International symposium on *North Pacific transitional areas*

A scientific symposium focusing on *Transitional areas in the North Pacific* was held in La Paz, Baja, Mexico, April 23-25, 2002. The meeting was sponsored by the North Pacific Marine Science Organization (PICES), Centro de Investigaciones Biológicas del Noroeste, SC (CIBNOR), and Centro Interdisciplinario de Ciencias Marinas del IPN (CICMAR-IPN). Drs. Daniel Lluch-Belda (CICMAR-IPN, México), William T. Peterson, Jeffrey J. Polovina (National Marine Fisheries Service, U.S.A.), and Takashige Sugimoto (University of Tokyo, Japan) served as scientific co-convenors.

92 scientists from Canada, Japan, Mexico and U.S.A. registered for the symposium. There were 34 oral presentations and over 30 posters covering the broad geographic region of the western transitional areas off Japan, the central North Pacific Transition Zone, and the eastern transitional areas off the coast of the United States and Mexico.

The presentations on the *western transitional areas* considered the transitions between coastal waters and the Kuroshio and Oyashio Currents, the transitions between these currents and offshore waters, and the north-south transition between these two currents. Several talks presented overviews of this region. It was noted that since the Kuroshio and Oyashio are strong boundary currents, they produce strong horizontal physical and biological gradients and eddies and fronts in this region. The western transitional area is most physically energetic of the three transitional areas. It is also an area that exhibits considerable decadal variability in the strength and spatial pattern of the Oyashio, Kuroshio and Kuroshio Extension Currents, and other physical features such as the mixed layer depth.

Warm-core rings are one example of a mesoscale feature frequently observed in the western transitional area, and this was the focus of one paper. It was noted that warm-core rings are formed when a meander of the Kuroshio Extension Current breaks off and travels northwest to Japan. These rings transport oceanic water and species northwest into cooler coastal waters. They have a strong sea surface temperature and sea surface height signature and hence are easily monitored with both satellite temperature and altimetry sensors. Warm-core rings typically have a life of about one year but some have persisted for up to 5 years. Simulation studies found that the movement and life of these rings depend on the strength of the Oyashio and Kuroshio Currents. The warm-core rings depend on the strength of the Oyashio and Kuroshio Currents. The warm-core rings circulate in a clockwise fashion resulting in a shoaling of the thermocline around the perimeter and a deepening of the thermocline in the center. Skipjack tuna and other pelagic fish often forage around the ring's perimeter and follow the feature as it moves.

The presentations on the *central transitional area* all dealt with the Transition Zone, generally defined as the region between the subtropical and subarctic North Pacific gyres. Most presentations located this zone between about 30-45ºN, centered in the Kuroshio Extension Current in the west with a northward tilt in the east. Several overviews noted that it is a region containing strong north-south gradients in various parameters including temperature, salinity and chlorophyll. Physically, the Transition Zone can be considered as two different regions. West of the dateline, presentations described the strong zonal flow to the east from the Kuroshio Extension Current with extensive meanders and westward propagating eddies. To the east of the dateline, the zonal flow, meanders and mesoscale activity are all weak. At about the dateline, the chain of Emperor Seamounts represents an interesting region of strong mesoscale activity as the Kuroshio Extension Current interacts with the seamount topography.

Talks on the biology in this region indicated that data from the historical driftnet fishery provides much of our current knowledge on the distribution of the higher trophic level species. Many species exhibit latitudinal gradients in distribution and a north-south seasonal migration pattern. Squids and pomfrets represent the key forage species in this ecosystem. They migrate south in the winter to spawn in the subtropical gyre and north in the summer to access the most productive waters. Tunas, sharks and billfishes follow this migration.

One presentation focused on zooplankton in the Transition Zone, and examined in particular the question of how zooplankton populations might persist in this region with a eastward zonal flow. This question has yet to be completely resolved. However, it was suggested that in the western portion of the Transition Zone, while the zonal flow is strongly to the east, there is sufficient return circulation and westward propagating eddies to maintain a population of zooplankton. In the eastern portion of the Transition Zone, the eastward zonal flow is sufficiently weak that zooplankton populations may be able to persist, aided by occasional westward propagating eddies and input from the western side. The advective losses of zooplankton to the north and south would be relatively small and may be replaced by zooplankton population growth.

Several talks showed that satellite remotely sensed physical and biological data are useful in studying the region. Warm and cold core eddies are easily monitored with both satellite altimetry and temperature sensors. The Kuroshio Extension Current and various fronts are captured with satellite altimetry data. Satellite ocean colour data show that there is a strong chlorophyll front spanning the Transition Zone, which moves northward as the region becomes more vertically stratified in the summer. This front, called the Transition Zone Chlorophyll Front, is a migration and forage habitat for some pelagic animals.

Finally, a few talks discussed temporal variations in the region. In addition to the strong seasonal dynamics, interannual and decadal variations are observed, and forcing appears from both the atmosphere and the Kuroshio Extension Current. Some authors indicated that the changes that have occurred since 1999 may represent a persistence of the 1999 La Niña or the beginning of a new regime.

In the session on the *eastern transitional areas*, there was considerable discussion on the links between the central Transition Zone and the eastern transitional areas. Because of weak flows, the degree to which the eastern Transition Zone and California Current are connected was difficult to evaluate. Regardless, one can use zooplankton and fish species to study these interactions with the result that two community types are seen in the northern California Current. One is an offshore community composed of Transition Zone and other warm waters species, and the other is a continental shelf and adjacent slope community composed of cold water subarctic species. The demarkation of these two community types is controlled chiefly by the process of coastal upwelling. Upwelling generates vigorous circulation patterns on the shelf, and due to transport of water out of the coastal Gulf of Alaska, favours the development of a community of zooplankton and fish that are subarctic in origin. The offshore warm water community of zooplankton and fish appears to be a mixture of Transition Zone species as well as species that are transported north along the California (CA), Oregon (OR), Washington (WA) and British Columbia (BC) coast in winter with the Davidson Current, but then become permanent residents in offshore waters during summer.

The transition area is a very narrow zone in the west but as the waters move eastward, it could be said that the interaction with the California Current is over an extremely broad region, ranging from southwestern BC (approximately 50ºN) south to at least central CA (35ºN). The breadth of the interaction in the eastern boundary current region is clearly seen in charts showing the distributions of transition zone species. Also, we saw from analysis of WOCE drifter tracks (drogued at 15 m) that flows on the WA and OR shelf are southerly in summer and with high speeds, but drifters launched in offshore waters show sluggish flows, with meandering and/or westward tracks being common. However, once the shelf and offshore drifters pass Cape Blanco (OR) and the OR-CA border (42ºN), they are transported offshore, suggesting another interaction of the Transition Zone with

Drs. Jeffrey Polovina, Francisco Brizuela Venegas (Director-General of the Direccion General de Educacion en Ciencia y Tecnologia del Mar), Daniel Lluch-Belda and Ian Perry at the Opening Session.


Participants mingling at the Wine & Cheese Poster Session.


Dr. Sei-ichi Saitoh giving a presentation on satelite detection of primary production along the Kuroshio Extension.


Drs. Brenda Norcross, Francisco E. Werner and Toshio Suga etc. dancing with Mexican performers.


Symposium convenors Drs. Daniel Lluch-Belda, Takashige Sugimoto, Jeffrey J. Polovina and William T. Peterson give a toast at the Mexican Diiner.

Drs. Manuel O. Nevárez-Martínez, Salvador E. Lluch-Cota (local organizer), Yoshiro Watanabe & Ichiro Yasuda at the Poster Session.

the California Current in waters south of 42ºN. These interactions are currently being studied by the U.S. GLOBEC program.

North-south interactions were also discussed in papers which showed that the Pacific Decadal Oscillation affects California Current temperatures chiefly in the north, whereas the El Niño-Southern Oscillation chiefly affects the waters of the southern California Current. In the central and southern California Current waters, interactions between shelf and offshore waters become extremely complicated by eddies which propagate in deep water hundreds of kilometers offshore, making it difficult to construct coupled physical-biological models of Transition Zone - California Current interactions.

Another issue discussed was that despite the strong environmental gradients between the northern and southern portions of the California Current, and of the variability in the Transition Zone - California Current interactions, many zooplankton and fish species occupy the entire range of the California Current, and others (such as the euphausiid *Euphausia pacifica* and the copepod *Calanus pacificus*) are dominant species across the entire Pacific, from Japan to Oregon, then south to Baja California. Some species range from the Bering Sea south in coastal waters of central California (the euphausiid *Thysanoessa spinifera* and probably the copepod *Pseudocalanus mimus*). Species with broad distribution must deal with a wide range in environmental variability, leading one to ask if there are different life history strategies among populations of these species.

Several presentations on sardines generated considerable discussion. Three hypotheses on the regulation of sardine population abundance were discussed. The <u>loophole theory</u> argued that the sardine population was capable of explosive growth when rapid changes in the physical environment disrupted predator-prey relationships, providing a loophole that allowed larval and juvenile sardines to escape the normally heavy predation. The <u>thermal-gate hypothesis</u> considered that temperature restricted the distribution and therefore the abundance of California sardine. During cool periods, sardines are restricted to the southern part of the California Current, whereas during warm periods, the environmental restrictions move northward (the thermal-gate is opened) allowing the sardine population to move north into these more productive areas and increase in abundance. Finally, the <u>"meander" hypothesis</u> argued that changes in the speed of the California Current changed the extent it meandered. More meandering lead to more productive sardine forage and spawning habitat, and ultimately to more sardines.

Bays and lagoons also represent transitional areas between offshore and inshore regions. A number of papers addressed various aspects of the spatial and trophic dynamics in lagoons and bays on both the Pacific and Gulf of California sides of the Baja Peninsula. These talks introduced PICES scientists to the remarkable marine ecosystems of the Baja Peninsula. Discussions noted interesting opportunities to compare ecosystem dynamics between locations inside and outside the Gulf of California at the same latitude.

Selected papers from the symposium will be published in a special issue of *Journal Oceanography* in August 2003 (Vol. 59, No.4). Guest Editors for the volume include Michio Kishi, Daniel Lluch-Belda, Skip McKinnell (Chief guest editor), Arthur Miller and Yoshiro Watanabe.

The local organizing committee consisted of representatives from CIBNOR, led by Salvador Lluch-Cota, and CICIMAR-IPN, headed by Agustin Herrera. Their efforts produced an extremely well organized and smoothly run meeting that everybody enjoyed. The format of 30 minutes for each presentation produced thorough and informative presentations with ample time for questions and discussion.

The evening activities included a Welcome Cocktail on the first night, and a wine and cheese Poster Session on the open-air patio on the second night with an opportunity to sample local Mexican wines. A local group of musicians accompanied the symphony of posters on the terrace. The third and final night concluded with a performance of regional dancing by a very talented group of local dancers, accompanied by a delicious Mexican buffet. For the majority of participants, the symposium was not only a scientific event of high quality, but also a first introduction to the delights of Mexican culture.

The symposium in La Paz was the first scientific meeting organized by PICES in collaboration with Mexican scientists on Mexican soil, but we certainly hope it will not be the last. Mexico is not a PICES member country yet, but there has been steady progress in developing PICES-Mexico relations, and the *North Pacific transitional areas* symposium might be instrumental in formally bringing Mexico to PICES. For both scientific and social reasons, we hope Mexico will soon become a member of PICES.

Jeffrey J. Polovina
National Marine Fisheries Service, NOAA
Honolulu Laboratory
2570 Dole Street,
Honolulu, HI 96734, U.S.A.
E-mail: Jeffrey.Polovina@noaa.gov

William T. Peterson
National Marine Fisheries Service
Hatfield Marine Science Center
2030 South Marine Science Drive,
Newport, OR 97365, U.S.A.
E-mail: Bill.Peterson@noaa.gov

PICES Volunteer Observing Ship (VOS) Workshop

Charles B. Miller
College of Oceanic & Atmospheric Sciences
Oregon State University
Corvallis, OR
U.S.A. 97331-5503
E-mail: cmiller@coas.oregonstate.edu

David L. Mackas
Institute of Ocean Sciences
P.O. Box 6000
Sidney, British Columbia
Canada. V8L 4B2
E-mail: mackasd@pac.dfo-mpo.gc.ca

Sonia D. Batten
Sir Alister Hardy Foundation
1 Walker Terrace,
The Hoe, Plymouth,
United Kingdom. PL1 3BN
E-mail: soba@mail.pml.ac.uk

On April 4-5, 2002, the PICES MONITOR Task Team, the PICES Continuous Plankton Recorder (CPR) Advisory Panel, and the Exxon Valdez Oil Spill Trustee Council's Gulf Ecosystem Monitoring (GEM) program convened a workshop in Seattle, U.S.A., to consider enhanced instrumentation for volunteer observing ships (VOS), particularly instruments to complement CPR data. Ships instrumented to gather oceanographic data secondarily to their main mission can range from fishing vessels to the largest commercial ships on long trans-oceanic runs. The focus of the workshop was the latter, with the expectation that suitably instrumented ships could obtain data from the farthest ocean reaches on a frequent and recurring basis for long periods.

The rationale is old, simple and important. The long time scales of significant oceanic environmental events, such as coupled changes of climatic and fishery regimes, require long time series of data to document them. At the present time, expedition style cruises aboard dedicated research ships are too expensive and too irregular to accomplish this, particularly far from shore where only reasonably large, expensive vessels can venture. Therefore, the workshop participants aimed to review developments in instrumentation that can provide rich data sets when coupled to commercial vessel sea chests. Large vessels move many cubic meters of water per minute through their intake systems for cooling and other purposes. Our instrumental requirements will be liters per minute and can readily and safely be coupled to these larger flows.

Participants of the PICES MONITOR VOS Workshop: front row from left - Sei-ichi Saitoh (PICES MONITOR Task Team, University of Hokkaido, Japan), David Cutchin (Scripps Institution of Oceanography, U.S.A.), Ricardo Letelier (Oregon State University, U.S.A.), David Mackas (PICES MONITOR Task Team, Institute of Ocean Sciences, Canada, Chairman), Akira Harashima (National Institute for Environmental Studies, Japan); back row from left - Robert Decker (NOAA SEAS, U.S.A.), Phillip Mundy (Exxon Valdez Oil Spill Trustee Council, U.S.A.), Warren Wooster (University of Washington, U.S.A., local host), Ronald Zaneveld (Oregon State University, U.S.A.), Charles Miller (PICES CPR, Oregon State University, U.S.A.), David Welch (PICES CPR, Pacific Biological Station, Canada), Sonia Batten (PICES CPR, Sir Alister Hardy Foundation for Ocean Science, UK), David Hyde (National Environmental Research Council, Southampton Oceanographic Centre, UK); Not in picture: Jeffery Napp (National Marine Fisheries Service, U.S.A.).

Relevant experience was represented among the participants as follows:

Drs. Batten and Welch manage continuous plankton recorder operations on commercial vessels running between Valdez, Alaska, and Long Beach, California, and between Vancouver, Canada, and Japan.
Dr. Hyde has experience with the European Union "Ferry Box" program that instruments several ferries operating around Europe.
Dr. Harashima is instrumenting ferries operating in Japanese waters and crossing to Korea.
Dr. Cutchin has experience with installing, maintaining and retrieving data from thermosalinograph and XBT systems on commercial ships.
Dr. Zaneveld is working with a range of optical instruments likely to be part of sea chest instrumentation.
Dr. Letelier is familiar with fluorometers and fast repetition rate fluorometers which could be utilized on VOS.
Capt. Decker manages data transfer communications for several NOAA operations.
Dr. Mundy is responsible for the EVOS Gulf Ecosystem Monitoring (GEM) initiative, concerned with the ecosystem health of the Gulf of Alaska.
The other participants are oceanographers interested in time-series sampling.

The workshop opened with a presentation by Dr. Batten on the status of a PICES VOS program now in operation. That is the spring-summer CPR sampling aboard tankers of the Polar Corporation running from Valdez to Long Beach, and a once per year CPR tow from Seaboard International Ltd. ships running from Vancouver to Japan via the Bering Sea. Her report is available at the PICES website as a brief CPR Program Status Report. Three years of CPR data from the Valdez-Long Beach line have shown definite interannual variations in developmental timing and abundance of dominant Gulf of Alaska zooplankton species (principally copepods of the genus *Neocalanus*). CPR results demonstrate extended seaward transport of coastal plankton stocks (*Acartia* spp., *Calanus marshallae*) by the Haida eddy and other large coastal eddies along the coasts of British Columbia and southeast Alaska. In addition to producing some actual PICES science, the CPR program shows that shipping companies are willing to help with well-designed oceanographic observations which do not interfere with their transport operations.

