosphere and sea-ice systems; (3) studies that separate the stochastic and deterministic components of low-frequency climate fluctuations; (4) analysis of long-term observations collected in regional environments across the Pacific, specifically their relationship to large-scale climate processes as opposed to local-scale dynamics; (5) climate change and how it may impact the statistics of Pacific climate (*e.g.*, frequency of "regime shifts"); and (6) more generally studies that propose new mechanisms underlying low-frequency Pacific climate variability.

List of papers

Oral presentations

Topic 1: Pacific Large-scale dynamics and variability

Sumant Nigam and Bin Guan (Invited)
Ocean-atmosphere structure of Pacific decadal variability

Curtis Deutsch and Taka Ito (Invited)
Oxygen variability in the North Pacific

Sang-Wook Yeh, Yune-Jung Kang, Yign Noh and Arthur J. Miller
Characteristics in the North Pacific mean SST and its variability in climate transition periods

Skip McKinnell and Nate Mantua
Regimelettes – PDO variability in the 21st Century

Muyin Wang, James E. Overland and Nicholas A. Bond
A means for reducing projection uncertainty of climate models on regional scale

Topic 2: Tropical / Extratropical connections

Lixin Wu (Invited)
A unified teleconnection mechanism between extratropical and tropical oceans

Michael Alexander, Daniel J. Vimont, Ping Chang and James Scott (Invited)
The impact of extratropical atmospheric variability on the tropical Pacific: Testing the seasonal footprinting mechanism

Daniel J. Vimont (Invited)
The role of thermodynamic coupling in connecting subtropical and tropical Pacific climate variations

Xiaohui Tang, Ping Chang and Fan Wang
Influence of reducing weather noise on ENSO prediction

Topic 3: Western North Pacific dynamics and variability

Bo Qiu, Shuiming Chen and Niklas Schneider (Invited)
Forced versus intrinsic variability of the Kuroshio Extension system on the decadal timescales

Shoshiro Minobe, Jiaxu Zhang and Miho Urasawa
Kuroshio Extension variability during the last 50-years and its predictability

Rong-shuo Cai, Qi-long Zhang and Hong-jian Tan
The long-term transport variation of Kuroshio and its adjacent currents in the western North Pacific Ocean

Masami Nonaka, Hisashi Nakamura, Bunmei Taguchi, Youichi Tanimoto and Hideharu Sasaki (Invited)
Decadal variability in the oceanic frontal zones in the western North Pacific Ocean

Elena I. Ustinova and Yury D. Sorokin
Low-frequency fluctuations of thermal conditions in the Far-Eastern Seas and large-scale climate processes

In-Seong Han, Young-Sang Suh, Jae-Dong Hwang and Joon-Soo Lee
Long-term change of thermal structure in the surface layer due to wind-induced conditions around the Korean Peninsula

Konstantin A. Rogachev and Natalia V. Shlyk
Surface freshening and mid-depth warming in the Pacific Western Subarctic since 1950s

Topic 4: Air Sea interaction and coupled structures

Bunmei Taguchi, Hisashi Nakamura, Masami Nonaka, Nobumasa Komori, Akira Kuwano-Yoshida, Hideharu Sasaki, Koutarou Takaya and Shang-Ping Xie (Invited)
Decadal variability of the Kuroshio/Oyashio Extension fronts and their atmospheric influences

Niklas Schneider, Yoshinori Sasaki, Axel Lauer, Bo Qiu, Arthur J. Miller and Detlef Stammer
Extratropical ocean to atmosphere coupling via atmospheric Ekman pumping

Topic 5: Discussion/Synthesis

Emanuele Di Lorenzo, Niklas Schneider, Kim M. Cobb, Jason Furtado and Michael Alexander
ENSO and the North Pacific Gyre Oscillation: An integrated view of Pacific decadal dynamics

Arthur J. Miller, Emanuele Di Lorenzo, Shoshiro Minobe and Niklas Schneider
North Pacific decadal variability: Current understanding and unresolved issues

Posters

Rong-shuo Cai, Qi-long Zhang and Qing-hua Qi
Spatial and temporal oscillation and long-term variation in sea surface temperature field of the South China Sea

Yuri Nikonov
Description of seasonal water circulation variability in Tatar Strait in the Japan Sea by numerical method

Ling Ling Liu, Rui Xin Huang and Fan Wang
The role of diurnal cycle and mixed layer depth perturbations in ventilation: Subduction and obduction

