# The state of PICES Science - 2001

The PICES Tenth Annual Meeting, held October 5-13, 2001, in Canada, was a celebration of the tenth anniversary of PICES. The meeting attracted 477 people, including many of those who had been instrumental in the creation of PICES as an organization. Seven workshops, twelve topic sessions and several working group meetings were conducted with a total of 162 oral presentations and 208 posters presented. The meeting was hosted by the PICES Secretariat at the Victoria Conference Centre in Victoria, British Columbia, Canada. The keynote lecture on "PICES – the first decade and beyond" by Dr. Warren S. Wooster, reviewed the history of the development of PICES as an organization, and its broad scientific interests over the past decade. His lecture was followed by the Science Board symposium, "Ten years of PICES science: decadal-scale scientific progress and prognosis for a regime shift in scientific approach", where key PICES scientists provided in-depth reviews of the scientific accomplishments of PICES over the past decade. Internationally renowned speakers gave perspectives on possible future scientific directions. It was evident from this symposium that PICES has tackled many key areas of scientific interest in marine science during the last decade by convening sessions at its Annual Meetings, by publishing reports of the activities of its Working Groups (WG), and by implementing the PICES-GLOBEC Climate Change and Carrying Capacity Program (CCCC). We have conducted some of the background work to describe important physical oceanographic and biological components of North Pacific ecosystems and how climate variability influences those components. However, it is clear that we have a great deal of work ahead. The development of more comprehensive monitoring systems, including the often-neglected biological components such as zooplankton, mesopelagic species and non-commercial fish species, is needed. Data and information management for operational oceanography requires a more open and accessible system, and PICES can be instrumental in providing a regional mechanism to achieve this. We must bring a broader ecosystem-based view to fisheries management systems and provide ecosystem-based advice to North Pacific policy makers. Although we have documented some of our scientific accomplishments in the PICES Annual and Scientific Reports and special issues of primary journals, the Organization must do a better job of documenting the scientific questions that remain, and devise schemes for PICES to tackle those questions in a prioritized way. To facilitate this, the objectives and structure of PICES will be examined during the coming year to identify possible changes that might help the Organization meet its scientific objectives.

The PICES X topic session on "Plankton size classes, functional groups and ecosystem dynamics: Causes and consequences", and the special issue of *Progress in Oceanography* that will result from the session were dedicated to the memory of the late Prof. Michael M. Mullin. His colleague at Scripps, Dr. David Checkley, Jr.,

followed the example that Mike himself had set many years ago, when Mike completed the dissertation of one of his students who passed away before completing it – David completed the manuscript that Mike had nearly finished before his death and presented it in Mike's name at this PICES topic session.

The PICES Tenth Annual Meeting was shortened to four days from five in previous years. The shorter meeting worked well and participants seemed pleased with the number and types of topic sessions offered. A late afternoon/evening session was dedicated to posters and the TCODE electronic poster session. This session provided an excellent format for interaction and scientific discussions that we hope to continue at future meetings. Participants arrived from several non-PICES countries, and of particular interest this year was the participation of Mexican scientists. We hope their participation grows and continues as Mexico seriously considers becoming a PICES member country.

Interdisciplinary workshops and sessions started even before the main scientific meeting. WG 15 organized a practical workshop on "Taxonomy and identification of harmful algal bloom species" at UBC in Vancouver. Regional comparisons of the REX Task Team of PICES-GLOBEC Climate Change and Carrying Capacity Program (CCCC) included a broader look at changes in size-at-age for fish species. MONITOR Task Team reviewed monitoring progress and other CCCC Program workshops worked on integration issues, with MODEL Task Team developing models to compare basin and regional ocean areas. Three advisory panels of PICES (Iron Fertilization Experiment, Marine Birds and Mammals, and Continuous Plankton Recorder) met and discussed progress, outstanding scientific issues, and developed future research plans.

Congratulations are in order for winners of the Best Presentation Awards at PICES X. These awards are given to scientists, nominated by each PICES Scientific Committee and the Science Board, who gave the best presentation in a topic or paper session sponsored by a committee or program. The 2001 winners are: the BIO Award - Sanae Chiba (Japan) for her paper "Plankton community study: A better way to understand ecosystem dynamics in the Japan Sea"; the FIS Award - David Hyrenbach (U.S.A.) for his paper "Oceanographic habitats of two sympatric North Pacific albatrosses: Scale-dependent patterns"; the MEQ Award - Adrian Marchetti (Canada) for his paper "Evidence of toxin production by the oceanic diatom, *Pseudo-nitzschia* during Fe stimulated growth in an HNLC Region"; the POC Award - Myong Sook Park (Korea) for her paper "A numerical study on the physical processes and seasonal variability of eddies in the East/Japan Sea"; and the CCCC Award - Takahiro Iida (Japan) for his paper "Temporal and spatial variability of coccolithophore blooms in Eastern Bering Sea Shelf". Science Board gave a Best Poster Award to Sonia Hamilton (U.S.A.) for her electronic poster on "The Bering Sea and North Pacific Ocean Theme Page: A web-based ocean information system".

The year 2001 saw continued progress in the area of international collaborative field and laboratory work by the PICES scientific community. The WG 15 Practical Workshop on "Taxonomy and identification of HAB species" provided practical training to scientists from PICES member nations. The Iron Fertilization Experiment Advisory Panel reported results from an iron fertilization experiment in the western North Pacific, and discussed progress in implementing an experiment for the eastern North Pacific. Finally, the PICES-GLOBEC Climate Change and Carrying Capacity Program (CCCC) continued its two-year study to initiate continuous plankton recorder (CPR) monitoring in the North Pacific, and showed further results with regard to a latitudinal gradient in maturation timing for winter-spring dominant copepods.

PICES international collaboration is expanding beyond the North Pacific. PICES designed and produced the poster and first announcement for the upcoming ICES/PICES/GLOBEC Symposium on "The Role of Zooplankton in Global Ecosystem Dynamics: Comparative Studies from the World Oceans" to be held May 20-23, 2003, in Gijón, Spain. PICES will co-sponsor a Symposium on "The causes of marine mortality of salmon in the North Pacific and North Atlantic Oceans and in the Baltic Sea" that is to be held March 14-15, 2002, in Vancouver, British Columbia, Canada with cosponsoring organizations NPAFC, NASCO, IBSFC and ICES. PICES is continuing the dialogue with Mexican marine scientists that started last spring, when a delegation of PICES officials visited Mexican marine science institutions. PICES will cosponsor a symposium on "North Pacific Transitional Areas" from April 23-25, 2002, in La Paz, Mexico. PICES was involved in the NEAR-GOOS forecasting workshop in August 2001. Collaborations with the Census of Marine Life, JGOFS, GLOBEC and the International Argo Science Team continue to grow.

PICES scientific achievements in 2001 took various forms. They appeared as PICES Scientific Reports, as special issues in primary journals, and as books. Four volumes of the PICES Scientific Report series were produced in 2001: Volume 16 contains the final report of WG 8 on Practical Assessment Methodology, Volume 17 is the annual report of the CCCC Program activities, Volume 18 has the results of the PICES/CoML/IPRC workshop on "Impact of climate variability on observation, and prediction of ecosystem and biodiversity changes in the North Pacific", and Volume 19 contains the final report of WG 12 on Crabs and Shrimps. Many papers presented at the Beyond El Niño Conference in La Jolla, U.S.A., in March 2000, were published in a

*(cont. on page 15)*

# Remarks at a reception for participants at the PICES Tenth Annual Meeting

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Dr. William Doubleday joined the Public Service in 1973 as a research scientist at St. Andrews Biological Station (Fisheries & Oceans Canada), New Brunswick. He was Director of the Fisheries Research Branch (1981–1986) and Chairman of the Canadian Atlantic Fisheries Scientific Advisory Committee (1983-1984), and worked as Director, Policy and Program Coordination for Science (1986-1991) and as Director General, Policy and Strategy Directorate for Science (1991 to 1994). He also served as Acting Assistant Deputy Minister, Science (May 1998 - February 1990, and January 1992 - June 1994), and after that, as Director General, Fisheries and Oceans Science Directorate. Dr. Doubleday first became involved with PICES in 1986, and participated in some of the discussions leading to the establishment of PICES. He had been Canadian Delegate of the PICES Governing Council from 1994 to 2001, and Chairman of PICES from 1996 to 1998.

I would like to share with my colleagues how PICES has changed my perspective on fisheries research. In a sense, PICES has made me aware of the water I was swimming in as a fisheries scientist, something I was not conscious of ten years ago.

The inaugural symposium for PICES was held in the Victoria Convention Centre in October 1992. Canada had closed the fishery for Northern cod (off Newfoundland) a few months earlier, with the expectation of reopening it after a three-year moratorium. We expected a substantial recovery from the sudden, unexpected decline of 1991.

I presented a paper at the PICES symposium linking the productivity of Northern cod to the North Atlantic oscillation, an indicator of the winter climate regime in the North Atlantic. The paper observed that Northern cod had been much less productive in the 1980s than in the 1960s as the North Atlantic oscillation changed from mainly negative values to mainly positive values. The paper did not predict the future of Northern cod because I was uneasy and unsure that the underlying correlations would be sustained. Dr. Richard Beamish, the conference convenor and editor of the conference volume repeatedly encouraged me to publish the paper in his volume. I repeatedly refused. Everyone involved in the Northern cod fishery sought reliable predictions of the coming years. I felt a duty to predict the future course of Northern cod and considered my inability to do so a failure.

Subsequent events were dramatic and unexpected. Research survey abundances continued to decline after the cosure, suggesting that total mortality for adult cod increased after the closure instead of decreasing to a low level as expected. What happened was worse than my model suggested and far worse than projections based on standard assessment techniques, which suggested recovery after three years of moratorium.

The predictions of fisheries science often fail, and when they do, scientists often respond by saying "we must do better". We must obtain larger samples or more detailed data or seasonal data to allow better understanding of the marine ecosystem and better prediction of the future. The goal of the fisheries scientist has been to understand nature, finding and modeling the smooth relationships governing stock and ecosystem dynamics, then to monitor, estimating model parameters and the current state of the system, and, finally, to project the models into the future in order to predict and control a fishery. This goal is very much alive in the minds of scientists today. You can see it, for example, in the Proceedings of the PICES/CoML/IPRC Workshop on "*Impact of Climate Variability on Observation and Prediction of Ecosystem and Biodiversity Changes in the North Pacific*" (PICES Scientific Report No. 18, 2001).

Since the 1992 PICES symposium, I have been privileged to attend many PICES Annual Meetings. I have seen the evidence for decadal scale ocean climate regime shifts accumulate. I have seen how these shifts are linked to dramatic changes in the productivity of major fish stocks. After ten years, the evidence is overwhelming and widely accepted.

The world's fisheries are dominated by a few highly productive species and stocks. Robust and resilient, they may sustain huge fisheries employing thousands of fishermen for a decade or more. I once believed that this high productivity and resilience were inherent qualities of these species and stocks. I still believe that productivity and resilience are intrinsically linked, but papers on climate regime shifts have convinced me that high productivity is not a timeless property of successful species and stocks. When the ocean climate regime shifts, highly productive, resilient stocks can lose their productivity and become fragile while formerly minor species become robust and dominant. The alternation of shrimp and crab with groundfish in the Bering Sea is one example of this.

Why is this relevant to the fishery scientist's duty to predict? The prediction process is strongly rooted in the past. We study the laws governing stock dynamics and monitor to estimate parameters during a phase of an ocean climate regime. We project these laws forward into the future. The projection assumes that the future will be a mirror image of the recent past.

An analogy can help to make this clear. Imagine driving a car with the windshield covered by mud. You can see the road behind using the rear view mirror, but you cannot see the road ahead. You could steer the car by projecting the most recent few hundred metres forward and adjusting the course as you see yourself drifting to one side or the other. This could succeed if the road is straight and you drive slowly enough. It would lead to disaster if you encountered a sudden turn in the road where the hundred metres behind you were unrelated to what lies ahead.

An ocean climate regime shift is like a sharp curve in the road. Just when the demand for predictions is greatest because the productivity of major stocks is weakening, the normal prediction process fails. When the climate regime shifts, the models of the past decade are no longer valid. Projecting the models of one climate regime across the transition into the next regime is the worst action a scientist could take in these circumstances. Assuming that the productivity of major stocks will remain high when it is falling rapidly will lead to very high exploitation rates and will drive these stocks rapidly down.

PICES has taught me that the smooth relationships and models governing stock and ecosystem dynamics during a climate regime can shift suddenly and dramatically during the transition between regimes. Stock and ecosystem dynamics might be inherently predictable during a stable ocean climate regime but they are intrinsically unpredictable during the transitions. We should not feel obliged to predict when prediction is unreliable. We should not feel we have a duty to hold our mirror up to the recent past to see the future at these times. We should recognize that stock and ecosystem dynamics is inherently unpredictable during transitions between ocean climate regimes and we should follow a different course.

I do not see all of the course we should follow, but the first part seems obvious. We should become skilled at early detection of shifts in the ocean climate regime so that we will know when not to predict in the usual way. We should study how the productivity of species and stocks changes when climate regimes change. We should understand how recruitment, growth and natural mortality can be affected, how the laws of population dynamics are rewritten by a regime shift. We should resist the obligation to predict at these times and find another basis for scientific advice to fishery managers.

I hope that, in the coming decade, PICES will lead the world's fishery scientists in building a new foundation for advice on fisheries conservation and management just as, over the past decade, PICES has shown the world the reality and importance of ocean climate regime shifts.

## First Annual Wooster Award to Michael M. Mullin

The late Professor Michael M. Mullin (Scripps Institution of Oceanography) was honoured with the first annual Wooster Award at the PICES Tenth Annual Meeting in Victoria, Canada. The Wooster Award, named after the principal founder and first Chairman of PICES, Dr. Warren S. Wooster (University of Washington), is given annually to an individual who has made significant scientific contributions to North Pacific marine science. Mike's excellence in research and teaching, and his broad involvement in North Pacific marine science spanned many nations, disciplines and scales (see Mike's biography in PICES Press Vol. 8 (1), 2000). His career sets a standard for future Wooster Award recipients to equal (**call for nominations for the 2002 Wooster Award can be found on page 36**). Dr. Wooster presented a commemorative plaque to Professor Mullin's widow, Constance, and son, Stephen (photo on page 16). A permanent plaque identifying Wooster Award winners will reside at the PICES Secretariat in Sidney, British Columbia, Canada.

# The state of the western North Pacific in the first half of 2001

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***Sea surface temperature***

Figure 1 shows monthly mean sea surface temperature (SST) anomalies in the western North Pacific from January to June 2001, computed with respect to JMA's 1971-2000 climatology. Satellite-derived SSTs (NOAA/AVHRR) as well as *in situ* observations are used for the area between 20ºN and 50ºN from 120ºE to 160ºE, and only *in situ* observations are used in other regions.

Figure 2 shows time-series of 10-day mean SST anomalies for the nine regions indicated on the bottom panel. Throughout the period, positive SST anomalies prevailed in the south of the western North Pacific and negative SST anomalies in the north (Fig. 1). Negative SST anomalies exceeding -1ºC were found between 40ºN and 50ºN from January to March 2001, and they persisted west of 160ºE in April and May. SST anomalies for both the regions 1 and 2 were below -1ºC from January to April (Fig. 2).

