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Taking stock and looking to the future – note from former PICES Chairman

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This short note gives me an opportunity to express my personal perspective on PICES, its evolution and suggested future directions. The views expressed are entirely my own. They are offered as suggestions for the PICES community.

The Early Years, 1992-96

PICES was established in 1992 as an intergovernmental organization with three main purposes:

- To promote and coordinate marine science in the northern North Pacific and adjacent seas, particularly north of 30 degrees north;
- To advance scientific knowledge about the ocean environment, global weather and climate change, living resources and their ecosystems, and the impacts of human activities on them;
- To promote the collection and rapid exchange of scientific information on these issues.

These purposes have been furthered by Scientific Committees, Annual Meetings, workshops, and activities of the Secretariat.

PICES has established a series of Working Groups of finite duration to advance knowledge and understanding of major issues. We have also convened workshops and symposia on topics of interest.

PICES established an interdisciplinary program, the PICES-GLOBEC International Program on Climate Change and Carrying Capacity (CCCC), which focuses on the effects of climate variation on marine ecosystems. As national GLOBEC programs move from planning to field work, PICES CCCC has moved from planning to implementation.

Annual Meetings have played a key role in promoting marine science and bringing together marine scientists from member countries. Participation in Annual Meetings has increased steadily as PICES has become better known in the scientific community.

The Technical Committee on Data Exchange (TCODE) has provided an inventory of data series relevant to PICES work.

The Secretariat has set up and maintained a web page, which promotes PICES and provides various information relevant to PICES.

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The state of the western North Pacific in the first half of 1998

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Mr. Satoshi Sugimoto is a Scientific Officer of the Oceanographical Division of the Climate and Marine Department at the Japan Meteorological Agency (JMA). He is working as a member of a group in charge of monitoring and forecasting sea surface temperature and sea surface current in the western North Pacific. Based on in situ and satellite data, this group provides various oceanographical products. One of the main products is the "Monthly Ocean Report", which is published and distributed by JMA every month. Mr. Sugimoto is now involved in developing a new analysis system for sea surface and subsurface temperature to improve sea surface temperature forecasts in the western North Pacific.

Sea Surface Temperature

Figure 1 shows monthly mean sea surface temperature (SST) anomalies in the western North Pacific from January to June 1998, computed with respect to the JMA's 1961-90 climatology. JMA operationally produces SST analysis for 1x1 degree grid points over the western North Pacific, using *in situ* observations. Other daily SST analysis is performed in seas around Japan, between 20˚N and 50˚N from 110˚E to 160˚E. In analysis, satellite-derived SST (NOAA/AVHRR) and *in situ* observations are both used. JMA adopted SST of this new analysis for that region from January 1998.

It is remarkable that SST was below normal along 40˚N throughout the first half of 1998. In particular, negative SST anomalies exceeding -1˚C were observed in June. On the other hand, SST was above normal along 30˚N throughout this period, and more than 2˚C above normal south of Japan in May. In the western tropical Pacific, positive SST anomalies exceeding +0.5˚C were present in the seas around the Philippines to 145˚E in June. Positive SST anomalies exceeding +1˚C were found in the South China Sea from January to March.

Oyashio and Kuroshio

Figure 2 shows the temperature distribution at the depth of 100 m east of Japan in February and April 1998. These charts are based on JMA's objective 100m water temperature analysis for 0.25 x 0.25 degree grid point values in seas adjacent to Japan. Temperatures colder than 5˚C are recognized as the Oyashio cold water. In February, the Oyashio cold water extended southward, reflecting its seasonal variation. It widely extended southward reaching 38˚N in March and April. *Figure 3* shows the location of the Kuroshio axes in May and June 1998. The Kuroshio retained a non-large-meander path south of Japan. A small meander of the Kuroshio was found near 135˚E at the end of May, after which it moved eastward. Its southernmost position was near 32˚N, 138˚E in the last 10 days of June.

Sea Ice in the Sea of Okhotsk

The first and last dates of drift ice appearance along the coast of Hokkaido are shown in Table 1, with location of the stations in *Figure 4*. The first dates of drift ice on shore and the first dates of shore lead appearance are also included. The sea ice extent in the Sea of Okhotsk was almost the same as normal (the 20-year averaged values from 1971-90) in this sea ice season, except it was below normal in late January. The sea ice extent was largest on March 5, when it was slightly above normal, though the maximum sea ice extent was below normal for the last 10 years. Drift ice began to flow into the Pacific through the Kunashiri Pass in early February, through the Nemuro Straits in mid-February, and through the Etorofu Straits in mid-March. The flow into the Pacific came to an end in early April.

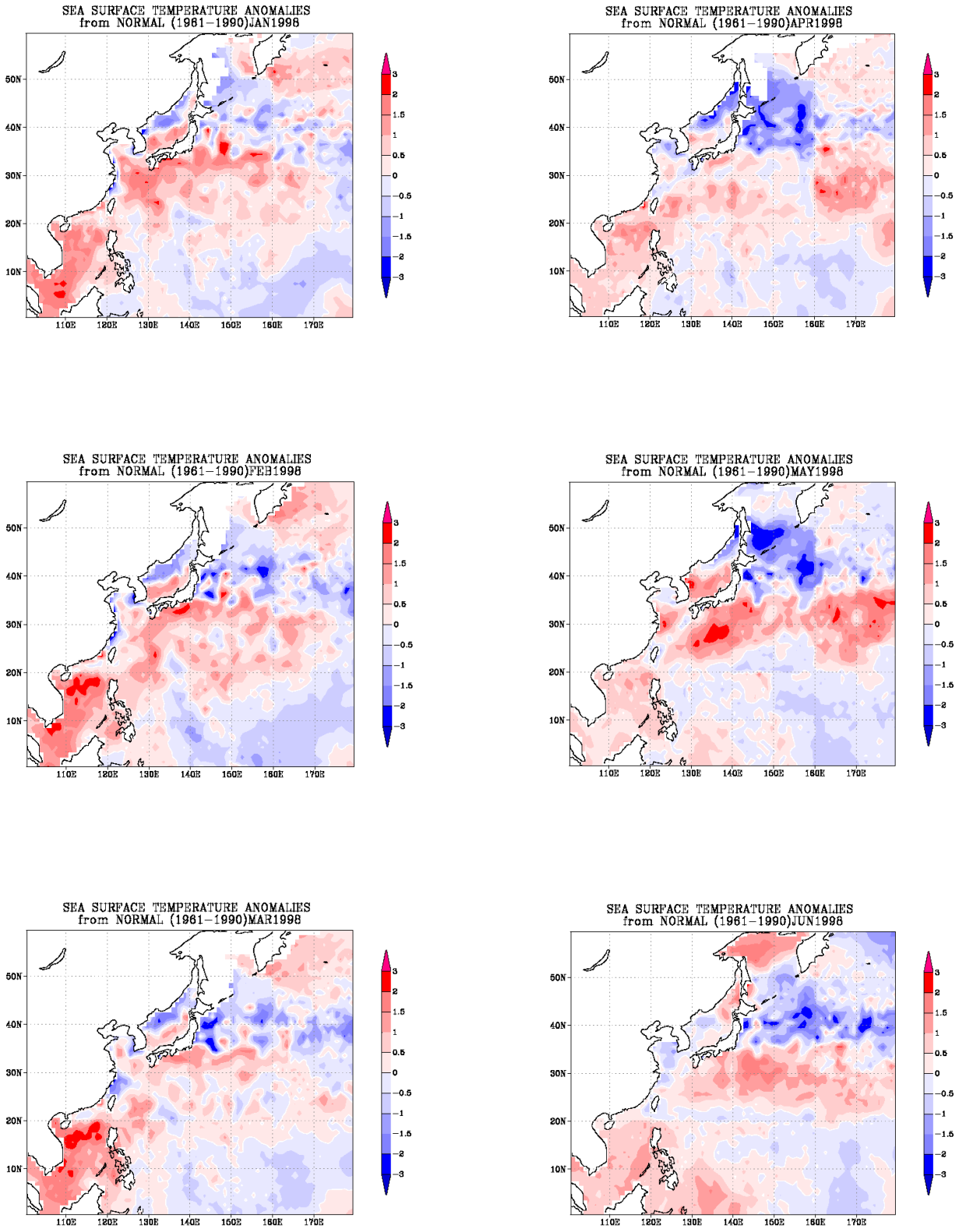

Fig. 1 Monthly mean sea surface temperature anomalies (˚C). Anomalies are departures from the JMA's 1961-1990 climatology.

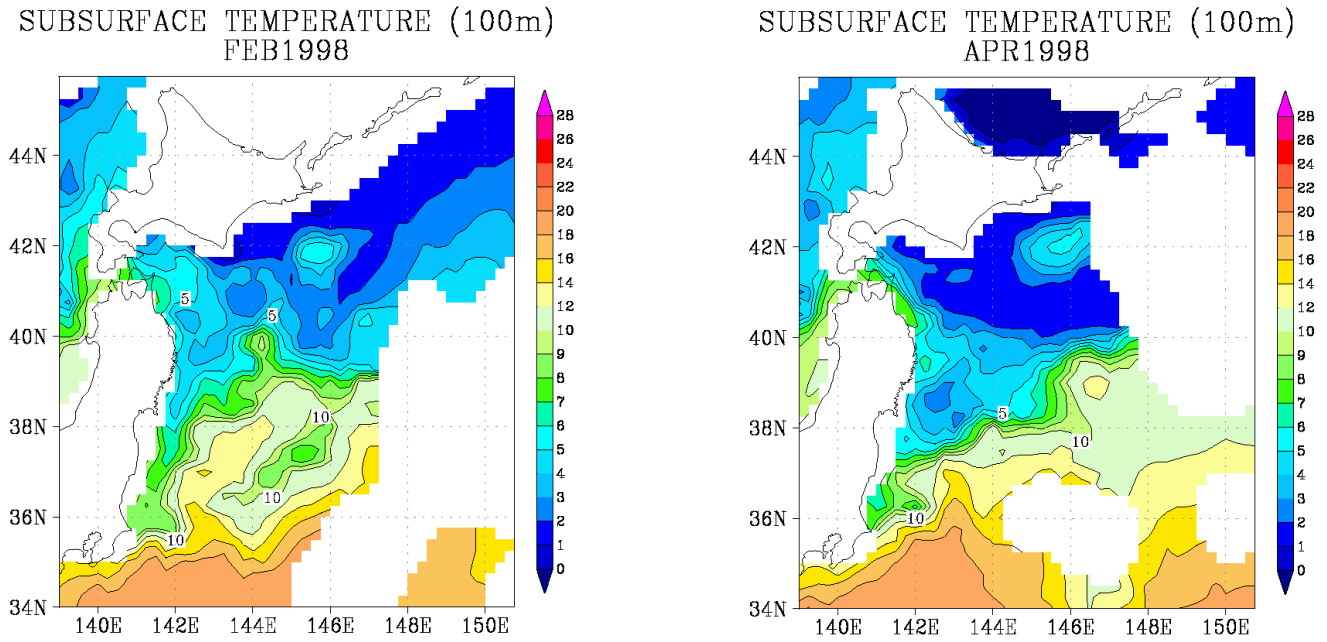

Fig. 2 Temperature (˚C) at the depth of 100m east of Japan in February (left) and April (right) 1998.

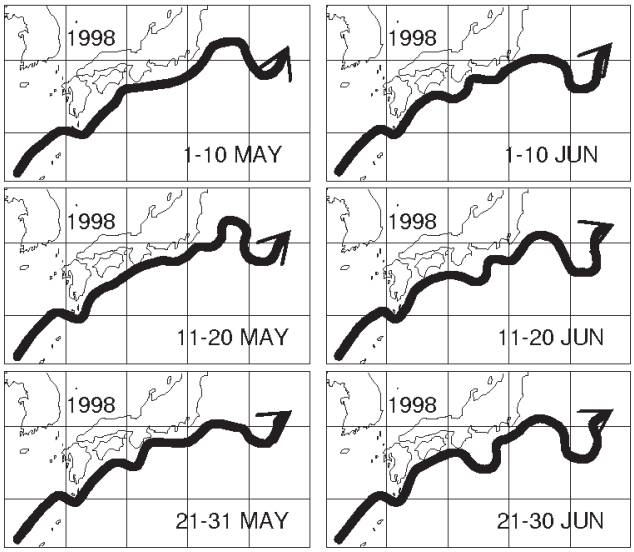

Fig. 3 Location of the Kuroshio axis in May and June 1998.

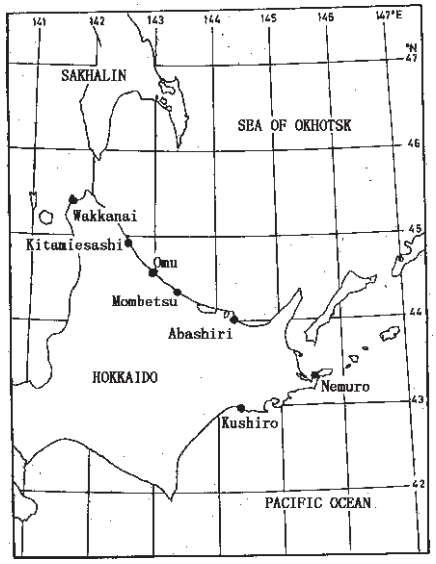

Fig. 4 Location of the sea ice stations along the coast of Hokkaido.

Table 1

Station	Drift Ice				First date of drift ice on shore	First date of shore lead appearance
	First date	Last date	Period	Days		
WAKKANAI	-	-	-	0(-15)	-	*
KITAMIESASHI	1.27(+7)	3.20(-11)	53(-18)	37(-15)	2.07(+11)	3.02(+11)
OMU	1.27(+8)	3.11(-26)	44(-34)	38(-23)	2.08(+11)	3.06(-8)
MOMBETSU	1.17(-1)	3.20(-18)	63(-17)	53(-11)	2.06(+7)	3.20(+3)
ABASHIRI	1.16(-1)	3.26(-23)	70(-22)	63(-20)	1.27(-1)	3.19(-5)
NEMURO	2.11(+2)	3.27(-6)	45(-8)	38(+4)	2.16(+2)	*
KUSHIRO	-	-	-	*	-	*

( ) : deviation from normal for the period from 1961 to 1990; * : no observations, - : no phenomenon
+ : earlier or more than normal; - : later or less than normal

Subsurface Temperature along 137˚E

JMA conducted oceanographic observations along the 137˚E in the western North Pacific on board the *R/V Ryofu Maru* in summer and winter. The depth of the thermocline along 137˚E varies with ENSO conditions (*Figure 5*). After the onset of the 1997/98 El Niño, the thermocline was shallower than normal, and negative anomalies exceeding -5˚C were found from 5˚N to 7˚N. However, positive anomalies prevailed between 4˚N and 10˚N in June/July 1998, in association with the weakening of the El Niño.

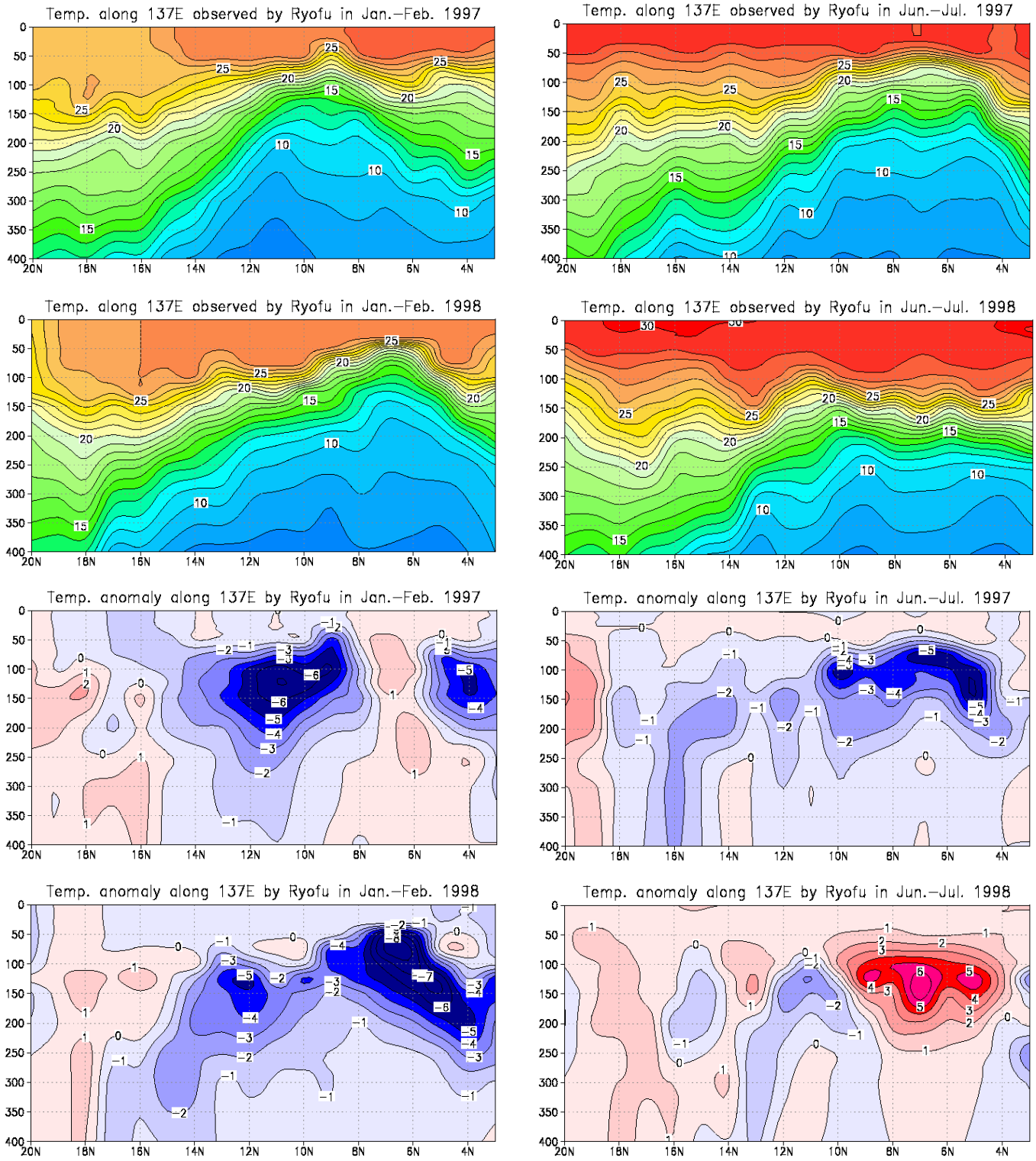

Fig. 5 Vertical sections of water temperature along 137˚E in the tropical regions observed by the R/V Ryofu Maru from January 1997 to July 1998.

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The status of the Bering Sea during the first 8 months of 1998

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Dr. Phyllis J. Stabeno, a physical oceanographer at the Pacific Marine Environmental Laboratory (PMEL) of NOAA, conducts research focusses on understanding the dynamics of circulation of the North Pacific, Bering Sea and their adjoining shelves. She is the PMEL Director of NOAA Fishery Oceanography Coordinated Investigations (FOCI), and by applying her knowledge of physical processes to fisheries oceanography, she plays a vital role in its success. FOCI research focusses on building sustainable fishery resources in the Gulf of Alaska and Bering Sea while maintaining a healthy ecosystem. Phyllis is also a Principal Investigator on several research elements for other programs, including: Southeast Bering Sea Carrying Capacity (Coastal Ocean Program), the Bering Sea Green Belt: processes and ecosystem production (Arctice Research Initiative) and Prolonged Production and Trophic Transfer to Predators: processes at the inner front of the southeast Bering Sea (National Science Foundation). This research seeks to improve our understanding of ecosystems through the integration of physical and biological phenomena.

