

SUMMARY OF SCIENTIFIC SESSIONS AND WORKSHOPS



Science Board Symposium (S1)

Mechanism of climate and human impacts on ecosystems in marginal seas and shelf regions

Co-Convenors: Kuh Kim (SB), Michael J. Dagg (BIO), Yukimasa Ishida (FIS), John E. Stein (MEQ), Michael G. Foreman (POC), Igor I. Shevchenko (TCODE), Jeffrey M. Napp (MONITOR), and Harold P. Batchelder and Suam Kim (CCCC)

Background

There are many examples of statistical correlations that demonstrate relations between climate or human impacts and ecosystems. While retrospection may be informative in revealing patterns, it rarely leads to mechanistic understanding required for eventual prediction. This session, instead, will focus on physical and biological mechanisms in the marginal seas and shelf regions. Many coastal species have life histories/cycles that rely on specific geographic features, and they may be particularly vulnerable to the effects of human activities and climate variability. In order to predict the impacts of climate and human activities, we need to understand the mechanisms responsible for shifts in ecosystem structure and function. We will consider “wind to whales” in this session. This theme was designed to provide opportunities to address questions such as: How widespread is bottom-up control of fluxes? At what spatial and temporal scales are: 1) trophodynamic demands and food supply in balance? 2) signals amplified in food webs? and 3) physical processes most important in impacting marine populations? The human impacts that could be considered include fishing and fisheries enhancement, changes in biodiversity, petroleum development, eutrophication, mariculture, non-point source pollution, and others.

Summary of presentations

The session consisted of 3 invited talks, presented by Sok Kuh Kang, Franz Mueter, Tetsuo Yanagi, 8 contributed oral presentations plus 12 posters. As diverse topics were

addressed across the North Pacific by these papers, these presentations are summarized geographically, from western to eastern regions. Along the Primorye coast, rapid changes occurred in physical and biological fields during the transitional period of monsoon winds in September and October, associated with coastal upwelling and the beginning of sea surface cooling and convection. In this region, stratification developed in spring due to meltwater advected from Tatarsky Strait, resulting in spring blooms that occurred earlier in the year than most areas of the Japan/East Sea. The bloom might be delayed by strong winds in some years. Seasonal variation of mixed layer depth and surface chlorophyll distribution and the long-term change of sea level in the Japan/East Sea were also discussed. Harmful algal blooms in Osaka Bay, Japan were dominated by non-diatoms in the early 1990s, but diatoms dominated in late 1990s. An ecosystem model that included nitrogen, phosphorus and silicate cycling explains this remarkable change. Comparison of growth patterns of Japanese chum salmon in the Okhotsk Sea and Bering Sea indicates that the life history strategy of Pacific salmon offers a useful framework for evaluating not only inter- and intra-specific interactions, but also climate-related risk factors around the North Pacific. The partial pressure of CO₂ in the surface water measured during the 1st and 2nd Chinese National Arctic Research Expeditions during the summers of 1999 and 2003, show sharp fluctuations on the Chukchi Sea continental shelf, which can be traced to inflows from the Bering Abyssal Plain and the Alaska Coastal Current as well as local effects such as absorption of atmospheric CO₂ in summer, rapid ice melting, high primary

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production in the continental shelf and marginal ice zone, and the transformed water from the Bering Sea. The Fishery Interaction Team at the Alaska Fisheries Science Center investigated whether fishing affects prey fields. They focused on Pacific cod, Atka mackerel and walleye pollock and found that fish movement plays an important role in determining the potential for commercial fishing to cause localized depletions of fish. It is also key to assess the efficacy of trawl exclusion zones for maintaining local concentrations of fish for foraging sea lions. Comprehensive data from mesoscale mapping cruises in the northern

California Current System show profound influence of flow-topography interactions and its year-to-year modulation by large-scale climate variability on the local ecosystem, from creation of nearshore hypoxic zones to increased frontal habitat. The northern California Current ecosystem in 2004 and 2005 closely resembled what might be expected during a major El Niño: warm water copepod species were abundant. Yet conditions in the tropical Pacific were El Niño-neutral so there is a clear need to find new terminology for a warm California Current under “El Niño-like conditions”.

List of papers

Oral presentations

Franz J. Mueter, Jennifer Boldt, Bernard A. Megrey and Randall Peterman (Invited)

Spatial and temporal scales of variability in the productivity of Northeast Pacific fish stocks

Tetsuo Yanagi and Mitsuru Hayashi (Invited)

Numerical model on the changing dominant species of red tide in Osaka Bay from 1990 to 2000

Sok Kuh Kang, Joseph Y. Cherniawsky, Michael G.G. Foreman, Sinjae Yoo, Hong Sik Min, Cheol-Ho Kim and Hyoun-Woo Kang (Invited)

Patterns of recent sea level rise in the East/Japan Sea and their ecological implication in the Ulleung Basin

Vyacheslav Lobanov, Vladimir Zvalinsky, Pavel Tishchenko, Anatoly Salyuk, Sergei Zakharkov, S. Ladychenko and E. Shtraikhert

Mechanisms of fast changes in physical and biological fields along the Primorye coast in the Japan Sea

Chun-Ok Jo and Kyung-Ryul Kim

Effects of melting sea ice in the Tatarskiy Strait on spring bloom along the Primorye coast in the East Sea

Hyun-cheol Kim, Sinjae Yoo and Im Sang Oh

The relationship between the mixed layer depth and surface chlorophyll in the Japan/East Sea

Masahide Kaerivama, Sei-ichi Saito and Akihiko Yatsu

Comparison of the growth pattern for Japanese chum salmon in the Okhotsk Sea and the Bering Sea

Liqi Chen, Zhongyong Gao, Liyang Zhan and Suqing Xu

Carbon cycling in the Bering Sea and its impacts on marine ecosystems in the subarctic waters and the western Arctic Ocean

Elizabeth A. Logerwell, A.B. Hollowed, C.D. Wilson, P. Walline, P. Munro, M.E. Connors, S. McDermott, S. Neidetcher, D. Cooper and K. Rand

Fish movement plays a key role in understanding the potential for commercial fishing to impact prey fields of endangered Steller sea lions

John A. Barth, Stephen D. Pierce, Timothy J. Cowles and William T. Peterson

Flow-topography interaction and its influence on ecosystem dynamics in the northern California Current System

William Peterson, Rian Hooff and Robert Emmett

Extreme climate variability in the northern California Current: Can we explain the current anomalous warm state and its effects on the coastal upwelling ecosystem off Washington and Oregon?

Posters

Zhongyong Gao, Liqi Chen and Suqing Xu

Comparisons of carbon cycling between the Bering Sea and bipolar regions: Distributions of $p\text{CO}_2$ in the surface seawater and their control

In Seong Han, Hee Dong Jeong, Ki Tack Seong and Ju Lee

Mass mortality of the scallop *Haliotis gigantean* affected by high frequency fluctuations around the eastern coast of Korea

Kiyotaka Hidaka and Kaoru Nakata

Interannual variation in the winter-spring plankton community in the late 1990's: Relationship between communities in the "slope water" and Kuroshio axis

Hee Dong Jeong, Ki Tack Seong and In Seong Han

Recent variations of the thermocline in Korean waters

Young Shil Kang, SeungH. Heo and Jae-Kyoung Shon

Mesozooplankton responses to regime shifts associated with the changes in oceanographic conditions in the eastern area of the Yellow Sea

Dmitry D. Kaplunenko, Vladimir I. Ponomarev and Antonina Polyakova

Study of climate oscillations at different time scales in the North Pacific

Vjacheslav S. Labay and Georgy V. Shevchenko

Hydrodynamic influences on macrobenthos structural characteristics of the northeastern Sakhalin shelf

Jae-Young Lee, Chung Il Lee and Kyung-Ryul Kim

Effects of climate change on physical and biogeochemical elements in the East/Japan Sea

Chuanlan Lin, Xiuren Ning and Jilan Su

Changes in biogenic elements of the Yellow Sea and their influences on its ecosystem

Jisoo Park, Sinjae Yoo and Im Sang Oh

Estimation of primary production in the Yellow Sea

Mikhail V. Simokon and Lidia T. Kovekovdova

Spatial distribution of heavy metals in bottom sediments of Peter the Great Bay (Sea of Japan) and related environmental complications

Elena I. Ustinova, Natalia I. Rudykh, Yuri D. Sorokin and Vladimir I. Ponomarev

Variability of thermal regime and various climatic indices in Far East Seas

BIO Topic Session (S2)

Life history and ecology of euphausiids in coastal and oceanic waters around the Pacific Rim

Co-Convenors: William Peterson (U.S.A.), Michael Dagg (U.S.A.) and Anatoly Volkov (Russia)

Background

Euphausiids are among the most important links in coastal and oceanic food webs, transferring energy from primary and secondary producers to higher trophic level animals such as salmon, herring, sardines, mackerels, Pacific whiting, sablefish, many rockfish species, auklets, shearwaters, and whales. Given their importance in the food chain, euphausiids may be regarded as a keystone sentinel taxa. Moreover, many in PICES are interested in formulating ecosystem models with better parameterizations of the euphausiid component. Therefore a half-day topic session was convened at PICES XIV to invite scientific papers that review and discuss results of research on the ecology and life history of euphausiids in the North Pacific Ocean, with a focus on comparative studies in continental shelf and slope waters around the Pacific Rim.

Summary of presentations

The session anticipated 8 oral presentations and 7 posters but the numbers were reduced to 7 and 3 on the day. Between 30-40 people attended the session. All papers dealt with some aspect of the ecology of euphausiids and most were concerned with one species, *Euphausia pacifica*. Four talks were based on work carried out on euphausiids in the California Current (three from Oregon and one from California), one talk on the Gulf of Alaska/Bering Sea, one Japan and one Korea. One common theme of most talks was the extreme variability in euphausiid distribution, abundance, growth and egg production rates. High variability was attributed to the very plastic life history characteristics of these animals, and the tendency for adults to form swarms. Concerning reproduction, it was also agreed that long-term studies seem necessary since these animals have such variable

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brood sizes, interbrood periods, growth rates, spawning seasons. One generalization that can be made is that egg production seems to be highest during phytoplankton blooms. However some spawning was observed nearly year round both off Oregon and in Oyashio waters off Japan. Another generalization is that *E. pacifica* seems to be mostly herbivorous, shown by stomach content analysis of animals from Japan, and through the use of lipid biomarkers in

animals from Oregon. Work done off Oregon and California showed that euphausiid numbers were greatly reduced in 2005, and this was correlated with complete nesting failure of Cassin's auklets at the Farallone Islands off San Francisco. Finally, we learned that *E. pacifica* can at times present a problem for a nuclear power plant in Korea because they clog the screens which filter water for the cooling towers.

List of papers

Oral presentations

Kenji Taki (Invited)

Distribution and life history of *Euphausia pacifica* off northeastern Japan

Jinho Chae, Doo-Jin Hwang, Young-Ok Kim, Dongsung Kim and Jae-Hac Lee

Euphausiid distribution near Uljin with special reference to its importance as a food source of demersal fish and impingement on the cooling water intakes of a power plant

Sonia Batten, David Welch and Doug Moore

Seasonal distribution of euphausiids on a transect from the Gulf of Alaska to the Bering Sea

Leah R. Feinberg, William T. Peterson, C. Tracy Shaw and Jaime Gomez-Gutierrez

Euphausiid reproduction off the Oregon Coast, U.S.A.

