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PICES-GLOBEC Program on CCCC

At the PICES Third Annual Meeting in October 1994, a Science Plan for the PICES GLOBEC Program on Climate Change and Carrying Capacity (CCCC) was approved. The goal of the CCCC program is to understand, and eventually predict, the effects of climate variation on ecosystems of the subarctic Pacific. As the Science Plan emphasizes, activities in the CCCC are anticipated on two spatial scales:

1. Basin-scale studies to determine how plankton productivity and the carrying capacity for high trophic level, pelagic carnivores in the North Pacific change in response to climate variations.
2. Regional-scale, ecosystem studies comparing how variations in ocean climate change species dominance and fish populations in the coastal margins of the Pacific Rim, from China to California.

An Implementation Group has been established, to initiate development of an implementation plan. The Executive Committee of that Group met in Honolulu on May 24-26. One of its tasks was to reconsider the Key Scientific Questions of the Science Plan which it proposed to restate as Central Scientific Issues, in the following terms:

Forcing: What are the characteristics of climate variability, can interdecadal patterns be identified, how and when do they arise?

Lower trophic level response: How do primary and secondary producers respond in productivity, and in species and size composition to climate variability in different ecosystems of the subarctic Pacific.

Higher trophic level response: How do life history patterns, distributions, vital rates, and population dynamics of higher trophic level species respond directly and indirectly to climate variability?

Ecosystem interactions: How are subarctic Pacific ecosystems structured? Do higher trophic levels respond to climate variability solely as a consequence of bottom up forcing? Are there significant intra-trophic level and top down effects on lower trophic level production and on energy transfer efficiencies?



The Science Plan describes key research activities which apply to both basin and regional scales, although emphases and priorities will differ from project to project. Retrospective studies are the only way whereby observed variability beyond the decadal scale can be examined. Such studies are an important precursor to model and process studies, on which the design of observation systems will depend. Model development includes conceptual-theoretical studies, with the eventual goal of a coupled atmosphere-ocean-ecosystem model. Process studies include experimental approaches to study or test specific mechanisms linking ecosystem responses to environmental variability. Observation systems will be

needed to monitor changes in both environmental forcing and ecosystem response. The data management problems include archiving data generated by process studies and observing systems and making these and other data easily available to interested scientists.

On the regional scale, comparative studies of ecosystems along the continental margins of the subarctic Pacific will be of particular interest. National programs, GLOBEC or otherwise, are being identified that will contribute to such comparative studies, and a first attempt has been made to identify a minimum set of program outputs needed for such comparisons. National GLOBEC Committees will play a key role in development of the CCCC Program and are strongly represented on the Executive Committee of the Implementation Group. Development of an implementation plan for basin scale studies is still under consideration by the Executive Committee.

The CCCC Program will draw upon the help and guidance of other PICES bodies, the Scientific Committees and Working Groups, and especially on those concerned with coastal pelagic fish (WG3), modeling (WG7), monitoring (WG9) and data exchange (TCODE). It is hoped that higher trophic level studies where salmonids are concerned can be developed in cooperation with the North Pacific Anadromous Fish Commission (NPAFC). Cooperation with other relevant international organizations and programs will also be essential to the success of the program.

Present plans are to circulate the draft implementation plan widely to all interested parties by mid-August, with a view to considering appropriate action on the plan during the Fourth Annual Meeting in Qingdao.

(W. S. Wooster)

CCCC Implementation Group members: R. J. Beamish, Michael A. Henderson, David L. Mackas, R. Ian Perry, Dan Ware (Canada); Qi-Sheng Tang, Ji-Lan Su, Rong Wang (China); Makoto Kashiwai*, Kazuya Nagasawa, Yasunori Sakurai, Makoto Terazaki, Tokio Wada (Japan); Sin-Jae Yoo (Korea); A. I. Boltnev, Vadim V. Navrotsky, Vladimir I. Radchenko (Russia); Robert Francis, Bruce W. Frost, Anne B. Hollowed, Brenda L. Norcross, Warren S. Wooster* (USA); Michal L. Dahlberg (NPAFC). (* Co-chairmen)

Vladivostok Workshop

PICES Workshop on the Okhotsk Sea and Adjacent Areas was held in Vladivostok, Russia, on June 19-24, 1995. At the beginning of the opening ceremony in the morning of June 19, Dr. W. S. Wooster, chairman of PICES addressed the gathering. It was followed by a keynote lecture on Physical Oceanography of the Okhotsk Sea and Oyashio Region by Dr. L. D. Talley, chair of the former WG1 of PICES. Four other keynote lectures were given in the afternoon: Biota of the Okhotsk Sea - Structure, Long-term Dynamics and Present Status by Drs. V. P. Shuntov and E. P. Dulepova, Maritime Nature Use Problems by Dr. B. V. Preograzhensky, Northwest Pacific Paleohydrography by Dr. L. D. Keigwin, and Bank of Fishery-Biological and Oceanographical Data by Drs. L. N. Bocharov and V. K. Ozerin.

On June 20-23, the following eight symposium sessions were held in parallel in three meeting rooms:

- (1) Circulation and water mass structure of the Okhotsk Sea and north-western Pacific,
- (2) Sea ice and its relation to circulation and climate,
- (3) Waves and tides,
- (4) Physical oceanography of the Japan Sea,
- (5) Communities of the Okhotsk Sea and adjacent waters: composition, structure and dynamics,
- (6) Abundance, distribution, dynamics of the common fishes of the Okhotsk Sea,
- (7) Salmon of the Okhotsk Sea: biology, abundance and stock identification, and
- (8) Biodiversity of island ecosystems and seaside of the North Pacific.

97 papers (including 16 from overseas) were given in the oral sessions, 44 papers in the poster sessions. A total of 141 scientists attended the workshop.

The Scientific Steering Committee of the workshop met in the evening of June 20 to discuss detailed workshop items. A special meeting on data management took place in the evening of June 21.

A one-day cruise excursion on board POI research vessel was held on June 23, and free discussions on board were very useful to create a better understanding among the researchers. The Scientific Steering Committee had a second meeting on board to make preparations to write a draft report to be presented to the Science Board of PICES.

The plenary session was held in the morning of June 24. Summary reports of the eight sessions were presented. The outline of the workshop report prepared by the Scientific Steering Committee was also presented and accepted by the plenary session. The workshop was closed by an address from Dr. W. Wooster.

Future actions and recommendations

By reviewing recent oceanographic studies on the Okhotsk Sea and its adjacent areas, the workshop identified the special characteristics of the oceanic conditions: the Okhotsk Sea has a low-salinity surface layer, and sea ice formation occurs at considerably low latitudes. While it is a well-closed marginal sea, it exchanges a large amount of water with its adjacent seas: inflow and outflow through the northern and southern straits of the Kuril Islands from and into the Pacific Ocean, respectively, and inflow of high salinity water through the Soya Strait from the Japan Sea. The active ice formation on the shelf region of the north-western Okhotsk Sea produces water of high density throughout winter. This heavy water loses its high-salinity characteristics before it flows out into the central part of the Okhotsk Sea, and forms fresh water at the density level of the North Pacific Intermediate Water. In addition, strong tidal currents cause active tidal mixing in the shallows and straits in and near the Okhotsk Sea.

