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REPORT OF OPENING SESSION



The Opening Session was called to order at 09:00 hours on October 16, 2006, by the Chairman, Dr. Vera Alexander, who welcomed delegates, observers and researchers to the PICES Fifteenth Annual Meeting (PICES XV).

Welcome addresses on behalf of the host country, the host city and the host agency

Mr. Akira Nakamae (Deputy Director-General of the Fisheries Agency of Japan) welcomed participants on behalf of the host country (*OP Endnote 1*), Mr. Hiroshi Nakada (Mayor of Yokohama) addressed the session on behalf of the host city (*OP Endnote 2*), and Mr. Kyouichi Kawaguchi (President of the Fisheries Research Agency of Japan) greeted participants on behalf of the host agency (*OP Endnote 3*).

Remarks by representatives of Contracting Parties and the Chairman of PICES

Dr. Alexander invited Dr. Laura Richards (Regional Director of Science, Pacific Region, Fisheries and Oceans Canada) to make a statement on behalf of the Canadian Government. Dr. Richards addressed the session and her remarks are appended to the report as *OP Endnote 4*.

Dr. Alexander called upon Mr. Fengkui Liang (Division Director, Department of International Cooperation, State Oceanic Administration, People's Republic of China) to make a statement on behalf of the Chinese Government. Mr. Liang addressed the session and his remarks are appended to the report as *OP Endnote 5*.

Dr. Alexander then asked Dr. Ig-Chan Pang (Director, Headquarters for Marine Environment, National Fisheries Research and Development Institute, Ministry of Maritime Affairs and Fisheries, Republic of Korea) to speak on behalf of the Korean Government.

Dr. Pang addressed the session and his remarks are appended to the report as *OP Endnote 6*.

Dr. Alexander invited Dr. Lev N. Bocharov (Director-General, Pacific Scientific Research Fisheries Center, Federal Agency on Fisheries, Russian Federation) to make a statement on behalf of the Russian Government. Dr. Bocharov addressed the session and his remarks are appended to the report as *OP Endnote 7*.

Dr. Alexander requested Dr. Samuel Pooley (Director, Pacific Islands Fisheries Science Center, National Oceanic and Atmospheric Administration, United States of America) to speak on behalf of the U.S. Government. Dr. Pooley addressed the session and his remarks are appended to the report as *OP Endnote 8*.

Dr. Alexander called upon Dr. Tokio Wada (Counselor, Resources Enhancement Promotion Department, Fisheries Agency, Japan) to speak on behalf of the Japanese Government. Dr. Wada addressed the session and his remarks are appended to the report as *OP Endnote 9*.

Dr. Alexander thanked Mr. Nakamae, Mr. Nakada and Mr. Kawaguchi, and all the delegates for their remarks and spoke on behalf of PICES. The text of her address is appended to the report as *OP Endnote 10*.

Wooster Award presentation ceremony

Dr. Alexander and the Science Board Chairman, Dr. Kuh Kim, conducted the Wooster Award presentation ceremony. Dr. Kim quoted the following Science Board citation for the 2006 Wooster Award (reading of the citation was accompanied by a special slide show dedicated to Dr. Makoto Kashiwai):

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

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

Dr. Kashiwai has authored or co-authored more than 20 primary journal articles, book chapters or review papers covering several disciplines that include fine-scale coastal hydrodynamics, biological production and fish population dynamics, and climate-scale ocean variability. His early career was with the Faculty of Fisheries at Kyoto University, where his research used hydraulic model experiments and theory to study tidal exchange, residual circulation and tidal vortices in Kumihama Bay. While in Kyoto, he also investigated the formation of the anoxic layers of water in Kumihama Bay using field observations, and he contributed to the development of a continuous fish egg sampler, which was used in interdisciplinary studies of the microdistribution of fish eggs, larvae and plankton and its relation to ocean microstructure.

In 1986, Dr. Kashiwai moved to the Hokkaido National Fisheries Research Institute where he worked as the Head of the Physical Oceanography Section, and later as the Director

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

Dr. Kashiwai has been generous in serving the ocean science community at both the national and international levels. He served as a member on several committees of the Japanese Society of Fisheries Oceanography, and later as the Vice-President of that society. OK, but what has he done for PICES, you wonder? Well, his service to PICES has been also extensive and in many roles. He was a member of PICES' Working Group 1 on the Okhotsk Sea and Oyashio region. Japan offered to host the PICES Third Annual Meeting in Nemuro in 1994. Makoto

was appointed the main local coordinator of the meeting. On October 5th, 10 days before the start of the Annual Meeting, an 8.1-magnitude earthquake occurred in the southern Kurils and northern Hokkaido. The arranged venue for the PICES meeting was severely damaged and unusable. Makoto took the lead in arranging alternate facilities and preparing everything from scratch for the meeting, which was finally held primarily in the Nemuro-City Library. At the same meeting, he convened a PICES/GLOBEC workshop and was appointed the Co-Chairman of the PICES/GLOBEC initiative on Climate Change and Carrying Capacity (CCCC). He devoted significant time toward getting the CCCC Program up and running, establishing task teams, and contributing scientifically to the MODEL Task Team. At PICES IV in 1995, he succeeded his friend and colleague, Dr. Daniel Ware, as the Chairman of the Science Board of PICES. His term as the Science Board Chairman concluded in 1998, and that same year, the Japanese Government appointed him as national delegate to PICES. Thus, in a few short years, he had served as Co-Chairman of the first PICES scientific program, as Science Board Chairman, and as a national delegate on Governing Council. But, that apparently was not enough, for in 2000 he became again the Co-Chairman of the CCCC Program for another three years!

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

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

PICES, and we are pleased to honor him today with this award.

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

It is an honor for me to participate in this award to Makoto Kashiwai, one of the early and most substantial contributors to the scientific programs of PICES. He first made his mark with development of the CCCC Program. While the question was inspired by the threat of saturating the North Pacific with expatriate salmon, its broad scope became clear in Makoto's classic paper on the history of the carrying capacity concept. This demonstrated that carrying capacity was not just an arbitrary and ill-defined constant in a theoretical productivity equation, but was an index of ecosystem productivity and a variable function of environmental change. It made evident, to me at least, that the carrying capacity for a specific population, for example that of Steller sea lions, could change with the climate as did the availability of suitable food. The development of this program, to which Makoto has made major contributions, has been fundamental towards achieving the scientific goals of PICES.

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

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

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

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

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

My first project was to compose the Chairman's Handbook. The most important task for me was to incorporate the guideline "Use slow and

clear English, not machine-gun talk", which was much help through my PICES days. This might be one of the expectations of Warren. This Handbook was not an instruction booklet made by the Secretariat, but a driving manual for new Chairmen of any subsidiary body of PICES, hoping that PICES can be an organization driven by scientists.

During my Science Board Chairmanship, both PICES and I benefited from the powerful participation of elder and younger colleagues, and it was a truly rich and enjoyable time. Thus, this award is a proof of the achievement by all the PICES scientists who shared my PICES days with me. So, I would like to ask all of the PICES colleagues here to share this honour and happiness with me. Thank you.

PICES "Year-in-Review" 2006

Dr. Kuh Kim reviewed PICES' scientific accomplishments since the Fourteenth Annual Meeting (*OP Endnote 11*).

Keynote lecture

The keynote lecture entitled "*Biological production, animal migration and ecosystem regime shifts in the Kuroshio and Oyashio Currents: Perspectives for sustainable use*" was given by Dr. Akihiko Yatsu (Hokkaido National Fisheries Research Institute) as a part of the Science Board Symposium on "*Boundary current ecosystems*". The abstract of his presentation is appended to the report as *OP Endnote 12*.

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

OP Endnote 1**Welcome address on behalf of the host country by Mr. Akira Nakamae**

Madame Chairperson, distinguished guests, ladies and gentlemen: It is my great pleasure to be able to hold the Fifteenth Annual Meeting of the North Pacific Marine Science Organization (PICES) in the city of Yokohama. On behalf of the Government of Japan, let me extend my sincere welcome to you.

Since its foundation, PICES has made valuable scientific contributions toward the issues of climate change and to the responses observed in the marine ecosystem. It has recently dealt with the problems in coastal areas being shared by the member nations, such as the occurrence of harmful algal blooms, the outbreak of jellyfish on a large scale, or the spreading of invasive alien organisms, and attained profound results. I would like to pay my full respect to those who extended their best effort during this period, in particular to the Chairperson, Dr. Vera Alexander, and the Executive Secretary, Dr. Alexander Bychkov.

I have been involved with various international fisheries negotiations, including those on tuna and whales. Through these negotiations, which

sometimes have led to a severe conflicting position due to one's own interests, I strongly feel that what is most important is an objective discussion based on the scientific knowledge and the spirit of reciprocity. The benefits of living marine resources and marine ecology are the common assets nature has given to mankind, and it is our duty to conserve them appropriately and to utilize them in a sustainable and wise manner. In undertaking such obligations, the advancement of marine science carried out by PICES, and by coordination and cooperation of the member countries for that target will, I am sure, render a great support. I expect that in the future PICES will continue to play a central role in the research of marine science in the North Pacific Ocean, and will return the outcomes to various areas of the North Pacific Ocean as well as to the member countries.

Finally, I wish this Annual Meeting will bear scientifically fruitful results and give an opportunity to deepen the mutual friendship and trust among all the participants.

Thank you very much.

OP Endnote 2**Welcome address on behalf of the host city by Mr. Hiroshi Nakada**

Distinguished ladies and gentlemen: On behalf of the 3.6 million citizens of Yokohama, I would like to celebrate the opening of the Fifteenth Annual Meeting of the North Pacific Marine Science Organization (PICES). I am very pleased to hear that PICES was established to serve the collaboration of fisheries and marine science in the North Pacific Ocean area.

The Red Brick Warehouse where you are presently was a popular building from Meiji through the Taisho period, that is, from around 130 years ago to the 1920s, and until 1955, freighters were installed here, carrying goods and fisheries products from the port. So this red brick building on the water-front is a historical structure and symbolizes Yokohama.

I am sure you have already seen some parts of Yokohama. As the city is on the seaside, whales and young tuna were seen in the olden days. The high-grade materials for Japanese Edo style sushi, such as mantis shrimp or sea eel used to be harvested here. There are beautiful water-front scenery, the biggest China-town in the world and shopping areas for you to enjoy.

The world, in particular Yokohama city, is watching the activities of PICES this time. Please attain a fruitful meeting and provide us with the scientific information. I wish that your work will further be developed and your research will contribute to the society.

Thank you very much.

OP Endnote 3

Welcome address on behalf of the host agency by Mr. Kyouichi Kawaguchi

Madame Chairperson, distinguished guests, ladies and gentlemen: On behalf of the hosting organization for the Fifteenth Annual Meeting of the North Pacific Marine Science Organization (PICES), as the President of the Incorporated Administrative Agencies, Fisheries Research Agency, I would like to extend my cordial welcome to you all.

PICES, since its establishment in 1992, has carried out, until now, various scientific activities to advance marine science in the North Pacific Ocean and to promote international cooperation toward that objective. During this period, a rapid expansion was noticed in the exchange between scientists and research institutes of the member countries, advancing research in diverse fields of marine science and strengthening the ties among scientists and research institutions.

The Fisheries Research Agency, having its head office here in Yokohama, is a core organization of marine research in Japan. It has actively performed activities of PICES together with other universities and research institutes of fisheries or marine studies. We are very pleased to have contributed, during these years, to the measures such as changes in the marine ecosystem of the North Pacific Ocean, elucidation on the dynamic movement of marine ecosystem, and counter-measures against toxic red tide or outbreak of jellyfish. And it is a great honor for us to help organize the Annual Meeting at this occasion.

Today, when the influence of global warming is getting visible, and since the main focus of PICES is placed on climate changes and elucidation on the response by marine ecosystems, the activities of the Organization will be much more important in the future, not only for the member nations, but also for the Pan Pacific area. Under such circumstances, the research institutes and universities in the member countries have to keep closer ties and work in collaboration to elucidate the problems we are facing, and widely return the fruitful outcomes to society. At present, the Fisheries Research Agency is aiming to build a comprehensive and cooperative relationship with the Chinese National Marine Science Research Institute and with the Korean National Fisheries Research and Development Institute. A Memorandum of Understanding is scheduled to be signed in the near future.

I strongly believe that the closer ties among the three countries, Japan, China and Korea, will further advance research on fisheries and the ocean, and at the same time make activities of PICES further developed.

Lastly, I wish that this Annual Meeting would be completed with great success, and I hope you will enjoy a comfortable stay in Yokohama.

Thank you very much.

OP Endnote 4

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

Madame Chairman, distinguished guests and colleagues: On behalf of Canada and the Canadian delegation, I would like to thank the Fisheries Research Agency and the Government of Japan for inviting us here to the beautiful port city of Yokohama.

PICES has just completed another exciting year with the CCCC synthesis symposium in Hawaii.

This symposium not only examined how ecosystems respond to climate variability but also identified priorities for the next stages climate-ecosystem variability research. Then, the Line-P symposium in Victoria in July examined 50 years of oceanography along Line-P, and outlined plans to ensure the continuation of this important data series. Another highlight is the planning for the next

major integrative scientific program. These events continue the long history of research in oceanography and fisheries science in the North Pacific – a history of which PICES now plays a proud part.

The new program, FUTURE, will build on the success of the CCCC Program and continue to advance PICES' work by developing a forecasting capability, thereby further developing PICES' ability to advise member nations on important changes that are occurring in the Pacific Ocean. This will require, more than ever, a truly multinational, interdisciplinary approach – an approach that PICES will continue to foster. These developments will ensure that PICES stays relevant by providing information to help governments and society in

making the tough choices that lie ahead. FUTURE should also bring new people and fresh ideas into PICES to keep it a vibrant and dynamic organization. I expect FUTURE to be a hot topic of conversation during this meeting.

For next year, I look forward to welcoming you all to Victoria when it is Canada's turn to host the PICES Sixteenth Annual Meeting. This will be a particularly special event for us, since it will mark the beginning of a year-long celebration recognizing 100 years of science at the St. Andrews Biological Station on Canada's east coast and the Pacific Biological Station at Nanaimo, north of Victoria, on Canada's west coast. I hope to see you there.

Thank you.

OP Endnote 5

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

Respected Chairperson, distinguished delegates, representatives and guests, ladies and gentlemen: First of all, I would like, on behalf of the Chinese Delegation, to extend our thanks to the Government of Japan and the PICES Secretariat for inviting us to attend this Fifteenth Annual Meeting of PICES. Our thanks also go to their hard effort devoted to the preparation of the meeting. It is our great pleasure and honor to be able to participate in this important gathering in the field of marine science in the region.

For the past decade, PICES has grown into a full fledged and an important intergovernmental regional organization for marine science. The successful implementation of its various programs and activities by the participating governments and their distinguished scientists contributed a lot to the sustainable use of the ocean resources of the member countries. And now, more and more countries have paid greater attention to the role of marine science in promoting the sustainable development of ocean resources. In order to achieve the sustainable development of the ocean, an ecosystem

approach has been widely advocated by several UN agencies, governmental and non-governmental organizations, including the World Summit on Sustainable Development. There is general understanding that there is still great uncertainty how the ecosystem-based approach works in science. There will be a great role for PICES to exert in solving these uncertainties through science. And therefore, we in principle endorse the proposed themes for the future PICES Integrative Scientific Program entitled *Forecasting and Understanding Trends, Uncertainty and Responses of Ecosystems*, which is to be the focus of the future activities of the Organization for the next phase. We would also continue encouraging Chinese scientists to be more deeply involved in the implementation of the PICES program and contribute to its success.

Finally, we wish all of us a wonderful stay in Japan and great success for the Annual Meeting. We welcome you all to Dalian in 2008 for the PICES Seventeenth Annual Meeting.

Thank you very much.

OP Endnote 6

Remarks at the Opening Session by Dr. Ig-Chan Pang (Republic of Korea)

The Chairperson of PICES, distinguished delegates, guests, colleagues, and ladies and gentlemen: On behalf of the Republic of Korea and the Korean delegation, it is my great honor to welcome all of you to this Fifteenth Annual Meeting of PICES. I would like to express our sincere thanks to the Government of Japan, the Chairperson of PICES, Dr. Vera Alexander, the Executive Secretary of PICES, Dr. Alexander Bychkov, and the local organizing committee for hosting this important meeting.

Through PICES activities, we in the North Pacific are expanding our international and interdisciplinary scientific cooperation. I would like to appreciate the enthusiastic efforts of PICES scientists. The Republic of Korea realizes the importance of international cooperation in ocean science, and our government is getting more interested in PICES activities and has encouraged young scientists to join PICES activities with various supporting programs. One of such programs is to bring 24 young scientists to PICES XV by the research

vessel *Gaya* of Pukyong National University from Busan port in Korea to Yokohama port in Japan. As a part of PICES activities, the CREAMS/PICES international workshop and the first PICES international summer school, held in Korea this summer, were partly supported by our government, and both were well attended and concluded with very good results. The Government of the Republic of Korea is willing to support PICES activities.

PICES is a unique organization that includes the involvement of both scientists and governments. Through the coordinated efforts of PICES scientists, we can maintain the North Pacific ecosystem. PICES is getting important and therefore, can play an important role in the future in helping the member countries in policy decision making for the ecosystem.

I wish all of you successful achievement at this Fifteenth Annual Meeting with the PICES spirit.

Thank you very much.

OP Endnote 7

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

Dear Dr. Vera Alexander, distinguished guests, dear participants, ladies and gentlemen: First, on behalf of the entire Russian delegation I would like to thank PICES for the invitation to take part in the Fifteenth Annual Meeting. I would also like to thank the local organizing committee for their prompt and effective activity during the preparation of the meeting.

The scale of PICES activities has enormously increased during the 14 years since the origin of the Organization. Today, PICES is a widely known and authoritative international organization, whose role in the study of oceans and seas has been constantly growing. PICES relationships and joint activities with other international organizations have notably strengthened during the last years. Interest in PICES projects as demonstrated by a wide international audience has increased as well.

At the moment, PICES is considering the possibility of new coming members and observers from other Pacific Rim countries to join the organization. Involvement of new countries will certainly improve our knowledge and understanding of marine ecosystems, particularly, their state-of-the-art dynamics and interaction.

Much work is done in between PICES Annual Meetings. Scientists from various fields (biology, oceanography, chemistry, *etc.*) are involved in research under the auspices of PICES. They develop complex ecosystem approaches, organize inter-disciplinary symposia and promote research projects.

The Russian Federation has always paid much attention to the development of scientific knowledge about marine living resources of the

World Ocean. That is why an international scientific community, called “PICES”, and its activities, are highly appreciated in Russia. The fact that Russia is involved in PICES provides an additional credit to our country and favors our increasing influence on the development of international cooperation in the Pacific Ocean region of Asia.

The participation of Russian scientists in various PICES programs and conferences provides an access to the extensive set of data on fundamental and applied ecosystem studies for other PICES countries. These data are incorporated into the international database thus improving our understanding of global processes underlying environmental changes and their impact on marine inhabitants.

All of us are now completing the integrative CCCC Program, and working on development

of the next PICES integrative scientific program, “FUTURE”. Russia is interested in pooling efforts of all the PICES members to fulfill these programs. We have worked out several concrete suggestions on how to implement these programs.

“Boundary Current Ecosystems” of the North Pacific Ocean is the key theme of the PICES Fifteenth Annual Meeting. I am quite sure that the progressive ecosystem approach towards the study of the ocean will be widely used by all nations in their endeavors towards the utilization of marine living resources and the development of aquaculture.

In conclusion I would like to wish all the participants of this meeting an interesting and fruitful meeting.

Thank you for your attention.

OP Endnote 8

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

Good morning, distinguished delegates and fellow scientists. It is with great pleasure that the United States thanks the Government of Japan for hosting this year’s PICES Annual Meeting at this wonderful venue in Yokohama. Yokohama has a rich history and we look forward to getting to know it better.

The United States understands that this is a pivotal meeting for PICES as we develop a program for our future work. Collaborative science is the hallmark of PICES, and our future integrative science program must weave these strands in a truly interdisciplinary fashion. But this integration is not easy, just as the work of an essentially voluntary organization of academic, governmental, and independent scientists is not easy. Both depend on a strong spirit of collegiality and creativity. The challenge is even greater as we bring the forces of climate and human impacts into the equation concerning ecosystem processes, biological productivity, and resource use.

The development of young scientists in all member nations goes hand-in-hand with developing the new PICES science program. The United States is pleased to host the 2007 ICES/PICES Early Career Scientists Conference, as well as to continue its support of the PICES Intern Program to help build capacity in young scientists internationally. We encourage strong participation in the Early Career Scientists Conference and look forward to continued success for the Intern Program.

It is a special pleasure for me to represent the United States at this meeting in Yokohama since the staff of my own fisheries research laboratory has a 50-year history of work with Japan’s Far Seas Laboratory located nearby in Shimizu. When we look at the patterns of productivity in the North Pacific albacore fishery, we see strong decadal signals that can only be caused by complex interactions of biology with an underlying oceanographic process. Similarly, new technologies allow us to identify so-called “hot spots” of the occurrence of bigeye tuna and

other fishery species at 30°N related to oceanographic conditions. We hope that PICES will broaden its focus to include new species such as tunas and their more extensive habitats.

Finally, let us hope that the close working interactions of the PICES scientific community

foster the kind of international cooperation that enhances the role of science in society.

With that, let me close by wishing everyone a productive fortnight.

Thank you for your attention.

OP Endnote 9

Remarks at the Opening Session by Dr. Tokio Wada (Japan)

Madam Chairperson, distinguished delegates, guests, ladies and gentlemen: Welcome to Yokohama! On behalf of the Japanese participants, and as a citizen of Yokohama, I would like to extend my sincere welcome to all of you. One hundred and fifty years ago, Yokohama opened its port to the world. Thereafter, Yokohama has been developed as a Japanese window where the East meets the West beyond the Pacific Ocean. Therefore, I could say that here is the best place to hold this PICES Fifteenth Annual Meeting.

Boundary current ecosystems, the theme of this Annual Meeting, have been a basic topic for PICES. We have frequently discussed various aspects of their role, such as a transport system of eggs and larvae, a migration passage of marine organisms, and a transport system of heat and other materials. Those discussions have not only promoted the North Pacific marine science, but also affected fisheries management and

ecosystem conservation in the Contracting Parties.

On the other hand, the boundary current is an interface of coastal and offshore waters. If its heat transport changes with global warming, coastal ecosystems must be strongly affected. Therefore, studies on the interaction between boundary currents and coastal waters are important for understanding the influence of global warming to various ecosystem services of coastal waters.

As an old proverb says, by exploring the old, one becomes able to understand the new. I would like to expect that this Annual Meeting will provide an opportunity to synthesize the previous discussions, and will be a starting point for more advanced studies.

Thank you very much.

OP Endnote 10

Welcome Address by Dr. Vera Alexander, Chairman of PICES

Mr. Nakamae, Mr. Nakada, Mr. Kawaguchi, distinguished delegates and members of the PICES community: It is a great pleasure to be warmly welcomed here in Yokohama. Yokohama is a strong and vital maritime center, famous as a focus for Japanese research on the deep sea and for advanced technology. We thank our hosts for their vision and hospitality in making this unusual and charming venue available for this PICES Annual Meeting.

This is the last time that I will have the pleasure of addressing you as Chairman of PICES, and I

have to tell you that I have enjoyed working with this marvelous PICES family over the past 4 years as Chairman and, in fact, during the entire gestation and life of the Organization in other capacities as well. I say “family” rather than our more usually applied term “member” because that is what we are. We are a multinational multitude of scientists all united in a common cause – developing an in-depth and predictive understanding of the North Pacific Ocean. The contributions by scientists from all the signatory nations have been amazing. As a result, our goal of advancing knowledge of the

North Pacific Ocean is being achieved. Not only have official participants in the various bodies of the Organization worked hard and effectively, but a much broader community has been engaged in the scientific meetings, symposia and workshops.

The theme of my message to you today, as I prepare to step down as Chairman, is the compelling need to continue to address our changing world, and the important role PICES has to play in this. Why? In the process of developing PICES, well before the memorable occasion in Ottawa in November 1992, when finally signatures were put on paper, the group that I call the “PICES plotters” held meetings and symposia that, for the first time, examined the relationship between oceanographic processes, climate and biological processes, including fisheries. This blending of disciplines was prescient, and led towards the contemporary approach, now universally accepted — almost! It is hard for our young scientists to understand that there once were formidable difficulties in bringing long-established disciplines together. No one recognized this more than our founder, Dr. Warren Wooster, a physical oceanographer himself. Now, we accept the juncture among fields, and the holistic approach to our oceans.

The PICES/GLOBEC CCCC Program built on this enlightened approach. The practical application of its results becomes even more important, as climate warming persists and we recognize that now, more than ever, biological resources need a new management paradigm. This will be to the benefit of all PICES nations and beyond. A comprehensive understanding of ecosystem science is needed to enable a new enlightened approach.

PICES has produced the report on the status of the North Pacific Ecosystem and is winding down the CCCC Program. The nature of the

next large integrative PICES program is as yet unknown. As we proceed with the conception and planning, PICES almost certainly will bring a new dimension into the picture — the human dimension.

History shows that PICES can rise to the occasion, and address timely and important scientific issues. Arguably, nothing is more critical than the potential effects of climate change, and nothing confounds our ability more to predict future conditions. Managing fisheries in the context of such change and taking into account the complexities of a marine ecosystem, is a daunting task, and acquiring an in-depth scientific knowledge is but the first step.

We will need to take our collective knowledge, apply newly emerging scientific understanding, and develop a new paradigm for dealing with our Pacific Ocean. This will be to the benefit of all PICES nations and beyond. The next decade promises to be fruitful, if we can continue to apply the PICES tradition of relentless international cooperation in addressing the problem. We are a small organization, with six nations and a small secretariat. The Pacific Ocean is vast, and relatively understudied, at least in comparison with the Atlantic. We must count on you, the PICES scientists, to lead the charge and get the job done.

Science is truly the international language, and it recognizes no boundaries. Just as we break the scientific barriers through cooperation, so we also develop a mutual understanding among the nations on the North Pacific margins, again to the benefit of all. There is a lot of work to be done, and the PICES family is ready, willing and able to move ahead. Let this meeting be a milestone in effecting a regime shift in knowledge.

Thank you for your attention.

OP Endnote 11

PICES “Year-in-Review” 2006 by Dr. Kuh Kim, Chairman of Science Board

PICES aims to develop international collaborations by bridging scientists across disciplines, national boundaries and institutions through the organization of meetings and publications.

PICES has maintained excellence in its record of publications in 2006. Selected papers from two Topic Sessions convened at PICES XIII in 2004 on “*Mechanisms that regulate North Pacific ecosystems: Bottom up, top down, or something else?*” and “*Hot spots and their use by migratory species and top predators in the North Pacific*” are published this year in *Progress in Oceanography* (Vol. 68, Nos. 2-4) and *Deep-Sea Research II* (Vol. 53, Nos. 3-4), respectively. Two more major publications are now in press: results of the IFEP SERIES experiment will be published by the end of 2006 in *Deep-Sea Research II* (Vol. 53, Nos. 20-22), and a set of papers on NEMURO and NEMURO.FISH models will appear in *Ecological Modelling* in February 2007. I would like to take this opportunity to express our thanks to the guest editors of all four special issues for their outstanding efforts to make these publications possible in time.

Since its inception, PICES has established the Scientific Report Series as an essential vehicle to distribute its knowledge, and in 2006 two more reports are added. *PICES Scientific Report No. 31* is the proceedings of the 2004 workshop on “*In situ iron enrichment experiments in the eastern and western subarctic Pacific*”, and *PICES Scientific Report No. 32* is the proceedings of the 2005 workshop on “*Oceanic ecodynamics comparison in the subarctic Pacific*”. Results of the PICES/NPRB workshop on “*Integration of ecological indicators of the North Pacific with emphasis on the Bering Sea*” will be published in December as *PICES Scientific Report No. 33*.

This year is particularly notable in that the PICES community has met thirteen times at workshops and meetings around the world since

the 2005 Annual Meeting in Vladivostok. Some of these include:

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

As PICES has been recognized as a very successful organizer of international meetings, several big symposia are already in front of us. Preparation is well underway for the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (co-sponsored by PICES, GLOBEC and ICES) to be held in May 2007, in Hiroshima (Japan). Active participation of the PICES community is expected in the 5th International Conference on “*Marine bioinvasions*” (co-sponsored by ICES, PICES and the U.S. National Sea Grant Program) in May 2007 (Cambridge, U.S.A.), and in the International Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” (co-sponsored by NAFO, PICES and ICES) in October 2007 (Lisbon, Portugal). PICES will organize, with ICES and IOC, an International Symposium on “*Effects of climate change on the world’s ocean*” to be held in May 2008, in Gijón (Spain).

PICES’ long-term interests in capacity building resulted in organizing the first PICES summer school on “*Ocean circulation and ecosystem modeling*” held August 23–25, 2006, in Busan (Korea). This school was co-sponsored by PICES and several Korean universities and institutions. Seven lecturers from Japan and U.S. taught a total of 37 participants from all 6 PICES member countries plus Chile and Indonesia (14 Ph.D. and 11 M.Sc. students, 7 early-career scientists, 4 undergraduate students, and 1 from a private company). Certificates were delivered to all participants on completion of the school. PICES has already received a proposal from Japan to host a second summer school on “*Ecosystem-based management*” in September 2008, at Hokkaido University, in Hakodate.

It has taken 3 years for PICES and ICES to prepare the Early Career Scientists Conference on “*New frontiers in marine science*” to be hosted by the University of Maryland Center for Environmental Science from June 26–29, 2007, in Baltimore, U.S.A. The goal of the conference is to foster the development of contacts, collaborations, and associations among early career scientists that will persist for decades, and

to establish personal and institutional networks that will help to advance our understanding of the marine environment. Approximately 100 young scientists from around the globe will be invited to share their interests in marine sciences. For detailed information about the conference please visit the PICES website.

Now I would like to turn to the most important agenda of this Annual Meeting. As all of you know very well, a Study Group was formed in May 2005 to develop recommendations for one or more new integrative scientific programs to be undertaken by scientists in PICES member countries, as the CCCC Program will come to its completion in the near future. Since then, ideas and themes have been widely solicited from PICES communities, reviewed and assessed at a special meeting convened on October 4, 2006, during PICES XIV in Vladivostok, and presented at the PICES XIV Closing Session.

As reported in the July 2006 issue of *PICES Press* by Dr. Vera Alexander, PICES Chairman, and Dr. John E. Stein, Science Board Vice-Chairman, the Study Group has developed a preferred theme, and a working document is produced out of intense discussions at the joint 2006 inter-sessional Science Board/Governing Council Meeting under a tentative title “FUTURE”, which stands for “*Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem*”. It was agreed that the ultimate goal for the Program is “*To understand and forecast responses of North Pacific marine ecosystems to climate change and human activities at basin-wide and regional scales, and to broadly communicate this scientific information to governments, resource managers and the general public*”.

Central Scientific Issues to be addressed by FUTURE include:

- marine ecosystem responses on seasonal, annual and decadal time scales;
- climate forcing of physical, biological and biogeochemical processes at scales relevant to PICES member countries;
- ecological interactions and linkages across ecosystems;

- the direct and indirect effects of human activities such as fishing, aquaculture, species invasion, and pollution;
- the cumulative impacts of multiple ecosystem stresses on biological diversity;
- forecasting in a policy environment through risk-based ecological assessments.

It is expected that all of you will participate in Committee meetings on Wednesday (October 18) afternoon to further review the preferred theme and specify the key research activities of FUTURE. At the Open Forum on Thursday (October 19) afternoon we will hear outcomes from Committee meetings on the highest priority research activities, what type of forecasts should we develop and what our focus should be to broaden the communication of PICES science.

Finally, I would like to announce that to facilitate the continuity of Science Board affairs, the Governing Council (at the 2006 inter-sessional meeting) established a Science Board

Chairman-elect position to allow the election of the Science Board Chairman 1 year before the official change of the chairmanship. It is my honor to report to you that Dr. John Stein (U.S.A.) was elected as the next Science Board Chairman for 2007–2010. Dr. Stein has been the Vice-Chairman of the Science Board and the Chairman of the MEQ Committee. Please welcome Dr. Stein.

PICES XVI will be held from October 26–November 5, 2007, in Victoria, Canada. The theme of this Annual Meeting is “*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*”. In 2008, we will meet in Dalian, China, for PICES XVII.

All materials in my presentation and up-to-date information of PICES are available real-time on the PICES website, and I urge you to be part of PICES through this website.

Thank you.

OP Endnote 12

***“Biological production, animal migration and ecosystem regime shifts
in the Kuroshio and Oyashio Currents: Perspectives for sustainable use”***

Abstract of the keynote lecture

by Dr. Akihiko Yatsu (Hokkaido National Fisheries Research Institute, Japan)

The poleward-flowing Kuroshio and the equatorward-flowing Oyashio are western boundary currents that transport heat, nutrients, and planktonic animals, including fish larvae from the subtropical/subarctic gyres, to the coastal areas of the Japanese archipelago. They converge east of Honshu Island to form an oceanographically complex Transition Zone that is an important area for the recruitment of some pelagic fishes of commercial interest. These species have developed life history traits and horizontal migration patterns by adapting to the seasonality of biological production and oceanography. Climatic and ecosystem regime shifts are key factors affecting the population dynamics of species in this region and need to be considered for the sustainable use of the region's ecosystem services, including fish harvests.

Proper understanding of how ecosystem dynamics are linked to both climate and human activities is essential for wise management, which recognizes ecosystem factors and various uncertainties. The most plausible mechanisms for sardine/anchovy cycles in the Kuroshio/Oyashio system are discussed to highlight the importance of these interconnections. Perspectives for sustainable use of ecosystem services, including fishing, will be discussed more generally in relation to case studies involving: 1) reclamation effects on a coastal ecosystem, 2) mitigation efforts, 3) successful adaptive co-management in a coastal fish stock, and 4) failure of fisheries management due to an overcapitalization that resulted from a mismatch between investment to fishing fleets and ecosystem regime shifts.

REPORT OF GOVERNING COUNCIL

The Governing Council met from 9:00-12:30 on October 17, from 9:00-17:00 on October 21, and from 9:00-12:30 on October 22, under the chairmanship of Dr. Vera Alexander. All Contracting Parties were represented at the three sessions (*GC Endnote 1*). At the first session, the Chairman welcomed attendees, introduced the agenda and suggested the order in which to take up the various items. The agenda was adopted as presented (*GC Endnote 2*). This report summarizes the treatment of each agenda item during the course of the three sessions.

Report on Administration (Agenda Item 3)

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

Report of 2006 Governing Council inter-sessional meeting (GC Agenda Item 4)

The tradition of holding inter-sessional meetings of Science Board and Governing Council is fairly new, but has become an integral part of PICES management. As PICES is involved in a daunting array of activities, it is not practical for the governing entities to meet only once each year at the Annual Meeting, and the plan is to continue these inter-sessional meetings as needed.

At the invitation of Dr. Samuel Pooley, the U.S. National Delegate, the 4th inter-sessional Science Board meeting, with the participation of Council members, was convened on April 17-18, 2006, at the Ala Moana Hotel in Honolulu (U.S.A.). It was followed by the meeting of Council on the afternoon of April 18. The Pacific Island Fisheries Science Center of the National Marine Fisheries Service provided \$3,000 to partially offset PICES expenses for these events. The dates and location of the meetings were chosen to allow participants the option to attend the PICES/GLOBEC Symposium on “*Climate*

variability and ecosystem impacts on the North Pacific”, also held at the Ala Moana Hotel on April 19-21. The report of the inter-sessional Science Board meeting can be found elsewhere in this Annual Report. A summary report of the inter-sessional Council meeting is appended as *GC Endnote 4*. An article that briefly reviews the results from both meetings was published by Dr. Vera Alexander in PICES Press (Vol. 14, No. 2).

Membership and observers from other countries (Agenda Item 5)

The Secretariat did not receive proposals from any country to accede to the PICES Convention in 2006.

The Chairman pointed out that expansion of involvement with PICES among Pacific Rim countries has been the subject of discussion in Council. Earlier, Council expressed a strong interest in encouraging Mexico to accede to the PICES Convention (an initial resolution was adopted at PICES VIII, Decision 99/A/5), and spent significant efforts in doing so. Details can be found in the 1999-2005 PICES Annual Reports. Mexican scientists have been enthusiastic about their involvement in PICES activities. The formal response acknowledged the interest on the part of Mexico as well as the potential importance of membership. However, economic considerations precluded their joining at this time.

At PICES XIV, Council agreed that there is merit for the Organization to consider the Pacific Ocean in its entirety, and decided that it is time to explore interest from other Pacific Ocean countries in joining PICES activities, or even membership if the Organization were, at some point, to expand its geographic scope (Decision 05/A/6). The issue was further discussed at the 2006 inter-sessional Council meeting (see *GC Endnote 4* for details).

The Chairman informed Council on her contacts with 4 Pacific Rim countries that are currently affiliated members of ICES (Australia, Chile, New Zealand and Peru). Her letters of March 2, 2006, were intended to initiate a dialog that will allow Council to determine whether scientists from these countries might be interested in having a greater role in the activities of our Organization. PICES XV was suggested as the appropriate venue to continue this dialog, and invitations were extended to their representatives to attend this Annual Meeting as observers.

Responses indicating an interest in taking up the dialogue were received from 3 leading scientific organizations: CSIRO Marine and Atmospheric Research (CSIRO, Australia), National Institute of Water and Atmospheric Research (NIWA, New Zealand) and Instituto del Mar del Perú (IMARPE, Peru). Two organizations sent their representatives, Drs. John Gunn (Deputy Chief, CSIRO) and Julie Hall (Biological Oceanography Program Leader, NIWA), to participate in PICES XV. IMARPE was unable to send an observer to PICES XV, but an invitation was extended to PICES to visit IMARPE to inform scientists and authorities about activities of the Organization, and to discuss how PICES and IMARPE can work together in the future. The suggested time for this visit is in conjunction with the international conference on “*The Humboldt Current system*”, to be held November 27–December 1, 2006, in Lima. PICES is one of the co-sponsors of this conference hosted by IMARPE.

Argo International Program
Asia-Pacific Network for Global Change Research (APN)
Bering Ecosystem Study (BEST)
Census of Marine Life (CoML)
Climate Variability and Predictability Program (CLIVAR)
Ecosystem Study of Sub-Arctic Seas (ESSAS)
Food and Agriculture Organization (FAO)
Global Ocean Ecosystem Dynamics (GLOBEC)
International Council for the Exploration of the Sea (ICES)
International Geosphere-Biosphere Program (IGBP)
Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)
Northwest Association of Networked Ocean Observing Systems (NANOOS)
North East Asian Regional GOOS (NEAR-GOOS)
Northwest Pacific Action Plan (NOWPAP)

At the first session of Council on October 17, Drs. Gunn and Hall gave presentations on the structure and activities of their respective organizations and potential areas for their cooperation with PICES. They kindly allowed us to make their presentations accessible for Council, Science Board and F&A Committee members for future references. The Chairman thanked both guests for addressing the Council, and confirmed that they will be informed on actions decided by PICES.

After long discussion Council approved the recommendation of the F&A Committee that a Study Group be established to explore options on how scientific cooperation with other (non-member) countries could be best achieved (Decision 06/A/6). Terms of Reference and membership of the Study Group are listed in *GC Appendix B*. Council also agreed that Dr. R. Ian Perry, PICES member of the Scientific Steering Committee for the Humboldt Current system conference, will visit IMARPE on behalf of PICES to discuss potential areas and means for collaboration.

Relations with relevant organizations and programs (Agenda Item 6)

Letters of invitation to attend PICES XV were sent to organizations and programs on the agreed 2005–2006 *Standing List* (with some additions), and the following sent observers:

Dr. Nobuyuki Shikama
Mr. Hiroki Hashizume
Dr. George L. Hunt, Jr.
Dr. Ron O’Dor
Dr. William R. Crawford
Dr. Kenneth F. Drinkwater
Mr. Ichiro Nomura
Dr. Manuel Barange
Dr. Adolf Kellermann
Dr. Manuel Barange
Dr. Julie Hall
Dr. Jack Barth
Dr. Takashi Yoshida
Dr. Norio Baba
Dr. Jeung Sook Park

North Pacific Anadromous Fish Commission (NPAFC)
 North Pacific Fishery Management Council (NPFMC)
 Pacific Coast Ocean Observing System (PaCOOS)
 Scientific Committee on Oceanic Research (SCOR)
 Surface Ocean Low Atmosphere Study (SOLAS)
 IOC Sub-Commission for the Western Pacific (WESTPAC)
 Yellow Sea Large Marine Ecosystem project (YSLME)

Dr. Richard J. Beamish
 Dr. Diana Evans
 Dr. Jonathan T Phinney
 Dr. Julie Hall
 Dr. Shigenobu Takeda
 Dr. Hyung-Tack Huh
 Dr. Yihang Jiang

The Executive Secretary provided a report on communication with the relevant international and national organizations and programs since last year's Annual Meeting (see *GC Endnote 3* for details). At the first session of Council (October 17, a.m.), invited representatives of several organizations and programs (APN, BEST, CoML, ESSAS, FAO, IMBER, NOWPAP, NPAFC, PaCOOS, SCOR, SOLAS, YSLME) expressed their views on potential areas of collaboration with PICES. The Chairman thanked all guests for attending and presenting their thoughts, and assured them that PICES will continue expanding its relationships with organizations and programs aligned with the PICES ecosystem research focus, and that their proposals will be carefully considered by relevant Committees and Science Board. All available presentations will be posted on the PICES website.

Some programs and organizations (AOOS, Argo, APN, BEST, ESSAS, IMBER, NANOOS, NOWPAP, NPRB, PaCOOS) had posters on display outlining general information and highlighting their scientific objectives and recent activities. Representatives of GLOBEC and ICES were invited to discuss on-going or proposed joint activities with PICES at the Science Board meeting.

Council reviewed the progress made in the integration and coordination of PICES activities with other international and national scientific organizations and programs, and discussed the *Standing List of International and Regional Organizations and Programs* and priorities for interaction in 2006–2007. It was noted that no changes or additions were recommended by Science Board to the *Standing List* approved for 2005–2006 (Decision 05/S/7, *SB Endnote 7* in the 2005 PICES Annual Report).

At PICES XIV, Council pointed out the importance of establishing relations with the Asia Pacific Economic Cooperation (APEC), and suggested that Science Board develop potential areas of cooperation with APEC Working Groups on *Fisheries* (APEC-FWG) and *Marine Resources Conservation* (APEC-MRC). Unfortunately, no progress was made on this issue.

Progress report of the Study Group on *Future Integrative Scientific Program(s)* (Agenda Item 7)

At the 2005 inter-sessional meeting, Council established a Study Group (SG-FISP) to develop ideas for one or more new integrative scientific program(s) to be undertaken by scientists in PICES member countries (Decision 05/S/6). A presentation on the progress made by SG-FISP in 2006 was given by Dr. John E. Stein (Science Board Chairman-elect) on October 21.

After PICES XIV, the themes proposed for the next PICES integrative scientific program, **FUTURE – Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Marine Ecosystem**, and their short descriptions, as well as a 2005 SG-FISP progress report were posted on the PICES website for comments and advice from the scientific community. Feedback from PICES colleagues and SG-FISP members stimulated an in-depth discussion of FUTURE at the 2006 inter-sessional Science Board/Governing Council meeting. This meeting, reviewed actions taken by SG-FISP since PICES XIV, and developed a list of central scientific issues and key words, and what was considered to be the ultimate goal for the Program: *To understand and forecast responses of North Pacific marine ecosystems to climate change and human activities at basin-wide and regional scales, and*

to broadly communicate this scientific information to governments, resource managers and the general public.

A sub-group composed of Drs. Stein, Michael J. Dagg and Michael G. Foreman was formed and requested to prepare a draft outline of central scientific issues and key research activities for FUTURE. The draft outline was sent to Council, Science Board and SG-FISP members for review on May 26, 2006. Responses were collated by the Secretariat and provided to the sub-group on June 15. The revised FISP outline was widely circulated within the PICES community on September 1, and posted on the PICES website for comments. The document pointed out that FUTURE is motivated by three important societal issues in the North Pacific: *(1) the loss of resilience and productivity of natural environmental capital, such as renewable resources and habitat, and irreparable damage to non-renewable resources; (2) the loss of socioeconomic opportunities due to natural and anthropogenic change in marine ecosystems; and (3) increased uncertainty and risk in decision making faced by managers and policy makers due to climate change and irreversible ecosystem change.*

The FUTURE outline was assessed at the FISP Open Forum held on October 19 at PICES XV. The Forum included the review of the outline by Dr. Stein, presentations by all Scientific and Technical Committees to suggest the priorities within FUTURE from the perspective of each Committee, and comments from PICES scientists and guests. Subsequent discussion at the Science Board meeting resulted in the draft workplan and timelines for the development of FUTURE, which were presented to Council.

Proposed workplan and timelines were reviewed at the Council meeting on October 22. The U.S. delegation indicated that they had some comments on the development of FISP they wished to share with other Contracting Parties and Science Board. Some of their questions and comments were raised on October 21 during Dr. Stein's presentation, and then on October 22 with Dr. Kuh Kim during his presentation of the Science Board report. A written record of their

comments was provided on October 25 and is appended as GC Endnote 5.

Council instructed the PICES Secretariat to circulate the U.S. write-up and ask for additional comments and recommendations from the other Contracting Parties. Then all materials had to be directed to Science Board. Council also suggested that input from Science Board by mid-November 2006 would be important to prevent delays. [A revised work plan with associated timelines was prepared, taking into consideration the U.S. comments on FISP planning, and approved by Council in December 2006. Simultaneously, as a part of this work plan, a FISP Writing Team, that includes 14 scientists representing all PICES member countries, was established to develop a Science Plan for FUTURE.]

High priority projects (Agenda Item 8)

Council reviewed the current status of the high priority initiatives identified at the 2005 inter-sessional Science Board/Governing Council meeting:

- the development of PICES future integrative scientific program(FISP);
- the preparation of the next North Pacific Ecosystem Status Report (NPESR);
- capacity building; and
- GOOS integration.

Details on the development of FISP can be found under Agenda Item 7.

North Pacific Ecosystem Status Report

The responsibility for the development of the next NPESR was assigned to the MONITOR Technical Committee. It was expected that, in consultation with the Secretariat and other appropriate PICES entities, MONITOR will establish procedures, and schedule for the report production. The first step in this direction was made at PICES XIV (October 2005, Vladivostok, Russia) when a workshop on "Filling the gaps in the PICES North Pacific Ecosystem Status Report" was convened to review the successes and shortcomings of the pilot NPESR (published in December 2004), and

to decide how future reports should look. At PICES XV, MONITOR recommended that the following NPESR-related products be developed: (1) a website reporting seminal time series from Large Marine Ecosystems in the PICES region, (2) a paper (and PDF) version of the full report, and (3) brochure-like Outlooks or Advisories to PICES member countries on emerging ecosystem issues, and that a Section within MONITOR be formed to deliver all 3 products (*MONITOR Endnote 3*).

These recommendations were not supported by Council. Instead, it was agreed to establish a Study Group on *Ecosystem status reporting* under the direction of Science Board, with terms of reference and membership as described in *GC Appendix B* (Decision 06/S/6(ii)).

Capacity building

PICES' strategy for capacity building was approved in 2003, and is available on the PICES website at http://www.pices.int/about/capacity_strategy.pdf. At the 2005 inter-sessional Science Board/Governing Council meeting, several capacity building initiatives were identified as the most important: (1) 2007 ICES/PICES Early Career Scientists Conference (ECS Conference); (2) PICES summer schools on marine sciences; (3) travel support for early career scientists to attend PICES Annual Meetings and symposia; (4) PICES Intern Program; (5) workshops on ecological modeling; and (6) international student exchange.

ICES/PICES ECS Conference

It has taken three years for PICES and ICES to prepare an Early Career Scientists Conference on "*New frontiers in marine science*" to be hosted by the University of Maryland Center for Environmental Science from June 26–29, 2007, in Baltimore, U.S.A. The goal of the conference is to foster the development of contacts, collaborations, and associations among early career scientists that will persist for decades, and to establish personal and institutional networks that will help to advance our understanding of the marine environment. Participation is by

invitation only, and approximately 100 scientists from around the world will be invited by the Conference Scientific Steering Committee to share their interests in marine sciences. Detailed information about the conference can be found on the PICES website. Lodging and meals will be provided by organizers at no cost to all participants. Limited funds will be also available to cover the cost of travel for selected scientists. Major funding for the conference comes from ICES and PICES. ICES' contribution is US \$90,000. At PICES XIV, Council approved \$25,000 from the encumbered funds designated for high-priority PICES projects to be earmarked for the ECS Conference (Decision 05/A/8). Our fund-raising resulted in additional support for this event from the North Pacific Research Board (NPRB, US \$15,000) and the Korean Ocean Research and Development Institute (KORDI, US \$3,000). Council also agreed to use part of the surplus (\$20,000) generated by the successful fund-raising for the 2006 CCCC Symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" to finance the ECS Conference.

PICES summer schools on marine sciences

The first PICES summer school on "*Ocean circulation and ecosystem modeling*" was held on August 23–25, 2006, in Busan, Korea. Seven lecturers from Japan and the U.S. taught a total of 37 participants from all 6 PICES member countries plus Chile and Indonesia (14 Ph.D. and 11 M.Sc. students, 7 early-career scientists, 4 undergraduate students, and 1 from a private company). The major part of the funding for the project was provided by the Seoul National University (SNU), the Korean Ocean and Research Development Institute (KORDI), the Korean Ministry of Maritime Affairs and Fisheries (MOMAF), the National Fisheries Research and Development Institute (NFRDI), and the Brain Korea 21 (BK 21) Program of the Korean Ministry of Education and Human Resources.

A proposal has been received from Japan to host the second PICES summer school on "*Ecosystem-based management*" in September

2008, at Hokkaido University, in Hakodate. Possibilities for co-funding include: the Hokkaido University Sustainable Government Project (HU-SGP), the Japanese Society for Promotion of Science (JSPS) and the Asia Pacific Network (APN).

Travel support for early career scientists

Travel support for early career scientists to attend PICES XV was provided from the Trust Fund. Applications received for this support and their dispositions were reported at the F&A meeting. Total expenses are close to \$35,000, but ~28% of this amount was granted by the Scientific Committee on Oceanic Research (SCOR). SCOR also allocated funds for scientists from countries with “economies in transition” to participate in the 2006 CCCC Symposium (US \$6,800), the 2007 Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (US \$6,000) and the 2008 Symposium on “*Effects of climate change on the world’s oceans*” (US \$7,500). The University of Hawaii Pelagic Fisheries Research Program (UH PFRP, U.S.A.) provided travel support for 7 students and post-docs from the Pacific Rim countries to attend the 2006 CCCC Symposium.

PICES Intern Program

Details can be found under Agenda Item 9.

Workshops on ecological modeling

It was recommended that PICES partner with other organizations/programs to broaden applications of the NEMURO.FISH model developed by our MODEL Task Team. The first in the series was a workshop on “*Climate interactions and marine ecosystems*” (co-sponsored by the Asia Pacific Network and PICES) convened October 10–13, 2004, in conjunction with PICES XIII (Honolulu, U.S.A.). A workshop on “*Global comparison of sardine, anchovy and other small pelagics: Building towards a multi-species model*” was held November 14–17, 2005, in Tokyo, Japan. Support for the workshop was provided by the Japanese Fisheries Research Agency, PICES, GLOBEC, the Asia Pacific Network for Global

Change Research (APN), Scientific Capacity Building/Enhancement for Sustainable Development in Developing Countries Program (CAPaBLE) and the Inter American Institute for Global Change Research (IAI), enabling participation by 22 attendees from Chile, China, India, France, Japan, Mexico, Pakistan, the Philippines, South Africa, the United Kingdom, and the United States of America. Lectures and practical exercises on ecosystem modeling using NEMURO and NEMURO.FISH were also included in the first PICES summer school.

International student exchanges

At PICES XIV, it was recommended that for international student exchange PICES should explore a possibility to match funds with the Office of International Science and Engineering at the National Science Foundation. No action has been taken so far.

GOOS integration

At PICES XIV, a Study Group to develop a strategy for GOOS was established under the direction of the MONITOR Technical Committee (Decision 05/S/6(v)). This Study Group will meet at PICES XV to complete its report. The preliminary recommendation, yet to be considered by MONITOR and Science Board, is that PICES should not propose a North Pacific GOOS pilot project to I-GOOS and should focus its efforts to facilitate the cooperation and coordination among the existing North Pacific observing systems and GOOS Regional Alliances (GRAs) in developing cross-GRA observing projects and technologies, and common communication protocols for sharing of data and information. Council agreed that this approach is an effective way to implement one of PICES’ major objectives – to coordinate and facilitate observations on the status of the North Pacific ecosystems.

The F&A Chairman, Dr. Laura Richards, reminded Council that the amount of the encumbered funds kept in the Working Capital Fund under the general “high priority projects” category is about \$110,500. She pointed out that the F&A Committee was unable to earmark a

level of expenditures for any individual high priority project as specific activities under these projects are not sufficiently well defined at this point to make meaningful recommendations.

PICES Intern Program (Agenda Item 9)

The PICES Intern Program was approved in 1999 (Decision 99/A/7) and commenced in 2000. Council reviewed the current status of the Intern Program and confirmed that PICES and member countries are benefiting from the Program, and that it should be continued.

The Executive Secretary reminded Council that Mr. Xuewu Guo (Yellow Sea Fisheries Research Institute, China) was selected as the next PICES intern, and his term is expected to start on February 1, 2007. This term could be from 8 to a maximum of 12 months, depending on the intern's performance, the workload in the Secretariat and availability of funds. At the recommendation of the F&A Committee, Council extended the deadline of nominations for the 2008 PICES Internship until the 2007 inter-sessional meeting (Decision 06/A/8(iii)). Japan and Korea in particular, were encouraged to nominate candidates for this term.

The Intern Program has not been budgeted for, and over the years has been financed solely by voluntary contributions. Following Decision 05/A/7(ii), Contracting Parties were invited to provide voluntary contributions to support the Program. In response to this request, the Pacific Islands Fisheries Science Center and the Alaska Fisheries Science Center (NMFS, U.S.A.) contributed US \$15,000 and US \$10,000, respectively, to the Trust Fund for the Program. Council requested the Executive Secretary to send a letter to the National Marine Fisheries Service (U.S.A.) to thank them for their continuing support of the Intern Program (Decision 06/A/8(i)).

Council instructed the Executive Secretary to invite Contracting Parties to provide voluntary contributions to support the Program in 2006

and beyond (Decision 06/A/8(ii)). These contributions are crucial, as expenses for the

Intern Program in *FY* 2007 are estimated at the level of \$28,000, whereas the amount of funds held for the Program is about \$22,000.

Council also confirmed that the stipend should be kept at the current level of \$2,000 per month, and given the modest stipend, advised Contracting Parties to consider whether the personal circumstances of the intern warrant supplementation (Decision 06/A/8(iv)).

Improvement of participation in PICES activities (Agenda Item 10)

At the last three Annual Meetings, Council extensively discussed ways of improving the participation of scientists from PICES Contracting Parties in the activities of the PICES Standing Committees and their subsidiary bodies, and made several recommendations targeting at resolving existing problems. The Executive Secretary reported on the implementation of these decisions.

Guidelines for Chairmen and Convenors

Council requested that relevant information be provided to national delegates by the Secretariat to be used when selecting members for PICES permanent committees and temporary expert groups, and clarifying their responsibilities at the time of their appointment (Decision 03/S/7(iii)).

The second edition of the PICES Handbook was published prior to PICES XV, as the first PICES Handbook, compiled in 1998 and re-printed in 1999, is outdated and out of stock. The goal of this publication is to have in one place all basic documents regulating the functioning of the Organization. The format of the new Handbook allows the replacement of a revised clause or an outdated document, and the addition of a document at low costs. The Handbook will be sent to all committee and expert group members immediately after the Annual Meeting. National delegates are encouraged to use materials from the Handbook when appointing new members for these committees and groups.

Guidelines for temporary expert groups

Important lessons can be learned from the performance and experience of past temporary expert groups (Working Groups, Study Groups, Task Teams, Advisory Panels). At the request of Council (Decision 04/S/7(i)), Science Board performed a review of the temporary expert groups established since the inception of the Organization. The purpose of the review was not to evaluate the performance of any single group, but to get an idea of whether the current approach of the formation and financing of these groups is working. After presenting an assessment report at PICES XIV, Dr. Michael G. Foreman (POC Chairman) was asked to use the results of his analysis to prepare a set of guidelines for future PICES temporary expert groups. The draft document was reviewed by the F&A Committee at PICES XV. Given the extensive overlap between this document and the existing PICES Handbook for Chairmen and Convenors (prepared in 1999 and amended in 2001), it was recommended that the documents be merged, and the final document be presented for approval at the next Annual Meeting.

National membership review

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

National membership lists

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

In the following discussion, the importance of inter-agency coordination was re-iterated. Within Contracting Parties, different agencies have the principal responsibility for interaction with PICES. The lead agencies often do not represent the interest of other agencies or coordinate PICES interactions with them. In fact, few countries have an effective inter-agency coordination mechanism. The problem of inter-agency cooperation and coordination is one that must be faced at the national level, and PICES can only urge that it be recognized and solved at that level. The formation of national committees to enhance and coordinate involvement of scientists in PICES activities, as recommended by the PICES Review Committee, might be the appropriate solution.

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

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

At the 2005 inter-sessional meeting, Council approved the proposal of Canada to host the Sixteenth Annual Meeting in Victoria, in 2007 (Decision 05/A/5(i)). At the 2006 inter-sessional meeting, Council accepted the new dates, October 26–November 4, 2007, for PICES XVI (Decision 06/A/7(i)). These dates are later than usual, but will avoid the overlap with the extended national holidays in China in early October, and with several international scientific meetings at the end of September or early October (including the 2007 ICES Annual

Science Conference in Helsinki, and the 2007 NPAFC Annual Meeting in Vladivostok). The theme of PICES XVI will be “*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*”, and the list of various scientific sessions and workshops to be convened at the meeting can be found in Decision 06/S/1. Dr. Laura Richards confirmed that Canada is not planning to request any funds from PICES to cover Annual Meeting costs.

At the 2006 inter-sessional meeting, Council approved the proposal of China to host the PICES Seventeenth Annual Meeting in Dalian, with the National Marine Environmental Monitoring Centre of the State Oceanic Administration as the local organizer (Decision 06/A/7(ii)). China was requested to inform the Secretariat by November 15, 2006, if changing the initially agreed dates of October 16–26, 2008, to October 23–November 2, 2008, is acceptable. The new dates are now confirmed by the State Oceanic Administration. The theme of PICES XVII will be “*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the future*”.

Following the established 6-year rotation cycle, Council invited Korea to explore the feasibility of hosting the PICES Eighteenth Annual Meeting in 2009, and inform the Secretariat on this matter by March 31, 2007 (Decision 06/A/7(iii)).

Council confirmed that the practice of charging a registration fee for future PICES Annual Meetings should continue, and accepted the same registration fee structure for 2007 as was decided for the previous three Annual Meetings (Decision 06/A/7(iv)). Fees will be collected by the Secretariat and credited to the Working Capital Fund to support high priority projects and the Intern Program, and to cover costs associated with Annual Meetings. The allocation among these three purposes should be flexible and decided by the Executive Secretary (Decision 04/A/5(iv)).

Council re-iterated its strong support for the concept of inter-sessional Science Board meetings with the participation of Council

members, but confirmed that the need for such a meeting should be evaluated each year and, given meeting costs and time commitment of the members, an inter-sessional meeting should be held only if the agenda is substantive. Council thanked the Pacific Islands Fisheries Science Center (NMFS, U.S.A.) for co-sponsoring the 2006 inter-sessional meeting.

Council approved an inter-sessional Science Board/Governing Council meeting in conjunction with a workshop to develop a Science Plan for the new integrative scientific program of PICES, provided that costs are carefully controlled. Council accepted Japan's offer to host both events in Yokohama in April 2007 (Decision 06/A/7(v)).

Report of Science Board (Agenda Item 12)

The Science Board met under the chairmanship of Dr. Kuh Kim, who presented the report to Council on October 22. The report was approved by Council, and is included elsewhere in this Annual Report. Details are given in *GC Appendix A* (Decisions 06/S/1–06/S/7).

Report of F&A Committee (Agenda Item 13)

The Finance and Administration Committee (F&A) met under the chairmanship of Dr. Laura Richards, who presented the report to Council on October 21. The report was approved by Council, and is included elsewhere in this Annual Report. Details are given in *GC Appendix A* (Decisions 06/A/1–06/A/11).

13.1 Audited accounts for fiscal year 2005

At the recommendation of the F&A Committee, Council accepted the audited accounts of *FY 2005* (*F&A Endnote 3*, Decision 06/A/1).

13.2 Annual contributions

Council reviewed the payment schedule of annual fees to the Organization (*F&A Endnote 4*), and noted that even though only two (Japan and Canada) of the six annual contributions for *FY 2006* arrived prior to the due date (January 1, 2006), there has been an overall improvement in

the timeliness of payment, and the annual contributions have been received within the first two months of the PICES fiscal year from all Contracting Parties except China. Korea and Russia have made especially impressive progress, moving the time of their payments from the third/forth quarters in 2000-2001 to February in 2006.

Council instructed the Executive Secretary to send a letter to Contracting Parties commending them for improved performance in submitting annual contributions for *FY* 2006, and describing the difficulties that late and/or partial payment cause the Organization (Decision 06/A/2(i)).

Council re-iterated that for the planning of their funding requests for annual contributions, Contracting Parties should continue to use the guideline generally accepted at PICES VIII (Decision 99/A/2(ii)), which states that the annual contributions will increase at the rate of inflation in Canada (Decision 06/A/2(ii)).

13.3 Fund-raising activities

External funding and voluntary contributions received for the period since PICES XIV for various activities of the Organization are reflected in *GC Endnote 3* and *F&A Endnote 5*.

It was pointed out that due to efforts from the PICES scientific community, national delegates, F&A Committee members, and the Secretariat, the level of external funding for various activities initiated by PICES has increased significantly over the last several years, and about a third of the current operational budget is now supported by voluntary contributions and partnerships. Fund-raising continues to be an important component of PICES activities, but most of the funding offers have specific product and service requirements. Therefore, it is becoming critical to develop a strategy to manage the workload of the Secretariat, the size and structure of which have remained unchanged for the last 12 years.

13.4 Budget

Estimated accounts for fiscal year 2006

The estimated accounts for *FY* 2006 were reviewed by the F&A Committee and approved by Council (Decision 06/A/3(i)).

Relocation and Home Leave Fund

The status of the Relocation and Home Leave Fund (RHLF) was reviewed. At the end of the fiscal year, RHLF will be approximately \$5,300 below the currently required amount of \$110,000. No relocation or home-leave expenses are expected in *FY* 2007, and interest earned during that year will bring RHLF close to the required amount. Therefore, the F&A Committee does not foresee a need to transfer funds to maintain RHLF at \$110,000 at the end of *FY* 2006. Council supported this suggestion.

Trust Fund

In *FY* 2006, more than \$65,000 from the Trust Fund was used to finance the Intern Program, and to support participation of young scientists from all Contracting Parties and scientists from countries with “economies in transition” to scientific meetings organized and co-sponsored by PICES. These expenditures were only partly compensated for by interest earned by the Fund, the voluntary contributions for the Intern Program, and a travel grant from SCOR. Council approved a transfer from the Working Capital Fund to the Trust Fund to recover the 2006 expenses, and to restore the Trust Fund to the level of \$110,000 by the end of the fiscal year (Decision 06/A/4(ii)).

At the 2006 inter-sessional meeting, Council adopted the revised guidelines for operating the Trust Fund (Decision 06/A/4(i)). The guidelines are posted on the PICES website and included in the new PICES Handbook.

Working Capital Fund

After inter-fund transfers approved by Council (Decisions 06/A/3(ii) and 06/A/4(ii)), the amount of funds available in the Working Capital Fund

is estimated at about \$276,308. This includes \$175,054 in encumbered funds held for special and high-priority PICES projects with completion in 2007-2008, leaving a balance in operating funds slightly above the required level of \$100,000. The F&A Committee was unable to earmark a level of expenditures for specific high priority projects as these activities are not sufficiently well defined at this point to make meaningful recommendations.

Proposed budget for fiscal year 2006

Council approved the proposed FY 2007 budget of \$745,000 (F&A Endnote 6). The amount of \$94,000 will be transferred from the Working Capital Fund to balance the budget, setting the total annual contribution at \$651,000, and the 2007 annual fee at \$108,500 per Contracting Party (Decision 06/A/3(ii)).

Forecast budget for fiscal year 2007

The FY 2007 forecast budget of \$760,000 was examined by the F&A Committee and presented to Council for information only. It will be further discussed at PICES XVI.

Election of Chairman and Vice Chairman (Agenda Item 14)

In accordance with Rule 6 of the PICES Rules of Procedure, *“The Chairman and the Vice-Chairman shall each be elected from among the Delegates for a term of two years and each shall be eligible for re-election only once for a successive term”*.

Dr. Vera Alexander (U.S.A.) was elected as the Chairman of Council in 2002 at PICES XI (Qingdao, People’s Republic of China). She was re-elected in 2004 at PICES XIII (Honolulu, U.S.A.), with her second term ending at the completion of this year’s Annual Meeting.

Following Rule 5(ii) of the Rules of Procedure, *“Nominations of candidates for elections in the Council shall be sent in writing to the Executive Secretary at least 60 days prior to the start of the Annual Meeting at which the election will occur”*. Prior to the deadline (August 16, 2006),

Mr. Akira Nakamae (Deputy Director General, Fisheries Agency of Japan) nominated Dr. Tokio Wada (National Delegate of Japan) to be considered for the next PICES Chairmanship. At the meeting, Council unanimously elected Dr. Wada as the Chairman of PICES for a 2-year term (Decision 06/A/9(i)).

Delegates expressed their gratitude to Dr. Alexander for her strong leadership and efforts over the past years. She will continue serving PICES as the Past-Chairman (Decision 96/A/5) and, in this capacity, will attend the meetings of Council for the period of Dr. Wada’s Chairmanship.

Dr. Wada was elected the Vice-Chairman in October 2004 at PICES XIII, and his term will end at the conclusion of this year’s Annual Meeting. Prior to the deadline, Dr. Lev N. Bocharov (National Delegate of Russia) was nominated for this position by Mr. Vladimir Izmaylov (Deputy Minister, Russian Ministry of Agriculture), Mr. Stanislav Il’yasov (Head, Russian Federal Agency for Fisheries), and Dr. Samuel Pooley (National Delegate of U.S.A.). At the meeting, Council unanimously elected Dr. Bocharov as the Vice-Chairman of PICES for a 2-year term (Decision 06/A/9(ii)).

Delegates congratulated Drs. Wada and Bocharov on their election, who expressed their thanks for the support given by Council.

Appointment of F&A Chairman (Agenda Item 15)

Dr. Laura Richards (Canada) was appointed as the Chairman of the Finance and Administration Committee in 2004 at PICES XIII, and her first term of office will end at the completion of this year’s Annual Meeting. At the recommendation of the F&A Committee, and in accordance with Rule 19(iii) of the PICES Rules of Procedure, Council re-appointed Dr. Richards as the F&A Chairman for another 2-year term (Decision 06/A/10).

Other business (Agenda Item 16)

No other business was identified by members.

GC Appendix A

2006 Governing Council decisions

06/A/1: Auditor

Council accepted the audited accounts for *FY* 2005.

06/A/2: Annual contributions

- i. Council instructed the Executive Secretary to send a letter to Contracting Parties commending them for improved performance in submitting annual contributions for *FY* 2006, and describing the difficulties that late and/or partial payment causes the Organization.
- ii. For planning of their funding requests for annual contributions, Contracting Parties should continue to use the guideline generally accepted at the PICES Eighth Annual Meeting (Decision 99/A/2(ii)), which states that the annual contributions will increase at the rate of inflation in Canada.

06/A/3: Budget

- i. Council accepted the estimated accounts for *FY* 2006.
- ii. Council approved the 2007 budget of \$745,000. The amount of \$94,000 will be transferred from the Working Capital Fund to balance the budget, setting the total annual contribution at \$651,000, and the 2007 annual fee at \$108,500 per Contracting Party.

06/A/4: Trust Fund

- i. Council adopted the new guidelines for operating the Trust Fund (at the 2006 inter-sessional meeting).
- ii. Council approved a transfer from the Working Capital Fund to the Trust Fund to recover the 2006 expenses, and to restore the Trust Fund to the level of \$110,000 by the end of the fiscal year.

06/A/5: Rules of Procedure and Financial Regulations

Council adopted the new Rules of Procedure and Financial Regulations (at the 2006 inter-sessional meeting).

06/A/6: Scientific cooperation with non-member countries

A Study Group has been established under the direction of Council, to explore options on how scientific cooperation with other (non-member) countries could be best achieved. Terms of Reference and membership of the Study Group are listed in *GC Appendix B*.

06/A/7: Schedule and financing of future Annual Meetings and inter-sessional Science Board/Governing Council meetings

- i. Council accepted the new dates, October 26–November 4, 2007, for the PICES Sixteenth Annual Meeting to be held in Victoria, Canada (at the 2006 inter-sessional meeting). The theme of PICES XVI will be “*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*”.
- ii. Council approved the proposal of China to host the PICES Seventeenth Annual Meeting in Dalian with the National Marine Environmental Monitoring Centre of the State Oceanic Administration as the local organizer (at the 2006 inter-sessional meeting). China was requested to inform the Secretariat by November 15, 2006, if changing the initially agreed dates of October 16–26, 2008, to October 23–November 2, 2008, is acceptable (the new dates are now confirmed). The theme of PICES XVII will be “*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the future*”.
- iii. Following the established 6-year rotation cycle, Council requested Korea to explore

the feasibility of hosting the PICES Eighteenth Annual Meeting in 2009, and inform the Secretariat on this matter by March 31, 2007.

- iv. Council accepted the same registration fee structure for 2007 as was maintained for 2004-2006:

Type	CDN \$
Registration fee	225
Early registration fee	150
Students registration fee	50
Spousal registration fee	50

- v. Council approved an inter-sessional Science Board/Governing Council meeting, in conjunction with a workshop to develop a Science Plan for the new integrative scientific program of PICES, provided that costs are carefully controlled. Council accepted Japan's offer to host both events in Yokohama in April 2007.

06/A/8: Intern Program

- i. Council requested the Executive Secretary to send a letter to the National Marine Fisheries Service (U.S.A.) to thank them for their continuing support of the Intern Program.
- ii. Council instructed the Executive Secretary to invite Contracting Parties to provide voluntary contributions to support the Intern Program in 2007 and beyond.
- iii. Council extended the deadline of nominations for the 2008 PICES Internship until the 2007 inter-sessional Science Board/Governing Council meeting.
- iv. Council confirmed that the stipend should be kept at the current level of \$2,000 per month. The nominating Contracting Party could consider supplementing this modest stipend, depending on the intern's personal circumstances.

06/A/9: Election of Chairman and Vice Chairman

- i. Council unanimously elected Dr. Tokio Wada (Japan) as the Chairman of PICES for a 2-year term (2006-2008). Accordingly

Dr. Vera Alexander (U.S.A.) will serve as the Past-Chairman.

- ii. Council unanimously elected Dr. Lev N. Bocharov (Russia) as the Vice-Chairman of PICES for a 2-year term (2006-2008).

06/A/10: Appointment of F&A Committee Chairman

Council re-appointed Dr. Laura Richards (Canada) as the Chairman of the Finance and Administration Committee for a 2-year term (2006-2008).

06/A/11: Science Board Chairman-elect

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

06/S/1: PICES Sixteenth Annual Meeting

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

- A ½-day BIO (MIE-AP) workshop on "*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*";
- A 1-day FIS workshop on "*Methods for standardizing trawl surveys to ensure constant catchability*";
- A 1-day FIS/MEQ (WG 19) workshop on "*Comparative analysis of frameworks to develop ecosystem-based approach to management and research needed for implementation*";
- A 1-day MEQ (HAB-S) workshop on "*Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophytes*" preceded by a ½-day laboratory demonstration on *Heterosigma* cell and toxin detection;
- A ½-day MONITOR/BIO workshop on "*Monitoring primary productivity in the North Pacific*";

- A 1½-day POC/CCCC (WG 20/CFAME) workshop on “*Climate scenarios for ecosystem modeling*”.

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

- A ¾-day Science Board Symposium on “*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*”;
- A 1-day BIO Contributed Paper Session;
- A 1-day BIO/POC Topic Session on “*Decadal changes in carbon biogeochemistry in the North Pacific*”;
- A ½-day BIO/FIS/POC Topic Session on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*”;
- A 1-day CCCC Contributed Paper Session;
- A 1-day CCCC/FIS Topic Session on “*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*”;
- A 1-day FIS Contributed Paper Session;
- A 1-day FIS Topic Session on “*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*”;
- A ½-day FIS/CCCC/BIO Topic Session on “*Fisheries interactions and local ecology*”;
- A 1-day MEQ Topic Session on “*The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region*”;
- A ½-day MEQ/FIS Topic Session on “*Coldwater biogenic habitat in the North Pacific*”;
- A 1-day MONITOR Topic Session on “*Recent advancements in ocean observation systems: Scientific discoveries and technical aspects*”;
- A 1-day POC Contributed Paper Session;
- A 1-day POC/CCCC/MONITOR Topic Session on “*Operational forecasts of oceans and ecosystems*”;

- A ½-day TCODE Topic Session on “*Data management, data analysis and data delivery systems to support detection and prediction of North Pacific ecosystem changes*”.

06/S/2: Inter-sessional meetings/workshops

The following inter-sessional meetings and workshops are to be convened/co-sponsored in 2007 and beyond (a List of Acronyms can be found at the end of the Annual Report):

- A 2-day meeting of the FISP Writing Team, February 16–17, 2007, Seattle, U.S.A.;
- A 2-day meeting of CREAMS-AP, March 2007, Qingdao, China;
- A 3-day workshop to develop a Science Plan for future integrative scientific program of PICES and an inter-sessional Science Board/Governing Council meeting, April 16–19, 2007, Yokohama, Japan;
- A display of PICES publications at the joint meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society, May 2–4, 2007, La Paz, Mexico;
- A 5th International Conference on “*Marine bioinvasions*” (co-sponsored by ICES, PICES and the U.S. National Sea Grant College Program), May 21–24, 2007, Cambridge, U.S.A. (approved in 2003);
- A 2-day joint meeting of PICES WG 21 on *Non-indigenous aquatic species*, ICES WG on *Introductions and Transfers of Marine Organisms* and ICES/IOC/IMO WG on *Ballast Waters and Other Ship Vectors*, May 25–26, 2007, in Cambridge, U.S.A.;
- A 3-day FIS workshop on “*Forecasting climate impacts on fish production*”, May 2007, Seattle, U.S.A., or June 2007, Hakodate, Japan;
- A 3-day CFAME workshop on “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*”, May 2007, Seattle, U.S.A., or June 2007, Hakodate, Japan;
- A 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (co-sponsored by PICES, ICES and GLOBEC), May 28–

- June 1, 2007, Hiroshima, Japan (approved in 2003);
- ESSAS/PICES Workshops on “*Evaluation of climate scenarios for subarctic regions*” (1 day) and “*The role of seasonal sea ice cover in marine ecosystems*” (2 days), June 4–6, 2007, Hakodate, Japan;
- An ICES/PICES Conference for Early Career Scientists on “*New frontiers in marine science*”, June 26–29, 2007, Baltimore, U.S.A. (approved in 2003);
- ICES/PICES Theme Sessions on “*Integrating observations and models to improve predictions of ecosystem response to physical variability*”, on “*Comparative marine ecosystem structure and function: Descriptors and characteristics*” and on “*The ecosystem approach: What’s the impact on marine science, science based advice and management of marine ecosystems*” at the ICES Annual Science Conference, September 17–21, 2007, Helsinki, Finland;
- An International Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” (co-sponsored by NAFO, PICES and ICES), October 1–3, 2007, in Lisbon, Portugal;
- An International Symposium on “*Effects of climate change on the world’s oceans*” (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR and WCRP), May 19–23, 2008, Gijón, Spain (approved in 2005).

06/S/3: Travel support

PICES will provide travel support for:

PICES XVI

- Invited speakers for Topic Sessions at the Annual Meeting with the normal allocation of approximately \$5,000 per Committee (including Science Board) and CCCC Program; additional requests are subject to fund availability;
- 1 invited speaker for the BIO workshop on “*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*”;
- 1 invited speaker for the FIS workshop on “*Methods for standardizing trawl surveys to ensure constant catchability*”;

- 1 invited speaker for the FIS/MEQ workshop on “*Comparative analysis of frameworks to develop ecosystem-based approach to management and research needed for implementation*”;
- 2 invited speakers for the MEQ workshop on “*Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophytes*”;
- 1 invited speaker for the POC/CCCC workshop on “*Climate scenarios for ecosystem modeling*”.

Inter-sessional meetings

- PICES representative to participate in the 3rd Forum of GOOS Regional Alliances (November 14–17, 2006, Cape Town, South Africa);
- PICES representative to attend the GOOS Scientific Steering Committee meeting (March 13–17, 2007, Seoul, Korea);
- PICES representative to present information on activities of the Organization at the joint meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society;
- 2 invited speakers for the FIS workshop on “*Forecasting climate impacts on fish production*”;
- 2 invited speakers for the CFAME workshop on “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*”;
- 2–3 Asian scientists to attend the 5th International Conference on “*Marine bioinvasions*” and the joint meeting of PICES WG 21, ICES WGITMO and ICES/IOC/IMO WGBOSV;
- PICES SSC members for the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*”;
- 1 member of WG 20 to attend ESSAS/PICES workshops on “*Evaluation of climate scenarios for subarctic regions*” and “*The role of seasonal sea ice cover in marine ecosystems*”;
- PICES representative to attend the IOC General Assembly (June 2007, Paris, France);
- PICES convenors to the joint ICES/PICES

Theme Sessions at the ICES Annual Science Conference;

- PICES representative to attend the SCOR Executive Committee meeting (August 2007, Bergen, Norway);
- PICES representative to attend the NPAFC Fifteenth Annual Meeting (September 2007, Vladivostok, Russia);
- PICES convenor and SSC member to attend the Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*”.

Science Board Chairman to attend:

- The workshop to develop a Science Plan for future integrative scientific program of PICES and an inter-sessional Science Board Meeting (April 2007, Yokohama, Japan);
- PICES Sixteenth Annual Meeting (October 2007, Victoria, Canada).

06/S/4: Publications

i. Council approved the following publications:

PICES Scientific Report Series, 2007–2008

- Final report of WG 16 on “*Climate change, shifts in fish production, and fisheries management*” (approved in 2002 for publication in 2004; delayed till 2007, pending review by FIS);
- Guide to best practices for oceanic CO₂ measurements and data reporting (approved in 2002 for publication in 2004; delayed till 2007, pending review by CC-S);
- Report of FIS workshop on “*Forecasting climate impacts on fish production*” (2007);
- Final report of WG 19 on “*Ecosystem-based management science and its application to the North Pacific*” (planned for 2008).

Special issues of primary journals, 2007–2008

- *Ecological Modelling* (February 2007; Guest Editors: M.J. Kishi, S.-I. Ito, B.A. Megrey and F.E. Werner) – selected papers on NEMURO and NEMURO.FISH models (approved in 2004);
- *Deep-Sea Research II* (2007; Guest Editors: K. Drinkwater, G.L. Hunt, D.L. Mackas and S. McKinnell) – selected papers from the ESSAS Symposium on “*Climate variability*

and sub-arctic marine ecosystems” (approved in 2005);

- *Progress in Oceanography* (2007; Guest Editors: H. Batchelder and S. Kim) – selected papers from the PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” (approved in 2005);
- *Progress in Oceanography* (2007; Guest Editors: A. Peña, S. Bograd and A. Bychkov) – selected papers from the symposium on “*Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P*” (approved in 2005);
- *Plankton and Benthos Research* (2007–2008; Guest Editors: H. Iizumi and TBD) – selected papers from the PICES XV Topic Session on “*The human dimension of jellyfish blooms*”;
- *Journal of Marine Systems* (2007-2008; Guest Editors: K.-I. Chang, S. McKinnell, C. Mooers and TBD) – selected papers from the 2006 CREAMS/PICES workshop on “*Model-data inter-comparison for the Japan/East Sea*”;
- *ICES Journal of Marine Science* (2008; Guest Editors: J. Carlton, J. Pederson and TBD) – selected papers from the 5th International Conference on “*Marine bioinvasions*”;
- *ICES Journal of Marine Science* (2008; Guest Editors: M. Dagg, R. Harris, L. Valdez and S.-I. Uye) – selected papers from the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*”;
- *Journal of Northwest Atlantic Fishery Science* (2008; Guest Editors: R.D. Brodeur, M. Dickey-Collas and E. Trippel) – selected papers from the International Symposium on “*Reproductive and recruitment processes of exploited marine fish stocks*”.

Other publications, 2007–2008

- American Fisheries Society book on “*The ecology of juvenile salmon in the Northeast Pacific Ocean: Regional comparisons*” (approved in 2005 for publication in 2006; delayed till 2007; Guest editors: R.D. Brodeur, C. Grimes, L. Haldorson and S. McKinnell);

- Brochure on “*Ecosystem-based management science and its application to the North Pacific*” (planned for 2008).
- ii. Council established a new electronic PICES Technical Report series. The TCODE report on “*Metadata federation of PICES member countries*” will be the first report published in this series in 2007.

06/S/5: Future of current groups

- Study Group (under the direction of Council) on *Rules of Procedure and Financial Regulations* should be disbanded after completing its task (Council adopted the new Rules of Procedure and Financial Regulations at the 2006 inter-sessional meeting);
- Working Group 18 (under the direction of FIS and MEQ) on *Mariculture in the 21st century – The interaction between ecology, socio-economics and production* should be disbanded for inadequate progress in achieving its tasks;
- POC should withdraw as a co-sponsor of the North Pacific Data Buoy Advisory Panel, and this Advisory Panel should report only to the Data Buoy Cooperation Panel

(DBCP). The Executive Secretary was requested to send a letter informing DBCP on this decision.

06/S/6: New PICES groups

- A Study Group on *Scientific cooperation between PICES and non-member countries* has been established under the direction of Council, with terms of references and membership as described in *GC Appendix B*;
- A Study Group on *Ecosystem status reporting* has been established under the direction of Science Board, with terms of reference and membership as described in *GC Appendix B*;
- A Study Group on *Marine aquaculture and ranching in the PICES region* has been established under the direction of Science Board, with terms of reference as described in *GC Appendix B*.

06/S/7: Relations with other organizations and programs

Council approved the revised Standing List of International Organizations and Programs, and agreed with the identified priorities for interaction in 2006–2007.

GC Appendix B

Study Group on *Scientific cooperation between PICES and non-member countries*

Terms of Reference:

1. Identify options and propose mechanisms for scientific cooperation between PICES and non-member countries within the current Convention. The options considered will include a review of the ICES “Affiliate Status” arrangement and how it could be adapted to the needs of PICES. Benefits and drawbacks should be identified for each option in terms of (a) scientific objectives of PICES, (b) financial and human resources implications, and (c) needed changes to the Rules of Procedure and Financial Regulations.
2. Assess the benefits and challenges in terms of the scientific objectives of PICES of

expanding the “area concerned”, as specified under Article II of the Convention, to the Southern Pacific, and provide a compilation of all Contracting Parties’ views on such a change to the Convention.

3. Provide its report by August 15, 2007, for consideration at PICES XVI (October 2007, Victoria, Canada).

Membership:

The Study Group will be chaired by the Chairman of the F&A Committee, and its membership will include one representative from each Contracting Party, plus a representative from Science Board and a representative from the Secretariat.

Study Group on *Ecosystem status reporting*

Terms of Reference:

1. Develop options and budgets for paper and electronic versions of the North Pacific Ecosystem Status Report;
2. Provide its report by April 15, 2007, for consideration at the 2007 inter-sessional Science Board/Governing Council meeting.

Membership:

The Study Group membership will include one representative from each Contracting Party and a representative from the Secretariat.

Study Group on *Marine aquaculture and ranching in the PICES region*

Terms of Reference:

1. Review and assess why PICES WG 18 on *Mariculture in the 21st century – The interaction between ecology, socio-economics and production* had limited success in achieving its terms of reference;
2. Determine the highest priority marine aquaculture and/or ocean ranching science

needs (< 10) for the next 5–10 years in each PICES member country;

3. Develop recommendations for joint activities in marine aquaculture and/or ocean ranching using the PICES Action Plan format;
4. Provide its report by September 2007, for consideration at PICES XVI.

GC Endnote 1

Participation list

Canada

Serge Labonté
Laura Richards

Japan

Tokimasa Kobayashi (advisor, October 21 only)
Hideki Nakano (advisor)
Yoshihide Tsuda (alternate delegate)
Tokio Wada

People's Republic of China

Zhi-Xin Chen (alternate delegate, October 17 only)
Fengkui Liang (alternate delegate, October 17 only)
Fangli Qiao (advisor, October 17 and 22 only)
Gongke Tan (advisor)
Dongmei Tang (advisor, October 17 only)

Republic of Korea

Seok Jin Kang (alternate delegate)
Ig-Chan Pang

Russia

Lev N. Bocharov
Oleg Katugin (advisor)
Igor Shevchenko (advisor, October 17 only)

U.S.A.