C. Tracy Shaw, Leah R. Feinberg and William T. Peterson (Invited)

Seasonal variations in intermolt period and growth of *Euphausia pacifica* and *Thysanoessa spinifera* in the coastal Pacific Northwest

Se-Jong Ju, H. Rodger Harvey, William T. Peterson, Leah Feinberg and Tracy Shaw (Invited)

Understanding the nutritional status, diet, and demographic structure of *Euphausia pacifica* through multiple organic markers

Jaime Jahncke, Benjamin L. Saenz, Chris Rintoul and William J. Sydeman

Krill and krill-predators: Habitat associations in the dynamic Gulf of the Farallones, California

Posters

Jaime Gómez-Gutiérrez, Carlos J. Robinson and Karmina Arroyo Ramírez

Egg production and molting rates of the subtropical sac-spawning euphausiid *Nyctiphanes simplex* in the southern part of the California Current System

Se-Jong Ju, H. Rodger Harvey, Jaime Gómez-Gutiérrez and William T. Peterson

The role of lipids during egg development in *Euphausia pacifica* and *Thysanoessa spinifera*

Jinhui Wang, Yawei Sun, Caicai Liu, Xiangshen Chen and Ren Xu

Quantitative distribution of euphausiids in the East China Sea and the Yangtze Estuary in relation to the environmental conditions

BIO/MBM-AP Topic session (S3)

Factors affecting distribution, foraging ecology and life histories of top predators in the western North Pacific and its marginal seas

Co-convenors: Hidehiro Kato (Japan), William Sydeman (U.S.A.), Alexander Kitaysky (U.S.A.) and Andrew Trites (Canada)

Background

Top predators may integrate fluctuations in lower trophic levels and ocean climate, and may

therefore serve as reliable indicators of change. But, how ubiquitous are these patterns, spatially and temporally? What are the time lags between the occurrence of an environmental change and

the responses of top predators? What taxa, guilds and parameters would be best suited to serve as ecosystem samplers and monitors? This multi-disciplinary, multi-trophic level topic session examined the oceanographic and ecological factors determining the distribution, foraging ecology, and life history dynamics of top marine predators in the northwestern North Pacific and its marginal seas, focusing on the Sea of Okhotsk/Oyashio and western Bering Sea. Focal organisms include predatory marine fish, marine birds and mammals, and their prey resources (copepods, euphausiids, squids, forage fishes). Presentations were invited describing spatio-temporal variation in distribution, abundance, life history, demography, and food habits of predators and/or prey species or communities in relation to atmospheric and physical oceanographic variability, including ice cover. In particular, the hope was to deepen our understanding of the response of top predators to ocean climate variability and change in the northwestern Pacific Ocean regions. These questions are critical to future efforts to monitor the North Pacific, as well as important to fisheries oceanography in the Sea of Okhotsk and western Bering Sea.

List of papers

Oral presentations

Konstantin Rogachev (Invited)

Physical forcing of marine ecosystems and long-term oceanographic changes in the Sea of Okhotsk

Andrew W. Trites and **David A.S. Rosen** (presented by **Edward J. Gregr**)

Marine mammals in the North Pacific as indicators of ecosystem change

W.J. Sydeman, J. Jahncke, B.L. Saenz, C.Rintoul and R. Bradley

2005: An unprecedented breeding failure for planktivorous auklets in the Central CCS.

Yutaka Watanuki, Motohiro Itoh and Hiroshi Minami

Do parents of seabirds feed chicks with prey that is different from their own?

Aleksey Yu. Merzlyakov, Elena P. Dulepova and Valerii I. Chuchukalo

Modern state of pelagic communities in the Okhotsk Sea

Tomio Mivashita, Valery L. Vladimirov and Hidehiro Kato

Current status of cetaceans in the Sea of Okhotsk

Rolf R. Ream and Vladimir Burkalov

Trends in abundance of Steller sea lions and northern fur seals across the North Pacific Ocean..

Yuri M. Yakovlev and Olga Yu. Tyurneva

Photo-identification of the western gray whale (*Eschrichtius robustus*) on the northeastern Sakhalin shelf, Russia, 2002-2004

Alexander S. Kitaysky and Elena Yu. Golubova

Reproductive responses of planktivorous and piscivorous birds to climate variability in the northern Sea of Okhotsk

Edward J. Gregr, Stephen Ban, Ryan Coatta and Andrew W. Trites

Ecological characterization of Steller sea lion rookeries and haulouts in the North Pacific

Summary of presentations

This half-day session was convened on October 4, 2005, with 10 oral and 3 poster presentations. It was viewed as completely successful, taking both a wide geographic approach, and regional focus (Sea of Okhotsk). All presentations were excellent and represent continuing integration of MBM research in PICES community. The session provided overview of oceanography of the western North Pacific and Sea of Okhotsk, as well as specific MBM research in the region. Highlights included information on the occurrence of extremely rare northern right whales in Sea of Okhotsk and interactions between Sakhalin Island oil exploration and endangered gray whales. Differences in the scale of responses to climate variability between marine mammals and marine birds were discussed. A trans-Pacific overview of Steller's sea lion and northern fur seal population dynamics was presented.

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Posters

Svetlana V. Naydenko and Natalia T. Dolganova

Estimation of hydrobiont consumption food by the basic nekton species in the upper epipelagic Russian economic zone of the Japan/East Sea

Seong-Hwan Pae

Ecologically important areas for waterbirds in Yellow Sea

Larisa A. Zelenskaya

Inter-annual and inter-colonial variability in the diet of Slaty-backed Gulls (*Larus schistisagus*)

CCCC/CFAME Topic Session (S4)

The comparative response of differing life history strategists to climate shifts

Co-Convenors: Hyung-Ku Kang (Korea) and Gordon A. McFarlane (Canada)

Background

In recent years we have come to accept that regime shifts are real and produce species and ecosystem-level responses, however not all species and ecosystems are equal. In particular, there is the need to move beyond correlative indices between climate variables and species indicators, and consider the temporal and spatial scale of the mechanisms, especially as they may differ between different life history strategists within an ecosystem. In this session, contributions were invited which examine the scale of response of species to climate, especially from an east/west comparative perspective. Papers investigating the underlying mechanisms of responses, with an emphasis on targeting critical life history stages and differences in sensitivity to climate for different life history strategists (for example, between equilibrium and opportunistic strategists) were especially encouraged. It is intended that selected papers (oral and poster) will be published in an international scientific journal.

Summary of presentations

The CCCC/CFAME Topic Session was held on October 4, 2005. Fourteen oral and 3 poster presentations were made during this 1-day session. Two other speakers were unable to attend due to travel difficulties. The session was extremely well attended. Our goal of examining not only correlative indices between species and

climate change, but to consider temporal and spatial scales of the actual mechanisms involved was successfully addressed, especially as they differed between different life history strategists and trophic levels. During the session, speakers addressed these responses at trophic levels from zooplankton to fish to birds. The responses of these life history strategists to climate change in ecosystems from around the North Pacific, and suggestion on how to incorporate this information into ecosystem assessment, both traditional and non-traditional, were a highlight of the session.

Jacquelynn King was the first speaker, and presented how life history strategies can apply to fisheries management, based on five categories of fish strategists: Opportunistic, Periodic, Equilibrium, Salmonic and Intermediate strategists. Kerim Aydin presented a system of management evaluation, which combines survey trends, fishing history, and life history characteristics in order to pinpoint vulnerable non-target species within a fishery. Kazuaki Tadokoro showed that interdecadal variability in body size of *Neocalanus* copepods from the historical sample in the Oyashio water, and body size of copepods was negatively correlated with the SST, and some species were positively correlated with PO₄ concentrations. However, future work will include examining chlorophyll concentrations and other potential factors. David Mackas presented the recent trend of the exotic copepod *Acartia tonsa* on the British

Columbia continental margin and posed several research questions (e.g. origin, ocean process involved, potential competition with native zooplankton) and proposed his hypothetical answers. Hiroya Sugisaki presented long-term variation of species and life stage composition of zooplankton in the western North Pacific in relation to the Odate project, and showed there were 20 years' oscillation in zooplankton biomass, copepod abundance and copepod life stage abundance, with suggestion of potential reasons. Alexander Goryainov presented the relationship between atmospheric processes above the Asian continent and the North Pacific Ocean, and the abundance of Asian chum salmon and pink salmon. He presented a new approach to examine the linkages between atmospheric processes and the fluctuation in abundance of these salmon. Francisco Werner and Shin-ichi Itoh presented the interannual response of growth of Pacific herring and saury to the 3-D global NEMURO output with realistic atmospheric forcing. In the case of Pacific saury, an automatic calibration program PEST was applied to overcome smaller zooplankton density estimated from NEMURO.

After lunch, Yoshiro Watanabe presented the manuscript of the invited speaker Shang Chen and showed that the East China Sea has experienced three ecological regime shifts in the

last 50 years, different with the NW Pacific and similar with the NE Pacific. Guram Tsitsiashvili proposed the method of interval recognition for diagnosis and prognosis of extreme natural phenomena in the Russian Far East. Yongjun Tian noted that an oceanic regime shift from cold to warm is identified in the Tsushima Warm Current in the late-1980s, and showed that the response pattern of the pelagic and demersal fish were different between cold and warm water species. Vladimir Sviridov examined the adaptive significance of spatial distribution patterns as a reflection of life history strategy and density dependence in populations of some pelagic fish, squid and jellyfish species in the Russian EEZ of North Pacific. Akihiko Yatsu examined mechanistic responses of Japanese sardine, anchovy and chub mackerel in the Kuroshio/Oyashio system to regime shifts, and suggested that the different life-histories of sardine and anchovy took advantage of different regime characteristics. William Sydeman compared the response of a piscivorous marine bird between California and the Tsushima Current system to oceanographic variability in the North Pacific Ocean. This session clearly pointed out the importance of incorporating life history strategies in future studies of ecosystem dynamics to climate change.

List of papers

Oral presentations

Jacquelynn R. King and Gordon A. McFarlane

Life history strategies: Applications to fisheries management

Todd TenBrink, Anne Hollowed and Kerim Aydin

Evaluating the climate-moderated fishing vulnerability of different life history strategists in Alaskan waters

Kazuaki Tadokoro, Toru Kobari, Hiroaki Saito and Hiroya Sugisaki

Interdecadal variability in body size of *Neocalanus* copepods in the Oyashio waters from 1960 to 2002 - A study of the Odate Project

David L. Mackas and Moira D. Galbraith

Appearance and rapid increase of the exotic copepod *Acartia tonsa* on the British Columbia continental margin

Hiroya Sugisaki and Hiroshi Ito

Long term variation of species and life stage composition of zooplankton in the western North Pacific: Introduction of the Odate project

Alexander A. Goryainov, Tatiyana A. Shatilina, Guram Sh. Tsitsiashvili and Vera A. Kochetova

The relationship between atmospheric processes above the Asian continent and the North Pacific Ocean and the abundance of Asian chum salmon and pink salmon in 20th century

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Yongjun Tian, Hideaki Kidokoro and Tatsuro Watanabe

Differing response patterns of pelagic and demersal fish assemblages to the late-1980s regime shift in the Japan Sea

Kenneth A. Rose, Bernard A. Megrey, Francisco E. Werner, Yasuhiro Yamanaka, Maki Noguchi-Aita, Shin-ichi Ito and Michio J. Kishi

Interannual response of fish growth to the 3-D global NEMURO output with realistic atmospheric forcing. Part I: Latitudinal differences in Pacific herring growth

Shin-ichi Ito, Kenneth A. Rose, Maki Noguchi-Aita, Bernard A. Megrey, Yasuhiro Yamanaka, Francisco E. Werner and Michio J. Kishi

Interannual response of fish growth to the 3-D global NEMURO output with realistic atmospheric forcing. Part II: Pacific saury growth

Shang Chen, Yoshiro Watanabe and Yan Ma (Invited)

Ecological regime shift events in the East China Sea

Guram Sh. Tsitsiashvili, Tatiyana A. Shatilina, Alexander A. Goryainov, T.A. Radchenkova and L.Yu. Matyushenko

Diagnosis and prognosis of extreme natural phenomena in the Russian Far East

Vladimir V. Sviridov

Adaptive significance of spatial distribution patterns as reflection of life history strategy and density dependence in populations of some pelagic fish, squid and jellyfish species in Russian EEZ of North Pacific

Akihiko Yatsu, Hiroshi Kubota, Akinori Takasuka, Motomitsu Takahashi, Norio Yamashita, Hiroshi Nishida, Chikako Watanabe and Yoshioki Oozeki

Distribution and population dynamics of Japanese sardine, anchovy and chub mackerel in the Kuroshio/Oyashio system: Seeking for mechanistic responses to regime shifts

Julie A. Thayer, Yutaka Watanuki, Tomohiro Deguchi, Akinori Takahashi and William J. Sydeman

East/West comparative responses of a Piscivorous marine bird to oceanographic variability in the North Pacific Ocean: California versus Tsushima current systems

Posters

Miriam J. Doyle, Ann C. Matarese, Morgan S. Busby and Deborah M. Blood

Life history strategies of selected Gulf of Alaska fish species with reference to recruitment vulnerability under fluctuating environmental conditions

Gordon A. McFarlane, S. Kim, J.R. King, R.J. Beamish, C. Zhang and J.H. Oh

Contrast in life histories of commercially exploited marine fishes off the coasts of Canada and Korea and changes in ecosystem structure

Lubov N. Vasilevskaia, Pavel I. Khazantsev and Denis N. Vasilevskii

Annual changes of areas of trade of pollock in the Sea of Okhotsk and Bering Sea for the last thirty years

CCCC/MODEL Topic Session (S5)

Modeling climate and fishing impacts on fish recruitment

Co-Convenors: Jacob Schweigert (Canada) and Yury I. Zuenko (Russia)

Background

To model the state of fish populations, both individual growth and the population number are necessary. Recently the PICES MODEL Task Team has generalized ecosystem models for the North Pacific, and applied the prototype model of lower trophic models (NEMURO) for the growth of individual fish, at present Pacific saury and herring. However, the same developments were not implemented at the fish

population level. Clearly, the abundance depends strongly on reproductive success and fish survival during early life stages, and these are, in turn, affected by the environment. The goal of this session was to review existing models and related scientific knowledge on fish recruitment under varying environmental conditions, and create a foundation for their incorporation in the ecosystem model for the North Pacific and its regions.