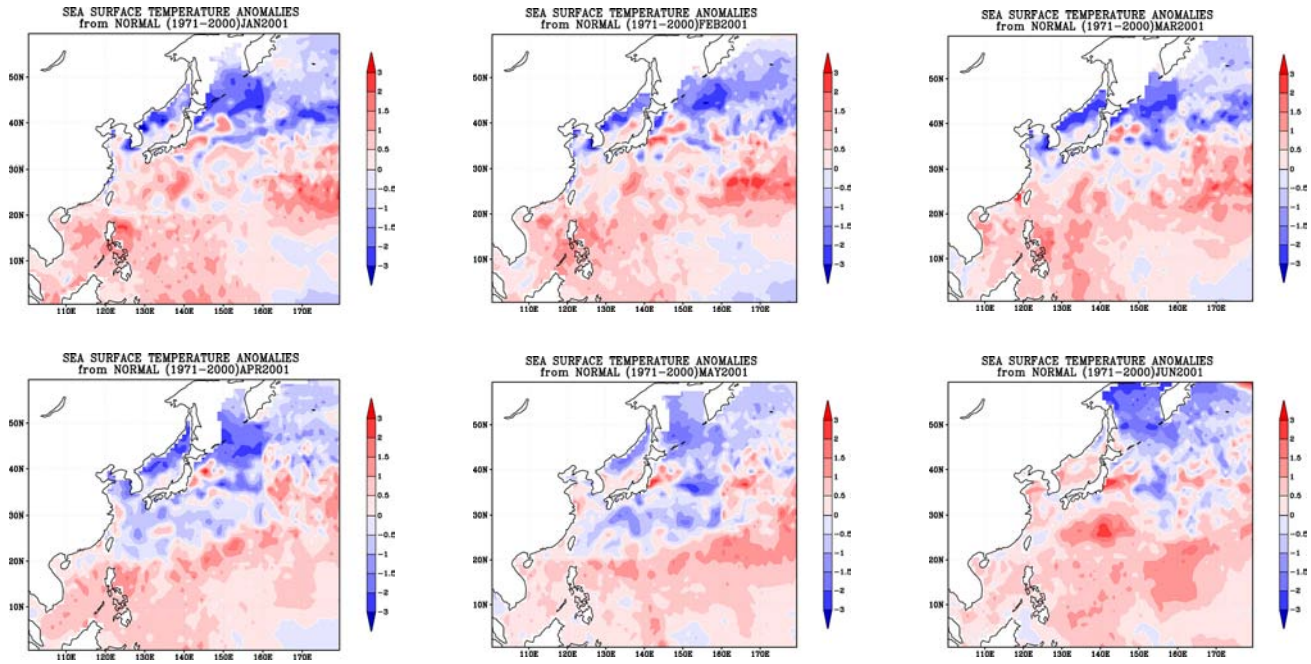


*Fig. 1 Monthly mean sea surface temperature anomalies (°C). Anomalies are departures from JMA's 1971-2000 climatology.*

Positive SST anomalies exceeding +0.5ºC were found from east off the Philippines to the date line between 10ºN and 30ºN throughout the period.

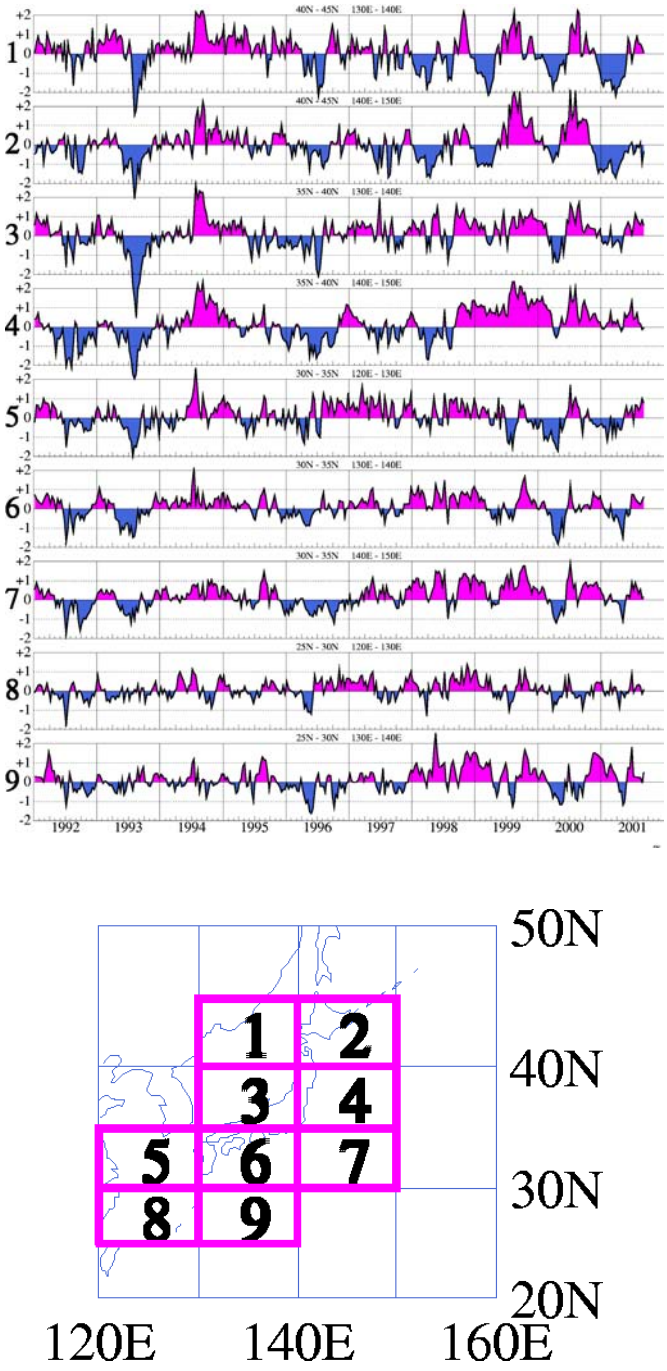


*Fig. 2* *Time-series of the 10-day mean sea surface temperature anomalies (ºC), computed from JMA's 1971-2000 climatology, for nine regions indicated on the bottom panel.*

***Kuroshio and Oyashio***

Figure 3 indicates the location of the Kuroshio axis, which is decided based on *in situ* currents, SST, subsurface temperature and sea surface height. The Kuroshio meandered south of Japan throughout the period. This condition has lasted since November 1999. The southernmost position of the meander in this period was 31ºN, 139.5ºE during the last two decades of February.

Figure 4 shows subsurface temperature distributions at the depth of 100 m east of Japan for March and June 2001. These charts are based on JMA's Ocean Comprehensive Analysis System, which has been in operation since January 2001. The system includes objective analyses and a numerical ocean data assimilation model with 0.25 x 0.25 resolution adjacent to Japan, using TOPEX/POSEIDON altimeter observations and *in situ* water temperature data from ships and buoys.

The Oyashio cold water (area colder than 5ºC in Fig. 4), reached southward to 38ºN east of Japan in March, reflecting its seasonal variation. In June, the Kuroshio flowed eastward near 38ºN, 143ºE, where the Oyashio cold water existed in March, and the Oyashio cold water was found north of 40ºN.

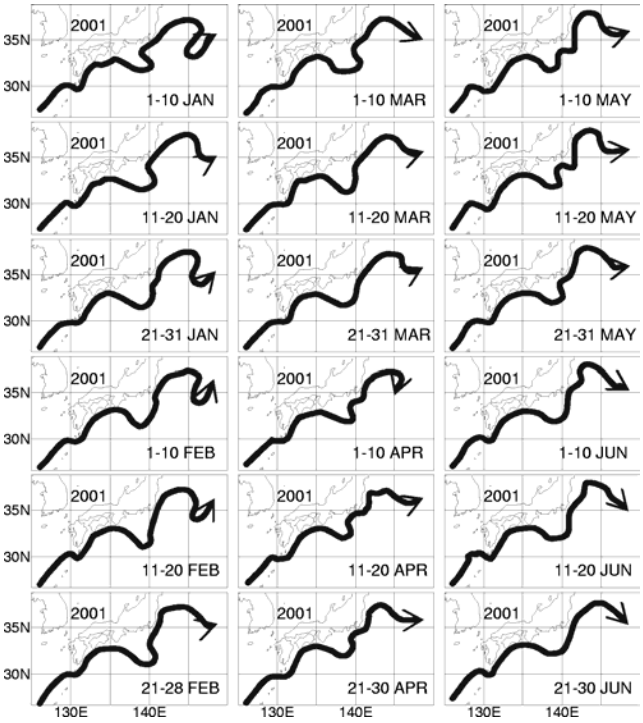


*Fig. 3* *Location of the Kuroshio axis from January to June 2001.*

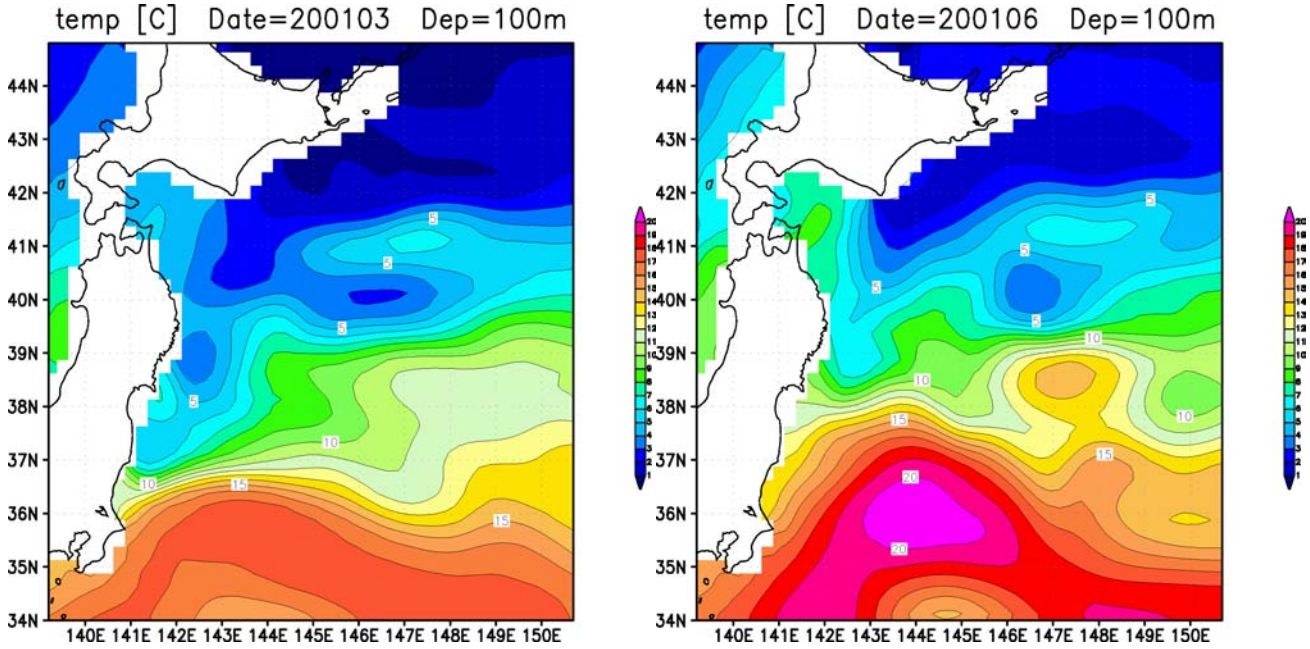


*Fig. 4* *Subsurface temperature (°C) at the depth of 100 m east of Japan for March 2001 (left) and June 2001 (right).*

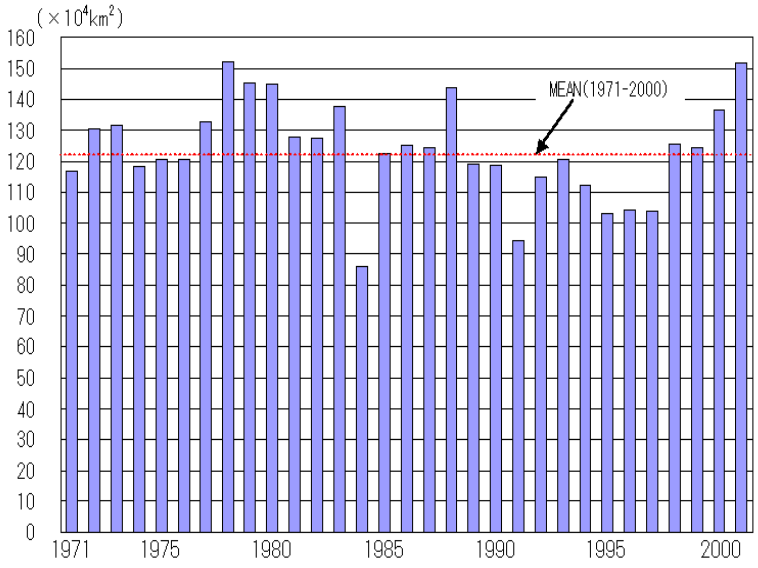


*Fig. 5* *Time series of the maximum sea ice area in the Sea of Okhotsk for each year since 1971.*


*Fig. 6* *Sea ice extent in the Sea of Okhotsk on March 5, 2001, with the normal ice edge.*

***Sea ice in the Sea of Okhotsk***

Sea ice conditions in the Sea of Okhotsk are analyzed based on visible and infrared images of the Geostationary Meteorological Satellite (GMS) and NOAA satellite. JMA issues the information on sea ice extent and its concentration in the Sea of Okhotsk twice a week from December to May, and re-analyzes sea ice conditions every 5 days for statistical study.

Sea ice area in the Sea of Okhotsk was above normal (30-year averaged values from 1971 to 2000) throughout the last sea ice season and came to a maximum of 151.67 x $10^4$km$^2$ on March 5, 2001 (Fig. 5). This is the second largest record, next to the first of 152.25 times $10^4$km$^2$ on February 25, 1978, and it means that 97% of the Sea of Okhotsk was covered with sea ice (Fig. 6).

# The status of the Bering Sea: January – August 2001

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During the latter part of 2000, air-sea interaction in the Bering Sea was dominated by effects associated with an unusually strong, and northward-displaced, Aleutian low. As a consequence, anomalous northward winds of 2-3 m $s^{-1}$ occurred over the eastern shelf, and anomalous southward winds occurred off the Kamchatka Peninsula. The anomalous winds in the northern Bering Sea blew from the east, and were substantially warmer than normal. This resulted in unusually warm conditions in December over the northern Bering Sea. These conditions persisted well into February, when the pattern changed to the more typical frigid winds out of the north.

The unusual atmospheric conditions in the fall of 2000 directly impacted the formation of sea ice over the shelf. Usually, cold winds out of the northeast freeze the seawater and advect the resulting ice southwestward over the shelf. Usually by December, much of the northern shelf is ice covered. At the beginning of January 2001, however, the northern Bering Sea shelf was largely ice-free. Maximum ice extent occurred in mid to late March, which is typical, but the coverage over the eastern shelf was far less than was common during the previous decade (Fig. 1). Except for the shallow areas next to the coast, the southeastern shelf was ice-free.

Observations collected at a mooring site (Site 2: 56.9°N, 164°W) over the middle shelf showed an anomalously warm, well-mixed water column during most of the winter.