A forthcoming addition to the east-west CPR run is a seabird observer to be directed by Dr. William Sydeman of the Point Reyes Bird Observatory. At the moment, insurance considerations are being negotiated with Seaboard. The primary concern is the possibility that ship time would be lost if an observer was to require diversion because of sickness or injury. From this we are learning the problems and possibilities of placing scientists on board VOS, which eventually may be more valuable than the bird data.

Next we reviewed currently active VOS instrumentation systems operating in Japan and Europe. The Japanese program is managed by the Center for Global Environmental Research (CGER) and Marine Environmental Research Laboratory (MERL) of the Japanese National Institute for Environmental Studies (NIES). Dr. Harashima of NIES reported on instrument suites making continuous computerized records of data on a number of runs, including one from Osaka to Malaysia. Instrumentation includes: temperature, salinity, pH, fluorescence, dissolved oxygen, periodic automated filtration and sample storage for shoreside analysis of nutrients (NO_3, NO_2, NH_4, PO_4, $Si(OH)_4$), and preserved whole water sampling for microscopic analysis of phytoplankton. An important result of tow basin and numerical modeling research by Dr. Harashima and colleagues, is that intake water on a large ship can be displaced downward from its original position near the ocean surface by several meters. Intakes do not receive water that was originally at their depth below the surface.

Dr. Hyde reported that the European Union is supporting a wide array of different ferry instrumentation efforts, under an umbrella organization called the "Ferry Box Program". The common effort is to examine data comparability and to push forward with addition of pollutant identification instrumentation. Various systems include: temperature, salinity, turbidity, fluorescence and CO_2. A system under development at the Southampton Oceanographic Centre determines nutrients on a relatively high frequency basis, operating on water drawn from an intake stream with a reagent addition and colorimetry system comparable to autoanalyzers but compact and fully automated. Good stability has been achieved, but frequent checks with standards remain an essential part of establishing and sustaining data reliability. Indeed, the standard checks are included in this system's automation scheme. Such gear is becoming available from several other laboratories around the world and is nearly ready for off-the-shelf application.

Japanese and European ferry systems are also carrying various bridge-mounted instruments, including radiometers, both upward looking (sky and total downward radiance) and water-leaving radiance meters. The latter are much more problematic, according to Dr. Zaneveld, because the results are extremely sensitive to angle (which is hard to hold constant) and to bubbles that are copiously, but variably, produced by waves and the instrumented ship.

Dr. Cutchin and Capt. Decker reported on bridge wing XBT operations. These involve automated or manual launch from ships at regular locations along standard routes. One example is the WOCE program on the Hawaii to Alaska ferry. Expense of the expendable probes is a significant issue, with current prices of $40 each for XBT probes and $600 for XCTD (conductivity) probes. The XCTD price has proved prohibitive for all but very special operations.

Dr. Saitoh reported on satellite remotely-sensed data which could usefully be collated with the VOS trackline data. Examples include surface temperature and ocean color, surface roughness (a proxy for wind speed), and sea-surface elevation (a proxy for geostrophic current fields). Benefits of this collation are mutual: the remotely-sensed data provide a broader spatial view that greatly aids interpretation of features observed by the VOS, while the VOS provides valuable open-ocean sea-truth sampling needed for calibration of satellite algorithms.

The group discussed a wide range of issues regarding gear installation on VOS. Cabling between engine room instruments and bridge instruments to gather data in a common computer came in for particular attention. Running cable can be difficult and, therefore, expensive. Cabling and all other aspects of installation depend upon excellent relations with the shipping company and ship's personnel at all levels. This takes negotiating skill and constant attention to relationships throughout any VOS program. Positive relationships with vessel personnel are as important to the success of VOS operations as reliable equipment and good maintenance when the ships reach port.

A highly specific discussion followed on available instruments, the value of the data they produce and the problems they present. Potential instrumentation discussed divides into engine room (water intake) and bridge measurements. The following are the practical, meaningful measurements available "off the shelf" at the present time, which could be coupled into primarily Canadian and U.S. systems we dubbed the *CanAm Ferry Box* and *CanAm Wing Pod*. In order to represent input and possible cooperation throughout PICES, these might better be called the *PICES FerryBox and Wing Pod*. We will gladly name it after any agency or other entity willing to fund their development (e.g., the *PICES/GEM Ferry Box*).

Components of proposed VOS Data Systems

CanAm Ferry Box

Flow through T and S
T via hull conductance (±0.1ºC)
Fluorometer
Transmissometry
OPC
Spectral Absorbance (AC-9)
Nutrient concentration
Colored-DOM fluorescence

CanAm Wing Pod

XBT launcher
Downwelling irradiance
Recording of ship high frequency echosounder and doppler speed log
Meteorology package
Navigation (GPS)
Accelerometer (sea state)

In the future, the *Ferry Box* could be upgraded to include fast repetition rate fluorometry (FRRF, potentially a photosynthesis rate measurement), a 100-wavelength spectrophotometer, a FlowCam for accumulating particle images and the pollutant sensors under development in Europe. The *WingPod* could eventually include a downlooking LIDAR system to profile chlorophyll.

The *Ferry Box* and *Wing Pod* systems must be coupled with suitable and redundant computing and recording capability to archive the substantial data sets that will be produced, to maintain accurate time marks for all observations, accounting for varying instrumental delays (those of automated nutrient analysis, for example). Several options for frequent or real-time telemetry of data to shore exist, including application of Iridium satellite phone technology. A variety of computational and communications hardware and software issues are involved in this aspect of the design. All of them have solutions. A rough cost estimate, with plenty of engineering money included, suggested an initial version of the *CanAm* systems could be assembled for around $250,000. Installable copies of the Mark I might run about $130,000 each.

Panel members will prepare a detailed proposal to develop these VOS systems in the near future. It is our hope that PICES will take a strong interest in supporting development of the *CanAm Ferry Box* and *CanAm Wing Pod*. The currently active European and Japanese programs for ferry instrumentation show that complex VOS programs can generate long-term and frequent data strongly indicative of ecosystem conditions. In addition to the CPR surveys (in their current form or enhanced in the future), the full extent of the North Pacific can be sampled in this way at a very reasonable cost.

Joint meeting on *Causes of marine mortality of salmon in the North Pacific and North Atlantic Oceans and the Baltic Sea*

Douglas E. Hay
Pacific Biological Station
3190 Hammond Bay Road
Nanaimo, BC
Canada. V9R 5K6
E-mail: HayD@pac.dfo-mpo.gc.ca

Dr. Doug Hay joined the Pacific Biological Station (Fisheries and Oceans Canada) as a research scientist in 1977. There he has worked on many aspects of the biology and assessment of Pacific herring, including a variety of tasks concerned with the early life history, habitat impacts, trophic biology and juvenile rearing behaviour of herring and other small pelagic fishes. Doug has been with PICES as a member of Fishery Science Committee (FIS) since 1997, and was elected as the Chairman of the Committee at PICES VIII in 1999.

Probably the worst thing about this meeting was its title: it was a title that could only have been designed by a committee (and it was). Probably one of the best and remarkable things about the meeting was that it occurred at all! This meeting represented the collective efforts of five international organizations to work together to achieve a positive end. *A priori*, one would have not thought this to be possible, but the meeting was held (March 14-15, 2002, Vancouver, Canada), interesting and useful presentations were made, some synthesis were attempted and a publication is in the works.

This meeting was unique. It occurred as a result of co-operation among five international organizations: North Pacific Anadromous Fish Commission (NPAFC), North Atlantic Salmon Conservation Organization (NASCO), International Baltic Sea Fishery Commission (IBSFC), International Council for the Exploration of the Sea (ICES), and North Pacific Marine Science Organization (PICES). The ostensible purpose of the meeting was to look for common factors affecting mortality of salmonids, identify new and promising areas for research and discuss potential international co-operation. To that end, the meeting may have achieved some success, although the end was a bit ragged, with few firm conclusions about the past or resolutions for the future.

The meeting was very well attended: with 143 registered participants - substantially more than the organizing committee anticipated. These participants came from at least 15 different nations including Belgium, Canada, Faroe Islands, Finland, Greenland, Iceland, Ireland, Japan, Lithuania, Norway, Poland, Russia, Sweden, the United Kingdom, and the United States.

One might have guessed that such a meeting would be prone to long-winded introductions that we all have suffered - the shallow platitudes from representatives of each organization. Thankfully, and to the credit of the organizers, this did not occur. The convenors of the meeting were brief and to the point, at the beginning, and throughout the meeting. The meeting was well-organized (many thanks to the local host – the NPAFC Secretariat) and fairly well run. Most of the speakers were good, some very good and the quality of the presentations was high. There were only a few run-on speakers. In general, most presentations were followed by lively discussion.

There were three sessions after the Introduction:

An overview session on *The status of salmon stocks and fisheries* was short and provided reviews of the Baltic Sea, North Atlantic and Pacific Oceans. These overviews did not enter into substantial discussion on the causes of changes in salmon mortality.

The second session was the one with substance. It dealt with *Possible factors associated with increased marine mortality*: (i) climate and oceanographic factors; (ii) human induced factors; and (iii) ecological factors. At least 9 of the oral presentation actually dealt with the topic - of factors affecting marine survival, with 2 papers making only limited reference to the main theme. 3 papers, while presenting interesting, useful and substantial information, did not address the session theme. Of the 17 papers presented as posters, 9 were directly on the topic ("marine" mortality), 3 made limited reference to it and 5 were off the topic.

The last session was the meeting conclusion: a 2-hour session called "synthesis and general discussion". In my view, this session was a disappointment. It started off well, with a thorough and extraordinarily concise but information-rich review by Peter Hutchinson. In a PowerPoint presentation, he provided summaries of papers, and key points of presentations made only minutes earlier. Quite remarkable!

Were there any key points – "take-home" messages about the causes of marine mortality? The answer, in my view, is that many hypotheses were presented, and there may have been some common trends to focus on survival and the growth during the early stages of marine life, there were few generalities - and perhaps, some hesitation or reluctance to look for them.

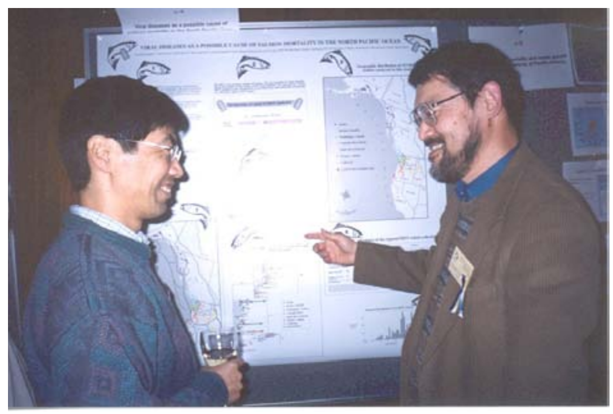
An interesting observation for me, as a person more familiar with clupeids, was that there appeared to be less in common among salmon biologists working in the Pacific and Atlantic than among herring biologists from the same areas. I think the herring people communicate more, and the researchers know each other better. Perhaps this is to be expected, because the life histories of the Atlantic salmon and all Pacific species, except steelhead, are very different. Even within each ocean, there is considerable variation in the status of runs. In the Pacific this variation occurs among species and geographically. Perhaps for this reason the meeting brought out some interesting differences in approach. There seems to have been a more thorough review and understanding of anthropomorphic factors in the Atlantic, especially the possible role of contaminants. On the other hand, the variation in Pacific salmon life history may provide many useful perspectives for better-understanding Atlantic salmon.

Were there any generalities? Perhaps. A key difference between Atlantic and Pacific salmon is that, when all species are pooled as "salmon", Pacific salmon are much more abundant than Atlantic. Also, their geographic distribution and life history is more varied. Also, it seems that the populations in the extreme southern edges of the ranges, both in the Pacific and Atlantic, are the ones of greatest concern - specifically the Atlantic salmon in Spain, and the north-east coastal areas of the U.S.A. In the Pacific, the greatest concern is for certain populations in southern areas, particularly in the Columbia and Fraser Rivers, although, like the Atlantic, some mid-latitude and northern range populations also worry many people.

Where do we go from here? It is not clear if the meeting was sufficiently definitive to provide a basis for further meetings of this kind - on this specific topic. In part, the longer-term utility of the meeting will depend on the timing and quality of the resulting publication. If the manuscripts are well done, and if the report is produced rapidly and carefully, the meeting may be judged to be a success.

An interesting point was raised at the end of the meeting. A participant, who described himself as a retired journalist, pointed out that the press was not in attendance. He suggested that the omission of the press was a tactical error. His point was that the public is vitally interested in ecological issues, especially salmon and especially topics such as salmon mortality. Public interest, he explained, was the pre-requisite for better research funding, from all sources. I think he was correct. In retrospect, it was remarkable that there was no media coverage of this meeting - which was both unique and of considerable local interest. For such an omission, you can blame the organizing committee, which includes me, as the PICES representative.

Dr. Richard J. Beamish (Fisheries and Oceans Canada) describes the natural mortality of Pacific salmon at the session on Climate and oceanographic factors.



Dr. Shigehiko Urawa (left) and Dr. Kazuya Nagasawa (right) of the Fisheries Agency of Japan consider Pacific salmon in the eastern Pacific during the poster session.

Drs. George Boehlert (National Marine Fisheries Service, U.S.A.), Kenneth Whelan (Marine Institute, Ireland) and Peter Hutchinson (NASCO) engaged in the closing panel discussion.

The state of the western North Pacific in the second half of 2001

Toshiyuki Sakurai
Office of Marine Prediction, Climate and Marine Department
Japan Meteorological Agency
1-3-4 Otemachi, Chiyoda-ku,
Tokyo 100-8122, Japan
E-mail: tsakurai@met.kishou.go.jp

Mr. Toshiyuki Sakurai is a scientific officer of the Office of Marine Prediction at the Japan Meteorological Agency (JMA). He is working as a member of a group in charge of oceanic information in the western North Pacific. Using a new "Ocean Comprehensive Analysis System" (in operation since January 2001), this group produces surface and subsurface temperature, salinity and current with 0.25×0.25 resolution in waters adjacent to Japan. Monthly averaged fields obtained from the system are included in the "Monthly Ocean Report" published by JMA. Mr. Sakurai is now involved in developing a new daily analysis system for sea surface temperature in the global ocean, using in situ *observations and data from several satellites with infrared and microwave sensors.*

Sea surface temperature

Figure 1 shows monthly mean sea surface temperature (SST) anomalies in the western North Pacific from July to December 2001. The Japan Meteorological Agency has operationally produced ten-day (Fig. 2) and monthly mean SST for 1×1 degree grid points over the western North Pacific. Both NOAA/AVHRR satellite data and *in situ* data are used for the area between 20ºN and 50ºN from 120ºE to 160ºE, and only *in situ* observations are used in other regions.

It is remarkable that SSTs were more than 1ºC above normal around Japan in July, and more than 2ºC above normal in the western part of the Japan Sea in August. SST anomalies were almost the highest in the past 9 years in the regions 4, 7 and 8 in July, and in region 3 in August (Fig. 2). Positive SST anomalies exceeding +1ºC were found east of 170ºE between 30ºN and 45ºN throughout the period, and positive anomalies exceeding +2ºC were observed in September and October. SSTs were generally below normal north of 50ºN and in the seas around the Kuril Islands.