The workshop recognized the importance of the studies of the Okhotsk Sea not only because the ocean is scientifically interesting but also because it has a close relation with global climate change. The workshop concluded that further investigations are urgently needed. The workshop was quite successful as a first step in providing a rare chance of information exchange and mutual understanding among the researchers concerned. It was recommended that PICES through one of the science committees hold a second Okhotsk Sea workshop in 1998, or an Okhotsk Sea symposium at PICES Annual Assembly.

The workshop appreciated the activity of WG1/POC and the publication of the PICES Scientific Report No.2, 1995, on the Okhotsk Sea and Oyashio Region. As the report focuses mainly on physical oceanographic problems, and does not fully include the recent Russian works, the workshop recognized the need to publish the proceedings of the PICES Vladivostok Workshop. A Russian scientist group has a

plan to carry out the publication, and we would like to request that PICES endorses and supports such activity. A Russian book on hydrography and physical oceanography of the Okhotsk Sea would be useful for all the marine scientists, and it is desirable that the book will be published as soon as possible. It is our hope that PICES will take an initiative to translate it into English. A publication on the Okhotsk Sea region on biological and fisheries aspects would also be desirable, and it is recommended that BIO and/or FIS/PICES takes the initiative.

Almost all of the Okhotsk Sea region belong to the economic zones of Russia and Japan. Therefore, international cooperation is essential for the studies of the Okhotsk Sea (the similar situation exists for the studies of the Japan Sea and the Bering Sea). The workshop recommends that PICES and its member countries bordering the Okhotsk Sea facilitate access to investigators for scientific and logistic purposes. PICES should endorse and support international research programs such as the Soya/La Perouse Project, a first step of which is going to start under the cooperation between Sakhalin TINRO and the Hokkaido Experimental Station. We expect that other relevant institutions will join and reinforce the project under the guidance and advice of PICES. It is recommended that CCCC Program will coordinate an international cooperative project on the Okhotsk Sea area as one of its key projects.

The number of the papers concerning the Japan Sea was rather limited in the workshop. We recognize, however, that Japan Sea is another very important region and requires more research. The Japan Sea Proper Water is apparently very young, probably of an order of several tens of years. The Japan Sea may be considered as a suitable domain to test our models on formation and circulation of the abyssal waters. It is recommended that POC will take an initiative also on the studies on the Japan Sea in the same way as POC did for the Okhotsk Sea and Oyashio region.

The workshop also recognized that the data and information exchanges in the regions under consideration are limited. As the studies on the Okhotsk Sea are done not only by the established institutions like POI, TINRO, and FERHRI of Russian and JFA and universities in Japan, but also by many local organizations of both countries. Complete inventories of the relevant institutions and individuals are necessary. Also, we need to have a nomenclature list of the

bays, the straits, the currents, etc. It is recommended that TCODE will take an initiative to solve these problems. The attendants of the workshop will certainly support such activities of TCODE.

Acknowledgments

As the chair of the Scientific Steering Committee of the Vladivostok Workshop, I would like to express my thanks to the two co-chairs, Drs. V. Lobanov and L. Talley, and other committee members for their efforts in preparing and conducting the workshop. I also thank the members of the Local Organizing Committee and of the Workshop Secretariat, and the PICES Secretariat for their work which contributed tremendously to the success of the workshop. I also express my thanks to the Russian agencies that gave various supports for the workshop.

(Yutaka Nagata)

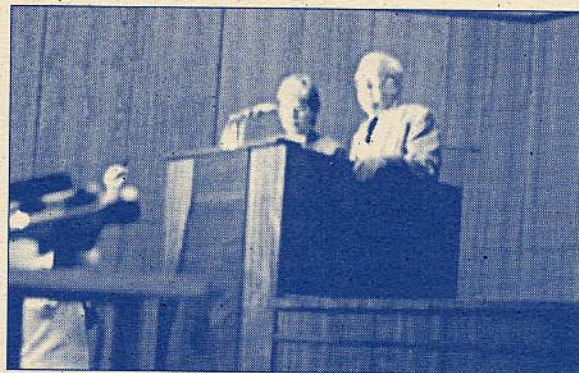
Russia & Korea Join PICES

The Secretariat is busy planning for the Fourth Annual Meeting which will be expanded to include two countries that have joined PICES since the beginning of the year. We would like to welcome the Russian Federation (became a member of PICES in late December, 1994) and the Republic of Korea (will be a member as of the July 30, 1995) as members of PICES. We look forward to their contribution to the goals and activities of the Organization.

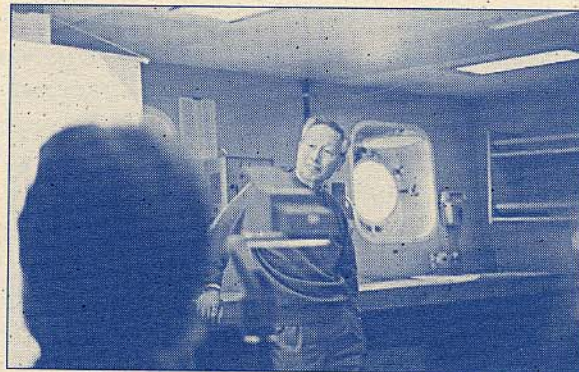
The Fourth Annual Meeting in Qindao will certainly be memorable as the first meeting in which these countries officially take part in PICES activities. The Chairman, the Secretariat as well as others involved in PICES look forward to meeting and working with the new delegates, members of committees and working groups at the Fourth Annual Meeting in October.

Note From Editor

The editor would be pleased to receive any contributions that you may wish to make. Articles received will be published in the next edition of PICES PRESS.



Dr. W.S. Wooster, Chairman of PICES, giving opening address at the Vladivostok Workshop.



Prof. Y. Nagata in discussion with Russian scientists on a 1-day cruise excursion on board a POI research vessel.



Reception hosted by new POI Director, Dr. V.A. Akulichev. From left: Y. Nagata, H.J. Freeland, L.D. Talley, W.S. Wooster, V.A. Akulichev, Y.J. Ro and J.C. Lee.

New Publication

PICES Scientific Report No. 2
The Okhotsk Sea and Oyashio Region
(Report of WG1, Physical Oceanography
and Climate Committee)
Edited by Lynne D. Talley and Yutaka Nagata
227pp., April 1995
(Available upon request free of charge)

Coastal Ocean Processes Experiment of the East China Sea (COPEX-EXS)

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1. General description

The East China Sea (ECS) acts as a large reservoir and supplier of energy and matter originating from both land and ocean. The basin consists of a vast shelf area and a narrow long slope region which is connected to the Yellow Sea in its northwest and to the East Sea (Japan Sea) through the Korea/Tsushima Strait. The Kuroshio (the western boundary current of the North Pacific subtropical circulation) flows along the continental slope of the ECS after leaving the shelf northeast of Taiwan. The Kuroshio has two branch currents which directly transport water and materials onto the ECS shelf area: the Tsushima Warm Current (TWC) into the eastern basin and the Taiwan Current into the southwestern basin. Further, abundant river discharge carries a tremendous amount of fresh water and land-based materials to the northwest Pacific, the Yellow Sea, and the East Sea through the ECS shelf.

In the ECS, various oceanographic processes of different temporal and spatial scales are involved in the transport, exchange, and mixing of water and materials. These processes may occur independently or in combination. Furthermore, the tide and monsoons play an important role in making the processes more complex. However, very few of the processes have been elucidated to date. For instance, the origin of the TWC, along with its path and seasonal variability, has long been debated. The Yellow Sea Warm Current has not been tracked by direct measurements. The volume transport, passing through the Korea/Tsushima Strait to the East Sea, has not been studied with reasonable accuracy. Biogeochemical processes that are closely related to physical processes are yet to be determined.