Gennady V. Khen
Variability of the Kamchatka Current transport in the Kamchatka Strait

In-Seong Han, Takeshi Matsuno, Tomoharu Senjyu, Young-Sang Suh and Joon-Soo Lee
Behavior of low salinity water mass from Northern East China Sea to Korea Strait

POC/BIO Workshop (W9)
Mesoscale eddies and their roles in North Pacific ecosystems

Co-Convenors: Kyung-Il Chang (Korea), William Crawford (Canada), Shin-ichi Ito (Japan) and Vlacheslav Lobanov (Russia)

Background

Mesoscale eddies move through the ocean carrying physical, biological, and chemical anomalies. They translate over space scales of hundreds to thousands of kilometers and exist for periods lasting from months to years. Eddies are found throughout the North Pacific Ocean in association with strong boundary currents like the Kuroshio and Oyashio and the Alaskan Stream, and also with North Pacific eastern boundary currents like the California and Alaska Currents. They are also prevalent in marginal seas. Generation and evolution of eddies are thought to be related to the shear instability of boundary currents like the Kuroshio, and topographic features in the California and Alaska Currents. Mesoscale eddies affect the structure of marine plankton in various ways. Horizontal advection and vertical mixing by eddies contribute to the generation of high chlorophyll concentration off the coast. They draw shelf water containing nutrients and planktons into the deep offshore waters. Mesoscale eddies are also important for survival of larvae. Eddy pumping also plays a role in episodic nutrient injections into the photic zone resulting in enhanced primary production inside the eddy for cyclonic eddies. For anticyclonic eddies, ageostrophic upwelling and divergent Ekman pumping due to winds over the eddies yield upwelling within the eddy. This workshop addressed: 1) dynamical characteristics of mesoscale eddies in different parts of PICES domain, focusing on their similarity and difference; 2) influences of eddies in constituting the dominant physical forcing on the ecosystems; and 3) expected future eddy activities and their possible impacts on North Pacific ecosystems.

Summary of presentations

The session started with a brief introduction of the session; the topic of mesoscale eddies is one of overarching problems which engaging physics to biology. About 50 persons attended and 16 presentations were made. An invited talk by Carol Ladd reviewed characteristics and impacts of eddies in the Gulf of Alaska, and 4 following talks (by William Crawford, Vincent Combes, Hiromichi Ueno and Sonia Batten) showed its details. There are three eddy formation areas in the Gulf of Alaska; Haida, Sitka, and Yakutat. In addition to these, eddies generated in the Alaskan Stream region were introduced by Hiromichi Ueno, giving a fourth generation region. All are anticyclonic. Eddy formation and propagation patterns change according to gyre strength and hence to atmospheric forcing. These eddies contribute to water exchanges between shelf (less nutrient and rich iron) and offshore (rich nutrient and less iron) regions. Offshore primary production depends on upwelling process made by eddies, including 1) spin down of anti-cyclonic eddy, 2) westward movement of anti-cyclonic eddies into regions of denser waters, and 3) eddy-wind interaction. Influences of these eddies on zooplankton production and fish larval transport were also shown. It was noted that impacts on biota depend on location, age and season of each eddy. The Gulf of Alaska eddies are labeled as “floaters” (refer to process 2 above) to distinguish them from westward-moving cyclonic eddies of the California Current that sink below less dense waters of the sub-tropical gyre.

Eddies in California Current were introduced by Emanuele Di Lorenzo and a clear relation between wind forcing and eddy activity was shown. Wind stress curl gradients control the strength of California Current and hence eddy activity. However, eddies have a 1- to 2-year life time and modulate the atmospheric forcing to low-frequency signals.

Eddies in the western side of North Pacific were shown in 8 talks. Vyacheslav Lobanov presented anticyclonic eddies in the seas between Korea, Japan and Russia. The eddies in the west region and east region showed different characters and some eddies showed multi-structured cores, which suggests merging and splitting processes of eddies. Svetlana Ladychenko introduced anticyclonic eddies along the Primorye coast and Peter the Great Bay. Sang-shin Byun showed an impressive observation of the Ulleung eddies by a mooring system that captured near-inertial wave reflections in the upper thermostad layer, revealing a region of enhanced mixing near 350 m depth. Sergey Zakharkov described characteristics of eddies in the confluence zone between the cold Primorye and warm East Korean current. Sachihiko Ito showed three eddy propagation routes of mesoscale eddies in the Kuroshio-Oyashio Extension: Japan Trench, Subarctic Front, and Subarctic Boundary. Natalya Luk'vanova introduced anticyclonic eddies in the Soya Warm Current region and Xiao-Hua Zhu showed eddies in southeast of Okinawa Island and its baroclinic mechanism.

