

## Summary of Scientific Sessions and Workshops

### Science Board Symposium (S1)

#### *Mechanisms of Marine Ecosystem Reorganization in the North Pacific Ocean*

Co-Convenors: *Sinjaee Yoo (SB), Atsushi Tsuda (BIO), Mikhail Stepanenko (FIS), Steven Rumrill (MEQ), Hiroya Sugisaki (MONITOR), Kyung-Il Chang (POC), Toru Suzuki (TCODE), Thomas Therriault (AICE), Hiroaki Saito (COVE), Robin Brown (SOFE) and Fangli Qiao (China)*

#### **Background**

Marine ecosystem variation often is attributed to natural or anthropogenic stressors, especially climatic or hydrological forcing. These studies typically show correlations among ecosystem characteristics and indices of global warming or climatic oscillations. Also, changes in biological communities often are described in terms of their correlative relationships to these large-scale indices. While these studies have produced interesting results, the underlying mechanisms responsible for ecosystem change have not been totally identified, especially when it comes to understanding how populations, communities, and ecosystems are reorganized, sometimes dramatically, over short time periods. Complexity, arising from varying influences of biotic and abiotic factors on multiple spatial and temporal scales, challenges our understanding of these processes. Because of our insufficient understanding of ecological mechanisms for oceanic regions, it is not unusual to find that what has happened in the past cannot adequately predict what will happen in the future. Thus, the focus of this Science Board Symposium will be on describing mechanisms of ecosystem change and reorganization. The influence of factors operating at various temporal and spatial scales will be considered. This symposium will lead to a better understanding of factors that control species composition and ecosystem structure in the North Pacific Ocean, and improve our ability to predict system responses to future stressors, including climate change.

#### **Summary of Presentations**

The Science Board Symposium was held on Monday, October 17, 2011 (full day) and was launched with a keynote address by Olga Temnykh and included five invited presentations: Sukgeun Jung (Jeju National University, Korea), Maurice Levasseur (Université Laval, Canada), William Sydeman (Farallon Institute for Advanced Ecosystem Research, U.S.A.), Mitsuo Uematsu (University of Tokyo, Japan), and Igor Volvenko (TINRO-Center, Russia). In addition, there were seven contributed oral presentations and six poster presentations.

The keynote address was given by Olga Temnykh (Pacific Research Fisheries Center, TINRO-Center) who provided a view of recent climate variability relative to variability observed over much longer time scales. Dr. Temnykh highlighted the role of cosmologic and geophysical factors responsible for shaping the atmosphere and hydrosphere. Using recently compiled datasets on variations in productivity of pelagic and bottom fish, squid, zooplankton and jellyfish acquired by TINRO-Centre in the northwestern Pacific Ocean over the past 30 years, she showed that biotic responses might be synchronous or asynchronous with global and/or regional climate processes. Thus, caution must be exercised when linking observed changes in ecosystem properties to climate variability. Lastly, Dr. Temnykh highlighted the need for extreme caution when attempting to forecast ecosystem changes as this can only be accomplished once the underlying mechanisms have been resolved.

There is little doubt that volcanic eruptions can significantly impact atmospheric and oceanographic processes. Mitsuo Uematsu highlighted the fact that impacts on atmospheric processes have been relatively well studied while those on oceanographic ones have not. Using three case studies, Mitsuo showed how biogeochemical processes in the North Pacific Ocean are affected by volcanic eruptions and the importance of these events in

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maintaining North Pacific marine ecosystems. For example, the Miyake-jima volcano (Tokyo, Japan) is an important source of nitrogen compounds, Mt. Okmok (Aleutian Islands, USA) is an important source of iron, and emissions from Kilauea volcano (Hawaii, USA) can alter cloud cover and thus the amount of light/radiation able to reach the ocean's surface and contribute to primary productivity. Advances in monitoring and ocean observing programs are making it possible for (almost) real time data to be shared broadly.

Keeping with the volcanic theme, Maurice Levasseur introduced us to his research into the role of volcanic dust in promoting phytoplankton productivity. Maurice noted that although Fe limitation has been noted for some time in the Alaskan Gyre, most efforts to understand how increasing Fe might increase productivity have largely been indirect. For example, *in situ* observations of large scale fertilization experiments or addition of chemical forms of iron. To better understand the actual bioavailability of iron in the ocean and its potential contribution to primary productivity, Maurice presented the results of his incubation studies that tested different sources and concentrations of Asian dust and volcanic ash on plankton communities in the North Pacific. Further, results suggest potential changes in pH could dramatically alter the biogeochemistry of iron in North Pacific marine ecosystems.

Igor Volvenko presented a conceptual and mathematical approach to integrate total biomass, animal size, and species richness, diversity, and evenness. Applying these approaches to multispecies assemblages of the Northwest Pacific he was able to demonstrate that a set of general principles could be used to characterize the organization of pelagic ecosystems in 4-dimensional space and provided some thoughts on how these might change in the future in response to ecosystem variability/change.

Using the California Current ecosystem as a case study, William Sydeman investigated how global climate change might affect this upwelling ecosystem. He showed that many species in this system are able to quickly take advantage of favorable conditions and are able to buffer themselves when conditions are poor. In addition to looking at species-specific responses (*e.g.*, range shifts), Dr. Sydeman explored potential mechanisms responsible for determining ecological interactions (*e.g.*, trophic relationships). The extensive study of the region allows detection of changes in currents, upwelling, and stratification. Not surprising, krill, forage species and predators have each altered their distribution in response to these ecosystem changes. However, non-linear responses also have been observed. For example, increased mis-match between predators and prey that ultimately decrease the predictability of the system which in turn has significant ecosystem and management implications. Thus, it is critical to start incorporating biological parameters in ocean observing programs.

Using long-term datasets from Korea, Sukgeun Jung explored the relationships between: 1) meteorological and hydrographical conditions; 2) volume transport of the Tsushima Warm Current; 3) zooplankton abundance/biomass; and 4) fishery catch. Applying categorical multivariate analyses Prof. Jung was able to demonstrate four regimes characterized by commercial species exploited during them: 1) saury; 2) pollock; 3) sardine; and 4) squid. Other shifts in commercial catches seemed to be related to strong El Niño events despite a lack of confirmation from oceanographic measurements in Korea.