2. Related regional programs

Three important ECS interdisciplinary programs are being conducted independently by Korea, Japan-China, and Taiwan. The first is the Coastal Ocean Processes Experiment of the East China Sea (COPEX-ECS), a ten year project that was initiated in 1993 by the Korea Ocean Research and Development Institute (KORDI). The second is a study of Marginal Sea Flux Experiment in the West Pacific (MASFLEX); the second phase of which started this year as a Japan-China joint project. The third is the Kuroshio Edge Exchange Processes in its second stage (KEEP-II) which has been conducted by oceanographic institutions in Taiwan since 1993. The main objective of the COPEX-ECS is to understand major processes of the basin scale circulation and material flux. The MASFLEX is focused mainly on understanding exchange of materials between the ECS and the northwest Pacific. The KEEP aims to investigate the exchange processes between the ECS and Kuroshio in the southwestern ECS. No official linkage between these three programs has been put in place so far, but more frequent exchange of both information and scientists is anticipated in the near future.

3. Coastal Ocean Processes Experiment

COPEX-ECS is a research program funded by the Ministry of Science and Technology of Korea. Its main objectives are:

- (1) to understand the mechanism of circulation and material flux of the ECS,
- (2) to clarify major processes in relation to the circulation and flux,
- (3) to elucidate the role of physical processes in ecosystem dynamics, and
- (4) to develop a comprehensive predictive model of tide and circulation.

The first phase of COPEX (1993-1996) is focused on:

- (1) the circulation and material flux of the eastern ECS,
- (2) branching of the TWC from the Kuroshio,
- (3) mixing of fresher shelf water and saltier oceanic water, and
- (4) spatiotemporal patterns of primary productivity and plankton dynamics.

Seven working subgroups were formed for the first phase study: (i) current dynamics, (ii) water mass

and mixing process, (iii) biogeochemical process, (iv) ecosystem dynamics, (v) tide and tidal current, (vi) circulation model, and (vii) oceanographic conditions around Cheju Island. Interdisciplinary surveys were planned to be conducted at four different times: December 1993, August/September 1994, April/May 1995, and October 1996. Three cruises have been

completed by KORDI R/V Onnuri (1400 ton class) in the eastern ECS. Figure 1 shows locations of CTD castings and water samples taken. The branching area of the TWC was chosen as an intensive study area of the first phase to investigate major processes in relation to the separation from the Kuroshio.

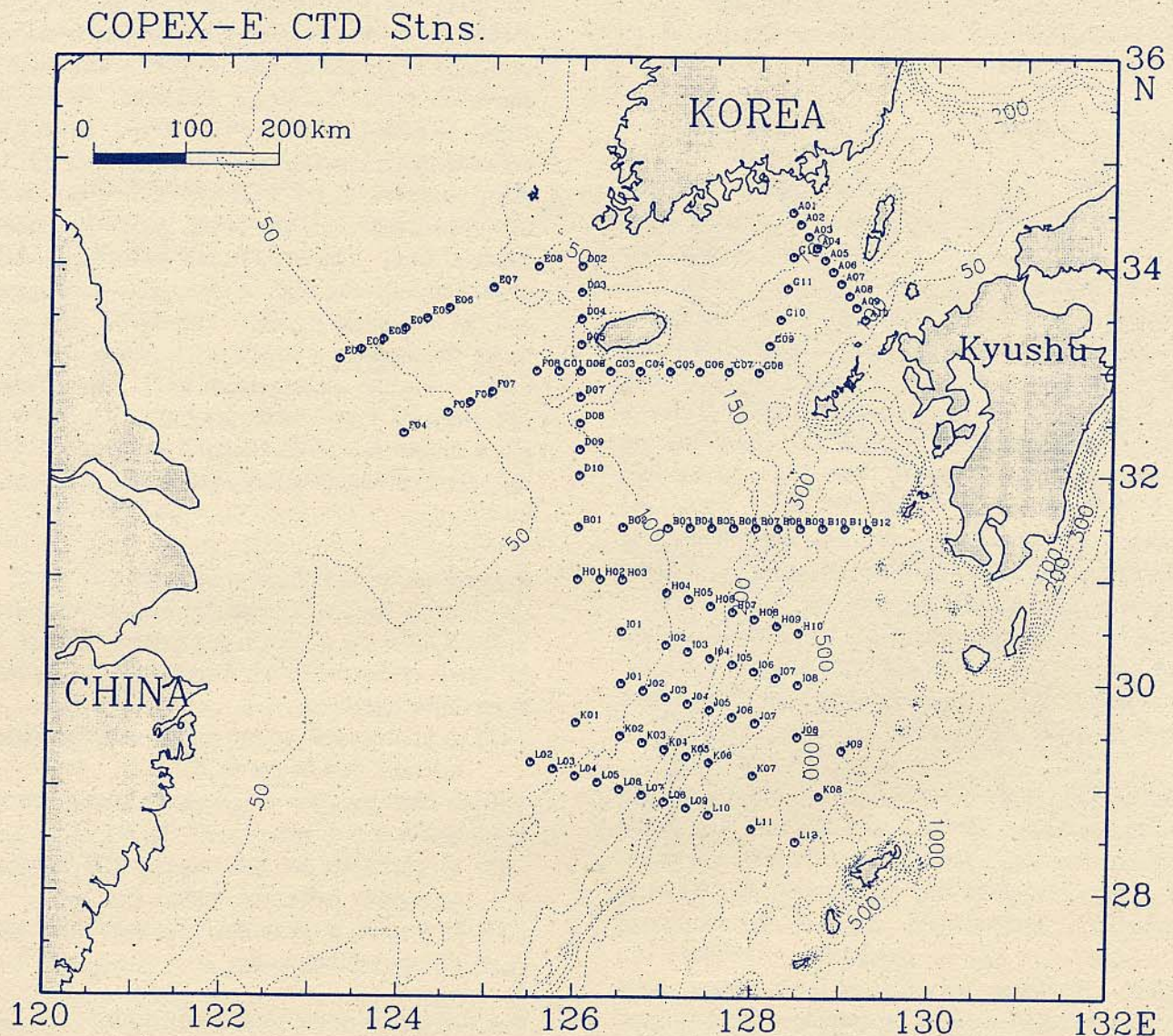


Fig. 1 Locations of CTD stations

4. Origin of the Tsushima Warm Current

Two different studies have been presented on the origin of the TWC. One is that the TWC separates from the Kuroshio southwest of Kyushu and then flows northward through the deep trough to the northern tip of the Okinawa Trough. The other is

that it is a northeastward continuation of the Taiwan Current passing through the Taiwan Strait flowing over the shallow ECS shelf at 50-100m depth. Due to the lack of sufficient direct current measurements and hydrographic data collected together, the origin of the TWC and its physical characteristics remain

unclear, though various speculations have been postulated.

Tracking of surface drifters and CTD castings were taken three times in the eastern ECS during 1991-1992. The results show that a persistent northward current exists, both on the shelf west of the deep trough off Kyushu and on the western flank of the trough. The northward flow on the shelf continues to flow northward toward the Korea Strait along the 100-150m isobaths, but the flow along the western wall of the trough forms a clockwise circulation and finally joins the Kuroshio. Lie and Cho (1994) concluded that the northward flow could be the shore side fringe of the Kuroshio, thus forming the origin of the TWC. The Kuroshio main stream, located on the shelf break, turns toward the Tokara Strait just before the southwestern corner of the trough and overshoots the mouth of the trough. However, the shore side fringe of the Kuroshio, a relatively weak current, does not leave the shelf but follows shallow isobaths near the shelf edge, being consistent with the potential vorticity conservation.

