

DOCUMENTING SCIENTIFIC SESSIONS AT PICES XII



Session S1 (Science Board Symposium)

Human dimensions of ecosystem variability

Co-Convenors: R. Ian Perry (SB), Vladimir I. Radchenko (BIO), Yukimasa Ishida (FIS), John E. Stein (MEQ), Kuh Kim (POC), Igor I. Shevchenko (TCODE), and Harold P. Batchelder & Makoto Kashiwai (CCCC).

Background

Marine ecosystems are dynamic in terms of climate and physical features, and the species that inhabit them. Human relationships and interactions with the ocean have been long-lasting and changing in their nature and strength over the years. Even though natural variability in marine systems is thought to be large, separating natural climate variability from human-induced sources is an on-going challenge. This session examined how natural environmental processes and human activities interact to cause changes in marine environments and human societies. Various human activities have the effect either of removing, altering or adding nutrients or species to areas. The session considered how changes in nutrient composition and amounts, fishery removals or discards, habitat alteration, introduction of non-native species or pollutants, might change ecosystem structure and production. It also examined case studies of the effects of ecosystem change on human societies, including the implications of fisheries management decisions which affect the nature and functions of ecosystems. The session highlighted the many ways that humans interact with marine ecosystems and the scientific efforts to quantify and predict human impacts on such dynamic systems.

Summary of presentations

The session consisted of 11 oral presentations and several posters. Papers dealt with topics that range from the environmental and biological variability of marine systems and their consequences for human societies, to issues of human interventions in marine ecosystems and

their impacts. Several of the presenters were from social science disciplines, who would not normally participate in PICES. They provided very interesting insights into the human impacts of marine ecosystem changes, including changes in populations, sex and age ratios, and changes in market demand and choice of marine products as economies improve. Most presentations showed variable effects of marine ecosystem changes on human societies: some effects and impacts in some locations were severe, whereas other effects or impacts in other locations were relatively mild (sometimes even positive). It was beyond the scope of this session to make cross-comparisons as to the reasons for these variable impacts, but differing degrees of resilience and vulnerability on the part of human societies and marine ecosystems appeared to be important factors. A leading question is what makes human societies resilient to marine ecosystem changes, and what makes marine ecosystems resilient to human impacts? Several presentations underlined the difficulties in distinguishing human from natural (climatic) environmental changes, and argued for more and careful observations of longer duration to disentangle these factors. There was also little evidence presented of how far down the trophic web the impacts of human interventions could be detected. The paper by Martell and Cox attempted to examine this problem in the central North Pacific, but only to the level of small tunas. Three very interesting presentations from China demonstrated the difficulties in predicting the effects that changes in human societies will have on marine ecosystems: as the economy of China continues to improve and more people enter the middle class, the demand for seafood has actually increased so that fishing of wild populations is unable to meet this demand. The

response has been a tremendous increase in aquaculture activities, which themselves make

new demands and have different impacts on marine ecosystems.

List of papers

Oral presentations:

Lawrence C. Hamilton (Invited)

Ecosystem-society interactions in the Northern Atlantic: Human dimensions of fisheries collapse

Chris Frid, Odette Paramor, Leonie Robinson and Catherine Scott (Invited)

Long-term changes in the North Sea ecosystem: Disentangling fisheries, climate and eutrophication

David L. Fluharty (Invited)

Ecosystem variability and human response: An exploration of effect and affect (S1-970)

Jie-Hua Lu and Ping Lv

Effects of population changes and GDP growth on the marine ecosystem in coastal regions of Northeast Asia

Yu-Zhu Li

A macroeconomic approach to underlying driving forces of the depleting marine fisheries in PRC with economies in transition

Shang Chen, Zhao-Hui Zhang, Jing Wang and Wei-Jun Bian

Quantitative analysis of damage of Bohai sea ecosystem by risk assessment technique

Hidetada Kiyofuji, Sei-ichi Saitoh, Kazuhito Watanabe and Teisuke Mimura

Environmental impact assessment of squid fisheries in Japan using RS/GIS

Alexander Bogdanovsky, Igor E. Kochergin, Igor A. Arshinov, Sergey I. Rybalko, Valentina D. Budaeva, Vyacheslav G.

Makarov, Pavel A. Fayman, Vasily F. Mishukov and Valeriy P. Tunegolovets

Results of oil spill modeling for the most potential spill sources in the Russia Far East Seas

Anatoly V. Smirnov and Artem Yu. Sheybak

Changes of East Sakhalin walleye pollock stock and offshore oil and gas development - whether is connection?

Steven J.D. Martell and Sean P. Cox

Assessment of the trophic impacts of fishing in the central Pacific Ocean

Douglas E. Hay

Coherence of stock fluctuations in Atlantic and Pacific herring: Evidence and explanations

Posters:

Tatyana A. Belan

Anthropogenic pollution and present status of benthos near Vladivostok (Peter the Great Bay, Sea of Japan)

Alexander Bogdanovsky, Igor E. Kochergin, M.V. Mischenko and Sergey I. Rybalko

Modeling of impact produced on marine environment by the construction activities within Sakhalin oil and gas projects

Galina Borisenko, Viktor V. Shcheglov and Olga S. Yurcheko

Influence of radioactive pollution on biological resources of the Far Eastern seas

Sergey A. Cherkashin, M.V. Nikiforov and V.A. Shelekhov

Estimation of influence of zinc, cadmium and lead on survival rate of prelarvae of some sea fishes

Nancy Davis and Kate Myers

Review of food habits methods used for NPAFC BASIS-related studies

Dmitry Galanin

Biological characteristics of *Paralithodes brevipes* in coastal waters of southeast Sakhalin

Eugeny N. Ilynskiy

Trends in the composition of demersal fish community on the shelf of western Kamchatka

Eung Kim and Young-Jae Ro

Production of monthly hydrographic OA Map of KODC datasets

Yuriy R. Kochnev

Traumatism of snow crab, *Chionoecetes opilio*, in the eastern Tatar Strait (S1-942)

Natalya V. Konovalova and Irina V. Motylkova

Phytoplankton on the northeast shelf of Sakhalin

Kitack Lee and Guen-Ha Park

Quantifying anthropogenic CO₂ in the ocean using the optimum multiparameter analysis

Olga N. Loukianova and Margarita D. Boyarova

Organochlorine compounds in the marine food net of Posyet Bay (Sea of Japan)

Olga N. Loukianova

Oxidative damage in marine mussels influenced by anthropogenic pollution

Ping Lv

An analysis on development condition of consumption structure of marine products and the contributing population factors

Igor V. Melnikov

Juvenile northern Atka mackerel (*Pleurogrammus Monopterygius*) in the epipelagial of deep-sea areas of the northern Pacific Ocean

Olga N. Moukhametova

Taxonomic composition and distribution of ichthyoplankton of inshore waters of northeastern Sakhalin

Galina V. Moyseychenko and Victor V. Scheglov

Drilling mud's impact on phytoplankton synthesis

Elena V. Oleynik, Tatyana A. Belan and Tatyana V. Konovalova

Use of computer method of ABC-curves (PRIMER) for estimation of benthic community state at the Sakhalin Island shelf in autumn 1999

Svetlana L. Ovsyannikova

Modern state of walleye pollock stock in the South Kuril region

Peng Liu

The NIE analysis of the marine fishery protection policy

Victor V. Scheglov, Alla A. Ogorodnikova and Ludmila V. Nigmatulina

Urgency of search of conjugation relations between intensity of pollution and response of biota in coastal sea areas

Vladimir M. Shulkin, Elena N. Chernova, Viktor Ya. Kavun and Svetlana I. Kozhenkova

Accumulation of metals by macrophytes and mollusks: Human influence versus natural variability

Mariya A. Smirnova

Microbial indication of ecological conditions along the Aniva Bay coast in winter 2002

Alexander Tkalin, Tatiana Lishavskaya and Alexander Moschenko

Bottom sediment contamination at the Sakhalin Island shelf

Alexander I. Varkentin and N.P. Sergeeva

Fishery as a principal factor of walleye pollock (*Theragra chalcogramma*) stock abundance decrease in the east part of the Okhotsk Sea for recent years

Session S2 (POC/BIO Topic Session)

Physical and biological responses of coastal ocean ecosystems and estuaries to inputs of freshwater

Co-Convenors: Michael J. Dagg (U.S.A.) and Yury I. Zuenko (Russia)

Background

Freshwater input affects physical and biological processes in many ways. Properties of the receiving waters are directly modified by fresh water and its constituents, but impacts also extend to include the entire water column and sea-bed. Time and space scales over which these modifications occur vary with factors such as scales of freshwater discharge, dissolved and particulate composition of materials in the freshwater discharge, latitude of discharge (which affects the magnitude of Coriolis acceleration, the light environment and the

temperature regime, which in turn affect biological rates), wind and tides (which affect circulation and surface layer behavior) and bottom topography of the receiving basin. Meteorology and climatology also affect the linkages and pathways between freshwater inputs, physical responses, lower trophic level responses and higher trophic level responses. This session explored ways in which the inputs of freshwater and its dissolved and particulate constituents influence physical and biological processes, including higher trophic levels, in the receiving waters of estuarine and coastal ocean systems.

Summary of presentations

This topic session consisted of 12 oral presentations and 10 posters. The speakers represented five PICES countries: Canada, China, Korea, Russia, and the United States. Large rivers are generally considered to be important sources of freshwater for the coastal ocean and papers were presented on the Yangtze, Mississippi and Fraser Rivers. Processes associated with relatively small rivers of the Russian and Korean coasts were also discussed. In addition, the first speaker pointed out the significance of the broad band of coastal runoff from the mountainous regions along the coast of Alaska and Canada.

The session presented information on a wide range of responses of coastal ecosystems to terrestrial inputs of freshwater, including: coastal water circulation; spatial and vertical water structure; nutrient supply; suspended matter concentration and sedimentation; trophic interaction and processes; bottom sediments; primary production and bloom conditions; bacteria, phytoplankton and zooplankton abundance; distribution and species composition; macrozoobenthos communities; fish feeding; and fish migrations. In addition, statistical data on fish recruitment and catch were presented. The morning presentations focused mainly on physical and lower trophic level processes and the afternoon talks saw the theme extended further to include responses at the fish and higher trophic level.

It was clear that strong linkages exist between the inputs of freshwater, the associated physical and biochemical components, and biological production. However, there was no evidence of a direct influence of fresh or low salinity water on the biological components of marine ecosystems, except for anadromous fishes' smoltification. Rivers often supply dissolved nutrients to the coastal systems, leading to trophic stimulation across broad regions. The 'classical' food chain especially is impacted because the new nutrients injected into the coastal system by the freshwater promote diatom growth.

Concentrations of nutrients and suspended matter are typically lower farther away from the river sources because of consumption/dilution and sedimentation. Responses in biological properties are more complicated. Primary production needs optimal correspondence of nutrients and light, so phytoplankton concentration usually increased at some distance from the river mouth, depending on the size of suspended particles in river water. Simultaneously, the species composition of phytoplankton changes. The zone of maximum productivity typically is in the mid-salinity region but does not coincide with an absolute salinity. Responses of higher trophic levels tend to be further shifted seaward but extreme spatial variability and short time scales make understanding of all linkages very challenging. In addition, physical processes associated with the freshwater, including vertical stratification and frontal convergence, can lead to aggregation and concentration of organisms. However, it is definitely clear that species composition of zooplankton and zoobenthos changes from river to sea with complete replacement of freshwater species to brackish-water ones, and then to marine ones.

At least two human dimensions of the fresh water input were noted. The most important is its influence on fisheries always seems to be positive. Highly productive fishery grounds form in the areas of considerable fresh water input because of the high primary productivity of these areas and perhaps also because of favorable conditions for reproduction and survival. Processes that modify freshwater inputs, such as the construction of dams like the Three Gorges Dam, are a concern for fisheries scientists. An interesting possibility was presented concerning the consequences of a much reduced freshwater input from the coast of North America during the most recent ice age for the populating of North America.

These scientific reports and discussions allowed the participants of the session to exchange information and ideas on the session theme and to improve their understanding of the state and functioning of marine ecosystems.

List of papers

Oral presentations:

Thomas C. Royer and Chester E. Grosch (Invited)

The role of freshwater in the coastal circulation in the Northeast Pacific: Past, present and future

Im-Sang Oh and Tae-Wook Park

Numerical experiments on the dispersion of the Yangtze River water in the Yellow and East China Seas

Michael J. Dagg and G.A. Breed

A conceptual model of the biological effects of Mississippi River nitrogen on the northern Gulf of Mexico

Wonho Yih, Young-Geel Kim and Sundo Hwang

Ecosystem response to fresh-water discharge from Keum River estuarine weir: Distribution of phytoplankton and anchovy larvae

Victoria V. Nadochy, Yury I. Zuenko and Eugene Barabanshchikov

River-sea change of zooplankton species composition: A case of Amur Bay (Japan/East Sea)

Susan E. Allen, Shannon Harris, Beth Bornhold, Jim Gower, Mike Henry, Rich Pawlowicz and Randall Lee

Revisiting the role of fresh water in the timing of the spring bloom in the Strait of Georgia

Elena M. Latkovskaya, T.A. Belan, V.B. Krasavtsev, A.V. Polteva, I.V. Motylkova, T.G. Koreneva and T.A. Mogilnikova

Conditions of hydrobiological community formation in the lagoons of northeastern Sakhalin Island

Anatoly Semenchko (Invited)

Functional role of coastal waters for salmon: Is it an adaptation zone or a transit way?