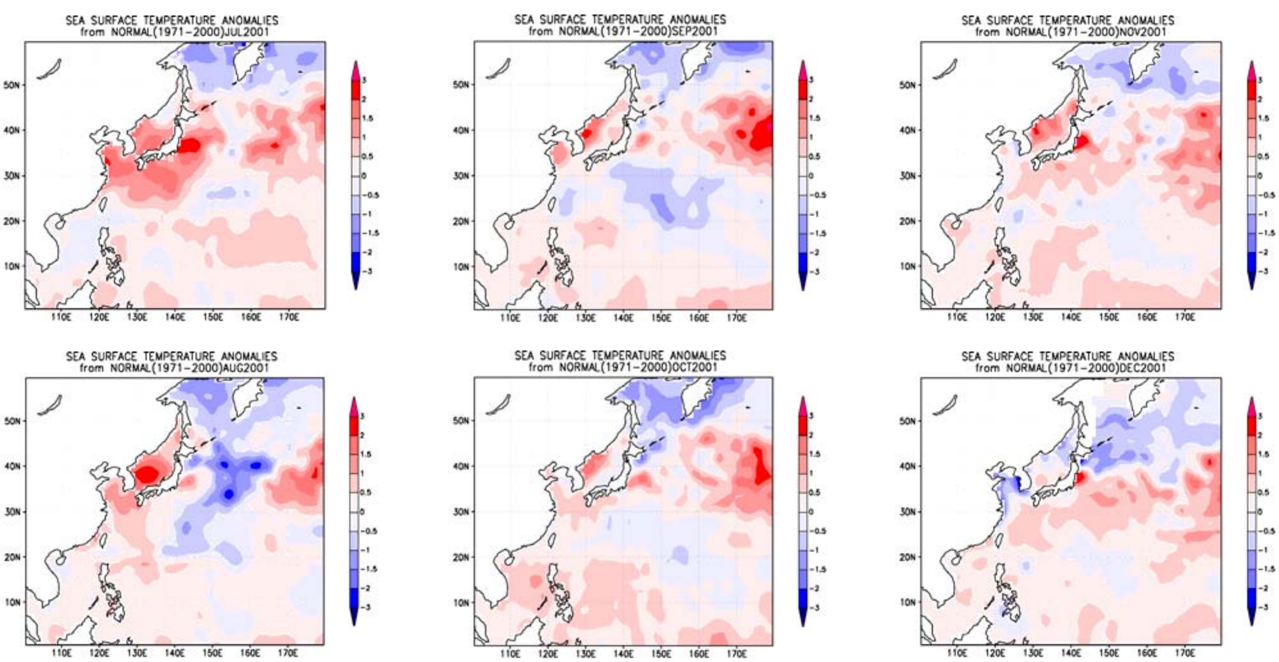


Fig. 1 Monthly mean sea surface temperature anomalies (ºC). Anomalies are departures from JMA's 1971-2000 climatology.

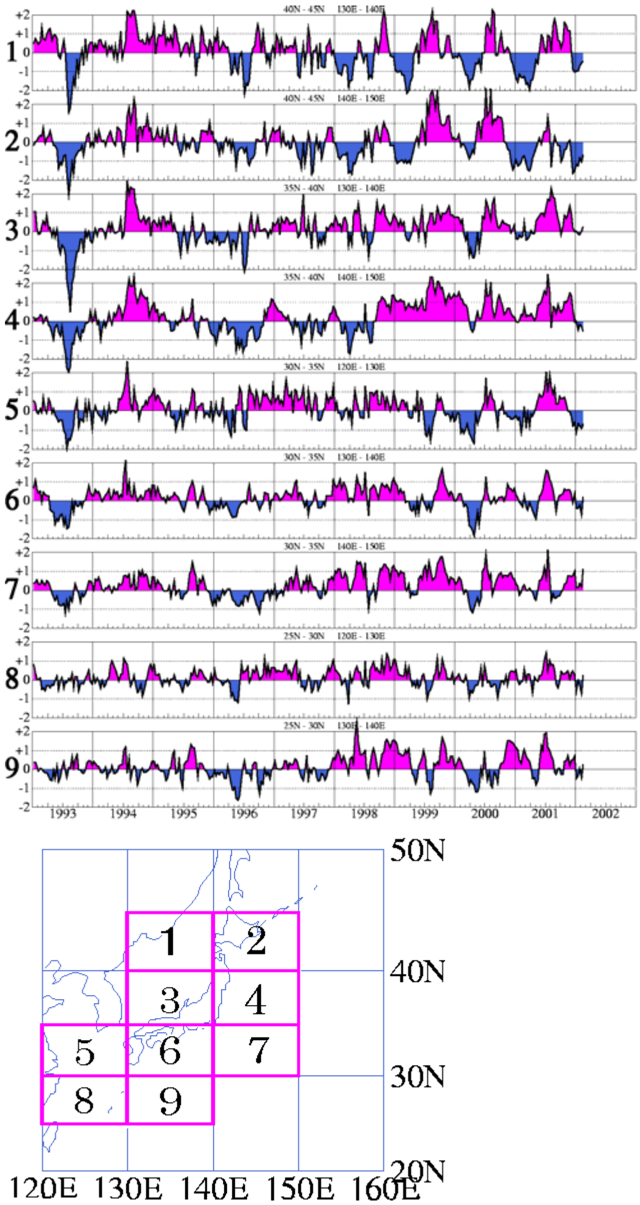


Fig. 2 *Time series of the ten-day mean sea surface temperature anomalies (ºC), computed from JMA's 1971-2000 climatology for the areas shown in the bottom panel.*

Kuroshio

Figure 3 indicates the location of the Kuroshio axis, which is derived from *in situ* currents, SST, subsurface temperature and sea surface height. The Kuroshio took a non-large meander path off Tokai from July to December 2001. However this path was variable around 140ºE, with frequently appearing small perturbations. The Kuroshio flowed northward to about 38ºN east off Japan for most of the period and caused the remarkable positive SST anomalies around 37ºN, 142ºE (Fig.1).

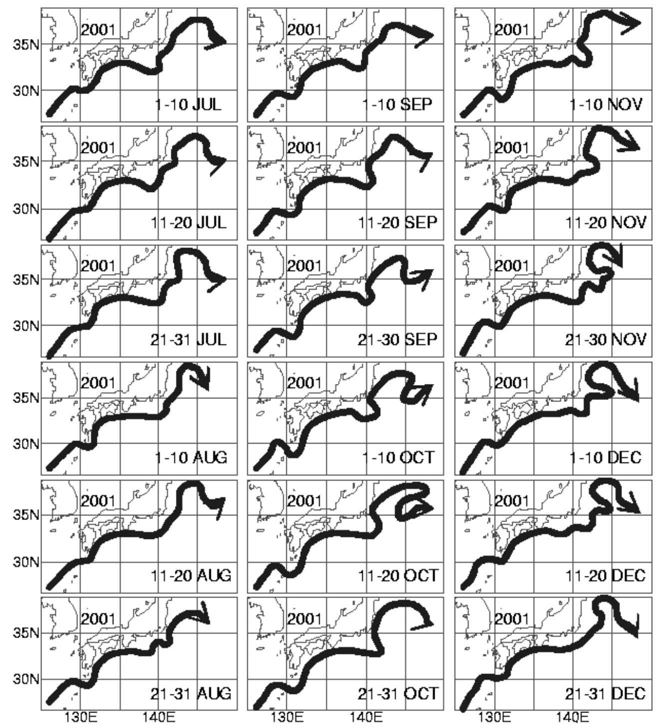


Fig. 3 *Location of the Kuroshio axis from July to December 2001.*

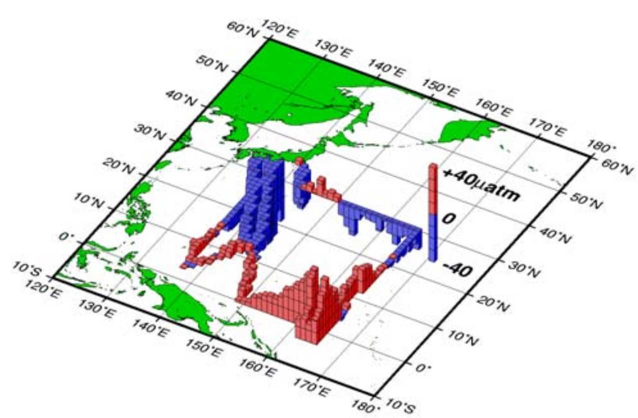


Fig. 4 *Distribution of the difference in CO_2 partial pressure between the surface seawater and the atmosphere from October to December 2001. Red and blue pillars indicate that the ocean emits CO_2 into or absorbs it from the atmosphere, respectively.*

Carbon dioxide

JMA has carried out carbon dioxide (CO_2) observations on board the R/V *Ryofu Maru* and *Keifu Maru*. Figure 4 shows the distribution of differences in CO_2 partial pressure between the surface seawater and the atmosphere from October to December 2001.

(*cont. on page 22*)

State of the eastern North Pacific in spring 2002

Frank A. Whitney
Institute of Ocean Sciences
Fisheries & Oceans Canada
P.O. Box 6000, Sidney, B.C.,
CANADA. V8L 4B2
E-mail: WhitneyF@pac.dfo-mpo.gc.ca

Frank A. Whitney has led the Line P program for the past 10 years, carrying out repeat oceanographic sections for WOCE (1991-97) and hosting the Canadian JGOFS program (1992-97) on these cruises. Through this time, his main research interest has been in understanding processes which control nutrient supply to the upper ocean. He has also surveyed mesoscale eddies several times in an attempt to estimate offshore transport of coastal waters in the Gulf of Alaska. Frank has been working in oceanography on the British Columbia coast since 1969.

The NE Pacific Ocean is in a slightly cool phase as we enter spring 2002. Line P surveys show that the heat transported into the Gulf of Alaska during the 1998 El Niño has taken a few years to dissipate (Fig. 1). Temperatures in the mixed layer are currently slightly below the 1956-91 climatology, and the heat that was injected into the pycnocline (100 to 250 m depth) is no longer evident. The cooler waters at these depths are slightly less saline, a signature of more nutrient rich waters of Alaska Gyre origin.

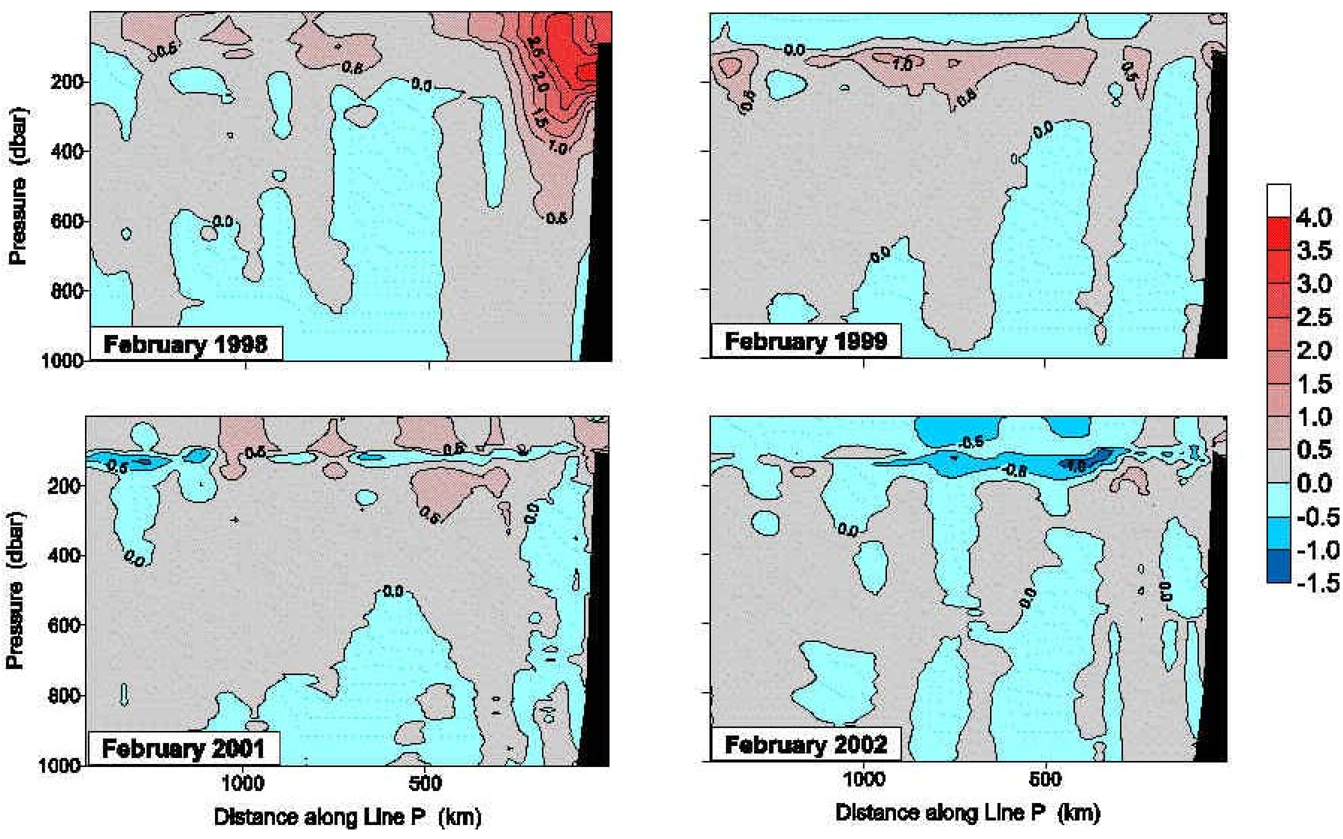


Fig. 1 Temperature anomalies along Line P, computed from a 1956-91 monthly climatology, which show that southern Gulf of Alaska waters have cooled over the past few years. Analysis by Marie Robert, IOS.

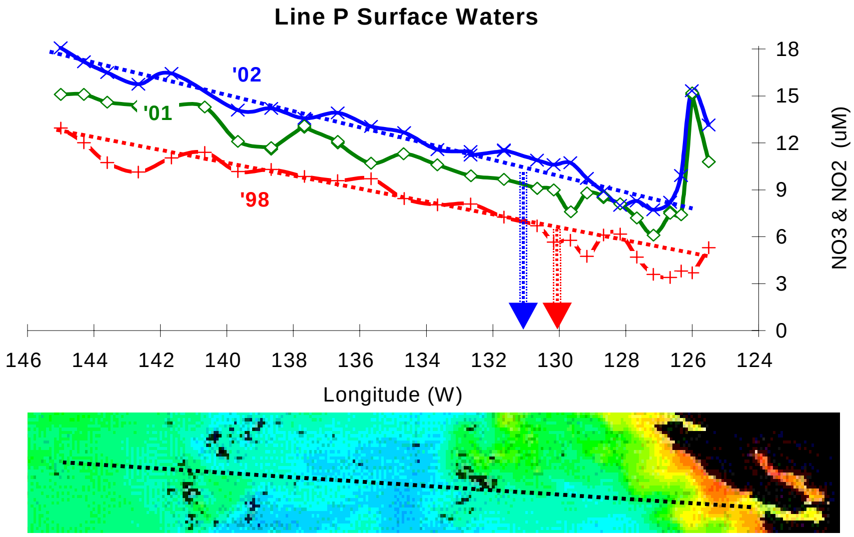


Fig. 2 *February nitrate levels in surface waters along Line P over the past few years. The location of Line is shown on a spring SeaWiFS image of sea surface chlorophyll.*

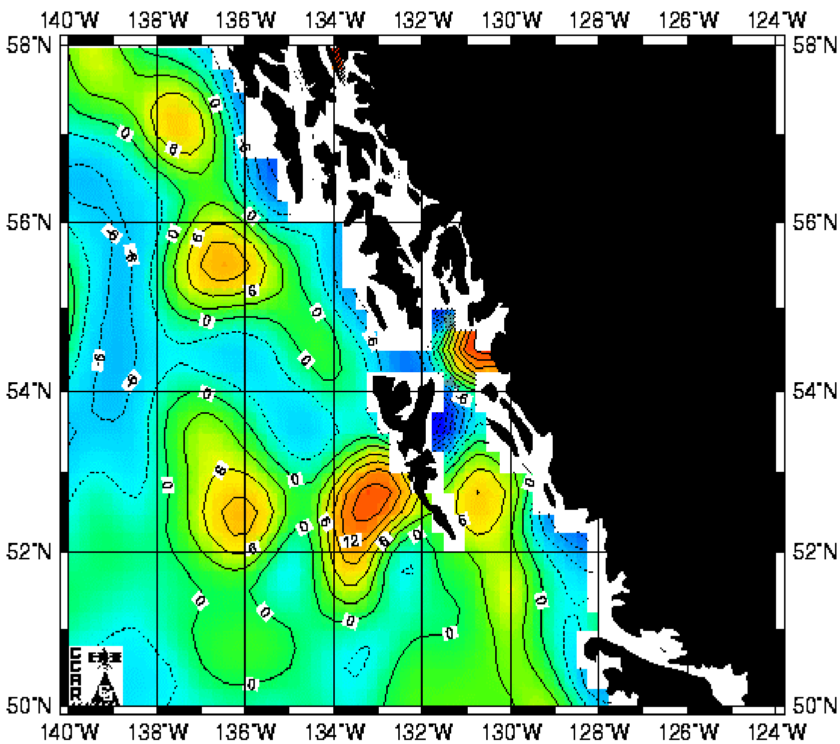


Fig. 3 *Satellite altimetry (T-P/ERS) showing the formation of the Haida-2002 eddy off the coast of the Queen Charlotte Islands.*

Nutrient levels in the mixed layer (ML) have increased over the same period (Fig. 2). Strong stratification and the presence of subtropical waters in the pycnocline combined to reduce winter nitrate levels in 1998. In 1999, ML was deeper in winter, and nutrient levels began to increase. Nutrient levels have continued to increase over the past few winters and have now returned to pre-1990s levels.

