

PICES - the first decade, and beyond

Warren S. Wooster

School of Marine Affairs, University of Washington, 3707 Brooklyn Ave. NE, Seattle, WA 98105-6715, U.S.A. E-mail: Wooster@u.washington.edu

While PICES celebrates its tenth anniversary, its origins can be traced back more than 25 years. Early informal discussions of the need for such an organization took place at an FAO Technical Conference on Fishery Management in Vancouver in 1973. More active consideration began at the University of Washington in 1976, and the first informal meeting on the subject occurred in 1978. Between then and March 1992, when the PICES Convention was signed, there were 8 other informal and formal reunions, involving participants from most of the present member countries. While some time was required to develop mutual understanding of what such an organization could accomplish, the long gestation period was mostly due to the shifting political relations among the countries concerned.

Early in the discussions, it became clear that interests of the proposed organization would not overlap with those of international organizations operating in the region. These were either global and broad in scope, or regional and specialized, in most cases for fishery management. PICES was envisioned as a regional organization, similar in many ways to the International Council for the Exploration of the Sea, ICES, in the North Atlantic, and was to be devoted to marine science in its broad aspects, and particularly to the interactions between the physical ocean environment and the ecosystems that function therein. This focus became particularly relevant as the impact of climate variations and the threat of climate change became apparent.

In its first decade, PICES considered a wide array of problems, including those of specific regions, such as the Okhotsk Sea and Oyashio region, the Bering Sea, the subarctic gyre, and the Japan/East Sea; circulation modeling, carbon dioxide, and the iron fertilization experiment; monitoring, data exchange and quality control; pollution assessment methodology; coastal pelagic fisheries, marine birds and mammals, crabs and

shrimps, and harmful algal blooms. The major program on Climate Change and Carrying Capacity incorporates an interdisciplinary, integrative, and comparative approach, encompasses estimations of ecosystem carrying capacity and will shed light on the implications of climate changes for fisheries management. These efforts continue as the problems evolve and new ones arise.

The coming decade may include more cooperative operational efforts, for example, in establishing an effective ecosystem monitoring system, and in data and information exchange and analysis in order to generate regular and timely ecosystem status reports, and to provide scientific assessment and advice to its members and to interested regional organizations. The goal of PICES should be to continue and enhance services to its members and to their scientists.

This may be the first PICES meeting for some, while others can trace their connection back to the dim past when PICES was struggling to be born. While we speak of the first decade, the actual history, from the first gleam in its parents' eyes to the present, covers more than 25 years. If I outline some of that history, it may help to understand the present personality of the Organization and to foretell where it might be going.

Marine research is accomplished in large part by marine scientists whose specialties reflect the broad and interwoven nature of the ocean, whose approaches range from the abstract to the applied, and whose sponsors include universities, government agencies and private corporations.

Since the physical and biological processes that operate in the ocean recognize no man-made boundaries, marine research is inherently an international as well as interdisciplinary undertaking. In studying a complex system like the ocean, cooperation among scientists of

different persuasions is always complicated, and even more so when they come from different countries and cultures with different languages. The need for successful cooperative efforts has led to the establishment of international organizations to facilitate those efforts. Of those organizations concerned to a significant degree with some aspect of marine science, one can distinguish two principal categories, that of non-governmental and that of intergovernmental character, with each having its special focus and motivation, *e.g.*, science or resource management, and its geographical scale, *e.g.*, global or regional.

To come quickly to the bottom line, PICES is regional and intergovernmental with a broad interest in advancing scientific knowledge of the ocean. In the course of its development, these characteristics were all negotiated, and the decisions drew upon the player's experience with global organizations (*e.g.*, Intergovernmental Oceanographic Commission, IOC and the Food and Agriculture Organization, FAO) and with regional specialized bodies (*e.g.*, International North Pacific Fisheries Commission, INPFC). Particular note was taken of the long success of an analogous organization in the North Atlantic, the International Council for the Exploration of the Sea, ICES. While the designers drew heavily on the ICES experience, they were also well aware of the significant geographical and political differences between the two regions.