Franz J. Mueter and Thomas C. Royer

Recruitment of pelagic and demersal fishes in the Gulf of Alaska in relation to coastal freshwater discharge

Fan Wang

The relationship between thermohaline structure and fish catch in the East China Sea

Richard D. Brodeur and Cheryl A. Morgan

Cross-shelf variability in hydrography, zooplankton and juvenile chinook diets in relation to the Columbia River plume

Churchill B. Grimes (Invited)

The influence of freshwater discharge on fishery production on continental shelves

Posters:

Nadezhda L. Aseeva

Adaptation of freshwater myxosporean parasites to marine habitat

Valentina D. Budaeva, George V. Shevchenko, Vyacheslav G. Makarov, G.A. Kantakov and V.N. Chastikov

Variability of oceanological conditions in Aniva Bay

Gennady A. Kantakov, George V. Shevchenko, Lyudmila Y. Gavrina, Irina Y. Bragina and Marina S. Selina

Low salinity signal in fall as attribute of the East-Sakhalin Current in Aniva Bay, Sea of Okhotsk

Elena M. Latkovskaya and Tatyana Belan

Environmental conditions and macrozoobenthos of Chayvo Bay

Elena M. Latkovskaya and Tatyana G. Koreneva

River runoff and hydrochemical conditions in Chayvo Bay (northeast of Sakhalin)

Alexander A. Mikheyev

Influence of freshwater discharge on biotope spatial organization of the northeastern Sakhalin shelf

Irina V. Motylkova, Alena I. Latkovskaya, Irina V. Motylkova, Tatyana A. Mogilnikova and Tatyana G. Koreneva

Influence of river runoff to formation of phytoplankton communities in Lunskiy Bay (northeast of Sakhalin)

Alexandra V. Polteva and Elena M. Latkovskaya

Influence of hydrological and hydrochemical conditions on formation microbial communities of Chayvo Bay (northeast of Sakhalin)

Aleksei V. Savchenko, Lev M. Gramm-Osipov, Valentina N. Gramm-Osipova and Man Sik Choi

Comparative analysis of the chemical elements behavior when river waters of different nature are mixed with the sea water (based on physical-chemical modeling)

Larissa S. Shkoldina, Olga O. Ermakova-Kalata and Natalja S. Zadvornaja

Distribution of copepods of genus *Centropages* in estuaries of the large rivers (Peter the Great Bay, Sea of Japan)

Session S3 (CCCC REX Topic Session)

Influence of fishing and/or invasive species on ecosystem structure in coastal regions around the Pacific Rim

Co-Convenors: William T. Peterson (U.S.A.) and Yoshiro Watanabe (Japan)

Background

Based on the theme of PICES XII on “human dimensions”, this session focused on the effects of two types of human activities on the structure of coastal marine ecosystems: invasive species and fishing. As such it was an extension of the Science Board Symposium. The session sought to address (and perhaps answer) two questions: (1) Do we know enough about the influence of fishing or invasive species on ecosystem structure to be able to identify an effect? and (2) Can we distinguish the signal from the noise?

Summary of presentations

The session consisted of 6 oral presentations and 5 posters. Attendance was very good and perhaps overwhelmed the room’s capacity as each of the 60 chairs was filled for each talk. Others were compelled to stand at the back. We also had sufficient time to devote to careful discussion of each paper. Only one papers dealt with the impacts of invasive copepod species on ecosystem structure; the other five were of a fisheries nature.

The invited paper on “invasive species” by Jeffrey Cordell discussed the introduction of copepods from Asian waters by ships’ ballast waters, to the ecosystem structure of several estuaries and rivers along the west coast of North America, and in the Columbia River and San Francisco Bay. The talk focused on the copepods *Pseudodiaptomus inopinus* in the rivers and estuaries of Washington and Oregon and *Tortanus dextrilobatus*. A predatory copepod that has colonized San Francisco Bay, *P. inopinus*, was found to be a dominant prey for mysids and shrimp in the estuaries of Washington and Oregon, and so perhaps is beneficial to the ecosystem. *T. dextrilobatus* is a heavy predator on the common *Acartia* species. In so doing, the predatory copepod is a direct

and efficient competitor with fish species that depend upon *Acartia* for growth and survival.

We learned from Tadanori Fujino’s talk that he is just beginning a study of how squid fishing may impact the “biological pump” in the sea of Japan. His hypothesis is that the lights from squid fishing boats cause the very abundant lantern fish, *Maurolicius japonicus*, to not ascend to the sea surface at night during its diel vertical migration, such that it would be less able to feed in surface waters and then excrete nitrogen into deep waters in the subsequent day time. The study has just recently been implemented so the hypothesis has not yet been tested rigorously.

Steven Martell reminded us that we will not get far in understanding effects of fishing on ecosystem structure until we develop models that accurately demonstrate the effects of fishing removals on energy flow and ecosystem structure. His contribution was to critique the ever-popular ECOPATH and ECOSIM models and to show where one can go wrong with these models. For many parameters that fit into this model, we have inadequate information such that we could be led down a blind path.

Anatoly Velikanov discussed the appearance of subtropical fish species in the waters off Sakhalin Island, and suggested that the appearance of these fishes (*e.g.*, sardines, mackerels and others) have changed the ecosystem structure of the epipelagic communities in the Tartar Strait. There were no obvious trends related to climate change, other than the presence/absence of warm water species that would persist for several years.

Douglas Hay reviewed herring spawning in the southern British Columbia waters, and showed that although the amount of herring spawning remains at a high level, the number of sites where herring spawn has decreased greatly. He

did not think that fishing had anything to do with the patterns, but, rather, speculated that an increase in population size of harbor seals, a major predator on herring, may be responsible for the phenomenon observed.

The final talk by Elizabeth Logerwell described a research project which is in its infancy: a study of the possible impacts of fishing activities

on the survival of Stellar sea lions in the Aleutian Islands and Kodiak Island. The hypothesis is that fishing activities may impact the foraging success of the sea lions, either through disturbance of prey schools, or through direct competition for a common prey. The fish species studied include walleye pollock, Pacific cod and Atka mackerel. This is a new study without tangible results yet.

List of papers

Oral presentations:

Jeffrey Cordell, Steve Bollens, Olga Kalata, Rian Hooff and Sean Avent (invited)

Introduced copepods and ecological change in estuaries of the Pacific coast of the United States

Tadanori Fujino, Hidetada iyofuji, Kazushi Miyashita and Ryo Kawabe

Do squid fishing lights affect the nitrogen cycle in the Japan/East Sea

Steven Martell and Sean Cox (invited)

Information requirements for assessing trophic impacts of fisheries on ecosystems

Anatoly Velikanov

Long term variability of pelagic fishes composition in the Tartar Strait (Sea of Japan) in connection with migrations of subtropical species

Douglas Hay and Bruce McCarter

Are changes in the abundance, distribution and timing of herring spawning in British Columbia related to changes in climate or anthropogenic factors?

Elizabeth A Logerwell, Anne B. Hollowed, Christopher D. Wilson, M. Elizabeth Connors, Peter Munro, Susanne McDermott, Sandi Neidetcher, Kim Rand, Lowell Fritz, Jim Ianelli, Martin Dorn, Steve Barbeaux, Yunbing Shi and Dan Cooper

The Fishery Interaction Team: Investigating the potential for commercial fishing to compete with endangered Steller Sea Lions for shared prey

Posters:

Larisa Afeichuk

Commercial withdraw influence on the state of arka-anadara (*Andara broughtoni*) in Ussury Bay (Japan/East Sea)

Pavel Balykin, Andrei Vinnikov and Dmitriy Terentiev

Features of fishery by active straining-off fishing gears in the eastern Sea of Okhotsk

Evgeny Drobjazin

Effect of fishing activity on size and sexual structure of *Sclerocrangon salebroso* populations in Peter the Great Bay

Larisa Gayko

Selection of hydrometeorological factors for the forecast of mariculture yield in the South of Primorski Krai

Sergey Korostelev and P. Vasilets (moved from Oral to Poster)

Composition changes in the bottom biocenoses at the shelf of Kamchatka under the influence of fisheries

Session S4 (MEQ/BIO Topic Session)

Aquaculture in the ocean ecosystem

Co-Convenors: Ik-Kyo Chung, In-Kwon Jang (Korea), Julia K. Parrish and John E. Stein (U.S.A.)

Background

Globally the demand for seafood is rising, with projections that aquaculture will provide a

steadily increasing proportion of the supply of seafood for human consumption. With this likely growth, aquaculture operations will expand to additional coastal areas, and most

probably into the exclusive economic zones (EEZ) of several countries. Progress has been made in evaluating the ecological risk and economic benefits from aquaculture in coastal areas, in developing standards for conducting aquaculture operations, and in exploratory research on the feasibility of offshore mariculture operations. The objectives of this session were to highlight recent developments relating to environmentally sustainable aquaculture, research on aquaculture in the EEZ, and to begin exploring marine aquaculture from an ecosystem perspective. One area of interest is the research and science underpinning the harmonization of aquaculture activities with other human activities that occur in the coastal zone, under the concept of integrated coastal zone management. To examine aquaculture within this broader context, presentations exploring the interrelationships between aquaculture and fishery management were also encouraged.

Summary of presentations

The session consisted of 13 oral presentations and 3 posters. The following scientific issues were noted in the presentations (these are not in priority order):

- Can aquaculture responsibly meet the growing demand for seafood products?
- How much biomass can aquaculture sustainably produce?
- How independent is aquaculture production from climate change/regime shifts?

List of papers

Oral presentations:

Richard J. Beamish, D. Noakes, C.M. Neville, R.M. Sweeting and A.J. Benson

Will climate change and aquaculture increase the abundance of Pacific salmon?

Sungchul C. Bai, Xiao-Jie Wang, Semin Choi and Kyungmin Han (Invited)

Present status and future prospects of world and Korean aquaculture industry, and development of low pollution diets for a sustainable, environmentally and economically sound aquaculture industry

Mac V. Rawson, Changsheng Chen, Dao-Ru Wang, Charles Yarish and James B. Sullivan (Invited)

Approaching coastal aquaculture from an ecosystem perspective

Yu-Feng Yang, Shi-Kui Zhai, Zhi-Gang Yu and Ik-Kyo Chung

Development of mariculture and its impacts in Chinese coastal waters

Sahoo Dinabandhu

Role of seaweeds in aquaculture – an Indian perspective

- What are the impacts of transgenics on aquaculture; should we be concerned?
- Can we integrate capture and culture fisheries? Should we?
- Is polyculture or integrated culture a reality in marine systems?
- How can disease (via intensification and/or introduction) be dealt with?
- Is there an opportunity for physical oceanography and aquaculture to integrate vis-à-vis circulation models, water quality, HABs and production?
- Should aquaculture concentrate on total lifecycle culture, or is there a place for wild capture of small individuals and fattening/grow-out? (E.g., crabs, tuna)
- Does aquaculture clean the environment or pollute it?
- Should aquaculture follow an industrial agriculture model (few species outplanted worldwide), or should it adopt a local species culture model instead?
- Is the offshore environment suitable for (industrial) aquaculture?
- Should we develop guidelines for the potential for invasion of our local species in other areas before they are cultured, or introduced accidentally?

Much of the discussion at the session focused on reviewing the Terms of Reference for the proposed PICES Working Group on *Marine aquaculture* (see *MEQ Endnote 6* and *SB Endnote 6*), and identifying scientific issues to be considered in carrying out these Terms of Reference.

Nikoliona Petkova Kovatcheva

Red king crab (*Paralithodes camtschaticus*) artificial cultivation - as a method of restoration its natural populations

Hiroshi Shimada, Hiroki Asami and Iori Tanaka

The occurrence of paralytic shellfish poisoning in summer and distribution of causative organism in the Sea of Okhotsk along the northeastern coast of Hokkaido, Japan

Dan Minchin (Invited)

Between a rock and a hard place: Aquaculture and challenges posed by invasions

Chul-Hyun Sohn, Ik-Kyo Chung, Yu-Feng Yang and Charles Yarish (Invited)

Historical review and future perspectives of aquaculture industry in Korea

Hajime Kimura, Hajime Kimura and Masahiro Notoya

Ulva pertusa and *Undaria undarioides* culture for reducing nitrogen from fish culture area in Wakayama Prefecture, Japan

Hyung-Seop Kim, Wonho Yih, Geumog Myung and Young Geel Kim

Cultured marine photosynthetic ciliate *Mesodinium rubrum* as a potential live feed species for aquacultured animals

Carolyn S. Friedman

Aquaculture, animal health and sustainability

Ik-Kyo Chung, Si-Jung Ryu, Yun-He Kang, Jin-Ae Lee, Tae-Ho Seo, Jong-Ahm Shin, Charles Yarish and Yu-Feng Yang

Evaluation of the bioremediation capability of the seaweed aquaculture in Korea

Posters:

Saywa Kim and Chul-Won Park

Artificial illumination on zooplankton dynamics in aquaculture

Sook-Yang Kim, Wol-Ae Lim, Sam-Geun Lee, Hak-Gyoon Kim and Sang-Ho Jun

Distributional characters of photosynthetic pigments before and after a *Cochlodinium polykrikoides* bloom in the South Sea of Korea

Kenji Tarutani, Takuji Uchida and Yukio Hanamura

Plankton dynamics in relation to the biochemical cycle of nitrogen in Hiroshima Bay, Seto Inland Sea of Japan

Session S5 (CCCC MODEL Topic Session)

Comparison of modeling approaches to describe ecological food webs, marine ecosystem processes, and ecosystem response to climate variability

Co-Convenors: Michio J. Kishi (Japan), Bernard A. Megrey and Francisco E. Werner (U.S.A.)

Background

Contemporary modeling efforts have shown remarkable achievements in the application of simulation, conceptual and analytic modeling to biological systems. This is especially true when it comes to modeling the lower trophic levels of marine ecosystems with NPZ type models (biomass based model), individual based models, and population dynamics models. Recent observations and data collections on marine ecosystem primary and secondary producers have provided the opportunity to generate hypotheses to explain the effects of regime shifts and the influence of climate variability. The objective for the session was to demonstrate the utility of using modeling and models to examine these and similar hypotheses. Papers dealing with linking regional scale

models to basin scale models, fisheries migration models, models that link lower trophic level models to higher trophic models, ecological food web models, and marine ecosystem process formulations were encouraged.

Summary of presentations

The session, which consisted of 10 oral presentations and 5 posters, was very well attended with approximately 80 people present in the audience.

The session began with a description of the problems and considerations modelling the physical system (Miller), and was followed by a paper addressing issues related to modelling impacts of climate change on the lower trophic

levels (Peña), and then moving to climate impacts on fisheries systems (Tian *et al.*). With the existing complexities of modelling the marine ecosystem, the last paper of the first segment (Lee *et al.*) examined the use of statistical models to identify and characterize the impact of environmental signals on biological systems.

Two papers describing the application of the NEMURO.FISH coupled model to saury (Ito *et*

al.) and herring (Megrey *et al.*) were given showing the progress that has been made in coupling a lower trophic level (nutrient-phytoplankton-zooplankton) model to the upper trophic level (fishes).

The session ended with several case studies from different systems including the California Current (Wainwright), eastern North Pacific (Mackas *et al.* and Allen *et al.*) and Yellow Sea (Yoo *et al.*).