Nutrient supply in the Gulf of Alaska is mainly controlled by winter mixing and summer upwelling. Winter levels set conditions which govern the intensity of the spring bloom, whereas upwelling enriches coastal waters through summer months. Both processes were weak in 1998, resulting in low spring and summer primary productivity in coastal areas (a good example being Willapa Bay on the Washington coast, Jan Newton, Univ. Washington). Based on the nutrient levels observed along Line P in February 2002 (Fig. 2), spring algal growth should be strong along the coast in the NE Pacific this year. For example, 6 uM nitrate was available for spring growth at 130ºW in 1999, whereas nitrate in excess of 10 uM is available in 2002. This is an area in which nitrate is totally utilized, so winter supply regulates the amount of biomass produced in spring.

Eddy watch: Recent studies have shown that mesoscale eddies forming along the coasts of northern British Columbia and southern Alaska transport large amounts of coastal water into the interior of the Gulf of Alaska. These eddies can contain between 3000 and 6000 km^3 of coastal waters which, when transported offshore, carry with them fresh water, heat, nutrients and continental shelf biota. This winter, a Haida eddy is again forming off the south coast of Queen Charlotte Island (Fig. 3). Haida eddies may modulate the success of Pacific cod populations, reducing survival of some year classes by advecting a large portion of larval fish offshore in years when warm waters accumulate along the coast (A. Sinclair and W. Crawford, IOS).

The status of the Bering Sea: July-December 2001

Phyllis J. Stabeno
Pacific Marine Environmental Laboratory
National Oceanic and Atmospheric Administration
7600 Sand Point Way NE,
Seattle, WA, 98115 U.S.A.
E–mail: stabeno@pmel.noaa.gov

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

The Bering Sea varies on a continuum of temporal scales. On scales longer than seasonal, most of the energy is found in the year-to-year variability, although the Bering Sea is also influenced by both the Arctic Oscillation (AO) and the Pacific Decadal Oscillation (PDO). Both of these decadal patterns have undergone changes since the mid-1990s. During 2001, the AO was strongly negatively, which resulted in weaker zonal flow and more north-south excursions in the atmosphere (Fig. 1).

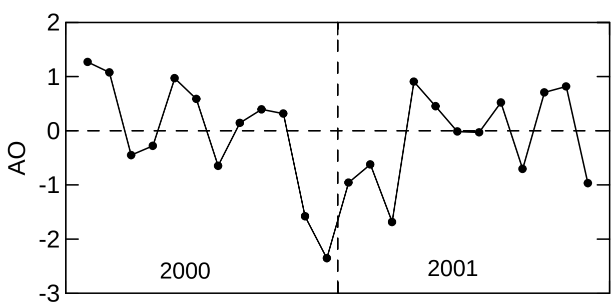


Fig. 1 Monthly values of the Arctic Oscillation Index in 2000 and 2001, showing the strongly negative trend during the winter of 2000/2001.

The PDO, which is the first mode of variability in sea surface temperature, changed from negative to positive in 1977 (Fig. 2). This regime shift in 1977 resulted in a reorganization of the Bering Sea ecosystem. During the La Niña of 1998, the PDO changed sign again. Historically, changes in the PDO have altered marine ecosystems around Alaska, especially salmon populations. It is too early to tell what impact on the Bering Sea ecosystem the change that occurred in 1998 will have. It should be noted that an El Niño is predicted for 2002. How the El Niño will interact with PDO in a negative state is not known.

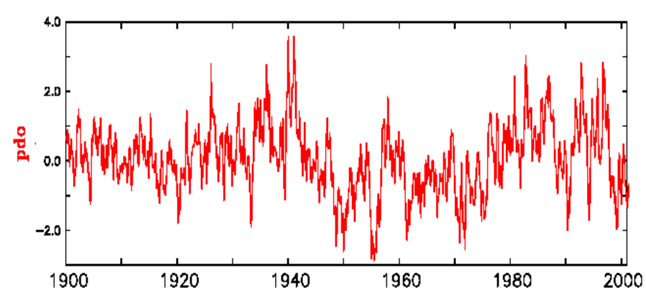


Fig. 2 The Pacific Decadal Oscillation from 1900 to 2001.

With the completion of two major research programs (Coastal Ocean Program's Southeast Bering Sea Carrying Capacity and NSF's Inner Front Programs) in 2000, there are limited oceanographic data available for the Bering Sea. In 1995, a biophysical mooring was deployed at 56.9ºN, 164ºW over the southeastern Bering Sea shelf (Fig. 3). This mooring site is located near the center (70 m isobath) of the middle shelf. Instruments measuring temperature, salinity, fluorescence, nitrate and currents are deployed year around. The mooring was maintained through 2001, providing seven years of almost continuous data at that site.

Shown in Figure 4 are near surface and depth average temperature data from spring and summer of 1995-2001 at Site 2. The pattern of sea surface temperature is fairly consistent. Coldest temperatures occur after the retreat of the ice. The upper layer typically begins warming in late March or early April, and temperature continues to increase through late July or early August, when maximum sea surface temperature typically occurs.

During the summer of 2001, both the sea surface temperature and the depth averaged temperature at Site 2 were similar to those observed in 1998. The temperature in early spring, 2001, was relatively warm at Site 2, because of the lack of sea ice the previous winter. While 1997 had

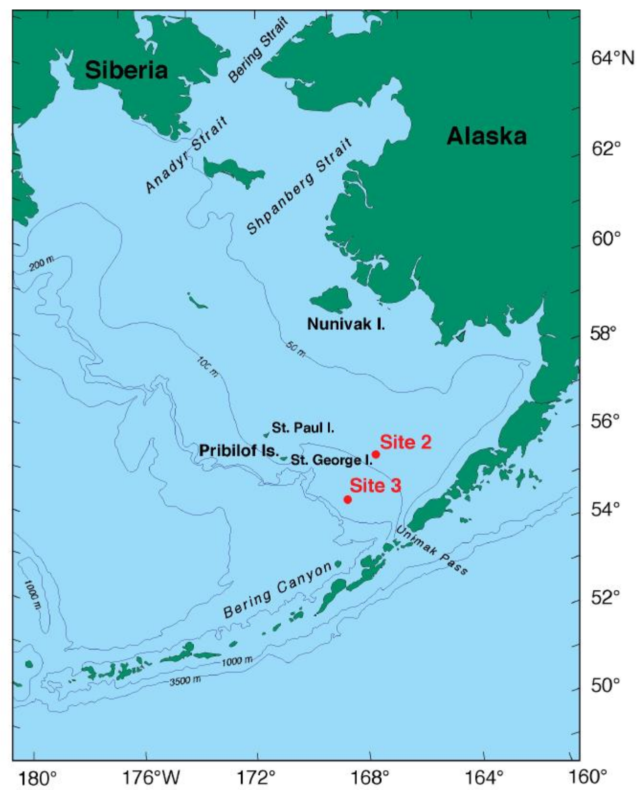


Fig. 1 Geography and place names in the eastern Bering Sea. The location of the two monitoring lists is indicated by bold numerals. Depth contours are in meters.

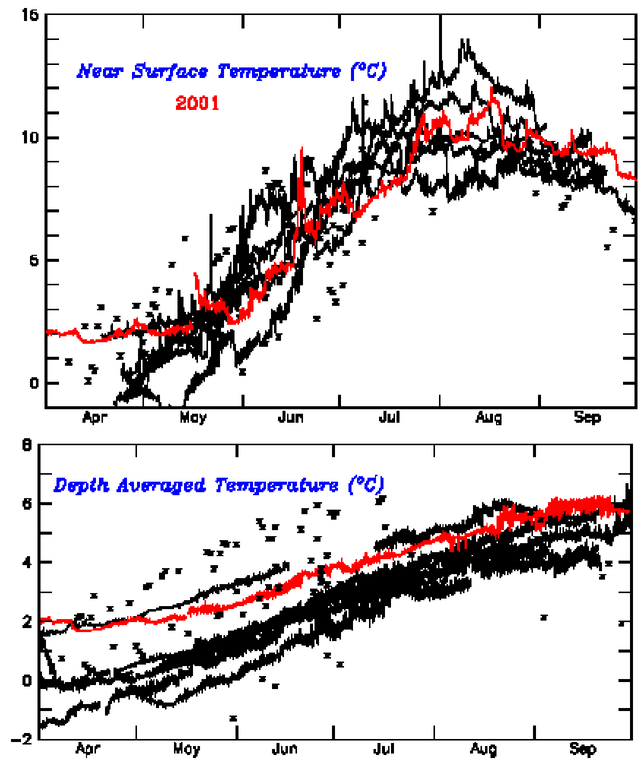


Fig. 4 The seasonal sign of near surface temperature measured (top panel) and the depth averaged temperature (bottom panel) at Site 2. Historical data from 1995-2000 are shown by solid black lines, and 2001 data as a red. Data from hydrographic surveys between 1966 and 1994 are shown as Xs.

the warmest sea surface temperatures, it was during 1998 that warmest depth average temperatures were observed (lower panel, Fig. 4). The water column became well mixed in late October and continued to cool through December to about 1.5°C. Flow was well defined along the 50 m isobath, which forms the boundary between the well-mixed coastal domain and the two-layered middle shelf.

Since 1997, a coccolithophore bloom has occurred over the eastern Bering Sea shelf each summer. Coccolithophores are small, photosynthetic cells. They are covered by calcareous plates, which reflect light and give the water a distinctive milky color. The bloom during the warm, calm summer of 1997 was clearly visible from ships and satellite images. While the bloom was evident in satellite images during 2001, shipboard measurements indicated that concentrations of cells were lower than had been observed in earlier years. It is not known whether this decrease was due to the timing of the measurements or if the bloom was weaker than in previous years.

PICES Workshop on "Perturbation analysis" on subarctic Pacific gyre ecosystem models using ECOPATH/ECOSIM

Participants of the PICES BASS/MODEL Workshop (left to right): Salvador Lluch-Cota (CIBNOR, Mexico, local host), Bernard Megrey (Alaska Fisheries Science Center, U.S.A.), Francisco Werner (University of North Carolina, U.S.A.), Gordon McFarlane (Pacific Biological Station, Canada, author of this article, mcfarlanes@pac.dfo-mpo.gc.ca), Jacquelynne King (Pacific Biological Station, Canada), Kerim Aydin (University of Washington, U.S.A.), Ian Perry (Pacific Biological Station, Canada) and Jeffrey Polovina (National Marine Fisheries Service, U.S.A.). Not in picture: Michio Kishi (Hokkaido University, Japan), Takashige Sugimoto, Ichiro Yasuda and Sachihiko Itoh (University of Tokyo, Japan).

Background

At the PICES Sixth Annual Meeting (October 1997, Pusan, Republic of Korea) the BASS Task Team sponsored a symposium on *Ecosystem dynamics of the eastern and western subarctic gyres*. The purpose was to bring together available information on the two gyres in a comparative framework. Topics included: 1) ocean responses to climate forcing, 2) nutrients and primary production, 3) structure of the lower trophic levels, mesozooplankton communities and epipelagic nekton, 4) mid-water fishes, and 5) the importance of these areas to marine birds and mammals. Papers presented at the meeting were published in 1999, in a special issue of *Progress in Oceanography* (Vol. 43, No. 2-4).

A series of follow-up workshops was convened to identify potential models which might have utility for examining gyre systems. This included: the BASS Workshop on *Development of a conceptual model of the subarctic Pacific basin ecosystem* (October 20-21, 2000, in conjunction with the PICES Ninth Annual Meeting in Hakodate, Japan), the BASS/MODEL Workshop on *Higher trophic level modeling* (March 5-6, 2001, in Honolulu, U.S.A.) and the BASS/MODEL Workshop to *Review ecosystem models for the subarctic Pacific gyres* (October 5, 2001, immediately preceding the PICES Tenth Annual Meeting in Victoria, Canada). At these workshops, the BASS and MODEL Task Teams examined the feasibility of using the ECOPATH/ECOSIM modelling approach as a means to organise our understanding of ecosystems of the subarctic gyres.

The BASS/MODEL Workshop to test the baseline models developed at the March 2001 workshop, and refined at the PICES Tenth Annual Meeting, was held April 21-22, 2002, in La Paz, Mexico. Specific objectives of the workshop were: (a) synthesise all trophic level data in a common format; (b) examine trophic relations in both gyres using ECOPATH/ECOSIM; and (c) examine methods of incorporating the PICES NEMURO lower trophic level model into the analysis.

Review of baseline models

ECOPATH baseline models and the NEMURO model have been reviewed in previous PICES reports (PICES Scientific Report Nos. 17 and 21). The two gyre ECOPATH models produced at that workshop should be viewed as work in progress. Estimates of biomass, productivity to biomass, consumption rate to biomass and diet composition were compiled from the literature and from research data provided by PICES member countries. In general, information available for 1990 (or 1990-1993) was used such that the two models could be viewed as representative of the early 1990's conditions. In total, 56 species groups (with three detrital groups) were included in the models, however, some species were not common to both regions. For example, Minke whales, common dolphin, Japanese sardines and anchovies were present in the western subarctic gyre (WSA) model but not in the eastern subarctic gyre (ESA) model. Conversely, elephant seals were present in the ESA model only. Many of the estimates are at best only guesses. Some observations were derived from coastal ecosystems and therefore may not be applicable to gyre ecosystems.

In general, the total biomass estimated for the WSA was higher than for the ESA. Major differences between the two model regions include higher biomasses of flying squid and Pacific pomfret in the ESA, higher biomass of chaetognaths in the WSA, and higher salmon biomass in the WSA (pink salmon) than in the ESA (sockeye salmon). Marine mammal biomass estimates were identical for each region since they were derived from basic-scale North Pacific estimates. No biomass estimates of forage fish and micronektonic species groups were available from the literature or from research survey data, so these were evaluated by top-down balancing of each model. Biomass estimates for lower trophic level plankton groups were derived from outputs of the NEMURO model that had been calibrated for Ocean Station P in the ESA.

NEMURO is a lower trophic level model (LTL) developed by the PICES MODEL Task Team during a modelling workshop held in Nemuro, Japan, in January 2000 (for details see Eslinger *et al.* 2000, and Megrey *et al.* 2000, in PICES Scientific Report No. 15). NEMURO simulates the annual dynamics of phytoplankton, zooplankton and nutrient concentrations for two locations in the North Pacific, Ocean Station P (57.5°N, 175°W) and station A7 (41.30°N, 145.30°E) off the A-line, an oceanographic sampling line off Hokkaido Island, Japan.

Ten years of output from the NEMURO model was used to supply "bottom-up" forcing to the ECOPATH/ECOSIM models, configured for each subarctic gyre system. NEMURO output from Ocean Station P was used to force the eastern subarctic gyre ECOPATH/ECOSIM model, and output from station A7 was used to force the ECOPATH/ECOSIM western subarctic gyre model. The model connection was a static one-way linkage.

Hypothesis testing

The purpose of this approach was to provide a "picture" of the two subarctic gyres, and to facilitate our understanding of how these systems respond to natural and anthropogenic change. It is hoped that it will form the basis of future work which will attempt to link the subarctic gyre systems to coastal systems.

A number of hypotheses were discussed as appropriate proxies to test the response of the two gyres to various trophic level changes and climate change scenarios. These were further refined into "Perturbation analyses" and "Function fitting and forcing".

Perturbation analyses

- Bottom up pulse

  Rationale: Increasing primary production could elucidate any bottom-up effects.

- Removal of squid

  Rationale: There is considerable confidence in the salmon diet composition for both gyres and discernible differences in the relative proportion of micronecktonic squid, forage fish and mesopelagic fish between the two gyre models. Since neon flying squid and boreal clubhook are probably competitors for micronektonic squid and forage fishes, their removal may have implications for prey availability for salmonids.

- Removal of salmon

  Rationale: Assuming that salmon abundance is determined outside of the gyre system, changes in abundance will greatly affect other trophic levels if salmon is a driving force within the gyre system.

- Removal of sharks

  Rationale: Sharks were selected as representative of a higher trophic apex predator.

Function fitting and forcing

Rationale: We were interested in investigating the changes that were required in productivity in order to explain changes in salmon abundance. Forcing functions at different trophic levels could be calculated by fitting the function to known salmon abundance data. We selected three trophic levels for which to fit foraging efficiency functions to salmon abundance trends and then using the function to perturb the models: small phytoplankton, neon flying squid and sharks.

The results of these analyses will be available shortly in a PICES Scientific Report.