The southeast Bering Sea (*Figure 1*) is one of the most productive ecosystems of the world with commercially valuable fishing grounds, because of this, it is the focus of oceanographic research. Starting in late spring 1997, a variety of anomalous conditions were observed in the Bering Sea including major coccolithophorid blooms (1997 and 1998), a large die-off of shearwaters (1997), far below predicted salmon returns (1997 and 1998), presence of whales on the shelf (1997 and 1998), and unusually warm sea surface temperatures (1997 and 1998). The causal mechanism for these events is not known, but major shifts in the ecosystem have occurred in previous years and we may now be witnessing such an event. It is unlikely that the changes in the Bering Sea are isolated, but rather they are part of the large-scale changes occurring in the North Pacific ocean/atmosphere climate system. For the cool season, two prominent modes of variability stand out. On the 2-7 year time scale, there are the systematic effects that occur with the now familiar El Niño - Southern Oscillation (ENSO). On the time scale of decades, there is the Pacific Decadal Oscillation or PDO (Mantua et al., A Pacific Interdecadal Climate Oscillation with impacts on salmon production. Bulletin of the American. Meteorological Socierty, Vol. 78, No. 6, 1069-1079, 1997). This mode has received considerable attention recently, because of its apparent links to salmon production and other aspects of the North Pacific ecosystem and climate. The climate variations of the North Pacific and Bering Sea can often be attributed to the superposition of the effects of ENSO and the PDO.

During the early portion of 1998, the intense El Niño of 1997-1998 dominated the North Pacific. The consequences for the Bering Sea included a deeper than normal Aleutian Low and a relatively warm middle to late winter for Alaska. This El Niño ended abruptly during the spring with rapid cooling in the tropical Pacific to moderate La Niña conditions. It is difficult to ascertain, at this time, whether any systematic shift is occurring in the PDO. Its last drastic change (to a strongly positive state) occurred in the late 1970s; at present there is the suggestion that it is tending to a negative or perhaps neutral state. It must be noted that the ENSO and the PDO generally affect the Bering Sea weather more during winter than summer. While the Bering Sea experienced greater than normal storminess during the late spring and summer of the 1998, it is not clear that this weather can be attributed to anything more than the natural variability of the atmospheric circulation over the North Pacific.

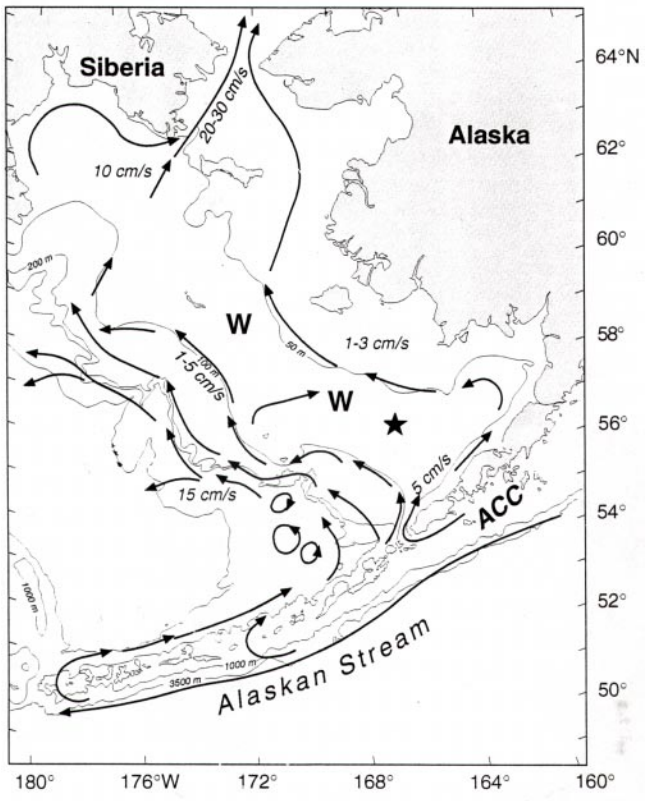

Fig. 1 A schematic of the mean circulation in the eastern Bering Sea. The Bering Slope Current (BSC) and Aleutian North Slope Current (ANSC) are shown. Site 2 (the star), the location of the time series measurements is indicated.

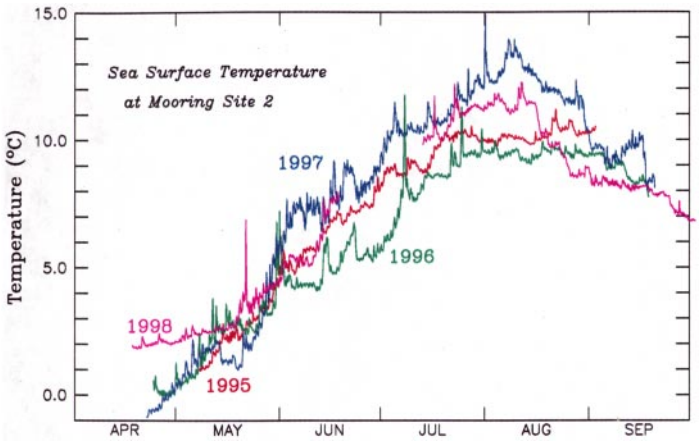

Fig. 2 Time series of sea surface temperature at Site 2 during spring and summer 1995, 1996, 1997 and 1998.

The seasonal variation of sea ice over the southeast Bering Sea is one of the striking characteristics of this shelf. The 1990s has seen an increase in the extent of sea ice over that which occurred in the previous decade. The extent of sea ice is largely determined by the strength and direction of winds. Strong, frigid winds out of the north blow the ice southward over the shelf. During 1998, ice arrived early (January) over the southeast shelf, and also retreated early (February). Historically we have observed that when sea ice is present over the southeast Bering Sea shelf during March, there is an accompanying spring bloom of phytoplankton which depletes the nutrients in the upper mixed layer. The retreat of ice in 1998 occurred early, before sufficient light was present to trigger a spring phytoplankton bloom. Ice melt provides an input of fresh water, that is the major contributor to stratification of the water column early in the year, while later in spring and summer, solar heating becomes the primary source of buoyancy. The southeast Bering Sea shelf is separated into domains characterized by their vertical structure. Over the middle shelf (50-70m water depth), the water column forms a two-layer system typically during April. Ice melt can provide fresh water to the upper layer thus initiating stratification. Beginning in April, solar heating can enhance this stratified system. In 1998, stratification of the water column occurred unusually late. Until June, winds were sufficiently strong over the shelf to keep the water column well mixed, thus delaying the formation of the two-layer system. The late setup and lack of low-salinity surface water caused by the early ice retreat resulted in a relatively weak density difference between the upper and lower layers. In addition, the warm water from the anonymously warm 1997 was still present over the southeast Bering Sea shelf in April. Sea surface temperature (SST) was warmer than in the previous 3 years at mooring 2 (*Figure 2*). The deepening of the mixed layer during April and May resulted in the SST increasing only slightly during those two months. The SST then increased rapidly through July. In mid-August, strong winds mixed the relatively weakly stratified water column, sharply reducing SST. Maximum temperature was not as warm as observed in 1997, but the warmest SST since the 1960s were observed in 1997 and 1998. The early ice retreat and lack of early stratification of the water column prevented the occurrence of a strong spring bloom. Typically the spring bloom completely uses the nutrients in the upper mixed layer (nutrients in the lower layer are isolated and high concentration remains through the summer). During 1998 there was a slow draw down of nutrients during the spring and summer, resulting in depleted nutrients over the shelf. These low nutrient conditions are very similar to conditions observed in 1997. The anomalous physical conditions during the last two years likely contributed to the large coccolithophorid bloom that was, and continues to be, observed. The bloom began in July 1997. Images in February 1998 show the aquamarine color that is indicative of these blooms.

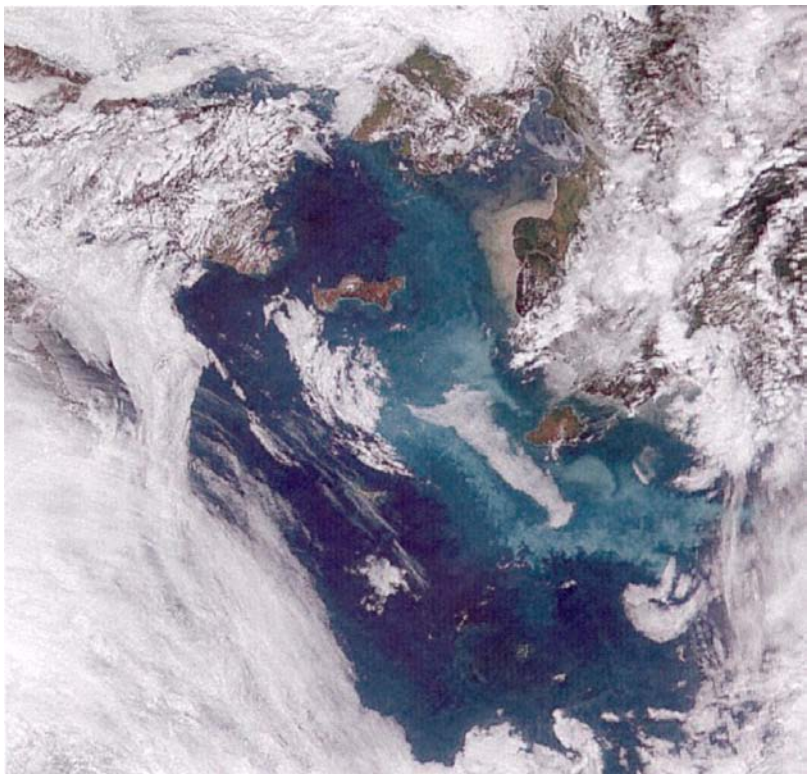

Fig. 3 SeaWiFs composite true color image (July 20, 1998) showing the extent of the aquamarine water which indicates the coccolithophorid bloom. Bering Strait is near the center at the top of the figure, with St. Lawrence Island just below. Runoff from the Yukon River is evident along the coast of Alaska. Figure provided by SeaWiFS Project, NASA/Goddard Space Flight Center.

An image in April shows the bloom covering much of the shelf. Satellite images (*Figure 3*) show the presence of a dense population of coccolithophores over the shelf in July 1998. The coccolithophores likely over-wintered due to mild temperatures on the shelf during this last winter. The 1998 bloom was more extensive than that observed in 1997, stretching north through Bering Strait. Cruises during July and August reported the aquamarine color, although it was not evident to personnel on cruises earlier in the year. Thus it appears that satellites can reveal coccolithophores in lower concentrations than the human eye can detect onboard ships.

The number of salmon returning to Bristol Bay during the last two years was far below expected. Traditionally it has been viewed that most salmon mortality occurs in early life, but research in the 1980s indicates the importance on early marine life. A recent paper by Kruse (Kruse, G. H., Salmon run failures in 1997-1998: A link to anomalous ocean conditions. Alaska Fishery Research Bulletin, 55-63, 1998.) discusses the Bering Sea salmon failures in 1997 and 1998 in detail. He concludes that marine environment contributed to the weaker than expected salmon runs in the last two years. Changing conditions have been observed during the last two years in the Bering Sea. Hopefully, the observations being made presently in the Bering Sea will be sufficient to elucidate the mechanisms that are resulting in the changes in the physical and biological environment of this productive ecosystem.

(cont. from page 5)

Carbon Dioxide

JMA observed the distribution of carbon dioxide (CO_2) in the western North Pacific onboard the *R/V Ryofu Maru* from January 27 to March 2, 1998 (*Figure 6*). The CO_2 concentration (partial pressure, $pCO_{2,sea}$) in the surface water were 20 µatm higher than those in February 1997, in the western equtorial Pacific (3˚N, 137˚E), and this area was a source for atmospheric CO_2. At 3˚N, 137˚E, the SST was about 1.1˚C lower (which corresponds to a decrease in $pCO_{2,sea}$ of about 20 µatm), whereas total inorganic carbon (TIC) concentration was 70 µmol/l higher (an increase in $pCO_{2,sea}$ of about 40 µatm), as compared to those observed in February 1997. The difference in $pCO_{2,sea}$ between the two years can be quantitatively explained by the reduction of the SST and the elevated TIC concentration. It is also evident that the elevated TIC concentration contributed to the increase in $pCO_{2,sea}$.

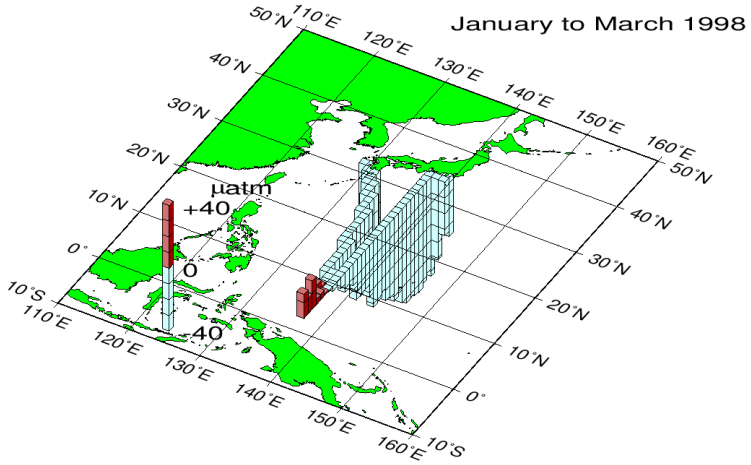

Fig. 6 CO_2 concentration difference between sea surface water and air in January - March 1998. Red upward bars indicate that the ocean emits CO_2 and blue downward bars indicate atmospheric CO_2 absorption by the ocean.

The state of the eastern North Pacific since February 1998

by Howard J. Freeland, Frank A. Whitney and William R. Crawford

At the Science Board Symposium of the PICES VII in Fairbanks, Alaska, reports were presented on observations of the rise and demise of the 1997/98 El Niño event in the N.E. Pacific. The changes in the physical and chemical environment were described by Bob Smith (T, S and velocity off Oregon), William Crawford (sea-level off British Columbia, presented by Mike Foreman), Howard Freeland (T, S and velocity off B.C.), Frank Whitney (nutrients off B.C.) and Thomas Royer (T, S and velocity off Alaska). The highlight was the large degree of internal consistency that arose from the various El Niño Watch programs, and the intriguing picture of nutrient depletion in the Gulf of Alaska.

It is now evident that the 1997/98 El Niño event reached its peak of influence in the N.E. Pacific during February 1998. *Figure 1* shows the distribution of sea-surface temperature in the N.E. Pacific derived from the so-called Reynolds data sets. The solid line on *Figure 1* indicates the approximate location of Line-P. A survey along Line-P was completed mid- to late February, and the structure of the temperature anomalies along Line-P is shown in *Figure 2*. Clearly these are not in perfect agreement. *Figure 2* shows surface anomalies approaching zero from positive values in the offshore regions, and *Figure 1* shows slightly negative anomalies in the same region. In fact, these differences are not surprising. The mean state defining *Figure 1* includes data only from 1982 to present, and for *Figure 2*, data from 1956 to present. However, there is clearly broad general agreement in the patterns and magnitudes of variation.

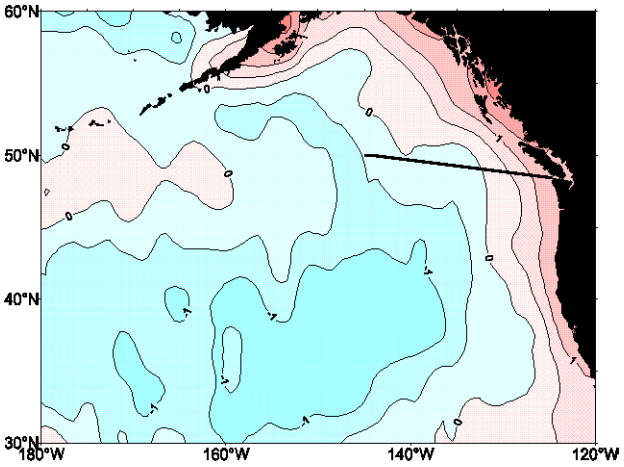

Fig. 1 Sea surface temperature anomaly in the N.E. Pacific during February 1998, using the Reynolds data-set.

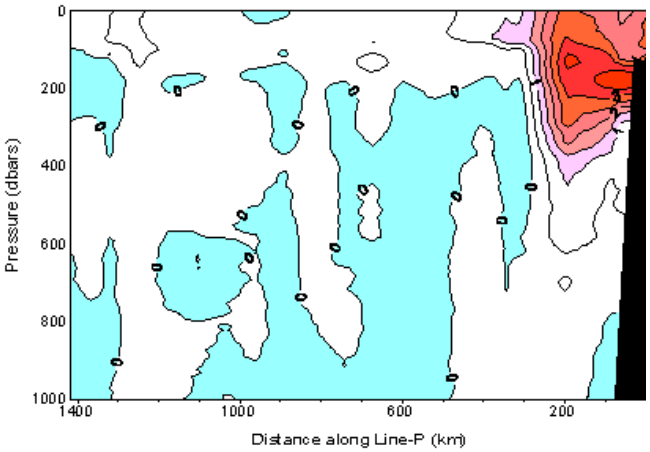

Fig. 2 Temperature anomaly along Line-P during February 1998.

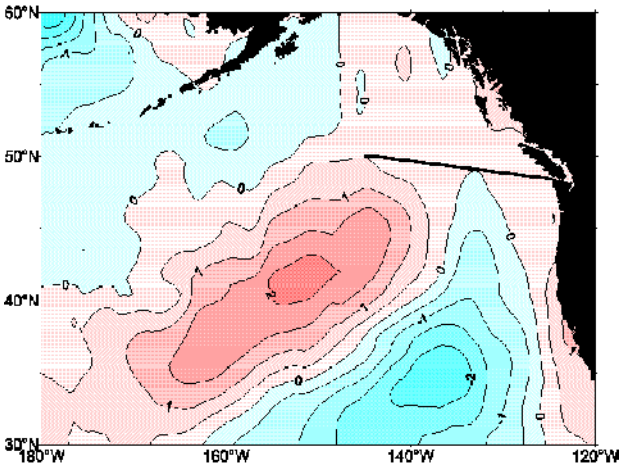

Fig. 3 Sea surface temperature anomaly in the N.E. Pacific during June 1998, using the Reynolds data-set.

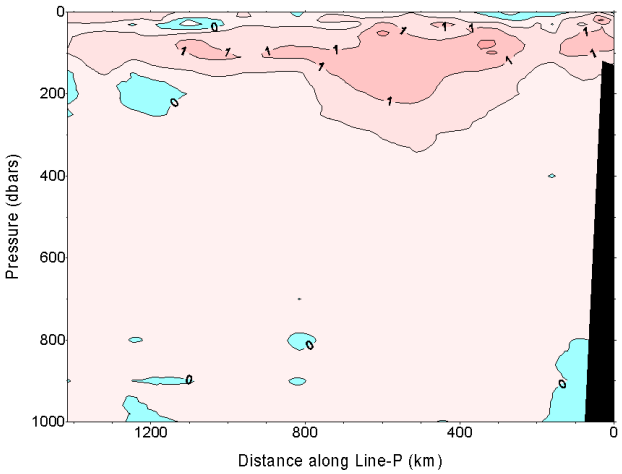

Fig. 4 Temperature anomaly along Line-P during June 1998.

Current meters deployed on the continental slope off Vancouver Island showed record high temperature anomalies that reached values of 6°C. Smith, during the Science Board Symposium, reported similar very large anomalies from observations acquired off Newport, Oregon.

During March 1998, the sea-level anomalies associated with the El Niño event declined very rapidly from the February peak of about 35 cm. Associated with the decline in sea levels, sea surface temperatures also declined, and this is illustrated in *Figure 3*. However, as the section along Line-P, completed in June 1998, shows, large subsurface anomalies persisted well into 1998 (*Figure 4*).