List of papers

Oral presentations:

Arthur J. Miller (invited)

Modeling Pacific decadal variability: Physics, feedbacks, and ecosystem impacts

M. Angelica Peña

Comparing the response of three vertically resolved planktonic ecosystem models to climate change in the NE subarctic Pacific Ocean

Yong-Jun Tian, Tatsuro Akamine and Maki Suda

Impacts of fishing and climate changes on the population dynamics of Pacific saury in the northwestern Pacific: A model approach

Yong-Woo Lee, Bernard A. Megrey and S. Allen Macklin

Comparative analysis of statistical tools to identify recruitment-environment relationships and forecast recruitment strength

Shin-Ichi Ito, Daiki Mukai and Michio J. Kishi

An analysis for seasonal and inter-annual growth change of Pacific saury using NEMURO.FISH

Bernard A. Megrey, Kenneth A. Rose, Douglas E. Hay and Francisco E. Werner

A coupled lower and higher trophic level marine ecosystem model of the North Pacific Ocean including Pacific herring

Thomas C. Wainwright

A comparison of two lower trophic models for the California Current System

David L. Mackas, Mark V. Trevorrow, Douglas R. Yelland, Maia Tsurumi and Mark Benfield

Observations of zooplankton aggregation due to tidal flow over a sill

Susan E. Allen, Debby Ianson, David L. Mackas, Mark V. Trevorrow and Maia Tsurumi

Modelling zooplankton aggregation due to tidal flow over a sill

Sinjaee Yoo, Hyun-Cheol Kim and Kyung-II Chang

On the conditions for *Cochlodinium* bloom

Posters:

Alexander I. Abakumov, Lev N. Bocharov and Yeugeny P. Karedin

Mathematical modeling for analysis of multi-species fishery

Harold P. Batchelder

Habitat selection by juvenile chinook salmon in the nearshore and continental shelf of Oregon: Simulations with numerical models

Edward James Gregr, Karin M. Bodtker and Andrew W. Trites

Defining biologically meaningful pelagic regions using physical oceanography

Irina V. Ishmukova

The models for ecosystem of the Okhotsk Sea

Yury I. Zuenko

Using the ecosystem modeling technology to understand a coastal ecosystem functioning

Session S6 (BIO/POC/CCC Topic Session)

Latitudinal differences in the responses of productivity and recruitment of marine organisms to physical variability

Co-Convenors: Steven J. Bograd (U.S.A.), David L. Mackas (Canada) and Yoshiro Watanabe (Japan)

Background

A scientific result of the PICES Symposium on “North Pacific Transitional Areas” (La Paz, Mexico, 2002) was the identification of distinct latitudinal differences in ecosystem structure and variability, including the distribution and productivity of plankton and the recruitment of fish stocks. The goal of the session was to explore latitudinal gradients in the biological and physical structure of marine ecosystems (in the eastern Pacific from Mexico to Alaska, and in the western Pacific from China to Russia), and how these gradients affect life history strategy, physiology, and response to temporal variability of physical forcing.

Summary of presentations

The session had a large participation level, both in the number of contributed papers and in audience attendance. There were two invited

papers on relatively large-scale latitudinal and temporal patterns: chlorophyll and transport variability in the California Current system (Thomas and Strub), and the stratification and productivity in the oceanic subarctic Pacific (Tadokoro *et al.*)

Contributed papers (16 oral presentations and 14 posters) covered a wide range of spatial scales and processes. Important and recurring scientific themes included:

- The role of strong local gradients (fronts, meanders, eddies) in regulating distributions and seasonal and inter-annual variability of migratory and advective transport pathways;
- Life stage transitions, and the use of different ocean regions during different parts of the life cycles of key species;
- Physiological rates and constraints, and how these affect population response to spatial and temporal gradients.

List of papers

Oral presentations:

Ki-Tack Seong, Young-Shil Kang and In-Seong Han

Long-term variation in the East Korean Warm Current and its impact on the bio-physical reaction in the southwestern region of the East/Japan Sea

Sachihiko Itoh and Takashige Sugimoto

Effect of eddy transport and blocking on the migration of small pelagic fishes

William T. Peterson, Leah Feinberg, Jaime Gómez-Gutiérrez, Tracy Shaw and Mitch Vance

A comparison of the productivity of the Euphausiid, *Euphausia Pacifica*, in the Oregon upwelling zone to similar findings around the Pacific Rim

Rubén Rodríguez-Sánchez, Héctor Villalobos and Sofía Ortega-García

Seasonal spatial dynamics of the Pacific sardine (*Sardinops caeruleus*) population in the California Current System and its interannual variability as a function of environmental variability during 1980-1997

Young-Shil Kang, Kitack Seong and Young-Sang Suh

Bio-physical reaction to regime shifts in the southwestern region of the East/Japan Sea

Kazuaki Tadokoro, S. Chiba, T. Ono, T. Midorikawa and T. Saino (Invited)

Increase of stratification and decreased primary productivity in the subarctic North Pacific

Toru Kobari and Toshiyuki Nagaki

Comparative life cycle patterns of interzonal migrating copepods in the North Pacific

Jin-Yeong Kim, Yang-Jae Im, Seok-Gwan Choi, Jina Oh and Tae-Won Lee

The role of the Tsushima Current as the nursery grounds of major fishery resources off Jeju Island, Korea

Svetlana Yu. Glebova

Cyclicality in formation of the types of synoptic situation above the Far East seas as a factor of their ecosystems' changes

Tae-Keun Rho, Terry E. Whittedge and John J. Goering

Interannual variations of nutrients and primary production over the southeastern Bering Sea shelf during spring of 1997,1998, and 1999

Andrew Thomas and P. Ted Strub (Invited)

Latitudinal differences in chlorophyll variability in the California Current

David W. Welch, Marc Trudel, Jen Zamon, John Morris and Mary Thiess

Latitudinal and temporal gradients in ocean productivity and survival of Pacific salmon

Takashi Kitagawa, Shingo Kimura, Hideaki Nakata and Harumi Yamada

Adaptation mechanisms of Pacific bluefin tuna to temperate waters as detected by archival tags

Jaime Farber-Lorda, Miguel Lavin, Armando Trasviña, Marco Guerrero, Ignacio Romero-Vargas and Cesar Almeda

The relationship between hydrography, trophic conditions and zooplankton biomass in the Eastern Tropical Pacific

Hee-yong Kim, Xin-Yu Guo and Hidetaka Takeoka

Influences of the Kuroshio front variability on the transport of eggs and larvae of pelagic fishes in the East China Sea

Vadim F. Savinykh, Vladimir A. Shelekhov, Svetlana V. Davydova, Svetlana V. Naydenko, Alexey A. Baytaluk, Gennady V. Khen, Gennady A. Shevtsov and Mikhail Zuev

Latitudinal changes of plankton and nekton biomasses in the Western Transition Zone

Xue-Lei Zhang

Ionic control of settlement and metamorphosis in larvae of the Serpulid Polychaete, *Hydroides elegans* Haswell

Yulia Moseikina, Olga Ivanova and Andrey Krovnin

Latitudinal difference in the Far East salmon stock response to the climate change in the Northwest Pacific region

Posters:

Tatyana A. Belan, Elena Oleynik, Ludmila Belan and Tatyana Konovalova

Characteristics of benthic communities at the Sakhalin island shelf

Tatyana A. Belan, Elena Oleynik, Luisa Propp, Marina Selina, Boris Borisov, Yury Korostelev and Tatyana Konovalova

Some characteristics of pelagic ecosystems of the North-East Sakhalin island shelf

Sanae Chiba , Toshiro Saino, Yuichi Hirota and Seizo Hasegawa

North-south contrast of multi-decadal scale variation of lower trophic level ecosystem in the Japan/East Sea: Light-limited versus nutrients-limited

Natalia T. Dolganova and Hideaki Kidokoro

Compared catch efficiency of different plankton nets in the Japan Sea

Elena V. Gritsay and M.A. Stepanenko

Recruitment of the Bering Sea pollock and identification of its spawning stocks

Young-Shil Kang

Inter-decadal and seasonal variations in calanoid copepods in the southwestern region of the East/Japan Sea

Hyung-Ku Kang, Yong-Joo Kang and Chul Park

Effect of suspended sediment on reproductive responses of *Paracalanus sp.* (Copepoda: Calnoida) in the laboratory

Vladimir V. Napazakov

Trophic structure of the groundfish community in the western Bering Sea

Evgeny E. Ovsyannikov

Size composition of pelagic walleye pollock eggs on spawning areas in the northern Okhotsk Sea

Marina A. Shebanova

Distribution and age structure of *Metridia Pacifica* in the Okhotsk Sea

Jeong-Min Shim, Ki-Tack Seong, Jin-Il Park, Hyun-Gook Jin, Un-Gi Whang and In-Seong Han

Distribution of phytoplankton in Wangdol-cho in the southwestern East/Japan Sea with concerning oceanographic conditions

Anatoly F. Volkov

Biomass, numerosity and size-structure of *Sagitta elegans* in the northern part of the Okhotsk Sea (spring 1997-2002)

Atsushi Yamaguchi, Naonobu Shiga, Tsutomu Ikeda, Shogo Takagi, Yoshihiko Kamei and Keiichiro Sakaoka

Latitudinal characteristics of epipelagic zooplankton community structure in the western North Pacific during the spring of 2002 and 2003

Seok-Hyun Youn and Joong-Ki Choi

Growth of *Acartia hongii* nauplii in Kyeonggi Bay, Yellow Sea

Session S8 (FIS Topic Session)

Management of eel resources

Co-Convenors: Tae-Won Lee (Korea) and Katsumi Tsukamoto (Japan)

Background

Anguillid eels are important fishes in riverine and estuarine ecosystems in many regions of the world, and are an important food resource in some eastern and western countries. The wild eel populations in several parts of the world have declined sharply in recent years, apparently due to a combination of factors, such as fishing pressure, water pollution, or loss of freshwater and estuarine habitats. In addition, global changes in the ocean-atmosphere system, which may affect larval migration in the ocean, have also been suggested as a possible cause for the decline. Therefore, effective management and research strategies need to be developed to understand the causes of the declines and to help rebuild the stocks. There has been considerable recent scientific research on the ecology, physiology and aquaculture of eels, but as anguillid stocks show evidence of decline worldwide, increased efforts are needed to integrate research and management efforts to avoid another global fisheries disaster as has been seen with so many other fish species.

Summary of presentations

The session, which consisted of 12 oral presentations and 17 posters, was attended by

List of papers

Oral presentations:

Yuki Minegishi, Jun Aoyama, Jun G. Inoue, Masaki Miya, Mutsumi Nishida and Katsumi Tsukamoto
Definitive identification of all species of the genus *Anguilla* using the complete mitochondrial genome

Sam Wouthuyzen, Jun Aoyama, Shun Watanabe, Michael J. Miller and Katsumi Tsukamoto (Invited)
Resources of tropical anguillid eels in Indonesia

Shingo Kimura and Katsumi Tsukamoto
Landmark for the spawning of Japanese eel

Tsuguo Otake, Michael J. Miller, Tadashi Inagaki, Gen Minagawa and Katsumi Tsukamoto
Evidence for migration of metamorphosing larvae of *Anguilla japonica* in the Kuroshio Current

Michael J. Miller, Jun Aoyama, Sam Wouthuyzen and Katsumi Tsukamoto
New information on the early life history of tropical eels: Implications for population structure and management

Sun-Do Hwang, Won-Seok Yang, Yeong-Jo Jo, Hyeong-Tae Moon, Tae-Won Lee, Ok-In Choi and Chi-Hong Kim
Factors affecting the daily catch of glass eels, *Anguilla japonica*, in the Geum-river estuary, Korea

more than 60 scientists. Papers dealt with species identification using new technology and ecological information on eels in various regions including Asian and European countries. Ecological studies on eels are dominant in Asian countries compared to a greater number of eel management papers from European countries.

The oral presentations and posters of the session reflected a broad range of research on the genetics, behavior, physiology, and ecology of eels that is being conducted in East Asian countries and elsewhere, which provided valuable new information about eels. Many of these studies also highlighted the need to continue to gain a greater understanding of the mysterious life cycle of eels in terms of their oceanic spawning, larval migration, recruitment, and the choice that eels make to live in either coastal, estuarine or freshwater habitats. In addition to further research efforts on these and other subjects, such as developing technology for the artificial production of glass eels to meet the demands of aquaculture, this session clearly showed that there is a great need for the development and coordination of management efforts within and among the countries of East Asia and elsewhere to conserve and manage the wild stocks of eels.

Wan-Soo Kim, Seong-Jin Yoon and Tae-Won Lee

Effects of sudden changes in salinity on the oxygen consumption of the glass eels, *Anguilla japonica*

Yu-San Han, John Y.L. Yu, I.C. Liao and Wann-Nian Tzeng

Salinity preference of the silvering Japanese eel (*Anguilla japonica*): Evidences from the pituitary prolactin mRNA levels and otolith strontium/calcium ratios

Aya Kotake, Takaomi Arai, Michael J Miller and Katsumi Tsukamoto

Differences in the migratory history of male and female Japanese eels, *Anguilla japonica*

Jun Aoyama

An initial investigation of the biological characteristics of the Japanese eel stock in Japan

Wann-Nian Tzeng

Relative importance of oceanic, estuarine and riverine growth histories of the Japanese eel, *Anguilla japonica*, as revealed by otolith microchemistry analysis

Eric P. Feunteun (Invited)

Conceptual principles for a restoration plan of European Eel (*Anguilla anguilla*)

Posters:

Tadashi Inagaki, Michael J. Miller, Jun Aoyama and Katsumi Tsukamoto

Current variability in the spawning and larval transport areas of the Japanese eel, *Anguilla japonica*, indicated by drifter buoys

Minjee Jeon, Kyungmin Han and Sungchul C. Bai

Effect of captured location on amino acids profile in domestic wild juvenile and adult eels

Wan-Soo Kim, Seong-Jin Yoon and Tae-Won Lee

The sensitivity of glass eels to water temperature changes

Yobuo Kimura, Satoshi Ishikawa, Mutsumi Nishida and Katsumi Tsukamoto

Population structure of the Japanese conger eel, *Conger myriaster*

Midori Kobayakawa, Yoshitaka Kobayakawa and Noritaka Mochioka

Musculature and skeleton system of leptocephalus eel larvae

Tae-Won Lee, Sun-Wan Hwang and Sun-Do Hwang

Stock size, recruitment and upstream migration rates of glass eels estimated by a marking experiment in the Cheonjeyeon estuary of Jeju Island, Korea

Tae-Won Lee, Hyung-Tae Moon and Sun-Do Hwang

Annual variation in glass eel (*Anguilla japonica*) catch in Korean estuaries

Tae-Won Lee, Hyung-Tae Moon and Gwang-Cheon Kim

Duration of leptocephalus and metamorphosis stages of *Anguilla japonica* as indicated from otolith microstructure in glass eels from the Korean estuaries

Tao Ma, Gen Minagawa, Michael J. Miller, A. Shinoda, Jun Aoyama and Katsumi Tsukamoto

Age, growth and distribution of marine eel leptocephali in the East China Sea

Michael J. Miller, Tadashi Inagaki, Akira Shinoda, Yuki Minegishi, Mari Kuroki, Jun Aoyama and Katsumi Tsukamoto

Transport of an *Anguilla japonica* leptocephalus into the Celebes Sea: Implications for recruitment success or failure

Gen Minagawa, Michael J. Miller, Tadashi Inagaki, Tsuguo Otake and Katsumi Tsukamoto

Larval distributions of marine eels in the Kuroshio Current and East China Sea

Noritaka Mochioka

Feeding ecology of leptocephalus eel larvae: Active feeding occurs during daytime

Akihiro Okamura, Aya Kotake, Katsumi Tsukamoto and Hideo P. Oka

Migratory history of introduced eels, *Anguilla anguilla*, in Mikawa Bay, Japan, revealed by otolith microchemistry

Dong-hwan Shin, Hajime Matsubara, Shohei Kaneko, Tomoya Kotani, Masakene Yamashita, Shinji Adachi and Kohei Yamauchi

Maturation factors as indicators of egg quality in Japanese eel, *Anguilla japonica*

Masanori Takahashi, Noritaka Mochioka, Sekio Shinagawa and Akinobu Nakazono

Distribution patterns of leptocephali in the North Pacific transition zone

Mei-Chen Tseng, Wann-Nian Tzeng and Sin-Che Lee

Historical decline of the Japanese eel, *Anguilla japonica*, in northern Taiwan

Shun Watanabe, Satoshi Ishikawa, Jun Aoyama and Katsumi Tsukamoto

Evaluation of the population structure of *Anguilla marmorata* inferred by meristic characters

Session S9 (TCODE E-Poster Session)
GIS/Geographic-based applications to marine sciences

Co-Convenors: Sung-Dae Kim (Korea) and Bernard A. Megrey (U.S.A.)

