NORTH PACIFIC MARINE SCIENCE ORGANIZATION

(PICES)

ANNUAL REPORT

SEVENTH MEETING

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REPORT OF OPENING SESSION

The meeting of October 19th was called to order by the Chairman, Dr. William G. Doubleday, who welcomed delegates, observers and researchers to the Seventh Annual Meeting.

Dr. Doubleday called upon Lieutenant Governor Fran Ulmer to welcome participants on behalf of the State of Alaska.

On behalf of Governor Knowles and myself, welcome to Alaska! As Lieutenant Governor, I am honored to have the opportunity to introduce you to the 49th State. I am proud that Alaska is the site of the Seventh Annual Meeting of PICES. It is also a great testimony to the spirit of 1998 - the Year of the Ocean - that we can gather such an impressive number of talented scientists from around the world to discuss pressing marine science issues.

The Governor and I truly do appreciate scientific symposia such as this. Fisheries is one of the major components of the Alaskan economy, the largest private sector employer in the state, and integral to the Alaskan way of life. Many Alaskans depend on fisheries resources as a source of sustenance, as a livelihood, and as a major contributor to our quality of life.

The Governor and I have both been personally involved in fisheries issues: the Governor was a member of the North Pacific Fishery Management Council prior to taking office as Governor. Also, I have been one of three U.S. commissioners on the North Pacific Anadromous Fish Commission since 1994, and will be serving two-year terms as vice-president and then president over the next four years.

Speaking of the North Pacific Anadromous Fish Commission, I am very encouraged that a proposed Memorandum of Understanding between PICES and NPAFC will be going before the two bodies for approval. It sets up a framework for increased cooperation and coordination on marine scientific research, data exchange, and related activities such as environmental studies. By working together on a regular basis and continually sharing information, both organizations will benefit. I am committed to fostering a close relationship between the two groups.

Opportunity for concurrent or overlapping meetings? PICES is here in Fairbanks this month, and next year I understand will be meeting in Russia. NPAFC will be meeting in a few weeks in Moscow, and will be in Alaska for its 1999 meeting. Wouldn't it be great if we could all be in one place at one time? Maybe in 2000?

One of the guiding principles of our administration is basing decisions on sound science. So, we both pay close attention to what you - the scientists - have to say about managing fisheries off Alaska.

Alaska is proud of its natural resources and, in particular, its marine and fishery resources. Alaska contains 70% of the U.S. continental shelf; 47,300 miles of marine coastline; 28% of the U.S. EEZ. I would like to give you some idea of the magnitude of the fishery harvests taken annually off the coast of Alaska:

- *Since 1978, harvests averaged 140 million salmon per year.*
- *More than 1 million metric tons of Pollock are caught annually - the largest fishery in the world.*
- *240 million pounds of snow crabs were harvested in 1998.*
- *Dutch Harbor-Unalaska is the largest fishing port in the U.S. in both volume and value.*

- *More fish (in volume) are landed in Alaska than in all the other states combined.*

Being blessed with abundant fishery resources also carries a tremendous amount of responsibility:

- *Alaska is unique among all states nationwide for our level of involvement in fishery management: the State of Alaska has lead management responsibility for all shellfish (e.g., crabs, shrimps, scallops, clams, etc.), salmon, and herring fisheries off the coast of Alaska. In addition, Alaska is responsible for management of state-waters groundfish fisheries, and we contribute to the federal management of offshore groundfish fishery resources through the North Pacific Fishery Management Council process. We also manage some of the nation's most prestigious freshwater fisheries.*

- *We are well aware of the recent media and scientific reports that show that many of the world's fisheries are in trouble. Overfishing and habitat destruction are often pinpointed as the reasons. The collapse of Atlantic cod stocks provides a glaring North American example. So, clearly the stakes for fishery management are very high.*

- *Avoiding the pitfalls repeated again and again elsewhere requires that we learn from these past experiences and that we act upon them in a responsible manner. Meetings such as this one are integral to the learning process. If we do not gather together the scientific experts to share knowledge and build upon the science, then we do not have the ability to learn from past mistakes.*

This is why ecosystem-based research programs such as GLOBEC (Global Ecosystem Dynamics) is so critical. PICES initiated planning for an interdisciplinary program called the PICES-GLOBEC International Program on Climate Change and Carrying Capacity (CCCC), now in the implementation phase, provides for comparative approaches to studying the relationships between fisheries and ecosystems.

Alaska is proud of our use of sustainable yield principles in fishery management:

- *Conservation is required under the Alaska State Constitution. Alaska's constitution, unique among the 50 states, has an article solely devoted to the management of natural resources. It mandates that renewable resources "shall be utilized, developed and maintained on the sustained yield principle."*

- *The Alaska Department of Fish and Game manages fisheries, while the Alaska Board of Fisheries is responsible for allocating yield among users. The clear separation of authority for conservation management from authority to allocate among users is one of the strengths of Alaska's management system.*

- *Alaska has a long and successful track record of managing and conserving fishery resources. Alaska's fishery program is built on the principles of conservative management, sound science and habitat protection. Marine fisheries are usually managed for a fixed harvest rate that represents a harvestable annual fraction of the resource that can be taken without jeopardizing the long-term health of the resource. Salmon fisheries are typically managed toward an escapement goal for returning adults.*

- *Alaska did not always have healthy salmon stocks. Prior to statehood, overfishing was a major factor in the*

declines of the Alaska salmon fishery. In 1959, statewide harvests totaled only about 25 million salmon - a level equivalent to less than 20% of current sustained production. Since statehood, stocks slowly rebuilt and harvests improved. Since 1978, annual salmon harvests have averaged 140 million fish. Alaska takes pride in this accomplishment.

Habitat protection is also an integral part of Alaska's natural resource management program:

- *Alaska has chosen to forego the economic benefits from other activities such as hydropower development in order to sustain salmon resources for future generations. For example, although the option of constructing and operating large-scale, hydropower facilities on both the Susitna River and the Yukon River were closely examined, neither was built. The salmon resources and fisheries of these river systems were major reasons that Alaska chose the no-dam option.*

- *Alaska has strict regulations governing development activities, such as road building and mining, to protect vital spawning and rearing salmon streams. Alaska has a Forest Practices Act requiring buffer zones from logging along salmon streams to prevent erosion and protect spawning and rearing habitat. Water discharge, such as sewage and other potential pollutants, are closely regulated to ensure high water quality.*

- *In 1973 the state instituted a limited entry system to protect Alaska's fisheries resources from overexploitation. This limited the number of fishers who could enter the fisheries, and established a fixed measure of effort, allowing managers to more accurately determine the effects of management decisions. With a fixed amount of gear, harvest rates were more stable, resulting in a more orderly and predictable fishery.*

Given the generally healthy status of Alaska's fisheries, these conservation safeguards, and habitat protection, it would be easy for us to sit back and rest comfortably and think that the collapses of other fisheries worldwide cannot occur here in Alaska. But they can!

In 1998 some salmon returns to western Alaska were very low. Although escapement goals were met, fisheries were drastically reduced resulting in economic disasters for some communities whose primary incomes and subsistence lifestyles depend on fishing. And these poor returns came on top of poor returns in 1997.

Parental spawning stocks for these low returns in 1997 and 1998 were healthy. Weak salmon returns were due to reduced returns per spawner, and not the result of low levels of parental escapement. So, clearly it is <u>not</u> sufficient to meet escapement goals and to expect that our job is finished.

Preliminary analyses of salmon age classes from western Alaska in 1997 and 1998 suggest a role of the marine environment. Also, returning salmon were often smaller than average and arrived unusually late. Migratory pathways appeared to have changed, and there was evidence of higher incidences of parasitism and predation. Fish under stress are less vigorous and more vulnerable. Undoubtedly, escapement levels, freshwater rearing conditions, and early marine life contribute to the strength of salmon returns. However, a growing body of evidence now indicates that marine conditions later in the life of salmon also contribute to run size.

We do know that the marine ecosystem is changing. As the old adage goes, "the only thing constant is change itself". The 1997/98 El Niño/Southern Oscillation was the strongest since the record-breaking 1982/83 El Niño. By some measures, it was the strongest. It started earlier and lasted longer than any El Niño on record. Coastal sea levels and sea surface temperatures in the eastern North Pacific and Bering Sea were generally very high. I am very much looking forward to the results of your day-long workshop on the 1997-98 El Niño.

In 1997 and 1998, for the first time we witnessed through satellites large regions of turquoise water in the Bering Sea. Apparently, the combination of warm surface temperatures, low winds, and very shallow mixing of ocean waters led to nutrient-depleted conditions. Extensive blooms of coccolithophores - a small phytoplankter more typical of subarctic or even subtropical regions, caused the turquoise water color. If the Bering Sea ecosystem changed at the base of the food web so profoundly that you could see it from space, what effects did it have throughout the ecosystem?

Also, in 1997 and 1998, we witnessed many shifts in the geographic distribution of species. In response to warmer temperatures many subtropical species (e.g., tuna, ocean sunfish, and Pacific white-sided dolphins) ranged further north than in normal years. If conditions benefited species that prefer warmer waters, what happened to species that prefer cooler waters more typical of Alaska?

In addition to very recent changes in the marine system, clearly changes have been occurring over the decades:

- *Most shrimp populations and many crab populations declined sharply in the 1980s.*
- *Stellar sea lions steadily decreased in numbers in the Aleutian Islands and Eastern Gulf and they are currently listed as endangered. Causes of these long-term declines are unknown but believed to be connected with available food supplies.*
- *Some seabird populations have been declining over recent decades as well. Some species of sea birds were further stressed in 1997, with die-offs of short-tailed shearwaters, black-legged kittiwakes, and common murres. Apparently, the coccolithophores blooms reduced visibility and prey availability to the seabirds.*

We now know that many changes in the Gulf of Alaska and Bering Sea are intimately linked to changes in the Aleutian Low Pressure System in winter. Some shifts in the productivity of species groups appear linked to the Aleutian Low. Salmon production in Alaska and the Pacific Northwest appear to be linked to the Aleutian Low in opposite ways: conditions favoring Alaskan salmon disfavor salmon in the Pacific Northwest, and vice-versa.

However, there remains much that we still do not understand. Are we currently in a regime shift between conditions that favor Alaskan salmon to a regime that favors shrimps and crabs? And what is the mechanism that leads to general associations of fish production with the Aleutian Low? These are just two of the many questions. Your work and that of your colleagues around the world will help answer these critical questions.

In 1998, we had disastrously low salmon returns to western Alaska. A regime shift? Maybe, maybe not. The total salmon harvest statewide was 144 million fish. This catch is actually just above the long-term average since 1978 when the last regime shift occurred! So, if there was a new regime shift, it clearly did not affect all Alaskan salmon stocks in the same way.

While the overall total was near the recent 20-year average, salmon stocks are managed separately according to a science-based assessment and management program. Thus, it matters a whole lot whether one stock experiences record returns in 1998 or if it experiences very poor returns that cause economic disaster for the region. Of course, it also matters if they come back as pink salmon worth 16¢ per pound or Chinook salmon worth $1.80 per pound!

In many quarters there is a growing interest in and focussed on the Bering Sea and North Pacific ... recognition that we need to make sense of all these research efforts and fashion a comprehensive understanding of the Bering Sea ecosystem. For example, recent joint effort of NMFS, ADF&G, and Interior: "Bering Sea Ecosystem - A Call to Action" and many other efforts.

We are at a critical juncture: unparalleled opportunity to craft the finest ocean science program in the world. Opportunity lies in significant new funding possibilities:

- *EVOS money: EVOSTC has collected public input, now must come to a unanimous decision on balance of habitat acquisition vs. research; setting up a framework for a long-term research endowment, to keep a finger on the pulse of ocean conditions, monitor indicator species, monitor contaminant levels, etc.*

- *Dinkum Sands money (about $6.6 million/year).*

- *1998 western Alaska salmon disaster funds for research: $7 million for research and prevention.*

- *Pacific Salmon Fund - proposed new federal fund to complement new state funding for conservation and restoration needs in Pacific Northwest and Alaska: requesting $200 million/yr. for 6 yrs. (($50 million each to Alaska, California, Washington and Oregon). Each state has created a science panel; a regional science panel would be created to provide regional guidance, review regional results, and address inter-jurisdictional and cross-boundary habitat concerns and regional biological issues.*

Role of North Pacific Research Board (NPRB)? (Latest information coming out of the budget process in Washington D.C. is that while NPRB will technically exist, it will receive no funding or statutory mandate.) Immediate role of 1998 Bering Sea Task Force:

- *1998 Bering Sea Task Force -- Among the other related efforts, the state is taking action to try to pull some of the existing knowledge together. Following the disastrous returns of salmon to the Bering Sea area this year, Governor Knowles named seven Alaskans to an interim task force to lay the groundwork for a formal scientific review of the probable causes of the disaster and ways in which the state can respond. The Governor has asked me to chair the task force, and has appointed six other widely respected individuals with expertise in science, government and traditional knowledge in the Bering Sea and communities affected by the 1998 salmon disaster, including:*

Steve Pennoyer	*Regional Administrator, Director, National Marine Fisheries Service*
Frank Rue	*Commissioner, ADF&G*
Robin Samuelson	*North Pacific Fishery Management Council*
Arliss Sturgulewski	*Advisory Council for the School of Fisheries and Ocean Sciences, UAF*
Harry Wilde, Sr.	*Mayor of Mountain Village*

Vera Alexander Dean, School of Fisheries and Ocean Sciences, UAF

Purpose:

- *To review the disastrous 1998 Bering Sea salmon returns including scientific information and research on changing ocean conditions, climate and other environmental factors affecting the survival and productivity and conservation of Bering Sea salmon and other fish populations.*

- *To catalogue the various entities which undertake marine and anadromous fish research in the North Pacific/Bering Sea, and report on their funding sources, research missions and normal reporting mechanisms.*

- *To make recommendations about creation of a science panel to review and integrate existing scientific and traditional knowledge of Bering Sea conditions and identify future Alaska research needs in order to improve the state's ability to anticipate and respond to changes in the productivity of salmon and other ocean species.*

We will prepare a report for the Governor detailing our findings and recommendations in approximately four months.

Conclusion:

- Obviously, we have much to learn about the function of the ecosystem before we can effectively build ecosystem considerations into our management programs. It is critical that we begin to move away from single-species management that ignores the ecosystem of which species are a part. To move forward requires understanding that develops from good science. And that is just what this conference is all about: to develop an understanding of ecosystem function and bring that knowledge to bear on fisheries management decision processes.

- *Critical to developing the sound science that we must base our decisions on is establishing strong working relationships between the organizations and scientists that are doing the research, ensuring that needed research is adequately funded, and creating avenues for sound science to get to the policymakers and managers.*

- *I urge you to help bridge the gap between the world of science and all its knowledge, and the general public. I hope each and everyone of you will adopt a decisionmaker, a legislator or governor, a member of the press, etc., to help them understand what is accomplished or learned here in Fairbanks. To help demystify the research process. To help people understand the relationship of El Niño and ocean currents and phytoplankton blooms and food supplies and the abundance of salmon and the prey/predator species relationships, and all the other things you research and write about that are so totally unclear to most people.*

- *You cannot complain about how law makers and law enforcers make poor decisions not based on science, if you as researchers sit by passively and expect that politicians will know what they need to know, when they do not and they cannot without your help.*

- *I encourage you to find new ways to convey your results to each other as well as to the public, by using information technology to organize and distribute the information you produce. Perhaps there should be some sort of virtual library that catalogues and cross references and coordinates research results by region, species, etc., which*

will help internal and external collaboration.

- *I think that this conference is a very important step toward this difficult task. I wish you all a very successful meeting, and I personally look forward to your findings and recommen-dations. Thank you.*

Dr Doubleday thanked the Lieutenant Governor and asked Dr. William Fox to welcome participants on behalf of the United States of America.

Thank you, Dr. Doubleday, for your kind introduction. On behalf of the United States, it is my pleasure to welcome my friends and colleagues from Canada, China, Japan, the Republic of Korea, and Russia to this Seventh Annual Meeting of the North Pacific Marine Science Organization (PICES). I am pleased that the United States is hosting this meeting in Alaska - a state with unparalleled ties to the ocean and the natural resources it contains. Judging from the program and the distinguished scientists in attendance, this promises to be an important meeting in the evolution of this organization.

I greatly appreciated the invitation from the two U.S. Delegates, Vera Alexander and Jim Balsiger, to speak to you today. Under the leadership and direction provided by Warren Wooster and Bill Doubleday, the first and second Chairmen of this organization, PICES has come a long way since its inception in the early 1990s. It is indeed encouraging to see that PICES has progressed from activities in its early days which focussed on reviewing scientific issues to its current efforts to develop cooperative scientific research programs addressing the vital marine science issues of our day.

A great deal of credit for the current success of PICES should go to the PICES Secretariat which has been very ably administered by the outgoing Executive Secretary, Dr. Doug McKone, and his excellent support staff including the Assistant Executive Secretary, Dr. Alex Bychkov, Administrative Assistant Ms. Chiu, and the Secretary, Ms. McAlister. Thanks, Doug, for your invaluable efforts in support of PICES and its mission.

I am pleased to represent the National Oceanic and Atmospheric Administration (NOAA) at this meeting. I am the Senior Scientist for the National Marine Fisheries Service (NOAA Fisheries), the component of NOAA which addresses the conservation and management of U.S. living marine resources. NOAA Fisheries has been an active participant in PICES from its outset and is highly supportive of the cooperative research being promoted in this organization since it fosters an interdisciplinary approach that is key to understanding the ecosystems which support marine life.

In the United States, NOAA Fisheries scientists collect and analyze scientific data on living marine resources, marine ecosystems, and the benefits they provide to our country. NOAA Fisheries uses these data to prepare scientific reports and technical presentations to fishery managers, industry and environmental groups, and the public, as well as the scientific community. These reports are NOAA Fisheries' foundation for developing sound policies governing the use and conservation of living marine resources and protecting their habitat.

To meet the requirements of the 1996 U.S. Sustainable Fisheries Act, NOAA Fisheries recently published a Strategic Plan for Fisheries Research which outlines future NOAA Fisheries research priorities, many of which are complementary to work taking place in PICES. This is particularly evident with regard to NOAA Fisheries research in

support of fisheries conservation and management. Research is taking place in the following areas:

1. *biological research concerning the abundance and life history parameters of fish stocks,*
2. *social and economic factors affecting abundance levels,*
3. *interdependence of fisheries or stocks of fish,*
4. *identifying, restoring, and mapping essential fish habitat, and*
5. *analyzing the impact of anthropogenic factors and environmental changes on fish populations.*

I would make special note of NOAA Fisheries efforts to increase research into social and economic factors which impact on the status of our living marine resources. Addressing these factors as well as the biological factors which have traditionally dominated fisheries research is necessary to gain a more complete understanding of our fisheries in support of sustainable management policies.

The PICES Seventh Annual Meeting takes place at an auspicious time for international marine science. During this International Year of the Ocean, NOAA has joined with our partners around the globe in celebrating the oceans and its many riches. The Oceans Exposition which recently concluded in Lisbon, Portugal, attracted people from all over the world who came to learn and share experiences about the ocean. Thanks to this event, many countries are taking a fresh look at oceans issues and public awareness concerning the importance of the oceans has increased to a remarkable extent.

In the United States, we brought together all of our major ocean interest groups for the National Ocean Conference which took place in Monterey, California, during June 1998. The conference participants represented the vast spectrum of U.S. citizens with an interest in oceans issues -- government officials, port authorities, environmental organizations, scientists, and fishermen.

The importance of ocean issues was highlighted in remarks made at the conference by the President, Vice President, and the First Lady. Nine major U.S. Oceans initiatives were announced at the Conference. Six of these focus on specific ocean topics, such as building sustainable fisheries and protecting coral reefs, and three focus on tools for observing, exploring, and utilizing ocean data - topics of vital interest to the work being undertaken in PICES.

With regard to the geographical area of interest to PICES, namely the North Pacific Ocean, the United States and Japan last week co-hosted the Asia-Pacific Economic Cooperation (APEC) Oceans Conference in Hawaii. The Conference brought together high-level officials representing the oceans interests of APEC member economies (including all the Contracting Parties in PICES) in order to promote regional cooperation on issues ranging from protection of the marine environment to exploration of the sea.

The Conference addressed three major themes:

1. *balancing coastal development and resource conservation;*
2. *ensuring safe and sustainable fisheries; and*
3. *understanding the oceans and seas.*

As a result of last week's conference, I am confident that APEC member economies will be able to work more effectively to tackle the considerable challenges which lie ahead in these three areas. Obviously, the oceans issues being addressed in APEC are of relevance to PICES, and I urge both organizations to continue coordinating with each other, and explore avenues for

cooperation to maximize benefits and avoid duplication of effort.

Speaking of cooperation between regional entities with common interests, I understand that there is a Memorandum of Understanding (MOU) under consideration that would facilitate cooperation between PICES and the North Pacific Anadromous Fish Commission (NPAFC). Since the work of PICES is clearly supportive of NPAFC's efforts to sustainably manage highseas North Pacific salmon stocks, I urge PICES to conclude this MOU with NPAFC.

With regard to the program for this Annual Meeting, I am pleased to see that PICES is addressing topics of vital importance to the oceans community. In the time since the United States last hosted an Annual Meeting in Seattle five years ago, it is evident that PICES has undertaken a wide range of cooperative activities which seek to better understand both short-term phenomena, such as the 1997/98 El Niño event, and long-term phenomena, such as climate change. The 1997/98 El Niño event has galvanized public interest in ocean/atmosphere interactions like nothing before it, so I look forward to the report of this year's timely and relevant Science Board Symposium.

I am particularly excited about the entities within PICES which are addressing long-term oceans research issues, such as the CCCC Program (Climate Change and Carrying Capacity of the North Pacific). The other sessions taking place at this meeting, such as "science and technology for environmentally-sustainable mariculture", and "contaminants in high trophic level biota", are also addressing topics of significance.

In this Year of the Ocean, the Seventh Annual Meeting of PICES provides a valuable forum for furthering oceans research of importance to all nations of the North Pacific. At a time when all Government agencies operate in an environment of limited resources, budgetary constraints, and increasing demands, it is clear that success in our research efforts is dependent on the promotion of partnering activities with entities both within our countries, and internationally with organizations such as PICES. Thank you for your considerable efforts to promote these linkages which will result in a better understanding of our oceans.

Dr. Doubleday called upon Dr. Michael A. Henderson to make a statement on behalf of the Canadian Government.

Lieutenant Governor Ulmer, members of the head table and delegates, the Canadian Delegation is very pleased to participate in the Seventh Annual Meeting of PICES in Fairbanks, Alaska. We look forward to moving ahead on the science agenda of the Organization and the work of FIS, MEQ, POC, BIO, TCODE, CCCC, REX, MONITOR, MODEL and the various Working Groups.

Canada has been a strong supporter of PICES since its inception. We need and use the information generated through the cooperative work of member states of PICES to manage, conserve, protect and ensure the sustainable use of the renewable resources of the North Pacific Ocean. The need for this information is particularly important during the current period where we are seeing very rapid changes in the marine environment of the North Pacific Ocean. The collaborative efforts of all member states in coordinating efforts and providing information is essential. PICES is a strong, vibrant and very important world science organization.

The Canadian Delegation would like to thank all those involved in preparing for and hosting the Seventh Annual Meeting of PICES. We would particularly like to

acknowledge the work of the Secretariat and our Executive Secretary, Dr. Doug McKone, the Local Organizing Committee, the State of Alaska, the University of Alaska Fairbanks, and Dr. Bill Doubleday, the Chairman of PICES.

The Canadian delegation wishes all participants, and observers attending the Seventh Annual Meeting of PICES success in their scientific undertakings.

Dr. Doubleday called upon Mr. Jing-Guang Li, to make a statement on behalf of the Chinese Government.

It is a pleasure for me and the Chinese delegation to come to Fairbanks, Alaska to attend the Seventh PICES Annual Meeting. First of all, I would like to extend, on behalf of the Chinese delegation, our warm congratulation to all who attend this meeting. This meeting will offer us a good opportunity to meet friends from the member states and from other international organizations, to share experiences and to discuss issues in which we all have interest. I would also like to express our sincere thanks to the host, the United States of America, for the excellent work in arranging this meeting. Our thanks should also go to the Local Organizing Committee and the PICES Secretariat for the preparation they have made for this meeting.

PICES is a young organization, but during the past years since it was created, it has played an important role in promoting and coordinating marine scientific research in the North Pacific region. The capability of PICES has been recognized by the member states. We would like to express our appreciation of the efforts and contribution made by Dr. Doubleday, Chairman of PICES, and the Secretariat for the successful performance of PICES' duties and functions.

As we all know that "Agenda 21" adopted at the UN Conference on Environment and Development held in Rio de Janeiro, Brazil, in 1992, states that the marine environment forms an integrated whole that is an essential component of the global life-support system and a positive asset that presents opportunities for sustainable development. Since the Rio Conference in 1992, the Chinese government has been attaching more and more importance to the development and protection of the ocean. In 1994, the Chinese government promulgated "China's Agenda 21 - White Paper on China's Population, Environment and Development in the 21st Century", which listed the sustainable development of ocean resources as one of the priority program areas. In 1995, China published its National Ocean Development Plan, in 1996, formulated "China's Ocean Agenda 21" and in 1998, issued its white paper "The development of China's Marine Programs". All these important documents have formed the policy guidelines for China's marine scientific research, marine resources exploitation, marine environmental protection, coastal management and international cooperation in marine affairs. Sustainable development of the marine environment and its resources has become an important component of China's national development strategy. We believe that our participation in the activities of PICES will help not only to promote the development of marine scientific research in the North Pacific region, but also to realize our national goals with respect to the ocean.

I am pleased to note that there will be a Science Board Symposium on the Impacts of the 1997/1998 El Niño event on the northern Pacific Ocean and its Marginal Seas during the meeting, and the Chairman has just said that there will be an International Conference on El Niño in the year 2000. These are activities of great significance. We all know that El Niño and La Niña have serious impacts on the world,

especially on the countries along the Pacific Rim. This year, China experienced the most severe floods since 1954, which is believed to be closely related to the anomalies of the ocean processes in the Pacific. Some other countries along the Pacific Rim have also suffered greatly from natural hazards in the past decades. Therefore, we hope that the study of El Niño-La Niña and the study of their impacts on climate, agriculture and marine ecosystem will become one of the top priority areas of PICES in the years to come.

Once again, I would like to thank our host and the Secretariat for their hospitality and their hard work. I wish the meeting a great success.

Dr. Doubleday called upon Dr. Satsuki Matsumura to speak on behalf of the Japanese Government.

Mr. Chairman, distinguished delegates, Local Organizing Committee members, ladies and gentlemen. It gives me great pleasure to have the opportunity to be here as part of the Japanese delegation. On behalf of the Japanese Government, Japanese colleagues and myself, I wish to express our warmest gratitude to our US colleagues for their enthusiastic efforts in hosting the Seventh Annual Meeting of PICES in Fairbanks.

I would like to take this opportunity to re-emphasize the background and spirit behind this forum, and take a look at the eventful years we have left behind. Recognizing the importance of North Pacific as a major part of World Ocean and its short-term and long-term impact on the human societies around the region, this organization was formed comprising of the six member countries around the North Pacific, to act on the shared sense of national interest, and to promote science in understanding the processes and role of the North Pacific Ocean on regional and global phenomena.

As oceanographers we all realize that we have a responsibility to address the growing problems of the increase in atmospheric carbon dioxide and the elevation of water temperature that have a disastrous effect on the marine ecosystem. The ocean has been a great life support system for human survival by providing food and natural resources, acting as a medium for transportation, and most importantly, by playing the role of climate controller and carbon dioxide buffer. We do not currently know if there is an effect of human activity on the global ocean phenomena such as El Niño. However, there have been signs of influence of El Niño on biological oceanographic phenomena in the North Pacific and it appears to cause changes in the delicate balance of the ocean-atmosphere system and the marine ecological system. Since we cannot stop some of the human activities as they are meant to sustain the increasing population, we should find the way for conservation of our environment by adopting proper management strategies.

It is heartening to note that PICES activities have been growing through the years. Many interesting results have come up under the program of each Science Committee. We are also developing scientific cooperation with other international organizations and committees. It is also quite encouraging to note that many of the techniques adopted for ocean science related investigations have been progressing well through the years. Moreover, demand for oceanographic investigations is increasing rather fast during recent years, in view of a growing resolve on the part of governments round the world to conserve the global environment. A number of earth observation satellites are presently in orbit collecting valuable data for oceanography. Many satellites will be launched in the

coming years by different countries. Investigations will also be undertaken by oceanographic cruises that are better equipped through the introduction of new instrumentation for collecting useful data at sea. However, the vastness of the ocean does not allow any one organization to deal with research problems in the regional and global scale because of limited research resources. That is why the effective links and bonds of common interest are the true bases of promotion and development of ocean science. PICES being a scientific forum is devoted to make this a reality by cooperative works not only amongst its member countries but also with other organizations with identical objectives.

I am confident that all of us are well aware of our responsibility. Every Science Committee and Working Group is interacting and making real progress in different branches of ocean science. It is evident from our short history that we can realize the goals of PICES by our common resolve. I believe this Seventh Annual Meeting of PICES is an achievement to rejoice for all of us, especially for the founding Chairman, Dr. Wooster. I am sure all of us will have a great time during this meeting discussing many valuable results and come up with many new ideas to be pursued in the future.

It is my pleasure to announce here on behalf of the Japanese government that we would like to host the Ninth PICES Annual Meeting in 2000 in Japan.

I would like to express thanks once again to all of our US colleagues for providing us with such a wonderful opportunity to be here in Fairbanks.

Dr. Doubleday called upon Dr. Jhin-Kyoo Chae to make a statement on behalf of the Republic of Korea.

Mr. Chairman, distinguished delegates, ladies and gentlemen. It is great pleasure for me to be here as part of the Korean delegation. I would like to extend thanks, on behalf of the Korean government and our ocean science community, to the US Government and the Local Organizing Committee for providing us with this wonderful opportunity of meeting in Fairbanks, Alaska, to interact with all PICES colleagues. As you know, the North Pacific Ocean is one of the world's most productive living marine resources areas, but it is also known that much of the potential living resources bio-mass has recently started to gradually decline. Although climatic change by El Niño is evident in many areas of the world in recent years, nobody seems to know exactly what to do about the phenomenon. So, ocean scientific research and related studies have become more vital to our improved understanding of how to wisely manage the abundance of living resources in relation to changes in the environment.

Today, environment deterioration, energy shortage and other problems have caused concerns for the world as they threaten human life. To solve these problems, there needs to be a wide range of international cooperation as well as mutual exchange of scientific and technical personnel, information and data. In this regard, the Korean Government has always supported multilateral exchange and cooperation in science and technology with all countries in the world. As PICES was born not so long ago as an inter-governmental organization, its existence could be challenged without efficient management. A strong research capacity and effective management are necessary to ensure continuity and on-going improvements of PICES. Specifically, integration and sharing of scientific data and environmental information are critical to the fulfillment of PICES' goals. These goals are not easy to accomplish, but we should continue our efforts to achieve the prosperity of PICES.

Our wish now is that this meeting of PICES will be successful in providing a favorable and satisfactory forum for every participant here. Also, I look forward to many productive decisions from the meeting. I hope that all scientists will take full advantage of this Seventh Annual Meeting of PICES to renew and extend contacts and friendships with colleagues from other nations and other organizations, and to learn from the work of others present here.

Best wishes for a successful conference.

Dr. Doubleday called upon Dr. Lev N. Bocharov to speak on behalf of the Russian Federation.

Mr. Chairman, distinguished delegates, PICES Secretariat members, Local Organizing Committee members, ladies and gentlemen. It is a pleasure for me and the Russian delegation to have an opportunity to meet again with all the participants at this Seventh Annual Meeting of PICES.

On behalf of my government and the Russian delegation, I would like to thank the United States and PICES for inviting us to participate in the Seventh Annual Meeting and particularly note the very good work of the Secretariat, the Executive Secretary, Dr. Doug McKone, the Local Organizing Committee, the State of Alaska, the University of Alaska Fairbanks, and Dr. Bill Doubleday, the Chairman.

The great Russian scientist and thinker Vladimir Vernadsky said that "the people may maintain their existence and inviolability of their bodies by assimilating other organisms or the products of these organisms. Humans cannot produce all necessary food requirements by themselves. They must look for food sources in the environment". The marine environment is not only the source of food for the coastal country peoples, it is an essential part of the global life support system. In Russia, the importance of investigating the different living marine resources was recognized long ago. In the past 80 years more than five thousand fisheries investigations were conducted by our country. The total expenditure accounts for more than 100 billion dollars. Now all the results of this work belong to all mankind. And we attach a big importance to the opportunity of continued scientific exchanging in the field of ocean environment studies and marine resources investigations.

It should be noted that at this meeting, a Science Board Symposium will be devoted to the 1997/1998 El Niño event and its impacts on the Northern Pacific Ocean and the Marginal Seas, including its living resources.

The prosperity of the Far-Eastern regions of Russia is highly dependent on the effective development and utilization of living marine resources, and the effects of environmental changes which may impact on the economy of the region.

We hope that the efforts of our Organization will help improve the coordination of the marine and fishery politics of the Pacific coastal countries. Future global progress is connected to the successful development of the ocean, and we are ready to do maximum efforts in this direction. The authority of PICES is growing and its activities are being coordinated with other international organizations on fishery and ocean investigations.
The experience of holding this PICES meeting in Alaska and previous years' meetings will be useful for us in arranging the Eighth PICES Annual Meeting in Russia. So I, as a representative of my government and Vladivostok scientists, invite all those who have come to this meeting to also come and participate in the

PICES Annual Meeting in the Far East of Russia in 1999.

On behalf of the Russian delegation I wish this meeting every success and hope there are many fruitful discussions and useful results for all the participants. I would like to express thanks once again to the United States, State of Alaska, and Fairbanks, for the hospitality, and providing us with this wonderful opportunity to attend the Seventh PICES Annual Meeting.

Dr. Doubleday called upon Dr. James W. Balsiger to provide a few words on behalf of the US Government.

Mr. Chairman, Ms. Lieutenant Governor, Dr. Fox, distinguished delegates, ladies and gentlemen. I am honored and privileged to be here today to present these remarks on behalf of the United States and the United States delegation.

We are pleased to be here in Fairbanks to participate in the Seventh PICES Annual Meeting. As part of the host country delegation, I am particularly happy to see PICES continue to gain momentum in the scientific community and to see that Fairbanks, Alaska, is now part of the force. I must be careful not to take personal credit, since the Secretariat, and especially Vera and her local troops, have handled all of the logistics. Thanks go to them.

Seven years is a good start. We can be proud of the progress that has been made under the PICES banner. I am not going to list the symposia and conferences that PICES has sponsored, but note that PICES support is increasingly being sought to co-sponsor international meetings. For example, as co-sponsor of the Pandalid Shrimp Fisheries Symposium to be hosted by the Scientific Council of the Northwest Atlantic Fisheries Organization, and as co-sponsor with the Tuna Commission for an El Niño follow-up workshop.

ICES is 100 years old. At this meeting of PICES we will consider a Memorandum of Understanding (MOU) with them to guide the development of scientific exchange between our two organizations. We will also look at an MOU with the North Pacific Anadromous Fish Commission. There are many more examples, but my point is that PICES is recognized now for the scientific prowess its member parties can provide to the world.

After seven years we will see a few changes. Dr. Warren Wooster told me earlier this week that this might be his last PICES Annual Meeting. I do not believe that, of course, but it will be quite a change when he is missing from the back row of most working sessions, committee and council meetings. We will soon have our third Chairman and our second Executive Secretary. I would like to mention the contribution of the Science Board and recognize the significant achievements that body has made — and note that Dr. Makoto Kashiwai is also at his last meeting as Science Board Chairman. We must give thanks to these people and many more for their tireless efforts to ground PICES in proper procedures, good strategies and solid science.

The good news is that because they (and PICES) have been so successful, we will not have difficulty in attracting talented people to follow them. PICES is indeed a good place for good scientists to meet and do their work.

I listened closely to the comments of both Lieutenant Governor Ulmer's remarks and then of Dr. Fox. They each make a strong case for the need for the broader community to understand the complexity of the oceans. The broader community includes the commercial fishers, the subsistence people and the non-consumptive users. Did you expect to see

the day when ocean carrying capacity research would escape the esoteric musings of a collection of egghead scientists? Well it has. It is on the top of the agenda at the Governor's office in Juneau. PICES has indeed come of age and has a role to play in the critical scientific questions of the day.
I look forward to a productive and enjoyable meeting. I thank you all for traveling to Fairbanks.

Dr. Doubleday thanked Lieutenant Governor Fran Ulmer, NOAA representative Dr. William Fox and all the delegates for their remarks and spoke on behalf of PICES.

Lieutenant Governor Ulmer, NOAA Science and Technology Director Fox, University of Alaska Chancellor Wadlow and President Hamilton, distinguished delegates, colleagues, ladies and gentlemen, I would like to begin my remarks by thanking our hosts, the United States of America for their hospitality in hosting this meeting, and the University of Alaska Fairbanks for their hard work in supporting the Seventh Annual Meeting of PICES in Fairbanks. While Fairbanks may seem far from the sea, its weather comes form the sea and the salmon that swim in the Chena River have spent years in the Bering Sea and the Pacific Ocean, so the influence of the sea is felt here in the heart of Alaska. The scientists from the main campus of the University of Alaska at Fairbanks have contributed strongly to PICES since its beginning. The Seventh Annual Meeting of PICES is an opportunity for scientists from PICES member states to strengthen contacts with their colleagues in Alaska and for Alaskans to learn about PICES and its work.

The hours spent in preparation for a meeting like ours are not fully appreciated because they are not visible to the participants. Those in the audience who have prepared past PICES meetings or other similar meetings understand what is involved and will join with me in expressing PICES' thanks. Many thanks to our hosts for bringing PICES to Fairbanks!

1998 is the International Year of the Oceans. The United Nations has formally recognized the importance of the oceans for mankind by this declaration. The Seventh Annual Meeting of PICES also shows the growing importance of the oceans. We anticipate over 300 participants at this meeting, continuing the steady growth of PICES.

Last year I spoke of the 1997/98 El Niño event which was gathering strength during our Sixth Annual Meeting. I urged PICES to seize the opportunity of major climate anomalies to advance understanding of the relation between ocean climate changes and the dynamics of the ocean's living resources. The El Niño event was exceptionally strong, with major impacts on the North Pacific Ocean, its living resources and the weather in countries bordering the PICES area. At this meeting we will see an overview of El Niño's effects on the physical and biological systems of the Pacific Ocean and adjacent seas. PICES is leading, with the participation of other organizations, plans for a major symposium in the year 2000 to examine in depth the implications of this El Niño event.

PICES scientists are working together to understand how variation in the climate of the North Pacific ocean influences marine ecosystems and fishery resources. To make our work more complete, we must also work together to understand how the ocean and atmosphere of the North Pacific cause climate variations. We need to bring atmospheric scientists into the PICES community to join our oceanographers in advancing knowledge and understanding of the Pacific Ocean climate system. The joint meeting of JGOFS North Pacific Task Team

with PICES this year is an important step in the right direction.

We should go further in this direction. The speed, with which temperature anomalies associated with the 1997/98 El Niño spread to high latitudes, underlines the importance of interactions between the ocean and atmosphere in the PICES area. PICES should play an active role in climate research. This will require us to bring scientists who study the linked ocean-atmosphere system into the PICES community. PICES should also link its research with worldwide programs of climate research, because the climate system is a global system. PICES should develop a positive role in the Global Climate Observing System by asserting a regional role in GOOS in the North Pacific.

Increasingly, PICES scientists are collaborating in joint research projects. This is commendable, but joint programs by PICES member states to study shared waters, shared ecosystems, and issues of common concern would bring still greater benefits by bringing greater resources to bear on important questions.

We have an exciting program of joint sessions and symposia this week with many interesting papers. I hope that all scientists will take full benefit from this Seventh Annual Meeting of PICES to renew and extend contacts and friendships with colleagues from other nations and other disciplines and to learn from the work of others presented here. Don't forget the coffee breaks and the evenings. The informal contacts and discussions among colleagues made possible by our Annual Meetings are just as important as the formal presentation of papers in the meetings.

Best wishes to all of you for a successful conference!

Dr. Doubleday introduced Dr. William G. Pearcy to give the keynote lecture. Dr. Pearcy discussed "What is the Carrying Capacity in the North Pacific for Salmonids?" He noted that these are exciting times for science in the dynamic North Pacific. The regime shift of the late 1970s had a profound effect on the ecosystem, including large increases in zooplankton, necton and salmon catches. Although many changes have been documented, how ecosystem changes are linked, directly or indirectly, to the growth and survival of salmonids is still very poorly understood. Research is urgently needed to describe the key mechanisms. Catches of salmon in the North Pacific during the 1980s and 1990s averaged about 800,000 T, a historic maximum. Over the last 20 years, declines in the average size at a given age have been abundantly shown around the Pacific Rim. We have approached the carrying capacity of oceanic waters of the North Pacific for salmon even though only a fraction of the primary production and zooplankton biomass is being utilized by salmon. What does the future portend for salmon? Since we have been experiencing record production in recent years, changes to either warmer or cooler conditions are not auspicious. If the warm sea temperature of the early and late 1990s continue, temperatures and increased buoyancy of the mixed layer may lower ocean productivity, salmon growth and the area inhabitable by salmon. We also need to have a better understanding of the interactions between wild and hatchery salmon and how hatchery fish affect growth, reproduction, and survival. Therefore, I recommend that PICES take the initiative and 1) sponsor a symposium by scientists to discuss and evaluate this issue; and 2) form a Working Group to explore the national and international implications of lower carrying capacity of the ocean "commons", and to evaluate the effect of hatcheries releases on the production and

value of salmon and on the future of wild stocks.

REPORT OF GOVERNING COUNCIL MEETINGS

The Governing Council met on October 19, 22 and 25, under the Chairmanship of Dr. William G. Doubleday. Drs. W. Doug McKone and Alexander S. Bychkov served as rapporteurs.

All Contracting Parties were represented at the three sessions (Endnote 1). The Chairman of the Science Board, Dr. Makoto Kashiwai and Dr. Warren S. Wooster, Chairman of the Finance and Administration Committee, were in attendance during part or all of each session.

Agenda Item 1. Opening Remarks

At the first session, the Chairman welcomed the delegates and noted that for this Annual Meeting Mr. Jing-Guang Li was representing the People's Republic of China; Mr. Jhin-Kyoo Chae the Republic of Korea; and Mr. Hideo Nishikawa was representing Japan.

The Chairman asked Parties to confirm their members who would attend the Finance and Administration Committee meeting (Endnote 1, Finance and Administration Committee report).

Agenda Item 2. Adoption of agenda

The Chairman reviewed the agenda and proposed the order in which to take up the various items. This report summarizes the treatment of each agenda item during the course of the three sessions.

Agenda Item 3. Appointment of Executive Secretary

Dr. Doubleday reported that the Selection Committee could not reach consensus on the selection of a new Executive Secretary. Council approved that the position should be advertised again and Parties were provided with a new advertisement to circulate in their countries (advertisement-Endnote 6). The Assistant Executive Secretary will run the Organization until a new Executive Secretary is appointed. Council decided that the Chairman of the new Selection Committee should establish a short list of three candidates, but he can include a fourth candidate if appropriate. Council noted that provision for paying the cost of candidates to attend the interviews was not considered at the F&A meetings, and approved that these costs should be from the Working Capital Fund.