When I moved to Seattle, in 1976, I was challenged by two colleagues, Don McKernan and Lee Alverson, to think about developing a new international organization to support the scientific investigation of the North Pacific, a sort of Pacific ICES (hence the nickname PICES). The first informal meeting to discuss the need for such an organization, was held in early 1978 and involved scientists from Canada and the United States. At the second such meeting a year later, participants from Japan and the USSR were included. Then there was a long delay, for a variety of reasons that reflected the international politics of the time.

Not until April 1986, were the next international discussions held, when participants from the four countries were joined by observers from China. The pace then quickened. Not only were

discussions more frequent, but they were more formal and among governments rather than just among interested individuals. By December 1989, the convention was drafted and a year later was accepted. Following an intergovernmental organizational meeting in March 1992, PICES was ready to hold its first Annual Meeting ten years ago, in Victoria, B.C., in October of that year. Russia replaced the USSR, and Korea soon became the sixth member state.

Rather than regaling readers with anecdotes from this long gestation period, I think it would be more useful to examine early aspirations, to compare them with accomplishments to date and to speculate on where this might all lead.

When the first informal meeting occurred, the Law of the Sea (LOS) negotiations were still underway and coastal states were preparing to assume jurisdiction over coastal waters, both for resource exploitation and for research. These circumstances flavored the questions addressed, such as the following:

- Who are the participants in marine scientific research in the North Pacific, and how do they interact politically and scientifically? What are their objectives in seeking cooperation and/or coordination of marine scientific research in the region?
- What are appropriate functions for the proposed scientific organization? How should the region of interest be defined? Should membership in the proposed organization be restricted to countries bordering the region? Are there existing international organizations that could carry out the functions proposed for the new organization?
- What international arrangements for consultation on fishery matters are likely to survive the LOS negotiations, and to what extent are they likely to carry out the functions of the proposed organization? What should be the role of the proposed organization with regard to the formulation of advice to member governments or to appropriate regional organizations? Can such advice be responsive to the collective requirements of members and yet be effectively insulated from political influence?

It seems curious now that so much concern was expressed at the meeting over consultation on fishery matters and on providing advice to member governments when the original impetus had centered mostly on cooperative scientific investigation. But the purpose of the new organization as proposed then will not sound strange to you:

- To promote the development of cooperative research activities and the exchange of information concerning (1) the North Pacific marine environment and its interactions with land and atmosphere, (2) uses of the North Pacific and its living and non-living resources, and (3) the effects of man's activities on the quality of the marine environment.

These goals would be achieved through exchange of data and information; review of research plans, programs, and progress; identification of critical research problems and of methods appropriate for their solution; planning, development, and coordination of cooperative investigations of problems of common interest; and evaluation and interpretation of available data and information from the scientific point of view.

When, after eleven years, a meeting was held to draft the PICES Convention, a spokesman for the United States Delegation opened discussion on the continuing need for the organization:

The need for a PICES has not diminished in the last year. Potential conflicts and uncertainties in how to respond to contentious questions in the northern North Pacific have arisen in large part from lack of scientific understanding of the issues involved. These issues are difficult and complex. Their consideration often requires data not generally available as well as the exchange and pooling of ideas among scientists that is now difficult to achieve, in part because some existing scientific institutions are tied to management responsibilities so that relevant data are not exchanged freely nor analysed objectively. Existing organizations tend to be narrowly conceived so that all dimensions of problems cannot be examined (i.e., they are mono- rather than multi-disciplinary), or they are so broad in membership and scope that their attention to a

single region, especially one in high northern latitudes, is only transitory at best.

The general characteristics of PICES were soon agreed, and the draft Convention was accepted in late 1990. A few months before the organizational meeting, in early 1992, a scientific workshop was held in Seattle to review the state of knowledge in selected fields, to list relevant ongoing research, to identify research gaps and priorities, and to consider joint action that might be developed through PICES. Several Working Groups (WG) were set up to consider selected topics.