Shoshiro Minobe and Hiroshi Sumata showed global eddy activities. Shoshiro Minobe introduced two additional upwelling process of anticyclonic eddies: 4) intensification of wind-eddy interaction by vertical momentum transfer induced by warm SST on anticyclonic eddies and 5) intensification of wind-eddy interaction by pressure adjustment on anticyclonic eddies. Hiroshi Sumata showed a state-of-art product of global eddy resolving ecosystem model. Additionally, eddies in the East India Coastal Current region were shown by Prescilla Kurien.

After these oral presentations, a group discussion focused on eddy mechanisms and their impact on ecosystems. It was noted that the PICES oceans and seas contain most of the types of eddies observed globally. Discussion focused on many aspects of eddies and their impacts: a) importance of eddies on global transport of carbon, b) impacts of eddy effects on global climate (up-scaling), c) importance of human dimension of eddies (*e.g.*, sea level rise), d) importance of development and encouragement of observations of eddies, e) continuous efforts to investigate mechanisms of nutrient supply by eddies, and f) close partnership with FUTURE's Advisory Panel on *Climate, Oceanographic Variability and Ecosystems* (COVE-AP) were encouraged.

List of papers

Oral presentations

Carol Ladd, Elizabeth Atwood, William Crawford, Phyllis Stabeno and Frank Whitney (Invited)
Eddies in the Gulf of Alaska

William Crawford and Nick Bolingbroke
Cross-shelf exchange by mesoscale eddies in the northeast Pacific Ocean

Vincent Combes, Emanuele Di Lorenzo and Enrique N. Curchitser
Interannual and decadal variations in eddy-induced cross-shelf transport in the Gulf of Alaska

Hiromichi Ueno, William Crawford and Hiroji Onishi
Impact of Alaskan Stream eddies on chlorophyll distribution in the central subarctic North Pacific

Sonia Batten, William J. Sydeman, Mike Henry, David Hyrenbach and Ken Morgan
Ship of opportunity observations of mesoscale eddies in the Gulf of Alaska

Vyacheslav B. Lobanov
A census of anticyclonic eddies in the northern Japan/East Sea

Svetlana Y. Ladychenko and Vyacheslav B. Lobanov
Mesoscale eddies near the Primorye coast in the northwestern Japan/East Sea

Sang-Shin Byun, Jong Jin Park, Jae-Hun Park and Kyung-Il Chang
Observation of near-inertial waves in an anticyclonic mesoscale eddy in the southwestern East/Japan Sea

Sergey P. Zakharkov, Tatyana N. Gordeychuk and Elena A. Shtraikhert
Variations of the production phytoplankton parameters of mesoscale anticyclonic eddy in the northwestern part of Sea of Japan

Shoshiro Minobe, Kunihiko Aoki, Youichi Tanimoto, Yoshinori Sasaki and Yoshikazu Sasai (Invited)
Meridional eddy heat transport estimations using satellite data and eddy resolving OGCM

Sachihiko Itoh and Ichiro Yasuda
Characteristics of mesoscale eddies in the Kuroshio–Oyashio Extension Region detected in the distribution of the sea surface height anomaly

Hiroshi Sumata, Taketo Hashioka, Maki N. Aita, Naoki Yoshie, Tatsuo Suzuki, Takashi T. Sakamoto, Naosuke Okada and Yasuhiro Yamanaka
Effects of eddy transport on the nutrient supply into the euphotic zone simulated in an ocean ecosystem model

Xiao-Hua Zhu, Jea-Hun Park and Daji Huang
Observation and dynamics of baroclinic eddies southeast of Okinawa Island

Jianping Gan and Anson Cheung
Vertically varying cyclonic eddy in the southwestern South China Sea

Prescilla Kurien, Motoyoshi Ikeda and Vinu K. Valsala
Mesoscale variability along the east coast of India in spring and fall revealed in satellite data and OGCM

Natalya B. Luk'yanova and Igor A. Zhabin
The interaction of Soya Warm Current waters with the anticyclonic eddies in the southern Sea of Okhotsk

POC/BIO Workshop (W10)
Carbon data synthesis workshop

Co-Convenors: Masao Ishii (Japan) and Robert Key (U.S.A.)