The remainder of the symposium included a variety of presentations related to the symposium theme. For example, Ryan Rykaczewski used a modeling approach to show how nitrogen concentrations are expected to increase while oxygen levels are expected to decrease in coastal waters as the age of water masses change with climate change. Similarly, Chan Joo Jang showed how mixed layer depth variability contributes to changes in chlorophyll concentrations as a function of changes in nutrient cycling and William Peterson showed a linkage between the PDO and a copepod index that showed in warm periods small, lipid-poor copepods dominated and in cold periods large, lipid-rich species dominated. These changes are important for understanding how upper trophic levels might be affected by changes in the PDO. Min Bo Luo used a variety of community metrics to show the impact of large scale development in the Yangtze Estuary, Sanae Chiba showed data on the start, peak and end of phytoplankton blooms in association with the PDO, and Yury Zuenko showed how changes in winter monsoon patterns can create a match/mismatch with the spring bloom and this in turn affects cod survival. The last oral presentation by Jameal Samhuri showed how an Ecopath with Ecosim model can be

used to infer trophic changes in response to the observed decrease in top predator biomass in the California Current system. Simulations suggest that the initial predator release might be short-lived as compensation by the rest of the community develops. His talk highlighted the complexity of marine ecosystems and the potential difficulty with forecasting specific ecosystem responses to observed or expected forcing.

## **List of Papers**

### *Oral Presentations*

**Vjacheslav P. Shuntov and Olga S. Temnykh** (Keynote)

Recent changes in the North Pacific marine ecosystems related to climate change: Global or regional forcing?

**Mitsuo Uematsu, Shigenobu Takeda, Hiroshi Furutani and Itsushi Uno** (Invited)

Potential importance of volcanic emissions on marine biogeochemical cycles and clouds over the North Pacific

**Maurice Levasseur** (Invited)

Response of the plankton ecosystem of the Alaska Gyre to dust and ash depositions under current and future pH conditions

**Ryan R. Rykaczewski, John Dunne and William T. Peterson**

Projected changes in the relationship between water-column stratification and nutrient supply in the northeast Pacific

**Igor V. Volvenko** (Invited)

Biological structure of the ocean and general patterns in the spatial-temporary distribution of the integrative characteristics of pelagic macrofauna of the north-west Pacific

**William J. Sydeman, Isaac D. Schroeder, Jarrod A. Santora, Sarah Ann Thompson, Jeffrey G. Dorman, John C. Field, Steven J. Bograd, Baldo Marinovic, Julie A. Thayer and Bryan A. Black** (Invited)

Mechanisms of change in the California Current: An ecosystem case history

**Chan Joo Jang, Sinjae Yoo, Taewook Park, Jisoo Park and Minho Kwon**

Mixed layer depth variability and its associated changes in chlorophyll concentration in the North Pacific Ocean

**William T. Peterson**

Variations in source waters which feed the California Current may be the mechanism which links the PDO and climate change with ecosystem response

**Min Bo Luo, Xin Qian Shen and Yun Long Wang**

Comparison between the biodiversity index, Exergy, and the AMBI index for the benthos during large-scale engineering within the Yangshan Deep-water Harbor (Yangtze Estuary, China)

**Sukgeun Jung and Hsu Choi** (Invited)

Climate-driven ecosystem shifts in Korean waters during the past 40 years

**Sanae Chiba, Kosei Sasaoka, Hiroya Sugisaki, Tsuneo Ono, Tomoko M. Yoshiki and Sonia Batten**

Phytoplankton phenology and community changes in the western subarctic North Pacific 2000-2009 based on satellite and CPR observation

**Yury Zuenko**

Winter monsoon influence on reproduction of winter-spawning fish (Japanese sardine and Saffron cod) in the Japan/East Sea

**Nick Tolimieri, Jameal Samhuri and Phillip Levin**

Ecological consequences of a precipitous decline in mean trophic level in the Northern California Current

**David M. Checkley, Jr.**

A framework for ocean observing

### *Poster Presentations*

**Chan Joo Jang, Jisoo Park, Taewook Park and Sinjae Yoo**

Projected changes in the North Pacific Ocean mixed layer depth and their impacts on primary production

**Jongyeon Park, Jongseong Kug, Jisoo Park, Sangwook Yeh and Chan Joo Jang**

Variability of chlorophyll associated with ENSO and its possible biological feedback in the Equatorial Pacific

**Jiyeon Kim, Kwangbae Kim, Chaewoo Ma and Heungsik Park**

Changes in the population and distribution of the amphipoda *Haustorioides koreanus* (Family Dogielinotidae) caused by the Hebei Spirit oil spill in the Hakampo and Ggotji beach on the west coast of Korea

**Kwangbae Kim, Jiyeon Kim and Chaewoo Ma**

Spatio-temporal changes in distribution and density of polychaete communities in Hebei Spirit oil spill impacted intertidal zones of the west coast of Korea

**Xinming Pu and Ruixiang Li**

Changes in phytoplankton within the Yellow Sea during the past 50 years

**BIO/POC Topic Session (S2)**

***Mechanisms of physical-biological coupling forcing biological “hotspots”***

Co-Convenors: *Jürgen Alheit (ICES/Germany), Elliott Hazen (PICES/U.S.A.), Oleg Katugin (PICES/Russia), Robert Suryan (PICES/U.S.A.), Yutaka Watanuki (PICES/Japan) and Ichiro Yasuda (PICES/Japan)*

Background

This session will examine the physical and oceanographic factors that correspond to ecological or economic “hotspots” in the North Pacific and North Atlantic and their marginal seas. For the Pacific, this session will focus on the Kuroshio/Oyashio extensions and ecotone, the intersection of the Sea of Okhotsk and the western North Pacific (Kuril Islands region), and the Western Bering Sea. For the Atlantic, this session will focus on the North Sea, the intersection of the Gulf Stream and Labrador Current, in addition to tidally driven systems such as the Gulf of Maine and Gulf of St. Lawrence. “Hotspots” can broadly be defined as areas encompassing high species diversity, high abundance of individuals, especially of important indicator species, or areas of high economic value. Interdisciplinary contributions on physical-biological coupling and resulting seasonal or year-round “hotspots” in primary to tertiary productivity are invited. This includes data on physics, phyto- and zooplankton, forage fish, and upper trophic level predators (*e.g.*, fish, seabirds, mammals, humans). We are particularly interested in simultaneous multi-species multi-use hotspots (*i.e.*, sites of ecological importance that overlap highly with sites of economic value) and potential changes in hotspots under future climate change scenarios. Modeling and empirical studies are encouraged. We will solicit a special publication in the primary literature pending subscription to the session.