Background

Over the past two decades there has been increasing recognition that problems in marine and fisheries science are nearly all manifest in the spatio-temporal domain. Geographical Information Systems (GIS), the natural framework for spatial data handling, are being recognized as a powerful tool with useful applications in marine sciences. GIS are becoming invaluable tools for monitoring and managing both open and coastal marine systems. Widespread acceptance and adoption of these and other geo-referenced methods speak to their power and effectiveness for addressing the diverse mix of factors that impinge on aquatic systems. The aim of this session was to provide an opportunity to showcase new and exciting GIS developments by PICES member countries including coastal, continental and deep ocean studies, dynamic relations that characterize the marine world, and the development of oceanography and fisheries GIS tools and applications.

Summary of presentations

The session consisted of 11 electronic posters dealing with applying new technologies to oceanographic (Dmitrieva *et al.*) and biological data (Miromanova *et al.*), activities of international Data Centers (Jung *et al.*), integrated digital mapping, data information management and decision support systems (Rostov *et al.*, Nemchinov *et al.*, Matyushenko *et al.*), data visualization software (Suzuki and Oguma), and GIS applications (Volvenko, Moiseenko *et al.*, and Megrey *et al.*).

The PICES community seems to accept seeing scientific information presented via E-posters and enjoy the interactive nature of E-posters. Good attendance at such E-poster sessions both this and past Annual Meetings indicates that these sessions are well received. PICES should consider making E-posters a permanent type of presentation alternative to any future poster sessions, and endeavour to make sure that candidate venues can accommodate the technical requirements of this and up-coming presentation formats.

List of E-posters

Elena V. Dmitrieva and Natalia I. Rudykh

New version of integrated oceanographic data base for the Japan Sea

Kyu-Kui Jung, Hee-Dong Jeong and Seung Heo

KODC activities on the oceanographic data management and its geographical application

Bernard A. Megrey, S. Allen Macklin and Kimberly Bahl

North Pacific Ecosystem Theme Page and Metadatabase: A collaborative research tool for fisheries oceanography and ecosystem investigations

Georgiy S. Moiseenko, Olga Moiseeva, Larisa Matyushenko, Ivan Visotskiy and Igor Shevchenko

Using GIS to investigate the ice distribution influence on the activity of catching ships in the Okhotsk Sea

Oleg Y. Nemchinov, Valery V. Peskov and Natalia K. Ni

The initial stage of work on the development of complex information system "Water biological resources and oceanologic conditions of their dwelling"

Oleg Y. Nemchinov and Valery V. Peskov

Creation of a digital map of trade division into districts and division of zones of the sea inspection responsibility in the North Pacific

Igor D. Rostov, Eugene Vyazilov, Nickolai Mikhailov, Victor Chepurnov, Sergey Belov, Sergey Sukhonosov and Vladimir Rostov

Integration of information resources in the Unified System of Information on the World Ocean State (ESIMO) of Russia

Lilya Miromanova, Georgy Moiseenko, Alexander Nikolayev and Igor Shevchenko

Meta-database of echo-integration trawl surveys

Larisa Matyushenko, Georgy Moiseenko and Igor Shevchenko

Electronic atlas of species of commercial value for the North Pacific

Toru Suzuki and Sachiko Oguma

The newest seafloor topography from satellite altimeter measurements in the western North Pacific region

Igor V. Volvenko

New GIS for spatial-temporal dynamics analysis of Okhotsk Sea nekton

Session S10 (MEQ/BIO/FIS Topic Session)

Ecosystem-based management science and its application to the North Pacific

Co-Convenors: Glen Jamieson (Canada), Patricia Livingston (U.S.A.), Vladimir I. Radchenko (Russia), Takashige Sugimoto (Japan), Qi-Sheng Tang (China) and Chang-Ik Zhang (Korea)

Background

Many recent national and international legal agreements use some form of the term “ecosystem-based approaches” when describing new methods to assess and manage marine living resources. These are usually understood to include objectives related to maintaining and monitoring biodiversity, productivity, and the physical and chemical properties of an ecosystem. It is often unclear, however, what this means in practice, what new information will be required, and whether scientific or management actions will actually change under these new approaches. This session invited papers on what ecosystem-based management approaches are, what they involve scientifically (what the information requirements are and if we can provide them), what initiatives are being undertaken elsewhere in the world, and how PICES countries are beginning to address the topic. The session provided a forum for presentations and discussion of how to improve the science that provides the framework for ecosystem-based management initiatives, and its application, in PICES countries.

Summary of presentations

The session consisted of 17 oral presentations and 4 posters. Major themes of the presentations included international and national overviews of the various ways in which ecosystem-based management was viewed, and also some of the research underway to assist nations with moving

towards more ecosystem-based management. The effect of climate on fishery resources was a major theme. The use of science-based ecosystem indicators to guide managers was also a central part of many talks. The role of marine protected areas was also discussed. Stakeholder involvement in the identification of ecological problems and the desired ecosystem state was mentioned as an important aspect of ecosystem-based management. Technological advancements were also mentioned as solutions to some human-induced impacts. Loss of marine habitat through human land reclamation, trawling, or environmental degradation was an important issue. Fishing effects on species composition, trophic level and biological characteristics of fish communities were demonstrated. Protection of biodiversity, long-term sustainability, and humans as ecosystem components were common goals of ecosystem-based management policies. Non-fishing threats to biodiversity included oil development, mining byproducts, chemical and nutrient pollution. Communication of ecosystem research and goals to the public was another facet of making progress with ecosystem-based management. Eco-regions or ecological boundary areas were considered an important aspect to an ecosystem approach.

Much of the concluding discussion focused on reviewing the Terms of Reference for the proposed joint FIS/MEQ Working Group on *Ecosystem-based management science and its application to the North Pacific* (see *MEQ*

Endnote 5 and *SB Endnote 5*). The following was noted:

- Charge of this Working Group was not thought to be the development of indicators, but rather, just listing indicators that were presently in use, and thus taking outputs from the symposium 2004 on “Quantative ecosystem indicators for fisheries management” might be most useful;
- Evaluation of indicators against a set of criteria as to their usefulness would be good;
- Stronger linkage between environmental management and fisheries management is desired;
- Identifying impacts in each area is needed to know what indicators should be considered;
- Feedback to FIS and MEQ after one year would be important;
- Joining efforts with other international organizations such as ICES is crucial.

List of papers

Oral presentations:

Chris Frid (Invited)

Ecosystem based management: A NE Atlantic view

Thomas C. Malone

Implementing the integrated design plan of the coastal module of GOOS

Hiroyuki Matsuda

Adaptive management and community interaction in fisheries

Glen S. Jamieson and Bob O'Boyle

Canadian initiatives towards the achievement of ecosystem-based management

Vjacheslav P. Shuntov and Vladimir I. Radchenko

Ecosystem based management of marine biological resources: Illusion and the reality

David L. Fluharty

Backing into the ecosystem: Development of practices for ecosystem-based fishery management in the United States

Xian-Shi Jin, Qi-Sheng Tang and Xian-Yong Zhao

Management implication of changes in ecosystem with reference to the eastern China seas

Chang-Ik Zhang, Sung-Il Lee and Jong-Man Kim

Ecosystem-based management of fisheries resources in the Tongyeong marine ranching area in Korea

Kaoru Nakata, Hirokatsu Yamada, Minoru Tomiyama, Katsuyuki Sasaki, Tadafumi Ichikawa and Hiromu Zenitani

Effects of variabilities in climate and planktonic ecosystem on fisheries management of sand lance in Ise Bay, Japan

Alexander Tkalin

Implementation of GEF projects as a tool for ecosystem-based management

Patricia A. Livingston

Ecosystem-based science for management of Alaskan fisheries

Richard J. Beamish, R.M. Sweeting, C.M. Neville and A.J. Benson

The importance of considering the impact of regimes when establishing ecosystem-based approaches to fisheries management

Shang Chen, Ming-Yuan Zhu and De-Wen Ding

Guidelines of marine ecological survey of China: Ecosystem health consideration

Franz J. Mueter and Bernard A. Megrey

Species-based indicators to assess the status of the Gulf of Alaska and Bering Sea ecosystems with reference points

William J. Sydeman, Kyra L. Mills, Diana Watters, Steve Ralston and Tom Laidig

Wings, fins, and the black box: Management implications of marine bird and fish trophic similarities

Sergey A. Bakharev and Svetlana Rjanitsyna

About the ecosystem approach to the problem of continental shelf bioresources management

Tatsu Kishida, Muneharu Tokimura and Tokimasa Kobayashi

Variable pelagic and demersal marine ecosystems and fisheries around Japan

Posters:

Kimberly Y. Bahl, S. Allen Macklin and Bernard A. Megrey

North Pacific Ecosystem Theme Page and Metadatabase

Yeong Gong and Young-Sang Suh

Effect of the environmental conditions on the structure and distribution of Pacific saury in the Tsushima Warm Current region

Alexander V. Nikolayev and Michael Kuznetsov

Acoustic monitoring as method for ecosystem studies in the northwestern Bering Sea

Konstantin A. Zgurovskiy, Vassily Spiridonov and Andrey Malyutin

Marine protected areas of the Russian Far East in ecosystem based management: Problems and perspectives

FIS Paper Session (FIS)

Co-Convenors: Yukimasa Ishida (Japan) and Chang-Ik Zhang (Korea)

Background

At the FIS meeting in 2002 (PICES XI), it was noted that there was no FIS Paper Session that year, and was pointed out that convening such a session at PICES XII would enhance fisheries science activities in PICES, and allow participation by more fisheries scientists with different interests.

Summary of presentations

The session consisted of 49 papers (9 oral presentations and 40 posters) submitted by scientists from almost all PICES member countries. Papers dealt with different aspects of fishery sciences in the North Pacific and its marginal seas. Most oral presentations were on

fish biology and fishery ecology, including species such as Pacific salmon, Pacific saury, sablefish, jack mackerel, pollock, hake, and Pacific ocean perch. One paper dealt with cephalopods and another paper was on sea lions. Abundances and recruitments of some fish species were correlated with environmental characters such as oceanic fronts (Pacific saury), current transports (jack mackerel), and water temperatures (walleye pollock and sablefish). Feeding ecology of chum salmon was compared between the western Bering Sea and the North Pacific. Oxygen isotopes provided environmental characteristics for walleye pollock, and parasites were used to determine stocks for shrimp. Study on the roar sound of the sea lion provided a lot of information on their behavior.

List of papers

Oral presentations:

Elena Dulepova

Comparison of feeding ecology of chum salmon in the western part of the Bering Sea and adjacent waters of the Pacific Ocean

Nozomi Ishiko, Hidetada Kiyofuji and Sei-Ichi Saitoh

Relationship between Pacific saury fishing grounds and the Oyashio front in the northwestern North Pacific

Michael J. Schirripa and Jim J. Colbert

Changes in sablefish (*Anoplopoma fimbria*) recruitment in relation to oceanographic conditions

Jae-Bong Lee, Chang-Ik Zhang, Anne Hollowed, James Ingraham and Young-Yull Chun

Relationship between potential transport and abundance of jack mackerel in Korean waters

Yoon-Seon Yang, Su-kyung Kang and Suam Kim

Oxygen isotopes evidence for environmental characteristics from walleye pollock (*Theragra chalcogramma*) otoliths

John R. Bower and Shogo Takagi

Vertical distribution of cephalopod paralarvae in the Northeast Pacific

Tae-Geon Park, Kohji Iida and Haruo Ogi

Relationship between roar sound and behavior of Steller sea lion, *Eumetopias jubatus*, migrating to the west coast of Hokkaido, northern Japan

Susan Coccetti and Michael J. Schirripa

Difficulty of age determination between Pacific hake (*Merluccius productus*), Pacific Ocean perch (*Sebastes alutus*), and sablefish (*Anoplopoma fimbria*)

Jung-Hwa Choi, Sung-Yun Hong, Hyung-Kee Cha and Glen Jamieson

Distinguished southern penaeid stock from western stock in Korea

Posters:

Alexander A. Bonk and A.Yu. Dubinina

Spawning grounds location influence upon the duration of embryonic development of herring eggs in the Western Bering Sea

Alexander A. Bonk

Consumption of herring eggs by predators in the Western Bering Sea

John R. Bower

Preliminary observations on gonatid paralarvae from the Northeast Pacific

Oleg A. Bulatov

The fishery and condition of the walleye pollock (*Theragra chalcogramma*) stock in the Bering Sea in 1979-2002

Seok-Gwan Choi, Won-Seok Yang, Jong-Bin Kim, Hyun-Su Jo and Yeong-Chull Park

Factors affecting the distribution of walleye pollock in the Aleutian Basin

Young-Min Choi, Chang-Ik Zhang and Jae-Bong Lee

Stock assessment and management implications of chub mackerel, *Scomber japonicus*, in Korean waters

Jung-Hwa Choi, Sung-Yun Hong, Chae-Woo Ma and Chul-Woong Oh

Growth and reproduction of *Metapenaeopsis dalei* (Decapoda, Penaeidae) in the western sea of Korea