Background

This workshop was a major step forward in the implementation of the North Pacific carbon data synthesis. Investigators who submitted data to the synthesis collectively reviewed the progress of the QA/QC process, and discussed the degree of success of the techniques applied and whether different or additional approaches were necessary. This was a highly 'hands-on' activity that involved data originators who submitted data to the synthesis and investigators participating in the synthesis processes, and which will lead directly to value-added data products and collective publications.

Summary of presentations

After the introduction of the goals and the agenda of this workshop by Masao Ishii and some discussions about what we will do in this workshop by participants, the following topics regarding our activity for Pacific data synthesis were presented.

Related activities
Rpbert Key talked about CARINA and some early scientific products from it. CARINA is the carbon database in the water columns in the Arctic, Atlantic and the Southern Ocean which was initiated by L. Mintrop and D. Wallace and developed as one of the activities of the EU-integrated project CARBOOCEAN. It was recently finalized and many papers describing how they conducted a 2nd-level quality control (QC) have been submitted to the journal *Earth System Science Data* and are now under review. We will synthesize the Pacific carbon data in a manner consistent with CARINA.

Michio Aoyama introduced activities toward preparing reference materials for nutrients in seawater (RMNS) and establishing the "International Nutrient Scale System". He also discussed their global nutrient data synthesis based on RMNS.

Datasets
- Toru Suzuki gave an overview of the datasets collected so far for our synthesis. He has collected data from 193 cruises including 30 WOCE cruises with 7545 stations since 1991. Data formats have been transformed into the "WOCE exchange format". Cruise information has been tabulated on the website http://cc-s.pices.jp/table.
- Akihiko Murata introduced JAMSTEC activities on their Repeat Hydrography/CO_2 and datasets they have provided. All their datasets have already been stored in MIRC.

- Chris Sabine introduced the activities of US CLIVAR Repeat Hydrography/CO_2 and datasets they have provided. All datasets have already been stored in CDIAC.
- Masahide Wakita introduced the data from repeat-lines on 155°E and the time-series stations KNOT and K2 in the western subarctic gyre that have been occupied by Hokkaido University and JAMSTEC Mutsu Institute of Oceanography. All these datasets have been submitted to MIRC.
- Jim Christian talked about the data from Line-P in the eastern subarctic gyre. The data have been submitted to CDIAC; some revisions will be made to the first QC following discussion among the group.
- Tsuneo Ono talked about the data from the repeat line "A-line" in the Oyashio region. This dataset has been submitted to MIRC.
- Masao Ishii talked about data sets from the Japan Meteorological Agency's repeat lines along 137°E and 165°E. The datasets have been submitted to MIRC but there are outstanding questions about the CFC data that are to be fixed soon. He also talked about the data set of the Meteorological Research Institute–JAMSTEC collaborative studies in the western equatorial Pacific.
- Ken'ichi Sasaki stood for the CFCs group in the Pacific and introduced the data and some potential methods of 2nd-level QC of CFC data.

Discussion about the implementation of the 2nd-level QC

Toru Suzuki introduced the method of a 2nd-level QC using the Matlab scripts provided by Toste Tanhua and Steven van Heuven from the CARINA group. Then we discussed the following issues regarding the implementation of the 2nd-level QC.

Working Groups
We decided to make two working groups, one for the open ocean and the other for marginal seas. These working groups are divided into sub-working groups as follows. The Open Ocean Group will be subdivided by data type while the Marginal Seas Group will be subdivided by region. We define the border between the East China Sea and East/Japan Sea as the Tsushima Strait.