5. Separation of the Kuroshio southwest of Kyushu

A drifter experiment in December 1993, concurrent with CTD castings, enabled us to locate the separation point of the TWC from the Kuroshio. As explained in the previous section, its shore fringe separates from the Kuroshio at the southwestern corner of the trough where the Kuroshio main stream detours toward the Tokara Strait. Drifters, moving from the shelf slope toward shallower shelf area, follow isohalines, not along isotherms or isopycnals. The drifter trajectories show that the separated branch penetrates onto the shelf, crossing isobaths. The result of a simple theoretical model of an inertial current entering upon a step rise topography shows a fairly good agreement with the observed bifurcation of the Kuroshio west of Kyushu that gives rise to the TWC (Hsueh et al. 1995).

6. Vertical distribution of hydrography and nutrients across the shelf slope

The shelf water originating from diluted water of the Changjiang River and the Korean coastal water is nutrient-rich, but the Kuroshio surface water which intrudes onto the ECS, is nutrient-poor. The two waters meet together along the shelf edge, forming surface fronts of temperature/density and nutrients.

The Kuroshio subsurface water on the slope of eastern ECS is identified as dissolved oxygen-poor and nutrient-rich water as observed on the slope of western ECS. The subsurface water is partly upwelled and penetrates into the bottom layer of the ECS shelf near the shelf edge. Qualities of dissolved inorganic nutrients and dissolved oxygen in the shelf edge/slope area are apparently determined by the physical properties of sea water.

7. Ecosystem dynamics

The ECS shows diverse ecosystem properties from the influence of several distinctive water masses. The estimate of water column primary productivity from a summer cruise in 1994 ranged from 65 (Kuroshio region) to 760 mgC/m²/day (Changjiang River mouth), which contrasts to the Yellow Sea where the spatial and temporal patterns of primary production are rather simple. Community structures of the commercial fish and the benthic mollusks in the vicinity of Cheju Island show a remarkable similarity to the primary productivity pattern which, in turn, reflects the circulation regime of the region. Our future research will be focused on clarifying whether such similarity across trophic levels is attributed to a coupling of the trophic levels. The role of physical forcing in the productivity and dynamics of the ecosystems of the ECS will continue to be studied as well.

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The Climate State of the Northeast Pacific in the First Half of 1995

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Early in 1995 conditions on the equator developed very close to, if not actually, El Nino conditions. The TOPEX/Poseidon satellite gave a spectacular picture of sea-level rise in the central Pacific in January of 1995. However, significant sea-level changes did not materialize on the coast of Peru, and neither did significant sea-surface temperature anomalies. After January 1995, the event retreated with surprising rapidity and the southern oscillation index in March 1995 produced its first positive value since January of 1991. It remains to be seen whether or not this signals the end of the protracted El Nino like episode that has dominated the Pacific for the last four years. The TOPEX data indicates that between March and June 1995 the equatorial sea-level has been very close to normal.

The TOPEX/Poseidon satellite is proving to be a spectacular success as it provides us with a continuing picture of the evolution of sea-level along the equator. Every month a group at the University of Texas, Austin, prepares a diagram illustrating the evolution of properties along the equator. This is available to anyone with file transfer protocol, as follows:

- > ftp nic.fb4.noaa.gov
- > UserID: ftp
- > Password: (Use your e-mail address)
- > cd pub/cac/nino/outside
- > type binary
- > get texas_jun95.gif

The three figures opposite show the sea surface temperature anomalies during January, March and May of 1995. These show that the putative 1995 El Nino did not actually have any influence on the N.E. coast of N. America. The maps opposite do indicate the possibility of some significant warming off the coast of Baja California, but this warming is in a region of the ocean that is particularly poor on data coverage.

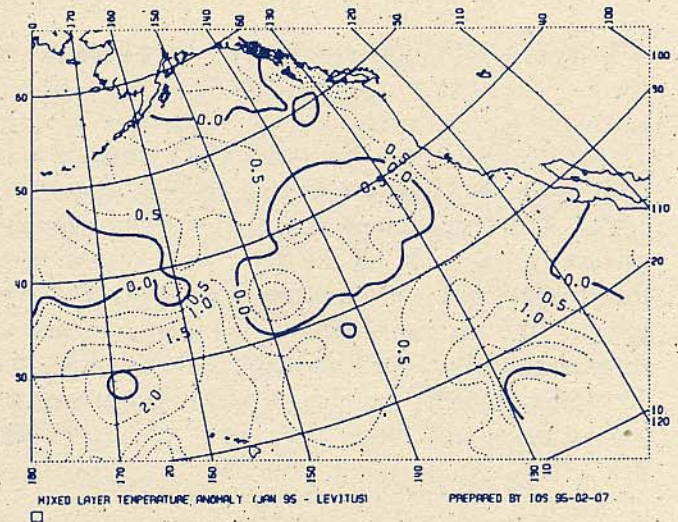


Figure 1: SST Anomaly for January 1995

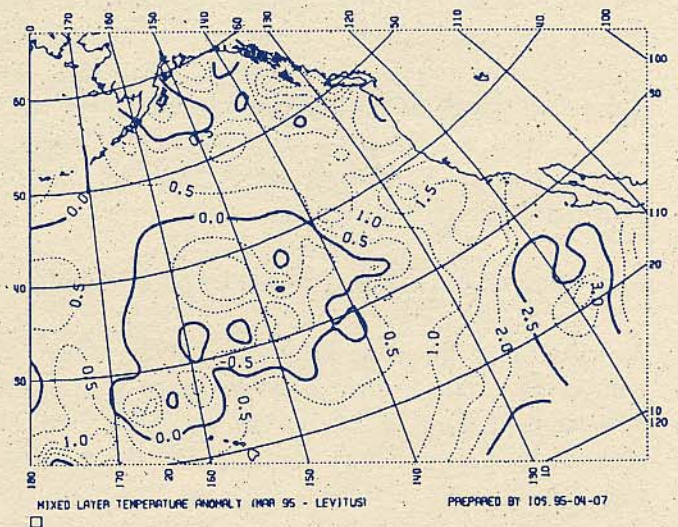


Figure 2: SST Anomaly for March 1995

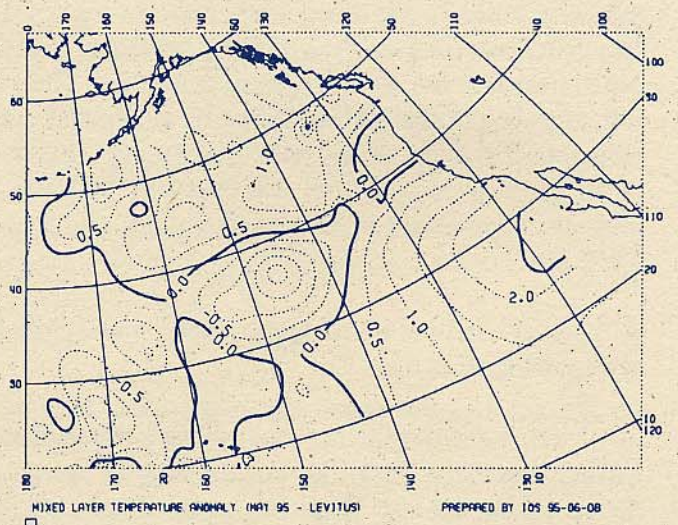


Figure 3: SST Anomaly for May 1995

Yellow Sea Large Marine Ecosystem (YSLME)

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The Yellow Sea, one of the most exploited regions in the world, is under the pressure of anthropogenic as well as natural stresses. The heavy exploitation, together with environmental degradation from coastal development in both Chinese and Korean coastal regions, resulted in drastic changes in the structure of the Yellow Sea ecosystem. They have caused the decline of major commercial fish stocks, fishing grounds, fisheries yields, and species composition. Potential factors that have led to the deterioration of the ecosystem, other than overfishing, include eutrophication, ship-traffic related pollution such as oil spills, heavy metal pollution, pesticides and PCBs, and land reclamation. The level of pollution in various forms, land-based, sea-based, and atmospheric origin, is ever increasing with the rapid industrialization of China, North Korea and South Korea.