There seems to be very good evidence that the warm upper layer created by the 1997/98 El Niño during the winter of 1997/98 increased the stability of the water column in the Gulf of Alaska and so reduced the supply of macro nutrients through upwelling and deep winter mixing. This is illustrated in *Figure 5*, which was compiled by Frank Whitney. The blue bars show a long-term average of nutrients at several coastal stations along Line-P. Thanks to the DFO El Niño Watch program we have a large number of samples already during 1998, shown in *Figure 5* by the yellow triangles and red line. In a normal year we acquire samples only three times per year, in February, May and September. In *Figure 5* we see the concentration of nutrients during seven months of 1998. The decline is really quite stunning and must be having a profound impact on the entire ecosystem of the N.E. Pacific. It was remarkable to note during PICES VII that similar stories are now emerging from Oregon and Alaska.

In the keynote talk during the Science Board Symposium, Dr. James O'Brien presented an overview of the 1997/98 El Niño and showed results obtained through modeling studies conducted at the Center for Ocean Atmosphere Prediction Studies at Florida State University. Notably, Dr. O'Brien showed evidence that as the sea-level anomaly associated with the 1998 El Niño event collapsed, a series of intense eddies should have been spun off from the coastal regions of the Gulf of Alaska. In fact, in February 1998, a very intense eddy was indeed seen to form near Dixon Entrance, near the border between British Columbia and Alaska. This feature propagated offshore, and then southwards towards Line-P, and crossed Line-P just in time for it to be detected by the September

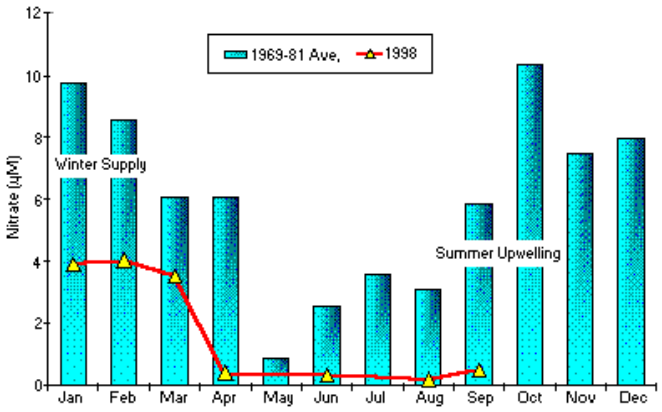

Fig. 5 Nutrients at coastal stations along Line-P (from F. Whitney).

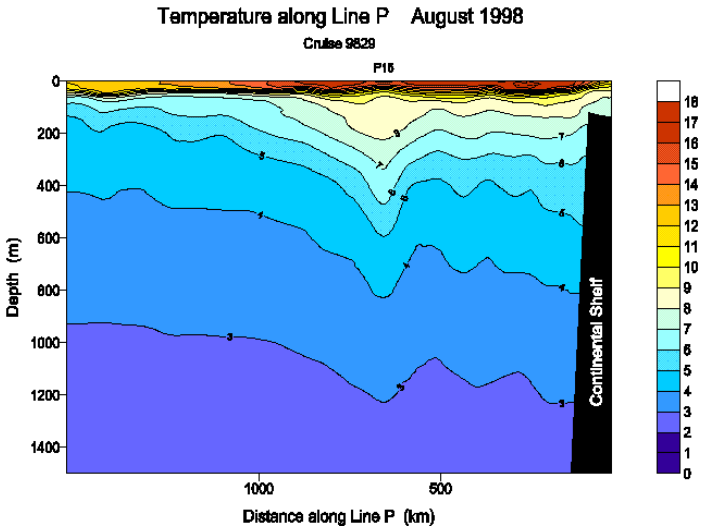

Fig. 6 Temperature distribution along Line-P in late August 1998.

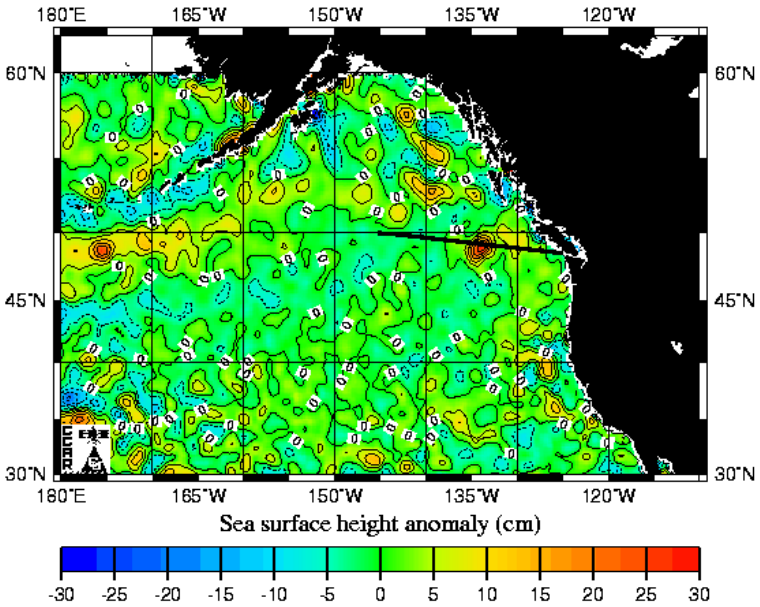

Fig. 7 Sea-level distribution in the Gulf of Alaska during August 1998.

1998 Line-P survey. Figure 6 shows the distribution of temperature along Line-P observed in August 1998. The dominant feature is a very large mid-water eddy. A similar feature was found in August 1995, and was seen by satellite SST, forming in spring along with 5 other eddies, in the coastal waters of BC (Thomson and Gower, 1998. JGR 103, 3033-3040). However, though eddies were already known to form as an El Niño relaxes, the intensity of the 1998 feature is beyond our experience. An examination of TOPEX pictures quickly showed the existence of the eddy in sea-level data. The map opposite, with Line-P superimposed, shows the distribution of sea-level anomalies in the N.E. Pacific during August 1998. The single dominant feature is an eddy neatly bisected by Line-P. Other TOPEX pictures clearly demonstrate the eddy detaching itself from the coast near the northern end of the Queen Charlotte Islands, spending a little time over Bowie Seamount before heading southwards towards Line-P. It is quite unclear how this eddy manages to propagate southwards against the general circulation pattern of the Gulf of Alaska.

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Dr. William R. Crawford (crawfordb@pac.dfo-mpo.gc.ca) graduated from the University of Waterloo with B.Sc. in Physics (1970), M.A.Sc. in Mechanical Engineering (1972), and from the University of British Columbia (UBC) with a Ph.D. in Physics and Oceanography (1976). He has been employed since 1977 as a research scientist in the Canadian Hydrographic Service, studying tidal prediction methods, coastal currents and regional tidal models. He is an adjunct professor at the University of Victoria, the University of British Columbia and the State University of New York at Stony Brook.

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The past two years

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The past two years have seen continued growth of PICES, both in terms of numbers of participating scientists and broadening of subject areas. The number of participants has risen more than 20% since PICES V. In 1998, PICES has hosted meetings of the North Pacific Task Team of JGOFS (The Joint Global Ocean Flux Study) and CREAMS II, (an oceanography program in East Asian marginal seas) in conjunction with the Annual Meeting. These specialized meetings have brought new scientists into the PICES community and are helping to involve PICES in broader studies of the ocean in the world climate system.

The content of the PICES web page has grown dramatically over the past two years. Our web site is an excellent source of news on upcoming scientific meetings, thanks to the work of Dr. Alexander Bychkov. Mr. Robin Brown also deserves thanks for incorporating TCODE's long-term data series inventory into the web page.

The 1997-98 El Niño gave PICES scientists an opportunity to study the effects of an extreme climate anomaly on the North Pacific ecosystem. The 1998 Science Board Symposium showed many dramatic observations and has raised interest in a more comprehensive symposium to be held in the year 2000, with co-sponsorship by other interested organizations.

PICES extended its cooperative links with other organizations in 1998. MOUs were signed with ICES, the International Council for the Exploration of the Sea, and NPAFC, the North Pacific Anadromous Fisheries Commission.

Next Steps

PICES has led the way in revealing the linkages between North Pacific climate variations and changing productivity and composition of fish communities. Further progress requires better understanding and prediction of the climate system. The climate of the North Pacific is part of the world climate system. Two international climate science programs are particularly relevant to PICES. CLIVAR (Climate Variability and Predictability Program) aims to advance knowledge and predictability of this system and GCOS, the Global Climate Observing System aims to observe ocean and terrestrial climate.

Within GCOS is found GOOS, the Global Ocean Observing System. GOOS has some regional programs now, especially NEAR GOOS and EUROGOOS, and more will likely follow. PICES can, and should, play an active role in developing and coordinating a North Pacific GOOS.

CLIVAR has major ocean components. The process studies are focussed mainly on the tropical oceans and teleconnections from them. CLIVAR modeling, however, aims at better understanding and predictability globally. PICES could provide a forum at Annual Meetings to present results of CLIVAR studies and coordinate CLIVAR research programs in the North Pacific.

PICES needs to give more emphasis to communicating its research. Most of the papers presented at Annual Meetings have very limited outside circulation. The new Publications Committee will address this issue. One attractive possibility would be to publish an electronic journal through the PICES web page.

PICES is improving its connections with other international organizations. The co-sponsorship of the major symposium on interdecadal climate variability planned for the year 2000 is a milestone. If possible, scheduling PICES and NPAFC meetings to permit more scientists to attend both would benefit both organizations.

Criteria for continued success

- A forum is a place to gather and debate. PICES should be the major forum for marine science in the North Pacific. If PICES continues to choose cutting edge topics for annual meetings, these meetings will interest many scientists and ensure that large numbers of scientists attend.
- Work on important issues will be supported financially. PICES should be sensitive to the needs and priorities of its member governments.
- Science needs constant renewal to remain vigorous. PICES should continue to encourage the participation of young scientists in its meetings and committee work.
- Communicate! The work of PICES is exciting and interesting. PICES should systematically promote its work and marine science in general to government policy makers and the broader scientific community.

In closing, I wish to thank all those who worked to further PICES over the past two years. Special thanks to Dr. Doug McKone and the PICES Secretariat, Dr. Makoto Kashiwai and other scientific Chairmen, and national delegates who have supported me.

Highlights of PICES VII, review of SB activities and future workplan

Highlights of PICES VII

The Seventh Annual Meeting of PICES was held in Fairbanks, Alaska, the northern most place among former venues. White snow and slippery roads welcomed the participants. Some were blessed with the opportunity to see the Northern Lights on clear nights.

The Seventh Annual Meeting means it has been six years from the First Annual Meeting. The term of office for Chairmen of PICES and Committees and other groups are two or three years. This Annual Meeting is the second occasion of simultaneous replacement of many chairmen. The PICES Chairman and Vice Chairman, the Chairmen of Finance and Administration Committee, Science Board, BIO, MEQ, and POC, the Co-Chairmen of CCCC-IP, CCCC-IP/BASS, CCCC-IP/MODEL, and one of the REX Co-Chairmen were newly elected or appointed. The Annual Report contains the names of all the new Chairmen. The number of chairmen between the East and West of the Pacific is near a balance. However, there is no chairman from the People's Republic of China.

The renewal of leadership is necessary to refresh and vitalize the Organization. However, the continuity of activities is also important, especially for the scientific part of the Organization. Thus, Science Board and the Scientific Committees made a review of past activities and future perspectives of each group. Some of the materials discussed will be published in the 1998 PICES Annual Report as working documents for the new Chairmen. A brief introduction of the review of Science Board activities and a future workplan (please note this is my personal view) are in this article.

The SB topic for this Annual Meeting was "*The Impacts of the 1997/98 El Niño event on the North Pacific Ocean and its marginal seas*". This timely topic makes it possible to understand many aspects of this largest recorded El Niño and the impacts just after its occurrence. The effects extended to Alaska not only in terms of water temperature anomalies, but also the northern extent of the California sardine migration. The obvious impacts were dominant on the eastern side of the Pacific because of the nature of the phenomenon, so the papers presented were almost all limited to the east side of the Pacific. The Best Presentation Award for the SB Symposium was given to Dr. Cynthia Tynan.

The long-term impacts of this 1997/98 El Niño will be manifested through the atmosphere-ocean interaction dominant in the western Pacific, e.g. through the change of precipitation that caused severe floods in China and brought anomalous freshwater input in the Japan/East Sea, or through the change of winter monsoons caused by hemispheric pressure patterns. The entire aspect of the impact of the 1997/98 El Niño on the whole North Pacific, including the impact on the western Pacific through subduction, is expected at the forthcoming inter-organizational conference "*Beyond El Niño: A conference on Pacific climate variability and marine ecosystem impacts, from the Tropics to the Arctic*" to be held in March 2000 in La Jolla; and at the SB Symposium at the next Annual Meeting "*The Nature and Impacts of North Pacific Climate Regime Shifts*".

Other scientific sessions of PICES VII were "*Controlling factors for lower trophic levels (especially phytoplankton stocks*" (BIO), "*Decadal variability of the North Pacific climate*" (POC), "*Carbon cycle in the North Pacific Ocean*" (POC, BIO and JGOFS co-sponsored), "*Science and technology for environmentally-sustainable mariculture*" (MEQ), "*Contaminants in high trophic level biota - linkage between individual and population responses*" (MEQ and BIO joint session), "*Climate change and carrying capacity of the North Pacific: recent findings of GLOBEC and GLOBEC-like programs in the North Pacific*" (FIS and CCCC-IP joint session). Dr. Kazuaki Tadokoro won the Best Presentation Award from BIO Committee, Mr. Jae Bong Lee from FIS Committee, Dr. Peter S. Ross from MEQ Committee, Dr. Hisashi Nakamura from POC Committee, and Dr. Kaoru Nakata from CCCC-IP. It should be noted that this is the first time that the CCCC Program has had a scientific session in the program of the meeting.

The most important subject that was discussed during the meeting by many formal and informal groups is how to incorporate marine birds and mammals into the PICES structure and activities. Temporal establishment of a working group cannot fill the serious gap in the marine science disciplines existing in the scientific scope of the present four Scientific Committees. A new Study Group established under SB will consider this subject and report at the next Annual Meeting. A balance between the smaller number of Scientific Committees to keep the structure of the Organization simple and a wider coverage of marine science research activities needs to be found to widen the scope of PICES.

The SB developed, with the help of the Secretariat, the Handbook for Chairmen and Conveners to aid new persons in carrying out the work of their various positions. This will be published and circulated to the new Chairmen early in the new year. In order to bring the Rules of Procedure in line with current practices, Rule changes were recommended and approved by Governing Council.

The topics at the next Annual Meeting scientific sessions to be held in Vladivostok in October 1999 are: "*Modelling and prediction of physical processes in the subarctic North Pacific: Progress since*" (POC), "*Coastal pollution - eutrophication, phytoplankton dynamics, and harmful algal blooms*" (MEQ and BIO joint session), "*Ecological impacts and mitigation of oil spills and oil exploration*" (MEQ), "*GLOBEC and GLOBEC-like studies and fisheries*

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The second PICES Workshop on the Okhotsk Sea and adjacent area

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The Second PICES Workshop on the Okhotsk Sea and Adjacent Areas was held in Nemuro, Japan, November 9-12, 1998. The workshop was coordinated by the Physical Oceanography and Climate Committee (POC) of PICES, and co-convened by Drs. Yutaka Nagata, Vyacheslav B. Lobanov and Lynne D. Talley (absent at the meeting). POC recognized the importance of the Okhotsk Sea, where sea ice is formed at the lowest latitudes in the world, and where the formation of dense origin water of the North Pacific Intermediate Water occurs. POC formed PICES Working Group 1 on the Okhotsk Sea, and published a review volume "The Okhotsk Sea and Oyashio Region" in 1995 (*PICES Scientific Report No. 2*). Following this, PICES held the first Workshop on the Okhotsk Sea and Adjacent Areas in Vladivostok, Russia, in June 1995, the proceedings of which were published as *PICES Scientific Report No. 6* in 1996. In addition, POC published the "Multilingual Nomenclature of Place and Oceanographic Names in the Region of the Okhotsk Sea" as *PICES Scienctific Report No. 8* in 1998. There has been a great deal of recent research activities in the Okhotsk Sea and adjacent areas, and many new findings and new knowledge have been gained since the first workshop in Vladivostok. The purpose of this Second Workshop is to exchange new findings and recent research results, and to review on-going and in-planning international and domestic projects in order to improve cooperative research.

The workshop was opened by the Mayor of Nemuro City, Mr. Hiroshi Fujiwara, and Dr. Vyacheslav B. Lobanov, explained the aims and the expected products of the workshop. The workshop discussion focussed mainly on physical oceanography, and talks covered a wide range of research: sea-ice characteristics and its movements; relation between ice-cover and atmospheric conditions; sea-ice and dense water (source water of NPIW) formation; ventilation and modification of water masses; tides and their effects on water mixing and on water exchanges through straits; meso-scale eddies, yearly to decal temporal variations, oceanographic database and atlas; and the relation of the oceanic state to spawning ground and to nutrients and chlorophyll-*a* distribution. Relations of these to local environments such as the northern Okhotsk Sea Shelf, Sakhalin and west Kamchatka shelves, Kuril Islands region, the Soya (La Perouse) Strait and northern coast of Hokkaido, were discussed. There were 42 participants and 38 presentations including 10 posters (22 papers and 10 posters by Russian scientists, 15 papers by Japanese scientists, and 1 paper by a US scientist).

Most of the on-going and in-planning international programs were discussed: such as the Soya/La Perouse program conducted by SakhNIRO and Hokkaido Central Fisheries Experimental Station, the Joint Japanese-Russian-US Study of the Sea of Okhotsk, and the joint studies between TINRO and Hokkaido National Fisheries Research Institute. Several research activities in Japan and Russia, for example, the Japanese Hydrographic Department, the Hokkaido University group, POI, TINRO FERHRI, were also introduced. Additional information was presented on the future activities relating to these projects during the plenary session by participating institutes and scientists. The participants of the workshop appreciated these efforts, and were impressed by the recent progress of the many Okhotsk Sea studies. However, there are still many problems to be solved, and many logistic and other kind of difficulties to expand our research activities and to organize further international cooperative studies on the Okhotsk Sea area.

Co-convenors of the Second Okhotsk Sea Workshop, Drs. Yutaka Nagata (Japan) and Vyacheslav B. Lobanov (Russia), the first and the third Chairmen, respectively, of the PICES Physical Oceanography and Climate Committee (POC). A detailed biography of Dr. Nagata can be found in PICES Press Vol. 5, No. 2 (July 1997), and a brief bio of Dr. Lobanov is in this issue (page 39).

The workshop recommends that PICES endorse and support the international cooperative projects mentioned above and that are to be developed in the near future. The activities should be extended not only to the Okhotsk Sea, but also to the Kuril Islands region and the Western Subarctic Gyre. PICES member countries boarding the Okhotsk Sea should facilitate access to investigators to cooperate on scientific research in the region. The workshop participants greatly anticipate the publication of the proceedings of this workshop in the PICES Scientific Report Series, and agreed that Drs. Vyacheslav B. Lobanov, Stephen C. Riser and Yutaka Nagata will serve as co-editors of the publication. The workshop also recommends that POC/PICES continue to overview and support the Okhotsk research activities, and consider holding another workshop in the near future, if warranted. Although the subjects of workshop talks were focussed on the physical field, many of the projects introduced are carried out in cooperation with other disciplines. The CCCC/PICES should take the initiative to organize a GLOBEC-like study for the Okhotsk Sea area.