Svetlana V. Davydova

The comparison of the peculiarity of spawn and egg/larvae distribution of the mass of subtropical fish species in coastal and open waters the northwestern Japan/East Sea

Alexander I. Glubokov

New data on the Pacific sleeper shark, *Somniosus pacificus* (Squalidae), in the northwest part of the Bering Sea

Stanislav Gorskiy, Daisei Ando, Yasuyuki Miyakoshi, Mitsuhiro Nagata and Masahide Kaeriyama

Distribution and growth of the ALC-marked juvenile chum salmon (*Oncorhynchus keta*) in the early marine life period

Kohji Iida, Tae-Geon Park and Haruo Ogi

Acoustic characteristics and morphological observation of roar sound of Steller sea lion, *Eumetopias jubatus*, migrating to the west coast of Hokkaido, northern Japan

Yukimasa Ishida, Tsutomu Saito, Shinji Uehara, Minoru Ishida, Hideki Akiyama, Takumi Mitani, Akihiko Yatsu, Ken Mori, Yasuhiro Ueno and Koji Takahashi

Detection of physical and biological regime shifts in the Kuroshio Current

Zoya G. Ivankova

Biology and stock condition of flounders in Peter the Great Bay (Japan Sea)

Elsa R. Ivshina

To the question of Sakhalin-Hokkaido herring decline in Sakhalin Island waters

Masahide Kaeriyama

Carrying capacity, population dynamics of Pacific salmon in the North Pacific Ocean in relation to the long-term climate change

Sung-Il Lee, Sung-Gyu Yun, Chang-Ik Zhang and Sang-Gyu Paik

An ecological study of benthos in the Tongyeong marine ranching area for ecosystem modeling

Igor V. Melnikov and Alexei M. Orlov

Sharks of the Russian EEZ in the Northwestern Pacific: An overview

Masayasu Nakagami, Satoshi Suyama and Yasuhiro Ueno

Long-term variability in length and condition factor of Pacific saury (*Cololabis saira*)

Jeffrey M. Napp, Russell Hopcroft, Christine T. Baier and Cheryl Clarke

Distribution and species-specific egg production by *Pseudocalanus* spp. in the Gulf of Alaska

Yury V. Novikov and Oleg A. Rassadnikov

Distribution of Pacific salmon in the period of anadromous migrations in the north Kuril Islands region in 2002

Vladimir A. Nuzhdin

The mechanism of formation of walleye pollock generations with various numbers

Jina Oh, Tae-Won Lee, Jin-Ku Kim and Jin-Yong Kim

Diurnal variation in catches of fish larvae collected by IKMT in the water off Jeju Island

Taeg-Yun Oh, Jae-Bong Lee, Hyung-Kee Cha, Jung-Hwa Choi, Jang-Uk Lee and Ju-Hee Lee

The biology of Penaeid shrimp stocks off Geomun, southern Korea

Kyum Joon Park, Chang Ik Zhang, Kyum Joon Park, Jong Hun Na, Zang Geun Kim and Hawsun Sohn

Abundance and growth of finless porpoise, *Neophocaena Phocaenoides*, in the west coast of Korea

Jong-Hwa Park, Yang-Jae Im, Hyung-Kee Cha and Young-Sang Suh

The relationship between oceanographic conditions and fishing conditions of anchovy, *Engraulis japonica*, in the Southern Sea of Korea

Eugene V. Samko, Alexander V. Kapshiter and Eugene V. Slobodskoi

Contemporary analysis of the neon flying squid distribution and satellite altimetry data

Young-Il Seo, Chang-Ik Zhang, Jae-Bong Lee and Jong-Hwa Park

Stock assessment using standardized fishing effort of purse seine fisheries in Korean waters

Dong-Wha Sohn, Sukyung Kang and Suam Kim

Stock identification of chum salmon (*Oncorhynchus keta*) using trace elements in otolith

Yuki Sugawara and Masahide Kaeriyama

Infection of *Anisakis simplex* in chum and sockeye salmon collected in the Gulf of Alaska, the Bering Sea, and rivers in Hokkaido, Japan

Akifumi Suzuki, Yasunori Sakurai, Jun Yamamoto, Tomonori Hamatsu, Shinichi Ito and Tsutomu Hattori

Influence of the Oyashio Current on stock fluctuation of walleye pollock in the Tohoku region, northern Japan

Katsuya Suzuki, Tsutomu Takagi, Yutaka Moritomi, Shinsuke Torisawa, and Kazushi Miyashita

A stochastic model of the schooling behavior of chub mackerel, *Scomber Japonicus*, in finite space

Kazuhisa Uchikawa, John R. Bower, Yasuko Sato and Yasunori Sakurai

Diet of the squid, *Beryteuthis anonychus* (Cephalopoda: Gonatidae), in the Northeast Pacific

Andrei V. Vinnikov

Stock abundance and peculiarities of fishing of Pacific cod in the eastern Sea of Okhotsk

Andrei V. Vinnikov

About 3 species of sharks sampled by bottom trawl on shelf of western Kamchatka (Sea of Okhotsk)

Takashi Yanagimoto, Yoshimi Takao, Kouichi Sawada and Neal J. Williamson

Distribution properties of walleye pollock, *Theragra chalcogramma*, in the Aleutian Basin of the Bering Sea

In-Ja Yeon, Hak-Jin Hwang, Young-Min Choi and Yang-Jae Im

Summer spatial distribution and abundance of major fisheries resources in the Yellow Sea of Korea

In-Ja Yeon, Byung-Kyu Hong and Joo-Il Kim

Long-term changes in the yellow croaker, *Pseudosciaena manchurica*, population in the East China and Yellow Seas

Ikuko Yosho

Long-term changes in distribution pattern of some demersal fishes in the Sea of Japan

Ikuko Yosho and Takashi Yanagimoto

Morphological variation in *Chionoecetes japonicus* (Decapoda, Majidae) in Japanese waters: A preliminary observation

Chang-Ik Zhang, Sang-Cheol Yoon and Jin Woo Choi

A population ecological study of pupfish washington clam (*Saxidomus purpuratus*) in adjacent waters of Geoje island, Korea

POC Paper Session

Convenor: Kuh Kim (Korea)

Background

The session consisted of 12 oral presentations and 20 posters on various aspects of physical oceanography in the North Pacific Ocean and the Japan/East Sea, and the air-sea interactions over the Yellow Sea and the East China Sea.

Summary of presentations

Physical oceanographic observations on the Juan de Fuca Eddy collected in June 2003 and

preliminary circulation modeling results were described by Foreman.

Subsurface frontal waves with a wavelength of 70-100 km were observed in the Kuroshio Extension, which grow and propagate downstream. These unstable waves play a key role in strong isopycnal mixing and cross-stream exchange between the Kuroshio and Oyashio waters, and that is a major formation process of the North Pacific Intermediate Water (Yasuda). An inverse method is employed to quantify the effect of cabbelling, which accounts for the

density increase during the formation of the North Pacific Intermediate Water (NPIW). The total diapycnal volume convergence into the NPIW may be up to 2.3 Sv in the entire NPIW region (Yun).

The duration of the 5°C isotherm presence south of 50°N was chosen as a criterion for the estimation of the cold period in the Far East Seas and the whole Northwest Pacific since 1966. There was a constant increase in the duration of the cold period from 70 to 170 days, associated with the early beginning of the winter season and late spring-summer warming (Krovnin). Application of the multiple imputation method developed for biomedical researches shows that the temperature contrast in the Subtropical Western Pacific increased, while the air temperature contrast over the East Asia decreased during the second half of the 20th century (Kaplunenko).

The disappearance of the East Korean Warm Current was examined in relation to the transport variation in the Korea Strait and the deep currents in the Ulleung Basin (Chang). Trajectory data from subsurface floats were used to understand intermediate circulation in the

southwestern part of the Japan/East Sea (Park). The sea level response to atmospheric pressure is not isostatic due to a Helmholtz-like resonance between the Japan/East Sea and the North Pacific Ocean through straits. Thus special care is necessary in analyzing TOPEX/POSEIDON altimeter data (2-20 day periods) taken in this region (Nam). A series of cruises with CTD and chemical observations implemented during 1999-2003 has provided an evidence of deep convection and water mass formation processes in the northwestern Japan/East Sea (Lobanov). The effect of the inflow condition on the circulation in the Japan/East was examined through numerical ocean modeling using the GFDL Modular Ocean Model (MOM3) (Kim).

Model hindcast winds were compared with the winds observed from JMA ocean buoys and the Kyushu ocean observation tower. Both the typhoon model and the primitive vortex model underestimate the observed winds (Kang). The formation and advection of fog in the Yellow Sea along the eastern coast of China and the western coast of Korea depend strongly on the wind field and sea states (Choi).

List of papers

Oral presentations:

Michael Foreman, Barbara Hickey, Vera Trainer, Amy MacFadyen and Emanuele Di Lorenzo
Preliminary modelling and observational studies of the Juan de Fuca Eddy

Ichiro Yasuda, Shinya Kouketsu and Yutaka Hiroe
Frontal waves and the formation of North Pacific intermediate water along the Kuroshio extension

Jae-Yul Yun and Lynne D. Talley
Cabbeling and the density of the North Pacific intermediate water quantified by an inverse method

Andrei S. Krovnin, Marat A. Bogdanov and George P. Moury
Recent climatic changes in the Northwest Pacific

Dmitri D. Kaplunenko and Vladimir I. Ponomarev
Assessing the climate change tendencies in the Northeast Asia and Northwest Pacific using the multiple imputation method

Kyung-II Chang and Y.B. Kim
Disappearance of the East Korean Warm Current in the southwestern East Sea

Young-Gyu Park, Kyung-Hee Oh, Moon-Sik Suk and Kyoung-II Chang
Intermediate level circulation in the southwestern part of the Japan/East Sea from subsurface floats

Sung-Hyun Nam, Sang-Jin Lyu and Kuh Kim
The corrections of the high-frequency (2-20 days) fluctuation effects on the TOPEX/POSEIDON altimeter data in the East (Japan) Sea

Young-Ho Kim and Kuh Kim
The effects of horizontal resolution in a Z-coordinate model of the East/Japan Sea

Vyacheslav Lobanov, Vladimir Ponomarev, Anatoly Salyuk, Pavel Tishchenko, Lynne Talley, Kuh Kim, Kyung-Ryul Kim, Dong-Jin Kang and Guebuem Kim

Ventilation of the Japan/East sea bottom layer

See-Whan Kang, Ki-Cheon Jun, Kwang-Soon Park and Sang-Ik Kim

A sensitivity analysis of typhoon wind models with wind observations in Northeast Asian Sea

Hyo Choi and Yuan-Hang Zhang

Modification of sea fog by sea-land breeze and sea surface temperature

Posters:

Li-Qi Chen, Zhong-Yong Gao, Wei-Qiang Wang and Xu-Lin Yang

Characteristics of $p\text{CO}_2$ in surface water of the Bering Abyssal Plain and their effects on the carbon cycling in the western Arctic Ocean

Pavel A. Fayman

Calculation of Peter the Great Bay (Japan Sea) currents using the adaptation model

Gennady A. Kantakov

Comparing moorings and PALACE data in the northern part of the Japan Sea

Vyacheslav G. Kuzlyakin

Intraannual variability of the heat content of waters in the California Current region

Carol Ladd, George Hunt Jr., Calvin Mordy, Sigrid Salo and Phyllis Stabeno

Marine environment of the central and eastern Aleutian Islands

Carol Ladd, George Hunt Jr., Dave Kachel, Sigrid Salo, and Phyllis Stabeno

Satellite tracked drifter studies in the eastern Aleutian Passes

Jong-Jin Park and Kuh Kim

Importance of surface water property in previous winter on the formation of HSIW in the East/Japan Sea

Kyung-Ae Park, Kyung-Ryul Kim, Jong-Yul Chung and Kuh Kim

Spatial and temporal variability of sea surface winds and Ekman pumping retrieved from satellite scatterometer-observed wind vectors over the East Sea

Vera A. Petrova, Alexander D. Nelezin and Alexander N. Manko

Annual variability of the sea surface heat fluxes in the North Pacific

Young-Jae Ro and Yong-Hoon Youn

Data assimilation experiment in the East (Japan) Sea based on POM-ES

Sergey I. Rybalko and George V. Shevchenko

Sea currents variability on the Sakhalin northeastern shelf (instrumental observations)

Nikolay A. Rykov

Variability of water temperature and salinity on the NE Sakhalin shelf in summer 2000-2002

Georgy Shevchenko, Gennady Kantakov and Valery Chastikov

The first ADP current measurements in the area of La Perouse Strait

Moon-Bo Shim, D.K. Lee, J.Y. Park, H.Y. You, J.W. You, S.Y. You and S.B. Oh

A study of sea surface currents of the East Sea using SVP drifter

Seung-Hyun Son, Janet Campbell, Mark Dowell and Sinjae Yoo

Seasonal and interannual variability of satellite measured chlorophyll and temperature in the Yellow and East China Seas

Valery Sosnin, Pavel Tishchenko and Nicole Biebow

Diapycnal entrainment of shelf waters into intermediate depths across the Sakhalin continental slope (Sea of Okhotsk)

Phyllis Stabeno, George Hunt Jr., David Kachel, Carol Ladd, Calvin Mordy and Sigrid Salo

Flow through the Aleutian Passes

Marina M. Subbotina, Richard E. Thomson and Mikhail Anisimov

Simulation of the currents, induced by hydrothermal vent field at Endeavour Ridge

Frank A. Whitney, Kim Conway, Richard Thomson, Vaughn Barrie and Manfred Krautter

Oceanographic habitat of sponge reefs on the western Canadian continental shelf

Ichiro Yasuda and Hiroaki Tatebe

Oyashio southward intrusion, associated cross-gyre transport and the formation of North Pacific Intermediate Water

Workshop W1 (MONITOR)

Examine and critique a North Pacific Ecosystem Status Report

Co-Convenors: Vyacheslav B. Lobanov (Russia), David L. Mackas (Canada), Phillip R. Mundy (U.S.A.), Sei-ichi Saitoh (Japan) and William J. Sydeman (U.S.A.)

Background

An important goal for the “operational” monitoring of the changing ocean conditions is the timely conversion of raw data to scientific and management “decisions”. Many different steps are implicit in this process: (i) compiling and summarizing a diverse suite of variables, measured by multiple data-collectors at multiple locations; (ii) recognizing “local” changes quickly; (iii) making comparisons among variables and among locations for evidence of consistency, spatial extent, and likely ecological impact; (iv) notifying “clients” (including policy makers, resource users, other scientists, and the general public); and (v) possibly triggering alterations in data collection or ecosystem management strategies.