Open Ocean Working Group:
- CO_2 system (TCO_2, TA, pH, discrete pCO_2): *M. Ishii, M. Wakita, C. Sabine, L. Miller†
- Oxygen and nutrients: *T. Ono, M. Aoyama, J. Christian, H. Garcia
- CFCs and other transient tracers: *K. Sasaki, J. Bullister
- Salinity: *T. Kawano, M. Aoyama, H. Freeland

Marginal Seas Working Group:
- East/Japan Sea: *K. Lee
- Sea of Okhotsk: *Y. Watanabe, A. Andreev†
- Bering Sea: *A. Murata, J. Mathis†
- South and East China Sea: *M. Dai†, A. Chen†

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*Group leader, † name put forward by colleagues, confirmation pending

Submission of new datasets
The deadline for data submission was January 2009. We agreed to accept additional data over the next few months, as these are important datasets and we are still early enough in the 2nd-level QC process. Datasets that were identified and promised are:

Area	Provider		Expected time of submission
East/Japan Sea	K. Lee	> MIRC	within a month
West coast of America	R. Feely	> CDIAC	within a month
Everything in CCHDO	R. Key	> CDIAC	by end of 2009
K2 and others	M. Wakita	> MIRC	by end of 2009

Additional potential datasets were identified and individuals volunteered to follow up to see if the data could be obtained in time.

Sea of Okhotsk	Y. Watanabe	contact by T. Ono.
East China Sea (SEATS)	A. Chen	contact by T. Saino.
Unsubmitted Russian data	A. Andreev	contact by A. Kozyr
Russian Arctic	R. Key	CD exists
Arctic nutrient data	L. Codispoti	contact by R. Key
137°E and 165°E	JMA	contact by M. Ishii

Correspondence to RECCAP

Chris Sabine introduced the GCP program RECCAP (REgional Carbon Cycle Assessment and Processes) for the synthesis of knowledge of the global carbon cycle. We discussed our potential role in RECCAP. The conclusions are:

- Because of the time table planned for RECCAP, it will be difficult to include the results of the Pacific data synthesis in RECCAP. We will proceed with our data synthesis activity in parallel with RECCAP.
- The chapter on carbon storage in the Pacific in the RECCAP report will be led by A. Murata with contributions from C. Sabine, M. Ishii and others using selected datasets from GLODAP, CLIVAR/CO_2 and time-series lines and stations.

Time table

We discussed the future timetable of our activity and decided as follows:

- We will hold an inter-sessional workshop in June 2010 in Japan (Tokyo or Tsukuba) or in the U.S. (Seattle).
- We will have our final workshop (2 full days including parallel sessions) in October 2010 as part of the PICES Annual Meeting in Portland, U.S.A.. At this workshop we will finalize the 2nd-level QC, and work on manuscripts to submit to ESSDD.

Potential scientific products

We discussed potential scientific products, including a list of papers potentially arising from the analysis. Likely authors were identified or volunteered. Topics include:

- Changes in the carbonate saturation state (R. Feely, A. Murata, L. Miller†)
- Alkalinity change (carbonate dissolution) in the water (K. Lee, J. Christian, R. Feely)
- Decadal change in anthropogenic carbon inventory (entire group).
- Regional decadal trends in water column carbon inventory at 137°E, 155°E ,165°E, equator K2 (M. Ishii, M. Wakita)
- Changes in oxygen and nutrient concentrations (T. Ono, M. Aoyama, J. Christian, , H. Garcia, R. Key, T. Saino, S. Emerson†, C. Deutsch†, D. Sasano†)
- Basin-integrated meridional carbon transport (A. Murata, A. McDonald†)
- North-east Asian marginal seas (K. Lee)
- Relationship to GLODAP versions 2 and 3 (R. Key, A. Kozyr, T. Suzuki)
- Relation to climate change and climate variability (J. Christian, K. Rodgers)
- Investigation of mapping techniques (R. Key)
- CFCs (K. Sasaki, J. Bullister†)
- Tritium and Helium (R. Key)
- CDIAC-MIRC data package NDP (A. Kozyr, T. Suzuki)

† name put forward by colleagues, confirmation pending

Name of our dataset

It was decided that our project and dataset requires a name and/or acronym, and it was proposed that we choose one soon so that interim or tentative names do not get into many documents. Candidates proposed by participants are:

- CARP (CARbon in the Pacific): Carp is the name of a Japanese professional baseball team, as well as a fish, which someone pointed out is actually a *freshwater* fish.
- CIPOC (Carbon In the Pacific OCean)
- CARIPOC (CARbon In the Pacific OCean)
- CARIPAC (CARbon In the PACific ocean)
- PCDS (Pacific Carbon Data Synthesis)

Masao Ishii will poll participants for their preference and decide the new name within one month following the workshop.