Summary of presentations

Session 2 at PICES 2011 had a total of 14 talks and with no fewer than 40 attendees in the audience. Some talks focused on the physical oceanography at known marine hotspots (4 papers), while others considered seabirds (4), fish (3), and marine mammal (3) hotspots, multispecies hotspots, and also overlaps between hotspots and human impacts. A common theme was the issue of scale underlying identification or formation of hotspots, from those formed by ocean currents spanning 5000 km<sup>2</sup> to tidally driven hotspots in the wakes of headlands at the scale of 100 km<sup>2</sup>. Scale differences highlight a range in biophysical factors affecting hotspot formation and persistence.

We discussed interest in assembling a special journal issue stemming from the theme session and at least half of the presenters were prepared to contribute a paper to a special issue. Our impression was that by reaching out to the broader community there will be sufficient interest for a full volume. Further interest and potential journals will be considered during the coming months. The audience felt that by focusing on mechanisms of hotspot formation in addition to other questions noted below, this volume would be sufficiently distinguished from the 2006 Deep-Sea Research II volume stemming from a 2004 PICES hotspot session. From the discussion session, we identified which questions about hotspots were most important to answer as a focus of the theme issue and came up with the following:

- 1) How do the two broad classes of hotspots differ, specifically what are the mechanisms of hotspot formation for both 1) aggregative and 2) bottom-up forced hotspots. How do the mechanisms allow the hotspot to persist or re-occur predictably?
- 2) How do we prioritize hotspots, *e.g.* does a certain percentage of the population have to visit a hotspot for it to be a hotspot, or are hotspots that support high biodiversity and strong ecological interactions the most important hotspots?
- 3) How might species interactions affect the use of hotspots by certain species?
- 4) What hotspots are at greatest risk? Which hotspots have greatest threat from human uses (*e.g.* fisheries, shipping lanes). For persistent or predictable hotspots, how persistent are they over decadal or multi-decadal time scales, *e.g.* which hotspots are likely to change under broad scale forcing such as regime shifts or climate change?

List of papers

*Oral presentations*

**Sei-Ichi Saitoh, Robinson M. Mugo, Mukti Zainuddin and Fumihito Takahashi** (Invited)

Potential fishing zones as “hotspots” of skipjack tuna (*Katsuwonus pelamis*) and albacore (*Thunnus alalunga*) in the western North Pacific

**Shin-ichi Ito, Yugo Shimizu, Shigeho Kakehi, Taku Wagawa, Masatoshi Satoh, Daisuke Ambe, Takeshi Okunishi and Kazuyuki Uehara**

A quasi-steady warm water jet and an ecological hotspots in the western North Pacific

**David G. Foley**

Constructing oceanographic data sets and delivery systems to meet the needs of biologists

**Robert Survan, Kathy Kuletz, Martin Renner, Patrick Ressler, Shannon Fitzgerald, Kiyooki Ozaki, Fumio Sato, Tomohiro Deguchi and Elizabeth Labunski** (Invited)

Mechanisms affecting seabird-prey associations over submarine canyons in the northwestern Bering Sea

**Igor M. Belkin** (Invited)

Satellite oceanography of fronts as biological hotspots

**Robinson M. Mugo, Sei-Ichi Saitoh, Fumihito Takahashi, Akira Nihira and Tadaaki Kuroyama**

When, where and why skipjack tuna, red flying squid and pacific saury potential fishing zones are likely to overlap in the western North Pacific: A proof of concept

**Takashi Yamamoto, Akinori Takahashi, Nariko Oka, Takahiro Iida, Nobuhiro Katsumata, Katsufumi Sato and Philip N. Trathan**

Foraging areas of streaked shearwaters in relation to seasonal changes in the marine environment of the Northwestern Pacific

**Jürgen Alheit** (Invited)

Climate variability impact on North Sea ecosystem

**Elliott L. Hazen, Scott A. Shaffer, Michelle A. Kappes, Ryan R. Rykaczewski, David G. Foley, Steven J. Bograd and Daniel P. Costa**

Oceanographic habitat segregation among postbreeding Hawaiian albatrosses and potential changes from 2001-2100

**Mary-Anne Lea, Jeremy T. Sterling, Nicholas A. Bond, Sharon Melin, Rolf Ream and Tom Gelatt**

Habitat use of Alaskan northern fur seal pups in the western North Pacific Ocean

**Kaoru Hattori, Takeomi Isono and Orio Yamamura**

Wintering aggregations of Steller sea lions in Ishikari-Bay, Sea of Japan

**Haruka Nishikawa, Ichiro Yasuda, Sachihiko Itoh, Yoshikazu Sasai and Hideharu Sasaki**

Impacts of climatic regime shift on Japanese sardine stock collapse

**Konstantin Rogachev**

Satellite and direct observations of circulations features associated with bowhead feeding hotspots in the Sea of Okhotsk

*Poster Presentations*

**Tomoko Harada, Kentaro Kazama, Tomohiro Deguchi, Hajime Suzuki and Yutaka Watanuki**

Foraging behavior of subtropical black-footed albatross *Phoebastria nigripes* and the marine environment around Bonin Islands

**Igor M. Belkin and S. Kalei Shotwell**

Propagation of SST anomalies along the North Pacific

**FIS Topic Session (S3)**

***Population dynamics, trophic interactions and management of cephalopods in the North Pacific ecosystems.***

Co-Convenors: *John Field (USA), Yasunori Sakurai (Japan), Mikhail Zuev (Russia)*

Background

Cephalopods are typically an important component of marine food webs due to their rapid growth, high population turnover rates and often great abundance. They also represent a major, and apparently growing, fraction of total catches, both in the northern Pacific and throughout the world's oceans. Populations tend to exhibit boom-bust cycles, challenging traditional management strategies, and at times representing highly visible indicators of ecosystem change. In this session, we considered papers that examined the ecology and management of cephalopods in North Pacific ecosystems, specifically on the known or suspected drivers of population dynamics and the consequences to fisheries and ecosystems.