The Selection Committee for the Executive Secretary is as follows:

Dr. Hyung-Tack Huh, Chairman
Dr. James W. Balsiger (U.S.A.)
Dr. Lev N. Bocharov (Russian Federation)
Dr. Michael A. Henderson (Canada)
Dr. Makoto Kashiwai (Japan)
Dr. Jhin-Kyoo Chae (Republic of Korea)
To be named after this meeting (People's Republic of China)

The Chairman encouraged China to name their representative as soon as possible after this meeting. (Note: Mr. Zhi-Xin Chen was named as representative of China in January 1999.)

Agenda Item 4. Preliminary Report on Administration

The Executive Secretary summarized the activities of the Secretariat during the previous year (Endnote 2). Fees or partial fees were received by the Secretariat from all Parties during the year. There were a number of changes in the membership of Council, Committees and Working Groups.

Canada was thanked for the new and much improved Secretariat accommodations at the Institute of Sciences, Sidney, British Columbia.

Agenda Item 5. Relations with other International Organizations and observers from such organizations

Council made minor editorial changes to the PICES-ICES Memorandum of Understanding that was received from ICES and agreed that the Chairman sign it on behalf of PICES (Endnote 4) (Decision 98/A/4).

Similarly, Council approved the Memorandum of Understanding with the NPAFC and asked the Chairman to sign it on behalf of PICES (Endnote 5) (Decision 98/A/5).

Letters of invitation to attend PICES VII were sent to the agreed list of Organizations, and the following sent observers:

Climate Variability and Predictability Program (CLIVAR) - Dr. Howard J. Freeland
North Pacific Anadromous Fish Commission (NPAFC) – Ms. Hiroko Omori
Scientific Committee on Oceanic Research (SCOR) - Prof. Shizuo Tsunogai and Dr. Roger Harris

Agenda Item 6. Membership and observers from other countries

Non-member countries were not officially represented as observers at this years meeting. The Secretariat did not receive any proposals to join PICES from non-member countries during 1998.

Agenda Item 7. Election of Chairman

Dr. Doubleday called for nominations for Chairman of Council in accordance with the Rules of Procedure. Dr. Hyung-Tack Huh of the Republic of Korea was nominated by the U.S.A. and seconded by the People's Republic of China. He was unanimously declared as Chairman for a first term. The Delegates congratulated Dr. Huh on his election. Dr. Huh expressed his thanks for the support given by Council.

Agenda Item 8. Appointment of Finance and Administration Committee Chairman

The Chairman opened discussion on proposals for Chairman of the Finance and Administration Committee in accordance with the Rules of Procedure. The U.S.A. proposed that Dr. Richard Marasco be appointed. The Council accepted the US proposal and appointed him for a two-year term. Dr. Marasco thanked Council for their support.

Agenda Item 9. Proposed change to Rules of Procedure

Council discussed the proposed Rule of Procedure changes recommended by Science Board that would improve the way the organization functions in relation to Working Groups, Technical Committees, Scientific Programs and other groups. Council edited and approved the Rules of Procedure as proposed (Endnote 3) (Decision 98/A/3).

Council reviewed the proposed Rule of Procedure 11 change for the Executive Secretary to publish proceedings from the Annual Meetings proposed by the Republic of Korea. As recommended by Science Board, Council requests that the Publication Committee consider the Korean proposal to publish proceedings from the Annual Meetings and report next year.

Agenda Item 10. Report of Finance and Administration Committee

The Finance and Administration Committee met under the Chairmanship of Dr. Warren S. Wooster, who presented the report to the Governing Council (see F&A Report for text). The report was approved by Council.

Audited accounts for Financial Year 1997

At the recommendation of the Finance and Administration Committee, the Governing Council accepted the audited accounts for 1997. Council reviewed bids from auditing firms and agreed to appoint the existing auditor for another year (Decision 98/A/1).

Estimated accounts for Financial Year 1998

The estimated accounts from October 1 to December 31 were reviewed by the Finance and Administration Committee and approved by Council (Decision 98/A/2).

Budget for Financial Year 1999

The total budget, increased to CDN $574,000, was approved by Council. Council also approved a transfer of CDN $58,000 from the 1998 Working Capital Fund surplus to reduce the fees for each Party to CDN $86,000 (Decision 98/A/2(1)).

Forecast Budget for Financial Year 2000

Council received the forecast budget for 2000 as an information item for Parties (Decision 98/A/2(2)).

Trust Fund

The Trust Fund is estimated to be CDN $63,656 at the end of 1998. Council would also like to thank the Republic of Korea for its generous contribution of CDN $40,000 to the Trust Fund in late October last year.

Working Capital Fund

The Working Capital Fund is estimated to be CDN $170,762 at the end of 1998. Thus, the Working Capital Fund will have an estimated residual surplus of CDN $70,762. Council approve the transfer of CDN $58,000 to reduce the fees for each Party and approve that five-sixths ($10,635) of the estimated remainder ($12,762) be transferred to the Trust Fund. The estimated remaining one-sixth ($2,127) to be held by the Secretariat for review by F&A at next year's Annual Meeting. Council also approved that the practice of transferring surpluses in the Working Capital Fund to the Trust Fund should continue in future years (Decision 98/A/2(3)).

Home Leave Relocation Fund

The status of the Home Leave Relocation fund was reviewed. No action was taken by Council on this matter.

Future meetings of the Organization and subsidiary bodies, including time and place for the Eighth and Ninth Annual Meetings

Council approved the recommendation that PICES VIII be held from October 11-17 in Vladivostok, the Russian Federation. Meetings of Working Groups, Task Teams and any other groups will be held in the week before the meeting. Council also accepted the invitation of Japan to hold PICES IX (Decision 98/A/6).

Agenda Item 12. Report and recommendations of Science Board

The Chairman reminded the National Delegates that approval of the Science Board recommendations implies that they will provide the necessary support to allow the successful accomplishment of the tasks that are planned within their country.

Council approved the Science Board Report (See Science Board Report for text). With

respect to the MEQ summary statement in the Science Board Report on their proposed Practical Workshop, the Delegate from China expressed the following comment: "The change in venue was necessary because of inadequate coordination among Chinese scientists concerned." And he supported the general view that "PICES at all levels must work together to ensure the inter-governmental projects sponsored by PICES are given necessary support and authorization so that projects be implemented successfully".

1. Planned and proposed future meetings in 1999-2000
   Council approved inter-sessional meetings (Decision 98/S/1) and proposed Workshops and Working Group meetings to be held at PICES VIII.

2. CCCC Program and CCCC -IP Task Teams
   Council approved recommendations concerning CCCC Program (Decision 98/S/2).

3. Proposed PICES Publications: 1999
   Council accepted the list of publications proposed (Decision 98/S/3).

4. Working Groups and new groups
   Council approved recommendations proposed concerning Working Groups and new groups (Decision 98/S/4 and 5).

5. PICES supported travel
   Council approved the recommended travel support (Decision 98/S/6).
6. Co-sponsor meetings
   Council approved the recommended cosponsoring meetings (Decision 98/S/7).

Agenda Item 13. Any other business

Election of Vice Chairman

Dr. Doubleday noted that as Dr. Huh was elected as Chairman, it would be necessary to replace him as Vice Chairman of Council, and he called for nominations in accordance with the Rules of Procedure. Dr. Vera Alexander of U.S.A. was nominated by Japan and seconded by Canada. She was unanimously declared as Vice Chairman for a first term. The Delegates congratulated Dr. Alexander on her election. Dr. Alexander expressed her thanks for the support given by Council.

Appendix

A. Decisions

98/A/1: Auditor

Council accepted the audited accounts for 1997 and agreed to continue with Flader and Greene as auditor for another year.

98/A/2: General Account

Council accepted the estimated accounts of 1998 and agreed to the following actions:

1. *1999 Budget*. The budget of $574,000 was approved. $58,000 was transferred from the Working Capital Fund to reduce the total contribution to $516,000, keeping the 1999 fees at $86,000.

2. *Forecast 2000 Budget*. The forecast budget for 2000 was reviewed and will be further considered during PICES VIII.

3. *Working Capital Fund*. The estimated surplus in the fund is $70,762. Council approved a transfer of $58,000 to the

General Fund for 1999. Council further approved that five-sixths ($10,635) of the estimated remaining surplus of $12,762 be transferred to the Trust Fund and one-sixth ($2,127) be held in the Working Capital Fund to be considered at next year's meeting of the F&A Committee. Council approved the practice to continue transferring future surpluses to the Trust Fund.

98/A/3: Rules of Procedure

Council approved the proposed Rules of Procedure changes to agree with the Handbook for Chairman and Convenors (see Endnote 3).

98/A/4: PICES-ICES Memorandum of Understanding (MOU)

Council approved the PICES-ICES MOU and asked the Chairman to sign it and transmit it to ICES for signature (see Endnote 4).

98/A/5: PICES-NPAFC Memorandum of Understanding (MOU)

Council approved the PICES-NPAFC MOU and asked the Chairman to sign it and transmit it to NPAFC for signature (see Endnote 5).

98/A/6: Future Annual Meetings

Council approved the Russian Federation's proposal to host the Eighth Annual Meeting in Vladivostok, October 11-17, 1999. Council approved the proposal of Japan to host the 2000 meeting. The date and place of the meeting in Japan is to be determined at next year's Annual Meeting.

98/S/1: Inter-sessional Workshops and Working Group Meetings

The following inter-sessional meetings are to be convened:

a. A 2-week MEQ Practical Workshop in Vancouver (Canada) in May 1999;
b. A 4-day WG 13 Technical Workshop in Tsukuba (Japan) in April 1999;
c. A 3-day WG 12 meeting in August or early September 1999 in the People's Republic of China or in conjunction with PICES VIII in Vladivostok;

98/S/2: CCCC Program and CCCC-IP Task Teams

a. The BASS Task Team should convene a 2-day workshop on *Development of a Conceptual Model for the Subarctic North Pacific Gyres* immediately prior to the PICES Eighth Annual Meeting in Vladivostok. Co-convenors are Gordon A. McFarlane (Canada) and Andrey S. Krovnin (Russia);
b. The MONITOR Task Team should convene a 2-day workshop immediately prior to the PICES Eighth Annual Meeting in Vladivostok. Co-convenors are Yasunori Sakurai (Japan) and Bruce A. Taft (U.S.A.);
c. The REX Task Team should convene a 2-day workshop on *Herring and Euphausiids* immediately prior to the PICES Eighth Annual Meeting in Vladivostok. Co-convenors are Douglas E. Hay (Canada), William T. Peterson (U.S.A.), Vladimir I. Radchenko (Russia) and Tokio Wada (Japan);
d. The MODEL Task Team should convene a 3-day workshop on *Prototype Lower Trophic Level Ecosystem Model for Comparison of Different Marine Ecosystems in the North Pacific,* in Nemuro, Japan, in early 2000.

98/S/3: Publications

The following reports are to be published:

a. Progress reports of Working Groups 8, 11-14 and the report of the Publication Study Group in the 1998 Annual Report;
b. Revised PICES Handbook and Handbook for Chairmen and Convenors;

c. Proceedings of the Science Board '97 Symposium on "*Ecosystem dynamics in the eastern and western gyres of the subarctic Pacific*" in the special issue of *Progress in Oceanography;*
d. Proceedings of the Science Board '98 Symposium on El Niño 1997/98 events in the PICES Scientific Report Series;
e. Proceedings of the Second Okhotsk Sea Workshop in the PICES Scientific Report Series;
f. WG 10 report in the PICES Scientific Report Series;
g. Proceedings of the MODEL, REX and MONITOR 1998 Workshops in a single volume of the PICES Scientific Report Series.

98/S/4: Future of Working Groups

a. WG 10 on "Circulation and ventilation in the Japan/East Sea" will be disbanded in spring 1999 after the POC Committee's approval of the publication of the final report;
b. WG 11 on "Consumption of Marine Resources by Marine Mammals and Seabirds" will continue its work for one more year. Simultaneously, a new Study Group to propose ways to incorporate marine birds and mammals expertise into the PICES structure and activity will be established;
c. Revised terms of reference for WG 14 be expanded to include the ecological role of micronekton in addition to sampling methods.

98/S/5 New PICES groups

A new standing Publication Committee reporting to Science Board was established. Membership shall consist of one participant from each member country, selected by Science Board from among members of PICES Scientific Committees, Working Groups, and Task Teams, together with an elected Chairman and a representative of the Secretariat. Members will be nominated inter-sessionally and a letter seeking the support of national delegates for the members of the committee will be sent by the PICES Secretariat. The Publication Committee will work inter-sessionally by correspondence and will convene during the Annual Meeting. The Publication Committee has the following terms of reference:

1. Review questions of publication policy;
2. Review questions of translation policy;
3. Review desirability of establishing a peer review publication;
4. Review desirability of establishing a PICES editorial board; and
5. Review other matters concerning PICES publications.

98/S/6 Travel support

a. PICES will provide partial support for Dr. Chang-Ik Zhang (FIS Chairman) to attend a joint SCOR WG 105 and ICES symposium on "*The Ecosystem Effect of Fishing"* in Montpellier, France, in March 1999;
b. PICES will cover the travel costs of two outside experts to provide keynote demonstration and/or presentation at the TCODE Workshop on "*Workshop on the application of scientific visualization to marine ecosystem analysis"* in conjunction with the PICES Eighth Annual Meeting in Vladivostok;
c. PICES will provide financial support for two scientists to attend the REX Workshop on "*Herring and Euphausiids";*
d. PICES will cover the travel cost of one invited speaker for the CCCC-related Scientific Sessions at the PICES Eighth Annual Meeting.

98/S/7 Co-sponsored meetings

a. PICES will co-sponsor a 4-day conference "*El Niño and Beyond: A conference on Pacific climate variability*

and marine ecosystem impacts, from the Tropics to the Arctic" in La Jolla, U.S.A., in March 2000, with IPHC, IATTC, ISC, and possibly other marine organizations; Drs. Paul H. LeBlond and Warren S. Wooster will serve as Co-Chairmen of the Steering Committee on behalf of PICES;

b. PICES will co-sponsor a 2-day workshop on "*Zooplankton Production Ecology"* in Hawaii, U.S.A., in late April/early May 2000, with ICES. Dr. Tsutomu Ikeda (BIO Chairman-elect) will represent PICES serving as a co-convenor.

Endnote 1

Participants

Canada
Michael A. Henderson (alternate delegate)
Richard J. Beamish (alternate delegate)

China
Jing-Guang Li (delegate)
Zhi-Xin Chen (alternate delegate)
De-Li Xin (advisor)
Qian-Fei Liu (advisor)
Yong Li (advisor)
Bo Lei (advisor)

Japan
Satsuki Matsumura (delegate)
Hideo Nishikawa (alternate delegate)

Republic of Korea
Jhin-Kyoo Chae (alternate delegate)
Hyung-Tack Huh (delegate)

Russian Federation
Lev N. Bocharov (delegate)
Alexander Kurmazov (advisor)
Igor I. Shevchenko (advisor)

U.S.A.
Vera Alexander (delegate)
James W. Balsiger (delegate)
Richard Marasco (Oct. 21-26 alternate for James W. Balsiger)
Dorothy Bergamaschi (advisor)

Others
William G. Doubleday (Chairman, PICES)
W. Douglas McKone (Executive Secretary) (Rapporteur)
Alexander S. Bychkov (Assistant Executive Secretary) (Rapporteur)
Makoto Kashiwai (Chairman, Science Board)
Warren S. Wooster (Chairman, Finance and Administration Committee; ex-officio Council member)

Endnote 2

Report on Administration for 1998

Council, Committees and Working Groups

1. Payment of National Contributions

All annual dues are payable by January 1 each year. Dues were paid as follows:

Japan	January 1998
Canada	February 1998
U.S.A.	May 1998
People's Republic of China	May 1998
Russian Federation	July 1998
Republic of Korea (partial)	December 1998

2. National Delegations

Japan

1. Mr. Kimihiro Ishikane replaced Mr. Akira Mizutani as a member of the Finance and Administration Committee.

People's Republic of China

1. Mr. Zheng-Ping Tang replaced Mr. Zuo-Fu Gan as a delegate to Council.
2. Mr. Jing-Guang Li replaced Prof. Yu-Kun Xu as a delegate to Council.

Republic of Korea

1. Mr. Kook-Jeon Ahn replaced Mr. Kyu-Seok Park as a delegate to Council.

Russian Federation

1. Dr. Lev N. Bocharov replaced Dr. Alexander Rodin as a delegate to Council.
2. Dr. Igor I. Shevchenko replaced Drs. Gennady Khen and Gennady Yurasov as member of the Finance and Administration Committee.

3. Committees and Working Groups

Japan

1. Dr. Tokimasa Kobayashi replaced Dr. Kiyoshi Wakabayashi on FIS.
2. Dr. Nobuo Suginohara replaced Prof. Yutaka Nagata on POC.
3. Dr. Akihiro Hara replaced Dr. Kiyotaka Otani on FIS.
4. Dr. Takeshi Uji replaced Dr. Masahiro Endoh on POC.
5. Dr. Ichiro Hara replaced Dr. Tokimasa Kobayashi on TCODE.
6. Dr. Toshio Nagai replaced Dr. Tadao Tatsuno on TCODE.

Russian Federation

1. Dr. Victor V. Lapko replaced Dr. Vladimir I. Radchenko on the FIS Committee.
2. Drs. Lev M. Gramm-Osipov and Tatiana Belan replaced Drs. Evgeny Shumilin and Stanislav Patin on the MEQ Committee.

4. Observers

Invitation letters were sent to inter-Governmental and non-Governmental organizations on the agreed standard list. Organizations and Programs that accepted our invitation are:

Climate Variability and Predictability Program (CLIVAR) - Dr. Howard J. Freeland

North Pacific Anadromous Fish Commission (NPAFC) – Ms. Hiroko Omori

Scientific Committee on Oceanic Research (SCOR) - Prof. Shizuo Tsunogai and Dr. Roger Harris

5. Travel and representation at other organization meetings

a. Dr. Chang Ik Zhang attended SCOR Working Group 105 meeting in Hobart, Tasmania, in January.
b. Dr. W. Doug McKone, Dr. Alexander S. Bychkov and Dr. Paul H. LeBlond attended NPAFC meeting in Vancouver in March.
c. Ms. Patricia Livingston attended GLOBEC Open Meeting in Paris in March.
d. Dr. W. Doug McKone and Ms Christina Chiu travel to the Fairbanks Alasks to discuss PICES Annual Meeting in April.

e. Dr. W. Doug McKone and Ms. Christina Chiu attended the Pension Society Meeting in La Jolla in May.
f. Dr. W. Doug McKone and Dr. Paul H. LeBlond attended planning meeting for El Niño Symposium 2000 in Seattle in August.
g. Drs. Kenneth L. Denman and Alexander S. Bychkov attended JGOFS Equatorial Pacific Synthesis Group meeting in Seattle in September.
h. Mr. Robin M. Brown (part support) attended JGOFS Data Management and Synthesis Workshop in Bergen in September.
i. Dr. W. Doug McKone to attend Okhotsk Sea Workshop meeting in Nemuro in November.
j. Per diem to be provided for 10 Russian Federation scientists to attend Okhotsk Sea Workshop in Nemuro in November.
k. Support was provided for 5 invited speakers to attend the Annual Meeting in October.
l. Support was provided for two candidates for the Executive Secretary position to the interview at the Annual Meeting.
m. Support was provided for Secretariat staff, Chairman Dr. William G. Doubleday and Science Board Chairman Dr. Makoto Kashiwai to attend Annual Meeting.
n. This year Trust Fund support was provided as follows:
   - Partial support for 10 scientists from the Russian Federation
   - Partial support for 10 scientists from the Republic of Korea
   - Full support for 5 scientists from the People's Republic of China
   - Full support for 2 young scientists

   The available funds were split equally among the three countries. The number of Chinese scientists supported was low because full support was required for each scientist.

Communication

1. Publications

List of publications produced this year:

a. Handbook 1998 was distributed in January
b. The Annual Report was published and circulated in January.
c. A poster for PICES VII was printed and distributed in January.
d. Vol. 6 nos. 1 and 2 of PICES Press were circulated in January and July.
e. The First Announcement for the Seventh Annual Meeting was circulated in January.
f. The 1998 Directory was updated and circulated in January.
g. The Final Announcement for the Seventh Annual Meeting was distributed in June.
h. A program and abstracts for scientific sessions were prepared for circulation at the Annual Meeting in October.
i. Scientific Report No. 8: Multilingual Nomenclature of Place and Oceanographic Names in the Region of the Okhotsk Sea, was circulated in November.
j. Scientific Report No. 9: PICES Climate Change and Carrying Capacity Workshop on the Development of Cooperative Research in Coastal Regions of the North Pacific, was circulated in November.
k. A program and abstract book for the Second PICES Okhotsk Sea Workshop was circulated at the Workshop in November.

2. Electronic Communication

a. On-line registration and abstract submission to PICES VII compared to last year: registration through the web decreased by 4% (to 52%) and submitted abstracts increased by 13% (to 34%).

b. CCCC sub-page on the PICES Home Page was re-designed to reflect the Task Team activities in August.
c. All PICES Scientific Report series publications with their graphics have been put on the PICES Home Page. This feature will be continued as new publications are produced.
d. The list of Internet resources and web sites of interest to PICES scientists was updated
e. Updates to the Long-Term Time Series Data Set Inventory were made.
f. The Secretariat continues to distribute a list of future meetings, information on new books and initiatives in marine science to more than 900 scientists.

Secretariat Matters

1. Administration/Financial

a. The Secretariat reviewed and produced an inventory of existing and disposed-of equipment. The list was split into two sections: one for electronics and one for furniture and other inventory. Software that was included in the Equipment category (of the PICES budget) was determined, and it was found that most of it was obsolete as software has a very short life span. In order for the Secretariat to be able to receive and work with documents from all sources, software must be current. Showing the cost of software as part of the Equipment category distorts the value of the inventory of equipment held by the Organization unless the cost is written off at the end of each year. After discussion with the auditor, expenditures for software are now charged to the Office Supplies category.

b. The Secretariat approached four new auditing firms to solicit bids as requested by Council. Two responded and the currently used auditor indicated that if PICES wished to continue with them the cost for the audit of the 1998 books would be the same as for last year.

c. Improved methods for handling registration and abstract submission for the Annual Meeting are still being developed by the Secretariat. The aim is to simplify the system while trying to reduce costs.

2. Space, Facilities and Equipment

a. The Government of Canada provided new and larger facilities for the Secretariat this year. We have one additional room which will be used as a library / meeting room, and can house a person visiting or seconded to the Secretariat. The facilities should be adequate to meet the needs over the next few years.

b. Secretariat electronic equipment has been upgraded or renewed over the last few years. There will likely be some costs for equipment as a result of moving into new facilities provided by Canada.

Endnote 3

Rule Changes

Rule 12

(ii) The Council may establish such *ad hoc* Committees, Working Groups, Technical Committees, Scientific Program Committees and other groups as it deems necessary and where appropriate Science Board shall recommend a person for Chairman for consideration and approval of Council.

Rule 13

Add new (iii) and (iv):

(iii) Technical Committees shall each consist of not more than two members from each Delegation recommended by Science Board for approval of national Delegates;

(iv) Science Board shall recommend members of Working Groups, Scientific Program Committees, and other groups for approval of national Delegates based on an appropriate representation that meets the needs of the particular Working Group, Scientific Program or other group.

Rule 14

Drop the last line of Rule (i) and add a new Rule (ii) that includes the dropped line as follows:

(ii) An additional member may be designated by each Contracting Party not otherwise represented on the Board. Chairmen of Technical Committees, and Scientific Programs reporting to Science Board may serve as observers without the right to vote.

Rule 16

Add new (ii) and (iii):

(ii) Chairmen of Technical Committees, Scientific Program Committees and other groups will be recommended to Council by Science Board for approval for a term of three years, shall assume office at the conclusion of the Annual Meeting at which appointed; and shall not be eligible for re-appointment for the immediate succeeding term.

(iii) Chairmen of Working Groups will be recommended to Council by Science Board for approval to serve for the life of the Working Group which usually will not exceed three years, and shall assume office at the conclusion of the Annual Meeting at which appointed.

Renumber - (ii) becomes (iv) and change as follows:

(iv) if for any reason the Chairman of any Committee, Working Group, Scientific Program Committee or other group is unable to complete the term of office, a new Chairman shall be designated in the same manner as provided originally for designation of the Chairman of that Committee, Working Group, Scientific Program Committee, or other group. In such circumstances, or if a Chairman is temporarily unable to act, the Chairman of Council after consultation with the Science Board Chairman and Council members, shall appoint a member of the Committee, Working Group, Scientific Program Committee or other group to act as Chairman; and

Renumber - (iii) to become (v).

Rule 17

The function of the Chairman of each of the Committees, Working Groups, Scientific Program Committees and other groups identified in Rule 13-15 shall be:

The rest of the text of Rule 17 will remain unchanged.

Endnote 4

MEMORANDUM OF UNDERSTANDING BETWEEN THE NORTH PACIFIC MARINE SCIENCE ORGANIZATION AND THE INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

Recognizing that the North Pacific Marine Science Organization, (PICES), hereinafter called "the Organization", exists to (a) promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources, including but not necessarily limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna, and ecosystems, its uses and resources, and impacts upon it from human activities; and (b) promote the collection and exchange of information and data related to marine scientific research in the area concerned. In order to further enhance its institutional capabilities, the Organization seeks, *inter alia*, to establish and maintain mutually agreed working arrangements with other international organizations which have related objectives.

Recognizing that the International Council for the Exploration of the Sea, hereinafter called "the Council", exists to: (a) promote and encourage research and investigations for the study of the sea particularly related to the living resources thereof; (b) draw up programmes required for this purpose and to organize, in agreement with its Contracting Parties, such research and investigations as may appear necessary; (c) publish or otherwise disseminate the results of this work; and (d) provide scientific information and advice to Member Country governments, and the regulatory commissions with which co-operative relationships have been established. In order to carry out these tasks appropriately and efficiently, the Council seeks, *inter alia*, to establish and maintain mutually agreed working arrangements with other international organisations which have related objectives.

The Organization and the Council, hereinafter called "the Parties", have, therefore, agreed to the following Understanding:

1. There shall be reciprocal consultations and regular contacts between the Parties on matters of common interest in the field of marine scientific research, data exchange, and training and related activities, including environmental studies;

2. There shall be regular exchange between the Parties of information, documents, and publications relating to programme and project plans and to the results of activities agreed to be of mutual interest, joint or otherwise;

3. The Parties shall invite each other to be represented, in an observer capacity, at meetings of common interest, to the extent that this is possible within their respective working procedures;

4. The Parties shall, as appropriate, undertake joint activities, including when required, the establishment of joint subsidiary bodies or other suitable arrangements, to study and report on matters of common interest, including the support of those activities that concern them both;

5. The Parties shall consult regularly on ways in which co-operation between them can be further improved and extended. Specific joint programmes and activities may be defined through addenda to this framework agreement on a biennial basis;

6. The terms of this Understanding may be revised by the Parties if they both agree. The Understanding shall continue on the basis of the existing terms until new terms have been agreed;

7. Either Party may withdraw from the Understanding at any time subject to giving one year's written notice to the other Party;

8. Any agreement, arrangement or joint activity entered into in consequence of this Memorandum of Understanding which involves a financial commitment will be covered by an annex to this Memorandum governing the provision of funds;

9. Recognizing and fully respecting their various mandates, policies and priorities, the Parties agree that this Understanding shall enter into force upon signature and shall remain in force unless either Party withdraws pursuant to Paragraph 7 above.

President International Council for the Exploration of the Sea (ICES)	Chairman North Pacific Marine Science Organization (PICES)
Date:	Date:

Endnote 5

MEMORANDUM OF UNDERSTANDING BETWEEN THE NORTH PACIFIC MARINE SCIENCE ORGANIZATION AND THE NORTH PACIFIC ANADROMOUS FISH COMMISSION

Recognizing that the North Pacific Marine Science Organization (PICES), exists to: (a) promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources, including but not necessarily limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna, and ecosystems, its uses and resources, and impacts upon it from human activities; and (b) promote the collection and exchange of information and data related to marine scientific research in the area concerned;

Recognizing that the North Pacific Anadromous Fish Commission (NPAFC) exists to: (a) promote the conservation of anadromous stocks in the Convention Area; and (b) consider matters related to the conservation of ecologically related species in the Convention Area;

Recognizing the mandatory powers, constraints and obligations under which PICES and NPAFC respectively operate;

Desiring to provide a framework for mutual cooperation;

PICES and NPAFC, hereinafter called "the Parties", have agreed to the following:

1. To maintain reciprocal consultations and regular contacts on matters of common interest in the field of marine scientific research;

2. To regularly exchange information, documents, and publications relating to program and project plans and to the results of activities agreed by the Parties to be of mutual interest, joint or otherwise;

3. To invite each other to be represented, in an observer capacity, at meetings of common interest, to the extent that this is possible within their respective working procedures;

4. To undertake joint activities, as appropriate, including when agreed, the establishment of joint subsidiary bodies or other suitable arrangements, to study and report on matters of common interest;

5. To consult, as appropriate, on ways in which cooperation between them can be further improved and extended. Specific joint programs and activities may be defined through addenda to this agreement;

6. To coordinate the time and place of Annual Meetings to facilitate the work of both Parties;

7. This Memorandum of Understanding (Memorandum) shall enter into force upon signature of the person duly authorized by each Party and shall remain in force unless either Party withdraws pursuant to paragraph 8 below;

8. The terms of the Memorandum may be revised by the Parties if they both agree. The Memorandum shall continue on the basis of the existing terms until new terms have been agreed;

9. Either Party may withdraw from the Memorandum at any time subject to giving one year's written notice to the other Party.

IN WITNESS WHEREOF, the undersigned, being duly authorized thereto, have signed this Memorandum of Understanding.

DONE at Moscow, this day of November 1998.

President North Pacific Anadromous Fish Commission (NPAFC)	Chairman North Pacific Marine Science Organization (PICES)
Date: _____	Date: _____

Endnote 6

Executive Secretary Position

Applications are invited for a five-year appointment to the position of Executive Secretary of the North Pacific Marine Science Organization (PICES).

The purpose of the Organization is to promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned (i.e. the northern North Pacific and adjacent seas especially northward from 30 degrees North Latitude) and of its living resources, including but not necessarily limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and impact upon it from human activities; and to promote the collection and exchange of information and data related to marine scientific research in the area concerned.

The Organization's main bodies - the Governing Council and Science Board - meet annually, and more often if necessary. Member States currently are Canada, the People's Republic of China, Japan, the Republic of Korea, the Russian Federation, and the United States of America. English is the working and official language of the Organization.

The Secretariat is located at the Institute of Ocean Sciences, British Columbia, Canada, and provides services to the Organization in the exercise of its duties and functions.

Description of the Position and Duties

The Executive Secretary is the Organization's chief administrative officer and must be impartial in promoting and coordinating the interests of all Contracting Parties. The Executive Secretary is responsible for the management of the Organization's office, staff, and funds, which are presently at the level of CND$500,000 - $600,000, contributed equally by the Member States; conducts business on behalf of the Organization; arranges annual and other meetings of the Organization and its constituent bodies and committees; prepares annual budget estimates and forecasts; prepares annual financial statements, and other documents as required; invests funds that are surplus to immediate needs; handles correspondence; prepares minutes of Governing Council, Science Board, and Finance and Administration Committee; prepares an annual report of the Organization for distribution to the Member States; and publishes the Annual Report and other scientific publications as required by the Organization. The successful candidate must be self-motivated and be responsible for administration and staff of the Organization; work with the Chairman of Council, Science Board, Scientific Committees, Working Groups, and other bodies.

The Executive Secretary is assisted by an Assistant Executive Secretary, Administrative Assistant, and a Secretary.

The term of office is a minimum of five years and may be renewed at the discretion of Council.

Qualifications and essential experience

Applicants must be a citizen of a Member State of PICES at the time of assuming office. Preference will be given to a candidate with a Ph.D. degree or equivalent experience in one of the marine science disciplines from a recognized university. The applicant must have significant experience in conducting and managing scientific research or significant administrative experience with international cooperative scientific programs and with scientists from a number of countries. This experience relates particularly to marine scientific research and marine scientists.

Applicants should also have experience in, or detailed knowledge of, the operations of intergovernmental organizations, including demonstrated experience in the selection and supervision of staff, and experience in the preparation of financial budgets and management of funds.

Applicants should have experience in the organization of large and small meetings and the provision of secretarial support, especially to scientific committees and groups, must submit examples of their writing, and be prepared to provide further examples if interviewed.

Applicants must be fluent in both spoken and written English and will be asked to write a paragraph or two if interviewed for the job. Fluency in another language of a member country would be a benefit. A knowledge of marine science activities in the northern North Pacific region is desirable.

Salary and benefits

The annual salary and benefits of the staff of the Organization are guided by but not limited to the host state (Canada) public service salaries for equivalent responsibilities. The salary is negotiable, in the range of CND$ 74,300 - 97,900, commensurate with quali-fications and experience. The salary is subject to the equivalent of Canadian income tax.

The Organization participates in:

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

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

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

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

Application procedure

An application should include a covering letter and resume written by the applicant. At least three references from persons with a knowledge of the applicant's qualifications and experience are required; it is desirable that at least one reference be from a country other than that of the applicant. Applicants should indicate in their letter a suitable starting date and acceptable salary level. A desirable starting date would be July 1, 1999.

Deadline for applications is February 1, 1999

Applicants placed on a short list should expect to be interviewed in late March 1999.

The applicant and writers of references should send their submissions marked 'Personal and Confidential' directly to either:

Dr. Hyung-Tack Huh, Chairman, PICES
Korea Ocean Research and Development Institute (KORDI)
Ansan P.O. Box 29,
Seoul,
Korea. 425-600
Phone: (82-345) 400-6201
Fax: (82-345) 408-5820
E-mail: hthuh@sari.kordi.re.kr

Dr. Vera Alexander, Vice Chairman, PICES
Dean, School of Fisheries and Ocean Sciences
University of Alaska Fairbanks
245 O'Neill Building,
Fairbanks, AK 99775-7220,
U.S.A.
Phone: (1-907) 474-6824
Fax: (1-907) 474-7204
E-mail: vera@ims.alaska.edu

REPORT OF SCIENCE BOARD

The Science Board met on October 18 (18:30-21:30) to review the order of the agenda, set up tasks for Scientific and Technical Committees agendas and hold the election of the Science Board Chairman; and on October 24 (09:30-16:30) for further discussion. Drs. W. Doug McKone and Alexander S. Bychkov served as rapporteurs. (See Endnote 1 for participants.)

October 18, 1998

The Chairman, Dr. Makoto Kashiwai, called the meeting of the 18th to order and welcomed the members of Science Board and observers. Dr. Kashiwai outlined the objectives of the meeting, the timetable for reports on Committees and Group activities, and significant issues for discussion. The agenda was circulated prior to the meeting. The Chairman reviewed the agenda, proposed the order in which to take up the various items, and asked for changes and additions. The agenda was adopted without changes (Endnote 2).

The Chairmen of the Scientific and Technical Committees, and the CCCC Implementation Panel presented agendas for their meetings. Additional items important for future general discussion were determined and recommended to be included into agendas (Endnote 3).

Dr. Kashiwai noted that the Chairmen of the Science Board, POC, BIO and MEQ Committees will have completed their terms of office after this Annual Meeting. To ensure that PICES activities are heading in the right direction for the new Chairmen, they have to pay special attention on the Strategic Workplans for at least the next three years. The discussion and revision of the Strategic Workplans should be completed during the Committee meetings and be reported to the Science Board. Dr. Kashiwai reviewed the Science Board activities for the period from PICES I to PICES VII and presented a draft Science Board Strategic Plan. Oral and written comments were solicited by the second Science Board meeting on Oct. 24.

Election of Science Board Chairman

Dr. Kashiwai introduced the PICES rule 14 for selection of the Science Board Chairman and informed that he had received only one written proposal from the U.S. Delegate, Dr. Vera Alexander, who nominated Ms. Patricia Livingston for the position of the Science Board Chairman. No other candidates were proposed at the meeting and Ms. Patricia Livingston was elected the new Science Board Chairman by acclamation. The Science Board members congratulated Ms. Livingston on her election. Ms. Livingston expressed her thanks for the support given by the Science Board.

Handbook for Chairmen and Convenors

The final draft of the Handbook for Chairmen and Convenors was prepared by the Secretariat and Science Board. Dr. Kashiwai reported that the draft changes in the Rules of Procedure were required for consistency with these Guidelines. After discussion and minor revision, the proposed Rule of Procedure changes, developed by the Executive Secretary, have been recommended to the Governing Council for approval. The Science Board also recommended that the Handbook for Chairmen and Convenors be published.

October 24, 1998

The Chairman opened the meeting of the 24th and proposed the order in which to take up the various items. The Science Board reviewed the findings and recommendations of the Scientific Committees, Implementation Panel for the CCCC Program, TCODE, and Study Group on Publications; the Strategic Plans developed by the Science Board and Scientific Committees; discussed the implementation of PICES VI decisions, and Science Board recommendations from 1997; made arrangements for future activities and planned a program for the Eighth Annual Meeting; discussed relations with other Organizations and Programs; and made recommendations to the Governing Council.

Reports and recommendations of the Scientific and Technical Committees, CCCC-IP/EC and Working and Study Groups

Reports of the Scientific and Technical Committees, the CCCC Implementation Panel and Publication Study Group were presented by their Chairmen and are summarized below (see reports for the full text). Although both TCODE and the CCCC/IP report to Science Board, for the purposes of the Annual Report, their accounts have been given more visibility under their own heading.

Biological Oceanography Committee – Prof. Patricia A. Wheeler

The Biological Oceanography Committee met on October 22 (13:30-16:20). The Chairman Dr. Patricia A. Wheeler called the meeting to order and welcomed the members of the Committee and observers. Dr. Vladimir I. Radchenko served as rapporteur. Suggestions were made about the agenda and the revised agenda was approved.

Dr. Wheeler distributed copies of a draft strategic plan for the BIO Committee that reviewed past activities and outlined plans for the future. The BIO Committee agreed with the recommendations for further integration of symposia and sessions with other PICES Scientific Committees and international organizations, to encourage an increased level of attendance at meetings of Scientific Committees, Working Groups, and Task Teams, and increased support for students to attend PICES meetings.
Dr. Wheeler reviewed the PICES rules for choice of the BIO Chairman. The formal election was conducted by Dr. W. Doug McKone, Executive Secretary of PICES. Dr. Tsutomu Ikeda was nominated and elected by acclamation in accordance with the Rules of Procedure.

The PICES Secretariat would like to improve its web page and BIO Committee selected Dr. Linda Jones to serve as the initial contact advisor for the Secretariat.

Dr. Wheeler reported on the plans for an ICES/PICES workshop on "Zooplankton Ecology" in April/May of 2000. The BIO Committee discussed the proposal and recommends Dr. Tsutomu Ikeda, BIO Chairman-elect, nominate a Committee member to serve as the main PICES representative in planning this workshop with further approval of this nominee by BIO.

Dr. Wheeler reported on the PICES plan for a four-day conference on "*El Niño and Beyond: A conference on Pacific climate variability and marine ecosystem impacts from the Tropics to the Arctic*" in late March 2000 in La Jolla, U.S.A. The BIO Committee discussed the proposed conference and voted in favour of supporting the proposal.
Dr. Richard D. Brodeur reported on the first meeting of Working Group 14 on Micronekton. WG 14's terms of references were expanded to include the ecological

role of micronekton in addition to sampling methods. The first report of Working Group 14 follows the report of the BIO Committee in the Annual Report.

Dr. Allen Macklin gave an update on the Bering Sea Metadata project and invited input of additional data.

Mr. Robin Brown described the proposal for a TCODE Workshop on Data Visualization. The BIO Committee discussed the proposal and voted by acclamation in favour of supporting the proposal.
Dr. Paul J. Harrison described the proposal for a CCCC Advisory Panel to evaluate the proposal for an Iron Fertilization Experiment in the North Pacific. The BIO Committee discussed the proposal and recommended it for Science Board approval with special note to future CCCC Advisory Panel members on the necessity undertaking a carefully controlled experiment and additional measurements to understand underlying processes.

Nominations were tabulated for BIO's Best Presentation Award. Based on these nominations, the BIO Committee selected a short list of seven candidates and voted for Dr. Kazuaki Tadokoro (co-author Dr. Takashige Sugimoto) "Importance of low saline advected water from the Sea of Okhotsk for spring blooming of phytoplankton in west side of the North Pacific Ocean" as the 1998 Best BIO Presentation.

Drs. George L. Hunt and Hidehiro Kato presented a summary of WG 11 progress. The final report will be submitted to BIO in spring 1999. BIO will review the final report and recommendations, and forward it with comments to SB prior to PICES VIII. WG 11 proposed several suggestions for establishing a 3-year Study Group on Marine Mammal and Seabird Ecology. The BIO Committee discussed these proposals and recommended approval by Science Board. On behalf of the BIO Committee, Dr. Wheeler thanked Drs. Hunt and Kato for their efforts.

The BIO Committee discussed possible Topic Sessions for PICES VIII. Past unselected topics and new topics (listed below) were discussed. A short list of possible topics was generated and the Committee selected "Recent findings of GLOBEC and GLOBEC-like programs in the North Pacific" as the next BIO/CCCC special topic. Possible BIO Co-Convenors are Drs. Vladimir I. Radchenko and Mark D. Ohman. The topic "Coastal eutrophication, phytoplankton dynamics, and harmful algal blooms" as a special MEQ/BIO session was also approved if scheduling permits. Dr. Kwang-Woo Lee was recommended as a possible Co-Convenor. The BIO Committee noted that this BIO/MEQ session might have greater attendance in PICES IX in Japan. Other topics suggested for PICES IX include "Marine birds and mammals", "The importance of microbial loop processes and cycling of DOC", "Zooplankton dynamics and top-down control" and as a result of the Science Board Symposium "A regional comparison of annual production".

Fishery Science Committee (FIS) – Dr. Chang-Ik Zhang

The Chairman, Dr. Chang-Ik Zhang, opened the meeting. The agenda was reviewed and approved by all members. Dr. Gordon H. Kruse was appointed as rapporteur. The FIS Committee welcomed one new member, Dr. Tokimasa Kobayashi (Japan).

Dr. Robert S. Otto summarized the activities and discussed a number of recommendations of WG 12. The FIS Committee supported the continuation of WG 12 activity for one more year and proposal to convene an inter-sessional WG 12 meeting in August or early September, 1999, in the People's Republic of China.

The FIS Committee requests a final report from WG 12 at PICES VIII in Vladivostok.

A SCOR WG 105 and ICES joint symposium on "The Ecosystem Effects of Fishing" will be held in March 16-19, 1999, in Montpellier, France. The FIS Committee recommends Dr. Zhang's participation in the symposium and requests partial support (per diem) for this trip.

The FIS Committee supports a proposal by Dr. Tokio Wada for a FIS Topic Session at the next Annual Meeting on "GLOBEC and GLOBEC-like studies and application to fishery management". The session would be co-convened by Dr. Tokio Wada (Japan) and representatives from other PICES countries. Dr. Gordon H. Kruse (U.S.A.) will be the interim contact.

The FIS Committee voted for the Best Presentation Award from talks presented during the FIS Paper Session and FIS/CCCC Joint Session. The award went to Mr. Jae-Bong Lee for his excellent presentation titled "The impacts of climate changes on the marine fisheries resources in Korea".

