

# **NORTH PACIFIC MARINE SCIENCE ORGANIZATION (PICES)**

## **ANNUAL REPORT**

### **1st MEETING OCTOBER 1992**

January 1993  
Secretariat/Publisher  
North Pacific Marine Science Organization (PICES)  
Institute of Ocean Sciences  
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## **PROCEEDINGS OF FIRST ANNUAL MEETING**

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**AGENDA**  
**FIRST ANNUAL MEETING**

Victoria, October 12 - 17, 1992

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**OPENING SESSION**

1. Addresses of welcome
2. Remarks by Chairman
3. Special presentations on international programs
4. Interim Executive Secretary's announcements

**GOVERNING COUNCIL**

1. Preliminary report on administration
2. Relations with other international organizations
3. Consideration of additional contracting parties
4. Election of Chairman, Vice-Chairman
5. Appointment of Chairman, Finance and Administration Committee
6. Report of Finance and Administration Committee
7. Approval of Headquarters Agreement
8. Estimated Accounts for financial year 1992
9. Budget for financial year 1993
10. Forecast budget for financial year 1994
11. Appointment of Executive Secretary
12. Report and recommendations of Science Board
13. Second (1993) and Third (1994) Annual Meetings
14. Any other business

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## REPORT OF OPENING SESSION

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The meeting, on Monday, October 12, was called to order by the Chairman, Dr. Warren Wooster, who welcomed delegates to the historic first official session of the new PICES organization in the Conference Center, Victoria, B.C., Canada. Dr. Wooster introduced Dr. L.S. Parsons, Director General, Biological Sciences Directorate, Department of Fisheries and Oceans, Canada, who welcomed delegates on behalf of the Minister of Fisheries and Oceans for Canada:

*Mr. Chairman, fellow delegates, PICES participants, ladies and gentlemen. On behalf of the Honorable John Crosbie, the Minister of Fisheries and Oceans for Canada, it gives me great pleasure to welcome you to the first annual meeting of this new Marine Science Organization for the North Pacific, PICES. This is, indeed, an historic occasion. It is very fitting that we are meeting here today on the Thanksgiving holiday in Canada. While Canadians are giving thanks for all the good things they enjoy, we here can celebrate the formation of this new organization. PICES offers a new and unprecedented opportunity for scientific exchange and cooperation in the North Pacific, and we in Canada are immensely pleased that PICES has established its headquarters in British Columbia.*

*In celebrating the formation of PICES, we owe a great deal to those whose vision and perseverance have resulted in us being here today. Our Chairman, Dr. Warren Wooster, has played a major role in the development of PICES from the time when it was just a glimmer in his eye and we thank you, Warren, for all your efforts. You have long been an advocate for bringing together oceanographers and fisheries biologists in a common forum. This organization provides for such a multi-disciplinary approach to tackling problems in the North Pacific. Dr. Wooster was encouraged to develop the PICES Organization by Lee Alverson of the National Marine Fisheries Service and Dr. McKernan of the University of Washington following international endorsement of the concept at an FAO meeting in Vancouver in the early 1970's. Warren held some meetings*

*in the late 1970's, but efforts to form PICES languished for a number of years.*

*Then in 1987 Canada endorsed the need for a new North Pacific Marine Science Organization in its new ocean policy. In recent years, a group of Canadians, headed by Dr. Barry Muir in Ottawa, worked with delegations from China, Japan, Russia and the United States to finalize the documents which established the PICES Organization. The dedication of that international group has brought us here today. Many of those responsible are in attendance at this meeting. A note of thanks to you all. We all look forward eagerly to seeing Russia, which participated in the drafting of the PICES convention, join us at the table as a member.*

*It is, however, the science and the activities of our scientists which will be the very essence of PICES. This scientific perspective will be essential for dealing with the problems and opportunities which we are facing in the North Pacific. The public and our clients will expect answers and action on major issues such as climate change, stock status, overfishing, environmental degradation and ecosystem integrity. Stresses on the North Pacific will intensify as global population, food demand and industrialization increase. It is evident that individual nations cannot address such issues effectively without the cooperation of others. PICES provides the means for such cooperation.*

*Here at this meeting, our scientists will be identifying the key issues, challenges and scientific questions which will frame the work of PICES over the next few years. We are fortunate that the major symposium on climate change and northern fish populations is being held in conjunction with PICES. The insights, dedication and ingenuity of our scientists will be vital to addressing the challenges which we face in the North Pacific. We have a great opportunity with PICES - let us resolve to make the most of it!*

*Please join me in wishing a most productive meeting to all the participants in the PICES*

*and the associated functions, including the scientific symposium on climate change and northern fish populations. And please enjoy the hospitality of beautiful Victoria.*

*Warren, I am here in a dual capacity. As Vice-President of ICES, the International Council for the Exploration of the Sea, I have been asked by its President to represent ICES as an observer at this meeting. Professor Wooster and I have both just come recently from the ICES statutory meeting in Warnemunde, Germany. ICES this summer celebrated its 90th anniversary.*

*PICES, although involving many fewer countries, is in many ways modeled on the structure of ICES. Its objectives are similar, although for a different geographic area.*

*On behalf of President David Griffith and ICES Delegates, I bring you warm greetings and best wishes for the first 90 years of PICES.*

Dr. Ji Xu, speaking on behalf of the Chinese Delegation and Mr. Jian San Jia who could not attend due to illness, expressed congratulations to the Parties for successfully establishing the PICES organization, as well as to the Chairman and the Secretariat for organizing the meeting. He mentioned that the major business now at hand was developing strong scientific cooperation between the countries which has important implications for the future. Dr. Xu stated that PICES will bring great achievements in international marine science through exploring issues of common interest to the Parties. It was his fervent hope that PICES would become an effective and active organization and he stressed that this first Annual Meeting was important.

Dr. Hiroshi Hatanaka welcomed delegates on behalf of Japan, expressing the gratitude of the Government of Japan to all those who had worked hard to make the organization a reality. He extended thanks to the Secretariat, the Government of Canada, China and the U.S.A. for contributing to the founding of PICES and anticipated the early accession of Russia to the new organization. Dr. Hatanaka pointed out that the Pacific Region was one of the most dynamic areas of the world, both politically and culturally as well as in a scientific sense. He encouraged cooperation between scientific organizations in the Region,

stressing the fact that even though the Region was vast in size, close contact between the nations and the scientists was of utmost importance. Dr. Hatanaka emphasized that Japan was most pleased with the formation of the new organization, pointing out that it will strengthen bonds between countries. Japan will give its full cooperation to PICES and will work to support the organization.

Dr. William Aron spoke on behalf of the United States, emphasizing that this meeting is a science meeting and that there was nothing more important than the need to understand the North Pacific ocean which was a complex system. In these times of budgetary shortfalls it was most important that countries cooperate on scientific matters. Dr. Aron stressed that the U.S.A. strongly supports PICES and its linkages to other organizations and programs like GOOS and the Bering Sea FOCI initiative. The U.S.A. regrets the difficulties that our Russian colleagues are having and hopes for their early accession to the organization. Dr. Aron also pointed out that the United States would like to see other Parties join the organization.

Dr. Warren Wooster addressed the session in his capacity of Chairman:

*After fifteen years of discussions and negotiations, the North Pacific Marine Science Organization (PICES) has finally been brought into the world and is now about to start its work. While we all have high expectations for its success, I suspect that amongst us we have different expectations. Some see PICES as primarily concerned with fishery questions while others are more interested in oceanographic research or in studies of climate or pollution. My own view is that the problems are all interconnected and that the study of each depends to some degree on, or contributes to, studies of the others. If we can make progress on the common question that emerged during the scientific workshop last December, both marine science and its applications will greatly benefit therefrom. That question is:*

*What is the nature of the subarctic Pacific ecosystem (or ecosystems), and how is it affected over periods of months to centuries by changes in the physical environment, by interactions among components of the ecosystem, and by human activities?*

*Many of us have experience with different international organizations and we tend to equate PICES with those that we know, be it the Intergovernmental Oceanographic Commission or the International North Pacific Fisheries Commission. From my own experience, I see PICES as most similar to ICES, the International Council for the Exploration of the Sea, in its focus on scientific questions and in the substantial involvement of scientists in its governance. I hope that a major part of PICES activities will be the implementation of scientific projects proposed by scientists through the four scientific committees we have established and the Science Board which is their voice to the Governing Council.*

*Some may feel that unless research is explicitly related to applied problems - for example, the assessment of fish stocks - it is of lower priority in these economically troubled times. As an academic scientist, I would argue that all of the short term payoffs in science depend on longer term and more fundamental studies. Obviously some judicious mix of research with short and with long term payoffs is needed, as much in PICES as in the government agencies that will support the scientists engaged in its projects.*

*One role that PICES will be called on to play is that of mobilizing scientific opinion to provide advice. That role was foreseen in the Convention where included among the scientific functions of the Council is "to consider requests to develop scientific advice pertaining to the area concerned" (Art. V.d). Already, Canada has asked the Council to consider the nature of advice it would be prepared to provide, and the recent FAO Technical Consultation on High Seas Fishing proposed PICES involvement in a technical meeting with other international organizations to develop priorities and procedures for high seas fisheries research.*

*In a somewhat related matter, the IOC and ICES have proposed that PICES cooperate with them in a study of toxic algal blooms. I think we can foresee other such requests and proposals in the wide variety of subjects in which PICES can become involved. Indeed, an important justification for creating PICES was that it could develop objective advice on scientific questions with great practical implications. But in each case we will have to consider carefully whether a useful response is*

*possible and to what extent the Organization has the necessary resources to undertake the work.*

*When the PICES convention came into effect in March 1992, time was short to organize a scientific meeting before the end of the year. It would be easy for scientists to spend all of their time at meetings with none to spare for the ship or laboratory. Thus it seemed desirable to find an occasion where there was already to be an aggregation of scientists with interests common to those of PICES. That opportunity was provided by the International Symposium on Climate Change and Northern Fish Populations whose close association with PICES was already foreseen by its organizers. I am grateful to Dr. Beamish for his eagerness to co-operate with PICES as planning proceeded.*

*You will find the two meetings cunningly intertwined, with no conflicts today and Saturday, but more than enough during the rest of the week to guarantee frustration. As you will note on the schedule, this session, meetings of the four scientific committees, and the session on GLOBEC are open to all symposium participants. We have also tried to schedule PICES events so that everyone could attend key sessions of the symposium. For the Second Annual Meeting next year, we will need to develop a scientific program of sufficient interest and importance to attract a good representation of marine scientists interested in problems of the northern North Pacific - this is one of the important tasks for the scientific committees this week.*

*PICES is not in competition with other international organizations nor with established international programs. Instead, we should find ways to complement and support such organizations and programs to the extent they relate to our objectives. Therefore, I thought it useful in this opening session to invite spokesmen for some of those programs to tell us what they are, what work is underway or planned in our region, and what PICES might do to support the programs. The scientific committees and the Science Board will then be able to take this information into account as they consider further actions that PICES might take.*

*PICES now exists, but it remains to be seen how it will develop and how effective it will be in promoting the scientific study of the*

*northern North Pacific. I call on all of you to help us ensure its success.*

Brief overviews of the special presentations follow:

World Ocean Circulation Experiment (WOCE) - Professor Lynn Talley, Scripps Institution of Oceanography

Dr. Talley outlined the goals of WOCE in the North Pacific which include the development of models useful for predicting climate change and the collection of data necessary to test them. An additional goal was determination of the representativeness of the specific WOCE data sets for the long-term behavior of the ocean and finding methods for determining long-term changes in the ocean circulation. Dr. Talley described the WOCE hydrographic program and observational commitments. WOCE includes a global survey of circulation, including direct current, hydrographic and sea level measurements, an intensive survey of the North Atlantic and numerical modeling. Organization structure includes a scientific steering group with three core projects (Global Description; Southern Ocean; Gyre Dynamics in the N. Atlantic) as well as a numerical experimentation group. Possible focal areas in the N. Pacific include intergyre exchange (N.E. Pacific), circulation and water mass variability, intermediate water formation, role of the Okhotsk and Bering Seas, Kuroshio transport and variability, meridional heat transport, and deep western boundary currents. Dr. Talley pointed out that the North Pacific Ocean provides a very useful counter example for the North Atlantic as the Pacific has no local deepwater formation with its relatively fresh surface layer. A number of illustrations were presented to describe the program and the location of WOCE hydrography lines, study areas and time series stations.