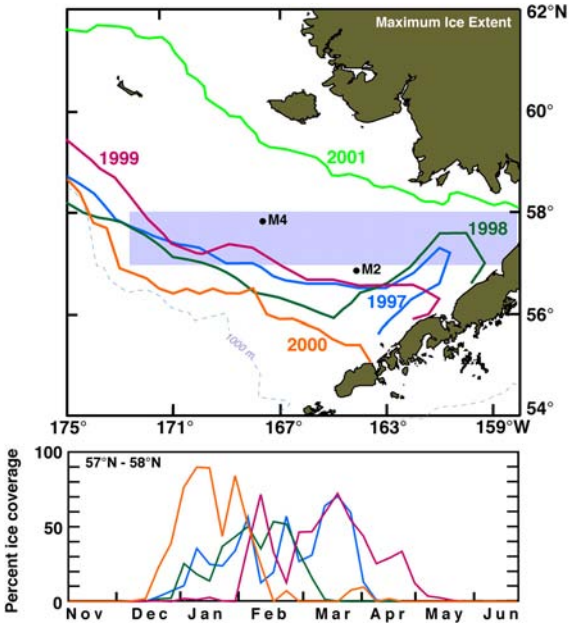


*Fig. 1* *Maximum ice extent over the eastern Bering Sea from 1997 through 2001 (top). A time series of percent of ice cover in a one-degree band of latitude (shaded area in top panel) shows the great variability in ice cover over the southern shelf. The light green line from 2001 does not appear in the lower panel, because there was no significant amount of ice south of 58°N during that year.*

Temperatures were >4°C until the end of January, and >3°C until mid-March. At the beginning of April, both the surface temperatures and the depth-integrated temperatures were similar to those observed in the warm period of the late 1970s and early 1980s (Fig. 2). Cool atmospheric conditions, resulted in little heating of the water column until May. Thus the sea surface temperatures during the summer were nearly normal compared to observations since 1995 (solid black lines, Fig. 2). The depth-averaged temperatures of the spring and summer, however, were among the warmest of the last decade.

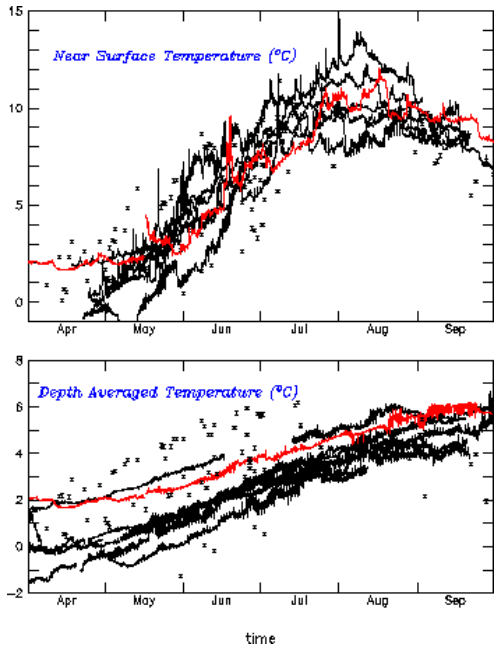


*Fig. 2* *(top) The seasonal signal of near-surface temperature at Site 2. Data (1995-2000) from the moorings at Site 2 are shown by solid black lines and 2001 as a red line. Data from hydrographic surveys between 1966 and 1994 are shown as Xs. (bottom) The depth averaged temperature for the same data shown in the top panel.*

During the summers since 1997, large coccolithophore blooms have appeared over the eastern Bering Sea shelf. Coccolithophores are small, photosynthetic cells covered by calcareous plates (liths), from which light reflects giving the water its distinctive milky white color. During each of the previous four years, the bloom had appeared by late July, and typically reached its maximum extent in the early fall. Its distinctive, milky-white color had been easily visible in satellite images. While active coccolithophore cells were observed over the middle shelf in August 2001, their numbers were lower than observed in previous years, resulting in a less noticeable bloom. A greatly altered zooplankton community was also observed by scientists in August 2001, with a conspicuous absence of calanoid copepods over the southeastern middle shelf (J. Napp, per. comm.).

For several days in early June, much of the eastern and northern Bering Sea was free from clouds, making it visible to satellites. A composite of SeaWiFS images from the first half of June (Fig. 3) shows several regions of high production over the middle shelf and along the outer shelf north of the Pribilof Islands. The high concentrations of chlorophyll over the southeastern shelf are unusual this late in spring, since the spring bloom usually occurs in May, or earlier if there is ice. Mesoscale features, including eddies, are evident in the image. Some eddies, such as the one seaward of the 1000 m isobath near the center of the image, are regions of elevated chlorophyll, while other eddies, such as the one south of the Pribilof Islands, appear to have lower concentrations of chlorophyll. The mechanisms that cause this variability are under investigation.

The large interannual variability of the Bering Sea is evident in both the time series from Site 2 (Fig. 2) and in the plots of ice extent (Fig. 1). While the maximum extent of ice did not vary greatly from 1997-2000, the timing of ice arrival or retreat differed greatly among years. For instance, the greatest ice coverage occurred in 2000, but this occurred early in the year and the shelf was largely ice free after mid-February. Alternately, during 1999, the ice arrived in February and persisted into May. The presence of ice over the southeastern shelf is closely related to the timing of the spring bloom. The historical time series at Site 2 (1995 – 2001) has supported the hypothesis that the absence of sea ice after mid-March results in an open water phytoplankton bloom in May. Alternately, when ice is present after mid-March, an ice-associated bloom occurs. The lack of ice over much of southeastern shelf in 2001 contributed to a late bloom over the southeastern shelf.

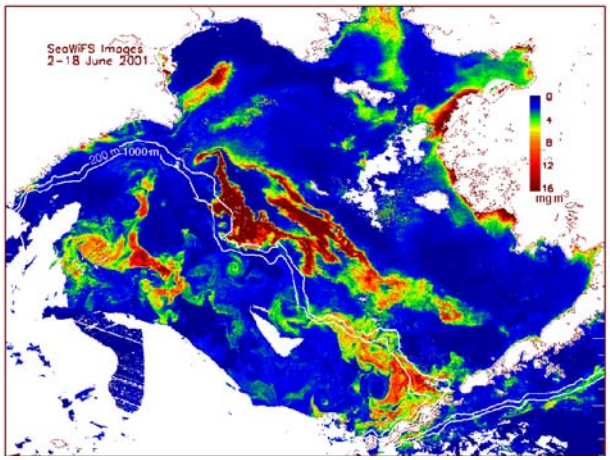


*Fig. 3* *SeaWiFs composite chlorophyll image (June 2-18, 2001). The image was provided by the SeaWiFs Project, and the Distributed Active Archive Center at the Goddard Space Flight Center, Greenbelt, MD. NASA's "Mission to Planet Earth Program" sponsors these activities.*

# The state of the eastern North Pacific since spring 2001

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One of the frequently asked questions is, "will there be a 2001/02 El Niño?" and our answer is simple, we don't know. At the time of writing, there do not seem to be any clear indicators that would suggest an incipient El Niño, yet many of the equatorial forecast models are forecasting a moderate warm event in the very near future. This is not supported by observations of the pressure gradient along the equator, as shown in Figure 1. However, the TOGA/TAO array of buoys has shown a steady warming of the surface layers of the equatorial Pacific over the last few months. Indeed, almost all of the surface ocean along the equatorial Pacific shows above normal sea-surface temperatures. The National Climate Prediction Center in the United States issued a notice on November 9, 2001, at the following URL - http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/. In the final paragraph, they state, "Considering the SST predictions, the time of year, and the observed oceanic and atmospheric circulation patterns, it seems most likely that a gradual evolution to warm episode conditions will continue in the tropical Pacific over the next several months." So, we will be watching to see if an El Niño event does develop.

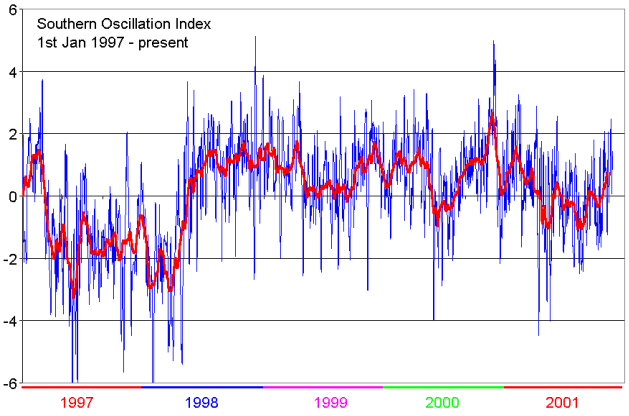


*Fig. 1 Daily values of the southern oscillation index (blue) and 31-day running mean (red) from Jauary 1, 1997, to December 2001.*

Figure 2 shows a selection of temperature anomaly maps in the Gulf of Alaska through the summer and fall of 2001. These clearly show the dominance of low temperature anomalies through this entire period. Indeed, the Gulf of Alaska has shown essentially the same pattern of

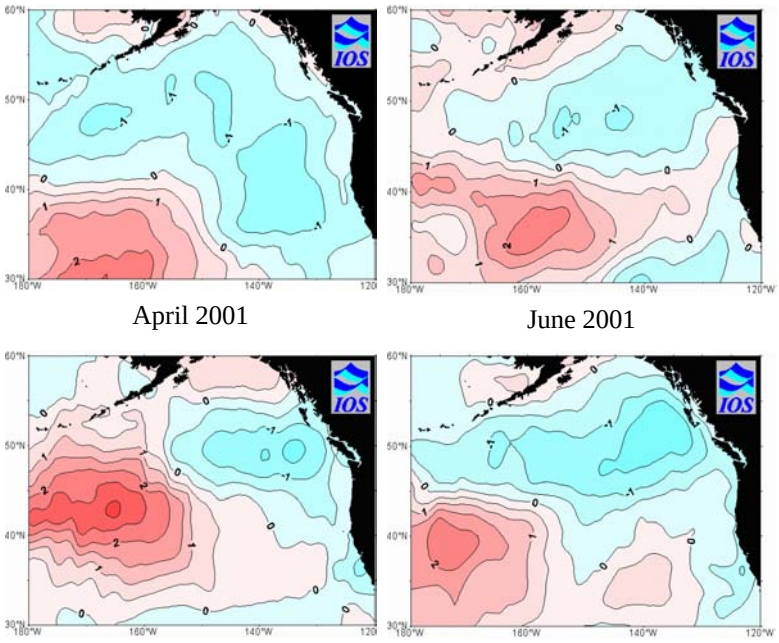


*Fig. 2* *Sea surface temperature anomalies in the Gulf of Alaska from spring to autumn 2001.*

temperature anomalies for most months since January 1999. This might be expected to change if an El Niño really does develop in the equatorial Pacific.

One of the results of low temperatures in the Gulf of Alaska is a decrease in the stability of the upper ocean, making it easier for storm events to mix deeper water into near-surface regions, and so enhancing the supply of nutrients to the upper ocean. This would be expected to have a direct impact on the primary and secondary production.

Secondary production in the Gulf of Alaska is difficult to measure, but measurements of zooplankton abundance or biomass can go some way towards it. The Continuous Plankton Recorder (CPR) surveys, which can provide an index of mesozooplankton abundance, are only in their second full field season. As such it is difficult to distinguish background levels of interannual variability from variability caused by El Niño type events. Fortunately, pilot sampling also took place in summer 1997, during an El Niño, and zooplankton abundances were about 5 times higher in the Gulf of Alaska than they were at the same time of year in the cool regime of 2000 (contrary to what the physics might lead us to expect!). On the contrary, abundances on the Alaskan continental shelf and slope, at the extreme north of the transect, were much higher in the cool regime of 2000 (Fig. 3).

Comparing the spring 2000 and 2001 transects in a similar way suggests that, overall, spring time variability within the current cool period is not so large as that shown between the cool and the warm (1997) regimes – almost the same number of organisms were present in the Gulf of Alaska in both years. However, the distribution of the mesozooplankton has shifted south so that this year abundance was lower in the northern Gulf of Alaska and higher in the southern part of the transect than in 2000 (Fig. 3). As the processing of the remaining months from 2001 is completed, it will be interesting to see if this pattern persists, and to find an explanation.

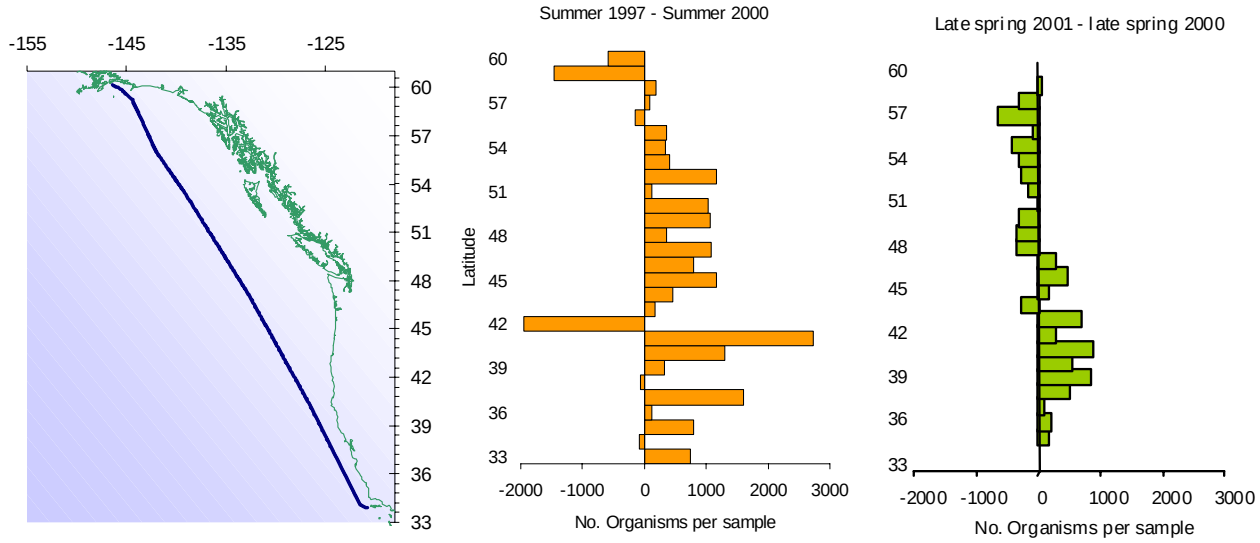


*Fig. 3* *The difference in abundance of mesozooplankton (organisms from about 200 µm to 5 mm in size) along the CPR transect in July/August 1997 and April/May 2001, when compared with corresponding periods in 2000. Abundances are mean numbers of organisms sample$^{-1}$ (~3m$^3$) averaged over 1° bands of latitude.*

# Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study (SEEDS) in the western North Pacific, summer 2001

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*Participants of SEEDS cruise after the experiment, forming a Chinese character for "iron" by men on the FRV* Kaiyo Maru, *August 2001.*

Iron limitation has been proposed as the reason for the existence of surface waters rich in macro-nutrients but low in phytoplankton biomass in the subarctic Pacific, the equatorial Pacific and the Southern Ocean. Recent *in situ* iron enrichment experiments confirmed this in the equatorial Pacific and the Southern Ocean. In the subarctic Pacific, with biology and water structure different from the other two regions, strong zonal gradients in atmospheric iron deposition existing between the eastern and western gyres may give rise to distinct phytoplankton communities that characterize these biogeochemical provinces. Here we present an overview of SEEDS (Subarctic Pacific Iron Experiment for Ecosystem Dynamics Study), the first *in situ* test of the iron limitation hypothesis on natural ecosystem and geochemical cycles in the subarctic Pacific, which was funded by the Ministry of Environment of Japan for 3 years. SEEDS 2001 was originally proposed by the Advisory Panel on An Iron Fertilization Experiment in the Subarctic Pacific Ocean (IFEP) at the PICES Eighth Annual Meeting in Vladivostok, Russia, but the funding and ship opportunity were fixed only in March 2001. Then, we started and rushed for preparations of the experiment.

FRV *Kaiyo Maru* of Fisheries Agency of Japan departed from Tokyo on June 28, with full loading of experimental equipment and materials (17 large trucks: new record of *Kaiyo Maru*!). Seventeen researchers from the Fisheries Research Agency, the Central Research Institute of Electric Power Industry, the National Institute for Environmental Studies, Hokkaido University, Nagoya University, University of Kyoto and University of Tokyo participated in the cruise. The first leg of the cruise was allotted for physical and biochemical survey of the target area, and performance tests of newly designed equipment such as the continuous measurement system of an inert tracer gas sulphur hexafluoride ($SF_6$), and the iron/$SF_6$ mixing and injection system.