Dr. Zhang drafted a "Review of Activities and Strategic Workplan of FIS Committee" that reviewed the Committee's activities and recommended a three-year workplan. The FIS Committee reviewed the report, and provided editorial remarks for inclusion in the final draft.

Marine Environmental Quality Committee – Prof. Makoto Shimizu

Prof. Makoto Shimizu opened the MEQ Committee meeting on behalf of Dr. Richard F. Addison, who was absent from this Annual Meeting. The election of a new Chairman was conducted by Dr. W. Doug McKone, Executive Secretary of PICES, and Dr. Alexander V. Tkalin was nominated and elected by acclamation.

The MEQ Committee discussed and endorsed the report of WG 8, and the recommendation of the WG to change the venue for the Practical Workshop to Vancouver Harbour, B.C., Canada. Dr. Colin D. Levings (Canada) was appointed as Co-Chairman of the Implementation Team for the Practical Workshop. The change in venue was necessary because permission was denied by the Chinese authorities to conduct the workshop in Jiaozhou Bay, China. The Committee noted that the denial of permission demonstrates that PICES, at all levels, must work together to ensure that inter-governmental projects sponsored by PICES are given the necessary support and authorization to be implemented successfully. The tasks of WG 8 would be complete at PICES VIII and a task team will be identified to complete the final report of the Practical Workshop.

The Committee reviewed the scientific sessions of the MEQ and was encouraged by higher attendance, quality and number of presentations as compared to sessions at previous meetings. The session on "Science and technology for environmentally sustainable mariculture" was well attended and addressed issues from environmental impacts and global feed requirements for sustainable production to research on salmon hatchery practices to meet recovery objectives for depressed or endangered salmon populations. The joint session with the BIO Committee on "contaminants in high trophic level biota – linkages between individual and population responses" was deemed very successful and the Committee hopes to have future joint sessions with BIO. The Best Presentation Award was given to Dr. Peter S. Ross for his presentation "Marine mammals at the top of the food chain: ecological sentinels", which was presented in the MEQ/BIO Joint Session.

Several Committee members noted that in the announcement for PICES VII and in the

"online" registration form, that there was no mention of the MEQ Paper Session. In addition, the Committee recommends the inclusion of a description of topic areas for the MEQ Paper Session on the PICES Web page. (See attached).

It was agreed that the MEQ Committee would develop, inter-sessionally, a strategic plan for the Committee. The draft plan will be discussed and made final at PICES VIII. Drs. Richard F. Addison, current Chairman of MEQ, and Alexander V. Tkalin, Chairman-elect of MEQ, will develop the review draft.

The MEQ Committee proposed a joint MEQ/BIO session on "Coastal pollution – eutrophication, phytoplankton dynamics, and harmful algal events" for PICES VIII in Vladivostok.

The MEQ Committee recommended that the Topic Session for PICES VIII be "Ecological impacts and mitigation of oil spills and oil exploration". The convenor will be Dr. Alexander V. Tkalin.

The Committee also recommended that a follow-up session to the mariculture session at PICES VII be held as a Topic Session at PICES IX in Japan. The proposed title is "Science and technology for environmentally sustainable mariculture: impacts and mitigation in coastal areas".

Physical Oceanography Committee – Dr. Paul H. LeBlond

The POC Committee met on October 19 and October 22.

Dr. Christopher N.K. Mooers described progress of report of WG 10 on Circulation and Ventilation in the Japan/East Sea. A draft has already been circulated and comments received. More work is needed to complete the report. POC agreed on the following timetable and procedure.

The completed report will be submitted to the Secretariat by Dec. 1, 1998. It will then be posted on the PICES web site or otherwise made available to POC members for review. Comments on the report are to be made to the Chairman of POC, with copy to the Secretariat, by January 13, 1999. Final approval for publication will be made by the Chairman of POC by January 31, 1999.

In addition, Dr. Mooers reported on the creation of a modern bibliography on the Japan/East Sea. This document will be available on the PICES web site and will be kept up to date under POC supervision with the assistance of the Secretariat. POC members thanked Drs. Mooers and Sang-Kyung Byun, Co-Chairmen of WG 10, as well as other members of the Working Group, for their work. It was agreed that WG 10 should be disbanded after completion of its report.

Dr. Yukihiro. Nojiri, Co-Chairman of WG 13, reported on progress. The WG, under the co-chairmanship of Drs. Nojiri and Richard Feely, held a meeting and technical discussions in Fairbanks on Oct. 14-15, 1998. Plans formulated by the WG are presented (attached in the POC Report) and were discussed by POC, which arrived at the following recommendations:

The POC Committee recommends that PICES support a technical workshop "to discuss results of inter-comparisons of measurement techniques and to initiate detailed technical exchange on measurement technique and data quality between scientists studying CO_2 in the North Pacific". This workshop would be held in Japan, in April 1999. WG 13 Co-Chairmen would be responsible for its organization. The Committee supports the recommendation of travel assistance to Dr. Feely, as Co-Chairman of WG 13, to attend the JGOFS North Pacific Workshop in March 1999. The Committee also

expressed support for other initiatives of the WG. The idea of a data workshop in the year 2000 received support in principle, but will have to receive further justification and discussion at PICES VIII. Committee members agreed with the desirability of sampling the WOCE P1 line within a single year. Canadian participation in some of this work may be available.

Dr. Allen Macklin made a short presentation and answered questions on the Bering Sea Metadatabase.

Dr. Vyacheslav B. Lobanov (Russia) was elected by acclamation as the new Chairman of POC.

The structure of the draft Strategic Plan circulated by the Chairman was deemed generally acceptable with many useful suggestions about future POC directions. Particularly emphasized were:

a. the need to keep POC interdisciplinary – in close contact with other PICES Scientific Committees as well as integrating the physics and chemistry of the ocean and the atmosphere over short and long time scales;

b. development of scientific and technical basis for the forecasting of ocean conditions as the next stage in the progress of ocean sciences;

c. the importance of broadening the focus of POC both within PICES countries and through the scientific disciplines (more chemists, paleo-oceanographers…) – bring new people to PICES meetings, invite prominent scientists from all over the world;

d. PICES must continue to promote high quality science and communication among member countries;

These recommendations will be included in a revised version of the Strategic Plan for POC.

Prof. Steve C. Riser reported as POC observer at the recent CREAMS Workshop. CREAMS appreciates the support of PICES, especially in the matter of obtaining clearances to work in national waters. The resolution approved by PICES last year (1997 Annual Report, p 96) is re-affirmed. In addition, PICES ecological programs with the CCCC should be made aware of the extensive body of physical data about the Japan/East Sea to be gathered by CREAMS and their availability for ecosystem modeling.

Prof. Riser presented an overview of the Global Ocean Data Assimilation Experiment (GODAE) and its informational support, the Array for Real-time Geostrophic Oceanography (ARGO). U.S., European and Japanese groups are currently developing these programs. Assimilated data are to be freely available on the web. By 2003, the ARGO system is to consist of 3,000 PALACE floats deployed globally from ships of opportunity at a 300 km x 300 km resolution. GODAE and ARGO are to be components of GOOS. POC recommends that:

a. PICES encourage member countries to create national committees to plan for participation in GODAE and ARGO;
b. PICES encourage PICES members to make ARGO data and assimilation results from GODAE freely available to all users;
c. An informational article on GODAE and ARGO be prepared for PICES Press.

Drs. Vyacheslav B. Lobanov and Yutaka Nagata reported that the Okhotsk Sea Multilingual Nomenclature was published as PICES Scientific Report #8. POC members applauded their successful efforts.

POC discussed a proposal to publish an annotated bibliography of the Japan/East Sea oceanography, prepared by Dr. Mikhail A. Danchenkov (Russia). The bibliography is very extensive, containing more than 1,100 references. Publication has the support of WG 10. POC recommends publication of the bibliography as a PICES Scientific Report, with distribution appropriate to demand.

New technology for airborne sensing of salinity, of low accuracy, but appropriate for coastal areas, is becoming available. Dr. David L. Musgrave plans to apply to a U.S. agency for funding for such a device (approx. $500,000) and he requests PICES endorsement. After some discussion, POC agreed that the current Chairman would write a letter expressing general support for the use of such a device in coastal areas and possibility of application in many POC countries.

Following a request from the Secretariat for more scientific information on the PICES web page, Dr. Howard J. Freeland volunteered to help in this respect. He will liaise with the Secretariat to provide information and links to science programs for the web page.

Mr. Robin M. Brown briefly presented the TCODE proposal for a one-day data visualization workshop to be held before PICES VIII. POC enthusiastically supports this proposal.

The Second Okhotsk Sea Workshop will be held November 9-12, 1998, in Nemuro, Japan. To date, there are 23 participants from Japan, 13 from Russia and 2 from the U.S.A. Organizers expect a report including about 25 papers. POC supports the publication of the proceedings as a PICES Scientific Report. Manuscript submission deadline will be February 1, 1999, review and completion by May 1, 1999. The Committee members expressed their thanks to the organizers Drs. Vyacheslav B. Lobanov, Yutaka Nagata, and Steve C. Riser.

The POC Committee supports the plans for the formation of an advisory group under the BASS Task Team on an iron fertilization experiment in the subarctic Pacific.

The POC Committee proposes to hold a symposium at PICES VIII entitled: "Modeling and prediction: the state of the art". Convenors will be Drs. Takeshi Uji (or designate) and David L. Musgrave. They are to invite prominent modelers and address a broad scale of problems.

17 nominations for best presentation were received. The nominee receiving most votes was Dr. Hisashi Nakamura for the presentation of his paper: H. Nakamura and T. Yamagata "Observed association between SST and atmospheric anomalies in the North Pacific decadal climate variability".

Technical Committee on Data Exchange – Mr. Robin M. Brown

The Committee met on October 18 and October 22 during the PICES Annual Meeting. Participation was fairly good, with representatives from each PICES nation. The Committee discussed a wide range of issues and developed a work plan for the 1998/1999 year. A detailed report was prepared and is summarized below:

Achievements since 1997 – PICES VI

The TCODE Inventory of Long Time Series and the list of Internet resources (on the PICES web site) were reviewed, updated and expanded.

TCODE and the CCCC-IP are working together to develop a data management plan for the CCCC Program. Little progress was made and this remains an important item for TCODE.

TCODE members have done a lot of 'networking' to develop linkages with data management components of other projects, including GOOS, NEAR-GOOS, GLOBEC-International, JGOFS, and the World Data Center-A for Oceanography.

Workplan for 1998/1999

TCODE intends to make additions and improvements to the web pages on Long Time Series and Other Internet Resources, based, in part, on contributions from other Committees and WGs. In addition, the Inventory of Long Time Series will be restructured to be consistent with new metadata standards (such as DIF, FDGC). The Committee also intends to undertake some 'promotion' of these offerings on the PICES web site, to ensure that maximal use is made of this information.

TCODE will work with the CCCC-IP, national GLOBEC committees to develop a data management plan that will ensure proper archiving and allow for exchange of GLOBEC data amongst the participants.

TCODE will assist:

- CCCC-IP MONITOR Task Team to assemble a detailed list of ongoing monitoring activities (by time and location).

- CCCC-IP BASS Task Team to identify planned cruises in the open North Pacific in order to allow for sharing of ship time and improved program integration.

- CCCC-IP MODEL Task Team in identifying sources of nutrient data that are not yet in international databases.

TCODE recommends that Science Board approve its plan to organize a one-day workshop on the use of scientific data visualization to integrate diverse, multi-dimensional datasets in conjunction with PICES VIII in Vladivostok, Russia. The organizers of the workshop will be Dr. Bernard A. Megrey (U.S.A.), Dr. Igor I. Shevchenko (Russia) and Dr. Thomas C. Royer (U.S.A.). TCODE requests funds to support travel for two experts to provide 'keynote' demonstrations and/or presentations.

TCODE recommends that the following statement of concern be forwarded to Governing Council:

> The Technical Committee on Data Exchange notes that improvements in national data management systems in PICES nations are imperative in order to properly support programs and activities of PICES (such as the CCCC Program) and other modern, interdisciplinary marine programs such as JGOFS, GLOBEC and GOOS. These improvements are required to:
> - Ensure proper archival of the diverse datasets that support these programs.
> - Provide mechanisms for the efficient inventorying and exchange of these data.

The Committee also notes that valuable datasets may be endangered by the retirement of investigators and the re-structuring of government programs and advise that consideration of data integrity and preservation be included when research programs are re-structured.

Following rule changes, Mr. Brown agreed to serve a 3-year term as TCODE Chairman starting at the end of the Seventh Annual Meeting.

Implementation Panel on CCCC – Ms. Patricia Livingston

The CCCC-IP Panel met on Thursday, October 22, 1998. Agenda for the meeting is attached (Endnote 3). The meeting was

opened by the two CCCC-IP Co-Chairmen and the agenda was reviewed. An agenda item to discuss a CCCC web representative was added and the agenda item on national GLOBEC reports was omitted because GLOBEC representatives had previously provided their reports at the FIS-CCCC Topic Session. The Co-Chairmen discussed their activities of the previous year, including attendance at the GLOBEC International Open Science Meeting, design of the CCCC web pages, and regular provision of newsletter articles to the PICES Press, and the GLOBEC International newsletter. The Panel then heard reports of each of the Task Team accomplishments for 1998, and planned activities for 1999. The group accepted the proposal by Dr. C.S. Wong to add an advisory group under BASS to assist in the development and implementation of an iron fertilization experiment in the subarctic. The proposals developed by REX, MODEL, MONITOR, and BASS for workshops were discussed, revised, and accepted. It was noted that the first two weeks of April are not good for Japanese scientists to attend meetings or workshops due to the nature of the funding system and the school year. A recommendation was made to forward the Working Group 11 (Birds and Mammals) report to the MODEL Task Team for consideration and further action in deciding how to incorporate these data into upper trophic level models. The Panel received information about the current status of co-operation with other programs such as JGOFS, GLOBEC International, and the GOOS-LMR module. A recommendation was made and adopted that CCCC will nominate a representative from REX who will be the contact point to receive cruise information of CREAMS and other programs doing research in the Japan/East Sea region. Once received, this information will be posted on the PICES web site. Mr. Robin M. Brown presented a report on data management issues based on his attendance earlier in the year of a JGOFS data management meeting. The Panel discussed the responses received from the letter sent earlier in the year from TCODE and CCCC to national GLOBEC committees about data management issues. Mr. Brown made the suggestion that the CCCC-IP wait for the results from JGOFS in their trial of a structured inventory system before making suggestions to national GLOBEC committees about a standard format for the inventory system. Mr. Brown agreed to notify the CCCC upon completion of the JGOFS trial whereupon TCODE and CCCC would consult and jointly recommend a strategy to the national GLOBEC programs in PICES nations. The CCCC/IP agreed to nominate one CCCC representative as a web representative of the program, who would oversee and coordinate the provision of scientific information for the PICES web site.

The PICES CCCC/IP recommended:

Publications

Publication of the 1998 MODEL, REX, and MONITOR workshops' proceedings in a single volume of the PICES Scientific Report Series.

Travel support

- PICES travel support for 1 outside expert to attend the MONITOR Workshop in Hakodate, Japan, just prior to PICES VIII;
- PICES travel support for 1 outside expert to attend the BASS Workshop;
- PICES travel support for one scientist each from China and Korea to attend the REX Workshop;

Approval of members

- Drs. David W. Welch (Canada) and Suam Kim (Korea) as the new CCCC/IP Co-Chairmen;
- Dr. William T. Peterson as REX Co-Chairman to replace Dr. Anne B. Hollowed;

- Drs. Gordon A. McFarlane (Canada) and Andrei S. Krovnin (Russia) as the new BASS Co-Chairmen;
- Drs. Michio J. Kishi (Japan) and Dan M. Ware (Canada) as the new MODEL Co-Chairmen;
- Drs. C.S. Wong, Paul J. Harrison, N. Price (Canada), M. Wells, K. Coale, R. Bidigare (U.S.A.), S. Takeda, M. Kiyono, H. Obata (Japan) as members of the BASS Advisory Committee on an Iron Fertilization Experiment.

Proposed Workshops and symposia for 1999

- BASS should hold a 2-day workshop to identify key research questions and opportunities for co-ordinated research on climate change in the subarctic North Pacific;
- MONITOR should hold a 2-day workshop in Hakodate, Japan, just prior to the PICES Annual Meeting to design an improved monitoring system based on the findings of the BASS Workshop;
- REX should hold a 2-day workshop just prior to the Annual Meeting in Vladivostok, Russia, to compare vital rates of herring and examine food web interactions with euphausiids;
- A 2-day workshop on "Regime Shifts and their identification" to be held on the west coast of North America in early September;
- A half-day Topic Session on "Recent Findings of GLOBEC and GLOBEC-like programs in the North Pacific" to be convened at PICES VIII.

Proposed workshops and symposia for 2000

- A 3-day workshop on "Prototype lower trophic level ecosystem model for comparison of different ecosystems in the North Pacific" to be held in Nemuro, Japan, in February;
- A 2-day ICES/PICES workshop on "Zooplankton Production Ecology" to be convened in Hawaii, U.S.A., in March.

Publication Study Group – Dr. Warren S. Wooster

A Publication Study Group (PSG) was established at PICES VI. Its terms of reference were to review questions on publication and translation policy, to consider the desirability of establishing a peer-reviewed publication and a PICES editorial board, to consider policy for distribution of PICES publications, and to review budgetary and other matters concerning PICES publications. PSG members are William G. Doubleday, Makoto Kashiwai, Paul H. LeBlond, and Warren S. Wooster.

The PSG recommends the following to the Science Board:

1. That a standing Publications Committee reporting to Science Board be established, with the terms of reference given to the PSG. Membership shall consist of one participant from each member country, selected by Science Board from members of PICES Scientific Committees, Working Groups, and Task Teams, together with an elected Chairman and a representative of the Secretariat. The Publication Committee will work inter-sessionally by correspondence and will convene during the Annual Meeting.

2. The present PICES publications, with the following responsibilities, should be continued by the Secretariat:
   2.1. *Annual Reports* - reports of Annual Meetings, including decisions of the Governing Council, reports of the Secretariat, Science Board, Finance and Administration Committee, and other documentation of the meeting, together with reports of Working Groups and other bodies, as appropriate.
   2.2. *Scientific Reports* - occasional publication of technical

reports of the findings or activities of Working Groups, Task Teams, and other PICES scientific bodies, as recommended by Science Board.

2.3. *PICES Press* - twice-yearly bulletin of news on PICES activities and personalities, including scientific reviews as appropriate, such as state of the ocean articles, but not refereed scientific papers.

3. The Publications Committee should explore the desirability and feasibility of publishing a peer-reviewed scientific journal to deal with all aspects of marine science within the purview and geographical sphere of PICES interest. The relative advantages and budgetary implications of publishing in-house or commercially should be examined, with a view to presenting a proposal to PICES VIII.

4. The Publications Committee should examine the relative merits and costs of electronic publication and its applicability to PICES publication needs.

5. The Publication Committee should recommend a policy for translation and dissemination of papers endorsed by Scientific Committees, Working Groups, or other appropriate PICES scientific bodies. The translation policy should take into account the need for such translations, the likely beneficiaries, the reasons why PICES should undertake them, how they might best be done, and at what cost. Translation priorities should be recommended by the Publication Committee.

Implementation of PICES VI Decisions

Science Board reviewed implementation of PICES VI decisions.

a. Inter-sessional Workshops and Working Group Meetings (***97/S/1***)

i. The Second Okhotsk Sea Workshop will be held Nov. 9-12, 1998, in Nemuro, Japan and co-convened by Drs. Vyacheslav B. Lobanov (Russia), Yutaka Nagata (Japan) and Steve C. Riser (U.S.A.). The opportunity for 10 Russian scientists to attend the meeting was developed combining Nemuro-city and PICES funds with financial support provided by Russian institutions.

ii. MODEL Workshop on Lower Trophic Level Modelling planned to be organized in California in March 1998, was cancelled. Instead, a small, invitation-only workshop was held Oct. 14-15, immediately prior to PICES VII (Fairbanks, Alaska, U.S.A.) and co-convened by Drs. Sinjae Yoo (Korea) and Richard Dugdale (U.S.A.). The purpose of this workshop was to bring together experts in lower trophic level models to discuss and evaluate the various ways of expressing nutrient uptake, grazing, and predation in these models. The workshop presentations and in-depth discussion of actual model runs using various combinations of key sub-models were combined. Discussions were focussed on issues relating to model comparison. The latter part of the workshop was devoted to activities and discussion of a nutrient database.

iii. MEQ (WG 8) Practical Workshop did not happen either in Jiazhou Bay (China) or Masan/Chinhae Bay (Korea). In both cases approval from the host country was not granted. Currently MEQ is requesting to hold an approximately two-week MEQ Practical Workshop in Vancouver, Canada, in May 1999.

iv. Inter-sessional WG 12 meeting on the western side of Pacific was cancelled as consensus on a place was not achieved. A 4-day meeting was held Oct. 14-17, immediately prior to PICES VII in Fairbanks, Alaska.

b. Relations with other Organizations and Programs (***97/S/2***)

i. A draft Memorandum of Understanding (MOU) with the International Council for he Exploration of the Sea (ICES) prepared jointly by the PICES and ICES Secretariats was circulated to the Contracting Parties for review. MOU has been adopted and signed by PICES' Chairman on behalf of the Governing Council at PICES VII.

ii. The Secretariat contacted Dr. Bruce Leaman, Director of the International Pacific Halibut Commission (IPHC), to explore the possibility of developing an MOU with IPHC. A positive response was received indicating an aspiration to work on this issue in 1999.

iii. A draft MOU with the North Pacific Anadromous Fish Commission (NPAFC) was prepared by Canada and U.S.A., and circulated to other Contracting Parties with a request to consider if it will be possible to agree on the MOU at the Governing Council meeting during PICES VII. The MOU was adopted and signed by PICES' Chairman on behalf of the Governing Council at PICES VII, and will also be reviewed at the NPAFC Annual Meeting held Nov. 1-5, 1998, in Moscow, Russia.

iv. Dr. William G. Doubleday, the Chairman of PICES, wrote an endorsement letter to Circulation Research of the East Asian Marginal Seas (CREAMS) requesting an observer to the CREAMS planning meeting in February, 1998. Drs. Makoto Kashiwai (Science Board Chairman) and Steve C. Riser (POC member) represented PICES at the CREAMS planning meeting. The output from this meeting was reflected in the article written by Dr. Riser for the PICES Press (Vol. 6, No. 2). Council also accepted the CREAMS proposal to hold a Workshop in conjunction with PICES VII. The joint CREAMS-PICES Workshop convened by Dr. Kuh Kim (Korea) was held Oct.18, prior to PICES VII.

c. Publications (***97/S/3***)

i. Bering Sea: Physical, Chemical and Biological Dynamics review volume will be published by the end of 1998. All payments were transferred to Alaska Sea Grant and preparations for publication are at a final stage.

ii. Progress reports of WGs 8-12 and CCCC Task Teams (BASS, MODEL and REX) and the Report of the Study Group on PICES Communications were published in the 1997 Annual Report.

iii. Multilingual Nomenclature of Place and Oceanographic Names in the Region of the Okhotsk Sea was published as PICES Scientific Report No. 8. Publication costs were covered by the Marine Information Research Center (MIRC) and the Japanese Hydrographic Association. The document was also reprinted as MIRC Scientific Report No. 1.

iv. PICES CCCC REX 97 Workshop on the Development of cooperative

Research in Coastal Regions of the North Pacific was published as PICES Scientific Report No. 9.

v. The revised PICES Handbook was published.

vi. Proceedings of the BASS Symposium on Ecosystem dynamics in the eastern and western gyres of the subarctic Pacific will be published in 1999 as a special issue of *Progress in Oceanography*;

vii. PICES WG 10 Report was not published due to the delay in finalizing the document.

viii. MODEL 98 Workshop was cancelled and the report was not published.

d. Working Groups issues (***97/S/4*** and ***97/S/5***)

A new Working Group 13 on "CO_2 in the North Pacific" reporting to the POC Committee was established at PICES VI. Drs. Richard Feely (U.S.A.) and Yukihiro Nojiri (Japan) were appointed as Co-Chairmen. The first WG 13 meeting was held Oct. 14-15, just prior to PICES VII.

A new Working Group 14 on "Effective Sampling of Micronecton to Estimate Ecosystem Carrying Capacity" was established at PICES VI. Drs. Nikolay Parin (Russia) and Bruce Robison (U.S.A.) were appointed as Co-Chairmen. An organizational WG 14 meeting was held Oct. 19, at PICES VII.

e. CCCC Program and CCCC Task Teams (***97/S/6***)

A new MONITOR Task Team reporting to the CCCC/IP was established at PICES VI. Drs. Yasunori Sakurai (Japan) and Bruce A. Taft (U.S.A.) were appointed as Co-Chairmen. The Task Team organized a workshop on monitoring in the North Pacific to review existing monitoring activities of PICES member nations and to suggest improvements in the monitoring of the Subarctic Pacific to further understand the effects of climate variations on the marine ecosystems of the Subarctic North Pacific. The workshop was held on Oct. 16-17, immediately prior to PICES VII.

f. Travel Support (***97/S/7***)

i. Dr. Chang-Ik Zhang (FIS Chairman) attended SCOR WG 105 meeting in Hobart, Australia, in January 1998;

ii. Ms. Patricia Livingston (CCCC-IP Co-Chairman) attended the First GLOBEC Open Science Meeting in Paris, France, in March 1998;

In addition, the following scientists were supported to participate in international meetings on behalf of PICES:

iii. Drs. Paul H. LeBlond (POC Chairman) and W. Doug McKone (Executive Secretary) attended the planning meeting for the "El Niño and Beyond Symposium" in Seattle, U.S.A., in August 1998;

iv. Drs. Kenneth L. Denman (BIO member) and Alexander S. Bychkov (Assistant Executive Secretary) attended the JGOFS Equatorial Pacific Synthesis and Modelling Workshop in Seattle, U.S.A., in September 1998;

v. Mr. Robin M. Brown (TCODE Chairman) attended the JGOFS Data Management and Synthesis Workshop in Bergen, Norway, in September 1998.

g. Co-sponsorship for the Pandalid Shrimp Symposium (***97/S/8***)

PICES joined the Northwest Atlantic Fisheries Organization (NAFO) and the International Council for the Exploration of Sea (ICES) as sponsor of a symposium on "Pandalid Shrimp Fisheries – Science and Management at the Millenium". The Symposium will be held September 8 – 10, 1999, in conjunction with the NAFO 21st Annual Meeting and during the 50th Anniversary of ICNAF/NAFO. Dr. J. Boutillier represents PICES as Co-Convenor together with Drs. P. Koeller (NAFO) and S. Tveite (ICES).

Implementation of 1997 Science Board Recommendations

Science Board reviewed the implementation of 1997 Science Board recommendations.

a. Review of Activities and Strategic Plans for Science Board and Scientific Committees

   At the PICES Sixth Annual Meeting in Pusan, the Science Board proposed that all Chairmen prepare a draft review of activities during his/her term of office and a proposal of Strategic Workplan for the next three years for discussion at PICES VII. Dr. Kashiwai presented the Strategic Workplan for Science Board, and Science Board decided to include it in the Science Board Report as a working document. The Strategic Workplans for Scientific Committees were completed during the Committee business meetings and presented at the Science Board meeting. Science Board decided to attach these to each committee report as working documents.

b. Scientific Program and Schedule for PICES VII

   Science Board recommendations on the program and schedule for the PICES Seventh Annual Meeting were implemented successfully. For the first time:

   i. CCCC Program organized its own Topic Session (jointly with FIS);
   ii. PICES organized a joint Topic Session with another international program: POC/BIO Topic Session on "*Carbon Cycle in the North Pacific Ocean*", co-sponsored by JGOFS and LOICZ projects of IGBP;
   iii. All the Scientific Committee business meetings were scheduled simul-taneously for half a day.

c. Data Management for CCCC Program

   Mr. Robin Brown (TCODE Chairman) and Ms. Patricia Livingston (CCCC/IP Co-Chairman) drafted a letter to each of the national GLOBEC programs in the PICES area to determine the status of their data management and exchange policies. The letter was distributed by the Secretariat to the National GLOBEC Committees and National GLOBEC representative on CCCC/IP-EC. Responses were received from Canada GLOBEC and US GLOBEC and reviewed at TCODE and CCCC-IP meetings during PICES VII. Summary of this discussion was reported to Science Board.

d. Guidelines for co-sponsorship

   The Secretariat in consultation with Science Board has developed the guidelines for co-sponsorship and incorporated them in the Handbook for Chairmen and Convenors.

e. Recommendations of the Study Group on Communications

   The implemented recommendations of the Study Group on Communications are listed below. A few recommendations concerning primarily

enhancements to the PICES communication system are in progress or under consideration.

To foster interdisciplinary communication and to ensure that information is distributed in a reliable, timely and equitable manner to participants in all Contracting Parties, the Secretariat keeps sending ***all*** PICES publications to ***all*** members of the Governing Council, Committees, Working Groups, and CCCC Program by *airmail* (Report of the Study Group, 4.1.5.1 & 4.1.5.2);

The list of libraries that receive the complete set of PICES publications will be reviewed by the end of 1998 and published in the upcoming volume of PICES Press to allow researchers to gain access to PICES publications through the most appropriate source within their country (4.5.1.4);

The Secretariat continues practice of receiving "orders" for PICES Reports and documents through the PICES web site (4.1.5.6);

Electronic versions of PICES Annual and Scientific Reports (except PICES Scientific Rep. No. 2) with graphics are assembled and accessible through PICES web site (4.1.5.7);

A special ftp area for group document editing was established on the PICES server (4.2.2.1);

To improve the content of the PICES web site, ideas and contributions were requested from the Science Board, Committees, Working Groups, and CCCC Program. Only TCODE Chairman (Robin Brown), Co-Chairmen of CCCC-IP (Pat Livingston) and CCCC MODEL Task Team (Ian Perry) worked closely with the Secretariat to maintain material in their subject area (4.2.2.2);

A summary of the PICES Home Page contents and order form will be distributed with the upcoming issue of PICES Press (Vol. 7, No. 1) to allow users with limited WWW access to request printed versions of documents from the Secretariat (4.2.2.4).

Based on monitoring of PICES server usage a summary report was prepared by the Secretariat in consultation with TCODE (4.3.5.2).

PICES Eighth Annual Meeting

The Eighth Annual Meeting will be held in Vladivostok, the Russian Federation, in October 1998. The program of the meeting will include sessions of invited and contributed papers organized by the indicated committees on the following topics:

a. **Science Board Symposium**
"*Regime shifts: The what, where, when, and why*". Co-convenors: Steven R. Hare (U.S.A.), Shoshiro Minobe (Japan) and Warren S. Wooster. Session will be organized to review the physical and biological characteristics of regime shifts, the extent to which various elements of the ecosystem were (were not) affected, the special distribution of effects, and to determine whether there were precursors of these shifts that, in hindsight, could have been identified.

b. **Topic Sessions**

(POC) *Modeling and prediction: the state of the art*. (one-day session) Co-convenors David L. Musgrave (U.S.A.) and Nobuo Suginohara (Japan);

(MEQ/BIO) *Coastal pollution - eutro-phication, phytoplankton dynamics, and*

harmful algal events; (one-day session) Co-convenors TBA;

(MEQ) *Ecological impacts and mitigation of oil spills and oil exploration*. (half-day session) Co-Convenors will be Kwang-Woo Lee (Korea) and Alexander V. Tkalin (Russia);

(FIS) *GLOBEC and GLOBEC-like studies and fisheries management*. (1-day session) Co-Convenors will be Tokio Wada (Japan) and TBA, and Gordon H. Kruse will be the interim contact with a possibility to seek co-convenors from all six countries);

(BIO/CCCC) *Recent findings of GLOBEC and GLOBEC-type programs in the North Pacific* (1-day session). Co-convenors will be Vladimir I. Radchenko and Mark D. Ohman.

c. **Workshops and Working Group Meetings just prior to PICES VIII**

2-day REX Workshop on "*Herring and Euphausiids".* Co-Convenors: William T. Peterson (U.S.A.), Vladimir I. Radchenko (Russia) and Tokio Wada (Japan) (see ***Decision 98/S/2c***);

2-day BASS Workshop on Development of a Conceptual Model for the Subarctic North Pacific Gyres (Co-Convenors: Gordon A. McFarlane (Canada) and Andrei S. Krovnin (Russia) (see ***Decision 98/S/2a***);

2-day MONITOR Workshop. Co-Convenors: Yasunori Sakurai (Japan) and Bruce A. Taft (U.S.A.) (see ***Decision 98/S/2b***);

1-day Workshop on *Application of the Scientific Visualization to the Analysis of Marine Ecosystem*. Co-Convenors: Bernard A. Megrey (U.S.A.), Thomas C. Royer (U.S.A.) and Igor I. Shevchenko (Russia);

1-day Working Group 8 (Practical Assessment Methodology) meeting;

2-day Working Group 13 (CO_2 in the North Pacific) meeting;

2-day Working Group 14 (Micronekton) meeting.

Proposed Inter-sessional Meetings 1999-2000

Science Board reviewed the proposed inter-sessional meetings and recommended that the following meetings are to be convened (see ***Decision 98/S/1, 98/S/2d***):

1999

a. 2-week MEQ Practical Workshop in Vancouver, Canada, in May 1999;
b. 4-day WG 13 Technical Workshop in Tsukuba, Japan, in April 1999, to discuss results of intercomparisons of measurement techniques and to initiate detailed technical exchange on measurement technique and data quality between scientists studying CO_2 in the North Pacific;
c. 2-3 day Working Group 12 meeting in the People's Republic of China in August or early September 1999;

2000

d. 4-day conference *"Beyond El Niño: A conference on Pacific climate variability and marine ecosystem impacts, from the Tropics to the Arctic"* in La Jolla, U.S.A., in March 2000, with IPHC, IATTC, ISC, and possibly other marine organizations (see **Endnote 4**). Drs. Paul H. LeBlond and Warren S. Wooster will serve as Co-Chairman of the Steering Committee on behalf of PICES;

e. 2-day joint workshop on "Z*ooplankton production ecology"* in Hawaii, U.S.A., in

late April/early May 2000, with ICES. Dr. Tsutomu Ikeda (BIO Chairman-elect) will represent PICES serving as Co-Convenor;

f. 3-day workshop on "*Prototype Lower Trophic Level Ecosystem Model for Comparison of Different Marine Ecosystem in the North Pacific"* in Nemuro, Japan, in early 2000.

PICES Publications

a. Science Board reviewed a list of proposed publications and made recommendations (see ***Decision 98/S/3***).

b. Science Board reviewed POC Committee's proposal to publish Bibliography on the Japan/East Sea in the PICES Scientific Report Series, and decided to (with author Dr. Mikhail A. Danchenkov's approval) instead place on the PICES Home Page and provide printed copies upon request.

c. Science Board accepted the proposal of the Study Group on Publication to establish a standing Publication Committee reporting to the Science Board (see ***Decision 98/S/5***).

   SB referred the Korean proposal to publish proceedings from Annual Meetings to the Publication Committee as the first order of business.

Proposed new Committees and Working/Study Groups

Science Board discussed the future of the existing Working and Study Groups and recommended (see ***Decision 98/S/4***):

a. WG 10 on "Circulation and ventilation in the Japan/East Sea" be disbanded in spring 1999 after the POC Committee's approval of the publication of the final report.

b. WG 11 on "Consumption of marine resources by marine mammals and seabirds" continue its work for one more year. Simultaneously, a new Study Group to propose ways to incorporate marine birds and mammals expertise into the PICES structure and activity was established. Members are Ms. Patricia Livingston (SB), Drs. Patricia A. Wheeler (BIO), Warren S. Wooster, David W. Welch and Suam Kim (CCCC), George L. Hunt and Hidehiro Kato (WG 11).

   Terms of Reference
   1. Intersessional communication to formulate a plan for incorporation of marine birds and mammals into the PICES structure and activities.
   2. Nominate 4 marine mammal and 4 marine bird experts to serve on CCCC Task Teams and be invited to attend PICES VIII.
   3. Convene at PICES VII to finalize recommendation and submit to BIO, CCCC and SB.

c. Revised terms of reference for WG 14 were expanded to include the ecological role of micronekton in addition to sampling methods, and were approved.

d. CCCC-IP proposed to establish an Advisory Group (under BASS/CCCC-IP) on "An Iron Fertilization Experiment in the Subarctic Pacific Ocean" (see **Endnote 5** for rationale). Members are: Drs. C.S. Wong, Paul J. Harrison, N. Price (Canada), M. Wells, K. Coale, R. Bidigare (U.S.A.), S. Takeda, M. Kiyono and H. Obata (Japan).

Proposed travel support

Science Board recommends that Governing Council approve financial support for the

following scientists to participate in scientific meetings (see ***Decision 98/S/6***).

a. Dr. Chang-Ik Zhang (FIS Chairman) to attend a joint SCOR WG 105 and ICES symposium on *The Ecosystem Effect of Fishing* in Montpellier, France, in March 1999 (partial support);

b. two outside experts to provide keynote demonstration and/or presentation at the TCODE Workshop on "*The Application of Scientific Visualization to Marine Ecosystem Analysis*" in conjunction with PICES VIII in Vladivostok;

c. two scientists to attend the REX Workshop on "*Herring and Euphausiids*" immediately prior to PICES VIII;

d. one invited speaker for the CCCC-related scientific sessions at PICES VIII.

Relations with other Organizations and Programs

a. The Science Board, recognizing the importance of the proposed array for Real-time Geostrophic Oceanography (ARGO) and the Global Ocean Data Assimilation Experiment (GODAE) as tools for ocean current measurement and interpretation, and the desirability of sharing the resulting information, recommends that:

    i. PICES member countries create appropriate structures (such as national committees, or GOOS sub-committees) to consider and prepare for participation in GODAE and ARGO.
    ii. That data from ARGO and assimilation results from GODAE originating from PICES member countries be made generally available to all ocean scientists (e.g., on the web).

b. The Executive Secretary Dr. McKone notified Science Board on progress of developing MOUs, with ICES, NPAFC and IPHC. Memorandum of Understanding between PICES and NPAFC, and PICES and ICES were prepared, approved and signed by Council, and circulated to these respectable Organizations.

c. Chairman of FIS Committee, reported on relation between PICES and SCOR WG 105 on "The Impact of World Fisheries Harvests on the Stability and Diversity of Marine Ecosystem".

1998 Science Board Best Presentation Award

The Science Board reviewed the current Best Presentation Award practice (one award for each Scientific Committee and one for Science Board) and recommended one more award for the CCCC Implementation Panel starting from the Seventh Annual Meeting. The Secretariat should find additional funds ($50-70 CND) to support this practice.

The "Best Presentation Award" was made on the basis of nominations received from the audience at the Science Board Symposium. The winner was Dr. Cynthia Tynan (U.S.A.) for the paper entitled "*Redistributions of cetaceans in the southeast Bering Sea relative to anomalous oceanographic conditions during the 1997 El Niño*".

Other business

No other business was put forward for discussion.

Science Board recommendations

Discussion of Scientific and Technical Committee, Working Group and the CCCC Implementation Panel reports along with other issues led to a set of Recommendations for presentation to Governing Council for approval (see *Appendix (A)* to Council Report, ***Decisions of Council***).

Closing remarks

Dr. Kashiwai thanked the out-going Science Board members for the work they have done and expressed how much he enjoyed serving as the Science Board Chairman and working with them. He welcomed the new Chairman and members of the Science Board and wished them success in achieving goals of the Organization. The Science Board members warmly thanked Dr. Kashiwai for his effective leadership.

Scientific Program

An interdisciplinary one-day Symposium was organized by the Science Board to review the effects of the 1997/98 El Niño on the physical, chemical and biological state of the northern North Pacific Ocean. The object will be to establish a list of impacts that the climate anomaly has had on the ocean extending all of the way through the ecological system from the physics, to the plankton biology and onwards to the fisheries. The following papers were presented and Dr. Cynthia Tynan (U.S.A.) won the Best Presentation Award for this session.

The impacts of the 1997/98 El Niño event on the North Pacific Ocean and its marginal seas. Co-convenors: Howard J. Freeland (Canada), William T. Peterson (U.S.A.) and Al Tyler (U.S.A.)

James J. O'Brien (invited speaker). The big picture in the North Pacific in 1997-98

James E. Overland, J.M. Adams & N.A. Bond. Atmospheric anomalies in 1997: links to ENSO?