The workshop was closed following farewell addresses by the Vice-Chairman of the Nemuro Workshop Supporting Committee, Mr. Nobuyuki Fukui (Chairman of the Nemuro Junior Chamber) and the former PICES Science Board Chairman, Dr. Makoto Kashiwai. As mentioned by the PICES Executive Secretary, Dr. W. Doug McKone, in the Welcome Reception held by Nemuro City in the evening of November 10, this workshop is already the fifth PICES meeting in Nemuro. All of the participants greatly appreciate the support and hard work of the Nemuro people in providing facilities for PICES meetings, and expressed their thanks for the financial support given by Nemuro City, Hokkaido University and other institutions. Without this support the fruit of the workshop would be substantially limited.

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management" (FIS), "*Recent findings of GLOBEC and GLOBEC-type programs in the North Pacific*" (BIO and CCCC-IP joint session).

Governing Council approved other important SB recommendations that were based on discussions by the Scientific Committees: to establish a new standing Publication Committee; to co-sponsor a workshop with ICES on "*Zooplankton Production Ecology*" to be held in Hawaii in late April/early May 2000; and to convene intersessional workshops of MEQ, WG 13, CCCC-IP/BASS, CCCC-IP/MONITOR, CCCC-IP/REX, and CCCC-IP/MODEL.

Review of SB activities during the period from PICES IV to VII, and future workplan

The activities of Science Board during the first three years, from PICES I to PICES IV, chaired by Dr. Dan Ware, can be identified as the period that established the structure of the Organization and developed the direction of a new organization. The following three years, from PICES IV to PICES VII, can be recognized as the period toward maturity, that developed relations with other organizations and to developed policy and activities in order to perform the expected functions of the Organization. The 3 years from PICES VII to PICES X, shall be the period to develop the functions as a more mature organization in cooperating with other organizations as equal partners and to maintain and reproduce creative PICES scientists in member countries, in addition to continued efforts for internal maturity.

In order to achieve functions as a mature organization, a workplan should be developed: to refine the design of the scientific program of Annual Meetings; to deliver scientific contributions from PICES; to improve procedures for establishment of Working Groups; to start public education services; to take the initiative in inter-organizational cooperation and coordination; to develop criteria for prioritization of scientific plans; to make better use of the Trust Fund by including more young scientists; to find ways to facilitate intra-national coordination mechanisms; to organize cooperative research programs on the marginal seas; and to develop the scientific structure of PICES to cover broader fields of marine science.

I have finished my term of office as SB Chairman at the end of this Annual Meeting. It sometimes required hard work, but I am sure that the experience of being able to devote myself to the work of PICES was very beneficial. I had many debates with Dr. Doug McKone, the former Executive Secretary, because both of us were trying to find the best solution for PICES, one from the point of view of the scientific community, and the other from the point of view of the maintenance of an intergovernmental organization. I fully appreciate his support for me in performing my responsibility as SB Chairman. I extend my thanks to the staff of the Secretariat for giving me all the help that I asked for. Above all, the support given to me by my SB colleagues, especially their patience in listening to and decoding my terrible English. I express my hearty thanks to them. When I hesitated to accept the position of SB Chairman because of my English ability, Dr. Warren Wooster encouraged me by saying "your English ability is not the most important part of the job". I am sure I proved his expectations in my English ability! I am happy to be just a PICES scientist and would like to ask you to think of yourself as a PICES scientist and to enjoy PICES science.

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PICES-GLOBEC Climate Change and Carrying Capacity Program: A report from PICES VII

Comments from the Co-Chairmen

The CCCC Program had another activity-filled year, which saw the formation of a new Task Team, continued activities of existing Task Teams, and advances in communicating our work not just within PICES, but to the international scientific community as a whole. As part of our efforts to better communicate our activities, we have organized and added more information about the CCCC Program on the PICES web site. For 1999, we anticipate more advances, particularly beginning activities to aid research coordination in regions such as the subarctic North Pacific and the Japan/East Sea that are being studied by many different research programs of several nations but which do not yet have funding for a coordinated GLOBEC program of research. We will also have new Co-Chairmen for the CCCC Program and many of the Task Teams. Their new ideas and perspectives will ensure that we move forward with renewed energy to continue with our goal of integrating and stimulating national activities on the effects of climate variations on the marine ecosystems of the subarctic N. Pacific. Below is a summary of our activities for 1998 and plans for 1999. Please visit the PICES web site regularly to get more details on our past, present, and future activities!

Task Team Activities of 1998 and Plans for 1999

BASS Task Team

The **BAS**in **S**tudies Task Team, which coordinates biological and physical studies in the central subarctic Pacific, is completing the review process for the papers from their 1998 BASS Symposium. These papers will be published in a special issue of Progress in Oceanography in 1999. This volume will provide an excellent summary of what is known about the eastern and western subarctic North Pacific gyres at all ecosystem levels and provide some initial guidance on research gaps. BASS would like to build on this work by holding a workshop on the development of a conceptual model of the subarctic North Pacific gyres. They hope to use the information brought together in the BASS Symposium volume to identify research questions and opportunities, particularly with respect to: physical structure of the gyres in relation to climate change; long-term changes in plankton abundance and species composition; and trophic relationships of fish, birds, and mammals.

BASS is also planning to annually compile a list of cruises in the subarctic North Pacific through contacts in each member country and through other organizations such as the North Pacific Anadromous Fish Commission (NPAFC). These cruises and names of contact persons will be listed in the PICES web site to aid researchers interested in developing collaborative research efforts in this region.

MODEL Task Team

MODEL has continued with their primary role of facilitating communication among modeling studies and with field programs. They have built on their web page a directory of existing circulation models to include biological models. They plan to include a nutrient data base directory on the web this year.

A small workshop was held just prior to PICES VII this year in Fairbanks to deal with lower trophic level model comparison issues and to gather information for nutrient databases. Proceedings of the workshop will be published later this year in a volume of the PICES Scientific Report Series. Based on the discussions at this workshop, the Task Team recommended that a prototype lower trophic level model with 12 compartments that would be executable on the web be made available in 1999. Plans are developing to hold a workshop in the year 2000, to apply the model to two sites (Station P and Sanriku area), compare it with an existing Bering Sea model, and plan for its application to higher trophic level models, regional circulation models, and JGOFS models.

MONITOR Task Team

The newly formed MONITOR Task Team held a workshop just prior to PICES VII in Fairbanks to review existing activities of PICES member nations and to identify monitoring needs and intercalibration experiments that might need to be conducted. The workshop was highly successful with 15 papers presented. A workshop report will be prepared and published in 1999 in the PICES Scientific Report Series.

Based on the discussions at the workshop, the Task Team will be working on several projects in the coming year. One project is to construct a table of present shipboard monitoring in the subarctic North Pacific by time and space to more clearly identify monitoring gaps and assist in the design of an improved monitoring system. They will also be preparing a summary of the zooplankton sampling gear used in many of the long time series of zooplankton observations in the North Pacific shelf and basin ecosystems, and identifying the most important intercalibration experiments that need to be carried out in the near future. Another key project will be to develop a white paper on the use of continuous plankton recorder (CPR) observations in the North Pacific. The Task

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Data management for the CCCC Program

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The GLOBEC approach is to use a decentralised data management and distribution system. This means that most of the work will be done at the national or regional level, with a small co-ordination role for the International Program Office. Within PICES, the Technical Committee on Data Exchange (TCODE) and the CCCC-Implementation Panel have reviewed the options for CCCC data management and have recommended that the primary responsibility for data management should rest with the national programs, as opposed to some centralised data management office set up in the PICES Secretariat.

Having decided that national programs are to carry most of the responsibilities for data management, it is important to define (in detail) what these responsibilities are! These responsibilities fall into three main areas:

- **Inform interested scientists on the projects that are being carried out as part of national GLOBEC programs.**

  This obligation is being carried out quite well by the existing series of CCCC reports and National GLOBEC web sites (Canada, Japan and U.S.A.).

- **Create and maintain inventories of data acquired under GLOBEC (and GLOBEC-like) programs.**

  The draft GLOBEC Implementation Plan suggests that "*each GLOBEC programme/project should create an inventory of data and data products*" and that "*These inventories will be collated by the International Project Office to build the centralised database of meta-data and pointers to actual data locations*". This is an area that will need some attention by the national programs - this information is presently missing from all the national programme office web sites. In addition, it is not clear exactly what metadata is required, but a good model can be found in the Global Change Master Directory (GCMD), which is a large, searchable metadata database that is accessible on the web (http://gcmd.nasa.gov). Users can search this inventory using traditional search criteria (latitude and longitude range, date range and parameter) or by keyword/text searches for project or investigator information. For example, it is very simple to search for all GLOBEC data in this inventory (only two entries when I tried!). The search returns a description of each dataset, including area and period of sampling, parameters measured and location of the data.

- **Ensure that data are migrated to a permanent and secure archival centre.**

  Permanent, secure archival of data is an important aspect of large international programs such as GLOBEC. The International Geosphere-Biosphere Program (IGBP), which is a sponsor of the GLOBEC program, requires that permanent archival of these data be addressed in the Implementation Plan. This will be a challenge for GLOBEC, as there are few existing data centres that are equipped to handle the diversity of data collected as part of GLOBEC and there is limited experience in the GLOBEC research community with long-term data archival. There may be an important role for the various National Oceanographic Data Centres to provide a permanent home for these data, but handling the GLOBEC data will be a serious challenge for most of these centres as their expertise and experience is focussed on physical and chemical oceanographic data.

The draft International GLOBEC Implementation Plan further suggests that a Data Management Working Group (DMWG) be formed to "*review the existing GLOBEC data management systems, issues and problems*" and to

"*recommend specific strategies for dealing with the shortcomings of existing systems*". The DMWG and IPO staff would also "*monitor migration of data to permanent archives to ensure long term security of the data"*.

It is instructive to consider how other large international programs are handling their data management problems. The Joint Global Ocean Fluxes (JGOFS) program is another IGBP-sponsored marine science program that is more 'mature' than GLOBEC. This program is entering the 'Synthesis and Modelling' phase and the Scientific Steering Committee has been re-structured with synthesis and modelling in mind. The first objective in the revised JGOFS goals is "*Ensure that all JGOFS observations are lodged with organisations which can guarantee long-term stewardship. Provide web-based information on the availability and access mechanisms to all JGOFS data. Encourage the development of web-based data delivery systems*."

JGOFS recently (September, 1998) sponsored a Data Management and Synthesis Workshop, which was attended by national JGOFS data managers and researchers who are undertaking aspects of JGOFS data management and synthesis. The present status of data management and the requirements for data synthesis were discussed. The results were as follows:

- Preservation and permanent archival are handled by both migration of data to National Oceanographic Data Centres (and other data centres, such as the Carbon Dioxide Information Analysis Center) and publication of data compilations on CD-ROM;
- There is no adequate searchable metadata inventory of JGOFS data and this will be a barrier to progress in the synthesis and modelling phase. The JGOFS Data Management Task Team had accepted the responsibility for creating such an inventory, but was unsuccessful in actually completing this task. The present strategy is to explore the possibility of using the Global Change Master Directory system for storing the JGOFS metadata. One large advantage of using the GCMD system is that the "search engine" component is already in place, so it will only be necessary to create the metadata entries (not a trivial task!).

What is the message for the CCCC Program and data management? Staffing for the GLOBEC Program Office is taking place now and there will be a position established for a GLOBEC Data Manager/Co-ordinator. There will be calls for the formation of a GLOBEC Data Management Working Group (as outlined in the Implementation Plan) and the PICES-CCCC Program will be asked to participate in this Working Group. National programmes will be asked to create inventories of GLOBEC data and data products to allow construction of a master inventory of GLOBEC data. In addition, the national programmes will be asked to demonstrate their plans for the permanent archival of GLOBEC data.

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Team will also be developing recommendations about biophysical moorings and zooplankton production.

REX Task Team

The **RE**gional E**X**periments Task Team, which identifies and carries out cooperative research experiments among the PICES regions, made significant progress this year. They published the report of last year's developmental workshop in PICES Scientific Report No. 9, which forms the basis for their long-term work plan. A highly successful topic session was held jointly with the PICES Fishery Science Committee during PICES VII, highlighting the research findings of GLOBEC and GLOBEC-like programs. This topic session will be continued in future years to ensure a place for GLOBEC researchers to present their findings at PICES scientific meetings. This is an important aspect of scientific networking that provides rapid transfer of information to the GLOBEC research community.

The Task Team held an interesting and successful workshop on climate effects on small pelagic species just prior to PICES VII in Fairbanks. Nine scientific papers were presented and reviews of existing research programs on small pelagics in each of the PICES nations were provided. Key questions and hypotheses relating to small pelagic species were discussed and several research recommendations for the future were made. A full workshop report will be published in 1999 in the PICES Scientific Report Series. The Task Team plans to hold a workshop in 1999 just prior to PICES VIII in Vladivostok, Russia, on the comparative dynamics of herring and euphausiids. They also plan to compile a summary of the sampling strategies and methods used to assess the stocks of small pelagic species.

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Report on GOOS Living Marine Resource Panel Meeting

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Dr. Warren S. Wooster is an oceanographer who studies interactions between climate variations and marine ecosystems. He is a professor emeritus at the School of Marine Affairs, University of Washington, in Seattle, and Co-Chairmam of the Living Marine Resource Panel of the Global Ocean Observing System. Previously he was Secretary of the Intergovernmental Oceanographic Commission (1961-1963), President of the Scientific Committee on Oceanic Research (1968-1972) and of the International Council for the Exploration of the Sea (1982-1985), and the first Chairman of PICES (1992-1996). His earlier academic appointments were at the Scripps Institution of Oceanography (1947-1973) and the University of Miami, and he has been at the University of Washington since 1976. A detailed biography of Dr. Wooster can be found in PICES Press Vol.5, No.1 (January 1997).

The July 1998 issue of PICES Press contained a preliminary report on the GOOS Living Marine Resource Panel meeting in March. Since then, the document has been finalized; a summary, which was available to the CCCC Implementation Panel and Monitoring Task Team during PICES VII in Fairbanks (Alaska), is attached. The Science Board decision to focus its symposium at PICES VIII (Oct. 8-17, 1999, in Vladivostok, Russia) on the topic of "*The Nature and Impacts of North Pacific Climate Regime Shifts*" is particularly relevant to the LMR Panel recommendations about retrospective experiments. The 1976-77 regime shift in the North Pacific is the best known of this class of phenomenon, and a careful look at its features should tell us a great deal about the kinds of measurements that would be most valuable for environmental and living marine resource predictions as well as helping to identifying priorities for ecosystem research.

LMR-GOOS Panel summary

The Living Marine Resources Panel of the Global Ocean Observing System (LMR GOOS) held its first meeting at UNESCO, Paris on March 23-25, 1998. Agreement was reached on the following statement of goals and objectives:

The goal of LMR GOOS is to provide operationally useful information on changes in the state of living marine resources and ecosystems. The objectives are to obtain from various sources relevant oceanographic and climatic data, along with biological, fisheries, and other information on the marine ecosystems, to compile and analyze these data, to describe the varying state of the ecosystems, and to predict future states of the ecosystems, including exploited species, on useful time scales. A consequence of these efforts should be the identification and development of the more powerful and cost-effective means for monitoring marine ecosystems required meeting the LMR GOOS goal.

GOOS also has a Coastal Panel, with which there is potential for overlap. Initially the LMR Panel will focus on deep ocean and shelf sea conditions dominated by oceanic processes. Eventually the panels may be merged.

After a review of existing international monitoring programs, the Panel decided that its assessment was incomplete and therefore directed the following request to IOC:

Several national, regional, and other international organizations have conducted, or now conduct, repeated observations designed to monitor the status of marine ecosystems or selected biological or physical components thereof. While some of these programs are well known, e.g., California Cooperative Oceanic Fisheries Investigations (CalCOFI), others are known only locally. In addition, some programs periodically assess the changing state of local ecosystems. An integrated set of these assessments could improve the understanding of marine ecosystems globally, as well as indicating areas whose present monitoring is inadequate. The Panel therefore requests that IOC compile and make available information on significant monitoring and assessment programs of its member states. An analogous request was made to FAO:

A number of national and regional bodies collect and analyze fishery statistics and make fishery assessments. An aggregation of these analyses would be invaluable in assessing population changes in the upper trophic levels of marine ecosystems. The Panel therefore requests FAO, the global centre for fishery statistics, to identify on a global scale the existing fishery analyses that could contribute to the desired meta-assessment and to advise on how it could best be organized and carried out.

(cont. on page 26)

Highlights of the Sev

The Honorable Fran Ulmer, Lieutenant Governer of the State of Alaska, giving the opening address

Head Table at the Opening Session: Drs. M. Hamilton, J. Wadlow, W. Fox, W.G. Doubleday, M.A. Henderson, J.G. Li, S. Matsumura, J.K. Chae, L.N. Bocharov and J.W. Balsiger

The Opening Session of PICES VII

Ms. Christie McAlister in a rare quiet Secretariat office – when the action is elsewhere…

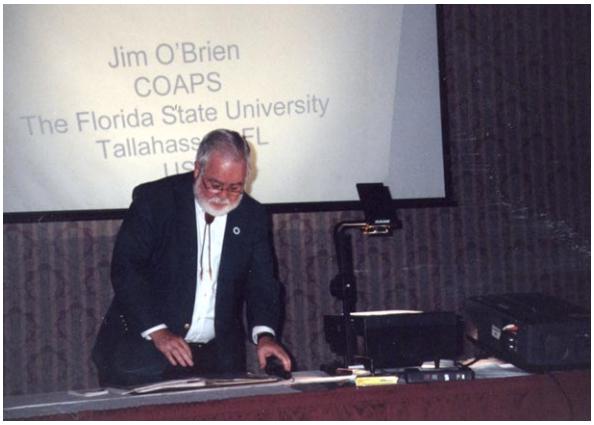
Dr. Joan Wadlow, Chancellor of the Univ. of Alaska Fairbanks; Dr. William Fox, Senior Scientist of NMFS, NOAA; and the Honorable Fran Ulmer; listen to Dr. Mark Hamilton, President of UAF, in the background giving an address

Dr. William G. Pearcy giving the keynote lecture

The Russian corner of the table that won the 'most international table award' at the Banquet, receiving a bottle of wine from Ms. Christina Chiu as prize

enth Annual Meeting

A special performance by the Inu-Yupiaq Dancers of the Univ. of Alaska Fairbanks at the Banquet



Dr. Jim O'Brien preparing for his special El Niño presentation at the Science Board Symposium

Scientific session in progress

Dr. William G. Doubleday, retiring Chairman, and Dr. W. Doug McKone, retiring Executive Secretary, receive Alaskan prints as souvenirs from new PICES Chairman Dr. Hyung-Tack Huh at the Chairman's Reception

Dr. Doubleday presents a bouquet to Dr. Vera Alexander in appreciation of her leadership and her staff's efforts in the local arrangements for PICES VII

Enjoying the Extravaganza Dinner - Dr. A.S. Bychkov, Ms. C. Chiu, Drs. Y. Nagata, A. Kurmazov, M. Kashiwai, L.N. Bocharov, W.S. Wooster, and Ms. S.O. Hamilton

Another scene at the Extravaganza Dinner – Dr. Hyung-Tack Huh, Dr. William G. Doubleday, Ms. Dorothy Bergamaschi, and Ms. Patricia Livingston

Governing Council Meeting – A. Kurmazov, L.N. Bocharov, H. Nishikawa, R. Marasco, S. Matsumura, W.D. McKone, V. Alexander, M.A. Henderson, W.G. Doubleday, W.S. Wooster, A.S. Bychkov, H.T. Huh, J.K. Chae, J.G. Li, Q.F. Liu, Z.X. Chen

Vjatcheslav Petrovich Shuntov

In his TINRO office, Vladivostok, September 1998.