During the second leg of the cruise, a meso-scale *in situ* iron enrichment experiment was conducted in the western subarctic gyre of the North Pacific (48.5ºN, 165ºE) from July 18 to August 1, 2001 (Fig. 1). The experiment consisted of a single addition of 350 kg iron as $FeSO_4$ (10,800 L of 0.5 M Fe) with 4100 L of $SF_6$ saturated seawater, over an 8×10 km patch with a mixed layer depth of 10 to 15 m. Using the GPS buoy-Lagrangian navigation system, the solution of iron and $SF_6$ mixed at a constant ratio was released under the ship's propellers within 24 hours. Initial concentration of dissolved iron in the iron-enriched patch was about 1.9 nM (mean value of day-1 underway transect; maximum recorded was 6.0 nM).

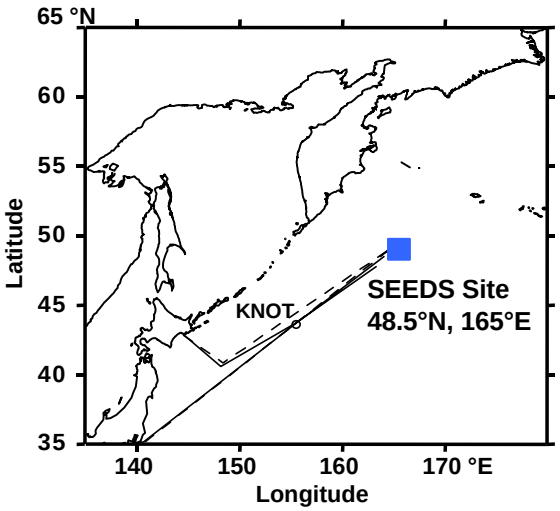


*Fig.1* *Location of SEEDS iron enrichment experiment.*

The weather was foggy but calm throughout the observation period, which was lucky for the participants in the cruise but less than ideal for satellite observation of the iron patch. The iron-enriched patch moved westward during the experiment, but we could successfully trace the iron-enriched patch for a 2-week observation period by measuring $SF_6$ in surface waters. Along with continuous surface measurements of $SF_6$ and iron concentrations, a fast repetitive-rate (FRR) fluorometer, which measures community photosynthetic competency (Fv/Fm), and an underway $pCO_2$ system, also provided real-time mapping. The first indication of a phytoplankton response to iron enrichment was a significant increase in Fv/Fm measured by the FRR fluorometer on the night of day-3, and the scientists on board get excited. By day 10, we observed unambiguous and massive biogeochemical responses to the iron addition, which resulted in an increase in chlorophyll *a* concentrations to as high as 20 µg/l, and large drawdowns in $pCO_2$ dioxide and nutrients (Fig. 2).

The iron-enriched water became a rich-soup of phytoplankton, and a change in the water color was recognizable for everyone after day-9 (Fig. 3). In addition, iron supply led to floristic shifts that resulted in the dominance of chain-forming large centric diatoms, unlike the equatorial Pacific and the Southern Ocean where iron stimulated the growth of pennate diatoms. We finished our observation with trawl sampling of salmons and other nekton in and out of the patch on day-14. The water mass with high chlorophyll and low $pCO_2$ was still there, but we had to leave.

Our initial findings clearly demonstrate that iron availability fundamentally controls the magnitude of phytoplankton response in high nutrient areas of the western subarctic Pacific. Analysis of samples from this experiment will also help to clarify the role which iron plays in regulating the biogeochemical processes such as export production. Furthermore, we realize that we need longer and more intense observation of the iron-enriched patch to understand the ecosystem-scale response to iron input, and the fate of accumulated organic carbon after the end of diatom blooming, which might only be possible with international cooperation.

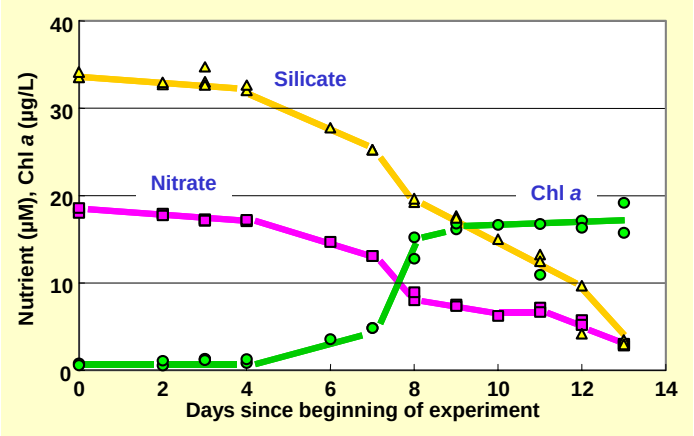


*Fig.2* *Changes in chlorophyll* a, *nitrate and silicate concentrations measured in the iron-enriched patch during SEEDS 2001.*

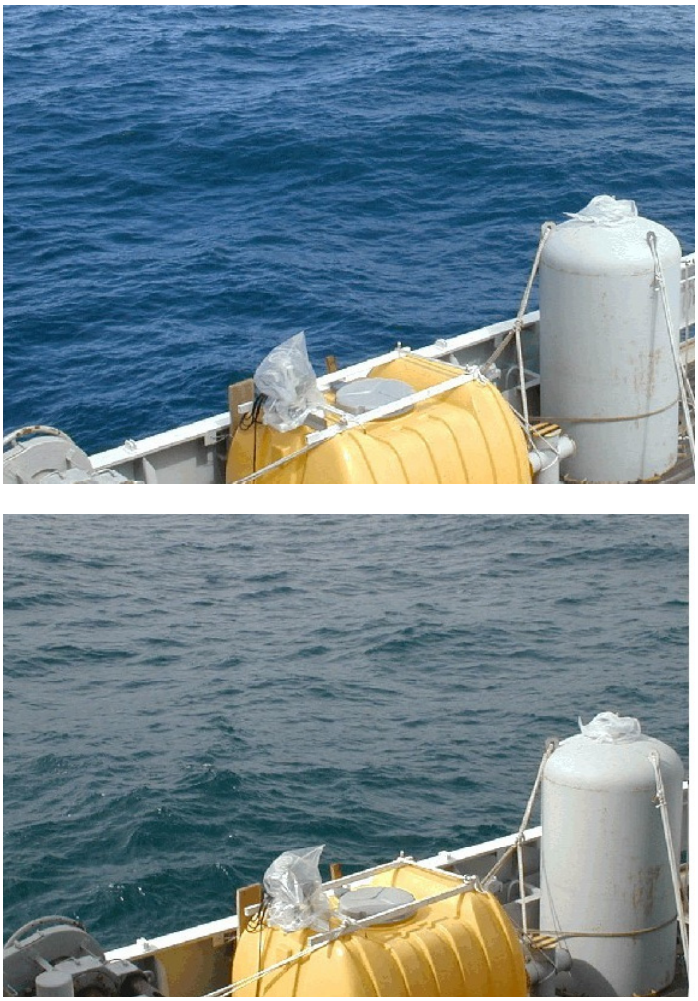

*Fig. 3* *Comparison of water color between the outside (top panel) and inside (bottom panel) of the iron-enriched patch on day-14. (Photo by H. Kiyosawa)*

# Plans for the Canadian SOLAS Iron Enrichment Experiment

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There are large areas of the North Pacific Ocean where iron limits primary productivity. At Ocean Station Papa (OSP; 50°N and 145°W) (Fig. 1), several iron enrichment experiments in carboys on board ship have demonstrated that in May/June and August/September, when 2-4 nM Fe is added to surface water, chlorophyll increases several fold and mainly pennate diatoms dominate the phytoplankton assemblage (Boyd *et al.* 1996. *In vitro* iron enrichment experiments in the NE subarctic Pacific. Mar. Ecol. Prog. Ser. 136: 179-193). These pennate diatoms do not appear to be eaten by the ambient mesozooplankton and likely sink when they have used up the added iron (Harrison *et al.* 1999. Comparison of factors controlling phytoplankton productivity in the NE and NW subarctic Pacific gyres. Prog. Oceanogr. 43: 205-234). However, it is not possible to measure the broader ecosystem response and carbon flux in carboy experiments. As the next step in the study of the ecosystem response to an iron addition at OSP, we proposed a large-scale open ocean iron enrichment, similar to IRONEX I and II, SOIREE and, more recently, the successful Japanese SEEDS experiment (this issue). These plans were initiated by the Advisory Panel on An Iron Fertilization Experiment in the Subarctic Pacific Ocean (IFEP) at the PICES Eighth Annual Meeting in Vladivostok, Russia, in October 1999 (for details see PICES 1999 Annual Report, pp. 108-110). Plans were further developed at the special IFEP Planning Workshop on "Designing the iron fertilization experiment in the Subarctic Pacific" that was held in October 2000, in Tsukuba, Japan, in association with the PICES Ninth Annual Meeting (for details see PICES 2000 Annual Report, pp. 89-95).

This year we received funding from the Natural Sciences and Engineering Research Council of Canada (NSERC) and Panel for Energy Research and Development (PERD) of Natural Resources Canada (NRCan) to Fisheries and Oceans Canada. This funding is part of the Canadian SOLAS (Surface Ocean Lower Atmosphere) program and it will form a contribution to the International SOLAS project, a new core project under the International Geosphere Biosphere Program. The main objective of the International and Canadian SOLAS program is to address the key interactions among the marine biogeochemical system, the atmosphere, and climate. One of the highlights of the Canadian SOLAS program is that it will bring the atmospheric scientists and the oceanographers together for the first time in this coordinated project. At OSP, we will test how an addition of iron (as a simulation of natural Fe additions via dust or offshore eddies) will increase primary productivity, the production of trace gases such as dimethylsulphide (DMS) and organic halides and the drawdown of $CO_2$, all of which can influence climate. We have adopted the acronym SERIES (Subarctic Ecosystem Response to Iron Enrichment Study) for our iron enrichment experiment.

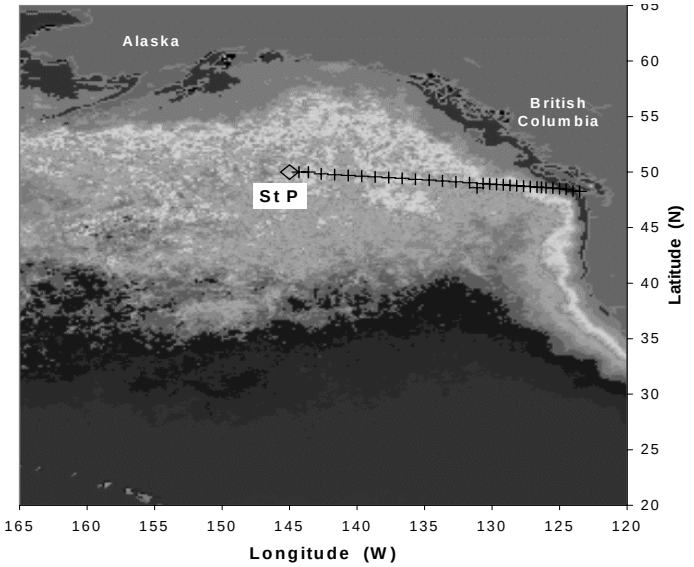


*Fig. 1 CZCS annual chlorophyll distribution in the NE Pacific. Line P stations (+) and Ocean Station Papa, which are sampled three times annually to provide time-series measurements of ocean variability, are indicated.*

In July 2002, we will collaborate with scientists from Japan and the United States to conduct an open ocean iron enrichment experiment at OSP. There will be two ships, Canadian CCS *John P. Tully* and Mexican R/V *El Puma* (Figs. 2 and 3), that will provide about 40 berths. We plan to enrich a 100-km$^2$ patch of the ocean and follow it for 2 to 3 weeks. Japanese scientists will visit OSP and extend the sampling time along with the US scientists (if they receive funding). This extension in following the patch should allow us to determine the fate of the bloom.

*Fig. 2* *The CGSS* John P Tully, *a 69 m research vessel operated by Fisheries and Oceans Canada to conduct oceanographic programs in the North Pacific.*

*Fig. 3* *The 50 m long R/V El Puma, the Pacific Coast vessel operated by the National University of Mexico (UNAM) to conduct oceanographic programs in the Pacific.*

We will measure a wide range of parameters to determine the response of the plankton community to the iron addition, the fate of carbon (drawdown of $CO_2$ and carbon export), production of trace gases (DMS, $N_2O$ and organic halides), iron chemistry (including iron complexation and the longevity of the bloom), and exchange processes at the air/sea interface. The field data will ultimately be integrated into coupled ocean and atmosphere models.

Our results will provide a very interesting comparison between the response of the NE (Canadian SOLAS) and NW (SEEDS Japan) subarctic Pacific gyres to iron enrichment. The NW gyre is less iron-limited since it is closer to an iron source, the dust from the Gobi Desert in China. The two gyres present a natural gradient of iron limitation and hence a different ecosystem response is expected to the iron enrichment.

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*(cont. from page 2)*

special issue of *Progress in Oceanography*, Vol. 49 (1-4), entitled "Climate variability and marine ecosystem impacts, from the tropics to the Arctic".

PICES Executive Secretary, Dr. Alexander Bychkov, organized and spearheaded efforts to publish a book in celebration of the PICES tenth anniversary. It took 18 months from concept to fund-raising, to final publication. The spectacular *Historical Atlas of the North Pacific Ocean: Maps of Discovery and Scientific Exploration 1500-2000* was written by Vancouver historian Derek Hayes.

POC WG 13 on *$CO_2$ in the North Pacific* had its final meeting at PICES X and will produce the final report in 2002. BIO WG 14 on *Effective sampling of micronekton*, MEQ WG 15 on *Ecology of harmful algal blooms*, and FIS WG 16 on *Climate change and fisheries management* will all continue for at least one more year.

The PICES-GLOBEC CCCC Program continues its work on integrating and stimulating national GLOBEC research efforts in the North Pacific. The Regional Experiments (REX) Task Team is presently focusing on comparative work on herring in the North Pacific and changes in size-at-age of fish around the North Pacific, with a goal of developing bioenergetic models that can be linked to lower trophic level models. Similarly, the Basin Scale Studies (BASS) Task Team is collaborating with the MODEL Task Team to link upper trophic level models of the subarctic gyres with lower trophic level models.

A new POC Working Group 17 on *Biogeochemical data integration and synthesis* was established at PICES X. A *North Pacific Data Buoy Advisory Panel* was also approved, which will be a cooperative effort between the WMO/Data Buoy Cooperation Panel and PICES, to encourage the exchange of ocean data and information in the North Pacific through provision of good quality and timely buoy data to users, and exchange information on data buoy activities.

PICES XI will be held October 18-26, 2002, in Qingdao, People's Republic of China. The theme for PICES XI is "Technological advances in marine scientific research", and a 1-day Science Board Symposium will be developed using this theme. This symposium is dedicated to the potential for implementation of technology to enhance the scientific activities conducted by PICES researchers. Check the PICES web site to see the full list of topic sessions and convenors. The Second GLOBEC Open Science Meeting will be held in Qingdao just prior to PICES XI, and the PICES GLOBEC CCCC Program is part of the International Scientific Program Committee for that meeting to ensure that North Pacific GLOBEC research interests will be met.