Joint Global Ocean Flux Studies (JGOFS) - Dr. Ken Denman, Institute of Ocean Sciences, Canada Department of Fisheries and Oceans

Dr. Denman described the JGOFS program as being directed at a better understanding of the ocean carbon cycle and particularly, of elucidating the role of the ocean in global carbon flux. He pointed out that man has perturbed the global system through addition of carbon by activities such as the burning of fossil fuels and deforestation. The operational

goal of JGOFS is to assess more accurately and understand better the processes controlling regional to global and seasonal to interannual fluxes of carbon between the atmosphere, surface ocean and ocean interior, and their sensitivity to climate changes. JGOFS program components include large scale surveys, process and regional studies, time series information, global synthesis and modeling, sedimentary records and continental margin boundary fluxes. Dr. Denman summarized the provisional schedule of field activities 1989-1998, pointing out time series station locations and mooring sites. Maps showing carbon dioxide survey transects were presented along with a description of the organizational structure of JGOFS. In terms of possible linkages between PICES and JGOFS, Dr. Denman thought that PICES could:

- provide infrastructure for North Pacific countries to communicate, attend meetings, exchange data;
- consider geochemical problems related to JGOFS in the Committees of PICES;
- organize and encourage a study of the Sea of Okhotsk and Bering Sea regions in relation to Intermediate Water Formation and the removal of carbon dioxide from the surface waters to deep waters;
- ensure that the WOCE Hydrographic Program (WHP) transects planned for the North Pacific are completed, with JGOFS carbon dioxide and surface pigment measurements.

Global Ocean Ecosystems Dynamics (GLOBEC) - Dr. Dan Ware, Pacific Biological Station, Nanaimo, B.C., Canada, Department of Fisheries and Oceans

Dr. Ware provided an overview of the GLOBEC initiative. GLOBEC stands for Global Ocean Ecosystems Dynamics and results from an IOC and SCOR-sponsored workshop held in 1991 which concluded that "concerns for global climate change emphasize the need to understand how changes in the global environment will affect the abundance, diversity, and production of animal populations comprising ocean ecosystems. The goal of GLOBEC is "to understand the effects of physical processes on



predator-prey interactions and population dynamics of zooplankton and their relation to ocean ecosystems in the context of the global climate system and anthropogenic change." GLOBEC has several working groups including one on population dynamics and physical variability; population dynamics and physical variability; numerical modeling; sampling and observation systems; Southern Ocean; and a cod and climate working group. More information on GLOBEC will be available at a session at the present meeting.

International North Pacific Ocean Climate Program (INPOC) - Mr. Robert Wilson, Institute of Ocean Sciences, Canada, Department of Fisheries and Oceans

The INPOC program shares many commonalities with PICES given that it involves a project in the international waters of the North Pacific. Canada, Russia and the United States are involved through an inter-institutional arrangement for five years cooperation involving the Institute of Ocean Sciences in Sidney, B.C., Scripps Institution of Oceanography, the University of Alaska and two institutes in Vladivostok-the Pacific Oceanological Institute and the Far East Hydrometeorological Institute. Generally, the North American side provides the technology, instrumentation, training, etc. and the Russian side provides vessels, crew and scientists. To date there have been eight Canada-Russia cruises and the first U.S.A.-Russia cruise is underway.

INPOC's goals include:

- study of the structure and variability of the subarctic frontal zone;
- understanding the heat and salt budgets for the region of the upper ocean north of the subarctic front;
- examination of the dynamics of boundary currents along the northwest margin of the Pacific;
- investigation of spatial and time-varying fluxes of carbon and associated elements (N, P, Si, O).

Field work in INPOC is planned to continue until 1994. PICES might be able to assist in future by providing a forum for coordination of INPOC program information and for developing a continuation of physical

oceanography and climate work after 1994. In addition, PICES could provide the infrastructure during 1993 and 1994 for meeting, planning and exchanging data.

Global Ocean Observing System (GOOS) - Dr. James Calder, Intergovernmental Oceanographic Commission (IOC) of UNESCO

Dr. Calder began by emphasizing how the IOC and PICES share many issues in common. There has been a long history of cooperation between ICES and the IOC involving sharing and dissemination of information, cooperative initiatives, etc. PICES is invited to participate in the upcoming IOC Assembly in Paris in March 1993. Some of the activities of the IOC of potential interest to PICES include GIPME (Global Investigation of Pollution in the Marine Environment), the International Mussel Watch Program in the Southern Hemisphere and the Harmful Algal Bloom Program.

GOOS stands for the Global Ocean Observing System which is built on the existing IOC science and monitoring systems which form its nucleus. GOOS involves a data collection network, data and information management, data analysis and preparation and dissemination of products, modeling, training, technical assistance and technology transfer. The program includes a global network of 300 sea level stations whereby countries collect and share information according to standardized procedures.

Bering Sea Fisheries Oceanography Coordinated Investigations (FOCI) - Dr. James Overland, Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, Seattle.

Dr. Overland provided a synopsis of work being conducted in Shelikof Strait and the Bering Sea that is aimed at determining what biotic and abiotic factors affect survival and recruitment of fish stocks. The initiative is linked to the Alaska pollock project conducted from the Alaska Fisheries Science Center. Dr. Overland described the life cycle of pollock and illustrated how oceanographic features may affect distribution and recruitment success of year classes. An additional major question is whether there are separate stocks in

the Bering Sea Basin or if a single stock is present. Dr. Overland described ocean circulation patterns in the North Pacific and Aleutians area, stressing the importance of obtaining information on long term variability in ocean features.

International North Pacific Fisheries Commission (INPFC) - Mr. Shigato Hase, Executive Director, INPFC, Vancouver

Mr. Hase thanked PICES for the invitation to speak and wished the new organization well in its endeavors. INPFC was established in the early 1950's by a convention between Canada, Japan and the U.S.A. and has primarily been concerned with regulation of salmon fishing in the North Pacific and Bering Sea. Since the United States has served notice to withdraw from the convention, the organization will cease operation on February 20th, 1993. As INPFC provides a mechanism for some very important exchange of information on stocks in the North Pacific, the Parties to INPFC

agreed that it is important to maintain continuity of data exchange and accomplish a smooth transition to new organizational arrangements. In that regard, a new convention dealing with anadromous stocks in the North Pacific has been negotiated by Canada, Japan, Russia and the United States and is awaiting ratification. INPFC will hold a Biology and Research Committee meeting during the week of October 19th in Seattle and a Finance and Administration meeting and a transition discussion early in November in Vancouver, B.C.

Mr. Hase emphasized that we are now at a historical turning point in the North Pacific with INPFC coming to an end, abstention from pollock fishing in the international waters of the Bering Sea, and a ban on driftnet fishing on the high seas at the end of 1992. He stressed the need to transfer essential functions to new organizations and accomplish a smooth transition. Mr. Hase hoped that these matters would be carefully discussed at the first annual meeting of PICES.

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## REPORT OF GOVERNING COUNCIL MEETINGS

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Two sessions of the Governing Council were held under the Chairmanship of Dr. Wooster. Mr. Willie Rapatz served as rapporteur:

Monday, 12 October, 1308 - 1500

Saturday, 17 October, 0900 - 1412

All Member Countries were represented at both sessions (see Endnote 1 for participation). The Chairman of the Science Board also participated in the second session.

At the first session, the Chairman welcomed the Delegates and reviewed the agenda and the order in which he proposed the various items be taken up. The report which follows summarizes the treatment of each agenda item regardless of the session when it was discussed.

### **Agenda Item 1. Preliminary Report on Administration**

Mr. Rapatz reported on establishment of the Secretariat in April 1992 and on administrative steps that had been taken since then (Endnote 1 of Finance and Administration Report).

### **Agenda Item 2. Relations with other International Organizations**

Dr. Parsons of Canada commented on the importance of relationships with other international organizations. He noted that some important issues had to be discussed to elucidate the role of PICES and referred to the discussion paper which had been circulated earlier regarding the Convention For the Conservation of Anadromous Stocks in the North Pacific Ocean (NPASC). He maintained that when the NPASC is in operation, the activities between it and PICES should be coordinated. The potential relationship between PICES and NPASC should be addressed and resolved. This is especially important during the transition phase from INPFC to NPASC. Canada believes that PICES should be an organization from which various other

international organizations should seek advice.

The Chairman pointed out that a role of PICES with respect to other organizations would be to supply advice through the Science Board and relevant scientific committees.

Dr. Aron of the United States pointed out that the rationale for PICES was avoidance of duplication of scientific activities, while INPFC is concerned with what happens to the data it holds. He said that as NPASC grows and evolves, it should take a critical look on how to use PICES. He suggested that PICES wait until the final report of INPFC is received.

Dr. John Davis of Canada remarked that scientific issues may also be determined by Council of PICES, not only through the Science Board. He noted that PICES should be concerned with how to divide the business between NPASC and PICES. This is not only a scientific issue but also a budget item for PICES. For instance, it may affect the qualifications of the people to be hired for the Secretariat.

The Chairman pointed out that it is quite difficult to determine the division of roles, since PICES exists now but NPASC does not yet. He said that he would like to see a specific recommendation which the Council can then discuss.

Dr. Parsons explained that Canada at this time does not have a specific recommendation, however, in order to make some progress with this question, he asked that a small Working Group be formed to discuss the item, perhaps collectively develop a specific recommendation and then bring it forward to the second session of Council.

Dr. Hatanaka of Japan agreed with the proposal of Canada to form a small Working Group, since INPFC is disappearing and no specific relationship has been established as yet. He said that there is an immediate need to know what will happen to INPFC data.

Dr. Aron pointed out that there is a problem with reaching an agreement at this time, especially in the absence of Russia, which is not yet a member of PICES. He remarked that the data resident at INPFC are only a small part of the total available data and would only be a small addition to that which PICES will have to come to grips with. PICES is willing to respond to a request, but we should not preempt the response of NPASC.

The Chairman agreed that a Working Group should be formed and that each delegation should name a member of this group. Dr. Parsons was asked to be the Chairman of that group and report back to the second session of Council. After much discussion at that session, a resolution was adopted (Endnote 2).

### **Agenda Item 3. Consideration of additional Contracting Parties**

Official observers had been named by Korea, Poland and Russia and had participated in open sessions of the Council and its scientific committees. Upon return to their countries, these observers will discuss the desirability of accession. No action can be taken by PICES until national applications have been received.

It was suggested that the Chairman write to these countries concerning procedures to be followed should they wish to accede to the PICES Convention. The Chairman agreed to draft such a letter and circulate it to Delegates for their review before it is issued.

### **Agenda Item 4. Election of Chairman and Vice-Chairman**

For this item the Interim Executive Secretary took the chair. He explained that in accordance with official procedures, there would be a single nomination from each delegation and then an election by closed written ballot. All Member States nominated Dr. Warren S. Wooster. It was moved by Dr. Aron and seconded by Dr. Parsons that the first ballot be considered the second ballot. This carried, and Dr. Wooster was elected to a two-year term.

Dr. Hiroshi Hatanaka of Japan and Mr. Yu Kun Xu of China were nominated for the position of Vice-Chairman. Both withdrew,

and it was decided that the election would be deferred until the Assistant Secretary had been appointed. It was agreed that the election would be by mail.

### **Agenda Item 5. Appointment of Chairman, Finance and Administration Committee**

Dr. Davis of Canada, now serving as Interim Executive Secretary, was appointed Chairman of the Committee from the time when the Executive Secretary takes office. In the meantime, and for the present meeting Mr. Robert Steinbock of Canada was appointed Interim Chairman.

### **Agenda Item 6. Report of Finance and Administration Committee**

The Finance and Administration Committee met under the chairmanship of Mr. Steinbock who presented their report to the Council (see Finance and Administration section for text of report). The report was accepted and its recommendations were considered in dealing with agenda items 7 - 10.

It was moved by Mr. William Sullivan of the United States and subsequently carried by Council, that Financial Regulation 8 (i) in attachment 2 of the Final Report of March 3, 1992 be changed to read as follows:

*The Executive Secretary shall designate a bank(s) or financial institution(s) within the host state, insured by the host state's Deposit Insurance Corporation, in which the funds of the Organization shall be kept. The Executive Secretary shall inform the Council of the name and branch of the bank(s) or financial institution(s).*

### **Agenda Item 7. Approval of Headquarters Agreement**

The Agreement, as revised by the Finance and Administration Committee, was approved (see Finance and Administration section for text of the Agreement). The Delegate of Canada stated that the document would be prepared at an early date for signature by the PICES Chairman and a representative of Canada.

### **Agenda Item 8. Estimated Accounts for Financial Year 1992**

The estimated accounts to September 30, were reviewed by the Finance and Administration Committee which recognized that some surplus was on hand since the Organization was only beginning to function. That surplus was taken into account in consideration of the 1993 budget. On recommendation of the Committee, the estimated accounts were approved by Council (see section on Finance and Administration).