Dr. Vjatcheslav P. Shuntov is rightfully considered to be an outstanding figure in world fisheries science. Dr. Shuntov has been devoted to studies about different aspects of biological resources and management in the World Ocean. His research interests include ichthyology, ecology, ornithology, squids and whales etc. The number of his published works is so big, that until recently, some foreign researchers had the impression that a group of Russian scientists were working under this pseudonym. He has authored more than 250 scientific papers devoted to ecology, biology and productivity of different fish species, sea birds, sea snakes, whales and dolphins, hydrobiont community structure and their dynamics, waves of abundance, and problems of rational marine fisheries. In the 1960s, Academician A.V. Zhyrmunsky told the story of how two leading specialists from the Institute of Zoology of the USSR Academy of Sciences (now – the Russian Academy of Sciences) argued about who this Shuntov is: one said, "he is an ornithologist", and the other said, "he is ichthyologist". This comical situation confirms Dr. Shuntov's all-round scientific interests and his ability to achieve success in those research issues which he studied.

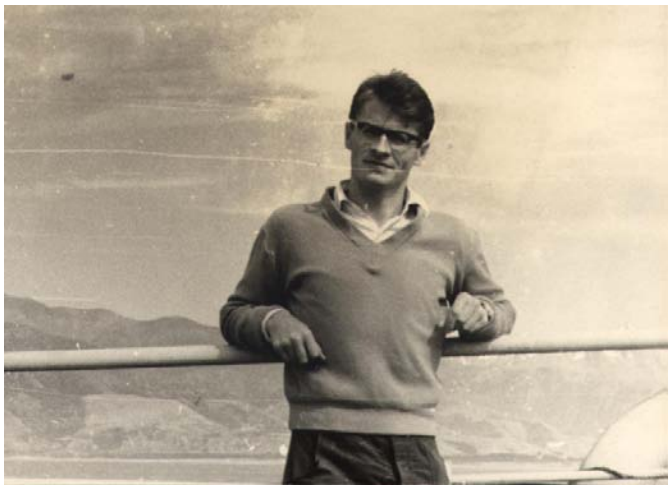
Dr. Shuntov began working in science in 1959, when he arrived in Vladivostok after graduating from Kazan State University. For almost forty years Vjacheslav Shuntov has worked at the Pacific Scientific Research Fisheries Center (TINRO-Center, or formerly TINRO). In 1981, he became Professor, in 1995, Academician of the Russian Academy of Natural Sciences, and now he is Chief Scientist at TINRO-Center.

His first steps as a marine researcher were at the Far-Eastern Scientific Fisheries Perspective Research Fleet Base. The young Shuntov landed in the Far East only by accident. The same can be said about his entering marine research, as he spent his childhood far from the sea in the Northern Urals, where he was born in 1937. He became interested in forestry, river and lake landscapes during his student years, when living in Kazan City on the Volga river. Even now, he is emotionally moved when contemplating terrestrial, not marine, vistas.

The first dozen years of Shuntov's work in TINRO was a time of continuous field expeditions. The 1960s was a period of expansion for the Soviet fisheries throughout the World Ocean, and scientific research vessels led the fishery fleets. In those years, Shuntov was engaged in searching for fish aggregations and new fisheries regions. He carried out special studies on halibut, saury, flying fish, and fish communities in the Far-Eastern seas, in numerous four- to six-month research cruises, in the Bering, Okhotsk and Japan (East) Seas, in Asian tropical waters, around the Australian and New Zealand plateau, and on the oceanic ridges and banks. It is interesting that all of the expeditions he participated in were considered successful, either in the search for new fisheries or from a scientific aspect. Scientific research executed in these expeditions provided information for the gradual expansion of the Russian commercial fishing harvest. These expeditions also made a valuable contribution to the development of scientific understanding of marine biota. In 1976, Shuntov received the Order of the Red Banner of Labour, the highest national award for outstanding services in studies of new fisheries regions.

Dr. Shuntov's first scientific papers were based on the results of fisheries research expeditions and were devoted to general biology and the distribution of Bering Sea fish fauna. In 1964, after returning from a Bering Sea cruise, he defended his Candidate thesis (equivalent to a Master of Science Degree in North America) on Greenland turbot and arrow-toothed flounder. He was the first to establish that main trophic linkages of commercial fish species dwelling in the continental slope, in particular halibuts, are directly connected to the planktonic communities or through planktivorous fishes. He established one important principle: that halibut can be found on shelf breaks and continental slopes, or where main currents are directed on to the slope zone from the deepwater.

Sea birds became one of the scientific passions of Dr. Shuntov, after seeing them in large numbers on Bering Sea expeditions. Henceforth, he always found time to conduct



As a youth in northern and southern latitudes, aboard the trawler "Zhemchug" in Bristol Bay in 1960 (left) and aboard the R/V "Akademik Berg" near New Zealand in 1965 (right).

On board TINRO research vessels in the Japan/East Sea, summer 1972 (top) and summer 1997 (bottom).

sea bird surveys on all his research cruises, despite the pressure of other work or bad weather (he participated in more than 20 sea expeditions). In the early 1960s, he participated in an expedition to the North Vietnam region where sea snakes piqued his interest. With his inherent enthusiasm, Shuntov attempted to determine the sea snakes' distribution in the South China Sea while continuing the routine ichthyology work of the North Vietnam expedition. It should be noted that the results from the complex research in the South China Sea and the Gulf of Tonkin continue to be valid. The enthusiasm of the young 24-year-old Shuntov and his hard work rightfully gained him the respect of the scientific community. The North Vietnam expedition gave him an opening to regularly study subtropical fish communities. As a young ichthyologist, he benefited from active participation in frequent sea expeditions in different regions (Far-Eastern seas, Southern Ocean). It expanded his biological and oceanographic horizons and gave him an opportunity to look at the structure and functioning of marine ecosystems from different points of view. This proved very useful to him later, when he organized the Laboratory of Applied Biocenology (i.e. Ecology) at TINRO.

Little by little, thousands of marine bird records have been stored from surveys carried out from the Bering Sea to the Southern Ocean, resulting in Dr. Shuntov's widely cited 1972 generalized work on "*Marine birds and biological structure of ocean*". For the first time, marine birds were discussed in relation to patterns of biogeographic and biological structures of the ocean. Based on the surveys, the abundance of marine birds in the World Ocean has been estimated to be 1.5 to 3 billion. In 1973, Shuntov successfully defended his Ph.D. thesis based on this book. In 1974, the work was translated into English.

From 1969 to 1983, Dr. Shuntov stopped going to sea due to health problems, and focussed on writing popular scientific articles and books on the conservation and rational exploration of natural resources. He also worked on long-term fluctuations of the Pacific sardine abundance and found that these fluctuations are related to solar activity and climate-oceanological regime shifts. Based on this work, forthcoming sudden increases of Pacific sardine abundance and their dramatic decline were forecast several years before they occurred.

In 1980, Dr. Shuntov initiated a new program on ecosystem studies of the biological resources of the Far-Eastern seas, which is known in PICES

reports as FES-LIRES (Far-Eastern Seas Living Resources' Studies). His book "*Biological resources of the Sea of Okhotsk*", prepared mainly from archival data, reviewed the results of studies by many other scientists. Numerous scientific questions arose during the review and resulted in Dr. Shuntov's return to sea expeditions. In the 1980s - 1990s, he led seven multi-vessel sea expeditions, and about 30 other expeditions were conducted in the Russian Exclusive Economic Zone by his colleagues who were inspired by his leadership and shared his scientific approach. These inter-disciplinary expeditions involved a wide range of meteorological, hydrological, chemical, trawl-acoustic, and planktonic research in the Russian Far-Eastern seas. The distribution, migration, feeding, and physiology of nektonic organisms were also studied. Data on primary production, bacteria, protozoa, and early fish stages were collected, examined, and processed on board the research vessels in some expeditions. In essence, large-scale monitoring was organized to study conditions of the pelagic and bottom hydrobionts' communities in the Russian waters. The support of many specialists in the Laboratory of Applied Biocenology and Dr. Shuntov's skill at co-ordinating a group of scientists to work on solving important ecosystem problems guaranteed the success of all expeditions.

In that period, Dr. Shuntov's experience helped to develop a greater intuition and better understanding of processes and phenomena in the marine environment. Technical advances also made great strides in research by allowing powerful research vessels to tow large-dimension trawls and recover the nets quickly. All the technical advances created the opportunity to carry out calculations of nektonic and nectobenthic organisms during large-scale and complex surveys. A variety of information on oceanological and hydrobiological environments and their dynamics were synchronously collected. Estimations of the food supply state for fish species were possible owing to the availability and wide application of new methods of zooplankton and fish stomachs sample processing.

During a relatively short term, the composition of pelagic and bottom hydrobionts' communities were defined and quantitatively estimated throughout the Russian Exclusive Economic Zone. In particular, it was found that the potential productivity of the Far-Eastern seas was underestimated by previous research due to the method of data collection and processing. A thorough review of the historical data and literature allowed Dr. Shuntov to derive a model for energy and biomass flow through the Bering and Okhotsk Seas' pelagic ecosystems. His colleagues presented this model, at the PICES Scientific Workshop in Seattle, in 1991, and at PICES Okhotsk Sea Workshop in Vladivostok, in 1995. Based on new data, a large-scale regime shift in the climate-oceanological surroundings and biota of the Far-Eastern seas was predicted several years before it happened. For example, as far back as the 1980s, the following changes in the abundance of fish species were predicted: the "pollock epoch" replaced by the "pollock - herring" in the northern temperate waters and the "Pacific sardine epoch" replaced by the "squid - anchovy" in the southern temperate region.

Based upon a large amount of new information and data on some common fish species collected during the ecosystem studies, Dr. Shuntov, along with his colleagues, wrote and published "Walleye pollock in the Far-Eastern seas ecosystems" and several other articles on the marine life stages of Pacific salmon. Further, they developed a conceptual model of the consequences of the pollock biomass decline in the Far-Eastern seas ecosystem. This model was briefly described in a Russian report at the REX Workshop in October of 1997 (PICES Scientific Report No. 9). It is notable that the differentiation of anadromous Pacific salmon groups migrating to regions of the Far East coast were developed by Dr. Shuntov and his colleagues. At the same time, methods of abundance estimations and terms defining salmon entering the inshore areas were also worked out. Dr. Shuntov resumed marine bird surveys in the 1980s-1990s, during which time whales and dolphins were also recorded.

Despite the considerable number of years spent working hard under a great deal of pressure, Dr. Shuntov always sets aside time in summer or winter, on holidays, to walk many kilometers in the vicinity of Vladivostok. In winter, he feeds the small birds in the forest, and on early summer mornings goes there to hear their hubbub and pipe. In summer, he picks mushrooms, berries and grasses, and goes sport fishing to manage the rhythm of life and cope with the many tasks and problems that are brought daily to him at work. He is a unique asset of TINRO, as one can discuss with him scientific issues, problems of sorrow and grief and ask for worldly advice. In prolonged expeditions at sea, Dr. Shuntov always finds a word, serious or humorous, to support tired colleagues. Once, during some free time in the last months of a strained cruise, he used a deck of cards to tell the fortunes of his colleagues. His lively mind, quickness and gumption allowed him to interpret any card combination in the most optimistic manner. Knowing his colleagues' characters and anxieties, he successfully understood the most sensitive chords of their beings. At the end of the evening all had regained their good spirits.

Since he has been at TINRO, Dr. Shuntov has never said no to a scientist who asked him to be his scientific supervisor. More than 40 Ph.D. theses were prepared under his supervision. "Follow me", and "Only one who keeps going will reach his destination" are the main mottoes that he suggests to people working with him. Just as a squadron leader pilots a team of airplanes in intricate formations, Dr. Shuntov is distinguished among the researchers as a forerunner in his field.

Dr. Shuntov often expressed regret among his colleagues that he did not establish his own scientific school. Of course, he means a "classical" scientific school, where the majority of students, scientists and technicians work under the direct supervision of a leader on the same general objectives.

Dr. Shuntov's favorite outdoor activities: hunting, strolling with his grandson, playing soccer.

However, as the situation turned out, Dr. Shuntov's younger colleagues were keenly sought to fill key positions in the fisheries and academic institutions in the Russian Far East and are carrying on research using his scientific principles, approaches and methods.

His zest for life still strong, Dr. Shuntov enjoys playing soccer, where he "works" with younger colleagues. If you see Dr. Shuntov on the soccer field, his place is where the action is, striving to be the victor. Mostly, he plays forward position, or goalkeeper if the regular goalkeeper is absent. It is impossible to calculate the number of goals he has scored during his "soccer career".

Dr. Shuntov has enormous personal charm and intelligence that attracts others to him like a magnet. However, he is a rare guest at meetings or symposia due to his character and depth of scientific understanding. As he says, "he does not fly in flocks". As an individualist and a conservative man, he changes his surroundings with difficulty, except when at sea where he is confident. In new and unaccustomed places he feels emotional discomfort. The lifestyle he has developed during these many years is to avoid scientific gatherings, but to always be aware of new ideas. Administrative appointments and positions proposed to him on many levels are also alien to him. "As an unpretentious hard-worker in science", all his energy is directed towards the realization of his scientific goals. For him reading a large number of published papers (including English papers) replaces the personal contacts with researchers, although, he never denies meeting with a guest visiting TINRO.

Dr. Shuntov's working day begins at 7:30 when he arrives at the institute and continues until after midnight at home. Often he continues to work during holidays and vacations. Despite the rigorous work schedule, he finds time for public activities. He is a member of the editorial board of two leading Russian scientific journals on marine and fish biology ("*Russian Journal of Marine Biology*", and "*Journal of Ichthyology*"), and is a member of two Specialized Councils conferring scientific degrees. He also continues to study marine birds, whales, and squids in his leisure time. He remains a propagandist of scientific knowledge on marine nature and sea animals. Besides his several popular books, for more than 10 years Dr. Shuntov has worked as chief editor of collected papers for a popular scientific series called "*Humankind and the Ocean*". His last popular book is devoted to marine bird "professions" (i.e. ecological specialization) in the World Ocean. He tells about

the behavior, ecology, and migrations of this animal group, closely related to the sea, with great sympathy and warmth in a fascinating manner.

Regarding future plans for this extraordinary man, Dr. Shuntov is trying to summarize all his work and experience in science. Several years ago he wrote a polemic book of memoirs "*Zigzags of Fisheries Science*" but has not exhausted this theme. Currently his main task is considering a generalization of stored knowledge on the Far Eastern seas biota (he has no time or interest to do the same kind of book on the overall Pacific). In late 1998, the first volume of the monograph "*Marine birds of the Far-Eastern seas of Russia*" was published. At the same time the first volume of a generalized work "*Fundamentals of biological productivity of the Far-Eastern seas of Russia*" was completed. The following volumes will be put together soon. Going to sea will continue to be Dr. Shuntov's plan for the future.

With colleagues from the Laboratory of Applied Biocenology at the Pacific Research Institute of Fisheries and Oceanography (TINRO), Vladivostok, May 1995.

This article is written by Drs. Elena Dulepova (indicated on photo by red arrow), Vladimir Radchenko (blue arrow) and Olga Temnykh (green arrow) in appreciation and recognition of Dr. Vjacheslav Petrovich Shuntov's outstanding service to the Pacific Rim scientific community over many years. The authors are working under the leadership of Dr. Shuntov over dozens of years.

At the time of the publication of this newsletter, Dr. Shuntov was still in the hospital. We sincerely wish him a speedy recovery.

(cont. from page 19)

A generic table was prepared of the ecosystem components and conditions for which information is desired:

- *Ecosystem components*: Top predators, commercial finfish, forage and nekton, benthos, zooplankton, and phytoplankton;

  Desired information: Abundance and distribution; reproduction, recruitment, growth; ecosystem role; causes of mortality.

- *Ecosystem conditions*: nutrient chemistry; temperature, salinity, dissolved oxygen; ocean velocity field; atmospheric forcing;

  Desired information: Magnitude and distribution, causes of variations.

The scope of an actual monitoring program will depend on which of these classes are already adequately monitored regionally, which are most salient for the recognized problems of the region or system, and which can be incorporated in a designed monitoring program at acceptable cost and using available technology. A vital monitoring base should be in place in all coastal states to which selected measurements can be added as appropriate. This base should include:

- coastal station measurement of sea level, surface temperature and salinity, winds, and atmospheric pressure;
- general knowledge of occurrence and life history of major marine species;
- measures of catch, effort, and size frequency distribution of major commercial species.

Panelists are to provide more detailed specification of monitoring needs in regions with which they are most familiar.

It was proposed to test the concept of monitoring, analysis, and prediction in several well-sampled regions where significant ecosystem changes such as regime shifts have been observed. In such regions one could ask to what extent ecosystem changes could have been predicted from the observed variables. Could predictability have been improved if additional or different variables had been monitored? Was inadequate predictability a consequence of inadequate monitoring, inadequate analysis, or inadequate understanding? Proposed locations for these retrospective experiments include Baltic Sea, CalCOFI area, Japan Sea/East Sea, Northwest Atlantic demersal stocks, Northeast Atlantic, Benguela, and Black Sea.

The Panel will meet again in Montpellier, France, March 22-23, 1999. Members from the PICES area include Michael Laurs (Hawaii), Daniel Lluch-Belda (Mexico), Takashige Sugimoto (Japan), Chang-Ik Zhang (Korea), Warren Wooster (USA).

GLOBEC Canada: who we are, what we've been doing, and where we're headed

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David L. Mackas (green arrow in Fig. 1) is a biological oceanographer and zooplankton ecologist working for the Canadian Department of Fisheries and Oceans at the Institute of Ocean Sciences, Sidney, B.C. His research is mainly focussed on the distribution and dynamics of zooplankton population in the coastal and oceanic waters of the North Pacific. R. Ian Perry (red arrow in Fig. 1) is a fisheries oceanographer, also with DFO, and is based at the Pacific Biological Station, Nanaimo, B.C. He is interested in oceanographic influences on the distribution and recruitment dynamics of key commercial finfish and invertebrate population in the North Pacific. Both are members of the GLOBEC Canada Scientific Steering Committee

GLOBEC Canada has been underway as a funded national program since June 1996. Planning activities date back to 1992. This report gives a brief update on our present program objectives and Pacific-based participants and activities. All of these are almost set through early in the year 2000. But we are now slightly past the mid-point of our first four-year proposal cycle, and are starting to plan for the next cycle. So at the end of the report, we will also attempt to predict what CGLOBEC Phase II might look like, and how we might fit with PICES CCCC in the next millenium.

Fig. 1 Team photo taken during a May 1998 CGLOBEC research cruise off Vancouver Island. Authors indicated by arrows. (front row L-R) S. Harris, D. Varela (both UBC), R. Shippe (UCSB), L. Lee (UBC), B.-W. Lu (UVic), D. Tuele, S. Romaine, D. Yelland (all IOS); (back row L-R) Perry, Mackas, D. Moore (IOS), J. Olson (UBC), H. McLean(UBC) , I. Beaudet (UVic), B. Minkley (IOS), M. Bentley (CWS), and R. Veefkind (UVic). Codes for affiliations: IOS=Institute of Ocean Sciences, PBS=Pacific Biological Station, UBC=University of British Columbia, UVic=University of Victoria, CWS=Canadian Wildlife Service, UCSB= University of California, Santa Barbara

History and Structure

GLOBEC Canada forms the Canadian contribution to GLOBEC International (GLOBEC.INT), and to the PICES CCCC and ICES CCC programs. Shared planning history among these, and with other national GLOBEC programs, will make many aspects of our program familiar to PICES Press readers. Like other GLOBEC programs, our overall goal is improved understanding of how marine ecosystems respond to interannual to interdecadal changes in ocean climate. A conceptual framework for these interactions is shown in *Fig. 2*. Of course, there are many specific ways in which oceanographic conditions and processes can affect organisms. In CGLOBEC, we have emphasized subsets that are particularly important in oceanic and continental margin waters off Canada. These include:

- Importance of seasonality and timing match between critical physical and biological events (shifts in these are likely to be among the strongest "climate change" signals).
- Amount and timing of freshwater inputs, and effects on physical mixing and transport patterns.
- Importance of advective coupling among continental shelf banks and basins and between the open ocean and continental margins.
- Interaction between zooplankton and fish populations.