Scientists from South Korea and China are developing a cooperative program to preserve the Yellow Sea marine ecosystem based on LME concept. The Korean government-supported program will begin in the autumn of 1995. Korea and China have submitted a joint project proposal to GEF (Global Environment Facility). If accepted, the program will start sometime in 1996. It is composed mainly of three parts: core ecosystem monitoring and ecosystem management.

Ecosystem monitoring consists of four modules: Living Marine Resources Module, Productivity Module, Ecosystem Health Module, and Data Management & Exchange Module. Productivity Module makes use of ship-of-opportunity measurements while Living Marine Resources Module and Ecosystem Health Module uses traditional ship surveys.

In the Productivity Module, plankton productivity and biodiversity are of major concern. The advent of new platforms will enable us to make observations at such temporal and spatial scales of sampling as required for lower trophic level biota. Ship-of-opportunity

platforms, such as a continuous plankton recorder, will be equipped with various sensors as well as a plankton sampler. FRR fluorometers, nutrient sensors and hydrocarbon sensors will be available as well. Optic sensors include PAR, light transmission, CDOM fluorometer, and upwelling and downwelling radiometers. Proposed routes are ferry and container lines across the Yellow Sea. The instruments can be operated continually. For example, one unit can sample from Pusan to Shanghai, to Incheon, to Qingdao, and back to Pusan completing a cycle. The instruments will be deployed at an interval of two weeks to a month. These ship-of-opportunity surveys may be greatly enhanced by synoptic views of sea surface temperature and primary productivity observed by satellite remote sensing instruments (AVHRR, SeaWifs, OCTS, etc.).

The Living Marine Resources Module covers five submodules: distribution and abundance of major resource organisms, fish biology, population dynamics, ecosystem structure, and pollution. For the first submodule, various devices and samplers are to be employed, such as hydroacoustics and bottom trawls, to sample the resource organisms. For the fish biology submodule, age and growth, maturation and spawning, early life history, and feeding and species interactions will be studied for major species of fish and shellfish. Based on the above information on the abundance and biological characteristics, population dynamics of the major resource organisms should be studied to provide the basis of management decisions. Net samples for plankton and grab samples for benthic animals will be taken at the same time for the assessment of ecosystem health.

Finally, the monitoring of pollution will be conducted by examining contaminants from samples of sea water, sediments, and tissues of selected organisms including microorganisms. Analysis would be made for heavy metals, persistent organics, petroleum hydrocarbons, PCBs, pesticides, toxic metals, and radionuclides. Also, the pathology of fish and shellfish will be studied to monitor the level of biological effects of contamination. This basic information will be used to assess contamination flux and long and short term impacts on the marine ecosystem. The ship surveys for Living Marine Resources and Ecosystem Health Module will be made quarterly at stations spaced by 30' interval.

Gulf of Alaska Zooplankton Data

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From 1956 to 1980, zooplankton samples were routinely collected at Ocean Station Papa (50N, 145W) using vertical net hauls from 150m to the surface. Summaries of these data have appeared in print but the detailed data have never been published and are not yet fully described in the primary literature. The data include counts by size-class by species for samples collected from 1968 to 1980. Although daily tows were taken, the number of samples analyzed in detail varies among years.

The principal investigators responsible for the collection, analysis, reporting, and maintenance of these data are either retired or deceased. A data reconstruction project at the Pacific Biological Station (Canadian Department of Fisheries and Oceans) has produced an electronic version of the data that will be available for distribution in the fall of 1995. A report describing the data, editing and revision will be published at approximately the same time.

At the PICES Third Annual Meeting, the Governing Council endorsed a recommendation supporting a PICES role in facilitating exchange of unique data sets such as those collected at Ocean Station Papa. This release of detailed zooplankton data from Ocean Station Papa is a Canadian contribution in support of this objective. The first release of these data will be at the Fourth Annual Meeting in Qingdao, China. PICES and DFO will collaborate to produce a single floppy disk containing the original data set (discovered in the archives), the revised data, an audit trail of changes/corrections made to the data, and a Word Perfect 5.1 version of the manuscript report that accompanies the data. Only 8.9cm (3.5in) diskettes (1.4MB) are available.

Persons interested in obtaining a copy of the diskette should contact the PICES Secretariat before September 1 to insure that enough copies of the diskette are available. Following the PICES Annual Meeting, the data files will also be available via internet. Proce-

dures for access to the data via internet will be published in a future PICES newsletter.



Working Group Progress Report

WG3 (Coastal Pelagic Fish)

RECENT EVENTS FACILITATE COMPARISONS OF ECOSYSTEMS SUPPORTING COASTAL PELAGIC FISHES

The Executive Committee of the PICES-GLOBEC implementation group adopted an ecosystem comparison as one of two principal themes. This has also been the central theme of the PICES Working Group on Small Pelagic Fishes (WG3) described in PICES Scientific Report 1 (1993) and in Minutes from a 1994 workshop in La Jolla. WG3 developed an approach to compare similar species in different regions using life table matrix models. These models focus on population parameters and rate processes at various life history stages and include comparison of the important physical forces. The plan adopted in the PICES-GLOBEC implementation plan is similar but not as detailed as the life table models being used by WG3.

Several events have occurred recently which will facilitate comparisons of coastal pelagic fishes among North Pacific ecosystems. Tokio Wada (Japan) reported that a joint PICES cooperative program between the National Research Institute of Fisheries Science (Yokohama) and the National Marine Fisheries Service (La Jolla) was funded by the Japanese government. The funding will support exchanges of scientists between the two laboratories. The work will focus initially on comparative retrospective studies of the sardine and their ecosystem including, fitting environmental based recruitment models, life table comparisons, and trophodynamics modeling. Douglas Hay (Canada) and Vidar Weststad (U.S.A) have assembled a complete time series of catch,

abundance and recruitment data for herring stocks from British Columbia, Alaska, Russia and Hokkaido. They have also recently met with Russian scientists to discuss collaborative PICES projects including publications on comparative studies of Pacific herring population dynamics throughout the North Pacific, and a compendium of time series on all major stocks.

Yasunori Sakurai (Japan) reports that the Japanese Ministry of Education funded a joint PICES research program on walleye pollack between Hokkaido University and the University of Alaska. The funds will support scientific exchanges between the US and Japan. Additional support for the project will be provided by conducting joint cruises in the Bering Sea on the Japanese research vessel Oshoro-Marun over the next three years.