Robert L. Smith, A. Huyer, P.M. Kosro & J.A. Barth. Observations of El Niño off Oregon: July 1997 to present

William R. Crawford, J. Cherniawsky, M. Forman & P. Chandler. El Niño sea level signal along the west coast of Canada

Howard J. Freeland & R. Thomson. The El Niño signal along the west coast of Canada - temperature, salinity and velocity

Thomas C. Royer & T. Weingartner. Coastal hydrographic responses in the northern Gulf of Alaska to the 1997-98 ENSO event

Henry J. Niebauer. ENSO events and "regime shifts" in the North Pacific and Bering Sea

Vladimir I. Ponomarev, V.Yu. Arhipchuk & E.I. Ustinova. The ENSO signal in the north west Pacific

Andrei S. Krovnin, G.P. Vanushin, M.Yu. Kruzhalov, M.A. Bogdanov, B.N. Kotenev & V.V. Maslennikov. The state of the far east seas during the 1998/98 El Niño event

William T. Peterson. Hydrography and zooplankton off the central Oregon coast during the 1997-1998 El Niño event

Patricia A. Wheeler & Jon Hill. Biological effects of the 1997-98 El Niño event off Oregon: nutrients and chlorophyll distributions

Frank Whitney, D. Mackas, D. Welch; M. Robert. Impacts of the recent and past El Niño events on nutrient supply, primary production and plankton distribution off the B.C. coast

Stacy L. Smith & S.M. Henrichs. Phytoplankton collected by a sediment trap deployed in the middle shelf domain of the southeast Bering Sea during 1997

Kristen L.D. Milligan, C.D. Levings & R. DeWreede. Data compilation and preliminary time series analysis of

abundance of a dominant intertidal kelp species in relation to the 1997/1998 El Niño event

G.A. McFarlane & R.J. Beamish. Large numbers of sardines return to British Columbia waters

Cynthia T. Tynan. Redistributions of cetaceans in the southeast Bering Sea relative to anomalous oceanographic conditions during the 1997 El Niño

Akihiko Yatsu, J. Mori, H. Tanaka, T. Watanabe, T. Meguro, Y. Kamei & Y. Sakurai. Stock abundance and size compositions of the neon flying squid in the central north Pacific Ocean during 1979-1998

Oleg B. Feschenko. New point of view on El Niño mechanism

Skip M. McKinnell. Did Canadian sockeye invade the United States?..Another story from the 1997 El Niño

Craig McNeil, D. Farmer & M. Trevorrow. Dissolved O2 and N2 measurements at Station P4 during the 97-98 El Niño

Kenneth H. Morgan. Impact of the 1997/1998 El Niño on seabirds of the N.E. Pacific

Vadim P. Pavlychev. Sharp changes of hydrometeorological conditions in the northwestern Pacific in period of 1997/1998 El Niño event

John Piatt & D. Roseneau. Biological effects of the 1997/1998 El Niño in Lower Cook Inlet, Alaska

Endnote 1

Participants

Makoto Kashiwai (Chairman, Science Board)
Patricia Wheeler (Chairman, BIO)
Chang-Ik Zhang (Chairman, FIS)
John E. Stein (Chairman WG 8) for Richard F. Addison (Chairman, MEQ)
Paul H. LeBlond (Chairman, POC)

Other
Robin M. Brown (Chairman, TCODE)
Yutaka Nagata (Co-Chairman, CCCC/IP)
Patricia Livingston (Co-Chairman, CCCC/IP; Chairman-elect, Science Board)
William G. Doubleday (Chairman, PICES)
Warren S. Wooster (*ex-officio* Council member, PICES)
W. Doug McKone (Executive Secretary, PICES)
Alexander S. Bychkov (Asst. Executive Secretary, PICES)
Tokio Wada (Japan)
Ming-Yu Zhou (People's Republic of China)
Igor I. Shevchenko (Russia)
Alexander V. Tkalin (Chairman-elect, MEQ)

Endnote 2

Science Board Agenda
October 18 and 24, 1998

1. Welcome and Opening Remarks
2. Adoption of Agenda
3. Election of Science Board Chairman
4. Chairmen's Handbook
5. Reports of the Scientific and Technical Committees, CCCC IP, Working and Study Groups
   - Biological Oceanography Committee
   - Fishery Science Committee
   - Marine Environmental Quality Committee
   - Physical Oceanography and Climate Committee
   - Technical Committee on Data Exchange
   - CCCC Implementation Panel
   - Publication Study Group
6. Implementation of PICES VI Decisions
7. Implementation of 1997 Science Board Recommendations
8. Scientific Program for PICES Eighth Annual Meeting

9. Proposed Inter-sessional PICES Meetings/ 1998-2000
10. Proposed Publications/1998-1999
11. Proposed New Committees and Working/Study Groups
12 Proposed Travel Support
13. Relations with Other International
14. 1998 Science Board Best Presentation Award
15. Other Business
16. Summary of Science Board Recommendations
17. Closing Remarks

Notes for Consideration under SB Board Agenda Items

4. Chairmen's Handbook
   The Executive Secretary will provide a report on the final draft of the Chairmen's Handbook and consistency of these guidelines with the proposed changes to Rules of Procedure
5. Reports of the Scientific and Technical Committees, CCCC IP and Publication Study Group
   - 1998 Accomplishments
   - 1999 Planned Activities
   - Recommendations to Science Board
6. Implementation of PICES VI Decisions
   - Inter-sessional Workshops and Working Group Meetings (*96/S/1*)
   - Relations with other Organizations and Programs (*96/S/2*)
   - Publications (*97/S/3*)
   - Working Groups issues (*97/S/4* and *97/S/5*)
   - CCCC Program and CCCC Task Teams (*96/S/6*)
   - Travel Support (*97/S/7*)
   - Co-sponsorship for the Pandalid Symposium (*97/S/8*)
7. Implementation of 1997 Science Board Recommendations
   - Review of Activities and Strategic Plans for Science Board and Scientific Committees
   - Scientific Program and Schedule for PICES VII
   - Data Management for CCCC Program
   - Guidelines for co-sponsorship
   - Recommendations of the Study Group on Communication
8. Scientific Program for PICES Eighth Annual Meeting
   - Science Board Symposium
   - Topic Sessions
   - Workshops and Working Group Meetings prior to PICES VIII
   - Schedule for 1999 Annual Meeting
9. Proposed Inter-sessional PICES Meetings/1998-2000
   - Second Okhotsk Sea Workshop (November 1998, Nemuro)
   - MEQ Practical Workshop (summer 1999)
   - El Niño and Beyond (February 2000)
   - 1998 Decisions
10. Proposed Publications/1998-1999
    - Chairmen's Handbook
    - Proceedings of 1997 Science Board CCCC/BASS Symposium (Progress in Oceanography)
    - Proceedings of 1998 Science Board Symposium on 1997/98 El Niño Event
    - Proceedings of the Second Okhotsk Sea Workshop
    - Proceedings of the MODEL, REX and MONITOR Workshops
    - Bibliography on the Japan/East Sea
11. Proposed New Committees and Working/Study Groups
    - Publication Committee
    - Working Group on Subarctic Iron Fertilization/SF6 Tracer Experiment
    - Study Group on Marine Mammal and Seabird Ecology
13. Relations with Other International Organizations and Programs
    ICES and ICES GLOBEC
    NPAFC
    IPHC
    GOOS and LMR Panel of GOOS
    IGBP GLOBEC and IGBP JGOFS

Endnote 3

Composite Agendas of Scientific and Technical Committee Meetings

Biological Oceanography Committee
October 22, 13:30-17:30

1. Welcome to new members and attendees (Wheeler)
2. Approval or modification of agenda
3. Comments on Draft Strategic Plan (Wheeler)
4. BIO contact for PICES web page
5. PICES/ICES co-sponsorship of workshop on zooplankton ecology
6. PICES sponsored conference on El Nino and Beyond
7. Working Group 14 Micronekton Report. (Brodeur)
8. Advisory panel on Iron Fertilization Experiment (Harrison)
9. Election of new chairman for BIO (PICES Secretariat)
10. Proposed Data Visualization Workshop (TCODE, Brown)
11. Update on Bering Sea Ecosystem Metadata Base (Macklin)
12. 1998 Best Presentation Award
13. Working Group 11 Marine Birds and Mammals Report (Hunt)
14. 1999 Session Topics
15. Draft of report to Science Board

Fishery Science Committee
October 22, 13:30-17:30

1. Discussion and approval of agenda.
2. Review of the implementation of PICES VI decisions
   - 2.1 Review and comment the WG12 Report (97/S/1d)
   - 2.2 Relations with other organizations and program (97/S/2c)
   - 2.3 Publications of reports (97/S/3a, b)
   - 2.4 Future of Working Groups (97/S/3a, b)
   - 2.5 CCCC Program and CCCC Task Teams (97/S/6a, b)
   - 2.6 Travel support (97/S/7a)
   - 2.7 Co-sponsoring and Pandalid Shrimp Symposium (97/S/8)
3. Scientific items of the interests
   - 3.1 Review of scientific activity in the CCCC Program and the reports of REX, BASS and MODEL
   - 3.2 FIS role in the CCCC Program and the international GLOBEC
   - 3.3 SCOR WG 105 activity (97/S/7a)
   - 3.4 Review the work at PICES WG 12, and discussion of the WG recommendation for the next year
   - 3.5 Relationship with regional fisheries organizations or commissions
   - 3.6 Possibility to establish another working group
4. Proposals for the session topic for PICES VIII
5. Discussion of Best Presentation Award from FIS
6. Discussion of any other arising issues
7. Draft of report to Science Board

Marine Environmental Quality Committee
October 22, 13:30-17:30

1. Opening and Introduction of Members (All)
2. Minutes of MEQ business meeting, PICES 5 (M. Watson)
3. Business arising from Item 2
4. Report of WG 8, PICES VI (J. Stein)
   - (a) Proposal for Practical Workshop in Vancouver (R. Addison and C. Levings)
   - (b) Other WG 8 business
5. Report on MEQ scientific sessions (J. Stein and R. Addison)
6. Proposals for future MEQ scientific sessions (All)
7. Update on GIWA proposal (R. Addison)
8. Election of MEQ Chairman
9. Any other business

Physical Oceanography and Climate Committee
October 19, 11:00-12:00 and October 22, 13:30-17:30

Oct. 19 Part 1.
1. WG-10 report (Byun, Mooers)
2. WG 13 progress report (Nojiri)

Oct. 22 Part 2.
2. Other agenda items:
   - 2.1 Bering Sea Metadata Base
   - 2.2 Election of new Chairman
   - 2.3 POC Strategic plan: How should POC be most effective at monitoring and influencing scientific developments?
   - 2.4 PICES/POC-CREAMS relations (Riser, Kuh Kim)
   - 2.5 GODAE and ARGO (Riser)
   - 2.6 Okhotsk Sea Nomenclature (Lobanov)
   - 2.7 Japan/East Sea Bibliography
   - 2.8 Airborne salinity sensor (Masgrave)
   - 2.9 Contact for the PICES web page
   - 2.10 Data Visualization Workshop (Brown)
   - 2.11 Nemuro Okhotsk Sea Workshop (Lobanov)
   - 2.12 Iron Fertilization Experiment (Wong)
   - 2.13 Future symposia/Working Groups
   - 2.14 Best presentation award
   - 2.15 Other business

Technical Committee on Data Exchange
October 18, 09:00-17:30; October 22, 13:30-17:30

1. Introduction of Members
2. Review progress on items in the 1997 Workplan
   - 2.1 Updates and additions to the Long Term Time Series Dataset Inventory
   - 2.2 Improvements and extensions to List of Other Internet Resources
   - 2.3 Progress on merging the Inventory of Long Term Time Series with the Bering Sea Metadatabase (Megrey, Brown)
   - 2.4 Assistance with loading entries into the Bering Sea Metadatabase (Megrey)
   - 2.5 Assemble descriptions of monitoring programs for the 1997/1998 El Niño (Brown)
3. Updates on data management activities in PICES nations:
   - 3.1 Canada
   - 3.2 China
   - 3.3 Japan
   - 3.4 Korea
   - 3.5 Russia
   - 3.6 U.S.A
4. TCODE and other PICES Committees
   - 4.1 MODEL Task Team - Sources of High Quality Nutrient data
   - 4.2 CCCC-IP - National GLOBEC data management plans
   - 4.3 MEQ - entries in the Inventory of Long Term Time Series
   - 4.4 WG11 - Marine Birds and Mammals
5. Other Activities Relevant to TCODE
   - 5.1 NEAR-GOOS (Nagai)
   - 5.2 JGOFS - North Pacific Task Team (Brown)
   - 5.3 GLOBEC Program Office - Data Management Activities
6. Organization Details
   - 6.1 Revised rules for PICES Committees
7. TCODE Workplan for 1998

CCCC Program / Implementation Panel
October 18, 13:30-17:30

1. IP Co-Chairmen Reports
   - 1998 activities
2. Task Team Progress Reports
   - 1998 accomplishments
   - 1999 planned activities
   - Recommendations for Science Board
3. Status of cooperation with other programs
   - IPHC

- ICES GLOBEC
- IGBP GLOBEC
- NPAFC
- JGOFS
- LMR-GOOS

4. Other issues
   - Status of national GLOBEC Programs of PICES member nations
   - Data management issues and recommendations
   - ICES/PICES workshop on zooplankton production ecology
   - Backward facing workshop on regime shifts
   - North Pacific Iron Fertilization Experiment
   - CREAMS
   - Contact for PICES web page
   - CCCC-IP composition

Endnote 4

Beyond El Niño: A conference on Pacific climate variability and marine ecosystem impacts, from the Tropics to the Arctic

The very strong El Niño of 1997-1998 has stimulated interest in the effect of such events on longer term changes in the ocean and on the response of marine ecosystems and ultimately of marine fisheries. The Conference, tentatively scheduled for April 2000, will look at interannual, decadal, and interdecadal scales of variability in the Pacific from the tropics north to the Arctic. In each case, it will review the evidence for variability, the consequences of such variability, the mechanisms of interaction with the ecosystems, and the implications for fishery production and management. It will also examine the impacts of human activities on our ability to detect and interpret these effects. Preference will be given to papers that deal with synthesis of observations and elucidation of mechanisms. Participation of scientists from countries around the Pacific Basin will be welcomed**.**

An informal planning group met in Fairbanks on October 20, to discuss further development of plans for the proposed conference described in the above summary description. Participants were:

PICES: William G. Doubleday, Paul H. LeBlond, W. Doug McKone, Warren S. Wooster

IPHC: Steven Hare

Representatives of other sponsoring organizations, IATTC and ISC, were not able to attend. An observer from NPAFC, Ms. Hiroko Omori, was present for the discussions.

Recommendations of the earlier discussions, on August 12, 1998, in Seattle, were reaffirmed, some being repeated below, and agreement was reached on the followings matters:

Sponsorship: A report on planning progress and an invitation to sponsor the conference should be forwarded to NPAFC in time for consideration at its next meeting (starting November 1). An approach had been made to SCOR seeking its sponsorship, and decisions of PICES VII concerning the conference should be provided to SCOR promptly. Initial discussions have been held with IOC and FAO, and these should be followed up. An approach should also be made to CLIVAR.

Venue and time required: The preferred

time for the conference is during the first half of April 2000, the preferred place La Jolla, California, at the Scripps Institution of Oceanography (SIO). The breadth of subject coverage would seem to require a conference of four-days' duration.

Costs: The PICES Secretariat should prepare an estimated budget, with alternative scenarios on the level of supporting participant travel and expenses. The estimates can be used to seek financial support for the conference from its sponsors and other sources, the level of available support determining which scenario to apply.

Steering Committee: Drs. LeBlond and Wooster agreed to continue as Co-Chairmen. If NPAFC agrees to co-sponsor the conference, it should be invited to designate a member. A local arrangements committee will be required in La Jolla, and a representative of SIO should be asked to designate a member along with those from IATTC and the Southwest Fisheries Science Center (SWFSC).

Structure of conference: With a four-day conference, one half-day would be devoted to opening and keynote lecture(s) and to the summary by a panel made up of convenors. The conference would consist of four sections:

- evidence for the variability
- consequences of that variability
- mechanisms of interaction with the ecosystems
- implications for fisheries

Each of these sections would deal with the subject matter at the three scales (event/ interannual, decadal, interdecadal/ regime shift). As proposed at the earlier planning meeting, there should be no concurrent sessions. Contributions would be reviewed by convenors and selected for oral and for poster presentation. Preference for oral presentation would be given to papers dealing with synthesis of observations and elucidation of mechanisms.

Selection of convenor: Careful identification and recruitment of appropriate convenors representing the principal disciplinary areas and geographical regions is essential to success of the conference. The Steering Committee will seek suggestions from the Science Board and the sponsoring organizations and will agree on those to be approached before the end of the year.

Publication (from previous discussions): Selected papers from the conference should be published, preferably in an established professional journal that accepts conference papers - examples included *Fisheries Oceanography*, *Progress in Oceanography*, *Fisheries Research*, and special publications of the *Canadian Journal of Fisheries and Aquatic Sciences*. The convenors would serve as guest editors of such a publication.

Announcement and publicity: The meeting would be announced by PICES, through its web page and through mailouts and journal announcements by PICES and the other sponsoring organizations.

The Steering Committee seeks the agreement and support of Science Board and the Governing Council for its continuing work which will be conducted for the most part by correspondence (e-mail).

Endnote 5

Working Group: An Iron Fertalization Experiment in the Subarctic Pacific Ocean

Rationale: Iron fertilization of HNLC (High nutrients low chlorophyll) water is one possible approach to remove CO_2 from the atmosphere to combat global warming caused by GHGs. Natural iron fertilization has been hypothesized to control glacial/interglacial shift in atmospheric CO_2. Iron fertilization experiments were repeatedly done in the equatorial Pacific under the programs IRONEX I and II, and recently in the Southern Ocean. The subarctic Pacific, with different biology and unique water structure (e.g. strong pycnocline, fresher mixed layer) from the other two regions, is the only HNLC region without such experiment to assess the CO_2 removal question related to iron.

This proposed working group under PICES will have the following terms of reference:

1. Examine the reasoning for a subarctic iron experiment
2. Examine the scale, disciplines, and resources (personnel and ships) required ensuring success
3. Design the experiment and its timing, particularly, the suite of chemical measurements and forms of iron, the biological parameters, the tracking of the spread of iron-induced bloom using SF_6 tracer.

The membership for the Working Group may be benefited from expertise of S. Takeda, M. Kiyono (Japan), P. Harrison, N. Price, C.S. Wong (Canada), K. Van Scoy, Mark Wells (U.S.A.), subjected to national nominations for PICES and not necessarily limited to the above.

PROPONENT: C.S. Wong (IOS, Canada)
CO-PROPONENT: S. Takeda (CRIEPI, Japan)

REPORT OF BIOLOGICAL OCEANOGRAPHY COMMITTEE

The Biological Oceanography Committee met on October 22 (13:30-16:20). The Chairman Dr. Patricia A. Wheeler called the meeting to order and welcomed the members of the Committee and observers (see Endnote 1). Dr. Vladimir I. Radchenko served as rapporteur.

Suggestions were made about the agenda and the revised agenda was approved.

Dr. Wheeler distributed copies of a draft strategic plan for the BIO Committee that reviewed past activities and outlined plans for the future. The BIO Committee agreed with the recommendations for further integration of symposia and sessions with other PICES committees and international organizations, increased level of attendance for science committees, working groups, and task teams, and increased support for students to attend PICES meetings.

Dr. Wheeler reviewed the PICES rules for choice of the new BIO Chairman. The formal election was conducted by Dr. W. Doug McKone, PICES Executive Secretary. Dr. Tsutomu Ikeda was nominated and elected by acclamation in accordance with the Rules of Procedure.

The PICES Secretariat would like to expand the information reported through its web page and BIO selected Dr. Linda Jones to serve as the initial contact advisor for the Secretariat.

Dr. Wheeler reported on the plans for an ICES/PICES workshop on Zooplankton Ecology in April/May of 2000. BIO discussed the proposal and recommends Dr. T. Ikeda, BIO Chairman-elect to nominate a Committee Member to serve as the main PICES representative in planning this workshop.

Dr. Wheeler reported on the PICES plan for a 4-day conference on "*El Niño and Beyond: A conference on Pacific climate variability and marine ecosystem impacts from the Tropics to the Arctic*" in March or April 2000. The BIO Committee discussed the proposed conference and voted by acclamation in favor of supporting the proposal.

Dr. Richard D. Brodeur reported on the first meeting of Working Group 14 on Micronekton. Working Group 14's terms of references were expanded to include the ecological role of micronekton in addition to sampling methods. The first report of Working Group 14 is attached (see Endnote 2).

Dr. Allen Macklin gave an update on the Bering Sea Metadata project and invited input of additional data.

Mr. Robin M. Brown described the proposal for a TCODE Workshop on Data Visualization. The BIO Committee discussed the proposal and voted by acclamation in favor of supporting the proposal.

Dr. Paul J. Harrison described the proposal for a CCCC Advisory Panel to help develop the proposal for an Iron Fertilization Experiment in the North Pacific. The BIO Committee discussed the proposal and recommended it for Science Board approval by acclamation with special note to future CCCC Advisory Panel members on the necessity of careful controls and addition of measurements to understand underlying processes.

Nominations were tabulated for the Best Presentation Award. Based on these nominations the BIO Committee selected a short list of seven candidates and voted for Dr. Kazuaki Tadokoro (with T. Sugimoto), "Importance of low saline advected water from the Sea of Okhotsk for spring blooming of phytoplankton in west side of the North Pacific Ocean", as the 1998 Best BIO Presentation.

Dr. George L. Hunt and Dr. Hidehiro Kato presented a summary of WG 11 progress (see Endnote 3). The final report will be submitted to BIO in spring 1999. BIO will review the final report and recommendations, and forward it with comments to SB prior to PICES VIII. WG 11 proposed several suggestions for establishing a three year Study Group on Marine Mammal and Seabird Ecology. The BIO Committee discussed these proposals and recommended approval by Science Board. On behalf of the BIO Committee, Dr. Wheeler thanked Drs. Hunt and Kato for their efforts.

The BIO Committee discussed potential Topic Sessions for PICES VIII. Past unselected topics and new topics were discussed. A short list of possible topics was generated and the Committee selected "Recent findings of GLOBEC and GLOBEC-like programs in the North Pacific" as the next BIO/CCCC Topic Session. Possible BIO Co-Conveners are Drs. Vladimir I. Radchenko, Mark D. Ohman and David L. Mackas. The topic "Coastal eutrophication, phytoplankton dynamics, and harmful algal blooms" as a special MEQ/BIO session was also approved if scheduling permits. Dr. Kwang-Woo Lee was recommended as a possible Co-Convener. The BIO Committee noted that this MEQ/BIO session might have greater attendance at PICES IX in Japan. Other topics suggested for PICES IX include "Marine Birds and Mammals", "The Importance of Microbial Loop Processes and Cycling of DOC", "Zooplankton Dynamics and Top-down Control" and as a result of the Science Board Symposium, "A Regional Comparison of Annual Production".

Dr. Wheeler announced the schedule for the availability of the drafted minutes from this meeting and requested comments by 13:30, October 23, and written final approval by 18:30, October 23.

Scientific Program

The following scientific papers were presented from the BIO Committee sponsored part of the program.

Controlling factors for lower trophic levels (especially phytoplankton stocks). Co-Convenors: Vera Alexander (U.S.A.), Akira Taniguchi (Japan) & Paul J. Harrison (Canada)

Akihito Shiomoto. Controlling factors for phytoplankton biomass in the subarctic North Pacific

Karl Banse. Phytoplankton fall blooms in the open western and eastern subarctic Pacific: added iron or relaxed grazing?

Paul J. Harrison, P. Boyd & R. Goldblatt. Is there a connection between dust and fish? How is bottom up and top down control turned on and off?

Takashige Sugimoto & K. Tadokoro. Interdecadal variations of plankton biomass in the North Pacific

Kazuaki Tadokoro & T. Sugimoto. Importance of low saline advected water from the Okhotsk Sea for spring blooming of phytoplankton in west side of the North Pacific Ocean

Katsuyuki Sasaki, K. Kawasaki & K. Nakata. The change of chlorophyll *a*, nutrients and photosynthesis from subtropical to transition region in June around Kuroshio Extension

Terry E. Whitledge & D.A. Stockwell. Deep phytoplankton uptake and growth on the southeast Bering Sea shelf in 1997 and 1998

Jun Nishioka, S. Takeda & C.S. Wong. Change in the concentrations of iron in different size fractions during a phytoplankton bloom in control ecosystem enclosures

Endnote 1

Participants

Canada
Paul J. Harrison
David L. Mackas

China
Ming-Yuan Zhu

Japan
Takashige Sugimoto
Atsushi Tsuda

Korea
Jae-Hyung Shim

Russia
Vladimir I. Radchenko

U.S.A.
Linda Jones
Michael M. Mullin
Patricia A. Wheeler

Endnote 2

Report of Working Group 14
Effective sampling of micronekton to estimate ecosystem carrying capacity

The meeting was chaired by Dr. Richard D. Brodeur, since neither of the two Co-Chairmen (Robison/Parin) were able to attend.

Brodeur noted the complete absence of Chinese and Korean members and the representation of Russia by a non-WG 14 member. PICES should act to guarantee participation by these nations in subsequent WG 14 meetings.

Introductions

WG 14 members and other attendees introduced themselves and their interests in WG 14. Interests expressed included:

- Micronekton distributions
- Micronekton feeding ecology
- Role of micronekton in exporting Carbon from surface waters
- Position of micronekton in North Pacific food web
- Micronekton as food for other predators (salmon, other fish, mammals, birds)
- Micronekton life histories.

History of WG 14

Dr. Brodeur gave a brief overview of the genesis of WG 14. The idea was originally proposed by Drs. Jeffrey M. Napp and Brodeur two years ago and was approved by PICES BIO Committee in 1997. Original goal of the Micronekton WG proposal was to examine the various collection techniques currently being used to sample micronekton. BIO subsequently expanded this mandate to encompass an overall assessment of our current understanding of micronekton biology and their role in the North Pacific.

Terms of Reference

Dr. Patricia Wheeler (BIO Chairman) reviewed the Terms of Reference for WG 14 as well as general Working Group Guidelines. The guidelines include:

- All WG 14 activities to be coordinated by the two Co-Chairmen.
- Product of WG 14 is to be a report presented to BIO after 3 years.
- May be followed up by special workshops, etc.
- WG 14 will report annually to both BIO and FIS Committees at PICES Annual Meetings.
- Any changes to the Terms of Reference must be approved by BIO and SB.

Definition of micronekton

A discussion ensued as to how WG 14 will define micronekton for its purposes. It was pointed out that there are a variety of definitions based variously on size, swimming ability, Reynolds numbers, etc. The basic question revolved around whether to include adult euphausiids and other large zooplankton which border on micronekton since this would significantly increase the scope of the WG. It was decided that since WG 14 will focus primarily on oceanic rather than shelf communities, micronekton will be defined to include: mesopelagic fishes, squids, pelagic shrimps and mysids, plus adult euphausiids. The group decided not to include shelf forage fishes such as capelin, herring, and sand lance as these were already covered by PICES Working Group 3.

Past studies of micronekton and availability of existing data

Dr. Brodeur pointed out that although a substantial micronekton literature does exist, it is often neither widely available nor widely read. Particularly important starting points might include the 1988 two-volume set from the joint NSF-JSPS Honolulu Symposium edited by Nemoto and Pearcy, plus a special volume of Biological Oceanography devoted to micronekton, also edited by Dr. William G. Pearcy. A list of other notable papers was provided by Dr. Brodeur to assist those WG members less familiar with the micronekton literature.

Sampling problems

A discussion ensued regarding likely sampling problems that the group might want to address. As a starting point, Dr. Brodeur suggested the WG conduct an e-mail survey of various micronekton researchers in order to establish what gears are currently in use around the world. Such a survey should also include the opportunity for respondents to outline collection problems associated with various gear-types. It was also noted that the survey should ask why various agencies collect micronekton, since there was a feeling among the members that in many cases micronekton are primarily by-catch, and are rarely targeted explicitly.

Dr. Pearcy noted that big nets are not great for quantifying micronekton due to problems with unquantified levels of escape and avoidance behavior. Alternatives might include the use of acoustics or devices such as “pop-up nets”.

Dr. Michael M. Mullin pointed out that much of the initial work on micronekton was motivated by US Navy interests in deep scattering layers. This source of funding no longer exists and so it was noted that future efforts to mount targeted sampling programs for micronekton may be harder to fund.

The Japanese are currently collecting acoustic data on micronekton, but since they have yet to establish target strengths, they have been unable to estimate biomass. There was a general consensus that as acoustics will figure prominently in future micronekton studies, target strength research should be encouraged.

Other possible sampling techniques show some promise for studying micronekton, including the use of video cameras and ROV’s. These techniques may prove particularly useful for understanding the behaviors of micronektonic species, especially those that spend part of the diel cycle very close to the bottom (e.g., some mysids and euphausiid species) where they are unavailable to traditional sampling gear. It was suggested that combinations of nets, acoustics and cameras may be the optimal solution.

Planned micronekton work for the coming year

i. There will be a Hokkaido University micronekton sampling program (led by Dr. Yasunori Sakurai) in the Gulf of Alaska and the Bering Sea in the summer of 1999, aboard the *Oshoro Maru*. Data will first be collected via stomach analysis of micronekton predators (e.g. salmon)

collected with gillnets. This will be followed up with midwater trawl surveys specifically targeting micronekton. The trawl to be used will measure 4m x 20m and will primarily target small squid.

ii. There is currently funded U.S. proposal (led by Sinclair and Pearcy) to sample micronekton in the Green Belt region of the Bering Sea and the first cruise will take place in April 1999. The Green Belt region is an important area for feeding by marine mammals and birds.

iii. US GLOBEC Gulf of Alaska Monitoring component currently runs a north-south line that samples for micronekton at least once a year. There may also be micronekton sampling during two cruises in the Bering Sea in April and June of 1999 (led by Coyle).

iv. GLOBEC Canada is currently beginning to think about plans for their Phase II funding cycle. WG 14 should keep in touch with GLOBEC Canada to see whether field work might include the collection of micronekton samples.

v. Drs. Brodeur, Peterson, and Wilson are undertaking a sampling program that used Methot nets to sample micronekton off the outer Continental Shelf from California to B.C. with sampling in 1995 and 1998. There is also a proposal to use NOAA vessels returning to Seattle via Kodiak to collect micronekton during the winter in the Subarctic Gyre.

vi. Dr. Skip McKinnell (Canada) offered the use of a collection of some 60 dolphin stomachs collected in the central north Pacific Transition Zone during the summer of 1991 as potential sampling devices of micronekton.

WG 14 Plans for the coming year

- e-mail survey of researchers currently collecting micronekton.
- literature review of micronekton studies and circulation of key papers to all WG members
- Dr. Brodeur proposed a draft Table of Contents for the WG 14 final report to BIO. A discussion arose as to whether the group wanted to aim for a publication quality product that would serve as a "state of our existing knowledge" document about micronekton in the North Pacific. Dr. Brodeur will raise the issue with BIO.
- current plan is for WG 14 to meet again at next year's PICES Meeting in Vladivostok, Russia, or perhaps in conjunction with the MONITOR Task Team meeting in Hakodate, Japan, prior to PICES. If we cannot ensure sufficient attendance at that meeting we may approach BIO for funds to meet at some more convenient time.
- there will be some need to change the membership of the WG to account for gaps in expertise and/or national representation.

Endnote 3

Report of Working Group 11
Consumption of Marine Resources by Marine Birds and Mammals in the PICES Region

PICES WG 11 met October 14 to 17, 1998, in Fairbanks, Alaska, U.S.A., to estimate the biomass of prey required to support populations of marine mammals and seabirds in selected regions of the North Pacific Ocean. Since the last meeting of WG 11 in Pusan, Republic of Korea, we have completed assembling the available data on the sizes of populations of marine mammals and seabirds in 14 subregions of the PICES area, and the types and amounts of prey eaten by marine mammals and seabirds in these regions during the summer where

sufficient data permitted calculation of prey consumption based on estimated energy demand. The process of summarizing this data base is progressing well, and this report includes preliminary examples of the types of overview that we will produce. We expect to circulate our draft Final Report for comment in February 1999, and to submit the Final Report in May 1999.

WG 11 was asked for its assistance in supplying information to TCODE on the availability of time series data for marine mammals and seabirds in the PICES area (see later TCODE section of report).

WG 11 recognizes that PICES will continue to require sound information on marine mammals and seabirds. To the scientists involved in WG 11, it is clear that the PICES community has only begun to examine the ecological roles of the marine mammal and seabird components of North Pacific marine ecosystems. Therefore, WG 11 strongly recommends that PICES establish a Technical Committee on Marine Mammal and Seabird Ecology that would report to the Science Board. An important role of this committee would be to encourage the integration of marine mammal and seabird scientists into the PICES community. The Technical Committee would provide information on marine mammals and seabirds to the PICES Scientific Committees, and would identify important problems, scientific questions, and knowledge gaps that needed to be addressed. (See Recommendation section for details.)

Preface

The third meeting of the PICES WG 11 was held 14 to 17 October, 1998, in Fairbanks, Alaska, U.S.A. The purpose of the meeting was to finalize our estimates of marine mammal and seabird population size, the types of prey consumed, and the amounts of prey required to support marine mammal and seabird populations in the North Pacific Ocean, and to begin the compilation of our Final Report. Marine birds and mammals are important components of the marine environment for many reasons. As occupants of the highest trophic levels in marine ecosystems, they are important not only as consumers and processors of carbon, but also as key components in the composition and structuring of marine ecosystems. Furthermore, because of their physiology, mobility, and longevity, marine birds and mammals integrate environmental features and conditions over a broad range of temporal and spatial scales and therefore can provide useful insight into the status of marine ecosystems over time. The Terms of Reference given to WG 11 referred explicitly to the need to assess the role of marine birds and mammals in the consumption of marine resources (1996 PICES Annual Report).

This WG was proposed by BIO Committee and BIO believes that this WG activity will contribute to the ecosystem studies contemplated in CCCC. Dr. Linda Jones will be the point of contact for BIO. It is the intent of BIO that this WG encourage communication with CCCC/IP, with overlapping membership where possible.

Summary of WG 11 accomplishments

In the intersession between the Pusan meeting and the Fairbanks meeting, members of the WG assembled 84 working tables of the species-specific summertime marine mammal and seabird abundance, food habits and prey consumption for the 14 subregions (Figure 1) that the WG identified within the PICES area as agreed in Pusan. Except for the checking of a few cells for which questions remain open, these tables are now as complete as we can make them, and they will provide the data on which our Final Report will be based.

The tables vary in completeness because for some species and subregions data were unavailable. For some subregions and species, there is a solid record of the populations present and the relevant food habits, and it has been possible to estimate, by prey type, the amount of prey consumed during the summer season. In other regions or for certain populations, we have been able to estimate the sizes of the populations

present and their energy requirements, though a lack of knowledge of the mix of prey types taken has prevented the WG from developing quantitative estimates of consumption by prey type. In these cases we have provided an upper and lower estimate of the amount of prey consumed by dividing energy demand by the energy density of energy poor and energy rich prey, respectively.

To facilitate the use of the Final Report, and to emphasize patterns of energy consumption and prey use among subregions, we have developed a series of summary tables. In general, there is a greater wealth of information about seabirds than is available for marine mammals, and because the data for the pelagic distribution of seabirds was largely available in a single data base (the CAMRIS data base developed by Glenn Ford for the U.S. Fish and Wildlife Service), somewhat greater progress has been made in synthesizing the seabird data. Because some species of marine mammals move through two or more of the subregions, there are species for which a total population estimate is available, but the proportion in each subregion cannot be determined. Therefore, to show the size of marine mammal populations throughout the entire PICES area, a table summarizing the estimated abundances of marine mammals in the PICES will be constructed.

As an example of the direction that our summary efforts are taking, Table 1 provides an overview of the seabird survey effort in each of the subregions of the PICES area in relation to their surface areas. Based on these surveys and counts of birds at colonies, we developed estimates of the sizes of seabird populations in each of the subregions, their density, biomass per unit area, and energy requirements (Table 2). Although species richness is roughly equivalent across the subregions, there are considerable differences among subregions in the density of seabirds and in their energy requirements. For instance, in both the subarctic and transition zones, energy demand is higher on the western side. In Table 3, we summarize estimates of the minimum and maximum expected prey consumption by seabirds in each subregion, based on energy demands and assumptions about the maximum and minimum likely energy density of prey used. Again, there are large differences among the subregions in the flux per unit area to seabirds. In the Final Report, we hope to be able to relate these differences to variations in marine productivity or food web structure in the subregions.

The WG has identified regions for which data exist that were unavailable to us. We also identified certain subregions in which ongoing research suggests that changes in populations or food habits have occurred since the compilation of the data base on which its report is based. Additionally, because of the vast region and large number of species covered, we found it necessary to combine species of prey used into broad categories. We thus acknowledges that additional work could greatly enhance our knowledge of prey use or changes in populations or food habits in response to climate change.

In assessing our accomplishments, members of WG 11 expressed frustration at the limited opportunity for interdisciplinary collaborations with other groups within PICES. This problem was not because of a lack of interest on the part of other members of PICES, but rather the coincidence of our WG sessions with those of other groups with which we were to have interacted prevented us from contributing to their sessions. This was particularly unfortunate, as in the Terms of Reference it was specified that it was the intent of BIO that WG 11 be encouraged to develop communication with CCCC/IP by having overlapping membership where possible.

TCODE

WG 11 was asked for its assistance in supplying information to TCODE on the availability of time series data for marine mammals and seabirds in the PICES area. Because the 1998 meeting of WG 11 is the WG's last, it was clear that it would not be practical for it to take on the task of assembling the information requested.

However, individual WG members volunteered to assist TCODE on an *ad hoc* basis with the following suggestions for strengthening the TCODE meta-database:

1. Identifying meta-databases already in existence that may hold information relevant to marine mammals and seabirds in the PICES area (e.g., International Whaling Commission Scientific Committee, NOAA); links should be established to these and other databases, and

2. Compiling a list of marine mammal and bird scientists who may have relevant data sets, and who may be interested in listing these in the TCODE database (it is recommended that the TCODE Chairman contact the identified scientists directly to advise them of TCODE's objectives and to solicit their input.

Recommendation for the future inclusion of marine mammal and seabird scientists in PICES

As WG 11 concludes its work concerning the consumption of prey by marine mammals and birds in the PICES area, we are looking ahead to the continuing needs of PICES for sound information on marine mammals and seabirds. To the scientists involved in WG 11, it is clear that the PICES community has only begun to examine the ecological roles of the marine mammal and seabird components of North Pacific marine ecosystems. The participation of marine mammal and seabird ecologists in PICES would provide an important contribution to the understanding of many other issues, such as ecosystem responses to climate change, being addressed by scientists within the PICES forum.

It is difficult to see how ecosystem-oriented discussions of marine science can be considered complete without including components of marine ecosystems as numerically and ecologically important as marine mammals and seabirds. Yet at present, no efficient mechanism exists to serve as a focal point for bringing the contributions of marine mammal and seabird scientists into the mainstream of PICES deliberations. That omission represents a loss for marine mammal and seabird scientists whose work would benefit from the existence of an effective international forum for interdisciplinary collaboration in the North Pacific. It also represents a loss for other PICES scientists who do not have the benefit of active involvement with marine mammal and seabird scientists from the North Pacific rim. Therefore, we strongly recommend that there should be a functional presence of marine mammal and seabird science in PICES. The best way to encourage that presence is through the establishment of a group of technical experts that can develop a dynamic marine mammal and seabird voice within PICES, and can foster and maintain effective cross-disciplinary links to other groups within PICES.

We propose that PICES form a Technical Committee on Marine Mammal and Seabird Ecology that will continue on a long-term basis. Extending and expanding the terms of reference of WG 11 would not be desirable; a new marine mammal and seabird group with broader terms of reference should be established. An important function of the Technical Committee will be to encourage a two-way exchange of information between the marine mammal and seabird science communities and the disciplines represented in PICES. Additionally, the Technical Committee will function to support a broader participation of the marine mammal and seabird scientific communities in the activities of PICES.

Reporting:

The Technical Committee on Marine Mammal and Seabird Ecology will report to the Science Board.

Membership:

The Technical Committee on Marine Mammal and Seabird Ecology will consist of 1 marine mammal and 1 seabird scientist from each PICES country, with an intended minimum membership of at least 4 marine mammal and 4 seabird scientists. This

minimal number is requisite to creating a critical mass.

Terms of Reference:

1. Provide information, when requested, to PICES Scientific Committees, the CCCC Program and other PICES Task Teams on the biology and ecological roles of marine mammals and seabirds;
   For example, summarize the results of ongoing monitoring of marine mammal and seabird populations around the Pacific Rim for indications of environmental change;

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 reports and symposia; e.g., assemble time series data on seabird and marine mammal populations and examining them for congruence with other indices of change in the biological and physical environment;

4. Develop strategies to capitalize on opportunities for collaborative, interdisciplinary research.

DRAFT

Table 1. Surface areas and marine bird survey effort for subregions of the PICES area.

REGION	CODE	AREA Km^2	SURVEY EFFORT Km^2	Coverage (% of subregion)
Eastern Bering Sea Shelf	BSC	1,021,950	35,485	3.47
Western Bering Sea and Basin	BSP	1,357,655	8,755	0.64
Gulf of Alaska	ASK	428,520	15,735	3.60
California Current, North	CAN	166,455	3,446	2.07
Eastern Sub-Arctic	ESA	3,621,580	2,490	0.06
Western Sub-Arctic	WSA	2,168,315	4,340	0.20
Kamchatka and Kurile Islands	KM/KL	111,570	12	0.01
Sea of Okhotsk	OKH	1,599,225	0	0
California Current, South	CAS	128,620		
Eastern Transition Zone	ETZ	7,808,530	6,065	0.08
Western Transition Zone	WTZ	6,337,700	11,805	0.18
Kuroshio/Oyashio Current s Zone	KR/OY	348,455	700	0.20
Sea of Japan	SJP	1,006,455	0	0
East China Sea	ECS	435,235	0	0

DRAFT

Table 2. Summary of seabird species richness, density and energy demand within subregions of the PICES area.

Subregion	Number of Seabird Species	Total Birds Present	Seabird Density Individuals·km^{-2}	Seabird Biomass (kg·Km^{-2})	Seabird Energy Demand (kJ·km^{-2}·d^{-1}) x 10^3
BSC	38	34,690,000	33.9	18.6	36.6
BSP	46	22,325,000	16.4	7.0	14.0
ASK	39	16,139,825	37.7	21.5	42.2
CAN	51	8,426,975	50.6	15.1	32.8
ESA	24-36	7,905,000	2.2	0.8	1.5
WSA	30-31	14,945,000	6.9	3.8	4.5
KM/KL	47-54	2,635,000	23.6	15.6	26.8
OKH	41-43	10,005,000	6.3	1.8	4.0
CAS	48	2,720,000	21.1	16.0	28.1
ETZ	35-40	5,850,000	0.7	0.4	0.6
WTZ	35-40	56,620,000	8.9	3.2	6.4
KR/OY	56-63	15,555,000	44.6	11.8	24.7
SJP	30-31	365,000	0.8	0.1	0.1
ECS	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA

DRAFT

Table 3. Estimated Total Prey Consumption by Marine Birds in subregions of the PICES area. (metric tonnes per 92 day summer)

	Prey Consumption	
Subregion	Assuming all Prey with Energy Density of 7kJ/g	Assuming all Prey with Energy Density of 3kJ/g
BSC	655,753	1,530,091
BPS	333,066	777,155
ASK	316,396	738,259
CAN	98,209	229,155
ESA	91,561	213,641
WSA	240,237	560,554
KM/KL	52,238	121,889
OKH	112,647	262,841
CAS	63,151	147,356
ETZ	83,722	195,352
WTZ	712,341	1,662,130
KR/OY	150,348	350,814
SJP	2705	6,310
ECS	No Data	No Data
Total	2,912,374	6,795,547

Appendix 1

Participants

Canada
Ken Morgan

China

Japan
Norihisa Baba
Hidehiro Kato (Co-Chairman)

Korea

Russia

U.S.A
John L. Bengtson
George L. Hunt, Jr. (Co-Chairman)
Chadwick V. Jay
Lloyd F. Lowry

Endnote 4

Strategic Work Plan for BIO Committee

Presented by Patricia A. Wheeler

MISSION: The mission of the Biological Oceanography Committee is to promote and coordinate biological oceanography and interdisciplinary research in the northern North Pacific. Biological oceanography plays a key intermediary role with respect to the other PICES standing committees. For example, lower trophic levels may be the most directly affected by processes considered by the Physical Oceanography and Climate Committee. Biological Oceanography also plays a central role in defining "normal" conditions against which changes of interest to Marine Environmental Quality can be measured. Finally, Biological Oceanography interacts with the Fisheries Science Committee to provide scientific advice on interactions of harvested species with both lower trophic levels and with other non-harvested "top predators" such as marine mammals and birds.

RESPONSIBILITIES:

- Develop scientific programs for annual and inter-session meetings;
- Formation of working groups for key areas of interest;
- Participation in CCCC Implementation Panel and Task Teams;
- Develop coordination of activities with other international and national programs.

DEVELOPMENT: The developmental phase of BIO activities covers the period from 1992-1995. During this phase the biological oceanography scientific programs for annual meetings were generated. The next phase 1996-1998 evolved into more jointly sponsored sessions with the other scientific committees and the formation of two working groups.