George W. Boehlert
K. Alexandra Curtis (advisor)
Patricia Livingston (advisor, October 17 only)
Samuel Pooley

Other

Vera Alexander (Chairman, PICES)
Alexander Bychkov (Executive Secretary)
Hyung-Tack Huh (Past-Chairman, PICES)
Kuh Kim (Chairman, Science Board, October 22 only)
John E. Stein (Chairman-elect, Science Board, October 21 and 22 only)

GC Endnote 2**Governing Council meeting agenda**

1. Opening remarks
2. Adoption of agenda and meeting procedures
3. Report on administration
4. Report of 2006 inter-sessional Governing Council meeting
5. Membership and observers from other countries
6. Relations with relevant international and regional organizations
7. Progress report of the Study Group on *Future Integrative Scientific Program(s)*
8. High priority projects:
 - a. Development of the next PICES integrative scientific program
 - b. Preparation of the next North Pacific Ecosystem Status Report
 - c. Capacity building
 - d. GOOS integration
9. PICES Intern Program
10. Improvement of participation in PICES activities
11. Schedule and financing of future Annual Meetings
12. Report and recommendations of Science Board
13. Report and recommendations of F&A Committee
14. Election of Chairman and Vice-Chairman
15. Appointment of F&A Committee Chairman
16. Other business

GC Endnote 3**Preliminary Report on Administration for 2006****I. Annual contributions**

According to Regulation 5(ii) of the PICES Financial Regulations, all national contributions

to PICES are payable by the first day of the financial year (January 1) to which they relate. Dues for 2006 were paid as follows:

Japan -----	December 15, 2005
Canada -----	December 28, 2005
U.S.A. -----	January 30, 2006
Republic of Korea -----	February 8, 2006
Russian Federation -----	February 28, 2006
People's Republic of China -----	August 1, 2006

II. External and additional funding

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

III. Inter-sessional meetings

Since PICES XIV (October 2005), the following inter-sessional meetings were convened/co-sponsored, for which financial, travel and logistical arrangements were made:

- a SEEDS-II Experiment Workshop (co-sponsored by the Ocean Research Institute and PICES) to synthesize results from the

second *in situ* iron enrichment experiments in the western subarctic North Pacific (SEEDS II), and to discuss differences in magnitude, biology and export between SEEDS I and SEEDS II, October 17–18, 2005, Tokyo, Japan;

- an NPAFC/PICES Symposium on “*The status of Pacific salmon and their role in North Pacific marine ecosystems*”, October 30–November 1, 2005 (in conjunction with the NPAFC Annual Meeting), Jeju, Korea;
- an International Workshop on “*Global comparison of sardine, anchovy and other small pelagics – building towards a multi-species model*” (co-sponsored by FRA,

- APN, IAI, PICES and GLOBEC), November 14–17, 2005, Tokyo, Japan;
- an International Repeat Hydrography Workshop (co-sponsored by JAMSTEC, CLIVAR, IOCCP and PICES) and a meeting of the PICES Section on *Carbon and climate*, November 14–17, 2005, Shonan Village, Japan;
 - a CFAME Workshop on “*A comparison of regional mechanisms for fish production: Ecosystem perspectives*”, January 12–13, 2006, Tokyo, Japan;
 - Panel discussions at the “*Marine Science in Alaska*” Symposium (January 25, 2006, Anchorage, U.S.A.) and at the meeting of the North Pacific Fisheries Management Council (February 8, Seattle, U.S.A.), to involve the Bering Sea and international communities in the development of a set of operational objectives;
 - an inter-sessional Science Board/Governing Council meeting, April 17–18, 2006, Honolulu, U.S.A.;
 - a PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*”, April 19–21, 2006, Honolulu, U.S.A.;
 - a PICES/NPRB Workshop on “*Integration of ecological indicators for the North Pacific with emphasis on the Bering Sea*”, June 1–3, 2006, Seattle, U.S.A.;
 - a Workshop to develop comparative studies of the sub-Arctic seas (co-sponsored by ESSAS/GLOBEC, PICES and TINRO-Center), June 12–14, 2006, St. Petersburg, Russia;
 - a Symposium on “*Time series of the Northeast Pacific Ocean: A symposium to mark the 50th anniversary of Line-P*” (co-sponsored by DFO and PICES), July 5–8, 2006, Victoria, Canada;
 - an International Symposium on “*Bio-invasion of non-indigenous species*” and a workshop on “*Remote sensing of marine environment in the Northwest Pacific region*” (co-sponsored by KIOS, PKNU, NPEC, NFRDI, MOMAF, NOWPAP, IOC/WESTPAC and PICES), July 30–August 2, 2006, Busan, Korea;
 - a CREAMS/PICES Workshop on “*Model-data inter-comparison for the Japan/East Sea*” (co-sponsored by SNU, KORDI, PKNU and PICES), August 21–22, 2006; Busan, Korea;
 - a PICES Summer School on “*Circulation and ecosystem modeling*” (co-sponsored by SNU, KORDI, MOMAF, NFRDI and PICES), August 23–25, 2006, Busan, Korea;
 - ICES/PICES Theme Sessions on “*Large-scale changes in the migration of small pelagic fish and the factors modulating such changes*” (September 23, 2006) and on “*Operational Oceanography*” (September 19, 2006) at the ICES Annual Science Conference, Maastricht, Netherlands.
- The following workshops were convened in conjunction with PICES XV in Yokohama, Japan:
- a BIO/POC Workshop on “*Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing*”, October 12, 2006;
 - an IFEP/MODEL Workshop (co-sponsored by SOLAS) on “*Modeling iron biogeochemistry and ocean ecosystems*”, October 13, 2006;
 - an MIE Workshop on “*Micronekton sampling gear inter-calibration experiment*”, October 13, 2006;
 - a CFAME Workshop on “*Climate forcing and marine ecosystems*”, October 13, 2006;
 - a FIS Workshop on “*Linking climate to trends in productivity of key commercial species in the subarctic Pacific*”, October 13–14, 2006;
 - an MEQ Workshop on “*Review of selected harmful algae in the PICES region: II. Dinophysis & Cochlodinium*”, October 14, 2006;
 - a POC workshop on “*Evaluation of climate change projections*”, October 14, 2006;
 - an MEQ/FIS Workshop on “*Criteria relevant for the determination of unit eco-regions for EBM in the PICES area*”, October 15, 2006;
 - a MONITOR/TCODE Workshop on “*Data management, delivery and visualization of high-volume data products*”, October 15, 2006;

Preparations, arrangements or planning are in progress for:

- an International Conference on “*The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries*” (co-sponsored by IMARPE, IRD, NASA, FAO, GLOBEC, ICES, PICES and IMBER), November 27–December 1, 2006, Lima, Peru;
- a 5th International Conference on “*Marine bioinvasions*”, (co-sponsored by ICES, PICES and the U.S. National Sea Grant College Program), May 21–24, 2007, Cambridge, U.S.A.;
- a 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (co-sponsored by PICES, ICES and GLOBEC), May 28–June 1, 2007, Hiroshima, Japan;
- an ICES/PICES Conference for Early Career Scientists on “*New frontiers in marine science*”, June 26–29, 2007, Baltimore, U.S.A.;
- an International Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” (co-sponsored by NAFO, PICES and ICES), October 1–3, 2007, Lisbon, Portugal;
- an International Symposium on “*Effects of climate change on the world’s oceans*” (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR and WCRP), May 19–23, 2008, Gijón, Spain.

IV. Publications

Publications produced after PICES XIV or still in progress include:

Primary journals

- “*Marine ecosystem structure and dynamics*” (Guest Editors: G. Hunt and S. McKinnell) – *Progress in Oceanography*, Vol. 68(2-4), 2006 (special issue from the PICES XIII Topic Session on “*Mechanisms that regulate North Pacific ecosystems: Bottom up, top down, or something else?*”);
- “*Top predator hot spots in the North Pacific*” (Guest Editors: W. Sydeman, R. Brodeur, A. Bychkov, C. Grimes and S. McKinnell) – *Deep-Sea Research II*, Vol.

53(3-4), 2006 (special issue from the PICES XIII Topic Session on “*Hot spots and their use by migratory species and top predators in the North Pacific*”);

- “*Modeling of North Pacific marine ecosystems*” (Guest editors: M. Kishi, B. Megrey, S.-I. Ito and F. Werner) – *Ecological Modeling*, 2006 (special issue on NEMURO and NEMURO.FISH models);
- “*Canadian SOLAS: Subarctic Ecosystem Response to Iron Enrichment (SERIES)*” (Guest Editors: P.J. Harrison, P.W. Boyd, M. Levasseur, A. Tsuda, R.B. Rivkin, S.O. Roy and W.L. Miller) – *Deep-Sea Research II*, Vol. 53 (20-22), 2006 (papers from the IFEP-AP SERIES experiment).

Peer-review process is in progress for three special issues with expected publication in 2007:

- *Deep-Sea Research II* (Guest Editors: K. Drinkwater, G. Hunt, D. Mackas and S. McKinnell) – selected papers from the ESSAS Symposium on “*Climate variability and sub-arctic marine ecosystems*”;
- *Progress in Oceanography* (Guest Editors: H. Batchelder and S. Kim) – selected papers from the PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*”;
- *Progress in Oceanography* (Guest Editors: A. Peña, A. Bychkov and TBD) – selected papers from the symposium on “*Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P*”.

PICES Scientific Report Series

- Takeda, S. and Wong, C.S. (Eds.) 2006. Report of the 2004 Workshop on “*In situ iron enrichment experiments in the eastern and western subarctic Pacific*”. PICES Sci. Rep. No. 31, 207 pp.
- Miller, C.B. and Ikeda, T. (Eds.) 2006. Report of the 2005 Workshop on “*Oceanic ecodynamics comparison in the subarctic Pacific*”. PICES Sci. Rep. No. 32, 105 pp.

The following reports are to be published by the end of this year:

- Kruse, G.H., Livingston, P., Overland, J.E., Jamieson, G.S., McKinnell, S. and Perry,

R.I. (Eds.) 2006. Report of the PICES/NPRB Workshop on Integration of Ecological Indicators of the North Pacific with Emphasis on the Bering Sea;

- Megrey, B.A., Macklin, S.A., Bahl, K. and Klawitter, P.D. (Eds.) 2006. Metadata federation of PICES member countries.

Other publications

- PICES 2005 Annual Report;
- PICES Handbook;
- Announcement, poster and book of abstracts for PICES XV;
- Announcement and poster for the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*”;
- Announcement (flyer) for the ICES/PICES Conference for Early Career Scientists “*New frontiers in marine science*”.

PICES Press - Newsletters

- Two regular issues: Vol. 14, No. 1 (January 2006) and Vol. 14, No. 2 (July 2006).

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

- Dr. Skip McKinnell (Deputy Executive Secretary) represented PICES at the 2005 CalCOFI Conference and the PaCOOS Board meeting (December 2005, La Jolla, U.S.A.);
- Ms. Darlene Smith (WG 21 Co-Chairman) represented PICES at the meetings of the ICES/IOC/IMO Working Group on *Ballast Waters and Other Ship Vectors* and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (March 2006, Oostende, Belgium);
- Dr. Suam Kim (CCCC Co-Chairman) represented PICES at the 2006 Pacific-Rim Fisheries Congress (March 2006, Hanoi, Vietnam);
- Dr. Alexander Bychkov (Executive Secretary) represented PICES at the 2006 EGU General Assembly (April 2006, Vienna, Austria);
- Ms. Christina Chiu (Deputy on Administration) represented PICES at the

International Fisheries Commissions Pension Society meeting (April 2006, La Jolla, U.S.A.);

- Drs. Vera Alexander (PICES Chairman) and Kuh Kim (Science Board Chairman) and members of the Secretariat travelled in April 2006, to Honolulu, U.S.A., for the 2006 Science Board/Governing Council Meeting; and in October 2006 to Yokohama, Japan, for PICES XV;
- Dr. Harold P. Batchelder (CCCC Co-Chairman) represented PICES at the GLOBEC SSC meeting (April 2006, Honolulu, U.S.A.);
- Dr. Masahide Kaeriyama (FIS member) represented PICES at the 2006 NPAFC CSRS meeting (April 2006, Sapporo, Japan);
- Dr. Skip McKinnell represented PICES at the IOC Executive Committee meeting (June 2005, Paris, France);
- Dr. Yoshiro Watanabe (CFAME member) and Dr. Bernard A. Megrey (TCODE member) served as PICES convenors to the joint ICES/PICES theme sessions on “*Large-scale changes in the migration of small pelagic fish and the factors modulating such changes*” and on “*Operational Oceanography*”, respectively, at the ICES Annual Science Conference (September 2006, Maastricht, Netherlands);
- Dr. Alexander Bychkov will represent PICES at the NPAFC Fourteenth Annual Meeting (October 2006, Vancouver, Canada);
- Dr. R. Ian Perry will represent PICES (as a member of the SSC) at the International Conference on “*The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries*” (November 2006, Lima, Peru).

VI. Relations with international scientific organizations and programs

The following reflects relationships with international scientific organizations and programs of regional and global scale, and with regional scientific and monitoring efforts in the North Pacific:

Asia-Pacific Network for Global Change Research (APN)

- APN and APN CAPaBLE (the APN Capacity Building/Enhancement for Sustainable Development in Developing Countries Program) co-sponsored the MODEL Workshop on “*Global comparison of sardine, anchovy and other small pelagics – building towards a multi-species model*”, held November 14–17, 2005, in Tokyo, Japan (other co-sponsors were FRA, PICES and GLOBEC);
- Mr. Hiroki Hashizume (Director, APN Secretariat) attended PICES XV as an observer and addressed Council on potential areas of cooperation between APN and PICES. APN also had several posters at this meeting outlining general information and highlighting scientific objectives and recent activities of the project.

International Argo Program

- Dr. Nobuyuki Shikama (Argo Science Team) attended PICES XV as an observer. Argo also had a poster at this meeting outlining general information and highlighting scientific objectives and recent activities of the project.

International Research Programme on Climate Variability and Predictability (CLIVAR)

- PICES co-sponsored, with CLIVAR, JAMSTEC and IOCCP, an International Repeat Hydrography Workshop held November 14–16, 2005, at the Shonan Village, Japan, and convened a meeting of its Section on *Carbon and climate* in conjunction with this workshop;
- PICES Working Group 20 on *Evaluation of Climate Change Projections* (established in 2005) is the appropriate avenue to enhance collaboration with CLIVAR through its Pacific Panel. Currently Dr. William Crawford serves as a liaison between the two groups.

Census of Marine Life program (CoML)

- Dr. Ron O’Dor (CoML Chief Scientist) attended PICES XV as an observer and addressed Council on potential areas of cooperation between CoML and PICES. It

was suggested that CoML is interested in updating, prior to 2009, a report entitled “*Marine life in the North Pacific Ocean: The known, unknown and unknowable*” developed by PICES in 2005. This report was published as PICES Special Publication No. 2, and an interactive fully searchable version of the report was posted on the PICES website.

Ecosystem Studies of Subarctic Seas (ESSAS)

- In May 2005, PICES co-sponsored and served as the local organizer for the GLOBEC Symposium on “*Climate variability and sub-arctic marine ecosystems*” held in Victoria, Canada. The symposium brought together 230 scientists from 16 countries (including all six PICES member countries) to present current knowledge of the structure and function of sub-arctic marine ecosystems and to discuss, at two special workshops, the Science and Implementation Plans of ESSAS, a new GLOBEC regional program. A special issue of *Deep-Sea Research II* to be published in 2007 includes over 40 papers from the Symposium;
- PICES assisted in organizing the first ESSAS Workshop to develop comparative studies of the sub-Arctic seas (June 12-14, 2006, St. Petersburg, Russia), including the logistical arrangements and providing travel funds for scientists to attend;
- Drs. Kenneth Drinkwater and George Hunt (ESSAS SSC Co-Chairmen) attended PICES XV as observers and addressed Council on potential areas of cooperation between ESSAS and its U.S. component for the Bering Sea (BEST) and PICES. ESSAS and BEST also had posters at this meeting outlining general information and highlighting scientific objectives and recent activities of both projects.
- A series of ESSAS-related events, including workshops on “*Evaluation of climate scenarios for subarctic regions*” and “*The role of seasonal sea ice cover in marine ecosystems*”, is planned for June 2007, in Hakodate, Japan, and PICES agreed to co-sponsor these workshops.

Exxon Valdez Oil Spill Trustee Council (EVOS)

- The sample collection and analysis for the north-south transect of the PICES Continuous Plankton Recorder (CPR) survey of the North Pacific has been financially supported for the period from 2000 to 2006 by EVOS. In November 2006, this grant was extended to 2007.

Global Ocean Ecosystem Dynamics project (GLOBEC)

- The PICES Climate Change and Carrying Capacity (CCCC) Program provides a mechanism for integrating national GLOBEC research programs in the North Pacific and is a regional component of the international GLOBEC effort;
- The PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” was held April 19–21, 2006, in Honolulu, U.S.A. This symposium and a special issue of *Progress in Oceanography* to be published in late 2007 or early 2008 are considered as a part of GLOBEC synthesis efforts;
- PICES and GLOBEC are working together to organize the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” to be held May 28–June 1, 2007, in Hiroshima, Japan;
- Dr. Manuel Barange (GLOBEC Executive Director) and Dr. Francisco Werner (GLOBEC SSC Chairman) attended PICES XV as observers and briefed Science Board on GLOBEC’s synthesis and integration efforts and invited PICES’ involvement in these activities.

Global Ocean Observing System (GOOS)

- At the 2005 inter-sessional Science Board/Governing Council meeting, GOOS integration was identified as a high priority PICES activity. At PICES XIV, a Study Group (SG-GOOS) to develop a strategy for GOOS was established under the direction of the MONITOR Technical Committee;
- In its 2006 report, SG-GOOS suggested that PICES should direct its efforts to facilitate the cooperation and coordination among

North Pacific GOOS Regional Alliances (GRAs) in developing cross-GRA observing projects, observing technologies, and common communication protocols for sharing of data and information;

- A 1-day MONITOR/TCODE workshop on “*Data management, delivery and visualization of high-volume data products*”, highly-relevant to GOOS was convened at PICES XV;
- Dr. Takashi Yoshida (NEAR-GOOS Chairman) and representatives of several regional monitoring efforts (AOOS, NANOOS, PaCOOS) attended PICES XV and addressed MONITOR and SG-GOOS on potential areas of collaboration with PICES.

International Council for the Exploration of the Sea (ICES)

- PICES co-sponsored two Theme Sessions on “*Large-scale changes in the migration of small pelagic fish and the factors modulating such changes*” and on *Operational Oceanography* at the 2006 ICES Annual Science Conference. Drs. Yoshiro Watanabe and Bernard A. Megrey/Jeffrey Napp served as PICES convenors for these sessions;
- ICES accepted PICES’ invitation to support an invited speaker (Dr. Kenneth Drinkwater) for the Science Board Symposium on “*Boundary currents ecosystems*” convened at PICES XV;
- Dr. Adolf Kellermann (ICES Head of Science Program) attended PICES XV as an observer and addressed Science Board on potential future joint ICES/PICES activities;
- To discuss/initiate possible co-operation on marine bioinvasions, Ms. Darlene Smith (WG 21 Co-Chairman) attended the annual meetings of the ICES/IOC/IMO Working Group on *Ballast Waters and Other Ship Vectors* (WGBOSV) and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (WGITMO) in March 2006, in Oostende, Belgium. Dr. Judith Pederson (Chairman of WGITMO) and Dr. Anders Jelmert (Chairman of WGBOSV) participated in the annual meeting of WG 21 at PICES XV;

- ICES and PICES are working with the U.S. National Sea Grant College Program to organize the 5th International Conference on “*Marine bioinvasions*” to be convened May 21–24, 2007, in Cambridge, U.S.A. A 2-day joint meeting of WG 21, WGBOSV and WGITMO will be held immediately after the conference;
- ICES is one of the co-sponsors for the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*”, to be held May 28–June 1, 2007, in Hiroshima, Japan;
- The ICES/PICES Conference for Early Career Scientists on “*New frontiers in marine science*” will be held June 26–29, 2007, in Baltimore, U.S.A. The goal of the conference is to foster the development of contacts, collaborations and associations among early career scientists with similar interests from around the globe, that will persist for decades;
- ICES and PICES joined NAFO in organizing an International Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” to be held October 1–3, 2007, in Lisbon, Portugal;
- ICES and PICES initiated the organization of the International Symposium on “*Effects of climate change on the world’s oceans*” (other sponsors are IOC, GLOBEC, SCOR and WCRP) to be held May 19–23, 2008, Gijón, Spain.

Integrated Marine Biogeochemistry and Ecosystem Research (IMBER)

- The joint PICES/IMBER Topic Session on “*Interactions between biogeochemical cycles and marine foodwebs in the North Pacific*” was convened at PICES XV;
- Dr. Julie Hall (IMBER SSC Chairman) attended PICES XV as an observer and addressed Council on potential areas of cooperation between IMBER and PICES. IMBER also had a poster at this meeting outlining general information and highlighting scientific objectives and recent activities of the project;
- There is a strong interest in including issues of marine biogeochemistry and food webs

that would link PICES with IMBER in a new PICES integrative scientific program.

Intergovernmental Oceanographic Commission (IOC)

In 2002, IOC and PICES agreed to cooperate on four fronts: (i) monitoring (see under GOOS); (ii) ecosystem indicators (see under SCOR); (iii) CO₂ data integration and synthesis (see under IOCCP); and (iv) harmful algal blooms (see below).

- In June 2005, IOC and PICES signed a formal agreement to establish a partnership in systematically compiling, storing and presenting on-line, records on harmful algal events. Event records will be compiled and stored annually in the format specified in the HAE-DAT database. HAE-DAT is hosted at the IOC server in Paris and presented with equal credit to the partner organizations (PICES and ICES). The HAE-DAT partnership is open to other appropriate and complementary regional organizations as to achieve global coverage of HAE-DAT. Building a common data resource will allow inter-comparison of HAB species composition and the magnitude of environmental and economic impacts;
- IOC supported an initiative by ICES and PICES to organize the International Symposium on “*Effects of climate change on the world’s oceans*” to be held May 19–23, 2008, Gijón, Spain.

International Ocean Carbon Coordinated Project (IOCCP)

- IOCCP is working on establishing international agreements on observation methods, best practices, data management, and data sharing that will lead to the joint development of global data products and synthesis activities documenting the ocean carbon cycle. PICES, through its Working Groups on CO₂ in the North Pacific (WG 13, 1998–2001) and *Biogeochemical data integration and synthesis* (WG 17, 2002–2005), has been long acting as a regional coordinator for these activities. The PICES Section on *Carbon and Climate* provides clear channels of communication to IOCCP,

and to large-scale IGBP programs such as SOLAS and IMBER;

- IOCCP and PICES are co-sponsoring the preparation of the “*Guide to best practices for oceanic CO₂ measurements and data reporting*” to be published in the *PICES Scientific Report Series* in 2007.

North Atlantic Fisheries Organization (NAFO)

- NAFO and PICES (with ICES as another co-sponsor) partner to organize the International Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” to be held October 1-3, 2007, Lisbon, Portugal.

North Pacific Anadromous Fish Commission (NPAFC)

- NPAFC accepted PICES’ invitation for the Chairman of NPAFC’s Committee on Scientific Research and Statistics (CSRS) to present annual updates on the status of Pacific salmon in the North Pacific to the MONITOR Technical Committee. Every third year, the CSRS Chairman will make a more complete presentation on the status of Pacific salmon in the North Pacific as input to update the North Pacific Ecosystem Status Report. A representative of PICES will present the North Pacific Ecosystem Status Report to NPAFC Annual Meetings;
- Dr. Richard Beamish (NPAFC CSRS Chairman) attended PICES XV as an observer and addressed Council on potential areas for cooperation between NPAFC and PICES.

North Pacific Research Board (NPRB)

- NPRB approved a grant of \$90,000 for the production of the next North Pacific Ecosystem Status Report;
- NPRB provided US \$20,000 for the 2006 PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” (April 19–21, 2006, Honolulu, U.S.A.), and US \$15,000 for the ICES/PICES Conference for Early Career Scientists on “*New frontiers in marine science*” to be held June 26–29, 2007, in Baltimore, U.S.A.;

- A PICES proposal entitled “*Integration of ecological indicators for the North Pacific with emphasis on the Bering Sea*” was funded by NPRB (a grant of US \$99,957). The project goal is to provide a report on the merits and recommendations for use of various classes of ecosystem indicators, through the application of selection criteria and their correspondence to operational objectives. The project was successfully completed by convening a 3-day PICES/NPRB workshop on “*Integration of ecological indicators of the North Pacific with emphasis on the Bering Sea*” in June 2006, Seattle, U.S.A., and publishing proceedings of the workshop as PICES Scientific Report No. 33 in December 2006.

Scientific Committee on Oceanic Research (SCOR)

Relationships with GLOBEC, SOLAS, IMBER and IOCCP are reflected separately. Other collaborations between PICES and scientific projects and groups established/co-sponsored by SCOR are listed below.

- In October 2004, PICES established a new Working Group on *Ecosystem-based management science and its application to the North Pacific*. This Working Group will definitely benefit from activities of SCOR-IOC WG 119 on *Quantitative ecosystem indicators for fisheries management*. The Co-Chairman of SCOR WG 119, Dr. Villy Christensen, was one of invited speakers at the PICES/NPRB Workshop on “*Integration of ecological indicators for the North Pacific with emphasis on the Bering Sea*”;
- PICES strongly supported the formation of the SCOR WG 125 on *Global Comparisons of Zooplankton Time Series* and agreed to provide funding for one additional member from the North Pacific (Dr. Harold P. Batchelder, Oregon State University, U.S.A.) to participate in its activities. Some future meetings of this SCOR WG 125 are planned to be held in conjunction with symposia organized/co-sponsored by PICES;
- Since 2005, the PICES HAB Section has been convening an annual series of workshops to document the existing knowledge on the eco-physiology of HAB

species that impact all, or most, countries in the North Pacific. The SCOR GEOHAB Program is invited to play an active role in future workshops of this series;

- SCOR provided a total of US \$15,000 for scientists from countries with “economies in transition” to attend the 2006 PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” and PICES XV;
- SCOR has approved US \$6,000 for scientists from countries with “economies in transition” to attend the Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (May 28–June 1, 2007, Hiroshima, Japan) and US \$5,000 to travel to PICES XVI for SCOR-relevant sessions.

Surface Ocean-Lower Atmosphere Study (SOLAS)

- Meso-scale iron enhancement experiments are an important part in the agenda of both SOLAS and PICES. Three international collaborative field projects were developed under the umbrella of PICES, through its Advisory Panel on the *Iron Fertilization Experiment in the Subarctic Pacific Ocean* (IFEP) established in 2000. SERIES (Subarctic Ecosystem Response to Iron Enrichment Study) was performed in the eastern subarctic Pacific in summer of 2002, and SEEDS-I and SEEDS-II (Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study) were conducted in the western subarctic Pacific in the summers of 2001 and 2004, respectively. Important new findings from the first two experiments were

published recently in *Science* (SEEDS-I: Tsuda *et al.* 2003, 300: 958–961) and *Nature* (SERIES: Boyd *et al.* 2004, 428: 549–553). More detailed results from these experiments can be found in special issues of *Prog. Oceanogr.* 2005. Vol. 64, Nos. 2–4, pp. 91–324 (SEEDS-I) and *Deep-Sea Research II*. 2006. Vol. 53, Nos. 20–22, pp. 2005–2454 (SERIES);

- The joint PICES/SOLAS workshop on “*Modeling iron biogeochemistry and ocean ecosystems*” was convened at PICES XV;
- Dr. Shigenobu Takeda (SOLAS SSC member) attended PICES XV as an observer and addressed Council on potential areas of cooperation between SOLAS and PICES. SOLAS also had a poster at this meeting outlining general information and highlighting scientific objectives and recent activities of the project;
- PICES agreed to provide travel support for young Asian scientists to attend the SOLAS Open Science Meeting to be held in March 2007, in Xiamen, People’s Republic of China.

U.S. Fishery Management Councils

- The North Pacific Fishery Management Council (NPFMC) and Western Pacific Fishery Management Council (WPFMC) provided US \$5,000 and \$15,000, respectively, for the 2006 PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*”.

VII. PICES Intern Program

See GC Agenda Item 9 for details.

GC Endnote 4

Summary report of the 2006 inter-sessional Governing Council meeting

The 2006 inter-sessional Governing Council was held on April 18, under the chairmanship of Dr. Vera Alexander. The list of participants and agenda for the meeting are included at the end of this section. All Contracting Parties were represented at the meeting.

The main order of business was the adoption of the updated Rules of Procedure and Financial Regulations (RPFR). A Study Group on RPFR was established at PICES XIII (Decision 04/A/7). The intent was to ensure that the Rules of Procedure and Financial Regulations agreed with the current practice of the Organization,

and to eliminate problematic areas of ambiguity. A SG-RPFR report was presented by its Chairman, Dr. Laura Richards. She pointed out that discussion of the proposed amendments began at the 2005 inter-sessional Council meeting and continued at PICES XIV. After PICES XIV, all comments were collated by the Secretariat and used for preparation of the final drafts circulated on February 14, 2006, to ensure the 2-month period required for Council to consider the adoption of both documents.

Additional changes in *Rules 3-5, 11 and 20* of the Rules of Procedure were implemented during the meeting. It was also agreed that *Regulation 12(v)* of the Financial Regulations be revised at a later date (after consulting with a Canadian tax specialist on wording for this clause), to allow the extension of the tax levy practice to the Canadian staff members of the PICES Secretariat. The revised documents were approved by consensus (Decision 06/A/5).

The other matter discussed was the guidelines for operating the PICES Trust Fund. This fund, established in 1994 (Decision 94/A/4) and supported primarily by voluntary contributions from the Contracting Parties, has been a useful mechanism for facilitating involvement in PICES activities by young scientists, and for providing funds for the PICES Intern Program as needed. Since the guidelines had not been updated in more than a decade, the F&A Committee determined at PICES XIV that a review was warranted to bring the current practice and the guidelines into accord, and to improve transparency of the decisions. Canadian Delegate, Mr. Serge Labonté, worked with the Secretariat in updating the procedures. The proposed document was discussed at length, and after further revisions made in clauses 4(iv) and 7(i), it was adopted by consensus (Decision 06/A/4(i)).

Dr. Vera Alexander provided an update on her contacts with 4 Pacific Rim countries that are currently affiliated members of ICES (Australia, Chile, New Zealand and Peru). Her letters of March 2, 2006, were intended to initiate a dialogue that will allow Council to determine whether marine scientists from these four

countries might be interested in having a greater role in the activities of our organization. PICES XV was suggested as the appropriate venue to continue this dialogue, and invitations were extended to their representatives to attend this Annual Meeting. By the time of the 2006 inter-sessional Council meeting, the only response received was from Dr. Renato Guevara Carrasco (IMARPE, Peru), who indicated the enthusiasm of the IMARPE staff with respect to PICES' proposal. Mr. Serge Labonté pointed out the importance to understand why there are no other responses, and Dr. Laura Richards suggested that the start of a new PICES scientific program may encourage more interest. Dr. Tokio Wada indicated that Japan recognizes the importance and merit of cooperation beyond the North Pacific with the current expansion of PICES scientific activities, but it is the Japanese government's understanding that the expansion of the geographic scope and the introduction of an affiliated member system like ICES will require an amendment of the present PICES Convention. Japan believes that the expansion of research cooperation can be achieved through collaboration with other international organizations or countries under the present Convention, and this expansion alone is not a substantial reason that calls for an amendment of the Convention.

Council reviewed several recommendations from the 2006 inter-sessional Science Board meeting, and the following decisions were made:

- To facilitate the continuity of Science Board affairs, a Science Board Chairman-elect position was established to allow the election of the Science Board Chairman 1 year before the official change of the chairmanship (Decision 06/A/11).
- Dr. Phillip R. Mundy (U.S.A.) was appointed as the Chairman of the Study Group to develop a strategy for GOOS. This Study Group was formed at PICES XIV, under the direction of MONITOR (Decision 05/S/6).
- An amount of \$10,000 from the encumbered funds designated for high-priority projects was earmarked to support the preparation of a HUFO-DAT Vol. 2 CD-ROM with a 50-year gill net data collected by T/S *Oshoro-*

maru and T/S *Hokusei-maru* in the western and eastern North Pacific and the Bering Sea.

Other decisions/recommendations were:

- The new dates (October 26–November 4, 2007) for PICES XVI in Victoria, Canada, were supported by all Contracting Parties and permanent Committees, and accepted by Council (Decision 06/A/7(i)).
- Council approved the proposal of China to host PICES XVII (2008) in Dalian, with the National Marine Environmental Monitoring Centre of SOA as the local organizer. China was requested to inform the Secretariat by the end of April if the tentative dates of October 16–26, 2008, are acceptable (Decision 06/A/7(ii)).
- The United States urged that PICES consider charging overhead for running

various events. The Secretariat should contact the PICES auditor to determine the amount of overhead.

- China nominated Mr. Xuewu Guo from the Yellow Sea Fisheries Research Institute (Chinese Academy of Fishery Sciences, Qingdao) as the intern for the 2007 term of the PICES Intern Program.
- Canada suggested that the Secretariat should contact local universities that deal with training students for international relations to examine the possibility of broadening the Intern Program without budgetary implications.
- Council supported a recommendation of Japan to establish a new PICES award for monitoring and data management activities and requested Dr. Tokio Wada to prepare a proposal for consideration at PICES XV.

Participation list of the 2006 inter-sessional Governing Council meeting

Canada

Serge Labonté
Laura Richards

Japan

Tokio Wada
Yukimasa Ishida (advisor)

People's Republic of China

Fengkui Liang (alternate delegate)

Republic of Korea

Ig-Chan Pang

Russia

Lev N. Bocharov
Igor Shevchenko (advisor)

U.S.A.

George Boehlert
Patricia Livingston (advisor)
Samuel Pooley

Other

Vera Alexander (Chairman, PICES)
Alexander Bychkov (Executive Secretary)
Skip McKinnell (Deputy Executive Secretary)
Kuh Kim (Chairman, Science Board)
John E. Stein (Vice-Chairman, Science Board)

2006 inter-sessional Governing Council meeting agenda

1. PICES Rules of Procedure & Financial Regulations
2. PICES Trust Fund guidelines
3. Potential PICES membership
4. Recommendations from the 2006 inter-sessional Science Board meeting
5. Financial and administrative matters
 - 5.1 Auditor's report for FY 2005
 - 5.2 Status of annual contributions
 - 5.3 Status of voluntary contributions
 - 5.4 Administrative matters
6. Schedule and financing of future Annual Meetings of the Organization
7. PICES Intern Program
8. Other business

GC Endnote 5

U.S. comments on planning for the PICES Future Integrative Science Program as presented at the Governing Council meeting on October 22, 2006, in Yokohama, Japan

We very much appreciate the hard work that has been put into FISP. There was an excellent discussion at the Open Forum on FUTURE, and both the drafters of the Prospectus and the Committee Chairmen deserve congratulations for making this progress. We realize this is not an easy task, and it is a task that has substantial implications for PICES. So you will understand if the Governing Council is taking a careful look at the program's proposed Content as well the Process by which FISP moves forward.

Our questions on process focus on the Science Board's presentation to Governing Council on October 21. We realize that this is a work in progress, but we are also concerned that the time is shrinking in which to implement this program. We raised some of these concerns during the oral presentation on the Science Board's plan and discussed them further with the Science Board Chairman the following day.

Without benefit of a write-up on the process, our understanding of the FISP planning process is somewhat sketchy, but we believe we have the gist of it. Our understanding of the process is that the Committees will provide input to FISP by the beginning of December, and the FISP team will compile this information plus that provided from this year's Open Forum for a meeting of the Writing Team in February 2006. We also think we heard that between December and February team members in the Seattle (U.S.A.) area would get together to get a "head start." The Writing Team would generate a draft plan that would be further developed in a wider workshop including all of the Science Board and a number of scientists from within PICES, to be held in April 2007, in Yokohama. The structure of the workshop was not well defined, but the objective, as we understood it, was to finalize the FUTURE science plan. The product from that meeting would receive external review comments from individuals largely outside PICES. The final draft would be posted for external review and PICES comments in August, with the final version available for Governing Council review and approval at PICES XVI in Victoria (Canada), in October 2007. In the following year, an implementation plan for FUTURE would also be developed.

The Governing Council did support the spring 2007 workshop in Yokohama, Japan, and authorized work to proceed on that workshop, subject to some constraints.

1. Overall process

Collaborative research is both exciting and frustrating, the latter from the difficulties of coordinating researchers in different institutions. There are several approaches to cooperative research planning, including use of planning consultants, expert researchers, inter-active research teams, and planning workshops, to name several. The FISP process seems to promise all of these approaches except the use of planning consultants. But the exact constellation of these approaches is not at all clear. We believe SB/FISP should provide a much more detailed write-up of each step of the planning process. For example, for the workshop, we would like to see the objectives, proposed agenda, planning activities, and deliverables. We would like to see this kind of detail about each step in the process.

2. Geographical balance, including vetting by the Contracting Parties

The Science Board understands, as well as any of us, the importance of involving all components of PICES in its activities, and we recognize there has been an attempt to do so in the Writing Team and the workshop. However, this appears to have been incomplete and participation was not been vetted by the national delegates and Governing Council. We believe that the SB/FISP should provide its nominations for participation in the Writing Team and the workshop to the Contracting Parties, who will affirm these nominations to the Secretariat or suggest alternatives. The SB/FISP should also

identify methods for involving scientists from the western side of the Pacific in any informal meetings – using techniques such as teleconferencing or direct contacts.

3. Methodological balance

We may be treading on the terrain of Science Board to suggest that the gist of FISP is the kind of integrative modeling that ties together the components of PICES into a coherent perspective on the dynamics of the North Pacific ecosystem. It is this, plus the advice to management and communication of results, that differentiate FUTURE from the CCCC Program. Thus, expertise in these areas is crucial. We suggest that more attention be focused on the modeling aspect of the project, with top level modelers included in the process. We are pleased to see that several policy advisors have been suggested for the planning process, but we would suggest that the Communication theme is really quite different and needs a specialist on that topic. We would also like to see a more complete strategy for involving both the human dimensions of the research component and the communications strategy from the beginning, particularly as pertains to different approaches across the member countries.

4. New ideas

The Science Board and FISP team have dedicated a substantial amount of their professional time toward this project which we appreciate. Yet we have some concern that the project seems more like a roll-over of the CCCC Program rather than a new project. We would suggest some explicit reaching out to people in this region who either have not been involved in PICES, such as coastal scientists, or who have been involved and are faded away, as well as to young scientists.

5. Timeline

We all appreciate that pulling this together by next fall will be a major accomplishment, but we are concerned that the schedule is compressed toward the decision-making end of the timeline. We would like to see a schedule that accelerates the drafting process from the point of Committee input in December 2006 through the provision of the draft plan. If this schedule cannot be accelerated with the activities currently planned, then a re-evaluation of the process would be warranted.

6. Cost

Frankly we were worried that the cost of the FISP planning process may absorb all of the flexibility in the PICES budget. We agree this is the highest priority for PICES, but we would like to see an explicit budget. The United States suggests that the total cost of FISP science plan development in 2007 should not exceed one half of the PICES discretionary budget, *i.e.*, less than \$55,000. [The Chairman of F&A, Dr. Laura Richards, subsequently suggested a budget not to exceed \$40,000 would be appropriate.] We would like to see an explicit budget for the entire planning process, including best estimates for the implementation planning stage.

REPORT OF THE FINANCE AND ADMINISTRATION COMMITTEE



The Finance and Administration Committee (hereafter F&A) met from 09:00–12:00 hours on October 18, and from 14:00–14:30 on October 20, 2006, under the chairmanship of Dr. Laura Richards.

Opening remarks (Agenda Item 1)

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

Adoption of agenda (Agenda Item 2)

The Committee reviewed the draft agenda (*F&A Endnote 2*). At Canada's request, a discussion of procedures relating to membership and observers from other countries was added under Agenda Item 14 (Other business).

Audited accounts for FY 2005 (Agenda Item 3)

The FY 2005 financial statements were submitted to the PICES external auditor, *Flader & Hale*, on March 15, 2006. The Auditor's Report for FY 2005 (*F&A Endnote 3*) was completed and circulated by e-mail to all Contracting Parties on April 12, 2006, and hard copies of the report were distributed at the 2006 inter-sessional Council meeting held April 18, 2006, in Honolulu (U.S.A.). In the auditor's opinion, the financial statements are an accurate representation of the financial position of the Organization as of December 31, 2005. The Committee reviewed the Auditor's Report and recommended it for approval by Council.

Annual contributions (Agenda Item 4)

As stated in Financial Regulation 5(ii), all national contributions to PICES "*shall be considered due as of the first day of the financial year (January 1) to which they relate*". The

Executive Secretary reported on the 2006 annual fee payment dates, and provided information on the payment schedule of national contributions for the last 7 years (*F&A Endnote 4*).

The Committee noted that annual contributions were received within the first 2 months of the PICES fiscal year from all Contracting Parties but China. The Committee recommended that Council instruct the Executive Secretary to send a letter to Contracting Parties commending them for their performance in submitting annual contributions for 2006, and describing the difficulties that late and partial payment causes the Organization. It was also recommended that for planning purposes, Contracting Parties should continue to use the guideline generally accepted at the PICES Eighth Annual Meeting (Decision 99/A/2(ii)), which states that "*the annual contributions will increase at the rate of inflation in Canada*". This should assist member countries in preparing timely funding requests to cover annual contributions, and the Executive Secretary in developing future budgets.

At PICES XIV, the Committee noted that, from the high expectations placed on PICES, a case could be made to raise the contributions from Contracting Parties. To assess the relevance of any significant increase in annual contributions, the Executive Secretary was asked to study how the Organization might finance the anticipated growth in its activities from savings accrued as a result of reducing current expenditures. To assist in this analysis, F&A members were requested to consider which activities could be scaled back in order to operate PICES within the current (or a lower) budget, and to send their suggestions to the Executive Secretary no later than December 31, 2005. The only specific suggestions received were from Ms. Patricia Livingston (U.S.A.), who recommended consideration of (1) minimizing printing expenditures by making electronic copies of PICES publications available on-line and

charging for hard copies of these publications; and (2) recovering meeting costs by increasing meeting registration fees.

After extensive discussion, the Committee agreed that more work was still required to understand how PICES could operate within its budget. Canada (Mr. Serge Labonté) agreed to meet with the Secretariat to prepare options for presentation at the next F&A meeting in 2007.

In addition, the Committee requested that the Executive Secretary prepare a more detailed analysis of options for electronic publication of PICES documents. This report should include:

1. breakdown of publications into various categories;
2. printing and distribution costs, by category;
3. options for transition to electronic publications, by category;
4. impacts on existing distribution system (libraries; commercial distributors, *etc.*);
5. mitigation measures (if any) to rectify resulting distribution problems;
6. impacts on Secretariat infrastructure and document archival processes (with the assistance of TCODE);
7. consideration of impacts of any changes on each of the Contracting Parties;
8. recommended options and Action Plan.

The Committee noted that Contracting Parties must carefully review the draft document prepared by the Secretariat to ensure that any impacts on Contracting Parties (item 7) are correctly identified and communicated to the Executive Secretary.

Fund-raising activities (Agenda Item 5)

The Executive Secretary reported on fund-raising efforts for the period since PICES XIV (*F&A Endnote 5*). Fund-raising continues to be an important component of PICES activities, and about a third of the current operational budget is supported by external contributions and partnerships. It was indicated that as partnerships expand, a strategy will be needed to manage the workload of the Secretariat.

Budget (Agenda Item 6)

Estimated accounts for FY 2006 (Agenda Item 6a)

The Committee reviewed the estimated accounts for FY 2006 and recommended their acceptance by Council.

Interest and other income (Agenda Item 6b)

In FY 2006, the total income is estimated at \$337,919. This amount includes the income of \$123,275 from “guaranteed” sources and \$22,585 from other sources, and \$192,059 in voluntary contributions and grants as listed in *F&A Endnote 5*.

Relocation and Home Leave Fund (Agenda Item 6c)

The Relocation and Home Leave Fund (RHLF) is currently set at \$110,000. At the end of FY 2006, if home-leave expenses are offset only by interest earned by the Fund, RHLF will be approximately \$5,500 below the currently required amount of \$110,000. The Committee noted that no relocation or home-leave expenses are expected in FY 2007, and interest earned during that year will bring RHLF close to \$110,000. Therefore, the Committee does not foresee a need to transfer funds to maintain RHLF at \$110,000 at the end of the fiscal year.

Trust Fund (Agenda Item 6d)

In FY 2006, the Trust Fund (TRF) estimated income is at a level of \$47,425 (\$44,425 in voluntary contributions and grants) and estimated expenses are \$69,195. The Committee recommends a transfer from the Working Capital Fund (WCF) to recover the 2006 expenses and restore the Trust Fund to the level of \$110,000.

Working Capital Fund (Agenda Item 6e)

In FY 2006, the Working Capital Fund estimated income is at a level of \$287,769 (\$147,634 in voluntary contributions and grants) and estimated expenses are \$243,708. After

recommended inter-fund transfers, the amount of funds available in the Working Capital Fund at the fiscal year end will be \$276,308. This includes \$175,054 in encumbered funds held for special and high-priority PICES projects with completion in 2007–2008, and \$101,254 in “operating” funds.

F&A discussed whether a level of expenditures should be earmarked for specific high priority activities. However, the costs of these activities are not sufficiently well defined at this point to make meaningful recommendations.

Budget for FY 2007 and forecast budget for FY 2008 (Agenda Item 6f)

The Committee reviewed the proposed FY 2007 budget of \$745,000 (*F&A Endnote 6*) and recommended its approval by Council. The budget was noted to be consistent with the guideline generally accepted at the PICES Eighth Annual Meeting (Decision 99/A/2(ii)), stating that “*the annual contribution will increase at the rate of inflation in Canada*”. The Committee recommended a transfer of \$94,000 from the Working Capital Fund to balance the budget, setting the total annual contribution at \$651,000, and the 2007 fees at \$108,500 per Contracting Party.

The Executive Secretary presented the FY 2008 forecast budget of \$760,000, and noted that this budget is prepared based on preliminary information available as of August 10, 2006, and is about 2% higher than in FY 2007. It was indicated that if the inflation rate in Canada remains the same, then under the adopted guidelines, the 2007 annual fee should be set at a level of \$111,500 per Contracting Party. Then the total annual contribution would be \$669,000, and a transfer of \$91,000 from the Working Capital Fund would be required to balance the budget. The Committee submitted the FY 2008 forecast budget to Council for information only.

Financing of high priority projects (Agenda Item 7)

The Committee reviewed the high priority projects previously identified by Science Board.

As referenced under Agenda Item 6e, the cost requirements for these projects are not yet known. However, the Committee recommended that expenditures related to development of the future integrative scientific program be identified as the highest priority.

PICES Intern Program (Agenda Item 8)

The Committee reviewed the current status of the Intern Program. In April 2006, Mr. Xuewu Guo from the Yellow Sea Fisheries Research Institute (Chinese Academy of Fishery Sciences, Qingdao, China) was nominated and consequently accepted as the 2007 PICES intern. His 8-month term is expected to start on February 1, 2007. The term could be extended to a maximum of 12 months, depending on his performance, availability of funds, and the workload in the Secretariat.

Applications for the Intern Program, reviewed by national delegates, should normally be received by the Executive Secretary by the date of the first Governing Council session at the PICES Annual Meeting. Considering that Mr. Guo’s term will be completed not earlier than in September 2007, the Committee recommends that the deadline for nominations be extended until the 2007 inter-sessional Science Board/Governing Council meeting, or until the end of March 2007, if no inter-sessional meeting is held.

The Executive Secretary reminded the Committee that the Intern Program remains unbudgeted, and over the years has been financed solely by voluntary contributions. The Committee recommended that Council thank the National Marine Fisheries Service (U.S.A.) for their continuing support of the Intern Program, and instructed the Executive Secretary to invite Contracting Parties to provide voluntary contributions supporting the Program in 2007 and beyond.

The Committee reviewed the level of stipends for the interns and discussed whether this stipend is sufficient to cover the cost of living in Canada. It was recommended that the stipend be kept at the current level of \$2,000 per month.

The nominating Contracting Party could consider supplementing this modest stipend, depending on the intern's personal circumstances.

Schedule and financing of future Annual Meetings (Agenda Item 9)

At PICES XIV, Governing Council requested China to explore the possibility of holding the Seventeenth Annual Meeting in 2008, and inform the Secretariat on this matter by March 31, 2006 (Decision 05/A/5(ii)). At the 2006 inter-sessional Science Board/Governing Council meeting, the Chinese government confirmed their intention to host PICES XVII in Dalian, with the National Marine Environmental Monitoring Centre of SOA as the local organizer. China also accepted the proposed dates (October 16–26, 2008) for the Annual Meeting. However, the Committee subsequently learned that the 5th World Fisheries Congress will be held October 20–24, 2008, in Yokohama, Japan. To avoid overlap, the Committee recommended that the dates for PICES XVII be changed, and that the meeting begin instead on October 23, 2008. The Chinese delegation indicated that they could confirm these dates within the next 2 weeks.

The Committee recommended that, in keeping with the 6-year rotation cycle, Korea be invited to explore the feasibility of hosting the Eighteenth Annual Meeting in October 2009, and inform the Secretariat on this matter by March 31, 2007.

At PICES X, 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 credited to the Working Capital Fund to support high priority projects and the Intern Program, and to cover costs associated with Annual Meetings; the allocation among these three purposes should be flexible and decided by the Executive Secretary (Decision 04/A/5(iv)). Council accepted the same registration fee structure for PICES XV as was

decided for the previous two Annual Meetings (Decision 05/A/5(iii)). The Committee again reviewed the fee structure and recommended that Council maintain the same registration fee structure for PICES XVI in 2007:

Type	CDN \$
Registration fee	225
Early registration fee	150
Students registration fee	50
Spousal registration fee	50

The Committee recognized the importance of holding an inter-sessional Science Board meeting in 2007, in conjunction with a workshop to develop a Science Plan for the new integrative scientific program of PICES (FUTURE). The Committee recommended that Council accept Japan's offer to host this event. The Committee also emphasized the need to keep overall costs to the minimum possible.

PICES Handbook (Agenda Item 10)

The second edition of the PICES Handbook was published prior to PICES XV as the first PICES Handbook, compiled in 1998 and re-printed in 1999, is outdated and out of stock. The goal of this publication is to have in one place all basic documents regulating the functioning of the Organization. The new Handbook includes the text of the PICES Convention, the Headquarters Agreement between PICES and the Government of Canada, the revised PICES Rules of Procedure, Financial Regulations and Trust Fund Guidelines (approved at the 2006 inter-sessional Council meeting), the PICES Strategic Plan (approved at the 2004 inter-sessional Council meeting), and the historical list of PICES officers for the period from 1992-2006. It was noted that the PICES Handbook is printed in a format that allows the replacement of a revised separate clause or a whole outdated document, and the addition of a new document at low costs.

The Committee reviewed two documents ("Guidelines for Chairmen and Convenors" and "Guidelines for temporary expert groups") to be added to the PICES Handbook. Given the extensive overlap between these documents, the

Committee recommended that the documents be merged. The Committee further recommended that a small group be formed with the Chairman of F&A, the Secretariat, and representation by Science Board to work by correspondence to complete the document for approval at the next Annual Meeting. In the interim, these draft documents could be used as a guide.

Administrative matters (Agenda Item 11)

The Committee reviewed the progress on the status of income tax levies for personnel at the PICES Secretariat.

Space, facilities and services for the PICES Secretariat office (Agenda Item 12)

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

Space and certain general administrative services are traditionally provided to the PICES Secretariat by DFO. The original agreement commenced on April 1, 1992, and continues indefinitely with a periodic review. The last time the agreement was amended was on April 1, 2002, and it should be renewed by the end of 2006.

In *FY* 2006, PICES is to pay an annual sum of \$23,500 for postage and \$2,000 for janitorial/

maintenance services. Telephone and fax lines, previously covered in the amount of \$2,500 under the agreement, are currently paid by PICES to Telus directly. The new agreement between PICES and DFO should take into account the substantial increase in mailing costs by Canada Post and the costs that have shifted to PICES.

Appointment of F&A Committee Chairman (Agenda Item 13)

The Committee recommended that Dr. Laura Richards (Canada) be re-appointed to another 2-year term as F&A Chairman.

Other business (Agenda Item 14)

The Committee discussed the documentation provided in the Governing Council Briefing Book on membership and observers from other countries (GC Agenda Item 5). Should Council decide to expand PICES membership, the Committee recommended that a Study Group to explore options (for example, affiliate status or Memorandum of Understanding) and any legal recommendations (such as amendments to the Convention) be established.

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

The draft report has been circulated and approved by all F&A members. All recommendations to Council were brought forward by Dr. Richards at their meeting on October 21, 2006.

F&A Endnote 1

Participation list

Canada

Robin M. Brown
Serge Labonté

Japan

Tokio Wada
Hideki Nakano (advisor)

People's Republic of China

Zhixin Chen
Fangli Qiao (advisor)

Republic of Korea

Seok Jin Kang (alternate)
Ig-Chan Pang (advisor)

Russia

Igor Shevchenko

U.S.A.

K. Alexandra Curtis (alternate)
Patricia Livingston

Other

Laura Richards (F&A Chairman)
Vera Alexander (Chairman, PICES)
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 fiscal year 2005
4. Annual contributions
5. Fund-raising activities
6. Budget:
 - a. Estimated accounts for *FY* 2006
 - b. Interest and other income
 - c. Relocation and Home Leave Fund
 - d. Trust Fund
 - e. Working Capital Fund
 - f. Proposed budget for *FY* 2007 and forecast budget for *FY* 2008
7. Financing of high priority projects
8. PICES Intern Program
9. Schedule and financing of future Annual Meetings
10. PICES Handbook
11. Administrative matters
12. Space, facilities and services for the PICES Secretariat office
13. Appointment of F&A Committee Chairman
14. Other business
15. Adoption of report and recommendations to Council

F&A Endnote 3

Auditor's report (2005) to the Organization

To the Council of the
North Pacific Marine Science Organization

We have audited the statement of financial position of North Pacific Marine Science Organization as at December 31, 2005 and the statement of operations and changes in fund balances for the year then ended. These financial statements are the responsibility of the organization's management. Our responsibility is to express an opinion on these financial statements based on our audit.

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

In our opinion, these financial statements present fairly, in all material respects, the financial position of the organization as at December 31, 2005 and the results of its operations and changes in fund balances for the year then ended in accordance with Canadian generally accepted accounting principles.

Flader & Hale
Chartered Accountants
9768 Third Street
Sidney, B.C.,
Canada. V8L 4B2
PHONE: 1-250-656-3991
FAX: 1-250-656-6486
E-mail: mail@fladerandhale.ca

Sidney, B.C.
April 6, 2006

**NORTH PACIFIC MARINE SCIENCE ORGANIZATION
STATEMENT OF FINANCIAL POSITION
AS AT DECEMBER 31, 2005**

ASSETS

	2005	2004
CURRENT ASSETS		
Cash and short term deposits (note 4)	\$ 800,990	\$ 722,791
Accounts receivable	14,500	1,825
Prepaid expenses	2,560	3,096
	\$ 818,050	\$ 727,712

LIABILITIES

CURRENT LIABILITIES		
Accounts payable	\$ 56,683	\$ 34,886
Funds held for contracting parties (note 3)	105,500	102,500
	162,183	137,386

FUND BALANCES

WORKING CAPITAL FUND (note 4)	435,867	370,326
TRUST FUND	110,000	110,000
RELOCATION AND HOME LEAVE FUND	110,000	110,000
	655,867	590,326
	\$ 818,050	\$ 727,712

**NORTH PACIFIC MARINE SCIENCE ORGANIZATION
STATEMENT OF OPERATIONS AND CHANGES IN FUND BALANCES
FOR THE YEAR ENDED DECEMBER 31, 2005**

	Working		Relocation and		
	General	Capital	Trust	Home Leave	
	Fund	Fund	Fund	Fund	
FUND BALANCES, beginning of year	\$ -	\$ 370,326	\$ 110,000	\$ 110,000	\$ 590,326
SOURCES OF FUNDS					2004 Total
Contributions from Contracting Parties	615,000	-	-	-	615,000
Budgeted transfer to General Fund (note 5)	95,500	(95,500)	-	-	-
Voluntary contributions and grants (note 6)	-	259,570	45,225	-	304,795
Interest and other income (note 7)	-	112,443	2,092	2,078	116,613
	710,500	276,513	47,317	2,078	1,036,408
FUND BALANCES, before expenditures	710,500	646,839	157,317	112,078	1,626,734
EXPENDITURES					2005 Total
Personnel services	376,500	13,632	-	-	390,132
Annual Meetings	40,000	15,434	-	-	55,434
Special meetings	70,356	87,086	-	-	157,442
Travel	89,111	5,812	37,432	-	132,355
Printing	65,073	63,450	-	-	128,523
Communication	31,792	-	-	-	31,792
Equipment	7,374	-	-	-	7,374
Supplies	7,972	1,158	-	-	9,130
Contractual services	18,000	19,200	-	-	37,200
Miscellaneous	3,681	-	-	-	3,681
Intern program	-	-	14,459	-	14,459
Ecosystem Status Report	-	-	-	-	-
FERRRS Report	-	-	-	-	-
Relocation	-	-	-	-	-
Foreign exchange loss (note 8)	3,345	-	-	-	3,345
	713,204	205,772	51,891	-	970,867
NET FUNDS AVAILABLE	(2,704)	441,067	105,426	112,078	655,867
TRANSFER FROM WORKING CAPITAL FUND (note 4)	2,704	(2,704)	-	-	-
INTERFUND TRANSFERS (note 5)	-	(2,496)	4,574	(2,078)	-
FUND BALANCES, end of year	\$ -	\$ 435,867	\$ 110,000	\$ 110,000	\$ 655,867
					\$ 590,326

**NORTH PACIFIC MARINE SCIENCE ORGANIZATION
NOTES TO THE FINANCIAL STATEMENTS
DECEMBER 31, 2005**

1. PURPOSE OF ORGANIZATION

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

2. ACCOUNTING POLICIES

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

(a) Fund Accounting

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

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

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

(b) Capital Assets

Capital assets acquired by the Organization are expensed in the year of acquisition. During the current year the organization purchased \$7,374 of capital assets.

(c) Contributions

Contributions from contracting parties are recorded in the year in which they relate to. All other contributions and grants are recorded in the year received.

(d) Income Tax

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

(e) Foreign Exchange

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

(f) Financial Instruments

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

(g) Use of Estimates

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

3. FUNDS HELD FOR CONTRACTING PARTIES

The funds held for contracting parties are advance contributions from Japan (\$105,500).

4. WORKING CAPITAL FUND

Of the total amount in the Working Capital Fund, \$217,536 is restricted for specific designated projects.

Pursuant to decision 05/A/3(iii) of the Governing Council, \$97,000 of the funds held in the Working Capital Fund will be transferred to the General Fund at the beginning of the 2006 fiscal year to reduce 2006 contributions.

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 \$95,500 at the beginning of 2005 from the Working Capital Fund to the General Fund (Decision 04/A/3/ii), in order to facilitate in the reduction of the annual contribution fee per Contracting Party.

The Governing Council approved the transfer of funds from the Working Capital Fund to restore the Trust Fund to \$110,000 (Decision 05/A/3/iii). The amount of the transfer was \$4,574.

The Governing Council approved the transfer of the surplus in the Relocation and Home Leave Fund to the Working Capital Fund to return the Relocation and Home Leave Fund to \$110,000 (Decision 05/A/3/iii). The amount of the transfer was \$2,078.

6. VOLUNTARY CONTRIBUTIONS AND GRANTS

	Working Capital Fund	Trust Fund
AFSC/NWFSC (U.S.A.) contribution for interim meeting	\$ 12,458	\$ -
Contributions for 2006 CCCC Symposium:		
NPFMC (U.S.A.)	6,020	-
NPRB (U.S.A.)	23,622	-
PIFSC (U.S.A.)	11,610	-
DFO (Canada) contribution for 2006 Line P Symposium	10,000	-
EVOS (U.S.A.) contribution for GEM	18,248	-
GLOBEC contribution for ESSAS Symposium	11,332	-
Korean contribution for position at Secretariat	19,200	-
NPRB (U.S.A.) grant for second NPESR	37,080	-
U.S.A. contribution for high priority projects	110,000	-
AFSC (U.S.A.) contribution for young scientists	-	3,503
Contributions for Intern Program:		
DFO (Canada)	-	14,000
NMFS (U.S.A.)	-	17,415
TINRO-Center (Russia)	-	3,597
OECOS/OSU (U.S.A.) contribution for young scientists	-	690
SCOR travel grant for PICES XIV	-	6,020
	\$ 259,570	\$ 45,225

7. INTEREST AND OTHER INCOME

	Working Capital Fund	Trust Fund	Relocation and Home Leave Fund
Interest income	\$ 10,627	\$ 2,092	\$ 2,078
Income tax levies	23,611	-	-
GST, PST & WCB rebates	16,050	-	-
Registration Fees for PICES XIV	44,982	-	-
Registration Fees for CCCC Symposium	8,950	-	-
Reimbursement for <i>PiO</i> Publication	5,710	-	-
Other income	2,513	-	-
	\$ 112,443	\$ 2,092	\$ 2,078

8. FOREIGN EXCHANGE LOSS

At year end all funds held in foreign currency (US \$111,033) are converted to Canadian dollars using the December 31st exchange rate. A foreign exchange loss has been reported on the current year financial statements; this amount is an unbudgeted item which has been caused by the ongoing fluctuations in the US dollar (2005 =1.1659, 2004 =1.2020), and not by the actual purchase or sale of any foreign currencies.

9. FINANCIAL STATEMENTS

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

F&A Endnote 4

Payment schedule of annual contributions, 2000-2006¹

	<i>Canada</i>	<i>China</i>	<i>Japan</i>	<i>Korea</i>	<i>Russia</i>	<i>U.S.A.</i>
<i>2000</i>	Feb. 9, 00	Aug. 29, 00	Nov. 30, 99	June 1, 00	Nov. 2, 00	Jan. 18, 00
<i>2001</i>	Jan. 24, 01	Dec. 10, 01	Dec. 13, 00	Aug. 23, 01	May 18, 01	Jan. 3, 01
<i>2002</i>	Jan. 21, 02	Oct. 8, 02²	Nov. 27, 01	Aug. 26, 02	June 10, 02³	Dec. 24, 01
<i>2003</i>	Jan. 13, 03	Oct. 3, 03⁴	Dec. 11, 02	May 5, 03	Apr. 2, 03⁵	Dec. 6, 02
<i>2004</i>	Jan. 5, 04	Aug. 10, 04	Dec. 26, 03	Mar. 24, 04	Mar. 2, 04	Feb. 9, 04⁶
<i>2005</i>	Dec. 24, 04	Sept. 22, 05⁷	Mar. 2, 05	Mar. 30, 05	Mar. 31, 05 ⁸	Jan. 10, 05
<i>2006</i>	Dec. 28, 05	Aug. 1, 06	Dec. 15, 05	Feb. 8, 06	Feb. 28, 06	Jan. 30, 06

¹ payments made later than in the first quarter of the PICES fiscal year or partial payments are indicated in bold

² partial (95.7%) payment, remainder paid October 3, 2003 (21 months overdue)

³ partial (72%) payment, remainder paid October 10, 2002 (9 months overdue)

⁴ partial (78%) payment, remainder paid August 10, 2004 (19 months overdue)

⁵ partial (96.5%) payment, remainder paid July 18, 2003 (6 months overdue)

⁶ partial (50%) payment, remainder paid September 8, 2004 (8 months overdue)

⁷ partial (86%) payment, remainder paid December 30, 2005 (12 months overdue)

⁸ partial (96.6%) payment, remainder paid April 25, 2005 (4 months overdue)

F&A Endnote 5

External funding and special contributions received since PICES XIV

For the period since PICES XIV (October 2005), efforts from the PICES scientific community, national delegates, F&A Committee members, and the PICES Secretariat resulted in the following extra-budgetary contributions for various activities initiated/co-sponsored by PICES:

Special projects

- In 2005, the North Pacific Research Board (NPRB, U.S.A.) approved a grant of US \$99,957 to support a PICES project entitled “*Integration of ecological indicators for the North Pacific with*

emphasis on the Bering Sea: A workshop approach". The project will be completed by February 2007.

- In 2005, NPRB also approved the amount of CND \$90,000 for the development of the next North Pacific Ecosystem Status Report. Main activities in the project will be taking place in 2007–2009.

Symposia/sessions/workshops

- The Ocean Research Institute (University of Tokyo, Japan) and SOLAS-Japan provided funding for the IFEP workshop (October 17–18, 2005, Tokyo, Japan) to synthesize results from the second *in situ* iron enrichment experiment in the western subarctic North Pacific (SEEDS-II). Funds for the project were managed by Dr. Atsushi Tsuda (member of the PICES IFEP-AP).
- The Fisheries Research Agency of Japan (FRA), the Asian Pacific Network and the APN Capacity Building/Enhancement for Sustainable Development in Developing Countries Program (APN CAPaBLE) provided funding for the MODEL workshop on "*Global comparison of sardine, anchovy and other small pelagics: Building towards a multi-species model*" (November 14–17, 2005, Tokyo, Japan). Funds for the project were managed by Drs. Shin-ichi Ito (Co-Chairman of the PICES MODEL Task Team) and Michio Kishi (MODEL Task Team member).
- The Pacific Island Fisheries Science Center (PIFSC/NMFS, U.S.A.) allocated \$3,000 to partially offset PICES' expenses for the 2006 inter-sessional Science Board/Governing Council meeting (April 17–18, 2006, Honolulu, U.S.A.).
- The Global Ocean Ecosystem Dynamics Project (GLOBEC), U.S. GLOBEC, the Western Pacific Fishery Management Council (WPFMC, U.S.A.), and the Korean Ocean Research & Development Institute (KORDI, Korea) contributed US \$10,000, US \$12,000, US \$15,000 and US \$3,000, respectively, for the 2006 CCCC Symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" (April 19–21, 2006, Honolulu, U.S.A.). [In 2005, the North Pacific Fishery Management Council (NPFMC, U.S.A.), PIFSC (U.S.A.), and NPRB (U.S.A.) provided US \$5,000, US \$10,000, and US \$20,000, respectively, for this symposium.]
- The Pacific Scientific Research Fisheries Center (TINRO-Center, Russia) co-sponsored the ESSAS/PICES workshop (June 12–14, 2006, St. Petersburg, Russia) to develop comparative studies of the subarctic seas. Funds for the project were transferred directly to the host institute "Giprorybflot".
- The Department of Fisheries and Oceans (DFO, Canada) contributed \$3,975 for the 2006 Symposium on "*Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P*" (July 5–8, 2006, Victoria, Canada). [In 2005, DFO contributed \$10,000 for this symposium.]
- The Seoul National University (SNU), KORDI (Korea), and the Pukyong National University (PKNU) provided major funding for the CREAMS/PICES workshop on "*Model/data inter-comparison for the Japan/East Sea*" (August 21–22, 2006, Busan, Korea).
- FRA (Japan) allocated more than 4,500,000 JPY (about \$45,000) for invited speakers and convenors to attend PICES XV.
- The International Council for the Exploration of the Sea (ICES), Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) and Surface Ocean-Lower Atmosphere Study (SOLAS) accepted PICES' invitation to co-sponsor relevant sessions/workshops to be held at PICES XV and provided travel support for additional invited speakers for the Science Board Symposium on "*Boundary current ecosystems*" (ICES), BIO Topic Session on "*Interactions between biogeochemical cycles and marine food webs in the North Pacific*" (IMBER) and IFEP/MODEL Workshop on "*Modeling iron biogeochemistry and ocean ecosystems*" (SOLAS).

Capacity building

- PIFSC (U.S.A.) and the Alaska Fisheries Science Center (AFSC, U.S.A.) contributed \$17,095 (US \$15,000) and \$11,285 (US \$10,000), respectively, to finance the PICES Intern Program.
- The Asia Pacific Network for Global Change Research (APN), Scientific Capacity Building/Enhancement for Sustainable Development in Developing Countries Program (CAPaBLE) and the

Inter-American Institute for Global Change Research (IAI) provided support for scientists from developing countries to participate in the MODEL workshop on “*Global comparison of sardine, anchovy and other small pelagics: Building towards a multi-species model*” (November 14–17, 2005, Tokyo, Japan). Funds for the project were managed by members of the PICES MODEL Task Team, Drs. Michio Kishi and Francisco Werner.

- The Scientific Committee on Oceanic Research (SCOR) allocated \$16,675 (US \$15,000) for scientists from countries with “economies in transition” to attend the 2006 CCCC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” (April 19–21, 2006, Honolulu, U.S.A.) and PICES XV (October 13–22, 2006, Yokohama, Japan).
- The University of Hawaii Pelagic Fisheries Research Program (UH PFRP, U.S.A.) provided travel support for 7 students and post-docs from the Pacific Rim countries to attend the 2006 CCCC Symposium (April 19–21, 2006, Honolulu, U.S.A.).
- SNU (Korea), KORDI (Korea), the Korean Ministry of Maritime Affairs and Fisheries (MOMAF), the National Fisheries Research and Development Institute (NFRDI, Korea), and the Brain Korea 21 Program of the Korean Ministry of Education and Human Resources provided major funding for the first PICES summer school on “*Ocean circulation and ecosystem modeling*” (August 23–25, 2006, Busan, Korea).
- NPRB (U.S.A.) committed \$16,500 (US \$15,000) to support the PICES/ICES Early Career Scientists Conference (June 26–29, 2007, Baltimore, U.S.A.).

PICES Secretariat

- Korea contributed \$19,200 to support a part-time position at the PICES Secretariat.

F&A Endnote 6

Budget for FY 2007

Category	Allotment
Personnel Services	408,000
Annual Meeting	20,000
Special Meetings	88,000
Travel	82,000
Printing	70,000
Communication	40,000
Equipment	8,000
Supplies	7,500
Contractual Services	18,000
Miscellaneous	3,500
Total	745,000
Source	Contribution
Contributions from six Contracting Parties	651,000
Transfer from Working Capital Fund	94,000
Total	745,000
2007 Annual Fee for each Contracting Party	108,500

REPORT OF THE 2006 INTER-SESSIONAL SCIENCE BOARD MEETING



The fourth inter-sessional Science Board meeting, with participation from Governing Council, took place on April 17–18, 2006, at the Ala Moana Hotel, Honolulu, U.S.A. The meeting was hosted by the Government of the United States as represented by NOAA/Fisheries (National Marine Fisheries Service, NMFS). Dr. Kuh Kim, Science Board Chairman, welcomed the participants to the meeting. A list of attendees and the meeting agenda are appended as *SB-IM Endnotes 1* and *2*, respectively.

Mid-term updates (Agenda Item 2)

Biological Oceanography Committee (BIO)

BIO Chairman, Dr. Michael J. Dagg, reported that the Committee is sponsoring or co-sponsoring four theme sessions at PICES XV.

The Advisory Panel on *Micronekton sampling inter-calibration experiment* (MIE-AP) has re-analyzed most of the samples taken during the MIE-1 cruise from October 6–13, 2004, off Hawaii, U.S.A., in order to obtain the length frequency data of major taxonomic groups. Taxonomic verification of major species is continuing. The MIE-2 experiment, employing several micronekton gears on board the R/V *Hokko-Maru*, was conducted from September 23 to October 3, 2005, off Kushiro, Japan. Length frequencies of major species and taxonomic groups and acoustic data were taken and are being analyzed.

The Advisory Panel on *Marine birds and mammals* (MBM-AP) will co-sponsor a workshop (W8) in conjunction with PICES XV on “*Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing*”, with Hokkaido University Center of Excellence. Between 2 and 4 invited speakers will be funded by the University, but speakers have not yet been finalized. The final product resulting from the BIO/MBM-AP Topic Session convened at

PICES XIII will be published as a *Deep-Sea Research II* special volume on “*Top predator hot spots in the North Pacific*” in May, 2006.

The Advisory Panel on *Iron fertilization experiment in the subarctic Pacific Ocean* (IFEP-AP) held a 2-day workshop on the SEEDS-II experiment from October 17–18, 2005, in Tokyo, Japan, co-sponsored by the Ocean Research Institute (University of Tokyo). The goals of the workshop were to synthesize the results from the second *in situ* iron enrichment experiment in the western subarctic North Pacific (SEEDS-II) and to discuss similarities and differences in responses of biological processes and export fluxes between SEEDS-I and SEEDS-II. Thirty-nine scientists from Canada, Japan, New Zealand and the U.S. attended. A report of the workshop was published in *PICES Press* Vol. 14(1) in January 2006. A report on the IFEP 2004 workshop on *in situ* iron enrichment experiments in the western (SEEDS-I) and eastern (SERIES) subarctic North Pacific will be published in July 2006 in the PICES Scientific Report series. Twenty-five papers on the SERIES experiment will be published in a special volume of *Deep-Sea Research II* in late 2006. Dr. Jun Nishioka (Japan) will be a Co-Convenor from IFEP-AP for the IFEP/MODEL workshop (W1) on “*Modeling iron biogeochemistry and ocean ecosystems*” at PICES XV, but confirmation is still needed from MODEL-TT that Dr. Fei Chai (U.S.A.) will serve as another Co-Convenor.

The Section on *Carbon and climate* (CC-S) is getting organized and is coming up with good ideas. CC-S had its first meeting on November 17, 2005, in Shonan Village, Japan. Acting Co-Chairmen, Drs. James Christian (Canada) and Toshiro Saino (Japan) were elected as Chairmen during the meeting. Science Board approved the revision of the Section’s terms of reference at the inter-sessional SB/GC meeting in 2005, and the Section is looking to increase their activities. CC-S noted that they require a biologist to fill a gap in expertise. Since replacing WG 17, CC-S

is still awaiting the write-up of “*Guide to best practices for oceanic CO₂ measurements and data reporting*” by Dr. Andrew Dickson. The Executive Secretary, Dr. Alexander Bychkov, stated that PICES had an important commitment to produce the Guide since the Inter-governmental Oceanographic Commission (IOS) provided funds to PICES for its publication, and it will serve as a useful reference for the Repeat Hydrography Program of CLIVAR. Resources have been exhausted in trying to contact and urge Dr. Dickson to complete the Guide, and the Secretariat requested a U.S. delegate to resolve this issue. The Section has also submitted a proposal for a Topic Session tentatively entitled “Decadal changes in carbon and biogeochemical systems in the North Pacific” to be held at PICES XVI in Victoria, Canada.

Item 2 Action

Governing Council:

2.1 Dr. Boehlert to contact Dr. Dickson regarding the write-up of “*Guide to Best Practices*”.

Fishery Science Committee (FIS)

FIS Chairman, Dr. Gordon H. Kruse, briefly stated that the FIS-sponsored sessions and workshops for PICES XV were in good order. Convenors have been contacted to finalize descriptions, invited speakers, and funding needs. Dr. Richard J. Beamish, Co-Convenor of the FIS workshop (W2) on “*Linking climate trends in productivity of key commercial species in the subarctic Pacific*”, expressed concern about budget cuts in NOAA/Fisheries and requested funding for invited speakers. Dr. Kruse reported that the Northwest Atlantic Fisheries Organization (NAFO) is asking PICES to co-sponsor a symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” in fall 2007 (see Agenda Item 7 for details).

Marine Environmental Quality Committee (MEQ)

MEQ Chairman, Dr. John E. Stein, stated that the Committee is looking for a candidate from the western Pacific to take over the

Chairmanship position. MEQ has an alternative candidate from the eastern Pacific in case a western Pacific candidate cannot be found.

The Section on *Ecology of harmful algal blooms in the North Pacific* (HAB-S) is continuing to be productive. Co-Chairman, Dr. Vera L. Trainer (U.S.A.) is seeking funds from NOAA for the development of a mapping function for HAE-DAT (IOC/ICES/PICES Harmful Algal Event Database), and Dr. Tatiana Yu. Orlova and colleagues (Russia) have applied for funds from the Asia Pacific Network (APN) to improve the ability to forecast blooms. HAB-S is making progress in developing an international database, with the assistance from Dr. Henrik Enevoldsen of IOC.

Progress of WG 18 on *Mariculture in the 21st century – The intersection between ecology, socio-economics and production* is slow for various reasons. Dr. Yukimasa Ishida (Japan) noted that WG 18 was set up to encourage Asian participation. Mr. Fengkiu Liang (alternate delegate, China) agreed that there was a need for Chinese participation, and he will seek nomination of new members. All member countries have submitted their national reports on the status and projected trends in marine aquaculture, and the reports are under editorial review.

Members of WG 19 on *Ecosystem-based management science and its application to the North Pacific* were asked to characterize major “eco-regions” by defining the region’s ecological and management boundaries in order to see where different PICES countries can collaborate in studying and managing ecosystems that span international boundaries. National and international approaches to establishing science-based eco-regions will be compiled and compared to existing or planned “management” regions. All delineated areas will be gathered and digitized for a GIS chart, and a report will be prepared.

New Co-Chairman of WG 21 on *Non-indigenous aquatic species*, Ms. Darlene Smith (Canada), attended the annual meetings of the ICES/IOC/IMO Working Group on *Ballast*

Waters and Other Ship Vectors (WGBOSV) and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (WGITMO) in March 2006, in Oostende, Belgium. Dr. Stein noted that Dr. Stephan Gollasch's term as Chairman of both groups is coming to an end, and MEQ is keen to have Dr. Gollasch's expertise in invasive species and experience from ICES.

Technical Committee on Monitoring (MONITOR)

MONITOR Vice-Chairman Dr. Sei-ichi Saitoh,, reported that progress on NPESR is very slow. Dr. Bychkov expressed concern with the status of NPESR in which there does not appear to be a plan to proceed to the next step/version. The last report was published in late 2004. PICES has some funds from the North Pacific Research Board (NPRB) to publish the next version. Suggestions were made to base the next version on the same format as the pilot report, and just make modifications. Dr. Bychkov said this issue is not just a MONITOR problem, but that all Committees have to be looked at to determine the gaps that need to be filled. Committees need to provide advice to MONITOR; however, Committee Chairmen appear to be waiting for instructions from MONITOR. Science Board Chairman, recommended that Drs. Saitoh and Jeffrey M. Napp should decide what they need from the Committees.

Dr. Harold P. Batchelder noted that the Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* (CPR-AP) had completed their Terms of Reference. Dr. Saitoh said there were problems in obtaining financial support for the CRP program. Dr. Vera Alexander, enquired if the project scope could be expanded, since once ships are equipped, there are opportunities to expand the observations made from the ships of opportunity. Dr. Bychkov suggested that perhaps the Advisory Panel is no longer needed to supervise the CPR program, and that the activities can be overseen by MONITOR directly.

SG-GOOS was established at PICES XIV, and 6 members representing all PICES member

countries were selected, but communication amongst them has not yet occurred. Drs. Saitoh and Napp will meet at the ESSAS/PICES workshop in June 2006 to discuss a means of establishing communications.

Action

MONITOR:

2.2 *Discuss the need to maintain CPR-AP under MONITOR and report to Science Board at PICES XV.*

2.3 *Have ideas for next version of NPESR by PICES XV.*

Physical Oceanography and Climate Committee (POC)

POC Chairman, Dr. Michael G. Foreman, informed the meeting that the POC Action Plan was finalized, and Topic Sessions and workshops were set for PICES XV.

WG 20 on *Evaluations of climate change projections* was progressing well. Members were approved by the national delegates, membership was completed, and Co-Chairmen were in place. WG 20 will have their inaugural workshop at PICES XV.

The Advisory Panel for a *CREAMS/PICES Program in East Asian marginal seas* (CREAMS-AP) is very active in organizing an international workshop on "*Model/data inter-comparison for the Japan/East Sea*" scheduled for August 21–22, 2006, and followed by a summer school on "*Ocean circulation and ecosystem modeling*" from August 23-25, 2006, both to be held in Busan, Korea. They are seeking funding to turn this summer school into an annual event. There is discussion on whether or not to restrict the summer school to just East Asian Seas. The Panel just met on April 11–12, 2006, with 8 members from China, Korea, and Japan present, and much progress has been made. Dr. Ig-Chan Pang, Korean national delegate, informed the meeting that the Korean Ministry of Maritime Affairs and Fisheries (MOMAF) awarded a grant of approximately US \$1.1 million (1 hundred million Korean won) in 2006 for EAST-I (East Asian Seas Time series-I) as a program of CREAMS/PICES.

MOMAF will continue the financial support within the annual budget to accomplish the goal of the EAST-I program.

Technical Committee on Data Exchange (TCODE)

TCODE Chairman, Dr. Igor I. Shevchenko, presented the Committee report. TCODE maintains its own website, and this homepage contains Workplan and progress towards its implementation. TCODE has been involved in establishing dialogue with various bodies of the international, national, state and local organizations, commissions and programs dealing with marine data management of physical, chemical and biological properties. A TCODE member will participate at the meeting of the ICES Working Group on *Marine Data Management* in May of 2006. The WG Co-Chairmen have been invited to attend PICES XVI in Yokohama.

TCODE has collected the meteorological, physical, chemical, biological and fisheries oceanographic time series of PICES member nations. The North Pacific Ecosystem Metadatabase (NPEM) was developed under the PICES umbrella. Now TCODE is involved into a new project aimed to connect PICES member nations' metadatabase systems into one integrated resource. If accomplished, any user of any one metadata inventory will be able to search for data catalogued by any other participating system with a single search request. Separate metadatabases will be able to be cross-searched without compromising national data ownership, data integrity, or security of the national metadata products. PICES provided partial support for Phase I of this project in 2005, in which NPEM and KODC (Korea Oceanographic Data Center) adopted a pilot federation to allow a public internet search of their combined metadata collections in a single session. A report on Phase I findings of the data-sharing project for federated metadata on North Pacific ecosystems has been published in *PICES Press*, Vol. 14(1), 2006, and a PICES Scientific Report will be published in 2006. TCODE requests PICES support on the same level as in 2005 to federate with JODC (Japan

Oceanographic Data Center) and MIRC (Marine Information Research Center, Japan) in Phase II of the data-sharing project.

Discussions were under way between Dr. Thomas C. Wainwright and the PICES Secretariat to transfer the MODEL website contents (MODEL documents, NEMURO source code and documentation) to the PICES website. Dr. Shevchenko volunteered to host the MODEL website on the TINRO website, if the Secretariat was not able to do so.

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

The CCCC Program will convene a PICES/GLOBEC symposium on "*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*" on April 19–21, 2006, in Honolulu, U.S.A. Proceedings of the symposium will be published in a special issue of *Progress in Oceanography* in 2007 or 2008, and the accomplishments of the Program will be provided in a PICES Scientific Report. CCCC-IP Co-Chairmen, Drs. Batchelder and Suam Kim, were requested to have a plan for a wrap-up of the Program by PICES XV.

The Climate Forecasting and Marine Ecosystems Task Team (CFAME) held a 2-day workshop on "*A comparison of regional mechanisms for fish production: Ecosystem perspectives*" on January 12–13, 2006, at the Ocean Research Institute of the University of Tokyo, Japan. A brief report of the workshop was published in *PICES Press*, Vol. 14(1), 2006. They are planning their next workshop (W7) on "*Climate forcing and marine ecosystems*" in conjunction with PICES XV. Co-Convenors of the workshop are Drs. Kerim Aydin (U.S.A.), Jacquelynne R. King (Canada) and Akihiko Yatsu (Japan).

The MODEL Task Team extended its NEMURO model to sardine and anchovy in a workshop on "*Global comparison of sardine, anchovy and other small pelagics: Building towards a multi-species model*" held from November 14–17, 2005, also in Tokyo. A summary of workshop results was published in

PICES Press, Vol. 14(1), 2006. Dr. Michio J. Kishi, former MODEL Co-Chairman and one of the leaders in the development of the NEMURO model, was awarded the prestigious Japanese Society of Fisheries Oceanography Uda Prize for his work on ecological modeling studies.

Action

CCCC-IP:

- 2.4** *Provide a plan for wrapping up the CCCC Program by PICES XV.*

Action Plans (Agenda Item 3)

The Action Plan template was modified by Dr. Stein, with input from Science Board members, at PICES XIV. All members agreed that the outline and structure of the template were very useful in helping them put their plans together. Dr. Dagg inquired if it was better to be specific or generic when discussing tasks. Drs. Bychkov and Stein pointed out that it was up to each Committee. However, if tasks were to be specific, then timelines would be required. Dr. Alexander suggested inserting a timetable as an addendum, in order to add clarity. Action Plans will allow Committees/Program to get their focus in place and will help Council to review and determine if Action Plans are relevant to the Strategic Plan. The Action Plans will be updated yearly, and products will be included in the PICES Annual Report. It was also agreed that a list of priorities in each Action Plan would allow Council to revise the Strategic Plan as needed in order to meet the needs of the Committees/Program.