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*PICES X Governing Council, from the same vantage as the first Governing Council photo at PICES I. Front row: I. Perry, T. Wada, N. Uki, H.T. Huh, V. Alexander, L. Richards, R. Marasco, L. Bocharov, E. Marsollier, Q.F. Liu; back row: A. Bychkov, H. Watanabe, H.M. Xin, H.-E. Kim, E. Tirpak, P. Livingston, A. Kurmazov, S.M. McKinnell.*


*Secretariat staff and DFO volunteers at the Registration Desk.*

*Ann Ronald of DFO helps a copepod to register*

*Edmund Fok and Joe Linguanti, volunteer technicians from DFO, check audio/visual equipment to ensure smooth presentations.*


*The Chairman of PICES opens the Tenth Annual Meeting. At the head table: Hon. G. Parent, L. Richards, N. Uki, Q.F. Liu, J.Y. Kim, L.N. Bocharov, V. Alexander, P. Livingston.*

*Alex & Christina of the Secretariat proudly show the new Wooster Award plaque to Dr. Warren Wooster.*

*Mrs. Connie Mullin thanks the Chairman for the Wooster Award for the late Prof. Michael M. Mullin, with son, Stephen, looking on, while receiving a long standing ovation from the audience.*

*Dr. H.T. Huh gratefully accepts a beautiful photo album as a special anniversary gift from the NPAFC Secretariat, presented by Mr. Vladimir Fedorenko, the Executive Director of NPAFC.*

*Dr. Pentti Malkki, President of ICES, with S.M. McKinnell, H.T. Huh and A. Bychkov during a coffee break.*

*J.J. Polovina, T. Parsons and W. Aron enjoy a cozy chat at the Chairman's Reception.*

*Active interaction at the Poster Session.*

*Participants busy setting up stations for the Electronic Poster Session.*

*Vera Alexander, Vice Chairman of PICES, performs Stravinsky on the antique piano at the Chairman's Reception at Craigdarroch Castle.*

*Robin Brown and Bernard Megrey ponder serious topics at the Wine and Cheese Poster Session.*

*Outgoing Science Board Chairman, Pat Livingston, receives a memento from the Chairman of PICES for her hard work.*

# NEAR-GOOS 2001 Ocean Environment Forecasting Workshop

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*Maarten Kuijper, from the Netherlands, works for the Intergovernmental Oceanographic Commission of UNESCO. Based in Bangkok, Thailand, in the Regional Secretariat for the Western Pacific, he is coordinating the regional activities of the IOC. In that capacity, he is also acting as Technical Secretary for NEAR-GOOS and its Southeast Asian equivalent, SEAGOOS. Maarten is a marine biologist by background.*

In the last few issues, PICES Press has featured a number of articles related to the Global Ocean Observing System (GOOS). This clearly demonstrates the interest of the PICES scientific community in GOOS. Ten years have passed since GOOS first appeared on the agendas of intergovernmental meetings, and not surprisingly, many prominent PICES scientists have taken an active role in the establishment of this ambitious undertaking.

An important aspect in the development of GOOS is the establishment of the so-called GOOS regional alliances that provide much needed regional impetus to the overall system. Regional alliances are important building blocks where collaboration in operational oceanography among member countries is being actively pursued and tested. The first of such regional alliances established under GOOS is the Northeast Asian Region GOOS (NEAR-GOOS). Under the auspices of the IOC Sub-Commission for the Western Pacific (IOC/WESTPAC), the People's Republic of China, Japan, the Russian Federation and the Republic of Korea first started discussing NEAR-GOOS in 1993, with the formal establishment of NEAR-GOOS becoming a fact in 1996.

NEAR-GOOS has made a modest start, so far concentrating on the actual establishment of a mechanism for data exchange among the countries. During the last few years, a major emphasis of NEAR-GOOS operation was directed towards solving problems of communication, processing, archiving and product generation, while concentrating on a limited set of physical parameters. The parameters considered in the initial phase are temperature, salinity, currents, winds and waves.

The NEAR-GOOS system operates through two different modes, a (near-) real time database and a delayed mode database. Each of the countries has set up such databases for the purpose of collecting national data, often hosted by different agencies. The Japan Meteorological Agency (JMA) and the Japanese Oceanographic Data Center (JODC) carry out the aggregation of data at the regional level and thus function as the respective Regional Real Time Database and Regional Delayed Mode Database. A NEAR-GOOS Coordinating Committee reviews the management arrangements of NEAR-GOOS on an annual basis. All the four member countries have nominated two members to the committee who represent the respective real-time and delayed mode databases in those countries.

But GOOS goes beyond mere data exchange of a limited set of physical parameters alone. With this in mind, NEAR-GOOS has embarked on a strategic planning exercise that should provide a framework for the further development of NEAR-GOOS. Pertinent elements in this strategy plan are the addition of biological and chemical oceanographic parameters, the improvement of quality assurance and control procedures, work practices to assure the long-term stability of the record, and an improvement in the timeliness of data and provision of a range of forecasting tools including those for use in the management of marine ecosystems.

Of particular interest to NEAR-GOOS is the expertise of PICES in the field of ecosystem science and management. Such expertise is currently under-represented in the discussions of NEAR-GOOS. During the Ninth Annual Meeting of PICES in Hakodate, Japan, the MONITOR Task Team dedicated a short session to GOOS developments and the author presented a short introduction to the challenges faced by NEAR-GOOS. This resulted in a recommendation to seek further collaboration with NEAR-GOOS, initially through the co-sponsorship of a NEAR-GOOS Ocean Environment Forecasting workshop that was held in conjunction with the Fifth IOC/WESTPAC International Scientific Symposium in August 2001, in Seoul, Republic of Korea. Dr. Yoshioki Oozeki and Dr. Skip McKinnell represented PICES at that workshop.

The IOC/WESTPAC Secretariat and Dr. Dong-Young Lee, the present Chairperson of the NEAR-GOOS Coordinating Committee, jointly organized the workshop. PICES and KORDI co-sponsored the workshop by providing travel support to representatives / participants.

The workshop took the form of two days of scientific presentations and one full day of discussion on the status and need of a forecasting capability in the NEAR-GOOS region. The presentations in the first two days were divided over five topics, those being: sea state and ocean circulation, water quality and ecosystem dynamics, data collection, ocean remote sensing, and data exchange and management. Representatives from research groups from all over the region ensured that the presentations provided a comprehensive overview of the current research themes. The discussions on the next day highlighted the needs, capability and limitations of ocean forecasting in the region, and offered valuable insights in the type of parameters and research needed to make ocean forecasting in the NEAR-GOOS region a reality.

The workshop agreed that much progress could be made by building on existing research endeavors in the region. Several research groups are working in the field of operational oceanography, either by developing automated data collection platforms (i.e. profiling floats and drifters, ferry boxes, underwater cable voltage measurements, weather buoys, ocean stations and satellite technology) or in the development of new models for the prediction of circulation patterns, waves and storm surges, water quality and ecosystem processes. The latter categories of models still require a lot of research, data collection and development before they will become operational, and it is in this field that NEAR-GOOS can benefit from scientific developments under PICES.

Although NEAR-GOOS cannot determine the research agendas in the different countries per se, it is evident that through coordination and in collaboration and synergy with PICES and other organizations, an operational oceanography capacity will materialize. Progress cannot, however, be expected to be smooth, and it will require many years to develop. In this regard, it is important that organizations such as NEAR-GOOS and PICES have a common vision of what they want to achieve for the region.


*Participants of the NEAR-GOOS Ocean Environment Forecasting Workshop and the Fifth IOC/WESTPAC International Scientific Symposium held August 27-31, 2001, at Seoul National University, Republic of Korea.*

# IRI/IPRC Pacific Climate-Fisheries Workshop

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Motivation for the [1]IRI/[2]IPRC workshop was simple: many marine ecosystems appear to change in synchrony with climate on a global scale, but the mechanism(s) to explain this apparent synchrony remain elusive. An eclectic group of 40 scientists with expertise ranging through climate, oceanography, fisheries and social science met with their IRI/IPRC hosts at the East-West Center in Honolulu from November 14-17, 2001, to contemplate new ideas to describe the interaction of fisheries and climate and its human consequences. Despite strong evidence that such coherent (possibly coupled) changes of climate and fish populations occur on global scales, there are surprisingly few hypotheses about how these linkages operate and none of them have been tested rigorously. As workshop leader, Dr. Andrew Bakun (IRI, New York) said, "*The degree of basin-scale synchrony evident in fish population variations implies climatic linkages that must be reasonably direct, and that suggests that a few bright people with the right ideas should be able to solve this problem.*"

The major questions the workshop was asked to address were:

1. What are the effects of climate variability on the Marine Resource System (*MRS), and can we forecast these effects based on climate monitoring?
2. What can climate variability tell us about the internal dynamics of the *MRS, i.e., can we use climate variability as "experiments"?
3. What management actions could be enabled by significant scientific progress on specific aspects of questions 1 and 2?

There were no formal presentations; Chairman Dr. Juergen Alheit (Germany) led us through four days of discussion on:

- *Climate dislocations of **M**arine **R**esource **S**ystems* (*MRS – defined to include social, economic, etc., aspects)
- *Mechanisms potentially driving marine ecosystem regime shifts*
- *Indicators of marine ecosystem regime shifts*
- *Implications of rapid adaptive mechanisms operating in the fish habitat system*
- *Utility and mechanics of a global empirical comparative retrospective study of available data on MRS variability*
- *Choosing independent variables, methodologies and data for system analysis of the fish habitat system (i.e., the *MRS without the social and economic aspects)*
- *Appropriate retrospective analysis methodologies for an empirical study of *MRS responses and mechanisms*
- *Needed developments in climate research applications products*
- *A framework for Pacific project formulation*
- *What do we mean by "sustainable fisheries"?*

But the simple questions kept returning. How do synchronies in the abundance of small pelagic fishes arise on opposite sides of the Pacific Ocean? Alec MacCall (U.S. NMFS) was first off the mark with a hypothesis that basin-scale atmospheric/climate forcing in the Pacific affects the large-scale ocean circulation in the subtropical Pacific, and consequently affect mesoscale features in the boundary currents, the Kuroshio and California Current (as well as the Peru Current), will vary accordingly. For example, Takashige Sugimoto has observed that the Kuroshio exhibits more meandering during periods of reduced atmospheric forcing, while stronger large-scale circulation results in more laminar flow along the Japan coast with fewer mesoscale features. Sardine and anchovies have apparently adapted to this variability in different ways, such that a laminar flow regime enhances the reproductive success of nearshore species such as anchovy, while greater mesoscale complexity and reduced advective loss of eggs and larvae favours growth of offshore sardine populations. If this pattern of greater and lesser mesoscale variability can be linked to the interdecadal variability in the California and Peru Currents, it will provide a convincing mechanism for low frequency near-synchronous variability in widely separated sardine/anchovy populations.

Other hypotheses remain to be developed and tested and this became a consideration in plenary discussion of a Pacific climate/fisheries project. Workshop participants defined "Bakun's paradox": *Fisheries seem to fluctuate in*

[1] International Research Institute for Climate Prediction, Columbia University
[2] International Pacific Research Center, U. of Hawaii

*phases even though they exist in different ecosystems which appear to respond differently to common large-scale forcings (e.g., climate).* The interesting question, of course, is: Why? To explore this further, workshop participants endorsed the development of a Pacific climate/fisheries project, with continued leadership from IRI and IPRC, and PICES. This project would have its focus in the tropical Pacific and be linked, possibly through climate interactions, to PICES activities in the North Pacific. There was agreement that the report of the Honolulu meeting could be expanded to identify the major issues and research topics related to the interaction of climate and fisheries in the Pacific. There was also a sense that expanding the comparative approach to include the Atlantic and Indian Oceans should be highly beneficial. The report of the workshop should be available shortly.

## PICES North Pacific Ecosystem Status Report

PICES intends to expand the scope of its normal activities by undertaking a pilot project to produce the first North Pacific Ecosystem Status Report during the upcoming year. The proposed outline for the report is:

1. Introduction and scope
   a. Status of monitoring and databases
2. Hydrography and climate
   a. Large scale features and indices (e.g., ENSO, PDO, NPI indices)
   b. Regional features and indices (e.g., regional seas ice cover indices, annual air and ocean temperature anomalies, salinity anomalies, precipitation anomalies)
3. Chemistry
   a. $CO_2$ concentration
   b. Dissolved oxygen levels
   c. Nutrient levels and sources
   d. Trace metals and organic pollutants: sources and levels in seawater, sediments and biota
4. Biology
   a. Phytoplankton (chlorophyll, production, species composition and distribution, size composition, timing of spring bloom, harmful algal bloom number and extent)
   b. Zooplankton (biomass, species composition and distribution, size composition, production)
   c. Non-commercial benthos (biomass, species composition and distribution, size composition, summarized by feeding type)
   d. Fish, shellfish and squid (catch {including bycatch and discards}, mariculture activities, biomass, recruitment, species composition and distribution, size or age composition, mean weight at age, stock condition {number of stocks that are increasing, decreasing, stable}, rates of fish disease occurrence, diet, larval and egg stage abundance and distribution)
   e. Marine mammals and birds (number, reproductive performance, diet)
   f. Number and type of non-native species
5. Ecosystem analysis and predictions
   a. Status of modeling
   b. Identification of human and natural processes influencing ecosystem change (diagnostic models)
   c. Prediction of future ecosystem status (prognostic models)
6. Outstanding scientific questions and recommendations

A workshop was convened from March 7-9, 2001, in Honolulu, U.S.A., co-sponsored by PICES, the Alfred P. Sloan Foundation's Census of Marine Life program, and the International Pacific Research Center to identify data sources and key contributors to the ecosystem status report (See PICES Press 9(2)). The workshop had over 60 participants and identified many sources and types of time series data for inclusion into the report, along with existing diagnostic and predictive models presently in use. The workshop report was published as PICES Scientific Report No. 18 and is available on the PICES website or from the PICES Secretariat. It was recommended that information about the data sources identified at the workshop be put into a North Pacific ecosystem meta-database to aid future efforts to compile the status report.

In order to enhance regional contributions of the reports in the future, we suggest asking appropriate Member Nations to host 2 day regional workshops for a region of interest. Possible regions to cover are:

1. Bohai/Yellow/East China Sea hosted by Korea or China
2. Japan/East/Okhotsk Sea hosted by Japan, Korea, or Russia
3. Oyashio/Kuroshio hosted by Japan or Russia
4. Bering Sea hosted by U.S.A. or Russia
5. Alaska Current hosted by Canada or U.S.A.
6. California Current hosted by Canada or U.S.A.
7. Pacific Basin/Transition Zone - hosted by U.S.A. (Hawaii)

Each workshop would have one day of presentations (each with a written report) on the historical and current information about ecosystem status with everything from physics to whales, and one day to develop the key ideas for the current status, add limited interpretation for this year, and sketch out a summary report. In addition, there could be contributions by IPHC, NPAFC and IATTC on single species or taxonomic groups. The first draft of the first attempt is anticipated to be available by PICES XI in Qingdao.

# Recent achievements/activities of the U.S. GLOBEC Northeast Pacific Ocean Program

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*(Hal's photo and brief biography can be found in this issue on page 28.)*

U.S. GLOBEC observations in the Northeast Pacific (NEP) Ocean began in fall 1997, with initial long-term observation program (LTOP) cruises on the Seward line in central coastal Alaska (Coastal Gulf of Alaska; CGOA) and along several transect lines in the Pacific Northwest (PNW) between Newport, Oregon, and Crescent City, California (California Current System; CCS). LTOP cruises have continued 5-7 times per year, focusing on periods of the year in which key physical or biological processes occur. Other projects in 1997 began initial model development and retrospective data analysis of existing data sets. I reported on the initial activities of the U.S. GLOBEC NEP program in an earlier PICES Press article (Batchelder, H.P. 1998. Update on U.S. GLOBEC research projects and coordination activities in the Northeast Pacific. PICES Press, 6: 17-19). The program has expanded considerably since those initial LTOP, modeling and retrospective studies were funded, and is now midway through its program of field campaigns in both the CGOA and the CCS. It seemed timely for an update on who is involved in the program, where we are, and what has been accomplished.