Summary of presentations

This topic session consisted of 8 oral presentations and 1 poster. The speakers represented 5 PICES countries: Canada, Japan, Korea, Russia, and the United States.

The session was well-structured and covered several aspects of the difficulties related to modeling the recruitment of fish populations. The invited paper by F. Mueter provided a broad overview of the concepts as well as the pitfalls that may be encountered in modeling fish recruitment with examples from a range of species and areas. The second invited paper by C. Sassa discussed a comprehensive empirical approach to investigating the factors that affect the recruitment of jack mackerel, ranging from the effect of food supply to larval and juvenile transport to predation. The other papers were broadly focused on either examining the empirical effects of environment on fish survival and recruitment (Y. Zuenko, H. Nishikawa, M. Shirripa, J.-B. Lee, and T. Watanabe for anchovy, sardine, and sablefish), or presenting alternative modeling approaches for understanding aspects of ecosystem production or recruitment (I. Ishmukova, R.I. Perry, and M. Haltuch). Ishmukova presented details of parameter estimation in a theoretical NPZ model compared to empirical parameter estimates of mortality. Perry discussed an approach to estimating "carrying capacity" based on the concepts of annual production by the population. The method shows some promise from its application to Pacific herring stocks in Canada. Haltuch presented results from a simulation study that examined the ability to detect climatic forcing of recruitment in analytical models

assuming various levels of error in the input data as well as alternate climate scenarios on three life history scenarios typified by a short-lived sardine, a flatfish, and a long-lived rockfish. The conclusion was that it might be difficult to detect climatic forcing variables for some typical fisheries data series. Zuenko presented the results of modeling the survival of anchovy eggs and compared results with those from laboratory studies. Nishikawa presented the results of using a NEMURO physical forcing model to examine the relationship of mixed layer depth with the timing of the phytoplankton bloom and its subsequent effects on larval survival. Finally, Shirripa discussed the effects of variation in sea level on the recruitment of sablefish in the eastern Pacific, and its possible application for hind-casting abundance to derive a predictor of future recruitment and provision of advice to fishery managers. The climatic factors of sea surface temperature transport of eggs and larvae, mixed layer depth, sea level, and food ability were all identified as being important environmental factors influencing fish recruitment success for these species.

Overall, the session was very successful. There was extensive discussion of the usefulness and applicability of the suggested models and procedures for future studies. The methods and concepts presented could be easily applied for fish populations modeling in local areas. Additional discussion and focus of this type of research and analysis of climate and fishery effects on recruitment for a broader array of species in the entire PICES region is recommended for future meetings.

List of papers

Oral presentations

Franz J. Mueter (Invited)

Detecting and modeling environmental effects on recruitment: Strategies and pitfalls

Chiyuki Sassa, Youichi Tsukamoto, Yoshinobu Konishi, Songguang Xie, Yoshiro Watanabe and Hideaki Nakata (Invited)

Recruitment processes of jack mackerel (*Trachurus japonicus*) in the East China Sea (ECS) in relation to environmental conditions

Alexander I. Abakumov and Irina V. Ishmukova

Using the model approach to understand functioning of the Okhotsk Sea ecosystem

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R. Ian Perry and Jake Schweigert

Concepts of marine ecosystem carrying capacity, and their application to NE Pacific herring populations

Melissa A. Haltuch and Andre E. Punt

Life history, climate forcing, and fish stock assessment – Evaluating statistical power

Yury I. Zuenko and Svetlana V. Davidova

In situ experiments to investigate the Japanese anchovy eggs development

Haruka Nishiakwa and Ichiro Yasuda

Population decline of Japanese sardine and variation of mixed layer depth in the Kuroshio Extension

Michael J. Schirripa and J.J. Colbert

Incorporating environmental effects in the assessment of sablefish (*Anoplopoma fimbria*) off the continental U.S. Pacific coast

Posters

Kosei Komatsu, Akihide Kasai and Tomowo Watanabe

Modeling transport of eggs and larvae of jack mackerel in the East China Sea

FIS/CCCC Topic Session (S6)

Evidence of distributional shifts in demersal fish and invertebrates in relation to short and long term changes in oceanographic conditions

Co-Conveners: Gordon A. McFarlane (Canada), Michael J. Schirripa (U.S.A.), Mikhail A. Stepanenko (Russia)

Background

Demersal fish and invertebrates, either on the continental shelves, slopes, or sea mounts, support major fisheries in both the eastern and western Pacific. These include such fish as the rockfishes (genus *Sebastes*), thornyheads (genus *Sebastolobus*), many flounders (family Pleuronectidae), as well as invertebrate species. These species are known to exhibit periodic shifts in their distribution either latitudinally or longitudinally. While these shifts can at times be attributed to such factors as life history characteristics, often they are due to changes in the environment. Changes in the environment can be the result of short-term phenomena, such as seasonal depletions in oxygen levels, medium-term phenomena such as fishing, or long-term phenomena, such as decadal climate shifts. Shifts in the spatial distribution of these species due to changes in the environment can cause populations to move into and out of the areas traditionally covered by the fishing fleets they support, as well as the scientific surveys that seek to assess their abundance. As a consequence, scientific surveys designed to develop annual indices of abundance for these

species can produce erroneous trends, causing the stock assessments that depend on these surveys to be inaccurate. If the causes of these distributional changes were known, indices of abundance could be modeled to account for these changes in ways other than changes in overall stock abundance. The goal of the session was to provide sound evidence for ecosystem-based distributional shifts that can be used to account for some of the year-to-year variability in survey trends of demersal fish that may currently be attributed to changes in overall abundance. This session invited papers that describe changes in demersal fish distributions with specific emphasis on those changes due to changes in climate, either short or long term. Preference was given to work that results in functional relationships that can be directly incorporated either into indices of abundance or established stock assessment models.

Summary of presentations

The session consisted of 6 oral and 6 poster presentations. It was apparent after listening to the talks that fish distributions have, are, and will no doubt continue to change on an ongoing

basis. Shifts include both migrations (regular change) and excursions (boundary testing). It was shown that fish distributions shift over scales from geological (1000s km) to daily (m). Barriers to distributions include physical (landmasses, deep ocean, currents), physiological (temperature, salinity), behavioral (spawning fidelity, range), nutritional (food), and mortality (predators). Contemporary distribution changes can be caused by fishing, changes in the environment, or both simultaneously. Climate change will change barriers to fish distribution, so we should expect continued change in fish distributions in the future.

At contemporary scales of management, distribution shifts affect surveys and stock assessment. Methods were shown that could be used to quantify changes in spatial distribution of demersal fish and invertebrates. Statistically significant trends in distribution were found for several species in the Bering Sea. These include northward shifts in Pacific halibut (*Hippoglossus stenolepis*), Bering flounder (*Hippoglossoides robustus*), yellowfin sole (*Limanda aspera*), ronquils (Bathymasteridae), and tunicates. Southward shifts were found in arrowtooth flounder (*Atheresthes stomias*), Pacific cod (*Gadus macrocephalus*) and rex sole (*Glyptocephalus zachirus*). Potential causes of shifting, such as bottom temperature, density dependence, and residual long-term trends were discussed.

List of papers

Oral presentations

George A. Rose (Invited)

Demersal fish distribution dynamics in Boreal and Sub-Arctic marine ecosystems

Jin-Yeong Kim, Yang-Jae Im, Seok-Gwan Choi, Soon-Song Kim, Joo-Il Kim and Young-Yull Chun

Spatial limitation of demersal fish and ecosystem characteristics during wintering season in the southern waters of Korea

Oleg G. Zolotov

Long-term changes in Atka mackerel, *Pleurogrammus monopterygius*, distribution and abundance in waters off the northern Kurile Islands and southeastern Kamchatka

Alexei M. Orlov

Long-term and seasonal shifts of distribution of commercially important flat- and rockfishes in the Pacific off the northern Kuril Islands and southeastern Kamchatka: Probable affecting of changes in climatic and temperature conditions?

Paul D. Spencer and Tom W. Wilderbuer

Geographic distributions of eastern Bering Sea flatfish: Effects of environmental variability and population abundance

Franz J. Mueter and Bernard A. Megrey

Geographical shifts in the spatial distribution of Northeast Pacific groundfish populations in relation to water temperatures

The spatial distributions of rock sole and flathead sole appear to be related to temperature, although for rock sole this effect may reflect movement associated with density-dependent habitat selection. Several flatfish species on the Eastern Bering Sea shelf showed dramatic movements in 1999, which was an unusually cold year in the midst of an overall warming trend. Because broad regions of the Eastern Bering Sea shelf have similar depth characteristics, flatfish are able to maintain preferred depth while adjusting distributions. Survey catchability estimates may need to be adjusted to account for temperature anomalies. Habitat models for flatfish have generally not considered the effect of environmental variability, but these factors may be important (particularly in years corresponding to unusual events).

One of the more far reaching points made via the talks was the demonstration of a “domino effect” that can occur due to recently observed changes in the environment of the Pacific Ocean. Environmental changes can cause shifts in zooplankton distribution, which can lead to a shift in the distributions forage that feed on them. This in turn can lead to distributional shifts in larger predatory fish that often support substantial fisheries. As the fishing fleets shift their geographical distributions to follow the fish, it can result in significant changes in the human communities that these fisheries support.

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Posters

Leonid S. Kodolov and Maxim A. Ocheretyannyi

Distributional pattern and population structure of Greenland turbot *Reinhardtius hippoglossoides* in the Bering Sea

Leonid S. Kodolov and Vladimir N. Tuponogov

Impact of some biological features and environmental factors on distributional patterns of North Pacific deep-water fishes

Larisa P. Nikolenko

Influence of environmental factors on year-class abundance of the Greenland turbot (*Reinhardtius hippoglossoides*) in the Sea of Okhotsk

Larisa P. Nikolenko

Seasonal migrations of the black turbot (*Reinhardtius hippoglossoides*) in the Okhotsk Sea

Andrei A. Smirnov, Alexei M. Orlov and Yuri K. Semenov

Distribution of Greenland halibut, broadbanded thornyhead, skates, and eelpout in the eastern Sea of Okhotsk in relation to changes of water temperatures within the layers of their inhabitation

Vladimir N. Tuponogov

Vertical and spatial distribution of longfin grenadier off Japanese and Kuril Islands and in the Okhotsk Sea

MEQ/FIS Topic Session (S7)

Current and emerging issues of marine and estuarine aquaculture; carrying capacity, ecosystem function and socioeconomics

Co-Convenors: Ik Kyo Chung (Korea) and Galina S. Gavrilova (Russia)

Background

It is well recognized that for successful and long-term utilization of waters for aquaculture and other uses, we must consider the allocation of resources and trophic structure of the system. Ecosystem-based management of resources requires ways to monitor current conditions and predict future sites, particularly in response to known human activities that impact the marine environment. Mariculture is an important expanding industry in all PICES countries, and this session will consider mariculture as a case study on how the impacts of a particular human activity on marine ecosystems can be managed. Indicators and predictive models are being used to evaluate and hypothesize the responses of an ecosystem to environmental impact and resulting management actions. This session brought experts together to identify criteria for suitable indicators and the utilities of predictive models relevant to the impacts of mariculture, to assess the sensitivities of indicators, and to highlight gaps in current knowledge.