Summary of presentations

This half-day session included eight oral presentations and eight poster presentations. The first speaker, Chingis Nigmatullin (Russia, invited) began the session with a discussion of the community ecology of ommastrephid cephalopods in pelagic food webs, and specifically, the relationship between the parasites of nektonic squids and their hosts throughout the world oceans. The talk focused on the role of large ommastrephid populations "ecosystem enzymes" that help to accelerate basic ecosystem processes and trophic interactions through considerable horizontal and vertical migratory behavior. Next, Dr. Mitsuo Sakai (Japan, invited) provided a logical continuation of the first talk by evaluating the fluctuations of Pacific ommastrephids relative to fisheries and markets for squid products. Interestingly, their results suggested some relationship between squid abundance and environmental forcing factors for some species and ecosystems, but they did not suggest basin-wide synchrony in the abundance and dynamics of large ommastrephid populations in the Pacific. Mary Hunsicker (USA, invited), rounded out the discussion with an evaluation of the direct (commodity) and supportive role of cephalopods to global fisheries, with some focus on fisheries and ecosystems of the North Pacific. Her results suggest that the total contribution of cephalopods in marine ecosystems varied considerably, but ranged as high as 55% of landings and 70% of landed values, with the commodity values tending to be greatest in coastal ecosystems and the supportive role tending to be more important in pelagic ecosystems.

The next sequence of papers investigated the population dynamics, movement and bioenergetics of the common squid, *Todarodes pacificus*, throughout the western Pacific. Hideaki Kidokoro (Japan) investigated how catches, stock size, distribution and movement patterns varied between the 1950s and the recent era, emphasizing the cooperation in both research and management between Japanese and Korean fisheries for this important species. Similarly, Alexander Dulenin (Russia) reported on the migration of *T. pacificus* north to the Russian waters of the Tartar Strait, a migration that resumed in the 1990s following an extended period when migrations were not observed. His conclusion that a return to previously observed migration patterns was a result of warming trends, and this was consistent with that of the previous talk by Kidokoro, who demonstrated that catches and abundance of this species were low during the cool conditions of the 1970s and 1980s, but began to increase in the early 1990s. Hyejin Song (Japan) explored the bioenergetics and the trade off between growth and maturation of *T. pacificus* in waters around Japan and Korea, which were consistent with the hypothesis that water temperature (rather than prey density) was a key driver of growth and maturation for this species. Mikhail Zuev (Russia) provided a comprehensive overview of both seasonal progression and long-term variability in gonatid squid abundance and distribution in the northern Sea of Okhotsk. Finally, Horomichi Igarashi (Japan) presented a habitat suitability model for neon flying squid (*Ommastrephes bartramii*), which suggested that transport and eddy formation in the Kuroshio-Oyashio transition zone leads to high productivity and suitable habitat for this species.

List of papers

*Oral presentations*

**Chingiz M. Nigmatullin** (Invited)

Structural and functional aspects of nektonic squid food and parasite relations in the World Ocean ecosystems

**Mitsuo Sakai, Yoshiobu Hiraoka, Taro Ichii, Hitoshi Imaizumi, Shintaro Imamura, Denzo Inagake, Toshie Wakabayashi, Yoshiki Kato, Katsuhiko Miki, Hideki Nikaido, Yosuke Ochi, Yuji Omura, Hiroaki Saito, Go Takayama, Takakashi Yanagimoto, Takanori Kobayashi, Nobuhide Hamaji and Ken-Ichi Ishida** (Invited)

Utilization structure of jumbo flying squid stock in fluctuating environments: Possible impact on other squid harvests in the North Pacific

**Mary E. Hunsicker, Timothy E. Essington, Reg Watson and Ussif R. Sumaila** (Invited)

The value of cephalopods to global marine fisheries

**Hideaki Kidokoro, Norio Yamashita, Sangwoo Kim, Youngmin Choi and Yasunori Sakurai**

Ecological traits and population dynamics of Japanese common squid *Todarodes pacificus* that concerned with the fishing grounds and fishing seasons of Japanese and Korean fisheries

**Polina Dulenina and Alexander Dulenin**

Some data on biology and fishing of Pacific squid (*Todarodes pacificus*) in northwestern part of the Tartar Strait and their relations with hydrological processes

**Hyejin Song, Michio J. Kishi and Yasunori Sakurai**

Prediction of trade-off between growth and maturation depending on the environmental conditions in common squid *Todarodes pacificus*

**Mikhail A. Zuev, Nikolai S. Vanin, Oleg N. Katugin and Gennady A. Shevtsov**

Long-term fluctuations in gonatid squid (Gonatidae) abundance in the Okhotsk Sea

**Hiromichi Igarashi, Toshiyuki Awaji, Masafumi Kamachi, Yoichi Ishikawa, Norihisa Usui, Yosuke Fujii, Takahiro Toyoda, Shuhei Masuda, Toshimasa Doi, Shiro Nishikawa, Yoshihisa Hiyoshi, Mitsuo Sakai, Yoshiki Kato, Sei-Ichi Saitoh and Shin-ichi Sato.**

A statistical approach to identify optimal habitat suitability of neon flying squid in northwestern North Pacific by using satellite datasets and 3-D ocean data assimilation product

*Poster Presentations*

**Osamu Tamaru, Kazushi Miyashita, Yasuzumi Fujimori, Toshihiro Watanabe and Teisuke Miura**

Fishery Income fluctuation by selecting fishing ground in the Japanese coastal squid jigging fishery

**Mikhail A. Zuev, Gennady A. Shevtsov and Oleg N. Katugin.**

Seasonal shifts in species composition and distribution of cephalopods in the epipelagic northwest Pacific Ocean

**Gennady A. Shevtsov and Konstantin A. Karvakin**

Pelagic cephalopods of the Subarctic transition zone in spring 2010

**Toshie Wakabayashi, Takashi Yanagimoto, Shiro Wada, Yoshiki Kato and Mitsuo Sakai**

A review of population structure of the neon flying squid, *Ommastrephes bartramii* and new findings based on mtDNA sequence data

**Konstantin A. Karyakin, Gennady A. Shevtsov and Oleg N. Katugin**

Cephalopods from the Emperor Seamounts

**Julia S. Stewart, William F. Gilly and John C. Field**

Movement patterns and foraging ecology of the Humboldt squid in the California Current

**Vasiliy D. Didenko, Nikolai S. Vanin and Oleg N. Katugin**

Is there a relation between the abundance of *Berryteuthis magister* (Teuthida: Gonatidae) off the Kuril Islands and variability in atmospheric circulation patterns?