Ichiro Hara (Japan) reports that two independent acoustic surveys in the East China Sea indicate anchovy biomass levels of at least one million tons. These surveys may provide the basis for collaborative work by Chinese, Korean, and Japanese scientists.

Communication is also a vital link in carrying out a coastal ecosystem comparative program. To that end, WG3 will soon have available a computer based inventory of North Pacific scientists working on small pelagic fishes; the inventory includes research specialties in addition to names and addresses. Brenda Norcross (U.S.A) completed the inventory and the data are being entered and will be available by the annual meeting. Scientists who are interested in coastal pelagic fishes and have not completed a form are urged to contact Dr. Norcross. Her internet address is: norcross@ims.alaska.edu or you can fax her at (907) 474-7204.

(J. Hunter)

WG5 (Bering Sea)

The Bering Sea Working Group has plans well under way to develop a review volume on the marine science of the Bering Sea. The book will include five sections each with four to eight chapters that are either extensive reviews or results of new relevant research. Sections include: Physical characteristics of the Bering Sea: circulation, topography, weather patterns, variability of sea ice; Chemical characteristics: carbon budgets, heavy metals, hydrocarbons; Biological characteristics: primary productivity,

zooplankton, significant invertebrates, fish, birds, and mammals; Uses of the Bering Sea: fisheries, native cultural use, hydrocarbon exploration; Synopses of major research programs: PROBES, FOCI.

Each section will contain a chapter that reviews our present understanding of the subject area and also chapters on technical aspects. The importance of variability will be stressed as well as other research questions that are paramount to the advancement of understanding of the subject.

It is anticipated that the volume will be published as a 400 to 500 page book, perhaps with more than one volume. The section editors are now selecting authors and providing guidance on content and format. Chapter outlines will be formulated over the summer. A first draft of each chapter will be due by the end of the calendar year. Publication is anticipated by the end of 1997.

Co-editors-in-chief are Dr. Tom Loughlin, National Marine Mammal Laboratory, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA, 7600 Sand Point Way NE, Seattle WA 98115-0070, USA; and Prof. Kiyotaka Ohtani, Department of Fishing Science, Hokkaido University, 3-1-1 Minato-cho, Hakodate, Hokkaido 041, Japan.

(A. Tyler)

WG7 (Modeling of the Subarctic North Pacific Circulation)

Following its meeting in Nemuro, members of Working Group 7 dispersed to prepare a final version of their report to be completed in time for submission at the Qindao meeting of PICES. The report includes an overview of models of the circulation of the subarctic North Pacific. Models of the upper ocean are clearly more developed and reliable than those of deeper flows. Improvements are necessary at the level of supporting data as well as in the physical formulation of these models. The report focuses on features specific to the area, rather than on the general problem of ocean modeling. It will identify areas where special attention is necessary and make recommendations for improvements. Communication about the theme of this working group is to be addressed to the co-chairs: M. Endoh (endoh@mri-jma.go.jp) and P. LeBlond (leblond@ocgy.ubc.ca).

(P. LeBlond)

WG8 (Practical Assessment Methodology)

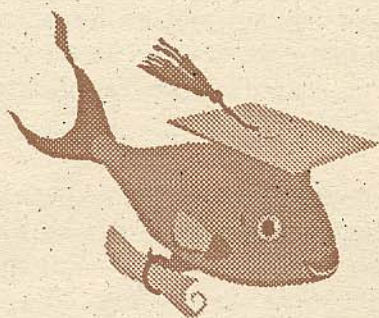
WG8 will hold a meeting immediately before the PICES Fourth Annual Meeting in Qingdao. This meeting will focus on plans for a practical co-operative workshop to be held in 1996 or 1997.

(R. Addison)

WG9 (Subarctic Pacific Monitoring)

WG9 is going to have a meeting at Pacific Marine Environmental Station of NOAA in Seattle, Aug. 1 - 3, 1995.

(B. Taft)



Technical Committee on Data Exchange

The Technical Committee on Data Exchange (TCODE) has been formed and two members (representing fisheries and oceanography interests and concerns) have been appointed from each PICES nation. The Chairman is Robin Brown (Institute of Ocean Sciences, Canada).

The Chairman has met with the Chairman of the Science Board (Dan Ware) and the former chairman of WG 4 -Data Exchange (Skip McKinnell) to review the recommendations from the Working Group and develop an action plan. A summary of the issues and options arising from this review has been circulated to the TCODE members for comment.

Over the summer, TCODE members will identify the high priority issues and develop plans to address these issues. TCODE will likely recommend the formation of small, temporary task groups with particular expertise to work on the high priority issues.

The range of issues under consideration is very broad, ranging from assembling high level inventories of data holdings in PICES member nations to assembly and distribution of specific data sets that are in high demand. Please feel free to provide any comments you might have on these issues to your TCODE representative or the chairman (Robin Brown: E-mail: rmbrown@ios.bc.ca; fax: 604-363-6378).

(R. Brown)

Committee Members:

Robin Brown, Bill Shaw (Canada); Song-Nian Jiang, Ling Tong (China); Tokimasa Kobayashi, Tadao Tatsuno (Japan); Lev N. Bocharov, Gennady I. Yurasov (Russia); William A. Karp, James H. Swift (USA).

Meetings of Interest

The following is a sample of future meetings that might be of interest. Your help in making a more comprehensive list would be greatly appreciated.

1995

Jul 5-10: 1995 World Conference on Natural Resource Modeling, Pietermaritzburg, South Africa. (John Hearne; e:hearne@math.unp.ac.za; f:27-331-2605599)

Jul 10-14: Second International Conference on Pelagic Biogeography, Amsterdam, The Netherlands. (Institut voor Taxonomische Zoologie, Zoologisch Museum, Mauritskade 57, Postbus 94766, 1090 GT Amsterdam, The Netherlands)

Jul 11-14: Symposium on Changes in the North Sea Ecosystem and their Causes, Arhus, Denmark. (General Secretary, ICES, Palaegade 2-4, 1261 Copenhagen K, Denmark; t:45-3315-4225; f:45-3393-4215)

Jul 12-16: 7th International Conference on Toxic Marine Phytoplankton, Sendai, Japan. (Takeshi Yasumoto, Dept. of Applied Biological Chemistry, Faculty of Agriculture, Tohoku Univ., Tsutsumidori-Amamiya, Aoba-Ku, Sendai, Miyagi, Japan 981; f:22-275-3603)

Jul 17-22: Coastal Zone 95, Tampa, USA.

Jul 24-27: 3rd International Symposium on Air-Water Gas Transfer, Heidelberg, Germany. (B. Jaehne, Univ. of Heidelberg, Im Neuenheimer Feld 368, D-69120 Heidelberg, Germany; f:49-6221-56-5224; e:bjahne@davinci.iwr.uni-heidelberg.de; or E. Monahan, Univ. of Connecticut, 1084 Shennecossett Rd., Groton CT, USA 06340-6097; f:1-203-445-1049)

Jul 24-Aug 4: UN 5th Fisheries Conference, New York, USA.