Activities of BIO Committee:

PICES I (1992)

PICES II (1993) Recommend development of straw man proposal for PICES-GLOBEC

PICES III (1994) Symposium "Structure and ecosystem dynamics of the subarctic and transition zone North Pacific – is the east like the west? (Co-Convenors: Brodeur and Taniguchi)

PICES IV (1995) Topic Session "Factors affecting the balance between alternative food web structures in coastal and oceanic ecosystems" (Co-Covenors: Omori and Wang)

PICES V (1996) Topic Session "Regional and interannual variants in life histories of key species" (Co-Covenors: Mackas and Ikeda)

Recommended increased BIO representation for CCCC-IP, REX Task Team (Hunt) and MODEL Task Team (Jones)

Zhang appointed to SCOR WG 105 as PICES representative and as rapporteur to BIO and FIS for SCOR WG 105

Recommended WG11: Consumption of marine resources by marine birds and mammals in the PICES region"

PICES VI (1997) BIO/FIS Topic Session "Micronekton of the North Pacific: Distribution, biology and trophic linkages" (Co-Convenors: Brodeur and Kawaguchi)

BIO/MEQ Topic Session "Harmful algal blooms: Causes and consequences" (Co-Convenors: Forbes and Shim)

Recommended WG14: Effective sampling of micronekton to estimate ecosystem carrying capacity

PICES VII (1998) BIO Topic Session "Controlling factors for lower trophic levels (especially phytoplankton stocks)" (Co-Convenors: Alexander, Taniguchi, and Harrison)

POC/BIO Topic Session "Carbon cycle in the North Pacific Ocean" (Co-Convenors: Tsunogai and Wong)

MEQ/BIO Topic Session "Contaminants in higher trophic level biota – linkages between individual and population responses" (Co-Convenors: Addison and Jones)

Recommended PICES/ICES collaboration for GLOBEC zooplankton workshop in 2000

Approved recommendation for Iron Experiment Advisory Panel

STRATEGIC PLAN FOR THE FUTURE

- Increased cooperative activities with other components of PICES;
- Increased interaction with other international organizations;
- Increased targeted activities for recognized scientific issues for which international coordination and support is needed;
- Improved member participation in committees, task teams and working groups;
- Increased inter-session work via e-mail for committees and working groups and shorter annual meetings;
- Increased travel support for student participation at annual meetings.

REPORT OF FISHERY SCIENCE COMMITTEE

Approval of agenda

The Chairman, Dr. Chang-Ik Zhang, opened the meeting. The agenda was reviewed and approved by all members (see Endnote 1). The Chairman appointed Dr. Gordon H. Kruse as rapporteur. The FIS Committee welcomed one new member, Dr. Tokimasa Kobayashi (Japan).

Review of WG 12 Report

Dr. Robert S. Otto summarized the activities of WG 12. WG 12 convened its third meeting in Fairbanks, Alaska, U.S.A., during October 14-17, 1998 (see Endnote 2). The main objectives of this meeting were to review ocean processes that may control crab and shrimp recruitment and to review problems of sampling and data analyses used to assess trends in abundance. 8 of 15 members from 5 countries participated in the meeting of WG 12.

Dr. Otto discussed a number of WG 12 recommendations:

1. Continue WG 12 activity beyond its current (third) year and to modify the Terms of Reference for WG 12. Proposed changes were to redefine the area covered to include the PICES area as far west as the Yellow Sea to reflect lack of information from China (Term of Reference A), to identify agencies and institutions rather than individuals who conduct work on crabs and shrimps (Term of Reference B), and to include consideration of marine sanctuaries for their effects on crab and shrimp populations (Term of Reference E).

2. Establish a Working Group on introduced species.
3. Request participation from North Korea and the People's Republic of China.
4. Hold an inter-sessional meeting (August or early September 1999 in Asia) focussed on spatial structure of populations; the effectiveness of marine sanctuaries; and restriction of fishing activities on crabs and shrimps.

FIS reviewed the interim report and recommended the following:

1. After much discussion, FIS supported the proposal to convene one more inter-sessional meeting so that WG 12 can conclude its work within one year. FIS requests a completed, final report from WG 12 at PICES VIII in Vladivostok.

2. FIS denied the request to modify the Terms of Reference to include consideration of marine sanctuaries for their effects on crab and shrimp populations. FIS is very concerned about broadening the Terms of Reference that might jeopardize the completion of WG 12 in one year.

3. FIS expressed regret that WG 12 continues to lack participation from the People's Republic of China and encourage Chinese scientists to contribute to WG 12 activities.

4. FIS accepted the interim report of WG 12 to be published in the PICES 1998 Annual Report.

Relations with other organizations

Dr. Zhang reported on the development of Memoranda of Understanding (MOU) between PICES and the North Pacific Anadromous Fisheries Commission (NPAFC) and with ICES. Both MOUs are nearly finalized for signing. Among other items, the MOU with NPAFC calls for the coordination of the place and dates of annual meetings. FIS noted that PICES received a request from NPAFC for non-anadromous

catch statistics for their yearbook, and that the MOU between PICES and NPAFC needs to be signed before the next step can be taken.

Publication of reports

The book on the Bering Sea is nearly ready to be published by Alaska Sea Grant. This was a product of the Bering Sea Working Group. Proceedings of the REX Workshop held in 1997 were published as PICES Scientific Report No. 9, "Climate Change and Carrying Capacity: Workshop on the Development of Cooperative Research in Coastal Regions of the North Pacific". Progress reports from Working Groups 8-12 were published in the PICES Annual Report for 1997.

New Working Groups

Three proposals were submitted to FIS for new Working Groups. Two were proposed in 1997: "Climate Change and Shifts in Fish Production" (originally proposed by Dr. Richard J. Beamish) and "Stock Assessment and Methodology Development" (originally proposed by Dr. Mikhail Stepanenko). The third was proposed for 2000 by Dr. Tokio Wada. Although the name of the new WG was not specified, it will address climate change and fisheries management.

Given the recommended continuation of WG 12 for one more year, FIS took no action on proposals for new Working Groups. However, FIS discussed similarities among the proposed new Working Groups and noted that a FIS Topic Session at PICES VIII on "Climate Change and Fisheries Management" would be an ideal mechanism to further develop Terms of Reference for a future Working Group.

CCCC Program and CCCC Task Teams

Dr. Zhang noted that the revised Terms of Reference of the CCCC Program were approved.

Travel support

Dr. Zhang noted that PICES provided travel support for him to attend the meeting of SCOR Working Group 105. A summary of this meeting was published in PICES Press Vol. 6 No. 1 in January 1998, and a full report is available via the PICES web page. A joint symposium on "The Ecosystem Effects of Fishing" will occur in March 16-19, 1999, in Montpellier, France. Peer reviewed papers will be published in the ICES Journal of Marine Science. FIS recommended Dr. Zhang's participation in the symposium and partial support (per diem for the symposium) for travel costs.

Pandalid Shrimp Symposium

Dr. Zhang noted that NAFO, ICES and PICES are co-sponsoring an International Pandalid Shrimp Symposium in Halifax, Nova Scotia, Canada, during September 8-10, 1999. Members of WG 12 are actively involved.

Scientific items of interest

Dr. Wada reported on the REX Workshop on the "Small Pelagic Species and Climate Change in North Pacific Ocean" which occurred immediately prior to PICES VII. More than 25 scientists from 10 countries participated.

Dr. Gordon A. McFarlane reported on BASS. The 1997 symposium proceedings are nearly ready to be published in *Progress in Oceanography*.

Ms. Patricia Livingston (Co-Chairman of the CCCC Implementation Panel) reviewed current proposals for scientific sessions. A REX workshop on herring and zooplankton was recommended prior to the next Annual Meeting in Vladivostok. CCCC recommends a symposium on results from GLOBEC and GLOBEC-like research at the next PICES Annual Meeting. At the PICES meeting in 2000, there are proposals for a workshop on the

design of iron fertilization experiments and a symposium on climate change on small pelagics.

Six inter-sessional workshops are proposed. One, to be held on the west coast of North America, would address indicators of regime shifts. Also, the MONITOR Task Team is planning a workshop on intercallibration of sampling gear in October 1999 prior to the PICES Annual Meeting. The BASS Task Team proposed to hold a workshop in mid-1999, to determine how the ecosystems of the subarctic Pacific gyres function and how they respond to regime shifts. In 2000, proposed inter-sessional workshops include "El Niño and Beyond" in April in La Jolla, U.S.A., a MODEL workshop in February in Nemuro, Japan, and a joint ICES/PICES workshop on Zooplankton Production and Ecology in March or April in Hawaii, U.S.A.

Dr. Bernard A. Megrey presented a proposal on a "Workshop on the Application of Scientific Visualization to Marine Ecosystem Analysis" to be convened by Drs. Bernard A. Megrey, Thomas C. Royer, and Igor I. Shevchenko. The proposal is sponsored by TCODE. FIS supports this proposal for a workshop to be held immediately prior to the PICES Annual Meeting in 1999 or 2000.

FIS Session Topic for PICES VIII

FIS supports a proposal by Dr. Wada for a FIS session topic at the next Annual Meeting on "GLOBEC and GLOBEC-like Studies and Fisheries Management". The purpose of this session is to identify ways that GLOBEC studies can be applied to sustainable use of fisheries resources. The session would be co-convened by Dr. Wada. A Co-Convenor from U.S.A. or Canada is being sought, and Dr. Gordon H. Kruse is an interim contact. After the conclusion of the FIS Committee meeting, FIS members recommended the possibility to seek Co-Convenors from all six PICES countries.

Best Presentation Award

FIS voted for the best presentation award from talks presented during the FIS Paper Session and FIS/CCCC joint session. The award went to Mr. Jae Bong Lee for his excellent presentation titled "The impacts of climate changes on the marine fisheries resources in Korea".

Arising issues

Dr. Zhang drafted a "Review of Activities and Strategic Workplan of FIS Committee". The report was requested of Scientific Committee Chairmen to review the Committee activities and to recommend a three-years workplan. FIS reviewed the report, and provided editorial remarks. A final document was prepared (see Endnote 3).

Dr. Allen Macklin presented a report on the Bering Sea Ecosystem Biophysical Metadatabase. The purpose of the project is to facilitate research, management, and education. Dr. Macklin reported on the geographic distribution of contributors, showed how a search of the database is conducted, and showed how data records can be entered electronically by their web site. Assistance is sought to identify colleagues with data that can be contributed to this metadatabase.

Dr. Zhang indicated that PICES should seek a U.S. or Canadian member to serve as a contact for PICES so that the scientific content of the home page can be improved. Dr. Kruse accepted this responsibility.

Scientific Program

The following scientific papers were presented from the FIS Committee and CCCC Program jointly-sponsored part of the program.

*Climate change and carrying capacity of the North Pacific: Recent findings of GLOBEC and GLOBEC-like programs in the North Pacifi*c. (FIS/CCCC Joint Session) Co-Convenors:

Anne B Hollowed (U.S.A., R. Ian Perry (Canada) & Takashige Sugimoto (Japan)

Roger Harris. GLOBEC and GLOBEC-like research programs in the Atlantic

Alex Smirnov, E.T. Burden & N.P. Smirnov. Environmental change in the North Atlantic region and the health of terrestrial and marine biotic resources

Chang-Ik Zhang & J.B. Lee. The impacts of climate changes on the marine fisheries resources in Korea

Kaoru Nakata. Long term fluctuations of the biomass and size composition of copepods in the Kuroshio and the Japanese slope water in relation to climate

Mitsuyuki Hirai & T. Goto. Effects of hydrographic conditions on the formation of spawning grounds for sardine, *Sardinops melanostictus*, in the Japan Sea

Makoto Kashiwai, T. Wada, D. Ware, C. Robinson & O. Yamamura. Carrying capacity change of Oyashio Shelf ecosystem with disappearance of Japanese sardine

Orio Yamamura. Temporal variability of food-web structure in the Oyashio-Kuroshio transition region

Kenneth L. Denman, M.A. Peña & S.P. Haigh. Modelling the response of the planktonic foodweb to climate variability in the subarctic Pacific

David L. Mackas. Season, size and depth partitioning of copepod production in the subarctic Pacific

Michael Fogarty. Overview of U.S. GLOBEC research activities.

Takashige Sugimoto. Overview of Japan GLOBEC research activities

Suam Kim. Overview of Korea GLOBEC research activities

Richard D. Brodeur, P.T. Strub, F. Schwing, M. Ohman & H. Batchelder. Retrospective data analysis in the U.S.-GLOBEC northeast Pacific (NEP) Program

Albert J. Hermann & H. Batchelder. Modeling activities within the U.S.-GLOBEC northeast Pacific Program

Kerim Aydin. Pacific salmon carrying capacity, ecosystem structure, and density dependent predator-prey interactions on the high seas

Anne B. Hollowed, S.R. Hare & W.S. Wooster. Pacific basin climate variability and patterns of northeast Pacific marine fish production

Boris N. Kotenev, A.S. Krovnin & V.V. Maslennikov. Changes in year-class strength of pollock stock in the Russian EEZ of the Bering Sea in relation to climatic variations in the North Pacific

J.J. Goering, S. Henrichs, T.K. Rho, S. Smith, T.E. Whitledge, C.T. Baier, R.D. Broderr, D.M. Blood, J.M. Napp, J.J. Cullen, R.F. Davis, J.D. Schumacher, P.J. Stabeno, G.L. Hunt, Jr. & G.L. Swartzman. Southeast Bering Sea carrying capacity (SEBSCC): ecosystem dynamics research in a marginal sea

Vidar G. Wespestad & B.A. Megrey. On relationships between cannibalism, climate variability, physical transport and recruitment success of Bering Sea walleye

Bernard A. Megrey. Application of fuzzy logic to forecasting Alaska walleye pollock recruitment

Jacke Helle. Ocean Carrying Capacity Program

Dean A. Stockwell & T.E. Whitledge. GLOBEC 1998: Preliminary monitoring data from the Gulf of Alaska

Thomas Weingartner. The Gulf of Alaska GLOBEC long-term observation program (LTOP)

Bruce Finney. Long-term variability in sockeye salmon abundance in the Gulf of Alaska and California current systems

R.J. Beamish, G.A. McFarlane & R. Sweeting. The impacts of decadal scale changes in climate on the Strait of Georgia ecosystem

Susan E. Allen, C. Vindeirinho, R.E. Thomson & D.L. Mackas. Upwelling currents around a shelf-break canyon and influences on zooplankton

Claire L. Smith & M.G. Foreman. Progress report on the development of a biophysical model for the west coast of Vancouver Island

Ruben J. Veefkind, J.J. Whiticar, J.N.C. Whyte & R.I. Perry. Measuring the stable carbon isotope ratio of individual fatty acids, a novel tracer in marine foodweb studies?

Stephen R. Okkonen. Altimeter observations of the mesoscale eddy-field along the shelfbreak in the central Bering Sea

Endnote 1

Participants and observers

Canada
Gordon A. McFarlane (for Richard J. Beamish)

China

Japan
Tokio Wada
Akihiko Hara
Tokimasa Kobayashi

Korea
Chang-Ik Zhang (Chairman)
Suam Kim

Russia

U.S.A.
Richard Marasco (for Loh-Lee Low)
Gordon H. Kruse

Endnote 2

Report of Working Group 12
Crabs and shrimps

Introduction

Working Group 12 (WG 12) held its interim meeting in Fairbanks, Alaska, U.S.A., from October 14 to 17, 1998, just prior to the main meeting of PICES. This was the third meeting of WG 12 but only the second in which both North American and Asian members were present. The Working Group welcomes Mr. Zhi-Meng Zhang, who replaces Mr. Sheng-Min Ren of China, but sadly reports that we still have had no participation or correspondence from China.

The main purposes of the third meeting were to review oceanographic processes that may affect recruitment to stocks of crabs and shrimps in the PICES region (generally north of 33^{o} North Latitude) and to review problems of sampling and data analysis used to assess trends in abundance. WG 12 also invited Drs. Kashiwai and Livingston to speak on the topics of 1) PICES as an organization, and 2) the PICES-GLOBEC Program and its components. WG 12 wished to review these two topics in order to better focus on the problems of completing our work and recommending how various topics concerning crabs and shrimps might best be integrated into PICES for longer term consideration.

Attendance was 8 of 15 members in 1998 as compared to 11 of 15 members in 1997. Five nations were represented in both years.

As was true in 1997, WG 12 members unanimously agreed that it was desirable for scientists from the People's Republic of China and North Korea to attend future meetings. This concern was re-iterated in 1998 for the reasons detailed in our 1997 report.

Review of Terms of Reference

WG 12 considered the terms of reference formally adopted by FIS in 1997. There was a lot of discussion as to the importance of introduced species. While our terms of reference seem adequate relative to introduced species, this problem needed to be more broadly considered. WG 12 also considered changes to terms of reference as indicated in **bold** type below and requests that they be formally

approved or disapproved (with guidance) by the FIS.

WG 12 is established to:

1. Consider those crabs, shrimps and lobsters that are utilized in commercial, subsistence or recreational fisheries **within the portion of the PICES area as far west as the Yellow Sea**. This may include introduced species if they are directly important or impact human utilization of any other marine species. (FIS declined to change this item in favor of anticipated participation by the Republic of China.)

2. Identify **agencies, educational institutions and scientific societies or other formally constituted groups** from each **nation** that are performing scientific work on the distribution, recruitment, larval transport, migration, population dynamics, and influences of environmental conditions for crabs and shrimp**s in the PICES area.** (FIS felt this could be accommodated in the WG 12 final report without Changing terms of reference).

3. Identify available data that would assist in the analyses of factors affecting abundance trends.

4. Review and exchange current knowledge and data concerning factors affecting abundance and survival of crabs, shrimps and spiny lobsters and identify key scientific questions regarding reasons for abundance fluctuations.

5. **Consider marine sanctuaries of various sorts and their effects on conservation of crab and shrimp stocks.** (FIS felt that this would better be included as an item in the WG 12 final report.)

After considerable discussion, WG 12 members agreed unanimously that we cannot finish our work in a timely manner if we continue to include Chinese coastal waters which are located west of the Yellow Sea. We have received no information concerning crab and shrimp stocks in this area and see little way of acquiring reasonable amounts of information in a timely manner. Conversely there has been a lot of information exchanged between China and Japan or Korea during various meetings and diplomatic negotiations concerning fisheries in the Yellow Sea and adjacent areas of the East China Sea. WG 12 thought that we could acquire sufficient information to meaningfully discuss stocks from these two areas with or without Chinese participation. Members wish to emphasize that it is not our desire to exclude participation by Chinese scientists.

Reasons for changes in other Terms of Reference are that WG 12 wishes to clarify our intent respecting item 2 and that we consider that crab and shrimp stocks have more localized spatial distributions and critical habitats than are frequently manifested for stocks/ populations of finfish, micronekton or plankton respecting item 5. WG 12 also noted that several protected areas now exist as areas closed to bottom trawling to protect crab stocks and that various marine sanctuaries are being planned or proposed in the United States, Canada and Japan.

Oceanography and recruitment

A. Overview

The PICES region contains approximately 65% of world crab resources and 23% of world shrimp resources according to United Nations (FAO) landing statistics. Unfortunately, it is not currently possible to deduce the importance of many individual resources from UN/FAO statistics or the contribution of aquaculture as opposed to harvest of wild stocks. The PICES region encompasses all of FAO Area 61 (Northeast Pacific), a small part of Area 71 (Eastern Central Pacific) and most of Area 67 (Northwest Pacific). As an approximation, landings from the PICES region would include all landings in Area 61, only U.S. landings from Area 71 and summed landings from Chinese, Japanese, North Korean, South Korean and

Russian marine waters from Area 67. It is unclear how Chinese waters south of 33º North Latitude should be included or excluded.

WG 12 identified the stocks of concern within our terms of reference in our 1996 report and will publish a final list with our final report. Here we note that major stocks of crabs and shrimps inhabit or historically occurred in all of the PICES Regions identified by the CCCC Program but not in the deep waters underlying the Eastern and Western Subarctic Gyres. There appear to be few trans-boundary stocks with respect to PICES Regions although a given region may contain multiple stocks of a species. For example, the eastern Bering Sea Region contains three stocks of red king crab (*Paralithodes camtschaticus*): Norton Sound, Bristol Bay and Pribilof Islands. PICES Regions hence serve as useful geographic units with respect to crab and shrimp stocks.

Our discussions were limited to well known stocks as examples of various processes and their effects rather than a systematic consideration for all stocks that we have identified. This was necessary due to the large number (ca 120 for crabs and 65 for shrimps) of stocks involved and the fragmentary information available for many of them. In general it appears that spatial structure is extremely important in the maintenance of recruitment of crab and shrimp stocks.

B. Crabs

Dungeness crab (*Cancer magister*) have cyclic populations in northern California, Oregon and Washington with peaks and troughs every 8-10 years. Landings 1970-1996 minimum 5,000 t (1974) to maximum of 26,000 t (1977). A collapse of central California stock occurred 1956-1970 with little recovery since. British Columbian and Alaskan landings are more consistent from year to year and do not display cyclic patterns. Fluctuations in Alaskan landings may have been market-related at times.

Hypothesized environmental and ecological effects include elevated temperatures, nemertean worm predation on clutches, salmon predation on larvae, and various cyclic phenomena (cannibalism, up welling, wind stress, geostrophic flow, fishing effort). Fishing impacts that complicate recruitment trends include ghost pot fishing and fishery handling of sub-legal males and females. The fishery selects the largest males and there is the possibility of females not getting bred or that there is significant evolutionary selection against fast growing crabs.

The list of factors used to explain changes in Dungeness crab populations is a fair sampling of factors that are thought to control crab populations in general. Additionally, predation on adults, parasitism and epizootic diseases are known to be important in a number of King and Tanner crab populations.

There has been no general agreement as to the mechanisms responsible for cyclic trends in Dungeness crab abundance observed from northern California through Washington. In Canada, larval sampling has shown that megalopae off the west coast of Vancouver Island use wind driven currents that reverse seasonally as a mechanism of longshore dispersal before eventual shoreward transport. Such mechanisms are by no means certain as to settlement location. Of Vancouver Island, megalopae may be concentrated in boundary areas between surface currents of opposing direction, and this may limit opportunity for them to reach shallow water, where survival after settlement is maximised. The confinement of outer coast megalopae to the upper 25 m of the water column is a behavior that apparently fosters beneficial transport. By contrast, megalopae resultant from spawnings in the Fraser River delta area within the Strait of Georgia find themselves in an estuarine circulation pattern, where surface water (<100 m) flows outward through the Strait of Juan de Fuca and is replaced by an influx of saltier water at depth. Strait of Georgia larvae make daily vertical migrations (surface at night, at depth

during daylight) of about 160 m, and with the long day length, are thereby effectively retained within the Strait of Georgia oceanographis system. This is an example of very different larval behaviors, despite the close geographic proximity of the two populations, resulting in transport favorable for each population. Hypothetically, such behaviors probably evolved relatively rapidly, perhaps within a few thousand years at most, as the Strait of Georgia didn't exist ca 10,000 years ago, as it was glaciated. It therefore seems quite plausible that different crab or shrimp populations of other species may also have population-specific behaviors which help spatially-structured adult populations persist. Care must therefore be taken in suggesting dispersal patterns for species as a whole, and for even specific populations unless dispersal patterns from those populations have been specifically studied.

Red king crabs (*Paralithodes camtschaticus)* are annual spawners with relatively high fecundity and small eggs, as compared to blue king crabs (*P. platypus)* which are usually biennial spawners with lesser fecundity and somewhat larger eggs. From an oceanographic point of view, this is curious, since blue king crab tend to form localized populations around offshore islands of the eastern Bering Sea. Hypothetically either localized transport mechanisms or demersal larval behavior might be involved in maintaining populations of blue king crab. Both species inhabit the Pribilof Islands and other areas where their dynamics may be explored. However, to date, oceanographic information in near shore areas has been insufficiently described and larval surveys, mostly just for relative abundance with a specific survey design, have been sporadic.

In many areas of the Gulf of Alaska and northern British Columbian coast, populations of king crab seem to spawn predominately in near shore areas and may spend their entire life span in bays or fjords.

The West Kamchatka stock of red king crabs seems to follow a basic denatent-contranatent life history pattern, where adults are positioned up current from juvenile nursery grounds and a contranatent ontogenetic migration to the adult habitat. Sub-population units of adults have there own seasonal pattern of offshore-onshore migration that is apparently mediated by temperature. Positioning of females at the time of egg-hatching relative to long-shore currents appears important. The life history pattern of Bristol bay red king crab appears similar to that of the west Kamchatkan stock except that there is currently only one area or sub-population of adults. In both populations, the spatial structure of adults appears to be important and the critical juvenile habitat appears to be limited in area.

Tanner (*Chionoecetes bairdi)* and snow (*C. opilio)* crabs have broad distributions across several zoogeographic provinces and PICES Regions. In general, their distributions are less patchy and they form fewer apparent stocks than king crabs. Snow crab range from the Beaufort Sea to the Sea of Japan, and also occur in the northwest Atlantic. Since snow crab inhabit several zoogeographic provinces and its life history is well known, the species provides an excellent opportunity for comparative retrospective analysis. Deep water members of the genus are less well known, although there are developing fisheries in both Asia and North America. For example, the Japanese Tanner crab, or benizuwai gani, *Chionoecetes japonicus*, is fished in Japanese, South Korean and possibly North Korean waters. Near Kodiak, recent studies of Tanner crab reproduction have shown different spawning behaviors of primiparous and multiparous females. Primiparous females spawn singly while multiparous females form dense aggregations of mounded females that are apparently a mechanism which facilitates larval release. Mounding of females seems to be timed so as to release larvae during the highest spring tides of the year. This is an extreme example of spatial population structuring related to spawning and larval release, as this behavior is not found at other times of the year.

C. Shrimps

Pandalid shrimps are protandric hermaphrodites, and larger, older individuals that support fisheries are mostly mature females. Two species dominate trawl fisheries. Ocean pink shrimp, *P. jordani* are distributed from northern California to British Columbia and northern pink shrimp, *P. borealis*, are distributed from British Columbia to the Bering Sea. Alaskan trawl fisheries also included *P. goniurus, P. hypsinotus, P. platyceros* and *Pandalopsis dispar*.

Pandalid shrimp populations and fisheries in Alaska collapsed in the late 1970's and most fisheries remain closed today. Very small trawl fisheries for side striped shrimp, *Pandalopsis dispar*, and pot fisheries for spot prawns, *P. platyceros*, still persist in some areas. Spot prawns are an economically important fishery in British Columbia. The collapse of the pandalid shrimp complex in Alaska was concurrent with both the late 1970's oceanographic regime shift and a sharp increase in predator populations, particularly Pacific cod (*Gadus macrocephalus*) populations. Landings of ocean pink shrimp also declined sharply in the late 1970s, reaching their lowest levels in 1983, but in contrast with northern pandalid shrimps, have increased in abundance since then. Landings of *P. jordani* have undergone two cycles between 1970 and 1995. The recovery of *P. jordani* contrasts sharply with other pandalids to the north and would also be a good species for retrospective study.

Pandalid shrimps occur in the western Bering Sea, the Okhotsk Sea and in the Japan/East Sea as far west as Korea, providing additional possibilities for comparative study. It is frequently unclear whether recruitment to populations or mechanisms that concentrate adults are most important in forming high densities of pandalid shrimp in open ocean environments. Both environmental effects and oceanographic forcing appear important in recruitment of pandalid shrimp stocks in the western Gulf of Alaska.

Four species of penaeid shrimps are important in the Yellow Sea. Several of these species are found in southern Japan as well. Peneid shrimps differ from pandalids in that they are not hermaphroditic, are semelparous rather than multiparous, and are relatively short lived. Most species complete their life spans in less than two years and frequently within one year, while northern pandalid shrimps typically live for at least three years and frequently for 7-8 years. Both transport by currents and inshore-offshore migrations appear to be important, relative to larval recruitment.

Sampling and data analysis

Topics discussed included skewed distributions resulting from aggregated populations and methods of dealing with them, and catchability experiments and visual methods of sampling, such as a LASER Line Scan System. A synopsis will be provided at a later date.

Plenary session

1. Requests that FIS formally adopt changes in the WG 12 terms of reference or otherwise provide guidance as to how we should proceed.

2. Recommends that FIS consider the possibility of convening a working group on introduced species. This recommendation was occasioned by discussions of the introductions of green crab (*Carcinas maenas*) and two species of mitten crabs (*Eriochier* spp) into the United States Pacific coast and the subsequent spreading of their geographic ranges.

3. WG 12 restates our request that scientists from North Korea are asked to participate in WG 12 activity.

4. WG 12 again requests the participation of Chinese scientists. There has been no response from the Chinese members of the WG as to the last 3 meetings of WG 12. Although Mr. Zhi-Meng Zhang has been

appointed to replace Mr. Sheng-Min Ren, no action has ensued.

5. How to proceed in the future?

    a. Time of year to hold an Interim Meeting was discussed, and it was agreed that August or early September were best. The place of the meeting was not agreed upon, although it was accepted that it should be held in Asia to facilitate representation from Asian nations. The place of the meeting is to be determined by correspondence.

    b. The 1998 interim meeting should focus on the following:
        i. Spatial structuring of crab and shrimp populations.
        ii. Consideration of the effectiveness of marine sanctuaries and restrictions of fishing activities on crabs and shrimps.
        iii. Conclusion of WG 12 activities and provision of final report to FIS.

Appendix 1

Participants and observers

Canada
Glen Jamieson

China

Japan
Hideo Sekiguchi

Republic of Korea
Sung Yun Hong
In Ja Yeon

Russia
Boris Ivanov
Vitaly Rodin (Co-Chairman)

U.S.A.
David A. Armstrong
Robert S. Otto (Co-Chairman)

Observers
Makoto Kashiwai (Chairman, Science Board)
Alexander A. Kurmazov (Russia)
Patricia Livingston (PG/IP Co-Chairman)
Alan M. Springer (U.S.A.)
Bradly G. Stevens (U.S.A.)

Endnote 3

Review of Activities and Strategic Workplan of FIS Committee

Prepared by Chang Ik Zhang, Chairman, FIS Committee

1. Introduction

During PICES VI, the Science Board proposed that Chairmen of all the Scientific Committees prepare a review of activities during his/her term of office and a proposal of strategic workplan for the next three years, which will be discussed at PICES VII prior to the election of new Chairmen. The discussion of the strategic workplan was to be completed during the FIS Committee meeting and reported to Science Board.

2. Mission and responsibilities of the FIS Committee

According to Rule 12, the Council may establish permanent Scientific Committees for any specific purposes to meet the Organization's needs; the permanent Scientific Committees shall each consist of not more than three members, designated for the purpose by each Delegation, who may be accompanied by experts and advisers.

There are currently four permanent Scientific Committees. Each Scientific Committee elects a Chairman from amongst its members for a period of three years. The Chairman shall not seek re-election for the immediate succeeding term. The Chairman takes office at the conclusion of the Annual Meeting at which elected.

The Committees are responsible for reviewing and coordinating scientific investigations in the subject or area defined by the Committees' responsibilities. The Chairman's responsibility involves:

1. Chairing meetings;
2. Preparing agenda and circulating it to members one month before any meeting;
3. Communicating with Committee members and ensuring that work is carried out in accordance with the program and to obtain records thereon;
4. Compiling a general review of the work done and results achieved;
5. Annually furnishing Science Board with a summary report of the Committee's deliberations and recommendations together with an annotated estimated account of their financial needs;
6. Preparing an annual report reviewed and revised by the Committee that should be provided to the Secretariat no later than one month after the Annual Meeting.

The Scientific Committees organize Topic and Paper Sessions. Their portion of the program consists of invited and/or contributed papers relevant to topics selected by the Committee (Topic Sessions) and contributed papers relevant to the general interests of the Committee (Paper Sessions). The Scientific Committees have the responsibility of organizing sessions they sponsor, which includes the designation of convenors for their Topic Session. Committee Chairmen normally convene their Paper Sessions or designate other Committee members to undertake this responsibility.

3. Distinction among the phases

Phase 1, i.e. the 3 years from PICES I to PICES IV, was the period to establish structure of organization and to set it into activities included in the motivation of the establishment of PICES.

Phase 2, i.e. the 3 years from PICES IV to PICES VII, is the period toward maturity to develop relations with other organizations and to develop policy and ways of performing activities expected of the Organization.

4. Achievements and major scientific decisions by FIS Committee

Phase 1:

PICES I: - Established WG 3 on Dynamics of Small Pelagics in Coastal Ecosystems

PICES II: - Became one of the four permanent Scientific Committees
- Renamed WG 3 as Coastal Pelagic Fish
- Recommended the development of PICES-GLOBEC Program

PICES III: - Jointly established PICES-GLOBEC Program (CCCC Program)

Phase 2

PICES IV: - Completed WG 3 on Coastal Pelagic Fish
- Established the new WG 12 on Crabs and Shrimps
- Supported the establishment of CCCC/REX Task Team
- Identified the need to study the separation of fishing effects from environmental effects in the dynamics of fish populations
- Recommended a Topic Session on 'Ecological effects of truncated age and size distribution and fishing on fish populations'

PICES V: - Elected new FIS Chairman
- Recommended PICES representation in SCOR-WG 105 activities
- Stressed the need to develop close relationships with regional fisheries commissions
- Recommended a joint Topic Session on 'Models for linking climate and fish' for PICES VI with BIO
- Discussed future perspectives for PICES

PICES VI: - Accepted revised Terms of Reference of WG 12
- Carried out a joint session with BIO successfully
- Recommended a joint Topic Session on "Research findings of GLOBEC and GLOBEC-like research in the North Pacific" with CCCC Program
- Endorsed the REX Symposium/ Workshop on small pelagic species
- Supported convening an inter-organizational symposium on the 1997/98 El Niño event
- Recommended participation in SCOR WG 105 meeting in Hobart, Australia

PICES VII: - Discussed FIS Strategic Workplan

5. FIS Strategic Workplan for Phase 3: PICES VII to X

Phase 3, i.e. the 3 years from PICES VII to PICES X, shall be the period to develop functions as a matured organization cooperating with other organizations as an equal partner and to develop functions to produce creative PICES scientists in member countries, as well as to continue putting enough efforts for the internal maturity.

5.1 Interactions with fisheries commissions

PICES has no authority for fishery management. However, fisheries research can contribute to the use and management of fisheries resources. FIS believes that this is a critical part of its mission. Therefore, FIS should develop ways to interact with other fisheries commissions to accomplish this goal.

5.2 Establishment of new Working Groups

During the initial stage of PICES activity, there are some cases that show lack of understanding on the Terms of Reference or on the purpose of establishing a Working Group. It is necessary to develop workflow for the proper establishment of Working Groups, by deepening focal subject through a preceding topic session and designing workshop.

Working Groups need to work closely with the sponsoring Committee to ensure they are "on track."

5.3 Selection of Topics for Topic Sessions

Selection of topics for FIS Topic Session should be based upon a long-term strategic plan. The following criteria will be used to prioritize FIS topics:

- Meet the needs of as many member countries as possible
- Increase activities in support of fisheries research
- Enforce support for cooperative programs of PICES
- Give opportunities for PICES initiatives
- Elicit interests of excellent scientists

5.4 Inter-organizational cooperation and coordination

PICES should send delegates or liaison to attend important international coordinating meetings - e.g., IOC, ICES, and SCOR. One other possible area for FIS might be a collaborative open-ocean sampling program - perhaps in conjunction with the GOOS-LMR Panel. There are some other organizations and structures that promote and enhance investigations on the continental margins, but research studies that sample the open ocean are necessary.

5.5 Scientific contribution from PICES

There is a need to consider the role of PICES as a publisher of "high-level" scientific publications. It may be important for PICES to provide timely scientific publications on fisheries and ocean sciences. This might be a useful way for PICES to work with an existing publisher/journal (e.g., Fisheries Oceanography) for the "high-quality" publications. This issue should be referred to the Study Group on Publications for resolution.

REPORT OF MARINE ENVIRONMENTAL QUALITY COMMITTEE

The MEQ Scientific Committee met on Thursday, October 22, 1998, at PICES VII in Fairbanks, Alaska, U.S.A. The meeting was convened from 1330 to 1730 hours. See Endnote 1 for participants.

Introductions

Since MEQ Chairman Dr. Richard F. Addison was unavoidably unable to attend PICES VII, Prof. Makoto Shimizu of Japan agreed to chair the MEQ Meeting. Prof. Shimizu welcomed all participants, and asked that each introduce themselves and their affiliations. Dr. C. Michael Watson served as rapporteur.

Adoption of MEQ agenda

The Chairman then offered a proposed agenda for the meeting. A brief discussion ensued from the floor, during which Science Board Chairman Dr. Makoto Kashiwai reminded the group of the necessity for MEQ and other Scientific Committees to make the Science Board aware of their recommendations as soon in the process as possible, so that Science Board would have more time and opportunity for adequate discussion and consideration of the various issues at hand. After further discussion, the proposed agenda was unanimously accepted, and the meeting was called to order.

Election of new MEQ Chairman

Because Dr. Addison's tenure as MEQ Chairman expires this year, it was necessary for MEQ to elect a new Chairman at this time. The MEQ Committee unanimously expressed its gratitude for Dr. Addison's leadership and efforts, and especially for his work and dedication in helping develop critical groundwork for the proposed MEQ Practical Workshop.

As per the PICES Rules of Procedures, Executive Secretary Dr. W. Doug McKone called for nominations. Dr. Alexander V. Tkalin was unanimously selected as the new MEQ Chairman-Elect.

Bering Sea Ecosystem Biophysical Metadatabase Project: presentation by Ms. Sonia O. Hamilton, Metadatabase Coordinator, NOAA

As a follow-up to Mr. Allen Macklin's introduction of this database to MEQ at our PICES VI Meeting (1997), Ms. Hamilton briefly updated MEQ on recent progress. The Bering Sea Biophysical Metadatabase is dedicated to advancing the understanding of the structure and function of the Bering Sea Ecosystem, through the development of a collaborative research tool for fisheries-oceanography and ecosystem investigations. Its mission is to facilitate and enhance the ability of researchers, managers, students, fishermen, and the general public to investigate and understand the functioning of the complex ecosystem of the Bering Sea.

"Metadata" refers to data about data, rather than to the actual data *per se*. Objectives are to determine what data exist, where it is located, and who holds the data. Also, to provide standardized descriptions of the data holdings, to develop an indexed annotated catalogue (the actual metadatabase), and make this information available through various mechanisms including the World Wide Web.

Because the metadatabase references only the existence of data and information products, researchers do not have to submit their actual data; but should merely describe the content, quality, condition, spatial and temporal characteristics of the data. The data are organized according to Federal Geographic Data Committee (FDGC) metadata standards. The Bering Sea Metadatabase was recently selected by the principal agencies of the Bering Sea Ecosystem Initiative and the North Pacific Research Council as the primary vehicle

for data sharing and exchange on the Bering Sea ecosystem among agencies and scientists conducting research in the Bering Sea. The metadataabase has recently joined efforts with TCODE, and now has approximately one thousand individual sets of information.

Ms. Hamilton hoped that MEQ /PICES and their various colleagues will contribute as much as possible to the Bering Sea metadatabase, and stressed that the actual data itself will remain under the control of the researcher or similar source person. The program is interested in contaminant-related data, and will be receptive to any other types of information relevant to the Bering Sea. The metadatabase now has established a home page, at: http://www.pmel.noaa.gov/bering/mdb/toc.html

Dr. Shimizu led a brief discussion of this issue. MEQ agreed to study the issue further, and to advise Ms. Hamilton of our likely level of participation after the PICES Annual Meeting.

Review of minutes from MEQ Meeting, PICES VI

To help familiarize newer attendees with the recent history of MEQ and its activities, Rapporteur Dr. Watson briefly sketched the evolution of MEQ /PICES, and its Working Groups, through the series of six prior sequential Annual Meetings held at Victoria, Seattle, Nemuro, Qingdao, Nanaimo, and Pusan. He then highlighted key points from the 1997 PICES VI MEQ Meeting at Pusan, Republic of Korea. First was an overview of MEQ's long-term plan and continuing effort to sponsor and carry out a "practical workshop" originally planned for the Western Pacific. The planning and coordination for the practical workshop has been undertaken by WG 8. The goal of the workshop is harmonization of research and analytical methodologies among participating scientists from the six PICES member countries.

The concept of such a workshop was first put forth at Nemuro (PICES III, 1994), with the goal of holding the practical workshop at Jiaozhou Bay (Qingdao, Shandong Province), People's Republic of China, and a target implementation date of spring, 1998. As a contingency that the Qingdao site might not be available because of time constraints and other factors, MEQ at PICES VI selected the Chinhae-Masan Bay region in the Republic of Korea as an alternate possible site for the workshop. Dr. Watson then referred back to the receipt of the January 22, 1998 letter sent to PICES by Chinese authorities in Beijing, informing PICES "... that the present situation in Jiaozhou Bay is not suitable to host the workshop". He also related that for the proposed Korean fallback site, it had then become obvious that the process of obtaining full government permission to utilize the alternate workshop site might take longer than our workshop timeline would allow. Thus, the plan for the workshop needed to be significantly altered as to venue and time. A detailed description of the events surrounding the scheduling of the Workshop is provided in the letter from Dr. Addison to Dr. Watson which is appended to this report (Endnote 2).

A brief review was then given of the MEQ PICES VI Scientific Sessions, which had been convened by Dr. Dong-Beom Yang. The MEQ Topic Session, "Processes of Contaminant Cycling" was very well received, with eleven papers presented. An excellent poster session was also noted. The joint MEQ/BIO Session, "Harmful Algal Blooms", was also very well received, with eleven papers presented. This session provided an excellent overview of HABs around the Pacific, some of the various contributing factors to HABs, and one paper even recounted the notation of various HABs in Korea during ancient times. The MEQ Best Presentation Award was given to Dr. Dmitry Aminin, of the Far Eastern Division of the Russian Academy of Sciences, Vladivostok, who presented a joint Russian-Korean paper entitled "Use of fluorescent probes for biochemical monitoring of environmental contamination".

Dr. Watson also outlined the four MEQ Topics which were proposed at Pusan for the PICES VII symposia in Fairbanks. These included (1) a session outlining the research design and

preliminary results of the proposed Jiaozhou Bay Workshop (subsequently cancelled; see above) (2) a joint MEQ/BIO Session entitled "Contaminants in high trophic level biota: linkages between individual and population responses"; and (3) an MEQ Topic Session, "Science and technology for environmentally sustainable mariculture". It was also resolved to continue the MEQ Paper Session along the general theme of "Processes of contaminant cycling". Specific sub-themes which should continue to receive specific MEQ focus also included "marine oil spills", "HAB toxins", and "metal speciation /biogeochemical cycling".

The PICES VI MEQ Meeting also included discussions about establishing a more concrete set of criteria for shaping the future activity and focus for MEQ. It was suggested that MEQ/WG 8 select a long-term goal of preparing 3 separate "white papers", to help guide future MEQ activities. The suggested topics were (1) "Environmentally sound mariculture: status and technology needs", (2) "HABs: causes, consequences and mitigation", and (3) "MEQ/PICES interactions with GIWA: a feasibility study". These three issues are still in the planning and preparation process.

Dr. Watson also discussed and summarized various remaining MEQ business items occurring at PICES VI. These included briefings on HABs, (Mr. Forbes, NOAA), and also on the Bering Sea Metadatabase, (Mr. Macklin, NOAA). MEQ also continued its discussions from prior sessions about interactions with the PICES Technical Committee on Data Exchange (TCODE). MEQ also had extensive discussions regarding future focusing of any "new" working groups which would eventually be established to replace WG 8 after the completion of the MEQ practical workshop.

Business arising from the previous agenda item

After brief discussion, the informal overview of last year's MEQ Meeting's minutes was accepted as read.