Status and future plans for SOLAS-Japan

Mitsuo Uematsu
Ocean Research Institute, University of Tokyo
Minami-dai 1-15-1, Nakano-ku,
Tokyo 164-8639, Japan
E-mail: uematsu@ori.u-tokyo.ac.jp

Tsuneo Odate
National Institute of Polar Research
9-10, Kaga 1-chome, Itabashi-ku,
Tokyo 173-8515, Japan
E-mail: odate@nipr.ac.jp

Dr. Mitsuo Uematsu received his Ph.D. in Geochemistry from Hokkaido University, Japan, in 1980. He worked on the Sea/Air Exchange (SEAREX) Program at the Center for Atmospheric Chemistry, Graduate School of Oceanography, the University of Rhode Island as a research associate from 1980 to 1987. Then he joined a new department of marine science and technology, Hokkaido Tokai University until 1997. He is currently an Associate Professor at the Center for International Cooperation, Ocean Research Institute, the University of Tokyo. His major research interests include long-range transport of natural and anthropogenic substances over the ocean, marine aerosol properties and their impact on climate change. He is serving as the chairman of American Geophysical Union's regional advisory committee for Japan, a member of SOLAS SSC and the associate editor for Geochemical Journal.

Dr. Tsuneo Odate received his MSc. (1986) and Ph.D. (1989) in Fisheries from Hokkaido University, Japan. He worked as a research assistant at the Faculty of Bioresources, Mie University, from 1990 to 1995, and at the Faculty of Fisheries, Hokkaido University, from 1995 to 1997. Dr. Odate joined the National Institute of Polar Research in 1997, and he is currently an Associate Professor at this institute and at the Graduate Institute for Advance Studies. He has been involved in research on various aspects of biological oceanography and polar biology, but his major scientific interest is phytoplankton ecology in the polar seas. He was the cruise leader of the 43rd Japanese Antarctic Research Expedition (JARE-43) on R/V Tangaroa, *which is one of the activities of the STAGE (Studies on the Antarctic ocean and global environment) program. Dr. Odate is a member of the Oceanographic Society of Japan and the Plankton Society of Japan.*

The Surface Ocean-Lower Atmosphere Study (SOLAS) is a new international research initiative sponsored by the International Geosphere Biosphere Program (IGBP), the Commission on Atmospheric Chemistry and Global Pollution (CACGP) of the International Association of Meteorology and Atmospheric Sciences (IAMAS), and the Scientific Committee on Oceanic Research (SCOR). The goal of SOLAS is: *To achieve quantitative understanding of the key biogeochemical-physical interactions and feedbacks between the ocean and the atmosphere, and how this coupled system affects and is affected by climate and environmental change*.

Current status of SOLAS planning in Japan

Our SOLAS national committee was authorized as one of the IGBP sub-committees by the Science Council of Japan in December 2001 (Fig. 1 shows the structure of the second phase of IGBP and the SOLAS-Japan logo). Several SOLAS-related project proposals have been submitted and approved, and some projects have already started. On February 22-23, 2002, the first meeting of the SOLAS-Japan committee was held at Nagoya University, after a joint meeting with the JGOFS-Japan members. Each member introduced the ongoing project and research interests as the SOLAS-Japan activity. The topics presented covered most of the activities under Focus 1 through 3 of the international SOLAS focuses, which are:

1. Biogeochemical interactions and feedbacks between ocean and atmosphere;
2. Exchange processes at the air-sea interface and the role of transport and transformation in the atmospheric and oceanic boundary layers; and
3. Air-sea flux of CO_2 and other long-lived radiatively active gases.

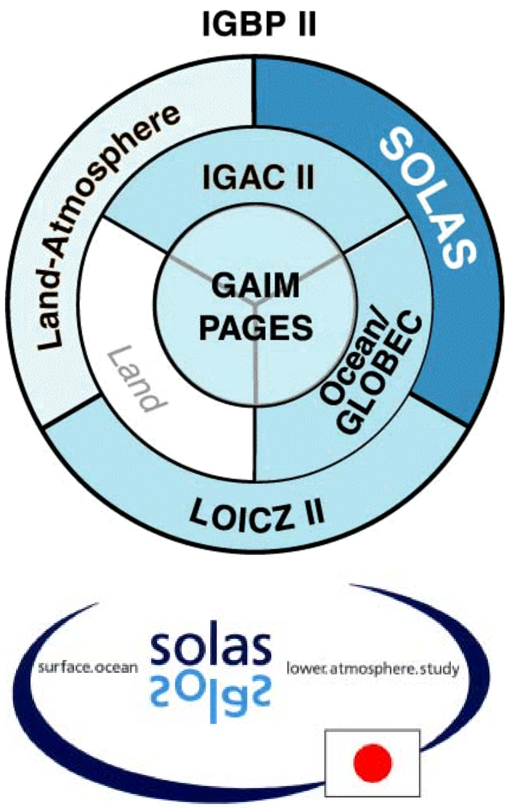


Fig. 1 Structure for IGBP II and the logo of SOLAS-Japan.

In planning SOLAS-Japan, we agreed that several advantages should be taken into account, such as geographical location, the unique emission sources (high primary productivity, volcanic emission, Asian dust, sea ice, etc.), and human resources in the fields. Some issues that we discussed were:

- Observation of emissions of marine biogenic gases from the regions of high primary productivity such as the marginal seas around Japan and the Antarctic Ocean.
- Observation of the effect caused by atmospheric depositions of mineral dust (iron) and anthropogenic nitrogen compounds transported from the Asian continent on marine biological productivity and carbon uptake.
- Observation of carbon uptake by nitrogen fixation of marine biota in the Kuroshio region.
- Effects of volcanic gases and aerosols from active Japanese volcanoes to atmospheric and oceanic environment.
- Process of interfacial transfer mechanisms on physical factors within the boundary layers around Japan.

In March 2002, a special issue on "Acceleration of marine biological productivity and its effect to marine atmosphere" was published in the journal "Kaiyo Monthly" (14 papers in Japanese) as a related SOLAS-Japan activity. Plans of SOLAS-Japan were presented at the IGBP national symposium on "Marine sciences and future" on March 25, 2002. We also agreed to hold a national "Ocean future" meeting coordinating several projects related to marine sciences such as GLOBEC, JGOFS, LOICZ, PAGES and SOLAS, in the summer of 2002.

Status of ongoing projects

- **Subarctic ocean enrichment and ecosystem dynamics study (SEEDS)**; Project leader: Dr. Atsushi Tsuda (Hokkaido National Fisheries Research Institute, HNFRI).

SEEDS conducted a very successful *in situ* iron fertilization experiment in the western subarctic Pacific gyre, in July-August 2001. The data workshop of the SEEDS-West cruise and the SOLAS activity was held November 15-16, 2001, at the Ocean Research Institute. During the 2002 spring meeting of the Oceanographic Society of Japan, 14 papers were presented at the special session with over 100 participants. SEEDS has been cooperating with the Canadian SOLAS group. For more information on SEEDS and Canadian SOLAS, see PICES Press Vol. 10, No. 1, pp. 12-15.

- **Studies on the Antarctic ocean and global environment (STAGE)**; Project leader: Dr. Mitsuo Fukuchi (National Institute of Polar Research, NIPR).

NIPR started a comprehensive 5-year Antarctic research project which included SOLAS-related investigations. The 43rd Japanese Antarctic Research Expedition (JARE) has chartered a research vessel, R/V *Tangaroa* (New Zealand), to conduct the marine science program, in the Indian sector of the Antarctic Ocean. The main themes of STAGE are shown in Figure 2.

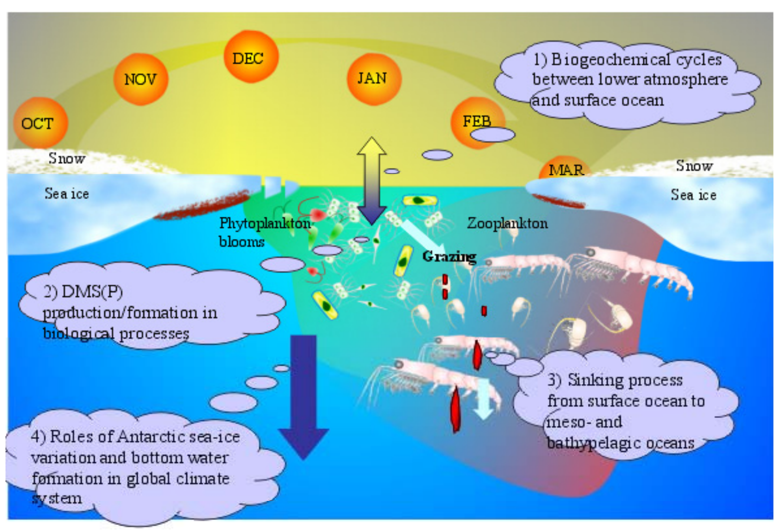


Fig. 2 The STAGE project of the Antarctic Ocean.

The major target area in the 2001/2002 austral summer was south of 61°S along 140°E, where the time series observations have been completed by several research vessels, namely: R/V *Aurora Australis* (October-December 2001), R/V *Hakuho Maru* (January 2002), R/V *Tangaroa* (February 2002), and R/V *Shirase* (March 2002). R/V *Tangaroa* departed on February 6th and returned on March 7th, 2002, with fruitful results for SOLAS-related studies. A similar time series observations will be conducted in the 2002/2003 austral summer, by R/V *Aurora Australis* (ANARE), T/S *Umitaka Maru* (Tokyo University of Fisheries), R/V *Shirase*, and a charter vessel (JARE-44). This program is supported by JARE (MEXT).

- **Variability of marine aerosol properties and its impact on climate change (VMAP)**; Project leader: Dr. Mitsuo Uematsu (University of Tokyo).

The VMAP project, supported by Core Research for Evolutional Science and Technology (CREST) of Japan Science and Technology Corporation (JST), has been going well since 1998. It has contributed largely to the atmospheric field observations for the ACE-Asia/IGAC campaign at the first stage. After the success of the observation cruise by a newly developed self-cruising observation boat named SCOOP (Fig. 3), we plan to deploy SCOOP to the high primary productivity regions off the Japan islands periodically as a SOLAS-Japan activity. A ground station at a lighthouse in Hachijo-jima is now in operation to measure the chemistry of marine atmosphere and seawaters.

- **Long-term marine observation for biogeochemical parameters related to climate change**; Project leader: Dr. Shizuo Tsunogai (Hokkaido University).

A biogeochemistry group has submitted a proposal to develop an Autonomous buoy (SOLAReS) to measure physical and chemical parameters of seawater and marine atmosphere, as a long-term observation platform for SOLAS to the Special Coordination Funds for Promoting Science and Technology of MEXT in April 2002.

Future plans for national SOLAS activities

The SOLAS-Japan committee functions as a place to exchange information and integrate accomplishments. We will discuss the possibility of submitting a large proposal to cover most of the SOLAS activities in Japan by the members of the committee of the SOLAS-Japan. The current funding situation for these projects is good for at least the next 2 or 3 years, so now is an appropriate time to start discussion about the strategy for a new proposal. A SOLAS-Japan workshop will be held in Nagoya in the summer of 2002. International cooperation with other SOLAS national communities is an important key for the success of our SOLAS activities, as well as cooperation with other core projects in Japan.

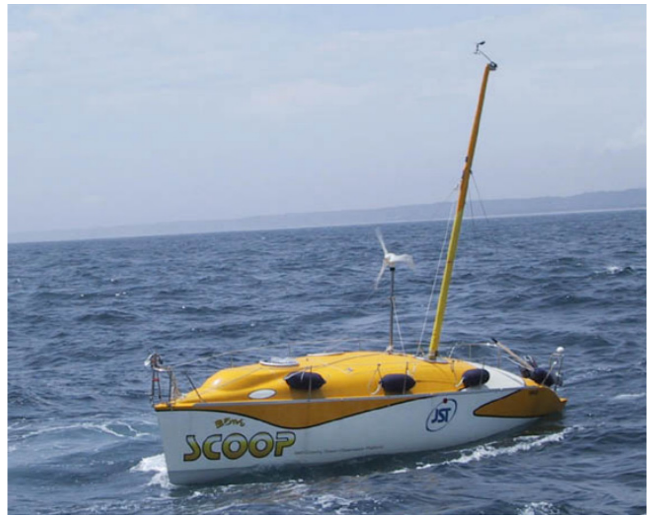


Fig. 3 Self Cruising Ocean Observation Platform (SCOOP) nicknamed "Kan-chan" *in Japanese. The boat is made of FRP with a length of 8 m and a maximum width of 2.8 m. It is powered by a diesel engine, which drives DC and AC dynamos. SCOOP is propelled by the DC motor and travels at a speed of 2-4 knots. It contains two 700 l fuel tanks that enable 700 hours of continuous operation without maintenance. We can control SCOOP and obtain real time observing data and CCD pictures via satellite communication systems (N-Star and ORBCOMM). SCOOP is equipped with an atmospheric autonomous measurement system, including the newly developed micro flow injection analyzers for SO_2 and NH_3, and a dichotomous aerosol filter sampler with an absorption spectrometer for elemental carbon and a beta absorption detector for mass concentration. Simultaneously, vertical profiles of temperature, salinity, chlorophyll fluorescence and turbidity can be obtained by a Yo-Yo system.*

SOLAS-Japan committee members

Mitsuo Uematsu (Chairman)	University of Tokyo	Marine aerosol chemistry
Toshiro Saino	Nagoya University	Primary productivity
Jota Kanda	Tokyo University of Fisheries	Nitrogen cycle
Yukihiro Nojiri	National Institute of Environmental Studies (NIES)	Carbon cycle
Yutaka W. Watanabe	Hokkaido University	Gas exchange
Tsuneo Odate	National Institute of Polar Research (NIPR)	Polar marine biology
Shigenobu Takeda	University of Tokyo	Iron marine geochemistry
Michio J. Kishi	Hokkaido University	Marine ecological modeling
Masao Fukasawa	JAMSTEC	Physical oceanography
Katsu Kajii	University of Tokyo	Atmospheric trace gases
Kazuo Osada	Nagoya University	Polar atmospheric chemistry
Urumu Tsunogai	Hokkaido University	Stable isotope geochemistry

China-Korea Joint Ocean Research Center: A bridge across the Yellow Sea to connect Chinese and Korean oceanographic institutes and scientists

Dong-Young Lee
China Korea Joint Ocean Research Center
19 Nanling Road, Hi-Tech Industrial Park
Qingdao 266101,
People's Republic of China
E-mail: dylee@kordi.re.kr

Gongke Tan
China Korea Joint Ocean Research Center
19 Nanling Road, Hi-Tech Industrial Park
Qingdao 266101,
People's Republic of China
E-mail: gongke_tan@public.qd.sd.cn

Dr. Dong-Young Lee is a coastal engineer with a background in Physical Oceanography, Marine Meteorology and Engineering Mechanics. He has been working at the Korea Ocean Research and Development Institute (KORDI) since 1985, especially focusing on building the Integrated Coastal Monitoring Program in Korea and the Wave Measurement and Prediction System. He is currently the Chairman of NEAR-GOOS and the Director of CKJORC.

Mr. Gongke Tan received his Master's degree in Physical Oceanography from the First Institute of Oceanography, State Oceanic Administration. In the beginning of his career, he concentrated on dynamics in shallow seas, but his current research interests are ecosystem and environment dynamics and modeling. Gongke has been involved in international cooperation since 1995. He joined CKJORC in 1997 and was appointed the Deputy Director in May 2001. He was the first PICES intern in 2000.

Establishment of the Center

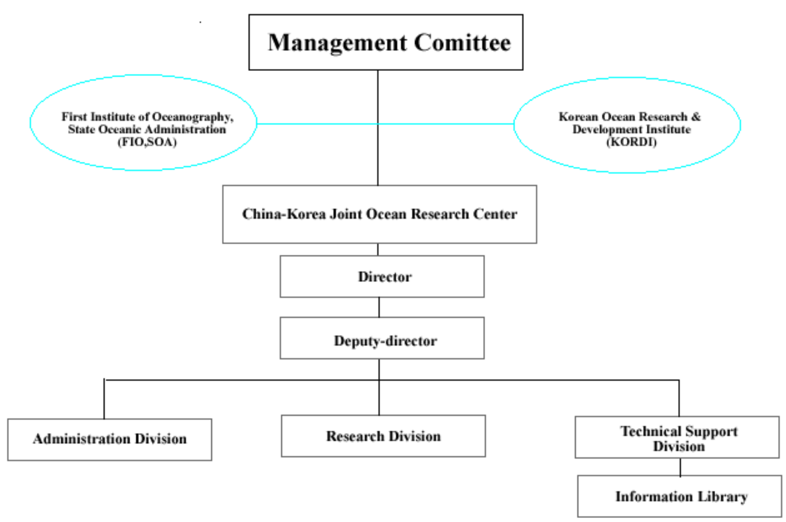
Cooperation and joint efforts between the countries sharing the same water body are necessary for effective ocean research, development and conservation of the regional seas. There are many international and regional cooperation programs in ocean sciences dealing with the trans-boundary problems of the marginal seas. However, the most effective way to prepare and implement a specific action plan is through a bi-lateral governmental program.