Summary of presentations

The session consisted of 8 oral presentations and 6 posters. The following scientific issues were noted in the presentations (not in priority order):

Determination of potential carrying capacity of bays and economic aspects were highlighted and an ecosystem model was developed to describe the estuarine coastal systems. Indices for environmental management of fish farms and the range of assimilative capacity and the stocking density of cultured fish have been developed. The preferential control by cultured bivalve molluscs on dinoflagellate biomass in the field was presented with laboratory experiments. The concept of simultaneous coupling of nutrient removal between fed and extraction culture, and the long-term delayed seasonal removal of nutrients between a summer fed culture and a winter extraction culture, implies that any kind of seaweed cultivation could be a part of the biofilter in the holistic sense and could be a good measure of ecosystem-based management in coastal waters. Some of these potential effects are related to decadal scale regime shifts that affect freshwater

discharge and surface salinities in spring, which in turn affect the outbreak of sea-lice in salmon culture. Technology and production trends of

salmon, crustacean and sea urchin cultivation in Russia were presented in several posters.

List of papers

Oral presentations

Galina S. Gavrilova

The current status of research and problems of invertebrate mariculture in the Russian Far East

Yongsik Sin

Use of ecosystem models for study and management of coastal estuarine ecosystems in Korea

Hisashi Yokoyama

Proposal of site selection guidelines for fish farming in Japanese coastal waters

Xuelei Zhang, M.Y. Zhu, L.H. Zhang and D. Zhang

A first exploration on differential impacts of bivalve mollusc on the two phytoplankton groups, diatom and dinoflagellate

Ik Kyo Chung, Yun He Kang and Yu-Feng Yang

Seasonal assembly of seaweed species in the sustainable seaweed integrated aquaculture system in Korea

Richard J. Beamish, Chrys-Ellen M. Neville and Ruston M. Sweeting

Regimes and the relationship between farmed and wild salmon in British Columbia

Igor Khovansky and Anastassia Mednikova

Perspectives of salmon sea ranching in the coast of the Okhotsk Sea and in estuaries of rivers

Larissa A. Gavko

Influence of environmental factors to forecast the yield of mollusks on marine farms (Sea of Japan)

Posters

Marianna V. Kalinina and Elena G. Semenkova

Use of a visual method of estimation of Japanese mitten crab ovaries by maturity stages

Nikolina P. Kovatcheva

Crustacean cultivation in artificial conditions: Promising trends in aqua- and mariculture in Russia

Nikolai I. Krupjanko and Aleksei V. Lysenko

Reproduction of chum (*Oncorhynchus keta*) and masu (*O. masu*) salmon at salmon hatcheries in Primorye (Peter the Great Bay)

Dmitry S. Pavlov, George G. Novikov and Andrei N. Stroganov

On some ways of preservation of local fish populations

Nadezhda E. Struppul and Olga N. Lukyanova

Selenium content in marine organisms from the Russian coast of the Sea of Japan

Galina I. Victorovskaya, Anatoly S. Socolov and Igor J. Suhin

Increasing sea urchin settlement productivity using various forms of melioration

MEQ/FIS Topic Session (S8)

Ecosystem indicators and models

Co-convenors: Glen Jamieson (Canada), Xian-Shi Jin (China), Pat Livingston (U.S.A.), Tokio Wada (Japan), Vladimir Radchenko (Russia) and Chang-Ik Zhang (Korea)

Background

Ecosystem-based management (EBM) of resources will require ways to monitor current conditions and predict future states. Ecosystem indicators are single variables that reflect the

status of broad suites of management activities or environmental conditions, and their assessment is key to monitoring the achievement of EBM. Predictive ecosystem models can be used to hypothesize the responses of an ecosystem to management actions, to assess the

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sensitivities of indicators, and to highlight gaps in current knowledge. This session brought experts together to identify criteria for suitable indicators and the utilities of predictive models, and to present candidates of indicators and models that are actively in use in PICES areas.

Summary of presentations

Thirteen of 15 scheduled oral papers were presented plus several posters. Presentations included reviews of indicators in simulation models that attempted to describe key elements of entire ecosystems, and the ecosystem behavior that might result from perturbation,

indicators relative to describing the consequences of fishing and/or environmental features in particular, modeling of specific ecosystem energy pathways, approaches to the identification of indicators that track ecosystem characteristic shifts, identification of important spatial areas where monitoring activities might most cost-effectively be focused, and the utility of different bioindicators for monitoring specific impacts. Given this diversity of papers, discussion was wide-ranging and reflected the challenges in trying to identify relevant, cost-effective and conceptually easily explainable potential indicators for evaluation of success in achieving EBM.

List of papers

Oral presentations

Elizabeth A. Fulton, Michael Fuller and Anthony D.M. Smith

Management strategy evaluation and indicators for ecosystem-based fisheries management

Gordon H. Kruse, Patricia A. Livingston and Glen S. Jamieson

Evolution of ecosystem-based fishery management

Sang Cheol Yoon and Chang Ik Zhang

A comprehensive ecosystem-based approach to management of fisheries resources in Korea

James E. Overland, J. Boldt, J. Grebmeier, J. Helle, P.J. Stabeno and M. Wang

Multiple indicators track major ecosystem shifts in the Bering Sea

Michio J. Kishi, Ippo Nakajima and Yasuko Kamezawa

Fish growth comparisons around Japan using NEMURO.FISH

Vladimir I. Zvalinsky

Ecosystem parameters and stability: Theoretical considerations

Glen Jamieson and Cathryn Clarke

Identification of ecologically and biologically significant areas in Pacific Canada

Chuan-Lin Huo, Geng-Chen Han, Ju-Ying Wang and Dao-Ming Guan

EROD as bioindicator for monitoring of marine contaminants along the Dalian coast

Sun-Kil Lee, Jae Bong Lee, Chang-Ik Zhang and Dong Woo Lee

Comparisons in ecosystem effects of fishing in Korean waters

Zhenyong Wang, Hao Wei and Zuwei Zhang

Application of modified NEMURO Model to Jiaozhou Bay

Thomas C. Wainwright, James J. Ruzicka and William T. Peterson

A biological production index for the northern California Current

Jie Li, Zengmao Wu and Xiaofang Wan

Modelling study of the new production and the microbial food loop impact in the Yellow Sea Cold Water Mass

Chris J. Harvey, Isaac C. Kaplan, Emily J. Brand, Elizabeth A. Fulton, Anthony D.M. Smith, Albert J. Hermann, M. Elizabeth Clarke and Phillip S. Levin

A spatially explicit ecosystem model to examine the effects of fisheries management alternatives in the California Current

Posters

Young-Min Choi, Kwang-Ho Choi, Yeong-Seop Kim, Jung Hwa Choi and Jong-Bin Kim

Ecosystem structure and fisheries resources status in the southern part of Korean waters

Jae Bong Lee, Chang-Ik Zhang and Dong Woo Lee

Ecosystem indicators for the recruitment of pelagic fish around Korean waters

MEQ Topic Session (S9)

Ecological effects of offshore oil and gas development and oil spills

Co-convenors: Tatyana Belan (Russia), Alexander Tkalin (UNEP/NOWPAP) and Takuya Kawanishi (Japan)

Background

In recent years, offshore oil and gas production expanded to new areas of the world ocean. Unfortunately, oil and gas exploration and extraction can be associated with negative ecological consequences. For example, seismic surveys may interfere with commercial fishing, installation of platforms may disturb habitats of marine fish and invertebrates, and the discharge of drilling muds introduces a number of contaminants into the surrounding waters. Oil spills associated with offshore operations or with tanker accidents also threaten the marine environment. Recent spills have demonstrated vulnerability of coastal communities. Oil slicks at sea can kill or otherwise adversely affect marine birds and mammals, zooplankton, as well as the eggs and larvae of fish and invertebrates. The goal of this session was to bring together marine scientists working on these issues and to

discuss what steps can be taken to minimize adverse ecological effects of offshore oil and gas production.

Summary of presentations

Fourteen oral papers scheduled were presented plus several posters. Presentations included reviews of environmental consequences of oil and gas extraction on sea shelf, monitoring results along the Sakhalin Island, possible influence of accidental oil spills on biota of the Far Eastern Seas, new monitoring and assessment techniques and other related issues. Discussions were useful for creating common understanding among participants from different scientific organizations and oil and gas companies. It was recommended that such sessions should continue to be organized in the future, and industry representatives are involved as much as possible.

List of papers

Oral presentations

Chang-Gu Kang, Seong-Gil Kang and Jeong-Hwan Oh (Invited)

Oil spills - Risk, preparedness and response in the Northwest Pacific

Kazuichi Hayakawa, Maki Nomura, Takuya Nakagawa, Seiji Oguri, Takuya Kawanishi, Akira Toriba and Ryoichi Kizu

Study on damage and recovery of coastlines for three years after the Nakhodka oil spill

Valentina V. Andreeva, Tatyana V. Kononova, Paul G. Mowatt and Olga V. Samoilyuk

Review of monitoring results in the area of Molikpaq platform (north-eastern shelf of Sakhalin)

Review by Tatyana A. Belan based on the following abstracts:

Tatyana V. Kononova, Alexander V. Moshchenko, Tatyana A. Belan and Nadezhda K. Khristoforova

Alterations of biotopical conditions and variations of benthos distribution near Molikpaq platform (North-East Sakhalin Island shelf)

Alexander V. Moshchenko, Tatyana V. Kononova and Nadezhda K. Khristoforova

Changes of granulometric composition of bottom sediments near Molikpaq platform (North-East Sakhalin Island shelf)

Evgeniy V. Karasev, Tatyana S. Lishavskaya, Tatyana A. Belan, Alexander V. Tkalin, Alexander V. Moshchenko and Anastasia S. Chernova

Ecological investigations on the Sakhalin Island shelf, including Molikpaq platform monitoring: A review of FERHRI studies

Tatyana V. Kononova, Alexander V. Moshchenko, Tatyana S. Lishavskaya and Nadezhda K. Khristoforova

Interrelation of the contents of petroleum hydrocarbons, metals and granulometric composition of sediments near Molikpaq platform (North-East Sakhalin Island shelf)

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Takuya Kawanishi, Masayuki Kunugi and Kazuichi Hayakawa

Monitoring chemical substances in surface sea water in North Pacific Area

Review by Galina Moyseychenko based on the following abstracts:

Galina Borisenko and Galina Moyseychenko

The quantification of natural radioactive background levels of radioactivity in offshore bottom sediments of northeastern part of Sakhalin Island

Inna Nemirovskaya, Galina Moyseychenko and Yury Blinov

Concentrations and compositions of aliphatic and polycyclic hydrocarbons in bottom sediments off Sakhalin Island

Xuelei Zhang, R.J. Wu, Z.H. Zhang and Z.F. Dong

Benzene toxicity to the scallop, *Chlamys farreri*, and the shrimp, *Penaeus japonicus*

Galina Moyseychenko and Alla Ogorodnikova

Possible influence of accidental oil spills on the Far Eastern Sea shelf biota

Svetlana V. Davydova and Sergey A. Cherkashin

Ichthyoplankton as an indicator of the state of coastal ecosystems in the areas of oil and gas deposits on Sakhalin shelf

Alexander Bogdanovsky, John Wardrop, Igor Kochergin, Sergei Pokrashenko, Igor Arshinov and Sergey Rybalko

Progress in oil spill risk assessment for Sakhalin shelf conditions

Posters

Andrey P. Chernyaev

Petroleum hydrocarbon pollution of Ussuriyskiy Bay (Japan Sea) in 2003 – 2004

Sam Geun Lee and Eun Seob Cho

Effects of oils and chemical dispersants on the growth of the phytoplankton, *Cochlodinium polykrikoides*

Olga N. Lukyanova, Andrey P. Chernyaev, Sergey A. Cherkashin and Svetlana A. Aleshko

The distribution of petroleum hydrocarbons and biota assessment in Amursky Bay (Japan Sea)

Valeriy I. Petukhov, Irina G. Lisitskaya and Alexandra V. Romanchenko

Research of the composition of petroleum products to identify petroleum contamination

Sergey Rybalko, Igor Kochergin, Victor Putov and Tatyana Belan

Complex environmental impact assessment within marine seismic surveys

TCODE Topic Session (S10)

Data management and delivery systems to support ecosystem monitoring

Co-Convenors: S. Allen Macklin (U.S.A.), Bernard A. Megrey (U.S.A.) and Igor I. Shevchenko (Russia)

Background

A stated objective of PICES is to provide data in exchangeable formats to better enable the evaluation of North Pacific ecosystems status and trends, and to support other strategic pursuits. PICES scientists face challenges in managing and delivering data in a shareable way. Furthermore, a growing number of ocean observing systems require data management and communication methodologies that conform to rigid standards and protocols. For the most part, traditional science education of the past century offered little training in data management. Today's typical scientist, although supportive of

data exchange, lacks the background to understand techniques to facilitate it.