PICES VIII Scientific Sessions: Proposals for future session topics

Dr. John E. Stein then led a discussion to set forth MEQ's future activities for PICES VIII (Vladivostok). A lengthy dialogue ensued about the general topic of offshore oil and gas exploration, which is currently planned for at least two major sites at Sakhalin Island, and is a very important topic in the Russian Far East. Dr. Colin Levings noted there are suggestions that the moratorium for exploratory drilling off the coast of British Columbia might be lifted. After extensive discussion and consideration, the following topics were chosen for the MEQ scientific sessions at PICES VIII:

a. A proposed joint MEQ /BIO session entitled "Coastal pollution: eutrophication, phytoplankton dynamics and harmful algal events". Rationale supporting this topic include: (a) nutrient pollution and entrophication are associated with HAB events and are a concern for all PICES countries, particularly Russia, Japan and China; (b) HAB events are of concern to Canada and the US on the North American West coast, however, support for research is meager compared to North American East Coast; and (c) because of development of new techniques there is considerable new information from monitoring recent HAB events.

b. An MEQ Topic Session entitled "Ecological impacts and mitigation of oil spills and oil exploration". Much discussion revolved around the topic of oil spills *per se*, versus oil drilling /exploration. There is great interest in Russia about modeling and forecasting harmful environmental effects of such oil and petroleum related phenomena. Industrial stakeholders are also very interested in gaining experience in assessing such environmental impact, much after the fashion of the Prudhoe Bay experience gained by their professional counterparts in the U.S.A.

c. Various topics for a MEQ Paper Session for PICES VIII were also discussed. It was

strongly suggested to keep the MEQ Paper Session very broad and interdisciplinary, so as not to exclude participation of scientists presenting MEQ issues with special relevance to the far northwestern Pacific region. It was also suggested that MEQ be more clear in specifying the interdisciplinary breadth and scope of the various papers we are soliciting for PICES VIII. After much discussion, it was agreed that the MEQ Topic Session for PICES VIII will be "Impacts of Pollution in Coastal Areas". Subcategories of interest to the MEQ Committee for this PICES VIII topic will include, but not be limited to, such areas as: harmonization of methods, assessment of biological effects of toxic chemicals, marine pollution, modeling, contaminant cycling, ecotoxicology, ecosystem effects, biomarkers, and other indicators of marine environmental quality.

Beyond PICES VIII; implications for PICES IX (Japan):

a. Continuation of the MEQ's "Mariculture" theme: At both PICES VI and PICES VII, MEQ Scientific Sessions on environmental impacts of mariculture proved to be timely and well attended. It was pointed out by Prof. Shimizu that there is a continued high level of interest in this topic, especially among PICES scientists from Japan, Korea and China. After discussion, it was unanimously agreed that MEQ should reconvene its mariculture theme as a Topic Session at PICES IX in Japan. This MEQ Topic Session will be "Science and technology for environmentally sustainable mariculture: impacts and mitigation in coastal areas".

b. Impacts of climate change: The MEQ also recognized and highlighted an additional key topic, which should be included in future plans for MEQ symposia, and which merits further discussion and consideration. This is the issue of "Climate change and its impact on the fate and effects of contaminants in the Pacific region". MEQ agreed to retain and revisit this topic in its planning cycle for future symposia.

Report of Working Group 8, PICES VII: Dr. John E. Stein (Co-Chairman, WG8)

Dr. Stein summarized the findings of WG 8's PICES VII Meeting, which took place October 18-19, in Fairbanks prior to the PICES opening sessions. The purpose the meeting was to review and refine the draft work plan for convening the MEQ Practical Workshop. The purpose of the workshop, also described previously, is to harmonize approaches and methods among PICES countries when assessing ecological impacts of pollution.

a. Overview and Recent Developments in the Workshop Plan: Dr. Stein briefly reiterated some of the history of the workshop plan, explaining that over several years prior, MEQ/WG 8 had hoped to conduct the workshop at Jiaozhou Bay, China, with the Chinhae-Masan Bay in Korea serving as an alternate choice, should the logistics or other circumstances somehow preclude holding the workshop in China during the desired (May, 1998) timeframe. But as mentioned earlier in the meeting, on January 22, 1998, PICES Executive Secretary McKone received a letter from Mr. Zuo-Fu Gan, Deputy Director-General of the Ministry of Agriculture, Beijing, stating that the conditions were not suitable to hold the workshop in Jiaozhou Bay. Shortly afterward, it also became obvious that if MEQ were to host the workshop in our alternate chosen site --Korea--, the timeframe and necessary steps to obtain bibliographic information about the ecosystem, plan the logistics and receive the various permits would extend many months beyond our original time frame for carrying out the project.

b. Modifications to the Workshop Plan: WG 8 reconfirmed that this workshop is a necessary step in establishing scientific cooperation for future collaborative efforts and in the harmonization of approaches of PICES member countries in assessing the broader

scale impacts from human activities on North Pacific marine habitats essential to living marine resources. Revisions to the work plan were made in continued recognition of the need of PICES countries to work toward harmonizing approaches and methods for assessing marine pollution effects.

i. Change in location: Because of the various logistic and other problems outlined above which preclude holding the workshop in the Western Pacific as originally planned, Dr. Stein reported that through the efforts and recommendations of Drs. Addison and Levings, WG 8 recommends to MEQ that a more practical and accessible location – Vancouver Harbour (British Columbia, Canada)-- be utilized for the practical workshop. Vancouver Harbor is a large, multi-use urban embayment, and is relatively close to two major Canadian governmental marine pollution laboratories. Via the Puget Sound and Georgia Basin continuum, it is also easily accessible to vessels, equipment and personnel from the Seattle NMFS Laboratories to the South. Vancouver Harbour also has a relatively extensive database of prior marine pollution studies. Dr. Stein asked that MEQ consider and accept the WG 8 proposal to use Vancouver Harbour for the workshop, which would take place May 24 - June 8, 1999.

ii. Goals and scientific design: Dr. Stein explained that other than changing the location from the Western Pacific to Vancouver Harbour, the specific goals and essential scientific design of the workshop remain essentially the same as set forth in previous MEQ/WG 8 planning sessions. However, there is some likelihood for the inclusion of a few additional pollution-related study topics (e.g., endocrine disruptors) in the technical scope of the study as it becomes more finalized.

iii. Participation and planning: It was deemed critical by both MEQ and WG 8 that participation by at least 2 scientists from each of the PICES member countries would be necessary for a successful workshop. It was also recommended that a Canadian scientist be appointed as a Co-Chairman of the Implementation Team, if the alternate Workshop site, Vancouver Harbour Canada, is accepted.

iv. Funding needs: Dr. Stein also reviewed funding plans for the workshop, which date back to PICES V in Qingdao, at which the Governing Council first approved $20K in funds to support the workshop. Total estimated cost of the Vancouver workshop is now estimated at $33,300. This sum also does not include travel, lodging and meal costs for US and Canadian Scientists, nor does it include member country support for supplies and analytical costs for analyses of additional samples following the Practical Workshop, nor costs of data analysis and reporting. Because the change of venue to Vancouver, there are now less operating costs required for vessel support, laboratory space and support, supplies, etc. Research vessels, laboratory space, a technician, and sampling equipment will be supplied at no charge by both Canada and the U.S.A. Mindful of these new considerations in the plan, WG 8 pointed out that there were two basic options for securing adequate travel funds for scientists from PICES member countries to participate in the Vancouver Workshop: (a) to seek the travel funds for their participating scientists through their respective member countries, or (b) to reallocate funds within the original PICES/MEQ operational budget (see Annex 6 of WG 8 Report), and /or seek additional funds from the PICES Secretariat. With this new projected budget in mind it was thus recommended that MEQ request the PICES Science Board to continue support

at $20K.

v. Research time line: The proposed date for the MEQ Practical Workshop is now May 24 - June 8, 1999, with a preparatory session on May 25 to prepare the final agenda, brief all participants and finalize tasks.

c. Presentation of Workshop results: Discussion then arose about how MEQ should present preliminary results from the practical workshop. It was agreed that preliminary results of the workshop will be discussed and evaluated at a special MEQ/WG 8 session at PICES VIII (Vladivostok). At these preliminary sessions, MEQ will schedule a presentation outlining the research design and nature of the workshop, documenting what took place. Although the format will be left "open", room will be made for a concurrent presentation of available preliminary results from the workshop. At PICES VIII, a task team will also be identified to complete the final report of the practical workshop. A presentation of the final results from the workshop will take place in a special MEQ session at PICES IX (Japan), followed by publication in a scientific journal.

d. Summary of MEQ decisions regarding WG 8 plan for MEQ/WG 8 Practical Workshop: It was unanimously resolved that MEQ will conduct its practical workshop May 24- June 8, in Vancouver Harbour, British Columbia, Canada. MEQ also approved the WG 8 Report, and recommended that Science Board accept the proposed changes in funding outlined in Annex 6 and discussed in detail as outlined above. It also approved the appointing of an additional WG 8 Workshop Implementation on-site Co-Chairman, Dr. Colin Levings, to be tasked with assisting Drs. Stein, Addison, Tkalin, and Prof. Zhou, in planning and implementing the Vancouver Practical Workshop May 24 - June 8, 1999.

Report on MEQ Scientific Sessions

Session Co-Convener Dr. Stein reported on the three MEQ Sessions which had taken place at PICES VII. The MEQ Topic Session "Science and technology for environmentally-sustainable mariculture" had seven excellent papers. A very broad spectrum of topics was presented, ranging from feed requirements, to genetic drift and the changing role of hatchery stocks, to off-site contamination from medication used in fish farms, etc. Filling in for a paper which had been canceled due to unavoidable circumstances, Dr. Shimizu provided MEQ Topic Session attendees to an excellent overview of recent developments and future trends in Japanese mariculture.

The MEQ Paper Session continued with our core theme, "Processes of contaminant cycling". Although several cancellations occurred due to unavoidable travel and funding problems, the session nonetheless enjoyed five excellent presentations, covering issues of biomarkers /bioassays, and the geochemical cycling of elements in estuarine systems, all of which were very pertinent and appropriate to the goals of our ongoing MEQ research theme.

A joint MEQ/BIO Session entitled "Contaminants in high trophic level biota: linkages between individual and population responses" was also held. This session was extremely well attended, and very successful. Papers embraced areas ranging from climate change, to fate and transport, bioaccumulation and metabolism, and health assessment in fish, marine mammals, and even possible implications for humans. Dr. Stein noted that although appropriate researchers on contaminants in birds had been invited, none were able to attend. The results of such a successful joint session led MEQ to agree unanimously to continue to pursue such interdisciplinary joint sessions in the future. Also, MEQ was encouraged by the higher attendance and quality and number of presentations as compared to sessions at previous meetings.

Best Presentation Award

After lengthy discussion of the various papers presented at the three various MEQ-sponsored sessions for PICES VII, MEQ voted unanimously to award the Best Presentation to Dr. Peter S. Ross, Visiting Fellow, Contaminants Sciences Section, Institute of Ocean Sciences, Sidney, B.C., Canada. Dr. Ross's winning presentation, entitled "Marine mammals at the top of the food chain: ecological sentinels", and co-authored with Dr. Richard Addison, was one of several excellent papers given in the joint MEQ/BIO session on contaminants in high trophic levels.

Update on Global International Waters Assessment (GIWA) Program Proposal

This issue originated during last year's meeting at Pusan, at which time GIWA had formally approached MEQ/PICES and its member nations to ask for our cooperation and support. Since the focus of GIWA is traditionally upon the open ocean, rather than coastal areas, MEQ has been conducting further review of the request before deciding whether or not to formally participate and what role to assume. Drs. Addison and Park of MEQ have explored the likelihood of common functions shared between MEQ and communicated their findings to Dr. William G. Doubleday. Dr. Addison drafted a letter from Dr. Doubleday (on behalf of PICES) to Dr. J.M. Bewers (on behalf of GIWA). This stated that MEQ recognizes that some of the aims of GIWA are close enough to those of PICES that it is desirable for the two bodies to discuss what practical objectives they could address collaboratively, and that PICES is therefore interested in continuing discussions with GIWA to identify immediate objectives of interest to both groups. When those objectives are defined, and the resources required to address them are identified, then PICES would make a final decision about its involvement. MEQ members will be informed of PICES' level of involvement and recommended course of future action with GIWA as soon as a final decision is made.

Other business

a. Strategic Plan, Vision Statement, and future directions of MEQ: Considerable discussion was devoted to updating the MEQ strategic plan, and the request by Science Board to have a final plan delivered to them soon. Much reference was made to the need for continued progress on developing the three "white paper" topics proposed at PICES VI (Pusan) as a comprehensive tool for future MEQ planning and scientific focus. The MEQ agreed to continue to play a strong inter-sessional role in developing and drafting the three discussion papers, on topics of interest to it and other committees. The three topics will be: (1) "Environmentally sound mariculture: status and technology needs", (2) "Harmful algal blooms (HAB): causes, consequences and mitigation", and (3) MEQ/PICES interactions with GIWA: a feasibility study".

   These "white papers" would provide much of the basis for member country decisions on MEQ's activities over the next few years. It was also suggested and agreed that prior to PICES VIII, MEQ should work toward developing a comprehensive Vision Statement for Science Board, which will be based heavily upon overviews and prioritizations of the MEQ-related research and policy needs of each member nation.

   It was agreed that the MEQ Committee would develop, intersessionally, a strategic plan. The draft plan will be discussed and made final at PICES VIII. Drs. Richard Addison, current Chairman of MEQ, and Alexander Tkalin, Chairman-Elect of MEQ, will develop the review draft.

b. Development of new MEQ-related Working Groups, and the fate of WG 8: With completion of the Vancouver Practical Workshop in May, 1999, and the WG 8 meeting at PICES VIII, the scientific mission of WG 8 will likewise end. In the near future, changes in the focus of future research topics

being planned by MEQ will thus require the formation of new Working Groups. With this in mind, what should be the next critical scientific task(s) of subsequent Working Groups which will replace WG 8 in advising the MEQ Committee? After appropriate discussion, MEQ agreed and resolved that increased effort will be devoted this year toward defining and convening a new Working Group to guide and support our evolving future MEQ research activities. This issue will require further clarification from Science Board.

c. Interdisciplinary nature of MEQ, and advantages of assimilating other PICES scientists in related fields: Discussion revolved around the issue of whether or not MEQ would be the appropriate PICES Scientific Committee to best provide a forum, and a PICES niche, for chemical oceanographers, marine bird and mammal scientists, and various other scientists who currently participate in PICES but whose interests and research focus may not necessarily be a good fit with the 3 other PICES Scientific Committees. It was generally agreed that it is appropriate for MEQ to embrace and encourage a wide and diverse group of scientific membership, and that our group is sufficiently interdisciplinary to serve a wide range of interested ocean scientists.

d. PICES Web page: Several Committee members noted that in the announcement for PICES VII and in the "online" registration form, there was no mention of the MEQ Paper Session. In addition, the Committee recommends inclusion on the PICES Web page of a description of topic areas for the MEQ Paper Session.

NOTE: MEQ suggests the following text for inclusion on the PICES Web page under the MEQ Committee section:
The theme areas for the MEQ paper session at PICES Annual Meetings are as follows:

Ecosystem effects of anthropogenic substances
Indicators of marine environmental quality
Ecotoxicology
Biological effects of toxic chemicals
Biomarkers of contaminant exposure and effects
Contaminant cycling
Nutrient cycling
Harmonization of methods
Modeling

MEQ Report to Science Board

The MEQ Committee discussed and endorsed the report of WG 8, and the recommendation of the WG to change the venue for the Practical Workshop to Vancouver Harbour, British Columbia, Canada. The Committee also appointed Dr. Colin Levings of Canada as a Co-Chairman of the Implementation Team for the Practical Workshop. In addition, the MEQ Committee concluded that the tasks of WG 8 would be complete at the conclusion of PICES VIII, at which time a task team will be identified to complete the final report of the Practical Workshop.

The MEQ Committee drafted the following recommendations to the PICES Science Board:

a. The MEQ Committee accepts the change in venue for the Practical Workshop to Vancouver Harbour, Canada, and recommends continued support by PICES of $20K for the workshop. Attendance by at least two scientists from each member country is critical to the success of the workshop in achieving the stated goal and objectives.

b. The MEQ Committee proposed to BIO a joint session on "Coastal pollution: eutrophication, phytoplankton dynamics, and harmful algal events", for PICES VIII in Vladivostok.

c. The MEQ Committee recommends that the Topic Session for PICES VIII be "Ecological impacts and mitigation of oil spills and oil exploration". The Convener of the Topic Session will be Dr. Alexander V. Tkalin.

d. The Committee also recommends that a follow up session to the mariculture session at PICES VII be held as a Topic Session for PICES IX in Japan. The proposed title is "Science and technology for environmentally sustainable mariculture: impacts and mitigation in coastal areas".

Adjournment

The MEQ Scientific Committee concluded its meetings for PICES VII, and was adjourned by Acting Chairman Prof. Shimizu at 1730 hours on Thursday, October 22, 1998.

Scientific Program

The following scientific papers were presented from the MEQ Committee sponsored part of the program.

Science and technology for environmentally-sustainable mariculture. (MEQ) Convenor: John E. Stein (U.S.A.)

Conrad Mahnken. The status of aquaculture in North Pacific Rim nations - was Peter Larkin right?

Colin D. Levings, S.F. Cross & S.J. Gormican. A preliminary examination of the transfer of oxytetracycline (OTC) from farm fish to fauna adjacent to a net-pen operation in British Columbia

Lee W. Harrell. Perceptions, attitudes and biological realities associated with wild fish and fish held in artificial culture facilities

Gregory T. Ruggerone & D.L. Alverson. Potential effects of farmed salmon on wild salmon stocks in the Pacific Northwest

Ronald W. Hardy. Global feed requirements to sustain expansion of aquaculture production

Thomas A. Flagg, C. Mahnken, J. Colt, D. Maynard & R. Iwamoto. The endangered species act and the changing role of artificial propagation

Makoto Shimizu. Mariculture in Japan (special short presentation)

Contaminants in high trophic level biota - linkages between individual and population responses. (MEQ/BIO Joint Session) Co-Convenors: John E. Stein (representing R.F. Addison) & Linda Jones (U.S.A.)

Ross J. Norstrom. Persistent organic pollutants in arctic marine mammals

Peter S. Ross & R.F. Addison. Marine mammals at the top of the food chain: ecological sentinels

John E. Stein, M. Arkoosh, T. Collier & E. Casillas. Estuarine pollution and juvenile salmon health

Kimberlee B. Beckman, G.M. Ylitalo, M.M. Krahn, R. Towell & J.E. Stein. Organochlorine levels and immune system function in northern fur seals (*Callorhinus ursinus*) from St. George Island, Alaska

Todd M. O'Hara & V. Woshner. Contaminants and health assessment research in arctic Alaska wildlife: biologists, veterinarians, and subsistence hunters take on the challenge

Robert B. Spies. Research and monitoring in the wake of the Exxon Valdez oil spill: the long-term dividends

Cynthia T. Tynan. Effects of climate change on the transport, pathways, and availability of contaminants

Sandie O'Neill, J. West, L. Johnson & M. Myers. Chemical contaminant exposure and associated biological effects in Puget Sound fishes

Endnote 1

Participants

Canada
Colin D. Levings*

China

Japan
Makoto Shimizu*

Korea
Kwang-Woo Lee

Russia
Lev M. Gramm-Osipov
Alexander V. Tkalin*

U.S.A.
John E. Stein* (representing Usha Varanasi)
C. Michael Watson

* WG 8 member

Endnote 2

November 30, 1998
Dr. Michael Watson
Rapporteur, PICES MEQ Committee
USEPA, 1200 6th Ave.,
Seattle, WA 98101-3188
U.S.A.

Dear Michael:

Now that I am stepping down as Chairman of MEQ, this seems to be an appropriate time to review the work of the Committee over the past three years. I hope this record will be useful to my successors.

The main work of MEQ has been to plan a practical workshop, which will have the objective of harmonising approaches used by PICES member states to assess the effects of marine pollution. (This objective was embodied in the terms of reference of WG 2, later WG 8, which reported to MEQ.) The idea of a practical workshop was first outlined at PICES II (Seattle, 1993); it was to be modelled on the successful IOC/GEEP Workshops whose proceedings have been published elsewhere (Mar. Ecol. Prog. Ser., vol. 46, 1988; J. Exp. Mar. Biol. Ecol. vol. 138, 1990 and Mar. Ecol. Prog. Ser. vol. 91, 1992). The idea was subsequently discussed and approved at PICES III (Nemuro, 1994). In 1995, PICES met in Qingdao, and at the meeting of WG 8 which immediately preceded the full PICES meeting, Prof. Ming-Jiang Zhou proposed that the workshop be held at the Academia Sinica Institute of Oceanology in Qingdao, and that Jiaozhou Bay (an industrialised harbour) and a suitable reference site on the Shandong peninsula be the focus of the workshop. This invitation was accepted by WG 8 and the proposal approved by MEQ and subsequently by SB and the Council at PICES IV.

The next two years involved considerable work by WG 8 and others. Prof. Ming-Jiang Zhou and his colleagues provided lists of equipment and laboratory space to be made available at his Institute, and provided several publications and reports which described oceanographic conditions, biota and contaminant concentrations in various environmental "compartments" in the region. Several of these articles were translated at PICES' expense. At the same time, WG 8 members refined the plans for the workshop, based on this information; this involved at least one meeting in Seattle of North American members. At the WG 8 and MEQ meetings at PICES VI (Pusan, 1997), the final plans were presented and approved, and endorsed by SB

and the Council. At that meeting, MEQ also discussed the desirability of having a "fallback" site, and agreed to consider the Masan-Chinhae Bay area in Korea for this.

Following PICES VI, I drafted (for Bill Doubleday's signature) a formal request to the appropriate Chinese authorities for permission to run the workshop in spring 1998. This was refused on the grounds that "… the present situation in Jiaozhou Bay is not suitable to host the workshop" (letter, Mr. Zuo-Fu Gan, Jan. 22, 1998). (PICES had, in fact, written to Chinese authorities in late 1996 and early 1997 on the subject of the workshop, but had received no reply.) Following Mr. Gan's letter, we reverted to our fallback position of using the Masan-Chinhae Bays in Korea; however, after several discussions with the Korean scientists involved, it became clear that a workshop could not be organised there at short notice. In the light of this, John Stein, Colin Levings and I undertook to move the workshop to West Vancouver, where it is now scheduled for spring 1999 (see MEQ Report, PICES VII, 1998).

There are lessons for MEQ (and other PICES Committees) in this. The most important one is probably that Committee members and delegates must realise that *SB and GC endorsement of a Committee recommendation implies a commitment by Council Delegates to try to implement that recommendation*. Although the recent events I have described surrounding the planning of the practical workshop have been frustrating, the experience will not have been wasted if PICES learns from it.

Finally, although most of our effort has focussed on organising the practical workshop, MEQ has had other activities. Probably the decision with the furthest-reaching implications is our agreement to support the GIWA project, at least to the extent of keeping in touch with GIWA (MEQ Report from PICES VI, Pusan). It is in the nature of UN-supported programmes to move ahead only slowly, but assuming that PICES will become involved in GIWA, this will have a considerable influence on the MEQ's activities over the next few years.

I hope this summary of our activities will be a useful record for the committee. Despite the frustrations of the last year or so, I have enjoyed my involvement with PICES and I have appreciated very much the opportunity to interact with a very pleasant and stimulating group.

Yours sincerely

(signed)

R.F. Addison
Head, Contaminants Science

Endnote 3

Report of Working Group 8
Practical Assessment Methodology

The meeting of WG 8 was convened at 0900 on October 17, 1998. Attendees are given at the end. Dr. John E. Stein noted that Prof. Ming-Jiang Zhou, WG 8 Co-Chairman, was not able to attend PICES VII. Dr. Colin Levings agreed to serve as rapporteur.

The meeting agenda was reviewed and approved. The overall objective of the meeting was to review and refine the draft workplan for convening a Practical Workshop in Vancouver Harbour, Canada, aimed at harmonizing approaches and

methods among PICES countries when assessing ecological impacts of pollution.

Dr. Levings gave a presentation on the proposed study area and members commented on the overall study design for the proposed practical workshop. Vancouver Harbour was accepted as a proposed site and the workplan was amended accordingly. There was substantial discussion of options for funding travel to the Practical Workshop. Participation by at least 2 scientists from each of the PICES member countries was deemed critical to the success of the Practical Workshop.

The WG members present approved the draft meeting report and recommendations to the MEQ Committee.

The meeting was adjourned at 1430 h on October 18, 1998.

Appendix 1

Participants and observers

Canada
Colin Levings*

China

Japan
Makoto Shimizu
Yoichiro Ishibashi (observer)

Korea

Russia
Lev M. Gramm-Osipov
Alexander V. Tkalin*

U.S.A.
John Stein (Co-Chairman)*

*Member of WG 8 Implementation Group for Practical Workshop

Appendix 2

Recommendation to MEQ

Working Group 8 recommends that the MEQ Committee accept the modified plan (Annex 3 to 5) for the Practical Workshop developed during the WG meeting that preceded PICES VII (Fairbanks, Alaska). The new proposed site for the Practical Workshop is Vancouver, Canada. Revisions to the workplan were made in continued recognition of the need of PICES countries to work toward harmonizing approaches and methods for assessing marine pollution effects.

During PICES V, the Governing Council approved funds to support operational expenses of the Workshop. The WG 8 recommends that the MEQ Committee accept the budget in Annex 6. The WG 8 also points out that there are two basic options for securing travel funds for scientists from PICES member countries to participate in the Workshop: 1) to seek the travel funds for their participating scientists through their member countries, 2) to reallocate funds within the operational budget given in Annex 6 and or seek funds from the PICES Secretariat. In addition, WG 8 recommends that a Canadian scientist on the Workshop Implementation Team be appointed as a Co-Chairman of the Implementation Team, if the alternate workshop site, Vancouver Harbour, Canada, is accepted.

The WG reconfirmed that this workshop is a necessary step in establishing scientific cooperation for future collaborative efforts and in the harmonization of approaches of PICES member countries in assessing the broader scale impacts from human activities on North Pacific marine habitats essential to living marine resources.

Background and history on workshop development

PICES WG 8 (formerly WG 2) has discussed approaches to fulfilling its terms of reference at meetings in Seattle, Nemuro, Qingdao, and Nanaimo (coinciding with the PICES Second, Third, Fourth and Fifth Annual Meetings). Briefly, the aim of the WG 8 is to promote the collection and exchange of information about approaches PICES member countries use by assessing the biological impact of marine pollution. The WG 8 agreed to approach this by organizing a *practical* Workshop, during which participants could work together to evaluate methods used to assess ecological effects of pollution. The format of the workshop is being developed along the lines of the successful Intergovernmental Oceanographic Commission/ Group of Experts on the Effects of Pollutants (IOC/GEEP) workshops whose results have been published in Marine Ecology Progress Series (vol. 46 (1988) and vol. 91 (1992)) and in the Journal of Experimental Marine Biology and Ecology (vol. 138 (1990)).

Jiaozhou Bay, China, was selected for this workshop, because extensive data sets describing biota and contamination in the Bay are available from the Institute of Oceanology, the State Oceanic Administration (SOA), and other institutions and Universities, and there are laboratory facilities on the Bay, including a joint Korea/China Center. The bay is influenced by a range of human activities that will allow the evaluation of methods that are being used in PICES countries to assess the biological effects of pollution. For these reasons, Jiaozhou Bay is a good site to examine harmonization of methods used by PICES member countries for assessing biological effects.

In regard to the logistics for conducting the workshop, Prof. Ming-Jiang Zhou extended an invitation to use the facilities and research vessels of the Institute of Oceanology, Academia Sinica, for the workshop. In addition, Dr. Dong-Beom Yang from Korea Ocean Research and Development Institute (KORDI) subsequently confirmed that the joint Korea/China Center in Qingdao could offer additional facilities.

The MEQ and WG 8 formed an informal Workshop Implementation Team at the PICES Fourth Annual Meeting. The team had ongoing correspondence, and an informal *ad hoc* meeting of some of the North American members was held in Seattle in June 1996, to develop a work plan. Implementation Team members tentatively identified the kinds of sampling and analyses to be carried out and suggested possible participants from all the PICES member countries. This draft list and tables outlining the suite of analyses proposed was sent to the Workshop Implementation Team members in Russia, Japan, China and Korea that were unable to attend the *ad hoc* meeting. Their review, advice and suggestions were sought and comments incorporated into a revised draft workplan as appropriate. The revised workplan was further refined and formally adopted by WG 8 at PICES V, Nanaimo, Canada (October 1996). At PICES V, the MEQ submitted the Workplan to the Science Board, and the plan was approved subsequently by the Governing Council. The Governing Council also approved PICES funds to support operational expenses for conducting the Workshop in Qingdao, China. By April 1997, literature searches on Jiaozhou Bay were conducted, a bibliography developed, and several key papers were translated to English, and distributed to members. Unfortunately, approval to conduct the workshop in Jiaozhou Bay and the necessary funding to support travel of participating scientists were not obtained to carry out the workshop in 1997. At PICES VI in Pusan, it was anticipated that final revisions to the workplan would be made following discussions with scientists from the laboratories in Qingdao. Immediately following PICES VI, the PICES Chairman formally requested consideration by the Chinese government to grant approval for conducting the workshop in Jiaozhou Bay. On January 22, 1998, the Chinese authorities notified PICES that the request for the workshop to be held in Jiaozhou Bay was denied.

The Chairman of the MEQ Committee then

pursued options for an alternate site. Korean representatives at PICES VI suggested that a site in Korea was possible as an alternate site in the eventuality that the workshop could not be conducted in Jiaozhou Bay. After consultations with Korean MEQ members, it was concluded that permission from Korean authorities for conducting the workshop in Korea could not be given in time to have the workshop in the spring of 1998 or 1999. Given the time constraints it was concluded that an alternate site in North America should be investigated. Drs. Levings and Addison proposed Vancouver Harbour as an alternate, and subsequently developed a presentation for to be given to the WG 8 at PICES VII in Fairbanks.

Practical Workshop Workplan

Purpose:
Work towards harmonizing approaches and methods used in assessing ecological impacts of human activities on the environmental quality of North Pacific marine ecosystems.

Objective:
To work cooperatively in assessing the ecological impacts of contaminants on benthic invertebrate and fish communities.

Specific goal:
To evaluate and compare methods used to assess ecological effects of chemical contaminant exposure.

Study site:
Contaminated sites and reference sites within Vancouver Harbour will be sampled. (See Annex 1). The sites are shown in Figures 1 through 3 (Goyette and Boyd 1989, Environment Canada, Regional Program Report 89-02) and were selected according to criteria in Annex 1. The sites to be evaluated were also selected based on geographic location, existing background information, previous and ongoing monitoring, and logistics such as proximity to appropriate laboratory facilities in West Vancouver.

Workshop (see flowchart in Annex 2):

1. The workshop will commence with a meeting to discuss monitoring approaches used by the various PICES countries and a review of the sampling and analysis schedule for the Practical Workshop. The meeting on monitoring approaches will occur the day before the Practical Workshop starts.

2. The biological responses to be evaluated include: benthic community structure; sediment quality assessment (bioassays), demersal fish health and condition (including histopathology), biota age and size relationships; biochemical changes linked to contaminant exposure (e.g., cytochrome P-4501A induction, bile metabolites), and assays to detect endocrine disrupting chemicals (e.g., the YES bioassay) or exposure to endocrine disrupting chemicals (levels of vitellogenin in male flatfish such as English sole) (see Annex 3 and 4). These data will also be used for interpretation of organism, population, and community responses. As appropriate, replicate samples will be collected to allow scientists to analyze the same sample to assess reproducibility. Assessing the relationship of the biological responses to contaminant exposure requires information on current levels of contaminants in biotic and abiotic compartments of the study site. Concentrations of the following classes of chemical contaminants, polycyclic aromatic hydrocarbon (PAHs), tributyltins, dioxins, chlorinated hydrocarbons, selected metals, and endocrine disrupting chemicals will be determined in sediment or biota as appropriate.

3. During the cooperative activities there will be up to 16 scientists participating in the workshop, with at least 2 scientists from each PICES member country. Other scientists may augment this effort, at their own expense.

4. Samples will be obtained using the NOAA research vessel HAROLD W. STREETER, which is equipped with most of the appropriate onboard trawls and grabs. Analyses will be carried out cooperatively at the West Vancouver Laboratory of the

Canadian Department of Fisheries and Oceans, using specialized instruments from other laboratories. In addition routine analyses (e.g., aging) that do not involve cooperative evaluation will be conducted at other laboratories, such as at the Pacific Biological Station in Nanaimo. Scientists participating in the workshop will collect additional (replicate) samples for further analyses to be done after the Practical Workshop. Data Coordinator will be Dr. Colin D. Levings (or designee) with cooperation from Dr. John E. Stein (or designee). The data coordination efforts will include preparing data collection sheets and incorporating measurements and calculations into a database.

5. The workplan is being developed to encourage comparison and harmonization of methods currently being used by scientists in PICES countries for evaluating ecological effects of pollutants. It is anticipated that a suite of methods will be identified which will complement existing evaluation methods being used in various PICES countries. All work is being designed to be scientifically sound and publishable.

6. The proposed time for the Workshop is May 24 to June 8 1999 (see timeline, Annex 5). On May 24 a half-day orientation meeting will be held. The workshop will consist of a one-day meeting on May 25, 1998 (convened by Drs. Levings and Stein) to discuss monitoring approaches used by PICES member countries, followed by cooperative sampling and analysis of biotic and abiotic samples from May 26 to June 5. Preparations for sample shipment, archiving, and data organization will be concluded by June 8.

7. It will be necessary to hold meetings following the Practical Workshop. In October 1999, at PICES VIII, we would review preliminary results in the WG 8 meeting and discuss the format of a descriptive report on the fieldwork possibly to be published in the PICES Scientific Report Series. A paper will also be prepared for presentation at PICES VIII. It is proposed to have a more complete discussion of results during the PICES IX meeting in October 2000. Final publication of results in the scientific literature, as appropriate, to follow soon after.

   Figures and Tables in Annexes expand on the information presented above and include: a chart of proposed sampling sites; sampling-site selection criteria; a flowchart for the workshop and follow-up activities; methods to be evaluated and responsible investigators; and a timeline for implementing and conducting the workshop; and the workshop budget.

Expected products of Vancouver Harbour Practical Workshop

1. An improved appreciation by PICES participants of the approaches and techniques used by other member countries to assess the effects of marine pollution, and improved mutual understanding and technology transfer among scientists from PICES countries.

2. The generic results should be applicable to other coastal areas in the PICES region. The data will be archived and made available to PICES country scientists. A series of papers evaluating the methods for characterizing the effects of pollution on Vancouver Harbour is anticipated.

Figs. 1-3. Charts of Vancouver Harbour, B.C., Canada, showing proposed sites (Stations 11b, 15, 16, 19, 35, 38) for evaluating methods to assess relationships between contaminant exposure and biological and population level effects. Proposed reference sites are PEI and a site in outer Howe Sound (latter site not shown). The Howe Sound site is approx. 25 km. northwest of Vancouver Harbour.

Annex 1
Criteria for selection of sites in Vancouver Harbour

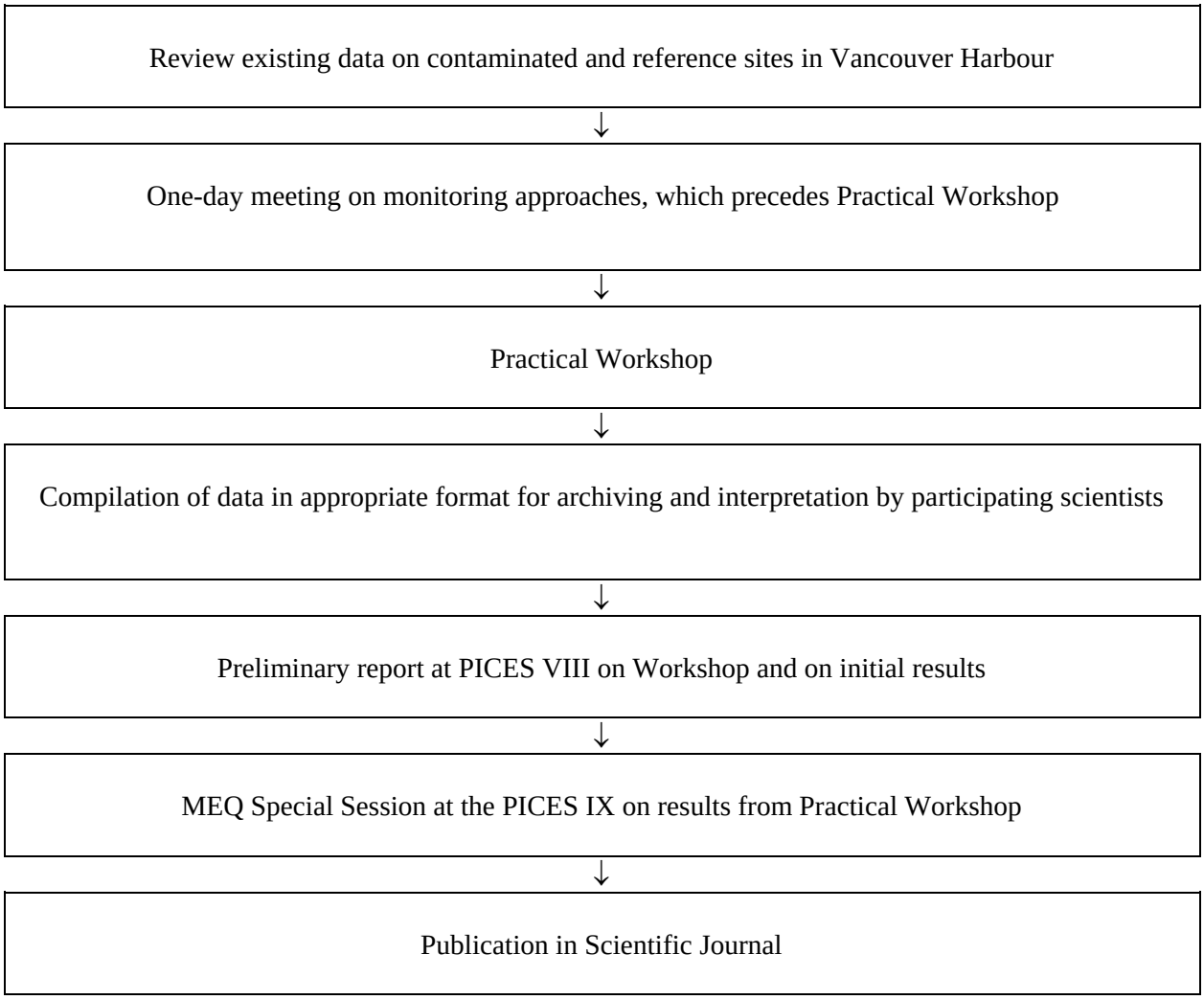
- Sites previously sampled
- Comparable sediment types
- Potential different pollution sources
- Benthic invertebrates present
- Avoid dredged areas
- Sites with flatfish species present
- Sites with mollusc species present (mussels, clams)
- Comparable oceanography (estuarine circulation)

Sampling Sites in Vancouver Harbour

Site (SN = station number)	Primary Contaminant at the Site
Port Moody	
2 Trawl sites Port Moody 1 (SN 35) Port Moody 2 (SN 38)	Polycyclic Aromatic Hydrocarbons
Inner Burrard Inlet	
4 Trawl sites Inner Burrard 1 (SN 11B) Inner Burrard 2 (SN 15) Inner Burrard 3 (SN 16) Inner Burrard 4 (SN 19)	Heavy Metals Non-Point Source (Combined Sewer Outfalls)
Outer Burrard	
1 Trawl site Outer Burrard (SN PE1)	Reference site (fish)
Outer Howe Sound	
1 Trawl site Outer Howe Sound 1	Reference site (benthos/sediment)

Annex 2

Flowchart for Practical Workshop



Annex 3

Methods for Determining the Ecological Effects of Contaminant Exposure

Methods to be Evaluated	Current participants
For molluscs:	
•contaminant levels	Russia (Tkalin)
•condition factor and other ecophysiological methods for mussels	Canada (Levings)
•imposex (gastropod)	Korea (TBD), China (Zhou)
•age/size relationships, growth rate	China (Zhou)
For benthic fish:	
•contaminant levels	Russia (Tkalin)
•health and condition (condition factor, HSI, tissue lipids, etc)	USA (Stein)
•histopathology	Canada (Levings/Devlin/Kent), USA (Myers)
•age/size and food habit relationships	Canada (Levings)
Biomarkers: •CYP1A	Canada (Addison), Korea (Yang)
•vitellogenin in males (for EDCs)	USA (Johnson), Japan (TBD)
•YES bioassay (for EDCs)	USA (French)
•bile metabolites	USA (Krahn)
For benthic community:	
•abundance/diversity	Russia (Belan), China (Zhou), Korea (Je)
•sediment quality (bioassays)	Canada (Levings), China (Zhou)
sediment contaminants	Canada (Addison), USA (Krahn) Russia (Tkalin)

Abbreviations: CYP1A cytochrome P4501A, HSI = hepatosomatic index, EDCs = endocrine disrupting chemicals, TBD = to be determined, YES = yeast estrogen system

Annex 4

Ancillary Information Needed for Conducting the Practical Workshop

Biological Parameters	**Information needed**
Species identification	observation at time of collection (use photographs)
Length and weight	measurements conducted at time of collection
Sex	observation at time of collection
Age	collection of otoliths or shells
Maturation stage	observation at time of collection, gonad weight, for gonadosomatic index
Stomach fullness	observation at time of collection, weight of contents
Stomach taxonomy	stomach samples preserved
Condition factor	whole body, liver, and gutted body weight at time of necropsy
Other observations:	observable lesions, parasites, deformities, etc.; observations conducted at time of collection (use photographs)
Sediment Characteristics	observations on sediment characteristics (use photographs); TOC, TON, grain size, minerology, metals and organic contaminants
Water characteristics	measurements conducted at time of collection; temperature, salinity, dissolved oxygen, turbidity, nutrients
Sample identification[1]	sample number, date collected, site location, method of collection, DGPS, water depth, etc., observations conducted at time of collection

[1] The numbering scheme will be devised to ensure that all samples are handled "blind" by the researchers conducting analyses (i.e., without the participants knowing the origin of the sample).

Abbreviations: DGPS = differential global positioning system, TOC = total organic carbon, TON = total organic nitrogen

Annex 5
History for Proposed Jiaozhou Bay Practical Workshop

October 1996	Contact with Head of China PICES Delegation.
October 1996	Approval by PICES Science Board and Governing Council of funds to partially support the workshop.
December 1, 1996	Data compilation on biology, oceanography, and pollution; and the translation and distribution of some key papers were initiated (contract established in consultation with M.J. Zhou). (Completed April 1997).
October 1997	WG 8 met at PICES VI to refine workplan and discuss logistics.
January 1998	Request to conduct Practical Workshop in Jiaozhou Bay was denied.

Timetable for Vancouver Harbour Practical Workshop

October 1998	WG 8 met at PICES VII to revise workplan to hold workshop in Vancouver, B.C., Canada.
January 5 1999	Deadline for confirmation of participation by scientists from PICES countries.
February 15 1999	Conference call to review workplan and draft timetable for Workshop.
March 15, 1999	Final draft of the workshop timetable to be completed by participants and/or designates; completed list of supplies.
April 15, 1999	Supplies for workshop on site.
May 24 - June 8, 1999	Conduct Practical Workshop on monitoring approaches used by PICES member countries
September 15, 1999	Summary report of workshop activities completed by participants. The report will constitute the final draft of the activity report for discussion and review at PICES VIII meeting.
October 1999	Discuss or develop at the PICES VIII working group meeting the: - preliminary results - follow-up analyses - data archive and distribution procedures - proposed publication format - designation of report editor - one comprehensive (40 min.) presentation on the workshop as part of MEQ session.
December 1999	All workshop results available to participants.
June 2000	Complete statistical analyses and interpretation of findings, participants begin preparation of reports to be presented at PICES IX.
October 2000	Presentation of workshop findings at PICES IX meeting, complete papers submitted for compilation as workshop report.