Some of our program structure has been conditioned by our geography. Canada is a very large country with long coastlines but a relatively small population and economy. Marine science expertise is split among several regional centers. To allow the most complete use of these resources, we have made several choices:

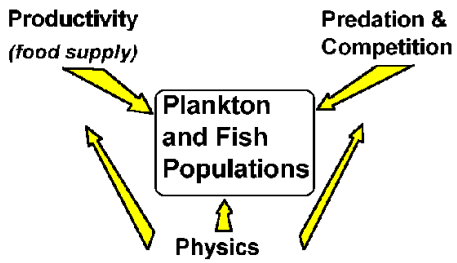

Fig. 2 Conceptual diagram of variables and interactions being examined in GLOBEC Canada.

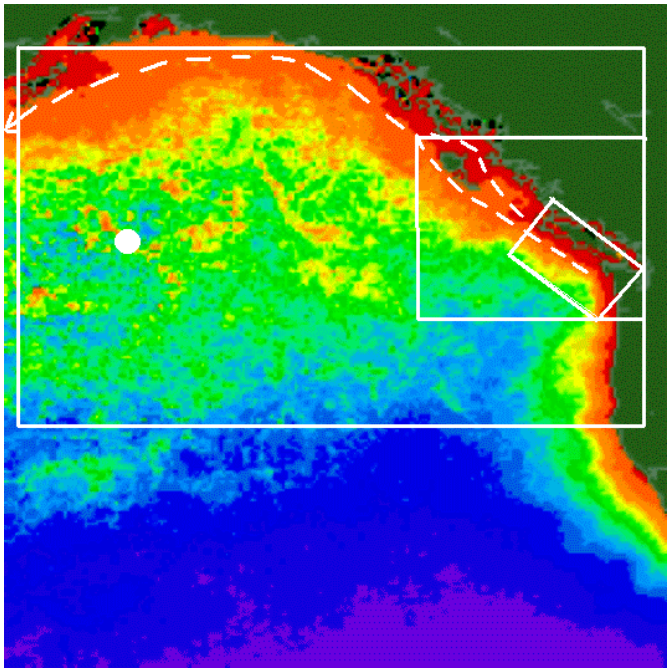

Fig. 3 Spatial hierarchy of GLOBEC Canada study areas in the NE Pacific (white borders) superimposed on a CZCS composite image of ocean color (courtesy NASA, red = high chlorophyll, blue= low). Dashed white line shows typical outmigration path of juvenile salmon; the large white dot shows the location of Ocean Station P.

(1) We designed our program as a partnership between government laboratories and universities. Research funding comes from both the Department of Fisheries and Oceans and the Natural Sciences and Engineering Research Council; leadership of component projects is evenly split between DFO and university-based scientists.

(2) Research topics and expertise are strongly multidisciplinary, designed from the start as mixed teams of physicists, biological oceanographers, and fisheries biologists.

(3) We work in both the Atlantic and the Pacific.

(4) Although we combine retrospective and on-going time series with field process studies and integrative numerical models, we have not included major expenditure on instrument development.

Pacific Ocean Science Activities and Results

CGLOBEC study areas are spatially nested in both oceans, but especially so in the Pacific (*Fig. 3*). This hierarchy allows us to examine (and, we hope, to integrate) the importance of variability at scales ranging from the entire Alaska Gyre to individual bathymetric features such as banks and shelf-edge canyons. These different scales are highly interconnected. Each has important, seasonally variable, and physically-driven exchanges of nutrients and plankton with its surroundings. Each also contains large populations of migratory fish. In particular, Pacific salmon integrate, over the course of their life cycle, the consequences of ocean physical and biological processes occurring in both coastal and offshore regions. Our most intensive sampling and modelling efforts are focussed on the continental margin off Vancouver Island (*Fig. 4*).

Table 1 lists titles and investigators for the 8 CGLOBEC projects in the Pacific (additional 7 projects are underway in the Atlantic). Additional information on individual projects is available from the GLOBEC Canada web site: http://www.globec-canada.mun.ca. As indicated in the table, there is a mix of modelling, retrospective, ongoing time series, and field process study approaches. The variables being examined in greatest detail include currents and winds, temperature and salinity, nutrient concentrations, mesozooplankton (especially euphausiids and large calanoid copepods), and pelagic fish (especially salmon, hake, and herring).

The 1990s have been an exciting decade to be making these observations, because off B.C. it has witnessed the major 1997-98 El Niño event, and a continued trend in oceanic waters toward stronger stratification and summer nutrient depletion. What have we learned so far? Highlights include a variety of new evidence that NE Pacific ecosystems are strongly variable at interannual to decadal time scales. For example, since the mid 1970s, ocean growth rates of salmon have decreased significantly and the seasonal peak of zooplankton biomass has moved earlier in the year by more than a month (see Perry et al. article in PICES Press Vol. 6, No. 1). From both models and field observations, we are also learning much more about spatial and timing interactions between wind and current patterns, bathymetry, and biological distributions. We are learning that shelf-edge submarine canyons are important sites for vertical nutrient supply, and for aggregation of both zooplankton and fish.

Plans for the future

CGLOBEC goals and activities will evolve, particularly as we enter our next funding cycle. An evening meeting to discuss future directions took place during PICES VII in Fairbanks, and was well-attended by both Canadians and participants in other GLOBEC programs.

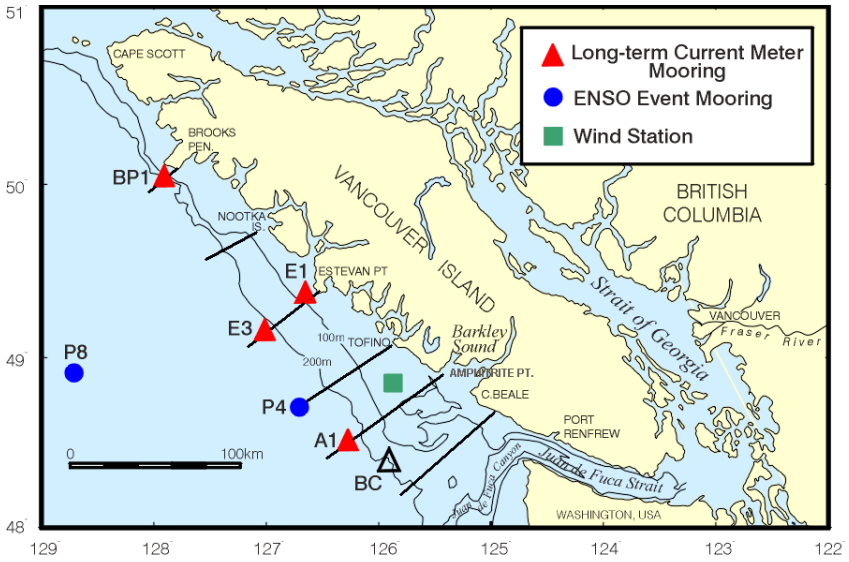

Fig. 4 Detail of CGLOBEC sampling on the Vancouver Island continental margins (the smallest box in Fig. 2). Thick black lines show standard hydrographic and plankton survey lines, triangles show multi-year moorings, circles show moorings added during the 1997-98 ENSO event. Open triangle shows location of Barkley Canyon moorings and surveys (Allen et al. project).

Table 1. GLOBEC Canada projects in the northeast Pacific. Project lead investigator is listed first, others in alphabetical order. Affiliations as in the group photo above, plus AES= Canadian Atmospheric Environment Service. Under type of research, M = modelling, R = retrospective analysis, T = on-going time series sampling, P = process study, I = instrument development.

Project title	Principal Investigators	"Type" of research	Spatial scale
Biophysical modelling for the western continental margin of Vancouver Island	M. Foreman (IOS), D. Ware (PBS), R. Thomson (IOS), P. Harrison (UBC)	M	Vancouver Island shelf and slope
Effects of current patterns on primary productivity, zooplankton, and feeding by fish	S. Allen (UBC), M. Foreman (IOS), P. Harrison (UBC), D. Mackas (IOS), I. Perry (PBS), R. Thomson (IOS), M. Whiticar (UVic)	P	Vancouver Island shelf and slope
State-of-the-ocean time series	R. Thomson (IOS), B. Hargreaves (PBS), P. Harrison (UBC), K. Hyatt (PBS), D. Mackas (IOS), G. McFarlane (PBS), I. Perry (PBS), R. Stull (UBC), D. Ware (PBS)	T, R	Vancouver Island shelf and slope
Hindcast models of currents and temperatures along the B.C. continental margin	W. Crawford (IOS), P. Cummins (IOS), M. Faucher (AES, UBC)	R, M	full BC continental margin
Gulf of Alaska zooplankton	S. McKinnell (PBS), D. Mackas (IOS)	R, T	Alaska Gyre
Ocean effects on salmon growth	D. Welch (PBS), I. Perry (PBS)	R, T	continental margin, Alaska Gyre
Coupled ocean general circulation and foodweb model	W. Hsieh (UBC), K. Denman (IOS)	M	entire North Pacific
Migratory behaviour of salmon: ultrasonic tagging	C. Hawryshyn (UVic)	I	continental margin

The final choice(s) of direction will be decided by a combination of investigator interest, funding agency priorities, and external review. But from this and similar meetings at other venues, we (Mackas and Perry) forecast that the central scientific theme for CGLOBEC Phase II will become something like "decadal shifts in ecosystem structure". CGLOBEC will probably continue to be a two-ocean program, with cross-region comparisons of east coast and west coast ecosystems. In the Pacific, we also anticipate very close collaborative and comparative links with the U.S. and Japan GLOBEC programs. Our own geographic focus in the Pacific may shift or expand to include more work further north along the B.C. continental margin. "Target species" emphasis will probably remain similar to the present balance.

The Ocean Carrying Capacity Research Program (OCC) at the Alaska Fisheries Science Center, Auke Bay Laboratory, Juneau, Alaska

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Dr. Helle was appointed Program Manager for the Ocean Carrying Capacity Program in 1996 at Auke Bay Laboratory. His research history at the Auke Bay Laboratory started as a seasonal employee in 1958-59, studying age and size at maturity of chum salmon in Prince William Sound. He began his full-time career as a fishery research biologist at Auke Bay Laboratory in 1960, studying the success of intertidal spawning pink and chum salmon in Prince William Sound. His research on age and size at maturity continued and expanded in the early 1970s to include chum salmon throughout their range in North America. Dr. Helle directed research on genetic stock identification at Auke Bay Laboratory in the 1980s to mid 1990s and this research was coordinated with other researchers in California, Oregon, Washington, British Columbia and Alaska. This genetic research was expanded to include cooperative genetic stock identification research with groups in Russia and China. He has been active on technical committees within the U.S./Canada Pacific Salmon Treaty and the North Pacific Anadromous Fish Commission. He received his B.S. (1958) and M.S. (1961) degrees in Fishery Management from the University of Idaho, spent a year as an Honorary Research Fellow (1964-65) at Marischal College, University of Aberdeen, Scotland, and completed his Ph.D. (1979) degree in Fisheries Science at Oregon State University.

After the ocean regime change of 1976-77, salmon (*Oncorhynchus spp*.) catches increased greatly in Alaska (*Fig.1*). Salmon catches also increased after the regime change in Japan and Russia. However, salmon on both sides of the Pacific Ocean started to decline in size at maturity about 1980, and continued to decline through 1994. Data from chum salmon *(O. keta*) from 1972-98 at Fish Creek, near Hyder, Alaska, exemplify this decline in size (*Fig. 2*). Chum salmon and other species of salmon matured at older ages during this time. These changes in size and age at maturity associated with large increases in salmon abundance provided evidence for an inverse relationship between body size and abundance of salmon in the Pacific Ocean. Responding to this evidence, the North Pacific Anadromous Fish Commission (NPAFC) called for research on the "critical issue of the impact of change in the productivity of the North Pacific Ocean on Pacific salmon" by studying factors affecting 1) current trends in ocean productivity and their effects on salmonid carrying capacity, and 2) changes in the growth, size at maturity, oceanic distribution, survival, and abundance of Pacific salmon.

The Ocean Carrying Capacity (OCC) Program at Auke Bay Laboratory was formed in 1995 to specifically address the NPAFC concerns. The OCC Program coordinates its research activities with NPAFC, Canadian Department of Fisheries and Oceans (DFO), Alaska Department of Fish and Game (ADF&G), the North Pacific Marine Science Organization (PICES), U.S. Global Ocean Ecosystems Dynamics (U.S. GLOBEC), the Pacific Salmon Commission (PSC), and the Exxon Valdez Oil Spill Trustee Council (EVOS).

The OCC research strategy has three major components: 1) distribution and migration of juvenile, immature, and maturing salmon and associated marine species in coastal and offshore waters, 2) monitoring studies, and 3) retrospective studies.

Distribution and Migrations of Juvenile, Immature, and Maturing Salmon and Associated Marine Species in Coastal Waters

The major objectives of this research component of the OCC Program are 1) to learn the ocean migration patterns and distribution of juvenile, immature, and maturing salmon, 2) to examine variability in these migrations due to species and

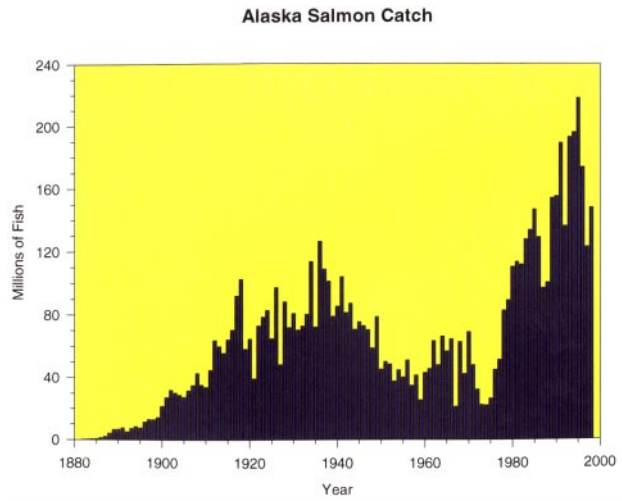

Fig. 1. Catch of all species of salmon in Alaska from 1880 through 1998 (data from Alaska Department of Fish and Game).

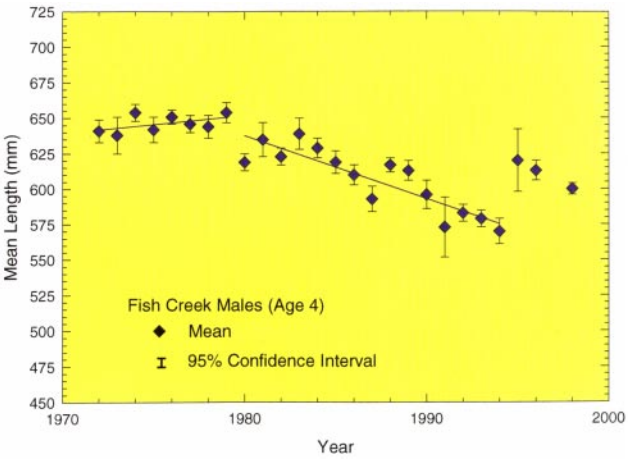

Fig. 2. Mean length and 95% confidence interval for age-4 male chum salmon spawners at Fish Creek, 1972-98. Length measurement is mid-eye to end of hypural plate. Escapement in 1997 was insufficient to obtain samples.

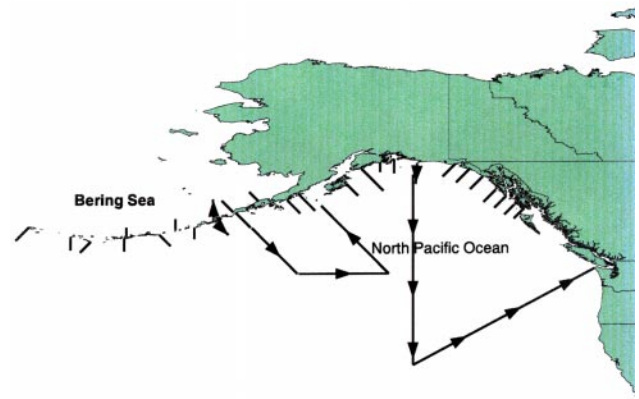

Fig. 3. Habitat types fished on coastal transects from the chartered F/V Great Pacific in 1996-98.

stock differences, 3) to identify the major food items of salmon at sea, and 4) to examine how growth and survival of salmon at sea relates to ocean environmental conditions.

Salmon are captured at sea mostly from a chartered fishing vessel built for trawling. Other government vessels of opportunity are also used, e.g. the NOAA research vessels *(R/V) Miller Freeman* and *John N. Cobb*, and the Canadian *R/V Ricker.* A large trawl towed near the surface has proved effective for sampling, especially juvenile and immature salmon. The trawl is towed through four habitat types from near shore to beyond the edge of the continental shelf-nearshore, shelf, slope, and oceanic (*Fig. 3*). Most transects are fished perpendicular to shore and start near shore and extend beyond the continental shelf (*Fig. 4*). Some purely oceanic transects have been fished to locate salmon on the high seas. Transects have been made from offshore of central California to beyond Attu Island in the Aleutian Islands (*Fig. 4*).

Samples of chum, pink (*O. gorbuscha*), and sockeye (*O. nerka*) salmon are retained for genetic stock identification and otolith studies. Samples of all species of salmon and most marine species are sampled for scales, length, weight, condition, and stomach content. Adipose-clipped salmon (primarily coho [*O. kisutch*] and chinook [*O. tshawytscha*] salmon) are retained for coded-wire-tag (CWT) analysis. Conductivity-temperature-depth (CTD) measurements are taken between most tows. In addition, certain transects are identified as oceanographic transects, and plankton are sampled along with CTD measurements from near shore to beyond the continental shelf.

The "heat marks" recorded on the otoliths of chum and pink salmon by changing incubation temperatures in hatcheries in Alaska and British Columbia have turned out to be a good source of growth and stock identification information. We have captured hatchery fish with these marks in surprising numbers offshore (*Fig. 5*). We have also captured much smaller numbers of heat-marked otoliths from sockeye salmon from enhancement facilities in southeastern and southcentral Alaska.

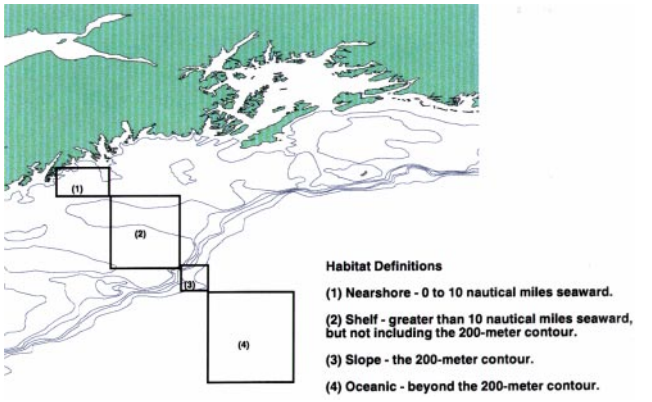

Fig. 4. Transects fished from the chartered F/V Great Pacific in 1996-98. Transects with arrows were fished in April and May 1998. Transects along the coast without arrows were fished in July and August 1996 and 1998.