List of papers

Oral presentations

Masao Ishii
Introduction: Background and goal of the workshop

Related activities

R.M. Key, S. Jutterström, M. Hoppema, A. Olsen, T. Tanhua and D.W.R. Wallace (Invited)
The CARINA data product

M. Aoyama
Global nutrient data synthesis for WOCE and CLIVAR data based on Reference Material for Nutrients in Seawater

Overview of the datasets

Toru Suzuki
Overview of the Pacific carbon data collected

Christopher Sabine
US CLIVAR Repeat Hydrography/CO2

Akihiko Murata
JAMSTEC's Repeat Hydrography/CO2

Wakita
Western North Pacific repeat-lines and time-series stations by Hokkaido University, and JAMSTECMIO

Masao Ishii
Western North Pacific repeat-lines by MRI/JMA

Masao Ishii
Equatorial Pacific

Sasaki (or Bullister)
CFCs in the Pacific

Toru Suzuki
Method of the 2nd-level QC using Matlab and the role of each WG. The working group web portals (created by T. Suzuki).

Poster

Chihiro Miyazaki, Shin-ichiro Nakaoka and Yukihiro Nojiri
NIES ocean pCO_2 measurement of VOS over the Western Pacific

Best Presentations for Committee/Program-sponsored Topic Sessions or Workshops at PICES-2009

Science Board Best Oral Presenation

Erlend Moksness (Institute of Marine Research, His, Norway) on **"***Major human activities affecting Norwegian coastal marine ecosystems: Present status and challenges*"

Best Oral Presentation by an early career scientist for the BIO-sponsored Contributed Paper Session

Bryan A. Black (Hatfield Marine Science Center, Oregon State University, Newport, U.S.A.) on "Growth-increment chronologies reflect ecosystem responses to climate variability in the northeastern Pacific"

Best Poster for the BIO-sponsored Contributed Paper Session

Tetsuichi Fujiki (Mutsu Institute for Oceanography, Japan Agency for Marine-Earth Science and Technology, Mutsu, Japan) on "Time-series observation of phytoplankton productivity in the western subarctic gyre of the North Pacific"

Best Oral Presentation by an early career scientist for the FIS-sponsored Contributed Paper Session

Hyunjung Kang (National Fisheries Research and Development Institute, Busan, Korea) on "Maturity and spawning of small yellow croaker, *Larimichthys polyactis*" co-authored with Yeonghye Kim, Jinkoo Kim, Sungyeon Kim, Sukgeun Jung, Dong-woo Lee and Dae Soo Chang

Best Poster for the FIS-sponsored Contributed Paper Session

Tatiana Tunon (SOLV Consulting Ltd., Vancouver, Canada) on "Using classification trees to capture a manager's interpretation of Bayesian projections" co-authored with Gottfried Pestal

Best Oral Presentation by an early career scientist for the MEQ-sponsored Topic Session on "The role of submerged aquatic vegetation in the context of climate change"

I Nyoman Radiarta (Graduate School of Fisheries Sciences, Hokkaido University, Hakodate, Japan) on "The impact of climate change on the development of marine aquaculture: A case study on Japanese scallop aquaculture in Funka Bay, Hokkaido, Japan" co-authored with Sei-ichi Saitoh and Toru Hirawake

Best Poster for the MEQ-sponsored Topic Session on "The role of submerged aquatic vegetation in the context of climate change"

Sang Rul Park (Pusan National University, Busan, Korea) on "Growth and photosynthetic characteristics of three *Zostera* spp. (*Z. japonica*, *Z. marina* and *Z. caespitosa*) along vertical gradient: Implications for seagrass zonation" co-authored with Kun-Seop Lee

Best Oral Presentation by an early career scientist for the MONITOR-sponsored Topic Session on "State of the arto f real-time monitoring and its implication for the FUTURE oceanographic study"

Kelly J. Benoit-Bird (Oregon State University, Corvallis, U.S.A.) on "Trophic cascades in Hawaii's nearshore ecosystem: Using observing technology to understand ecological interactions"

Best Poster for the MONITOR-sponsored Topic Session on "State of the arto f real-time monitoring and its implication for the FUTURE oceanographic study"

Shin-ichi Ito (Tohoku National Fisheries Research Institute, FRA, Shiigama, Japan) on "A profiling mooring buoy to observe mixed layer formations in the western North Pacific and its combination with a deeper type underwater glider" co-authored with Yugo Shimizu, Shigeho Kakehi, Fumitake Shido, Taku Wagawa, Kazuyuki Uehara, Toshiya Nakano and Masafumi Kamachi