#### **Agenda Item 9. Budget for Financial Year 1993**

The Finance and Administration Committee recognized the need for flexibility in budgeting salary levels before the Secretariat positions were filled. When the Organization is fully operational, there will be expenses that cannot now be foreseen. Some 1992 funds, such as those allocated to relocation expenses, should be carried over to 1993. Nonetheless it seemed appropriate to use a portion of the 1992 surplus as a credit against the contributions required for the 1993 budget. Taking these views into account, the Council approved the Budget for 1993 and the level of contributions called for therein (see section on Finance and Administration).

#### **Agenda Item 10. Forecast Budget for Financial Year 1994**

The Finance and Administration Committee noted that this budget was predicated on there being five Contracting Parties in 1994 and that the required level of national contributions would be the same as proposed (prior to credit) for 1993. The Council received the forecast budget for further consideration and action in 1993 (see section on Finance and Administration).

#### **Agenda Item 11. Appointment of Executive Secretary**

An Interview Committee composed of the PICES Chairman and representatives of each of the Contracting Parties interviewed the five short listed candidates and recommended appointment of Dr. W.D. McKone, for an initial period of 5 years. The Council accepted this recommendation,

as did Dr. McKone who participated in the remainder of the session as the Executive Secretary designate.

In recruiting the Assistant Executive Secretary, it was agreed that preference should be given to candidates with skills and experience complementary to those of the Executive Secretary. For example, an appropriate appointee might be a physical scientist familiar with the language, organization and conduct of marine scientific research in one of the Asian member countries. An invitation to apply for this position will be prepared by the Interim Executive Secretary in consultation with the Chairman and distributed through the delegates. Council agreed to a deadline of 1 January 1993 for receipt of applications. It was agreed that the period for which the Assistant Executive Secretary will be appointed is to be three years.

With regard to the position of Administrative Assistant, there was consensus that the candidate should be recruited from, and with good knowledge of, the local area. In evaluating relevant skills and experience for the position, preference would be given to candidates having Japanese or Mandarin language skills.

#### **Agenda Item 12. Report of Science Board**

Dr. Ware was elected Chairman of the Science Board by members of the Board. Since this left the Chairmanship of the Fishery Science Committee vacant, the Chairman of PICES, in accordance with the Rules of Procedure, appointed Dr. Tang of China to serve as Chairman until the next Annual Meeting when an election could be held.

The design of the Second Annual Meeting was discussed based on the proposals from the Science Board. It was suggested by Dr. Aron that the Chairman of the Science Board and of PICES work together to reduce program overlap as much as possible, since the emphasis of PICES should be integration of different sciences. It was important that scientists of different disciplines be able to attend each others sessions as much as possible. Dr. Davis proposed that the schedule be developed in such a way that delegates and members of

other committees can attend scientific sessions. He also strongly recommended PICES have some process of closure, whereby the results of the meetings are available in an open plenary session. There was considerable discussion on this suggestion. The chairman noted that he will try to arrange a closing session.

After a question by Dr. Hatanaka, if there had been discussion in the Science Board on whether PICES should support international scientific meetings, Dr. Ware explained that there had been no such discussion but that, in his opinion, simultaneous meetings of PICES and other international scientific organizations should be contemplated.

Regarding the Working Groups proposed by the Science Board, the Chairman noted that Conveners should be selected, that intersessional meetings of the Working Groups should be arranged, and that the Groups should report to the Second Annual Meeting. It was suggested that for some Working Groups, observers with special knowledge, for example from Russia, should be invited to participate. It was also noted that in some cases Working Groups may desire participation of experts from other countries not members of PICES and that in such cases PICES should consider the possibility of meeting the costs of participation.

Dr. Davis suggested that the Secretariat might support the meetings of these Working Groups, by attending the meetings and supplying organizational support, while Member States would provide the facilities. There would be a need to develop agreed procedures for such intersessional arrangements.

The Report of the Science Board was accepted and the following recommendations were agreed:

1. Working Groups on the following topics will be established:

WG 1. Okhotsk Sea and Oyashio region (POC);

WG 2. Development of common assessment methodology for marine pollution (MEQ);

WG 3. Dynamics of small pelagics in coastal ecosystems (FIS);

WG 4. Data collection and quality control (Science Board);

WG 5. Bering Sea (Science Board);

WG 6. Subarctic gyre (Science Board).

2. The Working Groups will be organized by the committees indicated in parentheses above. Terms of reference will be as proposed by the Science Board (Endnote 3).

3. The program of the Second Annual Meeting will include sessions of invited and contributed scientific papers organized by the indicated committees on the following topics:

1. Ocean circulation and climate variability in the subarctic Pacific (POC);

2. High resolution paleoecological studies in the subarctic Pacific (BIO);

3. Priority chemical and biological contaminants in the North Pacific ecosystem (MEQ);

4. Shifts in fish abundance and species dominance in coastal seas (FIS);

5. Long-term monitoring from platforms of opportunity (Science Board).

### **Agenda Item 13. Second and Third Annual Meeting**

It was agreed that the latter part of October would be the appropriate time to hold Annual Meetings of the Organization. Dr. Aron, on behalf of the United States, invited the Organization to hold its Second Annual Meeting at the NOAA facility in Seattle, on 25 - 30 October, 1993. This invitation was accepted.

The Chairman noted that the Third Annual Meeting, in October 1994, might appropriately take place on the western side of the Pacific.

### **Agenda Item 14. Other Business**

It was suggested that at some regularly scheduled times each year the Executive Secretary should provide a newsletter to inform the Parties of the activities of

working groups, developments to date and schedule for meetings. Such a newsletter would serve the function of a central communication system of use to the Parties.

Consideration was given to a proposal by Dr. K.R. Benson, Co-Chairman of the Fifth International Congress on the History of Oceanography, that PICES cosponsor the meeting which will be held in La Jolla,

California, on July 7 - 14, 1993. This will be the first time that the Congress has been held in the Asia-Pacific region, and the title "Oceanography: The Pacific Perspective" has been given to the meeting. The Council agreed to sponsor the meeting without obligation to provide financial support.

There being no further business the meeting adjourned at 1412.

## **Endnote 1**

### **Representatives Participating**

#### **Canada:**

Dr. L. S. Parsons (Delegate)  
Dr. J. C. Davis (Delegate)  
Mr. R. Steinbock (Advisor)  
Mr. C. C. Graham (Advisor)  
Dr. B. Muir (Advisor) (1st session only)

#### **Japan:**

Dr. H. Hatanaka (Delegate)  
Mr. Y. Hayashi (Delegate) (1st session only)  
Mr. M. Namba (Advisor)  
Mr. T. Sasaki (Advisor)

#### **China:**

Dr. Yu Kun Xu (Delegate)  
Mr. Ji Xu (Delegate - Alternate)  
Mr. Hong Xi Wang (Advisor)  
Mr. Chen Lian Zeng (Advisor)  
Mr. Liang Lin (Advisor)

#### **United States:**

Dr. V. Alexander (Delegate)  
Dr. W. Aron (Delegate)  
Mr. W. Erb (Advisor) (1st session only)  
Mr. W. Sullivan (Advisor)  
Ms. R. Tuttle (Advisor)

#### **Others:**

Dr. W.S. Wooster	Chairman - PICES
Mr. W.J. Rapatz	Coordinator - PICES
Dr. D. Ware	Chairman - Science Board (2nd session)
Dr. W.D. McKone	Executive Secretary designate (2nd session)

## **Endnote 2**

### **RESOLUTION under Agenda Item 2**

Under Article V.(1.D.) of the Convention for the North Pacific Marine Science Organizations (PICES), the Governing Council affirms that the Organization will

consider requests to develop scientific advice pertaining to the Convention Area. In the context of Article III of the Convention, the Governing Council

recognizes that, among other things, the purpose of PICES shall be to promote and coordinate marine scientific research in order to advance scientific knowledge of the Convention Area and of its living resources and to promote the collection and exchange of information and data related to marine scientific research in the Convention Area.

The Governing Council recognizes the need to clarify the respective roles of PICES and various other international organizations, existing or new, with a view towards

avoiding duplication and overlap in the activities of these organizations.

The Governing Council therefore authorizes the Chairman of PICES to respond to requests from other organizations, if initiated, to enter into discussions in order to clarify respective roles, including maintenance and continuation of INPFC databases and scientific records, and to report back to the Governing Council on the results of such discussions.

### **Endnote 3**

#### **Terms of Reference for Scientific Working Groups**

##### **Working Group 1 - The Okhotsk Sea and Oyashio Region (POC)**

With regard to the importance of the Okhotsk Sea and Oyashio Region on the ventilation of the North Pacific Ocean, such as the formation of the North Pacific intermediate water:

- Review the present level of knowledge of the oceanic circulation and water mass modification in this area, and identify gaps in this knowledge;
- Review studies relating chemical, biological and geographical regimes, and encourage interactive understanding and planning of multidisciplinary experiments.
- Identify the scientific and logistical difficulties of ocean studies in the area;
- Encourage the planning of experiments and discussion of related physical processes in the area;

##### **Working Group 2 - Development of Common Assessment Methodology for Marine Pollution (MEQ)**

- Identify the information which exists in the PICES participating countries, and determine the mechanisms of data and information exchange;

- Identify the most important problems, scientific questions, knowledge gaps and assessment methodology to determine marine environmental quality;
- Develop programs using new techniques and methodologies to assess the state of marine environmental quality in the coastal and oceanic regions of the North Pacific.

##### **Working Group 3 - Dynamics of Small Pelagics in Coastal Ecosystems (FIS)**

- Develop a program for a comparative study of the population dynamics and productivity of small pelagics (focusing on herring, sardine, anchovy, and mackerel) in the coastal ecosystems along the western and eastern continental margins of the North Pacific;
- Review the present state of knowledge, identify the key scientific questions and hypotheses that could be tested, including environmental effects on fish production and ecosystem structure;
- Identify who is working in this field, and what data are available for retrospective analyses;
- Determine which member countries would be willing to participate in a coastal ecosystems program.



#### **Working Group 4 - Data Collection and Quality Control**

- Identify existing international programs and standards relevant to data exchange within the PICES region;
- Identify data sets which are available and suitable for exchange, and which would contribute to identified PICES goals;
- Recommend on exchange protocols for these data sets, and for data sets generated by new programs related to PICES objectives;
- Advise on quality control procedures and production of reference data sets in support of the scientific objectives of PICES.

#### **Working Group 5 - The Bering Sea**

- Review present knowledge of the atmospheric and oceanic circulations of the Bering Sea and their variability;
- Review present knowledge of the Bering Sea ecosystem and its responses to environmental variability;
- Identify the major gaps in present knowledge, and propose methods and approaches for reducing them;
- Consider development of a symposium on the Bering Sea ecosystem for possible inclusion in the 1994 Annual Meeting.

#### **Working Group 6 - The Subarctic Gyre**

- Review the existing level of description of ocean circulation and climate variability in the subarctic North Pacific and identify gaps in knowledge;
- Review the present level of knowledge of the important processes determining ocean circulation in the subarctic North Pacific and identify gaps in knowledge;
- Review existing information on the biomass of major trophic levels, and distribution of the dominant species within each level;
- Review existing information on the carrying capacity for salmon and other nektonic species in the subarctic, and what is known about variations in the carrying capacity of this region in response to climate change. Advise on how changes in carrying capacity could be quantified;
- Review existing level of knowledge of the processes affecting primary and secondary production in this region and identify information gaps. Advise on how these gaps could be studied;
- Identify key scientific questions, and propose collaborative programs which can be conducted to advance knowledge and test major hypotheses;
- Determine relationship to GLOBEC. Advise which PICES and GLOBEC objectives could be linked.



## **REPORTS OF SCIENCE BOARD AND COMMITTEES**

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## REPORT OF SCIENCE BOARD

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The Board met on October 16, from 1300 to 1730.

### **Participants were:**

Dr. D. Ware - Chairman, Science Board  
Dr. W. Wooster - Chairman, PICES  
Dr. Q. Tang - Chairman, Fishery Science Committee  
Professor M.M. Mullin - Chairman, Biological Oceanography Committee  
Professor J. Zhou - Chairman, Marine Environmental Quality Committee  
Dr. Y. Nagata - Chairman, Physical Oceanography and Climate Committee

The Chairman, Dr. Ware, called the meeting to order and the task before the Board was discussed. The Board was to review the findings of each of the PICES scientific committees as presented by their chairmen and discuss the business flowing from the reports, particularly that leading up to the design of the Second Annual Meeting. Reports from each of the scientific committees are appended and are summarized as follows:

### **Biological Oceanography Committee (BIO) - Professor Michael Mullin**

The Committee discussed presentations of a prototypical scientific program by each member. The Committee was not prepared to recommend any scientific programs at the first meeting, but is clearly interested in developing a large scale, long term approach emphasizing ecological concepts or processes that could be tested in several regions.