Annex 6

Estimated Costs for Vancouver Harbour Practical Workshop (Can.$)

1.	Travel (see attached table) 8 participants (4 each Canada and USA) round trip 8 participants (2 each from China, Russia, Japan and Korea) round trip air fare $1500 each person	 $NC $12,000
2.	Lodging and Meals (see attached table) (See attached memo and memo from proposed housing facility) 8 participants for 15 days at $40 dollars/day/person	 $4,800
3.	Vessel Costs (Provided by Canada and USA)	$NC
4.	Laboratory Space (Rental)	$1,500
5.	Supplies and Shipping (laboratory supplies, reagents, disposable equipment, transport of equipment, air cargo expenses)	 $14,000
6.	Contract for literature review on Jiaozhou Bay	$1,000
	TOTAL ESTIMATED COST:	**$33,300**
	Funds Contributed by PICES	$20,000
	Funds from PICES Member Countries*	$13,300
	TOTAL FUNDS:	**$33,300**

*Funds accounted reported here do not include travel and lodging and meal costs for US and Canadian scientists. Also, they do not include member country support for supplies and analytical costs for analyses of additional samples following the Practical Workshop, nor costs of data analysis and reporting.

Publication costs, costs of any subsequent travel or "wrap-up" conferences are not included above. In previous IOC/GEEP workshops, all these items have been considered desirable, although most of the costs have usually been borne by individual investigators or their agency. It is proposed that the “wrap-up” symposium be conducted as part of PICES IX.

PICES travel funds may be needed to assist some scientists in attending PICES VIII and IX. Attendance by participating scientists at PICES VIII and IX will be important to the overall success of the workshop. At PICES VIII, an initial assessment of the data from the workshop will be conducted, additional planning for report preparation will take place, and one presentation in the MEQ session will be given on the what was accomplished during the workshop and initial results. At PICES IX, the MEQ Topic Session may be used as a venue for formally presenting the results of the Practical workshop.

Detailed Description of Funding to Support Travel, Lodging and Meals for PICES Member Country Scientists to Participate in the Vancouver Harbour Practical Workshop

Travel by PICES Country [Country (number of scientists)]	Funding Source ($Can. Funds)
Canada (4)	Canada
China (2)	PICES funds allocated to Workshop ($3 K)
Korea (2)	PICES funds allocated to Workshop ($3 K)
Japan (2)	PICES funds allocated to Workshop ($3 K)
Russia (2)	PICES funds allocated to Workshop ($3 K)
United States (4)	United States
Lodging and Meal Costs [Country (number of scientists)]	Funding Source
Canada (4)	Canada
China (2)	PICES funds allocated to PW ($1.2 K)
Korea (2)	PICES funds allocated to PW ($1.2 K)
Japan (2)	PICES funds allocated to PW ($1.2 K)
Russia (2)	PICES funds allocated to PW ($1.2 K)
United States (4)	United States

REPORT OF PHYSICAL OCEANOGRAPHY AND CLIMATE COMMITTEE

The meeting of POC was held in two sessions. An aggregate list of participants and observers is to be found in Endnote 1.

The meeting began at 11:15 on Oct 19. The Chairman, Dr. Paul H. LeBlond (Canada) welcomed participants and observers.

WG 10 (Japan/East Sea Circulation)

Co-Chairman Dr. Christopher N.K. Mooers described progress of the final report. A draft has already been circulated and comments received. More work is needed to complete the report, which will be submitted to the Secretariat by Dec. 1, 1998. It will then be posted on the PICES web site or otherwise made available to POC members for review. Comments on the report are to be made to the Chairman of POC, with copy to the Secretariat, by Jan. 13, 1999. Final approval for publication will be made by the Chairman of POC by Jan 31, 1999. In addition, Dr. Mooers reported on the creation of a modern bibliography on the Japan/East Sea. This document will be available on the PICES web site and will be kept up to date under POC supervision with the assistance of the Secretariat. POC members thanked Dr. Mooers and Dr. Sang-Kyung Byun, Co-Chairmen of WG 10, as well as other members of the working group, for their work. It was agreed that WG 10 should be disbanded after completion of its report.

WG 13 (CO_2 in North Pacific)

Dr. Yukihiro Nojiri, Co-Chairman of WG 13, reported on progress. The WG, under the co-chairmanship of Dr. Nojiri and Dr. Richard A. Feely, held a meeting and technical discussions in Fairbanks on Oct 14-15, 1998 (see Endnote 2). POC recommended support for a technical workshop to discuss results of intercomparisons of measurement techniques and to initiate a detailed technical exchange on measurement technique and data quality among scientists studying CO_2 in the North Pacific. This workhop is to be held in Japan, in April 1999. Travel assistance was also requested for Dr. Feely to attend the JGOFS North Pacific Workshop in March 1999. POC also expressed support for other initiatives of the WG. The idea of a data workshop in the year 2000 received support in principle, but will have to receive detailed justification and further discussion at PICES VIII. POC members agreed with the desirability of sampling the WOCE P1 line within a single year. Canadian participation in some of this work may be available.

The meeting adjourned at 12:15 and resumed at 13:30 on Oct 22.

Election of new Chairman

Dr. Vyacheslav B. Lobanov was elected by acclamation as the new Chairman of POC. Members thanked the outgoing chairman and welcomed Dr. Lobanov.

Strategic plan

The structure of the draft circulated by the Chairman was deemed generally acceptable. A lively discussion about the future role of POC led to a number of suggestions, which were incorporated in the strategic plan attached as Endnote 3.

POC-CREAMS relations

Drs. Stephen C. Riser and Kuh Kim reported on the recent CREAMS Workshop (Oct. 18, 1998). Besides the original physical core of CREAMS, results of a number of ecosystem studies were reported at the workshop. Consequently, POC members suggested that the Japan/East Sea might be a suitable area to start a REX pilot

project. CREAMS appreciates the support of PICES, especially in obtaining clearances to work in national waters. The resolution approved by PICES last year (1997 PICES Annual Report, p. 96) is re-affirmed.

GODAE and ARGO

Dr. Riser presented an overview of the Global Ocean Data Assimilation Experiment (GODAE) and its informational support, the Array for Real-time Geostrophic Oceanography (ARGO). U.S., European and Japanese groups are currently developing these programs. Assimilated data are to be available freely on the web. The ARGO system is to consist of 3,000 PALACE floats deployed globally from ships of opportunity at a 300 km x 300 km resolution by the year 2003. GODAE and ARGO are eventually to be components of GOOS. POC recommends that PICES encourage member countries to create national committees to plan for participation in GODAE and ARGO and that ARGO data and assimilation results from GODAE remain freely available to all users. An informational article on GODAE and ARGO in PICES Press would be desirable.

Okhotsk Sea Multilingual Nomenclature

Drs. Lobanov and Yutaka Nagata reported that the Nomenclature has been completed and published as PICES Scientific Report No. 8. POC members applauded their successful efforts.

Japan/East Sea Historical Bibliography

POC discussed a proposal to publish an annotated bibliography of the Japan/East Sea oceanography, prepared by Dr. Mikhail A. Danchenkov (FERHRI, Russia). The bibliography is very extensive, containing more than 1,100 references. Publication has the support of WG 10; it would be suitable as a PICES Scientific Report. In view of the limited distribution expected, the Secretariat should consider appropriate publication options.

PICES web page

Following a request from the Secretariat for more scientific information on the PICES web page, Dr. Howard J. Freeland volunteered to help in this respect. He will liaise with the Secretariat to provide information and links to science programs for the web page.

TCODE

Mr. Robin M. Brown briefly presented the proposal for a one-day data visualization workshop to be held before PICES VIII. POC enthusiastically supports this proposal.

Second Okhotsk Sea Workshop, Nemuro

This workshop will be held Nov 9-12, 1998. To date, 23 participants from Japan, 13 from Russia and 2 from the U.S.A. are expected. Organisers expect a report including about 25 papers (at 10 pp each). Manuscript submission is expected by Feb. 1, 1999, review and completion by May 1, 1999. POC members expressed their thanks to the organizers: V. Lobanov, Y. Nagata and S. Riser, and supported publication of the proceedings as a PICES Scientific Report.

Iron fertilization experiment

POC was apprised of the plans for the formation of an Advisory Group on an iron fertilization experiment in the Subarctic Pacific and expressed general support for this endeavour.

Future symposia

POC proposes to hold a symposium at PICES VIII entitled: "Modeling and prediction: the state of the art". Convenors will be Drs. Nobuo Suginohara (Japan) and David L. Musgrave (U.S.A.). They are to invite prominent modelers and address a broad range of problems.

Best Presentation Award

17 nominations for the Best Presentation Award were received. The nominee receiving most votes was Dr. Hisashi Nakamura for his

presentation of the paper of H. Nakamura and T. Yamagata: "Observed association between SST and atmospheric anomalies in the North Pacific decadal climate variability".

Scientific Program

The following scientific papers were presented from the POC Committee sponsored part of the program.

Decadal Variability of the North Pacific climate. (POC) Convenor: James E. Overland (U.S.A.)

Shoshiro Minobe. Bidecadal and pentadecadal climatic oscillations over the North Pacific

David W.J. Thompson & J.M. Wallace. The arctic oscillation

Koji Yamazaki & Y. Ohhashi. Variability of the eurasian pattern and its interpretation by wave activity flux

J. King, R.J. Beamish, G.A. McFarlane, D. Noakes & R. Sweeting. Synoptic wind flow patterns off the west coast of North America in relation to recent changes in Pacific salmon catches

Ming-Yu Zhou & Y. Liu. Decadal variability of aerosol characteristics and deposition of crustal substances and pollutants in ocean areas near China

Sergey M. Varlamov & N.A. Dashko. Stable local wind patterns over the Sea of Japan and Okhotsk Sea, derived from the high resolution ECMWF operational analysis and forecasting system

Sub-session on Atmosphere - SST/Ice Coupling

Hisashi Nakamura & T. Yamagata. Observed association between SST and atmospheric anomalies in the North Pacific decadal climate variability

Andrei S. Krovnin & N.V. Klovach. Changes in abundance of salmon stocks in the context of climatic variations in the North Pacific region

Mark Johnson & A. Proshuntisky. Decadal variability of the Arctic Ocean and the Gulf of Alaska

Seiji Yukimoto, M. Endoh, Y. Kitamura, A. Kitoh, T. Motoi & A. Noda. Two distinct interdecadal modes of the Pacific in a coupled GCM

Jia Wang & M. Ikeda. Seasonal and interannual variability of sea-ice cover in the arctic and subpolar regions, 1900-1997: Signatures of AO, NAO and ENSO?

Meiji Honda & H. Nakamura. Influence of Okhotsk sea-ice extent anomalies upon the atmospheric circulation over the North Pacific: implications to the decadal climate variability

Kiyotaka Ohtani. Interannual change in residence time of the sea ice in the eastern Bering Sea

Sub-session on Ocean Response

Kimio Hanawa. Decadal/interdecadal scale variations found in the North Pacific

Yoshihiko Sekine. On the teleconnection processes around the North Pacific with reference to the decadal variations in atmosphere and ocean

V.A. Luchin, A.V. Saveliyev & V.I. Radchenko. Long-periodical climatic waves in the western Bering Sea and their effect on biological productivity

Lynne D. Talley. Simple coupled models of the PNA, circumpolar wave and NAO

David L. Musgrave. A temperature minimum in the Gulf of Alaska

Stephen C. Riser. Interannual variations in North Pacific intermediate water in the N. Pacific subtropical gyre

Carbon cycle in the North Pacific Ocean. (POC/BIO Joint Session) Co-Convenores: Shizuo Tsunogai (Japan) & C.S. Wong (Canada)

Robert M. Key. Radiocarbon in the North Pacific: What we have learned since GEOSECS

C.S. Wong, F.A. Whitney, W.K. Johnson, D. Crawford & E. Wong. Carbon flux in the subarctic northeast Pacific

Paulette P. Murphy, D.E. Harrison, R.A. Feely, T. Takahashi, R.F. Weiss & R.H. Gammon. Variability of pCO_2 in the subarctic North Pacific: a comparison of results from four expeditions

Yukihiro Nojiri. Seasonal and spactial characteristics of fCO_2 in the northern North Pacific monitored by a ship-of-opportunity

Hyung-Hoon Shin, S. Noriki, M. Itou & S. Tsunogai. Carbon cycle studied with settling biogenic particle in the western North Pacific

Noriko Nakayama, S. Watanabe & S. Tsunogai. Directly obtained CO_2 exchange rate at the sea surface from carbon and its isotopes

Shizuo Tsunogai & S. Watanabe. Role of the northwest Pacific in the absorption of atmospheric CO_2 specifically "continental shelf pump" working in the East China Sea

Shu-Lun Wang, C.T. Chen, G.H. Hong & C.S. Chung. Carbon dioxide and related parameters in the East China Sea

Paval Ya. Tishchenko, G.Yu. Pavlova, A.N. Salyuk & A.S. Bychkov. Carbon dioxide and dissolved oxygen in the Japan Sea: estimation of biological and thermal effects

Akihisa Otsuki, S. Watanabe & S. Tsunogai. Carbonate system of the Sea of Okhotsk controlled by sea ice formation

Igor P. Semiletov, P.Ya. Tishchenko, J.P. Christensen, I.I. Pipko & S.V. Pugach. On carbonate system of the Chukchi Sea and Bering Strait

Takashi Midorikawa, N. Hiraishi, K. Nemoto, K. Ogawa, T. Umeda, H. Hagai, N. Kubo & M. Ishii. Effects of biological production and air-sea interaction on seasonal variations of carbon dioxide in the subarctic North Pacific

Akihiko Murata, M. Honda, Y. Kumamoto, M. Kusakabe, K. Nemoto, T. Hiraishi, T. Midorikawa & H.Y. Inoue. Surface seawater pCO_2 distributions in subarctic water of the western North Pacific

Endnote 1

Participants and observers

Canada
- Howard J. Freeland
- Paul H. LeBlond (Chairman)
- C.S. Wong

China
- Ming-Yu Zhou

Japan
- Takeshi Uji

Korea
- Sang-Kyung Byun
- Kuh Kim
- Jae Yul Yun

Russia
- Gennady V. Khen
- Vyacheslav B. Lobanov

U.S.A.
- David L. Musgrave
- James E. Overland
- Stephen C. Riser

Observers

Robin M. Brown (TCODE Chairman)
Alexander S. Bychkov (Asst. Executive Secretary, PICES)
Yong-Jean Choi (Korea)
Michael G. Foreman (Canada)
Victor I. Kuzin (Russia)

Toshio Nagai (TCODE representative)
Yutaka Nagata (CCCC IP Co-Chairman)
Yukihiro Nojiri (WG 13 Co-Chairman)
Seelye Martin (U.S.A.)
Christopher N.K. Mooers (WG 10 Co-Chairman)
Thomas C. Royer (TCODE representative)
Alex Smirnov (Canada)

Endnote 2

Report of Working Group 13
CO_2 in the North Pacific

The Working Group was attended by representatives from Canada, Japan, China, Russia, and the United States of America. After a brief welcome by the Chairmen (Dr. Richard A. Feely, U.S.A., and Dr. Yukihiro Nojiri, Japan) and by Dr. Alexander S. Bychkov of the PICES Secretariat, the first day of the meeting was devoted to a series of technical presentations (see last section of report).

The North Pacific is an important sink for atmospheric carbon dioxide in the oceans and, consequently, plays an significant role in controlling long-term climate changes on the Earth. Some biogeochemical processes relating to the oceanic CO_2 system are peculiar to the North Pacific. This occurs because (i) the North Pacific is the final destination of circulation of the deep water that contains a high level of preformed nutrients and (ii) the North Pacific Intermediate Water stores dissolved CO_2 for more than a few tens of years. There is a considerable contrast in the ecosystems producing organic carbon and $CaCO_3$ particles, one of factors determining the CO_2 sink strength in the ocean, between the eastern and western North Pacific. The contrast is likely due to the difference in the nutrient composition in water supplied from the subsurface to the surface euphotic layer (i.e. physical forcing which affects mixed layer depth) and in the atmospheric input of iron and other substances. Continental shelf water is now receiving significant attention as a CO_2 sink. The extent of CO_2 exchange under heavy winter storms in high-latitude oceans is also not well known.

The presentations addressed a number of issues concerning the oceanic carbon dioxide system in the North Pacific. Collaborative research conducted by Japanese and Canadian scientists onboard the *M/S Skaugran* have identified the major source and sink regions for carbon dioxide north of 35°N. This region of the North Pacific is a large net sink for CO_2 (~0.3 PgC/yr) with large wintertime sources in the convective overturn regions of the western North Pacific and large spring and summertime sinks in the northwestern Pacific and Bering Sea regions due to high nutrient concentrations and primary production. Studies of anthropogenic CO_2 invasion into the central North Pacific, based on CO_2, hydrographic, and carbon isotope data, indicate downward mixing of anthropogenic CO_2 to depths of about 800–1200m. Time-series plots of anthropogenic CO_2 and chlorofluorocarbons at Ocean Station Papa show significant increases in the penetration of both anthropogenic CO_2 and chlorofluorocarbons over the last decade. Recent studies by U.S., Canadian and Japanese investigators have shown large interannual variations of pCO_2 in surface water along the west coast of North America due to the effects of the 1997-98 El Niño. The interannual pCO_2 variations are large enough to have a significant impact on the growth rate of CO_2 in the atmosphere during this period.

There were also descriptions of field programs being conducted by Canada, Japan, Russia, and the U.S.A. together with some preliminary interpretations based on the data from these programs. In addition, there were presentations on the technical issues involved in ensuring high-quality oceanic CO_2 measurements. The intercomparison of CO_2 measurement is the essential matter to have coherent data set over the global ocean. For the pCO_2 measurements, some intercomparison programs were completed in the United States and Japan. The recent Japanese intercomparison study showed reasonable agreement among various types of pCO_2 systems. It was understood the next intercomparison of DIC, alkalinity and carbon isotope is now necessary within PICES countries to understand the accurate CO_2 budget in the Pacific.

Dr. Andrew Dickson briefly outlined the planning for quality control for oceanic carbon data that was undertaken for the US Global CO_2

Survey and for other US JGOFS activities. The goal of quality control is to ensure that data generated are of known accuracy to some stated, quantitative degree of probability. This was achieved by a three-pronged approach that (a) encouraged participants to use well understood and documented analytical methods, (b) provided appropriate reference materials (developed specifically for the JGOFS program), and (c) held frequent technical discussions between the participating groups aimed at resolving issues that affected data quality. He recommended that the PICES WG 13 consider implementing such a plan for measurements in the North Pacific.

The second day was devoted to discussions and formulation of recommendations that the WG felt were important to achieve their overall objective of improving the degree of collaboration and communication between the various PICES nations making oceanic CO_2 measurements in the North Pacific.

These discussions were very valuable and resulted in the following plans and recommendations:

1. The WG would plan to carry out a series of between laboratory comparisons of measurement techniques for the parameters: total dissolved inorganic carbon, total alkalinity, and the $^{13}C/^{12}C$ ratio of the inorganic carbon in seawater. We recommend that PICES help to sponsor a technical workshop in April 1999, to discuss the results of these studies, and to initiate detailed technical exchange regarding measurement techniques and data quality between the scientists involved in studying CO_2 in the North Pacific.

2. The WG would conduct a pilot study (using samples collected on cruises to the Japanese KNOT time series station and other cruises that seem appropriate) to develop a protocol for collection and exchange of oceanic CO_2 samples for on shore analysis in multiple laboratories.

3. The WG should ask the JGOFS North Pacific Task Team to co-sponsor a data workshop in the year 2000 which is aimed at achieving a detailed comparison of existing data sets for CO_2 in the North Pacific. The goal of this workshop is to identify what needs to be done to provide effective data exchange, i.e. including a full understanding of data quality and limitations.

4. The WG requests funds from PICES to send the Co-Chairman to participate in the JGOFS-sponsored synthesis SEATS workshop in Taipei in March 1999. The Co-Chairman will coordinate PICES WG 13 activities with JGOFS.

5. The WG expressed its appreciation of Japanese plans to complete the WOCE Hydrographic Program P1 line, including high-quality CO_2 measurements and wished to encourage this activity as being important for a full understanding of the North Pacific CO_2 system.

The following presentations and discussions were made at the WG 13 meeting:

Yukihiro Nojiri - Results of NIES/IOS ship-of-opportunity monitoring and preliminary results from KNOT time series program

Akihiko Murata - Distributions of carbonate species in the western North Pacific: results from the *R/V Mirai*'s cruises in 1997-1998

Igor P. Semiletov - The Pacific Water Plume in the Arctic Ocean: an influence on carbon cycling

Richard Feely - Interannual variability of pCO_2 in the equatorial Pacific

Andrew Dickson - The quality control of oceanic carbon dioxide measurements

Vyacheslav B. Lobanov - Physical processes affecting CO_2 distributions

Yukihiro Nojiri - pCO_2 intercalibration results and ideal seawater pool facility of Fishery Engineering Institute

C.S. Wong - The ocean carbon cycle in subarctic North Pacific: interannual variability

Paul Quay - $^{13}C/^{12}C$ ratios of dissolved inorganic carbon in the N. Pacific: A tracer of anthropogenic CO_2 uptake

Discussion of Reference Materials and Intercomparison Studies - Dickson and Nojiri (Discussion Leaders)

Discussion of planned national and international CO_2 research programs in the North Pacific - Nojiri and Wong (Discussion Leaders)

Suitable sets on the CO_2 system in the North Pacific and discussion of mechanisms for data and information exchange - Dickson and Quay (Discussion Leaders)

Endnote 3

POC Review and Strategic Plan

1. Review of Activities

In its first year (PICES I - 1992), POC identified scientific issues of greatest interest and relevance which could be addressed by Working Groups: Ocean circulation and climate variability in the subarctic North Pacific; the Okhotsk Sea and the Oyashio region; new technologies and observing strategies; data collection and quality control. WG 1 on the Okhotsk Sea and Oyashio Region was created.

At PICES II (1993), POC received the report of WG 1 and endorsed its recommendations, especially on holding a workshop on the Okhotsk Sea in Vladivostok. WG 7 on Modelling of the Subarctic North Pacific Circulation was created. The theme session was on "Ocean circulation and climate variability in the subarctic Pacific".

At PICES III (1994), POC held a session on "Physical processes and modelling of the subarctic North Pacific and its marginal seas" and received an interim report from WG 7. Later in the year, POC took a leading role in holding the workshop on "Okhotsk Sea and adjacent areas" (Vladivostok, June 1995).

At PICES IV (1995), POC held a session on "Circulation in the subarctic North-Pacific and its marginal seas, and its impact on climate". It received the final report of WG 7 and moved the creation of WG 10 on "Circulation and Ventilation of the Japan/East Sea".

At PICES V (1996), POC held a session on "Exchanges of waters, organisms, and sediment between continental shelf waters and the nearby ocean" and received an interim report from WG 10. Work started on a Okhostk Sea Russian-Japanese English oceanographic nomenclature lexicon. POC also supported the plans of REX and BASS Task Teams of CCCC to hold a MODEL workshop.

At PICES VI (1997), POC and WG 10 held a session on "Circulation and ventilation of North Pacific marginal and semi-enclosed seas". WG 10 task was to be completed during the year. A second Okhotsk Sea workshop, to be held in Nemuro, was recommended. WG 13 on CO_2 in the North Pacific was created. POC also recommended that closer links be established between PICES and CREAMS.

At PICES VII (1998), POC discussed a draft of the final report of WG 10. It heard about a workshop held concurrently with the Annual Meeting by WG 13 as well as future plans of that Working Group. The published Okhotsk Sea Nomenclature was received. The Second Nemuro workshop on the Okhotsk Sea was to be held in November 1998. The POC topic session

was on “Decadal variability in the North Pacific”. POC and BIO joined forces to hold a session on “Carbon cycle in the North Pacific Ocean”.

In summary, over the past years, the Physical Oceanography and Climate Committee of PICES has provided a focus for scientific interest in the circulation of the subarctic North Pacific and its marginal seas; it has forged closer links between ocean and climate scientists of member countries; it has enhanced participation of physical oceanographers and climate scientists in interdisciplinary ocean ecology program of PICES (the CCCC Program).

2. The future

POC is one of the main instruments of PICES in working towards its purpose of advancing "scientific knowledge about the ocean environment, global weather and climate change, living resources and their ecosystems, and the impacts of human activities". To be an effective agency for its member-states, PICES must provide a forum for exchange of information and knowledge on these issues, especially on those aspects, which are of direct benefit to their citizens, and the interests of their state. Given the increasing role that the ocean will play in global human ecology, it is important to develop mechanisms favouring close collaboration between scientists, research and educational institutions, and even the general public on ocean-related issues.

POC should continue to work towards creating new opportunities for international interactions. Enhanced participation by younger scientists in PICES activities, by participating in meetings and joint research programs, is particularly important. It is also important to broaden interest in POC within PICES countries and through the scientific disciplines (more chemists, paleo-oceanographers...) by bringing new people to PICES meetings and inviting prominent scientists from all over the world.

As a forum of international experts, POC should identify priorities for physical oceanography and climate studies in the PICES area, helping to develop the scientific and technical bases for a better understanding of the ocean and its interactions with the atmosphere, and for the development of forecasting methods in ocean sciences.

REPORT OF THE TECHNICAL COMMITTEE ON DATA EXCHANGE

1. Introduction of Members

The Chairman, Mr. Robin M. Brown, welcomed two new TCODE members (Dr. Bernard A. Megrey who replaces Dr. William A. Karp and Dr. Tatsu Kishida who replaces Dr. Ichiro Hara). (See Endnote 1 for participants.) Dr. Yutaka Nagata (Japan) attended as an observer.

2. Review of progress on items in the 1997 Workplan

2.1 Updates and additions to the Long-Term Time Series Dataset Inventory

The Committee reviewed progress on this item and found that while the content of the Inventory was quite satisfactory, it was underutilized. The following actions were considered and approved:

- All members will examine web sites to determine suitable places for "links" to this inventory. Members will report their suggestions to the Chairman, who will approach the webmasters of these sites to establish links.
- Dr. Megrey will review the use of HTML metatags (for improved indexing by WWW search engines) and recommend appropriate tags for the Inventory.
- Mr. Brown will review PICES web site statistics regarding usage of the Inventory and report to TCODE members.
- Members will explore other "advertising" possibilities, including PICES Press and possibly producing a brochure.

2.2 Improvements and extensions to list of other Internet resources

The Committee reviewed the list and recommended a new section for "directories" or "lists" of scientists and their areas of expertise. Mr. Toshio Nagai reported that the IOC already has assembled such a directory (GLODIR) and that this was a good mechanism for searching for scientists/specialists. The following actions were approved:

- An additional section will be added to this web page for "pointers" to various lists of scientists. At a minimum, this will contain a reference to GLODIR.
- All members should forward information on other such "inventories" to the Chairman for inclusion in this new section.

2.3 Merging the Inventory of Long Term Time Series with the Bering Sea Metadatabase (Megrey, Brown)

Dr. Megrey reported on his efforts at matching the fields in the Bering Sea Metadatabase and the fields in the TCODE Inventory of Long Time Series. In general, the matching was very good, although the Bering Sea Metadatabase requires additional information on geographic location and contacts. The following action was approved:

- The structure of the TCODE Inventory of Long Time Series will be modified to match the Bering Sea metadatabase and to be compliant with structured metadata systems, such as FGDC (Brown, Megrey).

2.4 Assistance with loading entries into the Bering Sea Metadatabase (Megrey)

Dr. Megrey reported on progress in loading the Bering Sea Metadatabase. Substantial progress has been made and there are contributions from all PICES countries. TCODE members offered to continue to assist Drs. Megrey and Macklin in the identification of data sources. The following action was approved:

- Dr. Megrey will produce summaries of the existing entries in the Bering Sea metadatabase and will distribute these to TCODE members for review and comment. TCODE members will forward any

corrections or omissions to Dr. Megrey.

2.5 Assemble descriptions of monitoring programs for the 1997/1998 El Niño

Very little progress on this item was made in 1997/1998. Mr. Brown reported on descriptions of the Canadian programs listed on the Institute of Ocean Sciences web page and noted that no information was returned for other PICES nations. No further efforts will be undertaken to assemble this information.

3. Updates on data management activities in PICES nations:

3.1 Canada

Mr. Brown reported that Canada is planning to assemble a national database of biological/chemical oceanographic data (including plankton taxonomic data). Existing archives are very fragmented and much of this data is at risk of being lost.

3.2 China

Mr. Ling Tong reported on the Chinese Oceanographic Information Net. This network will link State Oceanographic Agency and Fisheries Agency laboratories. The system is now partially in place, but slow communication lines are limiting the usefulness of this system. Plans have been made to improve the communications links. The Chinese Oceanographic Information Database is at the National Marine Information Center and links to this web site to the PICES web site will be established.

3.3 Japan

Mr. Toshio Nagai reported on JODC staffing, organization and activities. JODC is now serving as the national data management office (DMO) for the Japan JGOFS program. Mr. Nagai also presented an overview of the JODC web site and capabilities for accessing oceanographic data holdings.

Dr. Tatsu Kishida reported that catch and effort statistics are available from JFA, but there is no access via the Internet. Much of these data are stored in regional laboratories and/or by principal investigators, so access is difficult.

3.4 Korea

Dr. Kee-Soo Nam reported on the restructuring of data management in Korea following the creation of the Ministry of Maritime Affairs and Fisheries (MOMAF). Oceanographic and fisheries research are conducted by government agencies (under MOMAF) and by universities (under the Ministry of Education) and there is weak data exchange between universities and government agencies. Three major institutes under MOMAF are:

- KORDI (Korea Ocean Research and Development Institute) - This institute is focussed on oceanographic research, including physical, chemical, biological, geophysical, geological and antarctic research. The KORDI Oceanographic Information and Instrumentation Center was disbanded in the recent reorganization and separated into its member departments (Remote Sensing, Instrumentation, Oceanographic Data Management, Library and Management Information Services)

- NORI (National Ocean Research Institute) - This institute is focussed on hydrographic affairs, geophysical and bathymetric surveys and coastal tidal observations.

- NFRDI (National Fisheries Research and Development Institute) - This institute is focussed on fisheries-related research and observations and marine environmental protection. The Korean Oceanographic Data Center (KODC), headed by Dr. Sangbok D. Hahn, is part of this agency.

Historically, data exchange amongst these agencies has been difficult, but things are improving. A master plan for integrated data services was published in July 1998. Dr. Nam also noted that there is a small data management

program established to support the Yellow Sea Program and that this has provided a successful example of integrated data management.

3.5 Russia

Dr. Igor D. Rostov submitted a detailed summary of data management activities at the Pacific Oceanological Institute in Vladivostok.

3.6 U.S.A

Dr. Thomas C. Royer reported that the U.S. NODC seems to be healthy and active, but there are some concerns about migration of data from WOCE, JGOFS and GLOBEC programs to WDC-A/NODC as these programs wind down over the next few years. A recent review of National Science Foundation (NSF) programs called for acquisition of global data sets, including long time series. There was an emphasis on the importance of ocean salinity measurements and the conclusion was that the community was not doing a very good job of acquisition of ocean data.

Dr. Megrey reported that U.S. Federal Geographic Data Committee (FGDC) has completed a review of the FGDC standard for metadata that will better accommodate descriptions of biological data.

Following these reports, there was a discussion of the problems that many countries are experiencing in the management and archival of ocean data. The Committee recommended the following note of concern be forwarded to Science Board and Governing Council:

TCODE notes that improvements in national data management systems in PICES nations are imperative in order to properly support programs and activities of PICES (such as the CCCC Program) and other modern, interdisciplinary marine programs such as JGOFS, GLOBEC and GOOS. These improvements are required to:

- *Ensure proper archival of the diverse datasets that support these programs.*
- *Provide mechanisms for the efficient inventorying and exchange of these data.*

The Committee also notes that the retirement of investigators and the re-structuring of government programs may endanger valuable datasets and advise that consideration of data integrity and preservation be included when research programs are re-structured.

4. TCODE and other PICES Committees

4.1 MODEL Task Team - Sources of High Quality Nutrient data

Mr. Brown reported on the MODEL Task Team session on nutrient data and reviewed the status of the World Ocean Database 1998 and new efforts in quality control being implemented at the Ocean Climate Laboratory. He also noted that there was a very good web site (GOODbase) for extracting data from the World Ocean Database (http://oceans.ucsd.edu/goodbase/).

4.2 CCCC-IP - National GLOBEC data management plans

Mr. Brown reviewed the action to date on the issue of management of GLOBEC/CCCC data. Responses were received from the U.S.A., and Canada to the letter sent out by the CCCC-IP Co-Chairmen and the TCODE Chairman regarding national GLOBEC data management plans. The poor response may indicate future problems with GLOBEC data management and archival. TCODE will continue to work with the GLOBEC International Program Office (IPO) and the CCCC-IP to address this issue.

4.3 MEQ - entries in the Inventory of Long-Term Time Series

The MEQ Chairman was contacted to determine their interest in adding entries to the Inventory. The conclusion is that there are few contaminant datasets that would meet the criteria for inclusion in this inventory.

4.4 WG 11 - Marine Birds and Mammals

WG 11 was contacted to determine the level of interest in adding entries for Marine Birds and/or Marine Mammals to the inventory of long time series. This will be considered by the Working Group, but they are presently focussed on completing their report. Dr. Megrey noted that the Bering Sea Metadatabase already contains many entries for the N.E. Pacific and Bering Sea.

4.5 MONITOR Task Team

Dr. Thomas C. Royer has been appointed as the TCODE Liaison member on this Task Team.

5. Other activities relevant to TCODE

5.1 North East Asian Regional - Global Ocean Observing System (NEAR-GOOS) (Nagai)

Mr. Nagai reported on the North East Asian Regional component of the Global Ocean Observing System and the various web sites that are associated with this program.

5.2 JGOFS - North Pacific Task Team (Brown)

Mr. Brown reported on the JGOFS Data Management and Synthesis meeting in Bergen, Norway, in September 1998. As JGOFS moves into the Synthesis and Modeling phase, the systems for archival and retrieval of JGOFS data are being put to the test and the results have not been as good as expected. The JGOFS Steering Committee has established three priorities for data management in JGOFS:

- Ensuring that JGOFS data are securely archived and preserved
- Creation of web-based inventories to allow researchers to identify and locate JGOFS data
- Encourage development of web-based systems to deliver JGOFS data to interested researchers.

Although JGOFS and GLOBEC are similar programs, the JGOFS project is more mature and can provide insight into the problems that the GLOBEC project will face in the next few years. TCODE will monitor the efforts of the JGOFS project to create a searchable inventory of JGOFS metadata and make recommendations to the CCCC-IP, based on our analysis of the JGOFS experience.

5.3 GLOBEC Program Office - data management activities

The GLOBEC International Program Office (IPO) has been established, but the staff positions have not been filled yet. GLOBEC plans to have some data management function at the IPO, but the details are not yet available. TCODE will monitor activities at the IPO and make recommendations to the CCCC-IP as the data management requirements are defined.

6. Organization details

6.1 Revised rules for PICES Committees

Mr. Brown reported on revised rules for PICES Committees which were passed by Governing Council during PICES VII. For TCODE, the major change is that the term of service for the Chairman has been set at three years, with the start date set as October 1998. The PICES Secretariat will print the revised PICES Handbook, and Handbook for Chairmen and Convenors, early in 1999 and printed copies will be available on request from the PICES office. These documents will also be posted on the PICES web site.

7. New business items

7.1 Proposal for TCODE Session on Data Visualization (Megrey)

Dr. Megrey presented a proposal for a session on data visualization to be held at the next PICES Annual Meeting (Vladivostok -October, 1999). After receiving support for this proposal from TCODE, the proposal was also presented to Scientific Committees (POC, BIO and FIS) who were also supportive. This proposal has been accepted for the PICES VIII Annual Meeting. Convenors/organizers will be Drs.

Bernard A. Megrey, Igor I. Shevchenko and Thomas C. Royer. Dr. Shevchenko has also volunteered to look after the local technical arrangements for this session.

7.2 Proposal for new Working Group on Iron Fertilization Experiments

TCODE reviewed this proposal and decided that it was not appropriate for TCODE to make a recommendation.

7.3 WG 13 - CO_2 in North Pacific

This Working Group proposed that PICES support two significant data management-related activities:

- A CO_2 measurement inter-calibration exercise (tentatively scheduled for Japan in April 1999)
- A CO_2 data intercomparison workshop (tentatively scheduled for 2000)

TCODE enthusiastically supported these initiatives, and suggested that it was important for a TCODE member to attend the data intercomparison workshop.

7.4 JGOFS North Pacific Task Team

The JGOFS North Pacific Task Team (NPTT) met prior to PICES VII and requested support for two PICES representatives to attend the JGOFS Synthesis and Modeling Workshop in Taipei in March 1999. They suggested that the Co-Chairmen of WG 13 and Chairman of TCODE should attend as PICES representatives.

TCODE recommends that a single PICES representative (one of the Co-Chairmen of WG 13) should be supported.

7.5 GOOS - North Pacific Coordination

Mr. Brown reported on discussions about creating a position for a North Pacific Global Ocean Observing System Coordinator, which would be housed at the PICES Secretariat. There is a broad base of support for this and PICES has offered to provide office space and logistical support, but there is still no firm plan to actually create and staff such a position. The major problem appears to be finding funds to pay the salary for this position.

7.6 PICES "Expertise" database

At the REX Task Team meeting, a suggestion was made that a database of researchers and their areas of expertise would be a useful contribution for PICES activities. Mr. Nagai reported that such a database (GLODIR) already exists and is supported by IOC/IODE. This database is available on the IOC web site (http://ioc.unesco.org/iode/activities/info_man/glodir.htm). The application allows individual researchers to create and maintain their personal entries in this database.

TCODE agreed to provide links to this directory (and any similar directories) in the TCODE "Other Internet Resources" web page.

7.7 Action Plan for the Protection, Management and Development of the Marine and Coastal

Dr. Nagata presented some documents describing the Environments of the Northwest Pacific Region Project (NOWPAP), which included plans for database and information management system as well as plans for collaborative monitoring. This is an IOC/UNEP sponsored program that involves Japan, China, Korea and Russia. These documents will be copied and distributed to TCODE members for information.

7.8 Publication Study Group

TCODE members reviewed the recommendations of the Publication Study Group and supported their recommendation to form a permanent Publications Committee. The committee noted that the composition of this committee may need careful review, should PICES decide to produce a new peer-reviewed scientific journal.

8. TCODE Workplan for 1998

The Committee adopted the following workplan for 1998:

8.1 Continued efforts to develop a Data Management Plan for the CCCC Program

TCODE will work with the CCCC-IP, national GLOBEC committees and the GLOBEC International Program Office to develop a data management plan that will ensure proper archival and allow for exchange of GLOBEC data amongst the participants. TCODE will also monitor the data management activities of the JGOFS project to identify successful strategies.

8.2 Continue to upgrade and improve the TCODE web pages including

- Re-structure the Inventory of Long-Term Time Series to make it compatible with other structured metadata standards (like FGDC)
- Add entries to Inventory of Long-Term Time Series for marine birds and mammals (if supplied by WG 11)
- Improve "Other Internet Resources" web page offerings in the area of Data analysis/visualization/graphics tools by reorganizing some current categories
- Add "Directories of Marine Scientists" section to "Other Internet Resources" web page
- Improve usage of TCODE web pages by adding metatags, identifying locations for links to PICES pages and promoting the use of the PICES web site.

8.2 Organizing the Data Visualization Workshop at PICES VIII

8.3 Assist MONITOR Task Team to assemble a detailed list of ongoing monitoring activities (by time and location)

8.4 Assist BASS Task Team to identify planned cruises in the open North Pacific in order to allow for sharing of ship time and improved program integration

8.6 Assist MODEL Task Team in identifying sources of nutrient data that are not yet in international databases

Endnote 1

Participants

Canada
Robin M. Brown (Chairman)

China
Ling Tong

Japan
Tatsu Kishida
Toshio Nagai

Korea
Kee-Soo Nam

Russia
Igor I. Shevchenko

U.S.A.
Bernard A. Megrey
Thomas C. Royer

REPORT OF THE IMPLEMENTATION PANEL ON THE CCCC PROGRAM

The CCCC-IP Panel met on Thursday, October 22, 1998. The meeting was opened by the two CCCC-IP Co-Chairmen and the agenda was reviewed. An agenda item to discuss a CCCC web representative was added and the agenda item on national GLOBEC reports was omitted because GLOBEC representatives had previously provided their reports at the FIS/CCCC Topic Session. The Co-Chairmen discussed their activities of the previous year, including attendance at the GLOBEC International Open Science Meeting, design of the CCCC web pages, and regular provision of newsletter articles to the PICES Press, and the GLOBEC International newsletter. The Panel then heard reports of each of the Task Team accomplishments for 1998, and planned activities for 1999. The panel accepted the proposal by C.S. Wong to add an advisory group under BASS to assist in the development and implementation of an iron fertilization experiment in the subarctic. The proposals developed by REX, MODEL, MONITOR, and BASS for workshops were discussed, revised, and accepted. It was noted that the first two weeks of April are not good for Japanese scientists to attend meetings or workshops due to the nature of the fiscal year and the school year. A recommendation was made to forward the Working Group 11 (Birds and Mammals) report to the MODEL Task Team for consideration and further action in deciding how to incorporate these data into upper trophic level models. The Panel received information about the current status of cooperation with other programs such as JGOFS, GLOBEC International, and the GOOS-LMR module. A recommendation was made and adopted that CCCC will nominate a representative from REX who will be the contact point to receive cruise information of CREAMS and other programs doing research in the Japan/East Sea region. Once received, this information will be posted on the PICES web site. Mr. Robin M. Brown presented a report on data management issues based on his attendance earlier in the year of a JGOFS data management meeting. The Panel discussed the responses received from the letter sent earlier in the year from TCODE and CCCC to national GLOBEC committees about data management issues. Mr. Brown made the suggestion that the CCCC-IP wait for the results from JGOFS in their trial of a structured inventory system before making suggestions to national GLOBEC committees about a standard format for the inventory system. Mr. Brown agreed to notify the CCCC upon completion of the JGOFS trial whereupon TCODE and CCCC would consult and jointly recommend a strategy to the national GLOBEC programs in PICES nations. The CCCC/IP agreed to nominate one CCCC representative as a web representative of the program, who would oversee and coordinate the provision of scientific information for the PICES web site. Dr. David Welch accepted this responsibility.

The PICES CCCC/IP recommended:

Publications

1. Publication of the 1998 MODEL, REX, and MONITOR workshops' proceedings in a single volume of the PICES Scientific Report Series.

Travel support

2. PICES travel support for one outside expert to attend the MONITOR Workshop in Hakodate, Japan, just prior to the PICES VIII Annual Meeting.
3. PICES travel support for one outside expert to attend the BASS Workshop.
4. PICES travel support for two scientists to attend the REX Workshop.

Approval of members

5. Drs. David W. Welch (Canada) and Suam Kim (Korea) as the new CCCC/IP Co-Chairmen; Dr. William T. Peterson (U.S.A)

as REX Co-Chairman to replace Dr. Anne B. Hollowed; Drs. Gordon A. McFarlane (Canada) and Andrei S. Krovnin (Russia) as the new BASS Co-Chairmen; and Drs. Michio Kishi (Japan) and Dan Ware (Canada) as the new MODEL Co-Chairmen. Drs. C.S. Wong, Paul J. Harrison, N. Price (Canada), M. Wells, K. Coale, R. Bidigare (U.S.A.), S. Takeda, M. Kiyono, H. Obata (Japan) as members of the BASS Advisory Committee on an Iron Fertilization Experiment.