Best Oral Presentation by an early career scientist for the POC-sponsored Workshop on "Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales"

Xiaohui Tang (Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China) on "Influence of reducing weather noise on ENSO prediction" co-authored with Ping Chang and Fan Wang

Best Poster for the POC-sponsored Contributed Paper Session

Satoshi Osafune (Ocean Research Institute, University of Tokyo, Tokyo, Japan) "Numerical study of bidecadal water mass variations in the subarctic North Pacific related to the 18.6-year tidal cycle" co-authored with Ichiro Yasuda

LIST OF PICES ACRONYMS

AP-AICE	FUTURE Advisory Panel on *Anthropogenic Influences on Coastal Ecosystems* (Oct. 2009 –)
AP-COVE	FUTURE Advisory Panel *on Climate, Oceanographic Variability and Ecosystems* (Oct. 2009 –)
AP-CPR	Advisory Panel on *Continuous Plankton Recorder Program* (Oct. 1998 –)
AP-CREAMS	Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (Nov. 2005 –)
AP-IFEP	Advisory Panel on *Iron Fertilization Experiment* (Oct. 1998 – Oct. 2007)
AP-MBM	Advisory Panel on *Marine Birds and Mammals* (Oct. 1999 –)
AP-MIE	Advisory Panel on *Micronekton Sampling Inter-Calibration Experiment* (Oct. 2002 – Oct. 2009)
AP-NPDB	Advisory Panel on *North Pacific Data Buoy* (Oct. 2001 – Oct. 2006)
AP-SOFE	FUTURE Advisory Panel on *Status, Outlooks, Forecasts and Engagement* (Oct. 2009 –)
BIO	Biological Oceanography Committee
CCCC	Climate Change and Carrying Capacity Scientific Program (Oct. 1995 – Oct. 2009)
F&A	Finance and Administration Committee
FIS	Fishery Science Committee
FUTURE	Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem (Oct. 2009 –)
GC	Governing Council
IP-WT	FUTURE Implementation Plan Writing Team (Jun. 2008 – Apr. 2009)
MEQ	Marine Environmental Quality Committee
MONITOR	Formerly Task Team on Monitoring (Oct. 1997 – Oct. 2004), renamed to Technical Committee on Monitoring
NEMURO	North Pacific Ecosystem Model for Understanding Regional Oceanography
NEMURO.FISH	NEMURO for Including Saury and Herring
NEMURO.SAN	NEMURO for Sardine and Anchovy populations
NPESR	North Pacific Ecosystem Status Report (Oct. 2002 – Oct. 2004)
PICES	North Pacific Marine Science Organization
POC	Physical Oceanography and Climate Committee
RHLF	Relocation and Home Leave Fund
SB	Science Board
S-CC	Section on *Carbon and Climate* (Oct. 2005 –)
S-HAB	Section on *Ecology of Harmful Algal Blooms in the North Pacific* (Oct. 2003 –)
SG-CB	Study Group on *PICES Capacity Building* (Oct. 2002 – Oct. 2003)
SG-COM	Study Group on *Communication* (Oct. 2007 – Oct. 2009)
SG-EBM	Study Group on Ecosystem-based Management Science and its Application to the North Pacific (Oct. 2003 – Oct. 2004)
SG-ESR	Study Group on *Ecosystem Status Reporting* (Oct. 2006 – Oct. 2007)
SG-FERRRS	Study Group on *Fisheries and Ecosystem Responses to Recent Regime Shifts* (Oct. 2003 – Oct. 2004)
SG-FISP	Study Group on *Future Integrative Scientific Program(s)* (May 2005 – Oct. 2009)
SG-GOOS	Study Group to develop a strategy for GOOS (Oct. 2006 – Oct. 2007)
SG-HD	Study Group on *Human Dimensions* (Oct. 2009 –)
SG-MAR	Study Group on *Marine Aquaculture and Ranching in the PICES Region* (Oct. 2006 – Oct. 2007)
SG-RAM	Study Group on *Restructuring of the PICES Annual Meeting* (Oct.2008 - March 2009)
SG-RPFR	Study Group on *PICES Rules of Procedure and Financial Regulations* (Oct. 2004 – Oct. 2006)
SG-SC	Study Group on *Scientific Cooperation between PICES and Non-member Countries* (Oct. 2006 – Oct. 2007)
SG-SI	Study Group on *PICES Strategic Plan* (Oct. 2003 – Oct. 2004)