Action

Committee Chairmen:

- 3.1** *Prioritize the activities within their Action Plans prior to Science Board and Council meetings at PICES XV.*

Status of preparations for PICES XV (Agenda Item 4)

Japanese national delegate, Dr. Tokio Wada, thanked the Executive Secretary for meeting with the Local Organizing Committee in Yokohama in November 2005. He informed Science Board and Council that accommodation

information is posted on the PICES website. Entrance visas will be required for Chinese and Russian participants. Details will be shortly available on the PICES website. Dr. Wada also stated that the Fishery Research Agency (FRA) of Japan will commit about \$30,000 to support travel of invited speakers and convenors to attend the Annual Meeting, and \$40,000 will be coming from PICES. Dr. Bychkov stated that IMBER, SOLAS, and ICES are acting as co-sponsors of specific Topic Sessions and workshop, and that overall, PICES XV is in good shape. Dr. Bychkov will contact convenors of all sessions/workshops to see who will need funding to attend the Annual Meeting.

Action

Secretariat:

- 4.1** *Contact session convenors to see who will require funding to attend PICES XV.*

Status of proposed publications (Agenda Item 5)

Dr. Bychkov reported that a total of 8 PICES Scientific Reports were expected for publication in 2006. The final report of WG 16 on *Climate change, shifts in fish production, and fisheries management* has come back from 2 reviewers (feedback from a third reviewer is pending) who have suggested substantial changes, which may delay publication. As the report stands, only the Gulf of Alaska region has been submitted for the United States. Options were to publish as an unbalanced report or wait until an author could be found to write the U.S. west coast section. Ms. Patricia Livingston suggested that since the terms of reference have changed for the Working Group, perhaps the report could be written on what still needs to be accomplished. Drs. Bychkov and Suam Kim pointed out that this could be done in a foreword. The status of “*Guide to best practices for oceanic CO₂ measurements and data reporting*” is unknown (see Agenda Item 1 for details). The Russian contribution to the WG 18 report based on the national reports on the current status and trends in aquaculture in PICES member countries has just been received this year, but there is no word from WG 18 Co-Chairmen, Drs. Ik-Kyu Chung

and Carolyn Friedman if the report will be ready for 2006.

Deputy Executive Secretary, Dr. Skip McKinnell, presented a progress report on 7 special issues that are slated for publication in primary journals in 2006 and 2007.

Action

Secretariat:

5.1 *Discuss with Drs. Beamish and Yatsu the feasibility of adding a section to the final report of WG 16 on what still needs to be accomplished.*

Future Integrative Scientific Program(s) for PICES (Agenda Items 6 and 11)

Discussion focused on how to reach consensus on a preferred theme with the candidate title “Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Marine Ecosystem” (FUTURE) for the Future Integrative Scientific Program(s) (FISP). Actions taken by the Study Group on FISP (SG-FISP) since PICES XIV were reviewed. Science Board and Council members were encouraged to contribute a short, one-page description, similar to that provided by Drs. Wada and Ishida, of what was considered to be the ultimate goal(s)/theme for the Program, along with a list of associated central scientific issues and key research activities. An *ad hoc* FISP sub-group, consisting of Drs. Stein, Dagg and Foreman, was nominated to distill input and to prepare a 2-page draft summary of FUTURE which will be distributed to SG-FISP, Science Board and Council within one month of this inter-sessional meeting for review and feedback. The final document will be circulated to SG-FISP, Science Board and its Committees and Program, and Council prior to PICES XV. Dr. Stein will present the FISP outline and the next steps in the development of the Program at an Open Forum during PICES XV.

Status of proposed inter-sessional symposia and workshops (Agenda Item 7)

Dr. Bychkov presented the status of symposia and workshops for 2006 and beyond. A

CREAMS/PICES workshop on “*Model/data inter-comparison for the Japan/East Sea*” will be held in Busan, Korea, on August 21–22, 2006, followed by a summer school on “*Circulation and ecosystem modeling*” from August 23–25. The summer school is a new endeavor for PICES. The organizers have resources to support young scientists from all PICES member countries, and Dr. Bychkov requested national delegates to convey this information to their agencies.

An international conference on “*The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries*” is scheduled for November 27–December 1, 2006, in Lima, Peru. Dr. R. Ian Perry has been nominated to the Scientific Steering Committee as a representative of PICES. The venue for an ICES/PICES conference on “*Marine bioinvasions*” has been set in Washington, DC, U.S.A., in the spring of 2007, but the Scientific Steering Committee is yet to be decided. The 4th International Zooplankton Production Symposium, co-sponsored by ICES, PICES and GLOBEC, will take place from May 28–June 1, 2007, in Hiroshima, Japan. The Scientific Steering Committee (SSC) has selected titles for the sessions, but does not yet have descriptions of session themes, and must do so by May 2006. Dr. Bychkov requested Dr. Dagg, who is one of symposium convenors, to urge the SSC members to decide on descriptions. Dr. Kruse informed Council and Science Board that the Northwest Atlantic Fisheries Organization (NAFO) had contacted PICES to inquire if PICES would be willing to co-sponsor a symposium with ICES and NAFO on “*Reproductive and recruitment processes in exploited marine fish stocks*” to be held October 1–3, 2007. Dr. Kruse distributed this proposal to his FIS where it was viewed with interest by the Russian members, but Canadian members felt it would be better for PICES to have its own symposium or Topic Session. Science Board agreed that PICES should be involved.

Action

Governing Council:

7.1 *Inform agencies in their countries that PICES has funds available for young*

scientists to attend the summer school in Busan, Korea, August 23-25, 2006.

Dr. Dag:

7.2 *Urge International Zooplankton Production Symposium Steering Committee members to finalize session theme descriptions by May 2006.*

Secretariat:

7.3 *Draft a letter to the Executive Secretary of NAFO agreeing to co-sponsor the symposium but suggesting options that would be more desirable to PICES.*

Interactions with other organizations and programs (Agenda Items 8 and 15)

Dr. Bernard A. Megrey and others from the U.S. and Norway proposed a scientific theme session entitled “*Comparative marine ecosystem structure and function: Descriptors and characteristics*” to be held at the 2007 ICES Annual Science Conference (ASC) in Helsinki, Finland. It has been accepted by the ICES Consultative Committee and the ICES Bureau. Dr. Ian Perry accepted their offer to be a co-convenor. Drs. Megrey and Perry have invited PICES to co-sponsor this session. This item was deferred until PICES XV.

Dr. Bychkov stated that ICES and GLOBEC were still PICES’ most important strategic partners at this time. PaCOOS (Pacific Coast Ocean Observing System) is anticipating increased funding for its ocean observing system and is considered a potential partner for future relations. Dr. McKinnell currently sits as an *ex officio* member on their Governing Board. Council had discussed building bridges with the APEC (Asia Pacific Economic Cooperation) Working Groups on Fisheries (APEC-FWG) and Marine Resources Conservation (APEC-MRC). The Secretariat is attempting to find contacts to these groups.

Action

Science Board:

8.1 *Discuss the possibility of committing PICES resources and funds to sponsor a theme session at ICES ASC in 2007.*

Secretariat:

8.2 *Seek APEC contacts.*

Status of memberships and chairmanships (Agenda Item 9)

Dr. Stein is in his fifth year as MEQ Chairman. Science Board requested help from Council to find suitable candidates to replace him. TCODE Chairman, Dr. Shevchenko, was into his third year. Dr. Shevchenko will discuss taking over this position with TCODE Vice-Chairman, Dr. Megrey, at PICES XV. CCCC-IP Co-Chairman, Dr. Batchelder, was into his fourth year, and a suitable replacement has not yet been found. The situation has been complicated by the uncertainty of the exact time the CCCC Program will wrap up. In addition, another CCCC-IP Co-Chairman, Dr. Suam Kim, is due to rotate off at PICES XV. Dr. McKinnell suggested that two Co-Chairmen from the CCCC Task Teams be invited to oversee CCCC’s chairmanship. Dr. Napp nominated Dr. Phillip R. Mundy (U.S.A.) to be Chairman of SG-GOOS (under MONITOR). Science Board and Council endorsed the nomination.

Action

Governing Council:

9.1 *Seek nominations for chairmanship of MEQ Committee.*

Specific activities within high priority projects/and issues (Agenda Items 10 and 13)

Dr. Kuh Kim proposed the establishment of a Science Board Chairman-elect position which would facilitate the continuity of Science Board affairs as PICES continues to expand. Science Board unanimously endorsed this suggestion. Pending Council’s decision, the position would take affect at PICES XV. If approved, the Vice-Chairman position would not be needed in the third year of a 3-year term of chairmanship.

The merit of having a FISP workshop in 2007 was discussed. Science Board agreed to plan for a workshop in March 2007 to draft a Science Plan for FUTURE. A FISP sub-group (see Agenda Items 6 and 11) was nominated to prepare a 2-page draft outline of the goal(s)/theme, central scientific issues and key research activities for the Program. The outline will be reviewed by FISP-SG, Science Board and

Council and revised as needed before a final decision will be made at PICES XV.

Capacity building activities were reviewed under Agenda Item 14. The other two high priorities (North Pacific Ecosystem Status Report and GOOS integration) were briefly discussed in Agenda Item 2.

Hokkaido University has digitized some of their hydrographic time series data dating from 1934 to produce Volume 1 of their fisheries and oceanographic data base (HUFO-DAT) on CD-ROM. Work on Volume 2 that includes gill net data collected by T/S *Oshoro-maru* and T/S *Hokusei-maru* in the western and eastern North Pacific and the Bering Sea, is in progress. Dr. Saitoh informed the meeting that 2/3 of the data still needs to be processed and the project is stalled due to a lack of funding. It would take US \$20,000 to digitize 50 year's worth. Ms. Livingston stated that NOAA may be able to contribute funds, as some cruises have sampled in U.S. waters. Dr. McKinnell proposed that PICES contribute \$10,000. Other potential sources of funding may be NPAFC and NPRB. Science Board and Council endorsed contributing to the cost of this endeavor.

Action

FISP sub-group:

13.1 *FISP sub-group to prepare a 2-page draft outlining central scientific issues and key research activities to be distributed to SG-FISP, Science Board and Council within a month of the inter-sessional Science Board/Governing Council meeting, and to have a revision completed by early July for distribution to member countries.*

Secretariat:

13.2 *Contact various agencies for the purpose of matching funds with PICES to support Hokkaido University's data digitizing project (HUFO-DAT).*

Selection of PICES XVI Topic Sessions (Agenda Item 12)

The theme for PICES XVI, scheduled for October 26–November 4, 2007, in Victoria, Canada, is *“The changing North Pacific:*

Previous patterns, future projections and ecosystem impacts”. A tentative title submitted for the BIO/CC-S Topic Session was *“Decadal changes in carbon and biogeochemical systems in the North Pacific”*, convenors and some potential invited speakers were suggested.

Action

Committee Chairmen:

12.1 *Provide names of potential invited speakers.*

Dr. Richards/Mr. Labonté:

12.2 *Provide name of potential keynote speaker.*

Capacity building actions (Agenda Item 14)

PICES/ICES have a contract with the University of Maryland to provide local organizing support for the Young Scientist Conference in Baltimore, U.S.A. The Conference is scheduled in the week of June 24, 2007, but a contract with the venue has not yet been signed.

Discussion of a PICES summer school on marine sciences as a regular event was deferred to a future date. Dr. Kuh Kim suggested that once the outcome of the first CREAMS/PICES summer school (see Agenda Item 7 for details) was known, Science Board would be able to better assess the feasibility of holding a summer school on an annual basis.

PICES spends \$25,000–30,000 annually on travel for young scientists. Dr. Bychkov stated that the best approach to continue support for young scientists is for member countries to match funds with PICES. For example, GLOBEC-Korea and the State Oceanic Administration (SOA) provided funds for young Korean and Chinese scientists, respectively, to attend PICES XIV. Dr. Suam Kim noted that GLOBEC-Korea will continue this funding pattern for another 8 years.

Guidelines for future Working Groups (Agenda Item 16)

Dr. Foreman began a draft set of guidelines for future Working Groups, but asked for guidance from Science Board on the best approach to take regarding certain items. Some related

suggestions for preparing the guidelines included putting WG 20 on the PICES website as a model, providing advice for potential Chairmen, and having Working Groups meet inter-sessionally. Dr. Bychkov said there might be proposals for new Working Groups by PICES XV, so it would be desirable to have a set of guidelines in place by then.

Action

Dr. Foreman:

16.1 *Prepare a draft of guidelines, circulate to Science Board for comments, and try to have a set of guidelines in place by PICES XV.*

PICES communications (Agenda Item 17)

It was stressed that an important component of PICES' profile was its ability to communicate to users. PICES Web Administrator, Ms. Julia Yazvenko's presentation, showing progress since a new PICES website was created in 2004, was favourably received by Council and Science Board members. A comparison of 2005 with

2004 showed a continued improvement in information and user-friendliness, and a substantial increase in website traffic. Dr. Batchelder, Web Committee Chairman, requested that a replacement be found for him, and that members were still needed for POC and MONITOR Committees.

Action

Science Board and Committees:

17.1 *Nominate a Web Committee replacement for Dr. Batchelder.*

17.2 *Nominate Web Committee members from POC and MONITOR..*

2006 Wooster Award (Agenda Item 18)

Documents for the Wooster Award nominee were reviewed and discussed by Science Board *in camera*.

Other business (Agenda Item 19)

There was no other business.

SB-IM Endnote 1

Participation list

Science Board members

Harold P. Batchelder (Co-Chairman, CCCC-IP)
Michael J. Dagg (Chairman, BIO)
Michael G. Foreman (Chairman, POC)
Kuh Kim (Chairman, Science Board)
Suam Kim (Co-Chairman, CCCC-IP)
Gordon H. Kruse (Chairman, FIS)
Sei-Ichi Saitoh (Vice-Chairman, MONITOR)
Igor I. Shevchenko (Chairman, TCODE)
John E. Stein (Vice-Chairman, Science Board;
Chairman, MEQ)

Governing Council members and advisors

Vera Alexander (Chairman, PICES)
Lev N. Barcharov (national delegate, Russia)
George Boehlert (national delegate, U.S.A.)
Yukimasa Ishida (advisor, Japan)
Serge Labonté (national delegate, Canada)

Fengkui Liang (alternate national delegate,
People's Republic of China)
Patricia Livingston (advisor, U.S.A.)
Ig-Chan Pang (national delegate, Republic of
Korea)
Samuel Pooley (national delegate, U.S.A.)
Laura Richards (national delegate, Canada)
Tokio Wada (national delegate, Japan)

Invited Guests

Kelvin Richards (International Pacific Research
Center, Univ. of Hawaii, U.S.A.)
John Burke Burnett (Pacific Science
Association, Honolulu, U.S.A.)

PICES Secretariat

Alexander Bychkov (Executive Secretary)
Skip McKinnell (Deputy Executive Secretary)

SB-IM Endnote 2

Science Board inter-sessional meeting agenda

Monday, April 17, 2006

1. Welcome, participants, logistical details, purpose of meeting
2. Mid-term update on activities of Committees and CCCC Program and their subsidiary bodies
 - 2.1 BIO (Dagg)
 - 2.2 FIS (Kruse)
 - 2.3 MEQ (Stein)
 - 2.4 MONITOR (Saitoh)
 - 2.5 POC (Foreman)
 - 2.6 TCODE (Shevchenko)
 - 2.7 CCCC (Batchelder/Kim)
3. Action Plans for each Committee and Program
4. Status of preparations for PICES XV
5. Status of proposed publications
6. Future Integrative Scientific Program(s) for PICES
7. Status of proposed inter-sessional symposia and workshops

8. Interactions with other organizations and programs
9. Status of memberships/chairmanships for Committees/Program and their subsidiary bodies
10. Specific activities within high priority PICES projects/and issues

Tuesday, April 18, 2006

11. Future Integrative Scientific Program(s) for PICES (Agenda Item 6, continued)
12. Selection of PICES XVI topic sessions
13. Specific activities within high priority PICES projects/and issues (Agenda Item 10, continued)
14. Capacity building actions
15. Interactions with other organizations (Agenda Item 8, continued)
16. Guidelines for future Working Groups
17. PICES communications
18. 2006 Wooster Award
19. Other business

REPORT OF SCIENCE BOARD

The Science Board met from 12:30–14:00 hours on October 15, 2006, to review the agenda and to discuss items relating to the upcoming PICES scientific sessions. An Open Forum on the next integrative science program, FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem) was convened on October 19 (17:00–18:00). Science Board met again on October 21 (9:00–18:00) to talk about the remainder of the agenda. Ms. Rosalie Rutka served as rapporteur for the Science Board and open forum meetings. (See *SB Endnote 1* for list of participants.)

October 15, 2006

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

Drs. Manuel Barange (Executive Director of GLOBEC International Project Office) and Francisco E. Werner (Chairman of GLOBEC Scientific Steering Committee) were invited to this session and met with Science Board to discuss the ongoing links between GLOBEC and PICES, via the Climate Change and Carrying Capacity (CCCC) Program, the context of the CCCC synthesis as part of the GLOBEC synthesis, the development of PICES-GLOBEC links through ESSAS (Ecosystem Studies of the Sub-Arctic Seas Program), and to acknowledge the work PICES and GLOBEC conduct in partnership.

Review of procedures for Best Presentation Awards and Closing Session (Agenda Item 3)

The Chairman, with assistance of Deputy Executive Secretary, Dr. Skip McKinnell, reviewed the criteria for Best Presentation Awards. One Best Presentation and one Best Poster Award will be given by each Committee and Program, regardless of the number of Topic/Contributed Paper Sessions sponsored, to

recipients who are early career scientists. The Science Board Symposium Best Presentation Award is open to all presenters, regardless of stage of career. Each Committee/Program Chairman/Co-Chairman would be responsible for selecting the award recipients. Dr. McKinnell proposed that the Science Board Symposium Best Presentation Award be renamed to the Ware Award, in honour of the memory and scientific excellence of the Science Board's first Chairman, Dr. Daniel Ware, but it was not unanimously supported.

The Closing Session will consist of a brief summary of PICES XV by the Science Board Chairman, followed by presentations of awards from each Committee and Program. Dr. John E. Stein will then review the next steps for the implementation of FUTURE.

Review of procedures for documentation of PICES scientific sessions (Agenda Item 4)

Documentation of scientific sessions and workshops is required by the PICES Secretariat for the Annual Report (*SB Endnote 3*). Science Board members were asked to be responsible for ensuring that the convenors for their sponsored session/workshop complete their reports by the end of PICES XV.

Election of the next Science Board Chairman (Agenda Item 5)

Dr. Stein was unanimously endorsed by Science Board to be Chairman-elect. This position will be for one year until the end of PICES XVI, and will allow for the continuity of Science Board business.

October 19, 2006

Open Forum on *FUTURE*

An Open Forum on the future integrative science program of PICES was led by Dr. Stein, who reviewed the draft outline for FUTURE prepared

following the inter-sessional Science Board/Governing Council meeting held in April 2006. The goal of the Open Forum was to increase the specificity of the key research activities of FUTURE, such as scientific understanding, forecasts, and communication. Dr. Stein invited each Committee/Program Chairman to present comments from their business meetings on themes and directions for FUTURE. Afterwards, audience members provided comments or expressed their views. Dr. Stein thanked everyone for their participation and emphasized that written comments to him or the Secretariat were still welcome.

The next steps in developing the FUTURE Science Plan are to (1) establish a Writing Team to draft the Plan, (2) hold a workshop in April 2007, to refine the draft Plan, (3) review the revised Plan within the PICES community, (4) hold a workshop at the next Annual Meeting to review and revise the Plan, and (5) seek outside peer reviews of the Science Plan.

October 21, 2006

The Chairman opened the second session of Science Board and welcomed the participation of Drs. Glen Jamieson (Chairman-elect of MEQ) and Michio J. Kishi (Co-Chairman-elect of CCCC-IP).

High priority projects (Agenda Item 6)

Timelines and preliminary details for a Science Plan for FUTURE were discussed. Participants for the proposed FISP Writing Team, external reviewers, and potential workshop attendees were considered and nominated by Science Board.

Completion of Science Board recommendations and Governing Council decisions from PICES XIV and the 2006 inter-sessional SB/GC meeting (Agenda Item 7)

Science Board accepted the report on decisions and recommendations from PICES XIV (*SB Endnote 4*) and the 2006 inter-sessional Science Board/Governing Council meeting that were of relevance, with minor changes occurring for

(1) the publication of the special issue of *Ecological Modelling* delayed from 2006 to early 2007.

Status of action items from the 2006 inter-sessional Science Board/Governing Council meeting (Agenda Item 8)

Mid-term updates (*Inter-sessional meeting Agenda Item 2*)

Dr. Jeffrey M. Napp, Chairman of MONITOR, reported that the Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* (CPR-AP) was making progress in its program and strongly recommended the need to maintain it under MONITOR. He indicated that minor changes in CPR-AP's terms of reference may be proposed at the next inter-sessional Science Board meeting in 2007.

Science Board endorsed the establishment of a Section on *North Pacific Ecosystem Status Report* within MONITOR that would deliver three types of products for the next NPESR on a timely basis. Information would be made available annually in web format, synthesis and analysis on a less frequent basis (3 to 5 years), in the form of a hard copy report (and web), and a long-range outlook once every 5 to 10 years. Dr. Napp agreed to investigate costs and methods of producing the data.

Dr. Harold Batchelder, CCCC-IP Co-Chairman, informed Science Board that PICES XVI in Victoria, Canada, would be the last meeting in which the Program would sponsor scientific sessions. A strategy to wrap up the Program had not been put in place, but he and Dr. Kishi, would evaluate the progress of the new PICES integrative science program, before ending the CCCC Program. Future plans include preparing a PICES Scientific Report.

Action Plans (*Inter-sessional meeting Agenda Item 3*)

Science Board members had a short discussion on Action Plans and a suggestion was made to update the plans yearly, but no firm steps were taken to endorse it.

A sub-committee was formed under the auspices of the BIO Committee to revise and update the BIO Action Plan by the 2007 inter-sessional Science Board/ Governing Council meeting.

Interactions with other organizations (*Inter-sessional meeting Agenda Items 8 and 15*)

Invited guest, Dr. Adolf Kellermann, Head of the ICES Science Program, discussed plans for the restructuring of the ICES organization to facilitate better communication and flow of information, which would be presented to ICES Council for endorsement. He invited Science Board members to review and see if they wished to co-sponsor three theme sessions at the 2007 ICES Annual Science Conference in Helsinki, Finland, and a symposium on “*Herring: Linking biology, ecology and status of populations in the context of changing environments*” to be held in Galway, Ireland, in 2008.

Guidelines for future PICES Working Groups (*Inter-sessional meeting Agenda Item 16*)

Science Board thanked Dr. Michael G. Foreman, POC Committee Chairman, for his efforts in preparing a set of guidelines for future PICES Working Groups in place by PICES XV.

PICES communications (*Inter-sessional meeting 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.

Report of elections of new Committee/Group Chairmen (Agenda Item 9)

Science Board recommended the following changes which were presented to Governing Council for approval:

- Dr. Glen Jamieson to replace Dr. John Stein as MEQ Chairman;
- Dr. Hak-Gyoon Kim to be Vice-Chairman of MEQ;
- Dr. Michio Kishi to replace Dr. Suam Kim as Co-Chairman of the CCCC Program;
- Dr. Hao Wei to be the new MODEL Task Team Co-Chairman;
- Dr. Young-Shil Kang to be the new CFAME Task Team Co-Chairman.

Reports from Scientific and Technical Committees, CCCC IP and subsidiary bodies (Agenda Item 10b and 10c)

Science Board discussed reports from its Committees and Program. Specific details can be found in the individual reports of the Committees/Program elsewhere in this Annual Report.

Science Board recommended that:

- WG 18 on *Mariculture in the 21st century – The intersection between ecology, socio-economics and production* be disbanded for inadequate progress in achieving its tasks;
- PICES withdraw as a co-sponsor of the *North Pacific Data Buoy* Advisory Panel.

Science Board recommended establishing:

- A Section on the *North Pacific Ecosystem Status Report* under the direction of the MONITOR Technical Committee (terms of reference can be found in *MONITOR Endnote 3*);
- A Study Group on *Marine aquaculture and ranching in the PICES region*, under the direction of Science Board (terms of reference can be found in *GC Appendix B*).

High priority projects (Agenda Item 11)

Science Board recommended that Dr. Kishi defer proposing a 2008 PICES summer school until the 2007 inter-sessional Science Board/ Governing Council meeting.

Dr. Napp reported that SG-GOOS had almost fulfilled its terms of reference and recommended that PICES should not propose a North Pacific GOOS pilot project and instead, it should play a

strong role in coordination and facilitation of North Pacific regional projects by being active in the GOOS Regional Alliance (GRA) programs.

Items with financial implications (Agenda Item 12)

Inter-sessional meetings (Symposia, workshops, Working Group, Section, and CCCC Program meetings) proposed for 2006 and beyond (Agenda Item 12a)

The following inter-sessional meetings/workshops are to be convened/co-sponsored in 2006 and beyond (a List of Acronyms can be found at the end of the Annual Report):

- An international conference (co-sponsored by IMARPE, IRD, NASA, FAO, GLOBEC, ICES, PICES, IMBER) on “*The Humboldt Current system: Climate, ocean dynamics, ecosystem processes and fisheries*”, November 27–December 1, 2006, Lima, Peru;
- A 2-day meeting of the FISP Science Plan Writing Team, February 16–17, 2007, in Seattle, U.S.A.;
- A 2-day meeting of CREAMS-AP, March 2007, in Qingdao, China;
- A 3-day workshop to develop a Science Plan for future integrative scientific program of PICES and an inter-sessional Science Board meeting, April 16–19, 2007, in Yokohama, Japan;
- A display of PICES publications at the joint meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society, May 2–4, 2007, in La Paz, Mexico
- A 3-day CFAME workshop on “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: a comparative approach*”, May 2007, in Seattle, U.S.A., or June 2007, in Hakodate, Japan;
- A 3-day FIS workshop on “*Forecasting climate impacts on fish production*”, May 2007, in Seattle, U.S.A., or June 2007, in Hakodate, Japan;
- The 5th International Conference on “*Marine bioinvasions*” (co-sponsored by

PICES, ICES and the U.S. National Sea Grant College Program), May 21–24, 2007, in Cambridge, U.S.A. (approved in 2003);

- A 2-day joint meeting of PICES WG 21 on *Non-indigenous aquatic species*, ICES WG on *Introductions and Transfers of Marine Organisms* and ICES/IOC/IMO WG on *Ballast Waters and Other Ship Vectors*, May 25–26, 2007, in Cambridge, U.S.A.;
- The 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (co-sponsored by PICES, ICES and GLOBEC), May 28–June 1, 2007, Hiroshima, Japan (approved in 2003);
- ESSAS/PICES workshops on “*Evaluation of climate scenarios for subarctic regions*” (1 day) and “*The role of seasonal sea ice cover in marine ecosystems*” (2 days), June 4–6, 2007, in Hakodate, Japan;
- Conference for Early Career Scientists on “*New frontiers in marine science*”, (co-sponsored by ICES), June 26–29, 2007, in Baltimore, U.S.A.;
- ICES/PICES Theme Sessions on “*Integrating observations and models to improve predictions of ecosystem response to physical variability*”, on “*Comparative marine ecosystem structure and function: Descriptors and characteristics*” and on “*The ecosystem approach: What’s the impact on marine science, science based advice and management of marine ecosystems*” at the ICES Annual Science Conference, September 17–21, 2007, Helsinki, Finland;
- An International Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” (co-sponsored by NAFO, ICES and PICES), October 1–3, 2007, in Lisbon, Portugal;
- An International Symposium on “*Effects of climate change on the world’s oceans*” (co-sponsored by ICES, PICES, IOC, GLOBEC, SCOR, and WCRP), May 19–23, 2008, in Gijón, Spain.

Travel requests for 2007 (Agenda Item 12b)

PICES XVI

- Invited speakers for Topic Sessions at the

Annual Meeting with the normal allocation of approximately \$5,000 per Committee (including Science Board) and CCCC Program; additional requests are subject to fund availability;

- 1 invited speaker for the BIO (MIE-AP) workshop on “*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*”;
- 1 invited speaker for the FIS workshop on “*Methods for standardizing trawl surveys to ensure constant catchability*”;
- 1 invited speaker for the FIS/MEQ (WG 19) workshop on “*Comparative analysis of frameworks to develop ecosystem-based approach to management and research needed for implementation*”;
- 2 invited speakers for the MEQ (HAB-S) workshop on “*Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophytes*”.

Inter-sessional meetings

- PICES representative to participate in the 3rd Forum of GOOS Regional Alliances (November 14–17, 2006, Cape Town, South Africa);
- PICES representative to attend the GOOS Scientific Steering Committee meeting (March 13–17, 2007, in Seoul, Korea);
- PICES representative to present information on activities of the Organization at the joint meeting of the Mexican Fisheries Society and the Mexican Chapter of the American Fisheries Society (May 2–4, 2007, in La Paz, Mexico);
- 2 invited speakers for the FIS workshop on “*Forecasting climate impacts on fish production*” (May 2007, in Seattle, U.S.A., or June 2007, in Hakodate, Japan);
- 2 invited speakers for the CFAME workshop on “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: a comparative approach*” (May 2007, in Seattle, U.S.A., or June 2007, in Hakodate, Japan);
- 2–3 Asian scientists to attend the 5th International Conference on “*Marine bioinvasions*” and the joint meeting of PICES WG 21, ICES WGITMO and

ICES/IOC/IMO WGBOSV (May 21–26, 2007, in Cambridge, U.S.A.);

- PICES SSC members for the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*” (May 28–June 1, 2007, in Hiroshima, Japan);
- 1 member of WG 20 to attend ESSAS/PICES workshops on “*Evaluation of climate scenarios for subarctic regions*” and “*The role of seasonal sea ice cover in marine ecosystems*” (June 4–6, 2007, in Hakodate, Japan);
- PICES representative to attend the IOC General Assembly (June 2007, in Paris, France);
- PICES representative to attend the SCOR Executive Committee meeting (August 2007, in Bergen, Norway);
- 3 PICES convenors to the joint ICES/PICES Theme Sessions at the ICES Annual Science Conference (September 17–21, 2007, in Helsinki, Finland);
- PICES representative to attend the NPAFC Fifteenth Annual Meeting (September 2007, in Vladivostok, Russia);
- PICES convenor and SSC member to attend the Symposium on “*Reproductive and recruitment processes in exploited marine fish stocks*” (October 1–3, 2007, in Lisbon, Portugal).

Science Board Chairman to attend:

- The workshop to develop a Science Plan for future integrative scientific program of PICES and an inter-sessional Science Board Meeting (April 2007, in Yokohama, Japan);
- PICES Sixteenth Annual Meeting (October 2007, in Victoria, Canada).

Proposed publications (PICES Scientific Report series and primary journals) for 2006 and beyond (Agenda Item 12c)

Special issues of primary journals (2007–2008)

- *Ecological Modelling* (February 2007; Guest Editors: M.J. Kishi, S.-I. Ito, B.A. Megrey and F.E. Werner) – selected papers on NEMURO and NEMURO.FISH models (approved in 2004);

- *Deep-Sea Research II* (2007; Guest Editors: K. Drinkwater, G. Hunt, D. Mackas and S. McKinnell) – selected papers from the ESSAS Symposium on “*Climate variability and sub-arctic marine ecosystems*” (approved in 2005);
- *Progress in Oceanography* (2007; Guest Editors: H. Batchelder and S. Kim) – selected papers from the PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” (approved in 2005);
- *Progress in Oceanography* (2007; Guest Editors: A. Peña, S. Bograd and A. Bychkov) – selected papers from the symposium on “*Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P*” (approved in 2005);
- *Plankton and Benthos Research* (2007-2008; Guest Editors: H. Iizumi and TBD) – selected papers from the PICES XV Topic Session on “*The human dimension of jellyfish blooms*”;
- *Journal of Marine Systems* (2007–2008; Guest Editors: K.-I. Chang, S. McKinnell, C. Mooers and TBD) – selected papers from the 2006 CREAMS/PICES workshop on “*Model-data inter-comparison for the Japan/East Sea*”;
- *ICES Journal of Marine Science* (2008; Guest Editors: J. Carlton, J. Pederson and TBD) – selected papers from the 5th International Conference on “*Marine bioinvasions*”;
- *ICES Journal of Marine Science* (2008; Guest Editors: M. Dagg, R. Harris, L. Valdez and S.-I. Uye) – selected papers from the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*”;
- *Journal of Northwest Atlantic Fishery Science* (2008; Guest Editors: R. Brodeur, M. Dickey-Collas and E. Trippel) – selected papers from the NAFO/PICES/ICES Symposium on “*Reproductive and recruitment processes of exploited marine fish stocks*”.

PICES Scientific Report series (2007–2008)

- Final report of WG 16 on “*Climate change, shifts in fish production, and fisheries management*” (approved in 2002 for publication in 2004; delayed until 2007, pending review by FIS; Editors: R. Beamish and A. Yatsu);
- Guide to best practices for oceanic CO₂ measurements and data reporting (approved in 2002 for publication in 2004; delayed until 2007, pending review by CC-S; Editor: A. Dickson);
- Final report of WG 19 on “*Ecosystem-based management science and its application to the North Pacific*” (Editors: G. Jamieson, P. Livingston and C.-I. Zhang; in 2008).

PICES Technical Report series (2007)

- *Metadata federation of PICES member countries* (Editors: B.A. Megrey, S.A. Macklin, K. Bahl and P.D. Klawitter; withdrawn from the PICES Scientific Report series).

Other publications (2007–2008)

- American Fisheries Society book on “*The ecology of juvenile salmon in the Northeast Pacific Ocean: Regional comparisons*” (approved in 2005 for publication in 2006; delayed until 2007; Guest editors: R.D. Brodeur, C. Grimes, L. Haldorson and S. McKinnell);
- Book of Abstracts for the 4th International Zooplankton Production Symposium on “*Human and climate forcing of zooplankton populations*”;
- Book of Abstracts for the ICES/PICES Conference for Early Career Scientists on “*New frontiers in marine science*”;
- Announcement, poster and Book of Abstracts for PICES XVI;
- Two issues of *PICES Press* (newsletter);
- PICES 2007 Annual Report.

Recommendations for new working groups and other subsidiary bodies (Agenda Item 13)

This was discussed under Agenda Item 10.

Development of PICES XVI draft schedule of scientific sessions and workshops (Agenda Item 14)

Science Board determined that the theme for PICES XVI, to be held October 26 to November 4, 2007, in Victoria, Canada, should be “*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*” (SB Endnote 5). The following sessions and workshops, in order of Committee/Program, were recommended to be convened at PICES XVI:

1-day Science Board Symposium:
The changing North Pacific: Previous patterns, future projections, and ecosystem impacts (SB Endnote 4);

1-day BIO Contributed Paper Session;

½-day BIO workshop:
Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data (MIE-AP Endnote 3);

1-day BIO/POC Topic Session:
Decadal changes in carbon biogeochemistry in the North Pacific (CC-S Endnote 3);

½-day BIO/FIS/POC Topic Session:
Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans) (BIO Endnote 4b);

1-day CCCC Contributed Paper Session;

1-day CCCC/FIS Topic Session:
Towards ecosystem-based management: Recent developments and successes in multi-species modeling (MODEL Endnote 3);

1-day FIS Contributed Paper Session;

1-day FIS Topic Session
Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks (FIS Endnote 3);

1-day FIS workshop:
Methods for standardizing bottom trawl surveys to ensure constant catchability (FIS Endnote 5);

1-day FIS/CCCC Topic Session:
Fisheries interactions and local ecology (FIS Endnote 4);

1-day FIS/MEQ workshop:
Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation (WG 19 Endnote 3);

1-day MEQ Topic Session:
Non-Indigenous Species: Climate Change, Evolutionary Consequences and Ecological Impacts (WG 21 Endnote 3);

½-day MEQ Topic Session
The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region (HAB-S Endnote 4);

1-day MEQ workshop:
Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophytes and ½-day laboratory demonstration on DSP detection (HAB-S Endnote 3);

1-day MEQ/FIS Topic Session:
Coldwater biogenic habitat in the North Pacific (MEQ Endnote 5);

1-day MONITOR Topic Session:
Recent advancements in ocean observing systems: Scientific discoveries and technical aspects (MONITOR Endnote 5);

½-day MONITOR/BIO workshop:
Measuring and monitoring primary productivity in the North Pacific (MONITOR Endnote 4);

1-day POC Contributed Paper Session;

1½-day POC/CCCC workshop:
Climate scenarios for ecosystem modeling (CFAME Endnote 4);

1-day POC/MODEL/MONITOR Topic Session:
Operational forecasts of oceans and ecosystems
 (POC Endnote 5)

½-day TCODE Topic Session:
Data management, data analysis and data delivery systems to support detection and prediction of ecosystem change in the North

Pacific and the Arctic and its impacts (TCODE Endnote 4)

To implement Council's request to have no more than three parallel sessions, adjustments in length for some sessions/workshops were made. A final draft schedule, below, and final session list (GC 06/S1) reflect these decisions.

Draft Schedule (January 30, 2007)

Time		Events						
Fri. Oct. 26	09:00-12:30	FIS/MEQ Workshop (W3)	BIO Workshop (W1)		POC/CCCC Workshop (W6)			SG-MAR Meeting
	14:00-18:00		MBM-AP Meeting			WG 21 Meeting		
Sat. Oct. 27	09:00-12:30	WG 19 Meeting	MEQ Workshop [#] (W4)	MONITOR/BIO Workshop (W5)	POC/CCCC Workshop (W6)		WG 21 Meeting	
	14:00-18:00			CREAMS-AP Meeting	WG 20 Meeting	CFAME Meeting		
Sun. Oct. 28	09:00-12:30	WG 19 Meeting	HAB-S Meeting	FIS Workshop (W2)	CC-S Meeting		MODEL Meeting	
	12:30-14:00	SB Lunch Meeting *						
	14:00-18:00	WG 19 Meeting	HAB-S Meeting	FIS Workshop (W2)	CC-S Meeting		CCCC IP/EC Meeting*	
	18:00-20:00	SG-GOOS Meeting			CPR-AP Meeting			
Mon. Oct. 29	09:00-10:30	Opening Session						
	11:00-18:00	Science Board Symposium (S1)						
Tues. Oct. 30	09:00-12:30	BIO/POC Topic Session (S2)		CCCC/FIS Topic Session (S3)		MEQ Topic Session (S6)		
	MEQ/FIS Topic Session (S7)							
Wed. Oct. 31	09:00-15:30	CCCC Paper Session		POC Paper Session		FIS/CCCC/BIO Topic Session (S5)		F&A Meeting *
	16:00-19:30	BIO Meeting	FIS Meeting	MEQ Meeting	POC Meeting	TCODE Meeting	MONITOR Meeting	
Thurs. Nov. 1	09:00-18:00	FIS Topic Session (S4)		MONITOR Topic Session (S8)		BIO Paper Session		
	18:00-20:30	Poster Session and E-Posters						
Fri. Nov. 2	09:00-12:30	POC/CCCC/MONITOR Topic Session (S9)		FIS Paper Session		BIO/FIS/POC Topic Session (S11)		
	TCODE Topic Session (S10)							
	17:30-18:30	Closing Session						
Sat. Nov. 3		FISP Workshop*						
Sun. Nov. 4	09:00-18:00	Science Board Meeting *			Governing Council Meeting *			
Mon. Nov. 5	09:00-18:00	Governing Council Meeting *						

Selection of PICES XVII theme and description (Agenda Item 15)

Science Board was unable to achieve consensus between “*Beyond observations to achieving understanding and forecasting in a changing North Pacific: Forward to the Future*” and “*Forward to the Future: Understanding and forecasting in a changing North Pacific*” for the preferred theme title for PICES XVII, to be held from October 23 to November 2, 2008, in Dalian, China, with the National Marine Environmental Monitoring Centre of the State Oceanic Administration as the local organizer. Both titles were submitted to Governing Council for review. The description for the theme will be discussed and finalized at the 2007 inter-sessional Science Board/Governing Council meeting.

Relations with other international programs/organizations (Agenda Item 16)

Science Board endorsed partial support for a 2007 ESSAS workshop on the “*Role of sea ice in marine ecosystems*”, co-sponsored by GLOBEC.

No additions were recommended by the Science Board for the existing Standing List of International Organizations and Programs (see the 2005 Annual Report *SB Endnote 7*).

Next inter-sessional Science Board meeting (Agenda Item 17)

The Chairman will contact Science Board members when a schedule has been set for the workshop to develop a Science Plan for FUTURE.

Other business (Agenda Item 17)

Dr. Tokio Wada, Japanese national delegate and Governing Council Vice-Chairman, proposed the establishment of a new PICES award certificate for organizations and groups that have made contributions to PICES activities and the progress of marine science in the North Pacific through long-term monitoring operations, and/or data management of various ocean conditions and marine bio-resources. Drs. Wada and Kim will discuss wording for the certificate, which will be circulated to the Science Board members for approval.

Dr. Suam Kim, CCCC Program Co-Chairman, informed Science Board that he had received comments from some participants during the Annual Meeting that room for e-posters had not been considered. Dr. Batchelder noted that some poster presentations were put up for only part of the day, providing little opportunity to assess them. He suggested establishing a set of guidelines for poster displays for the next Annual Meeting.

Because the majority of award recipients for Best Presentations at the Closing Session were not present, Dr. Dagg suggested that recipients for future Annual Meetings be encouraged to remain for the Closing Session.

Best Presentation and Poster Awards

Dr. Jack A. Barth (U.S.A.) received the Best Presentation Award at the Science Board Symposium for his paper (co-authored with John M. Bane) entitled “*Intra-seasonal wind oscillations and their influence on northern California Current coastal ecosystems*”.

Awards given by Committees and Program can be found elsewhere in the Annual Report.

The Science Board meeting concluded at 1730 hours.

SB Endnote 1

Participation list

Members

Harold P. Batchelder (Co-Chairman, CCCC-IP)
Michael G. Foreman (Chairman, POC)
Yukimasa Ishida (SB, representative of Japan)
Kuh Kim (Chairman, Science Board)
Suam Kim (Co-Chairman, CCCC-IP)
Gordon H. Kruse (Chairman, FIS)
Jeffrey M. Napp (Chairman, MONITOR)
Fangli Qiao (SB, representative of China)
Igor I. Shevchenko (Chairman, TCODE)
John E. Stein (Chairman, MEQ)

Invited Observers

Manuel Barange (Director, GLOBEC)
Glen Jamieson (Chairman-elect, MEQ)
Adolf Kellermann (Head, Science Programme, ICES)
Michio J. Kishi (Co-Chairman-elect, CCCC-IP)
Stewart (Skip) M. McKinnell (Deputy Executive Secretary, PICES)
Francisco E. Werner (SSC Chairman, GLOBEC)

SB Endnote 2

Science Board meeting agenda

October 15, 2006 (12:30–14:00)

1. Welcome and opening remarks
2. Adoption of agenda
3. Review of procedures for Best Presentation Awards and Closing Session
4. Review of procedures for documentation of PICES scientific sessions
5. Election of the next Science Board Chairman

October 16, 2006 (17:00–18:00)

Open forum on *FUTURE*

October 21, 2006 (09:00–17:30)

6. High Priority Projects
7. Completion of Science Board recommendations and Governing council decisions from PICES XIV and the 2006 inter-sessional SB/GC meeting
8. Status of action items from the 2006 inter-sessional Science Board/Governing Council meeting

9. Report of elections of new Committee Chairmen
10. Reports from Scientific and Technical Committees, CCCC IP and subsidiary bodies
11. High Priority Projects (Agenda Item 6, continued)
12. Items with financial implications
13. Recommendations for new working groups and other subsidiary bodies (Agenda Item 10, continued)
14. Development of PICES XVI draft schedule of scientific sessions and workshops
15. Selection of PICES XVII theme and description
16. Relations with other international programs/organizations
17. Next inter-sessional Science Board meeting
18. Other business

SB Endnote 3

Review of procedures to enhance documentation of PICES scientific sessions

(From: PICES Annual Review 2001, SB Endnote 11, p. 52)

For the last few years, PICES has only included information of the proposed Topic Sessions for

the upcoming year in its Annual Report, and has not provided details regarding the actual

scientific sessions after their conclusion, particularly with regard to any key discussions or recommendations that such sessions might have generated. It became clear to those who are preparing reviews of PICES scientific accomplishments over the last decade, that we have not well-documented the science contained in our Annual Meetings, with the exception of papers that were compiled later into PICES Scientific Reports or other publications.

If we are to better track the state of our knowledge and future needs for improvement, it seems we should have a better system for documenting our scientific sessions and the discussions and recommendations that come from those. One possible system would be that employed by ICES in their Annual Report. (See a copy of their latest annual report on the web at <http://www.ices.dk/products/AnnualRep/2001annualreport.pdf>). The section devoted to the Annual Science Meeting puts forth the following information:

- keynote lectures and abstracts
- science meeting agenda (session schedules)
- details of each scientific session

The last item, details of each scientific session, contains an organized description of each session that includes:

- purpose of the session (derived from the initial session description);
- details of the content of the papers presented in summary form;
- summary of the discussions and conclusions of the session with regard to: research gaps that need to be filled; recommendations for future sessions or groups, or work; recommendations for other actions; and
- list of the documents (author and title) presented.

PICES has struggled to enhance the discussions at our Topic Sessions, and if we ask convenors to document the sessions and the discussions, we may see a better organization of Topic Sessions in this regard. We would also have a more organized way to provide scientific recommendations for action to the parent Committee(s) that sponsored the session.

Recommendation: Session convenors be asked to provide a summary of their session that includes the four points listed above, and these summaries be included in the PICES Annual Report. This practice would begin with the PICES Eleventh Annual Meeting in 2002. Also, session convenors should be requested to include a fixed amount of discussion time at the end of their sessions (15 minutes) in order to provide for proper discussion of the papers and issues raised by the papers.

SB Endnote 4

Status of Science Board recommendations and Governing Council decisions from PICES XIV and the 2006 Inter-sessional SB/GC meeting

05/S/2: Inter-sessional meetings/workshops

The following inter-sessional meetings and workshops were convened or co-sponsored after PICES XIV:

- an FRA/APN/IAI/PICES/GLOBEC Workshop on “*Global comparison of sardine, anchovy and other small pelagics: Building towards a multi-species model*”, November 14–17, 2005, Tokyo, Japan (approved in 2004);
- an International Repeat Hydrography Workshop (co-sponsored by JAMSTEC,

CLIVAR and IOCCP) and a meeting of the PICES Carbon and Climate Section, November 14–16, 2005, Shonan Village, Japan;

- a SEEDS-II Experiment Workshop (co-sponsored by the Ocean Research Institute (University of Tokyo) and PICES) to synthesize results from the second *in situ* iron enrichment experiments in the western subarctic North Pacific (SEEDS II), and to discuss differences in magnitude, biology and export between SEEDS I and SEEDS II, October 17–18, 2005, Tokyo, Japan;

- a symposium, co-sponsored with NPAFC, on “*The status of Pacific salmon and their role in North Pacific marine ecosystems*”, October 30–November 1, 2005 (in conjunction with the NPAFC Annual Meeting), Jeju, Korea;
- a CCCC/CFAME Workshop on “*A comparison of regional mechanisms for fish production: Ecosystem perspectives*”, January 12–13, 2006, Tokyo, Japan;
- a panel discussion at the “*Marine Science in Alaska*” Symposium, January 25, 2006, Anchorage, U.S.A., and a session during the North Pacific Fisheries Management Council meeting, week of February 6, Seattle, U.S.A., to involve the Bering Sea and international communities in the development of a set of operational objectives;
- an inter-sessional Science Board/Governing Council meeting, April 17–18, 2006, Honolulu, U.S.A.;
- a PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*”, April 19–21, 2006, Honolulu, U.S.A. (approved in 2003);
- a PICES/NPRB Workshop on “*Integration of ecological indicators for the North Pacific with emphasis on the Bering Sea*”, June 1–3, 2006, Seattle, U.S.A.;
- an ESSAS/PICES Workshop to develop comparative studies of the sub-Arctic seas, June 12–14, 2006, St. Petersburg, Russia;
- a Symposium entitled “*Time series of the Northeast Pacific Ocean: A symposium to mark the 50th anniversary of P-line*” (co-sponsored with DFO), July 5–8, 2006, Victoria, Canada (approved in 2004);
- a CREAMS/PICES Workshop on “*Model-data inter-comparison for the Japan/East Sea*”, August 21–22, 2006, and a PICES summer school on “*Circulation and ecosystem modeling*”, August 23–25, 2006, Busan, Korea;
- ICES/PICES theme sessions on “*Large-scale changes in the migration of small pelagic fish and the factors modulating such changes*” and on “*Operational Oceanography*” at the ICES Annual Science

Conference, September 2006, Maastricht, Netherlands.

The following were held in conjunction with PICES XV in Yokohama, Japan:

- A 1-day IFEP/MODEL workshop (co-sponsored by SOLAS) on “*Modeling iron biogeochemistry and ocean ecosystems*”, October 12, 2006;
- A 2-day FIS workshop on “*Linking climate to trends in productivity of key commercial species in the subarctic Pacific*”, October 13–14, 2006;
- A 1-day FIS/MEQ workshop on “*Criteria relevant for the determination of unit eco-regions for EBM in the PICES area*”, October 15, 2006;
- A 1-day MEQ workshop on “*Review of selected harmful algae in the PICES region: II. Dinophysis & Cochlodinium*”, October 14, 2006;
- A 1-day POC workshop on “*Evaluation of climate change projections*”, October 14, 2006;
- A 1-day MONITOR/TCODE workshop on “*Data management, delivery and visualization of products from Ocean Observing Systems in major boundary currents*” October 15, 2006;
- A 1-day CFAME workshop on “*Climate forcing and marine ecosystems*” October 13, 2006;
- A 1-day BIO/POC workshop on “*Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing*” October 12, 2006.

05/S/3: Travel Support

Full or partial travel support was provided to:

PICES XV

- 1 invited expert from Europe (Patrick Gentien) to the MEQ (HAB-S) Workshop on “*Review of selected harmful algae in the PICES region: II. Dinophysis and Cochlodinium spp.*”;
- 1 invited speaker (Elizabeth Fulton) to the MEQ/FIS (WG 19) Workshop on “*Criteria*

relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area”;

- 2 invited speakers (Curtis Covey, Keith Rogers) to the POC (WG 20) Workshop on “*Evaluation of climate change projections*”.

Inter-sessional meetings

- PICES representative to attend the 2005 CalCOFI Conference and the PaCOOS Board meeting (December 2005, La Jolla, U.S.A.);
- PICES observer to participate in the NEAR-GOOS meeting (January 2006, Pusan, Korea; may or may not require travel support);
- 1 scientist to attend the CCCC/CFAME Workshop on “*A comparison of regional mechanisms for fish production: Ecosystem perspectives*” (January 2006, Tokyo, Japan);
- TCODE representative to attend the meeting of the ICES Working Group on *Marine Data Management* (dates and venue TBD);
- PICES representative to attend the meetings of the ICES/IOC/IMO Working Group on *Ballast Waters and Other Ship Vectors* and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (March 2006, Oostende, Belgium);
- Dr. Kenneth A. Rose (U.S.A.) to present MODEL contribution to the April 2006 CCCC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*”;
- 1 scientist to participate in the ESSAS/PICES Workshop to develop comparative studies of the sub-Arctic seas (June 2006, St. Petersburg, Russia);
- PICES representative to attend the IOC Executive Committee meeting (June 2005, Paris, France);
- 1 invited speaker to the CREAMS/PICES Workshop on “*Model-data inter-comparison for the Japan/East Sea*” and 1 lecturer to the summer school on “*Circulation and ecosystem modelling*” (August 2006, Busan, Korea);
- 1 PICES convenor to the joint ICES/PICES theme sessions at the ICES Annual Science Conference (September 2006, Maastricht, Netherlands);

- PICES representative to attend the NPAFC Fourteenth Annual Meeting (October 2006, Vancouver, Canada).

05/S/4: Publications

Publications produced after the PICES XIV include:

Special issues of primary journals in 2006

- *Progress in Oceanography*, Vol. 68(2-4), 2006 (Guest Editors: G. Hunt and S. McKinnell) – selected papers from the PICES XIII Topic Session on “*Mechanisms that regulate North Pacific ecosystems: Bottom up, top down, or something else?*” (approved in 2004);
- *Deep-Sea Research II*, Vol. 53(3-4), 2006 (Guest Editors: W. Sydeman, R. Brodeur, A. Bychkov, C. Grimes and S. McKinnell) – selected papers from the PICES XIII Topic Session on “*Hot spots and their use by migratory species and top predators in the North Pacific*” (approved in 2004);
- *Ecological Modelling* (2007; Guest editors: M. Kishi, B. Megrey, S.-I. Ito and F. Werner) – selected papers on NEMURO and NEMURO.FISH models (approved in 2004);
- *Deep-Sea Research II* (2006; Guest Editors: P. Boyd and P. Harrison) – selected papers from the IFEP SERIES experiment.

PICES Scientific Report Series

- Report of the 2004 Workshop on “*In situ iron enrichment experiments in the eastern and western subarctic Pacific*” (Report No. 31), S. Takeda and C.S. Wong (Eds.), 207 pp.
- Report of the 2005 Workshop on “*Oceanic ecodynamics comparison in the subarctic Pacific*” (Report No. 32), C.B. Miller and T. Ikeda (Eds.), 105 pp.

Other publications

- PICES Handbook and Handbook for Chairmen and Convenors.

PICES Press - Newsletter

- Two regular issues: Vol. 14, No. 1 (January 2006) and Vol. 14, No. 2 (July 2006).

05/S/5: Future of current groups

- WG 16 on *Climate change, shifts in fish production and fisheries management* (under the direction of FIS) should be disbanded;
- WG 17 on *Biogeochemical data integration and synthesis* (under the direction of POC) was disbanded and replaced by the Section on *Carbon and climate* (under the direction of BIO and POC); The completion of “Guide to best practices for oceanic CO₂ measurements and data reporting” is in progress;
- Responsibility for the Advisory Panel on *Continuous Plankton Recorder (CPR) survey in the North Pacific* moved from the CCCC Program to the MONITOR Technical Committee;
- Responsibility for the Advisory Panel on *Iron fertilization experiment in the subarctic Pacific Ocean* moved from the CCCC Program to BIO.

05/S/6: New PICES groups

- A Study Group on *Future integrative scientific program(s)* was established under the direction of Governing Council, (approved at the 2005 inter-sessional Governing Council meeting);
- A Section on *Carbon and climate* was formed under the direction of POC and BIO, (approved at the 2005 inter-sessional Governing Council meeting);
- A Working Group on *Evaluations of climate change projections* was established under the direction of POC;
- A Working Group on *Non-indigenous aquatic species* was formed under the direction of MEQ;
- A Study Group to develop a strategy for GOOS was established under the direction of MONITOR.

SB Endnote 5**Theme for PICES XVI (Victoria, Canada)*****“The changing North Pacific: Previous patterns, future projections, and ecosystem impacts”***

The PICES Special Publication, “Marine Ecosystems of the North Pacific”, concluded that “during the past five years profound changes have occurred in the North Pacific climate system, in the composition, abundance and distribution of its living marine resources, and in the human societies that depend on the North Pacific Ocean and its resources”. The Science Board Symposium at PICES XVI will build on studies of climate variability and other anthropogenic impacts in the North Pacific and its marginal seas, the latest North Pacific climate projections (whose results have been summarized in the Fourth Assessment Report of the Inter-governmental Panel for Climate Change), future scenarios for direct human forcing by population growth and fishing, and the combined impacts that these changes have

already had, and can be expected to have, on North Pacific ecosystems. This theme will address issues such as: 1) trends versus variability; 2) synergisms between climate and direct human forcing; 3) ecosystem indicators and their applicability in the future; 4) impacts arising from regional changes (*e.g.*, less ice-cover in the Bering Sea and Sea of Okhotsk, aquatic bioinvasions); 5) the effects of terrestrial climate change (*e.g.*, river discharge); 6) how projected global change and anthropogenic impacts may alter sustainability of the North Pacific; and 7) what should be the key messages for policy makers regarding sustainability of the North Pacific. Talks describing links with climate change in the Arctic and the International Polar Year Projects are also welcome.

REPORT OF BIOLOGICAL OCEANOGRAPHY COMMITTEE



The Biological Oceanography Committee (hereafter BIO) met from 16:00–18:30 hours on October 18, 2006. The Chairman, Dr. Michael J. Dagg, called the meeting to order and welcomed the participants (*BIO Endnote 1*). Dr. Sinjae Yoo served as rapporteur. The proposed agenda was reviewed and approved without additions (*BIO Endnote 2*).

Progress reports of existing subsidiary bodies (Agenda Item 3)

The full progress reports of all subsidiary bodies are included elsewhere in this Annual Report. Brief summaries are as follows:

Advisory Panel on Micronekton sampling inter-calibration experiment (MIE-AP)

A presentation was given by Dr. Evgeny A. Pakhomov, Co-Chairman of MIE-AP. He reviewed the results and data processing from the two inter-calibration cruises (MIE-1 and MIE-2) organized by the Panel in 2004 and 2005, and plans for the MIE-3 experiment. The report on the PICES XV MIE-AP workshop (W9) can be found in the *Session Summaries* chapter of this Annual Report. MIE-AP proposed a workshop on “*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*”, to be held next year at PICES XVI (*MIE-AP Endnote 3*). Convenors will be Drs. Pakhomov and Orio Yamamura. The Committee supported this proposal, but it was undecided if the workshop will be a ½- or ¾-day event.

Advisory Panel on Marine birds and mammals (MBM-AP)

A presentation was given by Dr. Hidehiro Kato, Co-Chairman of MBM-AP. He focused on the results of the PICES XV MBM-AP workshop (W8) on “*Responses of marine mammals and seabirds to large-scale and long-term climate*

change: Mechanisms of environmental forcing” (co-sponsored by BIO, POC and Center of Excellence of Hokkaido University). The brief report of this workshop can be found in the *Session Summaries* chapter of this Annual Report. Another main activity of the group is a joint CPR-AP/MBM-AP monitoring project using ships of opportunity.

MBM-AP proposed a ½-day Topic Session at PICES XVI (to be co-sponsored by BIO, FIS and POC) on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*” (*BIO Endnote 3b*). This was discussed in more detail under Agenda Item 5.

MBM-AP has continuing concern about lack of membership from all PICES member countries and requested PICES to communicate this concern to Canada, China and Korea.

The Committee was informed that MBM-AP was proposing to modify its Terms of Reference slightly, but these changes were provided after PICES XV (*MBM-AP Endnote 2*), and will be reviewed by BIO later.

The Committee recommended that PICES nominate Dr. Kato to serve as PICES’ representative to the International Whaling Commission.

Advisory Panel on Iron fertilization experiment in the subarctic Pacific Ocean (IFEP-AP)

A presentation was given by Dr. Shigenobu Takeda, Co-Chairman of IFEP-AP. He put the main emphasis on the recent and future publications from iron-enrichment experiments in the subarctic North Pacific initiated by the Panel, and on the results of the IFEP/MODEL workshop (W1) on “*Modeling iron biogeochemistry and ocean ecosystems*” and the BIO

Topic Session (S4) on “*Synthesis of in situ iron enrichment experiments in the eastern and western subarctic Pacific*” held at PICES XV (for details see the *Session Summaries* chapter of this Annual Report).

BIO supported the publication of a synthesis manuscript in *Eos* based on the three completed iron enrichment experiments in the subarctic North Pacific.

BIO also supported the proposal by IFEP-AP to close activity of the Panel at PICES XVI in October 2007, and to propose a new working group consisting of experimentalists and modelers to examine the causes for the different responses in the completed iron enrichment experiments in the subarctic North Pacific and to develop new hypotheses on the mechanisms controlling phytoplankton production in this region. Terms of Reference for a new working group under BIO have to be presented at the inter-sessional Science Board meeting in April 2007.

Section on Carbon and Climate (CC-S)

A brief summary of the CC-S activities is available in the POC report. Details can be found in the CC-S chapter of the Annual Report.

Summaries of scientific sessions/workshops at PICES XV (Agenda Item 4)

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

- IFEP/MODEL workshop (W1): *Modeling iron biogeochemistry and ocean ecosystems*;
- BIO/POC workshop (W8): *Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing*;
- MIE-AP workshop (W9): *Micronekton sampling gear inter-calibration experiment*;
- BIO/FIS Topic Session (S2): *The human dimension of jellyfish blooms*;

- BIO Topic Session (S3): *Interactions between biogeochemical cycles and marine food webs in the North Pacific*;
- BIO Topic Session (S4): *Synthesis of in situ iron enrichment experiments in the eastern and western subarctic Pacific*;
- BIO Topic Session (S5): *Advances in epi- and meso-pelagic ecosystem research*;
- BIO Poster session.

Projects, symposia and workshops (Agenda Item 5)

(a) Completed meetings

Summaries of three completed meetings originally recommended by BIO were presented:

OECOS East and West

Dr. Charles B. Miller summarized the status of the Oceanic Ecodynamics Comparison in the Subarctic Pacific (OECOS) project that was originally discussed as a comparison of various aspects of lower trophic level processes in the eastern and western gyres of the subarctic Pacific Ocean. Proceedings of the PICES-sponsored OECOS workshop, held in May 2005, in Corvallis (U.S.A.), were published in 2006 as PICES Scientific Report No. 32.

OECOS-East: The first proposal, involving U.S. and Canadian researchers, was declined by the U.S. National Science Foundation (NSF). It is now planned to propose to NSF a short-term, project development grant. If successful, the results will facilitate a new proposal to undertake shipboard investigations in 2009.

OECOS-West: The Japanese component has been funded, and two cruises are scheduled for 2007: March 6–16 on the R/V *Oshoru Maru*, and mid-April to mid-May on the R/V *Hakuho Maru*.

The Committee strongly supports OECOS, a collaborative program among PICES member countries, and encourages Dr. Miller to continue in his pursuit of funds for OECOS-East.

2006 Line-P Symposium

Dr. Angelica Peña noted that the symposium titled “*Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P*” was held in July 2006, in Victoria (Canada). A summary of the meeting is available in the most recent issue of *PICES Press* (Vol. 14, No. 2). All presentations are viewable at <http://www.pices.int/publications/presentations/default.aspx>. Selected papers from the symposium will be published as a special issue of *Progress in Oceanography* in late 2007 or early 2008. Drs. Peña, Steven Bograd and Alexander Bychkov are the Guest Editors for this volume.

2006 ESSAS workshop

Dr. George L. Hunt reported on the PICES-hosted ESSAS (Ecosystem Studies of the Sub-Arctic Seas) workshop to develop comparative studies of the sub-Arctic seas, held in June 2006, in St. Petersburg (Russia). A summary of the meeting is available in the most recent issue of *PICES Press* (Vol. 14, No. 2).

(b) Upcoming events

PICES XVI

The next PICES Annual Meeting (PICES XVI) will be held October 26–November 4, 2007, in Victoria (Canada). The theme for this meeting is “*The changing North Pacific: Previous patterns, future projections and ecosystem impacts*”. The Committee recommends that the following scientific sessions be convened at PICES XVI:

- A 1-day BIO Contributed Paper Session with papers focused on biological aspects of the meeting theme, and with specific encouragement for young scientists to give oral presentations (*BIO Endnote 3a*);
- A joint BIO/FIS/POC Topic Session on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*” (*BIO Endnote 3b*); it remained

unclear whether the requested time would be ½-, ¾-or a full day;

- A 1-day joint BIO/POC Topic Session on “*Decadal changes in carbon biogeochemistry in the North Pacific*” (*CC-S Endnote 3*);
- A 1-day joint FIS/CCCC/BIO Topic Session on “*Fisheries interactions and local ecology*” (*FIS Endnote 4*).

Committee members were requested to consider potential invited speakers for the Science Board Symposium, and to send their nominations to the BIO Chairman by e-mail.

PICES XVII

BIO discussed the 2008 PICES Annual Meeting to be held in Dalian, China. Discussion was limited by the absence of all BIO Committee members from China. BIO endorsed the meeting theme, “*Beyond observation of the North Pacific environment: Rebuild, nowcast and forecast*” proposed by China, but suggested adjusting the wording of the title to make the meaning clearer. It was also noted that the text of the description is too narrow, focused mainly on modeling, and it should be modified to be more consistent with the title. BIO endorsed the theme.

4th International Zooplankton Production Symposium

This symposium will be held May 28–June 1, 2007, in Hiroshima (Japan). Dr. Michio J. Kishi is a member of the Local Organizing Committee, and Drs. Daggy and David L. Mackas represent PICES on the Scientific Steering Committee.

Year of the Euphausiid

Dr. William T. Peterson summarized activities and plans for development of the *Year of the Euphausiid*. A document titled “*Protocols for measuring molting rate and egg production of live euphausiids*” has been prepared with the objective of providing uniformity of methods throughout PICES countries, and is posted on the PICES website. Activities in the coming

year will include a workshop on “*Krill biology and ecology*”, to be convened by Drs. So Kawaguchi and Peterson as part of the 4th Zooplankton Production Symposium. Dr. Peterson indicated that he may request PICES to form a Euphausiid Working Group at the next Annual Meeting.

(c) New proposals

4th PICES workshop on “*The Okhotsk Sea and adjacent areas*”

Dr. Kishi proposed that a 4th PICES workshop on “*Okhotsk Sea and adjacent areas*” be convened in the summer of 2007 (*BIO Endnote 4*). The previous workshops were held in 1995 (Vladivostok, Russia), 1999 (Nemuro, Japan) and 2003 (Vladivostok). BIO supported the proposal, but suggested postponing the workshop for one year (probably until August 2008), so further discussion and a financial request will occur at PICES XVI.

SOLOPCs float array

Dr. David Checkley (U.S.A.) was unable to attend the BIO meeting to present information about SOLOPCs. They are novel, profiling floats that combine a SOLO (~Argo) Lagrangian profiling float with a Laser-Optical Plankton Counter and fluorometer. Several parameters (T, S, P, Chl *a* fluorescence, particles, and zooplankton) are assessed autonomously, and data are sent ashore *via* Iridium. The array of SOLOPCs will be embedded within the much larger array of Argo floats and will provide useful information on constituents of the biological pump in the North Pacific. For wide coverage across the North Pacific, deployment of instruments will need the help of PICES members. The opportunity exists to collaborate in gathering comparative data from research vessels in the vicinity of SOLOPCs and interpreting the resultant data. Members were encouraged to talk with Dr. Checkley after his presentation at Topic Session S3.

2007-2009 ESSAS workshops

Dr. Hunt described a request from ESSAS for PICES to co-sponsor ESSAS workshops to be held in the next three years in: Hakodate, Japan (2007), Gijón, Spain (2008), and probably Seattle, U.S.A. (2009). BIO was generally supportive but had reservations about the funding.

Financial requests (Agenda Item 6)

Financial requests associated with proposed BIO activities for the next year include:

- travel support for 1 invited speaker for the BIO Contributed Paper Session and 1 invited speaker for each of three BIO-sponsored Topic Sessions at PICES XVI;
- travel support for 1 invited speakers for the MIE-AP workshop at PICES XVI;
- funds to publish the proceedings of the 2006 BIO/FIS Topic Session on “*The human dimensions of jellyfish blooms*” as a special issue of *Plankton and Benthos Research*.

BIO supported the requests from ESSAS for PICES to co-sponsor the ESSAS workshops in 2007–2009. Nevertheless, the Committee was concerned about committing PICES to all three workshops at once and suggested that each request should be evaluated separately.

BIO confirmed its support for PICES to co-sponsor a scientific session titled “*Comparative marine ecosystem structure and function: Descriptors and characteristics*” at the 2007 ICES Annual Science Conference in Helsinki, Finland. The Committee was later reminded that participation in this session had been approved previously at the April 2006 inter-session Science Board meeting.

BIO was informed by Dr. Atsushi Yamaguchi that Japan will host a workshop in May 2008, to discuss findings from the 2007 OECOS-West cruises, and that at next year’s PICES Annual Meeting, the organizers will request travel funds for several OECOS-East colleagues to attend this workshop.

BIO Action Plan (Agenda Item 7)

A sub-Committee consisting of Drs. Dagg, Kishi, Yoo and Vladimir Radchenko was formed to revise and update the BIO Action Plan. Revisions will be completed and circulated to all committee members for comments, then returned to the sub-Committee for finalization prior to the April 2007 inter-sessional Science Board meeting.

North Pacific Ecosystem Status Report (Agenda Item 8)

It was agreed that BIO should provide MONITOR with some ideas about what should be included in the next North Pacific Ecosystem Status Report, which is expected to be finalized in 2009. A sub-Committee consisting of Drs. Peña, Alexei Orlov and Patricia Wheeler was formed to address this issue, and to make recommendations to BIO at PICES XVI. Dr. Hunt indicated that this issue was also discussed at the June 2006 ESSAS workshop in St. Petersburg and agreed to forward their recommendations to the sub-Committee.

Future PICES integrative scientific program (Agenda Item 9)

There was discussion about the draft outline of FUTURE, the proposed new integrative science program for PICES. BIO supported the general goals of the program and made some specific suggestions, including:

- Outreach to society, managers and governments is not a one-way avenue, and mechanisms for two-way dialog need to be pursued.
- Each PICES member country has unique procedures for communication of important science findings to society, managers and government, so there can be no single PICES approach for all countries. It was agreed, however, that the broad goal of

better communication should be a part of the new Science Plan.

- The idea of conveying the degree of uncertainty (certainty) in communications was strongly endorsed.
- Smaller, point-by-point, comments on the draft outline will be sent to Science Board.

BIO web page (Agenda Item 10)

Each member of the Committee was asked to provide the BIO Chairman with a 1–2 sentence description of his/her area of scientific expertise for addition to the BIO web page. No additional recommendations were made.

Other business (Agenda Item 11)

This year, the Committee was responsible for selecting winners for BIO Best Presentation and Best Poster Awards from BIO-sponsored Topic Sessions S3, S4 and S5 (FIS handled the joint BIO/FIS Topic Session S2). Only young scientists were eligible for the Best Presentation Award.

The panel consisting of Drs. Dagg, Peña and Wheeler selected the paper by Andrew L. King (co-authored by Kathy Barbeau) entitled “*Macro- and micronutrient limitation of phytoplankton standing stock in the southern California Current System*” and given at the S3 BIO Topic Session as the best BIO presentation.

The panel consisting of Drs. Richard Brodeur, Dagg, Peña and Wheeler selected the paper by Satoshi Kitajima (co-authored by Fuminori Hashihama, Shigenobu Takeda and Ken Furuya) entitled “*Nitrogen fixation in the subtropical and tropical western North Pacific*” and presented at the S3 BIO Topic Session as the best BIO poster.

At next year’s Annual Meeting in Victoria, awards for the best oral presenter and best poster will be determined by Drs. Peña and Wheeler. Additional committee members may be added.

BIO Endnote 1

Participation list

Members

Richard D. Brodeur (U.S.A.)
Michael J. Dagg (U.S.A., Chairman)
Michio J. Kishi (Japan)
David L. Mackas (Canada)
Hideki Nakano (Japan)
Alexei Orlov (Russia)

Angelica Peña (Canada)
Vladimir Radchenko (Russia)
Patricia A. Wheeler (U.S.A.)
Atsushi Yamaguchi (Japan)
Sinjae Yoo (Korea)

(Observers' names were not taken.)

BIO Endnote 2

BIO meeting agenda

1. Welcome and introductions, appointment of rapporteur
 2. Approval of agenda
 3. Progress reports of existing subsidiary bodies:
 - MIE-AP
 - MBM-AP
 - IFEP-AP
 - CC-S
 4. Summaries of scientific sessions/workshops at PICES XV
 5. Projects, symposia and workshops:
 - (a) Completed
 - OECOS East and West
 - 2006 Line-P Symposium
 - 2006 ESSAS workshop
 - (b) Upcoming events
 - PICES XVI in Victoria (Canada)
 6. Financial requests
 7. BIO Action Plan
 8. North Pacific Ecosystem Status Report
 9. Future PICES integrative science program
 10. BIO web page
 11. Other business
 12. Adjournment
- PICES XVII in Dalian (China)
 - 4th International Zooplankton Production Symposium
 - Year of the Euphausiid
 - (c) New proposals
 - 4th PICES workshop on “*The Okhotsk Sea and adjacent areas*”
 - SOLOPCs float array
 - 2007-2009 ESSAS workshops
 - Line-P letter of support

BIO Endnote 3

BIO-sponsored Topic Sessions proposed for PICES XVI

a) 1-day BIO Contributed Paper Session

The theme of PICES XVI is “*The changing North Pacific: Previous patterns, future projections, and ecosystem impacts*”. In this session, we welcome papers on biological aspects of the PICES XVI theme as well as papers on other aspects of biological oceanography in the North Pacific and its

marginal seas (except S2 and S11 topics). Young scientists are especially encouraged to submit papers to this session.

Recommended convenors: Michael J. Dagg (U.S.A.), Michio J. Kishi (Japan) and Angelica Peña (Canada).

b) ½- or 1-day BIO/POC/FIS Topic Session on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*”

Ecosystems of the North Pacific Ocean are characterized by strong seasonal variability in productivity. The Inter-governmental Panel for Climate Change projections indicate that substantial changes in phenology (timing events) and the biological interactions that depend on the seasonal cycle are likely. Several mechanistic hypotheses have been set forth to explain changes in fish production in relation to phenology, including “match-mismatch” and “optimal environmental window”, yet there have been few tests of these ideas. In light of climate change predictions and recent changes in phenology in some North Pacific ecosystems (e.g., late upwelling in the California Current in 2005/2006), the session will focus on the implications of changes in the timing of seasonal zooplankton production to upper trophic level organisms through changes in their trophic

ecology, physiology and behavior. Physical environmental changes that influence phenology also are within the scope of this session. Papers which test hypotheses, present new theoretical treatments, and/or provide models of life history variation are encouraged. In particular, integrated, multi-trophic level, multi-disciplinary analyses are sought. We anticipate publication of the papers from this topic session in primary literature.

Recommended convenors: Elizabeth A. Logerwell (FIS, U.S.A.), David L. Mackas (BIO, Canada), Shoshiro Minobe (POC, Japan) and William J. Sydeman (MBM-AP, U.S.A.).

Potential invited speakers: Gregory Beaugrand (UK) and Nils Stenseth (Norway).

c) 1-day BIO/POC Topic Session on “*Decadal changes in carbon biogeochemistry in the North Pacific*” (CC-S Endnote 3)

d) 1-day joint FIS/CCCC/BIO Topic Session on “*Fisheries interactions and local ecology*” (see FIS Endnote 5).

BIO Endnote 4

Proposal for a 4th PICES workshop on “*The Okhotsk Sea and adjacent areas*”

The Okhotsk Sea and its adjacent area play an important role in the circulation and formation of water masses in the North Pacific Ocean. It is unique because of the formation of seasonal sea ice. The disappearance of ice will cause drastic changes and affect the oceanographic conditions and ecosystems of the North Pacific. In spite of its important role, no significant cooperative research activities on ecosystem dynamics in this area were conducted during the CCCC Program time period. Thus, PICES needs to take the lead in promoting and coordinating cooperative research in this region by convening the proposed workshop. The main objective of the workshop will be to identify the key scientific questions concerning the response of Okhotsk Sea and adjacent area ecosystems to

climate change. These can potentially be addressed as a component of the next PICES integrative scientific program, FUTURE.

Time: Summer of 2007 (or 2008)

Place: Abashiri (or Nemuro), Japan

Potential convenors: Makoto Kashiwai, Michio J. Kishi and Tokio Wada (Japan), Vyacheslav Lobanov and Vladimir I. Radchenko (Russia), and TBD (U.S.A.).

Plan: A 3-day workshop will consist of plenary sessions to review physical forcing, LTL and HTL chemistry and biology, and the fisheries of the area, group discussions and a summary session.

REPORT OF FISHERY SCIENCE COMMITTEE

The meeting of the Fishery Science Committee (hereafter FIS) was held from 16:00–19:40 hours on October 18, 2006. Dr. Gordon H. Kruse called the meeting to order and welcomed the participants. The meeting was attended by 12 FIS members and 22 observers representing all PICES member countries except China (*FIS Endnote 1*). Dr. Paul Spencer served as rapporteur.

The draft agenda was reviewed, and the only change was to move discussion of the FIS Action Plan after discussion of proposals for Topic Sessions and workshops (*FIS Endnote 2*).

Implementation of PICES XIV decisions (Agenda Item 3)

At PICES XV, FIS sponsored a 1-day BIO/FIS Topic Session on “*The human dimension of jellyfish blooms*” (S2), a 1-day FIS/CCCC Topic Session on “*Key recruitment processes and life history strategies: Bridging the temporal and spatial gap between models and data*” (S7), a 1-day FIS/MEQ Topic Session on “*Aquaculture and sustainable management of the marine ecosystem*” (S8), and a 2/3-day FIS Contributed Paper Session. Also, FIS sponsored a 2-day FIS workshop on “*Linking climate to trends in productivity of key commercial species in the subarctic Pacific*” (W2), and a 1-day MEQ/FIS workshop on “*Criteria relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area*” (W3). Summaries of these sessions and workshops can be found in the *Session Summaries* chapter in this Annual Report.

2006 FIS Best Presentation and Poster Award (Agenda Item 4)

The FIS Best Presentation Award is available to early career scientists only. The FIS Best Poster Award is open to all scientists, but the recipient must be the senior author of the poster and must have attended the Annual Meeting.

This year’s winners were selected from the FIS Contributed Paper Session and the BIO/FIS Topic Session S2. The committee consisting of Drs. Kruse, Richard D. Brodeur (convenor of Topic Session S2) and Chang Ik-Zhang selected the paper by Min Ho Kang (co-authored by Jung Youn Park and Suam Kim) entitled “*Genetic variations and differences of chum salmon (*Oncorhynchus keta*) collected from the Bering Sea and along the North Pacific region*” and given at the Topic Session S2 as the best FIS presentation. The committee consisting of Drs. Masahide Kaeriyama and Hyoungh Chul Shin selected the paper by Atsushi Kawabata entitled “*Distribution and biomass of the Japanese common squid, *Todarodes pacificus*, estimated by acoustic survey in the Pacific coastal waters off the northern Japan*” and presented at the FIS Contributed Paper Session as the best FIS poster.

New PICES integrative science program, FUTURE (Agenda Item 5)

The Committee reviewed the draft outline for the next PICES integrative science program (FUTURE). The U.S. delegation presented a draft set of potential science priorities for FUTURE, which formed the basis for further discussion. FIS identified the following science priorities:

1. global climate change (*e.g.*, shifts in species distributions, changes in productivity, shifts in predator-prey dynamics);
2. natural and human effects on marine ecosystems (*e.g.*, separate effects of climate vs. human effects such as trawling effects on seafloor, the study of local ecological mechanisms, the need for field experiments);
3. improved monitoring to detect change (*e.g.*, monitoring systems needed to detect changes in the environment of fishes, improved stock assessments, advancements in development of ecosystem indicators);

4. forecasting (e.g., the need to predict changes in fish stocks with climate change at various scales of variability);
5. ecosystem-based fishery management (e.g., development and validation of ecosystem models, development of operational objectives for conservation and socio-economics, advancement in the science of ecosystem-based management); and
6. more effective communication (e.g., strengthen communication to managers, the general public and others outside of PICES, strengthen partnerships with organizations having shared interests).

Other discussion included the need to develop forecasts (priority area 4) at scales relevant to ecology and fisheries. This priority was distinguished from monitoring because it is model-based. Discussion also considered the need for hypothesis testing, for instance, within science priority area 2. An example could be experiments with control and treatment areas within the sea. There is a strong need to move beyond correlations and to take a more mechanistic approach. Finally, the need to consider feedback between monitoring and modeling was discussed.

A FIS Writing Team was formed to prepare a 3- to 5-page summary of the FIS science priorities. The team will consist of the FIS Chairman, plus one member from each country: Dr. Laura Richards (Canada), Dr. Yukimasa Ishida (Japan), Dr. Chang-Ik Zhang (Korea), Dr. Alexander Glubokov (Russia), Dr. Michael Schirripa (U.S.A.), and a Chinese representative to be named later. Dr. Kruse will prepare a first draft for review and revision by the Writing Team. Then he will incorporate contributions from the Writing Team in a second draft to be sent for review to the full FIS Committee.

Review of FIS Action Plan (Agenda Item 6)

Dr. Kruse suggested that he can update the FIS Action Plan using information provided by the FIS-sponsored Working Groups and FIS members, and circulate it for review to the full Committee prior to the 2007 PICES Annual Meeting in Victoria.

Report of WG 16 on *Climate change and fisheries management* (Agenda Item 7a)

Dr. Richard Beamish reported on progress in completing the report from FIS WG 16 on *Climate change, shift in fish production, and fisheries management*. Since last year, the document has been assessed by three reviewers. The reviewers' comments have been addressed by Dr. Beamish. Reports from the various countries sometimes speculated on the effects of global warming on fish populations. Different countries had different interpretations, and those differences are reflected in the document. Not all countries considered the same species. Some of the reviewers' comments regarded choice of species. Dr. Beamish respected the choices of the countries in these matters. There was an attempt to standardize styles of national reports to the extent possible. Dr. Steven J. Bograd has been asked to help prepare a synopsis of the results; otherwise, a synopsis written by Dr. Beamish will be used. The revised report has been submitted to FIS. FIS formed a committee consisting of the FIS Chairman and Drs. Yukimasa Ishida, Elizabeth A. Logerwell and Mikhail Stepanenko to review the revised report and to advise PICES on report publication.

Progress report of WG 18 on *Mariculture in the 21st century* (Agenda Item 7b)

Dr. Michael Rust reported on progress by MEQ/FIS Working Group 18 on *Mariculture in the 21st century – The intersection between ecology, socio-economics and production* (see WG 18 chapter in this Annual Report for details). The first two Terms of Reference were completed; the third is to propose a joint MEQ/FIS workshop for PICES XVI in Victoria. The duration of this workshop will be determined later. The workshop would produce an Action Plan on scientific issues for aquaculture. Dr. Richards indicated that the workshop will be important for completing the Terms of Reference of WG 18. The Working Group has suffered low attendance in the past two meetings due to lack of adequate financial support. Providing support for the attendance of Chinese scientists would help, as well as funding

for a professional facilitator. Dr. Glen Jamieson reported that MEQ proposed that WG 18 be disbanded and that a Study Group be formed to determine the next steps for PICES concerning aquaculture.

Progress report of WG 19 on *Ecosystem-based management science and its application to the North Pacific* (Agenda Item 7c)

Dr. Jamieson reviewed activities of MEQ/FIS WG 19 on *Ecosystem-based management science and its application to the North Pacific*, and the results of the PICES XV MEQ/FIS workshop (W3) on “*Criteria relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area*”. The report of WG 19 is included elsewhere in this Annual Report, and the workshop summary can be found in the *Session Summaries* chapter. The Working Group proposed a joint FIS/MEQ workshop on “*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*” to be held at PICES XVI (WG 19 Endnote 3). The Committee noted that excellent progress has been made by this Working Group.

Proposals for new subsidiary bodies (Agenda Item 8)

One proposal for a new FIS Working Group on *Theoretical anadromy* was presented by Dr. Skip McKinnell. The proposal noted that there are competing mechanisms for the rapid increase in catches that occurred in the latter part of the 20th century. A significant reduction in the age of smolts was observed in several Bristol Bay sockeye salmon populations after 1976/77, causing greater numbers of juveniles to enter the sea. Smolt age and survival are linked because most of the mortality of sockeye salmon, for example, happens in fresh water. The main objective of the Working Group would be to build a high-resolution salmon model to examine the influence of inter-annual variation in important life-history characteristics. The model should be generally applicable to all salmonids and could potentially be linked to NEMURO. Dr. Beamish commented that ocean

mortality may still be a driving factor in population regulation. Dr. McKinnell clarified that the model would be an entire life-cycle model. It was suggested that this need could potentially be addressed by a NPAFC Working Group (as they are interested in the effect of climate), or it could be a cooperative effort between PICES and NPAFC. Drs. Ishida and Zhang indicated that this proposal is a low priority to Japan and Korea, respectively, and that it is most likely a low priority for China. It was also noted that starting this Working Group now may preclude other subsidiary bodies more aligned with FUTURE, which could be developed at PICES XVII. FIS decided to postpone formation of a new Working Group until a Science Plan for FUTURE is finalized.

Proposals for Topic Sessions and workshops at PICES XVI (Agenda Item 9)

Proposals for Topic Sessions included:

- a 1-day FIS Topic Session on “*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*” presented by Dr. Ishida (FIS Endnote 3);
- a 1-day joint FIS/CCCC/BIO Topic Session on “*Fisheries interactions and local ecology*” put forward by Dr. Logerwell (FIS Endnote 4);
- a 1-day joint MEQ/FIS Topic Session on “*Coldwater biogenic habitat in the North Pacific*” suggested by Dr. Jamieson (MEQ Endnote 5);
- a ½-day joint BIO/FIS/POC Topic Session on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*” presented by Dr. Logerwell (BIO Endnote 3b);
- a 1-day joint CCCC/FIS Topic Session on “*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*” presented by Dr. Jacob Schweigert (MODEL Endnote 3).