Summary of presentations

This session was designed to acquaint PICES scientists with state-of-the-art information about metadata description, data delivery and data browsing techniques, with emphasis on existing standards and web services recommended for ocean observing systems. Basic to advanced methods were presented. Presenters described successful systems and learned ways of mapping existing data structures into conformant, exchangeable formats using no-cost, open-source and/or commercial applications. Session

topics covered database aggregation, real-time ship-shore data exchange protocols, cabled observatory data management, and GIS techniques.

The session's invited speaker, Dr. Anthony Isenor, established a foundation for the proceedings by discussing, with examples, three conceptual models for the exchange of data between systems. The first model, relying on a central data structure for passing data among nodes, is used commonly in meteorology and oceanography. A second, more formal model uses instances of a common data model. Nodes exchange data with an instance of a common database, with data replicated between the common-instance databases. The third conceptual model entails wrapper software that encapsulates the data asset. Applications query the data asset using an intermediate layer, sometimes called an integrator or mediator, to

identify the required data asset. The mediator then deals with critical data issues such as consolidation of parameter codes, units, replicate data, metadata content and multiple structures. The resulting data is provided to the user as a coherent and internally consistent data set.

This session was the first scientific session organized by TCODE. Papers covered topics of real time data delivery between ships at sea and land-based laboratories, marine data exchange protocol options and standards, merging and aggregating data sets and data streams from diverse sources, and metadata search and federation systems. Eleven papers were delivered and 5 posters. The session was received very well by PICES scientists and attendance was high, sometimes reaching 50 people, even though two other concurrent sessions were taking place.

List of papers

Oral presentations

Anthony W. Isenor (Invited)

Data exchanges, XML, and why the exchange problem is still unsolved

Deng-Wen Xia

Marine data exchange prototype based on XML

Dmitry. D. Kaplunenko, Vyacheslav B. Lobanov, Young Jae Ro and Mikhail Danchenkov

Merging Argo data and ship CTD observations to study mesoscale patterns in the Japan/East Sea

Natalia I. Rudykh, Elena V. Dmitrieva and Vladimir I. Ponomarev

Use of diverse database aggregation for the study of variability in oceanographic parameters of the Japan/East Sea

Shin-ichi Ito, Shigeo Kakehi, Motohiko Kashima, Yoshioki Oozeki and Kazuyuki Uehara

A system development for near-realtime data exchange between ship and shore-based analysts in Japan's Fisheries Research Agency (FRA)

Benoît Pirene and Robin Brown

NEPTUNE and VENUS: Data management and archival system for cabled ocean observatories

Kimberly Bahl, Hee Dong Jeong, Kyu Kui Jung, Hae Seok Kang, S. Allen Macklin and Bernard A. Megrey

Federated metadata of PICES member nations: Information sharing across international boundaries

Alex Kozyr and Misha Krassovski

The Mercury Metadata Search System and Web-Accessible Visualization and Extraction System (WAVES) for oceanographic data

Igor D. Rostov, Vladimir I. Rostov, Natalia I. Rudykh, Elena V. Dmitrieva and Alexander A. Pan

Oceanographic data base applications for the Far Eastern Region of Russia

Sei-Ichi Saitoh, Hidetada Kiyofuji, Daichi Tachikawa, Mihoko Abe, Kazuhiko Tateyama and Motoki Hiraki

Research and development of ubiquitous information services for integrated fisheries activities in the offshore around Japan

Anatoly I. Alexanin, Marina G. Alexanina, Pavel V. Babyak and Michail V. Kruglov

Problems of satellite data delivery and their solution by the FEB RAS Centre for Regional Satellite Environment Monitoring

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Posters

Stepan A. Antushey, Vitaliy K. Fischenko and Andrey V. Golik

About the scope of Grid technologies for support of complex oceanographic research in the northern Pacific

Sergey A. Fedorov, Vitaliy K. Fischenko and Andrey V. Golik

Web-based technology of CTD data visualization in FEB RAS corporate oceanographic GIS

Sergey M. Krasnopeyev and Alexander O. Teregulov

Metadata catalogue service based on the preliminary national standard

Alexander A. Pan and Vladimir I. Rostov

Tools for the visualization of gridded oceanographic data

Tomowo Watanabe and Yukimasa Ishida

Oceanographic data in the Japan Fisheries Oceanography DataBase (JFODB)

FIS Paper Session

Session Convenors: Yukimasa Ishida (Japan) and Gordon Kruse (U.S.A)

Background

Fishery science is a broad field in the PICES region, not only due to species diversity but also the wide geographical range of the North Pacific Ocean. Therefore, a specific topic session sometimes does not fully cover the science communication needs of fisheries scientists of PICES member countries. At the FIS meeting in 2002, it was noted that there was no FIS Paper Session at PICES XI. Furthermore, it was pointed out that convening such a session at PICES XII would enhance FIS activities in PICES by allowing participation of more fisheries scientists with different interests. The FIS paper session is also a good way to provide presentation opportunities by young scientists including students. These ideas were also confirmed at the FIS meeting in 2004. The FIS Paper Session in 2005 received 49 submissions, including 19 oral presentations (3 of which were withdrawn) and 30 posters (2 of which were withdrawn) that covered a wide variety of fish species from all member countries.

Summary of presentations

The session consisted of 16 oral presentations plus 28 posters. The most common topics during the oral session included presentations on the effects of ocean conditions on species

distributions, food and feeding. Species covered in these topics included shrimp, crab, squid, black snake mackerel and Pacific saury. One paper on Pacific cod recommended studies by PICES member countries to define population structure for management purposes, whereas a study of walleye pollock examined the role of climate regime shifts on recruitment and abundance. It appears that dynamics of walleye pollock biomass are related to changes in water temperature, primary productivity and zooplankton, and all of these were related to the 1977 regime shift. Another paper considered the effects of coastal pollution on the biomass distribution of macrobenthos. On a very different topic, a study was conducted on the effectiveness of a device, called an orca-sphere, to reduce depredation of longline catches by killer whales. The orca-sphere emits ultrasonic signals that appear to discourage killer whales from feeding on halibut, cod and Greenland turbot caught on longlines. Depredation of longline gear has also been a problem for these same fisheries, as well as sablefish fisheries in Alaska.

The most common taxa covered during the presentations were salmon and squid with 4 talks each. Papers presented on salmon covered the use of sea surface temperature to recommend fry release dates, a new estimation on return rate, use of otolith microchemistry, and tracking of

tagged salmon by the Pacific Ocean Shelf Tracking (POST) system. It appears that otolith microchemistry, particularly Sr/Ca and Ba/Ca, hold much promise to separate salmon stocks as well as to reconstruct life history patterns of migration from freshwater to estuary to marine and return to freshwater. The POST project continues to provide interesting results. Individual tagged salmon have been tracked as they migrate along the coast, and the project allows estimates of important parameters such as migration and survival rates. The number of presentations on squids at PICES has been increasing over the past several years. Despite

this trend, it is clear that much additional work is needed. For instance, very little is known about the life history of gonatid squids, especially the location of spawning. Estimates of squid abundance are lacking, but distribution and feeding ecology are becoming better understood. Off Korea, it was shown that common squid largely consume fish (perhaps mostly anchovy) and molluscs (including cannibalism of other squid). Based on the number of presentations and posters, breadth of species and subjects covered, and quality of the presentations, the FIS paper session was very successful.

List of papers

Oral presentations

Gennady A. Kantakov and Sergey D. Bukin

Oceanographical conditions changing and *Pandalus borealis* redistribution in the northern part Sea of Japan

Yuri Yu. Nikonov, Andrey S. Krasnenko and Valeriy N. Chastikov

Numerical analysis of the *Paralithodes brevipes* larvae migration in the Southern-Kurile strait's region

John R. Bower

Paralarval distribution patterns of the gonatid squid *Berryteuthis anonychus* in the North Pacific

Hyoung-Chul Shin, Don Hyug Kang and Yoon-Seon Yang

Fate of the common squid population in Korean waters; a natural oceanographic experiment over various time scales

Eun Jung Kim, Suam Kim, Dae-Yeon Moon and Jeong-Rack Koh

The vertical and horizontal distribution of bigeye (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) related to ocean structure

Toshiyuki Konishi, Hidetada Kiyofuji and Sei-Ichi Saitoh

Predictability of Pacific saury fishing grounds in the Northwestern North Pacific using satellite remote sensing data

Oleg Bulatov

The Bering Sea pollock and regime shifts

Alexei M. Orlov and Andrei N. Stroganov

Prerequisite of the study of Pacific cod population structure

George Shevchenko and Olga Shershneva

Monitoring of SST in the areas adjacent to the river mouths of Sakhalin applied to the problem of fry salmon release

Hyunju Seo, Suam Kim, Sukyung Kang and Kibeik Seong

A new estimation of salmon return rate and its use in environmental studies

Vladimir A. Rakov, Valentina V. Goncharova and Yulia V. Zavertanova

Monitoring of macrobenthos and larvae of fish at the Vrangell Bay (Sea of Japan)

Hyejin Song, Gun Wook Baek and Suam Kim

Food and feeding of the common squid *Todarodes pacificus* (Cephalopoda: Ommastrephidae) off Busan, Korea

Hiroshi Kubota, Yoshioki Oozeki and Ryo Kimura

Feeding ecology of larval and juvenile black snake mackerel (*Nealotus tripes*, Gempylidae) and their roles in the fish communities of the Kuroshio Extension Region

Dongwha Sohn, Sukyung Kang and Suam Kim

Comparison of otolith microchemistry between chum salmon (*Oncorhynchus keta*) and cherry salmon (*Oncorhynchus masou*) in Korean waters

David Welch, Peggy Tsang, Jayson Semmens, Sonia Batten and R. Scott McKinley

Performance of the POST (Pacific Ocean Shelf Tracking) array in 2004-05, and plans for the future

Konstantin A. Karvakin

The use of the "Orca Sphere" device in bottom longline fishery in the Okhotsk Sea

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Posters

Nadezhda L. Aseeva

Change of Myxozoa life strategy in the Japan/East Sea in XX Century

Nadezhda L. Aseeva

Myxozoa parasites in the fishes of the Japan Sea

Alexander A. Bonk

The loss of herring developing eggs in spawning grounds in the western Bering Sea

Oleg Bulatov and Georgiy Moiseenko

The Bering Sea pollock stock assessment using GIS "Fishery"

Svetlana V. Davydova

Interdecadal variations of the masses subtropical fishes reproduction and their influence on ichthyoplankton community of northwestern Japan/East Sea

Elena E. Andreeva, Svetlana V. Davydova and Marina A. Shebanova

Species composition, distribution and food habits of ichthyoplankton in the Okhotsk Sea in summer-autumn, 2003-2004