Aug 5-6: 3rd Annual Meeting of Organization of Fish and Wildlife Information Managers, Fayetteville AR, USA. (Tom Wilcox, Virginia Dept. of Game and Inland Fisheries, 4010 West Broad St., Richmond VA, USA 23230-1104; t:804-367-0909; f:804-367-2427)

Aug 5-12: 21st General Assembly of IAPSO, Honolulu, Hawaii, USA (Robert E. Stevenson, P.O. Box 1161, Del Mar, California, USA 92014-1161; e:iapso@oceans.org; t:619-481-0850; f:619-481-6938 or Robin Munench; e:rmunench@frazil.nw.saic.com)

Aug 9: Workshop on Fossil Turbulence: Microstructure and Hydropaleontology, Honolulu HI, USA. (Carl Gibson; e:cgibson@ucsd.edu; See also WWW home page: <http://sdcc8.ucsd.edu/~am170s>)

Sept 6-8: Symposium on the Role of Marine Mammals in the Ecosystem, Dartmouth NS, Canada. (Tissa Amaratunga, NAFO Secretariat, Northwest Atlantic Fisheries Organization, P.O. Box 638, Dartmouth NS, Canada B2Y 3Y9; t:902-469-9105; f:902-469-5729)

Sept 12-15: Parallel Computing Technologies, Sankt-Peterburg, Russia. (Victor Malyshkin; t:7-3832-350994; e:malysh@comcen.nsk.su)

Sept 12-16: COSPAR Colloquium: Space Remote Sensing of Subtropical Oceans, Taipei, Taiwan, China. (Cho-teng Liu, Inst. of Oceanography, N. Taiwan Univ., Taipei POB 23-13, Taiwan 106, China; e:ctliu@ccms.ntu.edu.tw; t:886-2-362-0624; f:886-2-363-5165, 392-5294)

Sept 12-16: International Workshop on Long-Wave Runup Models, San Juan Island WA, USA. (Harry

Yeh, Dept. of Civil Eng., Univ. of Washington, Seattle WA, USA 98195; e:harryeh@u.washington.edu. Or Costas Synolakis; e:costas@mizar.usc.edu)

Sept 18-20: Third Thematic Conference on Remote Sensing for Marine and Coastal Environments, Technology and Applications, Seattle, Washington, USA. (ERIM Marine Environment Conference, P.O. Box 134001, Ann Arbor MI, USA 48113-4001; t:313-994-1200, ext.3382; e:rrogers@erim.org; f:313-994-5123)

Sept 21-26: ICES Statutory Meeting: Intermediate-Scale Physical Processes and their Influences on the Transport and Food Environment of Fish, Copenhagen, Denmark. (B. MacKenzie, Danish Institute for Fisheries and Marine Research, Charlottenlund Castle, DK-2920 Charlottenlund, Denmark; t:45-3396-3403; f:45-3396-3434; e:brm@fimdfh.fin.dk, or Francisco E. Werner, Univ. of North Carolina, Chapel Hill NC, USA 27599-3300; t:919-962-0269; f:919-962-1254; e:cisco@hydra.chem.unc.edu)

Sept 21-29: ICES 1995 Annual Science Conference, Aalborg, Denmark. (General Secretary, ICES, Pa-laegade 2-4, DK-1261, Copenhagen K, Denmark; e:postmaster@server.ices.inst.dk; t:45-3315-4225; f:45-3393-4215)

Sept 26-28: 8th PAMS (Pacific Asian Marginal Seas) and JECSS (Japan and East China Seas Study) Workshop, Ehime University, Matsuyama Japan. (T. Yanagi; e:tyanagi@ehimegw.dpc.ehime-u.ac.jp; t:81-899-24-7111 ext.3751; f:81-899-27-5852)

Sept 26-29: 42nd Annual Eastern Pacific Oceanic Conference (EPOC), Fallen Leaf Lake CA, USA. Special topics: eastern boundary currents (with an emphasis on remote sensing); processes in regions of freshwater influence; dynamical processes workshop on physical-biological-chemical interactions. (Mike Kosro, College of Oceanic & Atmospheric Sciences, Oregon State Univ., Ocean Admin Bldg 104, Corvallis OR, USA 97331-5503; e:kosro@oce.orst.edu; t:503-737-3079; f:503-737-2064)

Sept 29-Oct 6: SOPAC/STAR 24th Annual Session, Suva, Fiji Islands. (K. Crook, Science Tectonics and Resources of the South Pacific, Hawaii Undersea Res. Lab., Univ. of Hawaii, 1000 Pope Rd., MSB 303-B, Honolulu HI, USA 96822; t:808-956-9429; f:808-956-9722; e:crook@iniki.soest.hawaii.edu)

Oct 3-7: APFIC Committee on Marine Fisheries, Ninth Session, Yogyakarta, Indonesia. (Veravat Hongkul, APFIC Secretary, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, Bangkok 10200; t:662-281-7844; f:662-280-0445)

Oct 9-12: Oceans '95, San Diego CA, USA.

Oct 10-14: 5th International Conference on Paleocyanography, Halifax, Nova Scotia, Canada. (Lewis International Inc., ICP-V Registration, Richmond Terminal, Pier 9, 3295 Barrington St., Halifax NS, Canada B3K 5X8)

Oct 11-13: International Symposium on Biology, Management, and Economics of Crabs from High Latitude Habitats, Anchorage AK, USA. (Brenda Baxter, Alaska Sea Grant College Program, Univ. of Alaska Fairbanks, PO Box 755040, Fairbanks AK, USA 99775-5040; t:907-474-6701; f:907-474-6285; e:fnbrm1@aurora.alaska.edu)

Oct 12-13: Fisheries & Pollution: A Conference on Population-Level Effects of Marine Pollution, Baltimore MD, USA. (Daniel Grosse, Rifkin & Associates, 10480 Little Patuxent Parkway, Suite 725, Columbia MD, USA 21044; t:301-596-3855; f:410-995-3821; e:dgrosse@access.digex.net)

Oct 16-20: GCOS Joint Scientific and Technical Committee, Japan.

Oct 16-22: PICES Fourth Annual Meeting, Qingdao, China. (PICES Secretariat, c/o Institute of Ocean Sciences, P.O. Box 6000, Sidney BC, Canada V8L 4B2; e:pices@ios.bc.ca; t:604-363-6366; f:604-363-6827)

Oct 18-21: Canadian Coastal Conference 1995, Dartmouth NS, Canada. (S.M. Solomon, Atlantic Geoscience Centre, Bedford Inst. of Oceanography, P.O. Box 1006, Dartmouth NS, Canada B2Y 4A2, f:902-426-4104)

Oct 30-Nov 3: Bering Sea Annual Meeting, Seattle WA, USA.

Oct 31-Nov 2: CalCOFI (California Cooperative Oceanic Fisheries Investigations) Annual Meeting, Lake Arrowhead CA, USA. (George Hemingway or Mary Olivarria, MLRG, Scripps Institution of Oceanogr., La Jolla CA, USA 92093-0227; t:619-534-4236/2868; e:ghemingway@ucsd.edu; f:619-534-6500; e:molivarria@ucsd.edu)

Mid-late October: APEC Marine Resource Conservation Working Group ad hoc meeting on UNCED Follow-up, Honolulu, USA. (W. Erb, Division of Marine Science, US Dept. of State, Washington DC, USA 20520-7817; f:202-647-1106. Or Yang Yafei, APEC Secretariat, 438 Alexandra Rd, #19-01/04 Alexandra Point, Singapore 0511; f:65-276-1775)

Mid-late October: APEC Marine Resource Conservation Working Group Workshop on International Coastal Zone Management Policies, Honolulu, USA. (J. R. Forbes, Dept. of Fisheries and Oceans, Inst. of Ocean Sciences, PO Box 6000, Sidney BC, Canada V8L 4B2; f:604-363-6479. Or Yang Yafei, APEC Secretariat, 438 Alexandra Road, #19-01/04, Alexandra Point, Singapore 0511; f:65-276-1775)

Nov 5-9: Second SETAC World Congress (Soc. of Environmental Toxicology and Chemistry), Vancouver BC, Canada. Theme: Global Environmental Protection: Science, Politics, and Common Sense. (Rod Parrish, SETAC, 1010 N. 12th Ave., Pensacola FL, USA 32501; t:904-469-1500; f:904-469-9778)

Nov 6-11: NPAFC 3rd Annual Meeting, Seattle WA, USA. (North Pacific Anadromous Fish Commission, 6640 Northwest Marine Drive, Vancouver BC, Canada V6T 1X2; t:604-228-1128; f:604-228-1135)

Nov 22-25: International Conference on Dynamics of Ocean and Atmosphere, Moscow, Russia. (V. Zhmur; f:7-095-124-59-83; e:gfdl@glas.apc.org)

November: Intergovernmental Meeting on the Protection of the Marine Environment from Land-Based Activities, Washington DC, USA.