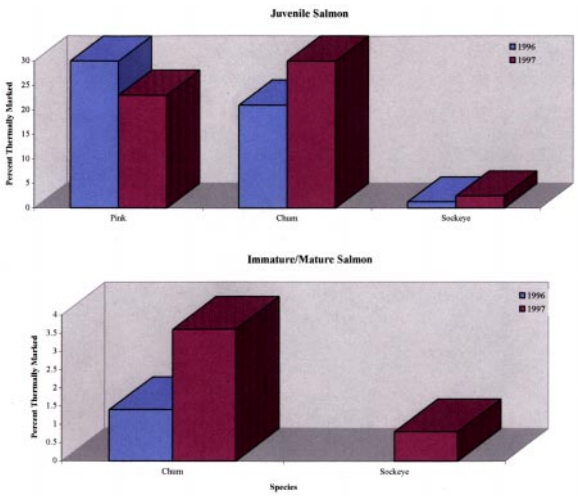

Fig. 5. Percent of otolith-marked juvenile, immature, and mature pink, chum, and sockeye salmon captured during cruises from the chartered F/V Great Pacific in 1996 and 1997.

Distribution and Migration of Immature and Maturing Salmon in Offshore Waters

Cooperative salmon research on the high seas with Japan is contracted by OCC through the University of Washington's Fisheries Research Institute (FRI). This research is also coordinated through the NPAFC. Research is focused on OCC objectives and is accomplished from Japanese research vessels. Activities include sampling salmon for size, age, maturity, condition, and diet. Some salmon are also tagged and released with Petersen disk tags or archival tags to monitor migrations and habitats. Recoveries of archival-tagged salmon in 1998 have shown remarkable variations in daily water temperature experience.

FRI scientists have also developed baseline databases on scale patterns of chum, chinook, and sockeye salmon and use this information to estimate stock origins of salmon captured in the high seas.

Monitoring Studies

Long-term monitoring activities provide data for evaluating the influence of marine climate on the dynamics of salmon and marine fish populations. Abundance and age and size at maturity of salmon are essential information for monitoring studies. Chum salmon populations are of special interest because most of their growth occurs in the ocean and they mature at various ages. OCC monitors the age and size at maturity and abundance of chum salmon in Olsen Creek, on the eastern shore of Prince William Sound; Chilkat and Klehini Rivers, in northern southeastern Alaska; Fish Creek, at the head of Portland Canal in southern southeastern Alaska; and Quilcene National Fish Hatchery, in Hood Canal west of Seattle, Washington.

The OCC has also resumed the operation of the weir at Sashin Creek, in Little Port Walter, on the southern end of Baranof Island. This weir was first operated in the early 1930s and abandoned in the mid 1980s. Pink salmon is the dominate natural species of salmon at Sashin Creek and because of their strict adherence to a two-year life cycle, they provide yearly information on brood abundance.

Retrospective Studies

Understanding the influence of marine climate change on the abundance, age, and size of Pacific salmon in the past is crucial to understanding the present status of salmon populations as well as to our attempts to predict these parameters in the future. The OCC Program is concentrating retrospective research in three areas: 1) examining salmon growth from historical collections of scales, 2) time-series analyses of catch, escapement, and growth of salmon, and 3) reconstruction of salmon abundance from paleoenvironmental analysis of sediment cores from sockeye salmon lakes and anoxic isolated marine bays. Some of these scale studies are contracted, and the sediment core research is contracted with the University of Alaska Fairbanks.

Reconstructing long-term growth patterns from scales is in process for sockeye, chum, and pink salmon. Marine and freshwater scale growth patterns are being reconstructed for sockeye salmon from the early 1900s to the present from Karluk Lake on Kodiak Island and in Bristol Bay from the Kvichak River. Estimating marine growth patterns from chum salmon scales is in process from the early 1970s to the present for populations from the Yukon River, Fish Creek, Chilkat and Klehini Rivers, Olsen Creek (Prince William Sound, Alaska), and Quilcene National Fish Hatchery. Estimating growth from pink salmon scales from the mid-1970s to the present is in process for Auke Creek (near Juneau, Alaska).

Time-series analyses of catch, escapement, and growth data are in process for sockeye salmon populations in Bristol Bay and for other major sockeye salmon stocks in Alaska and British Columbia.

Conclusion

Understanding carrying capacity for salmonids in the Pacific Ocean and the Bering Sea is an enormous task. We have no pretensions about being able to accomplish this goal quickly. However, since the mid-1970s, huge changes in abundance, size, and growth of Pacific salmon have occurred. When I started my career in fisheries science in the late 1950s and early 1960s, I never dreamed we would experience salmon catches again like those that occurred in the early part of this century, but in Alaska in the mid-1980s through the mid-1990s, we greatly exceeded those catches. And it appears that we are again in the midst of changes: catches in Alaska have declined from the peak in 1995, and the mean size of chum salmon has increased since 1995. Biologically, these past 20 years have been increasingly exciting times to study the dynamics of Pacific salmon populations. We have a unique opportunity to attempt to understand these changes in relation to the changing ocean conditions. Hopefully, we are expending enough research effort to obtain the answers we need to anticipate biological responses to future ocean climate changes.

JAMSTEC Research Activities in the Northern North Pacific

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Dr. Masashi Kusakabe received his Ph.D. from Hokkaido University, Japan, in 1980. He worked at the Department of Geological Sciences, University of Southern from 1980 to 1992, studying behaviors of radioisotopes in the ocean. Dr. Kusakabe has been working at the Japan Marine Science and Technology Center (JAMSTEC) since 1992. Now he is Head of the Biogeochemistry Research Group of the Ocean Research Department of JAMSTEC. From 1992 to 1996, the target area of his research was the East China Sea. Although he misses the comfortable weather of the East China Sea, he is ready to proceed to the northern North Pacific.

The northern North Pacific, especially its western part, has been attracting attention of biogeochemists because of its importance in global biogeochemical cycle of carbon and its related substances. In addition, physical oceanographers have been interested in that region with respect to the formation of the North Pacific Intermediate Water. Despite its importance, there has been few systematic surveys to cover the temporal and spatial variation of biogeochemical processes in the area.

The Japan Marine Science and Technology Center (JAMSTEC) began a biogeochemical study of the northern North Pacific and its adjacent seas two years ago. However, the field campaign, which is expected to last at least 5 years, was not started until JAMSTEC obtained the new research vessel *Mirai* ("future" in Japanese) in the fall of 1997. The vessel is capable of winter operations in high latitudes (length of 130 m, gross tonnage of 8600 tons, service speed of 16 knots and capacity of 28 researchers and 18 technicians). She will enable us to fill data gaps in the high latitudes of the ocean.

Goals of the project are:

- To assess the spatial and temporal variation of flux of CO_2.
- To understand the mechanisms that control the biological pump and its role in the carbon cycle.
- To clarify transportation processes of dissolved materials in in relation to the formation of intermediate water.
- To evaluate the fluxes of carbon and other materials carried by particulate matter to the interior of the deep ocean, and their spatial and temporal variation.
- To determine the past change of ocean environments from records in sediments.

Due to the vast spatial and temporal variability of the biogeochemical processes in the northern North Pacific, JAMSTEC cannot be a sole player in the field, but must coordinate with the Japan JGOFS community, especially NPPS (North Pacific Process Study) group. In 1997, a new Ocean Time Series project in the western North Pacific was funded in Japan, which is an intensive study of seasonal and interannual variation of the processes occurring at station KNOT located at 44˚N and 155˚E (see PICES Press Vol. 6, No. 2, p. 32 for details of the project). JAMSTEC will also be one of the key players in the project. In addition, since *Mirai* cruises are open to scientists outside JAMSTEC, our project is inevitably complementary to other projects. In other words, the JAMSTEC project is within the framework of JGOFS and closely related to other on-going projects.

After the *Mirai* was launched in 1997, there were a series of the shakedown cruises until October 1998. The biogeochemistry group of JAMSTEC joined three cruises. Summary of the cruises is shown in *Table 1*.

Table 1. Summary of shakedown cruises.

Cruise	Date	Area	Activities
MR97-02	11/10/97 12/5/97	northwestern North Pacific	• Deployment of sediment traps (3 stations). • Sampling of bottom sediment by a piston corer and multiple corer. • Underway measurement of pCO_2 TCO_2, and nutrients in the surface water. • Hydrocasts at 13 stations for carbonate species, nutrients, DO, ^{14}C, radioisotopes (^{234}Th), trace metals (Fe), etc.
MR98-05	7/06/98 | 7/24/98	northwestern North Pacific	• Recovery and re-deployment of sediment traps. • Sampling of bottom sediment by a piston corer and multiple corer. • Hydrocasts at 4 stations for carbonate species. • Underway measurement of pCO_2, TCO2
MR98-06	7/30/98 | 9/10/98	northern North Pacific, Bering, Chukchi and Beaufort Seas	• Underway measurement of pCO_2, TCO2, and nutrients in the surface water • Hydrocasts at 25 stations for carbonate species, nutrients, DO, ^{14}C etc.

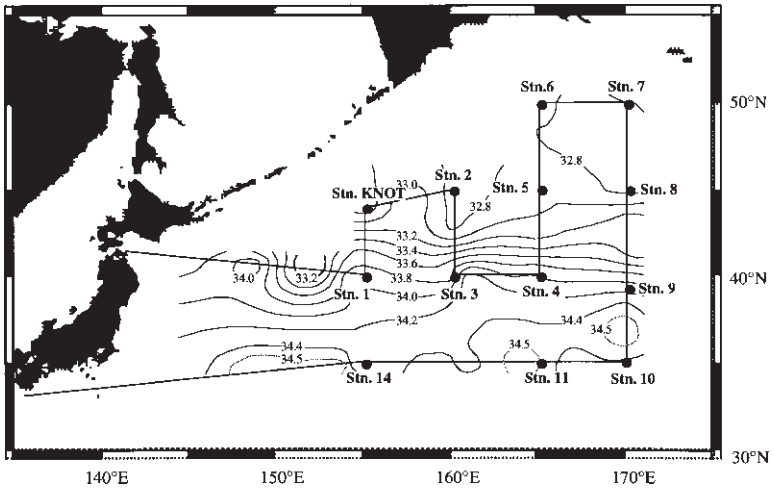

Fig. 1 Distribution of salinity in the surface water along the cruise track and sampling stations in Nov.-Dec., 1997 (MR97-02).

All the observations listed in the table were carried out by JAMSTEC scientists. During the shakedown cruises, we not only tested equipment on board and trained ourselves and technicians, but also carried out a reconnaissance survey in the northern North Pacific.

During the first cruise (MR97-02) in 1997, we occupied 13 stations for hydrocasts (*Figure 1*). In addition, sediment traps were deployed at three stations and bottom sediments were collected. Working in the northern North Pacific in November, the *Mirai* proved to be operable in rough weather. The following are some results obtained during the cruise:

The survey area has clear latitudinal variation. *Figure 2* displays a T-S diagram for all the stations occupied. Water mass structure in the region has three distinct characteristics: (1) the subarctic zone (Stns. 2, 5, 6, 7, 8, KNOT) (2) transition zone (Stns. 1, 3, 4, 9) and (3) subtropical zone (Stns. 10, 11, 14). Chemical constituents also change accordingly. Vertical profiles of nutrients and carbonate species such as alkalinity and total CO_2 show a downward increase with significant influence of upwelling in the subarctic region (see nitrate + nirite profiles in *Figure 3* as an example).

Distributions of atmospheric and surface seawater pCO_2 in latitudes 35˚N - 50˚N along the 170˚E meridian are shown in *Figure 4*, together with the distribution of sea surface temperature (SST), salinity and wind speed. Surface seawater pCO_2 generally increases northward while SST and salinity decrease. In addition to the overall tendency, meso-scale variability of surface seawater pCO_2 was also found. Surface seawater pCO_2 reveals up-down fluctuations associated with SST and salinity in latitudes 38˚N - 44˚N, where the Kuroshio and Oyashio meets (Interfrontal Zone). In fact, surface seawater pCO_2 in the area is well formulated by a multiple linear regression equation with SST (T) and salinity (S) (see *Figure 4*). Thus the meso-scale variability in surface seawater pCO_2 can be attributed to water mixing by the currents. The area south of 45˚N acted as a sink for atmospheric CO_2, while surface seawater pCO_2 in the latitudes north of 45˚N was almost in equilibrium with the atmosphere.

The second cruise (MR98-05) was mainly focused on the sediment trap recovery and redeployment, and bottom sediment sampling (*Table 1*). The sediment traps were successfully recovered and redeployed. Most of the cores taken by a piston corer were more than 15 m in length. The longest one was approximately 17 m (a Japanese record!).

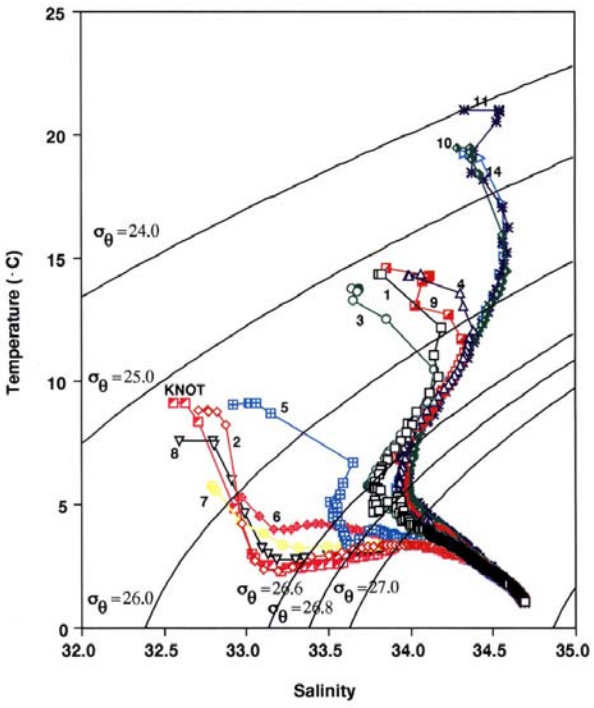

Fig. 2 T-S diagram (MR97-02 cruise). Numbers represent stations.

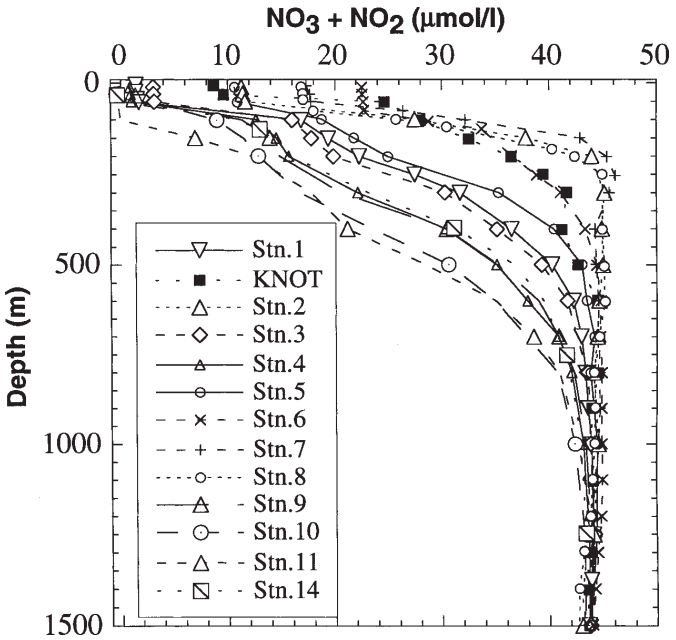

Fig. 3 Vertical distributions of nitrate + nitrite (MR97-02). Data provided by Dr. C. Saito.

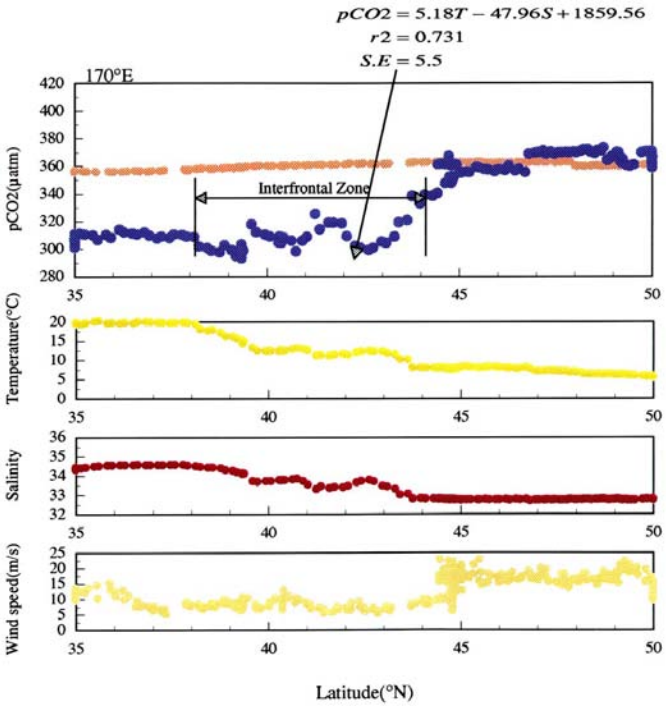

Fig. 4 Latitudinal distribution of pCO_2, surface temperature, surface salinity and wind speed along the 170˚E line (MR97-02). Data provided by Dr. A. Murata.

Since then, we have been working hard to decipher chemical and biological codes embedded in the sediments, though it may take years to clarify the paleoenvironment of the high latitude seas.

In the summer of 1998, surface seawater pCO_2, SST, salinity and wind along the transect from Japan to the Arctic Seas were measured (*Table 1*). The results are displayed in *Figure 5*. During the observations, the research vessel was moving northeastward from 45˚N to 50˚N, and surface seawater pCO_2 was measured with a new membrane-type equilibrator and alternately with a traditional shower-head-type one. As found from *Figure 5*, the pCO_2 values by the membrane-type equilibrator followed the values by the shower head-type. This successful measurement by the new equilibrator encourages us to detect meso-scale variations in surface seawater pCO_2, because the membrane-type equilibrator has a shorter equilibrium time. A distinct feature of the pCO_2 distribution during the summer cruise was that surface seawater pCO_2 was extremely high (frequently greater than 400 µatm) in longitudes from 162˚E to 177˚W along latitudinal zones of 45˚30'N - 47˚30'N. Since the atmospheric CO_2 was about 355 µatm during the cruise, the area acted as a source for atmospheric CO_2. Historical data (e.g., T. Takahashi's data by volunteer ships) revealed that summer surface seawater in the subarctic North Pacific Ocean is undersaturated with atmospheric CO_2 due to biological utilization. Therefore the situation observed in the summer of 1998 is unusual. We speculate that

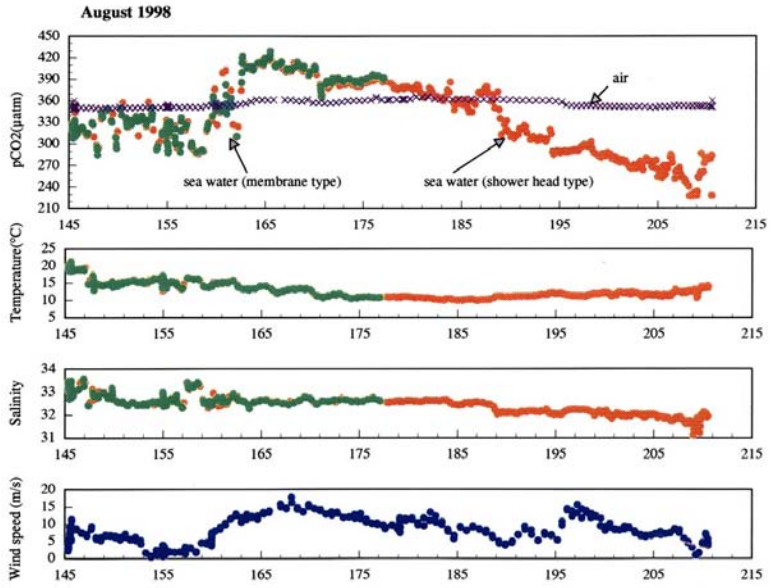

Fig. 5 Longitudinal distribution of pCO_2, surface temperature, surface salinity and wind speed along the 45-50˚E line in Aug. 1998 (MR98-06). Data provided by Dr. A. Murata.

the extremely high surface seawater pCO_2 caused by: (1) weak biological activity due to lack of sufficient light; and (2) mixing of surface water with subsurface water by atmospheric disturbance. The first speculation comes from the consistent cloudy weather during the cruise. High wind speeds may have raised subsurface waters rich in CO_2 into the sea surface layer.