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

Elena V. Gritsay

The northern Bering Sea pollock fishery in 2004

Soto-o Ito and Yukimasa Ishida

Species identification and age determination of Pacific salmon (*Oncorhynchus* spp.) by scale patterns

Victor A. Nazarov, Boris I. Ivanov and Nikolay A. Chernykh

Changes of fish communities in estuaries of the Peter the Great Bay during the 20-21st centuries

Yeong Hye Kim, Dong Woo Lee, Jae Bong Lee, Kwang Ho Choi, Young Seop Kim, In Ja Yeon, Byung Kyu Hong and Soon Song Kim

Age and growth of the yellow croaker, *Larimichthys polyactis* in the East China Sea

Nikolai V. Kolpakov

Interannual variability of species composition and structure of circumlittoral fish community of Russkaya Bay (northern Primorye, Sea of Japan)

Svetlana Davydova, A. Zhigalin and N. Kuznetsova

About species composition and distribution of ichthyoplankton in the northwestern part of Pacific Ocean

You Jung Kwon, Dae Yeon Moon and Chang Ik Zhang

Stock assessment of bigeye tuna (*Thunnus obesus*) in the Pacific using the AD model builder

G.V. Avdeev and E.E. Ovsvannikov

The northern Okhotsk Sea pollock year-classes abundance

S.L. Ovsvannikova

Walleye pollock distribution and migrations in the south Kuril region in 1999-2004

Andrew B. Savin

Seasonal migrations of Pacific cod (*Gadus macrocephalus*, Gadidae) nearshore of Kamchatka peninsula

Victor A. Nazarov, Eugene I. Barabanshchikov, Nikolay A. Chernykh, Alexander A. Goryainov, Boris I. Ivanov, Nikolay I. Krupyanko, Anatoly Yu. Semenchenko, Vladimir I. Tarazanov and Sergey F. Zolotukhin

Characteristics of salmon association in the Sea of Japan's EEZ of Russia on boundary of the 20-21st centuries

Alisa V. Semina, Neonila E. Polyakova and Vladimir A. Brykov

Genetic divergence in daces of the *Tribolodon* genus (Teleostei: Cyprinidae) from Far Eastern seas

Young Il Seo, Jin Yeong Kim, Joo Il Kim, Sung Tae Kim, Chang Ik Zhang and Jae Bong Lee

Assessing the impact of yellow goosfish predation on small yellow croaker in the East China Sea of Korea

E.I. Barabanshchikov, N.V. Kolpakov and M.E. Shapovalov

Appraisal of striped mullet (*Mugil cephalus*) stock near-shore of Primorye

Marina A. Shebanova

Feeding of juvenile *Cololabis saira* in waters of Peter the Great Bay (Sea of Japan)

Hirofumi Shimizu, Kiyoshi Fujita and Yoshioki Oozeki

Bone abnormality of Pacific saury larvae *Cololabis saira*

M.A. Stepanenko and E.V. Gritsay

Effects of 2000-year class for recruitment Pollock in the eastern Bering Sea

Katsuya Suzuki, Tsutomu Takagi, Shinsuke Torisawa, Hiromu Fukuda, Osamu Murata, Shinji Yamamoto and Kazushi Miyashita

Evaluating the roles of vision and the lateral line in the schooling behavior of chub mackerel (*Scomber japonicus*) using a mathematical model

Inja Yeon, Yangjae Im, Hakjin Hwang and Myoungsohn

Current status of the Yellow Sea fisheries resources and management in Korea

Hakjin Hwang, Inja Yeon, Yangjae Im and Myoungsohn

Current stock conditions of yellow croaker, *Pseudosciaena manchurica*, in the Yellow and East China seas

Inja Yeon, Yangjae Im, Myoungsohn, Hakjin Hwang and Manwoo Lee

Morphological identification of subpopulations of the blue crab, *Portunus trituberculatus*, in the western sea of Korea

POC Paper Session

Convenor: Michael G. Foreman (Canada)

Background

Papers were invited on all aspects of physical oceanography and climate in the North Pacific and its marginal seas, particularly those related to the impacts of future climate change.

Summary of presentations

The session consisted of 26 oral presentations and 23 posters covering a wide range of physical oceanographic and climate issues. After a brief introduction by Dr. Foreman outlining a new working group entitled "Evaluation of Climate Change Projections", that will hopefully be established under POC, two invited speakers gave presentations related to recent climate change models that have been submitted to the Inter-governmental Panel on Climate Change (IPCC) for their Fourth Assessment Report. Dr. Hasumi described the high and medium resolution coupled atmosphere-ocean models that are presently being run on the Earth Simulator in Japan, and Dr. Wang described her preliminary analyses of 15-20 IPCC climate model simulations for the Arctic and North Pacific Oceans. Subsequent talks in the first afternoon session presented results on ecosystem changes in the Northwest Pacific associated with global warming (Yamanaka), analyses of temperature regimes in the northwest Japan/East Sea (Gayko), the predictability of seasons in the Bering and Okhotsk Seas (Tananaeva), the importance of including a surface wave

parameterization in numerical circulation models (Qiao), an improved tropical teleconnection index for the Northeast Pacific (McKinnell), and the role that the 18.6-year nodal modulation of diurnal tides in the Kuril Islands may play in intermediate water formation in the Northwest Pacific and Sea of Okhotsk (Osafune), and perhaps climate variability for the entire North Pacific (Yasuda).

On the second day, talks in the morning session prior to the coffee break focussed on numerical modelling. Presentations included predicting the location of the Kuroshio Extension and Oyashio First Branch with the JDOPE model (Ito), modelling and observational studies of the Juan de Fuca Eddy (Foreman), assimilating temperature and salinity data into a circulation model for the Japan/East Sea (Platov), comparing numerical current simulations with infrared satellite imagery in the Japan/East Sea (Trusenkova), and modelling and analysing North Pacific sea surface temperature variability using EOF and cluster approaches (Kuzin). After the coffee break the presentations were more varied. They included studies of seasonal hypoxia near the Changjiang Estuary (Wei), realtime monitoring and modelling in Kanjin Bay Korea (Ro), water and chlorophyll modelling in Aniva Gulf (Nikonov), interannual changes in dissolved oxygen in the Sea of Okhotsk (Mateev), and the development and interaction of eddies in the Kuroshio Current (Obukhova). The final part of the session after

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lunch included presentations on variations in North Pacific intermediate water formation (Shimizu), seasonal variability along the line between Cape Aniva and Cape Dokuchaev (Shevchenko), the impact of tidal and atmospheric forcing variability on salinity and dissolved oxygen in the western subarctic Pacific (Andreev), meridional mass and heat transport across a line in the East/Japan Sea (Park), the effects of eddy dynamics on phytoplankton distributions in the Eastern Kamchatka and Oyashio Currents (Takemura), and interannual variations in temperature in the Sea of Okhotsk (Zhigalov).

Satoshi Osafune (Japan) and Yuri Nikonov (Russia) were named co-winners of the Best Presentation Award from the POC Committee for their respective presentations "*Bidecadal variability in the intermediate waters of the northwestern subarctic Pacific and the Okhotsk*

Sea in relation to the 18.6-year nodal tidal cycle" and "*Water and chlorophyll circulation modeling of Aniva Gulf according to oceanographic data from the year 2002*". The Best Poster Award for the entire meeting was awarded to Hanna Na (Korea) for her submission "*Temporal variation of the estimated volume transport through the Korea and Tsugaru Straits*" to the POC Paper Session.

Overall, the session was a success. The number of submitted abstracts exceeded expectations (necessitating a session expansion from 1.0 to 1.5 days), the foundation was laid for a new working group on evaluating climate change projections, and all participants left with a lasting impression of the breadth and depth of physical oceanographic studies being carried out in the North Pacific.

List of papers

Oral presentations

Michael G. Foreman

Evaluation of climate change projections: A new Working Group under the PICES Physical Oceanography and Climate Committee

Hiroyasu Hasumi, Tatsuo Suzuki, Takashi T. Sakamoto, Seita Emori, Masahide Kimoto and Akimasa Sumi

Present and future of the North Pacific simulated by a high resolution coupled atmosphere-ocean general circulation model

Muyin Wang and James E. Overland

A first look at the new IPCC AR4 climate model simulations over the North Pacific

Yasuhiro Yamanaka, Taketo Hoshioka, Maki N. Aita and Michio J. Kishi

Changes in ecosystem in the western North Pacific associated with global warming

Larissa A. Gavko

The analysis of temperature regimes in coastal areas of the north-west Japan/East Sea by climatic periods

Ichiro Yasuda, Satoshi Osafune and Hiroaki Tatebe

Possible mechanism of bi-decadal North Pacific ocean/climate variability in relation to the 18.6-year period nodal cycle

Skip McKinnell

Detecting the 1972/73 El Niño in the Northeast Pacific with an improved tropical teleconnection index

Victor I. Kuzin, Aleksandr S. Lobanov and Valery M. Moiseev

Analysis and modeling of north and tropical Pacific SST variability

Yulia N. Tananaeva and Marat A. Bogdanov

Interannual variability of cold and warm seasons and their duration in the North West Pacific

Satoshi Osafune and Ichiro Yasuda

Bidecadal variability in the intermediate waters of the northwestern subarctic Pacific and the Okhotsk Sea in relation to the 18.6-year nodal tidal cycle

Fangli Qiao, Changshui Xia, Zhenya Song, Yongzeng Yang and Yeli Yuan

Ocean surface waves play an essential role in air-sea interaction from an atmosphere-wave-ocean coupled model

Shin-ichi Ito, Shigeo Kakehi, Motohiko Kashima, Kosei Komatsu, Takashi Setou and Yasumasa Miyazawa

Predictability of location of the Kuroshio Extension and the Oyashio First Branch by JCOPE

Michael Foreman, Wendy Wiggins, Angelica Peña, Emanuele Di Lorenzo, Barbara Hickey, Amy MacFadyen and Vera Trainer

Modelling and observational studies of the Juan de Fuca Eddy

Gennady A. Platov, Elena N. Golubeva, Young Jae Ro and John F. Middleton

Numerical study of the general circulation in the Japan/East Sea with simple assimilation of temperature and salinity data

Olga O. Trusenkova, Vyacheslav B. Lobanov and Aleksandr A. Nikitin

Seasonal and interannual variation of currents in the western Japan/East Sea: Numerical simulation in comparison with infrared satellite imagery

Hao Wei, Yunchang He, Qingji Li and Zhiyu Liu

Seasonal hypoxic zone adjacent to the Changjiang Estuary

Young Jae Ro and Kwang Young Jung

Realtime monitoring of oceanic state variables in Kangjin Bay, South Sea, Korea

Yuri Yu. Nikonov, Valeriy N. Chastikov and Ludmila Yu. Gavrina

Water and chlorophyll circulation modeling of Aniva Gulf according to oceanographic data from the year 2002

Vladimir I. Matveev

Interannual changes of dissolved oxygen in an active layer of the Okhotsk Sea

Nafanail V. Bulatov and Natalya G. Obukhova

One type of eddy development in the northeastern Kuroshio branch

Yugo Shimizu, Lynne D. Talley, Shin-ichi Ito and Miyuki Tatesawa

Distribution and transport variations of source waters for North Pacific Intermediate Water formation revealed by multiple tracer analysis

George Shevchenko and Valery Chastikov

Seasonal variability of oceanological conditions in the southern part of the Okhotsk Sea from CTD surveying on standard section Cape Aniva – Cape Dokuchaev

Andrey G. Andreev and Victoria I. Baturina

Impacts of the tides and atmospheric forcing variability on salinity and dissolved oxygen in the western subarctic Pacific

Young-Gyu Park, Kyung-Hee Oh and Moon-Sik Suk

Meridional mass and heat transport across the 38-40°N line in the East/Japan Sea

Hiroki Takemura and Sei-Ichi Saitoh

Spatial phytoplankton distributions affected by eddy dynamics in the Eastern Kamchatka Current and Oyashio regions during the spring between 1998-2004

Vladimir A. Luchin and Igor A. Zhigalov

Typical distribution of interannual variations of water temperature in the active layer of the Okhotsk Sea and their possible prediction

Posters

Valentina D. Budaeva, Georgi V. Shevchenko, Vajcheslav Makarov and Valery N. Chastikov