**FIS/POC Topic Session (S4)**

***Recent changes of North Pacific climate and marine ecosystems: Implications for dynamics of the dominant species***

Co-sponsored by: ICES

Co-Convenors: *Sukyung Kang (Korea), James Overland (U.S.A.), Akihiko Yatsu (Japan) and Skip McKinnell (PICES)*

Background

The coincidence of multidecadal-scale alternations of dominant marine fish species coupled with multidecadal-scale “Climatic Jumps” created a concept of the Regime Shift. The recently published PICES North Pacific Ecosystem Status Report noted that the frequency of these events appears to have increased, and various indicators suggest that their amplitude has increased as well. The Arctic Oscillation Index, for example, reached an extreme negative anomaly during January-March of 2010, which brought a severe winter to much of the Northern Hemisphere, while other areas were warmed equivalently by the effects of the 2009/10 El Niño. The summer of 2010 saw record-setting high temperatures in some PICES member countries, accompanied by an abrupt shift in the tropics from El Niño to La Niña in July 2010. In the northwestern Pacific, after decades at low levels, sardine abundance has begun to increase, while the anchovy abundance is declining; perhaps signaling a new Regime. This session will review recent ocean/climate variability, with emphasis on what has occurred from 2009 to 2010. It will focus on the major ecological components of North Pacific marine ecosystems, particularly commercially important fish species. Papers on mechanistic linkages between population dynamics of marine species and environmental conditions are especially encouraged.

Summary of presentations

Drs. Kang, McKinnell and Yatsu chaired the session as Dr. Overland was unable to attend. Dr. Yatsu welcomed the many participants to the session and introduced the main theme. Emanuele DiLorenzo began his invited talk by asking how the regime-like states of marine ecosystems might arise from alternative physical models of forcing and dissipation (memory) in ocean. Biological processes tend to act as a low pass filter that removes high frequency noise. A first integral of a noisy time series, for example, enhances lower frequencies, and a second integration does it again. Prof. Di Lorenzo used a krill (*Nyctiphanes simplex*) time series as an example of how double integrating physics, in this case the PDO index, has a correlation ( $r = 0.55$ ) with *N. simplex*. Double integration of the PDO gives a correlation of  $r = 0.84$  with the Aleutian Low. The presentation was followed by a lively discussion. Tracy Shaw followed with a presentation on the relatively intimate linkages between physical forcing, plankton community composition, and salmon survival in the Columbia River (USA). Tomoko Yoshiki introduced some new results from the Japanese CPR program in the western Pacific. She divided the transect into east and west regions at 155° E longitude and found that, except for *Eucalanus bungi*, development times were similar in west and east despite differences in SST in these regions. *E. bungi* development was perhaps tied to the chlorophyll bloom. The beginning of this bloom is earlier in the west. Earlier blooms after 2005 were associated with earlier development in the west. On behalf of David Mackas and Moira Galbraith, who were unable to attend, Skip McKinnell described new findings from a 20 year reconstructed time series of zooplankton biomass in the Strait of Georgia. Most of the larger crustacean taxa in the Strait of Georgia show strong multi-year fluctuations and/or downward trends of annual average biomass. Strong subsurface warming of the Strait is likely an important environmental driver. Changes of the zooplankton community are likely to have contributed to reduced growth and survival of planktivorous fish (e.g. juvenile salmon). Lu Guan has been sampling the ichthyoplankton of the Strait of Georgia since 2007. She found that the ichthyoplankton community composition was very different in 2007, 2009, and 2010...with a shift from pelagic to demersal species over the period. The ichthyoplankton in 2007 was dominated by Pacific hake (*Merluccius productus*). Abundances were low in 2009 for many species, but all increased dramatically in 2010. Larval mean size was examined and was found to vary significantly across years. She demonstrated that some of this difference could be attributed to different hatching dates among years. Jinyeong Kim examined

factors that may affect the recruitment and biology of anchovy in Korean waters. She postulated that a strong (weak) Siberian High is associated with increasing (decreasing) anchovy abundance. Condition factor and GSI were positively correlated with copepod density and physical properties. Invited speaker Jürgen Alheit described coincident regime shifts in the late 1980s in the Baltic Sea, North Sea, and North Atlantic Ocean. Southern species generally replaced more northern species, a pattern that was also found in lakes. Water temperatures were increasing in many ecosystems in the late 1980s. In the central Baltic Sea, the change occurred between 1987 and 1988 while in the North Sea, the change occurred in 1989/90. Anatoliy Ya. Velikanov reported on the intermittent appearance of warm-water fish species in the Okhotsk Sea. Walleye pollock (*Theragra chalcogramma*) spawning biomass along the west coast of Sakhalin dropped dramatically in 1999. On the eastern side, it has an increasing trend. There was an increase in the abundance of warm-water species in the 1980-90s and there was higher abundance of species that have winter-spring spawning. Yongjun Tian reported that a regime shift from cold to warm occurred in the late 1980s. The fish community structure changed as well. The response to the shift was species-specific. A small number of indicator species were selected: yellowtail (*Seriola quinqueradiata*), bluefin tuna (*Thunnus thynnus*), jack mackerel (*Trachurus symmetricus*), anchovy (*Engraulis japonicus*), sardine (*Sardinops melanostictus*), Pacific cod (*Gadus macrocephalus*), and snow crab (*Chionoecetes japonicus*). Their selection was based on factors like trophic level, and demersal/pelagic, etc. The indicator species suggested that changes in the fish community occurred in 2004/05. Anne Hollowed described time series of recruitment variability in many demersal stocks of the eastern Bering Sea where cooling was detected from 2006. Stock-recruitment curves are a strong assumption with an uncertain validity. Grouping of time series was made on the basis of similarity in the time domain. Life history strategies are important when examining recruitment time series. A recruitment index showed a change in 2007 in a shorter life-span group. Andrei S. Krovnin examined low-frequency variability in Western Kamchatka pink salmon. For even years, there are high correlations with catches and climate are pan-hemispheric (resembles EOF1 of SSTA). For odd year, the high pan-regional correlations are with EOF2. The strongest shift in EOF1 occurred in 1998/99. A sharp increase in odd year catches occurred in 1992/93. He predicted that high catches will remain until the end of the warm phase of the Atlantic Meridional Oscillation. Akihiko Yatsu reported on a very high probability of at least a minor regime shift between 2005 and 2010, suggesting that it was in 2006/07. He reported similarities between recent years and early 1970s in the PDO, SOI, high abundances of copepods in the Kuroshio and Oyashio/Kuroshio transition, and high reproductive success rates in two stocks of sardine. He also noted that swift shifts in ENSO state are generally associated with regime shifts. Sangdeok Chung found a shift in fish species composition in a bay of western Japan that was associated with the 1988/89 regime shift and decreased oxygen. Jacquelynne King reported an abrupt change in migratory behaviour of Pacific hake in British Columbia around 2006. She also discussed the implications of having a mixture of migratory and resident populations on fisheries management. J. Anthony Koslow presented results of time series analyses of midwater and pelagic fishes in CalCOFI region, which suggested more important ecological roles of midwater species than considered so far, and changes in their biomass associated with dissolved oxygen conditions. Session convenors thanked ICES for co-sponsoring the session by providing travel support to Dr. Alheit, the invited speakers and the participants for their efforts to produce a scientifically interesting session. If there was any shortfall in the session, it was a generally lack of presentations that focused on the most recent period of ecosystem variability, but perhaps many felt that more time is needed before strong conclusions about a recent regime shift can be generated.