The People's Republic of China (China) and the Republic of Korea (Korea) are neighbors sharing the Yellow Sea, and so the development, utilization and conservation of this sea are common problems of both countries. According to the relevant agreement between the two governments, the China-Korea Joint Ocean Research Center (CKJORC) was established on May 12, 1995, as a bridge linking Chinese and Korean institutes and researchers in the field of ocean sciences.

Functions and operations of CKJORC

The Center is a cooperative institution fostered by China and Korea to enhance the level of ocean sciences and technologies of both countries, to promote marine environment protection and development and utilization of ocean resources, and to expand and develop scientific cooperation between China and Korea.

A re-union of former and current staff of CKJORC las year (Dr. Dong-Young Lee is fourth from the left and Gongke Tan is fourth from the right).



The Management Committee is composed of Chinese and Korean government officers, and meets once a year to discuss and coordinate ocean science cooperation between the two countries and the operation of CKJORC. The key staff of CKJORC, the Director (currently Dr. Dong-Young Lee, KORDI) and the Deputy Director (currently Gongke Tan, SOA), are appointed by the Management Committee and serve for two years at the Center located in Qingdao, China.

Linkage of oceanographic institutes and scientists in China and Korea

CKJORC maintains two networks: (1) for data and information exchange, and (2) for coordination and promotion of research cooperation. The *data and information network* consists of more than 40 Chinese and Korean agencies, and the *coordination network* at present links about 30 oceanographic agencies in China, including universities, local government agencies and institutes. The coordinators representing member agencies meet routinely to discuss the research cooperation for the Yellow Sea. Last year's meeting was held at Wuyusan, China, with 30 participants from about 20 Chinese institutes. A similar coordinating network will be organized in Korea in near future.

Joint research projects

Using a limited fund provided by the two governments, CKJORC sponsors joint research projects. From this year on, CKJORC will manage a project entitled "Feasibility study and strategic planning for China-Korea cooperation for the establishment of the operational oceanography of the Yellow Sea". This includes the following six sub-projects:

- Feasibility study and basic design of the joint ocean
- Monitoring system for the Yellow Sea
- Feasibility study and planning of the ocean data assimilation for operational ocean prediction for the Yellow Sea
- China-Korea cooperation in ocean forecast for disaster prevention and ocean service
- Application of remote sensing for operational oceanography of the Yellow Sea
- Environmental assessments for the Yellow Sea and ocean research policy for China-Korea cooperation

This year's plan also includes a *training program for marine environment and ecosystem modeling* and a *joint CKJORC-PICES workshop* on "Regional cooperation for the conservation and management of the marine environment and resources of the Yellow Sea". Held in conjunction with the Eleventh Annual Meeting of PICES (October 25, 2002, Qingdao), the workshop will provide an excellent forum for exchange of ideas between scientists of the two organizations and will discuss suggestions on new areas of bilateral and regional cooperation.

Further development of CKJORC

The environment in the Yellow Sea has changed considerably since the establishment of CKJORC, and the approach in coordinating scientific cooperation and the operation of CKJORC may need to be revised accordingly. It is necessary to review and evaluate the performance of the China-Korea ocean science cooperation program from the last seven years to establish a strategic plan for further cooperation. CKJORC is now preparing a more effective implementation plan for the development of the ocean research cooperation program between China and Korea.

(cont. from page 11)

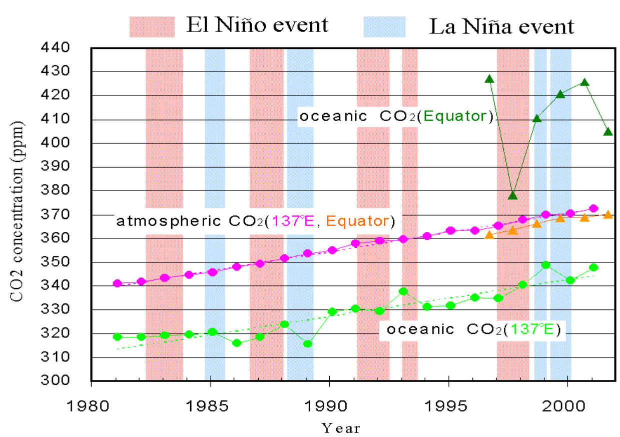


Fig. 5 Year-to-year variations of oceanic (green) and atmospheric (red) CO_2 concentration along 137ºE (averaged from 3-30ºN) in winter (solid circle) and along the equator (averaged from 156-165ºE) in autumn (solid triangle). The periods of El Niño and La Niña events are also shown.

CO_2 observations along the equator have been carried out since 1996. It is well known that the equatorial Pacific is the largest source of oceanic CO_2 to the atmosphere, and that oceanic CO_2 greatly varies during El Niño and La Niña events. Figure 5 shows year-to-year variations of oceanic CO_2 concentration in the western equatorial Pacific (156º-165ºE) in autumn (solid green triangles). In 2001, the oceanic CO_2 concentration was 27 ppm higher than that in October 1997 (El Niño event), while it was 16 ppm lower than that in October 1999 (La Niña event).

Winter CO_2 observations along 137ºE have been made periodically since 1981. In this region, the oceanic CO_2 has been lower than the atmospheric CO_2 (solid green and red circles in Fig. 5), implying that the ocean has acted as a sink for atmospheric CO_2 in winter. For the period from 1981-2001, the oceanic CO_2 concentration has increased by about 1.5 ppm/year, which was nearly equal to the rate of CO_2 increase in the atmosphere (1.6 ppm/year).

Persistent changes in the California Current ecosystem

The Fourth Annual *ad hoc* Salmon Ocean Ecosystem Meeting was convened January 15-16, 2002, at the U.S. NOAA/National Marine Fisheries Service Santa Cruz Laboratory. Convenors included George Boehlert, Richard Brodeur, Skip McKinnell, William Peterson, and host Churchill Grimes, who offered ~95 participants an exceptional venue with lots of opportunity to discuss the changing world of Pacific salmon, their environment, and the fates of ecologically-related species in the eastern North Pacific.

The central California venue meant that the meeting was held near or beyond the southern ranges of most Pacific salmon species, and so influenced the theme for the first day of "Adaptations of Pacific salmon to extreme ocean environments". Salmon production and ocean survival vary out of phase in Alaska and the west coast, and papers on the first day examined how ocean variability impacts salmon at the extremes of their ranges. What characteristics of salmon biology and ocean variability cause these differences? What determines the boundary between the "north response" and the "south response", and how does it vary? What role does the ocean play in the range endpoints of different species or the boundaries of Evolutionary Significant Units?

Both days touched on what has been a regular theme for the last few meetings, the increasing abundance of Pacific salmon in the California Current region and the ecosystem changes that accompanied this increase. For animals that rely on copepods for food, things are looking better than they have for most of the past decade off Oregon. For the past two years, William Peterson (NMFS/Newport) has reported that copepod biomass has increased dramatically from low levels during the 1990s (Fig. 1).

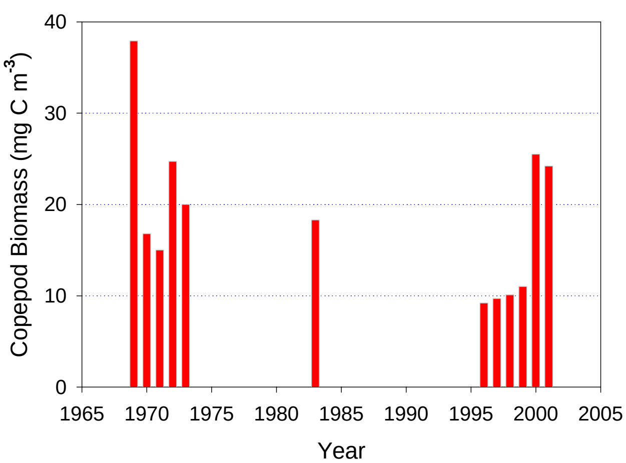


Fig. 1 May-September average copepod biomass off Newport, Oregon, at Station NH 5 (Source: William T. Peterson, NOAA/NMFS Newport.)

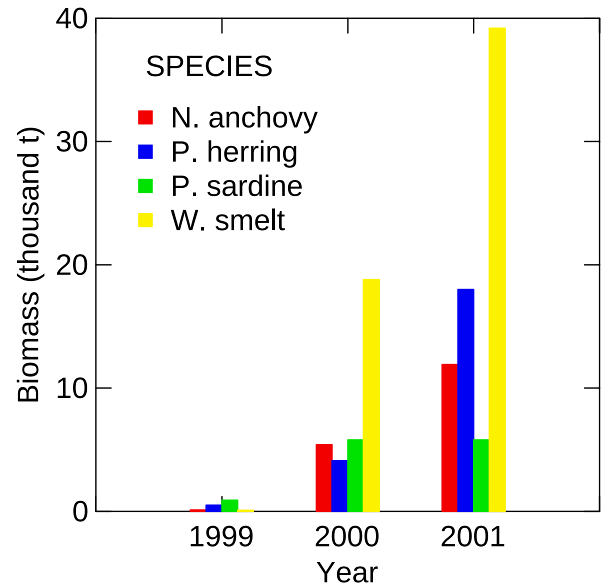


Fig. 2 Annual densities of whitebait smelt, Pacific herring, northern anchovy, and Pacific sardine off the mouth of the Columbia River from April to July. (Data courtesy of Robert Emmett, NOAA/NMFS Newport.)

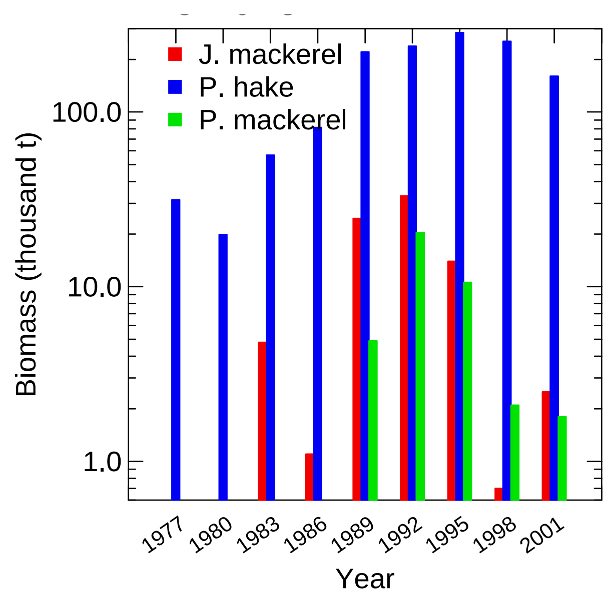


Fig. 3 Estimated biomass of Pacific hake, jack mackerel and Pacific mackerel in NMFS triennial shelf trawl surveys from 1977 to 2001. (Data courtesy of Bob Emmett, NOAA/NMFS Newport.)

Sampling during the past year has reinforced observations of fundamental changes in the coastal ecosystem after the 1998 El Niño (Fig. 2). Robert Emmett (NMFS/Newport) reported that catches of forage fishes (whitebait smelt, Pacific herring and northern anchovy) had increased significantly each year from very low levels in 1999. Only sardine abundance remained constant between 2000 and 2001. In fact, many of the species that are typically associated with warmer waters, such as sardine, Pacific hake, jack mackerel and Pacific mackerel, have declined in trawl surveys of the west coast of the United States (Fig. 3). Similar declines were also reported in British Columbia.

Edmundo Casillas (NMFS/Northwest Fisheries Science Center, Seattle) reported that increased abundances of juvenile chinook and coho salmon that were first observed off the Columbia River in 1999, have persisted through 2001.

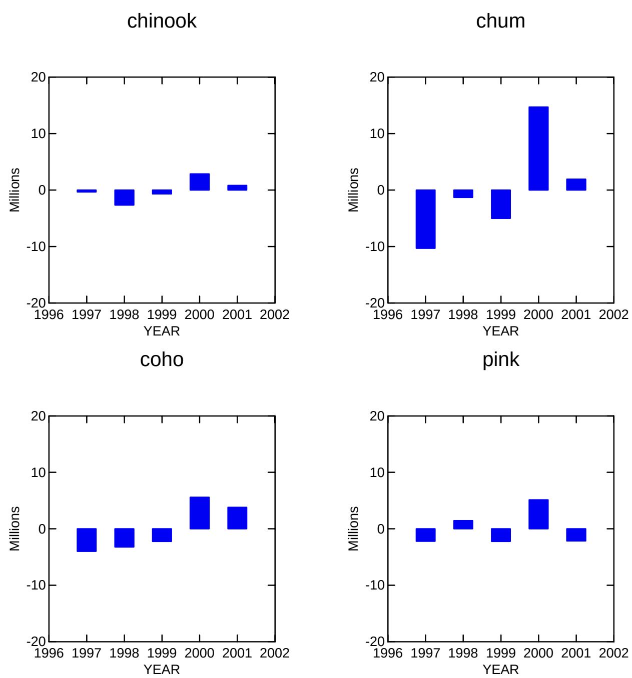


Fig. 4 *The abundance of juvenile chinook, chum, coho, and pink salmon expressed as anomalies (millions) in July trawl surveys in the Strait of Georgia. Note the positive anomalies for all species beginning in 2000. (Source: R.J. Beamish, DFO/Nanaimo.)*

At the previous meeting at the Pacific Biological Station in Nanaimo, (PICES Press Vol. 9, No. 2), Richard Beamish reported that juvenile chinook, coho and chum salmon abundances in the Strait of Georgia also increased dramatically, but the change in juvenile abundance did not appear until 2000. These increases have persisted through 2001 (Fig. 4). These recent years of greater abundance correspond to years of greater prey availability. A lesser proportion of sampled stomachs were empty in recent years (Fig. 5). Although adult returns of coho salmon around the Strait of Georgia were generally higher in 2001 than has been observed for many years, Fisheries and Oceans Canada anticipates poor marine survival to continue (DFO Science Stock Status Report No. D6-07). Bruce Ward (Province of British Columbia) reported that steelhead trout abundance in a major index river on northeastern Vancouver Island remains at very low level.

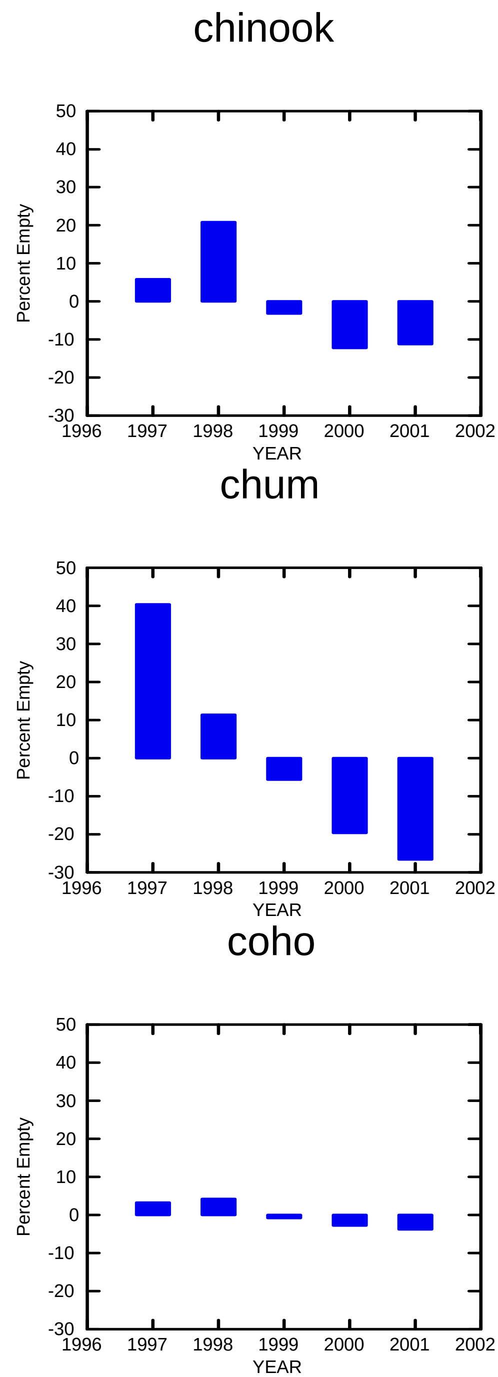


Fig. 5 *Percent of juvenile chinook, chum and coho salmon stomachs empty (as anomalies) in July sampling in the Strait of Georgia (Source: R.J. Beamish DFO/Nanaimo.)*

Skip M^c^Kinnell
Assistant Executive Secretary
PICES Secretariat
E-mail: mckinnell@pices.int

The *Hokusei Maru*: 53 years of research in the Pacific

John R. Bower
Northern Biosphere Field Science Center, Hakodate Branch
Hokkaido University
3-1-1 Minato-cho
Hakodate, Hokkaido, 041-8611
JAPAN
E-mail: akaika@fish.hokudai.ac.jp

John Bower began his fisheries career in 1986 as an NMFS observer aboard several South Korean trawlers in the Bering Sea. During 1987-89, he was a Peace Corps Volunteer in the Philippines, where he first became interested in cephalopods. John completed graduate degrees at the University of Hawaii (Dept. of Oceanography) and the Hokkaido University (Faculty of Fisheries) studying two nektonic squids (Ommastrephes bartramii *and* Todarodes pacificus*), and became an assistant professor at the Hokkaido University in 1999. During 1991-97, he participated in five cruises aboard the* Hokusei Maru *around the Hawaiian Islands and along 155ºE in the northwest Pacific.*

Between 1949 and 2002, the *Hokusei Maru I*, *II*, and *III* of the Faculty of Fisheries, Hokkaido University (Japan), conducted more than 150 research cruises throughout the Pacific. This paper chronicles the ships' histories and major achievements.