Intraannual thermohaline dynamics in Aniva Bay

Boris S. Dvakov

Spatial and temporal variability in circulation and hydrophysical fields in Tatar Strait

Lyudmila Yu. Gavrina, L.N. Propp and V.N. Chastikov

Factors of the environment and production characteristics in Aniva Bay, Sea of Okhotsk and bordering straits (Laperuz, Tatarsky) in 1996-2002

Shigeho Kakehi, Shin-ichi Ito, Motohiko Kashima, Kosei Komatsu, Takashi Setou and Yasumasa Miyazawa

The comparisons between JCOPE and observed data in Tohoku regions

Kosei Komatsu, Takashi Setou, Yasumasa Miyazawa, Akira Kusaka, Shin-ichi Ito, Shigeho Kakehi, Motohiko Kashima, Manabu Shimizu, Hideki Akiyama, Kazuyuki Uehara and Mitsuyuki Hirai

Verification of JCOPE Ocean forecast system using *in situ* data of Japanese fisheries research institutions

Takashi Setou, Kosei Komatsu, Yasumasa Miyazawa, Shin-ichi Ito, Kazuyuki Uehara, Manabu Shimizu, Akira Kusaka, Shigeho Kakehi, Motohiko Kashima, Hideki Akiyama and Mitsuyuki Hirai

Incorporating *in situ* data obtained by Japanese fisheries research institutions into the JCOPE Ocean forecast system

Young Jae Ro and Kwang Young Jung

Hydrographic and hydrodynamic variability in Kangjin Bay, South Sea, Korea

Yun-Bae Kim, Kyung-II Chang, JongJin Park, Kuh Kim, Jae Hak Lee and Jae-Chul Lee

Flow through the Ulleung Interplain Gap in the southwestern East/Japan Sea

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Zhiyu Liu, Haitang Wang and Hao Wei

Bottom drag coefficient estimates in the tidal bottom boundary layer from acoustic Doppler velocimeter data

Vasily F. Mishukov, Alexander N. Medvedev and Andrey S. Neroda

Natural and anthropogenic sources of chemical elements in aerosols over Vladivostok

Valentina V. Moroz and Konstantin T. Bogdanov

Water structure and circulation variability in the Kuril Straits area

Hanna Na and Kuh Kim

Temporal variation of the estimated volume transport through the Korea and Tsugaru Straits

Aleksander A. Nikitin

Thermal features of water structure of the Japan/East Sea on satellite and ship observations

Aleksander A. Nikitin, Yury Novikov and Vadim Petruk

Monitoring of Peter the Great Bay (Japan/East Sea) on IK-images and hydrological data in April-May of 2005

Alexander A. Nikitin, Larissa S. Shkoldina, Ekaterina N. Selivanova and Lyana D. Kulichkova

The phenomenon of warm water allochthons in the north-western Japan/East Sea during winter-spring 2003-2004 and peculiarities of the thermal regime

Eugene V. Samko and Vadim M. Petruk

Research on Bering Sea geostrophic circulation from satellite altimetry data: Two approaches to solving the problem

Antonina M. Polyakova

Especially dangerous wave heights and safety of the fishing fleet in the Northern Pacific

Antonina M. Polyakova

Ice formation is especially dangerous for fishing boats in the Northern Pacific and for the safety of the fishing fleet

Eung Kim and Young Jae Ro

Structure of seawater properties profiled by the Argo floats in the Ulleung-do area (East/Japan Sea), 2003-2004

Tatyana A. Shatilina, L.Yu. Matyushenko and R.B. Kravchenko

Monitoring of baroclinic circulation conditions and ice cover by GIS methods in the Far Eastern Seas

Young-Sang Suh, Hiroshi Kawamura, Futoki Sakaida, Sang-Woo Kim, Lee-Hyun Jang and Na-Kyung Lee

Daily variation of abnormal ocean conditions in the northwestern Pacific Ocean using NGSST satellite data

Svetlana N. Taranova and Igor A. Zhabin

Water mass transformation in the Japan/East Sea

Galina A. Vlasova and Vladimir I. Rostov

Analysis of seasonal variability of hydrodynamic structures in the Sea of Okhotsk and their dependence on baric systems in the atmosphere

MEQ Workshop (W1)

Review of selected harmful algae in the PICES region: I. Pseudo-nitzschia & Alexandrium

Co-convenors: Tatiana Orlova (Russia) and Mark Wells (U.S.A.)

Background

This workshop is the beginning of an annual series in which harmful algal bloom (HAB) species that impact all or most countries in the North Pacific are discussed in detail. In 2005, the workshop focused on two genera, *Pseudo-nitzschia* and *Alexandrium*. Topics included detection methods, ecosystem comparison, and new advancements in physiology and ecology from each of the member countries. In particular, we would like to stress those factors,

which need additional study in order to develop a predictive capacity for these HABs. Specific subjects included: a comprehensive listing of both macro- and micro-nutrient requirements, toxin production, light and temperature requirements, environmental conditions, species and strain variability, cyst formation, shellfish species impacted, modeling, and genetics. We documented our knowledge on the ecophysiology of these HAB species as a result of this workshop. During future workshops we anticipate discussing additional HAB species,

including: *Cochlodinium*, *Heterosigma akashiwo*, *Dinophysis*, *Heterocapsa*, *Chattonella*, *Gymnodinium catenatum*, and *Karenia mikimotoi*. This workshop was preceded by a ½-day laboratory demonstration on detection techniques for algal toxins at the TINRO-Center in Vladivostok.

Summary

The workshop was held on September 30, 2005, at the TINRO-center in Vladivostok, Russia, and was attended by 22 participants, including 11 members of the HAB Section from Canada, Japan, Korea, Russia and the United States of America. The convenors organized the presentations to include *Alexandrium* spp. in the morning session and *Pseudo-nitzschia* spp. in the afternoon session. Each session was started with a series of brief (10-15 min) overviews provided by each PICES country. These were followed up by invited presentations on what is known about the ecophysiology of the organism, including the factors governing growth rates and toxin production. Combined, this information on distribution and ecophysiology was served as a framework for discussions on the key research goals needed to strive towards gaining better understanding of HAB events and the future of HAB work within PICES. HAB species that impact all or most countries in the North Pacific are discussed in detail.

The workshop discussions addressed *Alexandrium* spp. in the morning session and *Pseudo-nitzschia* spp. in the afternoon session. Both discussions were structured around the three main stages presented in Dr. Trick's initial review seminar. These stages influence both the appearance and persistence of toxic phytoplankton in coastal waters of different regions. They are:

- Getting There
- Being There
- Staying There

Where "getting there" reflects the transport of a toxic species to the new region via natural (*e.g.*, water movement) or anthropogenic (*e.g.*, ballast water or aquaculture) means. "Being there"

reflects the ability of the cells to reproduce and remain viable over the course of the growth season. "Staying there" reflects the persistence of the species over several annual cycles. During the subsequent discussions the group selected a series of key questions that were both central to understanding the ecophysiology of these toxic species and of sufficiently narrow focus that they could be addressed successfully over the next several years.

Alexandrium spp.

Does toxin play a role in any of the three stages necessary for a toxic bloom event? What are the factors responsible for the greater diversity of *Alexandrium* species in the western Pacific *vs.* the eastern Pacific Ocean, and also the Northern and Southern reaches of the western Pacific Ocean? Does greater genetic diversity make up for the lesser diversity of species and geographic diversity in the eastern Pacific - or is this related to a paucity of different potential habitats in the eastern Pacific Ocean (western North America) compared to the western Pacific (environmental-based).

Does toxin confer a competitive advantage for *Alexandrium* spp.? We need a physiological comparison between toxic and non-toxic strains. Could one strain under different conditions produce different toxins (*e.g.* nutrient limitation), and thus be a factor responsible for regional variations in toxin type and/or production?

Is the composition of the toxin physiological (genetic) or environmental-based? In other words, do the environment factors select for the successful propagation of *Alexandrium* spp. and its production of specific toxins?

Does sediment composition affect the survivability of cysts and their viability, and hence bloom distributions?

Do the complexities of eutrophication affect toxin production? For example, does the change in nutrient ratios influence the total production and composition of the saxitoxin isomers?

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How might (does) climatic change affect *Alexandrium* distribution and its toxicity? It is important to consider that the stability of the water column could be the 'key' to the success of *Alexandrium*, and how could this be impacted by a) changes in hydrological patterns (*i.e.* riverine discharge), b) storm severity/frequency resulting in surpassing natural physical barriers for cyst transport, and c) sea temperature effects on the distribution of *Alexandrium* spp?

Pseudo-nitzschia spp.

What chemical or biological factors contribute towards toxin production in *Pseudo-nitzschia*. This question is of particular significance because blooms of a given species can be either non-toxic or extremely toxic for reason not yet understood.

Is there a difference in the degree of toxin production in *Pseudo-nitzschia* species between the Eastern and Western margins of the North Pacific? If so, why? For example, is it related to the structure of the food web, the growth conditions for the organisms, or total nutrients inputs?

What is the capacity of different *Pseudo-nitzschia* species to produce domoic acid? In other words, are there truly non-toxic *Pseudo-nitzschia* species? Or, is the absence of toxin in cultures of isolates due to culture conditions being unfavorable to toxin production?

Does domoic acid production confer some competitive advantage to toxic cells? Some current hypotheses suggest that the toxin serves some metabolic role, but if so, what benefit do *Pseudo-nitzschia* species gain by producing domoic acid?

Is high cell toxicity in coastal waters associated primarily with cell senescence, or actively growing populations? In other words, can the stage of the *Pseudo-nitzschia* bloom serve as a rudimentary predictor of bloom toxicity?

Is there a common succession pattern of phytoplankton leading to toxic *Pseudo-nitzschia* blooms? Does the removal or addition of nutrients or compounds by preceding phytoplankton populations enhance the success or toxicity of subsequent *Pseudo-nitzschia* blooms?

List of papers

W1 (MEQ) Workshop

Charles G. Trick (Invited)

Occurrence and effects of *Alexandrium* species in the environs of the North Pacific

Satoshi Nagai

Microsatellite markers reveal population genetic structure of the toxic dinoflagellate *Alexandrium tamarense* (Dinophyceae) in Japanese coastal waters

Shigeru Itakura, Satoshi Nagai, Yukihiro Matsuyama and Mineo Yamaguchi

Notes on *Alexandrium* bloom occurrence in Japanese coastal waters

Ruixiang Li and Mingyuan Zhu

The distribution and HAB formation of *Alexandrium* spp. in Chinese coastal waters

Changkyu Lee, Ensub Cho, Jongkyu Park, Changhoon Kim, Wolae Lim and Giyoung Kwon

Occurrence of *Alexandrium* species in Korean coastal waters

Tatiana Orlova, Marina Selina and Inna Stonik

Species of the genera *Alexandrium* from the east coast of Russia

Vera L. Trainer, B-T.L. Eberhart, J.C. Wekell, N.G. Adams, L. Hanson, F. Cox and J. Dowell

Paralytic shellfish toxins from *Alexandrium* in Puget Sound, Washington, U.S.A.