Proposed workshops and symposia for 1999

6. a. BASS should hold a 2-day workshop to identify key research questions and opportunities for coordinated research on climate change in the subarctic North Pacific.
   b. MONITOR should hold a 2-day workshop in Hakodate, Japan, just prior to the PICES VIII Annual Meeting to design an improved monitoring system based on the findings of the BASS Workshop.
   c. REX should hold a 2-day workshop just prior to the Annual Meeting in Vladivostok, Russia, to compare vital rates of herring and examine food web interactions with euphausiids.
   d. A 2-day workshop on Regime Shifts and their Identification to be held on the west coast of North America in early September.
   e. A half-day topic session on Recent Findings of GLOBEC and GLOBEC-like programs in the North Pacific, to be convened at PICES VIII.

Proposed workshops and symposia for 2000

7. a. A 3-day workshop on prototype lower trophic level ecosystem model for comparison of different ecosystems in the North Pacific to be held in Nemuro in February.
   b. A 2-day ICES/PICES Zooplankton Production Ecology Workshop to be convened in Hawaii in March.

BASS Task Team Report

Co-Chairmen: Dr. Richard J. Beamish and Prof. Makoto Terazaki

1998 Accomplishments

- Publication of 1997 Symposium Proceedings

  - The symposium proceedings will be published in a special issue of *Progress in Oceanography* at no cost to PICES (for publishing).

  - All papers have been received except for one. This paper will be submitted by mid-December.

  - We have also received a paper by Banse and English on phytoplankton seasonality in the eastern and western subarctic Pacific and the western Bering Sea. This paper was not part of the symposium but will be included in the proceedings.

1999 Planned Activities

- the Co-Chairmen of BASS, R. Beamish and M. Terazaki, have both asked to be replaced. BASS nominates Gordon A. McFarlane (Canada) and Andrei S. Krovnin (Russia) as the new Co-Chairmen.

- In 1999, we propose to (1) identify new BASS members to assist in the development of a long-term work plan for BASS and (2) hold a special workshop to develop a conceptual model of how subarctic gyres work and how they change with regime shifts.

- Assign BASS representative to coordinate provision of a list of annual cruises to PICES, through contacts in each member country and through other organizations such as NPAFC, GLOBEC, etc.

- BASS received a proposal on an iron fertilization experiment from C.S. Wong.

- BASS recognizes iron limitation as an important unanswered question in the North Pacific and at last year's meeting identified this as an area requiring further research

- BASS recommends that CCCC-IP brings this proposed experiment into the CCCC Program and provides support to meet the goals of the experiment by identifying national expertise from PICES nations that could assist in carrying out the experiment.

BASS Workshop: *Development of a Conceptual Model of the Subarctic North Pacific Gyres*

Objective: Determine how the ecosystems of the subarctic North Pacific gyres function and how they respond to regime shifts.

Outline:
- Workshop format will be similar to the 1997 REX Workshop.
- We will use the information brought together in the BASS Symposium volume to identify research questions and opportunities.
- A conceptual model comparing the two gyres will be developed.
- The initial focus will be on three areas of research:
  - physical structure of the gyres in relation to climate change;
  - long-term changes in plankton abundance and species composition;
  - trophic relationships; fish, birds, mammals.

Participants:
- Representatives from each country
- Invited participants with expertise in these areas of research

Venue: TBA
Duration: 2 days
Organizers: Gordon A. McFarlane and Andrei S. Krovnin

MODEL Task Team Report
Co-Chairmen: Drs. Sinjae Yoo and Ian Perry.

1998 Accomplishments
- Home page
  Directory of existing circulation models and outputs for embedding ecological models has been contructed. Information includes the contact point, area, resolution, related publication, etc. Currently 5 basin models and 3 regional models are listed.

  Web site address:
  http://pices.ios.bc.ca/new/newf.htm

- Lower trophic level model workshop
  A small workshop was held during October 14-15, 1998, to deal with model-comparison issues and to gather information for nutrient data bases.

- Model-comparison
  - The participants discussed about related JGOFS/GLOBEC activities after reviews were presented. They agreed that: i) Models with too diverse structures might be difficult to compare, and ii) comparison protocols are necessary to tackle the problem.

  - Model behavior with different combination of formulations were presented by Dr. Michio Kishi. A lower trophic model of the Equitorial Pacific was presented by Dr. Dick Dugdale.

  - The participants recommended development of a prototype model and comparison protocols as a long-term activity.

- Availability of nutrient data bases
  Presentations were made on nutrient data availability of NODC holdings, ship-of-opportunity program, Station "P" , PROBES, and Japanese national data base.

1999 Planned Activities

- A prototype model (with 12 compartments as was recommended in Nemuro Workshop) executable on web will be made available by June 1999, by Dr. Kishi.
- The model will be applied to more than two sites, including Station P and Sanriku area and will be compared with the Bering sea ecosystem model.
- Directory home page will be continuously expanded to include more regional models.
- Directory of nutrient data base will also be added to the home page.

Recommendations to Science Board

- Approve new Co-Chairmen: Drs. Dan Ware and Michio Kishi.
- Publish the workshop report as a part of PICES Scientific Report Series.
- Facilitate model activities using the MODEL home page, which will include directory of circulation models and nutrient data base, and prototype lower trophic level model.
- Facilitate interactions with JGOFS/GLOBEC modeling activities.
- Convene a workshop on the development of prototype model and comparison protocols.

PICES-GLOBEC/Lower Trophic Level Model-ling Workshop: *International Workshop on Prototype Lower Trophic Level Ecosystem Model for Comparison of Different Marine Ecosystems in the North Pacific*

Objectives :

- To develop a prototype lower trophic level ecosystem model for comparative study on marine ecosystems in the North Pacific;
- To develop model comparison protocols.

Outline of planned activities:

- Pre-workshop collaboration in Kushiro
- Presentation of prototype model
- Demonstrate applicability of the prototype model by comparing lower trophic ecosystem dynamics among different study sites of CCCC Program
- Comparison of the prototype model with other models
- Identification of necessary process study and monitoring
- Planning of application to higher trophic models, regional circulation models, and JGOFS models

Venue: Nemuro, Hokkaido, Japan
Time & Duration: Early 2000 (Feb.?), 3 days
Funding Sources: PICES, Nemuro, JSTA
Organizing Committee (tentative): Drs. Sinjae Yoo, Michio Kishi, Dan Ware, Makoto Kashiwai, Bernard A. Megrey, Richard Dugdale, Jeffrey M. Napp

MONITOR Task Team Report

Co-Chairmen: Drs. Yasunori Sakurai and Bruce A. Taft

1998 Accomplishments

The MONITOR Task Team was formed during 1998. A workshop was held just prior to PICES VII to outline the present monitoring activities in PICES nations and to identify future monitoring needs and intercalibration experiments that might need to be conducted. Task Team members and others contributed to the workshop. The workshop was successful with 15 papers presented including GLOBEC monitoring plans. A workshop report will be prepared and published in the PICES Scientific Report Series. Based on the presentations and discussions at the workshop and during the Task Team meeting the following monitoring activities were outlined for the upcoming years.

Geographic coverage of monitoring in the subarctic N. Pacific

Sampling in NW Pacific is more dense than in the NE Pacific. The first priority is to increase coverage in the east and maintain present monitoring in the west.

ACTION (inter-sessional): Construct time (monthly)/space break-out of present monitoring shipboard observations to clearly reveal gaps. This document will be used to guide the Task

Team in designing an improved monitoring system.

RECOMMENDATION: The present time series in PICES area must be maintained. For example, Central Pacific sampling lines now occupied by research ships *Oshoru Maru* and *Hokusei Maru* must be continued with replacement ships, if these ships are pulled out of program.

Continuous plankton recorder

There are few large-scale zooplankton data sets collected in the NE Pacific. Ship-of-opportunity (SOP) continuous plankton recorder (CPR) observations provide an attractive method to obtain these data. The SOP/CPR is capable of sampling a long track in both winter and summer (sample annual cycle) and it efficiently samples a part of the zooplankton community that does respond to climate variability.

ACTION (inter-sessional): Prepare a white paper on the use of CPR in PICES region.

PALACE float array

The US has plans (ARGO) to deploy PALACE floats (measure temperature and salinity profiles and velocity at 1,000 m) in the North Pacific as part of a global measurement program. Sampling resolution is 300 km in space and 10 days in time. The North Pacific array will be deployed late in 2000. The ARGO temperature and salinity data between the surface and 1,000 m in the PICES region will provide a vital climatic data set. For example, at the present time we do not have a large-scale description of the depth and strength of the halocline in the subarctic.

RECOMMENDATION: PICES support the ARGO plan to begin subarctic North Pacific PALACE float deployment in 2000.

Zooplankton time series

Many types of sampling gear have been used to collect zooplankton abundance data in the open ocean and coastal regions of the North Pacific. Adequate intercalibration data for many of these sampling systems do not exist and the time series are flawed by systematic errors.

ACTION (inter-sessional): Prepare a report on the sampling gear used in the North Pacific and the status of the calibration data. Based on the report, we will develop a plan for obtaining needed calibration data.

Biophysical moorings

In September 1998, an ATLAS mooring, modified for the subarctic N. Pacific, was deployed at station PAPA to test the system for survivability. It will be replaced in September 1999. The test mooring has only meteorological and subsurface physical sensors.

RECOMMENDATION: At the completion of the engineering studies, moorings with a complete suite of meteorological, biological, and physical sensors should be designed and installed near the centers of the Alaska Gyre and the Western Pacific Gyre.

ACTION (inter-sessional): Task Team will prepare for a discussion of the optimum set of biological sensors to be installed on the mooring.

Zooplankton production

There is very little monitoring data on the variability of zooplankton production in the subarctic.

ACTION (inter-sessional): The Task Team will prepare for a discussion of the need for an expanded monitoring of zooplankton production in the subarctic. Specific suggestions for the design of a monitoring system will be addressed.

Regime-shift description

There was a substantial delay between timing of 1976-77 regime shift and its recognition by scientists and assessment of its impact. An interesting question is whether there were precursors that were overlooked. Analysis of data at the time of the transition will provide insight into what type of monitoring will improve our description of the shift.

RECOMMENDATION: PICES should sponsor a workshop to review physical and biological characteristics of regime shifts and the extent to which various elements of the ecosystem were affected.

Next meeting
The 1999 meeting of the Task Team will address the above items as well as others that will be suggested during the year.

REX Task Team Report
Co-Chairmen: Drs. Anne B. Hollowed, Vladimir I. Radchenko and Tokio Wada

1998 Accomplishments
- The PICES Climate Change and Carrying Capacity Workshop on the Development of Cooperative Research in Coastal Regions of the North Pacific was published as PICES Scientific Report No. 9.
- A 2-day workshop on climate effects on small pelagic species was convened prior to the PICES VII Annual Meeting, in Fairbanks, Alaska (see attached report).
- A scientific session highlighting research findings of GLOBEC and GLOBEC-like programs was convened in the PICES VII Annual Meeting.

Short-term recommendations for future work
- REX recommends that William Peterson replace Anne Hollowed as REX Co-Chairman.
- Collate and synthesize small pelagic species data for comparative studies. Initially, this could involve the exchange of scientists **(or a workshop)**, data assembly, and development and application of analysis tools. The purpose of exchanging scientists is to:

  - Facilitate a comparative analysis of larval and juvenile vital rates of **Pacific herring** from different regions of the North Pacific and its adjacent seas.
  - Facilitate comparative studies of the life pattern of dominant zooplankton species **(especially euphausiids and calanoids (*Calanus, Neocalanus*))** .

  REX will conduct a two day workshop for these purposes just prior to PICES VIII in Vladivostok, Russia. We anticipate that 12-15 scientists would participate in the workshop and request that PICES provide some funds (for 2 scientists) to attend this meeting and facilitate this exchange.

- REX recommends that the report of the REX Workshop on "Small Pelagic Species and Climate Change" be published in the PICES Scientific Report Series.

- Compile a summary of the sampling strategies and methods used to assess the stocks of small pelagic species.

- Continue to encourage discussions of small pelagic species through REX Task Team. Conduct a CCCC symposium on small pelagic species for the year 2000.

- REX endorses the proposal for a meeting to review the 1976/77, and 1988/89 regime shifts and will assist in preparing for this symposium.

- REX encourages a review of the relationship between El Niño events and regime shifts.

Long-term activities
- PICES Scientfic Report No. 9 provides long-term research questions and activities.

- REX highlights the recommendation for compiling a catalogue of historical samples and data sets which are not yet analyzed or readily available as a high priority activity. **Initially, this could be done for egg and ichthyo-plankton samples and catch data by research vessels.**

REX Workshop in 1999: *Herring and Euphausiids*

Background

Herring and euphausiids are key species of coastal ecosystems in the sub-arctic region in the North Pacific. Juvenile herring is a predator of euphausiids, but it is a competitor with euphausiids for copepods such as *Calanus* and *Neocalanus* as common prey. The biomass fluctuations of euphausiids usually correspond well with changes in primary production, and it is suggested that biomass fluctuations are strongly affected by climate variability. Changes in euphausiid biomass affect the growth of juvenile herring, and eventually determine the degree of winter mortality. At the same time, predation mortality of juveniles by hake or pollock, etc. is also changed because these predators also feed on euphausiids. Therefore, to examine the ecosystem response, we must know the dynamics of the herring - euphausiids inter-action through the comparative studies among areas in the sub-arctic region in the North Pacific.

Proposal

In the workshop, for the major herring populations in the Pacific Rim, we will compare the population dynamics, then identify the fluctuation pattern and changes in life history parameters with climate variability. We also analyze the food web by area, and try to compare the ecosystem response to climate change by developing a simple trophodynamic model.

Venue: Vladivostok, Russia
Time: 2 days just prior PICES VIII
Tentative Co-Conveners: William Peterson (U.S.A.), Vladimir I. Radchenko (Russia) and Tokio Wada (Japan)

Summary of REX Task Team Workshop "Small Pelagic Species and Climate Change" Oct.16-17, 1998, Fairbanks, Alaska, U.S.A.

Participants: K. Asano, Richard D. Brodeur, E. Brown, I. Hara, Douglas E. Hay (Co-Convener), Anne B. Hollowed, B. Holladay, Makoto Kashiwai, T. Kishida, H. Lee, Bernard A. Megrey, Michael M. Mullin, H. Nshida, Brenda Norcross, S. Ohshimo, Vladimir I. Radchenko (Co-Convener), Yasunori Sakurai, S. Thornton, Ling Tong, H. Yamada, Orio Yamamura, Tokio Wada (Co-Convener), Chang-Ik Zhang

Objectives

The REX Task Team convened a workshop October 16 - 17, 1998. The objectives of the workshop were:

- to compare the present findings on the response of small pelagic species to ocean climate changes in the PICES areas, and
- to encourage the research collaboration among member countries through identifying key hypotheses and research methods suitable for testing the hypotheses.

Workshop schedule

1st day:
- Present findings on the response of small pelagics to ocean climate changes

2nd day:
- Present situation in GLOBEC and GLOBEC like programs related to small pelagics in each country
- Discussion on key questions, key hypotheses, and recommendations

Present findings on the response of small pelagics to ocean climate changes

Nine papers were presented from seven areas of the PICES region.

Tokio Wada. A Population dynamics model for Japanese sardine - Why the sardine shows such a large population fluctuation?

Larry Jacobson. Biological production, variability, and standards for sustainable yield in the great sardine and anchovy stocks (presented by T.Wada)

Makoto Kashiwai. Carrying capacity change of Oyashio shelf ecosystem with disappearance of Japanese sardine

Seiji Ohshimo. Acoustic estimation of biomass of the small pelagic fishes in the East China Sea

Douglas Hay. Changes in the timing and distribution of herring spawn in British Columbia: An impact of climate change?

Vladimir I. Radchenko. Scale and causes of growth of the Pacific herring abundance in the western Bering Sea in 1990s

Richard D. Brodeur. Forage fishes in the Bering Sea: distribution, species associations, and biomass trends

Hiroshi Nishida. Effect of short-term fluctuation of water temperature on fish-catch by set-net fishing around Awa-shima Island, the Sea of Japan

Yasunori Sakurai. Which is responsible for fluctuating squid catch rates - fishing or climate change?

Brenda Norcross kindly presented her work on herring recruitment model in the Prince William Sound. E. Brown also talked about her work on biomass assessment for small pelagic fishes using aerial observation and acoustic survey in their area. Their formal title will be listed later.

Present situation in GLOBEC and GLOBEC like programs related to small Pelagics in each country

Present situation of the on going and planed programs were reported from Canada, Japan, Russia, and U.S.A. by participants.

Key questions and hypotheses discussion points

Participant addressed the following as the discussion points to identify key questions:

- Recruitment prediction
- Spatial studies: Nursery / spawning areas
- Size at age / somatic growth
- Species alternation
- Assessment / sampling methods

Key questions

Participants considered the following key questions which were related to higher trophic levels and addressed in CCCC Implementation plan as the basic key questions.

- How do life history patterns, distributions, vital rates, and population dynamics of small pelagic species respond directly and indirectly to climate variability? (PICES Scientific Report No. 4)
- Do small pelagic species respond to climate variability solely as a consequence of bottom-up forcing? Are there significant intra-trophic level and top-down effects on small pelagic species? (PICES Scientific Report No. 4)

Participants addressed the following as the questions specific for small pelagic species:

- Do small pelagic species respond in the same way between high and low latitude and longitude?
- Can we distinguish between changes induced by climate change and those changes related to fishing other anthropogenic, or intrinsic biological variation?
- How does small pelagic fish community structure vary with oceanographic conditions?
- Do small pelagic species in the eastern and western Pacific exhibit similar patterns of year-class strength?
- Does spawning time (duration) and spatial range change with stock abundance and size structure?
- Does size at age change with stock size?

Key hypotheses

In the last REX Workshop, the mid-water and demersal fish group considered the principal mechanisms underlying the fish species response to climate variability, then they addressed key hypotheses that correspond to each mechanism. Participants in the present workshop adopted that approach, and identified starvation, transport, concentration, prey suitability, prey type, competition, and predation mortality as the mechanisms that determine survival in the early life stages. Participants also considered that changes in distribution and growth rate resultant of climate change in adult stage affect to the survival of early life stages. Hypotheses linking climate variability and small pelagic species response can be stated as follows:

1. STARVATION:
   a. Survival of small pelagic fish larvae depends on matching hatch dates with the peak zooplankton production (i.e. the match mis-match theory).
      Factors that alter the timing of the spring bloom can influence "the match mis-match" between first feeding larvae and prey availability.
   b. Survival of small pelagic fish larvae and juveniles depends on sustained secondary production through out the spring and summer months.

2. TRANSPORT:
   a. Survival of small pelagic fish larvae depends on advection to favorable nursery grounds. Atmospherically driven shifts in large scale circulation patterns can impact recruitment success by changing larval distributions.
   b. Survival of small pelagic fish larvae depends on advection to favorable nursery grounds. Density dependent or climatically induced changes in spawning grounds can impact recruitment success by changing transport conditions in time and space.

3. CONCENTRATION:
   Survival of small pelagic fish larvae depends on mesoscale advection patterns that concentrate larvae and their prey. Mesoscale features such as eddies or frontal systems concentrate prey and enhance larval survival.

4. PREY SUITABILITY / COMPETITION:
   Survival of small pelagic fish larvae depends on the availability of the appropriate prey species at suitable size for consumption. Existence of other small pelagic species affect the survival through the competition for common food resources.

5. PREDATION MORTALITY:
   a. ADVECTION: Survival of small pelagic fish depends on advection processes that separate larvae and juveniles from their predators.
   b. SIZE DEPENDENT MORTALITY: Processes that enhance larval and juvenile growth rates will reduce predation mortality by reducing the time when larval or juvenile fish are vulnerable to predation.
   c. PREDATOR / PREY OVERLAP: Processes that separate predators from larvae and juveniles of small pelagic species influences the amount of predation mortality.

6. MATERNAL FACTOR:
   Survival of small pelagic fish larvae depends on maternal factors, such as fecundity, egg quality, mature age, and others, which are dependent on the physiological condition of adult and that is influenced by climate variability.

Recommendations

To facilitate the research cooperation for testing hypotheses, participants made following recommendations:

- Conduct comparative analysis of larval and juvenile vital rates of small pelagic species from different regions of the North Pacific and its adjacent seas.

- Collate and synthesize small pelagic species data for comparative studies. Initially, this could involve the exchange of scientists, data assembly, and development and application of analysis tools. Hopefully, this could be accomplished in 1999.

- Choice of scale should be carefully chosen to detect mesoscale response.

- Conduct comparative studies of stock structure of small pelagic species in the North Pacific. Specifically, we recommend analysis of genetics of small pelagic fish stocks to evaluate the potential for climate influence on marginal populations and stock separation.

- Define a suitable sampling protocol for use in assessing the distribution and ecology of small pelagic species.

- Examine sampling characteristics of gear: e.g. availability, selectivity, catchability.

- Choose sampling methods and technologies that are suitable for the temporal and spatial scales of the question.

- Continue to encourage discussions of small pelagic species through REX Task Team. Conduct a CCCC symposium on small pelagic species for the year 2000.

- Maintain an inventory of scientists active in small pelagic species research (perhaps activity for TCODE)

- Consider hake, pollock, and non-commercial species (e.g. sandlance, eulachon) in the small pelagic species discussions.

REPORT OF THE FINANCE AND ADMINISTRATION COMMITTEE

The Committee met Oct. 19, 20 and 24 under the Chairmanship of Dr. Warren S. Wooster and Drs. W. Doug McKone and Alexander S. Bychkov acted as rapporteurs (See Endnote 1 for list of participants).

Agenda Item 1. Opening by the Chairman

The Chairman called the meeting to order and welcomed the participants, stressing that the job of the Committee was to review financial and administrative matters in keeping with the Rules of the Organization and to provide a report to Governing Council for consideration and adoption.

Agenda Item 2. Adoption of agenda

The Committee reviewed and adopted the agenda without change.

Agenda Item 3. Proposed Rules of Procedure changes

The Committee reviewed changes in the Rules of Procedure proposed by Science Board. These include terms of office for certain Committees, Programs and other groups not currently covered by the Rules. The Science Board would be able to propose members of these Committees, Programs and other groups for approval by their governments. The Committee recommends that Council approve the proposed changes to the Rules.

Agenda Item 4. Audited accounts for Financial Year 1997

The Committee reviewed the Auditor's Report (Endnote 2) and recommends that Council approve it on the endorsement of the Executive Secretary.

The Executive Secretary noted that he approached five Chartered Accounting firms and received three bids to become the Organization's auditor. Bids were received from the current auditor Flader and Greene, Moore, Roberts & Company and Delloitte & Touche. The bids ranged from $3,000-$4,000. The Executive Secretary indicated that the current auditor's bid was one of the lowest and replacing him at this time could cause problems for a new Executive Secretary not familiar with the Canadian accounting procedures. The Committee recommends that Council appoint the existing auditor Flader and Greene for another year.

Agenda Item 5. Budget

a. Estimated accounts for fiscal year 1998

The Committee reviewed and discussed the estimated accounts for 1998.

The Executive Secretary noted that there were problems with receiving clearance from the People's Republic of China and subsequently from the Republic of Korea to hold the proposed MEQ Workshop, as a result there were no expenditures from the Special Meeting category. Canada has agreed to hold the Workshop in the spring of 1999.

The Committee recommends that Council accept the estimated accounts for 1998.

b. Budget for fiscal year 1999

The Committee reviewed the proposed 1999 budget CDN $574,000. Parties generally felt that the proposed budget is a modest increase over the previous year. Some Parties felt that the proposed

increase in fees to CND$89,000 was too much and suggested that some funds should be transferred from the Working Capital Fund to reduce the contribution level. The Committee recommends that Council approve a budget level of CDN $574,000 and that $58,000 from the Working Capital Fund be transferred to support special meetings and other scientific activities, thereby reducing the fees to CDN $86,000 for each Party. **The U.S.A. proposed to contribute CDN $3000 in addition to their annual assessment to support PICES VIII.**

c. Forecast budget for fiscal year 2000

This item was examined by the Committee and is recommended for information to Governing Council without need to adopt the forecast budget. The U.S.A. suggested that in future years it would be reasonable for Parties to expect that the forecast budget would be about 3% higher than the current years budget unless otherwise indicated. This was generally accepted.

d. Working Capital Fund

The Executive Secretary estimated that the Working Capital Fund would have a surplus of CDN $70,762 at the end of 1998. CND $58,000 of the estimated surplus should be used to fund special meetings and other activities. Five of the six Parties agreed that five-sixths ($10,635) of the remaining CDN $12,762 of the estimated surplus should be transferred to the Trust Fund. It is recommended that the remaining one-sixth ($2,127) of the estimate be held separately for review at F&A next year. **The practice of continuing to transfer surpluses in the Working Capital Fund to the Trust Fund was generally agreed.**

e. Trust Fund

The Executive Secretary reported that the Trust Fund is estimated to be CDN $63,656 by December 31, 1998. With the transfer of CND $10,635 from the Working Capital Fund the Trust Fund is estimated to increase to CND $74,291 at the end of 1998. This year, approximately CDN $40,000 was used to bring Korean, Russian, Chinese and young scientists to this year's Annual Meeting.

f. Home Leave Relocation Fund

The Executive Secretary reported that funds expended this year to send the Assistant Executive Secretary and family on home leave will be replaced from levies to keep the Fund at its maximum of CDN $110,000.

Agenda Item 6. Space, facilities and equipment

The Executive Secretary reported that the Canadian Government has provided new accommodations at the Institute of Ocean Sciences that has given the Secretariat more profile and increased space. He indicated the facilities should be sufficient for needs over the next few years and expressed his appreciation for this action of the Government.

The Executive Secretary reported that the electronic equipment has been upgraded over the last two years and it is not expected that major expenditures will be needed in the short term. In view of the upgrade, preparation of the requested five-year equipment plan has not been undertaken. Practicability of this request should be reviewed by the next Executive Secretary.

Agenda Item 7. Future meetings of the Organization and subsidiary bodies, including time and place for the 8th and 9th Annual Meetings

The Committee reviewed possible dates for the Eight Annual Meeting in Vladivostok, the

Russian Federation in 1999, and recommends to Council that the meeting be held October 11-17. Meetings of Working Groups and other groups being held at the time of the Annual Meeting would occur before the 11th. These dates were established in consultation with a member of the NPAFC Secretariat with a view to facilitate participation by those who attend both meetings. Council approved the principle that dates of future meetings be established in consultation with NPAFC. In particular, since in 2000 (see below) both meetings are to be in Japan, an effort should be made to have them held consecutively in nearby locations. Dr. Richard J. Beamish, who will represent PICES at the forthcoming NPAFC meeting, should be instructed to discuss these matters with that organization.

The Committee recommends that Council approve the Japanese offer to host the Ninth Annual Meeting.

Endnote 1

Participants and Observers

Canada
- Richard J. Beamish
- Michael A. Henderson

China
- Qian-Fei Liu
- Yong Li

Japan
- Satsuki Matsumura
- Hideo Nishikawa

Republic of Korea
- Jhin-Kyoo Chae
- Hyung-Tack Huh

Russia
- Lev N. Bocharov
- Vadim Minin
- Igor I. Shevchenko

U.S.A.
- Richard J. Marasco
- Dorothy Bergamaschi

Other
- Warren S. Wooster (Chairman, F&A Committee; ex-officio Council member)
- W. Doug McKone (Executive Secretary) (Raporteur)
- Alexander S. Bychkov (Assisstant Executive Secretary) (Rapporteur)

Endnote 2

Auditor's Report (1997) to the Organization

Flader and Greene
Chartered Accountants
9768 Third Street,
Sidney, B.C.
V8L 3A4

We have audited the statement of financial position of the North Pacific Marine Science Organization as at December 31, 1997, 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 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, 1997, and the results of its operations and the changes in financial position for the year then ended in accordance with generally accepted accounting principles.

Sidney, B.C. Canada
March 6, 1998

Flader and Greene
Chartered Accountants

Statement I

Statement of Assets and Liabilities
December 31, 1997

	1997	1996
ASSETS		
Current Assets		
Cash and term deposits	$ 366,807	$ 388,666
LIABILITIES AND FUND BALANCES		
Current Liabilities		
Accounts payable	$ 9,494	$ 20,561
Funds held for contracting parties	-	$ 50,000
	9,494	70,561
Fund Balances		
Working Capital Fund	146,249	110,014
Trust Fund	101,064	107,608
Home Leave Relocation Fund	110,000	100,483
	357,313	318,105
	$ 366,807	$ 388,666

Statement II

Statement of Operations and Changes in Fund Balances
For the Year Ended December 31, 1997

	General Fund	Working Capital Fund	Trust Fund	Home Leave Relocation Fund	1997 Total	1996 Total
Fund Balances, beginning of year	$ -	$ 110,013	$ 107,608	$ 100,483	$ 318,104	$ 189,302
Sources of Funds						
Contributions from Contracting Parties	508,800	-	-	-	508,800	558,800
Inter-Fund transfers	(47,289)	-	40,000	7,289	-	-
Interest and other income – Note 4	24,696	3,629	2,117	2,342	32,784	41,601
Fund Balances, before expenditures	486,207	113,642	149,725	110,114	859,688	789,703
Expenditures						
Personnel services	286,163	-	-	-	286,163	269,368
Travel	55,866	3,629	48,661	-	108,156	46,483
Communication	26,124	-	-	-	26,124	26,654
Contractual services	12,628	-	-	-	12,628	10,290
Printing	35,185	-	-	-	35,185	37,606
Supplies	4,376	-	-	-	4,376	6,339
Equipment	10,898	-	-	-	10,898	10,026
Annual General Meeting expenditures	5,296	-	-	-	5,296	20,738
Workshops	11,708	-	-	-	11,708	23,311
Relocation	-	-	-	114	114	17,247
Miscellaneous	1,727	-	-	-	1,727	3,536
	449,971	3,629	48,661	114	502,375	471,598
Net Funds Available	36,236	110,013	101,064	110,000	357,313	318,105
Transfers to Working Capital Fund	(36,236)	36,236	-	-	-	-
Fund Balances, end of year	$ -	$ 146,249	$ 101,064	$ 110,000	$ 357,313	$ 318,105

Notes to Financial Statements
December 31, 1997

1. Purpose of the 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 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 Home Leave Relocation Fund was established in 1996 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 provide home leave for international staff. This Fund is set at a maximum of $110,000.

b) Capital Assets

Capital assets acquired by the Organization are expensed in the year of acquisition.

c) Income Tax

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

d) 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 finance position date.

3. Commitments

Office space and services are provided to the Secretariat to the Organization by the Government of Canada through the Department of Fisheries and Oceans. This agreement commenced April 1, 1992, and continues indefinitely with a review every three years. The fixed cost for office space is $2,000 per year. Services provided are invoiced quarterly.

4. Interest and other income

	General Fund	Working Capital Fund	Trust Fund	Home Leave Relocation Fund
Interest income	$ -	$ 3,629	$ 2,117	$ 2,342
Income tax levies	20,911	-	-	-
GST rebates	3,785	-	-	-
	$ 24,696	$ 3,629	$ 2,117	$ 2,342

Endnote 3

Budget for Fiscal Year 1999

Source	**Contributions**
Contributions from six Contracting Parties	516,000
Category	**Allotment**
Personnel Services	293,000
Travel	76,000
Communication	28,000
Contractual Services	16,000
Printing	49,000
Supplies	7,000
Equipment	5,000
Annual Meeting	57,000
Special Meetings	40,000
Miscellaneous	3,000
Total	574,000
1999 Total Allotment	**516,000**
Transfer from Working Capital Fund	58,000
1999 Annual Fee for each Party	**86,000**

COMPOSITION OF THE ORGANIZATION

Officers:

Chairman: Dr. W.G. Doubleday
Vice-Chairman: Dr. H.T. Huh

Delegates:

Canada
Dr. J.C. Davis
Ms. K.A. Bruce

China
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Mr. J.G. Li

Japan
Dr. S. Matsumura
Mr. A. Suda

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Dr. H.T. Huh
Mr. K.J. Ahn

Russia
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Dr. S.E. Dyagilev

U.S.A.
Dr. V. Alexander
Dr. J.W. Balsiger

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Dr. J.C. Davis

China
Mr. L.Z. Wei
Mr. L. Yong

Japan
Dr. S. Matsumura
Mr. K. Ishikane

Korea
Mr. C.H. Yoo
Mr. S.H. Song

Russia
Dr. I.I. Shevchenko

U.S.A.
Dr. W.S. Wooster (Acting Chairman)
Ms. D. Bergamaschi

Science Board:

Chairman, Science Board	Dr. M. Kashiwai
Chairman, Biological Oceanography Committee	Prof. P.A. Wheeler
Chairman, Fishery Science Committee	Dr. C.I. Zhang
Chairman, Marine Environmental Quality Committee	Dr. R.F. Addison
Chairman, Physical Oceanography and Climate Committee	Dr. P.H. LeBlond

Secretariat:

Executive Secretary:	Dr. W.D. McKone
Assistant Executive Secretary:	Dr. A.S. Bychkov
Administrative Assistant:	Ms. C. Chiu
Secretary:	Ms. C. McAlister

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- Dr. K.L. Denman
- Dr. P.J. Harrison
- Dr. D.L. Mackas

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- Dr. V.I. Radchenko
- Dr. V.V. Sapozhnikov

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- **Prof. P.A. Wheeler** (Chairman)

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- Dr. G.H. Kruse

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Canada
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- Mr. L. Harding
- Dr. J. Pringle

China
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- Prof. X.P. Jia
- Prof. J.Y. Zhou

Japan
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- Prof. M. Shimizu
- Dr. M. Watanabe

Korea
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- Dr. D.B. Yang

Russia
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- Dr. S.A. Patin
- Dr. A.V. Tkalin

U.S.A.
- Dr. P.K. Park
- Dr. U. Varnasi
- Dr. C.M. Watson

Physical Oceanography and Climate Committee:

Canada
- Dr. H.J. Freeland
- **Prof. P.H. LeBlond** (Chairman)
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China
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- Prof. D.X. Hu
- Prof. M.Y. Zhou

Japan
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- Dr. N. Suginohara
- Dr. T. Uji

Korea
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- Dr. K. Kim
- Dr. J.Y. Yun

Russia
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- Dr. G.V. Khen
- Dr. V.B. Lobanov

U.S.A.
- Prof. D.L. Musgrave
- Dr. J.E. Overland
- Prof. S.C. Riser

Technical Committee on Data Exchange (TCODE):

Canada
- **Mr. R.M. Brown** (Chairman)
- Mr. W. Shaw

China
- Mr. S.N. Jiang
- Mr. L. Tong

Japan
- Dr. T. Kishida
- Dr. T. Nagai

Korea
- Dr. S.D. Hahn
- Dr. K.S. Nam

Russia
- Dr. I.D. Rostov
- Dr. N.A. Ryakov
- Dr. I.I. Shevchenko

U.S.A.
- Dr. W.A. Karp
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Working Group 8: Practical Assessment Methodology

Canada
- Dr. R.F. Addison
- Dr. C. Levings

China
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- Dr. A. Robertson
- Dr. B.M. Sanders
- **Dr. J.E. Stein** (Co-Chairman)

Working Group 10: Circulation and Ventilation in the Japan Sea (East Sea) and its adjacent areas

Canada
- Dr. G. Holloway

China
- Mr. S. Pu

Japan
- Dr. M. Hirai
- Dr. M. Takematsu

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- **Dr. S.K. Byun** (Co-Chairman)
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Russia
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- Dr. V. Pomonarev
- Dr. Y.I Zuenko

U.S.A.
- Dr. S. Martin
- **Dr. C.N.K. Mooers** (Co-Chairman)
- Prof. S.C. Riser

Working Group 11: Consumption of Marine Resources by Marine Birds and Mammals in the PICES Region

Canada
- Mr. K. Morgan
- Dr. A. Trites

China

Japan
- Mr. N. Baba
- **Dr. H. Kato** (Co-Chairman)
- Dr. H. Ogi

Korea
- Mr. Z.G. Kim
- Dr. J.U. Lee

Russia
- Dr. A.I. Boltnev
- Mr. K.A. Zharikov

U.S.A.
- Dr. J.L. Bengtson
- Dr. P.J. Gould
- **Dr. G.L. Hunt, Jr.** (Co-Chairman)
- Dr. C.V. Jay
- Mr. L.F. Lowry

Working Group 12: Crabs and Shrimps

Canada
- Mr. J. Boutillier
- Dr. G. Jamieson

China
- Mr. R. Shengmin

Japan
- Dr. Y. Ogawa
- Dr. H. Sekiguchi
- Ms. I. Yosho

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Russia
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- Ms. Yu. B. Zaitseva

U.S.A.
- Dr. D.A. Armstrong
- Dr. L.W. Botsford
- **Dr. R.S. Otto** (Co-Chairman)

Working Group 13: CO_2 in the North Pacific

Canada
- Dr. C.S. Wong

China
- Dr. Z.G. Wang

Japan
- Dr. A. Murata
- **Dr. Y. Nojiri** (Co-Chairman)

Korea
- Dr. M.W. Han
- Dr. D.-I. Lee

Russia
- Dr. A.P. Nedaskovsky
- Dr. I.P. Semiletov
- Dr. P.A. Tishchenko

U.S.A.
- Dr. A. Dickson
- **Dr. R.A. Feely** (Co-Chairman)
- Dr. P. Quay

Working Group 14: Effective Sampling of Micronekton to Estimate Ecosystem Carrying Capacity

Canada
Dr. J.F. Dower

China
Prof. M.Y. Zhu

Japan
Dr. O. Yamamura

Korea
Dr. T.W. Lee
Dr. C. Park
Dr. Y.C. Park
Dr. W.D. Yoon

Russia
Dr. A.A. Balanov
Dr. E.N. Il'insky
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Dr. R.D. Brodeur
Dr. K. Coyle
Dr. B.H. Robison (Co-Chairman)

PICES-GLOBEC Implementation Panel on Climate Change and Carrying Capacity Program:

Co-chairmen:
Prof. Y. Nagata (Japan)
Ms. P. Livingston (U.S.A.)

Executive Committee:
Dr. A.B. Hollowed (U.S.A. GLOBEC)
Dr. R.I. Perry (Canada GLOBEC)
Prof. Q.S. Tang (China GLOBEC)
Prof. M. Terazaki (Japan GLOBEC)
Dr. S. Yoo (Korea GLOBEC)
Dr. M.L. Dahlberg (NPAFC representative)

National Members:

Canada	Dr. R.J. Beamish	Korea	Dr. S. Kim
	Dr. M.A. Henderson		Dr. C.I. Zhang
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			Dr. V.V. Navrotsky
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Members:
Prof. P.A. Wheeler (BIO Chairman)
Dr. R.F. Addison (MEQ Chairman)
Prof. P.H. LeBlond (POC Chairman)
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MODEL Task Team:

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REX Task Team:

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MONITOR Task Team:

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China	Dr. D.J. Huang Mr. Z.Y. Zhao		Russia	Dr. V.B. Lobanov Dr. N.A. Rykov Dr. M.A. Stepanenko	
Japan	* **Dr. K. Nakata** * **Dr. Y. Sakurai**		U.S.A.	Dr. W. Karp Dr. J.M. Napp * **Dr. B.A. Taft**	

* Task Team Co-Chairman

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LIST OF ACRONYMS

ADCP	Acoustic Doppler Current Profiler
ALACE	Autonomous Lagrangian Circulation Explorer (float)
APEC	Asian Pacific Economic Cooperation
ARGO	Array for Real-time Geostrophic Oceanography
ASEAN	Association of Southeast Asian Nations
BASS (TT)	Basin Studies (Task Team)
BIO	Biological Oceanography Committee
CCCC	Climate Change and Carrying Capacity Program
CERN	Center for European Particle Research
CLIVAR	Climate Variability and Predictability Program
CPR	Continuous Plankton Recorder Program
CREAMS	Circulation Research of the East Asian Marginal Seas
CSR	Cruise Summary Reports
CTD	Conductivity, Temperature, Depth profiler
EC/IP	Executive Committee / Implementation Panel for CCCC
ECOR	Engineering Committee on Oceanic Resources
FAO	Food and Agriculture Organization
FEB RAS	Far Eastern Branch of Russian Academy of Sciences
FERHRI	Far Eastern Regional Hydrometeorological Research Institute
FIS	Fishery Science Committee
GIWA	Global International Waters Assessment
GLOBEC	Global Ocean Ecosystem Dynamics Programme
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
GST	Goods and Services Tax
HAB	Harmful Algae Blooms
IASC	International Arctic Science Committee
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tuna
ICES	International Council for the Exploration of the Sea
ICSU	International Council of Scientific Unions
IGPB	International Geosphere Biosphere Programme
IMB	Institute of Marine Biology
IMG&G	Institute of Marine Geology and Geophysics
IO RAS	Institute of Oceanology Russian Academy of Sciences
IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data Information Exchange (IOC)
IPHC	International Pacific Halibut Commission
ISC	Interim Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean
ITSU	International Coordination Group for the Tsunami Warning System in the Pacific
IUGG	International Union of Geodesy and Geophysics
JFA	Japan Fisheries Agency
JGOFS	Joint Global Ocean Flux Study (IGPB)

JODC	Japanese Oceanographic Data Center
KamchatNIRO	Kamchatka Research Institute of Fisheries and Oceanography
KORDI	Korea Ocean Research and Development Institute
LOICZ	Land Ocean Interaction in the Coastal Zone
MBARI	Montery Bay Aquarium Research Institute
MEDS	Marine Environmental Data Center
MEQ	Marine Environmental Committee
MIRC	Marine Information Research Center
MODEL (TT)	Conceptual / Theoretical and Modeling Studies (Task Team)
MONITOR (TT)	Monitor (Task Team)
MOU	Memorandum of Understanding
NAFO	Northwest Atlantic Fisheries Organization
NASCO	North Atlantic Salmon Conservation Organization
NOAA	National Oceanographic and Atmospheric Administration (U.S.A.)
NODC	National Oceanographic Data Center
NOP	National Oceanographic Program
NPAFC	North Pacific Anadromous Fish Commission
NSFC	National Science Foundation of China
ODC	Oceanographic Data Center
OECD	Organization for Economic Cooperation and Development
PAMS	Pacific Marginal Seas Studies
PIBOC	Pacific Institute of Bioorganic Chemistry
PICES	North Pacific Marine Science Organization
PNA	Pacific North America
POC	Physical Oceanography and Climate Committee
POI	Pacific Oceanological Institute
PSC	Pacific Salmon Commission
RAFOS	Listening float (SOFAR spelled backwards)
REX (TT)	Regional Experiments (Task Team)
RHLF	Relocation and Home Leave Fund
ROK	Republic of Korea
SakhNIRO	Sakhalin Research Institute of Fisheries and Oceanography
SCOPE	Scientific Committee on Problems in the Environment
SCOR	Scientific Committee on Oceanic Research
SOA	State Oceanic Administration
SOI	State Oceanographic Institute
SOPAC	South Pacific Applied Geoscience Commission
SPREP	South Pacific Regional Environment Programme
STA	Science and Technology Agency Japan
TCODE	Technical Committee on Data Exchange
TINRO	Pacific Research Institute of Fisheries and Oceanography
TT	Task Team
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention of the Law of the Sea
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNOLS	University National Oceanographic Laboratory System
VNIRO	Russian Federal Research Institute of Fisheries and Oceanography
WCF	Working Capital Fund

WCRP	World Climate Research Program
WDC-A	World Data Center - A
WESTPAC	Sub-Committee for the Western Pacific Intergovernmental Oceanographic Commission
WG	Working Group
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WWWP	World Wide Web Page