### **Fishery Science Committee (FIS) - Dr. Dan Ware and Professor Qisheng Tang**

Discussion in the Committee focused on comparative studies. There was unanimous agreement among the member countries that we conduct comparative studies on

important groups of species around the Pacific Rim. It was also agreed that FIS should participate in planning and promoting interdisciplinary studies in the Bering Sea and subarctic Pacific.

### **Marine Environmental Quality Committee (MEQ) - Professor Jiayi Zhou**

The Committee prepared summary recommendations for scientific sessions and inter-committee sessions for the Second Annual Meeting. In PICES the Committee felt that it should focus on the development of common assessment methodology for marine pollution in the North Pacific. There was a need to strengthen the role of inter-committee activities, by focusing the organizing and planning of the Second Annual Meeting on this goal. As a subset of activities directed at assessment techniques and methodologies in marine environmental quality, two areas were particularly important - algal blooms and chemical and biological contaminants. The Committee proposed a specific outline for meeting topics which expanded upon these two sub-themes.

### **Physical Oceanography and Climate Committee (POC) - Professor Yutaka Nagata**

The Committee reviewed important topics in physical oceanography and climate in the North Pacific. In addition to identifying important issues in the area, the Committee reviewed the relationship of PICES activities in the area relative to other programs such as WOCE, TOGA, GOOS, JGOFS, GLOBEC and INPOC. It was agreed that cooperation and communication with other initiatives was very important and that programs such as INPOC were excellent examples of the type of international cooperative venture that PICES should foster. The Committee supported data exchange between cooperating nations in the Region, and more international cooperation in the field of physical oceanography and climate. Continued

support from the governments for research vessel operations consistent with the past level of support is required. Formation of four working groups was proposed dealing with:

- Ocean circulation and climate variability in the subarctic N. Pacific;
- The Okhotsk Sea and Oyashio Region;
- New technology and observing strategies;
- Data collection and quality control.

### **Discussion of Organization of Science Activities for PICES**

There was considerable discussion of how the various working groups proposed by committees could be incorporated in a scientific program for PICES. There was consensus that a large number of groups would be unwieldy and that a relatively few groups which incorporate priority areas of particular interest to the member nations should be selected. Accordingly, the Board agreed to propose establishment of the following working groups:

#### **Committee Working Groups:**

WG 1. Okhotsk Sea and Oyashio Region (POC);

WG 2. Development of common assessment methodology (MEQ);

WG 3. Dynamics of small pelagics in coastal ecosystems (FIS);

#### **Inter-Committee (Science Board) Working Groups:**

WG 4. Data collection and quality control;

WG 5. Bering Sea;

WG 6. Subarctic gyre.

Terms of Reference for the Working Groups were developed (see Report of Governing Council Meetings).

It was agreed that conveners should be identified for these working groups, by POC, MEQ, and FIS respectively for the first three and by the Science Board for the rest. The Contracting Parties should be asked to nominate members. Work could be initiated by correspondence, but intersessional meetings should be anticipated; expenses of participation should be paid by the nominating Parties. The Working Groups should report to the Committees and Science Board at the Second Annual Meeting

Working Groups proposed by Committees that have not been incorporated in the approved list are tabled for further consideration.

### **Proposal for design of Second Annual Meeting:**

The Science Board recommends that the program of the Second Annual Meeting, in addition to providing for an opening session, meetings of the Science Board and Governing Council, and business meetings of the scientific committees, include sessions of scientific papers on the following topics (organizational responsibility of Working Groups or the Science Board indicated in parenthesis):

1. Ocean circulation and climate variability in the subarctic Pacific (POC);
2. High resolution paleoecological studies in the subarctic Pacific (BIO);
3. Priority chemical and biological contaminants in the North Pacific ecosystem (MEQ);
4. Shifts in fish abundance and species dominance in coastal seas (FIS);
5. Long-term monitoring from platforms of opportunity (Science Board).

Specific sessions will include invited and contributed papers, the latter handled in the most part, in poster sessions. Scientific committees (and the Science Board in the case of topic 5) will identify conveners and organize the sessions. The Board recommends this approach for consideration of Governing Council.

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## REPORT OF BIOLOGICAL OCEANOGRAPHY COMMITTEE

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The Committee met on October 14 under the Chairmanship of M.M. Mullin; D. Mackas served as rapporteur. The following members participated:

Canada:	K. Denman, D. Mackas, T. Parsons
China:	R. Wang
Japan:	T. Ikeda
United States:	L. Jones, M.M. Mullin

An election supervised by PICES Interim Executive Secretary, John C. Davis, confirmed convener M. M. Mullin as the first chair of the Biological Oceanography Committee.

Professor Mullin opened with an explanation of the role and duties of the PICES Scientific Committees. He then noted that Biological Oceanography plays a key intermediary role with respect to the other three PICES scientific Committees. For example, lower trophic levels may be the most directly affected by the processes considered by the Physical Oceanography and Climate Committee. Biological Oceanography will also play a central role in defining the "normal" conditions (or range of conditions) against which changes of interest to Marine Environmental Quality can be measured. Finally, Biological Oceanography will interact with the Fishery Science Committee to provide scientific advice on interactions of harvested species with both lower trophic levels (their forage base) and with other non-harvested "top predators" such as marine mammals and birds.

Committee members of signatory nations introduced themselves. Professor Mullin then asked official observers from non-signatory nations to identify and introduce themselves. Two did so: V.V. Kuznetsov of Russia and C.I. Zhang of Korea.

In his role as convener, Professor Mullin had by letter invited Committee members to prepare position papers identifying favored areas for PICES scientific activity. These

were not intended to be formal proposals to be subsequently approved or disapproved by the Committee, but rather to give a quick overview of the range of scientific priorities shared or spanned by the Committee membership. The texts of these position papers, which were distributed, are appended to this report. The chair and rapporteur of the Committee noted in their subsequent discussions that these papers indicate a common interest in the large scale structure and time variability of the Subarctic Transition Zone, the West Wind Drift/North Pacific Current and the two adjoining oceanic Subarctic Pacific gyres. There was a strong sense that variability within this large system strongly conditions the behavior of adjoining marginal seas and continental boundary currents.

However, despite this underlying interest in the large scale role of the oceanic Subarctic Pacific, and an awareness that proposals for regionally-focussed studies were being presented to the Fishery Science Committee, the Biological Oceanography Committee did not wish at this time to endorse studies limited to a particular region. The Committee felt that its most important contribution to any regional studies will be to emphasize the interconnectedness of the various oceanic regions, and to identify key oceanographic and ecological processes rather than study sites.

The Committee noted that the cost and availability of major research vessels is a major constraint for all participants interested in large-scale, long-term, and distant water research. The Committee recommended that the Secretariat explore and summarize for the Science Board opportunities for multinational access to available research vessel time. Specifically, can we facilitate opportunistic participation by scientists of one nation in the already planned research cruises of another nation? This could include, for example, a mechanism for rapid allocation of minor funding by one nation of the additional costs of research by (or conducted for) its scientists

on cruises organized and principally funded by another nation.

On this topic, the Committee specifically recommended that the Secretariat collect and collate the schedules for cruises in the Subarctic Pacific by major research vessels of the member nations, and disseminate (e.g. via a PICES.SHIPS electronic bulletin board) these to marine science institutions in member and North Pacific Rim non-member nations. The Korean observer, Zhang, stated that his nation would like to participate in such an exchange. The bulletin board should include dates, area of operation, general objective, and points-of-contact for each ship or cruise. Potential users could then request directly from the point-of-contact additional detail regarding capabilities and cost for add-on projects.

Professor Wang noted that formal ties between PICES research programs and other international scientific bodies and programs such as IGBP, IOC, JGOFS and GLOBEC should be clearly stated in order to promote national involvement.

Professor Mullin asked for specific comments on the apparently strongly shared objectives of PICES and the various national and international GLOBEC programs now being developed. Mackas noted that a GLOBEC strategy is to identify study areas in which process and time series work can be combined.

The Committee considered briefly an external proposal concerning toxic algal blooms. Several mechanisms already exist to mobilize scientific expertise on this class of phenomena, and the Biological Oceanography Committee decided to pass the proposal to the Marine Environmental Quality Committee because of the coastal nature of the impact and its hypothesized linkage in many areas to coastal eutrophication.

The Committee next considered candidate topics for the next general scientific meeting, and recommended that the following issues be addressed through symposia and/or workshops:

1. Long term time series monitoring of the ecology of the Subarctic North Pacific (SNP), including scientific objectives, technical capabilities, and statistical issues.

2. Paleoclimatology and paleoecology of the SNP, including potential new sampling sites for existing methods and possible new evidence from non-traditional (to an oceanographer) sources such as animal remains preserved in middens.
3. Evidence for top-down control of ecosystem structure by high order predators (including, but not limited to, fishing activity).
4. Theory of multiple stable states and evidence for "regime shifts" (particularly evidence from other than climate and harvested stocks). The Committee noted areas of common interest with the preceding topic.
5. Summary of existing large-scale ecosystem modeling in the SNP, particularly those models structured to suggest further research on particular processes or areas. Ikeda noted that existing data and models are spatially biased toward the eastern half of the oceanic SNP.

The Committee discussed ways in which PICES could facilitate identification, recovery and dissemination of underutilized data and archived samples. Professor Mullin voiced concern that financial and other disruptions could result in permanent loss of some information. Comments from various observers indicated that while data base extraction may be laborious, it is generally possible. Kuznetsov (Russian observer) did not support concern about permanent loss of archives. Stillwaugh (U.S., NODC) noted that national data banks and procedures for access are available. Nagata (Japan, chair of PICES Physical Oceanography and Climate Committee) noted that the diversity of data types and quality presents a problem that needs to be addressed in an interdisciplinary setting rather than within any single PICES scientific Committee. For this reason, the Committee decided to initiate no independent recommendations at this time.

The Committee discussed sponsorship of training courses, methodological handbooks and inter calibration exercises. The Committee recognized the value of these efforts to marine science. However, because many other international organizations have been or are

presently active in these areas, none was viewed to be an immediate responsibility of this PICES Committee.

With regard to its membership, the Committee would welcome expansion of the Japanese membership to three people. Additional expertise in the ecology of marine mammals and/or birds would also be desirable.

### Questions for possible consideration by BIO; contributions of committee members.

**Ken Denman, Canada. Does the subarctic Pacific gyre pelagic ecosystem have a carrying capacity and is that carrying capacity a function of climate scale change?**

Because the nitrates in the subarctic Pacific gyre seldom approach zero, it has been assumed that any carrying capacity for the ecosystem was seldom approached. Recent work suggests that possibly iron limitation rather than nitrate limitation controls the annual primary production. Therefore it is possible that the subarctic pelagic ecosystem does approach a carrying capacity. Near surface temperatures in the subarctic Pacific entered into a new regime in about 1976, in conjunction with a deepening of the Aleutian atmospheric low pressure system. There are strong indications that in the northeast subarctic Pacific many fish stocks underwent various types of changes in 1976 - 77 (Beamish, in press). Were these changes associated with a change in carrying capacity in response to different physical conditions?

PICES could put together physical and biological data bases from the subarctic Pacific to document ecosystem and fisheries changes that might have occurred as a result of

the 1976 - 77 transition in large scale atmosphere and ocean conditions. Retrospective analysis and modeling might identify crucial causal factors that could be used to predict future change. Also, such an exercise would identify data gaps and deficiencies that would need to be addressed if future changes in the pelagic ecosystem, in response to climate variation, are to be documented adequately. This might include design of some mid ocean time series stations that different PICES nations might sample at different times and then pool their data to for a more complete time series. More specific process studies could be carried out in conjunction with the time series data collection.

**T. Ikeda, Japan. East-west gradient of biological structure and function in the subarctic Pacific.**

Background

The subarctic Pacific has been known as a highly productive region. Most of the biological oceanography data that support this

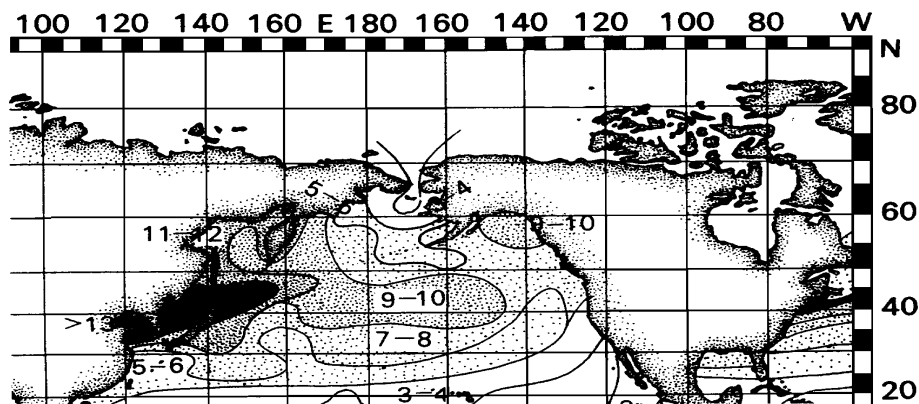


Figure 1. Seasonal sea surface temperature fluctuations (°C)  
(after "Comparative Atlas of Zooplankton" by Van der Spoel 1983)

idea are from the Bering Sea and the eastern subarctic region, and there are few data from the western subarctic. Both eastern and western subarctic have nearly common sets of planktonic species, but community structure and function in the two regions are expected to be significantly different. This is because oceanographic conditions prevailing in the two regions are not identical, reflecting dissimilar water circulation patterns and water temperature conditions (see figure) and meteorology. What is needed to fill this gap of knowledge and to facilitate our better understanding of these diverse subarctic ecosystems is a multidisciplinary research approach with close international coordination of effort. This effort should eventually extend through the entire PICES region (the North Pacific north of 30° N including the East China, Japan, Okhotsk, and Bering Seas) and should accumulate data in the region over a long time period.