The proposed FIS Topic Session on “*ecosystem approach to fisheries*” would address questions, such as “How do we rebuild depleted stocks

under variable climate regimes?” The proposal was unanimously supported by FIS members and was given top priority for PICES XVI.

It was suggested that the MEQ/FIS session on “cold-water biogenic habitat” is a low priority one compared to the other proposed sessions. Concern was expressed that this topic may not be of interest to all PICES member countries.

FIS had much discussion about the remaining three proposals. All topics are of interest to FIS, but there was concern that the Committee may not be able to co-sponsor so many sessions. It was noted that BIO supports the “fisheries interactions and local ecology” session proposal, and consideration was given to deferring to BIO only.

Discussion noted some commonalities between the session on “multi-species modeling” and the session on “fisheries interactions”. FIS opted to combine these two proposals, allowing for a 1.5-day session. It was noted that CCCC selected the unmerged version of the “multi-species modeling” session as a high priority. The merged session was approved by FIS and given a second priority behind the FIS Topic Session on “ecosystem approach to fisheries”. The FIS convenors of both sessions (Drs. Aydin and Logerwell) noted their preference to keep the two sessions separate, unless there is insufficient time in the schedule to convene both sessions. The decision to merge may need to be resolved at the Science Board meeting, where CCCC is present to discuss it.

FIS also supported the proposal for a ½-day “phenology” session and ranked this as a third priority. FIS requests the use of “timing” instead of “phenology” in the title, so it is more widely understood.

FIS unanimously approved having a 1-day FIS Contributed Paper Session at PICES XVI.

Proposals for workshops included:

- a 1-day FIS workshop on “Methods for standardizing trawl surveys to ensure constant catchability” (FIS Endnote 5);

- a 1-day joint FIS/MEQ workshop on “Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation” (WG 19 Endnote 3).
- a 1-day MEQ/FIS workshop on “Scientific issues for sustainable aquaculture in the PICES region.”

Dr. Logerwell described the proposal for the “trawl survey” workshop. This topic has been addressed by ICES, with U.S. participation. The workshop could be expanded to include acoustic surveys and off-bottom trawls, as well. It was suggested that Dr. David Reid (UK) would be a good invited speaker from ICES. It was noted that there has also been some work in standardization for surface trawls used in the NPAFC BASIS program. There is a need to ensure that we do not simply reproduce the work of ICES, and there may be unique issues for PICES nations. Dr. Ishida voiced support for this topic, and it was noted that this is part of the FIS Action Plan. Russia advised that standardization is a complicated, long-term problem. FIS supported the proposal and requested that this workshop consider trawl standardization (not just bottom trawls).

The FIS/MEQ workshop on “ecosystem-based approaches to management” was introduced by Dr. Jamieson. The proposed workshop would address the status and progress of ecosystem-based management science efforts in the PICES region, and would complete the Terms of Reference of WG 19. FIS gave this workshop top priority.

The details were not available for the MEQ/FIS workshop on “sustainable aquaculture”. Dr. Richards recommended that FIS yield sole sponsorship for this workshop to MEQ, and all members agreed.

Relations with other international programs and organizations (Agenda Item 10)

Dr. Ichiro Nomura explained the operations of the Fishery Department of FAO (Food and Agriculture Organization) and suggested potential areas for collaboration between FAO

and PICES. Among others, these areas include: (1) efforts to make the ecosystem approach to fisheries operational, (2) development of collaborative information systems, and (3) “fish in food” model and food safety. FIS looks forward to potential future collaborations with FAO.

The Committee discussed plans and proposals for upcoming FIS-related international meetings with requested PICES co-sponsorship.

The NAFO/PICES/ICES symposium on “*Reproductive and recruitment processes of exploited marine fish stocks*” was approved at the 2006 inter-sessional Science Board meeting and is now planned for October 1–3, 2007, in Lisbon, Portugal. Previously, FIS nominated Dr. Richard Brodeur (U.S.A.) to serve as a symposium convenor, and Drs. Suam Kim (Korea) and Jie Zheng (U.S.A.) as members of the Scientific Steering Committee.

A proposal was received requesting PICES sponsorship for the 1st GLOBEC/CLIOTOP (Climatic Impacts on Oceanic Top Predators) symposium to be held December 3–7, 2007, in La Paz, Mexico. The symposium will highlight the state of the art in the field and try to identify emerging directions and future challenges. Concern was expressed that the symposium organizers are seeking only a financial donation, and not scientific contribution, from PICES, and a flyer has been distributed already without indicating PICES involvement. Given the lack of PICES involvement in the planning of this forum, FIS does not endorse PICES sponsorship of the symposium.

FIS received two proposals inviting PICES to (1) co-sponsor, with NASCO, NPAFC and ICES, a symposium on “*Marine mortality of salmon*” to be held in 2009/2010; and (2) co-organize, with ICES, a symposium on “*Biodiversity and ecosystem-based management*” to be held in 2009. Neither proposal was very comprehensive, and no one present could offer more information.

Regarding marine mortality of salmon, it was determined that this topic may not be of broad interest to PICES, as related symposia in the

past have attracted few PICES scientists who were not already participating in NPAFC activities. Therefore, FIS does not feel that this topic is a high priority for PICES. Although the proposal for the biodiversity symposium was vague on details, FIS agreed that this topic is of much interest to PICES-member countries. As this symposium appears to be in the very early stages of development, FIS recommends that PICES obtain more information about the symposium, including opportunities for PICES involvement to help set symposium objectives and overall planning, and to consider co-sponsorship.

An international conference on “*Linking herring biology, ecology, and status of populations in a changing environment*” (sponsored by ICES, GLOBEC and the Marine Institute of Ireland) is already scheduled for August 26–29, 2008, in Galway, Ireland. ICES representative, Dr. Adolf Kellermann, indicated that PICES will be invited to join as another co-sponsor. It was noted that the former FIS Chairman, Dr. Douglas Hay (Canada), serves as a member of the Scientific Steering Committee.

Dr. George L. Hunt reported on progress by GLOBEC/ESSAS, including the workshop held in June 2006, in St. Petersburg, Russia. ESSAS made a formal request for PICES to support their work on sub-Arctic seas through the series of workshops to be held in the next three years: Hakodate, Japan (2007), Gijón, Spain (2008), and probably Seattle, U.S.A. (2009). The 2007 workshop will focus on the role of sea ice, the 2008 workshop will discuss the role of advection, and the 2009 workshop will be looking at the role of temperature. FIS follows with interest the work by ESSAS.

Proposed inter-sessional meetings (Agenda Item 11)

Dr. Anne Hollowed reported that participants of the PICES XV FIS workshop on “*Linking climate to trends in productivity of key commercial species in the subarctic Pacific*” (W2) recommended that FIS look at 30 key species to develop forecasts of their stock trends. It was noted that FIS would work with CCCC

(CFAME), POC (WG 20) and MONITOR to develop single-species forecasts. These forecasts could be developed in time to be included in the 2009 North Pacific Ecosystem Status Report. A 3-day inter-sessional FIS workshop on “*Forecasting climate impacts on fish production*” was proposed to bring together fishery scientists, oceanographers, and modelers. Two options were suggested: in May 2007, in Seattle (U.S.A.), or alternatively in association with the June 2007 ESSAS workshops in Hakodate (Japan). Travel funds from PICES are requested for two invited speakers. FIS supported this proposal for an inter-sessional workshop and travel request.

Proposed publications (Agenda Item 12)

- If accepted, the final report of WG 16 will be published as a PICES Scientific Report in 2007;
- Three FIS-sponsored Topic Sessions recommended for PICES XVI (“*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*”, “*Fisheries interactions and local ecology*”, and “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*”) include plans for publishing special issues in primary journals.

Requests for travel support (Agenda Item 13)

Travel support is requested for:

- 1 invited speaker for the FIS workshop at PICES XVI on “*Methods for standardizing*

trawl surveys to ensure constant catchability” (FIS Endnote 5);

- 1 invited speaker for the FIS Topic Session at PICES XVI on “*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*” (FIS Endnote 3);
- 1 invited speaker for the FIS/CCCC/BIO Topic Session at PICES XVI on “*Fisheries interactions and local ecology*” (FIS Endnote 4);
- 1 invited speaker, with costs to be shared with BIO and POC, for the BIO/FIS/POC Topic Session on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*” (BIO Endnote 3b).

Dr. Beamish recommended that financial support for scientists attending the PICES Annual Meeting should be given higher priority than travel of PICES scientists to non-PICES meetings. The low participation in the PICES Annual Meeting by Chinese scientists was noted, and FIS discussed whether this was an issue of travel support.

Theme for PICES XVII (Agenda Item 14)

No information was available on the proposed theme for PICES XVII to be held in Dalian, China.

Other business (Agenda Item 15)

No other business was raised.

FIS Endnote 1**Participation List**Members

Richard J. Beamish (Canada)
 Elena P. Dulepova (Russia)
 Alexander Glubokov (Russia)
 Toyomitsu Horii (Japan)
 Yukimasa Ishida (Japan)
 Masahide Kaeriyama (Japan)
 Gordon H. Kruse (U.S.A., Chairman)
 Elizabeth A. Logerwell (U.S.A.)
 Laura Richards (Canada)
 Michael Schirripa (U.S.A.)
 Hyoung-Chul Shin (Korea)
 Chang-Ik Zhang (Korea)

Observers

Kerim Y. Aydin (U.S.A.)
 Galina Gavrilova (Russia)

Christopher Harvey (U.S.A.)
 Anne B. Hollowed (U.S.A.)
 Evan Howell (U.S.A.)
 Chih-Hao Hsieh (Japan)
 George L. Hunt (U.S.A.)
 Oleg Ivanov (Russia)
 Yeonghye Kim (Korea)
 Hidetada Kiyofuji (U.S.A.)
 Hideaki Kudo (Japan)
 Patricia Livingston (U.S.A.)
 Skip McKinnell (PICES Secretariat)
 Ichiro Nemura (FAO)
 Jonathan Phinney (U.S.A.)
 Jacob Schweigert (Canada)
 Paul Spencer (U.S.A.)
 Oleg Zolotov (Russia)
 Jie Zheng (U.S.A.)
 Mikhail Stepanenko (Russia)
 Andrew Trites (Canada)
 Inja Yeon (Korea)

FIS Endnote 2**FIS meeting agenda**

1. Welcome, introductions, and nomination of a rapporteur
2. Adoption of agenda
3. Implementation of PICES XIV decisions
4. 2006 FIS Best Presentation and Poster Award
5. New PICES integrative science program:
 - a. Review of FUTURE outline
 - b. National perspectives on the content of FUTURE
 - c. Defining FIS science priorities within FUTURE
 - d. Formation of FIS writing team
6. Review of FIS Action Plan
7. Progress reports of the existing Working Groups:
 - a. WG 16 (FIS) on *Climate change, shift in fish production, and fisheries management*
 - b. WG 18 (MEQ/FIS) on *Mariculture in the 21st century*
 - c. WG 19 (MEQ/FIS) on *Ecosystem-based management science and its application to the North Pacific*
8. Proposals for new subsidiary bodies
9. Proposals for Topic Sessions and workshops at PICES XVI
10. Relations with other international programs and organizations:
 - a. FAO
 - b. Proposed joint symposia
 - c. Other organizations
11. Proposed inter-sessional meetings
12. Proposed publications
13. Travel support requests
14. Theme for PICES XVII (Dalian, China)
15. Other business

FIS Endnote 3

Proposal for a 1-day FIS Topic Session at PICES XVI on “*Ecosystem approach to fisheries: Improvements on traditional management for declining and depleted stocks*”

An ecosystem approach to fisheries (EAF), which recognizes the complexity of ecosystems and the interconnections between its component parts, has been recently advocated by many fisheries management bodies. In PICES countries, some fisheries resources are in high abundance and healthy, but others are decreasing or already depleted. Most causes of stock declines can be ascribed to climate changes and overfishing. Stocks in declining or depleted conditions require prompt, appropriate management actions, perhaps including ecosystem approaches. This session invites papers that examine: (1) major factors responsible for the status of fish stocks, particularly those that are decreasing or depleted; (2) limits to traditional fishery

management measures to address causes of stock declines; (3) new perspectives on fishery management that promote sustainable fishery management from an ecosystem perspective; and (4) case studies of rebuilding plans for depleted stocks – their successes and failures. Manuscripts contributed to this session will be considered for publication in the journal *Fisheries Research* following peer-review. Submission deadline of manuscripts is November 30, 2007.

Recommended convenors: Yukimasa Ishida (Japan), Gordon H. Kruse (U.S.A.), Ted Perry (Canada), Vladimir I. Radchenko (Russia) and Chang-Ik Zhang (Korea).

FIS Endnote 4

Proposal for 1-day FIS/CCCC/BIO Topic Session at PICES XVI on “*Fisheries interactions and local ecology*”

Ecosystem models are often employed to evaluate the effects of fishing and to distinguish natural variability from human impacts. These models typically operate at large spatial and temporal scales, which are appropriate for their goals and objectives. However, these models would benefit from better information on local-scale processes as there are likely to be bottlenecks at short time scales and small spatial scales that are critical to understanding recruitment variability. Similarly, there may be critical foraging interactions that happen at local scales, particularly for central place foragers such as marine mammals and seabirds. Small-scale effects of fishing such as “localized depletion” may have ecosystem-level consequences. More information on local-scale survival, foraging, movement, reproduction and

pelagic habitat selection would allow food-web and population dynamics modelers to make better scenarios of the effects of natural variability and/or fishing on ecosystems. Papers are solicited on the following topics: (1) current ecosystem models and the assumptions that require further research; (2) techniques for assessing climate impacts on predator-prey interactions at top trophic levels; (3) techniques for assessing local-scale dynamics of survival, foraging, movement, reproduction and pelagic habitat selection; and (4) techniques for assessing prey field response to fishing.

Recommended convenors: Kerim Y. Aydin (U.S.A.), Jason Link (U.S.A.) Elizabeth A. Logerwell (U.S.A.) and an Asian scientist (TBD).

FIS Endnote 5

**Proposal for 1-day FIS workshop at PICES XVI on
*“Methods for standardizing trawl surveys to ensure constant catchability”***

Standardization in the gear and methodology used to conduct pelagic and bottom trawl surveys is essential for a correct interpretation of catch per unit effort as a measure of relative abundance. In the United States, standardization problems stemming from inaccurate measurement of the towing warps on a NOAA survey vessel resulted in a thorough review of standardization methodology and the development of the National Bottom Trawl Survey Protocols (<http://spo.nmfs.noaa.gov/tm/tm65.pdf>) governing the operation of all NOAA-sponsored surveys. Subsequently, ICES formed the Study Group on *Trawl Survey Standardization* to examine the same issue for ICES-sponsored multinational surveys, and to formulate a similar set of standardized operating protocols expected to be published in the fall of

2007. The proposed workshop will review the various pelagic and bottom trawl surveys conducted by PICES member countries, with a focus on the operational protocols used to ensure that survey catchability remains constant over time. Topics to be discussed likely would include a consideration of various instruments to monitor trawl performance, such as acoustic trawl measurement systems, bottom contact sensors and speed through water sensors, as well as trawl design and operation procedures that allow trawl catchability to be robust to environmental variation.

Recommended convenors: David A. Somerton (U.S.A.), Greg Workman (Canada) and Jin-Yeong Kim (Korea).

REPORT OF MARINE ENVIRONMENTAL QUALITY COMMITTEE

The meeting of the Marine Environmental Quality Committee (MEQ) was held from 16:00–19:30 hours on October 18, 2006. The Chairman, Dr. John E. Stein, called the meeting to order and welcomed the participants and observers (*MEQ Endnote 1*). The level of attendance was much greater than last year, which was an encouraging development for MEQ. The Committee reviewed the draft agenda (*MEQ Endnote 2*), and it was adopted. Dr. Glen Jamieson served as rapporteur.

Implementation of PICES XIV decisions (Agenda Item 3)

There were no pressing issues for the Committee pending from last year's meeting in Vladivostok (Russia). The Chairman did not summarize the report of the inter-sessional Science Board/Governing Council meeting (April 2006, Honolulu, U.S.A.) because the main topic of this meeting was the development of a new integrative science program of PICES, which will be discussed in detail later (Agenda Item 6).

Membership and chairmanship of MEQ (Agenda Item 4)

A new Japanese member, Dr. Kunio Kohata, was introduced to the Committee. The Chairman acknowledged Japan's appointment of Dr. Kohata to MEQ.

There continues to be an overall issue of having full participation in MEQ by all PICES member countries. At this meeting, only 7 of the 17 members of MEQ were in attendance. The Committee expressed again its concern that there was no official participation in MEQ from China this year; however, we did have several observers from China. The Committee also noted that there was, for a second year in a row, minimal participation by the United States.

This was the sixth year of Dr. Stein's chairmanship of MEQ, and the Committee must

elect a new Chairman. All efforts to identify a candidate from the western Pacific were not successful. With Dr. Alexander Bychkov (Executive Secretary of PICES) in attendance, the Committee unanimously elected Dr. Glen Jamieson of Canada as the new MEQ Chairman. The Committee thanked Dr. Stein for his leadership of MEQ over the past years.

Dr. Hak Gyoon Kim of Korea was elected as the MEQ Vice-Chairman. The Committee commended Dr. Kim for being willing to accept the nomination and election as Vice-Chairman, since he already co-chairs the HAB Section.

2006 MEQ Best Presentation and Poster Awards (Agenda Item 5)

The MEQ Best Presentation Award was given to Masami Hamaguchi for the paper (co-authored by Naoaki Tezuka) entitled "*Biological impacts caused by the release of the imported manila clam, *Ruditapes philippinarum*, in Japan*" presented at the FIS/MEQ Topic Session on "*Aquaculture and sustainable management of the marine ecosystem*" (S8).

The MEQ Best Poster Award was given to Minkyu Choi for the paper entitled "*Behavior and contamination of estrogenic nonylphenols in Masan Bay, Republic of Korea*" presented at the MEQ Poster Session.

Review of MEQ Action Plan (Agenda Item 6)

Because of the importance of having appropriate time for discussion on the new integrative science program of PICES (FUTURE), the Committee did not review the Action Plan (*MEQ Endnote 3*). Nonetheless, the Committee had spent a considerable time last year on the Action Plan, and thus concluded that it is reasonably complete and reflects the current objectives of MEQ.

New PICES integrative science program (Agenda Item 7)

The Committee had a good discussion of the next integrative science program of PICES and, overall, endorsed the direction as outlined in the current draft of FUTURE. Members also found that the direction of FUTURE is well aligned with the objectives of MEQ. The Committee suggested that:

- climate change, ocean acidification, biological invasions and species expansion are major threats to the marine ecosystem globally, and should be focus areas for FUTURE;
- there is a need to identify the most appropriate ecosystem indicators for forecasting, and that additional effort and focus is needed to determine how we communicate science to managers and the general public in the most effective way;
- attention should be given to the issue of cumulative effects from multiple stressors on ecosystem structure and function.

Progress reports of MEQ subsidiary bodies (Agenda Item 8)

Section on Ecology of harmful algal blooms in the North Pacific

Drs. Vera L. Trainer and Hak Gyoon Kim, HAB Section Co-Chairmen, reported on the results of their workshop on “*Review of selected harmful algae in the PICES region: II. Dinophysis and Cochlodinium*” and laboratory demonstration on *Heterosigma* cell toxin detection, MEQ Topic Session on “*Harmful algal blooms in the PICES region: New trends and potential links with anthropogenic influences*”, and the HAB Section (HAB-S) business meeting convened at PICES XV. Summaries of the workshop and session can be found in the *Session Summaries* chapter of this Annual Report.

For PICES XVI, the HAB Section recommends continuing an annual series of workshops to document the existing knowledge on the eco-physiology of harmful algal bloom species that impact all, or most, countries in the North Pacific. This time, discussion will center on

Heterosigma akashiwo and other harmful raphidophytes. Other activities proposed for the Annual Meeting are: a Topic Session focusing on off-shore and in-shore sources to harmful algal bloom development and persistence, and a business meeting with country reports for HAB events in 2005–2006 and discussion of HAE-DAT use (see also Agenda Item 10).

In addition, the MEQ Committee heard a presentation from Dr. Monica Lyon on the IOC/ICES/PICES HAE-DAT (Harmful Algae Event Database). Substantive progress has been made in expanding HAE-DAT to be a truly global database. PICES and HAB-S were commended for their concerted and consistent efforts to work with HAE-DAT to get PICES member countries’ data into the system, and to assist in developing and testing the new web-based data entry interface. All PICES member countries were requested to:

- re-check their country monitoring descriptions to ensure they are correct and as comprehensive as possible;
- participate in a month trial period for suggestions/improvements to HAE-DAT;
- input HAB event data to HAE-DAT for 2003 directly to the on-line database.

The full HAB-S report is included elsewhere in this Annual Report.

WG 18 on Mariculture in the 21st century

Dr. Michael Rust, standing in for both WG 18 Co-Chairmen, reviewed activities of the Working Group and the results of the MEQ/FIS Topic Session on “*Aquaculture for sustainable management of marine environment and ecosystem*” and their business meeting. The report was also given to FIS. The summary of the session and full WG 18 report are included elsewhere in this Annual Report.

The Committee was very concerned for the second year of very poor attendance at the WG 18 meeting, only 4 of the 14 members were present, and neither of the Co-Chairmen attended. MEQ proposes to close this Working Group as it is not anticipated that they will be able to meet their Terms of Reference.

Nonetheless, the issue of marine aquaculture is of great interest to all PICES member countries. This was clear from the quality of talks in the aquaculture session this year and the good attendance at the session. Because of these findings, the Committee suggests forming a Study Group on *Marine aquaculture and ranching in the PICES region* that would make recommendations on the course that PICES could take in the science of marine aquaculture. These recommendations could be considered by MEQ and FIS for inclusion in their Action Plans (see *MEQ Endnote 4* for the proposed Terms of Reference).

WG 19 on *Ecosystem-based management science and its application to the North Pacific*

Dr. Glen Jamieson, WG 19 Co-Chairman, reported on the activities of the Working Group and the results of their workshop on “*Criteria relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area*”. The summary of the workshop and full WG 19 report are included elsewhere in this Annual Report. Dr. Jamieson noted that to date the Working Group has had no participation from China, so there is no data or input with respect to EBM initiatives occurring in this country. The Working Group proposed a 1-day FIS/MEQ workshop on “*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*” to be held at PICES XVI (*WG 19 Endnote 3*). Travel funds are requested for 1 invited speaker to attend the workshop.

WG 21 on *Non-indigenous aquatic species*

Ms. Darlene Smith, WG 21 Chairman, reported on the first meeting of the Working Group. In particular it was noted that a Co-Chairman from the western Pacific needs to be appointed. It was requested that Russia consider nominating Dr. Vasily Radashevsky as a member of WG 21, and that he, if appointed, be named as WG 21 Co-Chairman. For PICES XVI, the Working Group proposed a 1-day MEQ Topic Session on “*Non-indigenous species: Climate change, evolutionary consequences and*

ecological impacts” (*WG 21 Endnote 3*). Travel funds are requested for 2 invited speakers to attend the session. The Working Group also recommended a 2-day inter-session meeting with relevant ICES Working Groups on marine bioinvasions.

The full report of Working Group 21 can be found as a chapter in this Annual Report.

MEQ proposals for new subsidiary bodies (Agenda Item 9)

The Committee suggests that a Study Group on *Marine aquaculture and ranching in the PICES region* be created (*MEQ Endnote 4*). The Study Group should complete its report by April 2008, for consideration at the inter-session Science Board/Governing Council Meeting.

Proposals for Topic Sessions and Workshops at PICES XVI (Agenda Item 10)

The Committee proposes that the following Topic Sessions and workshops to be convened at PICES XVI:

- a 1-day MEQ/FIS Topic Session on “*Coldwater biogenic habitat in the North Pacific*” (*MEQ Endnote 5*);
- a 1-day MEQ Topic Session on “*Non-indigenous species: Climate change, evolutionary consequences and ecological impacts*” (*WG 21 Endnote 3*);
- a 1-day MEQ Topic Session on “*The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region*” (*HAB-S Endnote 4*);
- a 1-day MEQ workshop on “*Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophyte*” preceded by a ½-day laboratory demonstration on *Heterosigma* cell and toxin detection (*HAB-S Endnote 3*);
- a 1-day MEQ workshop on “*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*” (*WG 19 Endnote 3*).

Relations with other international programs and organizations (Agenda Item 11)

ICES and PICES are still cooperating on planning for the Fifth International Marine Bioinvasions Conference to be held May 21–24, 2007, in Cambridge, U.S.A. To foster interactions with ICES on marine bioinvasions, the WG 21 Chairman, Ms. Darlene Smith, attended the 2006 annual meetings of the ICES/IOC/IMO Working Group on *Ballast Waters and Other Ship Vectors* and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (March 2006, Oostende, Belgium). To continue these discussions, Dr. Judith Pederson (Chairman of WGITMO) and Dr. Anders Jelmert (Chairman of WGBOSV) attended the WG 21 meeting at PICES XV, and Ms. Smith is going to participate in the 2007 annual meetings of WGITMO and WGBOSV (March 2007, Dubrovnik, Croatia). A 2-day joint meeting of WG 21, WGITMO and WGBOSV is proposed in conjunction with the Marine Bioinvasions Conference. Topics for discussion include:

- ballast water sampling methods;
- NIS databases;
- taxonomic challenges;
- ICES Code of Practice for ship hull fouling;
- rapid response and control options.

Proposed inter-sessional meetings (Agenda Item 12)

MEQ supported a proposal to hold a 2-day joint meeting of WG 21 with ICES WGITMO and ICES/IOC/IMO WGBOSV, in fulfillment of one of its Terms of Reference. The meeting would be convened May 25–26, 2007, immediately following the Fifth International Marine Bioinvasions Conference. Travel funds from PICES are requested to permit 1 Chinese and 1 Russian member to attend the Conference and the joint meeting.

As pointed out in the WG 19 report, this Working Group has had no participation from China, meaning that there are no data or input with respect to EBM initiatives in this country. Suggestions are to: 1) have a preliminary meeting of WG 19 in China, in September 2007,

to facilitate and engage their participation, and to coordinate and compile all work to make sure they are prepared for PICES XVI, or 2) have a 2-day WG 19 meeting in Victoria in late October, in conjunction with PICES XVI for planning the final report, at which time Chinese participation will hopefully occur.

Proposed publications (Agenda Item 13)

The following publications were proposed for 2007–2008:

- a paper in a primary journal on national eco-region approaches based on the results of the PICES XV workshop on “*Criteria relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area*”;
- a paper in a primary journal on comparative EBM frameworks based on the results from the proposed PICES XVI workshop on “*Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation*”;
- final WG 19 report in the PICES Scientific Report series (2008);
- a WG 19 brochure on ecosystem-based management (2008) in a format similar to the FERRRS Advisory Report.

Travel requests (Agenda Item 14)

Travel support is requested for:

- 1 invited speaker for the MEQ/FIS Topic Session on “*Coldwater biogenic habitat in the North Pacific*” (MEQ Endnote 5);
- 1 invited speaker for the MEQ Topic Session on “*The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region*” (HAB-S Endnote 4);
- 2 invited speakers for the MEQ Topic Session on “*Non-indigenous species: Climate change, evolutionary consequences and ecological impacts*” (WG 21 Endnote 3);
- 2 invited speakers, 1 from the western Pacific and 1 from the eastern Pacific, for the MEQ workshop on “*Review of selected harmful algae in the PICES region*: III.

Heterosigma akashiwo and other harmful raphidophyte” (HAB-S Endnote 3);

- 1 invited speaker for the MEQ workshop “Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation” (WG 19 Endnote 3);
- 1 Russian delegate to attend the HAB Section meeting at PICES XVI (or request Russia to find a substitute member that can travel to HAB-Section meetings);

- 1 Chinese and 1 Russian member of WG 21 to attend the Fifth International Conference on “Marine bioinvasions” and a joint meeting of WG 21 with ICES WGITMO and ICES/IOC/IMO WGBOSV.

Theme for PICES XVII (Agenda Item 15)

Due to a lack of time this agenda item was not discussed.

MEQ Endnote 1

Participation list

Members

Glen Jamieson (Canada)
Hak-Gyoon Kim (Korea)
Kunio Kohata (Japan)
Olga Lukyanova (Russia)
Darlene Smith (Canada)
John E. Stein (U.S.A., Chairman)
Dong Beom Yang (Korea)

Chuanlin Huo (China)
Ichiro Imai (Japan)
Yoichiro Ishibashi (Japan)
Chang-Gu Kang (Korea)
Takuya Kawanishi (Japan)
Serge Labonte (Canada)
Chang Kyu Lee (Korea)
Sam Geon Lee (Korea)
Monica Lion (IOC)
Bruce Mundy (U.S.A.)
Jeung Sook Park (NOWPAP)
Vasiliy Radashevsky (Russia)
Michael Rust (U.S.A.)
Vera L. Trainer (U.S.A.)
Jinhui Wang (China)
Lijun Wang (China)
Yasunori Watanabe (Japan)

Observers

Alexander Bychkov (PICES)
Andrey Chernyaev (Russia)
Blake Feist (U.S.A.)
Galina Gavrilova (Russia)
Graham Gillespie (Canada)

MEQ Endnote 2

MEQ meeting agenda

1. Welcome and introductions
2. Adoption of agenda
3. Implementation of PICES XIV decisions
4. Membership and chairmanship of MEQ
5. 2006 MEQ Best Presentation and Poster Awards
6. Review of MEQ Action Plan
7. New PICES integrative science program
8. Progress reports of MEQ subsidiary bodies:
 - a. Section on *Ecology of harmful algal blooms in the North Pacific*
 - b. WG 18 (MEQ/FIS) on *Mariculture in the 21st century*
 - c. WG 19 (MEQ/FIS) on *Ecosystem-based*

- d. WG 21 (MEQ) on *Non-indigenous aquatic species management science and its application to the North Pacific*
9. Proposals for new subsidiary bodies
10. Proposals for Topic Sessions and workshops at PICES XVI
11. Relations with other international programs and organizations
12. Proposed inter-sessional meetings
13. Proposed publications
14. Travel support requests
15. Theme for PICES XVII (Dalian, China)
16. Other business

MEQ Endnote 3

MEQ Action Plan (October 2006 – First Draft)

Mission of the MEQ Committee

The MEQ Committee will expand its science from physical/chemical quality as related to toxic contaminants to include: structure, process, and function of the marine system that sustains both ecosystem and human health. Ecosystem health will ultimately affect human health. Rather than focusing on physical drivers of ecosystem change, MEQ is concentrating on anthropogenic drivers of marine ecosystem health.

The Committee notes that each nation has a different approach and management structure for insuring marine environmental quality, which in turn, influences the direction and relative priority for research and science advice. In other words, each culture and society has a different view of what quality represents. It is important to make sure that the efforts of MEQ include, and are useful to, each PICES member country.

Ecological health issues can include:

- Disease, biological pollution, bacteria, HABS;
- Biodiversity, species introductions and unintentional introductions of exotic species;
- Sustainability of the ecosystem, future use of resources;
- Integrated coastal zone management, ecosystem-based management;
- Predictive models, ecological forecasting.

Given the above view of MEQ's mission, the Committee made the following revisions to the list of issues in the current MEQ Action Plan.

Issues that were deleted because the focus is too narrow or they are the purview of another PICES Scientific Committee are:

- Impacts of climate change on coastal ecosystems;
- Biogeochemical processes regulating contaminant dynamics in sediments;
- Harmonization of existing methods used in PICES countries;

- Scientific criteria for protection of marine ecosystems from contaminants.

Issues remaining unchanged, altered to broaden focus, or included *de novo* are as follows:

- Mariculture;
- Biological and physical transport of anthropogenic substances in the marine environment;
- Anthropogenic impacts on benthic habitat (formerly in the Plan as “trawling effects on benthic habitat”);
- Identification and assessment of emerging chemical and biological pollutants (including exotic species), and their impacts on marine ecosystems;
- Definition of indicators or biological markers of marine ecosystem health, with relevance to human health and welfare;
- Needing further clarification is a topic addressing anthropogenic impacts on trophic dynamics and biodiversity that impact system sustainability.

Strategy of the MEQ Committee

The PICES mission has five central themes:

- A. Advancing scientific knowledge;
- B. Applying scientific knowledge;
- C. Fostering partnerships;
- D. Ensuring a modern organization in support of PICES activities; and
- E. Distributing PICES scientific information.

Specific goals are identified within each of these themes. The Actions of MEQ will seek to meet goals under each of the themes.

Theme A Advancing scientific knowledge

Goal 1 Understand the physical, chemical, and biological functioning of marine ecosystems

Action 1.1 Address the substantial need for improved data and information on the occurrence and mechanisms of harmful species in the North Pacific:

Task 1.1.1 Conduct a workshop on HAB species (*Dinophysis* and *Cochlodinium*) in 2006;

Task 1.1.2 Hold a scientific session on HAB research in the western Pacific (2006);

Task 1.1.3 Initiate discussion of the role of cnidarians and ctenophores in the marine environment.

Action 1.2 Develop a process for conducting holistic assessments of the impact of human activities, and identify a suite of indicators or variables that will facilitate the monitoring of ecosystem status:

Task 1.2.1 Produce an assessment of the spatial and temporal patterns of contaminants for inclusion in the NPESR;

Task 1.2.2 In conjunction with 1.2.1, initiate assessment of relationship between contaminant levels and their effects on marine ecosystems.

Goal 2 Understand and quantify the impacts of human activities and climate on marine ecosystems

Action 2.1 Evaluate and increase knowledge in PICES of the potential impacts of aquaculture on ecosystems of the North Pacific:

Task 2.1.1 Hold a scientific session on “*Aquaculture and the sustainable management of the marine environment*”;

Task 2.1.2 Hold a workshop to train PICES scientists in methods to conduct risk assessments on aquaculture activities (note the ICES Code of Practice for Introductions and Transfer of Marine Organisms).

Action 2.2 Evaluate and increase knowledge on the potential impacts of intentional and accidental introductions of non-native species and their vectors of introductions, and collaborate with ICES on introductions and transfers of non-indigenous organisms, including genetically modified organisms:

Task 2.2.1 Propose a PICES WG on introduced species (2006);

Task 2.2.2 Participate in the International Marine Bioinvasions Conference (2007);

Task 2.2.3 Conduct a joint PICES/ICES workshop on introduced species (2007/8).

Action 2.3 Evaluate and increase understanding of how human health issues are inextricably linked to ocean conditions, primarily in coastal areas:

Task 2.3.1 Conduct a workshop/session on “Oceans and human health” issues in the North Pacific.

Action 2.4 Develop the scientific basis for an ecosystem approach to management, including assessments and the provision of scientific advice:

Task 2.4.1 Identify and evaluate the use of indicators for assessing the achievement of ecosystem based management;

Task 2.4.2 Continue and expand the development of ecosystem models that facilitate the assessment of monitoring and scientific knowledge of ecosystem functions in a holistic manner;

Task 2.4.3 Hold a scientific session on approaches to designating eco-regions and areas that are ecologically and biologically significant (2006);

Task 2.4.4 Develop country reports on approaches to ecosystem-based management (2006);

Task 2.4.5 Hold a symposium on the science of ecosystem based management.

Goal 3 Provide advice on methods and tools to guide scientific activities

Action 3.1 Examine and assess methods for measuring HAB species and toxins for use by scientists and agencies of PICES member countries:

Task 3.1.1 Conduct a workshop at PICES XIV to review methods *Pseudo nitzschia* and *Alexandrium*;

Task 3.1.2 Work to develop capacity for Russian scientists to assess and monitor HAB species and toxin levels;

Task 3.1.3 Conduct a series of laboratory demonstrations of DSP detection.

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Theme B Applying scientific knowledge

Goal 4 Provide scientific advice towards wise use of the North Pacific Ocean

Action 4.1 None

Theme C Fostering partnerships

Goal 5 Promote collaboration with organizations, scientific programs, and stakeholders that are relevant to the PICES goals

Action 5.1 Develop an approach for formal linkages with ICES/IOC/IMO WGBOSV (WG on Ballast and Other Ship Vectors) and/or the ICES WGITMO (WG on Introductions and Transfers of Marine Organisms) over the long term.

Goal 6 Promote collaboration among scientists within PICES

Action 6.1 Develop and maintain joint activities of PICES scientists with IOC in development of an international HAB database (HAE-DAT):

Task 6.1.1 Prepare event reports for 2001–2003.

Action 6.2 Provide input to the implementation of activities of GEOHAB and IOC Intergovernmental Panel on Harmful Algal Blooms in the PICES area, such as the HAB database (see 6.1).

Theme D Ensuring a modern organization in support of PICES activities

Goal 7 Provide an effective infrastructure to support PICES programs

Action 7.1 None

Theme E Distributing PICES scientific information

Goal 8 Make the scientific products of PICES accessible

Action 8.1 Publish Working Group reports:

Task 8.1.1 Publish country reports on status of mariculture in PICES member countries in the PICES Scientific Report series;

Task 8.1.2 Publish inventories on non-indigenous organisms for PICES member countries in the PICES Scientific Report series;

Task 8.1.3 Publish a brochure on ecosystem based management.

MEQ Endnote 4

Proposed Terms of Reference for a Study Group on *Marine aquaculture and ranching in the PICES region*

1. Review and assess the reasons why PICES WG 18 had limited success in achieving their Terms of Reference;
2. Develop a list, by PICES member country, of the highest priority (but no more than 10)

- marine aquaculture and/or ocean ranching science needs;
3. Develop recommendations of goals and action items for the next 5–10 years that could be included in Action Plans of MEQ or FIS.

MEQ Endnote 5**Proposal for a 1-day MEQ/FIS Topic Session at PICES XVI on
“Coldwater biogenic habitat in the North Pacific”**

Some of the fauna that are most vulnerable to physical disturbances are the long-lived, slow growing and physically fragile species (corals and sponges) that provide biogenic habitat in deep water. It is increasingly recognized worldwide that deepwater biogenic habitat has not been conserved in the past, with the result that the conservation of such habitat has become a high priority in many jurisdictions. At least in the eastern Pacific, large areas have been established to exclude bottom trawling to protect deep-water corals and sponges. Considerable effort is being expended to identify and determine their distributions and to assess their

ecological role as fishery habitat. This session welcomes presentations that describe: 1) distributions of deepwater biogenic habitat in the PICES regions; 2) threats to biogenic habitat species in the area; 3) the ecological role of biogenic structures as habitat for commercial and other species; and 4) the management measures applied or developed to conserve these species and the habitat they provide.

Recommended convenors: Glen Jamieson (Canada), J. Anthony Koslow (U.S.A.) and Chang-Ik Zhang (Korea).

REPORT OF MONITOR TECHNICAL COMMITTEE



The Monitor Technical Committee (MONITOR) met from 16:00–18:30 hours on October 18, 2006, under the chairmanship of Dr. Jeffrey M. Napp. Eight of 16 MONITOR members were present, and a total of 20 scientists from all 6 PICES member countries were in attendance (*MONITOR Endnote 1*). The meeting agenda was slightly modified (*MONITOR Endnote 2*) to accommodate the needs of guest presenters and issues that arose after the original agenda was circulated. Dr. Phillip R. Mundy served as rapporteur.

North Pacific Ecosystem Status Report (Agenda Item 2)

The Committee reviewed the draft proposal for producing the next North Pacific Ecosystem Status Report (NPESR) and supported the plan for MONITOR to develop the following NPESR-related products: (1) a website reporting seminal time series from Large Marine Ecosystems in the PICES region, (2) a paper (and PDF) version of the full report, and (3) brochure-like Outlooks or Advisories to PICES member countries on emerging ecosystem issues (*MONITOR Endnote 3*).

The Committee recommended that a Section within MONITOR be established to deliver all 3 products. Suggested Terms of Reference and initial Co-Chairmen are included with the recommendation (*MONITOR Endnote 3*).

It was noted that several of PICES member countries (Canada, Japan, Korea, and the United States) either have ecosystem status reports of their own, or have data and time series available via the web with an English interface. China also has such a website, but there is not yet an English version. These will be valuable resources for the production of the LME web reporting and the next NPESR, and may help to dramatically decrease the amount of work necessary to develop the products.

One important issue is the funding of the website and NPESR. There is currently about \$80,000 for the NPESR in funding remaining from the North Pacific Research Board. The Committee asked the PICES Secretariat if the funds could be used to begin development of the website. The Committee recognizes that this will reduce funds available for a hardcopy report. Nevertheless, it was felt that fewer workshops would be needed to generate future versions of the hardcopy report because PICES already has significant experience in producing the first report, and the time series reported in the first version would only have to be updated, not recreated. The Committee leadership and PICES Secretariat should meet to discuss budgets for all proposed products and to identify other possible sources of funding. Included in these discussions will be a budget for personnel and funds necessary for continuation of the website after the contract with the developer expires.

Committee members emphasized that the website, if designed properly, would build towards the full hardcopy report and not be an additional, isolated project. The proposed NPESR Section is charged with formulating a statement of requirements to facilitate this outcome. When it comes time to prepare the hardcopy report, updated time series and interpretive text from the website can be used verbatim in the hardcopy report. The website can also be used to link to the most recent NPESR and related PICES reports regarding monitoring in PICES member countries.

Progress report of Study Group on PICES involvement with GOOS (Agenda Item 3)

Dr. Mundy presented the initial results of the Study Group to develop a strategy for GOOS (SG-GOOS). After consultation with national and international GOOS representatives, the Study Group recommended that PICES not

attempt to initiate a new GOOS North Pacific pilot project. Instead, it was suggested that PICES should play a strong role in coordination and facilitation of North Pacific regional projects. SG-GOOS further recommended that a Section on North Pacific Observing Systems (NPOS) be established within MONITOR, to track and organize PICES efforts in GOOS, and that MONITOR's Terms of Reference be amended to explicitly include facilitation of cooperation, communication and coordination among North Pacific ocean observing systems.

PICES has a long history of successful coordination and facilitation of research across national boundaries and can best contribute to GOOS by being active in the GOOS Regional Alliance (GRA) programs. PICES would provide a forum for representatives of the existing North Pacific observing systems to develop cross-GRA (international) observing projects, improve observing technologies, and compare data and information sharing protocols. The latter objective would be in cooperation with TCODE.

The Committee recommended that PICES send representatives to the 3rd Forum of GRAs to be held on November 14–17, 2006, in Cape Town, South Africa, and to the next GOOS SSC meeting to be held on March 13–17, 2007, in Seoul, Korea.

The Committee thanked Dr. Mundy for his leadership of the Study Group and the Study Group members for their contributions. The full SG-GOOS progress report is included elsewhere in this Annual Report.

Other relevant reports (Agenda Item 4)

PICES/NPRB Ecological Indicators workshop

Dr. Skip McKinnell (PICES Secretariat) briefed Committee members on a workshop on “*Integration of Ecological Indicators for the North Pacific with Emphasis on the Bering Sea*”. This workshop, co-sponsored by PICES and NPRB, was held on June 1–3, 2006, in Seattle, U.S.A. Details of the workshop are available on the PICES web site at <http://www.pices.int/>

projects/Bering_Indicators/bering.aspx). The draft meeting report is being reviewed by the meeting convenors and NPRB. It will soon be published and available to the public.

Progress report of CPR-AP and status of the PICES CPR Pacific project

Dr. Charles B. Miller (Chairman of CPR-AP) briefed the Committee on the results of the Advisory Panel's meeting and the current status of the CRP Pacific project. The project now includes collection of bird and mammal observations, as well as surface water properties (T, S, chlorophyll fluorescence) along the north–south and east–west runs. Scientific progress by the investigators is commendable. New patterns of temporal and spatial variability in plankton, birds, and mammals are being discovered and described. The full CPR-AP progress report is included elsewhere in this Annual Report.

An urgent issue before the Advisory Panel is the funding status of the CPR project. The east–west and north–south transect lines are funded by different entities, NPRB and the *Exxon Valdez* Oil Spill (EVOS) Trustee Council, respectively). Dr. Sonia Batten, principal investigator of the PICES CPR Pacific project, recently wrote a proposal to request funding to continue the north–south transect. While the EVOS Science Review Committee endorsed the proposal and recommended it for funding, the EVOS Science and Executive Directors recommended that it not be funded on the basis of low relevance to PWS (Prince William Sound) herring, the main focus of the Trustees. Without new funding, the north–south transect will be dropped. Funding for the east–west transect also needs to be renewed. Drs. Batten and David L. Mackas will submit a proposal to NPRB in December 2006, to continue work along that transect.

MONITOR supports the request by CPR-AP that a letter be sent to the EVOS Trustees on behalf of PICES strongly urging that the north–south transect of the CPR Pacific project receive funding for 2007 (*CPR-AP Endnote 3*). The timeline is very short as decisions are to be made by the end of October.

Science Board asked MONITOR to review the Terms of Reference for CPR-AP and determine whether or not there was a need to continue the Advisory Panel. This was discussed both at the CPR-AP meeting and at the MONITOR Committee meeting. Both groups believe strongly that an Advisory Panel is needed to advise and advocate for the CPR project. It was felt that MONITOR would be very busy creating the new website and developing NPESR, and that the CPR project would not receive the attention it needed without an Advisory Panel. The MONITOR and the CPR-AP Chairmen will review the Terms of Reference and, if necessary, make suggestions on how they should be changed. It should be noted that MONITOR did discuss whether or not the Terms of Reference should be expanded to include all vessel of opportunity programs in the PICES region since the east-west transects have bird and mammal observations as well as sea surface water properties. MONITOR felt that this was premature given the funding situation of the CPR Pacific project.

PICES web publications

The PICES *ad hoc* committee to improve PICES web content was not active last year. The MONITOR Vice-Chairman, Dr. Sei-Ichi Saitoh, graciously agreed to continue to serve as the MONITOR representative. Several suggestions were made for items that could be placed on the Committee's web page.

MONITOR/TCODE workshop at PICES XV

MONITOR and TCODE co-sponsored a 1-day workshop at PICES XV on "*Data management, delivery, and visualization of high volume data products*", with the subtitle "*How to drink from a fire hose without drowning*." The workshop was very successful and well attended. In addition to the oral presentations during the workshop, there were several electronic demonstrations given at the workshop and during the Poster Session. The workshop report can be found in the *Session Summaries* chapter of this Annual Report. The Committee thanked Drs. Mackas and Saitoh for their efforts as MONITOR co-convenors of this workshop.

Progress report of CREAMS-AP

Dr. Vyacheslav Lobanov described the recent activities of the POC Advisory Panel for a CREAMS/PICES Program in East Asian marginal seas (CREAMS-AP). The Panel's first meeting was held on April 11–12, 2006, in Seoul, Korea. He described the history of the various CREAMS programs (since 1993) and included the present program and expansion of the measurements into biology and chemistry by all the member countries.

CREAMS-AP has been very active in capacity building and hosted a first PICES summer school for young scientists on August 23–25, 2006, in Busan, Korea. The theme of the summer school was "*Ocean circulation and ecosystem modeling*". Lectures and tutorials were presented to 37 students from 8 countries (all PICES member countries plus Chile and Indonesia) by 7 lecturers and 3 assistants from Japan and the United States. The school was scheduled immediately after the CREAMS/PICES workshop on "*Model/data inter-comparison for the Japan/East Sea*" held on August 21–22, also in Busan.

The Advisory Panel proposed to MONITOR (and will make the same proposal to POC) that the following capacity building events for young scientists be organized:

- a winter school on "*Field survey of sea ice area*" in February or March 2008, in Vladivostok, Russia;
- a summer school on "*Ecosystem-based management and ecosystem approach*" in August 2008, in Hakodate, Japan;
- a summer school on "*Recent methods of investigating red-tide organisms and controlling red tides*" in 2009, in Busan, Korea).

MONITOR recommended that PICES support these capacity building activities.

New PICES integrative science program (Agenda Item 5)

Practically no time was spent on this issue at the meeting, except to note that MONITOR

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endorsed the draft outline of the new integrative science program of PICES, FUTURE. It was felt that the direction of FUTURE is well aligned with the objectives of MONITOR.

MONITOR Action Plan (Agenda Item 6)

MONITOR did not review its Action Plan during the meeting because much of the discussion had been on the NPESR development, which is the major element of the MONITOR Action Plan. It was announced that the Science Board was requesting that the Committees include a timeline with their Action Plans. The Chairman stated that when the request became official and Committee Chairmen were given guidance for the format, that he would draft a timeline and electronically circulate it to the MONITOR members for discussion, revision, and approval.

National reports of relevant monitor and observation activities (Agenda Item 7)

National reports were made by Canada (Mackas and Crawford), Japan (Saitoh and Sugisaki), Korea (Ro), Russia (Lobanov), and the United States (Barth, Mundy and Napp). The Chairman requested that presenters with electronic presentations provide a copy to Dr. Saitoh for posting on MONITOR's web page.

Planning for PICES XVI (Agenda Item 8)

MONITOR supported a proposal by Dr. Saitoh to convene a ½-day workshop on *“Measuring primary productivity in the North Pacific”*. He volunteered to be a co-convenor and has approached several other experts in the topic to join him. Later in the week, at the Science Board meeting, BIO expressed an interest in co-sponsoring this workshop and nominating a co-convenor. The workshop title was modified and the description was prepared after PICES XV (MONITOR Endnote 4).

The Committee strongly supported a proposal by Dr. Jack Barth to convene a 1-day Topic Session on *“Recent advancements in ocean observing systems: Scientific discoveries and technical aspects”* (MONITOR Endnote 5).

The Committee also agreed to co-sponsor, with POC and CCCC, a 1-day Topic Session on *“Operational forecasts of oceans and ecosystems”* (POC Endnote 4).

Proposal for inter-sessional meetings and publications, and travel support requests (Agenda Item 9)

The Committee did not receive any proposals for inter-sessional meetings and publications.

Travel funds are requested from PICES for:

- 1 invited speaker for the MONITOR Topic Session on *“Recent advancements in ocean observing systems: Scientific discoveries and technical aspects”*;
- 1 invited speaker for the MONITOR workshop on *“Measuring primary productivity in the North Pacific”*.

2006 MONITOR Best Presentation and Best Poster Awards (Agenda Item 10)

Presentations made at the MONITOR workshop (W6) on *“Data management, delivery, and visualization of high volume data products”* were not eligible for the awards. Given the mix of paper titles presented at the Topic Session (S10) on *“Synchronous and asynchronous responses of North Pacific boundary current systems to climate variability”* (jointly sponsored by POC, MONITOR and CCCC), the Science Board felt that POC should have primary responsibility for judging these papers and posters.

Other Business (Agenda Item 11)

It was reported that a letter of support for the preservation of Canadian oceanographic time series was being solicited from PICES by the convenors of the recent (July 5–8, 2006) symposium on *“Time series of the Northeast Pacific Ocean: A symposium to mark the 50th anniversary of Line-P”* in Victoria (Canada). The symposium affirmed the value of these time series and the need to continue them into the future. The letter was originally to come from BIO, but may be more appropriate coming from MONITOR. The Committee supports the

preservation and continuation of valuable time series and agreed to work with BIO and the Secretariat to find the correct way to write such a letter.

Dr. Saitoh announced that the Hokkaido University released version 1.1 of its fisheries and oceanographic data base (HUFO-DAT) on CD, and that copies are available.

MONITOR Endnote 1

Participation list

Members

Jack Barth (U.S.A.)
Vyacheslav B. Lobanov (Russia)
David L. Mackas (Canada)
Phillip R. Mundy (U.S.A.)
Jeffrey M. Napp (U.S.A., Chairman)
Young Jae Ro (Korea)
Sei-Ichi Saitoh (Japan, Vice Chairman)
Hiroya Sugisaki (Japan)

Observers

Vera Alexander (PICES Chairman)
William B. Crawford (Canada)
Kiyotaka Hidaka (Japan)
M. Hoshimoto (Japan)
Chuanlin Huo (China)
Yeong-Hye Kim (Korea)
Anthony Koslow (Australia/U.S.A.)
Skip McKinnell (PICES Secretariat)
Charles B. Miller (U.S.A.)
R. Ian Perry (Canada)
Kazuaki Tadokoro (Japan)
Takashi Yoshida (Japan, NEAR-GOOS)

MONITOR Endnote 2

MONITOR meeting agenda

1. Introductions
2. North Pacific Ecosystem Status Report
3. Progress report of the Study Group on PICES involvement with GOOS
4. Other relevant reports:
 - a. PICES/NPRB Ecological Indicators workshop
 - b. Progress report of CRP-AP and status of the PICES CPR Pacific project
 - c. PICES web publications
 - d. MONITOR/TCODE workshop (W6) at PICES XV
 - e. CREAMS Advisory Panel
5. New PICES integrative science programs
6. MONITOR Action Plan
7. National reports of relevant monitor and observation activities
8. Planning for PICES XVI
9. Proposal for inter-sessional meetings and publications, and travel support requests
10. 2006 MONITOR Best Presentation and Best Poster Awards
11. Other Business

MONITOR Endnote 3

Proposal for the development of future editions of the North Pacific Ecosystem Status Report

I. Brief history

At PICES XIV (2005), PICES convened a workshop to review the successes and shortcomings of the first (pilot) North Pacific Ecosystem Status Report (published in December 2004), and to decide how future reports should look. Discussion focused on several key topics or questions:

- What should the report contain?
- Who is the intended audience?
- How often should it be “published”?
- What form should it take?
- Who would be responsible for preparing it?

Those attending emphasized the need for timely information and suggested that the product, audience, and format might be best addressed in

future iterations if a staggered or nested approach was used in its development. Some (easy to obtain) information would be readily available on an annual basis, while the more synthetic information and analyses would be available less frequently. The participants also discussed the need to make some products specifically for policymakers from the PICES member countries. The group settled on the following approach (Table 1): whereby some of the time series are made available to users on an annual basis via the web, syntheses and interpretations (similar to the first NPESR) would be published on the web and in hardcopy less frequently (every 3–5 years), and longer range outlooks for policy makers might be published once every 5–10 years, or more frequently if there were emerging issues that warranted concern or special attention.

Table 1 NPESR-related products.

Product	Audience	Period	Form	Who
Time series	scientists, public	annual	web	Contractor and PICES Secretariat
Syntheses/interpretations of ecosystem status	scientists, public, policy makers	3–5 years	web and hardcopy	Working Group
Outlooks	policy makers	5–10 years	brochure and web	Working Group

II. Implementation of the future NPESR

The Committee recommends that a new section be established under MONITOR. The NPESR Section would be comprised of 4 members of MONITOR, 1 representative of each of the PICES Committees (BIO, FIS, MEQ, POC, TCODE) and a member from the PICES Secretariat. Drs. Napp and Saitoh are willing to be the first Co-Chairmen of this new Section.

Proposed Terms of Reference for Section

1. Serve as the Editorial Board for the NPESR web page to review format and content, to make initial recommendations on technical details of web page (location of server(s), distributed vs. single server, *etc.*), and to

- construct plan to transition responsibility for maintenance from a contractor to PICES;
2. Prepare the full NPESR paper publication for review at PICES XVII in October 2008, and for completion/publication no later than June 2009;
3. Evaluate NPESR Version 2 and make recommendations for the next iteration;
4. Evaluate options for passive and active communication of ecosystem status;
5. Recommend process for the development of Outlooks and oversee their publication.

NPESR time series website

The proposal is to create a PICES NPESR website (similar to the Bering Climate Page; www.Beringclimate.noaa.gov) that would serve many of the core indices/time series listed in the

last NPESR. The new website would contain explanations about the relevance of the different time series and how they are collected, just like the first NPESR. The website would need the dedicated attention of programmers and quality control persons the first couple of years. If PICES is interested, Dr. James Overland (PMEL, NOAA, U.S.A.) could manage a team to do the programming and maintenance for 3 years. After 3 years, responsibility for maintenance of the website would be transferred to another entity based on the recommendation of the NPESR Section and the approval of the Science Board. A rough cost estimate for start-up is \$35,000 in Year I (bare bones website), \$25,000 in Year II, and perhaps the same or less in Year III. It might be possible to use the funds already received from NPRB to fund the start-up of this website. This would leverage funds that NPRB already paid to initiate the Bering Climate Page, and would allow the website to be constructed much more quickly.

Table 2 Timeline for the time series website.

Task	When	Who
Build NPESR time series website	2007–2008	Contractor
Begin transfer of responsibility of website	2009	Contractor and TBD
Assume responsibility for website	2010	TBD

Table 3 Key responsibilities for the time-series website.

Data quality control	Initially contractor and NPESR Section, transferred to Section in 2009
Data selection and requests	Recommendations made by NPESR Section; data requests made through Secretariat or Section
Authorship of explanations	NPESR Section
Periodic review	MONITOR

The major question is “How will PICES fund the maintenance of the website after depleting existing funding?” Perhaps it could be funded

and hosted by an in-kind donation from a national laboratory, a national program, or a member country. It could be funded and hosted on a rotating basis among PICES member countries. The NPESR Section will write a proposal to fund maintenance.

Paper and web NPESR

The paper NPESR would be produced in ways very similar to the method used by PICES to produce the first report.

Table 4 Timeline for the paper NPESR.

Task	When	Who
Establish NPESR Section	2007	Science Board and Governing Council
Determine details of report and process	2007	Section and Secretariat
Determine chapter authors, begin writing	2007	Section and authors
Complete writing, hold synthesis workshop(s), present draft at annual meeting	2008	Section and authors
Final editing, publish report	2009	Section and Secretariat

Table 5 Key responsibilities for the paper NPESR.

Establish NPESR Section and Terms of Reference	Science Board and Governing Council
Establish report format and structure	NPESR Section
Address recommendations and reported gaps	NPESR Section
Identify authors and necessary synthesis workshops	NPESR Section
Write report	Chapter authors
Track writing progress	NPESR Section
Convene synthesis workshop(s)	NPESR Section and Secretariat
Publish report	Secretariat and NPESR Section

Major issues are:

- What is the true cost of publishing the report with only a single synthesis workshop?

How much of this cost was borne by PICES last time?

- If we use NPRB funds to establish the NPESR time series website, what will fund the synthesis workshop and the printing and artwork necessary to publish the report on paper?
- NPESR Section could write a proposal to NPRB.
- Use general funds or contributions from PICES member countries.

Outlooks

The Outlook is intended to contain short, broad statements to governments and the general public summarizing our current knowledge of ecosystem status and trends. It would most likely be published in the form of a color brochure, or short pamphlet, and may require publication in the language of each member country. The Outlook would state what we know, as well as what we think we need to know to have more confidence in our statements.

MONITOR Endnote 4

Proposal for a ½-day MONITOR/BIO workshop at PICES XVI on “Measuring and monitoring primary productivity in the North Pacific”

Marine net primary productivity is a key metric of ecosystem health and carbon cycling and is commonly a function of plant biomass, incident solar flux, and a scaling parameter that accounts for variations in algal physiology. Net primary productivity is defined as the amount of photosynthetically fixed carbon available to the first heterotrophic level, and is the relevant metric for addressing environmental questions ranging from trophic energy transfer to the influence of biological processes of carbon cycling. Long-term monitoring of primary productivity is a high priority for PICES nations because it is one of the essential parameters for the understanding of marine ecosystems and biogeochemistry. Recently, measurement technology of primary production has become extremely advanced through the application of fast repetition rate fluorometers, satellites, buoys, etc. However, inconsistencies between *in situ*

Table 6 Timelines for the Outlook.

Task	When	Who
Establish NPESR Section	2007	Science Board and Governing Council
Select subject for first Outlook	2008	NPESR Section
Write, edit, and translate first Outlook	2009	NPESR Section and Secretariat
Publish	2009	Secretariat and NPESR Section

Table 7 Key responsibilities for the Outlook.

Solicit member country needs to define scope and format	MONITOR and Science Board
Determine distribution methods	Secretariat, Governing Council

Major questions are:

- How would we fund such an Outlook?
- Are there issues that would affect how widely the Outlook did or did not get circulated?

measurements and satellites still exist, and there are some differences between the values obtained with C¹³ and C¹⁴ isotopic methodology.

This workshop will discuss the state-of-the-art primary productivity measurement technology and its application to understanding primary productivity in the North Pacific. Presentations at this workshop should: address techniques for measuring primary productivity, compare *in situ* and satellite measurements of primary productivity, demonstrate the utility of long time series measurements in understanding ecosystem variability, and describe the application of primary productivity studies to marine ecosystems and biogeochemistry.

Recommended convenors: Paul J. Harrison (Canada/Hong-Kong) and Sei-ichi Saitoh (Japan).

MONITOR Endnote 5**Proposal for a 1-day MONITOR Topic Session at PICES XVI on*****“Recent advancements in ocean observing systems: Scientific discoveries and technical aspects”***

Given the rapid development of ocean observing systems across the North Pacific, it is timely to discuss their use for scientific discovery and ecosystem research, and to describe the technical advancements in ocean sensors, observational platforms, and improvements in data management and exchange. By providing sustained interdisciplinary observations of atmospheric and oceanic processes, observing systems can capture important events influencing ocean ecosystems. Advanced sensors and platforms are creating new opportunities for deciphering ecosystem dynamics. With the increase in data return across observatories, it is critical that data management and interchange be addressed.

Papers are welcome on: scientific discoveries made possible by ocean observing systems; observed climate impacts on ocean ecosystems and fisheries; advanced ocean sensors including optical, acoustic and genomic devices; autonomous platforms including underwater vehicles and vertical profilers; data management and exchange; and interoperability among ocean observatories. The intention is to have a mixture of scientific and technical talks on ocean observing systems. The session will be complemented by commercial displays around the theme of ocean observatories.

Co-Convenors: Jack Barth (U.S.A.) and TBD.

REPORT OF PHYSICAL OCEANOGRAPHY AND CLIMATE COMMITTEE



The meeting of the Physical Oceanography and Climate Committee (hereafter POC) was held from 16:00–18:15 hours on October 18, 2006. The Chairman, Dr. Michael G. Foreman, called the meeting to order and welcomed members and observers (*POC Endnote 1*). Dr. Steven J. Bograd served as the rapporteur. The Chairman introduced Dr. Nathan Mantua (U.S.A.) as a new member of the Committee and thanked Dr. Stephen C. Riser (U.S.A.) for his past service. The draft agenda was adopted (*POC Endnote 2*).

Completion of PICES XIV decisions (Agenda Item 4)

The POC Contributed Paper Session proposed for PICES XV was approved by Science Board and held on October 17. Dr. Foreman gave a brief summary of the session. There were 19 presentations and 23 posters. A full report has been submitted to the PICES Secretariat and is included in the *Session Summaries* chapter of this Annual Report.

The POC/MONITOR/CCCC Topic Session on “*Synchronous and asynchronous responses of the North Pacific boundary current systems to climate variability*” was also approved by Science Board and will be held on October 20. (The summary of this session can be also found in the *Session Summaries* chapter of this Annual Report.)

The symposium titled “*Time series of the Northeast Pacific: A symposium to mark the 50th anniversary of Line-P*” was held in July 2006, in Victoria, Canada. A special issue of *Progress in Oceanography* is being prepared from papers presented at the symposium.

The CREAMS/PICES workshop on “*Model/data inter-comparison for the Japan/East Sea*” and the first PICES summer school on “*Ocean*

circulation and ecosystem modeling” were both approved by Science Board and held successfully in August 2006, in Busan, Korea. More details are provided in the report of the Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas (CREAMS-AP) under Agenda Item 5b.

The Early Career Scientists Conference (organized with ICES) entitled “*New frontiers in marine science*” was approved by Science Board and is scheduled for June 26–29, 2007, in Baltimore, U.S.A.

The ICES/PICES/IOC Symposium “*Effects of climate change on the world’s oceans*” was approved by Science Board and will be held May 19–23, 2008, in Gijón, Spain, with Luis Valdés, John Church, and William Peterson as convenors.

Progress report of the Section on Carbon and climate (Agenda Item 5a)

Dr. James Christian, Co-Chairman of the Section, reported that a productive 2-day meeting was held October 14–15, 2006. Several scientific presentations were given, and discussions on issues regarding data sharing and steps to getting a data synthesis process in motion to develop a North Pacific carbon database were carried out. A proposal to convene a Topic Session at PICES XVI in Victoria will be put forward to Science Board. Details can be found in the CC-S chapter of the Annual Report.

Progress report of CREAMS/PICES Advisory Panel (Agenda Item 5b)

This report was presented by Drs. Yasunori Sakurai, Co-Chairman of the Panel, and Kyung-Il Chang, organizer of the CREAMS/PICES workshop and summer school. The Panel met

twice during 2006. The first meeting was convened on April 11–12, in Seoul, Korea, hosted by the Research Institute of Oceanography of the Seoul National University. The second meeting was held on October 15 at PICES XV, in Yokohama, Japan. The details can be found in the CREAMS-AP chapter of this Annual Report.

A very successful workshop and a summer school were held August 21–25, 2006, in Busan, Korea. The workshop on “*Model-data inter-comparison for the Japan/East Sea*” included 24 presentations in separate sessions on *Observations*, *Model/data comparisons*, *Nowcast/Forecast systems*, and *Ecosystem modeling*. The workshop proceedings are available on a CD-ROM, and negotiations are underway to publish papers arising from the workshop in a special issue of *Journal of Marine Systems*. A positive response has been received from the Chief Editor, and a proposal is being prepared. This publication is planned for the summer of 2007, and will include approximately 17 papers.

The theme of the summer school was “*Ocean circulation and ecosystem modeling*”, and there were 7 lecturers. Forty-seven applications were received but space restrictions allowed the selection of only 37 participants. They were from all six PICES member countries plus Chile and Indonesia, and mostly graduate students. Tutorials were also given along with the lectures. Future summer schools are planned, but to avoid conflict with the ICES/PICES Early Career Scientists Conference in 2007, the next school will not be until 2008.

Progress report of North Pacific Data Buoy Advisory Panel (Agenda Item 5c)

A Power Point presentation was prepared by the Panel Technical Coordinator, Mr. Bruce Lohnes, and a summary was presented by Dr. Foreman. As this Advisory Panel usually has their annual meeting at the same time as PICES, their annual report is often a year out of date. For the POC meeting presentation, Dr. Foreman retrieved more up-to-date material online. Given the web availability of this data and problems associated

with receiving an accurate report, Dr. Foreman asked the Committee whether POC needs to keep getting this report each year. Dr. Foreman thinks it is no longer necessary, and no other opinions were offered by the Committee. Consequently a recommendation will be made to Science Board that POC no longer requests this report. The Chairman will also inquire what this means for the status of the Advisory Panel.

Progress report of WG20 on “*Evaluations of climate change projections*” (Agenda Item 5d)

Dr. Foreman reported that the proposed Terms of Reference for WG 20 were approved by Science Board and Governing Council and the membership was finalized. Drs. Foreman and Yasuhiro Yamanaka were named as Co-Chairmen. The first workshop for the group was held October 14, 2006, in Yokohama. Approximately 40 people (10 WG 20 members and 28 observers representing all PICES member countries and several international organizations) attended, and there were 3 invited and 11 contributed presentations along with discussions of future plans and collaborations for the group. Dr. Foreman also participated in the CFAME workshop and business meeting on October 13 and 15, respectively, and the JSC/CLIVAR Working Group on Coupled Modelling held in September 2006, in Victoria, Canada.

Workshop discussions focused on collaborations with CFAME. Outcomes were:

- Drs. Arthur Miller, Emanuele Di Lorenzo and Enrique Curchitser, all WG 20 members, are to provide outputs from their high-resolution circulation models of the California Current System to Dr. Vera Agostini (CFAME) for her ecosystem model;
- Drs. Hiroyasu Hasumi and Yasuhiro Yamanaka, both WG 20 members, to work similarly on the Kuroshio/Oyashio region;
- Dr. Ig-Chan Pang, WG 20 member, to investigate both the feasibility of using climate forcing for his high-resolution circulation model of the Yellow and East Seas, and collaboration with Dr. Jai-Ho Oh,

another WG 20 member, specializing in high-resolution atmospheric climate models;

- Ensemble global climate model results to be computed for the Sea of Okhotsk and provided to Dr. Victor Lapko for understanding possible changes to that ecosystem;
- A joint WG 20/CFAME workshop to be proposed for PICES XVI, with Drs. Foreman and Jacquelynne R. King (CFAME) as convenors.

Potential collaboration with ESSAS (Ecosystem Studies of Sub-Arctic Seas) was also discussed. Dr. James E. Overland, POC member, is planning an ESSAS working group to compute an ensemble of climate projections for sub-Arctic regions including the Bering and Okhotsk Seas, so there is an obvious overlap with activities of WG 20. In June 2007, ESSAS will have a workshop in Hakodate, and it was recommended that travel support be requested for one WG 20 member (probably Dr. Muyin Wang) to attend. Collaboration with CLIVAR, financial support for WG 20 research, and FUTURE (the new PICES integrative science program) were also briefly discussed. The summary of the workshop can be found in the *Session Summaries* chapter of this Annual Report.

POC Action Plan (Agenda Item 6)

The Chairman reported that the POC Action Plan was approved by Science Board and suggested that it need not be reviewed or updated this year. The Committee agreed.

Next major PICES integrative scientific program (Agenda Item 7)

This item was moved to the end of the meeting as it was expected to consume as much time as was available (which is basically what happened).

The Chairman gave a brief summary of the history leading up to the present 2-page outline for this scientific proposal (FUTURE). He stated that POC will likely play a stronger role in FUTURE than it did in the CCCC Program.

Dr. Christian initiated a lengthy discussion expressing concern about the term “forecasting” in the acronym. He stated that no models are currently available to provide ocean circulation forecasts, and that we have to be careful not to promise something that cannot be delivered. Dr. Foreman stated that in terms of forecasting, what might be possible are seasonal-scale and climate-scale forecasting. Dr. Shin-ichi Ito said that the term “projection” is better than forecast, as that is what is employed in the climate modeling community. However that would destroy the acronym. Dr. Albert J. Hermann suggested that the difference in terminology is semantic. He also suggested that “forecasting” might be replaced with “speculating” to give the new acronym SUTURE. Dr. Bograd also expressed concern with “forecasting”. We still have a long way to go to understand mechanisms, so it is not clear that we are at the stage to be able to forecast or predict. It was concluded that the key to any forecast is the expression of the associated uncertainty, and this is something that must be made clear to users of any forecast.

In response to one of the questions directed toward each PICES Committee on FUTURE, a discussion then ensued on assigning priorities to each of the key research activities. This evolved into a re-writing exercise, the outcome of which is given in *POC Endnote 3*. As expected, issues related to POC capabilities were given higher priority.

In response to another question “What type of forecasts should we develop?”, the consensus seemed to be any type that we believe can be developed with confidence. However, it was stressed that along with each forecast, it is essential to quantify the uncertainty.

With regard to a third question on “How to broaden the communication of PICES science?”, the final conclusion seemed to be that the emphasis by POC should be on communicating our science within the PICES community (BIO, FIS, *etc.*), who are closer to the policy makers and managers than us. The first requirement is to have them understand our science and the caveats that come with our products.

Planning PICES XVI (Agenda Item 8)

POC approved the following scientific sessions for PICES XVI:

- a 1-day joint POC/CCCC/MONITOR Topic Session on “*Operational forecasts of oceans and ecosystems*” proposed by Dr. Ito (*POC Endnote 4*);
- a 1-day joint BIO/POC Topic Session on “*Decadal changes in carbon biogeochemistry in the North Pacific*.” proposed by the Section on *Carbon and climate (CC-S Endnote 3)*;
- a ½- or 1-day BIO/FIS/POC Topic Session on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*”, proposed by MBM-AP (*BIO Endnote 3b*);
- a 1-day POC Contributed Paper Session to be convened by Drs. Foreman and Ichiro Yasuda; it was indicated that this session does not require invited speakers.

The Committee also approved the request for a joint POC/CCCC (WG 20/CFAME) workshop (*CFAME Endnote 4*) tentatively entitled “*Climate scenarios for ecosystem modeling*”, to be held at PICES XVI, with Drs. King and Foreman as convenors. There will be no invited speakers for this workshop.

Possible invited speakers for the Science Board Symposium at PICES XVI were briefly discussed, and only one name was put forward, Dr. Nathan Mantua. However, as he is a POC member and works in nearby Seattle, he may not need travel support.

PICES XVII theme (Agenda Item 9)

The theme suggested by China for PICES XVII, “*Beyond observation of the North Pacific Environment: Rebuilt, Nowcast, Forecast*” was briefly discussed. It was pointed out that it was perhaps too close to the POC/CCCC/MONITOR Topic Session proposed by Dr. Ito. Science Board will decide if changes are needed.

Relations with international programs and organizations (Agenda Item 10)

Dr. Vyacheslav Lobanov was not available to present a report on the status of the GOOS and NEAR-GOOS projects.

As mentioned in Agenda Item 5d, collaboration with ESSAS was encouraged, and a proposal to send a WG 20 member to the June 2007 ESSAS workshop will be made to Science Board.

Proposals with financial implications (Agenda Item 11)

Proposed inter-sessional meetings for 2007 and beyond:

- Logistical support for the April 2007 CREAMS-AP meeting to be held in Qingdao, China (suggested by Dr. Yury I. Zuenko).

Proposed publications for 2007 and beyond:

- “*Guide to best practices for oceanic CO₂ measurements and data reporting*” to be published in 2007 as a PICES Scientific Report (funds for this publication have already been allocated);
- Collection of papers from the August 2006 CREAMS/PICES workshop to be published in 2007 as a special issue of *Journal of Marine Systems*.

Travel support requests:

Travel support is requested for:

- 1 invited speaker for the POC/CCCC/MONITOR Topic Session (*POC Endnote 4*);
- 1 invited speaker for the BIO/POC Topic Session (*CC-S Endnote 3*);
- 1 invited speaker, with costs to be shared with BIO and FIS, for the BIO/FIS/POC Topic Session (*BIO Endnote 3b*);
- 1 WG 20 member to attend the June 2007 ESSAS workshop in Hakodate, Japan.

The first two requests have higher priority.

POC Best Presentation and Best Poster Award (Agenda Item 12)

Drs. Lobanov, Yasuda, and Foreman acted as judges for the POC Best Presentation Award to be given to an early career scientist presenting in the POC Contributed Paper Session or the POC/MONITOR/CCCC Topic Session S10. The winner was Ye Yuan (China) for his paper in the POC Contributed Paper Session on “*Estimating suspended sediment concentration using ADCP, LISST-100, and OBS in Jiaozhou Bay and Laizhou Bay, China*”.

Drs. Ito, Bograd, and Zuenko acted as judges for the POC Best Poster Award (which is no longer restricted to young presenters). The winner was Jong Jin Park (Korea) for his poster in the POC

Contributed Paper Session on “*Kinetic energy flux of inertial frequency motion out of the mixed layer and its balance with wind energy input in the global scale ocean*”.

Other business (Agenda Item 13)

No other business was raised.

Adoption of report and recommendations to Science Board (Agenda Item 14)

The preceding report has been circulated and approved by all committee members. All recommendations to Science Board were brought forward by Dr. Foreman at their meeting on October 21, 2006.

POC Endnote 1

Participation list

Members

Steven J. Bograd (U.S.A.)
 Kyung-Il Chang (Korea)
 James Christian (Canada)
 Michael G. Foreman (Canada, Chairman)
 Shin-ichi Ito (Japan)
 Hee-Dong Jeong (Korea)
 Young-Gyu Park (Korea)
 Elena Ustinova (Russia)
 Muyin Wang (U.S.A., alternate for J. Overland)
 Ichiro Yasuda (Japan, Co-Chairman)
 Yury I. Zuenko (Russia)

Observers

Albert J. Hermann (U.S.A.)
 Mingkui Li (China)
 Victor Kuzin (Russia)
 Vadim Navrotsky (Russia)
 Ig-Chan Pang (Korea)
 Gongke Tan (China)
 Yasuhiro Yamanaka (Japan)
 Fei Yu (China)

POC Endnote 2

POC meeting agenda

1. Welcome, introductions, opening remarks
2. Adoption of agenda
3. Introduction of new members
4. Completion of PICES XIV decisions:
 - a. POC Paper Session at PICES XV
 - b. POC/MONITOR/CCCC Topic Session at PICES XV
 - c. 2006 Line-P Symposium
 - d. 2006 CREAMS/PICES Workshop on “*Model/data inter-comparison for the Japan/East Sea*” and PICES Summer

- School on “*Ocean circulation and ecosystem modeling*”
- e. 2007 Conference for Early Career Scientists on “*New frontiers in marine science*”
- f. 2008 ICES/PICES/IOC Symposium, on “*Effects of climate change on the world's oceans*”
5. Progress reports of existing subsidiary bodies:
 - a. Section on *Carbon and climate*

POC-2006

- b. CREAMS/PICES Advisory Panel
- c. North Pacific Data Buoy Advisory Panel
- d. WG 20 on *Evaluations of climate change projections*
6. POC Action Plan
7. Next major PICES integrative scientific program (FUTURE): Roles for POC and respective member countries
8. Planning PICES XVI (Victoria, Canada)
9. PICES XVII (Dalian, China) theme
10. Relation with other international programs and organizations
11. Items with financial implication:
 - a. Proposed inter-sessional meetings for 2007 and beyond
 - b. Proposed publications for 2007 and beyond
 - c. Travel support requests
 - d. Other items
12. 2006 POC Best Presentation and Best Poster Awards
13. Other business
14. Adoption of POC report and recommendations to Science Board

POC Endnote 3

Suggestions from POC concerning the range of Key Research Activities described in FUTURE

The following are recommendations from POC for re-ordering and rewording of the Key Research Activities that are currently described in the FUTURE prospectus:

- investigate mechanisms underlying ecosystem response to change;
- develop integrated models to forecast ecosystem change scenarios and to provide estimates of the uncertainties associated with those forecasts;
- provide advice on the implementation of ocean observing systems;
- investigate climate change and develop human impact scenarios;
- develop integration and visualization tools to communicate ecosystem knowledge and complexity;
- develop data management protocols to support this research;
- develop indicators of ecosystem status and condition to meet conservation and management objectives;
- assess and communicate uncertainty and its implications to managers, communities dependent on the ocean, and the general public.

POC Endnote 4

Proposal for a 1-day POC/CCCC/MONITOR Topic Session at PICES XVI on “Operational forecasts of oceans and ecosystems”

Numerical models of ocean dynamics are becoming increasingly sophisticated and are now used to forecast future ocean states. The forecasts vary in geographic scale from local embayments to the global ocean, and on temporal scales, from one day to several years. Improvements in ocean forecasting will contribute directly to forecasts of fisheries where the linkages between ocean dynamics, fish migration, and fishery ground formation are understood. Likewise, lower trophic level (LTL) ecosystem models have been coupled to numerical models of ocean circulation and tested at many sites. LTL models can now anticipate

the production of planktonic prey and biomass when the state of the ocean is captured accurately by ocean circulation models. Moreover, fish growth and recruitment models are starting to be coupled to LTL ecosystem models. The growing interest in ecosystem-based management, and the need to develop a management/decision policy will no doubt rely upon forecasts from coupled physical-ecosystem models. To fully realize the potential of model-based products for ecosystem-based management, a relatively high predictability of ocean structures is essential. This session will review the current status of operational ocean

prediction models, discuss the ability of physical models to forecast ecosystem state and clarify the approaches needed for future studies and improvements. Ideally, we seek papers describing operational forecasts of oceans and/or ecosystem-state and, more importantly, evaluations of their performance. Operational

forecasts can be based on numerical or statistical models, and comparisons of these two approaches are welcome.

Recommended convenors: Michael G. Foreman (Canada), Shin-ichi Ito (Japan), Skip McKinnell (PICES) and Francisco E. Werner (U.S.A.).

REPORT OF TECHNICAL COMMITTEE ON DATA EXCHANGE

The meeting of the Technical Committee on Data Exchange (TCODE) was held from 16:00-19:30 hours on October 18, 2006. The Chairman, Dr. Igor I. Shevchenko, called the meeting to order and welcomed the participants. The meeting was attended by 7 TCODE members and 5 observers representing all PICES member countries and international organizations (*TCODE Endnote 1*). Mr. Robin M. Brown served as rapporteur. The Committee reviewed the provisional agenda, and it was adopted with several items added to New Business (*TCODE Endnote 2*).

Review progress on items in the 2005/2006 Workplan (Agenda Item 3)

Assistance with HAE-DAT database activities

The Committee reviewed the progress made with the development of the HAE-DAT (Harmful Algal Event Database) partnership. The new version of the IOC-ICES-PICES database was introduced at the HAB-S meeting. This version will allow users to input, view and search data on-line (<http://www.iode.org/haedat>) and to get maps via a map server. The system will be open within 1 month after PICES XV and will be on trial for several months before it is revised into its final format. It was recommended that continued assistance with the database and required metadata be provided to the Section on *Ecology of harmful algal blooms in the North Pacific*.

Convene joint MONITOR/TCODE Workshop at PICES XV on dense/real time data systems

A 1-day MONITOR/TCODE Workshop on “*Data management, delivery and visualization of high-volume data products*” was convened on October 15. Presentations covered a wide range of topics. Summaries of posters and e-posters were presented as a part of the workshop. After

the presentations, there was a lively discussion of future directions. The summary of the workshop is included elsewhere in this Annual Report.

Update NPEM and TCODE inventory

The North Pacific Ecosystem Metadatabase (NPEM) now contains all records from the TCODE metadata inventory, but there are questions about who is responsible for updating metadatabase. Current methods such as internal QC checking and regular mailout notifications are routine. It seems that only federated searching could be considered as the real solution.

Establish a dialogue with ICES Working Groups involved in data management issues

Dr. Shevchenko contacted Drs. Michele Fichaut and Helge Sagen, Co-Chairmen of the ICES Working Group on *Marine Data Management* (WGMDM). Dr. Georgiy Moiseenko, a member of WGMDM, attended their meeting (May 8–10, 2006, in Copenhagen, Denmark) and made a presentation on PICES TCODE activities. Some interest was expressed in making contacts and coordinating activities with TCODE. The WGMDM Co-Chairmen were invited, but were unable to attend PICES XV, as WGMDM will be disbanded by the end of 2006, and a new ICES Working Group on *Data and Information Management* (WGDIM) will be established. WGDIM will provide ICES with advice on all aspects of data management including technical, data policy, data strategy and user-oriented guidance, and will meet for the first time from June 12–14, 2007, in Copenhagen. Dr. Sagen and two former Co-Chairmen of the ICES Study Group on *Management of Integrated Data* (SGMID), Drs. Christopher Zimmermann and Peter Wiebe, will serve as Co-Chairmen of WGDIM.

At the 2006 ICES Annual Science Conference, Dr. Bernard Megrey participated in the theme session on “*Environmental and fisheries data management, access, and integration*” and discussed with session convenors, Drs. Zimmermann, Sagen and Wiebe, possible joint sponsorship of future meetings of mutual interest by the newly formed ICES WGDIM and PICES TCODE. A WGDIM plan is to sponsor a data theme session every other year to track new developments in this quickly changing field. TCODE should consider co-sponsoring these sessions to strengthen ties between ICES and PICES data management activities. In particular, there was some discussion about asking WGDIM, after it is formally constituted, to co-sponsor a TCODE session at PICES XVI in Victoria, Canada. Drs. Moiseenko and Megrey will report, through the TCODE Chairman, on changes in ICES groups and future opportunities for collaboration.

PICES Federated Searching Project

The objectives of the PICES project “*Federate metadata on North Pacific ecosystems*” were to create standardized metadata descriptions of national, institutional and agency databases and to serve those descriptions in a web-based, one-stop environment with search and delivery capability. In Phase I, KODC (Korean Oceanographic Data Center) and NPEM personnel, using partial support from PICES, developed the application over a year, with major progress coming from joint meetings held in August 2005 (Seattle, U.S.A.) and October 2005 (Busan, Korea). KODC had translated some metadata records to English and became a registered node of the National Spatial Data Infrastructure (NSDI) clearinghouse (<http://registry.fgdc.gov/serverstatus/>). A paper by S. Allen Macklin, Bernard A. Megrey, Kyu-Kui Jung and Hae-Seok Kang on Korea and U.S. federate marine metadata collections was published in *PICES Press* (Vol. 14, No. 1). Recently, Hae-Seok Kang has brought servers on-line and now more than 700 Korean records are available.

The PICES Federated Searching Project was continued in 2006. A workplan similar to that

developed for NPEM-KODC federation was used. Phase II included two successful planning meetings of NPEM and MIRC (Marine Information Research Center, Japan) personnel, again with partial support from PICES, to discuss required technical details and hurdles and the means to address and solve problems associated with metadata federating. A draft report on “*Metadata federation of PICES member countries*” was prepared by Bernard A. Megrey, S. Allen Macklin, Kimberly Bahl and P. Daniel Klawitter to provide technical guidance for anyone wishing to become a partner of this federation. The report will be finalized after its review by TCODE members.

Dr. Megrey described a change in international metadata standards from FGDC (Federal Geographic Data Committee) to ISO 19115 and its biological extensions. As a member of ISO (International Organization of Standards), the United States is required to adopt these standards. This will lead to modifications in the PICES metadata clearinghouse interface standards and will require changes for existing and future clearinghouse servers.