Hokusei Maru I

To boost fishery education in Japan following World War II, when much of the country suffered chronic food shortages, the Ministry of Education was granted 6,000,000 yen ($222,000 – here and throughout the text yen was adjusted to the value of the U.S. dollar in the year 2000) to purchase and refurbish two ships for its fishery schools at Hokkaido University and Kagoshima University. The main role of the ships would be to train students.

In 1948, the Ministry acquired two 27-meter, 70-gross-ton submarine chasers formerly of the Japanese Navy. Despite being only about 6 years old, both were dilapidated, and their wooden hulls leaked seawater, so in June 1948, they were towed to Shimonoseki port for renovation. During the seven months while awaiting this work to begin, they continued to leak seawater and required bailing out 3-4 times a day to prevent sinking.

To distinguish the ships during this period, both were given nicknames: the *Nansei Maru* (Southern Star) for the Kagoshima University-bound ship, and the *Hokusei Maru* (Northern Star) for the Hokkaido University-bound ship. Later, official names were proposed: the *Niishio Maru* (New Tide) for the Kagoshima University ship, and the *Kouchou Maru* (Lucky Tide) for the Hokkaido University ship. The name *Niishio Maru* was formally adopted, but the *Hokusei Maru* kept her original name, since she was considered more suitable for a ship that would be based in northern Japan.

Renovation was completed in April 1949, at a total cost of 15,000,000 yen ($330,000) for both ships. Work on the *Hokusei Maru I* included repairs of the hull, bridge, and stern, and replacement of the engine and radio equipment. The new 104-gross-ton ship was equipped with a 210-horsepower engine and had a complement of 32, including 16 crew and 16 students (Fig. 1). She was equipped to use a bottom trawl, a drift gillnet, and a stick-held dip net for Pacific saury (*Cololabis saira*).

Fig. 1 The Hokusei Maru I.

The *Hokusei Maru I* began training cruises in May 1949, and was used mainly around Hokkaido. The ship conducted drift-gillnet surveys of salmon off eastern Hokkaido in spring, and explored undeveloped fishing grounds near Musashi Bank in the northern Sea of Japan in summer. During the summer cruises, favorable fishing areas were located for arabesque greenling (*Pleurogrammus azonus*), which soon developed into an important fishery resource off northwest Hokkaido. The ship also conducted handline jigging surveys for Japanese common squid (*Todarodes pacificus pacificus*) near Funka Bay (southwest Hokkaido) during fall.

After only seven years of use, the *Hokusei Maru I* rapidly deteriorated and became unsafe to use. She was decommissioned in December 1956, after the National Budget appropriated funds for the construction of a replacement ship. She was then sold to private buyers and served for two years as a general merchandise transport ship in southern Hokkaido.

Hokusei Maru II

Construction of the *Hokusei Maru II* was completed in February 1957, in Shimizu City at a cost of 84,500,000 yen ($1,436,000). The 37-meter, 222-gross-ton ship was equipped with a 450-horsepower engine and a controllable pitch propeller, and had a complement of 43, including 21 crew, 20 students and 2 researchers (Fig. 2). She was equipped to use a drift gillnet, longline, and stick-held dip-net. In October 1965, the ship's hull was lengthened to 43 meters, the main engine's horsepower was increased to 600, and an anti-rolling tank was installed; these renovations increased the ship's gross tonnage to 273 (Fig. 3).

Fig. 2 The Hokusei Maru II *before renovation.*

The ship's inaugural research cruise was in June 1957, to the northern part of the Sea of Okhotsk to examine the offshore distribution of post-spawning herring. The results of this investigation were later used to help develop the Hokkaido herring fishery. Data from this and all subsequent cruises of the *Hokusei Maru II* and *III* were published annually by the university (Hokkaido University, 1958-2002).

During 1957-76, the *Hokusei Maru II* conducted annual winter cruises to the South Pacific and annual summer cruises to the Sea of Okhotsk and south of the Kuril Islands. In the South Pacific, students were taught how to use tuna longline gear, including a newly developed vertical longline. These cruises examined the distribution and ecology of tunas, particularly the vertical distribution of albacore (*Thunnus alalunga*). During the 1961-62 South Pacific cruise, she made her first foreign port call to Singapore; over the next 40 years, the *Hokusei Maru II* and *III* would make 84 port calls to 18 ports throughout the Pacific (Table 1). In the summer cruises, students were taught how to use salmon drift gillnets. In 1968, she began annual spring trawl surveys around southern Hokkaido.

Fig. 3 The Hokusei Maru II *after renovation.*

The *Hokusei Maru II* completed her 47th and final cruise in August 1976. During 19 years of service, she traveled 334,076 miles and carried 1503 students. A total of 143 Japanese researchers from both within and outside Hokkaido University also participated in these cruises.

Hokusei Maru III

Construction of the *Hokusei Maru III* was completed in October 1976, in Niigata City at a cost of 1,547,000,000 yen ($16,127,000). The 62-meter, 893-gross-ton stern trawler was equipped with a 2100-horsepower engine, a bow thruster, and an anti-rolling tank (Fig. 4). She had a complement of 71 (40 students, 27 crew, and 4 researchers) and was equipped to use a stern trawl, drift gillnet, tuna longline, and purse seine. The ship continued her predecessor's schedule of a winter cruise to the South Pacific, a spring cruise off southern Hokkaido and a summer cruise off northern Hokkaido. In 1987, she began annual fall trawl surveys off the Pacific coast of Hokkaido.

The summer cruises to the Sea of Okhotsk and northern part of the Sea of Japan focused on ecological studies of juvenile chum salmon (*Oncorhynchus keta*), particularly as they migrated offshore. Students were taught how to use a purse seine, drift gillnet, and surface trawl. As part of a government plan to develop new fishing grounds, the ship also conducted extensive surveys around the Emperor Seamounts during the 1977-80 summer cruises. Samples were collected near the seamounts using a deep trawl and a vertical longline, and the seafloor topography of the region was mapped. The 1978 cruise marked the first time a foreign scientist participated in a *Hokusei Maru* cruise.

During 1978-92, 14 guest scientists from the United States and Poland participated in *Hokusei Maru* cruises to the Northwest Pacific (Table 2). In 1982, the ship discontinued sampling in the Sea of Okhotsk and began sampling along 155º, 170º, and 175º30'E in the Northwest Pacific. These transects were sampled annually through 1999, providing a valuable time series for examining long-term changes in this region's ecosystem (e.g., Pearcy *et al.* 1996, Yatsu *et al.* 2000).

Fig. 4 The Hokusei Maru III.

Hawaii

The *Hokusei Maru III* also continued the annual winter cruises to the South Pacific, but when the numerous island nations in the region began establishing 200-mile exclusive economic zones in the 1970s, the ship headed to the high seas of the central North Pacific. In 1977, she ventured as far east as the Hawaiian Islands, making her first port call to Honolulu, and in 1979, began conducting tuna longline surveys near the Islands. In 1981, she conducted a cooperative research cruise with U.S. scientists from the University of Hawaii and the Honolulu Laboratory of the National Marine Fisheries Service. Between 1981 and 2001, 19 cooperative cruises involving scientists from the University of Hawaii and Hokkaido University were carried out near the Islands. Research focused largely on cephalopods (e.g., Harman *et al*. 1989, Sakurai *et al.* 1995, Young 1995, Bower *et al.* 1999) and the Hawaiian mesopelagic-boundary community (e.g., Reid *et al.* 1991). A total of 98 scientists from 14 universities and research institutions in the United States, Canada and France participated in these cruises (Table 3). Captains during the Hawaii cruises included Shoichi Yamamoto (1977-87), Genji Kobayashi (1990-91), Gen Anma (1992-93) and Toshimi Meguro (1994-2001).

End of the cadet training program

In 1953, the Faculty of Fisheries at Hokkaido University began offering a one-year postgraduate course in ship and fishery operations. Cadets in this course received classroom instruction in navigation, ship maneuvering, and maritime law, followed by at-sea training aboard the *Hokusei Maru*. During 1977-2001, 238 cadets participated in the winter cruises to the Hawaiian Islands. Similar courses were also offered at three other universities in Japan (Tokyo University of Fisheries, Kagoshima University and Nagasaki University), but due to declining enrollment, in 2002, these four curricula merged into one taught in Tokyo. Research was an important part of the *Hokusei Maru* cruises, but since 1949, the *Hokusei Maru*'s main role was to train fishery students. With the closing of the postgraduate course, the ship was decommissioned in March 2002 and will be not replaced. In 95 cruises over 25 years, the *Hokusei Maru III* sailed 527,456 miles and carried 3073 students, leaving behind a wealth of research achievements matched by few ships in the Pacific.

Acknowledgements

I thank Yoshiyuki Kajiwara, Yoshihiko Kamei, Toshimi Meguro, Yasunori Sakurai, Kenji Shimazaki, Hidekazu Yamaguchi, Jun Yamamoto and Richard Young for reading the manuscript. Meguro-sencho provided the photos. Much of the information in this paper came from Anonymous (1982) and Mishima (1988).

References

Anonymous. 1982. "Renshuusen", pp. 67-73. *In* M. Takagi (ed.) "Hokudai-suisan-gakubu nanajuu-go-nen-shi". Hakodate, Japan: Faculty of Fisheries, Hokkaido University [in Japanese].

Bower, J.R., M.P. Seki, R.E. Young. K.A. Bigelow, J. Hirota, and P. Flament. 1999. Cephalopod paralarvae assemblages in Hawaiian Islands waters. Marine Ecology Progress Series 185: 203-212.

Harman, R.F., R.E. Young, S.B. Reid, K.M. Mangold, T. Suzuki, and R.F. Hixon. 1989. Evidence for multiple spawning in the tropical oceanic squid *Stenoteuthis oualaniensis* (Teuthoidea: Ommastrephidae). Marine Biology 101: 513-519.

Hokkaido University. 1958-2002. Data record of oceanographic observations and exploratory fishing. Hakodate, Japan: Faculty of Fisheries, Hokkaido University. Nos. 2-45.

Mishima, S. 1988. "Hokusei Maru no oitachi to sono sokuseki". Oyashio 236: 4-6 [in Japanese].

Pearcy, W.G., J.P. Fisher, G. Anma, and T. Meguro. 1996. Species associations of epipelagic nekton of the North Pacific Ocean, 1978-1993. Fisheries Oceanography 5(1): 1-20.

Reid, S.B., J. Hirota, R.E. Young, and L.E. Hallacher. 1991. Mesopelagic-boundary community in Hawaii: micronekton at the interface between neritic and oceanic systems. Marine Biology 109: 427-440.

Sakurai, Y., R.E. Young, J. Hirota, K. Mangold, M. Vecchione, M.R. Clarke, and J. Bower. 1995.

Artificial fertilization and development through hatching in the oceanic squids *Ommastrephes bartramii* and *Sthenoteuthis oualaniensis* (Cephalopoda: Ommastrephidae). The Veliger 38(3): 185-191.

Yatsu, A., T. Watanabe, J. Mori, K. Nagasawa, Y. Ishida, T. Meguro, Y. Kamei, and Y. Sakurai. 2000. Interannual variability in stock abundance of the neon flying squid, *Ommastrephes bartramii*, in the North Pacific Ocean during 1979-1998: impact of driftnet fishing and oceanographic conditions. Fisheries Oceanography 9(2): 163-170.

Young, R.E. 1995. Aspects of the natural history of pelagic cephalopods of the Hawaiian mesopelagic-boundary community. Pacific Science 49(2): 143-155.

Table 1. Foreign ports visited by the Hokusei Maru II *and* III, *and years of visits*

Port	Year of visit	Port	Year of visit
Honolulu	‘77, ‘79, ‘80, ‘81^{2}, ‘82^{2}, ‘83^{4}, ‘85^{2}, ‘86^{2}, ‘87^{2}, ‘90^{2}, ‘91^{2}, ‘92^{2}, ‘93^{2}, ‘94^{2}, ‘95^{2}, ‘96^{2}, ‘97^{2}, ‘98^{2}, ‘99^{2}, ‘00^{2}, ‘01^{3}	Singapore Sandakan, Malaysia Kaohshiung, Taiwan	‘61 ‘62 ‘62
Suva, Fiji	‘63, ‘64, ‘66, ‘67, ‘68, ‘69, ‘70, ‘71, ‘77	Townsville, Australia	‘62
Noumea, New Caledonia	‘63, ‘65, ‘66, ‘68, ‘70, ‘78	Rabaul, Papua New Guinea	‘75
Levuka, Fiji	‘65, ‘68, ‘69, ‘71	Koror, Palau	‘75
Hilo, Hawaii	‘81, ‘83, ‘86, ‘00	Sydney, Australia	‘78
Kahului, Hawaii	‘83, ‘85, ‘87, ‘01	Honiara, Solomon Islands	‘79
Espirito Santo, Vanuatu	‘64, ‘67, ‘71	Nawiliwili, Hawaii	‘82
Apra Harbor, Guam	‘80, ‘89	Port Allen, Hawaii	‘93

(*Note: ^{2} - two visits; ^{3} - three visits; ^{4} - four visits*)

Table 2. Names and affiliations of foreign participants in the Hokusei Maru III *cruises to the Northwest Pacific*

David Ambrose, MMD	Stanislaw Kakolewski, ODSF	Michael Newcomer, MLML
Stanislaw Cichosz, ODSF	Thomas McIntyre, MMD	Zbigniew Stawny, ODSF
Tony DeGange, USFWS,	James Murphy, UAF	Lawrence Tsunoda, MMD
Edward Jameyson, NMML	Mary Nerini, MMD	Jack Turnock, NMML
Gerald Joyce, UW	Terrel Newby, MMD	

MLML: Moss Landing Marine Laboratories; MMD: Marine Mammal Division (NOAA); NMML: National Marine Mammal Laboratory (NOAA); NOAA: National Oceanic and Atmospheric Administration; ODSF: Odra Deep Sea Fishing Co. (Poland); UAF: University of Alaska, Fairbanks; USFWS: U.S. Fish and Wildlife Service; UW: University of Washington

Table 3. Names and affiliations of foreign participants in the Hokusei Maru III *cruises to the Hawaiian Islands*