The climate change group sought a description of the changing climate that would elucidate the processes involved and allow for prediction of the evolution of the physical and biological system. The Bering Sea group proposed studies of the relationships and variability among components of the physical and biological environment with regard to circulation, productivity, and biological interactions. The fishery oceanography group asked what governs fish resources, species, composition, and biomass in the North Pacific and Bering Sea and emphasized the importance of interactions among organisms and between them and the physical environment. Finally, the environmental quality group discussed problems of nutrient loading and eutrophication, the fate of chronic and persistent chemical pollutants, and the role of the North Pacific in waste disposal, in terms of environmental changes and ecosystem responses.

These discussions all converged on a common scientific problem:

- 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?
- So what is an appropriate way to assess PICES accomplishments in respect to the scientific questions mapped out nearly ten years ago?

One approach is to identify specific activities and products. From the beginning, there have been four standing Scientific Committees, in biological

oceanography (BIO), fishery science (FIS), marine environmental quality (MEQ), and physical oceanography and climate (POC). From these have arisen temporary Working Groups that are disbanded when their tasks are completed. The sixteen established until now have looked at various aspects of the problems identified in 1991 with topics ranging from a specific sub-region, the Okhotsk Sea and Oyashio Region, to the broad questions of climate change, shifts in fish production, and fisheries management (Table 1).

Two major issues have been addressed by special, more permanent bodies, both of them established in 1994. Data exchange has always been seen as a central and continuing issue in cooperative research, especially that on very large systems where pooling of information is essential. The incorporation of biological data, ranging from tiny plankton to enormous whales, presents particular problems. An early Working Group has evolved into a standing Technical Committee on Data Exchange, TCODE. In addition to reviewing technical aspects of data exchange, TCODE has identified and made available on the PICES web site an inventory of the major ocean databases in the subarctic Pacific.

The second continuing body arose during discussions on the possibility that more juvenile salmon were being pumped into the ocean from hatcheries than could be sustained by the ecosystem where they were feeding. In other words, the carrying capacity of the system for salmon was being challenged. In response, it was decided to create what has become a major research program on Climate Change and Carrying Capacity, CCCC (a.k.a. the Four Seas), in cooperation with the international GLOBEC program (Global Ocean Ecosystem Dynamics). CCCC has an Implementation Panel and Task Teams on the basin scale component, regional scale studies, and development of conceptual/theoretical and modeling studies. Subsequently a Task Team on monitoring was added. The CCCC Program is a major effort to wrestle with many of the scientific questions identified back in 1991.

Another measure of PICES activity is the list of subjects discussed in scientific sessions of the

Annual Meetings. These have steadily increased in number, from the single major symposium on climate change and northern fish populations at the First Annual Meeting to the eleven symposia and topic sessions at the present meeting. These have covered all the topics of interest to the standing Scientific Committees plus others of broader scope identified by the Science Board. From my count, some 60 topics will have been highlighted by the end of PICES X (Table 2).

A major scientific conference in March 2000 was entitled “Beyond El Niño” and concerned climate variability and marine ecosystem impacts, from the tropics to the Arctic. This not only had the interdisciplinary and ecosystem approach that has characterized PICES from the beginning, but was a first cooperative effort with four international fishery commissions in the North Pacific, those that deal with management of tropical (IATTC) and extra-tropical tuna (ISCTNP), Pacific halibut (IPHC), and high seas salmon (NPAFC).

Yet another measure of PICES scientific activity has been its scientific publications, not only the 19 scientific reports arising mostly from Working Groups but also several substantial monographs. These include a large volume (739 pages) on climate change and northern fish populations that resulted from the 1992 PICES I symposium, a major synopsis on the Bering Sea, and special volumes of *Progress in Oceanography* on ecosystem dynamics in the eastern and western gyres of the subarctic Pacific, and on North Pacific climate regime shifts. These will soon be joined by papers from the “Beyond El Niño” symposium (Table 3).

I think it is reasonable to argue that the majority of these activities and products arose or became evident through the efforts of PICES. Of course, there would likely have been some cooperative and collective activities as there were in the past, and the marine scientific world was already moving towards ecosystem approaches and inter-disciplinarity – we did not invent the idea back in 1978! But I have serious doubts that anything close to the breadth of interest and involvement displayed by PICES members in the last ten years and evident at the present meeting could have occurred had the Organization not existed.