With the move of the U.S. metadata clearinghouse interface from proprietary to open source software, the potential exists for PICES to adopt the open source standard, federate metadata internally and sever their relationship with the U.S. clearinghouse nodes. Related costs, consequences and benefits of this approach and recommendations were briefly discussed. The Committee asked Mr. Macklin to consider opportunities for establishing Asian-side “mirror” clearinghouse servers with the FGDC/NSDI Secretariat.

After the completion of Phases I and II of the project, the PICES Metadata Federation will include 5 nodes (PICES-NPEM, PICES-KODC, PICES-NFRDI, PICES-TINRO and PICES-MIRC) from 4 countries (the United States, Republic of Korea, the Russian Federation and Japan).

Future participation of Canada and China in the PICES Metadata Federation may be possible through NSDI-CAP (NSDI Cooperative

Agreement Program) funding, and TCODE will pursue this option. TCODE also requests that PICES support Phase III of this project at the same level (US \$4,000) as Phases I and II (pending successful funding applications elsewhere) (*TCODE Endnote 3*).

National annual reports (Agenda Item 4)

TCODE members from all member countries, Robin Brown (Canada), Ruguang Yin (China), Tomowo Watanabe (Japan), Kyu-Kui Jung (Korea), Georgiy Moiseenko (Russia) and Bernard Megrey (U.S.A.), presented national annual reports. These reports include lists of key institutes and agencies, key persons and contacts, links to data and metadata sets, ocean observing systems, data and metadata formats and standards, information technologies for collecting, measuring and enumerating marine organisms, marine data management programs that underpin marine science programs, data policies, software applicable in marine ecosystems studies and modeling, publications on marine data management issues, education materials, *etc.* All reports are posted at <http://tcode.tinro.ru/pices15.html>.

Updates on data management activities in PICES member countries and international organizations (Agenda Item 5)

Mr. Norio Baba (Japan) described ongoing data management programs of NOWPAP (Northwest Pacific Action Plan) and potential areas of collaboration with PICES. Regional Activity Centers of NOWPAP deal in particular with harmful algal blooms. Mr. Baba expressed interest in the Metadata Federated Searching Project and mentioned funding opportunities for capacity building to generate metadata records.

Discussion of new PICES integrative science program, FUTURE (Agenda Item 6)

The Committee reviewed the program description. There was much discussion about “prediction” and the difficulty it implied. TCODE could assist in some of the underpinnings (or infrastructure) of such a program through a federated metadata searching

capability. Metadata inventories also contribute to outreach. TCODE could continue to showcase new approaches to data integration, visualization and management. There was a feeling that the targeted “clients” of the program (governments, policy and resource managers) might not be all receptive. TCODE was designed to support the science program of PICES. However, at the moment, it is somewhat difficult to understand exactly what the requirements might be.

Planning for PICES XVI (Agenda Item 7)

TCODE proposed a scientific/e-poster session for PICES XVI on “*Data management, data analysis and data delivery systems to support detection and prediction of ecosystem change in the North Pacific and the Arctic and its impacts*” (*TCODE Endnote 4*).

PICES XVII theme (Agenda Item 8)

TCODE supported the proposal for the PICES XVII theme, “*Beyond observation of the North Pacific environment: Rebuild, nowcast and forecast*”. Some concern was expressed that the wording seems narrow and could be improved by replacing “environments” with “ecosystems”.

Relations with other international programs and organizations (Agenda Item 9)

No proposals on updates for the PICES Standing List of International and Regional Organizations and Programs were made. Potential relations with ICES and NOWPAP were discussed under Agenda Items 3 and 5.

Election of TCODE Chairman and Vice-Chairman (Agenda Item 10)

Dr. Shevchenko was requested, and agreed, to continue for one more year as TCODE Chairman. Dr. Megrey will serve as TCODE Vice-Chairman.

Items with financial implications (Agenda Item 11)

TCODE requests support for:

TCODE-2006

- 1 invited speaker to attend the TCODE scientific/e-poster session at PICES XVI;
- Phase III of the PICES project “*Federate metadata on North Pacific ecosystems*” (pending successful funding applications) (see *TCODE Endnote 3*).

New business (Agenda Item 12)

At the recommendation of the F&A Committee, TCODE asked Mr. Brown to be an advisor to the PICES Secretariat review of electronic publishing and archiving activities.

TCODE strongly supported a proposal by Dr. Tokio Wada for a PICES Monitoring Service Award. The award aims to recognize the organizations and groups of PICES member countries for their contribution to the progress of marine science in the North Pacific through their long-term monitoring operations and data management.

TCODE recommended that a new electronic PICES Technical Report series be established and that the report on “*Metadata federation of PICES member countries*” be published in this series.

To reduce publishing costs, PICES should adopt a practice common to other scientific meetings (e.g., ICES and AFS) to print only the meeting schedules and to prepare the Book of Abstracts for Annual Meetings and other symposia in CD-ROM format only. The CDs would be distributed to all meeting participants. It would

be very convenient to include key URLs for every paper in the Book of Abstracts (CD).

TCODE Workplan for 2006/2007 (Agenda Item 13)

Based on the discussion of all agenda items, the Committee adopted the following workplan:

- Continue to support HAB-S work with HAE-DAT database and required metadata (Responsibility – R. Brown);
- Continue Federated Metadata Searching Project (S.A. Macklin, B.A. Megrey, I. Shevchenko, N. Baba):
 - Complete Phase II report and promote use of metadata;
 - Carry out Phase III, including capacity building;
 - Investigate utility of an Asian-side metadata server;
 - Publish a report on “Metadata federation of PICES member countries” in the proposed PICES Technical Report series;
- Organize the scientific/e-poster session on “*Data management, data analysis and data delivery systems to support detection and prediction of ecosystem change in the North Pacific and the Arctic and its impacts*” at PICES XVI (K.K. Jung, S.A. Macklin);
- Develop collaboration with ICES Working Group on *Data and Information Management* (G. Moiseenko, B.A. Megrey, I. Shevchenko);
- Provide advice on electronic publishing and archiving to the Secretariat (R. Brown);
- Coordinate activities with MONITOR Technical Committee (T. Royer).

TCODE Endnote 1

Participation list

Members

Robin M. Brown (Canada)
Kyu Kui Jung (Korea)
Bernard A. Megrey (U.S.A.)
Georgiy Moiseenko (Russia)
Igor I. Shevchenko (Russia)
Tomowo Watanabe (Japan)
Ruguang Yin (China)

Observers

Norio Baba (NOWPAP)
John Holmes (Canada)
S. Allen Macklin (U.S.A.)
Toru Suzuki (Japan, CC-S liaison)
Joon Yong Yang (Korea)

TCODE Endnote 2**TCODE meeting agenda**

1. Welcome and introduction of members
2. Adoption of agenda
3. Review progress on items in the 2005/2006 Workplan:
 - a. Continue to support HAB-S work with HAE-DAT database and required metadata
 - b. Convene joint MONITOR/TCODE Workshop at PICES XV on dense/real-time data systems
 - c. Update NPEM and TCODE inventory
 - d. Initiate a dialogue with ICES Working Groups involved in data management issues
 - e. Prepare and post a report on the PICES Federated Searching Project: Phase I
 - f. Continue the PICES Federated Searching Project: Phase II
 - g. Update TCODE Action Plan
 - h. Coordinate activities with MONITOR
4. National annual reports
5. Updates on data management activities in PICES member countries and international organizations
6. FUTURE (new PICES integrative science program)
7. Planning for PICES XVI
8. PICES XVII theme
9. Relations with other international programs and organizations
10. Election of TCODE Chairman and Vice-Chairman
11. Items with financial implications
12. New business:
 - a. Review of PICES electronic publishing and archiving
 - b. Monitoring Service award
 - c. PICES Technical Report series
 - d. Book of Abstracts on CD-ROM
13. TCODE Workplan for 2006/2007

TCODE Endnote 3**Data-sharing project “*Federate metadata on North Pacific ecosystems: Phase III*”**

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

TCODE adopted a pilot KODC-NPEM federation as part of its 2004/2005 Workplan. In Phase I of this project, the first two PICES nodes (PICES-NPEM and PICES-KODC) were registered with the National Spatial Data Infrastructure (NSDI) clearinghouse. Since then another Korean node (PICES-NFRDI KODC) and a Russian node (PICES-TINRO Metadata Node) have been brought on line.

In Phase II of this project, with the successful 2006 NSDI Cooperative Agreement Program (CAP) proposal “North Pacific Ecosystem Metadata Federation: Japanese Component” and PICES support, a Japanese node (PICES-MIRC) was brought on-line on October 19, 2006.

The status of the PICES nodes can be found at <http://registry.fgdc.gov/serverstatus/> by scrolling down to the servers whose name begins with PICES, and the nodes can be searched by going to <http://clearinghouse3.fgdc.gov/>. The PICES Metadata Federation now includes 5 nodes from 4 countries (Japan, Republic of Korea, the Russian Federation and the United States of America). The addition, in the nearest future, of Chinese and Canadian metadata will complete the Metadata Federation of PICES nations. The new 2007 NSDI CAP announcement will appear in early November, and we plan to prepare at least one proposal to complete the PICES Metadata Federation.

TCODE-2006

We propose, as Phase III of the project, to federate with Canada and/or the People's Republic of China and ask PICES to continue to support this project at the same level as last year (US \$4,000), conditional on three essential elements: (1) confirmation by Canada and/or China that they are willing to federate metadata; (2) that there will be suitable programs in the upcoming announcement by the NSDI CAP against which we can propose for further financial assistance; and (3) that TCODE can prepare a successful proposal to the NSDI CAP.

Since NSDI CAP funds cannot be programmed to foreign countries, PICES support will enable travel for training of non-U.S. personnel to attend planning meetings to discuss technical issues related to metadata standards and communication protocols required by the clearinghouse.

Proponents of the proposal: S. Allen Macklin (NOAA/PMEL, U.S.A.) and Bernard A. Megrey (NOAA/AFSC, U.S.A.).

TCODE Endnote 4

Proposal for a Topic Session at PICES XVI on

“Data management, data analysis and data delivery systems to support detection and prediction of ecosystem change in the North Pacific and the Arctic and its impacts”

Profound changes have occurred in the North Pacific climate system, in the composition, abundance and distribution of its living marine resources, and in the human societies that depend on the North Pacific Ocean and its resources. New and novel techniques are needed to handle the ever-increasing volume of scientific data and to understand its meaning with respect to climate variability, anthropogenic impacts and the combined impacts that these changes have already had, and can be expected to have, on North Pacific ecosystems. This session will address methods

such as high-volume data management, cabled observatories, regime shift detection and prediction, and ocean observing systems. Presentations describing links with climate and ecosystem change in the Arctic and relating to the International Polar Year Projects are also welcome. Oral presentations and electronic posters are encouraged.

Recommended convenors: Kyu Kui Jung (Korea) and S. Allen Macklin (U.S.A.).

REPORT OF THE SECTION ON CARBON AND CLIMATE



The meeting of the Section on *Carbon and climate* (hereafter CC-S) was held from 09:00–17:00 hours on October 14 and October 15, 2006. Drs. James Christian and Toshiro Saino, Co-Chairmen of CC-S, opened the meeting and welcomed members and observers (*CC-S Endnote 1*). The draft agenda was reviewed and adopted unanimously (*CC-S Endnote 2*).

Methods manual (Agenda item 2)

Dr. Christian gave an update on the progress of the “*Guide to best practices for oceanic CO₂ measurements and data reporting*” that remains as unfinished business of WG 17. He has worked with Drs. Andrew Dickson and Christopher Sabine and PICES staff (Ms. Rosalie Rutka) to transfer the chapters to a Microsoft Word/MathType format for more accessible editing by the community, and several chapters have already been extensively edited and re-written. A list of chapters was presented and volunteers were solicited to review the scientific content. These chapters are to be posted on the web for community input, as decided at the November 2005 CC-S meeting. Dr. Alex Kozyr agreed to host the interactive review web page on his servers at CDIAC. (Update: As of December 2006, almost all chapters have been converted to the Word format and posted on the CDIAC website for review.)

Reports of collaborating organizations and agencies (Agenda item 3)

Reports were given on several national and international programs relevant to the mandate of CC-S, and of individual agencies within PICES member countries. From Japan, separate reports were received from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC, Shuichi Watanabe), the Japan Fisheries Agency (JFA, Tsuneo Ono), the Centre for Global Environmental Research

(CGER, Yukihiro Nojiri), and the Japan Meteorological Agency (JMA, Masao Ishii). All have ongoing observational programs which will contribute data to the North Pacific carbon data synthesis. Dr. Saino (Nagoya University) reported on a new moored profiling system for daily *in situ* measurements of primary productivity. The instrument has operated successfully at Station K2, which is also regularly occupied by JAMSTEC.

Other ocean carbon programs represented included: CLIVAR/Repeat hydrography (Richard A. Feely), SOLAS (Mitsuo Uematsu), IMBER (Hiroaki Saito) and CARBO-OCEAN (R. Feely and A. Kozyr). GEOTRACES was briefly discussed, but was not represented at the meeting. CLIVAR is funded until 2012 in the United States, and the current decadal survey is about 40% complete. SOLAS and IMBER have published a joint plan on carbon cycle research. SOLAS-Japan has been funded until 2010. IMBER-Japan expects funding for field work in the western North Pacific over the next 6 years (2007-2012).

CARBO-OCEAN is an Atlantic-centric program scheduled from 2005 to 2009. While doing extensive field surveys, they also had the first meeting on synthesizing carbon data from the Atlantic, Arctic and Southern Oceans in June 2006, in Iceland. Two CC-S members, Drs. Feely and Kozyr, are on the CARBO-OCEAN Scientific Steering Committee, and Drs. Steven Emerson, Kitack Lee and Toshiro Saino, all CC-S members, are on its International Advisory Panel. The initial 2 years’ results will be presented at an upcoming workshop in the Canary Islands in December 2006.

The most recent IOCCP progress report (May 2006) was briefly discussed. The report indicated that PICES WG 17 had disbanded, but its authors did not seem to be aware of the formation of CC-S. The Section will inform IOCCP of this, and of progress on the methods

manual. IOCCP and the SOLAS/IMBER Carbon Group will be holding a workshop in Paris, France, in April 2007. Drs. Feely and Lee are on the workshop Organizing Committee.

NOAA-PMEL hosted a workshop on carbon fluxes along the North American Continental Margins (NACM) on October 10–11, 2006. The workshop declared as an objective a compilation of all historic measurements out to ~300 km from shore. The current estimate of net C uptake by NACM is 1.9 Pg/y ($\pm 100\%$). Lower latitudes tend to be a carbon source, and higher latitudes ($>30^\circ\text{N}$) tend to be a sink. There are too few data to state definitively whether the system as a whole is a source or a sink. There are few data from the Gulf Coast, or from the Canadian and Mexican parts of the Pacific coast. Future goals of NACM are (1) to integrate with fisheries and coastal management to get carbon observations on as many programs as possible, (2) to integrate numerous existing programs, and (3) to improve remote sensing and in water autonomous technologies and promote broader implementation of existing technologies. These activities are closely related to CC-S objectives.

CC-S will ask participants to provide updates at future CC-S meetings, and may ask PICES to co-sponsor future joint workshops.

Data integration for synthesis: Why do we need the integrated dataset? (Agenda Item 4)

Synthesis of carbon data for the North Pacific was extensively discussed. A similar undertaking in the Atlantic Ocean is underway under CARBO-OCEAN. PICES is clearly responsible for the North Pacific in this respect. It was suggested that the GLODAP (Global Ocean Data Analysis Project) synthesis could serve as a model. GLODAP is still collecting data, and has developed a consistent system for QA/QC. The person principally responsible for this is Dr. Robert Key (Princeton University, U.S.A.). Dr. Feely is a Principal Investigator on the NOAA grant that funds this work, and he offered some of his time to this effort. Dr. Key also works closely with Dr. Kozyr of CDIAC. The present GLODAP data set in the North

Pacific (2004) has very limited temporal coverage (89% of DIC data north of 20°S were collected in the years 1991–1994).

Several technical and organizational issues relating to metadata were raised. Dr. Kozyr stated that use of the CDIAC data-submission webform is not mandatory, and that they will accept user metadata in plain text, Word or PDF format. CDIAC needs information from individual investigators that cannot necessarily be obtained from other data centers. JODC, for example, does not handle metadata. CDIAC also requires English metadata, which can create bottlenecks due to the expense of translation.

The group decided that PICES will create a working synthetic data set, open within the group but not public domain, as we did for the 2004 Seattle workshop (http://cdiac.ornl.gov/oceans/NOAA_Workshop/Data.html), using GLODAP as a model. The ocean will be divided into 4 regions: Northwest Pacific, Northeast Pacific, Tropical Pacific and South Pacific. Marginal seas will be initially excluded. The data set will include all nutrient and oxygen measurements as well as carbon system measurements, but will not include cruises where no carbon measurements were made. Investigators responsible for each region are: Drs. Nobuo Tsurushima (Northwest Pacific), Sabine (Northeast Pacific), Feely and Masao Ishii (Tropical Pacific) and Key (South Pacific). Drs. Key and Kozyr will serve as overall project coordinators.

Science topic presentations (Agenda Item 5)

Presentations were given by several CC-S members and observers (see *CC-S Endnote 2*). Topics ranged from biogeochemistry of a northwest Pacific estuary to estimating surface ocean pCO_2 at basin-scale from satellite data.

Topic Session at PICES XVI (Agenda Item 6)

The description of a 1-day BIO/POC Topic Session proposed to Science Board at the April 2006 inter-sessional meeting was submitted to the membership. Some revisions were made to the text, and possible invited speakers discussed.

The revised description (*CC-S Endnote 3*) was submitted to POC and BIO on October 18, and

to Science Board on October 21. Financial support for 2 invited speakers was requested.

CC-S Endnote 1

Participation list

Members

Andrey Andreev (Russia)
James Christian (Canada, Co-Chairman)
Richard A. Feely (U.S.A.)
Hernan Garcia (U.S.A.)
Alex Kozyr (U.S.A.)
Tsuneo Ono (Japan)
Toshiro Saino (Japan, Co-Chairman)
Toru Suzuki (Japan)
Shuichi Watanabe (Japan)
Pavel Tischenko (Russia)

Observers

Norio Baba (Japan)
Alexander Bychkov (PICES)
Rongshuo Cai (China)

Fei Chai (U.S.A.)
Michael Dagg (U.S.A.)
Makio Honda (Japan)
Akio Ishida (Japan)
Masao Ishii (Japan)
Michio Kawamiya (Japan)
Mingkui Li (China)
Akihiko Murata (Japan)
Xiuren Ning (China)
Jun Nishioka (Japan)
Yukihiro Nojiri (Japan)
Keith Rodgers (U.S.A.)
Fangli Qiao (China)
Hiroaki Saito (Japan)
Vedula V.S.S. Sarma (Japan)
Zhenya Song (China)
Hiroya Sugisaki (Japan)
Nobuo Tsurushima (Japan)
Mitsuo Uematsu (Japan)

CC-S Endnote 2

CC-S meeting agenda

1. Welcome, introductions, approval of agenda
2. Methods manual for CO₂ measurements
3. Reports of collaborating organizations and agencies
4. Data integration for synthesis: Why do we need the integrated dataset?
5. Science topic presentations:
 - a. Richard Feely: *Decadal changes in the aragonite saturation horizon*
 - b. Vedula Sarma: *Satellite algorithm for pCO₂ in the North Pacific*
 - c. Andrey Andreev: *Excess pH in the subarctic North Pacific*
 - d. Pavel Tischenko: *Hydrochemical study of the Amur River estuary*
 - e. Makio Honda: *JAMSTEC K2 time series*
6. Topic Session at PICES XVI in Victoria

CC-S Endnote 3

**Proposal for a 1-day BIO/POC Topic Session at PICES XVI on
*Decadal changes in carbon biogeochemistry in the North Pacific***

This session will be the first effort by the PICES Section on *Carbon and Climate* (CC-S) to synthesize the current understanding on inter-relationship between the carbon cycle and climate in the Pacific. Emphasis will be placed on decadal change in carbon cycling, *e.g.*, anthropogenic carbon, air–sea exchange of CO₂, the biological pump, impacts of increasing levels of carbon dioxide on carbonate chemistry and marine biota, and possible feedbacks to atmospheric greenhouse gases. We expect that the session will enable us to update our

understanding of the relationships between the carbon cycle, marine biota, and climate in the Pacific, and to identify gaps in our knowledge for future research in areas of importance for the PICES Section on *Carbon and Climate*.

Recommended convenors: James Christian (Canada) and Toshiro Saino (Japan).

Potential invited speakers: Taro Takahashi (U.S.A.), James Orr (France), Ichiro Yasuda and Makio Honda (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* (hereafter HAB-S) met from 08:30–17:30 hours on October 15, 2006, under the chairmanship of Drs. Hak-Gyoon Kim and Vera L. Trainer. The meeting was attended by 8 members from Canada, Japan, Korea, and the U.S.A. (*HAB-S Endnote 1*). While there were 5 observers from China, none from Russia attended the meeting. The proposed agenda for the meeting was reviewed and approved (*HAB-S Endnote 2*).

Scientific presentations (Agenda Item 3)

Presentations were given by several HAB-S members and observers (see *HAB-S Endnote 2*). Topics ranged from HAB monitoring to information on the development of new projects.

HAE-DAT database (Agenda Items 4 and 5)

Current status

Area codes have been finalized for all PICES member countries except for Canada, and its codes are being entered. In the summary of HAE-DAT since 2000, it is important to note that incomplete or missing data is not the same as no HABs present, which must be made clear on the website. Dr. Monica Lion and Mr. Benjamin Sims presented the new on-line version of the IOC/ICES/PICES database. National reports have been entered from the ICES area from 1987 to 2004 (1681 reports). At present, there are changes from the old form (10 questions) to the new form in a user-friendly format that now uses ISO country codes. PICES is the first group of countries to submit data in the new format.

Next steps

The new HAE-DAT system allows: (1) input of data by national representatives – an on-line

input form is ready for use; (2) one to view and search existing data on-line (90% done); and (3) to get maps (via a UMN map server). The development of the on-line system (<http://www.iode.org/haedat>) is currently being funded by NOAA/NOS/CSCOR. This system will be open for direct access of data and for comments within 1 month after PICES XV. Potential users will have about 2 months to comment before it is revised into its final format. PICES members have been asked to:

- join the HAE-DAT mailing list by getting a password/name;
- test the system to see what is wrong, and inform HAE-DAT staff;
- check the existing reports and correct them where necessary; and
- enter new records.

Suggested revisions by PICES members to HAE-DAT include:

- creating a general map of area codes in each country for reference, or a pop-up window with area codes (need a visual tool);
- using the depth of maximum cell or toxin concentrations;
- collaborating with NOWPAP (their bibliography of HAB references and their database);
- stating clearly on the website what each country is actually reporting and which areas are actually being monitored for HABs and for what species or toxin.

All PICES member countries were requested to:

- re-check their country monitoring descriptions to ensure they are correct and as comprehensive as possible;
- participate in a month trial period for suggestions and improvements to HAE-DAT (ICES members also will be contacted);
- input HAB event data to HAE-DAT for 2003 directly to the on-line database.

The further development of HAE-DAT will also benefit from establishing links with MON-DAT (shellfish monitoring program, currently not very user friendly) and with HAB-MAP (to compile information on occurrence of toxic species from gray literature, websites and databases (thru ISSHA) to make maps).

Discussion focused on HAE-DAT effectiveness, possible modifications and future data efforts followed by a practical exercise on entering national HAB data for the year 2002 in the database.

National reports (Agenda Item 6)

Canada: No report.

China: In 2002, bi-weekly sampling was carried out in 19 red tide monitoring zones. 453 red tides occurred in China from 2001-2005, most frequently in June. These are discoloration of water events so economic losses are not necessary, but there appears to be a trend toward more HAB species in China in recent years. Most red tides are found in the East China Sea. Red tides are found in all months in the South China Sea (more species due to its tropical nature), most frequently in spring. There is an increasing trend of elevated N:P ratios (> 100 or more) in some places like the Pearl River estuary.

Japan: There are 7 HAE area divisions in Japan (area codes: JP-01 to JP-07). In 2002, a total of 301 events were reported, 32 with damage. Most of them occurred in Kyusyu (JP-05) which had 123 events and 19 with damage. In the Seto Inland Sea (JP-04), there were 89 events and 8 with damage. The major species of concern are *C. antique*, *C. marina*, *H. akashiwo*, *K. mikimotoi* and *H. circularisquama*. *C. polykrikoides* was found in JP-06 (San-in area) for the first time. The first attention to PSP in Japan occurred in 1978. It used to be found only in northern Japan, but now it is also occurred in southern Japan. There was a US \$60 million loss to the finfish aquaculture industry in 1972. This stimulated the introduction of the Seto Inland Sea Law in 1973 to curb eutrophication.

Japan reports red tides separately from PSP and DSP events.

Korea: An overview on recent East Asian regional cooperation efforts was provided, including:

- IOC/WESTPAC HAB workshops;
- PICES HAB Section activities;
- NOWPAP activities since 1994;
- EAST-HAB (Japan, Korea and China) since 2004;
- MOMAF(NFRDI)/NOAA workshop on *Cochlodinium* in May 2006

Russia: No report.

U.S.A.: The U.S. National HAB Office takes charge of all the reports to be submitted to HAE-DAT from the country. Agencies responsible for HAB incidence reporting on the U.S. West Coast are: Alaska Department of Fish and Game, Washington Department of Health, Oregon Department of Agriculture, and California Department of Health.

Planning for PICES XVI (Agenda Item 7)

Since 2005, the HAB Section has been holding an annual series of workshops to document the existing knowledge on the eco-physiology of harmful algal bloom species that impact all, or most, countries in the North Pacific. For PICES XVI, the Section recommends a 1-day MEQ workshop on “*Review of selected harmful algae in the PICES region: III. Heterosigma akashiwo and other harmful raphidophytes*”, co-convened by Drs. Ichiro Imai and Charles Trick (*HAB Endnote 3*). A product from the workshop will be a list of recommendations to help guide collaborative HAB research priorities in PICES countries over the next 5 years. The workshop will be preceded by a ½-day laboratory demonstration on *Heterosigma* cell and toxin detection. Drs. Trainer, Trick and Mr. Robin Brown have agreed to co-lead the demonstration. Travel funds are requested for 2 invited speakers to attend the workshop. The suggested experts are: Atsushi Ishimatsu and Tatsuya Oda (Nagasaki University, Japan), Theodore Smayda (University of Rhode Island,

U.S.A.), and Carmelo Tomas (University of North Carolina, U.S.A.)

The Section also proposes a 1-day MEQ Topic Session on “*The relative contributions of off-shore and in-shore sources to harmful algal bloom development and persistence in the PICES region*”, co-convened by Drs. Hao Guo and Trainer (HAB-S Endnote 4). Travel funds are requested for 1 invited speaker to attend the session. The suggested experts are: Barbara Hickey (University of Washington, U.S.A.), Andy Thomas (University of Maine, U.S.A.) and a *Cochlodinium* expert from the western Pacific.

A 1-day HAB-S meeting is recommended, which includes country reports for HAB events in 2005–2006 and discussion of HAE-DAT use. To strengthen and ensure the success of HAE-DAT, the Section requests stronger participation by a delegate from Russia and funding for this delegate, if needed.

Other business (Agenda Item 8)

The results of the annual HAB workshops on *Alexandrium* and *Pseudo-nitzschia* (2005) *Cochlodinium* and *Dinophysis* (2006), and *Heterosigma* (2007) are expected to be published as a PICES Scientific Report or other publication. The lead authors and sections of this publication will be outlined at PICES XVI.

HAB Endnote 1

Participation list

Members

William P. Cochlan (U.S.A.)
 Ichiro Imai (Japan)
 Shigeru Itakura (Japan)
 Hak-Gyoon Kim (Korea, Co-Chairman)
 Vera L. Trainer (U.S.A., Co-Chairman)
 Charles Trick (Canada)
 Yasunori Watanabe (Japan)
 Mark L. Wells (U.S.A.)

Observers

Robin M. Brown (Canada)
 Rongshuo Cai (China)

Hao Guo (China)
 Janice Lawrence (Canada)
 Xuezheng Lin (China)
 Monica Lion (Spain, IOC)
 Kazumi Matsuoka (Japan)
 Kazutaka Miryahara (Japan)
 Satoshi Nagai (Japan)
 Tatsuya Oda (Japan)
 Beatriz Reguera (Spain)
 Jack Rensel (U.S.A.)
 Theodore Smayda (U.S.A.)
 Jinhui Wang (China)
 John E. Stein (U.S.A.)
 Lijun Wang (China)
 Takafumi Yoshida (Japan)

HAB Endnote 2

HAB-S meeting agenda

1. Welcome, goals of HAB Section meeting
2. Approval of agenda
3. Scientific presentations:
 - “*The monitoring system on HABs in China*” by H. Guo
 - “*A regional U.S. west coast observing system for toxigenic Pseudo-nitzschia*” by V.L. Trainer, B. Hickey and M.G. Foreman
 - “*An international paralytic shellfish poisoning project*” by B. Wright
4. Progress in the development of an international collaborative harmful algal event database: The joint IOC/ICES/PICES HAE-DAT
5. Discussion and assistance in entering year 2002 data into HAE-DAT
6. National reports/HAE-DAT (year 2002)
7. Planning for PICES XVI
8. Other business

HAB Endnote 3

**Proposal for a 1-day MEQ workshop and ½ day laboratory demonstration at PICES XVI on
“Review of selected harmful algae in the PICES region: III. *Heterosigma akashiwo* and other
harmful raphidophytes”**

This workshop is the third of an annual series in which Harmful Algal Bloom (HAB) species that impact all or most countries in the North Pacific are discussed in detail. In 2007, we will focus on one species of raphidophytes, in particular, *Heterosigma akashiwo*. This species is distributed throughout the PICES region and has caused serious damage to finfish aquaculture, resulting in severe economic losses in PICES member countries. The integration of information from each country will advance our understanding of this organism. Topics will include modes of toxicity, distribution, impact

(differences between toxic and nontoxic strains), as well as physiology and ecology in each of the member countries. In particular, we would like to identify additional studies needed specifically to define *H. akashiwo*'s mode of toxicity. Comparison with similar raphidophytes, namely *Chattonella* and *Fibrocapsa*, will also be included. The workshop will be preceded by a half-day laboratory demonstration on *Heterosigma* cell and toxin detection.

Recommended convenors: Ichiro Imai (Japan) and Charles Trick (Canada).

HAB Endnote 4

**Proposal for a 1-day MEQ Topic Session at PICES XVI on “The relative contributions of off-shore
and in-shore sources to harmful algal bloom development and persistence in the PICES region”**

There is increasing recognition that some harmful algal blooms (HABs) affecting coastal waters may not have local origins but are advected from offshore waters. This session will highlight recent advances in studying the processes involved in near-shore versus off-shore development and transport of harmful algal blooms in the coastal waters of the PICES region. Of particular interest are field studies where the relative importance of local versus

remote development of HABs has been assessed. The session convenors are soliciting papers describing known off-shore and near-shore initiation sites, seedbeds, and the physical factors that facilitate transport of HABs to coastal sites where they may impact fisheries.

Recommended convenors: Hao Guo (China) and Vera L. Trainer (U.S.A.).

REPORT OF WORKING GROUP 18 ON MARINE AQUACULTURE



The Working Group (WG 18) on *Mariculture in the 21st century – The intersection between ecology, socio-economics and production* met on October 14, 2006, with Mr. Michael Rust (U.S.A.) chairing the meeting. Dr. Jack Rensel served as rapporteur. Only 7 scientists from 4 PICES member countries were in attendance (representatives from China and Korea were absent), and only 4 of the 14 Working Group members were present (*WG 18 Endnote 1*). After brief introductions, the draft agenda was reviewed and approved with no additions (*WG 18 Endnote 2*).

Third International Symposium on “Stock enhancement and sea ranching” (Agenda Item 3)

The symposium took place in September 2006, in Seattle (U.S.A.), without PICES support. The abstracts and program of the meeting can be found at <http://www.searanching.org>. Posters from the meeting will be added in the future. The symposium proceedings will be published in *Reviews in Fisheries Sciences*. The next symposium will be held in China in 2010.

Reports on other relevant meetings (Agenda Item 4)

A meeting on “*The role of aquaculture in integrated coastal and ocean management*” was convened in April 2005, on Oahu, U.S.A. The product of that meeting entitled “*The role of aquaculture in integrated coastal and ocean management: An ecosystem approach*” (Eds. J.P. McVey, C-S. Lee, and P.J. O’Byrne) will be published by The World Aquaculture Society.

Drs. Galina Gavrilova and Vasily Radashevsky reported that the MEQ/FIS Topic Session on “*Current and emerging issues of marine and estuarine aquaculture in the Pacific Region: Carrying capacity, ecosystem function and socioeconomics*” was convened at PICES XIV

(October 2005, Vladivostok, Russia). The summary of the session is included in the 2005 PICES Annual Report. The talks on aquaculture in Russia and on salmon culture were very well attended. A conclusion from the discussion at the session was that the issues of carrying capacity should be continued. Unfortunately there was no participation by our Chinese colleagues, and WG 18 membership attendance was low (only 4 Working Group members were present).

Summary of WG 18 activities and history (Agenda Item 5)

WG 18 was established at PICES XII (2003) in Seoul (Korea), under the direction of the Fishery Science (FIS) and Marine Environmental Quality (MEQ) Committees. It was expected that the focus of this group should be on the environmental and ecosystem function, sustainability of production (*e.g.*, carrying capacity of ecosystems), and socioeconomics, rather than on the technology of aquaculture or specific aspects of nutrition of culture species. The WG 18 Terms of Reference can be found in *WG 18 Endnote 3*. WG 18 met for the first time at PICES XIII (October 2004, Honolulu, U.S.A.) to plan its activities.

National reports on “*Current status and trends in aquaculture*” of 5 PICES member countries were published in the 2004 PICES Annual Report, and the Russian report was included in the 2005 Annual Report. This accomplishes the first Term of Reference of WG 18.

The second Term of Reference was to develop an overview of current and emerging issues, with respect to environmental and ecosystem function, sustainability of production (*e.g.*, carrying capacity of ecosystems), and socioeconomics. Two MEQ/FIS Topic Sessions related to this issue were held at PICES Annual Meetings (on “*Current and emerging issues of*

marine and estuarine aquaculture in the Pacific Region: Carrying capacity, ecosystem function and socio-economics” at PICES XIV, and on “*Aquaculture for sustainable management of marine environment and ecosystem*” at PICES XV), but no overview of current and emerging issues was produced or discussed. The summary of the last session is included in the *Session Summaries* chapter of this Annual Report.

The third and final Term of Reference was to convene a workshop on “*Scientific issues for sustainable aquaculture in the PICES region*”. It was expected that a product from the workshop would be recommendations for a PICES Action Plan on scientific issues of marine aquaculture. No action on this issue was taken.

Discussion on WG 18 future (Agenda Item 7)

Some of the objectives in the WG 18 Terms of Reference were duplicated by other international groups, such as APEC, FAO and the World Aquaculture Society. The question arises – How should WG 18 fit in or add to what other groups are already doing? Another question is – What recommendation should be made to our parent committees, FIS and MEQ, based on progress on the three Terms of Reference?

After much discussion, three options were identified:

1. complete Terms of Reference 2 and 3; if so, then who does what?
2. change the Terms of Reference; if so, then to what and who takes leadership for this?
3. dissolve the Working Group.

However, given the importance of this decision and the lack of attendance of other WG 18 members, those present felt that an e-mail should be sent to all members to provide their input (*WG 18 Endnote 4*).

The Working Group has suffered from low attendance by members at the past two meetings (only 4 of the 14 members were present at both PICES XIV and XV), so work will be done by correspondence to ensure that any meeting or workshop at PICES XVI (October 2007,

Victoria, Canada) is interesting and attractive to members.

In discussion of option 2, each participant at the meeting was invited to answer the question “What would be most beneficial to your country for a PICES Working Group on Aquaculture to focus on?” Responses are below:

Canada: Salmon aquaculture is under attack from some sectors of society. There is considerable culture of shellfish on both coasts. NGO and fisheries groups oppose aquaculture and there is significant misinformation on the actual risks of aquaculture operations.

Japan: Economic issues, disease issues and improving effectiveness of stock enhancement (sea ranching works but populations continue to decline) are high priorities. An issue is to improve quality, not quantity of fish produced for higher price. Imports from Norway, Korea and China keep prices of fish low. Hatchery diseases are problematic, and while there has been achievements with sea ranching there has not been much success in recovery and enhancement of existing stocks.

Russia: There are few hatcheries or farms but they need to expand. Aquaculture has not been a focus in the past but is becoming more so now. In comparison to Japan and China, Russia is not a traditional seafood consuming country, but attitudes are changing about expanding seafood production. Progress is slow, and there are no government initiatives, but there is growing recognition that seafood in the diet is important for health and for socio-economic reasons.

U.S.A.: Marine aquaculture is not a highly developed industry except for mollusks and a few finfish on Pacific Coast. Public confidence in the industry and opposition by fishermen are major issues, and perhaps PICES should take a socio-economic focus. The national government is in the process of developing laws and regulations for off-shore aquaculture, and scientific efforts are being made to adopt and apply FAO guidelines for risk assessment to help in the decision-making process.

WG 18 Endnote 1**Participation list**Members

Galina Gavrilova (Russia)
 Toyomitsu Horii (Japan)
 Michael Rust (U.S.A.)
 Hisashi Yokoyama (Japan)

Observers

Vasily Radashevsky (Russia)
 Jack Rensel (U.S.A.)
 Darlene Smith (Canada)

WG 18 Endnote 2**WG 18 meeting agenda**

- | | |
|---|--|
| 1. Welcome and introductions, appointment of rapporteur | 4. Reports on other relevant meetings or WG interactions |
| 2. Comments from WG 18 Co-Chairmen | 5. Summary of WG 18 activities and history |
| 3. Report on Third International Symposium on “ <i>Stock enhancement and sea ranching</i> ” | 6. Discussion on future of WG 18 |
| | 7. Other business |

WG 18 Endnote 3**Email to WG 18 members sent October 14, 2006**

Dear WG-18 member,

We are having discussions in Yokohama that impact the future of our Working Group and would like your input. This is the third year of our Working Group and it is set to expire. Below are the Terms of Reference for our group that was agreed to at our first meeting in Hawaii. WG members from Japan, Russia, and U.S.A. have been discussing these along with observers from Canada and U.S.A. Our current status is listed under each Term of Reference.

Terms of Reference:

1. Review and report on the current status and projected trends in aquaculture in marine and estuarine regions of PICES that substantively contribute to world aquaculture; [Done – published by PICES]
2. Develop an overview of current and emerging issues, with respect to environmental and ecosystem function, sustainability of production (e.g., carrying capacity of ecosystems), and socio-economics; [Sessions at PICES XIV and XV were convened but no overview document was produced. Are meeting reports enough? How is this different from other non-PICES efforts?]
3. Convene a workshop on “*Scientific issues for sustainable aquaculture in the PICES region*”. A product from the workshop would be recommendations for a PICES Action Plan on scientific issues of marine aquaculture. [Not started yet. What do we want to do?]

Based on our progress on the three terms of reference, what recommendation should be made to our parent committees, FIS and MEQ? We have identified three options. Please vote for one and return the email to mike.rust@noaa.gov by Tuesday, October 17th.

Recommendations to FIS/MEQ

1. Go ahead and complete TORs 2 and 3? If so, then who does what?
2. Change the Terms of Reference? If so, then to what and who takes leadership for this?

3. Dissolve Working Group.

If you choose option 2 would you support a new Working Group focused on one of these issues? (Vote for all you would support)

1. Possible new aquaculture working group focused on Canada, Japan, Russia and U.S.A. common
2. Aquatic animal health
3. Economics and regulated development of aquaculture industry (how does science inform decisions?)
Do scientists have these skills alone? Who else should be included in human health (quality?) aspects of aquaculture?

REPORT OF WORKING GROUP 19 ON ECOSYSTEM-BASED MANAGEMENT SCIENCE



The Working Group (WG 19) on *Ecosystem-based management science and its application to the North Pacific* held its second meeting from October 13–14, 2006, under the co-chairmanship of Drs. Glen Jamieson and Chang-Ik Zhang, and Ms. Patricia Livingston. Dr. Christopher Harvey served as rapporteur. A list of participants and the meeting agenda can be found in *WG 19 Endnotes 1* and 2.

Review of national/international approaches to establishing science-based eco-regions (Agenda Item 2)

Dr. Ian Perry reviewed the definitions of North Pacific ecosystems put forth by PICES and other researchers and institutions, the different management zones defined by member nations, and how closely ecosystem boundaries and management boundaries matched one another. He concluded that:

- Ecosystem boundaries are often difficult to define due to the lack of fixed geography and due to long-term variability in non-static boundary-forming processes;
- The Large Marine Ecosystems (LMEs) as defined by Sherman appear to be the most useful conceptualization of ecosystems for PICES member countries;
- Management boundaries are generally consistent and complementary between nations, although perhaps less so in the Bering Sea and in the western Pacific;
- It will be difficult to change existing statistical areas due to the historic value and inertia placed upon their usage, so PICES must build on historical context rather than trying to change it;
- Management areas are generally much smaller than LMEs, but the management areas can generally be aggregated to reasonably approximate LMEs.

Theoretical evaluation of the consequences of an artificial boundary (Agenda Item 3)

Drs. Harvey and Elizabeth Fulton provided an update on efforts to use Atlantis, a spatially explicit marine ecosystem modeling software, to examine how different management strategies on either side of a jurisdictional boundary (e.g., a national border) affect cross-border ecosystems. Harvey and colleagues are still in the process of completing an Atlantis model of the northern California Current, and therefore have yet to finish this task. It will be done by next year's Annual Meeting, either using the northern California Current model or one of Fulton's models for Australia.

National ocean management activity reports (Agenda Item 4)

Each member country outlined the processes and frameworks they are using to implement ecosystem-based management (EBM). A common problem among member countries is that the elements of EBM are often handled by different government agencies (for example, fisheries are managed by one ministry and environmental monitoring by another), and that there is often very little communication and collaboration between those agencies.

As it was noted last year, there are different conceptual frameworks among member countries. In Canada, Russia and the United States, EBM is mainly directed at maintaining or restoring ecosystems to relatively pristine status, while in China, Japan and Korea, EBM is described in the context of resource enhancement. In addition, there is a need for greater coordination and integration of management efforts, both within individual nations and between nations for resources that inhabit multi-national waters. As within nations, different aspects of EBM are handled by

different agencies or ministries, frameworks may not exist for coordinating those activities. Across nations, all PICES member countries manage resources that move into other EEZs (Exclusive Economic Zones), and the Working Group encourages PICES to support the development of regional management plans in these multi-national areas.

Two other concerns were raised by WG 19 on this agenda item. Firstly, certain words (*e.g.*, “ecosystem”, “integrative”) have different meanings and applications among different member countries, and a glossary of terms with agreed-upon definitions should be a part of the WG 19 final report. Secondly, written volumes describing marine eco-regions and science supporting EBM are crucial and should be living, evolving documents. However, they can grow very large and thus inaccessible to readers who need the information that they contain.

National ecosystem monitoring approaches (Agenda Item 5)

WG 19 members described highlights of their national monitoring plans. Each nation has devoted considerable resources to monitoring programs; Russia and Korea, in particular, have developed long time series and broad spatial coverage of a wide range of oceanographic and biological variables. Emerging issues that different nations are encountering include:

- the need to better define ecosystem objectives, so that monitoring programs can be used most effectively in management;
- the difficulty of getting managers, who are often in different agencies or ministries, to use monitoring data in decision-making;
- maintaining funding for monitoring programs.

Summaries of recent scientific meetings on ecosystem indicators (Agenda Items 6 and 7)

Two recent scientific meetings on ecosystem indicators were reviewed. Drs. Perry and Fulton revisited the 2004 Paris Symposium on “*Quantitative ecosystem indicators for fisheries management*”, which was described at last year’s WG 19 meeting. They broadened the

discussion to include new thinking on indicators. Dr. Fulton stressed the value that several “types” of indicators have had in monitoring ecosystem change. They include: relative biomasses, biomass ratios (*e.g.*, piscivores to planktivores), size spectra, maximum fish length, total fishery removals (or some other total human impact), size at maturity, biodiversity, and biophysical variables (*e.g.*, Chl-*a*). These can be rapidly measured and do not require special expertise or modeling to quantify. She has concluded that monitoring pelagic ecosystems requires fewer total indicators, but signal detection is slow. By contrast, demersal systems require more indicators but signal detection is rapid.

Dr. Perry described the Bering Sea Ecosystem Indicators project, a PICES effort funded by NPRB to define objectives, a monitoring program, and effective indicators for managing the southeastern Bering Sea. The process featured pre-workshops with diverse experts and stakeholders to maximize participation. These meetings were preparatory to the PICES/NPRB Indicators workshop convened on June 1-3, 2006, in Seattle, U.S.A. The project has produced recommendations concerning ecosystem objectives, socio-economic objectives, and communication objectives for better disseminating the project’s work within PICES, to the broader scientific community, and to the public. The final report will be published as *PICES Scientific Report No. 33* by the end of this year. It will include three white papers developed for the workshop (on “*Operational objectives for the southeastern Bering Sea*” by Gordon Kruse and Diana Evans, on “*Toward ecosystem-based management of the oceans: A perspective for fisheries in the Bering Sea*” by Andrea Belgrano, Jennifer Boldt, Patricia Livingston and Jeffrey M. Napp, and on “*Ecological indicators: Software development*” by Sergei N. Rodionov) and a summary of workshop discussions and recommendations. Outcomes of the workshop have been used by NPRB in developing an integrated ecosystem research plan for the Bering Sea.

It was recommended that WG 19 should focus not on choosing specific indicators, but rather on developing a scientific process by which proper

indicators are defined for a given ecosystem, such that the process can be readily developed and implemented in an EBM framework.

Content of the WG 19 final report (Agenda Item 8)

The final WG 19 report, due prior to the 2008 PICES Annual Meeting, will include a general introduction, national definitions of EBM, and a glossary listing and defining key terms. It will then summarize activities toward meeting the WG 19 Terms of Reference (TOR). Reporting plans for TORs are detailed below:

TOR #1: Describe and implement a standard reporting format for EBM in each PICES country. The report will include: (1) national definitions of EBM; (2) national objectives for EBM; (3) descriptions of how objectives are made operational in each country; (4) reports on national ocean management activities; and (5) a synthesis that describes similarities and differences among national approaches. *The Working Group no longer feels it is practical to create a standard reporting format because it would be prohibitively labor-intensive, so this aspect of the term of reference will not be considered further.*

TOR#2: Review existing definitions of eco-regions and identify criteria used for defining ecological boundaries. The report will include national identification criteria as presented at the PICES XV MEQ/FIS workshop (W3) on “Criteria relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area”, with particular attention to how national definitions compare with other ecosystem definitions (e.g., LMEs). The brief report of the workshop is included in the *Session Summaries* chapter of this Annual Report.

TOR #3: Evaluate indicators from the 2004 Symposium on “Quantitative ecosystem indicators for fisheries management”. The report will present the WG 19 recommendations for types of indicators (and not specific indicators) that have been analyzed in publications generated since the 2004 symposium. *The Working Group feels that this*

term should be broadened to include and integrate findings from the NPRB-funded PICES Bering Sea Ecosystem Indicators project into the final report.

TOR #4: Describe relevant national marine ecosystem monitoring approaches, plans, and models for predicting human and environmental influences on ecosystems. The WG is concerned that much of this Term of Reference has already been addressed, in the *PICES Scientific Report No. 18* on “Impact of climate variability on observation and prediction of ecosystem and biodiversity changes in the North Pacific” (2001). *The Working Group proposes to change this TOR to: Determine if national monitoring data currently being collected are sufficient to allow calculations of key indicators.* Each nation will summarize the monitoring approaches in one ecosystem or eco-region that are most representative of their implementation of EBM. Tentatively, those case studies will be: the Kuroshio Current (Japan), the Yellow Sea (Korea), the Okhotsk Sea (Russia), the Pacific North Coast (Canada), and the Bering Sea (U.S.A.). Key indicators will be calculated for each system and data gaps will be identified.

TOR #5: Hold an inter-sessional workshop that addresses the status and progress of EBM science efforts in the PICES region. For the purposes of the final report, we will summarize the content of a 1-day FIS/MEQ workshop on “Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation” proposed for PICES XVI in Victoria, Canada.

In addition, WG 19 will create an 8- to 10-page brochure that is essentially an Executive Summary of the final report. It will be published in 2008, with the foreseen target audience to be determined later. We hope that the brochure will be translated into the languages of all PICES member countries.

Planning for PICES XVI (Agenda Item 9)

WG 19 proposes a 1-day FIS/MEQ workshop “Comparative analysis of frameworks to develop an ecosystem-based approach to management

and research needed for implementation” to be convened at PICES XVI (WG 19 Endnote 3).

The structure of the workshop would be:

- a keynote talk summarizing activities of the Working Group;
- invited talks from other PICES Working Groups and committees (e.g., MONITOR, TCODE, or parent committees) that describe EBM-related tools and themes developed by other groups in PICES;
- invited talks from representatives of external institutions (e.g., FAO) that describe EBM-related tools and themes developed outside of PICES;
- an invited talk on the constraints to implementation of EBM;
- an invited talk on governance issues and difficulties related to EBM;

- An invited talk on socio-economic issues related to EBM; and
- Contributed talks solicited through the general abstract submission process.

In the evening following the workshop, WG 19 would convene for 2 hours to discuss the content of the workshop and incorporate it into the final report.

The desired outcomes of this workshop are:

- to fulfill the Terms of Reference of WG 19;
- to promote general discussion on objectives, practices, and implementation of EBM in PICES member countries; and
- To generate papers for a special issue or theme section of a prominent marine science journal, such as *Marine Ecology Progress Series* or *Progress in Oceanography*.

WG 19 Endnote 1

Participation list

Members

Elena Dulepova (Russia)
David Fluharty (U.S.A.)
Christopher Harvey (U.S.A.)
Oleg Ivanov (Russia)
Glen Jamieson (Canada, Co-Chairman)
Tatsu Kishida (Japan)
Jae-Bong Lee (Korea)
Patricia Livingston (U.S.A., Co-Chairman)
R. Ian Perry (Canada)

Vladimir Radchenko (Russia)
Inja Yeon (Korea)
Chang-Ik Zhang (Korea, Co-Chairman)

Observers

Robin M. Brown (Canada)
K. Alexandra Curtis (U.S.A.)
Elizabeth Fulton (Australia)
Henry Lee (U.S.A.)
Jacob Schweigert (Canada)

WG 19 Endnote 2

WG 19 meeting agenda

October 13

1. Welcome and introductions
2. Review of national and international approaches (maps, processes used to identify area) to establishing science-based eco-regions, and compare these to existing or planned “management” regions
3. Theoretical evaluation of the consequences of an artificial boundary that splits an ecological process and how that could affect management

4. National ocean management activity reports: the process and framework that each country is using to implement an ecosystem approach to management
5. National ecosystem monitoring approaches relevant to the eco-regions considered above

October 14

6. Findings from the 2004 Paris symposium on “Quantitative ecosystem indicators for fisheries management”

- | | |
|--|--------------------------------------|
| 7. Findings from the NPRB-funded PICES Bering Sea Ecosystem Indicators project | 8. Content of the WG 19 final report |
| | 9. Planning for PICES XVI |

WG 19 Endnote 3

Proposal for a 1-day FIS/MEQ workshop at PICES XVI on

“Comparative analysis of frameworks to develop an ecosystem-based approach to management and research needed for implementation”

An ecosystem-based approach to management (EBM) is an integrated approach to management of land, water, and living resources that promotes conservation and sustainable use over a broad range of human activities in an ecosystem. Implementation of an EBM for marine ecosystems in the North Pacific Ocean requires a number of steps and activities. An explicit framework that outlines the objectives, legal mandates, and institutional roles and responsibilities is essential. Data requirements and analytical tools need to be developed. This workshop invites papers to: 1) highlight existing national and international frameworks for implementation of an ecosystem approach to management; 2) outline the data requirements for such an approach; 3) describe the analytical tools being developed; 4) show the progress in

communicating results of EBM activities; and 5) discuss outstanding research gaps for making progress. The workshop will be organized to allow time for keynote summaries of PICES Working Group 19 results, invited contributions from other PICES groups, insights by other organizations involved in providing integrated ecosystem advice, talks on governance issues and difficulties, socioeconomic issues, *etc.* During a discussion period, participants are welcome to advise the convenors on the desirability of publishing the results of the workshop in a leading primary scientific journal.

Recommended convenors: Glen Jamieson (Canada), Patricia Livingston (U.S.A.) and Chang-Ik Zhang (Korea).

REPORT OF WORKING GROUP 20 ON EVALUATIONS OF CLIMATE CHANGE PROJECTIONS



The Working Group (WG 20) on *Evaluations of climate change projections* held its first meeting in the afternoon of October 14, 2006. The Co-Chairmen, Drs. Michael G. Foreman and Yasuhiro Yamanaka, called the meeting to order and welcomed the participants. The meeting was attended by 10 Working Group members and 28 observers representing all PICES member countries and several international organizations (*WG 20 Endnote 1*).

The meeting began with a brief presentation by Dr. Akihiko Yatsu, Co-Chairman of the CFAME Task Team, on the objectives and progress of that group. Dr. Foreman then led a discussion on how WG 20 might collaborate with CFAME in providing climate change scenario information that would be useful for the third component (*Scenarios*) of the CFAME workplan. Drs. Arthur Miller, Emanuele Di Lorenzo and Enrique Curchitser, all members of WG 20 who have already developed high-resolution models for the California Current system that have been, or are soon to be run with climate forcing, agreed to work with Dr. Vera Agostini of CFAME in providing physical information that would be useful for her ecosystem model of that region. Dr. Hiroyasu Hasumi agreed to work with Dr. Yamanaka in providing analogous data from his climate models in the Kuroshio/Oyashio region. Dr. Ig-Chan Pang volunteered to adapt his one-tenth of a degree circulation model for the Yellow and East China Seas so that it could accept boundary and atmospheric forcing from one, or an ensemble, of IPCC global climate model scenario runs. (In subsequent discussion with Dr. Foreman he also agreed to contact Dr. Jai-Ho Oh, another WG 20 member (not present), to see if it would be feasible to use high-resolution atmospheric forcing produced by Dr. Oh's models for some of these simulations.) In the absence of a high-resolution circulation model for the Sea of Okhotsk, it was decided that an

ensemble of climate model results could be provided to Dr. Victor Lapko for understanding possible changes to that ecosystem. It was not determined who would compute this ensemble, but Dr. Muyin Wang, on behalf of Dr. James E. Overland, proposed (see second paragraph below for more details) that calculations of this type be carried out for all sub-Arctic seas (including the Sea of Okhotsk) under the auspices of the GLOBEC regional program on Ecosystem Studies of Sub-Arctic Seas (ESSAS). So the ensemble might be computed in collaboration with that group.

It was also decided (subject to confirmation by CFAME and approval by Science Board) to convene a joint WG 20/CFAME workshop on "*Climate scenarios for ecosystem modeling*" at PICES XVI (*CFAME Endnote 4*). This was subsequently approved with Drs. Jacquelynne R. King and Michael G. Foreman to be the co-convenors. The suggested duration of the workshop is 1.5 days, with a format being 0.5 days with the groups separate, 0.5 days together and then 0.5 days apart again.

Dr. Kenneth Drinkwater (ESSAS SSC Co-Chairman) gave a presentation on the ESSAS goals and activities, with particular attention paid to a workshop they are organizing in June 2007, in Hakodate, Japan. Under Dr. Overland's leadership, this workshop is planning to initiate the evaluation of climate change projections for each of the ESSAS regions, and it was agreed to submit, through POC, a travel request for one WG 20 member to attend this meeting.

The issue of financial support for WG 20 members to carry out research relevant to the Terms of Reference was also briefly discussed. Dr. Foreman pointed out that although the North Pacific Research Board (NPRB) does have a request for proposals due December 1, 2006, these proposals must fall under the Board's

Science Plan. As that plan does not have provision for physical or climate modeling, it precludes NPRB as a potential funding source. The Bering Sea Integrated Ecosystem Research Program of NPRB is expected to release a request for proposals soon but it remains to be seen if WG 20 activities might be supported from that source. Though WG 20 is happy to provide letters of support and generally facilitate individual members in seeking out funding from their national sources, it does not appear that there are international vehicles to provide this support.

The issue of collaborations with international organizations/programs was briefly discussed. Dr. William R. Crawford, a Canadian member of the CLIVAR Pacific Panel, stated that

although this group seems primarily concerned with the tropical Pacific, it is indeed interested in the PICES region north of 30°N. It was suggested that an invitation should be extended to the CLIVAR Pacific Panel to attend the next WG 20 workshop.

The final item of discussion was a draft outline of the integrative science program, FUTURE, that PICES is hoping to initiate in the next couple of years. The latest version of the program outline was presented, and it was pointed out that the activities of WG 20 fit very well with the proposal. No specific suggestions for revisions were given but all were encouraged to attend either the POC meeting on October 18, or the Open Forum on October 19, where further discussions were planned.

WG 20 Endnote 1

Participation list

Members

Enrique Curchitser (U.S.A.)
Emanuele Di Lorenzo (U.S.A.)
Michael G. Foreman (Canada, Co-Chairman)
Hiroyasu Hasumi (Japan)
Arthur J. Miller (U.S.A.)
Ig-Chan Pang (Korea)
Elena Ustinova (Russia)
Muyin Wang (U.S.A.)
Yasuhiro Yamanaka (Japan, Co-Chairman)
Sang-Wook Yeng (Korea)

Observers

Vera Agostini (U.S.A.)
Kerim Y. Aydin (U.S.A.)
Manuel Barange (GLOBEC, U.K.)
Harold P. Batchelder (U.S.A.)
Robin M. Brown (Canada)
Rongshuo Cai (China)

Curtis Covey (U.S.A.)
William R. Crawford (Canada)
Kenneth Drinkwater (ESSAS, Norway)
Lei Gao (China)
Albert J. Hermann (U.S.A.)
George L. Hunt (U.S.A.)
Masao Ishii (Japan)
Hee-Dong Jeong (Korea)
Michi Kawamiya (Japan)
Jacquelynne R. King (Canada)
Dong-Young Lee (Korea)
Dooji Li (China)
Skip McKinnell (PICES)
Phillip R. Mundy (U.S.A.)
Keith Rodgers (U.S.A.)
Ryan Rykaczewski (U.S.A.)
Zhenya Song (China)
Ping Wang (China)
Francisco C. Werner (GLOBEC, U.S.A.)
Ichiro Yasuda (Japan)
Akihiko Yatsu (Japan)
Yury I. Zuenko (Russia)

REPORT OF WORKING GROUP 21 ON NON-INDIGENOUS AQUATIC SPECIES



The Working Group on *Non-indigenous aquatic species* (WG 21) held its first meeting on October 13, under the chairmanship of Ms. Darlene Smith. A list of participants can be found in *WG 21 Endnote 1*. Dr. Graham Gillespie served as the rapporteur. The draft agenda was reviewed and adopted without changes (*WG 21 Endnote 2*).

Terms of Reference (Agenda Items 4-6)

The participants reviewed WG 21 Terms of Reference (TOR) approved at PICES XIV (October 2005, Vladivostok, Russia). Progress toward accomplishing these Terms of Reference and developing a plan for their completion were discussed concurrently as TOR were reviewed: A summary of discussion is reported after each TOR.

TOR#1 Complete an inventory of all aquatic non-indigenous species (NIS) in all PICES member countries together with compilation and definitions of terms and recommendations on use of terms. Summarize the situation on bioinvasions in the Pacific and compare and contrast to other regions (e.g., Atlantic, Australia, etc.):

Should the inventory of NIS include freshwater as well as marine species?

This was discussed at some length with the conclusion that the NIS list would include marine and estuarine species but would not include exclusively freshwater species. This decision was based on PICES' focus as a marine science organization and the large magnitude of species if freshwater NIS were included. It was suggested to explicitly indicate that "*The organismal domain of WG 21 will be non-indigenous aquatic taxa that spend any life history stage in marine, estuarine, or brackish systems (this includes anadromous and catadromous taxa)*".

Should WG 21 create a new on-line database or take advantage of existing systems such as NISBASE (<http://www.NISBASE.org/nisbase/index.jsp>) or the Global Invasive Species Information Network (<http://www.gisnetwork.org/pubs.html>)?

WG 21 recognizes that the creation of a new PICES on-line database would require resources, both human and financial. WG 21 members will investigate the existing internet databases and provide their preferences on how to proceed with this issue. [Action]

Drs. Henry Lee and Debbie Reusser will make contact with both the USGS-Gainesville and the Smithsonian about the process of linking into NISBASE. [Action]

Definitions of terms and recommendations on use of terms

A number of countries (China, Russia, Japan) do not have definitions described in law or policy, but do have terms that are generally used to describe non-indigenous species that may or may not be harmful. In Canada and the United States the implication of harmful is associated with invasive.

The Chairman will compile definitions from Canada, the U.S. and the ICES Working Group on *Introductions and Transfers of Marine Organisms* (WGITMO), and will seek input from China, Korea, Japan and Russia. Following this meeting draft PICES definitions will be produced for subsequent discussion and agreement.

Summarize the situation on bioinvasions in the Pacific and compare and contrast with other regions

This was discussed briefly and requires additional thought as it is potentially a large undertaking. It was noted that "situation" is a somewhat vague term. WG 21 seeks advice

from MEQ on what is meant by “situation”. It was suggested that “situation” could include a summary of national legislation/policy, research programs and management programs. It could also include a description of the major invasive species and the impacts they are having. [Action]

TOR#2 Complete inventory of scientific experts, in all PICES member countries, on aquatic non-indigenous species subject areas and of the relevant national research programs/projects underway:

An inventory of scientific experts

It was concluded that if distribution of an inventory of scientific experts was limited to PICES members that this should not be an issue. Should the inventory receive wide distribution, this will need to be re-visited.

The participants discussed the relative scarcity of taxonomic expertise in all member countries, with the situation perhaps most pressing in Western Pacific countries. The Census of Marine Life (CoML) was identified as an example of international exchange of taxonomic expertise, but it was noted that CoML has a limited lifespan. A joint ICES/PICES workshop was discussed as a means to continue centralizing expertise after CoML has completed its term.

The need to explore linkages between classical taxonomy and molecular techniques was also discussed. It was suggested that this would be an ideal theme for a future symposium.

Dr. Adolf Kellermann suggested that the PICES and ICES Working Groups may wish to produce a compilation of vernacular names, and that ICES and PICES could consider joint financial support of such an undertaking. The participants also brought up the possibility of PICES translating critical taxonomic keys into a common language (English). This is not exactly the same as a compilation of vernacular names.

The U.S. has conducted Rapid Assessment Surveys which are week-long field surveys attended by a broad range of taxonomic experts.

ToR#3 Review and evaluate initiatives on mitigation measures (e.g., ICES Code of Practice for the Introduction and Transfer of Marine Organisms; IMO Ballast Water Management Convention and others such as the Canadian Introductions and Transfers Code):

Again, this TOR is a significant project. For now, documents will be compiled and made available to WG 21 members. The list of documents was expanded beyond the suggested examples to add material from Australia and New Zealand, the Canadian Shipping Act and U.S. Management Plans and included the following documents:

- Australian guidelines for managing marine pest biofouling risks;
- RAC-SPA Action Plan concerning species introductions and invasive species in the Mediterranean Sea;
- Risk assessment of ballast water mediated species introduction: A Baltic Sea approach;
- Guidelines for controlling the vectors of introduction into the Mediterranean of alien species and invasive marine species: Hull fouling.

It was suggested that the documents be reviewed for commonalities and uniqueness. [This action was not assigned.]

Jeffery Herod is to supply a report developed by a Technical Advisory Group to the California State Lands Commission for Ballast Water Performance Standards. This report includes summary of best available information and IMO guidelines. [Action]

References to California reports:

<http://ucce.ucdavis.edu/files/filelibrary/5802/25917.pdf>

http://www.slc.ca.gov/Division_Pages/MFD/MFD_Programs/Ballast_Water/Ballast_Water_Default.htm

http://www.slc.ca.gov/Division_Pages/MFD/MFD_Programs/Ballast_Water/Documents_of_Interest.htm

References to National U.S.A. reports:

<http://www.anstaskforce.gov/Species%20plans/national%20mgmt%20plan%20for%20mitten%20crab.pdf>

http://www.anstaskforce.gov/Species%20plans/Mitten_Crab_NMP_Implementation_Table_092905.pdf

<http://www.anstaskforce.gov/Species%20plans/Final%20NMP%20for%20the%20Genus%20Caulerpa%20111005.pdf>

TOR#4 Summarize research related to best practices for ballast water management:

It was noted that only Canada and the U.S. have ballast water sampling programs.

Suggested sources for information included the U.S. Coast Guard and U.S. Geological Survey (USGS), and Richard Emmett at the USCG Washington DC office was recommended as a contact. The Northeast Midwest Institute website (<http://www.nemw.org>) summarizes ballast water legislation in the U.S.

Dr. Blake Feist has provided contact information for USGS work on development of molecular markers for verifying that ballast water exchange has occurred (Dr. Rusty Rodriguez, USGS/Biological Resources Division, Western Fisheries Research Center, ph.: 206-526-6596, e-mail: rusty_rodriguez@usgs.gov).

The ICES/IOC/IMO Working Group on *Ballast Waters and Other Ship Vectors* (WGBOSV) is in the process of developing a Technical Manual for Ballast Water Sampling. It was suggested that a draft of the document be distributed to WG 21 members.

Russian participants indicated that they were interested in ballast water sampling methods. Responsibility for collecting and summarizing available material will be assigned later. [Action]

TOR#5 Coordinate activities of WG 21 on non-indigenous aquatic species with related WGs in ICES through a joint back to back meeting of the PICES and ICES Working Groups on invasive species in 2007/2008:

The participants agreed that the objectives of the coordination of WG 21 and WGITMO and WGBOSV activities would be the sharing of information and avoidance of duplication of effort. This would be facilitated through joint meetings, cooperative document development, and post-meeting information exchange (e.g., through email summaries or web postings).

A joint meeting of ICES and PICES Working Groups was suggested. The most viable option seemed to be a meeting in conjunction with the 5th International Marine Bioinvasions Conference (May 2007, Cambridge, U.S.A.). Other possible venues include the spring meeting of WGITMO and WGBOSV (March 2007, Dobrovnik, Croatia) and PICES XVI (October 2007, Victoria, Canada).

Potential agenda items include: discussion of taxonomic issues and development of taxonomic expertise exchanges between ICES and PICES member countries; completion of a ballast water sampling technical manual; development/completion of Codes of Practice for ship hull fouling and port sampling; discussion of rapid response and control options; and consistency of information gathered, collated and distributed.

The possibility of using PICES funds to provide travel support for WG 21 members was discussed. Clarification was to be sought from the PICES Executive Secretary.

TOR#6 Develop and recommend an approach for formal linkages between PICES and ICES on non-indigenous aquatic species:

The participants suggested that (1) ICES and PICES Working Groups' Terms of Reference should be shared, and (2) a joint ICES/PICES fund for taxonomic specialist exchange be established. Dr. Kellermann indicated that ICES would seriously consider this.

Other linkages discussed included joint meetings, cooperative document development (e.g., ballast water sampling guidelines, code practice for hull fouling) and formal communication of minutes or meeting reports through e-mail and the web.

TOR#7: *Publish final report summarizing results and recommendations:*

Not much discussion took place on this point, and no formal dates or targets were set. WG 21 needs to make more progress toward accomplishing the Terms of Reference before diving into discussion of the final report.

Currently WG 21 has a 3-year mandate ending 2008. This is in contrast with WGITMO and WGBOSV which have been operating for many years. Depending on the future success of WG 21 in achieving its Terms of Reference and the extent of interest of PICES member countries, PICES may wish to consider creating a Section on non-indigenous aquatic species following the termination of WG 21.

PICES XVI – Proposal for a Topic Session on invasive species (Agenda Item 7)

WG 21 members agreed to propose a full-day MEQ Topic Session on non-indigenous species to be held at PICES XVI. During an extensive discussion, the following key areas for the session were suggested (*WG 21 Endnote 3*):

- Evolutionary consequences of invasions: “Know too much about ecology? Evolutionary consequences of marine NIS invasions on native species”. Studies abound documenting ecological impacts (*i.e.*, displacement, mortality, *etc.*) of NIS upon native populations, but there are comparatively few studies that demonstrate evolutionary impacts. As such, abstracts that address the topic of evolutionary impacts of NIS on native biota have to be solicited, and specifically, these abstracts need to demonstrate clear evolutionary responses of native species to selective pressure from invasive NIS. For example, an NIS invading and displacing a native species is an ecological consequence, but a native species evolving new anti-predator defenses in response to the invasion of an NIS is an evolutionary response;
- Ecosystem effects of bioinvasions;

- Impacts of climate change projections (and oceanographic variability) on bioinvasions: “Global climate change and its influence on the range expansion of NIS, and the amplitude and frequency of bioinvasions – it is not just for natives anymore”;
- Criteria used to identify species as native or non-native.

A balance must be reached between having too many topic areas *vs.* a very narrow selection that would reduce participation. Submitted abstracts that closely adhere to the theme would have priority for oral presentation, those that are more generally related to NIS can be accommodated for oral presentation as space allows or presented as posters.

Travel funds are requested from PICES for 2 invited speakers to attend the session. Should the session be approved, invited speakers must be secured as soon as possible. A few names were suggested (James Carlton, Chad Hewitt, Nicholas Bax, John Chapman, Andrew Cohen, David Pimentel, David Lodge, Michelle Mack, Daniel Simberloff, Ted Grosholz).

Discussion of potential joint ICES/PICES meetings (Agenda Item 8)

Two options for a joint meeting of ICES/PICES were discussed. The first is to take advantage of WG 21 members’ participation in the upcoming 5th International Marine Bioinvasions Conference in May 2007 (see Agenda Item 9). The second is to have it in conjunction with PICES XVI in October 2007. The following topics for discussion at the joint meeting were proposed:

- ballast water sampling methods;
- NIS databases;
- taxonomic challenges;
- ICES Code of Practice for ship hull fouling
- rapid response and control options.

It was suggested that a member of the U.S. Aquatic Nuisance Species Task Force be invited to the joint meeting. The issue of travel funds was raised by a number of WG 21 members.

Fifth International Marine Bioinvasions Conference (Agenda Item 9)

Dr. Judith Pederson provided an overview of the Conference to be held May 21–24, 2007, in Cambridge, Massachusetts, U.S.A. Details can be found on the Conference website at <http://massbay.mit.edu> or <http://www.mit.edu/mitseagrantweb>. Deadline for abstracts submission is January 2007. All WG 21 members are encouraged to attend the conference.

Informal round table discussion on priority aquatic invasive species issues in PICES-member countries (Agenda Item 10)

Canada – Discussion included: developing data standards related to geo-referencing and format and coding standards (including taxonomic issues related to standard species codes) as they relate to information transfer from regional to national initiatives; a summary of programs underway related to ballast water; bioinvasion biology, surveys and monitoring; risk assessment; rapid response plans and citizen engagement. Vectors of particular concern are ballast water, fouling, live seafood and aquarium trades.

China – Priority issues were non-native seagrass (*Spartina*) that invaded from North America in the 1960s and an exotic bivalve that invaded from Hong Kong and competes for food resources with cultured species.

Japan – Discussion focused on benthic community invasion in Tokyo Bay, including high densities of Mediterranean [European?] green crab, North American spider crab and Atlantic quahog clams. Interestingly, these species are dominant in polluted areas which limit their interaction with native species.

Russia – Priority issues were increased natural dispersal of tropical species in response to global warming; increased risk of invasion due to

shipping traffic to a proposed oil terminal; and species of particular concern (tunicates and spionid polychaetes).

U.S. – Discussion points included development of control management plans; increased awareness in the scientific community of NIS issues (the possibility of research projects as vectors); the need to develop information bases for native species (as our native is someone else's invader); and the need to be cognizant of potentially large ecological effects of relatively small species (*e.g.*, *Potamocorbula*).

Summary of recommendations to MEQ

WG 21 seeks MEQ approval of the following recommendations:

1. To hold a joint meeting of WG 21 with the ICES Working Group on *Introductions and Transfers of Marine Organisms* and the ICES/IOC/IMO Working Group on *Ballast Waters and Other Ship Vectors*, in fulfillment of one of its Terms of Reference. The meeting would be convened May 25-26, 2007, in Cambridge (U.S.A.), immediately following the Fifth International Marine Bioinvasions Conference. Travel funds from PICES are requested to permit 1 Chinese and 1 Russian member to attend the Conference and the joint meeting.
2. To convene a Topic Session at PICES XVI in Victoria, Canada. This session would focus on the following key areas:
 - Evolutionary consequences of invasions;
 - Ecosystem effects of bioinvasions;
 - Impacts of climate change projections (and oceanographic variability) on bioinvasions;
 Travel funds from PICES are requested for 2 invited speakers for this session.
3. To request that Russia nominate Dr. Vasily Radashevsky as a member of WG 21, and that he be named as WG 21 Co-Chairman.

WG 21 Endnote 1

Participation list

Members

Evgenyi Barabanshchikov (Russia)
Blake Feist (U.S.A.)
Toshio Furota (Japan)
Graham Gillespie (Canada)
Henry Lee II (U.S.A.)
Bruce Mundy (U.S.A.)
Darlene Smith (Canada, Chairman)
Lijun Wang (China)

Observers

Galina Gavrilova (Russia)
Jeffrey Herod (U.S.A.)
Anders Jelmert (Norway, ICES WGBOSV)
Adolf Kellermann (ICES)
Judith Pederson (U.S.A., ICES WGITMO)
Vasily Radashevsky (Russia)
Debbie Reusser (U.S.A.)
Chiemi Tezuka (Japan)

WG 21 Endnote 2

WG 21 meeting agenda

1. Welcome and introductions
2. Nomination of a rapporteur
3. Adoption of agenda
4. Review of WG 21 Terms of Reference
5. Review of progress in accomplishing the Terms of Reference
6. Develop a plan for completing the Terms of Reference
7. PICES XVI – Proposal for a Topic Session on invasive species
8. Discussion of potential joint ICES/PICES meetings
9. Fifth International Marine Bioinvasions Conference
10. Informal round table discussion on priority aquatic invasive species issues in PICES member countries

WG 21 Endnote 3

Proposal for a 1-day MEQ Topic Session at PICES XVI on

“Non-indigenous species: Climate change, evolutionary consequences and ecological impacts”

The global community is becoming increasingly aware of the importance of invasions of non-indigenous species in the marine environment. The issue is extremely complex. This session will be limited to three sub-topics of interest to PICES member countries:

- 1) Global climate change is further complicating the study and prediction of bioinvasions and its influence on the range expansion of non-indigenous species (NIS) and the amplitude and frequency of bioinvasions. This is particularly the case in areas where bioinvasions have been halted by climatic conditions. We are seeking presentations that document the impact of climate change on marine bioinvasions.
- 2) Studies abound documenting ecological impacts (*i.e.*, displacement, mortality, *etc.*) of NIS upon native populations, but there

are comparatively few studies that demonstrate evolutionary impacts. As such, we are soliciting papers that address the topic of evolutionary impacts of NIS on native biota, and specifically, presentations that demonstrate clear evolutionary responses of native species to selective pressure from invasive NIS. For example, an NIS invading and displacing a native species is an ecological consequence, but a native species evolving new anti-predator defenses in response to the invasion of an NIS is an evolutionary response.

- 3) Finally, we seek presentations that show the ecological impacts of bioinvasions that have led to declines in wild fisheries and mariculture.

Recommended convenors: Blake Feist (U.S.A.) and Graham Gillespie (Canada).

REPORT OF THE STUDY GROUP ON GOOS

The Study Group to develop a strategy for GOOS (hereafter SG-GOOS) met from 18:30–20:30 hours on October 17, to consider the draft report of SG-GOOS to MONITOR. All Study Group members were in attendance (*SG-GOOS Endnote 1*). The SG-GOOS Terms of Reference are presented as *SG-GOOS Endnote 2*.

An extensive discussion of the draft report occupied the available time at the meeting. Preliminary recommendations were expended to clarify the role of PICES as a coordinator of observing systems. It was noted that clarity must be achieved on what is an observing system*. In the future, it will be important to distinguish between observing systems, as indefinitely long-term multi-disciplinary integrated monitoring systems, and programs for producing a limited time series of observations for limited periods of time.

Recommendations

It is recommended that:

- PICES should not propose a North Pacific GOOS pilot project to I-GOOS;
- PICES should establish a coordinating body for North Pacific observing systems, NPOS, as a section under MONITOR (*SG-GOOS Endnote 3*). This NPOS Section would provide a forum for representatives of the existing North Pacific observing systems to develop, in cooperation with TCODE, cross-GRA (GOOS Regional Alliance) international observing projects, observing technologies, and data and information sharing protocols, starting in 2007;
- the Terms of Reference of the MONITOR Committee be modified to explicitly include facilitation of cooperation, communication and coordination among North Pacific ocean observing systems.

Next steps

It was suggested that the next steps should include:

- Sending a PICES representative to the 3rd Forum of GOOS Regional Alliances to be held on November 14–17, 2006, in Cape Town, South Africa. It appears that Dr. Vyacheslav Lobanov may be able to attend; however, Dr. Skip McKinnell may be able to serve as a backup;
- Contacting the GOOS Scientific Steering Committee (GSSC) to explore possible roles for PICES in the context of the broad objectives recommended above;
- Requesting the coordination role of PICES be placed on the agenda of the next GSSC meeting to be held on March 13–17, 2007, in Seoul, Korea, and sending a representative from the NPOS Section to attend this meeting. Dr. Dong-Young Lee, who chairs GSSC along with Dr. John Field, has offered to facilitate participation by the NPOS Section should it be approved by Council;
- Establishing contacts with the leadership of the relevant GRAs to explore ways in which PICES can enable their development and facilitate coordination with other North Pacific GRAs. The NPOS Section, if approved, will make these contacts, based on the information provided in Table 1;
- Tasking the NPOS Section to report annually on progress, and preparing further recommendations on relations between MONITOR and North Pacific GRAs for the purpose of developing scientifically and technically sound observing systems. This report would address status of coordination among the components of existing observing systems, status of cross-GRA projects such as the Continuous Plankton Recorder project, progress in establishing foundations for scientifically sound observing systems, and progress in the use of common information exchange methods such as the Global Telecommunications System (GTS).

* Working definition - Observing systems are bodies organized for long-term monitoring of marine environments

Table 1 Draft survey of North Pacific Ocean Observing Systems including LMEs.

Acronym or title	Contact Party	Status	Real time
<i>Western North Pacific</i>			
NEAR-GOOS	Takashi Yoshida	E	Y
CREAMS/PICES	Kyung-Ryul Kim and Yasunori Sakurai	E	N
EAST I	Kyung-Il Chang	E	N
SEATS	Kon-Kee Liu	E	Y
YELLOW SEA LME	Yihang Jiang	E	N
YOOS	Gongke Tan	P	
<i>Eastern North Pacific (north – south)</i>			
AOOS	Molly McCammon	E	Y
Canada Pacific Coast	David Mackas	E	Y
NANOOS	Jan Newton and David Martin	E	Y
NEPTUNE Canada	Chris Barnes	E	Y
ORION	K. Daly	P	Y
PaCOOS	Dolores Wesson	E	Y
CeNCOOS	Heather Kerkering	E	Y
SCCOOS	Eric Terrill	E	Y
PacIOOS	Eileen Shea	E	Y

Legend: E= existing, P= planned, Y= yes, N= no

Justifications

The establishment of the NPOS Section:

- Meets the PICES mission of promoting cooperation and collaboration in marine sciences among member nations; a forum for international collaboration within each region is much needed;
- Meets MONITOR Terms of Reference to promote international cooperation in development of observing projects, observing systems and means of data gathering and information exchange;
- Provides workers and contacts to assist in the production of the North Pacific Ecosystem Status Report, which is the responsibility of MONITOR.

Identification of North Pacific Observing Systems

The identification of specific data types by observing systems has been deferred pending the results of the Intergovernmental Oceanographic Commission (IOC) Circular Letter No. 2199, requesting that member states provide “National contributions to the Global Ocean Observing

System” which will be available at PICES XVI, and subsequent reports of the proposed MONITOR NPOS Section. In lieu of this information, two summary tables (Tables 1 and 2) have been provided.

Table 2 North Pacific Observing System national contacts and potential NPOS Section members.

Canada	William Crawford	E
	David Mackas	E
China	Shaohua Lin	E
Japan	Hiroya Sugisaki	E
	Sei-Ichi Saitoh	E
Korea	Hee-Dong Jeong	E
Russia	Vyacheslav Lobanov	E
	Evgeny Karasev	E
United States	Jack Barth	E
	Phillip Mundy	E

With input from the participants, SG-GOOS identified potential members of a North Pacific Observing Systems Section within MONITOR. Drs. Mundy and Lobanov were identified as possible Co-Chairmen.

Acknowledgements

The Study Group wishes to thank Prof. Worth Nowlin, Chairman of the U.S. GOOS Steering Committee, and the members of this committee

for their consideration of the issues and for their advice. Thanks also to Drs. Thomas Malone, Skip McKinnell and Alexander Bychkov for most helpful comments and advice.

SG-GOOS Endnote 1**Participation list**Members

William R. Crawford (Canada)
 Dong-Young Lee (Korea)
 Vyacheslav Lobanov (Russia)
 Phillip R. Mundy (U.S.A., Chairman)
 Sei-Ichi Saitoh (Japan)

Observers

Alexander Bychkov (PICES)
 Mizuho Hoshimoto (Japan)
 Adolf Kellermann (ICES)
 Anthony Koslow (Australia)
 Patricia Livingston (U.S.A.)
 Jeffrey M. Napp (U.S.A.)
 Jonathan Phinney (U.S.A./PaCOOS)
 John E. Stein (U.S.A.)
 Takashi Yoshida (Japan/NEAR-GOOS)

SG-GOOS Endnote 2**Terms of Reference for a Study Group to develop a strategy for GOOS**

1. Identify and describe the major observing systems (present and proposed) in the PICES region. Descriptions should include general data types, contact information, and data transmission (real-time vs. delayed);
2. Provide a recommendation and justification to MONITOR on whether or not PICES should propose a North Pacific GOOS pilot project to IGOOS.

SG-GOOS Endnote 3**Proposed Terms of Reference for a Section on North Pacific Observing Systems (NPOS)**

To establish a NPOS Section to:

1. Develop a scientific coordinating relationship with international GOOS (I-GOOS) through appropriate GOOS Scientific Steering Committees and regional observing systems;
2. Provide a forum for communication for existing North Pacific observing systems;
3. Assist in the development of international observing projects and observing technologies;
4. Aid, working in cooperation with TCODE, the development of data and information sharing protocols and the use of common information exchange methods such as the Global Telecommunications System (GTS).

REPORT OF THE IMPLEMENTATION PANEL ON THE CCCC PROGRAM



The Executive Committee of the Climate Change and Carrying Capacity Program Implementation Panel (hereafter CCCC-IP/EC) met from 18:00–20:00 hours on October 15, 2006. The meeting was chaired by Drs. Harold P. Batchelder and Suam Kim. The Co-Chairmen welcomed the participants, and after brief introductions of those present (*CCCC-IP Endnote 1*), the draft agenda was reviewed and adopted with slight modifications (*CCCC-IP Endnote 2*).

Business from PICES XIV (Agenda Item 3)

The minutes from PICES XIV (October 2005, Vladivostok, Russia) were accepted as is. No other items on-going from last year's meeting required discussion.

Review of procedures for Best Presentation Awards and Closing Ceremony

Awards for CCCC Best Oral and Poster Presentations were announced at the Closing Session. The Secretariat provided a list of presentations that were eligible for this award. Drs. Batchelder and Kim agreed to serve as judges to determine the best CCCC oral presentation from the eligible papers in the CCCC Topic Sessions (S6), FIS/CCCC Topic Session (S7) and the CCCC Paper Session. Dr. Batchelder was nominated and agreed to select the CCCC best poster for PICES XV. Ms. Muzzneena Ahmad Mustapha (Hokkaido University, Japan) won the CCCC Best Oral Presentation Award for her paper (co-authored by Sei-Ichi Saitoh) on "*Interannual variations of sea ice and spring bloom occurrences at the Japanese scallop farming area in the Okhotsk Sea*", presented at the CCCC Paper Session. Ms. Yasuko Kamezawa (Hokkaido University, Japan) won the CCCC Best Poster Presentation Award for her paper (co-authored by Tomonori Azumaya, Toru Nagazawa and Michio J. Kishi)

on "*Bioenergetics model of Japanese chum salmon (*Oncorhynchus keta*) growth*", presented at the FIS/CCCC Topic Session (S7).