PICES Acronyms-2009

SG-SP	Joint P/ICES Study Group on *Developing a Framework for Scientific Cooperation in Northern Hemisphere Marine Science* (Oct. 2009 –)
SG-USP	Study Group on *Updating the PICES Strategic Plan* (Oct. 2009 –)
SISG	Study Group on *PICES Strategic Plan* (Oct. 2003 – Oct. 2004)
SP-WT	FUTURE Science Plan Writing Team (Jan 2007 - Apr 2008)
TCODE	Technical Committee on Data Exchange
TT-MODEL	Conceptual / Theoretical and Modeling Studies Task Team (Oct. 1995 – Oct. 2009)
TT-CFAME	Climate Forcing and Marine Ecosystem Response Task Team (Oct. 2004 – Oct. 2009)
TT-BASS	Basin Studies Task Team (Oct. 1995 – Oct. 2004)
TT-MONITOR	MONITOR Task Team (Oct. 1997 – Oct. 2004)
TT-REX	Regional Experiments Task Team (Oct. 1996 - Oct. 2004)
TT-NEXT	NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography) Experimental Plan Team Oct. 2002 – Oct. 2003)
WG 1	Working Group on *The Okhotsk Sea and Oyashio Region* (Oct.1992 – Oct. 1993)
WG 2	Working Group on *Development of Common Assessment Methodology for Marine Pollution* (Oct.1992 – Oct. 1994)
WG 3	Working Group on *Dynamics of Small Pelagics in Coastal Ecosystems* (Oct.1992 – Oct. 1995)
WG 4	Working Group on *Data Collection and Quality Control* (Oct.1992 – Oct. 1994)
WG 5	Working Group on *The Bering Sea* (Oct.1992 – Oct. 1996)
WG 6	Working Group on *Subarctic Gyre* (Oct. 1992 – Oct. 1994)
WG 7	Working Group on *Modeling of the Subarctic North Pacific Circulation* (Oct. 1993 – Oct. 1995)
WG 8	Working Group on *Practical Assessment Methodology* (Oct. 1994 – Oct. 2000)
WG 9	Working Group on *Subarctic Pacific Monitoring* (Oct. 1994 – Oct. 1997)
WG 10	Working Group on *Circulation and Ventilation in the Japan/East Sea and its Adjacent Areas* (Oct. 1995 – Oct. 1999)
WG 11	Working Group on *Consumption of Marine Resources by Marine Birds and Mammals in the PICES Region* (Oct. 1995 – Oct. 1999)
WG 12	Working Group on *Crabs and Shrimps* (Oct. 1995 – Oct. 2001)
WG 13	Working Group on *Carbon Dioxide in the North Pacific* (Oct. 1997 – Oct. 2002)
WG 14	Working Group on *Effective Sampling of Micronekton to Estimate Ecosystem Carrying Capacity* (Oct. 1997 – Oct. 2004)
WG 15	Working Group on *Ecology of Harmful Algal Blooms (HABs) in the North Pacific* (Oct. 1999 – Oct. 2003)
WG 16	Working Group on *Climate Change, Shifts in Fish Production, and Fisheries Management* (Oct. 1999 – Oct. 2005)
WG 17	Working Group on *Biogeochemical Data Integration and Synthesis* (Oct. 2001 – Oct. 2005)
WG 18	Working Group on *Mariculture in the 21st Century – The Intersection between Ecology, Socio-Economics and Production* (Oct. 2003 – Oct. 2006)
WG 19	Working Group on *Ecosystem-based Management Science and its Application to the North Pacific* (Oct. 2004 – Oct. 2008)
WG 20	Working Group on *Evaluations of Climate Change Projections* (Oct. 2005 –)
WG 21	Working Group on *Non-indigenous Aquatic Species* (Oct. 2005 –)
WG 22	Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (Oct. 2007 –)
WG 23	Working Group on *Comparative Ecology of Krill in Coastal and Oceanic Waters around the Pacific Rim* (Oct. 2007 –)
WG-FCCIFS	Joint PICES/ICES Working Group *on Forecasting Climate Change Impacts on Fish and Shellfish* (Jan. 2009 –)
WG 24	Working Group on *Environmental Interactions of Marine Aquaculture* (Oct. 2008 –)

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