There are two central hypotheses to be tested:

1. Match/mismatch hypothesis: When the seasonal production cycles of phytoplankton and of the grazing activity of zooplankton are well synchronized, the standing stock of phytoplankton is maintained at a constant level throughout the year. In contrast to this "matched" situation, a "mismatched" production-consumption process results in a conspicuous accumulation of phytoplankton, a so-called "bloom".
2. Top-down/bottom-up control hypothesis: Production processes at various trophic levels are largely controlled by top predators (top-down control) or by organisms at lower trophic levels (bottom-up control).

The proposed program involved the following categories of investigation, most of which require complete seasonal coverage:

1. Meteorology, physical and chemical oceanography
2. Phytoplankton: size structure and species composition; timing, magnitude, and duration of blooming, if any; production and sinking loss. Techniques include bottle sampling, in situ fluorometer and

sediment trap installed in buoy and moored systems, and remote sensing

3. Micro/macrozooplankton: abundance, size structure, life history, behavior, growth, and mortality. Techniques include net sampling, multi-frequency acoustics, and automated samplers
4. Micronekton: abundance, life cycle, diel migration, growth, and mortality, by net sampling and acoustics
5. Nekton (both migratory and endemic species), mammals and birds

#### **Linda Jones, USA. Ecosystem models of the North Pacific Transition Zone.**

One area in which the Biological Oceanography Committee could encourage research is in the North Pacific Transition Zone (NPTZ). There are several reasons why further research effort in this region of the North Pacific is important and timely.

First, the North Pacific Transition Zone is a productive area that supports extensive fishing activities. It is a biologically interesting area due to the mix of subtropical and subarctic species. There is also a history of cooperative international research in this region in conjunction with high seas driftnet fisheries. Scientists of Canada, Japan, Republic of Korea, Republic of China and United States conducted research in this region through a scientific observer program on commercial vessels and on research cruises. Data were collected over several years on catch and bycatch in various driftnet fisheries; oceanography; life history, distribution and ecology of fish, mammals, turtles and birds; and distribution of plankton and other prey resources. Analyses have focussed on estimating abundance, mortality and biological parameters, and assessing effects of the commercial fishing. This year, the United States Driftnet Program initiated a study on species interactions and community structure of the North Pacific Transition Zone. Studies are planned which will integrate biological and physical environmental data to develop preliminary ecosystem models of the NPTZ. Studies are also continuing by scientists in other countries.



With the cessation of driftnet fishing on the high seas and the termination of the International North Pacific Fisheries Commission there is a need for a forum to discuss and develop cooperative research and to coordinate with other large-scale international research programs that are also collecting data from the NPTZ.

Data collected under the joint research programs will provide a basic understanding of the NPTZ ecosystems, however further cooperative studies are needed to develop adequate ecosystem models and understanding of the structure and functioning of the NPTZ. Particularly, more thorough sampling of lower trophic levels, including mesopelagic fish and squid, and the physical oceanography are needed.

**D.L. Mackas, Canada. What physical and biological interactions trigger major changes in community structure within large marine ecosystems?**

Widely-spaced but often rather abrupt changes in species dominance patterns occur in the ocean. These changes are ecologically, economically and sociologically disruptive. I would argue that the disruption is usually far out of proportion to accompanying changes in total ecosystem productivity or long term harvested yield, and is linked to their "surprise factor". The surprise comes because scientists and environmental managers do not now have an adequate understanding of the stability (instability?) properties of marine ecosystems. To make a valuable contribution, we do not need (and will probably be unable) to **prevent** ecosystem change. Probabilistic risk assessment and early recognition of change-in-progress would be a huge accomplishment.

We know that any given ecosystem always contains low to moderate levels of species capable of becoming alternate system dominants, and that ocean currents provide broad dispersal of seed stock for most marine species. Existing theories of community change (developed mostly for terrestrial and freshwater systems) do not deal with this situation. For example, spatial invasion by uncontrolled "weed" species is probably not common in the ocean. More generally, various "disruption-succession" theories seem applicable only to hard-substrate benthic communities. For other (animal?) groups, dispersal rates are too high and degree of local

habitat conditioning too low. Alternate hypotheses therefore need to be developed for pelagic systems.

At least to a plankton biologist, fishery stock collapse sequences seem strikingly similar and recurrent worldwide. What does the trajectory of one collapse tell us about another? Are the sequence and rates similar or drastically different in heavily vs. weakly vs. unexploited systems?

There are significant examples (e.g. Russell cycle, paleosedimentary record of California Current, CalCOFI and Hardy recorder time series) for which major dominance changes are not confined to a small number of harvested species. In these, there are often many and strong species-species and species-"physical environment" correlations. This suggests some form of climate coupling, and a need for effective collaboration between physical scientists and biologists (in all their diversity).

Because the interval between major community changes appears to be of order interannual to decadal, observation programs must include long time series. These are wildly popular immediately after a major "event" but in each subsequent year become progressively harder to sustain because they are expensive and, for much of their total life span, relatively unglamorous. (Paul E. Smith has a wonderful line to the effect that "the greatest value of the CalCOFI data series is its duration; its worst problem is its age") PICES should be a persistent lobbyist for "long term" science, reminding both institutions and individual researchers that the natural world does not necessarily tick to the 3 - 5 year clock of grant renewals and election campaigns.

PICES can also do a number of things to make these expensive regional time series observations more efficient.

One is to endorse and coordinate international collaborations, both within transboundary systems and on geographically-separated "parallel" systems, so that results from each participant nation can be inter compared and "ensemble-averaged".

Another is to recognize and promote key shorter-term process studies that can be imbedded in long term "monitoring" effort. (This is essentially a direct quote from the strategic objectives of GLOBEC programs).

While I think the design of elegant process studies should be by individuals, not committees, PICES could provide a meeting ground for these individuals and some high level balm for the irritations associated with "shared cruise" logistics.

Finally, I think some important advances (or at least different approaches) could be sponsored in marine ecosystem theory and modeling. Most existing models, at least of plankton, seem to me to imbed very simplified taxonomy in very detailed physics and/or physiology. In range of possible response, they are essentially locked into the community status quo. A greater range of possibilities needs to be considered.

**M.M. Mullin, USA. Variability in fish stocks and in large scale flow of the West Wind Drift.**

There is overwhelming evidence of interannual-to-interdecadal variation in both anadromous and demersal fish populations of commercial importance in the eastern North Pacific. There is also evidence of variability on similar scales in the latitudinal position of the West Wind Drift, or Transition Zone Current, and in the relative amounts of water it contributes to the two arms of its eastern bifurcation - California Current and the Alaska Gyre. It has been suggested that these two kinds of variability may be connected causally.

Even if the connection is statistically valid, the mechanism underlying the connection - i.e. how (or even, does) variation in the current system affect the balance of reproduction, growth and mortality of the fish populations? - remains as a fundamentally important question. Therefore, I propose that PICES coordinate and supervise the design of a program consisting of new research, re-analysis of previous research (and data sets), and cooperation with other research programs in the region to accomplish two goals:

1. Through examination of existing data and ongoing physical monitoring and commercial catch records, to test the hypotheses that variations in the large-scale flow of the West Wind Drift and in these fish stocks are indeed correlated
- 2 Through examining other data to distinguish between plausible causal mechanisms for a correlation

Goal 1 seems to me to be reasonably straightforward in a conceptual sense (though expensive). Monitoring of large-scale surface flow from satellites plus hydrographic surveys transecting the West Wind Drift, the northern California Current, and the southeastern Alaska Gyre is one component; a time series of biomasses of commercial stocks (derived largely from catch data), segregated as to age, is another. This simplified description minimizes many real problems in converting data on catches to real estimates of biomasses of populations.

Goal 2 is more complex because the problem is less well formulated, but it lies at the core of fisheries oceanography as I see it. The types of research and/or data analysis I envision can be categorized as follows:

- a) Direct measures of large-scale abundances of food and of predators such that years in which the nature of the West Wind Drift differences can be compared. This presumes that we know how to measure food and predators for particular species.
- b) Over a similar period of years, measures of food as perceived by the fish, through analysis of e.g. otolith widths, RNA/DNA ratios or other measures of physiological condition, or through at-sea estimates of mortality.
- c) Measures of food, or of predators, as perceived by other species. Other species in the environment which have ecologies similar to the commercial species ought to respond similarly to environmental change if, in fact, the mechanism we seek is one where their ecologies overlap (unless there is unknown niche separation). The responses of such species could either be positive or negative with respect to the commercial species (i.e. either a common depression or competitive replacement). The point of this approach is to use the responses of several species which are similar in some ecological requirements and differ in others to support or eliminate hypothesized causal mechanisms.

One can easily imagine supporting controlled experiments, etc. One can also imagine structuring the measurements such that meso-scale as well as large scale physical processes and biological responses can be compared. Conceptually, none of this is new. However, relatively few (perhaps no) studies have succeeded in doing all of these kinds of measurements for long enough to create the necessary data sets. It is this organizational/funding problem to which, I believe, PICES could contribute significantly.

**T.R. Parsons, Canada. A proposal for a trans-Pacific Continuous Plankton Recorder (CPR) program.**

In the North Sea a CPR program was started in 1931 and expanded into the North Atlantic from 1960 onwards. Currently there are various proposals for programs in other parts of the world oceans as shown in the Figure at the top of page 30. There is no proposal for a trans-Pacific program, although a similar program was started for a five year period in the 1960s under the general title of "Ships of Opportunity"; it used American Mail Line vessels traveling between Seattle and Yokohama.

The value of CPR data can only be assessed after a significant time series has been established. However, the data are expected to have multiple uses including detailed understanding of plankton species fluctuations, effects of global warming on the plankton community, the availability of specific food items for the large salmon stocks in the North Pacific, analysis of long term periodic fluctuations in plankton due to some yet undiagnosed physical processes and so on. By analogy with data from the Atlantic Ocean (e.g. See page 30.), trends in the abundance of planktonic organisms can only be observed

with a sufficient data set (i.e. >10 years). These data sets enable us to understand that there are changes in the biology of the oceans which are independent of anthropogenic effects, such as pollution and industrial fisheries. Only with such understanding can we hope to proceed towards a better management system for human effects on ocean ecology. The fact that zooplankton biomass does vary over long time periods in the North Pacific is summarized in publication by Brodeur and Ware (See page 30).

In a recent letter from Dr. John Gamble (14.8.92, copy available on request), the Director of the Sir Alister Hardy Foundation for Ocean Science has pointed out that the foundation is dedicated to the expansion of the CPR program and will take on training responsibility and also act as a quality control agency and custodian of a world-wide data base. Obviously it would be to the advantage of PICES to communicate further with the Director of this foundation, if it is agreed that a trans-Pacific CPR program should be one of the aims of the PICES Biological Oceanography Committee.

With regard to the costs of such a program, The Sir Alister Hardy Foundation for Ocean Science, which is entirely dedicated to CPR programs, operates on a budget of about \$700,000. Providing some co-operation can be obtained from shipping companies and that the salaries of research scientists involved in this program do not have to be covered by its operation, the annual technical costs of a trans-Pacific CPR program might be covered by a budget of \$150,000. This would not include, however, initial capital costs. The basic instrument with 6 internal replacement mechanisms costs about \$84,000. At least three of these would be needed.



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## REPORT OF FISHERY SCIENCE COMMITTEE

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The Committee met on October 15 under the Chairmanship of D. Ware; D. Eggers served as rapporteur. The following members participated:

Canada:	R.J. Beamish, J. Rice, D. Ware
China:	Q. Tang
Japan:	K. Ohtani, T. Sasaki, T. Wada
United States:	D. Eggers, J. Hunter, G. Stauffer

An election supervised by PICES Interim Executive Secretary, John C. Davis, confirmed convener Dan Ware as the first chair of the Fishery Science Committee.