#### List of papers

##### *Oral presentations*

**Emanuele Di Lorenzo and Mark Ohman** (Invited)

A null hypothesis linking zooplankton “regime shifts” to North Pacific climate

**Soonil An, Jiwon Kim, Seulhee Im, Beakmin Kim and Jaeheung Park**

Recent and future sea surface temperature trends in Tropical Pacific

**C. Tracy Shaw, Leah R. Feinberg, Cheryl A. Morgan and William T. Peterson**

Recent high variability in hydrography and lower trophic levels in the upwelling region off Newport, OR, USA

**Tomoko M. Yoshiki, Sanae Chiba, Hiroya Sugisaki, Kosei Sasaoka, Tsuneo Ono and Sonia Batten**

Interannual variability of zooplankton community structure based on Continuous Plankton Recorder in the western subarctic North Pacific during 2001-2009

## Session Summaries-2011

**David Mackas and Moira Galbraith (presented by Skip McKinnell)**

Zooplankton time series from the Strait of Georgia (British Columbia, Canada): Changes in biomass and community structure 1990-2010

**Lu Guan, John Dower, Skip McKinnell and Pierre Pepin**

Inter-annual variation in the spring ichthyoplankton assemblage in the Strait of Georgia from 2007-2010

**Jinyeong Kim, Heeyong Kim and Sukgeun Jung**

Predicting recruitment of anchovy based on oceanographic and reproductive conditions in the southern waters of Korea

**Jürgen Alheit, Simultaneous (Invited)**

Atlantic and Pacific regime shifts through northern hemisphere teleconnection pattern

**Anatoliy Ya. Velikanov**

Some features of changes in species composition and stock abundance for pelagic fishes off Sakhalin Island during the first decade of the 21 century: Recurrent influence of climatic regime shift

**Yongjun Tian and Hideaki Kidokoro**

Response patterns of the fish community in the Japan Sea to the climate regime shifts and identification of ecosystem indicators

**Anne Hollowed, Matt Baker, Megan Stachura, Nathan J. Mantua and Ray Hilborn**

Regime shift effects on Bering Sea fish and fisheries

**Andrei S. Krovnin, Nataliya V. Klovach, Boris N. Kotenev and George P. Moury**

Multi-decadal changes in the Far East salmon stocks in relation to climate regime shifts in the Northern Hemisphere

**Akihiko Yatsu, Kaoru Nakata, Kimio Hanawa, Tomowo Watanabe and Hiroya Sugisaki**

Recent changes in stock abundance of small pelagics in the Kuroshio/Oyashio ecosystem and associated physical conditions

**Sangdeok Chung and Hideaki Nakata**

The change in the environment and fish community structure in an enclosed bay of western Japan over the last five decades

**Jacquelynn R. King, Gordon A. McFarlane, Simon R.M. Jones, Scott R. Gilmore and Cathryn L. Abbott**

Abrupt changes in migratory behaviour of Pacific hake in Canadian waters: Stock delineation and implications for fishery management

**J. Anthony Koslow, A. Lara-Lopez, P. Davison and N. Bowlin**

Climate, biomass, and the trophic role of midwater fishes in the southern California Current

### *Poster Presentations*

**Kyungsu Kim, Jeonghee Shim and Suam Kim**

Effect of ocean acidification on the early life history of coastal fishes

**Dmitriy Antonenko and Nadezhda L. Aseeva**

The long-term dynamics of biomass and species composition of flatfish in waters of Primorye Region (Sea of Japan)

**Chih-Hao Hsieh, Wann-Nian Tzeng, Yu-Heng Tseng, Yu-San Han, Chih-Chieh Hsu, Chih-Wei Chang, Sen Jan and Emanuele Di Lorenzo**

Multi-scale climate effects on the recruitment of Japanese eel, *Anguilla japonica*, to Taiwan

**Kazuaki Tadokoro, Yuji Okazaki, Tsuneo Ono and Hiroya Sugisaki**

Recent changes of Neocalanus copepods biomass in the Oyashio waters, western North Pacific

**Sukyung Kang, Kwangho Choi, Jisuk Ahn, Jaedong Hwang and Dongwoo Lee**

Distribution and species composition of major fish species under varying climate scenarios in Korean waters

**MEQ Topic Session (S5)*****Harmful Algal Blooms in a changing world***

Co-Convenors: *Tatiana Morozova (Russia) and Mark Wells (U.S.A.)*

Background

The impacts of regional and global climate change and other anthropogenic forcing on the initiation, frequency and severity of harmful algal blooms (HABs) are widely anticipated but are difficult to identify. Often these “blooms” reflect subtle adjustments in the relative proportion of HAB species within a larger, more abundant phytoplankton community. In others, new blooms may reflect the possible climate-driven range extension of HAB species, but direct evidence that previous environmental conditions were unfavorable for bloom development normally is lacking. Ascribing HAB events to specific, but slowly evolving driving forces, will demand comparative observations among similar but geographically separated ecosystems. This session invites papers that focus on emerging toxic and ecosystem disruptive HAB events as well as changing plankton assemblages that are evolving towards more frequent or intense HAB incidents. Papers addressing long-term time series data, land use changes, effects of macro- or micro-nutrient stress on cell physiology, trophic interactions, and the impacts of changing riverine runoff, ocean development (*e.g.*, aquaculture, wind turbines), and ocean acidification are particularly encouraged. The goal of the session is to help formulate a better understanding of conditions enhancing the success of HAB species.