In general, the marine science community lacks both the tools and the habits needed to carry out these steps on a routine basis. As a step toward developing these tools and habits, the MONITOR Task Team convened a workshop to identify what should be addressed in the North Pacific Ecosystem Status Report (NPESR), using relevance to management decisions and relation to other pieces in other areas of the North Pacific as selection criteria. The format was invited cross-disciplinary presentations from each nation or region, followed by plenary and/or breakout discussion of if and how these pieces fit together as a picture of the entire North Pacific. The workshop was primarily seen as an exercise in ‘process’, and was not intended to produce a polished final product. However, the prototype report will be ‘published’ on the PICES web site.

Summary of presentations

The first day of the workshop included:

- Invited presentations on ecosystem status monitoring and assessment efforts carried out by ICES (Brander) and CCAMLR

(Reid). The invited talks stimulated much good discussion of Ecosystem Status Report goals, content, user groups, and logistics. On the topic of ‘standardization of sampling methods’ – both speakers noted that maintaining consistency within time series is usually more important and more feasible than altering ongoing programs to obtain standardization across time series.

- Synopsis of the draft PICES NPESR (Perry). This report will be printed in early 2004 after a final round of revision and review. It will include a summary chapter (Perry), a chapter on large-scale climate indices (Overland), several chapters on regional ecosystems, and chapters on trans-boundary fish stocks. The role of the MONITOR Task Team in this process and in the production of future versions of NPESR was a major topic of the plenary discussion at the end of the workshop (see below).
- Invited and contributed regional reports describing monitoring and status assessment efforts in different parts of the North Pacific (Hidaka, Kantakov, Shevchenko, Tan, Zhu, Mueter, Livingston, McFarlane, Bograd). Several of these were summaries of chapters in the NPESR.

The second day included:

- Discussions of some new monitoring approaches and hypotheses:
 - Proposed workshop on to identify global synchrony of zooplankton variability (Perry);
 - Multi-trophic level monitoring from ships of opportunity: CPR, physical variables, bird/mammal observations (Batten);
 - Ecosystem status information available from data on marine birds and mammals (MBM-AP: Sydeman, Thayer, Kato).
- Presentations on operational oceanography in western Pacific marginal seas: CREAMS (Kim) and NEAR-GOOS (Lobanov):

- Both of these are ongoing programs that are entering a second phase of design and implementation, and both are becoming more cross-disciplinary in focus;
- Notable effort and successes with real-time data transfer and analysis. These can be used as models for other regional monitoring efforts now being developed.
- Extensive plenary discussion of how to produce future editions of NPESR. Topics included NPESR content (what is in the report now, what should be added next time), update interval and format ('as available' on web, ~3-5 year interval as printed document), quality/completeness checks and peer review mechanisms (combination of internal and external), tools for outreach to 'users' and feedback from 'users', and broadening the base of PICES contributors.
- Discussion on the role of MONITOR in NPESR preparation and review. Task Team members agreed that this is important present and future work for MONITOR. Potential actions and activities are:
 - contribute expertise to 'scientific peer review';
 - initiate future NPESR editions (however, this role assumes a 'permanent' mandate for MONITOR, probably extending beyond the duration of the CCCC Program);
 - help future chapter authors find relevant 'data' and 'specialist expertise';
 - contribute to 'outreach' communication.

List of papers

Keith Brander (Invited)

Choosing, presenting and maintaining indicators for marine ecosystem monitoring - Experience from the NE Atlantic

Keith Reid (Invited)

The CCAMLR ecosystem monitoring programme: Application to the management of krill fisheries

R. Ian Perry

The PICES North Pacific Ecosystem Status Report

Kiyotaka Hidaka, Kaoru Nakata and Shin-Ichi Ito

Ecosystem monitoring in the western North Pacific off Japan

Gennady A. Kantakov

SST vs. layer temperature anomaly in the Western Subarctic Pacific: Contradictory or joint monitor tools?

George Shevchenko, Constantine Puzankov and Valery Chastikov

Monitoring of the Tsushima Warm Current in the northern Japan Sea in spring 2003

Jae-Bong Lee, Chang-Ik Zhang and Seok-Gwan Choi

Climate-induced variations in the abundance of fisheries resources and ecosystem structure in Korean waters

Dong-Yong Lee, Gong-Ke Tan, C.S. Kim and J.Y. Han

Approach to the operational ocean observing system in the Yellow Sea through China-Korea bi-lateral cooperation

Ming-Yuan Zhu, Rui-Xiang Li and Bin Xia

Marine ecosystem status in China Seas

Patricia Livingston

Ecosystem status of the Bering Sea

Franz Mueter

The Gulf of Alaska ecosystem: Status and recent trends

Gordon A. McFarlane

State of the ocean off the Pacific coast of Canada in 2002

Steven J. Bograd

A status report of recent environmental and ecosystem trends in the California Current system

R. Ian Perry, Harold P. Batchelder, Sanae Chiba, Edward Durbin, Wulf Greve, David L. Mackas and Hans M. Verheye

Identifying global synchronies in marine zooplankton populations: Issues and opportunities

Sonia Batten, William Y. Sydeman, David Hyrenbach, Ken Morgan, Peggy Yen, Mike Henry and David Welch

Multi-ecosystem sampling in the North Pacific Ocean using the Continuous Plankton Recorder

PICES Advisory Panel on Marine Birds and Mammals

Monitoring marine birds and mammals - summary of activities and MBM workshop discussions

Kuh Kim and Vyacheslav Lobanov

Summaries of CREAMS and NEAR-GOOS programs

Workshop W2 (MBM-AP)

Combining data sets on distributions and diets of marine birds and mammals

Co-Convenors: Hidehiro Kato (Japan) and William J. Sydeman (U.S.A.)

Background

The goal of the workshop was to explore the temporal and spatial patterns of ecosystem covariation, production of lower trophic level prey organisms by biophysical and climate forcing mechanisms, and the response of marine bird and mammal diets to those patterns. We focused on two species of birds (Rhinoceros Auklet, *Cerorhinca monocerata*, and one other) and two species of mammals (Steller sea lions, *Eumetopias jubatus*, and one other) that have representation on both sides of the North Pacific Ocean, and sufficient time series information to facilitate meaningful comparisons, either within or between regions. The workshop was built on previous efforts to examine bird and mammal prey consumption within the PICES region (PICES Sci. Rep. No. 14, 2000). We expected that the direct comparisons of data sets which have been examined in isolation in the past would facilitate the detection of underlying causes for regional differences in ecosystem organization, trophic transfer, and the timing of responses of marine birds and mammals in relation to climate change events. We also hoped that the workshop would provide a forum for discussions with physical, biological and fisheries oceanographers, and would serve to launch future collaborations within the PICES community.

Summary of presentations

The workshop consisted of 6 oral presentations, including 2 talks on marine birds (Rhinoceros Auklet), 3 talks on marine mammals (Steller's sea lion, minke whale and sei whale), and a brief overview of how to investigate predator behavior in the marine environment. A total of 19 people were in attendance.

Watanuki and Deguchi demonstrated that changes in the strength of the warm Tsushima Current affect anchovy biomass and growth and

breeding success of Rhinoceros Auklet in the Japan/East Sea.

Thayer *et al.* reported that Rhinoceros Auklet diet composition reveals spatial and temporal variations in forage fish communities in coastal regions of the North Pacific, some of which appeared to be related to oceanographic regime shifts.

Loughlin reviewed the available information on Steller's sea lion diet from the 1950's to the present in both western and eastern populations, and showed how the diet fluctuates spatially and temporally in the North Pacific Ocean.

Tamura and Kato described changes in common minke whales diet from the 1960's to the present in the western North Pacific, using data collected from the past commercial whalings and research taken under the scientific permit. They revealed a remarkable switching (on decadal scale) in preys that are likely related to regime shifts.

Ohki *et al.* demonstrated associations of sei whales with a region of elevated chlorophyll concentrations in the western North Pacific using remote sensing.

Hunt discussed how foraging seabirds sample the marine environment and highlighted the need for calibration of the marine bird and mammal data with independent measurements of prey availability and distribution.

Presentations and associated discussion revealed the following:

- Diet composition of birds and mammals varies between the western and eastern North Pacific;
- Diet composition of top predators has switched dramatically at decadal levels, probably due to regime shifts;
- Marine birds and mammals, including at

least Rhinoceros Auklet, Steller's sea lion and minke whale, can be used as an ecosystem indicator;

- There is a "hot spot" at about 40°N, 160°E

supported by higher chlorophyll concentration (and probably by other oceanographic factors) where marine birds and mammals are abundant.

List of papers

Yutaka Watanuki and Tomohiro Deguchi

Effect of physical factors and prey availability on diet and chick growth of Rhinoceros Auklet at Teuri Island in Japan/East Sea

Julie Thayer, Leslie Slater, Yutaka Watanuki, Douglas F. Bertram and William J. Sydeman

East, West, North and South: Spatio-temporal variation in the diet and prey characteristics of Rhinoceros Auklets in the North Pacific Ocean

Thomas R. Loughlin

Review of Steller sea lion diet in the eastern and western North Pacific

Tsutomu Tamura and Hidehiro Kato

Long-term changes in food and feeding habits of the common minke whales in the western North Pacific

Sachi Ohki, Sei-Ichi Saitoh, Hiroshi Kiwada and Koji Matsuoka

Relationship between sei whales distribution and the environmental conditions in the western North Pacific using multi-sensor remote sensing

Workshop W3 (WG 15/TCODE)

Harmful algal blooms – harmonization of data

Co-Convenors: Hee-Dong Jeong (Korea) and Vera L. Trainer (U.S.A.)

Background

Our ability to manage the Pacific coastal region seafood harvest is dependent, in part, on our ability to assure the safety of this harvest to human consumers. Our understanding of factors contributing to harmful algal bloom (HAB) events is limited by our access to comparative data from similar coastlines that face the same challenges from harmful biotoxins. A free flow of information to all interested investigators is vital in planning experiments, analyzing data, modeling HABs, and in putting together the broad picture of the relationship between biological, physical and chemical factors that influence the development of blooms in Pacific coastal regions. It is also critical to improve the forecasting of future bloom events and the protection of coastal fisheries in all PICES member countries. However, the historical data sets available for the analysis of coastal HAB events are widely dispersed among the various agencies responsible for monitoring biotoxin events. These data exist in various degrees of processing, quality assurance, and public availability, and much of the available data (*e.g.*

on phytoplankton assemblage characteristics) are in forms that are difficult to use. The goals of this workshop were (1) to look at and discuss the interest of PICES member countries in the establishment of a common database; and (2) to examine mechanisms for the integration of the ICES and PICES harmful algal bloom databases.

Summary of presentations and discussion

The workshop was held on October 10-11, 2004, in conjunction with PICES XII. After welcoming 18 participants (an additional 6-8 people also attended during various times), the convenors stated the goals of the workshop that included determining how harmful algal bloom and red tide data could be shared among PICES member countries. The agenda included 11 presentations.

Henrik Enevoldsen spoke first and discussed the IOC/ICES database for the North Atlantic, called the Harmful Algae Events Database or HAE-DAT. The main purpose of creating HAE-DAT is to develop an international structure for data storage that allows easy integration of data,

efficient search tools, and the possibility of conducting data analysis. This database does not share raw data and only includes harmful events that cause economic loss and human illness. Problems that must be overcome in a harmful algae database comprise: (1) some events are very difficult to compile in a common database; (2) some data are not accessible to the public; (3) data types are sometimes not comparable; and (4) compilation of the database is very resource intensive. HAE-DAT has been available since October 1999 and includes 1109 reports. The ambition is that HAE-DAT will eventually become a global database and will incorporate information on North America and Europe (including the Mediterranean Sea region), IOC ANCA (Caribbean), IOC FANCSA (South America), the North Africa network, and PICES, thereby establishing a world-wide system for sharing biological data.

HAE-DAT currently runs under the MS Access 97 programming routine (scheduled for replacement in the near future) and includes the general (location and date, microalgae type, environment and harmful effects) and complementary information about harmful algal blooms. HAE-DAT maps of HAB occurrences are not yet linked automatically to the database, although this is anticipated to occur next year. Decadal maps are prepared by IFREMER in France. The information plotted includes the presence of toxins or observations of mortalities (regardless of levels of toxicity). Blooms of potentially toxic species have been omitted. In the future, ICES delegates will divide their countries into HAE regions to overcome data sensitivity issues.

Nicolaus Adams spoke about the availability of harmful algal bloom data on the west coast of the United States and the formation of a regional HAB database. He focused on shellfish monitoring efforts in Alaska, Washington, Oregon, and California along with ancillary data that are being collected as part of routine monitoring programs. Initially, he compared and contrasted the HAB monitoring programs that occur in each west coast state. All of the west coast states have some sort of shellfish monitoring program that involves the testing for

Paralytic Shellfish Poison Toxins (PSP) and Domoic acid (DA). Each of the states adopted the testing for DA after the events that occurred on the west coast in 1991. Some of the differences included the species that were tested. For example, there is no good sentinel species for DA in California, whereas in Washington the razor clam is used as the test species for DA as blue mussels do not retain DA for very long.

Next, the HAB data availability in each state, starting with Alaska and progressing southward state-by-state, was discussed. The shellfish toxin data are mainly collected by departments in each state's government that are tasked with protecting public health.

In Alaska, the bulk of the available data are PSP in shellfish data, there are some data available for DA as well.

Washington State was discussed in more depth than the other states. In Washington, there is a long record of PSP data as well as a good dataset for DA starting in 1991. The Washington State Department of Health monitors all commercial and recreational harvesting areas as well as a network of >70 sentinel mussel cages throughout Washington State. There is no phytoplankton monitoring program that is run in conjunction with the shellfish testing program. However, there is a separate monitoring program on the Pacific coast of Washington, coordinated by the Marine Biotoxin Program of NOAA Fisheries that includes phytoplankton monitoring at 10 beach sites as well as DA analysis of the particulate fraction of seawater at 4 beach sites. Additionally, phytoplankton data have been collected at various sites in Washington State for many years by Dr. Rita Horner. There have been numerous ship-of-opportunity cruises from which data have been collected (*e.g.* oceanographic, phytoplankton, DA) by the Marine Biotoxin Program.

Most of the shellfish testing in Oregon centers around the oyster industry, although other species are routinely tested for PSP and DA. Within the last 6 months, a phytoplankton monitoring and DA analysis of seawater has

commenced at razor clam harvesting areas on the northern coast of Oregon State.

In addition to PSP and DA testing, California has a program that monitors the phytoplankton for harmful species. There is a network of >45 volunteers that collect samples along the entire coast of California. A core group of these volunteers performs the identifications and reports the data to the California Department of Health Services. These are qualitative data and are reported on a relative abundance scale.