Documentation of scientific sessions (Agenda Item 4)

CCCC-IP/EC discussed responsibilities for documenting CCCC-sponsored Topic Sessions and workshops at PICES XV. Dr. Suam Kim reminded the Committee that documentation of scientific sessions and workshops is required of session/workshop convenors. At PICES XV this responsibility rests with: Dr. Shin-ichi Ito for the CCCC Topic Session (S6) on "*Modeling and historical data analysis of pelagic fish, with special focus on sardine and anchovy*"; Dr. Akihiko Yatsu for the FIS/CCCC Topic Session (S7) on "*Key recruitment processes and life history strategies: Bridging the temporal and spatial gap between models and data*"; Dr. Suam Kim for the CCCC Paper Session; Dr. Fei Chai for the IFEP/MODEL Workshop (W1) on "*Modeling iron biogeochemistry and ocean ecosystems*", and Dr. Kerim Y. Aydin for the CCCC Workshop (W7) on "*Climate forcing and marine ecosystems*". These session and workshop summaries were provided to Dr. Batchelder by the end of Friday, October 20, and are included in the *Session Summaries* chapter of this Annual Report.

Progress reports of Task Team activities (Agenda Item 5)

CCCC-IP/EC received reports of CCCC Task Team activities from Co-Chairmen of MODEL and CFAME. On October 20, both Task Teams provided final reports that included a summary on their progress since PICES XIV and recommendations and planned activities for 2007, and even some for 2008.

Items of significance for CFAME were:

- review of activities from the January 2006 CFAME workshop (Tokyo, Japan), April 2006 CCCC Symposium (Honolulu, U.S.A.) and October 2006 CFAME workshop (Yokohama, Japan);
- discussion of future work within the CFAME Terms of Reference;
- discussion on the theme for the next major PICES scientific program (FUTURE);
- overview of the Bering Sea Ecosystem Study (BEST) of the GLOBEC regional program on Ecosystem Studies of Sub-Arctic Seas (ESSAS), and plans of the June 2007 ESSAS workshops in Hakodate, Japan;
- plans for an inter-sessional CFAME workshop in the spring of 2007 and a joint WG 20/CFAME workshop at PICES XVI in Victoria, Canada. WG 20 is developing scenarios of future climate in the North Pacific for use by CFAME (and others) to allow them to evaluate potential changes in marine ecosystems. The results of the spring 2007 inter-sessional workshop would be CFAME's contribution to the June 2007 ESSAS workshops and the October 2007 WG 20/CFAME workshop; and
- selection of a new CFAME Co-Chairman.

During the MODEL Task Team meeting the participants discussed:

- the accomplishments of MODEL over the past year;
- the outline for the next major PICES scientific program (FUTURE);
- plans for 2006–2007;
- requests for travel to future meetings;
- various new businesses; and
- the MODEL membership and selection of a new MODEL Co-Chairman.

Details of these discussions are provided in the MODEL and CFAME Task Team reports.

GLOBEC's activities on synthesis and integration (Agenda Item 6)

Drs. Francisco E. Werner (Chairman of GLOBEC-International SSC) and Dr. Manuel Barange (Executive Director of GLOBEC IPO) attended the CCCC IP/EC meeting to describe the synthesis and integration activities of

GLOBEC-International. GLOBEC-International ends in 2009, however, the recently established regional programs of GLOBEC such as CLIOTOP (Climate Impacts on Oceanic Top Predators) and ESSAS will continue beyond 2009, probably as part of a new science program of IGBP (International Geosphere-Biosphere Programme) called IMBER (Integrated Marine Biogeochemistry and Ecosystem Research). GLOBEC International and IMBER are exploring ways to merge these continuing GLOBEC programs into future IMBER activities. Funding was also kindly offered by GLOBEC-International to support travel costs of scientists from non-PICES nations to CCCC-related sessions at PICES XVI.

FUTURE – new PICES integrative scientific program (Agenda Item 7)

CCCC members reviewed the draft outline for a new PICES integrative scientific program on *Forecasting and Understanding Trends, Uncertainties and Responses of the North Pacific Ecosystem* (FUTURE). There was consensus that the direction of the proposed program is good, and that the focus is consistent with past and ongoing activities of the CCCC Program. Two major differences between CCCC and FUTURE are the emphasis on forecasting and on education, communication and outreach in the latter. FUTURE is consistent with the planned activities of MODEL and CFAME, and it is envisioned that the activities of these two Task Teams could become part of FUTURE.

There were, however, a number of concerns expressed by CCCC members about the FUTURE plan:

- The proposal emphasizes scientific work in a policy and management context, but the identity of the “clients” was not clear. Is it resource managers, the general public, or both?
- FUTURE is substantially different from CCCC in that FUTURE has an external constituency – there was a lack of consensus among CCCC members whether this constituency and the associated outreach and communication that are needed to “connect”

science with management/policy would require a different approach to science. Some members felt that the best approach was for scientists themselves to take on the task of communicating science to policy makers, but others felt that specialized experts in communication will be required.

- Although forecasts are technically feasible, the quality of forecasts will be a major issue. It will be very important that forecasts intended for policy decisions include estimates of uncertainty (probabilities), similar to what is presently done in weather forecasting. In particular, ecosystem models cannot yet provide useful long-term forecasts.
- PICES should be focused on doing good science, not on tailoring science to perceived management needs; if science is high quality and assists policy makers in decision-processes, then managers will embrace the science.
- Management systems and processes for connecting science to management may need to be tailored specifically for individual member countries, and it is not clear that a single program can address the needs of all.
- Scientific issues should be forwarded to the managers properly, and the focus on management and communications could require a new group within PICES such as an advisory panel to interpret science for management and the public. Research scientists may not be the best people to play the science policy role.
- The research on climate forcing and marine ecosystem responses needs to also include an emphasis on the short- and long-term effects of episodic events such as jellyfish outbreaks and hurricanes.

Changes in CCCC-IP/EC and Task Team membership (Agenda Item 8)

The CCCC-IP/EC decided to:

- Endorse requests to replace Drs. Akihiko Yatsu and Shin-ichi Ito with Drs. Young-Shil Kang (Korea) and Hao Wei (China) as new Co-Chairmen of CFAME and MODEL, respectively;

- Consider MODEL's request for nomination of two new members from Russia (instead of Drs. Irina Ishmukova and Gennady Kantakov), and addition of one new member (TBD) from Canada.

CCCC-IP/EC asked Dr. Batchelder to continue his chairmanship until the conclusion of the CCCC synthesis phase and development of the next PICES integrative scientific program, or through PICES XVIII (2009), whichever comes earlier. Dr. Michio J. Kishi has been elected as a new CCCC-IP/EC Co-Chairman, replacing Dr. Suam Kim.

Suggested changes in membership will be forwarded to Science Board and Governing Council for further actions.

The Executive Committee thanked the out-going Co-Chairmen (Drs. Yatsu, Ito, and Kim) for their leadership and contributions.

Proposals for new subsidiary bodies (Agenda Item 9)

The Executive Committee did not receive any proposals for new subsidiary bodies.

Planning for PICES XVI (Agenda Item 10)

The following scientific sessions and workshops were proposed:

- a 1-day CCCC/FIS Topic Session on "*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*" (MODEL Endnote 3);
- a 1-day POC/CCCC/MONITOR Topic Session on "*Operational forecasts of oceans and ecosystems*" (POC Endnote 4);
- a 1-day FIS/CCCC/BIO Topic Session on "*Fisheries interactions and local ecology*" (FIS Endnote 4);
- a 1-day CCCC Contributed Paper Session (CCCC Endnote 3); and
- a 1- or 1½-day POC/CCCC workshop, preceding the 2007 Annual Meeting, on "*Climate scenarios for ecosystem modeling*" (CFAME Endnote 4).

Theme proposal for PICES XVII (Agenda Item 11)

CCCC-IP/EC had no specific suggestions concerning the theme of the Science Board Symposium at PICES XVII (October 2008, Dalian, China).

CCCC inter-sessional activities and travel support requests/priorities for October 2006-October 2007 (Agenda Item 12)

The following inter-sessional meeting was proposed for the period between October 2006 and October 2007:

- A CFAME inter-sessional workshop (CFAME Endnote 3) on “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*” in preparation for active collaboration with WG 20, possibly held in North America in the spring of 2007. CCCC-IP/EC endorsed the CFAME request to support 2 invited speakers for this workshop (priority level 1).

CCCC-IP/EC requests travel support for:

- 2–3 CCCC scientists to attend the 4th International Zooplankton Production Symposium to be held May 28–June 1, 2007, in Hiroshima, Japan; it was noted that this symposium is co-sponsored by PICES;
- 1 invited speaker for the CCCC/FIS Topic Session on “*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*” (priority level 2);
- 1 invited speaker for the POC/CCCC/MONITOR Topic Session on “*Operational forecasts of oceans and ecosystems*” (priority level 2);
- 1 member of CFAME to attend the June 2007 ESSAS workshops (priority level 3).

Report of the April 2006 CCCC Symposium (Agenda Item 13)

Dr. Batchelder reported on the PICES/GLOBEC symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” held April 19–21, 2006,

in Honolulu, U.S.A. A total of 90 scientists from 12 countries attended the symposium. The symposium consisted of 3 sub-themes: (1) Regime shifts; (2) Ecosystem productivity and structural responses to physical forcing; and (3) Pan-Pacific comparisons. Panelists shared their thoughts and insights with audience at the Closing Discussion (see *PICES Press* Vol. 14, No. 2 for details). Outlets for future CCCC products include the GLOBEC Open Science Meeting in May 2009 and a planned GLOBEC Synthesis Book.

CCCC Action Plan (Agenda Item 14)

No time was spent on this issue at the meeting, except to note that Dr. Batchelder suggested that he can update the CCCC Action Plan using information provided by the CCCC Task Teams.

Relations to other international organizations and programs (Agenda Item 15)

ICES and regional/national GLOBEC programs remain the highest priority relations for the CCCC Program. CCCC-IP/EC identified linkages with ICES, GLOBEC-International, and the North Pacific Research Board (NPRB) as high priorities for the coming year. Also, there are several regional coastal observing programs in the Northeast Pacific (e.g., AOOS, PaCOOS, PNW-IOOS), the Northwest Pacific (e.g., CREAMS, NEAR-GOOS), that PICES should maintain connections with. CCCC-IP/EC must interact closely with NPAFC to address salmon issues of interest to the CCCC Program in the North Pacific.

Other business (Agenda Item 17)

Projected CCCC publications

- The scientific contributions of NEMURO and NEMURO.FISH will be published as a special issue of *Ecological Modelling* in the first quarter of 2007. Drs. M.J. Kishi, S.-I. Ito, B.A. Megrey and F.E. Werner are the Guest Editors of the special issue.
- A collection of papers from the April 2006 CCCC synthesis symposium will be published as a special issue of *Progress in*

Oceanography in 2008. Drs. Batchelder and Suam Kim are the Guest Editor of the special issue. Nineteen papers were submitted for review, but not all may be published. The target date for finishing all papers is June 2007.

- A final report of the CCCC Program is expected to be published in the PICES Scientific Report Series between PICES XVI and PICES XVII.

ICES/PICES Early Career Scientist Conference

Dr. Suam Kim described recent progress in planning the ICES/PICES Conference for Early

Career Scientists on “*New frontiers in marine science*” to be held June 26-29, 2007, in Baltimore (U.S.A.).

Recommendations to Science Board (Agenda Item 16)

- CCCC-IP/EC **recommends the approval** of changes in the CCCC-IP/EC and Task Team membership proposed under Agenda Item 8 above;
- CCCC-IP/EC **recommends the approval** of the sessions/workshops and travel requests detailed under Agenda Items 10 and 12.

CCCC Endnote 1

Participation list

Members

Kerim Y. Aydin (U.S.A.)
Harold P. Batchelder (U.S.A., Co-Chairman)
Shin-Ichi Ito (Japan)
Suam Kim (Korea, Co-Chairman)
William T. Peterson (U.S.A.)
Thomas C. Wainwright (U.S.A.)
Akihiko Yatsu (Japan)

Observers

Michio J. Kishi (Japan)
Manuel Barange (GLOBEC International)
Francisco E. Werner (GLOBEC International)

CCCC Endnote 2

CCCC-IP/EC meeting agenda

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Welcome and opening remarks 2. Adoption of agenda 3. Business from PICES XIV 4. Review of responsibilities for documenting CCCC Topic Sessions and workshops 5. Progress reports of Task Team (CFAME and MODEL) activities 6. Presentation of GLOBEC's activities on synthesis and integration 7. FUTURE – new PICES integrative scientific program 8. Changes in CCCC-IP/EC and Task Team membership 9. Proposals for new CCCC subsidiary bodies | <ol style="list-style-type: none"> 10. Planning for PICES XVI 11. Theme proposal for PICES XVII 12. Planned CCCC inter-sessional activities and travel support requests/priorities for October 2006-October 2007 13. Report on the April 2006 CCCC Synthesis Symposium 14. CCCC Action Plan 15. Relations with other international programs and organizations 16. Preparation of the CCCC report to Science Board 17. Other business |
|--|--|

CCCC Endnote 3

Proposal for a 1-day CCCC Contributed Paper Session at PICES XVI

North Pacific ecosystems and their response to climate variability have experienced intense study through GLOBEC and similar programs over the past 10 years. The PICES Climate Change and Carrying Capacity (CCCC) Program addressed the question of “how do interannual and decadal variations in ocean conditions affect the species dominance, biomass and productivity of the key zooplankton and fish species in North Pacific ecosystems?”. Ultimately, a goal of the CCCC Program was to forecast possible consequences of climate variability on the North Pacific ecosystem. As the CCCC Program nears completion, it is worthwhile to examine the program’s successes on addressing the key elements: climate change, carrying capacity, and forecasting. This

evaluation will provide useful information for moving forward with successor PICES integrative programs like FUTURE: *Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Ecosystems*. We invite abstracts that infer processes from patterns and link climate, ocean physics, populations and ecosystems. Provocative abstracts that retrospectively examine the successes and shortcomings of the CCCC Program are welcome, as are more traditional presentations on climate, ecosystems and forecasting.

Recommended convenors: Harold P. Batchelder (U.S.A.) and Michio J. Kishi (Japan).

REPORT OF CFAME TASK TEAM

The Climate Forcing and Marine Ecosystems Task Team (hereafter CFAME) met from 09:00–12:00 hours on October 15, 2006. Attending were 11 Task Team members and 7 observers (*CFAME Endnote 1*). The agenda was reviewed and adopted without modification (*CFAME Endnote 2*).

Inter-sessional activities (Agenda Item 2)

Dr. Akihiko Yatsu gave an overview of the results of the January 2006 CFAME workshop that was convened in Tokyo, Japan. These results were described in greater detail at the April 2006 PICES/GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*” that was held in Honolulu, U.S.A. A manuscript was submitted for the special issue of *Progress in Oceanography* that will follow the symposium. In brief, the manuscript examines species with different life history strategies (opportunistic, periodic, equilibrium, salmonic, intermediate) in the North Pacific and postulates mechanisms whereby climate might affect them. For example, the mechanism for intermediate strategists (*e.g.*, walleye pollock) appears to be ecosystem dependent (*i.e.*, different mechanisms in different ecosystems). This research is being conducted to develop the *Ecosystem Research* component of the CFAME workplan, specifically with regard to linking life-history strategies to ecosystems, and to answer the question “why do species with the same life histories have different abundance trajectories in different ecosystems?”.

Dr. Kerim Y. Aydin reviewed the CFAME discussion of carrying capacity at the January 2006 workshop. Carrying capacity can be defined as productivity (*i.e.*, rates) and not traditionally as production. This concept was also presented at the April 2006 PICES/GLOBEC Symposium. Due to a lack of time for ecosystem comparisons at the January 2006 workshop, this idea was not written up but will

be further developed within the *Ecosystem Research* component of the CFAME workplan.

CFAME workshop at PICES XV (Agenda Item 3)

Dr. Jacquelynne R. King gave an overview of the CFAME workshop held at PICES XV on October 13, 2006 (see *Session Summaries* chapter). It was attended by 21 participants, from all PICES member countries, and included presentations from the United States, Russia, Korea and China. This workshop addressed the first stage of the *Ecosystem Research* component outlined in the CFAME workplan. The objectives of the workshop were to review the three ecosystems identified at the October 2005 CFAME meeting at PICES XIV in Vladivostok, Russia: the California Current system, the Sea of Okhotsk and the Yellow/East China Seas.

For each region, conceptual mechanisms of climate forcing were identified. Workshop participants noted that each ecosystem had different climate forcing mechanisms: boundary current upwelling (California Current), sea ice (Sea of Okhotsk), and freshwater input (East China/Yellow Seas). Discussion also focused on ways to classify and compare ecosystems. Overall, the method employed will depend on the researchers involved and the level of data available for the ecosystems of interest. However, workshop participants agreed on the general themes captured by various ecosystem indicators and methods of comparison: food web structure, life history composition, structural stability, size composition, and change in rates (*e.g.*, PB vs. B, PB diversity pathways, predation load). It was suggested that such a list of specific comparison types could be made, and data could be obtained for these comparisons from each ecosystem. This idea provided strong motivation for an inter-sessional meeting on ecosystem-level carrying capacity and other ecosystem properties in 2007 (see request under Agenda Item 6).

Report of ESSAS activities (Agenda Item 4)

Dr. George L. Hunt presented an overview of the Bering Sea Ecosystem Study (BEST), a research group participating in the GLOBEC regional program on Ecosystem Studies of Sub-Arctic Seas (ESSAS). ESSAS aims to compare, quantify and predict the impact of climate variability and global change on the productivity and sustainability of sub-Arctic marine ecosystems, one of which is the Bering Sea. BEST is a large international and integrated research group. Its first focus will be on the effect of sea ice reduction (or absence). This topic is similar to CFAME's focus on the importance of sea ice in the Sea of Okhotsk. In June 2007, ESSAS will convene two workshops in Hakodate (Japan) on: (1) the role of sea ice in subarctic ecosystems and (2) evaluation of climate change projections for each of the ESSAS regions. These two workshops should be of interest to CFAME, particularly to the *Ecosystem Research* and *Scenario* components of its workplan.

Future Integrative Science Program (FISP) (Agenda Item 5a)

Overall, the FISP outline includes the key scientific issues of interest to CFAME, and to a varying degree, all are relevant to the work of CFAME. Most applicable are:

- marine ecosystem responses on seasonal, annual and decadal time scales;
- climate forcing of physical, biological and biogeochemical processes at scales ranging from the entire North Pacific, to marginal seas and convergence zones, to coastal regions relevant to PICES member countries;
- ecological interactions and linkages between coastal and offshore waters, western and eastern Pacific, northern and equatorial Pacific, and marine, estuarine and freshwater ecosystems;
- the cumulative impacts of multiple ecosystem stresses on biological diversity.

The research conducted by CFAME is applicable to the key activities proposed in FISP. The work of CFAME will provide a basis for

developing integrated models and scenarios of ecosystem change that could be applied to forecasting in a policy environment, although this is currently not a focus of CFAME. Some scientific issues that are missing or not yet highlighted are: (1) identifying levels of uncertainty in ecosystem forecasting, and (2) communication of PICES research to outside of the PICES community. Research on climate forcing needs to include episodic responses (*e.g.*, jellyfish outbreaks) to extreme warming events, affects of episodic climate events (hurricanes) and the changing structure of ecosystems.

Progress on CFAME Terms of Reference and Workplan (Agenda Item 5b)

The January 2006 workshop was shortened from 3 to 2 days to accommodate members' schedules. As a result, the preliminary *Ecosystem Research* component was postponed until October 2006. CFAME is therefore approximately 6 months behind in its workplan and proposes an inter-session workshop in the spring of 2007 to finalize its work on ecosystem mechanisms of climate forcing. This workshop will focus on formalizing the conceptual mechanisms of climate forcing; and applying the comparative approach to the selected focus ecosystems: the California Current system, the Sea of Okhotsk and the Yellow/East China Seas. Additionally, the Kuroshio/Oyashio Current system will be included since many of the species-mechanism work conducted by CFAME is applicable to this system, and it represents a second boundary current-dominated ecosystem which could simplify the comparisons between ecosystems by selecting two with similar dominant characteristics (*i.e.*, compared to the California Current system).

It was noted that there is potential overlap of CFAME Terms of Reference with the objectives of the PICES XV FIS workshop (W2) on "*Linking climate to trends in productivity of key commercial species in the subarctic Pacific*" (see the *Session Summaries* chapter of this Annual Report), so it was suggested that if this workshop was to lead to future work by the FIS Committee, collaboration between the two groups should be encouraged.

Interaction with WG 20 on *Evaluations of climate change projections* (Agenda Item 5c)

Several CFAME members attended all or part of the PICES XV POC workshop on “*Evaluations of climate change projections*” (W5) and were encouraged that climate modeling results would be available for CFAME’s modeling efforts. It was suggested that the period for greater interaction between CFAME and POC WG 20 on *Evaluations of climate change projections* would follow the proposed 2007 inter-sessional CFAME workshop. A joint workshop of the two groups in conjunction with PICES XVI would be timely.

Workshops and Topic Sessions for 2007 (Agenda Item 6)

CFAME placed their highest priority on a series of workshops. The sequence is as follows:

1. A CFAME workshop in the spring of 2007 (*CFAME Endnote 3*) to complete the comparisons of ecosystem forcing, structuring, and controlling mechanisms, in preparation for a collaboration with WG 20 in predicting future ecosystem states and controlling mechanisms. It was suggested that this workshop should be held in North America, possibly in conjunction with a workshop that was proposed as a follow-up from the PICES XV FIS workshop. The workshop could also be held in conjunction with the June ESSAS workshops in Hakodate, but it was felt that interactions between CFAME and ESSAS would be more focused if CFAME had completed this component of its workplan earlier in the spring, before discussing their results with ESSAS. It was also noted that attendance of North American members to an inter-sessional meeting in Japan might be difficult after three successive CFAME meetings in Asia (two annual and one inter-sessional).
2. A joint WG 20/CFAME workshop at PICES XVI where CFAME members would present the results of their inter-sessional meeting, and the feasibility and schedule for providing climate scenarios for CFAME models would be discussed (*CFAME Endnote 4*).

3. A WG 20/CFAME series of workshops and/or Topic Sessions beginning in 2008, possibly under the auspices of the new PICES integrated program (FUTURE).

MODEL presented a proposal for a joint CCCC/FIS Topic Session at PICES XVI to compare different model structures with climate forcing mechanisms to determine what advantages different components of a modeling “suite” might have for making biological projections (*MODEL Endnote 3*). CFAME agreed that this is a priority for a Topic Session and for CCCC in general. Dr. Vera Agostini was nominated as a co-convenor.

Drs. Aydin and Elizabeth Logerwell described a potential FIS/CCCC/BIO Topic Session on the importance and methods of measuring local interactions (*e.g.*, between predators on prey) and links to modeling (*FIS Endnote 4*). There is a potential for collaboration with ICES on this proposal. While CFAME felt that this topic was interesting, they suggested that FIS should take the lead in proposing this session, with CCCC (CFAME) acting as an interested collaborator. Several suggestions were made on the wording of the session description to broaden its interest to member nations, although these comments have not been included in the proposal.

Travel requests/priorities for 2007 (Agenda Item 7)

CFAME requests support (in the order of priority) for:

1. 2 scientists to attend the proposed spring 2007 inter-sessional CFAME workshop (*CFAME Endnote 3*). One of the two invitees will be a Russian scientist to provide data for the Sea of Okhotsk. The other invitee would depend on the workshop location, and participation of experts on the Yellow/East China Seas is especially encouraged;
2. A modeling expert from outside (*e.g.*, from Europe) of the PICES community for the proposed CCCC/FIS Topic Session at PICES XVI (*MODEL Endnote 3*);
3. A CFAME member to attend the June 2007 ESSAS workshops in Hakodate (see Agenda

Item 4). While the Task Team felt that collaboration with ESSAS should be encouraged, it was noted that at least one CFAME member and perhaps others are planning to go to Hakodate in their roles as ESSAS participants/members.

Co-Chairman of CFAME (Agenda Item 8)

The Task Team unanimously thanked Dr. Akihiko Yatsu for several years of his leadership and excellent work as the CFAME Co-Chairman (and previously as the BASS Co-Chairman). The Task Team recommended Dr. Young-Shil Kang as a new Co-Chairman of CFAME.

CFAME Endnote 1

Participation list

Members

Vera Agostini (U.S.A.)
Kerim Y. Aydin (U.S.A., Co-Chairman)
Sanae Chiba (Japan)
George L. Hunt (U.S.A.)
Masahide Kaeriyama (Japan)
Hyung-Ku Kang (Korea)
Young-Shil Kang (Korea)
Jacquelynne R. King (Canada)
Gordon A. (Sandy) McFarlane (Canada)
Yoshiro Watanabe (Japan)
Akihiko Yatsu (Japan, Co-Chairman)

Observers

Michael G. Foreman (Canada)
Shin-ichi Ito (Japan)
Yoshioki Oozeki (Japan)
Kenneth Rose (U.S.A.)
Jacob Schweigert (Canada)
Thomas C. Wainwright (U.S.A.)
Yury I. Zuenko (Russia)

CFAME Endnote 2

CFAME Task Team meeting agenda

1. Introductions and adoption of agenda
2. Follow-up of the January 2006 CFAME workshop and the April 2006 CCCC Symposium:
 - a. Comparisons between life-history strategists
 - b. Carrying capacity concept
3. Follow-up of the October 2006 CFAME workshop:
 - a. Comparisons between ecosystems
 - b. Approach to carrying capacity at ecosystem level
4. Report of ESSAS activities
5. Discussion of CFAME next steps:
 - a. Future Integrative Science Program
 - b. CFAME Terms of Reference and Workplan
 - c. Interaction with WG 20 on *Evaluations of climate change projections*
6. Workshops and Topic Sessions for 2007
7. Travel requests/priorities for 2007
8. Co-Chairman of CFAME
9. Other business

CFAME Endnote 3

Proposal for a 3-day CFAME inter-sessional workshop on “*Linking climate-forcing mechanisms to indicators of species ecosystem-level changes: A comparative approach*”

At various meetings in 2006, CFAME outlined the dominant species representing five life-history types in ecosystems across the North Pacific: opportunistic, periodic, equilibrium, salmonic, and intermediate. Intermediate forcing mechanisms were identified that vary by ecosystem within the North Pacific; distinguishing ice-driven processes, freshwater-driven processes, and boundary current-driven processes. Four contrasting ecosystems were selected to be examined: the California Current system (boundary current with upwelling), the Oyashio/Kuroshio Current system (boundary currents), the Sea of Okhotsk (sea ice cover), and the Yellow/East China Sea region (freshwater input). At this workshop, CFAME members will finalize their working hypotheses about mechanisms that link climate to key species in these ecosystems, and that link climate to changes in indices of ecosystem productivity, structure and function. The ecosystem indicators will be viewed through a

set of “lenses” that are either activating or constraining factors on growth and recruitment. For example, participants will examine how climate affects demographic, trophodynamic, and spatial transitions in size-spectra, food web structure, life-history strategies, turnover rates, and usage of physical habitat. The goal of finalizing these mechanisms is in anticipation of climate scenarios from POC WG 20 on *Evaluations of climate change projections* in order to develop ecosystem-level forecasts as part of FUTURE.

Recommended convenors: Kerim Y. Aydin (U.S.A.), Young-Shil Kang (Korea) and Akihiko Yatsu (Japan).

Date and Location: 3-day workshop to be held in May 2007, in Seattle, U.S.A. (possibly immediately preceding or following a proposed inter-sessional FIS workshop in the same location).

CFAME Endnote 4

Proposal for a POC/CCCC (WG 20/CFAME) workshop at PICES XVI on “*Climate scenarios for ecosystem modeling*”

This workshop will include invited papers from members of the Climate Forcing and Marine Ecosystem Task Team (CFAME) and the POC Committee Working Group on *Evaluations of climate change projections* (WG 20) on research activities related to applying output from WG 20 regional climate models, or IPCC (Intergovernmental Panel for Climate Change) global models, to CFAME ecosystem models. CFAME is developing conceptual and empirical models of the mechanisms relating climate forcing to the population dynamics of species and to ecosystem processes. CFAME has focused on four North Pacific ecosystems that represent different dominant physical processes: (1) California Current system (boundary current with upwelling); (2) Kuroshio/Oyashio Current system (boundary currents); (3) Sea of Okhotsk

(sea ice cover); and (4) Yellow Sea/East China Sea region (freshwater input). WG 20 is developing higher resolution regional coupled atmosphere–ocean models forced by IPCC global or regional models. These regional models could provide forecasts of regional parameters (such as SST, sea ice cover, and river discharge) relevant to ecosystem processes. This workshop will facilitate discussion between CFAME and WG 20 members for future collaborative research on forecasting the impacts of climate change (as represented by IPCC projection scenarios) on regional ecosystems and species of the North Pacific.

Proposed convenors: Michael G. Foreman (Canada), Jacquelynne R. King (Canada) and an Asian colleague (TBD).

REPORT OF MODEL TASK TEAM

The meeting of the MODEL Task Team (hereafter MODEL) was held from 14:00–18:00 hours on October 15, 2006. The Co-Chairmen, Drs. Thomas C. Wainwright and Shin-ichi Ito, called the meeting to order and welcomed the participants (*MODEL Endnote 1*). The draft agenda was reviewed and adopted (*MODEL Endnote 2*). During the meeting, the participants discussed:

- the accomplishments of MODEL over the past year;
- the outline for the next major PICES scientific program (FUTURE);
- plans for 2006-2007;
- requests for travel to future meetings;
- various new businesses; and,
- the MODEL membership and selection of a new MODEL Co-Chairman.

MODEL accomplishments after PICES XIV (Agenda Item 3)

The APN (Asia Pacific Network) project “*Climate interactions and marine ecosystems*” (PIs: Drs. Francisco E. Werner and Bernard A. Megrey) resulted in a series of successful workshops focused on modeling differences in Pacific herring growth in four locations: Bering Sea, Prince William Sound, West Coast of Vancouver Island, and Oregon Coast. Major hypotheses were addressed for three issues:

- geographic variation in fish growth;
- understanding of regime shifts;
- global climate change effects on energy pathways and fish production.

For all three issues, models were successfully developed and applied to evaluate basic relationships, but the project was not able to develop forecasts of future climate change scenarios. This project is now completed, and resulted in more than 10 conference presentations and more than 10 publications, as well as developing analytic capacity among the participants.

The project “*Fluctuations of marine coastal fisheries of sardines and anchovies and their impact on fishing-dependent human communities*”, funded by APN’s CAPaBLE program, has been completed. CDs with the report were distributed at the MODEL meeting by Dr. Michio J. Kishi (lead PI of the project). A brief report is also available in the August 2006 APN Newsletter at <http://www.apn-gcr.org/en/products/nl.html>.

The project “*Software framework for integrating marine ecosystem model*” (PIs: Drs. Thomas C. Wainwright and Bernard A. Megrey) was funded by NOAA in 2005. The objectives of the project are to:

- integrate NEMURO and NEMURO.FISH in the Earth System Modeling Framework (ESMF);
- provide a web-based interface for the NEMURO and NEMURO.FISH models;
- provide users’ guides and documentation on the web.

This project is still in progress, and it is expected that the Fortran model code will be available in spring 2007, with documentation and the web interface available later in 2007. The project will make the NEMURO code easier to integrate into other U.S. Climate Change research efforts and will also provide web-based tools to facilitate long distance collaboration.

MODEL had agreed previously to publish the scientific contributions of NEMURO and NEMURO.FISH as a special issue of *Ecological Modelling*. Drs. Kishi, Megrey, Ito and Werner are the Guest Editors of the special issue. This special issue is now in press, and is expected to be printed in February or March 2007. The issue contains 19 papers, including 15 research articles and 4 introductory and summary articles.

A FRA/APN/PICES/GLOBEC/IAI workshop on “*Global comparison of sardine, anchovy and*

other small pelagics: Building towards a multi-species model” was held November 14-17, 2005, in Tokyo (Japan). The purpose of the workshop was to extend the NEMURO.FISH model to simultaneously simulate sardine and anchovy bioenergetics (NEMURO.SAN). Several talks related to this project will be presented at the PICES XV Topic Session (S6) on “*Modeling and historical data analysis of pelagic fish, with special focus on sardine and anchovy*”.

Dr. Harold P. Batchelder reported on the PICES/ GLOBEC Symposium on “*Climate variability and ecosystem impacts on the North Pacific: A basin-scale synthesis*”, held April 19–21, 2006, in Honolulu, U.S.A. From the symposium, 19 papers have been submitted to a special issue of *Progress in Oceanography*, but not all may be published. Outlets for other CCCC products are the GLOBEC Open Science Meeting in May 2009 and a planned GLOBEC Synthesis Book.

Drs. Megrey and Ito attended an ESSAS (Ecosystem Studies of Sub-Arctic Seas) workshop held June 12–14, 2006, in St. Petersburg (Russia). Three working groups were established, including one on modeling. The long-term goal of ESSAS is to use a comparative approach to look at effects of climate change, similar to the work of MODEL.

MODEL assisted with the first PICES/CREAMS summer school on “*Ocean circulation and ecosystem modeling*”, held August 23–25, 2006, in Busan, Korea. Thirty-seven students from 8 countries (including all six PICES countries, plus Indonesia and Chile) attended the school. The schedule was quite full, and organizers should reconsider whether the same amount of material should be presented in the future. All lectures are available on the PICES website. The lecturers from MODEL (Drs. Ito, Kishi and Goh Onitsuka) recommended that rather than introducing new concepts in future summer schools, the topics should be revisited to improve the lecture materials and make the lectures more polished. A proposal has been received from Japan to host the second PICES summer school on “*Ecosystem-based management*” in September 2008, at Hokkaido University, in Hakodate, Japan.

In the past, Dr. Megrey maintained a website for MODEL at the NOAA Alaska Fisheries Science Center, where there was public access to MODEL reports and workshop products, as well as a private exchange area for works in progress. Due to changes in web policy at NOAA, that site was discontinued. With the gracious assistance of Ms. Julia Yazvenko, PICES Database and Web Administrator, all information from the old site was transferred to the MODEL page at http://pices.int/members/task_teams/MODEL.aspx. That page now provides public access to all MODEL reports, workshop archives, and NEMURO model code. There is also a link to a private page for work in progress.

At PICES XV, an IFEP/MODEL workshop (W1) on “*Modeling iron biogeochemistry and ocean ecosystems*” was held on October 13, 2006. MODEL also sponsored three Topic Sessions at PICES XV: “*Modeling and historical data analysis of pelagic fish, with special focus on sardine and anchovy*” (S6, October 17), “*Key recruitment processes and life history strategies: Bridging the temporal and spatial gap between models and data*” (S7, October 19, joint with FIS), and “*Synchronous and asynchronous responses of North Pacific boundary current systems to climate variability*” (S10, October 20, joint with MONITOR and POC). Summaries of the workshop and sessions are included in the *Session Summaries* chapter of this Annual Report.

Discussion of PICES FUTURE scientific program (Agenda Item 4)

MODEL members reviewed the draft outline for a new PICES integrative scientific program: FUTURE (*Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem*). There was a general consensus that the direction of the proposal is a good one, and the focus on forecasting system response to climate change is consistent with MODEL’s planned future directions. There were, however, a number of concerns expressed by individual Task Team members (not a consensus of MODEL as a whole):

- The proposal emphasizes scientific work in a policy and management context, but it is not clear who are the intended “clients”.
- FUTURE is substantially different from the CCCC Program in that FUTURE has an outside constituency—this would require a different approach to science.
- Forecasts are technically feasible, but quality of forecasts will be a major issue. In particular, ecosystem models cannot yet provide useful long-term forecasts.
- PICES should be focused on doing good science, not on tailoring science to perceived management needs; if science is high quality, managers will embrace it.
- Management systems differ among member countries, and it is not clear that a single program can address the needs of all.
- The focus on management and communications could require a new group within PICES to interpret science for management and the public. Research scientists are not the best people to play the science policy role.

Planning for 2006–2007 and travel support requests (Agenda Items 5 and 6)

Topic Sessions at PICES XVI

MODEL proposes a 1-day Topic Session (joint with CFAME and FIS) on *“Towards ecosystem-based management: Recent developments and successes in multi-species modeling”* (MODEL Endnote 3). Travel funds from PICES are requested for 1 invited speaker.

MODEL also supports a 1-day Topic Session (joint with POC and MONITOR) on *“Operational forecasts of oceans and ecosystems”* (POC Endnote 4). Travel funds from PICES are requested for 1 invited speaker.

Inter-sessional workshops

Drs. Ito and Wainwright will attend a FRA international workshop on *“Collaborative studies for ecosystem variation and climate change in the North Pacific”* to be held on October 21–23, 2006, in Yokohama.

No inter-sessional workshops are planned for 2007.

Other new business (Agenda Item 7)

MODEL was contacted by Dr. Ivo Grigorov of the Eur-OCEANS project regarding the inclusion of NEMURO and NEMURO.FISH in the Eur-OCEANS online database of ocean models. Dr. Kishi has been designated as the liaison between MODEL and Eur-OCEANS, and will provide the NEMURO model information for their database.

Dr. Werner is leading a proposal to the U.S. NSF PIRE program, with the purpose of linking Norwegian, Japanese, and U.S. research on marine ecosystems and forecasting. Brief pre-proposals are due at the end of October 2006. This project would have a strong emphasis on education as well as research, with inclusion of two summer schools to be held at NCAR in the United States. Research work would be related to work under the ESSAS program.

Dr. Jacob Schweigert announced the upcoming Tri-national (U.S., Canada, Mexico) Sardine Forum to be held November 1-3, 2006, in Vancouver, (Canada). This forum may be an important venue for MODEL work.

Dr. Yahusiro Yamanaka reported on planned further developments of the NEMURO and NEMURO.FISH models, which will be coupled with higher resolution ocean circulation models under new funding from JST/CREST and MEXT. This activity will be tied in with development of a new Peta-FLOPS computer, to be built in 2011.

Rotation of membership and selection of new MODEL Co-Chairman (Agenda Item 8)

Chairmanship

Dr. Shin-ichi Ito rotated off as Co-Chairman of MODEL, and the members enthusiastically recommended Dr. Hao Wei (China) as the new MODEL Co-Chairman. MODEL members offered great thanks to Dr. Ito for his strong leadership and efforts over the past years.

MODEL-2006

Membership

- Two members from Russia (Drs. Irina Ishmukova and Gennady Kantakov) are unable to continue serving on the Task Team, and MODEL requests their replacement. Dr. Anatoly Burago (TINRO) was suggested as a potential candidate.
- MODEL also requests the addition of one new member from Canada as presently the only Canadian member is Dr. Jacob Schweigert.

MODEL Endnote 1

Participation list

Members

Shin-ichi Ito (Japan, Co-Chairman)
Michio J. Kishi (Japan)
Bernard A. Megrey (U.S.A.)
Goh Onitsuka (Japan)
Jacob Schweigert (Canada)
Thomas C. Wainwright (U.S.A., Co-Chairman)
Francisco E. Werner (U.S.A.)
Sinjae Yoo (Korea)
Yury I. Zuenko (Russia)

Observers

Vera Agostini (U.S.A.)
Kerim Y. Aydin (U.S.A.)
Harold P. Batchelder (U.S.A.)
Fei Chai (U.S.A.)
Taketo Hashioka (Japan)
Skip McKinnell (PICES)
Ig-Chan Pang (Korea)
Kenneth Rose (U.S.A.)
Yasuhiro Yamanaka (Japan)
Naoki Yoshie (Japan)

MODEL Endnote 2

MODEL Task Team meeting agenda

1. Welcome and introduction of members
2. Review of agenda and inclusion of new items as needed
3. Review of MODEL accomplishments after PICES XIV
 - a. APN project “*Climate interaction and marine ecosystems*”
 - b. APN CAPaBLE project
 - c. NOAA project “*Software framework for integrating marine ecosystem models*”
 - d. *Ecological Modelling* special issue
 - e. APN/FRA/PICES/GLOBEC/IAI joint workshop (November 2005)
 - f. April 2006 CCCC Synthesis Symposium
- g. June 2006 ESSAS workshop
- h. August 2006 PICES/CREAMS summer school
- i. Update on MODEL web page
- j. Discussion/review/preview of workshops and Topic Sessions at PICES XV
4. Discussion of PICES FUTURE scientific program
5. Planning for 2007-2008
6. Requests for travel to future meetings
7. Other new business
8. Rotation of membership and selection of new MODEL Co-Chairman
9. Announcements

MODEL Endnote 3

Proposal for a 1-day CCCC/FIS Topic Session at PICES XVI on “*Towards ecosystem-based management: Recent developments and successes in multi-species modeling*”

Ecosystem-based management is becoming a focus for many fisheries and their management agencies worldwide. Much of the success of this

initiative will require improvements in understanding the interactions and linkages among species at both the lower trophic level

(LTL) and higher trophic level (HTL) within regional ecosystems. The recent success of modeling tools such as NEMURO.FISH in linking LTL forcing to the forecasting of fish growth for a number of pelagic forage species is encouraging. Ecosystem-based management will require the extension of this and/or similar approaches to multi-species systems. A variety of modeling tools is already in wide use to address this issue, including Ecopath/Ecosim, NEMURO, various IBM models, and others. This session will focus on contrasting different approaches to multi-species modeling and

evaluating their performance as a vehicle for assessing and forecasting the effects of climate change on ecosystem function. We encourage presentations that will highlight critical ecosystem interactions relevant for fishery management, and discuss how knowledge of these interactions will move us closer to ecosystem based fishery management.

Recommended convenors: Vera Agostini (U.S.A.), Shin-ichi Ito (Japan), Jacob Schweigert (Canada) and Chang Ik Zhang (Korea).

REPORT OF ADVISORY PANEL FOR A CREAMS/PICES PROGRAM IN EAST ASIAN MARGINAL SEAS

The Advisory Panel for a CREAMS/PICES Program in East Asian marginal seas (hereafter CREAMS-AP) met twice during 2006. The first meeting was convened on April 11–12, in Seoul, Korea, hosted by the Research Institute of Oceanography of Seoul National University (CREAMS-AP Endnotes 1–3). The second brief meeting was held on October 15 at PICES XV (CREAMS-AP Endnotes 4 and 5). This report summarizes discussions and recommendations from both meetings.

Symposia and capacity building in 2006

A very successful CREAMS/PICES workshop and summer school were held consecutively from August 21–25, 2006, in Busan, Korea. The workshop on “*Model/data inter-comparison for the Japan/East Sea*” included 24 presentations in separate sessions on *Observations*, *Model/data comparisons*, *Nowcast/Forecast systems*, and *Ecosystem modeling*, followed by extensive discussion. The workshop was co-sponsored by Seoul National University (SNU), Pukyong National University (PNU), the Korean Ocean and Research Development Institute (KORDI), the Brain Korea 21 (BK 21) Program of the Korean Ministry of Education and Human Resources, and PICES. The workshop proceedings are available on a CD-ROM, and negotiations are underway to publish papers arising from the workshop in a special issue of *Journal of Marine Systems*. A positive response has been received from the Chief Editor, and a proposal is being prepared. This publication is planned for the summer of 2007, and will include approximately 17 papers.

The first CREAMS/PICES summer school was co-sponsored by SNU, KORDI, BK 21, the Korean Ministry of Maritime Affairs and Fisheries (MOMAF), the National Fisheries Research and Development Institute (NFRDI), and PICES. The theme of the summer school

was “*Ocean circulation and ecosystem modeling*”, and there were 7 lecturers from Japan and the United States. Forty-seven applications were received, but space restrictions allowed the selection of only 37 participants. They were from 8 countries (all PICES member countries plus Chile and Indonesia) and included 14 Ph.D. and 11 M.Sc. students, 7 early-career scientists, 4 undergraduate students, and 1 from a private company. Tutorials were also given along with the lectures. Lecture notes and educational materials presented during this summer school can be downloaded from http://www.pices.int/2006_CREAMS_PICES_school.aspx. Future summers schools are planned, but to avoid conflict with the ICES/PICES Early Career Scientists Conference in 2007, the next school will not be until 2008.

A more comprehensive summary of the workshop and summer school was published in *PICES Press*, Vol. 15(1).

Further plans and recommendations

To build an international collaborative observing program for studying hydrography, circulation, and biology of the East Asian marginal seas, their variability, and effect of climate and long-term changes on their abiotic and biotic environments, CREAMS-AP recommends:

1. To support continuation and development of existing national observational programs and, when possible, their coordination, including exchange information on cruise schedules, and data, samples, personnel and equipment sharing.
2. To continue Russian–Korean observations along the repeated north–south sections in the Japan/East Sea (JES), and to start (beginning 2007) Korean–Japanese observations along the repeated west–east sections in the southern part of JES; more

- ecological parameters should be added to the observational programs.
3. To implement a comprehensive international basin-scale survey of JES and adjacent areas in summer 2009; the survey should include hydrographic, chemical and biological observations, sampling for trace elements (as a part of the Asian GEOTRACERS program), and observations carried out under regional national programs.
 4. To develop a CREAMS/PICES Capacity Building Program that will provide on-site training through international research at educational laboratories, training camps, inter-calibration centers, *etc.*, and to organize summer and winter schools for students and young researchers. Schools would include (tentatively):
 - a. A winter school on “*Field survey of sea ice area*” (February or March 2008, Vladivostok, Russia);
 - b. A summer school on “*Ecosystem-based management and ecosystem approach*”, (August 2008, Hakodate, Japan). At the April CREAMS-AP meeting, this school was proposed for 2007, but it was postponed until 2008 to avoid conflict with the ICES/PICES Early Career Scientists Conference in 2007;
 - c. A summer school on “*Recent methods of investigating red-tide organisms and controlling red tides*” (planned for 2009 in Busan, Korea).
 5. To collaborate with NEAR-GOOS on the development of an observing system, expansion of observational parameters and data sources (*e.g.*, more satellite data), and improvement of international data exchange in the region.
 6. To strongly support PICES activities related to the development of the GOOS component for the North Pacific.
 7. To provide frequent updates on progress of the CREAMS/PICES Program via the PICES website, and to publish in 2006 brief information on the program in a special issue of *Oceanography* (by TOS).
- An Action Plan for implementing these recommendations can be found in *CREAMS-AP Endnote 3*.

Next CREAMS-AP meeting

It was proposed to hold the next CREAMS-AP meeting in March or April 2007, in Qingdao, China.

CREAMS-AP Endnote 1

Participation list (April 11-12, 2006, Seoul, Korea)

Members

Toshitaka Gamo (Japan)
Kyung-Ryul Kim (Korea, Co-Chairman)
Jae-Hak Lee (Korea)
Sumei Liu (China)
Vyacheslav B. Lobanov (Russia)
Yasunori Sakurai (Japan, Co-Chairman)

Pavel Ya. Tishchenko (Russia)
Yury I. Zuenko (Russia)

Observers

Kyung-Il Chang (Korea)
Dong-Jin Kang (Korea)
Kyung-Ae Park (Korea)

CREAMS-AP Endnote 2**CREAMS-AP meeting agenda (April 11–12, 2006, Seoul, Korea)**

1. Opening remarks
2. National report on activities and plans related to the CREAMS/PICES program in Japan, Korea, Russia and China:
 - a. Overview of Japan-GLOBEC and research projects related to the CREAMS/PICES program in Japan (Y. Sakurai)
 - b. Perspectives on geochemical studies in Japan related to EAST-I (T. Gamo)
 - c. Korean East Asian Seas Time-Series-1 (EAST-I) (K.-R. Kim)
 - d. EAST-I activity in KORDI (J.-H. Lee)
 - e. Activities related to the CREAMS/PICES program at POI (V. Lobanov)
 - f. Impact of near-bottom geochemical processes on hydrochemical properties of the Japan/East Sea (P. Tishchenko)
 - g. TINRO surveys in 2005 and future perspectives (Y. Zuenko)
 - h. A brief introduction to time-series work in China's seas (S. Liu)
3. Discussion on how to coordinate these activities and the role of PICES
4. Capacity building:
 - a. CREAMS/PICES workshop on “*Model/data inter-comparison for the Japan/East Sea*” and summer school on “*Ocean circulation and ecosystem modeling*” (K.-I. Chang)
 - b. Summer school on “*Recent methods of investigating red-tide organisms and controlling red tides*” (K.-R. Kim)
 - c. CREAMS/PICES Capacity Building Program: International Research and Educational Laboratory (V. Lobanov)
5. Discussion on monitoring and data exchange systems in the region: Development of NEAR-GOOS, GOOS, GRAND and GEOSS projects (V. Lobanov)
6. Role of CREAMS-AP in FUTURE (new integrative science program of PICES)
7. Miscellaneous items:
 - a. Special issue of *Oceanography* on the CREAMS-II program results
 - b. Other issues
8. Summary and next actions

CREAMS-AP Endnote 3**List of actions proposed at the first CREAMS-AP meeting (April 11–12, 2006, Seoul, Korea)**

No.	Subject	Item	Action proposed	Responsible	Target date
1	Support for existing national observational programs and their possible international coordination	2	Request relevant agencies to continue existing national observational programs and recommend their international coordination, when possible, including exchange of information on cruise schedules, data, samples, personnel and equipment sharing	All members	When feasible
2	Repeated sections by Japan and Korea	2	Discuss feasibility and plans for joint observations along repeated west–east sections in the southern part of JES	Y. Sakurai	October 2006
3	International survey of JES and adjacent areas in 2009	2	Discuss plans for an international basin-scale survey of JES and adjacent areas in summer 2009, including Asian GEOTRACERS component	T. Gamo, all members	When feasible

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4	Summer school on “ <i>Ecosystem-based management and ecosystem approach</i> ”	4	Investigate feasibility of holding a summer school in 2007, in Japan, and, if positive, present a proposal for sponsorship to FIS and BIO Committees	Y. Sakurai	October 2006
5	Summer school on “ <i>Recent methods of investigating red-tide organisms and controlling red tides</i> ”	4	Present a proposal to sponsor a summer school in 2008 or 2009, in Korea to PICES MEQ Committee	K.-R. Kim	October 2006
6	International research and educational laboratory	4	Discuss a suggestion on establishing a CREAMS/PICES international research and educational laboratory at the next CREAMS-AP meeting	V. Lobanov, all members	October 2006
7	Collaboration with GOOS	5	Inform MONITOR Committee on CREAMS-AP interest in collaborating with GOOS and NEAR-GOOS, and support PICES activities related to the development of the GOOS component for the North Pacific	K.-R. Kim, Y. Sakurai	October 2006
8	Introduction of the CREAMS/PICES Program	7	Contact TOS or PICES Secretariat to publish a brief introduction of the program in a special issue of <i>Oceanography</i> or in <i>PICES Press</i>	K.-R. Kim	ASAP
9	Website	7	Consult with the PICES Secretariat on possibility of using the PICES website for information (frequent updates) on CREAMS/ PICES program development	K.-R. Kim, All members	ASAP, when feasible
10	Next meeting	8	Consult with the PICES Secretariat on possibility of holding a CREAMS-AP meeting at PICES XV in October 2006	K.-R. Kim	ASAP

CREAMS-AP Endnote 4

Participation list (October 15, 2006, Yokohama, Japan)

Members

Naoki Iguchi (Japan)
Kyung-Ryul Kim (Korea, Co-Chairman)
Vyacheslav B. Lobanov (Russia)
Yasunori Sakurai (Japan, Co-Chairman)

Yury Zuenko (Russia)
Sinjae Yoo (Korea)

Observer

Takuya Kawanishi (Japan)

CREAMS-AP Endnote 5

CREAMS-AP meeting agenda (October 15, 2006, Yokohama, Japan)

1. Opening remarks
2. National report on activities and plans related to CREAMS/PICES program in Japan, Korea and Russia
3. Discussion on how to coordinate these activities and role of PICES
4. Capacity building:
 - a. Report on CREAMS/PICES workshop on “*Model/data inter-comparison for the Japan/East Sea*” and summer school on “*Ocean circulation and ecosystem modeling*” (August 2006, Busan, Korea)
 - b. Winter school on “*Field survey of sea ice area*” (February or March 2008, Vladivostok, Russia)
 - c. Summer school on “*Ecosystem-based management and ecosystem approach*”, (August, 2008, Hakodate, Japan)
 - d. Summer school on “*Recent methods of investigating red-tide organisms and controlling red tides*” (planned for 2009)
 - e. Progress report on CREAMS/PICES Capacity Building Program: International Research and Educational Laboratory (V. Lobanov)
5. Discussion on monitoring and data exchange systems in the region (V. Lobanov)
6. Role of CREAMS-AP in FUTURE (new integrative science program of PICES)
7. Next CREAMS-AP meeting

REPORT OF ADVISORY PANEL ON CONTINUOUS PLANKTON RECORDER SURVEY IN THE NORTH PACIFIC



The Advisory Panel on *Continuous Plankton Recorder Survey in the North Pacific* (hereafter CPR-AP) met from 17:00–19:00 hours on October 15, 2006, under the chairmanship of Dr. Charles B. Miller. A list of participants and the meeting agenda can be found in *CPR-AP Endnotes 1 and 2*.

Dr. Sonia Batten, principal investigator of the PICES CPR Pacific project, was unable to attend the meeting. She provided materials for a presentation made by Dr. David L. Mackas, who has replaced Dr. David Welch as co-principal investigator on the project. Both the north–south and east–west runs of the CPR survey were sampled in spring–summer–autumn of 2006, and it was the seventh year of regular tows on north–south survey routes.

Program description and results are kept up to date at the Pacific project section of the Sir Alister Hardy Foundation for Ocean Research (SAFHOS) website at http://192.171.163.165/pacific_project_papers.htm. The annual report to the Exxon Valdez Oil Spill Trustee Council for 2006 will soon be placed there.

North–south CPR transect (Agenda Item 1)

It was the third year that the north–south transect has been occupied from Cook Inlet (British Columbia) to Puget Sound (Washington State). Seven transects were spaced approximately monthly from March to October. There were gear problems on several of the transects but even for those, some data are intact. The October tow was to “replace” the lost samples. Processing is well along, and approximately half the samples are complete. The preliminary results suggest that 2006 was a relatively high year for meso-zooplankton biomass, comparable to 2005, whereas 2004 was about half that of the other two years. In 2004, biomass was also low compared to earlier sampling (2000–2003, 5

times per year) from Prince William Sound (Alaska) to Long Beach (British Columbia). Causal explanation of the variation is likely to be possible, but is not ready to report. Not only does overall system biomass (implying production) vary from year to year, but timing of seasonal life-cycle events of the dominant copepod species can vary up to ~45 days between extreme years. The small sample size (6 years) suggests that the full variation in this important aspect of regional ecodynamics is even greater.

East–west CPR transect (Agenda Item 2)

The east–west route from Vancouver to Yokohama, in its seventh year, was run three times in 2006. Results from earlier years show correspondences between plankton assemblages and 10 distinctive zones of habitat along the transect. Some revisions to this habitat identification will be forthcoming based on 2005–2006 results.

Seabird survey along the east–west CPR transect (Agenda Item 3)

Dr. William J. Sydeman (Point Reyes Bird Observatory) described the current status and progress of bird and mammal observations that have been made during daylight on all east–west trips that towed the CPR since 2002. The same scientist made all observations. Twenty-three species of birds accounted for 97% of sightings, of which 12 are found mostly in the western Pacific, and 6 in the east. Especially large counts occur in “shearwater hotspots”, where sooty shearwaters can be seen in tens of thousands. These are all relatively close to land, at La Perouse Bank, Unimak Pass and offshore of coastal Honshu. Overall, the bird and mammal observations are a rich dataset, and findings are in the early stages of conversion to publication by Dr. Sydeman and colleagues.

Project status – funding (Agenda Item 4)

Continued funding for the Pacific CPR project is uncertain. The north–south transects have been funded, since their inception, by the Gulf Ecosystem Monitoring (GEM) program of the Exxon Valdez Oil Spill (EVOS) Trustee Council. This funding has supported sampling and analysis through 2006 for this transect. The EVOS Trustees have almost eliminated the GEM program, and the call for proposals to fund research in 2007 had a focus on herring stocks in Prince William Sound (PWS). The CPR project is germane to these stocks because herring (and salmon) survivorship depends upon the availability of planktonic food, much of which comes into PWS from the shelf, an important sector surveyed by the CPR survey. Even though the towing routes have been displaced to the west, the trajectory of the Alaskan Coastal Current insures that much the same plankton communities are sampled. Thus, events like the very low plankton biomass of 2004 that was observed with the CPR are certain to have been regional in extent and impact, including PWS. The impact of variations in zooplankton is both bottom-up (plankton are herring food) and top-down. Walleye pollock with sufficient planktonic food do not prey on herring larvae and juveniles, but when forced to broaden their diets due to low plankton availability, begin to affect herring and salmon populations through predation.

Dr. Batten’s proposal for 2007 to the EVOS Trustees received good reviews and a recommendation to fund it from the Scientific Review Committee. However, the program Science Director recommended that the project not be funded on the basis of low relevance to

PWS herring. The EVOS Executive Director also recommended “do not fund”. CPR-AP unanimously recommended to the PICES MONITOR Technical Committee that a letter be sent to the EVOS Trustees strongly urging that the recommendation of the Science Review Committee be accepted, and that the CPR Pacific project receive funding for 2007. Later in the week, MONITOR approved this recommendation, and the CPR-AP and MONITOR Chairmen drafted the letter (*CPR-AP Endnote 3*). It was sent to Science Board and Governing Council for approval.

It is clear that stable funding is a critical issue for the CPR Pacific project. The EVOS Trustees have decided to terminate GEM, and to spend the remaining trust fund principal. Very little of that expenditure will be for science in any case, and focus will be on land acquisitions and short-term activities in PWS. There will be no continuing EVOS endowment for marine science in PWS or elsewhere in the oil spill trajectory.

The North Pacific Research Board will continue to have a permanent endowment for scientific studies. They have had a strong interest in the CPR project, funding the east–west transects in recent years and continuing the work through 2007. Whether they can be convinced to take over funding for the north-south runs is an issue we will have to test in the very near future. It would be a very good thing if we could obtain funding from NOAA and DFO, and it is hoped that some part of the funds will flow to the wide array of proposed ocean observing system projects (*e.g.*, AOOS). The CPR-AP members and project investigators are urged to be alert to opportunities for such funding.

CPR-AP Endnote 1**Participation list**Members

Charles B. Miller (U.S.A., Chairman)
David L. Mackas (Canada)
Jeff M. Napp (U.S.A.)
Vladimir I. Radchenko (Russia)

Observers

George L. Hunt (U.S.A.)
Hyung-Ku Kang (Korea)
Phillip R. Mundy (U.S.A.)
William J. Sydeman (U.S.A.)

CPR-AP Endnote 2**CPR-AP meeting agenda**

- | | |
|--|--|
| 1. Discussion of recent CPR results from the Cook Inlet to Puget Sound (Seattle) route | 3. Discussion of bird survey results from the VY route |
| 2. Discussion of CPR results from the Vancouver to Yokohama (VY) route | 4. Matters affecting continued funding |
| | 5. Other time-series surveys in the North Pacific |

CPR-AP Endnote 3**Draft letter from PICES to the EVOS Trustee Council**

Exxon Valdez Oil Spill (EVOS) Trustee Council
Anchorage, Alaska

Dear Sirs and Madams,

We would like to suggest that continued funding of the EVOS-supported, continuous-plankton-recorder (CPR) study in the Gulf of Alaska is one of the best investments in marine science that the Trustee Council could make for 2007. The project was developed under the auspices of the North Pacific Marine Science Organization (PICES), and it has been financially supported throughout its work (1997 to 2006) by the EVOS Trust. The results are already extraordinary in respect to duration among marine ecosystem observations, and the scientific payoff has been excellent. Like all time-series studies, the longer it continues, the more informative it becomes. From it we now know with certainty that the plankton community of the Gulf of Alaska (the food-chain base for Alaskan fisheries like pollock, salmon and herring) varies strongly from year-to-year. With the CPR data, we begin to see how these variations are caused. We begin to have a clear picture of the shift in life-cycle seasonality between higher and lower latitudes. The principle investigator of the CPR Pacific project, Dr. Sonia Batten, can take pride in generating these ecological insights, and PICES takes pride in having fostered the project. Dr. Batten has been quick to publish and share the project results at the annual Alaska Marine Science Symposium. The EVOS Trustees can take great pride in having supported this accomplishment from the beginning. As representatives of PICES, we strongly urge that support be continued for at least 2007. The likelihood that other financing can be found is at best modest, given the circumstances of marine research agencies in the United States and Canada. The EVOS Trustee Council could make no other scientific investment with better certainty of success.

Concern was expressed in the publicly available, EVOS Science Director's comments on Dr. Batten's proposal that relevance of a transect that did not include Prince William Sound (PWS) was not made clear. We are aware that PWS is the area for which herring stocks are the main concern of the EVOS 2007 call for proposals. However, we call your attention to the fact that plankton stock levels all along the shelf from PWS to the eastern Aleutians are closely coupled by the Alaska Coastal Current (which this proposal samples), and that year-to-year and month-to-month variations will be much the same at both longitudes. Moreover, early EVOS-supported work on the plankton-salmon and plankton-herring relationships in PWS showed that influx to PWS from plankton stocks on the shelf is critical to the food supply in the Prince William Sound for herring and other fish. Supply of shelf plankton to the Prince William Sound also determines the degree of predation by pollock on juvenile pink salmon. Ending the continuous plankton survey project will leave all the funded herring projects without a vital piece of data.

Let us say it one more time. The continuous-plankton-recorder survey in the Gulf of Alaska is among the best scientific projects that EVOS funds have supported. Funding should be continued to obtain the

longest possible time-series and, thus, the maximum possible benefit to the preservation and management of Alaska's living marine resources.

Charles B. Miller, Ph.D.
Prof.-Emeritus, Oceanography
Oregon State University
Chairman, PICES-CPR-Advisory Panel

Jeffery Napp, Ph.D.
Supervisory Research Oceanographer
NOAA, PMEL, Seattle
Chairman, PICES Monitor Technical Committee

REPORT OF ADVISORY PANEL ON IRON FERTILIZATION EXPERIMENT IN THE SUBARCTIC PACIFIC OCEAN



The meeting of the Advisory Panel on *Iron fertilization experiment in the subarctic Pacific Ocean* (hereafter IFEP-AP) was held from 16:30–18:00 hours on October 13, 2006. The Panel Co-Chairman, Dr. Shigenobu Takeda called the meeting to order and welcomed the participants (*IFEP-AP Endnote 1*). The draft agenda was reviewed and adopted (*IFEP-AP Endnote 2*).

Report of the PICES XV IFEP/MODEL workshop (Agenda Item 2)

To enhance communication between experimentalists and modelers concerning the structure of iron biochemical models, IFEP-AP and the MODEL Task Team co-convened a 1-day workshop (W1) on “*Modeling iron biogeochemistry and ocean ecosystems*” at PICES XV. The workshop was held on October 13, 2006, and participation included 28 scientists from Canada, Japan, the United States of America, France and New Zealand (*IFEP-AP Endnote 2*). This workshop was co-sponsored by SOLAS (Surface Ocean–Low Atmosphere Study) who provided travel support for an invited speaker, Dr. Marie Boye (IUEM, France).

There were 7 oral presentations and 1 poster. Two talks focused on iron biogeochemistry based on observations, and 5 talks used numerical models to address the impact of iron on ecosystem dynamics. Discussion included chemical speciation of iron in seawater as well as iron released from atmospheric dust, biological availability of organically complexed iron, a conceptual model of the iron cycle in the surface ocean, and interaction between phytoplankton and zooplankton functional groups.

The workshop recommended that such communication between experimentalists and modelers who work on iron biogeochemistry

and ecosystem should continue. The summary of the workshop is included in the *Session Summaries* chapter of this Annual Report.

Report of the PICES XV BIO Topic Session (Agenda Item 3)

At PICES XV, IFEP-AP organized a 1-day BIO Topic Session (S4) on “*Synthesis of in situ iron enrichment experiments in the eastern and western subarctic Pacific*” held on October 17, 2006. The session was a compilation of results from the three successful meso-scale iron-enrichment experiments in the subarctic North Pacific, SEEDS-I, SEEDS-II and SERIES, that were initiated by IFEP-AP. The session consisted of 17 oral presentations and 7 posters. There was extensive discussion on the causes of the different responses in the 3 completed experiments. Several lines of hypothesis were set up by the participants to explain the relatively small response of diatoms in the SEEDS-II experiment. The session was very successful because it provided a comprehensive view on the role of iron as a limiting nutrient of phytoplankton production in the subarctic North Pacific, and because it established new hypotheses that should be tested in future studies. A summary of this session can be found in the *Session Summaries* chapter of this Annual Report.

Recent publications (Agenda item 4)

SEEDS-II 2005 Workshop report

A SEEDS-II (Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study, Phase II) Workshop was held on October 17–18, 2005, at the Ocean Research Institute, University of Tokyo, Japan. A brief report of the workshop was published in January 2006 in *PICES Press*, Vol. 14(1).

PICES Scientific Report

A *PICES Scientific Report No. 31* of the 2004 IFEP-AP workshop on “In situ iron enrichment experiments in the eastern and western subarctic Pacific” will be distributed to the PICES members after PICES XV. It includes a report and abstracts of the 2000 IFEP-AP planning workshop as appendices.

SERIES special volume

Twenty-four papers based on the results of the SERIES (Subarctic Ecosystem Response to Iron Enrichment Study) iron enrichment experiment will be published in November-December 2006, in *Deep-Sea Research II* Vol. 53 (20–22).

SEEDS-II special volume

Deep-Sea Research II or *Progress in Oceanography* were suggested as candidate journals to publish the results of the SEEDS-II experiment. Drs. Atsushi Tsuda, Mark L. Wells, Mitsuo Uematsu and Hiroaki Saito will serve as the Guest Editors for this special issue. The deadline for submission is March 1, 2007.

Future plans (Agenda Item 5)

Synthesis report of IFEP-AP

IFEP members will prepare a summary paper of SEEDS-I, SEEDS-II, and SERIES when the submission of original papers to the SEEDS-II special volume has been completed (perhaps by

March 2007). The summary paper will be submitted to *Eos* in order to attract a broad interest in the oceanographic community.

Future IFEP-AP activity

A timetable to complete IFEP-AP activities was discussed. There is no iron fertilization experiment planned. Editorial work on the SEEDS-II special volume and publication of the summary paper of SEEDS-I, SEEDS-II and SERIES may need one more year. Thus, it was recommended that the activity of IFEP-AP be closed at PICES XVI in October 2007.

IFEP-AP recognized that a new working group consisting of experimentalists and modelers would be useful to examine the causes for the different responses in the 3 completed iron enrichment experiments in the subarctic North Pacific, to set up new hypotheses on the mechanisms controlling phytoplankton production in the subarctic North Pacific based on small-scale onboard experiments and field observations, and to design and propose a large-scale experiment or field observation program to test these hypotheses.

Terms of Reference for a new working group under BIO will be prepared after PICES XV by selected members from IFEP-AP and MODEL. IFEP-AP will try to include suggestions from all PICES member countries and not only those participated in SEEDS-I, SEEDS-II, and SERIES. The new working group will be proposed to Science Board in April 2007.

IFEP-AP Endnote 1

Participation list*

Members

William P. Cochlan (U.S.A.)
 Paul J. Harrison (Canada/Hong Kong)
 Isao Kudo (Japan)
 Jun Nishioka (Japan)
 Hiroaki Saito (Japan)
 Shigenobu Takeda (Japan)
 Atsushi Tsuda (Japan, Co-Chairman)
 Mark L. Wells (U.S.A.)

Observers

Harold P. Batchelder (U.S.A.)
 Philip Boyd (New Zealand)
 Marie Boye (France)
 Fei Chai (U.S.A.)

James Christian (Canada)
 Hernan Garcia (U.S.A.)
 Albert J. Hermann (U.S.A.)
 Andrew King (U.S.A.)
 Maki Noguchi Aita (Japan)
 Hajime Obata (Japan)
 Atsushi Ooki (Japan)
 Sei-Ichi Saitoh (Japan)
 Taichiro Sakagami (Japan)
 Takashige Sugimoto (Japan)
 Charles Trick (Canada)
 Takaki Tsubono (Japan)
 Daisuke Tsumune (Japan)
 Thomas C. Wainwright (U.S.A.)
 Yasuhiro Yamanaka (Japan)
 Naoki Yoshie (Japan)

* All 28 scientists participated in the PICES XV IFEP/MODEL workshop (W1)

IFEP-AP Endnote 2

IFEP-AP meeting agenda

1. Adoption of agenda
2. Report of the PICES XV IFEP/MODEL workshop (W1) on “*Modeling iron biogeochemistry and ocean ecosystems*”
3. Report of the PICES XV BIO Topic Session (S4) on “*Synthesis of in situ iron enrichment experiments in the eastern and western subarctic Pacific*”
4. Recent publications (PICES Scientific Report, SERIES and SEEDS-II special volumes)
5. Future plans:
 - a. Synthesis report of IFEP-AP
 - b. Future IFEP-AP activity

REPORT OF ADVISORY PANEL ON MARINE BIRDS AND MAMMALS

The sixth meeting of the PICES Advisory Panel on *Marine birds and mammals* (hereafter MBM-AP) was held from 14:00–18:00 hours on October 13, 2006. Drs. Hidehiro Kato and William J. Sydeman, MBM-AP Co-Chairmen, called the meeting to order and welcomed the participants (*MBM-AP Endnote 1*). The Panel reviewed the Terms of Reference (*MBM-AP Endnote 2*) to orient the new observers. It was re-iterated that MBM-AP serves to generate interest in seabirds and marine mammals in PICES, and to coordinate multi-disciplinary investigations, symposia and workshops within the PICES community. The draft agenda was reviewed and approved (*MBM-AP Endnote 3*).

MBM-AP Workshop at PICES XV (Agenda Items 3)

A ½-day MBM-AP workshop (co-sponsored by BIO, POC and Hokkaido University Center of Excellence) on “*Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing*” was convened in the afternoon of October 12, 2006. Eight oral papers and 3 posters were presented. The summary of the workshop can be found in the *Session Summaries* chapter of this Annual Report.

The workshop was very successful. It was noted that an after-workshop meeting and/or dinner would be desirable for continued dialogue, and that posters need more attention and time. A full-day workshop might have been better for discussion. It was pointed out that we are still giving disparate talks, when more integration with each other would be good. The participants concluded that the workshop presentations were not appropriate for publication. While the material was excellent, some of it is already published, and the new material is in the early stages of analysis and interpretation. Integration of bird and mammal experts with climatologists and oceanographers was excellent, but mechanisms of seabird and marine mammal

responses are still poorly understood. There are, however, many aspects of research on marine birds and mammals that provide compelling advantages in looking at climate change impacts on marine ecosystems of the North Pacific.

Publication of previous workshops from PICES XIII and XIV on diet of predators in the North Pacific (Agenda Items 4)

In 2003 and 2004, MBM-AP convened two workshops on combining dietary datasets of marine predators. There are many very good data available, and it is important to highlight them through publication. The Panel believes this work should be resurrected.

Planning for PICES XVI (Agenda Item 5)

MBM-AP will put forth a modified description for a ½-day Topic Session at PICES XVI (to be co-sponsored by BIO, FIS and POC) on “*Phenology and climate change in the North Pacific: Implications of variability in the timing of zooplankton production to fish, seabirds, marine mammals and fisheries (humans)*” (*BIO Endnote 3b*).

MBM-AP membership (Agenda Item 6)

Dr. Sydeman pointed out the good participation in MBM-AP activities by Japanese and U.S. scientists. He also noted the improved involvement of Russian experts. The Panel is concerned by the lack of national participation from other member countries and recommends that:

- China be requested to assign experts on marine mammals (*e.g.*, from the State Oceanic Administration) and seabirds (*e.g.*, from the Forest Service Administration) to the Panel;
- Korea be asked to nominate experts from NFRDI and KORDI to the Panel; Korea is expending research on marine mammals and

seabirds, and the Yellow Sea Large Marine Ecosystem project offers new opportunities.

- Canada be encouraged to designate a seabird expert to serve on the Panel; Canada has many active marine bird research programs, yet the Canadian seabird position on the Advisory Panel has been vacant for 4 years.

Report of the Pacific CPR Program: Marine Bird and Mammal Project (Agenda Item 7)

Dr. Sydeman made a progress report on accomplishments of the Continuous Plankton Recorder (CPR) Marine Bird and Mammal Project.

Country reports: Climate change and marine birds and mammals (Agenda Item 8)

Dr. Sergey Kornev provided a report on Russian time series and studies.

Cooperation with IWC (Agenda Item 9)

MBM-AP asks that Dr. Kato be nominated as a PICES representative to the International Whaling Commission (IWC).

Terms of Reference–review (Agenda Item 10)

The MBM-AP Terms of Reference were reviewed, and some small modifications are recommended (*MBM-AP Endnote 2*).

Vision Statement–review (Agenda Item 11)

This was not accomplished due to a lack of time.

Other business (Agenda Item 12)

There was a discussion about the PICES North Pacific Ecosystem Status Report, and plan for its revision. In particular, the participants wondered when they could provide comments.

MBM-AP Endnote 1

Participation list

Members

Hidehiro Kato (Japan, Co-Chairman)
Sergey Kornev (Russia)
William J. Sydeman (U.S.A., Co-Chairman)
Andrew Trites (Canada)
Yutaka Watanuki (Japan)

Observers

Yoko Mitani (Japan)*
Keiko Kato (Japan)*
George L. Hunt (U.S.A.)
Julie Thayer (U.S.A.)

*first MBM-AP meeting attended

MBM-AP Endnote 2

Terms of Reference for Advisory Panel on *Marine birds and mammals*

1. Provide information and scientific expertise to BIO, CCCC/CFAME Program, and when necessary, to other scientific and technical (Standing) committees with regard to the biology and ecological roles of marine mammals and seabirds.
2. Identify important problems, scientific questions, and knowledge gaps in assessing the roles of marine mammals and seabirds in marine ecosystems.
3. Assemble relevant information on the biology of marine mammals and 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.

Suggested additions are underlined and deletions appear in (parenthesis)

MBM-AP Endnote 3

MBM-AP meeting agenda

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| <ol style="list-style-type: none"> 1. Welcome and introductions 2. Adoption of agenda 3. Review of MBM-AP Workshop (W8) at PICES XV on <i>“Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing”</i> 4. Discussion of publication of previous workshops from PICES XIII and XIV on diet of predators in the North Pacific | <ol style="list-style-type: none"> 5. Planning for PICES XVI 6. MBM-AP membership 7. Report of the Pacific CPR Program: Marine Bird and Mammal Project 8. Country reports: Climate change and marine birds and mammal 9. Cooperation with IWC 10. Terms of Reference–review 11. Vision Statement–review 12. Other business |
|--|--|

REPORT OF ADVISORY PANEL ON MICRONEKTON SAMPLING INTER-CALIBRATION EXPERIMENT



The PICES Advisory Panel on *Micronekton sampling inter-calibration experiment* (hereafter MIE-AP) was established to evaluate efficacy of sampling gears and the procedures employed by different investigators to sample micronekton in the North Pacific and other parts of the world's oceans.

MIE-AP met on the morning of October 13, 2006. After brief introductions of the participants (*MIE-AP Endnote 1*), a total 4 presentations were made on the results and data processing from the two field experiments organized by the Panel in 2004 and 2005, followed by questions and brief discussions on future activities (*MIE-AP Endnote 2*).

MIE-AP workshop (Agenda Items 2 and 3)

The workshop (W9) reviewed data and results from the MIE-1 cruise (off the west side of Oahu Island, Hawaii, October 6–13, 2004) and the MIE-2 cruise (in Oyashio waters off Japan, September 27–October 3, 2005). Sample processing and analysis was discussed, as were other sampling gears to be compared, and plans for the MIE-3 experiment. The summary of the workshop can be found in the *Session Summaries* chapter of this Annual Report.

MIE-AP future activities (Agenda Item 4)

Further data analysis

Although substantial progress has been achieved in the analysis of the MIE-1 and MIE-2 data, further analyses are required. In particular:

- The size-structure approach used by Dr. Evgeny Pakhomov for the MIE-1 data could be applied to the MIE-2 data sets.
- An inter-comparison between the MIE-1 and MIE-2 data should be attempted.
- The acoustic data need to be analyzed and compared in the light of gear densities. At

first, this should be done separately for each cruise.

Other sampling gears to be tested

- The results of the MIE-2 experiment revealed that the MOHT gear is among the most reliable and cost-effective micronekton gear developed to date, providing high quality and quantity micronekton samples. The development of a closing/opening mechanism could put this gear in the position to become a standard micronekton gear in the North Pacific and elsewhere in the world.
- It has been noted that the RMT-8 gear, as well as Russian micronekton sampling gear, should be included in future experiments to allow comparisons.
- Dr. Hiroya Sugisaki presented some preliminary results on the development a novel technology (a combination of acoustic and high resolution video imaging) to quantify deep-sea micronekton. MIE-AP felt that this technology could be beneficial and encouraged Dr. Sugisaki to describe the preliminary results of trials during the next PICES Annual Meeting.

Possibility of the MIE-3 experiment

MIE-AP felt strongly that a third experiment (MIE-3) is required to complete the geographical coverage, and to include gear types that were missed during the first two inter-comparisons. The major problem at the moment is the availability of ship time, and in this regard MIE-AP suggests pursuing three options:

- MIE-AP should work towards establishing a joint NPAFC-PICES research activity on micronekton sampling and conduct MIE-3 in the Bering Sea. Initial and encouraging contacts have already been made and will be followed in the forthcoming year.

MIE-AP-2006

- Dr. Orio Yamamura will apply for ship time (likely for RV *Hokko-Maru*) to carry out the MIE-3 experiment off Japan.
- The possibility of obtaining ship time for the MIE-3 experiment either in the Bering or Okhotsk Sea should be negotiated with the Russian Delegation.

In the light that the Panel activities will largely be concentrated in the northern Pacific seas, MIE-AP felt strongly that the membership of the Advisory Panel should be increased, particularly from Russia and the United States.

MIE-AP Endnote 1

Participation list

Members

Richard D. Brodeur (U.S.A.)
Kazushi Miyashita (Japan)
Evgeny A. Pakhomov (Canada, Co-Chairman)
Orio Yamamura (Japan, Co-Chairman)

Observers

Yoshioki Oozeki (Japan)
Larissa Pakhomova (Canada)
Hiroya Sugisaki (Japan)
Andrei V. Suntsov (Russia)
Hiroki Yasuma (Japan)

MIE-AP Endnote 2

MIE-AP meeting agenda

1. Welcome and introductions
2. MIE-1 results and data processing:
 - E.A. Pakhomov, M.P. Seki, A.V. Suntsov, R.D. Brodeur and K.R. Owen. *Comparison of three sampling gears during the first Micronekton Intercalibration Experiment (MIE-1): Size composition of selected taxonomic groups and total macroplankton and micronekton*
 - A.V. Suntsov, M.P. Seki, E.A. Pakhomov and R.D. Brodeur. *Diversity and abundance of Hawaiian ichthyoplankton: Comparison of three types of midwater nets*
3. Discussion on MIE-2 results and data processing:
 - O. Yamamura, H. Sugizaki, S. Abe, K. Sadayasu, R.-I. Matsukura, K. Miyashita, A. Hino and T. Tokai. *Inter-calibration of micronekton sampling gear during the 2005 MIE-2 cruise*
 - H. Yasuma, K. Miyashita and O. Yamamura. *Acoustic identification and density estimate of a lanternfish, *Diaphus theta*, off Hokkaido, Japan*
4. Discussion on future MIE-AP activities:
 - a. further data analysis
 - b. other sampling gears to be tested
 - c. possibility of the MIE-3 experiment
 - d. workshop/sessions at PICES XVI

Proposal of workshop/session at PICES XVI

MIE-AP proposed to convene a workshop at PICES XVI on “*Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data*” with the objectives of (a) finalizing MIE-1 and MIE-2 analyses, (b) presenting and discussing acoustic data sets from both cruises, (c) comparing ICES and PICES inter-calibration experiments, and (d) discussing recent developments in the field of micronekton quantitative techniques (*MIE-AP Endnote 3*). Travel funds from PICES are requested for two invited speakers.

MIE-AP Endnote 3

**Proposal for a ½ or ¾ -day workshop at PICES XVI on
*“Lessons learned during MIE-1 and MIE-2: Reconciling acoustics and trawl data”***

Micronekton is one of the important but largely understudied components of marine ecosystems functionally linking small zooplankton and higher trophic levels. Recent advances in acoustic devices and efforts to standardize sampling gears undertaken by both PICES and ICES communities have made the sampling of micronekton more precise. Nevertheless, the issue of inter-calibrating the growing number of micronektonic gears is still unresolved. The PICES Advisory Panel on *Micronekton sampling inter-calibration experiment* (MIE-AP) organized two field experiments (off Hawaii in 2004 and off Japan in 2005) to collect

comparative data for several micronekton sampling gears and a wealth of acoustic information. The main objective of this workshop will be: (1) to finalize the analysis and to compare MIE-1 and MIE-2 data sets; (2) to present and discuss acoustic data sets from both cruises; (3) to compare ICES and PICES inter-calibration experiments; and finally (4) to discuss new developments in the field of micronekton quantitative techniques.

Recommended convenors: Evgeny A. Pakhomov (Canada) and Orio Yamamura (Japan).

SUMMARY OF SCIENTIFIC SESSIONS AND WORKSHOPS

Science Board Symposium (S1)

Boundary current ecosystems

Conveners: Kuh Kim (SB), Michael J. Dagg (BIO), Gordon H. Kruse (FIS), John E. Stein (MEQ), Michael G. Foreman (POC), Jeffrey M. Napp (MONITOR), Igor I. Shevchenko (TCODE), Harold P. Batchelder (CCCC), Suam Kim (CCCC), Fangli Qiao (China) and Yukimasa Ishida (Japan)

Background

The North Pacific is surrounded by boundary currents (*e.g.*, Kuroshio, Tsushima, Oyashio, California, Alaska, Bering Slope) that support a diversity of ecosystems. These ecosystems are highly variable in space and time due to combinations of climate change, decadal “regime” shifts, ENSO and other interannual variability, seasonal and event mesoscale dynamics. This variability has led to dramatic changes at both low and high trophic levels, including productivity, range extensions, and species dominance. This theme provided opportunities to address questions such as: 1) How will climate variation and projected climate change influence the dynamics and variability of boundary currents? 2) How will boundary current ecosystems respond to these physical property and transport changes? 3) How does human activity (*e.g.*, fishing, hatcheries) alter the sensitivity of boundary current ecosystems to natural environmental forcing? and 4) What are appropriate management strategies to maintain healthy, sustainable living marine resources in boundary current systems that experience large environmental variations? Presentations that describe, compare and/or contrast physics, biology, fisheries, and geochemistry of boundary currents and the ecosystems they support were encouraged.

Summary of presentations

The session consisted of a Keynote Lecture, 5 invited talks and 8 contributed oral presentations. The Keynote Lecture by Akihiko Yatsu provided a broad review on climate and regime shifts affecting the population dynamics

of species in the Kuroshio and the Oyashio currents region and emphasized that proper understanding of ecosystem dynamics, linking both climate and human activities and taking into account ecosystem factors and uncertainties, are essential for wise management. The most plausible mechanisms for sardine/anchovy cycles in the Kuroshio/Oyashio system were presented to highlight the importance of these interconnections.

The invited paper by Ichiro Yasuda introduced a new mechanism for the cause of interannual variability in the formation of North Pacific Intermediate Water. Diapycnal tidal mixing around the Kuril straits and the Aleutian straits has an 18.6-year period that affects the Kuroshio and Oyashio currents and the Kuroshio Extension. Yasuda also showed that this long-term variability appears in the zooplankton of the Oyashio waters and in the species replacement of small pelagic fishes between Japanese sardine and Pacific saury. The invited paper by William Peterson presented results of monitoring the coastal ocean environment of Washington and Oregon since 1997. He showed that the northern California Current is a dynamic large marine ecosystem, varying at periods from daily to decadal time scales. The goal of this group is to communicate the status of salmon recruitment in the northern California Current ecosystem annually. The technical basis for the recruitment indices was presented and the approach for posting the state of the California Current on the web for managers to use was described. Arthur J. Miller’s invited paper presented analyses of the CalCOFI dataset in the southern California Current, revealing a significant surface-intensified warming and stratification changes across the 1976-77 climate

regime shifts. The average depth of the thermocline has not changed, but the strength of stratification did, affecting the quality of the upwelled water and the depth from which it is drawn. These historical changes can be useful in anticipating the potential impact of global warming on oceanic circulation off the coast of California. The invited paper by J. Anthony Koslow described the uniqueness of the Leeuwin Current as a warm, nutrient-poor current, which suppresses upwelling. He introduced a recent hypothesis for a mechanism underlying the apparently paradoxical correlation between the strength of the Leeuwin Current and western rock lobster recruitment. The final invited paper by Kenneth F. Drinkwater reviewed the boundary currents system in the North Atlantic in comparison with the North Pacific and their responses to climate change and variability, and discussed the effects of fishing on the sensitivity of fish species to climate forcing with a question of whether any additional insights into the effects of climate forcing on marine ecosystems could be gained by comparing and contrasting responses in the two oceans.