Dec 4-9: International Conference on Sustainable Contribution of Fisheries to Food Security, Kyoto, Japan. (International Affairs Division, Fisheries Agency of Japan, 1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo, Japan 100; t:81-3-3591-1086; f:81-3-3504-2649)



Dec 5-9: International Conference for Arctic Research Planning, Hanover NH, USA. (IASC Secretariat, P. O. Box 5072, Majorstua, 0301 Oslo, Norway; e:iasc@npolar.no; t:47-22-95600; f:47-22-959601)

Dec 11-13: Asian Computing Science Conference, Thailand, Pathumthani. (Kanchana Kanchanasut, The Asian Institute of Technology; e:kk@iist.unu.edu)



1996

Jan 22-25: 9th Western Groundfish Conference, Newport OR, USA. (Elaine Stewart; ODFW, 2040 SE Marine Science Drive, Newport OR, USA 97365)

Jan 22-26: International Symposium on CO₂ in the Oceans, Mayaguez, Puerto Rico. (Frank J. Millero, University of Miami, RSMAS, MAC, 4600 Rickenbacker Cswy, Miami FL, USA 33149; f:305-361-4144; t:305-361-4707; e:fmillero@rsmas.miami.edu or gingram@rsmas.miami.edu)

Apr 3-12: World Submarine Invitational '96, San Diego CA, USA. (Kevin Hardy; e:khardy@ucsd.edu or Jim Richardson; e:71233.2475@compuserve.com)

Mar 5-8: Oceanology International, Brighton, England.

May 19-22: 6th Annual Meeting of SETAC-Europe (Soc. of Environmental Toxicology and Chemistry), Taormina, Sicily, Italy. (Rod Parrish, SETAC, 1010 N. 12th Ave., Pensacola FL, USA 32501; t:904-469-1500; f:904-469-9778)

Jun 16-20: The 7th Pacific Congress on Marine Science and Technology, Honolulu HI, USA. (PACON International, P.O. Box 11568, Honolulu HI, USA 96828; e:saxena@wiliki.eng.hawaii.edu; t:808-956-6163; f:808-956-2580)

Jun 24-29: International Coral Reef Symposium, Panama.

Jul 14-17: The Coastal Society 15th International Conference "Seeking Balance: Conflict, Resolution & Partnership", Seattle WA, USA. (Megan Bailiff; e:mbailiff@u.washington.edu)

Jul 28-Aug 2: 2nd World Fisheries Congress: Developing and Sustaining World Fisheries Resources: The State of Science and Management. Brisbane, Australia. (Secretariat, P.O. Box 1280, Milton Brisbane, Queensland 4064, Australia; t:617-3369-0477; f:617-3369-1512; e:im@cc.uq.oz.au)

October - week of 14th (tentative): PICES 5th Annual Meeting, Nanaimo BC, Canada. (PICES Secretariat, c/o Institute of Ocean Sciences, P.O. Box 6000, Sidney BC, Canada V8L 4B2; e:pices@ios.bc.ca; t:604-363-6366; f:604-363-6827)

October commencing week of 21st: NPAFC 4th Annual Meeting, Japan. (North Pacific Anadromous Fish Commission, 6640 Northwest Marine Drive, Vancouver BC, Canada V6T 1X2; t:604-228-1128; f:604-228-1135)

Nov 13-15: International Symposium on the Role of Forage Fishes in Marine Ecosystems, Anchorage AK, USA. (Brenda Baxter, Alaska Sea Grant College Program, Univ. of Alaska, PO Box 755040, Fairbanks AK, USA 99775-5040; t:907-474-6701; f:907-474-6285; e:fnbrm1@aurora.alaska.edu)

Nov 17-22: 17th Annual Meeting of SETAC-North America (Soc. of Environmental Toxicology and Chemistry), Washington DC, USA. (Rod Parrish, SETAC, 1010 N. 12th Ave., Pensacola FL USA 32501; t:904-469-1500; f:904-469-9778)

Nov 25-27: International Symposium on Benguela Dynamics: Impacts of Variability on Shelf-Sea Environments and their Living Resources, Cape Town, South Africa. (The BEP Symposium Secretariat, Dept. of Zoology, Univ. of Cape Town, Rondebosch 7700, South Africa; e:bep@ucthpx.uct.ac.za; f:27-21-685-3937)

1997

Apr 6-10: 7th Annual Meeting of SETAC-Europe (Soc. of Environmental Toxicology and Chemistry), Amsterdam, The Netherlands. (Rod Parrish, SETAC, 1010 N. 12th Ave., Pensacola FL, USA 32501; t:904-469-1500; f:904-469-9778)

Sept 2-14: The Summit of the Sea, St. John's, Newfoundland, Canada.

Nov 16-21: 18th Annual Meeting of SETAC-North America (Soc. of Environmental Toxicology and Chemistry), San Francisco CA, USA. (Rod Parrish, SETAC, 1010 N. 12th Ave., Pensacola FL, USA 32501; t:904-469-1500; f:904-469-9778)

PICES Publication List

The following publications are available upon request free of charge.

1. Annual Report
1992 (out of stock)
1993
1994
2. PICES Press (ISSN 1195-2512)
Vol. 1 No. 1, June 1993 (out of stock)
Vol. 2 No. 1, January 1994
Vol. 2 No. 2, July 1994
Vol. 3 No. 1, January 1995
Vol. 3 No. 2, July 1995
3. PICES Scientific Report Series
No. 1: Part 1: Coastal Pelagic Fishes
Part 2: Subarctic Gyre
(130pp., October 1993)
No. 2: The Okhotsk Sea and the Oyashio Region
(227pp., April 1995)
4. The PICES Papers: Reports of Meetings Leading to the Establishment of the North Pacific Marine Science Organization (PICES), 1978 - 1992. (143pp., 1994)

PICES News E-mail Distribution

We are distributing, via e-mail, news and information on marine sciences in the North Pacific. Approximately 750 scientists from 28 countries all over the world are currently on the e-mail list.

If you want to be added to the list, please make a request by sending a message to:
Motoyasu Miyata (e-mail: moto@ios.bc.ca)

Fourth Annual Meeting Approaching

Time is passing fast and our Fourth Annual Meeting is fast approaching. The deadline for registration (with the PICES Secretariat) is August 31, 1995, and the deadline for hotel and flight reservation (with the Local Organizing Committee) is September 30, 1995. More details regarding the Fourth Annual Meeting can be obtained from the PICES Secretariat.



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