Discussion in the committee focused on comparative studies. It was recognized that the value of comparative studies is that the response of fish stocks to a wide range of oceanic conditions can be quantified by studying the same species, at the same time, in the same way, in different places. The results could provide some useful insights into how commercially important fish stocks are likely to respond to changing oceanic conditions in the North Pacific. There was unanimous agreement among the member countries that we conduct comparative studies around the Pacific Rim on important groups of species. The committee agreed that it wanted to promote and coordinate studies on gadoids, on small pelagic species, and on ecosystem and fish production modeling.

With respect to salmon, FIS noted that several lines of evidence indicate that the productivity in the Subarctic Pacific and the biomass of salmon and other large nekton species increased by a factor of two between the 1960s to 1980s. Current ideas about what controls production in the Subarctic cannot explain why the zooplankton and pelagic fish biomass doubled. This highlights the fact that we really don't

understand what regulates primary and secondary production in this region, and therefore what might cause it to fall in the future, with obvious consequences for wild and enhanced salmon stocks.

There was also unanimous agreement that FIS should promote and coordinate studies in the Bering Sea ecosystem, and recommend what research should be done. The chairman of FIS should contact the chairmen of the other scientific committees to see if inter-committee programs could be formed to meet some common objectives.

To begin the business of developing scientific programs FIS agreed to establish a number of working groups.

### Working Group Terms of Reference

FIS Working groups should be struck to address specific problems. With respect to these problems they should determine the present state of knowledge, identify and define the problem and hypotheses, who is currently working on the problem, identify relevant methodology, determine what data are available for retrospective analyses, determine what objectives each member country can contribute to, decide if the activities of the working group should be linked to other international programs in the Pacific like GLOBEC and INPOC.

The working group is requested to develop a research plan according to these terms of reference and report back to FIS at the 1993 PICES annual meeting. We noted that every nation does not necessarily have to have a member on every working group. Membership should be voluntary and the countries should have the opportunity to appoint members to the working group as they see fit. An effective size for a working group might include 2-3 members from each country.

## Recommendations

1. FIS recommends that comparative studies of selected gadoid and small pelagic species, be conducted at various locations around the Pacific Rim. Comparative fish production modeling activities should also be conducted. We recommend that three working groups be struck to address these problems:
  - a. a gadoid working group focusing on pollock, Pacific cod and hake.
  - b. a small pelagics working group focusing on herring, sardine, anchovy and mackerel.
  - c. a modeling working group focusing broadly on the impact of oceanic conditions on fish production, and ecosystem structure.
2. FIS recommends that a subarctic working group be struck to promote and coordinate fisheries research in the North Pacific. The committee requests that the working group develop a program which addresses the carrying capacity for salmon and other large nekton in the Subarctic Pacific and the Aleutian Basin of the Bering Sea, which is also an important salmon rearing area. The Chairman of the working group should contact the other PICES Scientific Committees to see if there is interest in developing a multidisciplinary ecosystem approach.
3. FIS recommends that a Bering Sea working group be established to promote and coordinate research in this region, and to develop contacts with the other PICES Scientific Committees to see if there is support for developing an ecosystem approach in some areas of common interest.
4. FIS recommends that for the 1993 PICES meeting we accept the offer by the NMFS in Seattle to host a workshop on the importance of juvenile pollock in the North Pacific and Bering Sea. We also recommend that the FIS working groups attract a few key contributed papers that address the main scientific questions the group is working on. We would also like to have a contributed papers session.
5. FIS is concerned about maintaining international cooperation and exchange of information on non-anadromous species and recommends that the INPFC transition team address this problem in the transition from INPFC to the new commission (NPAFC).
6. FIS recommends that PICES coordinate physical, biological and fisheries research surveys planned by different member countries in the PICES area of interest, and that a block of time be reserved at the Annual meetings to facilitate this.

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## REPORT OF MARINE ENVIRONMENTAL QUALITY COMMITTEE

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The Committee met on October 15 under the Chairmanship of J. Zhou; C.M. Watson served as rapporteur. The following members participated:

Canada:	W.J. Cretney (Alternate), M. D. Nassichuk, R.C.H. Wilson
China:	H. Wang
Japan:	M. Watanabe
United States:	W.S. Reeburgh, U. Varanasi, C.M. Watson.

Observers included C.I. Zhang, Korea;  
J.C. Davis, Canada; J.M. Coe and S.D. Stillwaugh. U.S.A.

### Introductions:

The meeting began with Professor Zhou extending a welcome, and asking all members and other interested parties to briefly introduce themselves and their backgrounds and interests. The general agenda for the Committee was then briefly set forth.

### Committee Tasks and Goals:

A preliminary discussion then ensued about the general sequence of tasks for the Committee, and what was to be accomplished. Central to this was the realization by all, that the question of marine environmental quality is quite different in the open ocean than it is in the (more polluted/degraded) coastal regions of the member countries. Mr. Wilson expressed the hope that the goals of the meeting would especially lead to a mechanism enabling the MEQ effort to help foster and strengthen international cooperation.

### Election of MEQ Science Committee Chair:

The first item of business was election of the Chairperson of the MEQ Science Committee for PICES. The election and balloting process was explained to all members by Dr. John C. Davis (Canada), who is also Interim Executive Secretary of PICES. After brief consultations among each country's membership, ballots were submitted, and Professor Zhou was

elected Chairperson by unanimous vote of all four member countries.

### Review of 1991 PICES Scientific Workshop, Seattle:

Dr. Varanasi then provided the committee with a brief review of the December 13, 1991 Report of the Environmental Quality Working Group (Chaired by Dr. John C. Davis, Canada), which met as part of last year's PICES Scientific Workshop held in Seattle. The 1991 Working Group had identified five research issues as being of primary importance to PICES. The five areas included:

#### (High Priority):

- (A) Nutrient loading and eutrophication;
- (B) Chronic and persistent chemical pollutants;

#### (Secondary Priority):

- (C) The role of the North Pacific in waste disposal;
- (D) Large-scale environmental impacts;
- (E) Biological community impacts due to exploitation.

Although coastal problems as a separate issue were not addressed by the 1991 report, at least four of the five issues identified do incorporate a very strong coastal focus in terms of MEQ. Also, each of the five major issues is strongly dependent on the central focus of Methodology.

### Identifying Common Scientific Problems:

The Chair then focused the discussion on reviewing Question #3 of his August 17, 1992 letter to all MEQ Scientific Committee members. This general question was "What are the common scientific problems needed to be solved or understood both in coastal areas and in the open ocean?" Mr. Wilson suggested that PICES could play a major role in sharing technology among member countries. For example, identifying and providing the latest methodologies in intercalibration, the sharing of techniques, etc. As a preliminary framework to stimulate discussion along these lines of thought, the

committee also briefly outlined the two important topics of **Data and Information exchange**, and **Research Projects and Programs**.

Data and Information which could be exchanged among PICES nations could include:

- Marine pollution monitoring
- Fluxes of land-based pollutants into coastal marine environments (including sewage and wastes)
- Ocean waste disposal, oil pollution
- Other

Research Projects and Programs which require urgent development should be identified and supported with highest priority. Possible research topics in MEQ/PICES could include such areas as:

- Methodology
- Monitoring
- Biological/ecological effects
- Transport/fate/bioconcentration/Bioaccumulation
- Development of MEQ criteria and standards
- Other

Linkages and Consequences were also discussed. e.g., are the effects due to the pollutant(s) in question? What does finding a particular pollutant actually signify, in terms of MEQ?

#### **MEQ in Coastal Areas versus the Open Ocean:**

Professor Zhou then led a renewed discussion of how, in general, deterioration of the marine environment is much more serious in coastal zones. Moreover, if the committee is to focus on a common area (e.g., Shanghai Harbor), it should not be an area of interest to just one country. Rather, we should somehow select an area of common interest to all.

Mr. Wilson emphasized the point that the relative absence of MEQ studies in the open ocean makes MEQ a very "different" area for the PICES network to absorb. The MEQ efforts of most countries are focused in individual embayments. He went on to point out that monitoring in the open ocean is important, because: (1) when effects are detected in the open ocean it is usually too

late, and (2) there is continual and increasing transport of pollutants to the open ocean, both from the continental shelf and from atmospheric pollution.

Focusing on a common need such as MEQ methodology for the open ocean was also heavily discussed. It was suggested that perhaps MEQ/PICES could focus on open ocean biomarkers, or foster better quality assurance (QA/QC) among all participants. Dr. Reeburgh suggested that it would be best to worry about calibration and standards, and trying to anticipate problems in the open ocean before they actually do occur.

The committee summed up its discussion of the open ocean problem by strongly suggesting that PICES be encouraged to begin discussions to:

- (1) Select suitable bio-indicator organism(s) for the North Pacific Ocean. Suggested candidates included tuna, squid, or similar pelagic species of multi-national importance. Also, PICES should be encouraged to:
- (2) Develop a suite of chemicals and other environmental pollution-related phenomena of concern for the open ocean. Hopefully, significant portions of this task could tie in with the effort on bioindicator organisms.

#### **The Bering Sea and MEQ:**

Portions of the meeting were also devoted to the issue of whether or not to consider the Bering Sea as a potential site for a baseline study. A MEQ focus using the Bering Sea would be of general benefit to PICES nations. However, the Bering Sea has only a relative few known examples of possible "pollution" or related undesirable environmental phenomena of interest to MEQ (e.g., very high levels of cadmium in walrus kidney and liver in certain areas). Is such an event a "natural" part of the ecosystem, or is it due to increased bioavailability of cadmium because of man's intervention, etc.? A baseline Bering Sea study at this time would thus seem to be useful only in establishing general parameters for what is reasonably believed to be a "clean" sea. It would also be time consuming and resource intensive, and would probably not be able to address questions in the near term



about serious MEQ problems elsewhere in the North Pacific.

### **Recommended Scientific Sessions for the Second Annual Meeting (SAM) in Seattle, 1993:**

The remainder of the meeting focused on the development of scientific sessions and intersessional activities for the Second Annual Meeting (SAM). The Committee agreed that its focus for the SAM should be on the goal of The Development of Common Assessment Methodology for Marine Pollution in the North Pacific. The focus outlined above should remain a general one, and not encumbered by too small a focus. The solicitation and acceptance of contributed papers should adhere rigorously to a state-of-the-art theme, and eschew the presentation of "data for data's sake".

Perhaps the most fundamental components underlying the central issue of Assessment Methodology are the concepts of "linkages" and "consequences" of contamination. Is the contaminant, or other offending substance, present at levels which are above what could be anticipated as reasonable background? Is it causing an adverse effect? Will it cause an effect later on? **Is the effect likely to be of consequence?** How? To what, and in what fashion? "Linkages" also follow strongly in the wake of our efforts at fostering greater intersessional activities in MEQ. Such linkages could, for example, include the development of uniform QA/AC techniques, tissue banks for comparability studies and status and trends information, open-ocean MEQ strategies for the future, and so forth.

With these factors in mind, the MEQ Scientific Committee recommends that the SAM focus on the general topic, **"Assessment Techniques and Methodologies in Marine Environmental Quality"**. This topic would be subdivided into two subsets:

#### **A: Algal blooms**

#### **B: Chemical and biological contaminants**

Initially, the Committee had identified the first subset topic as 'Harmful Algal Blooms'. However, Dr. Watanabe and others pointed out that such a topic would be too limiting, especially in light of the intersessional nature of MEQ activities. Hence, the topic was broadened to include algal blooms in general.

To design the scientific content and scope of the SAM, the MEQ also recommended **the establishment of an Intersessional Working Group** with the responsibility, which would include the selection of sessions and issuance of a call for appropriate research papers for the 1993 SAM in Seattle.