What next? I understand that the government of Mexico is seriously considering membership. This will of course increase our geographical, but more important, our intellectual coverage. The coming decade is likely to see an expansion of cooperative operational efforts, for example, in establishing an effective ecosystem monitoring system and in data and information exchange and analysis. This could lead to the generation of regular and timely ecosystem status reports that could be provided to PICES members and to interested regional organizations.

These reports would incorporate climate, oceanographic, and fisheries data from national and other sources and would include descriptions of the current state of the ecosystem and recent and longer-term changes therein, including the

abundance and distribution of various of its biological components. To the extent possible, now-casts and forecasts of probable future conditions would be made and widely distributed.

Until now, PICES members, unlike those of ICES, have shunned any sort of advisory capacity for PICES, largely because of fishery politics in the region. However, I believe that once PICES has developed its periodic ecosystem status reports, their availability will constitute a form of useful, yet apolitical, advice that members will welcome. This service could be a significant contribution to member governments as PICES pursues its continuing efforts “to promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources”.

Table 1 PICES Working Groups and CCCC Program.

No.	Working Group/CCCC Program		Year
1.	Okhotsk Sea and Oyashio Region	POC	1992-1993
2.	Development of common assessment methodology for marine pollution	MEQ	1992-1994
3.	Dynamics of small pelagics in coastal ecosystems <ul style="list-style-type: none"> renamed WG on Coastal pelagic fish 	FIS	1992 1993-1995
4.	Data collection and quality control <ul style="list-style-type: none"> renamed WG on Data exchange replaced with Technical Committee on Data Exchange, TCODE 	SB	1992 1993 1994
5.	Bering Sea	SB	1992-1996
6.	Subarctic gyre	SB	1992-1994
7.	Modeling of the subarctic North Pacific circulation	POC	1993-1995
8.	Practical assessment methodology	MEQ	1994-2000
9.	Subarctic Pacific monitoring	SB	1994-1997
	Scientific Steering Committee for PICES-GLOBEC Climate Change and Carrying Capacity Program, CCCC <ul style="list-style-type: none"> renamed CCCC Implementation Panel established Task Teams: BASS (basin scale component), REX (regional scale studies), MODEL (development of conceptual/theoretical and modeling studies) and MONITOR (development of PICES monitoring program) 		1994 1995
10.	Circulation and ventilation in the Japan/East Sea	POC	1995-1999
11.	Consumption of marine resources by marine birds and mammals	BIO	1995-1999
12.	Crabs and shrimps	FIS	1995-2001
13.	Carbon dioxide in the North Pacific	POC	1997-2002
14.	Effective sampling of micronekton to estimate ecosystem carrying capacity	BIO	1997
15.	Ecology of harmful algal blooms in the North Pacific		1999
16.	Climate change, shifts in fish production, and fisheries management		1999

Table 2 Scientific sessions at PICES Annual Meetings and selected symposia/workshops.