There are some coast-wide HAB data that are available in addition to data from each individual state. These data comprise standard oceanographic measurements, nutrients, DA in the particulate fraction of seawater, and phytoplankton cell counts.

Shellfish toxin data in electronic format are available: from 1989-present for Alaska, 1957-present for Washington, 1997-present (most likely includes older data as well) for Oregon. California's data are in a separate database so the information has not been received yet. Data prior to 1989 and 1957 for Alaska and Washington, respectively, are available only in hardcopy format. The hardcopy data are currently being digitized for entry into a database. All of the ship-of opportunity data collected by the Marine Biotoxin Program in Seattle are in electronic format, as are the data they have collected at the beach sites. Beach monitoring data and regional HAB project data from other states are in separate databases. There are also data stored on obsolete electronic media (*e.g.* magnetic tape) that are being recovered. Some problems and successes with sharing of these data were discussed and further work needed to streamline the database was outlined. The database initially started utilizing shellfish toxin data but now is expanding to include the other data types listed above.

Robin Brown gave a presentation of data prepared by Max Taylor and Ian Whyte on Canada's HABs. Canada's data are highly site specific and therefore aggregation may be confusing. Monitoring for PSP and ASP is done by a Federal agency (Canadian Food Inspection

Agency). Data are heavily biased to southern British Columbia where most people live and sites are easier to access for monitoring. For the most part, mussels are monitored as a sentinel species using standard methods. No phytoplankton monitoring takes place as part of routine sampling. What we know about HABs in Canada is that (1) there is inter-annual variability, and small scale variability – linked to local mixing and exchange; (2) exposed areas are less susceptible than sheltered areas; and (3) fish killing algae are not a high priority. Nicky Haigh from the Pacific Biological Station has a program on phytoplankton monitoring (called HAMP) that focuses on HABs that do not affect people, rather, done at and for fish farms. Participants and locations of farms change every year. Sampling includes phytoplankton (HAB species), nutrients, and some environmental data in order to provide early warning. Using this system, fish farmers can warn their neighbors of *Heterosigma*, *Chaetocers*, *Cochlodinium*, etc. blooms. Concerns that Canada has regarding a global HAB database include: (1) the security and preservation of older data, especially inspection data; (2) proprietary nature of industry data; (3) Canadian data are listed as occurrences and do not focus on commercial impact; (4) cooperation from investigators is a concern; and (5) support is required for a database effort.

Tatiana Orlova spoke about HABs on the Russia east coast. In that region, there are active fisheries contributing over 80% of the total Russian production. About 6 million people live in this region and it remains largely unpopulated, that is why there is no shellfish monitoring program. Scallop culture in Primorye was exhausted due to poaching. In 1971 there was the first scallop culture in Russia. The number of scallop farms increased from 3 (1980) to 20 (2000). HABs data in coastal waters of Primorye are available from 1980-2003. Each year there have been observations of recurrent blooms of nontoxic species, including *Skeletonema*, *Chaetocerus*, and others. Sampling has begun for *Alexandrium* and *Pseudo-nitzschia*. A *P. multiseries* isolated from eastern Russian waters was tested for toxicity by S. Bates, and a level of

180 ng/ml was measured. A recommendation was made for a shellfish testing program in Russia to the Academy of Science.

Paul Harrison reported about HABs in Hong Kong. There, phytoplankton monitoring is done rather than measurement of shellfish toxicity. In Hong Kong, “red tide” means colored water. In this region there are more fish kills than shellfish toxicity. Fish kills are largely due to oxygen problems. Hong Kong is at the end of the Pearl River basin (13th largest river in the world). A large sediment load comes out of the river. The Hong Kong government samples a fairly small area, but coverage is adequate to determine spatial and temporal variability. Upwelled water from the South China Sea is low in oxygen, and does not bring in high nutrients. The agencies involved in monitoring are:

- 1) Agriculture, Fisheries and Conservation (AFCD) - does phytoplankton monitoring and is charged with red tide management in fish culture zones;
- 2) Environmental Protection Department (EPD) - performs widespread monitoring of 94 stations in 10 water quality zones.

Ming-Yuan Zhu reported on HAB monitoring in China. There has been an increase in red tide occurrence since 1980. The three areas with frequent HABs are the Bohai Sea, the East China Sea, and the coast water of Guangdong. A new research project called CEOHAB (China Ecology and Oceanography of Harmful Algal Blooms) has the following objectives: (1) to measure the distribution and diversity patterns of key species; (2) to measure nutrients and HABs; (3) to look at key physical, biological and chemical environmental factors; and (4) monitoring, harmfulness and control. The ultimate goal for CEOHAB is to obtain some predictive capabilities for HABs. This project hopes to become part of the GEOHAB program. The body of the project is 5 research cruises every year. The data management system in China can be seen on www.china-hab.ac.cn, which includes mainly cruise data.

Yasuwo Fukuyo reported on HAB databases in Japan. He stated that the difficulty in “data harmonization” comes from the nature of HAB

monitoring and management in Japan, in that there are too much data on red tides and toxic contamination. All reports are written in Japanese. Translation is not possible due to budget limitations (cost vs. benefit). At present, Japan thinks that it is impossible to input Japanese data into a PICES database.

Monitoring in Japan consists of: (1) red tides (routine monitoring and emergency monitoring); (2) toxic plankton blooms (monitoring of shellfish); and (3) monitoring by research organizations – plankton, shellfish toxicity and/or oceanographic data. Several prefectures have monitoring programs (mostly in the south). Dr. Fukuyo questioned whether all Japan’s data should be input into the database? Who will do the work? What budget will be used? He remarked that most of the data are not properly published. In Japan, about 10% of the red tides are harmful. Others are harmless to fisheries industry. There are more than 80 different red tide species. In red tide cases there are: (1) high vs. smaller cell numbers, (2) large vs. small areas are affected, and (3) different durations of events ranging from 1 day to three months. These data are available at the website of the Fisheries Agency and local governments. The cautionary cell number vs. “alarm” cell number is different for each species. Red tide monitoring (cells) vs. toxin monitoring (DSP and PSP) must be considered. Domoic acid monitoring in seafood and seawater was done for 3 years. No domoic acid was seen, and so monitoring was stopped. Decadal maps of DSP and PSP in Japan are available.

Keiko Ide described the NOWPAP Data Action Plan for the Northwest Pacific. The area of NOWPAP interest includes the Japan/East Sea and the Yellow Sea. NOWPAP is a database and information management system, survey of monitoring programs, and a tool for cooperation, networking, increasing public awareness, and assessment of land-based activities. NOWPAP will develop tools for environmental assessment that can be used and shared among member countries. NOWPAP’s WG-3 on *Harmful Algal Blooms* (under CEARAC in Japan) will discuss coastal environmental assessment and evaluate the state of HABs in the NOWPAP region. This

WG will provide policy makers with information and establish collaborative monitoring programs. Their first meeting will be held at the end of October 2003. The NOWPAP data-related goals include: (1) to collect, analyze and provide data and (2) to establish a database. NOWPAP will use secondary data including papers and published literature for their database.

Hak-Gyoon Kim described HABs in Korea. Recently, fish-killing *Cochlodinium* has been a big problem. Types of data in Korea include cruises, coastal patrol, and aircraft that monitor the coast on a daily, weekly, and monthly basis. Both red tides and shellfish poisoning (ASP, DSP, PSP) are documented, as well as data on environmental quality and ocean dynamics. Routine monitoring is done from February through November at 77 stations. Fish-killing (red tide) monitoring takes place in June, July (weekly), and August through September (daily). The following agencies are involved in monitoring: NFRDI has research vessels, MOMAF assists with onshore watch and vessels, and NMFA has helicopters that assist with daily monitoring.

A hands-on demonstration of data visualization using Surfer was given by Nicolaus Adams. About 8 participants followed the demonstration by plotting data on their own computers.

The final presentation was on objectives and status of the GEOHAB Program by Henrik Enevoldsen.

The following problems with data sharing were identified during the presentations and the discussion that followed:

- Data are collected by managers and are not always accessible to researchers;
- Different countries have definitions of what constitutes a harmful algal bloom (*e.g.*, in China and Japan, “red tides” are defined as those algal blooms that attain sufficient densities to discolor water, but do not necessarily produce a toxin, while in Canada and the United States these algal blooms are not normally considered harmful);

- Different toxins are monitored in different countries (*e.g.*, whereas both DSP and PSP toxins are routinely monitored in Japan, in Canada or the western United States shellfish are only monitored for PSP and ASP toxins);
- Data are not always GIS-referenced, rather, shellfish closures are recorded for a region, not for a specific site;
- Shellfish monitoring is intense in some countries, but not in others (*e.g.*, in Russia, although HAB species are identified, there is currently no routine monitoring of toxins);
- Data are site specific (*e.g.*, most shellfish monitoring in western Canada occurs in the southern regions where commercial shellfish and fish farms are concentrated); and
- Data available from offshore research cruises indicating high toxin concentrations or elevated cell abundance estimates may not result in any significant coastal impact. Should such data be included in an “events” database?

All PICES member countries unanimously decided to adopt the IOC/ICES database for a one-year trial period. This database will now be called the HAE-DAT joint database to reflect the fact that PICES is actively using it. It was agreed that:

- Each country will enter one year’s HAB data in the database using a year of their choice;
- Each country will decide which data to enter, or in other words, will decide what constitutes a “problem” HAB in their country;
- Each country will define “regions” for their data entry that could include exact locations or more general areas (*e.g.* prefectures in Japan). This will allow issues of data sensitivity to be overcome;
- Each country will decide on a point person to oversee data entry into HAE-DAT during the next year; and
- For the next PICES Annual Meeting (October 2004, Honolulu, U.S.A.), each country will complete a “report card” describing what worked within the database, types of data that were difficult to deliver

(data access issues, etc.), and the overall usefulness of the database.

The following offered to be contact point people for data entry using HAE-DAT in their country:

- Canada, to be determined
- Japan, Ichiro Imai
- China, Ming-Yuan Zhu
- Korea, Hak-Gyoon Kim & Chang-Kyu Lee
- Russia, Tatiana Orlova
- USA, Vera Trainer & William Cochlan

In addition, contact will be made with Mexico to determine whether they would like to participate in this exercise.

List of papers

Henrik O. Enevoldsen and Monica Lion

The harmful algal event meta-data base HAE-DAT

Nicolaus G. Adams, Vera L. Trainer

A harmful algal bloom database for the US West Coast

Robin Brown (for F.J.R. Max Taylor and Ian Whyte)

HABs and shellfish toxicity monitoring and data in British Columbia, Canada

Tatiana Y. Orlova

Harmful algae from the Russian Pacific coast

Paul J. Harrison

HAB data in Hong Kong

Tian Yan and Ming-Jiang Zhou (presented by Ming-Yuan Zhu)

Introduction of HAB data in China (W3-1172)

Yasuwo Fukuyo, Satoru Toda, Shigeru Itakura, Ichiro Imai and Masaaki Kodama

HAB data management in Japan and inherent difficulty in joining PICES database

Keiko Ide

NOWPAP and developing a new database of red tides and related science based on secondary data

Hak-Gyoon Kim, Young-Shil Kang, Kui-Young Kim, Chang-Kyu Lee, Wol-Ae Lim, Sook-Yang Kim, Tae-Seek Lee, Ji-Hoe Kim, Jong-Su Park and Hee-Dong Jeong

HABs data collection and management in Korea

VIDEO PRESENTATION: Nicolaus G. Adams

Data visualization using Surfer

Donald M. Anderson, Patrick Gentien, Grant Pitcher and Henrik O. Enevoldsen

GEOHAB

Workshop W4 (MIE-AP)

Planning a micronekton sampling gear intercalibration experiment

Co-Convenors: Michael P. Seki (U.S.A.) and Evgeny Pakhomov (Canada)

Background

While a number of gears are presently being used to sample micronekton in the North Pacific and other parts of the world's oceans, there has been little effort expended in comparing the

The workshop participants unanimously recommended to convene a 1-day follow-up workshop on "Developing a North Pacific HAB data resource" at PICES XIII in Honolulu (see *MEQ Endnote 9* for description), and have determined that IOC involvement will be essential.

It was also recommended that the possibility of NOWPAP acting in some way as a data manager for Western Pacific countries be considered at the upcoming meeting of the NOWPAP Working Group 3 on *Harmful Algal Blooms*. At this meeting, the state of HABs in NOWPAP region will be discussed.

relative sampling efficiency and selectivity of these gears. At the recommendation of PICES Working Group 14 on *Effective sampling of micronekton*, a new PICES field effort to evaluate the efficacy of sampling gear and procedures employed by different agencies to

sample micronekton in the North Pacific was launched, the *Micronekton sampling gear Intercalibration Experiment* (MIE). This ½-day workshop of the MIE-Advisory Panel (MIE-AP) overseeing the field program was convened to discuss the goals, objectives, and status of the experiment, and begin the formal organization

and planning process for the experiment. No formal presentations were scheduled or made at the workshop, other than a short presentation on the facilities and capabilities of the research vessel for the initial phase of the experiment. A detailed discussion can be found in the report of the MIE-AP (see *BIO Endnote 4*).

Workshop W5 (BASS)

Linkages between open and coastal systems

Co-Convenors: Vladimir Belyaev (Russia), Gordon A. McFarlane (Canada) and Akihiko Yatsu (Japan)

Background

Recent BASS/MODEL workshops synthesized data and examined trophic relationships in the eastern and western subarctic gyres. These workshops facilitated our understanding of how these systems respond to natural and anthropogenic change. Participants at these workshops suggested the next phase of this work, from the standpoint of understanding the gyres, would integrate coastal, marginal seas and boundary current dynamics and linkages between gyres. To begin the process, this workshop was proposed to examine current information of the oceanographic and biological linkages between open ocean and coastal systems in the North Pacific Ocean.

Summary of presentations

In general, the oceanography and ecology of the subarctic Pacific gyres and Transition Zone (TZ) are poorly understood relative to coastal areas. Yet it is known that these gyres and TZ areas are extremely productive as evidenced by their abundance of fish, birds and mammals. Up to now, there has been little effort directed at understanding the relationships between these open ocean areas and coastal ecosystems. This workshop brought together physical, biological and fisheries oceanographers, as well as marine bird and mammal researchers to begin to remedy this.