The U.S. GLOBEC program in the CCS and CGOA has a goal of understanding how changes in the atmospheric forcing and circulation affect the productivity of the coastal ecosystems, and the survival of juvenile salmon after they enter the ocean. We hypothesize that the spatial and temporal variability in mesoscale circulation are a dominant physical forcing that impacts production, biomass and distribution of plankton in each region. Thus, the NEP program is using the strong temporal and spatial variability in physical and biological signals to examine the biophysical mechanisms through which zooplankton and salmon populations respond in the coastal regions of the CCS and CGOA.

At a larger spatial scale, the eastward flowing North Pacific Current splits as it nears North America and feeds water into both the counterclockwise Alaska Gyre and the equatorward California Current (Fig. 1). Records of salmon catch from these regions suggest that the biological productivity of these ecosystems alternates with characteristic periods of several decades. The intriguing aspect of these fluctuations is that salmon off Alaska are relatively more abundant when salmon off the PNW are scarce (Fig. 2). It has been hypothesized that the responses of the salmon stocks reflect fundamental changes in coastal productivity of the two regions, forced by large-scale atmospheric pressure systems and wind fields. Since 1998, this phase pattern has changed somewhat. Salmon

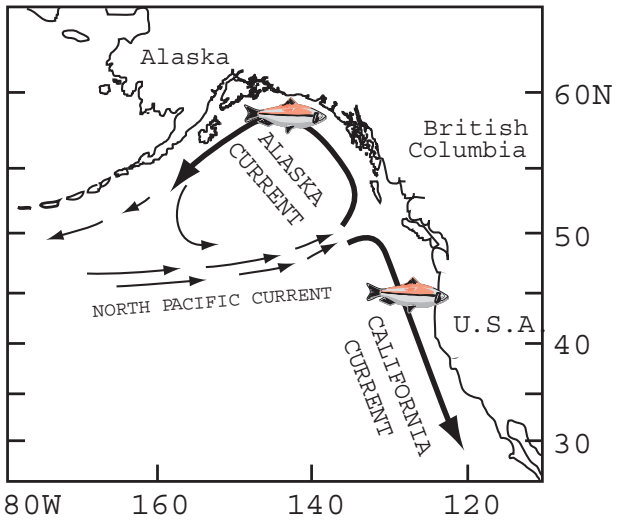



*Fig. 1* *Schematic diagram of the surface currents in the NEP ocean. U.S. GLOBEC study sites are indicated by the fish symbols.*

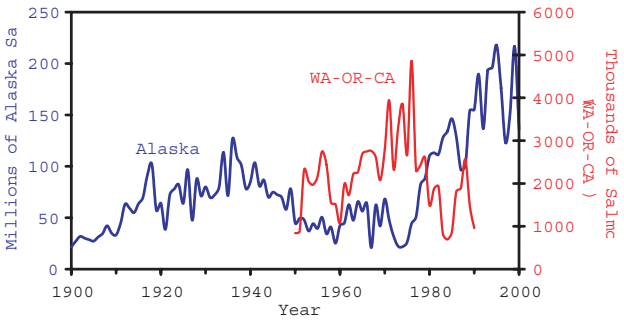



*Fig. 2* *Commercial catch of salmon in the two regions of the NEP. Fluctuations with high and low periods of 20-30 years are evident, as are shorter period fluctuations. Note that salmon catches are greater in Alaska when PNW catches are low and vice versa.*

returns appear to be up in the Pacific Northwest. Some stocks of Alaska salmon have shown evidence of lower returns since 1998; while others have not, and the total tendency of stocks in the Alaska region is not coherent or clear. Examination of atmospheric forcing (pressure systems and wind fields) suggest that winds in recent years are much more northerly, upwelling favorable, in the CCS, much like conditions prior to the mid-1970s. However, winds in the Gulf of Alaska have also changed, but have not returned to the pre-1977 conditions (Schwing, pers. comm.).

Does this "out-of-phase" relationship hold a clue to the underlying mechanism for changes in salmon abundance in both systems? Although Figure 2 shows a general inverse phasing of salmon (all stocks combined) abundance in the PNW and Alaska regions of the NEP, recent re-analysis by GLOBEC investigators (Botsford and Lawrence, submitted) indicates that the response to the "regime shifts" is species specific. Abundances of sockeye, pink and coho salmon in Alaska, and coho salmon in the PNW have responded strongly to large-scale changes in the marine climate (as evidenced by the Pacific Decadal Oscillation [PDO] index). However, chinook salmon populations in both the PNW and Alaska remained nearly constant during 1950-1990, which encompassed the time of the major 1976-77 shift in ocean conditions.

The U.S. GLOBEC research team investigating this mystery in the Northeast Pacific consists of thirty-four funded projects, and 90 investigators from 26 institutions (URL -http://globec.coas.oregonstate.edu/groups/nep/projs.html - lists all of the project titles and provides links to the project abstracts). Understanding the linkages between atmospheric and climatological forcing and ecosystem responses at various trophic levels from zooplankton to fish and mammals, requires an interdisciplinary research program which encompasses physical forcing and structure to biological responses at multiple space and time scales. Tables I-V summarize the key program activities and investigators. These include a sustained program to monitor changes in both systems, focused process-oriented shipboard investigations, computer models of ocean circulation and ecosystem-fish dynamics, and retrospective studies of longer time series of the ecosystems (currents, nutrients, plankton, fish, birds and mammals). Multiple and diverse platforms (ships, moorings, satellites, land-based radars, autonomous gliders) are used to make *in situ* and remote sensing observations of physics, chemistry and biology.

Juvenile salmon survival during their residence in the coastal ocean is controlled by their success at consuming prey and avoiding predation, parasites and disease. These are all likely to be spatially-dependent processes. Thus, U.S. GLOBEC field work emphasizes both process-oriented investigations and spatial surveys of juvenile salmon, their predators, their prey, and their condition. Major field years for the PNW studies are 2000 and 2002, while 2001 and 2003 are major field years for the Alaska region studies. At the time of the writing of this article, researchers in both regions have waged their first year's field campaigns, and very successfully. To illustrate the extent of the datasets generated, Figure 3 shows results of a three vessel survey of ocean conditions off Oregon and Northern California during August 2000, including descriptions of temperature, phytoplankton and copepod abundance, juvenile salmon, and birds and mammals. Near-surface nutrient (silicate, nitrate) distributions (not shown) largely reflect upwelling processes, varying inversely with temperature: e.g., higher nutrient concentrations nearshore in regions of low 5-m temperature, and lower concentrations offshore where surface temperatures are higher. There are clear patterns in the distributions, with evidence of concentrations of salmon, one of their prey (copepods) and predators (birds, mammals) nearshore, and especially over Heceta Bank and near Cape Blanco. Similar types of data were collected for the CCS in June 2000.

The field work off Alaska in 2001 examined similar processes to those examined in the PNW. Process cruises in April, May and July, provided detailed information on the physical-chemical structure and biological populations in the coastal zone, with experimental work conducted within the core of the Alaska Coastal Current (ACC) (inshore), at a midshelf station, and an offshore station in each cruise. Complementing the process cruises in May was a spatial mapping of the fields using CTD and net tows from a NOAA vessel. In the CGOA, pink salmon exit the fjords and embayments in late summer, spending much of the fall on the continental shelf, transported westward by the ACC. Consequently, fish trawling is concentrated into the period from July to October. In 2001, there were five occupations of the Seward line to sample fish, and one survey in July-August that extended over a much broader shelf region. Moorings along the Seward and the Gore Point lines (West of the Seward Line) are used to measure currents, water properties and biology—this included use of nitrate sensors to examine how nutrients are replenished to the inner shelf. The ship and mooring-based observations are complemented by satellite-sensed surface currents, temperature and chlorophyll distributions, which provide the larger-scale context for the field measurements.

Modeling is an important component of the NEP program. In addition to collecting data to describe and better understand the effects of climate variability and change on the distribution and production of plankton and fish, the program hopes to synthesize and interpret this understanding into diagnostic and prognostic models, capable of predicting ecosystem dynamics and responses on a range of time scales. Toward that end, a series of coupled modeling efforts are underway. First, numerical models of ocean circulation, stratification and structure are being coupled at basin-scale (ca. 40 km horizontal

*Table I. Activities/observations of the Mesoscale Survey/Mapping component.*

| *Activity* | *CCS* | *CGOA* |
|---|---|---|
| **IA. Mesoscale Survey** | | |
| CTD Profiles | Barth[1] | |
| Chlorophyll | Cowles[1]/Barth[1] | |
| Bio-Optics | Cowles[1] | |
| HF Acoustics (HTI) | Peterson[2]/Pierce[1] | *None in 2001* |
| OPC | Zhou[3]/Huntley[4] | |
| ADCP | Pierce[1] | |
| Underway Surface Mapping | | *TBD in 2003* |
| POC | Letelier[1] | |
| T/S | Barth[1]/Cowles[1] | |
| Chl/HPLC | Letelier[1] | |
| Nutrients | Hales[1] | |
| Primary Production | Letelier[1]/Abbott[1] | |
| **IB. Ancillary Mesoscale Observations – Station Work** | | |
| CTD Profiles | Huyer[1]/Peterson[2]/Batchelder[1]/Brodeur[2] | Stabeno[12]/Helle[20]/Strom[21]/ Weingartner[19] |
| Chlorophyll | Peterson[2] | Napp[22] |
| Bio-Optics | Cowles[1] | |
| Primary Production | Letelier[1]/Abbott[1] | |
| Nutrients | Hales[1] | Mordy[12] |
| ADCP | Pierce[1] | Stabeno[12]/Helle[20]/ Weingartner[19] |
| ZP (MOCNESS) | Peterson[2] | |
| ZP (Vert. Tow) | Peterson[2] | Napp[22] |
| Neuston | Brodeur[2] | Helle[20] |
| Fish | Brodeur[2]/Emmett[2] | Helle[20]/Haldorson[23] |
| Birds | Ainley[5] | |
| Mammals | Tynan[2] | |
| Underway Surface Mapping | Tynan[2]/Peterson[2] | Stabeno[12] |

1 Oregon State Univ.
2 Northwest Fish. Science Center, Newport, OR
3 Univ. Mass., Boston
4 Univ. Hawaii
5 Harvey Assoc.
6 Northwest Fish. Science Center, Seattle, WA
7 Naval Postgrad. School
8 Univ. Wash.
9 Ocean Imaging, Inc.
10 Univ. Maine
11 Univ. Maryland
12 Pacific Marine Environ. Lab, Seattle, WA
13 Rutgers Univ.
14 Univ. Calif., Berkeley
15 Univ. Calif., Davis
16 Scripps Institute Oceanogr.
17 Univ. Calif. Santa Cruz
18 Southwest Fish. Science Center, Pacific Grove, CA
19 Univ. Alaska, Fairbanks
20 Alaska Fish. Science Center, Auke Bay, AK
21 Western Washington Univ.
22 Alaska Fish. Science Center, Seattle, WA
23 Univ. Alaska Fairbanks, Juneau
24 Prince William Sound Science Center, Cordova, AK
25 BAE Systems
26 Louis. Univ. Mar. Consort.
* Project Concluded in Fall 2000

*Table II. Activities/observations of the Long-Term Observation Program component.*

| *Activity* | *CCS* | *CGOA* |
|---|---|---|
| **IIA. LTOP Cruises** | | |
| CTD | Huyer[1] | Weingartner[19] |
| Chlorophyll | Wheeler[1] | Whitledge[19] |
| Primary Production | | Whitledge[19] |
| DOC | Wheeler[1] | |
| POC | Wheeler[1] | Whitledge[19] |
| Nutrients | Wheeler[1] | Whitledge[19] |
| ADCP | Kosro[1] | Weingartner[19] |
| Underway Surface Mapping | | |
| T/S | Huyer[1] | Weingartner[19] |
| Chl | Wheeler[1] | Whitledge[19] |
| ZP (MOCNESS) | Peterson[2] | Coyle[19] |
| ZP (Vert Tow) | Peterson[2] | Coyle[19] |
| Microzooplankton Abund. | Sherr[1] | Lessard[8] |
| Microzooplankton Grazing | | Lessard[8] |
| Fish | | Haldorson[23] |
| Isotope Analysis - Fish | Casillas[6] | Kline[24] |
| Isotope Analysis - ZP | | Kline[24] |
| Birds | | Coyle[19] |
| Mammals | | Coyle[19] |
| Euphausiid Rates | | |
| Egg production | Peterson[2] | Hopcroft[19] |
| Copepod Rates | | |
| Egg production | | Hopcroft[19] |
| Growth | | Hopcroft[19] |
| HTI HF Acoustics | Peterson[2] | Coyle[19] |
| **IIB. LTOP Other** | | |
| Coastal Radar | Kosro[1]/Paduan[7] | |
| Glider (CTD,Fluorescence) | | Lee[8]/Eriksen[8] |
| Satellite Drifters | Barth[1] | Stabeno[12] |
| Moorings | | |
| Physics | Kosro[1]/Hickey[8]/Ramp[7] | Stabeno[12] |
| Bio-Optics | Letelier[1]/Abbott[1] | Napp[22] |
| Nutrients | | Mordy[12] |
| Bioacoustics | | Napp[22]/Holliday[25] |
| Satellite Imagery | | |
| AVHRR | Strub[1]/Svejkovsky[9] | |
| SeaWiFS | Thomas[10] | |
| SAR | Svejkovsky[9] | |
| MODIS | Letelier[1]/Abbott[1] | |
| Bi-weekly Sampling | | |
| Inshore ZP Abundance | Peterson[2] (Newport, OR) | Hopcroft[19] (GAK1) |
| CTD/Chlorophyll | Peterson[2] (Newport, OR) | |

*Table III. Activities/observations of the Process Studies component.*

| *Activity* | *CCS* | *CGOA* |
|---|---|---|
| **III. Process Studies** | | |
| Microzooplankton Abund. | | Strom[21] |
| ZP Abundance | Peterson[2]/Huntley[4] | Napp[22] |
| Nutrients | Hales[1] | Strom[21]/Mordy[12] |
| Chlorophyll | Peterson[2] | Strom[21] |
| Microzp -> macrozoop links | | Dagg[26]/Strom[21] |
| Microzp grazing | | Strom[21] |
| Copepod Vital Rates | | |
| Egg production | Huntley[4] | Napp[22] |
| Feeding | Huntley[4] | Dagg[26]/Strom[21]/Napp[22] |
| Development/growth | | |
| Isotope composition | | Kline[24] |
| Genetics | | Dagg[26] |
| Euphausiid Vital Rates | | |
| Egg production | Peterson[2] | |
| Feeding | Peterson[2] | |
| Growth | Peterson[2] | |
| Isotope composition | Brodeur[2] | Kline[24] |
| Age structure | Harvey[11] | |
| lipids | Harvey[11] | |
| Fish Vital Rates | | |
| Diet composition & selectivity | Brodeur[2]/Emmett[2] | Helle[20]/Heard[20]/Myers[8] |
| Parasites | Casillas[6]/Jacobson[2] | Casillas[6]/Jacobson[2] |
| Condition Index | Casillas[6] | Haldorson[23]/Heard[20]/Helle[20] |
| Genetics | Teel[6] | Helle[20] |
| Scales (age/growth) | Casillas[6] | Heard[20]/Myers[8]/Helle[20] |
| Otoliths (age/origin) | Casillas[6] | Helle[20]/Heard[20]/Haldorson[23] |
| Isotope Composition | Casillas[6] | Kline[24] |
| Micronekton->Bird links | Ainley[5] | |