Year	Scientific Session
1992	Climate change and northern fish populations
1993	<ul style="list-style-type: none"> • Long-term monitoring from platforms of opportunity (SB) • High resolution paleoecological studies in the subarctic Pacific (BIO) • Shifts in fish abundance and species dominance in coastal seas (FIS) • Priority chemical and biological contaminants in the North Pacific ecosystem (MEQ) • Ocean circulation and climate variability in the subarctic Pacific (POC)
1994	<ul style="list-style-type: none"> • Structure, trophic linkages, and ecosystem dynamics of the subarctic Pacific (SB) • Structure and ecosystem dynamics of the subarctic transition zone North Pacific - is the east like the west? (BIO) • Recruitment variability of clupeoid fishes and mackerels (FIS) • Interdisciplinary methodology to better assess and predict the impact of pollutants on structure and function of marine ecosystems (MEQ) • Physical processes and modeling of the subarctic Pacific and its marginal seas (POC)
1995	<ul style="list-style-type: none"> • Marine carrying capacity: fact or fiction? (SB) • Factors affecting the balance between alternative food web structures in coastal and oceanic ecosystems (BIO) • Density-dependent effects on fluctuations in the abundance of marine organisms (FIS) • Sources, transport and impact of chemical contaminants (MEQ) • Circulation in the subarctic North Pacific and its marginal seas, and its impacts on climate (POC)
1996	<ul style="list-style-type: none"> • Methods and findings of retrospective analysis (SB) • Regional and interannual variations in life histories of key species (BIO) • Processes of contaminant cycling (MEQ) • Exchanges of water, organisms, and sediment between continental shelf waters and the nearby ocean (POC)
1997	<ul style="list-style-type: none"> • Ecosystem dynamics in the eastern and western gyres of the subarctic Pacific (SB) • Micronekton of the North Pacific: Distribution, biology and trophic linkages (BIO/FIS) • Harmful algal blooms: Causes and consequences (BIO/MEQ) • Models for linking climate and fish (FIS/BIO) • Processes of contaminant cycling (MEQ) • Circulation and ventilation of North Pacific marginal and semi-enclosed seas (POC)
1998	<ul style="list-style-type: none"> • The impacts of the 1997/98 El Nio event on the North Pacific Ocean and its marginal seas (SB) • Controlling factors for lower trophic levels (especially phytoplankton stocks) (BIO) • Climate change and carrying capacity of the North Pacific: Recent findings of GLOBEC and GLOBEC-like programs in the North Pacific (FIS/CCCC) • Science and technology for environmentally-sustainable mariculture (MEQ) • Contaminants in high trophic level biota - linkages between individual and population responses (MEQ/BIO) • Decadal variability of the North Pacific climate (POC) • Carbon cycle in the North Pacific Ocean (POC/BIO)
1999	<ul style="list-style-type: none"> • The nature and impacts of North Pacific climate regime shifts (SB) • Modeling and prediction of physical processes in the subarctic North Pacific: Progress since 1994 (POC) • Coastal eutrophication, phytoplankton dynamics, and harmful algal blooms (MEQ/BIO) • Ecological impacts of oil spills and exploration (MEQ) • GLOBEC and GLOBEC-like studies and application to fishery management (FIS) • Recent findings of GLOBEC and GLOBEC-like programs in the North Pacific (BIO/CCCC)
2000	<ul style="list-style-type: none"> • "Beyond El Niño": A conference on Pacific climate variability and marine ecosystem impacts, from the tropics to the Arctic (March 23-26) • Subarctic gyre processes and their interaction with coastal and transition zones: physical and biological relationships and ecosystem impacts (SB) • Prey consumption by higher level predators in PICES regions: implications for ecosystem studies (BIO) • Recent progress in zooplankton ecology study in PICES regions (BIO/CCCC) • Short life-span squid and fish as keystone species in North Pacific marine ecosystems (FIS) • Large-scale circulation in the North Pacific (POC) • North Pacific carbon cycling and ecosystem dynamics (POC/BIO/JGOFS) • Recent findings and comparisons of GLOBEC and GLOBEC-like programs in the North Pacific (CCCC/GLOBEC) • Environmental assessment of Vancouver Harbor: results of an international workshop (MEQ) • Science and technology for environmentally sustainable mariculture in coastal areas (MEQ)
2001	<ul style="list-style-type: none"> • "Impact of climate variability on observation and prediction of ecosystem and biodiversity changes in the North Pacific" Workshop (March, 7-9) • Ten years of PICES science: Decadal-scale scientific progress and prognosis for a shift in scientific approach (SB) • Plankton size classes, functional groups and ecosystem dynamics: causes and consequences (BIO/JGOFS) • Migrations of key ecological species in the North Pacific Ocean (FIS) • Coastal ocean processes responsible for biological productivity and biological resource distribution (POC) • The physics and biology of eddies, meanders and rings in the PICES region (POC/BIO/FIS) • Sediment contamination - the science behind remediation standards (MEQ) • Physical oceanography to societal valuation: assessing the factors affecting coastal environments (MEQ) • Emerging issues for MEQ: a 10-year perspective (MEQ) • Physical, chemical, and biological interactions during harmful algal blooms (MEQ/BIO/POC) • A decade of variability in the physical and biological components of the Bering Sea ecosystem: 1991-2001 (CCCC) • Results of GLOBEC and GLOBEC-like programs (with emphasis on a possible 1999 regime shift) (CCCC)

Table 3 PICES Scientific Reports.