From November 1998, the cruises will be in full swing. In addition to JAMSTEC scientists, scientists from elsewere will join the cruises. Cruise plans have been made based on the results obtained during the shakedown cruises. Summary of the future cruises relevant to the biogeochemical study is shown in *Table 2*, which includes research that will be done by JAMSTEC scientists and "outside" scientists as well. The participants for cruises in 1998 and 1999 were already selected. However, participants and details of cruises from May 2000 are yet to be determined. JAMSTEC will invite applications for the cruise in the spring of 1999 and the application dead line will be the summer of 1999. Application procedure can be found at http://www.jamstec.go.jp/.

The JAMSTEC research activity in the northern North Pacific has just begun. By utilizing the *Mirai*, we (and I believe the whole Japanese scientific community too) are looking forward to doing research on a long term basis in the area, and hopefully in the Okhotsk and Bering Seas. ***Mirai is our future.***

Table 2. Summary of future cruises.

Cruise	Date	Participants	Activities
MR98-K1	11/2/98 12/16/98	26 scientists and students (9 research groups from 4 research institutes and 4 universities)	(1) Hydrocasts (DO, nutrients, carbonate species, ^{13}C, ^{14}C, chlorophyll, trace metals, gases, radioisotopes), (2) Underway measurements of surface pCO_2, T, S, nutrients, TCO_2, (3) Bottom sediments, (4) Drifting sediment trap, (5) Aerosol sampling, (6) Primary productivity, (7) Plankton, (8) XBT and XCTD, (9) CTP-ALACE Float
MR99-K2	5/2/99 6/1/99	29 scientists and students (9 research groups from 3 research institutes and 3 universities)	(1) Hydrocasts (DO, nutrients, carbonate species, ^{13}C, ^{14}C, chlorophyll, trace metals, gases, radioisotopes) (2) Underway measurements of surface pCO_2, T, S, nutrients, TCO_2, (3) Bottom sediments, (4) Moored sediment traps and drifting sediment trap, (5) Aerosol sampling, (6) Primary productivity, (7) Plankton, (8) XBT and XCTD, (9) CTP-ALACE Float, (10) In situ adsorber (Dioxin, PCB etc)
MR00-K1	1/3/00 2/6/00	22 scientists and students (6 research groups from 2 research institutes and 2 universities)	(1) Hydrocasts (DO, nutrients, carbonate species, ^{13}C, ^{14}C, chlorophyll, trace metals, gases, radioisotopes), (2) Underway measurements of surface pCO_2, T, S, nutrients, TCO_2, (3) Bottom sediments, (4) Drifting sediment traps, (5) Aerosol sampling, (6) Primary productivity, (7) Plankton, (8) XBT and XCTD
MR00-K3	5/8/00 6/9/00	JAMSTEC will invite applications for this cruise in the spring of 1999. Application forms can be found at http://www.jamstec.go.jp/.	

People and Events

At the PICES Seventh Annual Meeting in Fairbanks, PICES Governing Council elected Dr. Hyung-Tack Huh (Republic of Korea) as the new Chairman of the North Pacific Marine Science Organization. We extend our congratulations to Dr. Huh on his new position and look forward to working with him. A detailed biography of Dr. Huh can be found in PICES Press Vol. 6, No. 2 (June 1998).

Dr. William G. Doubleday of Canada is stepping down as Chairman of the North Pacific Marine Science Organization after two years of leadership. He has been deeply involved in PICES from the inception of the Organization as a member of the Governing Council and was elected Chairman at PICES V.

A biography of Dr. Doubleday can be found in PICES Press Vol. 5, No. 1 (January 1997).

1998 was a year of big turnover for PICES. It was time for the simultaneous replacement of the Science Board Chairman and Chairmen of three of four PICES Scientific Committees. For three years those Chairmen have been responsible for planning and implementing activities of the Committees. Having now completed their terms of office, and seen the results coming in, they leave positions with a sense of achievement. Other well-known scientists have been elected at the PICES Seventh Annual Meeting in Fairbanks to succeed them.

Science Board

Dr. Makoto Kashiwai was born as the second son of a Protestant minister. Under the influence of the dream of his father's young days, he was brought up to have a mind of devotion, logical thinking, interest in natural science and seeking after the truth. The religious part of his father's desire was taken up by his elder brother. He first saw the blue sea from the train to a town in Wakayama prefecture where his father was invited to serve in a church, as his former mission was destroyed in a B29 air raid. Swimming was frequently prohibited by the arrival of hospital ships full of repatriating defeated soldiers returning from the south Pacific islands. However, colorful small fishes in the clear blue water and a bubbling helmet diver repairing the wharf were enough to enchant the heart of a boy strange to the blue sea.

The early part of his student days in the Faculty of Fisheries, Kyoto University, was the time of an active student movement against the Japan - U.S. Security Treaty. Those days gave him an attitude of thoughtfulness in confronting history. His spare time and energy was then put into the establishment of the Kyoto University Cruising Club and the building of an open-deck ketch, *Puffinus-II*, converted from a lifeboat. She had to be pulled by oars in the calm and was the best teacher about wind and sea, team and leadership, and the importance of foresight. Then the years of the University Revolution came and the cruises of *Puffinus-II* could not be continued. He traded the joy of sailing with the joy of finding answers to the question of what science should be.

He got married and got a permanent job first at the Ehime University and then at the Kyoto University. As a university assistant he supervised many graduate students, including those left out from the selection by Professors and Assistant Professors, e.g. a quarterback, a kicker or a blues-band freak having poor attendance at the Professors' lectures. As the research boat belonging to the Faculty was only available for short day cruises because of working rules, he introduced a smaller boat, *Shiranami-maru*, classified as equipment and not as a facility, and took students and graduate students on overnight cruises serving as acting-owner/skipper. As the number of his sea-going graduate students increased, he had to lead his research fleet composed of *Shiranami-maru* and boats with inboard and/or outboard motor, by hand signal. In order to make it possible to identify the commander of the fleet from a distance, he made it a rule to wear a red cap, and that still rests on his head now.

His scientific interest is always in the dramatic and dynamical aspects of the nature. He was engaged in the study of tidal exchange through field, hydraulic model and theoretical approaches. In his doctoral thesis, the mechanism of tidal exchange was elucidated theoretically, but he also proposed a technology of controlling tidal exchange and tidal residual circulation. When he felt that time had come to leave his cadets to a younger leader and to engage in full scale marine science, he left university and moved to the Hokkaido National Fisheries Research Institute and became involved in the fisheries oceanography of the Oyashio. His international travel and experience started in his 50s with the initiation of collaboration on comparative ecosystem model study of the Oyashio shelf and the Vancouver Island shelf with Dr. Dan Ware of the Pacific Biological Station (Nanaimo, Canada).

Dr. Kashiwai has participated in PICES since the inception of the Organization. His first contribution to PICES activity was as the local contact for the PICES Workshop on the Subarctic Gyre held in Nemuro in 1993. He then served as the local contact for the Third Annual Meeting held in Nemuro in 1994 just after a serious earthquake. The legend has it that he struck the desk of the Mayor

pushing for the choice of a venue, in truth, it was another desk. At PICES III, he was appointed as a Co-Chairman of the Steering Committee (now Implementation Panel) for the PICES-GLOBEC CCCC Program, and at PICES IV (Qingdao, 1995), he was elected the Chairman of Science Board. Dr. Kashiwai is now stepping down as SB Chairman, but he plans to continue to be involved in activities of the Organization and enjoy being a PICES scientist.

Ms. Patricia Livingston was born and raised in the Great Lakes state of Michigan sometime during this century. Even in grade school her classmates used to tell her that she was going to be a scientist because of her great interest and budding natural ability in that area. After turning down an admissions offer from the prestigious University of Michigan (about which she still feels some regret) she went as an undergraduate to Michigan State University because of their notable fisheries and wildlife department, intending to major in the warm and fuzzy field of wildlife biology. After two years, however, she decided that there was more job potential in the study of cold and slimy fish and computers, so she changed her major to fisheries and began taking classes in fish biology and ecosystem modeling. She rushed to finish her undergraduate work in three years so that she could get out of school and find a job in the real world - only to find that jobs were somewhat scarce for the baby boom generation. Therefore, it appeared the only option was more school.

Pat decided to move nearer to a larger body of water such as the North Pacific, and study fish population dynamics at the University of Washington. While she worked towards her Master of Science degree, she started part-time work at the U.S. National Marine Fisheries Service (NMFS) research center in the area. Her job involved parameterizing, running and debugging various ecosystem models for areas from the California Current system to the eastern Bering Sea, that were devised by the brilliant curmudgeon, Dr. Taivo Laevastu. She finished her MS degree and obtained a permanent position in the ecosystem modeling group. Over the last fifteen years, Pat has built a solid field and laboratory program within the group to obtain information on groundfish feeding ecology, to properly quantify the food web linkages that are so critical to multispecies and ecosystem models.

During this period, Pat received some exposure to policy analysis and public administration in the director's office of her research center. This initial exposure sparked her interest in this different way of looking at the world and enterprise of science. So instead of following the traditional route of returning to school to obtain a Ph.D. degree in her current field of study, she decided to pursue a Master's degree in natural resources policy and administration. This degree serves her well in her present position as Head of the Resource Ecology and Ecosystem Modeling Program and in her involvement in science planning and coordination activities at NMFS and PICES.

Pat is still active in the field of modeling and has made advances in quantifying and incorporating predation into single-species, multispecies, and ecosystem models of the eastern Bering Sea and Gulf of Alaska. She has two children, ages 5 and 7, who know that their mom studies fish and that her favorite fish is walleye pollock. Her supportive husband is an associate research professor of biostatistics at the University of Washington. In her spare time, she plays soccer and is an avid reader of science fiction. In addition to her involvement in PICES, Pat has been an active member of several scientific societies, including the American Fisheries Society, the Association for Women in Science, and the American Institute of Fishery Research Biologists.

Pat has been involved in several aspects of PICES in the last few years, beginning with a brief appointment to the Bering Sea Working Group near the end of its work, and going on to be a CCCC Model Task Team member and Co-Chairman for CCCC-IP. At PICES VII she was elected the new Chairman of Science Board.

Physical Oceanography and Climate Committee (POC)

Dr. Paul H. LeBlond served as a member of POC since the inception of PICES and was elected Chairman of the Committee at PICES IV.

Paul was born in Québec City in 1938 into a medical family: his father, his maternal grandfather and a couple of uncles were physicians. He first followed the path, which would have made him one too, but lured by science, he went to McGill University to study Mathematics and Physics. Having then discovered that one could be a physicist and study the ocean, Paul moved to the other end of Canada to do so and met the Pacific Ocean, with which he has had a long and satisfying relationship. His studies at the University of British Columbia (UBC) continued until his retirement in 1996. In the mean time, he went from being a student, to a professor, to an administrator, and learned a lot about people in addition to oceanography.

Like many young physicists, Paul was first enamoured by mathematics and often gave as much attention to symbols as to facts. Waves in particular held his interest for many years. He taught courses in them, wrote a big book on ocean waves (with Lawrence Mysak), and never got tired of watching them on the beach, admiring arrested undular bores and getting his face swamped while

examining capillary waves on the front face of breakers.

Paul took on graduate students with a wide variety of interests and on his expression "learned at least as much from them as they did from me". In later years, he got interested in the influence of ocean properties and currents on fish migrations and learned a lot about salmon, cod, fishermen and their lives.

All through his life, Paul struggled with reconciling his many interests with the finite number of hours in a day. Early interests in sea-monsters culminated in the creation of the B.C. Scientific Cryptozoology Club and an international correspondence with similarly eccentric searchers. Patience in the face of long-windedness earned him respect in a variety of scientific and administrative fora. He got to be so busy with his inability to say no to anything interesting that he had to retire from his job at UBC in order to make room for the rest of his life.

So, there is still PICES, the Pacific Fisheries Resource Conservation Council, the Science Advisory Council of the Department of Fisheries and Oceans, etc.... For his sins, Dr. LeBlond is also President of the Canadian Ocean Frontier Research Initiative, a foundation that fosters the creation of partnerships between government, industry and academic scientists. Running away from Vancouver to live on Galiano Island has led him into the Boards of the local Conservancy Association, Museum Society, and the Access to Media Education Society.

Dr. Vyacheslav (Slava) B. Lobanov began to realize the importance of oceanography and marine ecosystem studies probably in his early years while trying to catch a big fish on the banks of Neva River in Leningrad (USSR) in the late 1950s. After a decade of seasonal experiments with ice by skating, jumping, falling through and floe sailing on the way back from school, he finally decided to go to deeper water and faraway seas. He entered the Department of Oceanography of the Leningrad University and graduated in 1977. It was a period of large-scale field experiments in the USSR such as Polygon, Polymode, Polex etc. During these hydrographic cruises, Slava received lots of experience in the stormy Greenland Sea.

After his graduation, he kept thinking the more water the better and moved to the Far East where he was hired as assistant researcher at the Pacific Oceanological Institute, a 4 year-old institute of the Academy system. Young enthusiastic people, 3-4 month long cruises to exotic seas from Kamchatka to Australia and from California to the Mediterranean, and hot discussions in the cabin on various oceanographic ideas kaleidoscoped around him. However he was focused on synoptic/mesoscale phenomena, being impressed by their energy and strong will to live.

He found, with his colleagues, large anticyclonic eddies permanently existing in the Kuril area, influencing water exchange between the Okhotsk Sea and the Pacific, local water mass modification and the structure of the western subarctic gyre. He also organized and analyzed long-term observations of the Kuroshio warm-core rings evolution. These results were included in his doctoral thesis. He also worked on the oceanographic application of satellite remote sensing data of optical and microwave bands.

In 1995, Slava accepted the position of Deputy Director of POI and most of his time became occupied by administrative work. In his spare time, he likes to fix his car and drive in the countryside to think about global ecosystem problems, and pick mushrooms with his 16 year-old daughter. His wife is an architect and designer, and sometimes consults him on figure design for presentations.

Slava joined PICES in 1993 at the Nemuro Workshop on Subarctic Circulation when he was involved in the later WG 1 activities. He was appointed as a POC member in 1995, and worked as Co-Chairman for the Okhotsk Sea workshops in Vladivostok (1995) and Nemuro (1998). At the PICES VII Annual Meeting, Slava began his term as the POC Chairman.

Biological Oceanography Committee (BIO)

Dr. Patricia Wheeler served as Chairman of BIO from 1995 to1998. She received her B.A., M.S. and Ph.D. degrees from the University of California, Irvine, and did postdoctoral work at CalTech, University of Toronto, and Harvard University. She has been on the faculty of the College of Oceanic and Atmospheric Sciences at Oregon State University since 1982. Her fields of interest include phytoplankton and nutrient dynamics, and the roles of bacteria and macroalgae in carbon and nitrogen cycling. Dr. Wheeler's current research efforts are in carbon cycling in the Arctic Ocean and its marginal seas, and in the lower trophic level dynamics in the northeast Pacific Ocean. The arctic work included analysis of autotrophic and heterotrophic standing stocks and activity across all four major basins during the 1994 US/Canada Arctic Ocean Section, and most recently similar sampling throughout a 13-month occupation of the SHEBA/JOIS ice camp. In the northeast Pacific Dr. Wheeler is participating in the NOAA- (GLOBEC) and NSF- (El Niño) supported studies of "Long-term obesrvations off Oregon for climate change studies". She recently served as guest editor for the 1997 Deep-Sea Research volume on the 1994 Arctic Ocean Section and is currently Associate Editor for the Journal of Phycology. Dr. Wheeler continues to be involved in PICES activities as a member of BIO Committee.

Dr. Tsutomu Ikeda was elected as the new Chairman of BIO at PICES VII. He has been a member of this Committee since 1993, and a member of the Scientific Steering Committee for GLOBEC International since 1996. Dr. Ikeda completed his M.S. and Ph.D degrees at the Graduate School of Hokkaido University, and got postdoctoral experience at the University of Miami. He worked at the Australian Institute of Marine Science, Australian Antarctic Division, and three Japanese National Institutes of Fisheries Science. Since 1996, he has been appointed Professor in Biological Oceanography of Hokkaido University. His major research interests include metabolism, growth and nutrition, and experiment-oriented life history study of marine zooplankton. To pursue his research interest, Dr. Ikeda has participated in many research cruises from the Arctic to the Antarctic. The current emphasis of his research is on the evaluation of the life cycle of major zooplankton species in the western subarctic Pacific. Dr. Ikeda has been serving as a regional editor for the Journal of Marine Biology since 1991.

Marine Environmental Quality Committee (MEQ)

Dr. Richard F. Addison has served as a member of MEQ since 1995, and was elected Chairman of the Committee at PICES IV.

Richard was born and educated in the UK, and joined the Fisheries Research Board of Canada in 1966. He worked on marine lipids until 1969, when he developed an analytical method for the determination of elemental phosphorus which, at the time, was causing problems of marine pollution in Newfoundland. This method still forms the basis of the current standard methods for elemental phosphorus determination in forensic science and environmental analysis. From 1971 to 1993, he worked at the Bedford Institute of Oceanography, where his research interests included studies of the distribution of trace organic contaminants in marine ecosystems, the factors governing their distribution and their effects on marine biota. Since 1993, he has been Head of Contaminants Science at the Institute of Ocean Sciences (Sidney, Canada).

Richard has had extensive experience with inter-governmental agencies. He has been active in the Intergovernmental Oceanographic Commission through its Group of Experts on the Effects of Pollution (GEEP) and was for some years Chairman of the ICES Working Group on Biological Effects of Contaminants. The GEEP Practical Workshops (on comparing methods to assess the effects of pollutants) are the model for the PICES/MEQ Practical Workshop on this topic to be held in Vancouver in spring 1999. The success of the GEEP workshops derives partly from the exchange of technical information and expertise that takes place during two weeks' or so of intensive collaborative work, but also from the cultural exchanges and personal relationships that develop during such an exercise. The GEEP Workshop led to valuable continuing collaborations, and Richard hopes that the PICES/MEQ Practical Workshop will lead to a similar outcome.

Richard maintains an active personal research program involving graduate students and visiting fellows. He tries to escape his desk-bound life once a year for field work among the grey seals on Sable Island, NS. One of his current aims is to organize a joint meeting of the PICES MEQ Committee and the ICES Working Group on Biological Effects. There is no difficulty, in principle, of course, but what neutral ground should be chosen that is equally accessible to all parties?

Dr. Alexander Tkalin was elected the new Chairman of the MEQ Committee at PICES VII.

Dr. Tkalin received his B.Sc. (1977) and Ph.D. (1985) in Oceanography from the Far East State University, Vladivostok, and the State Oceanographic Institute, Moscow, respectively. Currently Dr. Tkalin is Head of the Department of Oceanography and Marine Ecology of the Far Eastern Regional Hydrometeorological Research Institute, Vladivostok. His research activities deal with the distribution of petroleum and chlorinated hydrocarbons, trace metals and radionuclides in sea water, bottom sediments and biota. He participated in about 10 international marine expeditions in the NW Pacific marginal seas, and is the author of about 20 articles written in English. He has been a member of MEQ since 1994 and is also a member of the NEAR-GOOS Co-ordination Committee, American Geophysical Union and Korean Society of Oceanography.

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