*Table IV. Activities/observations of the Modeling component.*

| *Activity* | *CCS* | *CGOA* |
|---|---|---|
| **IV. Modeling** | | |
| Ocean Circulation | | |
| Basin-scale | Hermann[12]/Haidvogel[13]/Tokmakian[7] | |
| NEP-scale | Hermann[12] | |
| Regional-scale | Haidvogel[13]/Zhou[3] | Hermann[12] |
| NPZ+ Ecosystem | Powell[14]/Batchelder[1] | Hinckley[22] |
| Life History | Botsford[15] | Beauchamp[8] |
| Food Web Dynamics/UTL | Wainwright[2]/Brodeur[2] | |
| IBM (plankton/fish) | Batchelder[1]/Botsford[15] | Beauchamp[8] |
| Atmospheric Models | | |
| Basin-scale | Murphree[7] | |
| Regional | Murphree[7] | Overland[12]/Bond[12] |

*Table V. Activities/observations of the Retrospective Data Analysis component.*

| *Activity* | *CCS* | *CGOA* |
|---|---|---|
| **V. Retrospective Analysis** | | |
| ZP - Newport, OR | Peterson[2] | |
| ZP - CalCOFI | Ohman[16]/Rau[17] | |
| Analysis/Database for ocean and atmosphere | Schwing[18]/Murphree[7] | |
| Satellite Imagery | | |
| AVHRR | Strub[1]/Svejkovsky[9] | |
| SeaWiFS | Thomas[10] | |
| MODIS | Letelier[1]/Abbott[1] | |
| SAR | Svejkovsky[9] | |
| Altimeter | Strub[1] | |
| Fish Scale Analysis | | |
| Sablefish | Berkeley[1*] | |
| Salmon | Heard[20] | |
| Line-P | Strom[21*] | |
| Microzooplankton | | |
| Ichthyoplankton Abundance | Brodeur[2*] | |
| Salmon Abundance | Finney[19*] | |
| Top Predator Trophic Pos'n | Sinclair[22*] | |
| Euphausiid Distibutions | Swartzman[8] | |

resolution), NEP-wide-scale (ca. 10 km resolution) and regional-scale (ca. 2-3 km resolution) (Fig. 4). Second, at the regional, and perhaps, the NEP-scale, these circulation models are being coupled with Eulerian NPZ+ ecosystem models, and with Lagrangian particle tracking models of mesoplankton and fish, some of which include behavior. The eventual goal is to simulate "typical" ocean conditions during different recognized regimes in the NEP, and evaluate how those ocean conditions affect productivity, advection and retention in coastal zones. In addition, simulations will be forced with atmospheric forcings (wind, heating) from specific years to compare with field observations from the GLOBEC NEP field years.

Coordination of the program elements is a priority within each region, and more importantly, across the regions. In winter 2000, separate Scientific Investigator meetings were held for the two regions. In November 2001, the program took a step toward integrating the CGOA and CCS programs into a coherent single NEP program by having a joint Scientific Investigator meeting in Seattle. This afforded the researchers the opportunity to share their scientific results with their counterparts from the other region. The cross-regional connections that were established at that meeting will lead to valuable synthesis

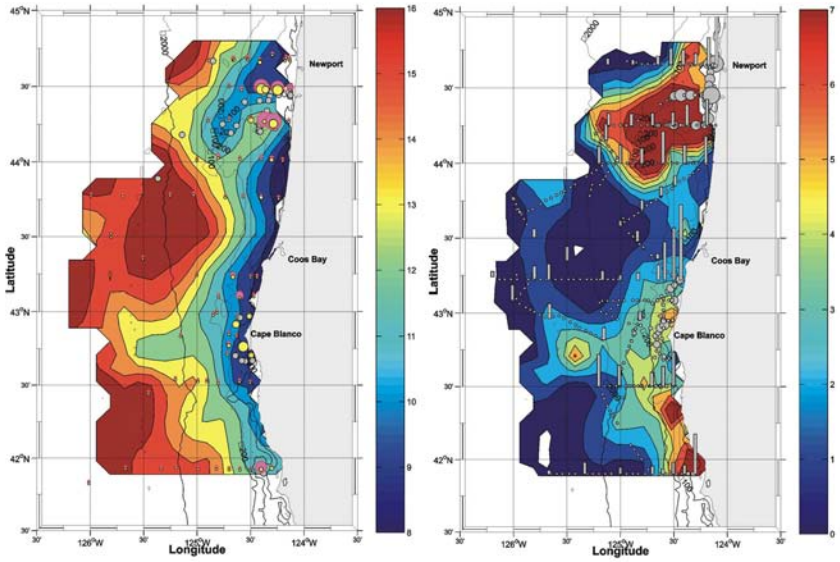



*Fig. 3* *August 2000 mesoscale survey data. Left Panel: Color contours show temperature (ºC) at 5 meters depth from sensors on a towed Seasoar undulator. Approximately, 12 equally spaced cross-shelf transects were used to provide the data for the contouring of temperature and chlorophyll (right panel). Yellow and magenta circles are abundances of juvenile chinook and coho salmon, respectively. The largest circles represent catches of ca. 10 fish per standard trawl. Smallest symbols (offshore) represent trawls in which salmon were not found. The grey circles represent sightings of humpback whales. Note that juvenile salmon were found over the shelf only, and humpback whales were concentrated on Heceta Bank and near Cape Blanco. Right Panel: Color contoured chlorophyll concentration (mg $m^{-3}$) at 5 meters depth, showing highest concentrations over Heceta Bank and nearshore south of Cape Blanco. Gray circles depict bird biomass (kg $km^{-2}$); largest circles represent 170 kg $km^{-2}$. Histograms (bars) indicate total copepod biomass (mg $m^{-3}$) from vertical plankton tows spanning the upper 100m or near bottom (if shallower). Tallest bars represent copepod biomass of 65 mg $m^{-3}$. Note the concentration of bird biomass nearshore and copepod biomass nearshore and on Heceta Bank. Seasoar data courtesy of Jack Barth and Tim Cowles. Whale sighting data courtesy of Cynthia Tynan. Salmon data courtesy of Richard Brodeur. Zooplankton data courtesy of Bill Peterson. Bird biomass estimates courtesy of David Ainley.*

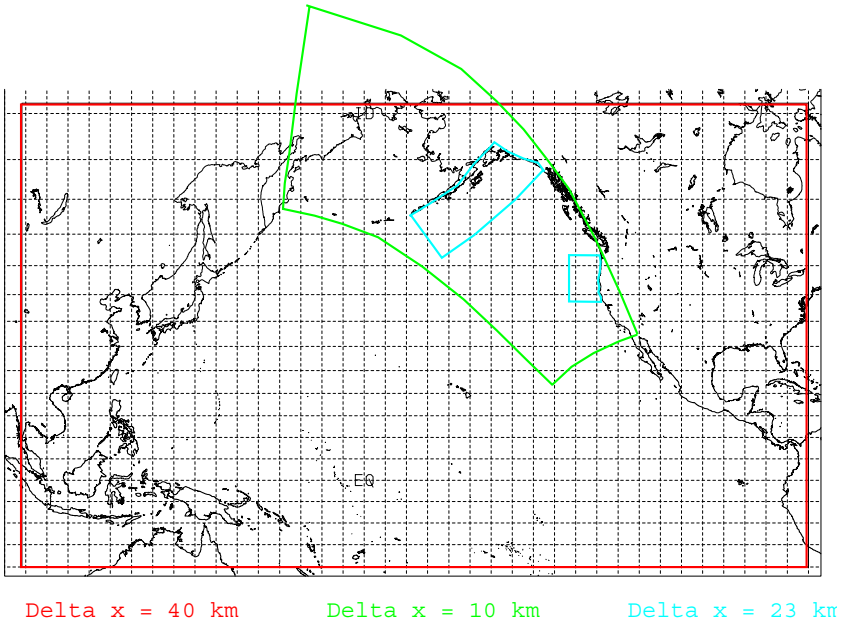



*Fig. 4* *Domains and resolutions of basin-scale (red), NEP-wide (green) and regional (blue) circulation models in the Northeast Pacific. Figure courtesy of Dale Haidvogel.*

*(cont. on page 29)*

# Science Board Chairman - R. Ian Perry

Dr. R. Ian Perry was elected Chairman of the PICES Science Board in October 2001, at PICES X in Victoria, B.C., Canada. Ian was born and raised in Vancouver, Canada, and from his early school years he had wanted to be a marine biologist. This was the 1960's, with increasing interest and awareness of the oceans thanks to authors like Rachel Carson and Jacques Cousteau. Of course, living by the sea and watching its changing moods helped, too. Once in university, he was surprised to find that everyone in biology wanted to be either a medical doctor or a marine biologist, so there was a lot of competition. He obtained his B.Sc. in zoology from the University of British Columbia, and then took a year off to work for Dr. Timothy Parsons on the CEPEX (Controlled Ecosystems Pollution Experiment) project and to travel. Working on CEPEX confirmed and rekindled his passion for oceanography. Although he considered doing his M.Sc. in Miami and Halifax, he stayed with Dr. Parsons at the University of British Columbia, reasoning that he could always go elsewhere for a Ph.D. Ian's graduate work involved a Ship-of-Opportunity sampling program on the north coast of British Columbia, a region whose biological oceanography was very poorly known. Coincidentally, the present Assistant Executive Secretary of PICES, Dr. Skip McKinnell, was conducting the shipboard sampling on the ship-of-opportunity. Ian ultimately skipped his M.Sc and went directly to a Ph.D. in zoology and oceanography, and was offered a position with Canada's Department of Fisheries and Oceans before he completed his thesis.

In 1984, Ian moved from Canada's third largest city on the mild west coast to a small village on Canada's cold east coast to join DFO's Biological Station in St. Andrews, New Brunswick, as a fisheries oceanographer. His responsibilities were to bridge the gap between fisheries and oceanography, two disciplines that had rarely worked together. He spent seven years in St. Andrews, working and building collaborative programs between fisheries scientists and oceanographers, focusing on the Scotian Shelf, the Gulf of Maine, and Georges Bank. Work in the latter two of these regions brought Ian into collaborative programs with the U.S. National Marine Fisheries Service and other scientists at Woods Hole, MA. This led to involvement in the circulation and biological modelling studies funded in the first U.S. GLOBEC program, on Georges Bank.

Ian moved to the Pacific Biological Station, Nanaimo, B.C., in 1991 to work in the newly formed Ocean Environment and Fisheries Section. This involved developing research programs concerning environmental influences on fish distributions and recruitment in the Pacific. Since then, he has conducted research on the environmental effects and food web interactions of larval, juvenile and adult stages of a number of species of both finfish and invertebrates. He developed a framework to provide stock assessment advice for species about which almost nothing is known. He conducts the stock assessments for green sea urchins along the B.C. coast; and most recently, he has begun exploring ecosystem-based approaches to the study and management of marine systems in B.C.

Ian served on the Scientific Steering Committee for the Canada GLOBEC program, and was a member of the Executive Committee of the PICES Climate Change and Carrying Capacity (CCCC) Program, being part of the team that drafted the CCCC Implementation Plan. Along with Dr. Sinjae Yoo of Korea, Ian served as the first Co-Chairman of the MODEL Task Team. For the past six years, Ian has been the Vice-Chairman of the IGBP/SCOR/IOC GLOBEC program, and served as the first Chairman of its Focus 1 Working Group on retrospective analyses and time series studies. He has also just finished a term as Chairman of the Invertebrate Subcommittee of DFO's Pacific Scientific Advice Review Committee (PSARC), which evaluates the stock assessment activities for invertebrates in B.C. In his spare time, Ian is an Associate Editor for *Fisheries Oceanography*, enjoys reading (other books in addition to submitted manuscripts), swimming, hiking, and spending time with his family. Ian is now looking forward to the opportunities and challenges of PICES' Science Board.

## CCCC Co-Chairman - Harold (Hal) P. Batchelder

Dr. Harold (Hal) P. Batchelder was born in New York, but grew up in Massachusetts, spending the summers of his youth at the beaches in New Hampshire and in the woods of New Hampshire and Maine. His father is a structural engineer, and once when asked by a teacher in grammar school to describe what his father does for a living, he responded, "he builds bridges out of toothpicks and glue". Clearly, there was more to it than that! He was never pushed to follow his father's footsteps in engineering, and was encouraged to pursue his own interests. In grade school he wanted to be a 'forest ranger' when he 'grew up', and he eventually went to the University of Maine to pursue this interest in forestry. Somewhere along the way as an undergraduate, he got "sidetracked" into marine science, with interests in, first, intertidal ecology, and later, plankton ecology.

In 1977 he moved west to Oregon State University, where he obtained an M.Sc in Oceanography working on the population dynamics and structure of intertidal sea anemones. Fortuitously, a technical position opened up on a project run by Professors Charles Miller and Bruce Frost, to sample zooplankton from the Canadian Weatherships *Quadra* and *Vancouver* at Station PAPA in the North Pacific, during their last 18 months prior to retirement (the ships, not the Professors!). Eventually, he returned to student status and completed a Ph.D. on the population dynamics and vital rates of the copepod, *Metridia pacifica*, in the subarctic Pacific.

Following a post-doctoral and marine research scientist position at the University of Rhode Island, Hal served for 6 years as the scientific director of the National U.S. GLOBEC Steering Committee Office, first at the University of California, Davis, and later at Berkeley. Presently he is an Associate Professor (Senior Research) at Oregon State University, and is Executive Director of the U.S. GLOBEC Northeast Pacific (NEP) Regional Coordinating Office. Consequently, most of his time is consumed by administrative work, but he still finds time to examine (via modeling studies) the interactions of plankton populations and physical flow fields, and has particular interests in coupling Lagrangian approaches, that include complex biological states and behaviors, with Eulerian descriptions of physics and lower trophic levels. In his spare time--what little there is--he goes hiking, biking and birding. Locally, he serves on the Board of the Audubon Society of Corvallis. Hal attended PICES II and PICES VII previously, but was only little involved in PICES administrivia. Obviously, that has changed dramatically since he began his term as PICES Climate Change and Carrying Capacity (CCCC) Co-Chairman at PICES X.

## TCODE Chairman - Igor I. Shevchenko

Dr. Igor I. Shevchenko graduated from the Far East State University (Vladivostok, Russia) in Applied Mathematics (M. Sc.) in 1976. He received his Ph.D. in Computer Sciences from the Institute for Control Sciences of Russian Academy of Sciences (Moscow, Russia) in 1983. He spent two years at the Science Information Processing Center of the University of Tsukuba (Tsukuba, Japan), doing some research in Differential Games and AI Applications. Dr. Shevchenko is Associate Professor and Head of Informatics Department of the Institute of Mathematics and Computer Sciences of the Far East State University. He has worked for TINRO-Center since 1995, first as Head of Applied Mathematics Laboratory, and then as Head of the Information Technology Department. During these years he was involved not only in data management activity, but also in implementation of software for archiving and processing different types of data and metadata related to the Pacific Ocean. Dr. Shevchenko has served as a representative of Russia on TCODE since the PICES Sixth Annual Meeting.

## POC Chairman - Kuh Kim

Dr. Kuh Kim got his Ph.D. in 1975 from M.I.T.-Woods Hole Oceanographic Institution Joint Program of Oceanography. Currently he is Professor of Physical Oceanography at the School of Earth and Environmental Sciences (SEES), Seoul National University. He has been the Dean and the Director of SEES since 1999. Dr. Kim's research interests include the meso-scale dynamics, circulation and climate change in marginal seas. His observations in the Japan/East Sea since 1980 have produced new findings on water masses and interannual variability in the Korea Strait and Ulleung Basin. He organized international expeditions called CREAMS (Circulation Research of the East Asian Marginal Seas) to study the circulation and its variability in the Japan/East Sea during 1993-1998 with Japanese and Russian colleagues. Since the First JECSS (Japan/East and East China Seas Study) Workshop in 1981, he has been working on the regional cooperation in oceanographic researches as a member of the JECSS Steering Committee, convenors of its bi-annual workshops, and editor of its proceedings. JECSS Workshop is changing its name to PAMS (Pacific-Asian Marginal Seas) Workshop, as exchange processes between the marginal seas and the North Pacific have been recognized as important parts of its interest. He has been the Chairman of the PAMS-JECSS Steering Committee since 1993. Presently, he also serves as a member of the International Argo Science Team. Dr. Kim has been with PICES as a member of the Physical Oceanography and Climate (POC) Committee since 1996, and was elected as the Chairman of POC at PICES X.