Summary of Presentations

The central goal of this session was to ascertain the leading current indicators of climate-related changes in the distribution, frequency or intensity of Harmful Algal Bloom (HAB) outbreaks in the PICES nations. The session began with an invited speaker, Dr. Feixue Fu, who presented her recent findings that increasing pCO<sub>2</sub> in seawater can dramatically increase growth rates and toxin production of HAB groups that already are a serious health and economic threat in the North Pacific. These novel studies highlight the synergistic interactions by which climate change may increase HAB problems beyond that due to range extension and evolving oceanographic conditions. The Session also learned about an extraordinary 35 year dataset detailing the dynamics of nutrients and harmful algal species in the eastern Seto Inland Sea; a rich database that tracks significant changes in HAB species occurrence through time. The importance of these changes in time was emphasized in a presentation of new information about the recent dramatic increases in Harmful Macroalgal Blooms (H-MABs) in Chinese coastal waters. Participants also learned about studies on the surprising distribution of ciguatera-producing *Ostreopsis* in Peter the Great Bay, and a summary of the spatial patterns of toxic phytoplankton in the Sea of Okhotsk. Perhaps one of the strongest findings of climate-associated range extension of HAB species is that of *Gambierdiscus* spp., responsible for Ciguatera Fish Poisoning, in temperate eastern coastal waters of Japan, where it appears to have migrated recently from the tropical and subtropical Ryukyu Island chain. Increasing toxic concerns also are suggested in Puget Sound, Washington State, USA, where model-projected continuation of increasing springtime freshwater runoff and higher surface water temperatures during summer are predicted to interact synergistically, resulting in more frequent, longer duration and higher intensity outbreaks of paralytic shellfish poisoning. Participants learned that this trend of increasing HAB outbreaks already is occurring along the California coast, where time series studies show that true red tides have increased dramatically since 2005 coincident with mesoscale changes in depth and intensity of stratification and upwelling favorable winds, as well as from land-sea coupling processes. These changes appear to be associated with decadal-scale oceanographic forcing and increasing anthropogenic impacts, though the mechanisms remain unclear. The well-attended session provided a dynamic platform for discussion and debate about the emerging indicators that climate and basin scale changes are leading to increased HAB problems in coastal waters of the North Pacific. There were 35 scientists in attendance: Japan (8), Korea (3), USA (9), China (7), Russia (8), Canada (0).

## Session Summaries-2011

### List of papers

#### *Oral Presentations*

**Feixue Fu** (Invited)

Global change and the future of toxic algal blooms in the North Pacific Ocean

**Tetsuya Nishikawa, Yutaka Hori, Satoshi Nagai, Kazutaka Miyahara, Yukinobu Nakamura, Kazuhiro Harada, Minoru Tanda, Takehiko Manabe, Kuninao Tada and Ichiro Imai**

Long term (35 years) observations in dynamics of nutrients and phytoplankton including the harmful diatom *Eucampia zodiacus* in Harima-Nada, eastern Seto Inland Sea, Japan

**Charles G. Trick and Brian Sutton-Quaid**

Are fish-killing flagellates a sign of things to come?

**Marina S. Selina, Tatiana V. Morozova, Nellya G. Litvinova, Dmitry I. Vyshkvartsev and Tatiana Yu. Orlova**

Seasonal dynamics and spatial distribution of *Ostreopsis* spp. in the Peter the Great Bay, the Sea of Japan

**Akira Ishikawa, Yumi Takeichi, Setsuko Sakamoto and Mineo Yamaguchi**

Year-round occurrence of the benthic dinoflagellate *Gambierdiscus* sp. in temperate coastal waters of Japan

**Mingyuan Zhu and Ruixiang Li**

HAB in coastal waters of China in 2010

**Ekaterina V. Lepskaya**

Toxic micro alga in Okhotsk Sea in Kamchatka shore

**Stephanie K. Moore, Vera L. Trainer, Nathan J. Mantua and Eric P. Salathé, Jr**

Future scenarios for environmental conditions favoring the accumulation of paralytic shellfish toxins in Puget Sound shellfish

**Raphael M. Kudela, John P. Ryan and Jenny Q. Lane**

Multiple, simultaneous harmful algal bloom organisms and toxins in the California Current: An emerging threat?

#### *Poster Presentations*

**Qiulu Wang and Yanxia Zhou**

The elementary study of the bacteria biomass and environmental factor in East China Sea

**Inna V. Stonik, Tatiana Yu. Orlova, Luisa N. Propp, Natalia L. Demchenko and Anna V. Skriptsova**

Bloom of Pseudo-nitzschia species in Amurskii Bay, the northwestern East/Japan Sea: The role of environmental factors in population dynamics

**Hao Guo**

Study on the growth characteristics of cultured red-tide-algae *Alexandrium tamarense*

### **MEQ/FIS Topic Session (S6)**

#### ***Identification and characterization of environmental interactions of marine aquaculture in the North Pacific***

Co-Convenors: *Katsuyuki Abo (Japan), Brett Dumbauld (U.S.A.) and Galina Gavrilova (Russia)*

#### Invited Speakers:

Tomoko Sakami (Tohoku National Fisheries Research Institute, Japan)

Shuanglin Dong (Ocean University of China, PR China)

### Background

Marine aquaculture is an important economic and social activity within PICES member countries. To ensure that development of aquaculture is environmentally and economically sustainable we need to: 1) improve our understanding of interactions between marine aquaculture and the environment (including wild stocks of plants and animals, 2) develop methods to study and/or predict such interactions, and 3) devise ways to reduce negative impacts on the environment. To this end the PICES Working Group on Environmental Interactions of Marine Aquaculture has begun to characterize the nature of these interactions with a focus on the benthic environment and aquatic animal health. To align with the activities, papers for this session are solicited in the

following areas: 1) identification and characterization of marine aquaculture-environmental interactions; 2) development of tools to identify and study such interactions; and 3) social science research related to aquaculture interactions with the marine environment.

### Summary of presentations

The presentations covered a variety of applications of marine aquaculture in PICES countries. There were 2 invited oral presentations, 6 oral presentations and 3 posters prepared for this session from Canada, China, Japan, Russia and USA. Two oral presentations were cancelled but one alternative oral presentation was presented by Dr. Hasegawa. About 50 people participated in the topic session.