It is particularly notable that most contributed oral papers presented recent findings providing new insights on ecosystems of the North Pacific. Robert M. Suryan reported results of satellite tracking of 19 albatrosses from their breeding colony on Torishima (Izu Islands) for three years, between 2002 and 2006, and identified prominent features of the Kuroshio-Oyashio current system that are important to foraging by this upper trophic level marine predator. Sanae Chiba reported on decadal changes in geographical distribution pattern of copepods in

the Kuroshio, Oyashio and Transition Zone using the historical zooplankton collection (Odate Collection), and suggested that the distributions of copepods were determined by the combined effects of lagged and un-lagged hydrographic variations that are closely related to the Pacific Decadal Oscillation. Jack Barth showed the importance of intra-seasonal oscillations (ISOs) in driving the California Current ecosystem. He found that upper-ocean temperature, phytoplankton and zooplankton in the Oregon coastal upwelling system varied principally on a 20- to 40-day time scale which correlated with the wind stress variations. Emanuele Di Lorenzo showed how the intrinsic mesoscale eddy field, arising from ocean internal dynamics without atmospheric coupling and stochastic forcing, develops in the California Current and leads to decadal variations in the temperature and salinity properties of the eastern subtropical mode waters. This research was based upon a multi-century long integration of an eddy-resolving ocean model of the Northeast Pacific. James Christian showed satellite images taken in the North Equatorial Countercurrent during the 1997-98 El Niño event, indicating phytoplankton blooms in a narrow meandering current against a backdrop of oligotrophic waters and discussed biological significance of this upwelling in the context of the world's largest underexploited oceanic fish populations. The final paper by Juergen Alheit explored the synchronous transition from an anchovy to a sardine regime that occurred in the Kuroshio and Humboldt Currents between 1969 and 1971, and raised a question of whether both systems are governed by basin-wide climatic teleconnection patterns.

List of papers

Oral presentations

Akihiko Yatsu (Keynote)

Biological production, animal migration and ecosystem regime shifts in the Kuroshio and Oyashio Currents: Perspectives for sustainable use

Ichiro Yasuda (Invited)

The Kuroshio and Oyashio current system: Variability and impact on the ecosystem

Robert M. Suryan, Fumio Sato, Gregory R. Balogh, Noboru Nakamura, Paul R. Sievert and Kiyooki Ozaki

Kuroshio and Oyashio boundary currents: Critical foraging habitat for the short-tailed albatross (*Phoebastria albatrus*), one of Japan's natural monuments

Sanae Chiba, Hiroya Sugisaki and Toshiro Saino

Decadal changes of the Oyashio and Kuroshio affected spatio-temporal variation of the copepod community in the western North Pacific

Edmundo Casillas and William T. Peterson (Invited)

The Northern California Current Ecosystem: Variability, indicator development, and an ocean condition index for fishery management

John A. Barth and John M. Bane

Intraseasonal wind oscillations and their influence on northern California Current coastal ecosystems

Arthur J. Miller (Invited)

Long-term changes in the climate of the California Current, with biological impacts

Emanuele Di Lorenzo and Niklas Schneider

Intrinsic oceanic decadal variability in the North Pacific generated in the Eastern Boundary Current System

James Christian

The North Equatorial Countercurrent: An anomalous boundary current with biologically significant upwelling and a predictable response to climate forcing

J. Anthony Koslow, Ming Feng, Stephane Pesant and Peter Fearn (Invited)

The biophysical oceanography of the Leeuwin Current, a poleward-flowing eastern boundary current off the west coast of Australia

Kenneth F. Drinkwater and Svein Sundby (Invited)

The response of North Atlantic boundary currents and their ecosystems to climate change and variability - Contrasts and comparisons with the North Pacific

Juergen Alheit

Synchronous ecological regime shifts in the Kuroshio and Humboldt Currents

BIO/FIS Topic Session (S2)

The human dimension of jellyfish blooms

Co-convenors: Richard Brodeur (U.S.A.), Jiahua Cheng (China), Horoshi Iizumi (Japan) and Won Duk Yoon (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. This session sought to understand the causes of the proliferation and expansion of these blooms

in coastal waters and whether climatic or anthropogenic changes have led to the recent blooms. In this regard, studies that examined the effects of these blooms on humans and their economies, and ways to predict their occurrence and spread were encouraged.

Summary of presentations

The session consisted of 13 oral and 7 poster presentations. The invited talks focused on factors that have led to increases in gelatinous zooplankton in a number of regions around the world. Jellyfish have replaced some major fish resources and have caused substantial damage to human endeavors such as fishing, aquaculture, the generation of electricity, and tourism. The economic implications of these blooms can be staggering, leading to complete loss of some very valuable fisheries. One of the more important ideas brought out at the session was the concept of a 'jellyfish spiral' where many

factors acting synergistically cause jellyfish to increase, and once these jellyfish populations are established, reverting to fish dominated ecosystems is difficult. However, in several case studies including the Bering Sea and Black Sea, there can be decreases in jellyfish populations due to decreased production and by the introduction of jellyfish predators, respectively.

Many of the contributed papers discussed 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. Three contributed talks and one poster covered North American studies in the Bering Sea, California Current and Northwest Atlantic. The subjects of talks covered not only the pelagic adult stage that is most visible but also the benthic polyp stage, about which we know relatively little for many species. Several presentations discussed ways of estimating jellyfish abundance by acoustics, examining the stomachs of predators, and by aerial photography. Numerical models of ocean circulation were shown to be an effective means of examining jellyfish dispersal in coastal waters. Several studies have started to use

ecosystem models to assess the effects of jellyfish on ecosystems, and some success has been achieved.

It became apparent during the session that jellyfish have been increasing in a number of ecosystems around the world and that with current scenarios of ocean change due to warming, overfishing, eutrophication, and habitat modification, we can expect to see this trend continue in the future. The fishing industry is beginning to adapt to these changes by employing jellyfish excluders on trawl nets and by finding new markets for jellyfish products. Some of the participants of the session met separately with representatives of the power generation industry to provide advice on ways to predict or control jellyfish ingress in power plant cooling systems. Cooperation between scientists and industry will be essential in averting what could become both an ecological and financial crisis in the future.

The convenors planned to produce a special issue of the journal, *Plankton and Benthos Research*, containing peer-reviewed papers from the session.

List of papers

Oral presentations

Jennifer E. Purcell (Invited)

Interactions of multiple factors contribute to infestations of jellyfish

Shin-ichi Uye (Invited)

Bloom of the giant jellyfish *Nemopilema nomurai*: A threat to the East Asian Marginal Seas fisheries sustainability

Tamara A. Shiganova (Invited)

Comparative analyses of invasive gelatinous species blooms in the Black, Azov, Caspian and Aegean Seas and their effect on ecosystems and fisheries

Hitoshi Iizumi, Osamu Katoh, Tatsuro Watanabe, Naoki Iguchi, Koh Nishiuchi, Toru Hasegawa, Kosei Komatsu, Kazufumi Takayanagi and Masaya Toyokawa

Mass appearance of the giant jellyfish, *Nemopilema nomurai*, along the coastal area of Japan

Joon-Yong Yang, Soo-Jung Chang, Jae Hong Moon, Won Duk Yoon and Donghyun Lim

Distribution of *Nemopilema nomurai* in Korean waters in 2005 and its possible origin

Jia-Hua Cheng, Feng-Yuan Ding, Sheng-Fa Li and Hui-Yu Li

Study on the quantitative distribution pattern of macro-jellyfish in the East China Sea

Jason S. Link, Michael D. Ford and Elizabeth Fulton

Widespread and persistent increase of Ctenophora in the Northeast U.S. shelf ecosystem: Evidence from spiny dogfish (*Squalus acanthias*) and implications for large marine ecosystems

Hye Eun Lee, Won Duk Yoon and Donghyun Lim

Predator on polyps of *Nemopilema nomurai* (Scyphzoa, Rhizostomeae)

Kristin Cieciel, Lisa Eisner, Angela Feldmann and Mary Courtney

Size structure, distribution, and interaction characteristics of dominant jellyfish from surface trawls in the Eastern Bering Sea

Haruto Ishii

Adaptation to coastal environmental changes in the polyp stage in relation to jellyfish blooms in Tokyo Bay

Richard D. Brodeur, Cynthia Suchman, Doug Reese, Todd Miller, Jim Ruzicka and Elizabeth Daly

Spatial overlap and trophic interactions between fish and large jellyfish in the northern California Current

Jing Dong, Chun-Yang Liu, Yang-Qing Wang and Bin Wang

Laboratory observations on the life cycle of *Cyanea nozakii* (Semeostomida, Scyphozoa)

Miyuki Hirose, Tohru Mukai, Kohji Iida and Doojin Hwang

Acoustic observations on the jellyfish *Nemopilema nomurai* in the East China Sea

Posters

Naoki Fujii, Akiko Fukushima, Yuta Nanjo and Hidetaka Takeoka

Aggregations of *Aurelia aurita* in Uwa Sea, Japan

Hye Eun Lee, Won Duk Yoon and Donghyun Lim

The prey passage of *Nemopilema nomurai* (Scyphozoa, Rhizostomeae)

Seok Hyun Lee, Won Duk Yoon and Dong Hyun Lim

Effect of heavy metals on polyps of the *Aurelia aurita*

Xiancheng Qu, Masaya Toyokawa, Ying Liu and Yasuaki Nakamura

Molecular biological analysis of jellyfish (*Nemopilema nomurai kishinouye*) mitochondrial 18S ribosomal RNA

James J. Ruzicka, Thomas C. Wainwright and Richard D. Brodeur

Trophic interactions within the pelagic community of the Oregon and Washington upwelling ecosystem: A modeling study of the role of large jellyfish

Jun Shoji

Quantitative and qualitative changes in predator-prey relationship between moon jellyfish and fish larvae in summer hypoxia: Possible increase in trophic flow to jellyfish in coastal ecosystems

Euikyung Kim, Seunghwan Lee, Jong-Shu Kim, Won Duk Yoon, Donghyun Lim, Andrew J. Hart and Wayne C. Hodgson

Cardiovascular effects of *Nemopilema nomurai* (Scyphozoa, Rhizostomeae) jellyfish venom in rats

BIO Topic Session (S3)

Interactions between biogeochemical cycles and marine food webs in the North Pacific Ocean

Co-convenors: Angelica Peña (Canada), Hiroaki Saito (Japan/IMBER) and Sinjae Yoo (Korea)

Co-sponsored by IMBER

Background

Marine food webs and their components respond to, as well as influence, the abundance and distribution of biogenic elements in the ocean. A better understanding of the fundamental interactions between biogeochemical cycles and food webs is necessary to advance our understanding of the response of marine ecosystems to natural and anthropogenic perturbations, such as changes in physical dynamics and carbon cycle chemistry, dust events, eutrophication and marine harvest. The North Pacific and adjacent seas include a wide

range of ecosystems and some unique environmental conditions (*e.g.*, high silicic acid concentration relative to nitrate, iron-limited HNLC region), providing the opportunity to investigate and compare the role of biological processes on biogeochemical cycles under varying environmental conditions. The main goal of this session was to review existing knowledge on the interaction between biogeochemical cycles and marine food webs in the North Pacific Ocean and to identify gaps in current knowledge for eventual prediction of the effect of human activities and climate change on marine ecosystems.

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Summary of presentations

There were 16 oral and 3 poster presentations in this session that was attended by about 75 persons. The presentations can be divided into four broad categories. There was a group that considered processes associated with nutrient supply, seasonal and recent decadal trends in nutrients, and micronutrient limitation. A second group of presentations described lower trophic level characteristics in the PICES region, including coastal and oceanic waters. Results from both field observation and modeling studies were presented. Three talks were related to the important topic of the effects of iron limitation in the North Pacific on marine food webs. Another set of presentations focused on vertical exchanges and processes, including new information of settling particles, phytoplankton resting spores, copepod ontogenetic migration and overall processes controlling vertical carbon transport. The last group of presentations discussed nutrient cycling in the context of

biological modeling, and presented information on a new free-floating oceanographic instrument for simultaneous tracking of water properties and large particles, including zooplankton. Presentations covered many biological and biogeochemical processes and served as a useful review and synthesis of present knowledge, but many addressed only one of either biogeochemical cycling or marine food webs. This session pointed out the challenges faced by the scientific community in linking biogeochemical cycling to marine food webs, especially to particular species or groups of organisms in higher trophic levels. On the other hand, several presentations clearly showed how marine food web processes drive specific aspects of biogeochemical cycling or flux. Overall, linkages between marine ecosystems and biogeochemical cycling were identified. Gaps highlighting a need for research were shown and discussed. We believe presentations in this session were inspirational for the future studies by attendees.

List of papers

Oral presentations

Kon-Kee Liu, Chun-Mao Tseng, I-I Lin, Hong-Bin Liu and Anond Snidvongs (Invited)

Effects of photoacclimation of phytoplankton and benthic-pelagic coupling on primary production in the South China Sea: Recent observations and modeling

Kazuaki Tadokoro, Tsuneo Ono, Akihiro Shiimoto and Hiroya Sugisaki

Trends and bi-decadal oscillations in PO₄ concentration in the Oyashio and Kuroshio-Oyashio mixed waters

Hernan E. Garcia, Tim P. Boyer, Sydney Levitus, Ricardo A. Locarnini, John I. Antonov, Daphne Johnson and Alexey Mishonov

Climatological annual cycle of inorganic nutrient content anomaly in the Pacific Basin

Andrew L. King and Kathy Barbeau

Macro- and micronutrient limitation of phytoplankton standing stock in the southern California Current System

Sinjaee Yoo, Man-Sik Choi, Sang-Hwa Choi, Jung-Ho Hyun, Hyung-Ku Kang, Dongseon Kim, Hyun-cheol Kim, Chang Rae Lee, Jeong-Ah Lee, Taehee Lee, Jae Hoon Noh, Chang-Woong Shin and Eun Jin Yang

Productivity and structure of lower trophic level communities and carbon flux in the Ulleung Basin in the JES in the summer of 2005

TaeKeun Rho, Sei-ichi Saitoh, Akihiro Shiimoto, Takahiro Iida and Toshiyuki Konish

Variability of summer primary production in the Subarctic North Pacific and the southeastern Bering Sea shelf

Hiroaki Saito, Takashi Ota, Koji Suzuki, Jun Nishioka and Atsushi Tsuda

Role of heterotrophic dinoflagellate *Gyrodinium* sp. in biogeochemical cycles

Koji Omori, Hidejiro Ohnishi, Toru Fukumoto, Shunsuke Takahashi, Hideki Hamaoka, Miyuki Ohnishi, Kenji Yoshino, Motomi Kato and Todd W. Miller

Two sources of primary production of sand bank ecosystems in Seto Inland Sea, Japan

Masahiko Fujii, Yasuhiro Yamanaka, Yukihiro Nojiri, Michio J. Kishi and Fei Chai

Comparison of seasonal characteristics in biogeochemistry among the subarctic North Pacific stations described with a NEMURO-based marine ecosystem model

George A. Jackson (Invited)

Using coagulation theory to predict maximum particle concentrations and fluxes from the surface ocean

Akira Kuwata

Resting spore formation and sinking of bloom forming diatoms in the Oyashio region of the western subarctic Pacific

Toru Kobari, Deborah K. Steinberg, Atsushi Tsuda and Minoru Kitamura

Active carbon transport by the ontogenetically migrating copepods in the western subarctic gyre

Atushi Yamaguchi, Yuji Watanabe, Hiroshi Ishida, Takashi Harimoto, Kazushi Furusawa, Shinya Suzuki, Joji Ishizaka, Tsutomu Ikeda and Masayuki M. Takahashi

Taxonomic and size composition of plankton community down to the greater depths in the western North Pacific

Angelica Peña, M. Foreman and J. Morrison

Modeling summer nutrient and phytoplankton dynamics off the entrance of Juan de Fuca Strait

Lei Gao, Dao-Ji Li, Yan-Ming Wang, Li-Hua Yu, Ding-Jiang Kong, Mei Li and Yun Li

Nitrogen and silicon cycling in sediment and porewater of Dongtan tidal flat in the Changjiang (Yangtze River) estuary

David Checkley, Russ Davis, Alex Herman, George Jackson, Brian Beanlands, Jesse Powell and Lloyd Regier

Simultaneous assessment of particles, including plankton, in the North Pacific by use of the SOLOPC

Posters

Satoshi Kitajima, Fuminori Hashihama, Shigenobu Takeda and Ken Furuya

Nitrogen fixation in the subtropical and tropical western North Pacific

Taehee Lee and Dongseon Kim

The cycling of organic carbon at the Ulleung Basin sediments, the East/Japan Sea

Yuri Yu. Nikonov

Numerical analysis of chlorophyll-*a* modification in the south-east region of Sakhalin Island

Takeshi Okunishi, Michio J. Kishi, Ryuichiro Shinohara and Toshihiko Yamashita

Impact of tidal mixing in the Kuril Strait on the surface nitrate distribution in the Okhotsk Sea and North Pacific during summer

BIO Topic Session (S4)

Synthesis of in situ iron enrichment experiments in the eastern and western subarctic Pacific

Co-Convenors: Maurice Levasseur (Canada), Shigenobu Takeda (Japan) and Atsushi Tsuda (Japan)

Background

Three successful meso-scale iron enrichment experiments have been conducted in the subarctic North Pacific (SEEDS-I & II and SERIES) over the last four years. The aim of this session was to synthesize the key findings of these experiments and to initiate the development of a common database. Of particular interest was contributions specifically comparing and contrasting the results obtained during the three experiments. This inter-comparison is especially important in regard to the unexpected response observed during the last experiment (SEEDS-II) which highlights our limited understanding of how iron affects biogeochemical cycles, and the complexity of ecosystem responses to iron in HNLC (High Nutrient Low Chlorophyll) waters. We also encouraged papers investigating how iron influences, and is in turn, influenced by ocean-atmospheric exchanges, plankton activities and

community structure, micronutrient chemistry, and other processes in the subarctic North Pacific.

Summary of presentations

The session was well attended and attracted many scientists who had not been involved in the experiments. The session consisted of 17 talks and 7 posters showcasing results from the three successful iron enrichment experiments conducted in the subarctic North Pacific: SEEDS-I (2001), SERIES (2002) and SEEDS-II (2004). These international collaborative experiments were initiated under the auspices of the PICES Advisory Panel on *Iron Fertilization Experiment in the Subarctic Pacific Ocean* (IFEP-AP).

Philip W. Boyd, in his invited talk, presented an insightful synthesis of the 12 meso-scale iron-enrichment experiments conducted so far in the

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various HNLC regions of the world, and reviewed the few studies that focused on natural iron fertilization events. He concluded with recommendations for future studies. The following talks summarized the key results obtained in SEEDS-I, -II and SERIES, and highlighted the major differences observed in the biological and geochemical responses during these experiments. SEEDS-I differed from the two others by its massive bloom of a neritic diatom species. SERIES, on the other hand, provided unique information on the fate of carbon after the decline of the iron-induced phytoplankton bloom. SEEDS-II was conducted in the same area as SEEDS-I, but resulted in a much smaller build-up of phytoplankton biomass. Several hypothesis were proposed by the participants to explain the relatively small response of diatoms in SEEDS-II as compared to

SEEDS-I. These included: a higher initial mesozooplankton biomass and grazing pressure, a deeper surface mixed layer depth, and iron limitation induced by organic iron-complexing ligands. Other papers presented the physical conditions during the experiments, the biogeochemistry of iron, carbon, nitrogen and silicon, the physiological and ecological responses of phytoplankton and zooplankton, and the cycling of dimethylsulfide (DMS) inside and outside the iron patches.

The session was very useful in providing a comprehensive view of the role of iron as a limiting nutrient for primary production in the subarctic North Pacific, in identifying weaknesses and gaps in our understanding of the functioning of this ecosystem, and in setting the base for future experiments.

List of papers

Oral presentations

Philip W. Boyd (Invited)

Mesoscale iron enrichments - A valuable tool to understand how Pacific HNLC waters function

Atsushi Tsuda, Shigenobu Takeda, Hiroaki Saito, Jun Nishioka, Yukihiro Nojiri and Isao Kudo
SEEDS I summary

Paul Harrison, Maurice Levasseur, Philip Boyd, C.S. Wong, Richard Rivkin and Tom Pedersen

Mesoscale Fe enrichment produces a large diatom bloom, draws down CO₂, but with limited production of DMS and carbon export in the NE Subarctic Pacific

Hiroaki Saito and SEEDS II participants

SEEDS II summary

Daisuke Tsumune, Jun Nishioka, Akifumi Shimamoto, Yutaka Watanabe, Shigenobu Takeda and Atsushi Tsuda

The physical behavior of the iron patches detected by SF₆ tracer during SEEDS-I and SEEDS-II

S. Takeda, J. Nishioka, C.S. Wong, W.K. Johnson, M. Kinugasa, Y. Kondo, K. Kuma, S. Nakatsuka, H. Obata, E. Roy, M. Sato, N. Sutherland, Y. Sohrin, H. Takata, H. Tani, A. Tsuda and M.L. Wells

Iron geochemistry of SEEDS-I, -II and SERIES

Jun Nishioka, Tsuneo Ono, Hiroaki Saito, Takeshi Nakatsuka, Shigenobu Takeda, Takeshi Yoshimura, Koji Suzuki, Kenshi Kuma, Shigeto Nakabayashi, Humio Mitsudera and Atsushi Tsuda

Iron supply to the western subarctic Pacific: Importance of lateral iron transport from the Sea of Okhotsk and winter mixing

Yukihiro Nojiri, Keiri Imai and Takafumi Aramaki

Analysis of changes in water and particulate material chemistry during iron-enrichment experiments in the subarctic North Pacific (SEEDS, SERIES and SEEDS-II)

Takeshi Yoshimura, Hiroshi Ogawa, Keiri Imai and Jun Nishioka

The dynamics of dissolved organic matter during *in situ* iron enrichment experiments in the subarctic North Pacific

Koji Suzuki, Hiroaki Saito, Akira Hinuma, Hiroshi Kiyosawa, Akira Kuwata, Kyoko Kawanobe, Toshiro Saino and Atsushi Tsuda

Comparison of community structure and photosynthetic physiology of phytoplankton in two mesoscale iron enrichment experiments in the NW subarctic Pacific

Charles G. Trick, William P. Cochlan, Mark L. Wells and Julia N. Betts

Complexity of grow-out experiments: Further iron stimulation of planktonic communities from the iron-fertilized mesoscale patch during SEEDS

Isao Kudo, Yoshifumi Noiri, Jun Nishioka, Yousuke Taira, Hiroshi Kiyosawa and Atsushi Tsuda

Phytoplankton community response to Fe and temperature gradients in the NE (SERIES) and NW (SEEDS) subarctic Pacific Ocean

Mark L. Wells, Charles G. Trick, William P. Cochlan and Julian Herndon

The persistence of iron limitation during the SEEDS-II mesoscale iron enrichment experiment

Atsushi Tsuda, Hiroaki Saito and Akash R. Sastri

Meso- and microzooplankton responses in the iron-enrichment experiments in the subarctic North Pacific (SEEDS, SERIES and SEEDS-II)

Maurice Lévasseur, Anissa Merzouk, Martine Lizotte, Michael Scarratt, Sonia Michaud, Yvonnick Le Clainche, Chi Shing Wong and Richard Rivkin

Impact of iron enrichment on DMS cycling in the subarctic Pacific: A synthesis of SERIES and SEEDS-II

Ipppei Nagao, Shinya Hashimoto, Shuji Toda, Shungo Kato, Yoshizumi Kajii, Yasushi Narita, Mitsuo Uematsu, Atsushi Tsuda, Hiroaki Saito and Koji Suzuki

Seawater and atmospheric DMS concentrations during SEEDS-II (Western North Pacific)

Yoko Iwamoto, Yasushi Narita and Mitsuo Uematsu

Single particle analysis of oceanic suspended matters during SEEDS-II

Posters

Takafumi Aramaki, Yukihiro Nojiri and Keiri Imai

Variations in total mass flux, nutrients and particulate matters during SEEDS-II

Yoshiko Kondo, Shigenobu Takeda, Jun Nishioka, Hajime Obata, Ken Furuya, William Keith Johnson, Agnes Sutherland and C.S. Wong

Behavior of organic iron (III) complexing ligands during SEEDS-II experiment

Isao Kudo, Yoshifumi Noiri, T. Aramaki, William P. Cochlan, Koji Suzuki, Tsuneo Ono and Yukihiro Nojiri

Primary production, bacterial production and nitrogen assimilation dynamics during the SEEDS-II experiment

Seiji Nakatsuka, Masatoshi Kinugasa, Yoshiki Sohrin, Jun Nishioka, Shigenobu Takeda and Atsushi Tsuda

Dynamics of bioactive trace metals during the mesoscale iron enrichment in the Subarctic Western North Pacific Gyre (SEEDS-I and -II)

Yasushi Narita, Yoko Iwamoto, Kentaro Yoshida, Masaki Kondo and Mitsuo Uematsu

Contribution of biogenic sulfur to the marine lower atmosphere in the Northwestern Pacific

Hajime Obata, Yasuko Hara, Takashi Doi, Yayoi Hongo, Toshitaka Gamo, Shigenobu Takeda and Atsushi Tsuda

Rare earth elements during an iron fertilization experiment in the western subarctic North Pacific (SEEDS-II)

Mitsuhide Sato, Shigenobu Takeda and Ken Furuya

Responses of pico- and nano-phytoplankton to artificial iron infusions during SEEDS-II

BIO Topic Session (S5)

Advances in epi- and meso-pelagic ecosystem research

Co-Conveners: Alexei M. Orlov (Russia), Evgeny A. Pakhomov (Canada) and Orio Yamamura (Japan)

Background

Micronekton is recognized as an important component of epi- and meso-pelagic ecosystems for its role in transferring mesozooplankton production to higher trophic levels. Due to its mobility, quantitative sampling of micronekton has long been regarded as virtually impossible. Recent advances in acoustic devices and efforts to standardize sampling gears have made the sampling of micronekton more precise. The session aimed to synthesize existing and new

knowledge on micronekton biology including distribution, life history and vertical migrations, relationships with commercial species and its functional role in the North Pacific boundary currents and open ocean ecosystems.

Summary of presentations

A total of 13 oral papers and 12 posters were presented during the session. Invited speakers, Richard D. Brodeur and Hiroaki Saito, reviewed micronekton activities in two North Pacific

regions, namely in the Northern California Current off Oregon (U.S.A.) and in the northwestern Pacific (Japan). In both presentations, the history of micronekton research, micronekton diversity and distribution, and its importance in epi- and meso-pelagic food webs were highlighted.

The theme of adaptive diversity and ratios between two main groups of mesopelagic micronekton (as potential estimates of mesopelagic micronekton community status) were brought up in presentations by Suntsov, Radchenko and Miller & Tsukamoto. Furthermore, a detailed analysis of micronekton and nekton distribution and an array of environmental parameters was provided in presentations by Orlov & Gruzevich, Yamamoto *et al.* and several posters (*e.g.*, Ivanov & Sukhanov, Savinykh, Tanimata *et al.*, Velikanov *et al.*)

By far, the predominant theme during the session was dealing with trophic interactions among micronekton and between micronekton and epi-pelagic fish species of commercial interest (*e.g.*, presentations on this theme included Kubota *et al.*, Miller *et al.*, Sugisaki *et al.*, Takagi *et al.*, and posters by Kosenok & Sviridov).

Only a few presentations covered other major groups of micronekton that have been largely ignored in the past due to logistical difficulties of collecting the data. These included diversity and distribution of squid (Katugin *et al.*, Zuev, Watanabe *et al.*) and the vertical distribution of

gelatinous micronekton (Toyokawa *et al.*). Only two presentations were devoted to both reproductive ecology (Belova & Savinykh) and growth (Shelekhov & Savinykh) of micronektonic fish.

Overall, the presentations at the session showed that the research on mesopelagic micronekton is more prominent than was previously believed. A measurable volume of research has been conducted in the North Pacific in particular. There is a growing interest in this type of research as the importance of mesopelagic processes for fisheries and global climate change is recognized. At this moment, arguably the majority of research is concentrated on a single group of micronekton, the fishes, and particularly on myctophids. This is, perhaps, due to possible competition of this group with species of commercial interest, and their significance as prey for a variety of these species and top predators, and their potential importance for future harvests. There was a strong feeling that more fundamental research should be conducted on other micronektonic groups, including crustaceans, gelatinous plankton and squid. Furthermore, more research should be directed to linking micronekton and top predators. Finally, the participants felt that the results of micronekton research should be communicated generally among the PICES research community as it has relevance for several major PICES themes including climate change, ecosystem responses to such changes, and biogeochemical processes in the North Pacific.

List of papers

Oral Presentations

Richard D. Brodeur (Invited)

Micronekton and their importance in the northern California Current Ecosystem

Andrey V. Suntsov

Adaptive radiations in mesopelagic fishes: The role of key innovations

Vladimir I. Radchenko

Ratio of myctophid and bathylagid fish biomasses as an index of mesopelagic fish community status

Michael J. Miller and Katsumi Tsukamoto

Distribution and ecology of leptocephali in the western North Pacific gyre ecosystem

Hiroshi Kubota, Yoshioki Oozeki and Ryo Kimura

Factors responsible for the differences in feeding habits of mesopelagic fishes (Myctophidae and Gonostomatidae) and larval and juvenile Japanese anchovy

Todd W. Miller, Richard D. Brodeur and Greg H. Rau

Trophic relationships of nekton and zooplankton in the northern California Current: Insights from diet and stable isotope analysis

Hiroya Sugisaki, Masatoshi Moku, Kazuhisa Uchikawa, Kotaro Tsuchiya, Yuji Okazaki and Makoto Okamoto

Vertical distribution and feeding habit of mesopelagic fishes and squids off northeastern Japan

Oleg N. Katugin, Gennady A. Shevtsov and Mikhail A. Zuev

Distribution and life cycle patterns of the squid *Gonatopsis octopedatus* and *Gonatopsis japonicus* (Cephalopoda: Gonatidae) in the northwestern Pacific Ocean

Kaori Takagi, Akihiko Yatsu, Hiroshi Itoh, Masatoshi Moku, Ken Mori and Hiroshi Nishida

Distribution and prey composition of juvenile small epipelagic fishes and myctophids in the Kuroshio-Oyashio Transition Zone in spring, 2002-2004

Hiroaki Saito (Invited)

Dynamic linkage between epipelagic and mesopelagic ecosystems by horizontal and vertical migrations of myctophids

Alexei M. Orlov and Anatoly K. Gruzdevich

Distribution of micronekton within lower mesopelagic layers of the Sea of Okhotsk and the Bering Sea in relation to hydrological and hydrochemical environmental parameters

Galina V. Belova and Vadim F. Savinykh

Reproductive biology of the mesopelagic fishes *Tarletonbeania crenularis* and *Ceratoscopelus warmingii* (Osteichthyes: Myctophidae) from the northwestern Pacific

Jun Yamamoto, Mio Tateyama, Yoshihiko Kamei, Keiichi Sakaoka, Naoto Kobayashi and Yasunori Sakurai

Interannual variability of the community structure of epipelagic nekton along 155°E longitude in early summer

Posters

Yoshinari Endo and Fuhito Yamano

Diel vertical migration of *Euphausia pacifica* in relation to molt and reproductive processes, and feeding activity

Oleg A. Ivanov and Vitaly V. Sukhanov

Species structure of epipelagic nekton in the northwestern part of the Japan/East Sea

Gennady A. Shevtsov, Oleg N. Katugin, Mikhail A. Zuev and Gennady V. Khen

Distribution of cephalopods in the western Subarctic Boundary in the autumn of 2001

Natalia S. Kosenok and Vladimir V. Sviridov

Feeding behavior and vertical migration of some common mesopelagic fish species in the Bering Sea during autumn of 2004

Vladimir A. Shelekhov and Vadim F. Savinykh

Age and growth of the Highsnout bigscale, *Melamphaes lugubris*

Vadim F. Savinykh

The micronekton community of the epi- and mesopelagic layers of the Kuroshio Current zone

Boyoung Sung, Hyoung-Chul Shin, Donhyug Kang and Suam Kim

Characterizing krill aggregations and linking them to some environmental factors in the Southern Ocean: Relevant to other krill-bearing marine ecosystem studies?

Masanori Takahashi, Noritaka Mochioka, Sekio Shinagawa, Hiroshi Nishida and Akihiko Yatsu

Fluctuations of epipelagic leptocephalus assemblages in the Kuroshio-Oyashio transition region

Naoki Tanimata, Orio Yamamura, Yasunori Sakurai and Tomonori Azumaya

Relationship between the inhabited environment and the distribution of *Stenobrachius leucopsarus* in the Bering Sea

Masaya Tovokawa, Hiroya Sugisaki and Hiroshi Morita

Vertical distribution of cnidaria and ctenophores in the A-Line

Anatoliy Ya. Velikanov, Dmitriy Yu. Stominok and Alexander O. Shubin

Interannual changes in fish communities of the Aniva Bay upper epipelagic zone (Sakhalin Island) and adjoining areas of the Okhotsk Sea in summer

Hikaru Watanabe, Tsunemi Kubodera and Masatoshi Moku

Diel vertical migration of squid in the Kuroshio-Oyashio transition region

Oleg G. Zolotov

Atka mackerel, *Pleurogrammus monopterygius*, larvae and fry in the upper epipelagic of the north-western Pacific Ocean

Mikhail A. Zuev

Squids of the family Enoploteuthidae in the epipelagic layer of the Kuroshio Current

CCCC/MODEL Topic Session (S6)

Modeling and historical data analysis of pelagic fish, with special focus on sardine and anchovy

Convenors: Shin-ichi Ito, Michio J. Kishi (Japan), Bernard A. Megrey and Francisco E. Werner (U.S.A.)

Background

During the synthesis phase of the CCCC Program, comparisons of life-history strategies in relation to climate change are underway for pelagic species. This session focused on modeling and analyses of processes affecting growth, survival and recruitment of small pelagics including sardine, anchovy and saury. Presentations included models and historical data analysis on the temporal and spatial variability of recruitment processes of the target fish, their linkages to changes in climate/environment. Advances in general spatially explicit modeling approaches that couple pelagic fish population dynamics with lower trophic ecosystems were also discussed.

Summary of presentations

Data

Historical data analyses and comparison of sardine and anchovy catch records from different regions of the world have resulted in the notion of synchrony occurring between widely separated ecosystems, independently of the effect of fishing pressure and management strategies, and the oceanographic domain and local forcing. Furthermore, it has been proposed that mechanisms underlying abundance changes must be simple and controlled by the same background climate signal. Biological processes have yet to be resolved to explain the out-of-phase oscillations of anchovy and sardine and their synchrony/asynchrony among ecosystems. Direct pathways to link climate changes and species alternations, were presented focusing on species-specific temperature optima. The idea proposed was that the “*optimal growth temperature*” hypothesis, based on differential optimal temperatures for larval growth rates of Japanese anchovy and sardine and temperature shifts between these values. Contrasting spawning temperature optima of anchovy and sardine between opposite sides of the Pacific

was suggested as an explanation for the synchronous alternations despite the reversed temperature regimes across the Pacific. Another study discussed the effect of advection of larval anchovy (*Engraulis japonica*) in Kashima-nada off eastern Japan. There is a remarkable inter-annual variability in larval anchovy catch. A relationship between the position of the Kuroshio’s axis relative to the Kashima-nada coastal region was suggested as explaining larval anchovy catch.

Models

A description of the next step in the evolution of the NEMURO.FISH coupled modeling approach – namely the simulation of Sardine and ANchovy population dynamics (NEMURO.SAN) was presented. The approach is a general two-dimensional framework that uses an individual-based approach for simulating the daily growth, mortality, reproduction, and movement of sardines and anchovy. Fish growth was based upon bioenergetics, with fish daily consumption dependent on the zooplankton and phytoplankton concentrations generated by NEMURO in each spatial cell. By making mixed layer depth, nutrients, and other inputs to NEMURO specific to each model grid cell, it was possible to simulate spatial heterogeneity in fish habitat.

Existing studies of NEMURO.FISH for Pacific saury with realistic climate forcing suggested the importance of competition for zooplankton prey between saury and sardine in the Northwestern Pacific. A study was presented where NEMURO.FISH was applied to Japanese sardine as a first step toward examining competition between these two species. Modeled sardine body length compared well with observed growth of Japanese sardine, with modeled fish reaching 20 cm within 4 years.

Another application of the NEMURO model examined the feeding environment of sardine

and saury and a hypothesis for the species replacement between Japanese sardine and Pacific saury was suggested. Since 1988, the shallow mixed layer depth in winter in the Kuroshio Extension has led to early phytoplankton blooms, and zooplankton populations have appeared earlier in the year. Consequently, winter zooplankton increased while spring zooplankton decreased. Pacific saury in the Kuroshio Extension in winter can take advantage of the early blooms, but the Japanese sardines that migrate to the Kuroshio Extension in spring could not survive because of low food density. This match/mismatch with the bloom was suggested as a possible explanation for the late 1980s species replacement from Japanese sardine to Pacific saury in the Northwestern Pacific.

An alternative spatially explicit model using an Eulerian approach focused on Pacific saury. The model assumed that saury hatch in southern Japan and are advected by the Kuroshio and its extension during their larval or juvenile stages. Then during summer, they migrate west against the current as the young or adult stages, and then from fall to winter, they migrate back to their original spawning area during the adult stage. The model successfully simulated the observed wet weight of Pacific saury over a 2-year period that included the observed seasonal migration.

A study that extended the NEMURO model to include subtropical groups of plankton (*i.e.*, small-size phytoplankton, zooplankton, and

bacteria) was presented. The extended **NEMURO** (eNEMURO) was applied to two stations, A7 and B1, in the subarctic and subtropic western North Pacific and successfully simulated the seasonal changes in plankton biomass observed at the both stations, and those of the small size plankton at each station.

Anchovy in the East China Sea have nearly disappeared in recent years. A model of anchovy was presented where modeled phytoplankton and zooplankton densities on a two-dimensional grid were used as background for the anchovy simulation, and individual-based models (IBMs) simulated the life history of anchovy. Two attributes of every individual anchovy (or egg) included genotype and phenotype.

An empirical multiple regression model of the sardine stock in the Japan/East Sea was proposed. Environmental factors included consideration of Cushing-like match/mismatch hypothesis, whereby the winter SST determines the time of hatching, but the spring-summer SST determines the time of spring plankton bloom: a match of these terms was found to be favorable for larval survival and a mismatch was unfavorable. Excluding environmental factors from the model worsens the model considerably. Generally, lower SSTs both in winter and spring-summer are favorable for sardine because of the higher plankton abundance in the feeding grounds and coincide with the times of larvae hatching and plankton bloom.

List of papers

Oral presentations

Salvador E. Lluch-Cota, Daniel Lluch-Belda and Daniel Lluch-Cota (Invited)

Eastern North Pacific sardine spawning through climate, latitudinal, and inshore-offshore gradients

Akinori Takasuka, Yoshioki Oozeki, Hiroshi Kubota, Hiroshige Tanaka, Ichiro Aoki and Salvador E. Lluch-Cota (Invited)

Potential biological mechanisms of anchovy and sardine alternations: Species-specific temperature optima and synergistic factors

Kenneth Rose, Vera Agostini, Larry Jacobson, Carl van der Lingen, Salvador Lluch-Cota, Shin-ichi Ito, Bernard Megrey, Michio Kishi, Akinori Takasuka, Manuel Barange, Francisco Werner, Yunne Shin, Lucho Cubillos, Yasuhiro Yamanaka and Hao Wei (Invited)

Towards coupling sardine and anchovy to the NEMURO lower trophic level model

Tadaaki Kuroyama, Akira Nihira and Sei-Ichi Saitoh

Larval anchovy catch distributions in the Kashima-nada relative to environmental features observed by satellite remote sensing

Xiangxin Li

Individual-based models of anchovy

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Shin-ichi Ito, A. Takasuka, Y. Oozeki, A. Yatsu, M. Noto, M. Kishi, Y. Yamanaka, T. Hashioka, M. Aita, K. Rose, B. Megrey, F. Werner, C. Lingen, M. Barange, Y. Shin, L. Cubillos, L. Jacobson, V. Agostini, S. Lluch-Cota, G. Onitsuka and Y. Kamezawa

A sardine growth model coupled with the NEMURO lower trophic level ecosystem model

Haruka Nishikawa and Ichiro Yasuda

Species replacement between Japanese sardine and Pacific saury in relation to variations in feeding environment

Yury I. Zuenko and Svetlana V. Davidova

Empirical modeling the stock fluctuations of sardine in the Japan/East Sea

Naoki Yoshie and Yasuhiro Yamanaka

Development of a lower trophic ecosystem model representing prey of juvenile pelagic fish in the subtropical western North Pacific

Fumitake Shido, Yasuhiro Yamanaka, Shin-ichi Ito, Taketo Hashioka, Daiki Mukai and Michio J. Kishi

A two-dimensional fish model simulating the biomass of Pacific saury

FIS/CCCC Topic Session (S7)

Key recruitment processes and life history strategies: Bridging the temporal and spatial gap between models and data

Convenors: Kerim Y. Aydin (U.S.A.), Shin-ichi Ito (Japan), Jacob Schweigert (Canada), Paul Spencer (U.S.A.), Akihiko Yatsu (Japan) and Yury I. Zuenko (Russia)

Background

Stock-recruitment relationships for exploited fishery stocks quite often show large deviations from theoretical curves. This results from the tremendous variability in survival rates in the early life stages of marine species. In the synthesis phase of the PICES CCCC Program, comparison of life-history strategies in relation to climate changes are recommended for pollock, pink salmon, capelin, sardines, anchovies, saury, euphausiids, squids, and others. Among the potential causes of succession of different life-history strategists, recruitment variability is one of the most important factors. To perform scientific management for target species, appropriate modeling of recruitment processes, including environmental effects, is needed. The session reviewed the temporal and spatial variability of recruitment processes of key species, their linkages to climate changes, human impacts and regional ecosystem structure, and explored new methodologies to plug the gaps between data and the current state of modeling.

Summary of presentations

A total of 16 oral talks and 6 posters were presented at the session. Recent progress in

studies of recruitment of marine fishes in the PICES region is significant and the knowledge is being applied in models. It was also recognized that recruitment processes are complex, consisting of constraining or activating factors that can be variable in both time and space. Therefore, further studies are needed. The major findings of each presentation are described below.

Deviations from spawner-recruitment curves such as the Ricker curve or the Beverton-Holt curve were shown along with environmental and maternal effects by Bulatov, Smirnov, and Spencer, who also advocated the use of a larval index in addition to spawning stock biomass to analyze recruitment. Ciannelli and Aydin reviewed mechanisms of recruitment of groundfishes in the eastern Bering Sea, and stressed that different factors are responsible for a series of “switches”, and factors can be either constraining or activating. Based on IBM-type life history model of the Japanese sardine, Suda concluded that species interactions were most influential. Wainwright constructed prediction models of recruitment of salmon stocks in the California Current using various physical and biological factors, and found that sectioning a long-term data into 10-year span give successful

predictions, since recruitment mechanisms may vary over time.

Beamish reviewed the life history, prevalence and intensity of parasitic copepods on the Pacific salmon in the British Columbia waters and discussed their implications. Hsieh compared variability of larval fish abundance between commercial and non-commercial species using CalCOFI data, and found that fishing increased the variability of recruitment, suggesting importance of diversity of biological traits such as age structure. Shaw reported that survival after recruitment of *Euphausia pacifica* off Oregon was stable and similar to what was found in a rearing experiment, but growth was affected by environmental condition. Oozeki showed results of the fine-scale field survey of saury larvae on their patchiness and natural mortality (30-40% per day in average). Ichii raised three questions on different migration and growth of autumn cohort and winter-spring cohort of the neon flying squid in the central North Pacific, and gave answers based on seasonal differential in latitudinal distribution of optimum spawning SST and productive feeding grounds in the Transition Zone. Lee analyzed recruitment of Japanese common squid and jack mackerel, and found three regimes in stock-recruitment relations since 1968 to present in Korean waters, where zooplankton and temperature condition were key factors for jack mackerel. Sakurai proposed comprehensive mechanisms of fluctuations in the stock size of Japanese common squid. Wind stress caused the mixed layer depth to change, and this was the critical factor for retention of the egg mass. Optimum temperature (19-23°C) for survival of larvae was based on tank rearing experiments. Zheng reported shifts in spatial and temporal

distribution of snow crab in the eastern Bering Sea, and discussed their effects on setting location and survival of larval through transport (southward is preferable). Using a bioenergetic model, Harvey compared four different life history strategies (sole, rockfish, sablefish and dogfish) for the effects of temperature on: 1) first year consumption, 2) lifetime consumption, 3) relative consumption to reach age of 50% maturity, and 4) lifetime egg production.

Takahashi compared early growth of sardines and anchovies from the Kuroshio and California Currents, and found that optimum temperature differs by species and that growth in the Kuroshio is faster than that of California for both species. Kubota detected no substantial difference in prey composition among larvae of Japanese sardine, anchovy and round herring in Tosa Bay, southern Japan, suggesting prey composition is not a key factor of species replacement, and match/mismatch between spawning season and plankton blooms may be the key. Nakatsuka examined the stomach contents of skipjack tuna in the Kuroshio area, and found that they consumed mainly anchovy larvae whose body size was slightly larger than those collected by nets. Kamezawa showed how the reduced size of Japanese chum salmon during the 1990s was more affected by zooplankton density than by SST. In contrast, Sugiyama reported opposite trend in early growth of sand lance in northern Honshu Island. Using 3-D NEMURO.FISH, Mukai indicated that growth of Pacific saury increased after the 1976/77 regime shift owing to increased zooplankton. Tian reported significant effect of fishing on stock abundance of loliginid squid in the Sea of Japan.

List of papers

Oral presentations

Lorenzo Ciannelli and Kerim Aydin (Invited)

Relating recruitment mechanisms to life-history strategies for Alaskan groundfish populations

Maki Suda, Tatsuro Akamine and Hiroshi Nishida (Invited)

A population dynamics model for Japanese sardine, *Sardinops melanostictus*, off the Pacific coast of Japan, consisting of spatial early-life stage and age-structured adult sub-models

Brenda L. Norcross, Sean-Bob Kelly, Peter-John Hulson and Terrance J. Quinn II

An early life history model for Pacific herring in Prince William Sound, Alaska

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Oleg Bulatov

The Ricker model and the pollock recruit abundance

Anatoly V. Smirnov

Parent-progeny relationships in the Okhotsk Sea walleye pollock

Paul D. Spencer

The effect of spawner age on stock productivity: Influences of life-history pattern and recruitment variability

Thomas C. Wainwright, Richard D. Brodeur, Robert L. Emmett, Peter W. Lawson, William T. Peterson, James J. Ruzicka and Laurie A. Weitkamp

Climate variation and salmon recruitment: Comparing climate indices for predicting salmon marine survival in the Northern California Current ecosystem

Motomitsu Takahashi, David M. Checkley Jr., Akihiko Yatsu and Yoshiro Watanabe

Growth of larval and early juvenile sardine (*Sardinops* spp.) and anchovy (*Engraulis* spp.) in the eastern and western North Pacific Ocean

R.J. Beamish, C.M. Neville and R.M. Sweeting

Life history strategies of sea lice in the subarctic Pacific

Chih-hao Hsieh, Christian S. Reiss, John R. Hunter, John R. Beddington, Robert M. May and George Sugihara

Fishing elevates variability in the abundance of exploited species

C. Tracy Shaw, Leah R. Feinberg, Hongsheng Bi and William T. Peterson

Analysis of key recruitment processes for *Euphausia pacifica* off the Oregon coast

Yoshioki Oozeki, Ryo Kimura, Hiroshi Kubota and Hiroshi Hakoyama

Patchiness structure and mortality of Pacific saury, *Cololabis saira*, larvae in the northwestern Pacific Ocean

Taro Ichii, Kedarnath Mahapatra, Mitsuo Sakai and Denzo Inagake

Life cycle characteristics of the neon flying squid associated with the oceanographic regime in the North Pacific

Jae Bong Lee, Chang Ik Zhang, Anne Hollowed, Dong Woo Lee and Sang Cheol Yoon

Variations in recruitment of small pelagic species around Korean waters

Yasunori Sakurai, Jun Yamamoto, Ken Mori, Tsuneo Goto and Hideaki Kidokoro

Can we explain and predict stock fluctuations of Japanese common squid, *Todarodes pacificus*, related to climatic regime shifts?

Jie Zheng and Gordon H. Kruse

Crab larval advection and recruitment in the Eastern Bering Sea

Chris J. Harvey

Using bioenergetics models to estimate sensitivity of California Current groundfish to temperature anomalies

Posters

Yasuko Kamezawa, Tomonori Azumaya, Toru Nagazawa and Michio J. Kishi

Bioenergetics model of Japanese chum salmon (*Oncorhynchus keta*) growth

Hiroshi Kubota, Tatsuya Kaji, Nobuhiro Saito, Akinori Takasuka and Yoshioki Oozeki

Seasonal variability in feeding habits in the larval stage of three clupeoid species in Tosa Bay, southern Japan

Daiki Mukai, Michio J. Kishi, Shin-ichi Ito, Yasuhiro Yamanaka and Fumitake Shido

Interdecadal variability on the growth and migration trajectory patterns of Pacific saury: A model-based study

Sayaka Nakatsuka, Akinori Takasuka, Hiroshi Kubota and Yoshioki Oozeki

Predation on larval and juvenile anchovy by skipjack tuna in the Kuroshio - Oyashio transition region

Kai Sugiyama, Tetsuya Takatsu, Yasuyoshi Fukui and Mikimasa Joh

Comparison of growth rate between hatching months of Pacific sandlance *Ammodytes personatus* in early life stages

Yongjun Tian

Impact of the late 1980s regime shift on the abundance and distribution of loliginid squid *Loligo bleekeri* in the southwestern Japan Sea

FIS/MEQ Topic Session (S8)***Aquaculture and sustainable management of the marine ecosystem***

Co-Convenors: Toyomitsu Horii (Japan), Jie Kong (China) and Michael B. Rust (U.S.A.)

Background

Activities associated with aquaculture can result in both positive and negative impacts on the marine ecosystem. The environmental, ecological and genetic capacities of the marine environment need to be considered to maintain sustainable aquaculture development and a healthy wild ecosystem. At various levels of aquaculture production, environmental hazards can be assessed and management measures developed to minimize those hazards to the marine ecosystem and/or their probability (risk) of occurrence. PICES WG 18 has begun to consider environmental and ecological impacts associated with aquaculture. These include ecological hazards associated with nutrient release, escaped or released cultured organisms (predation, competition), and the potential for disease transfer. In addition, the escape of genetic selected species used for aquaculture may have harmful effects on the genetics of wild populations of native species. Genetic risks should be evaluated based on potential impacts to biodiversity and ecosystem conservation using proper evaluation techniques. These techniques should be consistent among researchers where possible. Moreover, it is necessary to consider the influence on ecosystem and genetic diversity when artificially produced seedlings are released for stock enhancement or rebuilding. To promote responsible aquaculture in a healthy marine

ecosystem, it is critical to continuously evaluate and manage the aquaculture activity. Clearly defining the potential hazards to the ecosystem, assessing the probability that hazards will occur and implementing mitigation strategies to reduce or eliminate hazards can facilitate this oversight. The goal of this session was to identify and establish evaluation techniques and models for potential hazards which aquaculture exerts on genetic diversity, ecosystem function and/or the marine environment. The intent was also to explore the potential for standardization of methods and models that deal with interactions between aquaculture and wild organisms.

Summary of presentations

The session included 14 oral presentations. Twelve of these presentations dealt explicitly with the topic described above and two focused on invasive species issues in Canada and Russia. In addition, 9 posters were presented, including two on invasive species. Approximately 25-30 scientists participated in the session. Topics considered were: methods for mitigating impacts of aquaculture and determining associated risks (8 talks and 3 posters), details of environmental impacts associated with current aquaculture practices, both positive and negative (2 talks and 1 poster), descriptions of aquaculture technology (1 talk and 3 posters), and a study on socio-economic regulation of aquaculture (1 oral).

List of papers*Oral presentations*

J.E. Jack Rensel, Dale A. Kiefer and Frank J. O'Brien (Invited)

AquaModel: Mariculture model development and testing

Zhaohui Zhang, Zongling Wang and Mingyuan Zhu

Ecosystem services valuation of marine aquaculture

Colin E. Nash and William T. Fairgrieve

Ecological risk assessment of marine fish aquaculture in the coastal zone

Michael B. Rust

Risk and risk management for feed and seed for carnivorous marine fish aquaculture

Galina S. Gavrilova

Shellfish mariculture in the Russian Far East

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R.J. Beamish, C.M. Neville and E. Gordon

Sea lice production on farmed salmon – Not what you read in textbooks

Joseph S. Paimpillil

Eco-friendly shrimp culture with Pokkali paddy – Sustainable coastal resource management practice

Hee Won Park and Chang Ik Zhang

A study on the ecosystem-based resource management system of self-regulatory community fisheries in Korea

Yoh Yamashita and Yutaka Kurita

Carrying capacity of nursery grounds for Japanese flounder in relation to stocking densities

Tomohiko Kawamura, Hideki Takami and Toyomitsu Horii

Factors affecting recruitment fluctuations of abalone – Assessment of the stock management and enhancement activities in the last 30 years in Japan

Naoaki Tezuka and Masami Hamaguchi

Biological impacts caused by the release of the imported manila clam, *Ruditapes philippinarum*, in Japan

Tetsuo Fujii

Conservation of the genetic diversity of Japanese flounder *Paralichthys olivaceus* under successive mass release of hatchery-reared juveniles

Graham E. Gillespie, Antan C. Phillips, Debbie M. Paltzat and Tom Therriault

Distribution of non-indigenous intertidal species on the Pacific Coast of Canada

Vasily Radashevskiy

Alien polychaete worms (Annelida, Polychaeta) in the North Pacific

Posters

Eugene I. Barabanshchikov, Nikolay V. Kolpakov and Victor A. Nazarov

Invasion of non-indigenous animal species into the Russian Far East marine and estuarine ecosystems

Motoyuki Hara and Hiroshi Hoshikawa

Genetic analysis for reproduced contribution of released hatchery-produced abalone

Sergey I. Maslennikov and Victor V. Ivin

Environmental impact of scallop mariculture on coastal ecosystems in Russia

Chul Won Kim, Dae Hee Kim, Kyung Hyun Park, Seock Jung Han and Choon Goo Jung

Technology development for intermediate rearing of the sulf clam, *Tresus keenae*, in Korea

Dae-Hyun Kim, Jung Hwa Choi, Kwang Ho Choi and Sung Tae Kim

Relationship between nucleic acids and artificial gonad maturation of swimming crab (*Portunus trituberculatus*) by manipulating water temperature, photoperiod, and eyestock ablation

Sung Il Lee, Hyung Kee Cha, Young Seop Kim, Sang Cheol Yoon, Jae Hwang Yang and Kyunk Chan Know

Study on stock rebuilding plan for *Arctoscopus japonicus* in the East/Japan Sea of Korea

Won Chan Lee, Hyun Taik Oh, Sung Eun Park, Jun Ho Koo, Sok Jin Hong and Rae-Hong Jung

Ecosystem modeling for improvement the water quality in a eutrophic marine environment of Chinhae Bay, Korea

Xuezheng Lin, Kaoshan Chen and Xiaohang Huang

Advances in marine alien species invasion in China

Kyung Hyun Park, Chul Won Kim, Dae Hee Kim, Seock Jung Han and Choon Goo Jung

Growth and survival of the sulf clam, *Tresus keenae*, larvae according to rearing condition in Korea

MEQ Topic Session (S9)

Harmful algal blooms in the PICES region: New trends and potential links with anthropogenic influences

Convenors: William P. Cochlan (U.S.A.) and Ichiro Imai (Japan)

Background

The goal of this session was to highlight recent advances in the understanding of the ecology and physiology of harmful algal bloom (HAB)

species in the coastal waters of the PICES region. Of particular interest were laboratory and field research where anthropogenic factors have been studied in order to elucidate if links exist between the apparent increase in the

duration, distribution and impact of HABs, and environmental factors associated with human activities, including urban and agricultural runoff, climatic change and mariculture. This session complemented the continuing series of annual MEQ workshops where two new HAB genera found in the PICES region, *Dinophysis* and *Cochlodinium*, were examined in detail, but encouraged studies of other HAB genera of interest in the coastal waters of the North Pacific Ocean.

Summary of presentations

The session consisted of 10 oral presentations and 6 posters, representing authorship from all six PICES member countries and two non-PICES nations: Thailand and India. There was one last-minute cancellation. Attendance at the session was excellent, and the audience always exceeded 50 people throughout the day-long session.

After brief introductory remarks by one of the co-convenors (William Cochlan), the first invited speaker (Theodore Smayda) discussed whether the rise in harmful algal blooms is symptomatic of an emergent disequilibrium in phytoplankton dynamics, in particular the dynamics of flagellates species. He reviewed several theories to explain the HAB epidemic: the “changing environment” theories linking the HAB increase to anthropogenic habitat modification (including eutrophication, climate change and top-down, bottom-up modification); the “emigration” hypotheses attributing the HAB increase to the geographic dispersal of HAB species vectored in ballast water and shellfish transplantation; and the “natural variation” hypotheses of climate-driven oscillations and intrinsic rhythmicity. An underlying question addressed during his presentation was that the HAB epidemic is primarily the coincidence of isolated, regional blooms developing in response to different local causes, but that a global synchrony is occurring in this phenomenon, independent of, but enhanced by local and regionally variable anthropogenic factors.

The following two speakers discussed regional studies in two western Pacific locations, and the phytoplankton response to increases and decreases in nutrient loading. Paul Harrison showed evidence of dramatic reductions in Red Tide events in Hong Kong waters as a consequence of revised sewage abatement practices, and noted that when nutrients are limiting, nutrient ratios are a reflection of the community response, not a factor controlling HABs. Ichiro Imai provided a detailed review of the relationship between eutrophication and HABs in the Seto Inland Sea, and noted that the number of red tide events in this major fishing and aquacultural region is now relatively stable at ~100 events per year. Red tide events appear to have increased for *Cochlodinium polykrikoides* and *Chatonella* spp. (with *C. ovavta* being a new HAB species), whereas long-term decreasing trends for *Heterosigma akashiwo* and *Noctiluca scintillans* were observed. In-Seong Han discussed the relationship between physical factors and summertime HABs in Korean waters, in particular the large-scale blooms of *Cochlodinium polykroides* that have occurred since 1995. He noted that relatively lower surface water temperatures (and consequently weakened stratification) and relatively large Kuroshio upstream volume transport were frequently related to large-scale outbreaks of HABs, whereas elevated nitrate concentrations, although common, were not always necessary for such blooms to occur. Kanako Naito next presented a laboratory study on the role of iron and the growth of HAB species, specifically on the multiple forms of iron available for microalgal utilization, showing that various Red Tide species could use insoluble (particulate Fe, possibly from bottom waters), soluble organic Fe, ligand-bound Fe, and siderophore-mediated Fe for growth. She also demonstrated that high concentration of siderophores can inhibit the growth of various phytoplankton species, and speculated that this could be a possible mitigation strategy for HAB events. Tamiji Yamamoto discussed the role of dam construction on harmful algal blooms. Using a competition numerical model for three species

(*Gymnodinium catenatum*, *Chattonella antiqua* and *Skeletonema costatum*) they concluded that continuous nutrient supply (which is induced by dam construction) will favor the growth of flagellates, decrease species diversity, and enhance the growth of harmful flagellates as a result of suppressing diatom growth (through reduction of dissolved Si supply).

The final presentation before the lunch break by Ken Furuya was an intriguing laboratory and field study on *Noctiluca scintillans*, the most frequent causative organism of red tides in southeast Asian waters, and its photosynthetic endosymbiont, *Pedinomonas noctilucae*. Based on physiological studies, they postulated that despite the low growth rate of *N. scintillans*, its high photosynthetic performance and the internal ammonium accumulation within the cell (from its endosymbiont) provide competitive advantages for *N. scintillans*, and that once it becomes dominant in Manila Bay, Philippines, its active grazing on potential competitors prevents population growth of co-existing phytoplankton.

The final two oral presentations of the session outlined the role of viruses on HAB dynamics, a topic never previously discussed in the PICES HAB Section, but receiving increasing attention in marine microbial ecology. Janice Lawrence, our “Young Scientist” invited speaker, outlined the lytic virus life cycle and its effect(s) on algal blooms, specifically those of the raphidophyte, *Heterosigma akashiwo*. She concluded that there is no general response of a host algal cell

to viral infection, that infected cells are not generally sampled in healthy host populations (due to enhanced sinking from infection), and finally there is a need to better characterize known viruses and isolate novel viruses from marine systems in order to more fully understand the role of viruses in HABs. Keizo Nagasaki discussed the molecular differences between viruses infecting marine eukaryotic microalgae, and the specific relationship between the bloom-forming dinoflagellate *Heterocapsa circularisquama* and its infectious viruses in western Japan over a five-year period, including their novel finding that the abundance of sediment viruses was an important factor in determining the length and size of a bloom of *H. circularisquama*.

The session was concluded by a discussion led by convenors, which benefited greatly by the comments and observations of our invited speakers to this session and the MEQ workshop on selected HAB species in the PICES region. One conclusion evident in the discussion was the complexity of HAB dynamics, and the lack of a single or common anthropogenic cause for HABs, particularly as fewer “plant-like” and more “insect-like” behaviorisms become evident in some HAB species, particularly flagellates. As summarized by Theodore Smayda, our current attempts to understand the factors responsible for HABs and their apparent global increase, may be akin to characterizing the structure of a “layer cake”, while still exploring the icing. There is much work to be done.

List of papers

Oral Presentations

Theodore J. Smayda (Invited)

Harmful algal blooms: Global spreading or global synchrony?

Paul J. Harrison, Alvin Ho, Kedong Yin and Xu Jie

Nutrient and phytoplankton dynamics in Hong Kong and their response to sewage abatement

Ichiro Imai, Mineo Yamaguchi and Yutaka Hori

HAB occurrences and eutrophication in the Seto Inland Sea, Japan

Tatiana Yu. Orlova and Inna V. Stonik

Long-term changes in the phytoplankton of the coastal waters off Vladivostok (the north-western part of the Japan/East Sea)

In-Seong Han, Hee-Dong Jeong and Ki-Tack Seong

Physical oceanic conditions on summer time related with harmful algal blooms around the Korean Peninsula

Kanako Naito and Ichiro Imai

Iron and harmful algal blooms

Tamiji Yamamoto and Gen Hatta

Does dam construction induce harmful algal blooms?

Ken Furuva, Takuo Omura and Thaithaworn Lirdwitayaprasit

Noctiluca scintillans with endosymbiont, successful red tide species in SE Asian waters

Janice E. Lawrence (Invited)

The role of viruses on harmful algal bloom dynamics

Keizo Nagasaki, Yuji Tomaru, Hiroyuki Mizumoto, Yoko Shirai and Yoshitake Takao

Viral impact on the population dynamics of HABs

Posters

Seung Ho Baek, Shinji Shimode and Tomohiko Kikuchi

The role of temperature, salinity, light intensity and photoperiod for dinoflagellates, *Ceratium furca* and *Ceratium fusus*, in the temperature coastal water of Sagami Bay, Japan

Boris M. Borisov

Basic factors determinative phytoplankton bloom in the western subarctic Pacific and the adjacent deep area of the Bering Sea in spring of 2005

Lalit P. Chaudhari, A.G. Bhole, S.P. Yavalkar and N.K. Choudhary

Application of biotechnology for monitoring harmful algae in marine food resources

Maureen E. Auro, William P. Cochlan and Vera L. Trainer

Growth and toxicity of *Pseudo-nitzschia cuspidata* from the U.S. Pacific Northwest

Tomotaka Shiraishi, Kiyohito Nagai, Jyoji Go, Takashi Yamamoto, Michinori Yamakawa, Misa Inoue, Isao Kuriyama, Seiya Taino, Tetsu Ishikawa, Yoshihiro Hayashi, Shingo Hiroishi and Ichiro Imai

Population dynamics and overwintering of the shellfish killing dinoflagellate *Heterocapsa circularisquama* in the western coastal Sea of Japan

Wataru Takahashi, Hiroshi Kawamura, Takuo Omura and Ken Furuya

Detecting red tides in the eastern Seto Inland Sea with satellite ocean color imagery

POC/Monitor/CCCC Topic Session (S10)

Synchronous and asynchronous responses of North Pacific boundary current systems to climate variability

Co-Convenors: Jack Barth, Steven Bograd (U.S.A.), Shin-ichi Ito, Kosei Komatsu (Japan) and Vyacheslav B. Lobanov (Russia)

Background

This session was held to provide a comparative review of the physical and ecosystem variability of the boundary currents, to discuss the degree of synchronicity of this variability, and facilitate understanding of the connectivity between North Pacific boundary current systems. A more comprehensive understanding of the boundary current systems requires modeling approaches, although the data for model validation is often limited. This session also provided consideration of observing system requirements and techniques for monitoring boundary current circulation and ecosystems, in particular the necessary combination of data and models.

Summary of presentations

A total of 9 physical and 6 ecosystem aspect papers were given as oral presentation, and also two posters were provided. Two talks and 1 poster presentations were on basin-scale comparison, five oral presentations focused on variability in the eastern boundary currents and six oral presentations showed variability in the western boundary currents.

Physical aspects

The North Pacific Ocean circulation produced by an eddy-resolving global physical model was presented. It shows a systematic change of the

North Pacific Ocean currents response to the Aleutian Low strength. In response to the Aleutian low enhancement, Oyashio became strong, and cooler temperature anomalies propagated along the Subarctic Front, the Kuroshio migrated southward, the Alaska Gyre was enhanced in the southern part and weakened in the northern part, and the California Current was weakened largely except for the CalCOFI region. A new methodology state-space model was applied to long-term sea surface temperature data in the North Pacific, and the results suggested the existence of local processes modulating a global signal asynchronously, while it also suggested the overall warming trend synchronously accelerated and decelerated in the whole North Pacific. Other studies investigated the mechanism of major current systems (Kuroshio Extension, Kuroshio, Oyashio, California Current, Alaskan Gyre *etc.*) variation were also presented.

Ecosystem aspects

An idea was presented that steep multi-year changes (like regime shift) afforded distinct advantage to “active-opportunist” species (of which sardine might be a good example) to temporarily break out from normal biological constraints since they can migrate widely and utilize broad spectrum of acceptable food sizes. This idea may explain the paradox in the 1970s to mid-1980s, which showed synchronized variation of productivity while the ocean circumstances showed asynchronicity.

A recent abrupt change in 2005 in the California Current System was also presented. The result showed a similar decrease of zooplankton

biomass with El Niño events, however it persisted longer than previous phenomena. Inverse production of salmon between Alaska and the Pacific Northwest was reported. Although the inverse production correlated with Pacific Decadal Oscillation, the relation was modified recently accompanied with warming trends. Ecosystem responses in other regions were also presented in the session.

Recommendation

One outcome of the session was the realization of the value of long-term physical, chemical and biological data sets in the North Pacific for understanding, and eventually forecasting, ecosystem response to climate variability. Enormous progress has been made in using long-term remotely sensed (*e.g.*, satellite sea-surface temperature, ocean color and sea-surface height) and *in situ* data (*e.g.*, repeat hydrographic, plankton and fish survey lines) to understand mechanisms of ocean response to climate variability. The session conveners propose that PICES send letters of support for the continuation of the important long-term monitoring activities to the relevant agencies of the member nations. For example, there is no guarantee that the incredibly valuable satellite remotely sensed data sets will continue to be available for ecosystem research. The session conveners also propose to work with the POC, MONITOR committees and the CCCC Program to draft such letters, including sufficient detail linking important long-term data sets to progress in North Pacific ecosystem research. These letters would then be presented to the Science Board for consideration for official issuance by PICES.

List of papers

Oral presentations

Masami Nonaka, Hisashi Nakamura, Youichi Tanimoto, Takashi Kagimoto and Hideharu Sasaki (Invited)

Interannual-to-decadal variability in the Oyashio Current and its influence on the subarctic frontal region in an eddy-resolving OGCM

Harold P. Batchelder and Brie J. Lindsey

Modeling interannual variation of spring-summer transport of plankton and juvenile salmon in coastal regions of the northeast Pacific

Elena I. Ustinova and Yury D. Sorokin

Spring thermal conditions in the Northwestern Pacific boundary current systems

Steven J. Bograd, Roy Mendelssohn, Franklin B. Schwing and Cindy Bessey

On the (a)synchrony of long-term sea surface temperature trends in the western and eastern North Pacific

Andrew Bakun (Invited)

“Active opportunist” species and opportune multi-annual-scale events

Hiroshi Ichikawa and Xiao-Hua Zhu

Relation between the quasi-biennial variations of northeastward volume transport southeast of Okinawa Island and the Aleutian Low Pressure Index

Shoshiro Minobe

Anomalous SST warming over Kuroshio-Oyashio Extension from 1999 to 2001 and its possible ocean to atmosphere influence

George Shevchenko and Valery Chastikov

The influence of East Sakhalin Current on the South Kuril Region ecosystem

Bo Qiu (Invited)

Decadal variability of the Kuroshio Extension jet, recirculation gyre and mesoscale eddies, and its connection to PDOs

Shin-ichi Ito, Hiroshi Uchida, Yugo Shimizu and Shigeho Kakehi

Synchronous and asynchronous variability of the North Pacific western boundary currents: Kuroshio and Oyashio

David L. Mackas, William T. Peterson, Mark D. Ohman and Bertha E. Lavaniegos

Zooplankton anomalies in the California Current System before and during the warm ocean conditions of 2005

Jin Woo Kim and Im Sang Oh

A study of the Kuroshio in the South of Japan islands using remote sensing data

Igor A. Zhabin (Invited)

Large-scale and meso-scale variability in the East Kamchatka Current/Oyashio Current region

William T. Peterson and Robert L. Emmett

An investigation into time lags between recent high-frequency changes in the PDO and response of various components of the ecosystem in the northern California Current

Peter W. Lawson, Robert C. Francis, Steven R. Hare, Nathan J. Mantua and Laurie Weitkamp

Patterns in salmon production in the Northeast Pacific: Inverse production regimes revisited

Kiyotaka Hidaka and Kaoru Nakata

Climate effects on interannual variation in winter-spring plankton community in the slope water and Kuroshio

Posters

Gennady V. Khen, Elena I. Ustinova and Jury. D. Sorokin

Interannual variation of sea surface temperature in different areas of the northern Pacific

Victor I. Kuzin, Aleksandr N. Man'ko and Aleksandr D. Nelezin

Diagnosis of the Kuroshio Current on the basis of hydrological measurements during 1980-1990

Ryan R. Rykaczewski

Decadal-scale variability in upwelling processes in the California Current Ecosystem and potential biological responses

CCCC Paper Session

Convenors: Harold P. Batchelder (U.S.A.) and Suam Kim (Korea)

Background

The goal of this session was to describe patterns and processes of North Pacific ecosystem responses to physical forcing and climate change.

Summary of presentations

The session consisted of 10 oral and 5 poster presentations. Diverse topics across the North Pacific ecosystems were addressed in oral

presentations. The changes in various ecosystem components such as hydrography, phytoplankton, zooplankton, fish and mammals were examined with respect to different environmental conditions. From the eastern Pacific ecosystems, the responses of fish community to the climate/ocean variability were investigated in the California Current system and the Gulf of Alaska, focusing on hake distribution and fish community interactions, respectively. Also the level of fatty acids in various marine organisms was compared to

elucidate sources of nitrogen to the eastern Bering Sea ecosystem. In the western Pacific Ocean, the role of changing oceanographic conditions was hypothesized to reveal differences in planktonic production and nektonic abundances. The relationship between sea ice coverage and phytoplankton blooms in the southern Okhotsk Sea was investigated. Long-term variations of the East China Sea ecosystem were related to decadal-scale changes in meteorological phenomena and shifts in the path of the Kuroshio. ECOPATH modeling was used to examine interannual changes in the

porpoise population and its trophic level in the Yellow Sea during the early 2000s, and to synthesize fisheries resources and their dynamics in the western Japan/East Sea. Papers used hydrodynamic models to evaluate transport of phytoplankton and zooplankton, and to determine the relative contribution of local production vs. advection in creating observed patterns of LTL production in the Kuroshio and Kuroshio Extension regions, and to evaluate transport of eggs and juvenile stages of jack mackerel and their interannual variability in survival in the East China Sea.

List of papers

Oral presentations

John A. Holmes and Kenneth D. Cooke

Changes in the distribution of Pacific hake (*Merluccius productus*) in response to climate and ocean variability in the California Current

Hyoung-Chul Shin, Kang Hyun Lee, Kyung Ho Chung and Sung-Ho Kang

Zooplankton distribution off Sakhalin Island during summer and comparison with other sub-arctic waters

Anne B. Hollowed, Elizabeth Logerwell, Rebecca Isquith and Chris Wilson

The impact of regime shifts on the oceanography of the northern Gulf of Alaska and its influence on the species interactions between walleye pollock, capelin, and Steller sea lions

Jeffrey M. Napp, Lawrence E. Schaufler, George L. Hunt Jr. and Kathy L. Mier

Summer food web structure in the eastern Bering Sea: Fatty acid composition of plankton, fish, and seabirds around the Pribilof Islands

Elena Dulepova and Svetlana Glebova

An East-West comparison of plankton communities of the northern Okhotsk Sea

Muzzneena Ahmad Mustapha and Sei-Ichi Saitoh

Interannual variations of sea ice and spring bloom occurrences at the Japanese scallop farming area in the Okhotsk Sea

Vadim Navrotsky, T. Zadonskaya, V. Darnitsky, V. Chuchukalo, L. Bokhan and V. Napazakov

Hydrophysical and biological characteristics in the Kuril-Kamchatka Current and Oyashio region of the Northwestern Pacific

Hyejin Song and Young-shil Kang

Variations in zooplankton and oceanographic condition in the southwestern East/Japan Sea after the late 1990s

Takashige Sugimoto, H-Y. Kim, K. Tadokoro, K. Kuroda and N. Nagai

Stepwise increase of water temperature and zooplankton biomass after the mid-1980s in the East China Sea and their possible effect on the recovery of jack mackerel

Kyum Joon Park, Chang Ik Zhang, Zang Geun Kim, Seok Gwan Choi and Yong Rock An

Abundance of finless porpoise (*Neophocaena phocaenoides*) and their role in the eastern Yellow Sea ecosystem

Andrei Krovnin and G. Moury

The state of the climate system of the North Pacific and North Atlantic in 2000-2005 in comparison with the 2nd half of the XX century

Posters

Young Seop Kim, Hyung Kee Cha, Sung Il Lee, Seon Jae Hwang, Sang Cheol Yoon, Kyunk Chan Know and Jae Houn Yang

Application of the ecosystem structure model (Ecopath) to the East/Japan Sea in Korea

Kosei Komatsu and Akihide Kasai

Modeling annual variation of transport of eggs and larvae of jack mackerel in the East China Sea

Kosei Komatsu, Kaoru Nakata and Takahiko Kameda

3D modeling of size-dependent variation of phyto- and zooplankton biomass caused by advective processes around the Kuroshio and the Kuroshio Extension

Carol Ladd

Interannual variability of the Gulf of Alaska eddy field

Jong Hee Lee and Chang Ik Zhang

Analysis of the lower trophic level of the northern East China Sea ecosystem based on the NEMURO model

Ken-Ichi Sato, Atsushi Yamaguchi, Naonobu Shiga and Tsutomu Ikeda

Fine-scale vertical habitat separation among four grazing copepods (*Neocalanus cristatus*, *N. flemingeri*, *Eucalanus bungii* and *Metridia pacifica*) in the Oyashio region, western subarctic Pacific Ocean

Yulia N. Tananaeva and Marat A. Bogdanov

Interannual variability in development of the seasonal processes and their influence on fishery resources of the North Pacific

FIS Contributed Paper Session

Convenor: Gordon H. Kruse (U.S.A.)

Background

Fishery science is a broad field in the PICES region, owing in part to the diversity of species, water masses, and fisheries of the North Pacific Ocean. Therefore, a specific Topic Session sometimes does not fully cover the science communication needs of fisheries scientists of PICES member countries. A FIS Contributed Paper Session enhances FIS activities in PICES by allowing participation by more fisheries scientists with different interests. This session is also a good way to provide opportunities to give presentations by young scientists including students.

Summary of presentations

The session consisted of 14 oral presentations and 34 posters that covered a wide variety of fish species from five PICES member countries plus Mexico. The most common topics in both oral and poster sessions included presentations on the geographic distributions of fishes (*e.g.*, tunas) and squid, particularly with respect to sea surface temperature, chlorophyll, and water masses. Satellite tags have become increasingly useful to investigate the distributions of some large-bodied fishes (*e.g.*, swordfish) and turtles

at sea with respect to oceanographic conditions. However, traditional methods using tag-recapture techniques (*e.g.*, big skate), analysis of seasonal fishery bycatch patterns (*e.g.*, herring), and hydroacoustics (*e.g.*, anchovy post-larvae) remain very useful. Likewise, the value of process-oriented studies (*e.g.*, testing fishery competition with sea lions) is becoming more widely recognized. All of this research has benefited greatly from recent developments in the analysis of spatio-temporal data using Geographic Information Systems. Another common research topic during the session was ecosystem-based fishery management, particularly in the poster session. There were considerable efforts to develop ecosystem indicators based on metrics, such as mean trophic level, size based indicators and fish reproduction potential. Classical fishery research studies remain important, including studies of genetics (salmon), age and growth (minke whales, chub mackerel, shotted halibut, deep-sea fishes), reproduction (pollock, blue crab), and feeding (red king crab, salmon). Based on the number of presentations and posters, diversity of species, mix of topics, the high quality of the presentations, and large attendance, the FIS Contributed Paper Session at PICES XV was deemed to be very successful.

List of papers

Oral presentations

Churchill Grimes, Daniel Goodman, Peter Lawson, Richard Marasco, Andre Punt and Terry Quinn

Ecosystem-based fishery management; A pragmatic approach

Chang-Ik Zhang, Jae Bong Lee and Sun-Kil Lee

Size-based indicators to evaluate ecosystem variations in Korean waters

Session Summaries-2006

Doug Hay and Tom Therriault

Climate change: Important impacts on unimportant species?

Naoki Tojo, Gordon H. Kruse and Terrance J. Quinn II

Environmental cues for herring spawning timing in northern Bristol Bay, Alaska

Jong-Hun Na, Zang Geun Kim and Chang Ik Zhang

Estimation of growth parameters of minke whale, *Balaenoptera acutorostrata*, in Korean waters

Hidetada Kiyofuji, Evan Howell, Katsuya Saitoh, Sei-Ichi Saitoh and Jeffrey Polovina

Spatial and temporal dynamics of albacore tuna (*Thunnus alalunga*) and blue shark (*Prionace glauca*) in the Kuroshio Extension area

Evan A. Howell, Donald R. Kobayashi and Jeffrey J. Polovina

Identifying critical habitat of swordfish and loggerhead turtles from fishery, satellite tag, and environmental data

Nanami Kumagai, Hidetada Kiyofuji and Sei-Ichi Saitoh

Distributions of squid fishing grounds and their relationship to sea surface temperature and chlorophyll-*a* concentration in the Japan Sea

Gordon A. McFarlane and Jacquelynne R. King

Migration patterns of big skate (*Raja binoculata*) based on a large-scale tagging study in northern British Columbia waters: Preliminary results

Alexander I. Glubokov

Status of fishes in the outer shelf and upper slope of the Northern and Western Bering Sea

Kazushi Mivashita, Atsumu Watanabe, Saho Morioka, Yoshihiro Ikewaki, Ryu-ichi Matsukura and Hiroki Yasuma

Acoustic monitoring of Japanese anchovy (*Engraulis japonicus*) post-larvae “shirasu”

Min Ho Kang, Jung Youn Park and Suam Kim

Genetic variations and differences of chum salmon (*Oncorhynchus keta*) collected from the Bering Sea and along the North Pacific region

You Jung Kwon, Chang Ik Zhang, Dae Yeon Moon and Jeong Rack Koh

Stock assessment of southern bluefin tuna (*Thunnus maccoyii*) using MULTIFAN-CL

Elizabeth A. Logerwell, A.B. Hollowed, C.D. Wilson, P. Walline, P. Munro, M.E. Connors, S. McDermott, S. Neidetcher, D. Cooper and K. Rand

Fish ecology plays a key role in understanding the potential for commercial fishing to impact prey fields of endangered Steller sea lions

Posters

Elena N. Andreeva, Svetlana V. Davidova and Anatoly V. Smirnov

Dynamics of the flounders spawning during the spring seasons 1984-2005 depending on hydrological conditions of the Okhotsk Sea

John R. Bower, Saya Shimura and Shuichi Abe

Observations on the morphology and distribution of gonatid paralarvae in the northeast Pacific

Oleg Bulatov, Olga Moiseeva and Georgiy Moiseenko

The Okhotsk Sea pollock stock assessment using GIS “Fishery”

Jung Hwa Choi, Dae Soo Chang, Kang-seok Hwang, Young-yull Chun and Jong Bin Kim

Environmental effects on landings of penaeid shrimp in the Yellow Sea

Vladimir A. Belyaev, V.B. Darnitskiy, E.I. Ustinova and S.P. Bomko

Dynamics of oceanographic conditions near the Japanese Archipelago: Fluctuations, processes in ecosystems and mass pelagic species

Yurii P. Diakov

Geographic variations of seasonal spawning structure of *Pleuronectiformes* in the northern Pacific Ocean

Natalia T. Dolganova and A.E. Lazhentsev

Feeding of mass nekton species in the epipelagic waters of the northwestern Japan Sea

Maria V. Eletskaia, Vadim A. Shtrik and Minna I. Tarverdieva

Feeding of red king crab (*Paralithodes camtschaticus*) juveniles in the North Pacific and Barents Sea

Elena V. Gritsay

Geographical variability of walleye pollock maturation rate in the Bering Sea and Gulf of Alaska

Kazushi Kadomura, Makoto Sugihara, Sayaka Naruse, Takuji Nakashima, Kenichi Yamaguchi and Tatsuya Oda

ROS (reactive oxygen species) generation by several marine fish species during embryogenesis

Makoto B. Kashiwai

Challenge of Hanasaki Program: Toward management of Hanasaki crab including taste quality

Atsushi Kawabata

Distribution and biomass of the Japanese common squid, *Todarodes pacificus*, estimated by acoustic survey in the Pacific coastal waters off the northern Japan

Anastasia M. Khrustaleva, Alexander A. Volkov and Darya A. Zelenina

Study of the population structure of Asian sockeye salmon (*Oncorhynchus nerka*) using microsatellite polymorphism analysis

Hwa Hyun Lee, Min Ho Son and Suam Kim

Distribution of common squid, *Todarodes pacificus* (Cephalopoda: Ommastrephidae), larvae in the East China Sea in the early 2000s

Yeong Hye Kim, Kwang Ho Choi, Jin Goo Kim, Jong Bin Kim and Dong Woo Lee

Age, growth and maturity of shotted halibut, *Eopsetta grigorjewi*, in the southern coast of Korea

Toshiyuki Konishi, Hidetada Kiyofuji, Katsuya Saitoh and Sei-Ichi Saitoh

Predictability of Pacific saury fishing grounds using satellite remote sensing and a statistical model

Eugene V. Miheev and Nikolay N. Kovalev

Adaptation of Cephalopoda: A biochemical approach

Hideaki Kudo, Masakazu Shinto, Ikue Mio and Masahide Kaeriyama

Histological study of the olfactory system of immature and maturing chum salmon (*Oncorhynchus keta*) in the North Pacific Ocean

Sun-Kil Lee, Jae Bong Lee, Chang-Ik Zhang and Dong Woo Lee

Fish reproduction potential (FRP) index of marine ecosystems in Korea

Yong-Woo Lee

Bias in size distribution estimates for fish populations due to sampling gear selectivity and sample sizes

Pablo del-Monte-Luna, Salvador E. Lluch-Cota, Jesus Bautista-Romero and Daniel Lluch-Belda

Fishing down or just too many small pelagics?