*(cont. from page 26)*

activities in the future. Results from both the CGOA and CCS will be presentated at the Ocean Sciences special session on "Coupled biophysical processes, fisheries resources, and climate variability in coastal ecosystems of the Northeast Pacific Ocean" in February 2002. Meetings such as the GLOBEC International 2nd Open Science Meeting and PICES XI in Qingdao, People's Republic of China, in October 2002, will continue to provide additional venues for interactions between PIs working in the two regions, and with scientists from other GLOBEC or GLOBEC-like programs.

Most of the results that have been reported to date are the result of the initial monitoring, modeling and retrospective projects begun in 1997. Approximately two dozen papers funded by GLOBEC NEP appear in 3 special volumes of *Progress in Oceanography*. Additional papers are in press in other journals. An even greater number of scientists who were involved in the recently completed process studies of 2000-2001 are actively analyzing their data and preparing for the second year of intensive field studies. They have just had their first joint workshop to exchange information. What is clear is that the GLOBEC NEP program has been fortunate to occur at a time when ocean conditions in the NE Pacific have experienced strong signals—including a strong El Niño of 1997-98, the subsequent La Niña, and perhaps, although it is too early to say, a "regime shift" in the late 1990's. The species composition of zooplankton ranging from the CalCOFI region (Ohman, pers comm.) through the GLOBEC CCS region to the shelf off Vancouver Island (Peterson, W.T., and Mackas, D.L. 2001. Shifts in zooplankton abundance and species composition off central Oregon and southwestern British Columbia. PICES Press, 9: 28-29) indicates a shift from a warm, unproductive regime to a cool, productive regime in the CCS. It remains to be determined whether this shift is a manifestation of a low-frequency "regime-shift" or a residual effect of the El Nino-La Nina of 1997-1999. In either case, the GLOBEC NEP sampling has a strong signal to work with, in both physical and biological fields and time series.

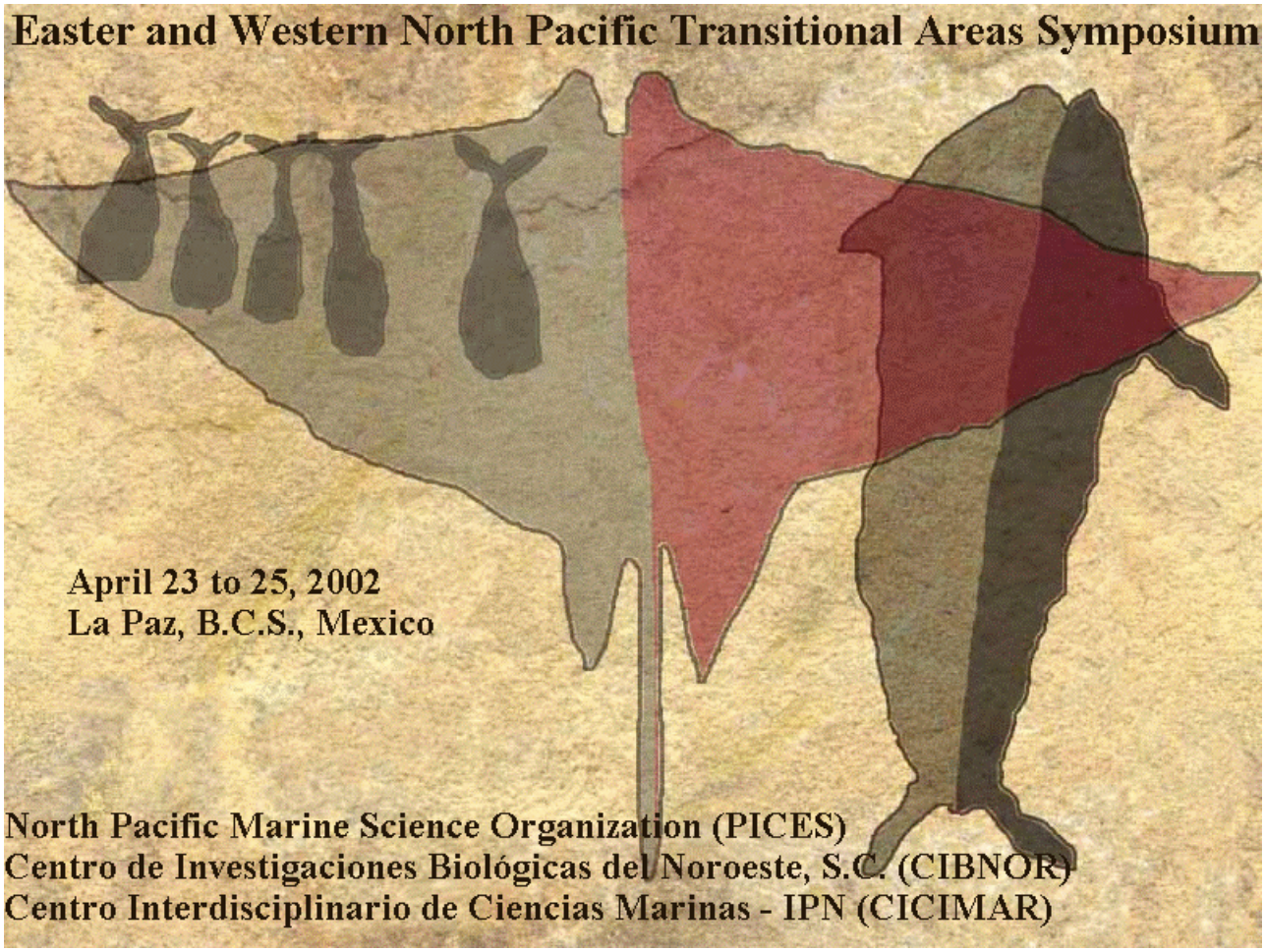
There have also been changes in the coordination of the NEP program. The NEP coordinating office moved to Oregon State University, Corvallis, OR, in June 2000. Hal Batchelder remains the Executive Director of the NEP program. The Interim Northeast Pacific Executive Committee that was described in 1998, has been replaced by a Northeast Pacific Executive Committee (NEPEXCO), consisting of scientists elected from among the funded principal investigators. Ted Strub of Oregon State University is the current Chairman of the NEPEXCO, which has 14 members representing diverse geographic, discipline and institutional interests. NEPEXCO members serve two-year terms, and can be re-elected.

# Upcoming PICES publications in 2002-2003

- PICES Scientific Report No. 19. Commercially Important Crabs, Shrimps and Lobsters of the North Pacific Ocean (Final Report of WG 12 on Crabs and Shrimps) (December 2001);
- Other PICES Scientific Reports
  - Review and results from the 1999 and 2000 PICES method inter-comparisons for carbonate parameters;
  - Proceedings of PICES X Anniversary Symposium;
  - Final report of WG 13 on $CO_2$ in the North Pacific;
  - Proceedings of the 2001 CCCC Task Team Workshops;
  - National reports on harmful algal blooms in the PICES region;
- A special issue of *Marine Environmental Research* (Guest editors: Richard F. Addison and John E. Stein) based on results from the 1999 MEQ Practical Workshop;
- A special issue of *Journal of Oceanography* on "Physics and biology of eddies, rings and meanders in the PICES region" (Guest editors: William B. Crawford, Alexander S. Bychkov, Stewart M. (Skip) McKinnell and Takashige Sugimoto);
- A special issue of *Progress in Oceanography* on "A Decade of variability in the physical and biological components of the Bering Sea ecosystem 1991-2001" (Guest editors: Allen Macklin, Jeffrey M. Napp, Vladimir Radchenko, Sei-ichi Saitoh and Phyllis Stabeno);
- Selected papers from the PICES X session on "Migration of key ecological species in the North Pacific Ocean" in *Canadian Journal of Fisheries and Aquatic Sciences* (Guest editor: James Irvine);
- A special issue of *Progress in Oceanography* on "Plankton size classes, functional groups, and ecosystem dynamics: Causes and consequences" (Guest editors: Alexander S. Bychkov and Angelica Peña).

# Upcoming PICES Meetings in 2002-2003

- MODEL/REX Workshop to build an NPZF (nutrient-phytoplankton-zooplankton-fish) version of the PICES NEMURO model, January 25-29, 2002, Nemuro/ Yokohama, Japan;
- Working Group 14 on Effective Sampling of Micronekton is meeting on February 16-17, 2002, in Honolulu, Hawaii, U.S.A.;
- NPAFC/NASCO/IBSFC/PICES/ICES Joint Meeting on "Causes of marine mortality of salmon in the North Pacific and North Atlantic Oceans and in the Baltic Sea", March 14-15, 2002, Vancouver, Canada;
- MONITOR Workshop on "Voluntary Observing Systems", April 4-5, 2002, Seattle, Washington, U.S.A.;
- BASS/MODEL Workshop on "Using models to test hypothesis on affects of climate change on the North Pacific subarctic gyre system", April 21-22, La Paz, Mexico;
- International Symposium on "North Pacific transitional areas", April 23-25, La Paz, Mexico;
- Working Group 16 on Climate change, shifts in fish production, and fisheries management is meeting on July 3-5, 2002, in Qingdao, People's Republic of China;
- PICES/CREAMS/ONR Symposium on "Recent progress in studies of physical processes and their impact to the Japan/East Sea ecosystem", third week of August, 2002, in Seoul, Republic of Korea;
- PICES Eleventh Annual Meeting, October 18-26, 2002, Qingdao, People's Republic of China;
  - PICES - GLOBEC Data Management Workshop on "Exchange, inventory and archival of GLOBEC data", October 19;
  - MONITOR Workshop on "Requirements and methods for early detection of ocean change" October 19;
  - PICES -CLIVAR Workshop on "Implementation of CLIVAR in the North Pacific", October 20;
  - CCCC Integration Workshop, October 20;
  - MONITOR Workshop on "Monitoring from moored and drifting buoys", October 23;
- JGOFS/PICES Symposium on "Carbon cycle in the North Pacific II: Last JGOFS synthesis", December 3-5, 2002, Nagoya, Japan;
- ICES/PICES/GLOBEC International Symposium on "Role of zooplankton in global ecosystem dynamics: Comparative studies from the world oceans", May 20-23, 2003, Gijón, Spain;
- PICES Twelfth Annual Meeting, October 10-18, 2003, Seoul, Republic of Korea;
- The Third PICES Workshop on "Okhotsk Sea and adjacent areas", June 2003, Vladivostok, Russia.




The North Pacific Marine Science Organization (PICES) announces the symposium on "North Pacific Transitional Areas" to be held April 23-25, 2002, at Los Arcos Hotel, La Paz, B.C.S., Mexico. This symposium is hosted by the Centro de Investigaciones Biologicas del Noroeste, SC (CIBNOR) and Centro Interdisciplinario de Ciencias Marinas del IPN (CICIMAR). Symposium convenors are Daniel Lluch-Belda (Mexico), William T. Peterson (U.S.A), Jeffrey J. Polovina (U.S.A.) and Takashige Sugimoto (Japan) .

This symposium will examine recent advances in understanding the dynamics of marine ecosystems in high gradient regions of the Asian and North American coastal zones and in the open North Pacific, as well as the role of mixing in the productivity of the ecosystems including convergent zones, open ocean, boundary currents, shelf/slope, etc. Session titles and invited speakers are:

**Session 1: Western Pacific transitional areas**
Takashige Sugimoto, Ichiro Yasuda & Yoshiro Watanabe

**Session 2: Central Pacific transitional areas**
Charles B. Miller & Skip McKinnell

**Session 3: Eastern Pacific transitional areas**
Richard D. Brodeur & P. Ted Strub

Sessions will include invited and contributed papers. Contributed papers will be selected for oral or poster presentation. Submissions can be done through the meeting registration page (www.cibnor.mx/anuncios/pices/registration.html) or by e-mail as an MS Word attachment (pices@cibnor.mx). Abstract submission deadline is **February 15, 2002**.

Two special issues of refereed papers based on invited and contributed oral and poster presentations are being considered: a special issue of *Journal of Oceanography* and a special issue of *Oceanides* (as evaluated by the convenors). Authors are encouraged to indicate their interest at the time of abstract submission and bring a completed manuscript to the symposium. Revisions will be required within a short timeframe to ensure publication by September 2003

Details, latest updates and registration forms can be found at the following websites:

- www.cibnor.mx/anuncios/pices/announcement.html
- www.cibnor.mx/anuncios/pices/services.html
- www.pices.int

## ICES/PICES/GLOBEC
## International Zooplankton Production Symposium

A symposium entitled *The Role of zooplankton in the global ecosystem dynamics: Comparative studies from the world oceans* will be convened to define the current "state of the art" of zooplankton ecology and to determine key research initiatives to be pursued in the 21st century. The Symposium will be held May 20-23, 2003, at the Congress Center, in Gijon, Spain. Sponsorship of the event reflects the global nature and importance of the role of zooplankton in food web dynamics and in biogeochemical cycles. A focus of this meeting will be the effect of climate variability and global climate change on zooplankton. Although local, regional, and global contributions are solicited, comparative studies among ocean basins are particularly encouraged. Since many ongoing research programs as well as national and regional GLOBEC and JGOFS efforts are now entering a mature phase, synthesis papers are especially welcome. Papers are invited in the following topic sessions:

- Physical variability and zooplanton population dynamics
- Role of zooplankton in biogeochemical cycles
- Climate influences – what are long-term zooplankton data sets telling us?
- New approaches to zooplankton modeling
- Progress in molecular biology
- Application of new technologies
- Comparative life histories and life cycles of zooplankton populations within and between the North Pacific and North Atlantic
- Role of microzooplankton in the sea

Sessions will include invited and contributed papers; the latter will be selected for oral or poster presentation. Abstracts should not exceed 250 words. The Final Announcement of the Gijón symposium will be produced in late February 2002, so registration and abstracts should be submitted electronically, after March 2002, through the PICES web site (www.pices.int). **The deadline for abstract submission is November 15, 2002.**

Information about the Symposium is available on the websites of all co-sponsoring organizations (ICES – www.ices.dk; PICES – www.pices.int; GLOBEC – www.globec.org) and will be updated periodically.

## PICES Interns

PICES offers special thanks to **Dr. Jung Hwa Choi**, the 2001 PICES Intern, who completed his term at the Secretariat and is returning to Korea with his family.

PICES is pleased to announce that **Ms. Natalya Bessmertnaya** from the Pacific Research Fisheries Centre (TINRO-Centre), Vladivostok, Russia, is the 2002 PICES Intern. Those of you who attended PICES VIII in Vladivostok will remember Natasha for her diligent work in organizing and supporting the Annual Meeting. You will have an opportunity to meet Natasha again or for the first time, at PICES XI in Qingdao or at the PICES Secretariat office.

## Wooster Award – Call for Nominations

**We are now soliciting nominations for the 2002 Wooster Award** (Contact the PICES Secretariat *secretariat@pices.int* or see PICES Press Vol. 9 (1), 2001 for selection criteria and award description). **Nominations must be received no later than May 1, 2002,** and should include the following information: nominee's name, institutional affiliation and title, address, biographical resume, and statement of justification for the nomination. The award will be presented during the Opening Session of the PICES Eleventh Annual Meeting on October 21, 2002, in Qingdao, People's Republic of China.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