### **Specific Outline for the Proposed SAM Meeting Topic:**

Although every possible effort should be made to focus these two sub-topics along an intersessional approach, a suggested detailed outline of possible problem areas and research issues to be addressed was put forth by the Committee as follows:

**A: Algal blooms:** Some suggested subsets of this topic at the SAM should include:

- National overviews from each participating country
- Future vision/new approaches to the topic
- Indicator organisms/trends
- Nutrient flux
- Monitoring techniques and methodology
- Development of new techniques to identify and understand biotoxins
- Mechanism of action/toxicology
- Epidemiology/clinical reports
  - fish, humans, etc.
  - case history studies
- Causal factors
- Ecodynamics
- Other

#### **B: Chemical and Biological Contaminants:**

Introductory papers on this topic at the SAM should also include National Overviews from each participating country, as well as a focus upon Future Vision/New Approaches to the topic. This topic can be further divided into two subsets:

##### **1. Sources, and Contaminants of Concern**

- Sewage discharge
  - pathogens, organics, metals, nutrients
- Waste dumping
  - industrial, dredge spoils, marine debris
- Fish/shellfish processing wastes
  - coastal versus vessels at sea

- pathogens, nutrients, sediment chemistry
- Agriculture/mariculture
  - pathogens, nutrients, sediment chemistry
- Ballast water as contaminant source
- Anthropogenic chemicals/events
  - organics, organometalloids, metals etc.
  - oil spills/oil seepages

2. Impact of These Contaminants on Natural Biogeochemical Processes and Cycling

- Transport/transfer
  - coast, shelf, open-ocean
- Transportation/metabolism
- Biodergradation/other
- deterministic and stochastic modeling

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## PHYSICAL OCEANOGRAPHY AND CLIMATE COMMITTEE REPORT

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The Committee met on October 15 under the Chairmanship of Y. Nagata; S. Riser served as rapporteur. The following members participated:

Canada:	J. Garrett, P. LeBlond, C.S. Wong
China:	M. Zhou
Japan:	Y. Nagata, Y. Sugimori, T. Uji
United States:	D. Musgrave, J. Overland, S. Riser

The meeting began with the unanimous election of Professor Yutaka Nagata of Japan as Chairman. Each member of the committee then briefly discussed the topics that he/she felt were of special importance and that should be addressed by PICES. These topics included the circulation of the subpolar gyre of the North Pacific, including its marginal seas; the interdisciplinary nature of the scientific problems in these regions; the need to focus on the variability of the circulation as well as on the long-term mean; the freshwater budget of the North Pacific circulation; development of models of the North Pacific circulation; and the use of satellite altimetry. The committee then proceeded to examine the goals of PICES in relation to other programs concerning the North Pacific such as WOCE, TOGA, GOOS, JGOFS, GLOBEC and INPOC.

It was agreed that one important role that PICES could play would be to facilitate cooperation and communication that is necessary to carry out such large international programs, especially in light of the fact that several of the programs named will conclude in the next two years and will ultimately be replaced by something else. As an example, the committee felt that the ongoing INPOC program is a good example of the type of

international cooperative venture that PICES should foster. Moreover, the INPOC agreement expires in 1994 and discussions about its renewal or replacement must begin soon. PICES member countries should be urged to support INPOC and future similar activities. In a similar vein, there is a great deal of planning for GOOS underway at present, and we as an international community hope to have input into these plans.

The discussion turned to questions of data management and exchange. It was suggested that data exchange in the PICES region is relatively difficult compared to other parts of the world, due partially to political reasons. More national cooperation is needed from PICES members. As a corollary, it was suggested that the governments of the nations involved in PICES should be encouraged to continue to support research vessels at a level consistent with past support, so that new data can be collected.

It was agreed that the scientific issues the group felt initially most important could be addressed through the formation of four working groups:

1. Ocean circulation and climate variability in subarctic North Pacific region
2. The Okhotsk Sea and Oyashio region
3. New technology and observing strategies
4. Data collection and quality control

Terms of reference for these working groups were prepared for consideration by the Science Board. It was agreed that one result of the working group discussions would be to plan a series of symposia on these topics that would take place at the next international PICES meeting.



## **FINANCE AND ADMINISTRATION**

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## REPORT OF THE FINANCE AND ADMINISTRATION COMMITTEE

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The Committee met on 13 and 16 October under the chairmanship of R. Steinbock; W.J. Rapatz served as rapporteur. Participants were:

A meeting of the Committee was held on October 13 and again on October 16, 1992.

Canada:	C.C. Graham
China	Mr. Ji Xu, Mr. Dachun Li, Mr. Liang Zeng Chen , Mr. Liang Lin
Japan:	H. Hatanaka, N. Namba
United States:	W. Erb, W.L. Sullivan, R. Tuttle

The PICES Chairman and the Interim Executive Secretary also attended.

### **Agenda Item 1. Call to Order:**

The meeting came to order at 1306. The convener welcomed the delegates. He noted that both a written and oral report of the Committee's observations and conclusions would be made to the Governing Council, hereinafter referred to as Council, on October 17, 1992. He proposed that the Committee meet again later in the week to approve and finalize the report. Mr. Rapatz was named as Rapporteur. The Agenda was adopted.

### **Agenda Item 2. Report on establishment of Secretariat and implementation of Final Report:**

Dr. Davis explained the report on the Establishment of the Secretariat and Implementation of the Final Report (Endnote 1). The Committee recommends that the Secretariat establish a separate account for the Working Capital Fund. The Committee also recommends that the Secretariat investigate the possibility of depositing PICES funds into several banks to take account of Government of Canada limits on deposit insurance and that this be done if found to be beneficial.

### **Agenda Item 3. Current budget status:**

Dr. Davis explained the status of the current budget. The Committee suggested that the Interim Executive Secretary or the Executive Secretary propose an external audit firm early in the new year to permit approval by Council before the end of March, 1993. The Committee recommended a specific budget item be established for financial support to other organizations and that the Council be consulted if exceptional proposals for assistance were made. The Committee requested that any credits to a Member State be identified in the budget documents.

### **Agenda Item 4. Budget proposals for 1993 and forecast budget for 1994:**

The Committee recognized that as 1992 was a start-up year for PICES, there was a significant surplus of funds available to the Organization. The Committee recognized, however, that the major business of the Organization would be driven by the recommendations and activities of the scientific committees and the Science Board, which would be considered by Council, both at the current and at future meetings. There will be substantive scientific issues identified in fisheries, biological oceanography, physical oceanography, climate and marine environmental quality discussions which are of vital importance to the Member States. Expenditures are expected in support of scientific initiatives of the Organization which will likely include but not be limited to, meeting costs, data analysis and exchange, data archiving, expanded publications, and travel.

The Committee recognized that it is difficult to accurately forecast these future costs as there is no actual experience with the operation of the Organization and the scientific program is in a developmental phase. It is clear, however, that the Organization will concern itself with a significant array of scientific issues in the North Pacific and will engage in an active relationship with a number of international organizations and processes.

The Committee noted that there will be additional budgetary items associated with

personnel services after the staff of the Organization is recruited. These items may include expenses related to home leave, education grants for the minor children of staff, relocation and termination benefits, and additional contractual services or hiring of full or part time staff. Most of these items are of a non-recurring nature and will appear in the budget only as required. Occasionally, the need to meet an expense cannot be predicted and may not have been specifically budgeted for. There are currently no provisions in the budgetary and contribution processes to accumulate a fund from which to meet these expenses. The Committee, therefore, suggested that once staff is recruited, the Executive Secretary present to the Committee, at the 1993 meeting, information concerning the estimated expenses of funding these items, and as possible, the likely budget year in which they will come due.

The Committee reviewed the Draft Budget for 1993. The Committee endorsed the principle that the Organization use the classification system, pay scales and other conditions in the Public Service of Canada as a model in classifying the duties of its staff and establishing its respective pay scales and staff regulations. The Committee recognized the difficulty in budgeting salary levels in the absence of respective job descriptions and the uncertainty of specific requirements for some of the Secretariat staff. The Committee recommended that Council establish limits for Personnel Services but not constrain flexibility to hire Secretariat staff. The Committee therefore recommended the budget provide the maximum level of salary scales for the Secretariat positions as adopted in the Final Report of March 3, 1992, but noted that certain positions may be filled at a lower level on the salary scale. The Committee recommended that the amount for employee benefits be reduced to reflect more closely the percentage generally used in the Canadian Government.

The Committee recommended that in view of the considerable surplus currently available, a portion of the surplus be used to hold 1993 contributions at \$ 88,000, as in 1992. As the draft budget totaled \$ 376,000, or \$ 94,000 per Member State, the Committee recommends that the difference of \$ 24,000 be obtained from the Working Capital Fund, to provide a credit of \$ 6,000 against the 1993 contributions for each current Member State.

The Committee recommends Council's adoption of the attached draft budget for 1993.

The Committee reviewed the Forecast Budget for 1994, which is for the consideration of Council. This budget forecasts total expenditures in 1994 of \$ 470,000. It is assumed that there will be five Member States in PICES in 1994. If this assumption is correct, the contribution per Member State would remain at \$ 94,000, the same amount as in 1993 prior to the credit, if the budget is adopted at that level.

#### **Agenda Item 5. Discussion of Headquarters Agreement:**

The convener explained that a draft of this Agreement had been prepared by the Canadian Government and circulated to member states. The current draft reflects all the comments received with the exception of a change recently proposed by China, as follows:

Article 6, line 2 and 3, delete "including alternative representatives, experts and advisors to representatives", Article 6, add at end: "For the purpose of this Agreement, representatives shall include alternate representatives, experts and advisors to representatives."

The Committee approved this change. It was noted that an authorized Canadian representative would arrange signing of the Agreement with the Chairman of PICES.

#### **Agenda Item 6. Discussion of the levy and tax status of Secretariat employees:**

This was considered an information item to be dealt with when the outcome of staffing is known. No further action is required at this time. A copy of a letter from the Canadian Department of Finance was tabled which indicated that a Canadian employee of PICES could pay a levy to PICES and obtain an equivalent income tax credit.

#### **Agenda Item 7. Consideration of "Staff Rules" document:**

The Committee recommends that the probationary period for the Executive Secretary be one year. The Committee suggested that the Interim Executive Secretary

request comments on these rules from Member States and provide them to the Executive Secretary when he takes office. It is suggested that the Executive Secretary finalize the staff rules in 1993.

**Agenda Item 8. Consideration of other business or additional items referred by Governing Council:**

It was noted that the invitation list for observers in the Final Report was applicable to this Annual Meeting only. The Committee suggests that the Executive Secretary propose a list for future Annual Meetings for modification and approval by Council through correspondence and through review at Annual Meetings.

The Committee noted the announcement by the United States delegation that it will issue an invitation to Council on October 17, 1992, to hold the Second Annual Meeting of PICES in Seattle, Washington.

Consistent with Rule of Procedure 15, the Committee recommends that Council appoint a Chairman of the Finance and Administration Committee. The Committee further recommends that this Chairman be appointed for a term of two years and that future Chairmen serve on a rotational basis among Committee members. The Committee recommends that Dr. J. C. Davis be appointed as the Chairman of the Committee, to take office once the permanent Executive Secretary takes office and in the meantime Mr. R. Steinbock be designated to serve as Interim

**Agenda Item 9. Preparation, review and approval of report for Governing Council:**

A draft report was distributed to Committee members and approved at a meeting on Friday, October 16, 1992. The Committee recommends consideration and approval of this report by Council.

**Endnote: 1**

**Report to the Finance and Administration Committee on the Establishment of the Secretariat**

**October 1992**

At the Organizational Meeting of March 3, 1992, it was agreed that Sidney, British Columbia, Canada, be the seat of the Secretariat and that Dr. J. C. Davis serve as Interim Executive Secretary until such time as a permanent Executive Secretary shall take office.

In April, 1992, Dr. Davis appointed Mr. W. J. Rapatz to serve as coordinator to the organization. Mr. Rapatz in turn contracted Mrs. T. C. Davis to serve as temporary Administrative Assistant. The duties of the Secretariat for the time period until the First Annual Meeting were to be the establishment of an office complete with necessary computing and communication equipment and supplies as required; assistance to the Chairman of PICES and the Interim Executive Secretary with the establishment of Scientific Committees, with the collation and filing of applications for the position of Executive Secretary; the carrying out of necessary correspondence, printing and duties as

the Chairman and Executive Secretary may determine; and the arrangements for the First Annual Meeting of the Organization in October 1992.

**Funding**

At the organizational meeting of March 3, the budget for the partial year from March 23 to December 31, 1992, was adopted and the Contracting Parties were asked to deposit funds of \$ 88,000 each to the Organization. On March 23, Japan's contribution of \$ 118,000 arrived. It is to be noted that Japan over-contributed by an amount of \$ 30,240. By Financial Regulation 6.vii. this sum is a credit to Japan which will be applied to its future contributions.

The contribution from the United States was deposited on April 24, from Canada on June 9 and

from the People's Republic of China on September 29, 1992.

In order to make good use of the funds as contributed to the Organization, Guaranteed Investment Certificates were bought from the Bank of Nova Scotia for varying periods and amounts. The interest rate in a GIC is superior to the rate received in a Savings Account in the bank. Up to September 30th, 1992, the Organization realized bank and GIC interest of \$ 3292.12. [Accounts to 31 December 1992 are reproduced in the following pages.]

A Working Capital Fund in the amount of \$ 25000 was established. The bank interest mentioned above was for the time being placed into the Working Capital Fund.

### **Establishment of Secretariat Office**

Two rooms were made available for the PICES Secretariat at the Institute of Ocean Sciences in

Sidney, British Columbia. The Institute also made available to the Secretariat the advice and assistance of the Institute Computer Staff and admittance to the IOS communications network such as telephone and computing net. At a reasonable charge we also receive cleaning of the offices, photocopying and office supplies.