Kazushige Oishi, Akira Nihira, Tadaaki Kuroyama and Sei-Ichi Saitoh

Predictable hotspots for Skipjack tuna, *Katsuwonus pelamis*, using multi-sensor satellite remote sensing off the east coast of Japan

Alexei Orlov and C. Binohlan

Length-weight relationships of deep-sea fishes from the western Bering Sea

Alexei M. Orlov and Vasily A. Ul'chenko

Seasonal changes of environmental conditions of the most abundant and common groundfish species in the Pacific off the North Kurils and South Kamchatka

Gennady V. Avdeev, Evgeny E. Ovsyannikov and Svetlana L. Ovsyannikova

Seasonal distribution of immature pollock in the northern Okhotsk Sea

Yosuke Sagawa, Hideaki Kudo and Masahide Kaeriyama

Feeding habits of Pacific salmon in the North Pacific Ocean in summer 2005

Aida Sartimbul, Hideaki Nakata and Ikuo Hayashi

Analysis of time series of coastal fishery catches in the Tsushima Warm Current region in relation to temperature changes

Young Il Seo, Joo Il Kim, Sun Do Hwang, Taek Yun Oh, Sun Kil Lee, Won Seok Yang, Sung Tae Kim and Hyun Joo

Coastal ecosystem of the Yeo-Ja Bay in the southern sea of Korea

Kyung-Jun Song, Zang Geun Kim, Hawsun Sohn, Seok Gwan Choi, Yong-Rock An and Chang Ik Zhang

The feasibility of photo-identification techniques for bottlenose dolphin (*Tursiops truncatus*) in Jeju Island, Korea

Mikhail A. Stepanenko and Elena V. Gritsay

Effect of biological and physical factors on recruitment variability of eastern Bering Sea pollock

Naoki Tojo, Gordon H. Kruse and Fritz C. Funk

Migration dynamics of Pacific herring (*Clupea pallasii*) and response to spring environmental variability in the southeastern Bering Sea

Norio Yamashita, Masayuki Noto, Chikako Watanabe, Atsushi Kawabata and Hiroshi Nishida

Distribution and growth of juvenile chub mackerel, *Scomber japonicus*, in the Kuroshio-Oyashio transition region

Hak Jin Hwang, Yang Jae Im, Myoung Ho Sohn, Inja Yeon, Naek Joong Choi and Mi-young Song

Spatio-temporal distribution of Pacific cod, *Gadus macrocephalus*, in the western sea of Korea

Inja Yeon, Hak Jin Hwang, Yang Jae Im, Myoung Ho Shon, Sung Hyun Hong, Yoon-Seon Yang and Mi-Young Song

The reproductive biology of blue crab, *Portunus trituberculatus* (Miers), in the western sea of Korea

POC Contributed Paper Session

Convenor: Michael G. Foreman (Canada)

Background

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

Summary of presentations

The session consisted of 19 oral presentations (after two cancellations – Chen and Wang) and 21 posters covering a wide range of physical and biogeochemical oceanographic research. The first sub-session, chaired by Michael Foreman, started with an interesting presentation by William Crawford on the transport and mixing of nutrients into the Gulf of Alaska by eddies that largely originate on continental shelves. Masatoshi Sato used recent Argo observations to describe variations in the current structure of the North Pacific. Young-Gyu Park used output from the Japanese high-resolution Earth Simulator model to identify seasonal variations in, and sources of, the Tsushima Warm Current. Ye Yuan described and compared observations of suspended sediment from three different instruments that were deployed near major river mouths along the Chinese coast of the Yellow Sea. The final speaker of this sub-session, Svetlana Glebova, described her analyses of 2000-2006 atmospheric circulation patterns over the Asia-Pacific region.

The next sub-session was chaired by James Christian and comprised of biogeochemical presentations. Pavel Tishchenko analysed and sought to explain peculiarities in the nitrogen/phosphate ratio in the Japan/East Sea. The next two speakers, Melissa Chierici and Agneta Fransson, used ship of opportunity observations of $p\text{CO}_2$ across the North Pacific to look for trends in the Oyashio, Alaskan Gyre, southern Bering Sea, and western subtropical gyre regions. Relationships between CO_2 and temperature and salinity were explored, but the relatively short time series (1995-2001) limited the strength of their conclusions. The final speaker before lunch, Shigeho Kakehi, related

changes in AOU (apparent oxygen utilization) in the North Pacific to mixing, biological activities, and air-sea exchange and estimated proportions for each.

The third sub-session was chaired by Ichiro Yasuda and began with three papers relating to the 18.6-year nodal tidal cycle, a topic that was introduced by Prof. Yasuda in his Science Board presentation the previous day. Konstantin Rogachev attributed the cooling at specific banks in the Sea of Okhotsk and Oyashio region to strong diurnal tidal currents and showed that the 18.6-year modulation of these currents was correlated with air temperatures at two cities on the Sea of Okhotsk coast. Michael Foreman described his assimilating model for the Bering Sea, estimated the tidal energy entering the sea through each of the Aleutian Passes, showed regions of dissipation and mixing, and finally quantified how much that mixing should change over 18.6 years. Satoshi Osafune used salinity and temperature observations from the world data base to identify regions in the western North Pacific, including the Bering and Okhotsk Seas, where there have been significant changes over 18.6 years, and to estimate the vertical diffusion coefficient associated with these changes. Leaving this topic, Fangli Qiao presented the results of model sensitivity studies to identify the unconventional dynamics that cause seasonal upwelling in the East China Sea near the mouth of the Changjiang River. The final speaker, Ig-Chan Pang, described the distribution of Changjiang diluted water in the East China Sea, with particular emphasis on predicting low salinity events before they hit Cheju Island.

The fourth sub-session, chaired by Fangli Qiao, began with an extensive analysis (using over 230,000 profiles) showing that atmospheric forcing was the primary cause of spatial and temporal variations in the mixed layer depth in the East Sea (Se-Han Lim). Olga Trusenкова computed and described variability modes and typical patterns of surface winds of the

Japan/East Sea and nearby land masses. Tohikuro Kono related 1989-1995 observations of walleye Pollock eggs and their survival to variations in the Coastal Oyashio Current and described the results of preliminary simulations with a circulation model that will be used for further studies. Jae-Yul Yun demonstrated that atmospheric bridging between Siberian Highs and the Indian Ocean is the reason behind El

Niño teleconnections to isopycnal fluctuations in the southwestern Japan/East Sea. Chnagshui Xia, described improvements to the Mellor-Yamada mixing formulation via the development of a wave-tide coupled model and demonstrated that these changes lead to more accurate mixing layers in the Yellow and East China Seas.

List of papers

Oral presentations

William R. Crawford

Transport and mixing of continental margin waters into mid-basin by anticyclonic eddies: An example from the Gulf of Alaska

Masatoshi Sato and Tokihiro Kono

Seasonal variation of current structure in the subarctic North Pacific from Argo data

Young-Gyu Park, Chang-Hwan Park and Sang-Wook Yeh

The formation of the Tsushima Warm Current in a high resolution ocean circulation model

Ye Yuan, Wen-Sheng Jiang and Liang Zhao

Estimating suspended sediment concentration using ADCP, LISST-100 and OBS in Jiaozhou Bay and Laizhou Bay, China

Svetlana Yu. Glebova

Features of atmospheric circulation over the Asian-Pacific region in 2000-2006

Liqi Chen

China's international polar year 2007-08 projects and CHINARE's SOLAS in polar regions

Pavel Ya. Tishchenko, Sergey G. Sagalaev, Vyacheslav B. Lobanov, Alexander P. Nedashkovskiy, Galina Yu. Pavlova and Lynne D. Talley

Peculiarities in distribution of the N:P ratio in seawater of the Japan/East Sea

Melissa Chierici, Agneta Fransson and Yukihiro Nojiri

Evolution of the surface water carbon dioxide in relation to the annual trends in salinity and temperature in the Oyashio region

Agneta Fransson, Melissa Chierici and Yukihiro Nojiri

Comparison of interannual trends in the surface water $p\text{CO}_2$, salinity and temperature in the subarctic North Pacific

Shigeho Kakehi, Kazuyuki Uehara, Shin-ichi Ito, Kosei Komatsu, Hiroaki Saito and Miwa Nakamachi

The processes of AOU change in the North Pacific

Konstantin Rogachev

Cooling at hot spots: Amplification of tidal currents over banks and 18.6-year tidal cycle in the Oyashio and Sea of Okhotsk

Michael G. Foreman, Patrick Cummins, Josef Cherniawsky and Phyllis Stabeno

Tidal energy and the 18.6-year cycle in the Bering Sea

Satoshi Osafune and Ichiro Yasuda

Bidecadal variations of water properties around the Bering Sea and the relation with the 18.6-year period nodal tidal cycle

Fangli Qiao and Xingang Lv

The upwelling system in the East China Sea in winter and summer

Ig-Chan Pang, Jae-Hong Moon, Takeshi Matsuno, John M. Klinck, Jin-Young Kim, Hee-Dong, Jeong, Ki-Tack Seong and In-Seong Han

Distribution mechanism of Changjiang diluted water in the East China Sea

Se Han Lim, Chan Joo Jang and Im Sang Oh

Spatial and temporal variations of the mixed layer depth in the East Sea

Olga O. Trusenkov, Sergey V. Stanichny and Yuri B. Ratner

Variability modes and typical patterns of surface wind over the JES and adjacent land

Tokihiro Kono, Tomonori Hamatsu, Keizo Yabuki, Kazutoshi Watanabe and Michael G. Foreman

Transport of walleye pollock (*Theragra chalcogramma*) eggs between 1989 and 1995 and its causes on the southwest coast of Hokkaido, Japan

Fan Wang

Long-term variability of temperature in the Yellow Sea and the East China Sea in the past 40 years

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Jae-Yul Yun, Kuh Kim, Kyung-II Chang, Yang-ki Cho and Lorenz Magaard

The El Niño teleconnection to the isopycnal fluctuations in the southwestern East Sea/Japan Sea

Changshui Xia, Fangli Qiao, Yongzeng Yang and Yeli Yuan

The development of a wave-tide-circulation coupled model and its application in the Yellow Sea and the East China Sea

Posters

Tatyana V. Belonenko and Alexey V. Koldunov

Rates of steric sea-level variation for the Kuril area in the North Pacific

Yongli Chen, Yongping Zhao, Fan Wang and Aiming Wu

The pathway of interannual and interdecadal variability of the Pacific subsurface ocean temperature anomaly

Yang Ho Choi, Young Jae Ro and Chang Su Jeong

Development of a hydrodynamic and eutrophication model of the west coast of Korea

Shan Gao, Fan Wang, Mingkui Li, Yongli Chen, Changxiang Yan and Jiang Zhu

Application of altimetry data assimilation on mesoscale eddies simulation

Hitoshi Kaneko, Hiroji Onishi and Ichiro Yasuda

Formation processes of temperature inversions in the subarctic North Pacific

Eung Kim, Young-Jae Ro, Yu-Hwan Ahn and Kwang-Young Jung

Estimation of sea surface current vectors based on satellite images around the Korean Marginal Sea

Yun-Bae Kim, Kyung-II Chang, Jae-Hun Park, Jong-Jin Park, D. Randolph Watts, Jae-Hak Lee and Kuh Kim

Low-frequency deep flow variability in the Ulleung Basin

Viktor V. Koldunov

Research of interannual variability of the mean sea level in the North Pacific

Kosei Komatsu, Takashi Setou and Yasumasa Miyazawa

Abrupt change of mixed-layer structures caused by horizontal intrusion of the warm water mass from the Kuroshio into the coastal region off Enshu-nada, south of Japan

Kosei Komatsu, Yasumasa Miyazawa and Takashi Setou

Effects of wind and waves on the jet-leaving transport of surface materials around the Kuroshio and the Kuroshio Extension

Kosei Komatsu, Yasumasa Miyazawa and Takashi Setou

Modification processes of intermediate water around the Kuroshio region

Mingkui Li, Fan Wang, Yongli Chen, Shan Gao and Fangli Qiao

Parameterization of tidal current-induced vertical eddy viscosity

Vyacheslav Lobanov, Vladimir Zvalinsky, Anatoly Salyuk, Pavel Tishchenko, Sergey Zakharkov, Svetlana Ladychenko,

Boris Lee, Kyung-Ryul Kim, Jae-Young Lee and Victoria Nadtochiy

Physical, chemical and biological structure of an anticyclonic eddy in the northwestern Japan Sea

Valentina V. Moroz and Konstantin T. Bogdanov

Variability of water characteristics in the Kuril-Oyashio Current system

Hanna Na, Kuh Kim and Kyung-II Chang

Application of high-frequency radar to the east coast of Korea

Masayuki Noto and Ichiro Yasuda

Bi-decadal variations in SST relating to a tidal cycle of 18.6-year periods around the Kuril and Aleutian Islands

Sachiko Oguma, Tsuneo Ono, Akira Kusaka and Yutaka W. Watanabe

Stable isotopes as chemical tracers in the coastal region around eastern Hokkaido

Jong Jin Park and Kuh Kim

Kinetic energy flux of inertial frequency motion out of the mixed layer and its balance with wind energy input in the global scale ocean

Natalia I. Rudykh, Vladimir I. Ponomarev and Elena V. Dmitrieva

Linkages of oceanographic characteristic variability in the Tatarskii Strait with the Amur River discharge

Yugo Shimizu, Hiroaki Tatebe, Ichiro Yasuda, Shin-ichi Ito, Shigeo Kakehi, Akira Kusaka and Tomoharu Nakayama

Southward Oyashio intrusion revealed by profiling floats set to drift in the intermediate layer

Miyuki Tatesawa, Shin-ichi Ito, Yugo Shimizu and Shigeo Kakehi

Seasonal variation of dissolved oxygen in the Oyashio

Shuichi Watanabe, Masahide Wakita, Vyacheslav B. Lobanov and Igor Zhabin

Distributions of chemical species in the subarctic North Pacific and the western Bering Sea during 2004 summer cruise

Masahiro Yagi and Ichiro Yasuda

Vertical eddy diffusivity at the Bussol' Strait in the Kuril Islands from CTD data

BIO Contributed Poster Session

Convenor: Michael J. Dagg (U.S.A.)

Posters on various aspects of biological oceanography in the North Pacific Ocean and its marginal seas (excluding S2-S5 topics) were

invited. Among 15 posters presented, 5 were from Russia, 6 from Korea, 3 from Japan and 1 from China.

List of posters

Tatyana A. Belan and Ludmila S. Belan

Distribution of macrozoobenthos in the North-West part of the Japan/East Sea in 2006

Andrew A. Bobkov and Kirill M. Petrov

Bionomic criteria for large marine ecosystem identification

Sachihiko Itoh and Shingo Kimura

Biological transport and survival of larval pelagic fishes in the Kuroshio system region estimated with Lagrangian drifters

Seung Jin Jeong, Ok Hwan Yu and Hae-Lip Suh

Secondary production of *Jassa slatteryi* (Amphipoda, Ischyroceridae) on a *Zostera marina* seagrass bed in Southern Korea

Young Shil Kang, Seung Heo and Hyunchul Kim

Zooplankton distribution, abundance and biomass relative to oceanographic conditions in the Yellow Sea

Valentina V. Kasyan

Composition, distribution and interannual variability of zooplankton in the inner part of Amursky Bay (Japan/East Sea)

Hyeok Chan Kwon, Sung Il Lee, Hyung Kee Cha, Seon Jae Hwang, Young Seop Kim and Jae Hwang Yang

Maturity and spawning of *Glyptocephalus stelleri* in the East/Japan Sea, Korea

Chang Rae Lee, Chul Park, Sungyull Yang and Yongsik Sin

Plankton distribution during the spring bloom in Asan Bay in the Yellow Sea, Korea

Wen-Tseng Lo, Ya-Ling Pan and Li-Lian Liu

Seasonal distribution of siphonophores in and near the Kuroshio Current off eastern Taiwan

Jun Nishikawa, Hiroya Sugisaki and Ichiro Yasuda

Increase in salp abundance during 1983-1993 in the western subarctic North Pacific

Marina S. Selina, Olga G. Shevchenko, Tatiana V. Morozova, Inna V. Stonik and Tatiana Yu. Orlova

Phytoplankton of the Amur River estuary and adjacent areas in July 2005

Yugo Shimizu, Kazutaka Takahashi, Shin-ichi Ito, Shigeho Kakehi, Akira Kusaka and Tomoharu Nakayama

Southward carbon transport of large subarctic copepods by the Oyashio current

Dong Hyun Shon

Differentiation of phytoplankton groups using in-water optical techniques

Vladimir I. Zvalinsky and Pavel Ya. Tishchenko

Natural and anthropogenic eutrophication of Amursky Bay (East/Japan Sea)

Keiko Yamada, Sang-Woo Kim, Hee-Dong Jeong and Woo Jin Go

Typhoon effects on the short-term variation of chlorophyll-*a* in the East/Japan Sea, derived by satellite remote sensing

MEQ Contributed Poster Session

Convenor: John E. Stein (U.S.A.)

Posters on various aspects of marine environmental quality in the North Pacific and

its marginal seas (excluding S8 and S9 topics) were presented.

List of posters

Tatyana A. Belan and Alexander V. Moshchenko

Near-bottom environmental conditions and state of benthos at the inner part of Amursky Bay (Peter the Great Bay, Japan/East Sea)

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Andrey P. Chernyaev and Alexander A. Vostroknutov

Determination of n-nonylphenol in the sea water

Minkyu Choi, Gui-Young Kim, Hyo-Bang Moon, Hee-Gu Choi, Jun Yu and Jong-Soo Park

Behavior and contamination of estrogenic nonylphenols in Masan Bay, Republic of Korea

Yoon seok Choi, Jong hui Kim, Chang su Jeong and Hyeon Seo Cho

Distribution and origins of PCBs and PAHs in sediments of Yellow Sea

Daoji Li, Lei Gao and Ping Wang

Nutrient exchange fluxes between water-sediment interface in tidal flat of Dongtan, Changjiang (Yangtze River) estuary

Tatyana S. Lishavskaya and Alexander V. Moshchenko

Contamination level and distribution of some pollutants in bottom sediments of the north-west part of the Japan/East Sea in 2006

Renyan Liu, Daoyan Xu, Yuhua Dong, Bingjun Chen, Bing Liang, Yubo Liang and Sai Ye

Preparation of monoclonal antibody against okadaic acid and development of ELISA to detect diarrhetic shellfish poisoning in shellfish from China

Olga N. Lukyanova, Svetlana A. Aleshko and Sergey A. Cherkashin

Mysids as sensitive bioindicators for coastal ecosystems monitoring

Tatiyana V. Pavlova, Vasiliy F. Mishukov and Larisa C. Buzoleva

Dynamics of number of oil oxidizing microorganisms in Golden Horn Bay of the Sea of Japan

Dariush Mowla and Majid Ahmadi

Theoretical and experimental investigation of biodegradation of hydrocarbon polluted water in a three phase fluidized-bed bioreactor with PVC biofilm support

Nadezhda E. Struppul, Olga N. Lukyanova and Yuri V. Prichod'ko

Selenium accumulation in trophic net of the Japan/East Sea

Anh Dieu Van, Jin Wang, Yoko Sano, Kentaro Uchida, Yoshishige Hayashi and Takuya Kawanishi

Partition of polycyclic aromatic hydrocarbons (PAHs) between the river water and bottom sediments at the estuary of rivers in Kanazawa, Japan

Haiyan Wang, Yusheng Zhang and Senming Tang

Status of combined heavy metal and POP pollution in Razor clam from coastal areas of Quanzhou, China

Maromu Yamada, Yasunobu Iwasaka, Guangyu Shi, Atsushi Matsuki, Dmitry Trochkin, Daizhou Zhang, Masahiro Nagatani, Hiroshi Nakata, Yoon-Suk Kim, Tetsuji Nagatani, Bin Chen, Shen Zhibao, Jingmin Li and Kazuichi Hayakawa

Existence of background dust in the free troposphere over an Asian dust source region

Xiao-Yang Yang, Yumi Okada, Ning Tang, Takayuki Kameda, Akira Toriba and Kazuichi Hayakawa

Long-range transport of polycyclic aromatic hydrocarbons and nitropolycyclic aromatic hydrocarbons from China to Japan

Observers Poster Session

Posters providing general information and highlighting scientific objectives and recent activities of scientific organizations, programs

and monitoring efforts of regional and global scale were presented.

List of posters

Norio Baba

Current activities and future plans of Northwest Pacific Action Plan (NOWPAP)

John A. Barth, Jan A. Newton and NANOOS Colleagues

Northwest Association of Networked Ocean Observing Systems (NANOOS)

Kenneth F. Drinkwater and George L. Hunt

Ecosystem Studies of Sub-Arctic Seas (ESSAS)

Julie Hall and Sylvie Roy

IMBER: Integrated Marine Biogeochemistry and Ecosystem Research

George L. Hunt Jr. and K. David Hyrenbach

The Bering Ecosystem Study Program (BEST): A new program for the eastern Bering Sea

Molly McCammon, G. Carl Schoch and Mark Johnson

AOOS: Implementing an Ocean Observing System in Alaska

Clarence Pautzke and Francis Wiese

Bering Sea and Aleutian Islands integrated ecosystem research program of the North Pacific Research Board

Howard J. Freeland, Nobuyuki Shikama and the Argo Steering Team

Argo – An ocean observing system for the 21st century

Usha Varanasi, William Fox, Elizabeth Clarke, Jonathan Phinney, Jack Barth, Russ Davis, John Hunter and Dolores Wesson

The Pacific Coast Ocean Observation System: A new approach to integrating ecosystem-based science observations for management

IFEP/MODEL Workshop (W1)

Modeling iron biogeochemistry and ocean ecosystems

Convenors: Fei Chai (U.S.A.) and Jun Nishioka (Japan)

Background

The workshop aimed to enhance communication between experimentalists and modelers, and to examine the role of the iron cycle and its complexity in regulating biological productivity and structure of ocean ecosystems. A total of 28 scientists from Canada, Japan, United States of America, Hong Kong, France, and New Zealand attended the workshop. There were 7 oral presentations and 1 poster. Two talks focused on iron biogeochemistry based on observations, and 5 talks used numerical models to address the impact of iron on ecosystem dynamics.

An invited speaker, Marie Boye, reviewed recent advances in understanding the marine iron cycle, the role of organic ligand chemistry in the ocean, and datasets of basin-scale iron ligand concentrations. Atsushi Ooki presented data on dust-iron solubility in the seawater. Modeling talks examined several different approaches to treating the iron cycle and complexity in models. An ocean carbon cycle model indicated that it is important to have realistic iron distribution (Daisuke Tsumune). A couple of models tested iron fertilization and its impact on marine ecosystem structures (Masakiho Fujii and Fei Chai). One presentation compared simple with complex ocean ecosystem models, as well as the models with an iron cycle against models without an iron cycle (Albert Hermann). An iron cycle module has been incorporated in the NEMURO ecosystem model, and some preliminary results were presented (Naoki Yoshie).

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

Summary of presentations

Suggestions from experimentalist

- Dust size, solubility, and its retention time are important factors for estimating bio-available iron in the surface layer, and these should be incorporated into models;
- Modelers should consider the significant differences in the concentrations of organic ligand among the ocean basins;
- Experiments are required on the bio-availability of organic iron species (dissolved, soluble and colloidal);
- There is a need to collect more data on the size-fractionated organic iron;
- Relationships between ligands and biogeochemical and environmental conditions should be investigated;
- Modelers should use the growing data sets of colloidal and soluble organic iron to examine meridional and zonal gradients of dissolved iron;
- Modelers should use available data sets of organic iron and the parameterizations provided by biogeochemists to develop and improve iron cycle models;
- Models should take into account species-specific bioavailability of organic Fe.
- A conceptual model focusing on iron chemistry should be established, and it

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should include the remineralization and photochemical processes;

- Changes in the chemical form of iron occur during remineralization and scavenging process, and these transformation should be considered in the models;
- End members can be used to parameterize iron dynamics in model studies;
- There is a need to establish observational systems to collect long-term time series data.

Suggestions from modelers

- Information on stoichiometry of phytoplankton is needed to improve iron distribution in the models;
- Iron dust deposition affects iron distribution, but current data are too sparse to quantify these relationships, and more data on this subject is needed;
- When only iron input from atmosphere is considered, the difference of iron concentration between basins could not be reproduced in the current models;
- Initial conditions (phytoplankton species, chemical and physical variables) are important factors for determining ocean ecosystem responses to iron enrichment;

- After iron enrichment in the equatorial Pacific, the ocean ecosystem needs about 60 to 90 days to return to the original state;
- Some comparison of iron cycle between subarctic and subtropical regions is needed;
- More information is required on interaction between phytoplankton and zooplankton functional groups, especially due to iron perturbations;
- Based upon comparative studies of different NPZ models, it appears that multiple classes of phytoplankton models with an iron cycle are needed to reproduce the basic characteristics of HNLC regions;
- There is a need for more information on organic-ligand chemistry and associated biogeochemistry from field observation in order to incorporate these processes into models.
- Long-term time series data are required for improving biogeochemical and ecosystem models.

The workshop recommended continuing the dialogue between experimentalists and modelers who work on iron biogeochemistry and ecosystem. A new working group consisting of experimentalists and modelers would be useful to examine the role of the iron cycle in regulating ocean productivity and marine ecosystem dynamics.

List of papers

Oral presentations

Marie Boye, Olivier Aumont, Constant M.G. van den Berg and Hein J.W. de Baar (Invited)

The organic complexation in modeling the iron geochemistry and bioavailability

Atsushi Ooki, Jun Nishioka and Tsuneo Ono

Determination of iron solubility of Asian dust in the surface seawater

Daisuke Tsumune, Keith Lindsay, Gokhan Danabasoglu, Scott C. Doney, Jun Nishioka, Takeshi Yoshimura, Frank O. Bryan and Nakashiki Norikazu

Phosphate and iron concentrations in an ocean carbon cycle model

Fei Chai, Lei Shi, M-S Jiang, Yi Chao, Francisco Chavez and Richard T. Barber

Modeling responses of iron enrichment in the equatorial Pacific Ocean

Masahiko Fujii and Fei Chai

Influences of initial plankton conditions and mixed layer depth on the outcome of iron-fertilization experiments

Albert J. Hermann, Thomas M. Powell, Elizabeth L. Dobbins, Sarah Hinckley, Enrique N. Curchitser, Dale B. Haidvogel and Kenneth Coyle

A comparison of different NPZ models for the Northeast Pacific

Naoki Yoshie, Katsunari Sato, Yasuhiro Yamanaka and Jun Nishioka

Incorporating iron cycle into a lower trophic level marine ecosystem model, NEMURO

Poster

Debby Ianson, Christoph Voelker Kenneth L. Denman, Eric Kunze and Nadja Steiner

The importance of iron in a biogeochemical patch model of the NE Pacific iron manipulation experiment, SERIES

FIS Workshop (W2)

Linking climate to trends in productivity of key commercial species in the sub-arctic Pacific

Convenors: Richard J. Beamish (Canada), Anne B. Hollowed (U.S.A.), Masahide Kaeriyama (Japan), Suam Kim (Korea), and Vladimir Radchenko (Russia)

Background

The objective of the workshop was to review the evidence for climate impacts on production of commercial fish species and to discuss the feasibility of developing medium- to long-term forecasts of climate impacts on fish production, and the responses of fisheries to these changes in production. Participants in this workshop addressed three themes: (1) Evidence of climate change impacts, (2) Management implications, and (3) Techniques for comparing production trends of selected species across regions. Oral presentations were given that addressed each theme and participants discussed the implications of research findings with respect to recommendations for PICES forecasts of climate impacts on marine resources.

Summary of presentations

Scientists from five of the six PICES member countries participated in the workshop. They identified 30 important commercial species or species groups that could be included in forecasts of climate change and its affect on fish production. Participants acknowledged that the goal of forecasting fish responses to future states of nature is an ambitious task that will require collaboration between climatologists, oceanographers, fisheries biologists and modelers. Implementing periodic forecasts will require on-going collaboration between several PICES groups (FIS, POC, MONITOR, CFAME, and MODEL). While ambitious and far reaching, workshop participants identified several reasons why PICES should take the initiative to make forecasts of future fish production using climate scenarios and their associated ocean conditions. The following

summarizes the views on the importance of forecasting:

- Studies linking climate to fish production have relied primarily on retrospective analysis of data. While several mechanisms have been advanced to explain fish responses to climate change, the scientific method requires hypothesis testing. For marine ecosystems, one of the few tests available is a test of our ability to accurately predict how fish populations will respond to variations in ocean conditions. While developing the hypothesis is important step, there is a need to test the hypothesis by comparing observed and predicted outcomes.
- Parallel forecasts of fish responses to climate in several different PICES regions would help to determine whether fish stocks are responding to local events or basin-scale forces.
- The scientific community is calling for advances in sustainable fisheries management by taking into account the influence of a variable ocean ecosystem. A central element of this approach is the need to understand the impact of commercial fishing on ecosystems. If forecasts are based on inaccurate representations of fish population dynamics or inaccurate patterns of fishing, the projections of ecosystem impacts of fishing derived from these forecasts will not provide managers with useful results and could provide mis-leading information.
- With time and proven predictability, industry and governments may begin to utilize model output in forming management decisions. Linking annual trends in key species production with climate and ocean

indices would also introduce a new dimension to PICES ecosystem status report that will attract a more general audience, including the popular press.

Workshop participants identified two types of forecasting approaches: index-based and quantitative modeling. Index-based forecasts involve the collection and comparison of time series of fish abundance, production, or condition. These data could be displayed as anomaly plots or charts in the North Pacific ecosystem status report. Tracking anomalies would serve as an early climate event detection system, and they would serve to provide a visual method for identifying similarities and differences between species in different PICES regions. If anomalies were used, scientists would need to agree on criteria for estimating means to ensure standardization across regions. It was noted that this type of forecasting tool could be applied to non-target and target species that are impacted by fishing. Participants felt this activity could be accomplished through collaboration with MONITOR.

The model-based forecasting approach would simulate functional responses of target species to expected future states of nature derived from climate forecasts and regional bio-physical models. To accomplish this task, members from each PICES nation would need to clarify the proposed mechanisms underlying the response of commercial fish to changes in climate. Members would prepare a list of core inputs necessary to develop a quantitative forecast. Fulfilling this request would require collaboration with members of POC to ensure requests are feasible. It is likely that the scenarios developed for CFAME models could also be utilized for projection of dynamic responses of commercial fish and fisheries.

It was noted that there are at least two types of quantitative forecasts that could be pursued. The first would involve forecasts based on coupled bio-physical models. Some progress has already been made in the development of this type of forecasting tool. For example, the MODEL Task Team has parameterized the NEMURO.FISH model for prediction of Pacific

herring and Pacific sardine recruitment. This modeling construct could be modified and adapted to other species, and linkages between annual fish production and future spawning stock biomass could be accomplished by extending the life cycle through adult life stages.

The second modeling construct would involve forecasts of future fish production using stock assessment projection models modified to incorporate climate forcing on core processes such as growth, maturation, production, predation mortality, catchability, availability, and fishing mortality. This modeling construct would require seasonal indices of climate/ocean conditions as well as indices of biological factors such as predator biomass and habitat volume (an index of competition). Functional responses of fish to climate would be developed to forecast changes in maturity schedule, growth, reproductive success, mortality, and selectivity of surveys or fisheries. We envision that over time, the FIS forecasting tools would be used to develop a decision tables for managers. Managers would use the decision tables to evaluate management strategies given probabilistic statements regarding expected ocean conditions over medium-term time periods. There are several advantages to this construct for forecasting. First, the framework would ensure continuity between changes in stock assessments and the forecasting tool. In several PICES countries, forecast models have been developed or are being developed to implement Management Strategy Evaluations (MSEs). These models could be modified to include climate forcing. Second, this type of modeling construct would facilitate rapid incorporation of new information for several managed species into ecosystem models providing improved whole ecosystem projections. Third, stock assessment authors throughout the PICES region are attempting to develop spatially explicit models. Utilizing a modeling construct that is consistent with stock assessment models would ensure rapid incorporation of spatial considerations into the forecast.

Participants discussed the spatial domain for the forecast and considered several candidates for

regional boundaries. Participants reviewed the PICES regions developed by the REX Task Team:

- California Current south
- California Current north
- Gulf of Alaska
- Bering Sea
- Sea of Okhotsk
- Japan/East Sea - Yellow Sea/East China Sea –Tsushima Warm Current (TWC)
- Kuroshio-Oyashio Current (KOC)
- Aleutian Islands
- Basin area

Upon review, it was noted that some stocks extend over multiple regions. To account for extended distributions, the Japan/East Sea and Yellow Sea/East China Sea regions could be combined into the TWC, and the Oyashio Current and Kuroshio Current regions could be combined into the KOC. Alternatively, it was indicated that quantitative forecasts might utilize the spatial domain used in stock assessments since this would be the primary source of detailed information on fish production. This option would provide consistency between assessments and forecasts.

Participants also discussed the schedule for implementing forecasts. Dr. Jeffrey M. Napp (MONITOR Chairman) informed participants that they plan to provide web accessible time series of ecosystem indicators in 2007. He mentioned that MONITOR plans to hold an inter-sessional meeting in 2007 to prepare for the next North Pacific Ecosystem Status Report to be published in 2009. Based on this input, workshop participants felt that the timing was sufficient to make progress on the development of a more formal construct for ecosystem

forecasting that could contribute to the next North Pacific Ecosystem Status Report in 2009.

Recommendations

FIS should attempt to forecast climate impacts on fish production and the responses of fisheries to these shifts.

Both empirical and numerical models should be considered and evaluated at an inter-sessional workshop. The workshop will discuss the details of each modeling approach. Convenors should seek to obtain consensus on how/if common models should be developed to ensure comparability of forecasts from different PICES regions.

An inter-sessional planning meeting should take place. The workshop would be 2–3 days in duration and would include a 25-member interdisciplinary team of scientists representing the fields of climatology (global climate modeling), oceanography (coupled bio-physical models, and physical oceanography, and biological oceanography), fisheries oceanography, fish population dynamics, fisheries assessment, fisheries economics and ecosystem modeling. Participants recognized the logistical difficulties of holding an inter-sessional meeting in June. Two options were discussed. The first option would be to convene the workshop in conjunction with the ESSAS workshops scheduled in June 2007, in Hakodate, Japan. The second option would be to hold the meeting in May, in Seattle, U.S.A. PICES is requested to provide some funds to support travel to this meeting. Participants also recognized that an external funding source will be needed to ensure the appropriate participation.

List of papers

Oral presentations

Richard J. Beamish

The impact of future climate trends on the key species and their fisheries off the Pacific coast of Canada

Vladimir I. Radchenko

Trends in Russian fisheries in the North Pacific in relation to basic stock conditions and their variability under the climate change

Yeong Gong, Hee-Dong Jeong, Jong-Hwa Park, Ki-Tack Seong, Sang-Woo Kim and In-Seong Han

Fluctuations of fish populations in the waters off Korea and its adjacent regions

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Masahide Kaeriyama

Long-term fluctuations of chum salmon and Pacific herring populations in Hokkaido during 1883-2000

Anne B. Hollowed and Jennifer Boldt

An overview of evidence for climate impacts on Northeast Pacific marine fishes and recommendations for a framework for forecasting annual marine production

Z.T. A'mar, A.E. Punt and M.W. Dorn

The Management Strategy Evaluation approach and the Gulf of Alaska walleye pollock fishery

Michael J. Schirripa

The potential effects of including/excluding environmental factors into stock assessments

Jae Bong Lee, Suam Kim, Chang-Ik Zhang, Jin-Yeong Kim and Sukyung Kang

Evidences of climate-induced impacts on key commercial species around Korean waters

Andrea Belgrano

Linking multi-species fisheries to climate variability: A phenomenological approach

MEQ/FIS Workshop (W3)

Criteria relevant to the determination of unit eco-regions for ecosystem-based management in the PICES area

Convenors: Glen Jamieson (Canada), Patricia Livingston (U.S.A.) and Chang Ik Zhang (Korea)

Background

The management of human activities that affect ocean ecosystems requires planning and the engagement of stakeholders to meet the objectives of ecosystem-based management. This, in turn, requires identification of areas to determine which stakeholders must be involved in each specific process. Area boundaries are typically based upon science (*i.e.*, eco-regions), human community (*i.e.*, coastal community composition), administrative (*i.e.*, historical resource management areas) and international considerations (*i.e.*, transboundary issues). This workshop considered the science requirements for eco-region identification in the PICES area, and presentations were solicited to: 1) highlight national or regional experiences or frameworks for delineating marine sub-regions or eco-regions; 2) demonstrate the use of a variety of physical and/or biological criteria for region identification; or 3) explain the specific management purposes behind various sub-regional identification schemes. Discussion involved participants in reviewing the existing Large Marine Ecosystem boundaries of the PICES area and in developing recommendations for criteria to be used in sub-regional identification in the North Pacific.

Summary of presentations

The workshop had 11 presentations, 2 of which were invited, that focused on the science requirements for eco-region identification in the PICES area. Presentations highlighted national or regional experiences or frameworks in place for delineating marine sub-regions or eco-regions (Jamieson, Lee *et al.*); demonstrated the use of a variety of physical and/or biological criteria for region identification (Fluharty, Harvey *et al.*, Shtrik, Sydeman *et al.*); and/or explained the specific management purposes behind various existing sub-regional identification schemes (Kishida, Livingston and Piatt, Seki and Makaiau). Invited speakers discussed: 1) a hierarchical classification scheme that has been successfully applied across multiple scales and in many system types and whose output is becoming an accepted component of management support packages – both as maps for use in defining coherent management areas, but also as part of ecosystem-level modeling tools (Fulton), and 2) issues associated with reconciling overlapping biogeochemical and fisheries-based ecosystem typologies, and the mesh of fisheries management and reporting areas which may, or may not, in turn be related

to marine ecosystem typologies (Perry). The workshop concluded with a plenary discussion

of issues raised from the presentations with respect to criteria for ecoregion determination.

List of papers

Oral presentations

Elizabeth Fulton, Vincent Lyne and Donna Hayes (Invited)
Bioregionalisation and ecosystem-based management in Australia

Glen S. Jamieson
Canada's ecoregion determination approach

Jae Bong Lee, Chang Ik Zhang, Dong Woo Lee, Jong Hwa Park and Jong Hee Lee
Marine sub-regions determined with physical and biological criteria in Korean waters

Chris J. Harvey, Isaac C. Kaplan and Phillip S. Levin
Selecting model domains and boundaries in ecosystem modeling of the U.S. West Coast: Process determines scale

David L. Fluharty
Aligning institutions with ecosystems for marine science

Patricia A. Livingston and John F. Piatt
Progress in U.S. ecoregion definitions for ocean ecosystems and an Alaskan example

R. Ian Perry (Invited)
Ecosystem typologies in the North Pacific – A useful concept for ecosystem-based management?

Michael P. Seki and Jarad Makaiau
Archipelagic fishery ecosystem plans for the U.S. central and western Pacific islands

William J. Sydeman, Sonia D. Batten, Michael Henry, Chris Rintoul, David W. Welch, Ken H. Morgan and K. David Hyrenbach
Meso-marine ecosystems of the North Pacific: Application to ecosystem-based management

Vadim A. Shtrik
Use of the classification and structure of coastal zone macro-vegetation for global and local eco-regional identification of coastal areas in the North Pacific

Tatsu Kishida
Physical and biological criteria for region identification around Japan

MEQ Workshop (W4)

Review of selected harmful algae in the PICES region: II. *Dinophysis* and *Cochlodinium*

Co-convenors: Charles Trick (Canada) and Yasunori Watanabe (Japan)

Background

This workshop was the second of an annual series of workshops on Harmful Algal Bloom (HAB) species that affect all or most countries in the North Pacific. In 2006, the focus was on two genera, *Dinophysis* and *Cochlodinium*. *Dinophysis*, including DSP (Diarrhetic Shellfish Poisoning) producing species such as *D. acuminata*, *D. acuta*, *D. caudata* and *D. fortii*, is distributed in the PICES region. The integration of the information from each country advanced our understanding of these genera. *Cochlodinium polykrikoides* causes serious damage to finfish aquaculture in Korea and

Japan, and it has potential to spread to other countries. Topics included detection methods, ecosystem comparisons, and new advancements in physiology and ecology from each of the member countries. Emphasis was on factors which need additional study in order to develop a predictive capacity for these HABs. The workshop was preceded by a half-day laboratory demonstration on detection techniques for algal toxins.

Laboratory demonstration

The laboratory demonstration was organized by Drs. Yasunori Watanabe and Ichiro Imai and

held on October 13, 2006, at the National Research Institute of Fisheries Science (FRIFS) of the Fisheries Research Agency. In total, 28 scientists from 7 nations (Canada-3, China-6, France-1, Japan-10, Russia-2, Spain-2, U.S.-4) were in attendance. Two demonstrations were carried out. The first demonstration on “Protein Phosphate 2A (PP2A) inhibition assay for okadaic acid and its analogs in shellfish” was conducted by Dr. Reiji Sekiguchi, Ms. Natsuki Takahashi and Dr. Toshiyuki Suzuki. They introduced a new toxin determination kit, based on the principle that okadaic acid and its analogs (OAs) strongly and specifically bind to PP2A and inhibit its dephosphorylation activity. If OAs is absent, PP2A hydrolyze a colorless substrate pNPP and produce a yellow product. But in the presence of OAs, the substrate remains colorless. Therefore, OA concentration is determined by measuring the intensity of yellow color. This newly developed determination kit is expected to be used for on-site monitoring of OAs in shellfish.

The second demonstration on “Simple, rapid, specific and cost-effective method for identifying *Alexandrium tamarense* and *A. catenella* using the LAMP method” was conducted by Drs. Shigeru Itakura and Satoshi Nagai. LAMP, which stands for Loop-mediated Isothermal **A**mplification, is a simple, rapid, specific and cost-effective nucleic acid amplification method developed by the Eiken Chemical Co., Ltd in Japan. The advantages of LAMP are:

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

- The amplification can be checked by eye through the presence of amplified product (the turbidity of magnesium pyrophosphate, a by-product of the amplification reaction).

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

Summary of presentations

The workshop was held on October 14, 2006, and attended by 22 scientists from 9 nations (Canada-2, China-1, France-1, Japan-8, Korea-1, Norway-1, Russia-1, Spain-2, and U.S.-5). The ecology, physiology, taxonomy and toxicity of two very important harmful algal species, *Cochlodinium* and *Dinophysis* spp., were discussed and compared. Ideas regarding these common themes were summarized in the three invited talks provided by Kazumi Matsuoka, Patrick Gentien and Beatriz Reguera. The invited presentations were very clear and complete and resulted in considerable discussion among the participants. As PICES had hoped, much of the discussion focused on two major themes: (1) Why does the distribution and toxicity of these two genera reside in the PICES countries of the Western Pacific, yet are not (as yet) detrimental to the PICES countries of the PICES countries in the eastern North Pacific? and (2) What are the environmental situations that enhance or stimulate toxin production?

The invited lectures were complemented by a series of presentations concerning these genera in the individual PICES countries. Vera Trainer and Charles Trick reviewed the low level of these two genera in waters adjacent to the North American coast. These were in stark contrast to the deep and profound negative impact of these genera in Korea (Hak Gyoong Kim), Japan (Kazutaka Miyahara and Ichiro Imai) and China (Jinhui Wang). More specific methodologies were also presented. Toshiyuki Suzuki

described modern methods of analyzing lipophilic toxins, and Takafumi Yoshida documented the activities of CERAC (NOWPAP) on developing a regional HAB database. The details of each topic were

summarized in an “enthusiastic” hour-long discussion aimed at establishing a list of “what is known”, “what is unknown” and “what sort of information is required next”.

List of papers

Oral presentations

Reiji Sekiguchi, Natsuki Takahashi, Toshiyuki Suzuki

Protein phosphatase 2A inhibition assay for okadaic acid and its analogs in shellfish

Satoshi Nagai, Yukihiro Matsuyama and Shigeru Itakura

Simple, rapid, specific and cost effective method for identifying *Alexandrium tamarense* and *A. catenella* using “LAMP” method

Kazumi Matsuoka (Invited)

Recent progress of the study on a harmful dinoflagellate - *Cochlodinium polykrikoides*

Hak-Gyoon Kim, Chang-Kyu Lee, Kyong-Ho An, Wol-Ae Lim, Sook-Yang Kim and Young-Tae Park

The known and unknown on the initiation of *Cochlodinium polykrikoides* blooms in Korean waters

Kazutaka Mivahara, Ryosuke Uji and Mineo Yamaguchi

Harmful blooms of *Cochlodinium polykrikoides* in the southwestern Sea of Japan (San-in coastal waters)

Changkyu Lee, Youngtae Park, Kyeongho An and Yoon Lee

Impact of yellow clay on respiration and phytoplankton uptake of benthic shellfish

Takafumi Yoshida and Takashi Ogawa

Activity of CERAC about Harmful Algal Blooms in the NOWPAP region

Tatiana Yu. Orlova, Marina S. Selina and Galina V. Kononova

Species of the genera *Cochlodinium* and *Dinophysis* from the east coast of Russia

Vera L. Trainer and Charles G. Trick

Cochlodinium and *Dinophysis* in western U.S. and Canada

Patrick Gentien (Invited)

The rare marine protist *Dinophysis acuminata*

Beatriz Reguera, L. Escalera, S. Gonzalez-Gil, G. Pizarro, L. Velo and J.M. Franco (Invited)

What we know and what we do not know about *Dinophysis*

Ichiro Imai and Goh Nishitani

Are *Dinophysis* spp. always responsible for DSP toxicity of bivalves?

Toshiyuki Suzuki, Akira Miyazono, Yutaka Okumura and Takashi Kamiyama

LC-MS/MS analysis of lipophilic toxins in Japanese *Dinophysis* species

Jinhui Wang, Yutao Qin, Caicai Liu, Xiangshen Chen and Ren Xu

Dinophysis spp.: The abundance, distribution and the toxicity of DSP in the East China Sea

Vera Trainer and Hak-Gyoon Kim

Welcome, goals of HAB Section meeting

Hao Guo

The Monitoring System on HABs in China

Vera L. Trainer, Barbara M. Hickey and Michael G. Foreman

A regional U.S. west coast observing system for toxigenic *Pseudo-nitzschia*

Henrik Oksfeldt Enevoldsen and Monica Lion

Progress in the development of an international collaborative harmful algal event data base: The joint IOC-ICES-PICES HAE-DAT

Yasunori Watanabe

Country Reports/HAE-DAT (year 2002) reports: Japan

Jinhui Wang

Country Reports/HAE-DAT (year 2002) reports: China

Hak-Gyoon Kim

Country Reports/HAE-DAT (year 2002) reports: Korea

Tatyana Yu. Orlova

Country Reports/HAE-DAT (year 2002) reports: Russia

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Charles G. Trick

Country Reports/HAE-DAT (year 2002) reports: Canada

Vera L. Trainer

Country Reports/HAE-DAT (year 2002) reports: U.S.A.

POC Workshop (W5)

Evaluation of climate change projections

Convenors: Michael G. Foreman (Canada) and Yasuhiro Yamanaka (Japan)

Background

The most recent set of global climate model projections has been submitted to, and is being analyzed by, the Intergovernmental Panel on Climate Change (IPCC) for the publication of their Fourth Assessment Report in 2007. PICES Working Group 20 was created to evaluate these projections for the North Pacific and its marginal seas, and to compute products such as ensemble averages, that would assist PICES groups like the Climate Forcing and Marine Ecosystem Response Task Team (CFAME), in their analysis of climate effects on marine ecosystems, and ecosystem feedbacks to climate. In this workshop, presentations and discussions focused on ongoing research that addresses the terms of reference of the Working Group, and on strategies for future work that are needed to fill the gaps. Presentations related to the direct analysis of global climate projections and the calculation of ensemble averages; results from higher-resolution regional ocean and coupled atmosphere-ocean models that are forced by, and take their boundary conditions from the IPCC models; and the development of local and regional data sets (*e.g.*, SST, river flow, sea ice cover) based on either model projections or historical observations were solicited. The development of work/action plans, liaisons with other PICES groups and outside organizations (*e.g.*, CLIVAR), and future activities were discussed.

Summary of presentations

This workshop consisted of 3 invited talks, 11 oral presentations, and a brief business meeting that discussed future activities of the Working Group 20. In a brief introduction, Michael

Foreman welcomed all participants, outlined the agenda for the day, and reviewed the Terms of Reference of WG 20. Yoshiro Yamanaka then introduced all speakers for the morning part of the session.

The first invited speaker, Curtis Covey, briefly described his experience in managing and using the archive of climate model output created by the Program for Climate Model Diagnosis and Intercomparison (PCMDI) at Lawrence Livermore National Laboratory for the IPCC Fourth Assessment Report (AR4). He summarized the IPCC objectives, including the release of their upcoming report and plans for adding biogeochemistry to the next generation of climate models, and gave two interesting examples of analyses arising from the model output. The next speaker, Hiroyasu Hasumi, presented an overview of results from two CCSR/NIES/FRCGC (Japan) climate models, one of which has the highest spatial resolution of all the IPCC models. His presentation focused on analyses aimed at understanding the different results that arise from this finer resolution. His ongoing comparison among high and medium resolution ocean general circulation models (OGCMs) with the same atmospheric forcing will provide useful information for constructing regional high resolution models forced by one, or an ensemble, of IPCC global climate model scenario runs. Muyin Wang next presented results from an analysis of IPCC models showing that a basin wide warming signal under the IPCC SRES A1B scenario is predicted to surpass the Pacific Decadal Oscillation as the leading mode of variability in the North Pacific in the next forty years. The spatial pattern of the model-projected temperature trends is more uniform than the east-west dipole pattern of the

PDO. Michael Foreman briefly summarized the major results of 11 recently published papers, each of which presented direct or derived results from individual or ensembles of climate models for the North Pacific. The results covered changes in oceanic properties ranging from sea surface temperature and salinity to the Rossby radius of deformation and shoaling of the depth at which calcifying organisms dissolve. However, there was not always consensus among the models. The final speaker before the morning coffee break, Rong-Shuo Cai, described observed climate changes in the East and South China seas over the last 50 years. These included a weakening of the summer and winter winds, increases in the sea surface temperature, and more frequent occurrences of red tides.

The morning session after coffee began with a second invited speaker, Michio Kawamiya, describing the positive feedback that arises when carbon cycle interactions are included in climate change models, and the inter-comparison project, Coupled Climate Carbon Cycle Model Intercomparison Project (C4MIP), that seeks to understand the differing results among various models that incorporate this cycle. Another invited speaker, Keith Rodgers, followed with description of his modelling study of variability in equatorial Pacific biogeochemistry and ecosystems, for which a major result was a decoupling of the pycnocline and nutricline. He pointed out a difference in simulated iron supply associated with equatorial upwelling between two re-analyse data sets: National Centers for Environmental Prediction (NCEP) and European

Centre for Medium-range Weather Forecasts (ECWMF), especially after the 1970s. Sang-Wook Yeh next described differences in observed sea surface temperatures warming trends in the North and Equatorial Pacific over epochs extending from the early 1900s to the present. The final speaker of the morning, Zhenya Song, demonstrated the importance of including the mixing from surface waves in global model simulations by comparing climatological observations with model results.

The first speaker in the afternoon, Elena Ustinova, described spectral analyses of, and correlations between, time series of sea ice extent and air and water temperature in the Okhotsk and eastern Bering Seas. William Crawford followed with an analysis of 50 years of salinity and temperature observations along Line-P. His main result was that many changes are strongly related to changes in the predominant wind direction. Hee-Dong Jeong carried out a similar analysis of 37 years of temperature observations around the Korean Peninsula, finding different trends in three sub-regions and in different depth ranges. Masao Ichii then described analyses of observations of total inorganic carbon and dissolved oxygen along the 165°E transect between 28°N and 50°N. His results suggested that changes were more likely due to variability in the circulation or biogeochemistry rather than the uptake of CO₂. The final speaker, Dong-Young Lee, described the problems associated with estimating design wave heights in light of climate change.

List of papers

Oral presentations

Curtis Covey (Invited)

Managing, using and expanding the IPCC database of climate model output

Hiroyasu Hasumi and Takashi T. Sakamoto

Overview of the present state and future projection of North Pacific climate simulated by CCSR/NIES/FRCGC global coupled models

Muyin Wang, James E. Overland and Nicholas A. Bond

What will the North Pacific look like in the next 40 years?

Michael G. Foreman

Highlights from recent publications describing climate projections for the North Pacific

Rong-Shuo Cai, Ji-Long Chen and Rong-Hui Huang

The response of marine environment in the offshore area of China and its adjacent ocean to recent global climate change

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Michio Kawamiya, Chisato Yoshikawa, Tomomichi Kato and Taroh Matsuno (Invited)

Significance of ocean's response to climate warming in the global carbon cycle

Keith B. Rodgers, Christophe Menkes, Thomas Gorgues, Laurent Bopp and Olivier Aumont (Invited)

A modeling study of interannual to decadal variability in Equatorial Pacific biogeochemistry and ecosystems

Sang-Wook Yeh, Cheol-Ho Kim, Young-Gyu Park and HongSik Min

Characteristics of Pacific sea surface temperature variability associated with global warming during the 20th century

Zhenya Song and Fangli Qiao

The establishment of the atmosphere-surface wave-ocean circulation coupled numerical model and its applications

Elena I. Ustinova

Evaluation of climatic variability in the Far-Eastern Seas using regional data sets

William Crawford, Jake Galbraith and Nick Bolingbroke

Temperature and salinity along Line-P: Fifty years of observations

Hee-Dong Jeong, In-Seong Han, Ig-Chan Pang, Ki-Tack Seong, Woo-Jin Go, Sang-Woo Kim, Won-Deuk Yoon, Yong-Kyu Choi and Jun-Yong Yang

Seasonal long-term variation of temperature in Korean waters

Masao Ishii, Takayuki Tokieda, Shu Saito, Takashi Midorikawa, Shinji Masuda and Akira Nakadate

Decadal trend of dissolved oxygen in the North Pacific along 165°E – A preview

Dong-Young Lee and K.C. Jun

Estimation of design wave height through long-term simulation of sea states for the North East Asia regional seas

MONITOR/TCODE Workshop (W6)

Data management, delivery and visualization of high-volume data products

Convenors: David L. Mackas (Canada), Sei-Ichi Saitoh (Japan) and Thomas C. Royer (U.S.A.)

Background

Long-term monitoring of multidisciplinary data in boundary currents is a high priority for PICES nations. Boundary currents are locations where many monitoring activities now take place. These regions are very important economically, and are highly variable in both space and time. Dense, near real-time data from many disciplines are vital to describe the systems for timely management of coastal resources. Rapid analysis of the data is also essential. However, increased data rates and their diversity provide challenges for both data managers and data users. Cabled arrays, satellite altimeters, ocean color and scatterometer (wind) measurements are examples of these new dense data sets. This workshop discussed the availability of such data and how they can be used effectively, focusing especially on availability, uses, GIS applications and other methods of display and analysis tools.

Summary of presentations and discussions

Oral presentations at this workshop included 14 papers, plus summaries of 6 posters and e-

posters. Two additional posters were presented at the Thursday evening Poster Session. Topics were wide and overlapping, including:

- issues and promising new tools for data management and “data serving” (9 talks);
- goals and products of continental margin (9) and offshore (2) monitoring programs; and
- approaches to reaching and serving non-scientist “clients” (7).

An invited speaker, Lynn DeWitt, noted that ocean science programs have traditionally provided more-or-less adequate funds and intellectual effort for data collection and in-house analysis, and are beginning to budget for web-based display of the analysis results (a form of advertisement of “what was done”). But there is still too little being allocated to make source data accessible to future users. Provision for “data transport” to users and into alternative formats is a key step. Many commercial and open-source software tools are now becoming available to make this step easier.

Other speakers covered a broad range of input and output data products, from conventional (but

greatly improved) temperature and salinity maps, to pin-pointing of economic opportunities (e.g., predicted distributions of fish) and hazards (e.g., predicted distributions of algal toxins or hypoxia).

After the presentations, attendees (~40) discussed future directions in terms of both accomplishments/opportunities (good news) and impediments/obstacles (bad news). A brief (and somewhat subjective) summary follows:

High points

- Lots of progress toward inter-operable formats and software for data access and visualization;
- Improving profile of and tools for “data transport”;
- Wide range of new sensors and platforms (especially for biology and chemistry) but many are considered prototypes under development;
- Strong commitment by PICES nations to “ocean monitoring”, especially of the ocean margins, creates opportunities to integrate observations across jurisdictional borders. (Can we come up with a basin-scale array for climate/ocean/ecosystem interactions in the North Pacific?)
- Consistent global physical context provided by ARGO and WMO;
- More “data owners” are becoming willing to contribute, and more clients want to use data [raw] or data products [processed toward “information”];
- Growing list of socio-economic applications: HAB, hypoxia, *etc.*;
- Could produce tools for “conservation” as well as for “exploitation” and “adaptation”;
- Still need progress toward ways to integrate across data and meta-data types.

List of papers

Oral presentations

Lynn M. DeWitt (Invited)

Simplifying data integration and interoperability through standardized data access and transport protocols

Takashi Yoshida

NEAR-GOOS and Japanese operational oceanographic observations

Issues and obstacles

- Dissimilarity of clients & variables/sampling designs among “regional” Ocean Observing System modules (as yet, no set of standard ingredients). This disparity is in part driven by region-to-region differences in client profiles;
- Possibly large changes over time of remote sensing and *in situ* observation and archival systems (removals, not just additions);
- Data archives serve multiple functions: complete and safe archival, quality assessment and control, and accessibility/transparency. These are all important but can be in competition when resources are scarce;
- Parallel developments of “toolkits” (OBIS, GLOBUS). Are they interoperable?
- Long term preservation of information is a concern. (e.g., media obsolescence). Can we avoid “obsolete” or “unsupported orphan” archives? An obsolescence issue for interpreted results (e.g., the disappearance of print journals);
- Some archives have “mandatory formats”, others offer “translation services”. Too many and too strict mandatory formats may discourage participation;
- As real-time information becomes more available and useful, they also become more valuable and “sensitive”. Will economic (individual or collective), political, or security interests begin to block data sharing?
- Increased dependence on high-bandwidth exchanges. Is this risky, given that some clients continue to use low-bandwidth connections?

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Gongke Tan, D.Y. Lee, X. Hu and M. Li

Design and operation of offshore observing platform in the Yellow Sea

Molly McCammon, G. Carl Schoch and Mark Johnson

AOOS: Implementing an Ocean Observing System in Alaska

John A. Barth, Jan A. Newton and NANOOS Colleagues

Northwest Association of Networked Ocean Observing Systems (NANOOS)

M. Elizabeth Clarke, Bob Gref, Frank Schwing, Chris Goldfinger, Chris Romsos and Jonathan T. Phinney

A pilot data system for the Pacific Coast Ocean Observing System (PaCOOS)

Vera L. Trainer, Barbara M. Hickey and Michael G. Foreman

A regional U.S. west coast observing system for toxigenic *Pseudo-nitzschia*

Nobuyuki Shikama

Japanese Argo Program

S. Allen Macklin, Bernard A. Megrey, Kimberly Bahl and Toru Suzuki

A federation of PICES member country metadatabases

Clarence Pautzke and Molly McCammon

The Alaska Marine Information System – A collective database for Alaska's large marine ecosystems

Takashi Setou, Kosei Komatsu and Yasumasa Miyazawa

Modification of the OI parameters for effective introduction *in situ* data obtained by Japanese local fisheries research institutions into the JCOPE Ocean forecast system

Katsuya Saitoh, Hitoshi Iizumi, Osamu Kato, Tatsuro Watanabe, Kosei Komatsu, Shi-ichi Ito, Kaoru Nakata and Kouji Aoyagi

Giant jellyfish monitoring system in Japan

Sei-Ichi Saitoh, Fumihiro Takahashi, Daichi Tachikawa, Motoki Hiraki, Masami Yoshida, Teruaki Hiura and Hidetada Kiyofuji

Research and development of ubiquitous information services for sustainable fisheries operation and management in the offshore around Japan

Young Jae Ro and Kwang Young Jung

Real-time monitoring experiences in the coastal waters in Korea: Implementation and scientific application

Posters

Stepan G. Antushev, Vitaly K. Fischenko and Andrey V. Golik

Implementation of distributed oceanographic data management and data processing technologies in FEBRAS

Hernan E. Garcia, Tim P. Boyer, Sydney Levitus, Ricardo A. Locarnini, John I. Antonov, Daphne Johnson, Igor Smolyar, Olga Baranova and Alexey Mishonov

The World Ocean Database and Atlas 2005

Andrey V. Golik, Stepan G. Antushev and Vitaly K. Fischenko

About scope of OpenGIS technology in oceanographic data management and visualization

Alex Kozvr and Misha Krassovski

Web-Accessible Visualization and Extraction System (WAVES) for oceanographic data

Dmitry D. Kaplunenko, Vyacheslav B. Lobanov, Olga O. Trusenкова and Svetlana Y. Ladychenko

Web-based system to study mesoscale water dynamics and structure by merging satellite and *in situ* data

Jee-Eun Min, Joo-Hyung Ryu, Yu-Hwan Ahn and Kyu-Sung Lee

Optical properties of marine particles around the Southwest Sea of the Korean peninsula

A. Gavrev, A. Pan, V. Plotnikov, V. Rostov and I. Rostov

Web-based sea ice data bases application

Joon-Yong Yang, Hee-dong Jeong, Kyu Kui Jung and Ki-Tack Seong

Real-time oceanographic information for pelagic fishery based on Argo data

CCCC Workshop (W7)

Climate forcing and marine ecosystems

Convenors: Kerim Y. Aydin (U.S.A.), Jacquelynne R. King (Canada) and Akihiko Yatsu (Japan)

Background

The CFAME (Climate Forcing and Marine Ecosystems) Task Team is developing new theoretical and mathematical frameworks to extend the traditional single species concept of carrying capacity into the multi-species and ecosystem domains. Three major ecosystems of the North Pacific were selected for this approach: Sea of Okhotsk, California Current System and East China/Yellow Sea. For each ecosystem the Task Team is reviewing the physical processes that define an ecosystem, build an overview of dominant species across trophic levels, and describe how the population dynamics of these species have changed over time. The conceptual linkages between the physical processes and food-web structures will allow a comparison of varying responses of the different North Pacific marine ecosystems to basin-wide climate forcing events. This workshop was a continuation of work that was initiated at a CFAME workshop in January 2006 (Tokyo, Japan). It focused on key species data for the East China/Yellow Sea and Sea of Okhotsk regions to facilitate inter-comparisons among the three target ecosystems.

Summary of presentations

The workshop was attended by 21 participants, from all PICES member countries, and included presentations from China, Korea, Russia and the United States. This workshop represents the first stage of the ecosystem research outlined in the CFAME workplan. For each ecosystem, conceptual mechanisms of climate-forcing were identified. Participants noted that each ecosystem had different dominant features of climate forcing mechanisms: boundary current upwelling (California Current); sea ice (Sea of Okhotsk) and freshwater input (East China/Yellow Seas). The afternoon focused on methods of classifying and comparing ecosystems. Overall, the method employed will depend on the researchers involved and the level of data available for the ecosystems of interest. However, participants agreed on the general themes captured by various ecosystem indicators and methods of comparison: food web structure, life history composition, structural stability, size composition, and change in rates (*e.g.*, PB vs. B, PB diversity pathways; predation load). It was suggested that such a list of specific comparison types could be made, and data obtained to make these comparisons from each ecosystems, giving a strong basis for an inter-sessional meeting in 2007 on ecosystem-level carrying capacity and other ecosystem properties

List of papers

Oral presentations

Vera Agostini, G.A. McFarlane and J.R. King (Invited)
An overview of the California Current ecosystem

Victor Lapko (Invited)
An overview of the Okhotsk Sea ecosystem

Young Shil Kang, Seung Heo, Jae-Kyoung Shon and Gyung Soo Park (Invited)
Variations of zooplankton and oceanographic conditions in response to climatic changes in the East China/Yellow Sea

Xiuren Ning, Chuanlan Lin, Jilan Su, Chenggang Liu and Junxian Shi
Environmental changes and the responses of the ecosystems in the Bohai Sea during 1960-1996

Sarah K. Gaichas, Kerim Y. Aydin and Vera N. Agostini
Quantitative methods for comparative ecosystem analysis: Relationships and thresholds in the Gulf of Alaska and the California Current

BIO/POC Workshop (W8)

Responses of marine mammals and seabirds to large-scale and long-term climate change: Mechanisms of environmental forcing

Conveners: Yutaka Watanuki, Shoshiro Minobe (Japan), Rolf Ream and William J. Sydeman (U.S.A.)

Background

Low-frequency climate changes sometimes result in profound effects on marine ecosystems, yet the influence on seabirds and mammals has not been adequately quantified. In the North Atlantic, the breeding performance and population dynamics of some species has been related to changes in the NAO. The workshop solicited papers that examine responses by these taxa to interannual to interdecadal climate variability in the North Pacific. A variety of studies describing patterns and testing mechanisms of environmental forcing, from physics to prey to predators, were presented.

Summary of presentations

Approximately 25 people attended the workshop. Using an elaborate modeling approach based on NEMURO.FISH, Shin-ichi Ito showed how growth of fishes (herring and saury) varies between regions of the North Pacific relative to ocean climate, suggesting that different physical and biological limiting factors are dominant in the eastern and western Pacific. Regional differences in primary production (Sei-ichi saito) and responses of marine birds (Sarah Wanless, Julie Thyer, Shoshiro Minobe and Motohiro Ito) and mammals (Arthur Miller, Keiko Kato, Andrew Trites, Shiroh Yonezaki and Hyun Woo Kim) to variation in temperature and regime shifts were described. The potential mechanisms of responses (changes in foodwebs, diets, nutritional condition of prey, *etc.*) were discussed. Spatial correlation analyses between SST and breeding performance of marine birds and mammals (suggested by Shoshiro Minobe), rather than using a specific climate index (e.g.,

PDO), may be useful for providing mechanistic understanding.

During general discussion, the followings points were elaborated:

- Collaboration between climatologists, oceanographers, and marine bird and mammal (MBM) experts is essential to developing the science of climate change and climate effects on seabirds and marine mammals;
- Whereas MBM specialists may offer local mechanistic hypotheses, climate scientists and oceanographers often provide a larger-scale physical context, and coupling these scales of analysis is likely to be critical to understanding the effects of climate on these top predators;
- Marine birds and mammals should be considered in developing PICES ecosystem models, including NEMURO. MBM-AP can provide parameters of interest;
- Correlations between climate indices and the food habits, breeding success and population parameters of marine birds and mammals are, in some cases, well known, but understanding of the mechanisms driving correlative relationship is lacking;
- Spatial and temporal scales, and species-specific life history differences, should be considered in analyzing the relationships between climate factors and responses of marine birds and mammals;
- Due to their visibility, and rapid and substantial responses, marine birds and mammals may be good indicators of marine ecosystem change, but to use them fully, calibration of climate-predator responses is needed.

List of papers

Oral presentations

Shin-ichi Ito, Kenneth A. Rose, Bernard A. Megrey, Francisco Werner, Douglas Hay, Maki Noguchi Aita, Yasuhiro Yamanaka, Michio J. Kishi, Jake Schweigert, Matthew Birch Foster, Dan Ware, David Eslinger, Robert Klumb and S. Lan Smith (Invited)

Responses of fish growth to large-scale and long-term climate change: A comparison of herring and saury in the North Pacific using NEMURO.FISH, a coupled fish bioenergetics and lower trophic level ecosystem model

Sei-Ichi Saitoh, Takahiro Iida, Suguru Okamoto, TaeKeun Rho and Toru Hirawake (Invited)

Temporal and spatial variability of primary production in the sub-arctic North Pacific using satellite multi-sensor remote sensing

Arthur J. Miller (Invited)

The climate-ocean regime shift hypothesis of the Steller sea lion decline in Alaska

Andrew W. Trites, Pamela M. Lestenkof and Erin Ashe

Responses of northern fur seals to large-scale and long-term climate change

Julie A. Thayer, Scott A. Hatch, Mark Hipfner, Leslie Slater, Yutaka Watanuki and William J. Sydeman (Invited)

Forage fish prey of a piscivorous seabird in the North Pacific: Synchrony and relationships with ocean climate

Shoshrio Minobe, William J. Sydeman, Yutaka Watanuki and Vernon Byrd

Climate influences on seabirds in the Japan and Bering Seas and California Current

Sarah Wanless and Morten Frederiksen (Invited)

Climate responses of avian predators in a heavily exploited shallow sea ecosystem: Effects on trophic interactions and consequences for ecosystem control in the North Sea

Hyun Woo Kim, David W. Weller, Amanda L. Bradford and Zang Geun Kim

Body condition of western gray whales in relation to environmental change in the North Pacific

Posters

Keiko Kato, Takeomi Isono, Kaoru Hattori, Orio Yamamura and Yasunori Sakurai

Winter movement of Steller sea lions (*Eumetopias jubatus*) to the northern coast of Japan related to sea-ice conditions in the Sea of Okhotsk during 1989-2004

Motohiro Ito, Hiroshi Minami and Yutaka Watanuki

Quick prey switching in a seabird: Seasonal changes of diet for adults and chicks of Rhinoceros Auklets

Shiroh Yonezaki, Masashi Kiyota, Hiroshi Okamura and Norihisa Baba

Possibility of diet selection of northern fur seals in the Northwestern Pacific

MIE-AP Workshop (W9)

Micronekton sampling gear inter-calibration experiment

Convenors: Evgeny A. Pakhomov (Canada) and Orio Yamamura (Japan)

Background

The PICES Advisory Panel on *Micronekton sampling inter-calibration experiment* (MIE-AP) was established to evaluate efficacy of sampling gears and the procedures employed by different investigators to sample micronekton in the North Pacific and other parts of the world's oceans. MIE-AP carried out their first 8-day cruise from October 6-13, 2004, aboard the NOAA ship *Oscar Elton Sette* in Central North Pacific waters off the west side of Oahu Island (MIE-1). The second cruise (MIE-2) took place from September 27 to October 3, 2005, on board

R/V *Hokko Maru* in Oyashio waters off Japan. The workshop reviewed data and findings from both cruises.

Summary of presentations

Pakhomov *et al.* recommended pursuing the use of larger size-classes of micronekton (10 mm instead of 5 mm) for inter-comparison of gears. They noted that the Cobb trawl mouth area should be adjusted according to the mesh size, which really catches micronekton. The use of total mouth area can result in underestimating plankton and micronekton densities. It was

suggested that perhaps acoustic data should be encouraged to become an “ideal” universal gear.

Suntsov *et al.* provided a remarkable overview of ichthyoplankton and an inter-comparison of their diversity between different gears. It also appears from their research that the Hokkaido net was the best gear for the quantitative and qualitative sampling of fish larvae. Two important questions were raised in this presentation: (a) What kind of analysis (*e.g.* community structure analysis) could be conducted with the data sets? and (b) Would further analysis of the adult population be beneficial for the community analysis of larvae?

Yamamura *et al.* compared six different sampling gears during their MIE-2 cruise. Sample composition, to a large extent, was mono-specific, which simplified the inter-calibration. Their experiment revealed that the

MOHT gear is among the most reliable and cost-effective micronekton gear developed to date, providing high quality and quantity micronekton samples. The development (in progress) of a closing/opening mechanism could put this gear in the position to become a standard micronekton gear in the North Pacific and elsewhere in the world. It was also found that towing speed matters, *e.g.* MOHT had the fastest towing speed, which raises standardization issues.

Yasuma *et al.* presented very encouraging results of developing a technique for an acoustic identification of myctophid fishes. The inter-comparison between acoustic and gear estimates of micronekton was highly recommended as the next step. Concern was raised on how organism orientation affects the target strength estimates. Authors were strongly encouraged to continue their analyses.

List of papers

Oral presentations

Evgeny A. Pakhomov, M.P. Seki, A.V. Suntsov, R.D. Brodeur and K.R. Owen

Comparison of three sampling gears during the first Micronekton Intercalibration Experiment (MIE-1): Size composition of selected taxonomic groups and total macroplankton and micronekton

Andrey V. Suntsov, Michael P. Seki, Evgeny A. Pakhomov and Richard D. Brodeur

Diversity and abundance of Hawaiian ichthyoplankton: Comparison of three types of midwater nets

Orio Yamamura, Hiroya Sugizaki, Shin-suke Abe, Kazuhiro Sadayasu, Ryu-ichi Matsukura, Kazushi Miyashita, Akihiro Hino and Tadashi Tokai

Inter-calibration of micronekton sampling gear during the 2005 MIE-2 cruise

Hiroki Yasuma, Kazushi Miyashita and Orio Yamamura

Acoustic identification and density estimate of a lanternfish, *Diaphus theta*, off Hokkaido, Japan

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LIST OF PICES ACRONYMS

BASS (TT)	Basin Studies Task Team (Oct. 1995 - Oct. 2004)
BIO	Biological Oceanography Committee
CCCC-IP/EC	Executive Committee of the Climate Change and Carrying Capacity Program Implementation Panel
CC-S	Section on <i>Carbon and Climate</i>
CFAME (TT)	Climate Forcing and Marine Ecosystem Response Task Team (Oct. 2004 -)
CPR-AP	Advisory Panel on <i>Continuous Plankton Recorder Survey in the North Pacific</i>
CREAMS-AP	Advisory Panel for a <i>CREAMS/PICES Program in East Asian Marginal Seas</i>
F&A	Finance and Administration Committee
FERRRS	Study Group on <i>Fisheries and Ecosystem Responses to Recent Regime Shifts</i> (Oct. 2003 - Oct. 2004)
FIS	Fishery Science Committee
GC	Governing Council
HAB-S	Section on <i>Harmful Algal Blooms</i>
IFEP-AP	Advisory Panel on <i>Iron Fertilization Experiment in the Subarctic Pacific</i>
MBM-AP	Advisory Panel on <i>Marine Birds and Mammals</i>
MEQ	Marine Environmental Committee
MIE-AP	Advisory Panel on <i>Micronekton Inter-calibration Experiment</i>
MODEL (TT)	Conceptual/Theoretical and Modeling Studies Task Team (Oct. 1995 -)
MONITOR	Formerly Task Team on Monitoring (Oct. 1997 - Oct. 2004), renamed to Technical Committee on Monitoring (Oct. 2004 -)
NEMURO	North Pacific Ecosystem Model for Understanding Regional Oceanography
NEMURO.FISH	NEMURO For Including Saury and Herring
NEMURO.SAN	NEMURO for Sardine and Anchovy populations
NEXT (TT)	NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography) Experimental Plan Team (Oct. 2002 - Oct. 2003)
NPDB-AP	<i>North Pacific Data Buoy</i> Advisory Panel (Oct. 2001 - Oct. 2006)
NPESR	Working Group on <i>North Pacific Ecosystem Status Report</i> (Oct. 2002 - Oct. 2004)
PICES	North Pacific Marine Science Organization
POC	Physical Oceanography and Climate Committee
REX (TT)	Regional Experiments Task Team (Oct. 1996 - Oct. 2004)
RHLF	Relocation and Home Leave Fund
SB	Science Board
SG-CB	Study Group on <i>PICES Capacity Building</i> (Oct. 2002 - Oct. 2003)
SG-EBM	Study Group on <i>Ecosystem-based management science and its application to the North Pacific</i> (Oct. 2003 - Oct. 2004)
SG-ESR	Study Group on <i>Ecosystem Status Reporting</i> (Oct. 2006 -)
SG-FISP	Study Group on <i>Future Integrative Scientific Program(s)</i> (May 2005 -)
SG-GOOS	Study Group to develop a strategy for GOOS (Oct. 2006 -)
SG-MAR	Study Group on <i>Marine Aquaculture and Ranching in the PICES region</i> (Oct. 2006 - 2007)
SG-RPFR	Study Group on <i>PICES Rules of Procedure and Financial Regulations</i> (Oct. 2004 - Oct. 2006)
SG-SC	Study Group on <i>Scientific Cooperation between PICES and non-member countries</i> (Oct. 2006 -)
SISG	Study Group on <i>PICES Strategic Plan</i> (Oct. 2003 - Oct. 2004)
TCODE	Technical Committee on Data Exchange

PICES Acronyms-2006

TRF	Trust Fund
WCF	Working Capital Fund
WG-1	Working Group on <i>Okhotsk Sea and Oyashio Region</i> (Oct.1992 - Oct. 1993)
WG-2	Working Group on <i>Development of common assessment methodology for marine pollution</i> (Oct.1992 - Oct. 1994)
WG-3	Working Group on <i>Dynamics of small pelagics in coastal ecosystems</i> (Oct.1992 - Oct. 1995)
WG-4	Working Group on <i>Data collection and quality control</i> (Oct.1992 - Oct. 1994)
WG-5	Working Group on <i>Bering Sea</i> (Oct.1992 - Oct. 1996)
WG-6	Working Group on <i>Subarctic Gyre</i> (Oct. 1992 - Oct. 1994)
WG-7	Working Group on <i>Modeling of the subarctic North Pacific circulation</i> (Oct. 1993 - Oct. 1995)
WG-8	Working Group on <i>Practical assessment methodology</i> (Oct. 1994 - Oct. 2000)
WG-9	Working Group on <i>Subarctic Pacific Monitoring</i> (Oct. 1994 - Oct. 1997)
WG-10	Working Group on <i>Circulation and ventilation in the Japan/East Sea</i> (Oct. 1995 - Oct. 1999)
WG-11	Working Group on <i>Consumption of marine resources by marine birds and mammals</i> (Oct. 1995 - Oct. 1999)
WG-12	Working Group on <i>Crabs and shrimps</i> (Oct. 1995 - Oct. 2001)
WG-13	Working Group on <i>Carbon dioxide in the North Pacific</i> (Oct. 1997 - Oct. 2002)
WG-14	Working Group on <i>Effective Sampling of Micronekton to Estimate Ecosystem Carrying Capacity</i> (Oct. 1997 - Oct. 2004)
WG-15	Working Group on <i>Ecology of Harmful Algal Blooms (HABs) in the North Pacific</i> (Oct. 1999 - Oct. 2003)
WG-16	Working Group on <i>Climate Change, Shifts in Fish Production, and Fisheries Management</i> (Oct. 1999 - Oct. 2005)
WG-17	Working Group on <i>Biogeochemical data integration and synthesis</i> (Oct. 2001 - Oct. 2005)
WG-18	Working Group on <i>Mariculture in the 21st century - The intersection between ecology, socio-economics and production</i> (Oct. 2003 - Oct. 2006)
WG-19	Working Group on <i>Ecosystem-based management science and its application to the North Pacific</i> (Oct. 2004 -)
WG-20	Working Group on <i>Evaluations of Climate Change Projections</i> (Oct. 2005 -)
WG-21	Working Group on <i>Non-indigenous Aquatic Species</i> (Oct. 2005 -)

LIST OF ACRONYMS

ADCP	Acoustic Doppler Current Profiler
AFS	American Fisheries Society
AFSC	Alaska Fisheries Science Center
AFS-CAR	American Fisheries Society Program on Climate and Aquatic Resources
AOOS	Alaska Ocean Observing System
APEC	Asia Pacific Economic Cooperation
APN	Asia Pacific Network for Global Change Research
BASIS	Bering-Aleutian Salmon International Survey, NPAFC
BEST	Bering Sea Ecosystem Study
BK 21	Brain Korea 21
CAP	Cooperative Agreement Program
CAPaBLE	Scientific Capacity Building/Enhancement for Sustainable Development in Developing Countries Program
CARBO-OCEAN	Marine carbon sources and sinks assessment
CDIAC	Carbon Dioxide Information and Analysis Center
CDN	Canadian Dollar
CeNCOOS	Central and Northern California Ocean Observing System
CGER	Centre for Global Environmental Research, Japan
CLIOTOP	Climate Impacts on Oceanic Top Predators
CLIVAR	Climate Variability and Predictability Program
CoML	Census of Marine Life Program
CREST	Core Research for Evolutional Science and Technology
CSCOR	Center for Sponsored Coastal Ocean Research
DFO	Department of Fisheries and Oceans, Canada
DIC	Dissolved Inorganic Carbon
DSP	Diarrheic Shellfish Poisoning
EAF	Ecosystem Approach to Fisheries
EAST-I	East Asian Seas Time-Series-I
EBM	Ecosystem-Based Management
EEZ	Exclusive Economic Zone
ESMF	Earth System Modeling Framework
ESSAS	Ecosystem Studies of the Sub-Arctic Seas
Eur-OCEANS	European Network of Excellence for Ocean Ecosystems Analysis
EVOS	Exxon Valdez Oil Spill (Trustee Council)
FAO	Food and Agriculture Organization, UN
FGDC	Federal Geographic Data Committee
FRA	Fisheries Research Agency of Japan
FUTURE	Forecasting and Understanding Trends, Uncertainty and Responses of the North Pacific Ecosystem
GEM	Gulf Ecosystem Monitoring and Research Program
GEOHAB	Global Ecology and Oceanography of Harmful Algal Blooms
GEOS	Global Earth Observing System of Systems, NOAA
GLOBEC	Global Ocean Ecosystem Dynamics Programme
GLODAP	Global Ocean Data Analysis Project
GOOS	Global Ocean Observing System
GRA	GOOS Regional Alliances
GRAND	GOOS Regional Alliance Network Development Project

Acronyms-2006

GSSC	GOOS Scientific Steering Committee
GST	Goods and Services Tax, Canada
GTS	Global Telecommunications System
HAB(s)	Harmful Algal Bloom(s)
HAE-DAT	ICES-IOC Harmful Algal Event Database
HTL	Higher Trophic Level
HUFO-DAT	Hokkaido University Fisheries and Oceanographic Database (CD-ROM)
IAI	Intra-American Institute for Global Change Research
ICES	International Council for the Exploration of the Sea
IGBP	International Geosphere-Biosphere Programme
IGOOS	Intergovernmental Committee for GOOS
IMBER	Integrated Marine Biogeochemistry and Ecosystems Research
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission, UNESCO
IOCCP	International Ocean Carbon Coordinated Project
IOOS	Integrated Ocean Observing System
IOS	Institute of Ocean Sciences, Canada
IPCC	Intergovernmental Panel on Climate Change
IPO	International Project Office
ISO	International Organization for Standardization
ISSHA	International Society for the Study of Harmful Algae
IUEM	Institut Universitaire Européen de la Mer
IWC	International Whaling Commission
JAMSTEC	Japan Marine Science & Technology Center
JES	Japan/East Sea
JFA	Japan Fisheries Agency
JODC	Japanese Oceanographic Data Center
JST	Japan Science and Technology Corporation
KODC	Korea Oceanographic Data Center
KORDI	Korea Ocean Research and Development Institute
LISST	Laser In-situ Scatterer and Transmissometer
LME	Large Marine Ecosystem
LTL	Lower Trophic Level
MEXT	Ministry of Education, Culture, Sports, Science and Technology, Japan
MIRC	Marine Information Research Center, Japan
MOHT	Matuda-Oozeki-Hu Trawl
MOMAF	Ministry of Maritime Affairs and Fisheries, Republic of Korea
NACM	North American Continental Margins
NAFO	Northwest Atlantic Fisheries Organization
NaNOOS	Northwest Association of Networked Ocean Observing Systems
NASCO	North Atlantic Salmon Conservation Organization
NEAR-GOOS	North East Asian Regional GOOS
NEPTUNE	North-east Pacific Time-series Undersea Network Experiments
NFRDI	National Fisheries Research and Development Institute, Korea
NGO	Non-Governmental Organization
NIS	Non-Indigenous Species
NISBASE	Non-Indigenous Species Database
NMFS	National Marine Fisheries Service, NOAA
NOAA	National Oceanographic and Atmospheric Administration, USA
NOS	National Ocean Service
NOWPAP	Northwest Pacific Action Plan

NPAFC	North Pacific Anadromous Fish Commission
NPEM	North Pacific Ecosystem Metadatabase
NPESR	North Pacific Ecosystem Status Report
NPFMC	North Pacific Fishery Management Council, NOAA
NPOS	North Pacific Observing Systems
NPRB	North Pacific Research Board, USA
NSDI	National Spatial Data Infrastructure
NSF	National Science Foundation, USA
NWFSC	Northwest Fisheries Science Center, NOAA
OBS	Ocean Bottom Seismometer
OECOS	Oceanic Ecodynamics Comparison in the Subarctic Pacific
ORION	Ocean Research Interactive Observatory Networks
OSU	Oregon State University
PacIOOS	Pacific Islands Integrated Ocean Observing System
PaCOOS	Pacific Coast Ocean Observing System
pCO ₂	Partial pressure of carbon dioxide in surface sea water
PICES	North Pacific Marine Science Organization
PIFSC	Pacific Islands Fisheries Science Center, NOAA
PIRE	Partnerships for International Research and Education
PKNU/PNU	Pukyong National University
PMEL	Pacific Marine Environmental Laboratory, NOAA
PNW-IOOS	Pacific Northwest Integrated Ocean Observing System
PSP	Paralytic Shellfish Poisoning
PST	Provincial Sales Tax, Canada
PWS	Prince William Sound
QA/QC	Quality Assurance/Quality Control
RAC-SPA	Regional Activity Centre for Specially Protected Areas
RMT	Rectangular Midwater Trawl
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SakhNIRO	Sakhalin Research Institute of Fisheries and Oceanography, Russia
SCCOOS	Southern California Coastal Ocean Observing System
SCOR	Scientific Committee on Oceanic Research
SEATS	South East Asia Time-series Study
SEEDS	Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study
SERIES	Subarctic Ecosystem Response to Iron Enrichment Study
SNU	Seoul National University
SOA	State Oceanic Administration, China
SOLAS	Surface Ocean Low Atmosphere Study
SOLO	Sounding Oceanographic Lagrangian Observer
SOLOPC	Sounding Oceanographic Lagrangian Observer with a Laser Optical Plankton Counter
SSC	Scientific Steering Committee
TBD	To Be Determined
TINRO-Centre	Pacific Scientific Research Fisheries Centre, Russia
TOR	Terms of Reference
TOS	The Oceanography Society
UMN	University of Minnesota
UN	United Nations
URL	Uniform Resource Locator
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey

Acronyms-2006

WCB	Workers' Compensation Board, Canada
WESTPAC	IOC Sub-Commission for the Western Pacific
WGBOSV	Working Group on Ballast Waters and Other Ship Vectors, ICES/IOC/IMO
WGDIM	Working Group on Data and Information Management
WGITMO	Working Group on Introductions and Transfers of Marine Organisms, ICES
WGMDM	Working Group on Marine Data Management, ICES
WPFMC	Western Pacific Fishery Management Council, NMFS/NOAA
YOOS	Yellow Sea Ocean Observing System