The workshop consisted of 15 oral presentations prepared by “teams” of invited investigators, and 5 posters. Presenters reviewed existing data, and

developed hypotheses for mechanisms that link open ocean and coastal systems. Presentations examined the physical oceanography of the western (Watanabe, Shin *et al.*, Gayko) and eastern (Ladd *et al.*) areas, primary (Tadokoro and Kobari, Whitney *et al.*) and secondary (Naydenko, Mackas and Coyle) productivity in both areas; mesopelagics (Yamamura *et al.*, King *et al.*); migratory pelagics (Yatsu and Kaeriyama, Beamish *et al.*, Belyaev); marine birds (Hunt *et al.*) and marine mammals (Ohki *et al.*, Ream *et al.*) or a combination of a number of disciplines (Sugimoto *et al.*, Aydin *et al.*, Bosley *et al.*, Kaneda *et al.*).

These presenters showed many instances of complex ecosystem linkages between the coastal and open ocean, but identified gaps in our knowledge which must be addressed in order to improve our understandings of these relationships. For example, the role of the gyres in controlling (maintaining, enhancing) productivity in the North Pacific, as well as how the systems may respond to climate forcing.

Some key issues raised during the sessions:

- A number of possible physical oceanographic mechanisms of variability was presented, which are most important in terms of linkages. What is the influence of large-scale forcing on local dynamics (fronts and currents)? What is the importance of the transfer of water masses (eddies), fresh water forcing and upwelling and downwelling?
- What are the key species at each trophic level? Do we have the minimum data, basic

biological parameters, fisheries statistics? What are the biological mechanisms for the transfer of energy, and which are most important? For example, is it the migration of forage fishes between areas (myctophids, saury, sardine, *etc.*) or is it through predation-related mechanisms (tunas, mammals, birds, *etc.*)?

- Are some areas more closely linked than others? For example, Gulf of Alaska, Oyashio/Kuroshio, Western Subarctic Gyre?

- In general, are physical linkages or biological linkages more critical, or combinations of a number of ecosystem levels?
- How do these linkages between systems change in relation to climate changes?

Selected papers from the workshop will be published in a special issue of *Deep-Sea Research II*.

List of papers

Oral presentations:

Tomowo Watanabe (Invited)

Structure and variability of the upper layer of the Western Subarctic Gyre

Hyo Choi

Wind-induced variability of sea surface temperature patterns in the eastern coast and open sea of Korea

Carol Ladd, Phyllis Stabeno, Nicholas Bond, Al Hermann, Nancy Kachel and Calvin Mordy (Invited)

Cross-shelf exchange in the Gulf of Alaska

Kazuaki Tadokoro and Toru Kobari (Invited)

Comparison of seasonal variations in Chlorophyll-a concentrations and oceanographic conditions between Oyashio and Ocean Weather Station P

Frank A. Whitney, P.J. Harrison and W.R. Crawford (Invited)

Enhancement of primary productivity in the Gulf of Alaska by transport between coastal and oceanic regions

Svetlana V. Naydenko (Invited)

Structure of zooplankton communities in the Russian Far Eastern region (Okhotsk and Bering Seas, and Pacific waters south off Kuril Islands)

David L. Mackas and Kenneth O. Coyle (Invited)

Cross-shore exchange processes, and their effect on zooplankton biomass and community composition patterns in the Northeast Pacific

Orio Yamamura, Kazuhisa Uchikawa, Masatoshi Moku and Hiroya Sugisaki (Invited)

Myctophids in the neritic and offshore areas of the subarctic North Pacific

Jacquelynne R. King, Richard J. Beamish and Gordon A. McFarlane (Invited)

How do myctophids get from the Eastern Subarctic Gyre to the coastal ecosystems of the Northeast Pacific?

Akihiko Yatsu and Masahide Kaeriyama (Invited)

Linkages between coastal and open ocean habitats of chum salmon and small pelagic fishes in the Northwestern and Central Pacific

Richard J. Beamish, Gordon A. McFarlane and Jacquelynne R. King (Invited)

Linkages between open and coastal ecosystems on the Pacific coast of North America

Takashige Sugimoto, Jun-Ichi Takeuchi and Takafumi Yoshida (Invited)

Processes of water exchange between coastal and open oceans, and their effects on plankton community and fish recruitment

Vladimir A. Belyaev (Invited)

Pelagic fishes of the Northwest Pacific and relationship between coastal and open ocean ecosystems

George L. Hunt, Jr., John Piatt and Leandra de Sousa (Invited)

The use and transfer of energy by marine birds in the Gulf of Alaska

Sachi Ohki, S.I. Saitoh, H. Kiwada and K. Matsuoka (Invited)

Variability of coastal and open ocean habitats of Sei whales in the western North Pacific using multi-sensor remote sensing

Rolf Ream, Jeremy Sterling and Tom Loughlin (Invited)

Oceanographic influences on Northern Fur Seal migratory movements

Posters:

Kerim Y. Aydin, Gordon A. McFarlane, Jacquelynne R. King, Bernard A. Megrey, and Sarah K. Gaichas

Linking subarctic shelf and oceanic food webs through fluctuations in Pacific salmon production

Keith L. Bosley, J. William Lavelle, Richard D. Brodeur, W. Waldo Wakefield, Robert L. Emmett, Edward T. Baker, and Kara M. Rehmke

Biological and physical processes in and around Astoria Submarine Canyon, Oregon, USA

Larissa A. Gayko

Cyclicity of long-term fluctuation of hydrometeorological parameters in the northwestern part of the Sea of Japan

Atsushi Kaneda, Taisuke Inai and Hidetaka Takeoka

Influence of the cross-shelf flows on the catches of the pelagic fishes in the Bungo Channel, Japan

Kyung-Hoon Shin, Tomoyuki Tanaka, Noriyuki Tanaka and Akihiko Murata

Linkage between coastal and shelf system in the western Arctic Ocean

Workshop W6

Status of the Yellow Sea and East China Sea ecosystems

Co-Convenors: Sinjae Yoo and Hyung-Tack Huh (Korea); R. Ian Perry and Stewart M. McKinnell (PICES)

Background

The Yellow Sea and East China Sea (YS-ECS) are epi-continental seas bounded by the Korean Peninsula, mainland China, Taiwan, and some Japanese islands (Ryukyu and Kyushu). Presumably, the YS-ECS ecosystems, with a dense population living along the coasts, are amongst the ecosystems in the Pacific, that are under the strongest influence of various human activities such as fishing, mariculture, waste discharge, dumping, and habitat destruction. There has also been strong evidence showing a gradual increase in water temperature in the past decades. Given the variety of forcing factors, complicated changes in the ecosystem are anticipated. Indeed, rapid changes and large fluctuations in species composition and abundance in the major fisheries have occurred. In this respect, it was timely that the YS-ECS ecosystem status was evaluated as a part of the PICES and Census of Marine Life (CoML) efforts of status assessment of the North Pacific Ecosystems. A workshop for this purpose was scheduled in April 2003 to gather scientists who have been working in this region, and to discuss and summarize what they learned about the YS-ECS ecosystems during the past. Many scientists expressed interests in participating the workshop. However, the workshop was postponed twice due to the outbreak of SARS in the spring of 2003. The workshop was finally held October 9, 2003, immediately prior to PICES XII. A draft chapter on the status of YS-ECS ecosystems for the PICES North Pacific

Ecosystem Status Report was written before the workshop based on the contributions by Drs. Hiroshi Ichikawa, Xian-Shi Jin, Young-Shil Kang, Suam Kim, Jai-Ho Oh, Sinjae Yoo, and Chang-Ik Zhang, instead of writing the draft after the workshop as was originally planned. The workshop was focused on the discussion of the draft.

Summary of presentations

About twenty scientists from all PICES member countries participated in the workshop. Dr. Ian Perry gave a general introduction to the NPESR project. The objectives, structure and target audience of the report were briefly explained.

Dr. Sinjae Yoo presented the outline of the draft for the YS-ECS chapter. First, geography, topography, circulation, flora and fauna of the region were described as background information. Next, potential critical factors causing change in the YS-ECS ecosystems were identified: environmental contamination, eutrophication, habitat destruction, over-exploitation, and changes in the circulation. In addition to climate-related changes in the circulation, the building of the Three-Gorges Dam in the upper reaches of the Changjiang River could bring changes to the ecosystem. Possible adverse effects were pointed out, such as a decrease in the primary productivity in the vicinity and reduced flushing in the YS. Then, details were described for physics, climate and chemistry of the region. There has been an

increase of 1.8°C in the water temperature in February in the seas around Korea during the past one hundred years. The rate of change became greater during the past decade. The nutrient loads into the sea have more than doubled during the last two decades. Data of heavy metals, PCBs, PAHs, and other persistent organic pollutants were shown. Phytoplankton species composition and primary productivity of the region were discussed next. There seem to be still uncertainties in the primary production estimates for both the YS and ECS. It seems interesting that the biomass of both phytoplankton and zooplankton increased in the YS since the late 1980's. Another sign of ecosystem change is the abrupt increase in HAB incidences in Chinese and Korean waters, causing huge economic damages. Concurrently with the changes in the physics, chemistry and lower trophic level, there have been dramatic changes in the higher trophic level in the YS and ECS as evidenced by fisheries data in the past three decades. Such changes can be summarized as follows. First, declines in biomass and catch of demersal species have occurred, and as a result, in catch proportions, pelagics have increased, while demersals have decreased. Second, the catch of pelagics species showed large fluctuations. Third, the average trophic level of fishery catches has gradually decreased, more rapidly in the YS than in the ECS. Following fisheries data, a brief description was made on the endangered species in the YS.

After the presentation of the draft outline, talks were given for each area ranging from climate and physics to fisheries. Dr. Jai-Ho Oh reported on long-term changes in the air temperature in Korean cities. He showed that there has been an increase of 0.11~0.23°C/decade since the 1910's in eight cities. The number of summer days increased by 22, while the number of winter days decreased by 27 days, showing a clear trend of warming. He also presented projections of future acceleration in the temperature rise using the regional climate MM5 model.

The next two presentations were on physical oceanography of the region by Drs. Heung-Jae Lie and Hiroshi Ichikawa. Dr. Lie discussed the origins of the Jeju Warm Current and Tsushima

Warm Current, and seasonality of the coastal currents. Using drifter data, he showed that the Tsushima Current branches from Kuroshio along the shelf edge of the ECS. In the YS, strong cyclonic circulation develops along the coasts in summer, while in winter southward currents develop along both Chinese and Korean coasts. Dr. Ichikawa summarized the general characteristics and forcing of the regional currents. His talk focused on the inter-annual variation in the Changjiang River discharge and its influence on the oceanographic properties in the vicinity. Classification analysis of water masses in the ECS using T, S, nutrients and chlorophyll-*a* was also presented.

After presentations on physics and climate in the morning session, talks on chemistry and biology followed in the afternoon. Dr. Jae-Ryoung Oh showed results of the pollution surveys in the YS in 2000. Heavy metals and organochlorine compounds, including pesticides, PCBs and PAHs, were analyzed from samples of sediments, tissues and liver of fish. Except for a few hotspots, in most of the samples, the level of these pollutants was below the known safe values. However, there are no criteria for safety for some chemical species, and continued monitoring is necessary.

Dr. Xian-Shi Jin presented Chinese records of dominant species of phytoplankton, zooplankton, and major fisheries species in the YS, ECS and Bohai Sea. The trend of major fisheries species composition paralleled what was observed in the Korean waters, *e.g.*, pelagics increased while demersal decreased. As an example of large fluctuations in the pelagics, he described the case of Japanese anchovy (*Engraulis japonicus*) which collapsed in the early 2000's. In contrast to the Korean records that showed a doubling trend in the zooplankton biomass in the YS since the late 1980's, the zooplankton biomass in the Chinese side decreased during the same period.

Dr. Ming-Yuan Zhu presented the recent trend in HAB outbreaks in the ECS. The most frequent time of the outbreaks was from May to June. There was a dramatic increase in the reported HAB outbreaks since 2001, partly due

to intensified monitoring activities. He also reported on oceanographic conditions of the outbreaks in 2002. In 2002, 79 events were reported, 55 of which occurred in the ECS and 4 occurred in the YS. It was suggested that changes in the N/P ratio might be important in the HAB outbreaks.

Investigation, using satellite data, on whether there have been real changes in the YS ecosystem over the past two decades was the topic of the next presentation by Seung-Hyun Son. He compared data of two ocean color sensors CZCS (Coastal Zone Color Scanner: 1978~1986) and SeaWiFS (Sea-viewing Wide Field-of-view Sensor: 1997~present). On the average, higher chlorophyll values were seen in SeaWiFS data. Likewise, water-leaving radiance decreased at 443 nm and increased at 555 nm. The *in-situ* data showed less evidence of decadal trends, but there were slight increases in temperature and zooplankton biomass, and slight decreases in salinity and Secchi depth.

Dr. Bernard Megrey gave a brief introduction to the North Pacific Ecosystem Metadatabase promoted by NOAA. He demonstrated the metadatabase web page and asked the audience for future participation.

The following discussion focused on how to improve the draft of the YS-ECS chapter. The main question was "What is missing and whether such information is available?". A number of items were listed, including alien

species, parasites, disease, and bacterioplankton. Data might be available for these items but are too scanty to be representative values. There are some items such as benthos with good data coverage, and certainly should be incorporated in the draft. Also, the distribution and productivity of commercial invertebrates, and the impact of aquaculture on natural communities would be valuable information for assessing the ecosystem status. Fish catch data in China as well as in Korea in the draft need to be updated, as some pelagic fishes show high frequency fluctuation. In addition to the missing data, discrepancies were found between datasets. For example, the zooplankton biomass in Korean waters in the YS increased since the late 1980's, while that in Chinese waters decreased in the same period. Sampling details should be compared to interpret such discrepancy. This illustrates the need for comparable sampling methods and gear in the future. There were different views about the impact of the Three-Gorges Dam on the YS-ECS ecosystems: some think the impact would be substantial, while others believe not. But most participants agreed on the need to monitor the future change. Then there was a suggestion that a PICES Working Group might be needed for this interesting semi-natural macrocosm experiment. The YS and ECS are the ecosystems where you can find complicated action of multiple forcing factors. Will we ever be able to understand what factors contribute, and how much, to the ecosystem change we observe?

List of papers

Oral presentations:

Sinjae Yoo and Suam Kim

North Pacific Ecosystem Status Report: Yellow Sea and East China Sea

Jai-Ho Oh

Climate Changes in Northeast Asia

Heung-Jae Lie, Cheol-Ho Cho and Suk Lee

An overview of shelf circulation of the Yellow and East China Seas

Hiroshi Ichikawa

Recent developments in the study of the current system in the Yellow and East China Seas

Xian-Shi Jin

Brief review of variability and status of the Yellow and East China Sea Ecosystem

Ming-Yuan Zhu

Occurrence of HAB in China in 2002

Bernard Megrey

North Pacific Ecosystem Metadatabase: A collaborative research tool for fisheries oceanography and ecosystem investigations