During the months of April and May telephones and facsimile machines were purchased and installed at the Secretariat and two IBM compatible 486 - SX computers were purchased from DELL Canada and installed with the assistance of a computer expert. An additional computer - workstation is yet to be purchased. An HP laser-printer was also purchased and installed. In August PICES.SEC was an established station in OMNET and soon after we received admittance to INTERNET through the IOS communications.

The office furniture was ordered early in May but arrived some items at a time during the months of July, August and September. By the end of September the PICES office was fully equipped.



# HEADQUARTERS AGREEMENT BETWEEN THE NORTH PACIFIC MARINE SCIENCE ORGANIZATION (PICES) AND THE GOVERNMENT OF CANADA

The North Pacific Marine Science Organization and the Government of Canada, wishing to conclude an agreement respecting the establishment in Canada of the headquarters of the Organization, have agreed as follows:

## ARTICLE 1

The North Pacific Marine Science Organization (hereinafter referred to as the Organization) shall have in Canada the legal capacities of a body corporate, including the capacity to contract, to acquire and dispose of property, and to institute legal proceedings.

## ARTICLE 2

The Organization, its property and its assets, wherever located and by whomsoever held, shall enjoy immunity from every form of judicial process except in so far as in any particular case the Executive Secretary of the Organization has expressly waived its immunity. Such waiver shall be understood not to extend to any measure of execution, save with the express consent of the Executive Secretary of the Organization. The Governing Council of the Organization shall establish guidelines as to the circumstances in which the Executive Secretary may waive any immunity of the Organization, and as to the method in which any such waiver shall be made.

## ARTICLE 3

The property and assets of the Organization, wherever located and by whomsoever held, shall be immune from search, requisition, confiscation, expropriation and any other form of interference, whether by executive, administrative, judicial, or legislative action, except with the consent of and under the conditions agreed to by the Executive Secretary of the Organization. This Article shall not prevent the reasonable application of fire protection regulations.

## ARTICLE 4

The archives and documents of the Organization shall be inviolable at any time wherever they may be.

## ARTICLE 5

The Organization, its assets, income, and other property shall be:

- (a) exempt from all direct taxes except for charges for public utility services;
- (b) exempt from customs duties and taxes in respect of articles imported or exported by the Organization in the furtherance of its function; articles imported under such exemption shall not be sold or disposed of in Canada except under conditions agreed to by the Government of Canada;
- (c) exempt from any prohibition or restriction on import, export or sale of its publications, and exempt from customs duties and excise taxes in respect thereof.

## ARTICLE 6

All representatives of Member States to the Governing Council of the Organization shall, while exercising their functions and during their journeys to and from the place of meeting, enjoy in Canada the privileges and immunities necessary for the independent performance of their function, and in particular immunity from personal arrest or detention and from seizure of their personal baggage, inviolability of all papers and documents, and, in respect of words spoken or written and all acts done by them in their capacity as representatives, immunity from legal process of every kind. The immunity from legal process in respect of words spoken or written and all acts done by them in discharging their duties as representatives shall continue to be accorded, notwithstanding that the persons concerned have ceased to be representatives of Member States. Such immunity may be waived only by the Government of the Member State. For the purpose of this Agreement, representatives shall include alternate representatives, experts and advisors to representatives.

## ARTICLE 7

The Chairman of the Governing Council of the Organization, and the Vice-Chairman when acting as Chairman, shall, while exercising the functions of the Chairman, and during their journeys to and from the place of meeting, or to and from the Secretariat, enjoy in Canada the privileges and immunities necessary for the independent performance of their function, and in particular immunity from personal arrest or detention and from seizure of their personal baggage, inviolability of all papers and documents, and, in respect of words spoken or written and all acts done by them in the capacity of Chairman, immunity from legal process of every kind. The immunity from legal process in respect of words spoken or written and all acts done by them in the capacity of Chairman shall continue to be accorded, notwithstanding that the person concerned is no longer the Chairman or acting Chairman. Such immunity may be waived only by the Governing Council of the Organization.

#### ARTICLE 8

Except in so far as in any particular case any privilege or immunity is waived by the Executive Secretary of the Organization, or, in a case involving the immunities of the Executive Secretary, by the Chairman of the Governing Council of the Organization, officials of the Organization shall:

1. (a) be immune from legal process in respect of words spoken or written and all acts performed by them in their official capacity;
- (b) be immune, together with their spouses and members of their families forming part of their households, from immigration restrictions and alien registration;
- (c) be immune from national service obligation;
- (d) be given, together with their spouses and members of their family forming part of their households, the same repatriation facilities in times of international crisis as diplomatic agents;
- (e) be accorded the same privileges in respect to exchange facilities as are accorded to officials of comparable

ranks forming part of diplomatic missions in Canada;

- (f) have the right to import free of duty their furniture and effects, including motor vehicles but not including spirituous liquors, at the time of first taking up their post in Canada;
  - (g) be exempt from taxation on the salaries and emoluments paid to them by the Organization.
2. The immunity from legal process in respect of words spoken or written and all acts done by them in their capacity as officials of the Organization shall continue to be accorded, notwithstanding that the person concerned is no longer an official of the Organization.

#### ARTICLE 9

No person shall be entitled to the privileges and immunities accorded in Article 8 unless and until the name and status of such person shall have been duly notified to the Secretary of State for External Affairs of Canada.

#### ARTICLE 10

An official of the Organization who is a Canadian citizen or a person admitted to Canada for permanent residence as defined by applicable Canadian immigration legislation shall enjoy only those privileges and immunities set forth in Article 8 (a), (b), and (c).

#### ARTICLE 11

Experts performing missions for the Organization shall be accorded such privileges and immunities as are necessary for the independent exercise of their functions during the period of their missions.

#### ARTICLE 12

The Organization shall cooperate at all times with the appropriate Canadian authorities to facilitate the proper administration of justice, secure the observance of Canadian laws and regulations, and prevent the occurrence of any abuse in connection with the privileges, immunities, and facilities mentioned in this Agreement.

#### ARTICLE 13

Any dispute between the Organization and the Government of Canada concerning the interpretation or application of this Agreement or any supplementary agreement, which is not settled by negotiation or other agreed mode of settlement, shall be referred to a tribunal of three arbitrators for final decision. One arbitrator shall be designated by the Chairman of the Governing Council of the Organization, and another by the Secretary of State for External Affairs of Canada. The two arbitrators shall appoint a third arbitrator.

#### ARTICLE 14

1. This Agreement will enter into force on the date of its signature.
2. This Agreement may be revised at the request of either Party. To do so, the two parties shall consult on the modifications in question. In the event that their negotiations should fail to produce an agreement within the period of one year, this Agreement may be renounced by either Party, upon giving notice of two years.

## INCOME IN 1992

### Contributions:

	\$	\$
Canada for 1992	88,000.00	
Canada for 1993	88,000.00	
China for 1992	88,000.00	
Japan for 1992 plus over contribution	118,240.00	
United States for 1992	<u>88,000.00</u>	470,240.00

### Interest:

Bank Interest	2,316.99	
Guaranteed Investment Certificates	<u>4,920.33</u>	<u>7,237.32</u>
Total		477,477.32
Less Overcontribution by Canada		(88,000.00)
Less Overcontribution by Japan		<u>(30,240.00)</u>
Total Income for 1992		<u>359,237.32</u>

Note 1: Canada and Japan will be credited in 1993 with their respective overcontributions.

Note 2: The above account of Income in 1992 is un-audited. An audited account will be presented in the 1993 Report.

## EXPENDITURES IN 1992

	Expended	Approved in 1992 Budget
	\$	\$
Personnel Services	52,687.07	159,000.00
Travel	12,916.53	15,000.00
Annual Meeting	31,728.58	30,000.00
Communications	4,175.43	6,000.00
Contractual Services	2,300.00	17,000.00
Printing	3,418.97	10,000.00
Supplies	2,439.87	10,000.00
Equipment	31,944.16	35,000.00
Relocation	0.00	40,000.00
Miscellaneous Expenditures	1,217.61	5,000.00
Working Capital Fund	<u>32,237.32</u>	<u>25,000.00</u>
	<u>175,065.54</u>	<u>352,000.00</u>
Excess of Income over Expenditure		184,171.78
Less approved carryover for relocation of officers		(40,000.00)
Less approved carryover in lieu of contributions		(24,000.00)
Carried to Working Capital Fund		120,171.78

Note: The above account of expenditures is un-audited. An audited account will be presented in the 1993 Report.

## ASSETS ON 31 DECEMBER 1992

Bank of Nova Scotia Chequing Account # 774 - 10	\$ 23,419.78
Bank of Nova Scotia Savings Account # 3052729	\$ 211,229.32
Bank of Nova Scotia Guaranteed Investment Certificate	<u>\$ 100,000.00</u>
Total Assets	<u>\$ 334,649.10</u>
Excess of Income over Expenditure	\$ 184,171.78
Overcontributions by Canada and Japan	\$ 118,240.00
Working Capital Fund	<u>\$ 32,237.32</u>
Total	<u>\$ 334,649.10</u>

Note: The above account of assets on 31 December 1992 is un-audited. An audited account will be presented in the 1993 Report.

## BUDGET FOR FISCAL YEAR 1 JANUARY TO 31 DECEMBER 1993

	\$	\$
<b>INCOME</b>		
Contribution from Canada	88,000.00	
Contribution from China	88,000.00	
Contribution from Japan	88,000.00	
Contribution from United States	88,000.00	
Holdback from Working Capital Fund	24,000.00	<u>376,000.00</u>
Total Income in 1993		<u>376,000.00</u>
<b>EXPENDITURES</b>		
Personnel Services	238,000.00	
Travel	33,000.00	
Communications	6,000.00	
Contractual Services	8,000.00	
Printing	25,000.00	
Rental	6,000.00	
Supplies	5,000.00	
Equipment	20,000.00	
Expenses for Annual Meeting	31,000.00	
Miscellaneous	4,000.00	<u>376,000.00</u>
Total Expenditures in 1993		<u>376,000.00</u>



## **COMPOSITION OF THE ORGANIZATION**



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## COMPOSITION OF THE ORGANIZATION

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### Officers:

Chairman:	Dr. W. S. Wooster
Executive Secretary	Dr. W.D. McKone

### Delegates and Points of Contact:

#### Canada:

Dr. L. S. Parsons (Delegate)  
Dr. J. C. Davis (Delegate)

#### Japan:

Dr. H. Hatanaka(Delegate)  
Mr. Y. Hayashi (Delegate)  
Mr. M. Namba (Point of Contact)

#### China:

Mr. Jian San Jia (Delegate)  
Dr. Yu Kun Xu (Delegate)  
Mr. Ji Xu (Point of Contact)

#### United States:

Dr. V. Alexander (Delegate)  
Dr. W. Aron (Delegate)  
Mr. W. Erb (Point of Contact)

### Finance and Administration Committee:

Chairman:	Dr. J. C. Davis
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### Science Board:

Chairman, Science Board	Dr. D. Ware
Chairman, Fishery Science Committee	Dr. Q. Tang
Chairman, Biological Oceanography Committee	Professor M. Mullin
Chairman, Marine Environmental Quality Committee	Professor J. Zhou
Chairman, Physical Oceanography and Climate Committee	Professor Y. Nagata

## **Scientific Committees:**

### **Biological Oceanography Committee:**

#### **Canada:**

K. Denman  
D. Mackas  
T. Parsons

#### **Japan:**

T. Ikeda

#### **China:**

Y. Chen  
R. Wang  
B. Wu

#### **United States:**

L. Jones  
M.M. Mullin (Chairman)  
P. Wheeler

### **Fishery Science Committee:**

#### **Canada:**

R.J. Beamish  
J. Rice

#### **Japan:**

K. Ohtani  
T. Sasaki  
T. Wada

#### **China:**

Q. Tang (Chairman)  
M. Zhou  
Z. Yan

#### **United States:**

D. Eggers  
J. Hunter  
G. Stauffer

### **Marine Environmental Quality Committee:**

#### **Canada:**

R. Wilson  
M. Nassichuk  
J. McInerney

#### **Japan:**

M. Watanabe  
T. Hirano  
M. Kinoshita

#### **China:**

J. Zhou (Chairman)  
H. Wang  
X. Jia

#### **United States:**

W.S. Reeburgh  
C.M. Watson  
U. Varanasi

### **Physical Oceanography and Climate Committee:**

#### **Canada:**

J. Garrett  
C.S. Wong  
P. LeBlond

#### **Japan:**

Y. Nagata (Chairman)  
Y. Sugimori  
T. Uji

#### **China:**

J. Chao  
M. Zhou  
D. Hu

#### **United States:**

D. Musgrave  
J. Overland  
S. Riser



## **PARTICIPANTS**

INSERT "LIST OF PARTICIPANTS" HERE