Stephen S. Bates (Invited)

Biology of the diatom *Pseudo-nitzschia*, producer of the ASP toxin domoic acid

Shigeru Itakura, Satoshi Nagai, Yukihiro Matsuyama and Mineo Yamaguchi

Notes on *Pseudo-nitzschia* bloom occurrence in Japanese coastal waters

Ruixiang Li and Mingyuan Zhu

The distribution and HAB formation of *Pseudo-nitzschia pungens* in Chinese coastal waters

Jinhui Wang, Nina Lundholm, Øjvind Moestrup, Yutao Qin and Ren Xu

Preliminary study of *Pseudo-nitzschia* spp. in the Yangtze estuary (China)

Changkyu Lee, Ensub Cho, Jongkyu Park, Changhoon Kim, Wolae Lim and Giyoung Kwon

Occurrence of *Pseudo-nitzschia* species in Korean coastal waters

Tatiana Orlova, Marina Selina and Inna Stonik

Species of the genera *Pseudo-nitzschia* from the east coast of Russia

William P. Cochlan, Julian Herndon and Nicolas C. Ladizinsky

Inorganic and organic nitrogen uptake capabilities of the toxigenic diatom *Pseudo-nitzschia australis*

HAB Section Meeting

Gennady A. Kantakoy, Marina S. Selina, Inna V. Stonik and Tatiana Y. Orlova

Oceanological conditions and HAB monitoring in Aniva Bay, Sea of Okhotsk during 2003

Mark L. Wells, Charles G. Trick, William P. Cochlan, Margaret P. Hughes and Vera L. Trainer

Domoic acid: The synergy of iron, copper and the toxicity of diatoms

Mingyuan Zhu and Ruixiang Li

Why the time of large scale HAB of *Prorocentrum* in the area south of Yangtze River Estuary changed in spring of 2005

Hak-Gyoon Kim, Tatiana Orlova, Vera L. Trainer, Charles G. Trick, Yasunori Watanabe and Ming-Yuan Zhu

Participation in the Intergovernmental Oceanographic Commission's Harmful Algae Event Database (HAE-DAT): The first year of PICES involvement

Henrik Oksfeldt Enevoldsen, Monica Lion and Benjamin Sims

Progress in the development of an international collaborative harmful algal event data base: The joint IOC-ICES-PICES HAE-DAT

MEQ Workshop (W2)

Introduced species in the North Pacific

Co-convenors: Yasuwo Fukuyo (Japan), Stephan Gollasch (ICES) and Glen Jamieson (Canada)

Background

The workshop concerned the status of introduced organisms in member countries and progress in developing inventories of introduced species; reports of activities related to research on vectors, including natural (currents and organisms such as turtles and birds), and anthropogenic (ballast water, hull fouling, fisheries, etc.) ones; reports of activities related to the Ballast Water Management Convention, especially measurement of compliance with ballast water exchange protocols, and measurement of effectiveness and development of systems of ballast water treatment. The workshop aimed to have a discussion on the establishment of a Working Group on introduced species under MEQ.

Summary of presentations

Fourteen of 15 scheduled speakers presented papers, with contributors from both PICES and ICES members. Papers presented ranged from descriptions and listings of NIS by geographic area, the characteristics of species that increase their survival if transported to new areas and habitats, the consequences of NIS on ecosystems, research requirements to address recently approved guidelines in the Ballast Water Management Convention that were established at MEPC 53 in July 2005, and the implications from using approved chemicals or products to treat water (possible within the Convention) for control of NIS, and finally, the characteristics of bacterial communities found in ballast water tanks and their reduction as a result of before and after mid-ocean exchanges.

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Discussion following the presentations included the impact of global warming on NIS spread, the utility of risk assessment in identifying the most important introduction vectors, the challenges in developing mitigation measures, and how changing water characteristics (quality and heat

discharge) seem to be favouring survival rates on new invaders.

The workshop discussion included a proposal to establish a new PICES Working Group on invasive species.

List of papers

Oral presentations

Alexander Yu. Zvyagintsev

Introduction of species into the northwestern Sea of Japan

Li-Jun Wang and Bin Wang

Marine introduced species in China seas and action plans

Hiroshi Kawai, Takeaki Hanyuda and Shinya Uwai

Macroalgal diversity of hull communities on trans-ocean coal carriers

Glen Jamieson, Colin Levings, Dorothee Kieser and Sarah Dudas

Marine and estuarine non-indigenous species in the Strait of Georgia, British Columbia, Canada

John E. Stein

Invasive species in the North Pacific – review of US research

Mitsunori Iwataki, Hisae Kawami, Kazumi Matsuoka, Takuo Omura and Yasuwo Fukuyo

Phylogeny and geographical distribution of *Cochlodinium polykrikoides* population (Gymnodiniales, Dinophyceae) collected from Japanese and Korean coasts

Sergej Olenin (Invited)

Xenodiversity versus biodiversity: Invasive alien species in European coastal marine ecosystems

Stephan Gollasch

Overview on introduced aquatic species in Europe – With focus on ICES Member Countries

Dan Minchin (Invited)

Vectors and processes involved in biological invasions

Akiko Tomaru, Yasuwo Fukuyo, Masanobu Kawachi and Hiroshi Kawai

Effect of mid-ocean exchange of ballast water on bacterial community in ballast tanks

Yasuwo Fukuyo, Katsumi Yoshida and Shin-ichi Hanayama

Importance of inputs from scientists to effective implementation of ballast water management convention

Shinichi Hanayama and Miyuki Ishibashi

Efforts of IMO to avoid secondary toxicity risk on the marine environment by chemical treatment of Ballast Water Management System

Helge Botnen and Stephan Gollasch

Tests of a ballast water treatment system onboard an ocean-going vessel and hints on a new sampling device for larger volumes of water

John E. Stein

Advantage of organizing a PICES Working Group on marine bioinvasions for future cooperation among PICES and ICES

Stephen Gollasch

Recommendation from the Chairman of ICES/IOC/IMO WGBOSV for the consideration by PICES in preparing the TOR for the new PICES Working Group

IFEP/MODEL Workshop (W3)

Modelling and iron biogeochemistry: How far apart are we?

Co-convenors: Fei Chai (U.S.A.), Jun Nishioka (Japan), Yasuhiro Yamanaka (Japan)

Background

Synthesis of data from three successful meso-scale iron enrichment experiments in the subarctic North Pacific (SEEDS-I & II and SERIES) is underway. This workshop was structured to enhance communication between experimentalists and modelers. For the most part, iron is not explicitly represented in current ecological models. The goal of this workshop was to examine the structure of iron biochemical models with respect to what is known about iron biogeochemistry, and to establish a framework for organizing a 2-3 day workshop to address this problem in detail, and to compare ecological models that describe how plankton ecosystem respond to meso-scale iron enrichment in the high-nutrient, low-chlorophyll waters of the subarctic Pacific.

Summary of presentations

An iron biogeochemist introduced recent knowledge of the marine iron cycle and explained the complexities of iron chemistry. Five modelers introduced various types of models that included iron response: a 1-D model representing the SEEDS experiment, a 3-D model with various sources of iron in the Sea of Okhotsk, a 1-D model for intercomparison of three iron fertilization experiments, a 1-D model

List of papers

Oral presentations

Peter L. Croot (Invited)

The importance of iron speciation and kinetics in understanding iron biogeochemical cycling in the open ocean: Effects on budget estimates from meso-scale tracer release experiments

Naoki Yoshie, Yasuhiro Yamanaka and Shigenobu Takeda

Development of a marine ecosystem model including intermediate complexity iron cycle

Michio J. Kishi, Takeshi Okunishi and Yukiko Ono

Lower trophic ecosystem model including effect of iron in the Okhotsk Sea and adjacent areas

M. Angelica Peña, K.L. Denman, C. Voelker and R.B. Rivkin

Modelling the ecosystem response to iron fertilization during SERIES

Masahiko Fujii, Naoki Yoshie, Yasuhiro Yamanaka and Fei Chai

Simulated biogeochemical responses to iron enrichments in three high nutrient, low chlorophyll regions

representing the SERIES experiment, and an ocean iron cycle model.

The discussion led to the following understanding:

- That in order to determine suitable model complexity, it is necessary to consider the identification of important processes, the selection of appropriate spatial and temporal scales, the determination of functional groups, *etc.*)
- That understanding the iron cycle and its effect on ecosystems involves goals that are both specific (mechanisms differ among iron fertilization experiments) and general (variability of ecosystem dynamics associated with climate changes in the near future, iron cycle in the ocean).

It was agreed that:

- Jointly with MODEL, an ecosystem model be developed that includes an iron cycle,
- Be facilitated intercomparisons of models with experimental databases provided by IFES,
- A 1-day IFEP/MODEL workshop be planned at PICES XV in Yokohama and travel support requested for 1 invited speaker (*IFEP Endnote 3*).

Session Summaries-2005

James Christian and **Christoph Voelker**

Modelling the ocean iron cycle – The major uncertainties

MONITOR Workshop (W4)

Filling the gaps in the PICES North Pacific Ecosystem Status Report

Co-convenors: Vyacheslav Lobanov (POC), Phillip R. Mundy (MONITOR), R. Ian Perry (SB), and Sei-Ichi Saitoh (MONITOR)

Background

PICES published its first North Pacific ecosystem status report (NPESR), as Marine Ecosystems of the North Pacific in 2004 (PICES Special Publication 1). The NPESR focused on the period from 1999-2003 in presenting information from throughout the PICES area on climate, oceanography and living marine resources. It also identified some of the critical factors responsible for change in the ecosystems of this area. Although the report covered a large diversity of information, much important information has yet to be incorporated. For example, benthic organisms, nearshore areas and contaminants were not well represented, nor were syntheses and summaries of ecosystem indicators that could be compared across regions widely represented. Determining the relative importance of these data gaps and other missing information are important considerations in producing the next NPESR. The PICES Scientific Report on *Fisheries and Ecosystem Responses to Recent Regime Shifts (FERRRS)* addressed some of these gaps and could become part of the NPESR in the future. The new MONITOR Technical Committee was assigned the responsibility to produce the next version of the NPESR. The purpose of the workshop was to guide the MONITOR Technical Committee by critically examining the current NPESR and the process that produced it. In addition the workshop considered and discussed other ecosystem status reports and other formats for providing similar information. Presentations on these topics were received and discussed during the workshop.

Summary of presentations

The workshop consisted of 7 oral presentations accompanied by extensive discussion of the issues surrounding the production of the North Pacific Ecosystem Status Report, NPESR. Papers addressed the purpose and content of scientific status reports relevant to the development of the NPESR. Five key issues in producing the report were presented and discussed:

- 1) Defining the overall process;
- 2) Filling data gaps;
- 3) Identifying themes to be more fully developed;
- 4) Identifying scientists to produce the report; and
- 5) Identifying clients and users of the report.

In the subsequent discussion of the five issues, two more important issues were identified:

- 6) Identifying the boundaries of the geographic regions used in the report,
- 7) Adding stock assessments of the approximately 15 species that are targets of the major North Pacific fisheries as indicators of ecosystem status.

A range of options for producing future reports, including labor intensive major re-writes with hard copy publication, and brief annual updates of selected topics on the web were presented and discussed. Significant gaps in data and analysis were noted in the areas of chemical oceanography, benthos, harmful algal blooms and indicators of the status of salmon populations. Hypotheses regarding the mechanisms of production of birds, fish and

mammals were presented as a means to identify gaps in the NPESR and monitoring programs in general. As one means to fill gaps, it was suggested that periodic workshops be conducted on themes including large basin scale physical oceanography including circulation analyses, contaminants, ecosystem level salmon status and trends, intertidal and subtidal ecosystems (see NaGISA presentation), human dimensions (*e.g.* fishing effort and other human activities), acidification and habitat. The NPESR could also benefit from balanced participation by scientists from all member nations. MONITOR was advised to take a proactive approach to understanding what organizations and professions may need in the NPESR, and how

the format (brochures, web site, full printed version) of the NPESR could be best designed to reach them. The experience in the Yellow Sea advises that thorough data mining will be necessary to ensure that significant information has not been overlooked. Overall, the workshop participants expressed enthusiasm for the present NPESR, and they were very positive about the future utility of the NPESR in a variety of formats for scientists, policy makers and implementers, NGO's and the concerned public. The workshop results guided the discussion in the MONITOR Technical Committee the next day.

List of papers

Oral presentations

R. Ian Perry and Skip McKinnell

PICES report on the marine ecosystems of the North Pacific: Why, how, and what's needed next

David L. Fluharty

Putting ecosystem science to work

Jacqueline Alder (Invited)

Millennium Ecosystem Assessment: Lessons learned

P. Robin Rigby, Tetsuya Kato and Yoshihisa Shirayama (Invited)

Broadening our understanding of the North Pacific nearshore ecosystem: Integrating PICES and NaGISA

Sinjaee Yoo

Filling the gaps: The case of the Yellow Sea

Peter S. Rand, Xanthippe Augerot and Cathy D. Pearson

Progress on a range-wide inventory for Pacific salmon monitoring data

Phillip R. Mundy

Hypothesis-driven ecosystem monitoring in the Gulf of Alaska