Koji Abe, UHH	Janice Hirota	Walter Matsumoto, NMFS-HL	Lee Shindel, UHH
Hitoshi Ariga, UHH	J. Chris Hirota, SLP	Asuka Matsuura, UHH	Rachael Spears, UHH
Toshiki Ariga, UHH	Jed Hirota, UHM	Hillary Maybaum, UHM	Yvonne Stoermer, UHM
John Arnold, UHM	Raymond Hixon, UT	Dan McGuire, UHH	Edward Stroup, UHM
Kent Backman, UHH	Jackie Hollbrook, UHH	Peter Morton, UHM	Satoru Taguchi, UHM
Mace Bacom, UHM	Charles Holloway, UHM	John Naughton, NMFS-HL	Ralph Takefuji
Ian Bartol, CWM	Ben Hong, UHH	Michelle Nawrocki, UHM	Gordon Taylor, UHM
Keith Bigelow, UHM	Juliana Horn, UHM	Robert Nishimoto, DAR	Joseph Tegeder, UHH
William Bishoff, UHM	Marc Hughes, UHH	Eugene Nitta, NMFS-HL	Bronte Tilbrook, UHM
John Bower, UHM	Walter Ikehara, DAR	Shawn Norris, UHH	Timm Timoney
David Carlini, CWM	David Jones, UHM	Ron O’Dor, DU	Richard Titgen
Michael Chalup, UHM	Jeff Jones, UHM	Yuko Okano, UHH	Gordon Tribble, UHM
John Constantinou, UHM	Richard Jurick, UHM	Shannon Oshiro, UHH	Paul Troy, UHM
Joan Culp, UHM	Tomoko Kato, UHH	Jessica Owens, UHH	Michael Vecchione, NMNH
Frances Cummings, CSUF	Steve Kemper	Edward Parnell, UHM	Philomene Verlaan, UHM
Paul Dulfer, UHH	John Kephart, UHH	Matt Parry, UHM	Lisa Wedding, UHH
Aisa Esquivel, UHM	Bert Kikkawa, NMFS-HL	Stewart Reid, UHM	Tammy Wenhem, UHH
Robert Ferguson, UHM	Karen Klein, OI, UHM	Clyde Roper, NMNH	John Wormuth, TAMU
James Finn, UHM	Don Kobayashi, UHM	Niklas Schneider, UHM	Don Worsencroft
Brad Gould, UHM	Brent Larsen, UHH	Wolfgang Schneider, UHM	Jeannette Yen, UHM
Richard Grigg, UHM	Erin Leistman, UHH	Roger Seapy, CSUF	Alan Young
Leon Hallacher, UHH	Normand Lezy, UHM	Michael Seki, NMFS-HL	Phyllis Young
Annie Hareau, UHM	Sean Lockerman, UHH	Keiko Sekiguchi, UHH	Richard Young, UHM
Robert Harman, UHM, DAR	Katharina Mangold, LA	Elizabeth Shea, BMC	
Skippy Hau, DAR	Kevin Mahoney, UHH	John Shears, UHM	

Note: BMC: Bryn Marr College; CSUF: California State University, Fullerton; CWM: The College of William and Mary; DAR: Division of Aquatic Resources, State of Hawaii; DU: Dalhousie University (Canada); LA: Laboratoire Arago (France); NMFS-HL: National Marine Fisheries Service-Honolulu Lab.; NMNH: National Museum of Natural History; OI: Oceanic Institute (Hawaii); SLP: Sea Life Park (Hawaii); TAMU: Texas A&M University; UHH: University of Hawaii at Hilo; UHM: University of Hawaii at Manoa; UT: University of Texas

First meeting of the CLIVAR Pacific Panel

Kelvin Richards
Southampton Oceanographic Centre
European Way, Southampton SO14 3ZH
United Kingdom
E-mail: kelvin@soc.soton.ac.uk

Kelvin Richards has been at the University of Southampton, UK, for the last 16 years where he holds a faculty position. His research interests include equatorial dynamics, local frequency variations of the ocean system, mixing and stirring of reactive tracers and the impact of physical processes on biological production. This spring he heads a cruise to the Irminger Sea to study the controls on the zooplankton species calanus finmarchicus*, as part of the UK Marine Productivity research programme. In the summer he moves to the University of Hawaii to take up a faculty position at the International Pacific Research Center (IPRC).*

The organisers of the meeting: from left to right - John Gould (Director of ICPO), Bob Weller (CLIVAR SSG representative), Daniela Turk (ICPO) and Kelvin Richards (CLIVAR Pacific Panel Chairman). Picture by Gisela Speidel (IPRC).

The first meeting of the newly formed CLIVAR Pacific Panel took place February 7-9, 2002, at the East-West Center, University of Hawaii, Honolulu. The International Pacific Research Center (IPRC) is to be thanked for the smooth running of the meeting. The main purpose of the meeting was to establish the role of the Panel, identify the major issues the Panel needs to address and setup a framework to address these issues. The Panel, chaired by Kelvin Richards (Southampton Oceanographic Center, UK), has at present 11 members from 10 different nations. The Panel was joined by a number of invited experts. The full report of the meeting will be available soon on the CLIVAR web page (www.clivar.org). This article attempts to give a brief overview of the meeting.

The meeting opened with a statement from John Gould, Director of the International CLIVAR Project Office (ICPO), who stressed the need to consider the objectives of CLIVAR, that not only is a better understanding of climate variability, but also an importance of collecting observations that adequately foresees future climatic changes.

The enormity of the task in making such advances should not be underestimated. The resources required will be larger than has hitherto been applied. The need for a well coordinated international effort making best use of those resources is paramount, but there is the potential for a large step-like gain in our understanding and predictive capabilities of climate variability.

Panel members gave reports on national programmes, which were followed by reports on sustained observational networks and process studies, both underway and in the planning stages. An impressive array of ongoing and planned science programme observations focused on the Pacific were presented at the meeting. A selection is given here.

The TAO/TRITON array continues to give high quality data essential for seasonal to interannual climate research and forecasting. The readily available data are being used in ocean state estimations and predictive models. Goals in the next few years are to improve data return, introduce new technologies, and work with the broader community to ensure that TAO/TRITTON is fully integrated with other elements of the global ocean observing system. Implementation of Argo in the Pacific is proceeding apace with increasing numbers of floats in the water. The coverage in the North and equatorial Pacific is improving, however, there is a serious shortfall in the South Pacific. There are commitments to repeat many hydrographic sections in both hemispheres. A notable commitment is from Japan to repeat the very long section across the South Pacific at 30^{o}S.

A major ongoing process study is the East Pacific Investigation of Climate (EPIC) project looking at the interaction between the ocean and atmospheric boundary layer and controls on the cold tongue. EPIC is well underway and producing interesting results.

The Panel was also briefed on a number of other process studies in the planning phase; this includes the Kuroshio Extension System Study (KESS), Thorpex, and the Pacific Basin Extended Climate Study (PBECS). PBECS is a long-term experiment to test and improve dynamical models of ocean processes that contribute to climate variability. The project is based on the belief that the best hope for climate prediction and assessment lies in models that have sound approximations of important physics, and models that are initialised and validated with abundant and accurate observations.

Two major issues emerged from the discussions. The first is the need for coordination of national and international observational programmes. Gaining an overview of the science, how to integrate different aspects of it in some way, and particularly, identifying gaps proves a big challenge. The framework adopted by PBECS (a U.S. CLIVAR programme) provides an effective way of integrating studies across a range of time and scales. PBECS is at an advanced stage of planning and has considered the issues involved at length. The Pacific Panel agreed to look at adopting an implementation approach and strategy closely aligned to PBECS. The exact nature of the framework needs careful consideration so that it fulfils the requirements of the international community, but the adoption of such a framework makes it easier to see the relevance of individual programmes and to spot the gaps.

The second major issue is the need to assess the adequacy of the observational/modelling systems to achieve CLIVAR Pacific objectives. Is the observational system capable of "adequately" depicting the season-to-interannual variability of the ocean and atmosphere? How well does a given oceanic observation improve our ability to describe and/or predict the system? Will an improvement in quantifying a given "process" improve the predictive skill of a model? The only way forward is a close working relationship between observationalists and modellers. Exploring ways of best achieving the necessary linkages will be a major task of the Panel.

Data, and its handling, is a big issue for CLIVAR. As a global multidisciplinary project, CLIVAR requires diverse data (ocean, atmosphere, model, paleo) in both real-time and delayed mode, and has struggled with the definition of an appropriate data structure. Discussion at the meeting indicated the need to identify relevant datasets, review how information about data is made available to the user, identify data exchange and availability problems, and to maintain communication with GOOS, GCOS and GODAE (Global Ocean Data Assimilation Experiment), to relay requirements specific to the Pacific.

Peter Hacker gave a presentation on the newly created Asia-Pacific-Data Research Center (APDRC) at the IPRC. The vision of the APDRC is to link data management and preparation activities to research activities within a single center, and to provide one-stop shopping of climate data and products to local researchers and collaborators, the national climate research community, and the general public. The Pacific Panel welcomed the establishment of APDRC and agreed to work closely with the APDRC on both the identification of CLIVAR related data sets, and on the management of ocean and atmosphere data from the Pacific sector.

Finally, much progress was made on the understanding of the impacts of changes to the physical ocean/atmosphere system on biogeochemical cycles. There is a growing desire to strengthen the links between CLIVAR and the biogeochemical and ocean carbon communities. To this aim, a joint PICES/CLIVAR workshop will take place as part of the PICES Eleventh Annual Meeting in Qingdao this coming October. The workshop will be co-convened by Kelvin Richards (CLIVAR) and Kimio Hanawa (PICES). The aims of the workshop are to bring together scientists interested in climate issues who would not normally communicate, to identify common PICES and CLIVAR themes, and to identify the need for common and complementary approaches and areas of collaboration. The outcome of the workshop will be reported in a later edition of this newsletter.

Participants of the first meeting of the CLIVAR Pacific Panel held February 7-9, 2002, at the East-West Center, University of Hawaii, Honolulu, U.S.A.

Call for contributions to the North Pacific Ecosystem Status Report

PICES is in the initial stages of developing a *North Pacific Ecosystem Status Report*. It will periodically review and summarize the status and trends of marine ecosystems in the North Pacific, and consider the processes that are causing or expected to cause change in the near future. Financial support for the project has been obtained from Alaska Fisheries Science Center (National Marine Fisheries Service, NOAA), the *Exxon-Valdez* Oil Spill Trustee Council, and the Census of Marine Life.

For 2002, PICES will produce an abbreviated version of the report as a pilot project. This will focus on geographic locations and subjects for which time series data or information are readily available. The report will also identify locations or subjects where data have been collected but are not yet available. The area of interest is the North Pacific Ocean, generally north of 30°N latitude, and its marginal seas. Within this area, the PICES-GLOBEC Climate Change and Carrying Capacity Program identified a number of regions of interest:

(1) California Current south
(2) California Current north
(3) Southeast and central Alaska
(4) Eastern Bering Sea
(5) W. Bering Sea / Kamchatka
(6) Okhotsk Sea
(7) Oyashio / Kuroshio
(8) Japan / East Sea
(9) Bohai, Yellow Seas
(10) East China Sea
(11) Western Subarctic Gyre
(12) Eastern Subarctic Gyre

PICES is seeking assistance in finding contributions to the report. Contributions from individuals and/or organizations will be acknowledged. In general, we wish to describe the current state of marine ecosystems in the North Pacific Ocean to understand whether they are similar or different from what has been observed in the past. Specifically, we request your help to tell us about, and to provide summary reports, figures, tables, websites, and/or data that describe, the recent (within about the last 5 years) status of marine ecosystems or their components. Those summaries and reports that compare recent conditions with those that were observed about 10 years ago or more will be particularly useful. Information from short time series that are expected to continue in the future is valuable too. The subjects of interest in each region are not limited to those described in the draft Table of Contents (see http://www.pices.int/Projects/ecostatus/toc.asp for details). Contributions need not be written in English, as efforts will be made to translate from other languages. If such summaries are not available in a region, it would be most helpful to know where to find the component reports or data to begin assembling similar summaries for each region.

Regional fisheries organizations including the International Pacific Halibut Commission (Pacific halibut), Inter-American Tropical Tuna Commission (tunas and billfishes), the North Pacific Anadromous Fish Commission (Pacific salmon) have agreed to contribute to the report.

A draft is anticipated by the Eleventh Annual Meeting of PICES in Qingdao, People's Republic of China, in October 2002, and will be available for discussion within the various PICES Scientific Committees at this same meeting.

If you have something to contribute, or know of someone who does, please respond directly to the PICES Secretariat (E-mail: ecostatus@pices.int) with a short description (scientific topic, temporal period, geographic area) of what you can contribute. We will advise you promptly if the material is suitable for this version of the report.

PICES/CREAMS symposium on the Japan/East Sea

PICES and the Circulation Research in East Asian Marginal Seas (CREAMS) program announce a joint Symposium "Recent progress in studies of physical processes and their impact to the Japan/East Sea ecosystem", to be held August 22-24, 2002, Seoul, Korea (for details see http://www.pices.int/meetings/jes2002). The purpose of the Symposium is to provide a forum to discuss new observational, modelling, and theoretical results relevant to physical processes in the Japan/East Sea, their interaction with adjacent marginal seas and the North Pacific, and their bio-physical linkages through all trophic levels of the Japan/East Sea ecosystem.

The Symposium will follow a successful format used in previous CREAMS meetings, with 2 days of plenary sessions, posters, and numerous informal opportunities for discussion. In addition, the morning of the third day will be a special workshop to select and to synthesize material for a Japan/East Sea chapter of the PICES North Pacific Ecosystem Status Report. Scientific sessions will include invited papers and contributed posters. All interested persons should provide abstracts of their presentation by **July 15, 2002.** The organizers intend to publish invited overview papers and selected contributed papers/posters in a special issue of *Progress in Oceanography*.

Upcoming PICES publications

PICES Scientific Reports in 2002:

- No. 20: Proceedings of the PICES X Anniversary Symposium
- No. 21: Report of the 2001 BASS/MODEL, MONITOR and REX Workshops, and the 2002 MODEL Workshop
- No. 22: Report of the MONITOR Workshop on **"**Voluntary observing systems"
- No. 23: Red tides, brown tides and other harmful algal blooms in the PICES region of the North Pacific (national reports)
- No. 24: CO_2 in the North Pacific (final report of WG 13)

PICES Scientific Reports in 2003:

- No. 25: Climate change and shifts in fish production (final report of WG 16)
- No. 26: Proceedings of the 2002 CCCC Integration Workshop and MONITOR Workshops
- No. 27: Ecosystem models for the subarctic Pacific gyres (BASS/MODEL Task Team report)
- No. 28: Mickronekton in the North Pacific (final report of WG 14)
- No. 29: Marine life in the North Pacific Ocean: The known, unknown and unknowable (CoML report)

PICES special issues in 2002-2004:

- Physics and biology of eddies, meanders and rings in the PICES region (Guest editors: William B. Crawford, Alexander S. Bychkov, Stewart M. (Skip) McKinnell and Takashige Sugimoto) - *Journal of Oceanography*, fall 2002, Vol. 58, No. 5
- 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) - *Progress in Oceanography*, fall 2002
- Environmental assessment of Vancouver Harbour - Results from the 1999 PICES Practical Workshop (Guest editors: Richard F. Addison and John E. Stein) - *Marine Environmental Research*;
- Migration of key ecological species in the North Pacific Ocean (Guest editor: James Irvine) - *Canadian Journal of Fisheries and Aquatic Sciences*
- Plankton size classes, functional groups, and ecosystem dynamics: Causes and consequences (Guest editors: Alexander S. Bychkov and Angelica Peña) - *Progress in Oceanography*, spring 2003
- North Pacific transitional areas (Guest editors: Michio J. Kishi, Daniel Lluch-Belda, Skip McKinnell, Arthur Miller and Yoshiro Watanabe) - *Journal of Oceanography,* summer 2003, Vol. 59, No. 4
- Detection of regime shifts in physics and biology (Guest editors: Jacquelynne R. King and James E. Overland) - *Journal of Marine Systems*, fall 2003
- Biogeochemical cycles in the North Pacific: JGOFS synthesis (Guest editors: Alexander S. Bychkov, Toshiro Saino) - *Journal of Oceanography,* fall 2003, Vol. 59, No. 6 (jointly with JGOFS)
- Recent progress in studies of the Japan/East Sea - *Progress in Oceanography*, spring 2004
- Concentrating marine organisms around shallow topographies: Importance of biophysical coupling - *Journal of Marine Systems*, spring 2004
- Role of zooplankton in global ecosystem dynamics: Comparative studies from the world oceans – *ICES Journal of Marine Science*, fall 2004 (jointly with ICES and GLOBEC)

Upcoming PICES meetings in 2002-2003

- PICES/CREAMS Symposium on "Recent progress in studies of physical processes and their impact to the Japan/East Sea ecosystem", August 22-24, 2002, in Seoul, Republic of Korea (see page 31)
- PICES Eleventh Annual Meeting, October 18-26, 2002, Qingdao, People's Republic of China (see detailed announcement on the PICES Home Page)
- JGOFS/PICES Session on "Carbon cycle in the North Pacific", October 1-2, 2002, Sapporo, Japan (in conjunction with the 2002 SCOR General Meeting)
- The Third PICES Workshop on "Physical and biological processes in the Okhotsk Sea and adjacent areas", June 2003, Vladivostok, Russia
- 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 (see detailed announcement on the PICES Home Page);
- PICES Twelfth Annual Meeting, October 10-18, 2003, Seoul, Republic of Korea

PICES PRESS

Published and produced by PICES Secretariat
c/o Institute of Ocean Sciences
P.O. Box 6000
Sidney, B.C., Canada
V8L 4B2
Tel: 1 (250) 363-6366
Fax: 1 (250) 363-6827
email: secretariat@pices.int
http://www.pices.int
ISSN 1195-2512