No.	Year	Title
1.	1993	Part 1. Coastal Pelagic Fishes (Report of WG 3) Part 2. Subarctic Gyre (Report of WG 6)
2.	1995	The Okhotsk Sea and Oyashio Region (Report of WG 1)
3.	1995	Monitoring Subarctic North Pacific Variability (Report of PICES -STA Workshop)
4.	1996	Science Plan, Implementation Plan (Report of the PICES-GLOBEC International Program on Climate Change and Carrying Capacity, CCCC)
5.	1996	Modelling of the Subarctic North Pacific Circulation (Report of WG 7)
6.	1996	Proceedings of the Workshop on the Okhotsk Sea and Adjacent Areas
7.	1997	Summary of the Workshop on Conceptual/Theoretical Studies and Model Development and the 1996 MODEL, BASS and REX Task Team Reports (CCCC)
8.	1998	Multilingual Nomenclature of Place and Oceanographic Names in the Region of the Okhotsk Sea
9.	1998	PICES Climate Change and carrying Capacity Workshop on the Development of Cooperative Research in Coastal Regions of the North Pacific
10.	1999	Proceedings of the 1998 Science Board Symposium on the Impacts of the 1997/98 El Niño Event on the North Pacific Ocean and its Marginal Seas
11.	1999	PICES-GLOBEC International Program on Climate Change and Carrying capacity. Summary of the 1998 MODEL, MONITOR and REX Workshops, and Task Team Reports
12.	1999	Proceedings of the Second PICES Workshop on the Okhotsk Sea and Adjacent Areas
13.	2000	Bibliography of the Oceanography of the Japan/East Sea
14.	2000	Predation by Marine Birds and Mammals in the Subarctic North Pacific Ocean (Report of WG 11)
15.	2000	Report on the 1999 MONITOR and REX Workshops, and the 2000 MODEL Workshop on Lower Trophic Level Modeling (CCCC)
16.	2001	Environmental Assessment of Vancouver Harbor Data Report for the PICES Practical Workshop (WG 8)
17.	2001	PICES-GLOBEC International Program on Climate Change and Carrying Capacity. Report of the 2000 BASS, MODEL, MONITOR and REX Workshops, and the 2001 BASS/MODEL Workshop
18.	2001	Proceedings of the PICES/CoML/IPRC Workshop on "Impact of Climate Variability on Observation and Prediction of Ecosystem and Biodiversity Changes in the North Pacific
19.	2001	Commercially Important Crabs, Shrimps and Lobsters of the North Pacific Ocean (WG 12)

Other publications resulting from PICES activities:

Beamish, R.J. (Ed.). 1995. Climate change and northern fish populations. Canadian Special Publication of Fisheries and Aquatic Sciences 121. 739 p.

Beamish, R.J., Kim, S., Terazaki, M., Wooster, W.S. (Eds.). 1999. Ecosystem dynamics in the eastern and western gyres of the subarctic Pacific. Progress in Oceanography 43 (2-1).

Loughlin, T.R. and Ohtani, K. (Eds.). 1999. Dynamics of the Bering Sea. University of Alaska Sea Grant. 825 p.

Hare, S.R., Minobe, S., Wooster, W.S. (Eds.). 2000. North Pacific climate regime shifts. Progress in Oceanography 47 (2-4).

McKinnell, S., Brodeur, R., Hanawa, K., Hollowed, A., Polovina, J. and Zhang, C.-I. (Eds.). 2001. Pacific climate variability and marine ecosystem impacts. Progress in Oceanography 49 (1-4).