The invited speaker, Dr. Tomoko Sakami (Fisheries Research Agency, Japan) started the session by describing an attempt to assess aquaculture environments using microbial communities in bottom sediments. She suggested sedimentary microbe genomic information is a prospective parameter to assess the environments influenced by fish aquaculture (Abstract S6-7567). Another invited speaker, Dr. Shuanglin Dong introduced integrated aquaculture in China. He described the history, ecological rationales, classification and development of integrated aquaculture in China (Abstract S6-7755).

Dr. Katsuyuki Abo summarized research on environmental interactions of marine aquaculture in Japan. He reviewed studies on impacts of marine aquaculture on benthic environments to identify and characterize the environmental interaction of marine aquaculture in Japan (Abstract S6-7736). Due to visa application trouble, Dr. Brett Dumbauld was unable to attend the topic session so an alternative presentation was given by Dr. Natsuki Hasegawa. He discussed the use of aquaculture species for monitoring change in coastal ecosystems and fisheries productions. He suggested bivalves and seaweed species for aquaculture as potential indicators of coastal ecosystem production (Abstract S6-7665-2; provided as *Endnote 1*). Dr. Stewart Johnson presented an overview of interactions between wild and farmed salmonids in Southern British Columbia. He summarized surveys of pathogens in wild salmonids, laboratory studies on pathogens and hosts, improved diagnostic methods and the use of physical oceanographic models to predict pathogen movements within the environment (Abstract S6-7861). The influence of environmental factors on hanging plantations for *Laminaria* kelp was presented by Dr. Tatiana Krupnova (Abstract S6-7858). Dr. Sei-Ichi Saitoh discussed the use of GIS-based spatial models to select Japanese kelp aquaculture sites in the Southwestern Hokkaido (Abstract S6-7580).

Dr. Chunjiang Guan presented a poster on absorption of carbon and nitrogen by culturing *Sargassum thunbergii* in coastal waters. He suggested *Sargassum thunbergii* culture played an important role in restoring eutrophied sea waters and in absorbing CO<sub>2</sub>.

At the end of the topic session, a proposed plan for a new SG at 2012 AGM was introduced to participants and ideas and suggestions of participants were requested during this year.

### List of papers

#### *Oral presentations*

**Tomoko Sakami, Ryuji Kondo and Takanori Bobayashi** (Invited)

An attempt to assess the environment by using microbial communities of the bottom sediments from marine areas of fish aquaculture

**Shuanglin Dong** (Invited)

Integrated aquaculture in China

**Katsuyuki Abo**

Environmental interactions of marine aquaculture in Japan

**Natsuki Hasegawa and Toshihiro Onitsuka**

Monitoring the change of coastal ecosystem and fisheries productions using an aquaculture system

**Stewart Johnson, Michael Foreman, Kyle Garver, Brent Hargreaves, Simon R.M. Jones and Chrys Neville**

## Session Summaries-2011

Interactions between wild and farmed salmonids in Southern British Columbia: Pathogen transfer

**Tatiana Krupnova, Vladimir Pavlutcykov and Nina Shepel**

Environmental influences on harvesting from hanging plantations for *Laminaria* kelp

**Nyoman Radiarta, Sei-Ichi Saitoh, Toru Hirawake and Hajime Yasui**

GIS-based spatial models for Japanese kelp (*Laminaria japonica*) aquaculture site selection in the Southwestern Hokkaido, Japan

**Wei Zheng, Honghua Shi, Xuelei Zhang, Mingyuan Zhu and Zongling Wang**

Ecological-economic assessment of monoculture and integrated multi-trophic aquaculture in Sanggou Bay, China

### *Endnote 1*

Abstract of the alternative presentation, S6-7665-2

## **Monitoring the change of coastal ecosystem and fisheries productions using an aquaculture system**

Natsuki **Hasegawa** and Toshihiro Onitsuka

Hokkaido National Fisheries Research Institute, FRA, 116 Katsurakoi, Kushiro, Hokkaido, 085-0802, Japan

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Linking changes in ecosystem and fisheries production with environmental factors which contribute to numerical models that predict that change is particularly difficult in coastal areas. Since there are more diverse organisms, landscapes, and interactions in coastal areas than those in offshore areas, change was not directly predicted by numerical models. Bivalves and seaweed species for aquaculture are potential indicators of coastal ecosystem production, because these primary consumers and producers are sensitive to environmental changes especially at early stages. However, changes in catch or landings do not reflect change in productivity and there might not be enough objective and scientific data on parameters like number and survival rate to estimate production in Japanese aquaculture using catch or landings alone. Therefore constructing a broad monitoring system of these productivity indices and other characteristics, which could be routinely collected with aquaculture, would be useful for analyzing catch data and for identifying change. Accumulation of these short-term data would effectively contribute to predicting mid and long term change in coastal ecosystem and fisheries production based on predictive environmental models.

### *Poster Presentations*

**Chunjian Guan and Feng'ao Lin**

Absorption of carbon and nitrogen by culturing *Sarassum thunbergii* in coastal waters

**Vera Valova**

The influence of salmon hatchery conditions on the physiological status of Amur sturgeon

**Olga G. Shevchenko**

Monitoring of potentially toxic microalgae in Severnaya Bight (Slavyanskii Bay, the Sea of Japan) in 2008, 2009

**MEQ/FUTURE Topic Session (S7)*****Land-sea interactions and anthropogenic impacts on biological productivity of North Pacific Ocean coastal ecosystems***Co-Sponsored by: *NOWPAP*Co-Convenors: *Masahide Kaeriyama (Japan), Olga Lukyanova (Russia), Steven Rumrill (U.S.A.) and Thomas Therriault (Canada)*Background

Land-sea interactions are widely recognized as an important component of coastal ecosystem processes throughout the North Pacific Region. Anthropogenic activities in upland and coastal areas can significantly alter the productivity of coastal ecosystems and disturb the communities that depend on them. Human activities such as pollution or overfishing can result in immediate and direct impacts on biological productivity. However, there are an increasing number of indirect impacts such as altering the flow of ecosystem-transboundary materials (ETMs) that are responsible for the enriched productivity of many northern coastal systems. In Asia, the dissolved iron that is transported from the Amur River basin into the Sea of Okhotsk and Oyashio Region is now recognized as a major regulator of the primary productivity in these coastal waters. Similarly, disruptions in the timing and amplitude of riverine discharges from the Columbia River Basin (Pacific Northwest) result in significant alterations of salinity regimes, sediment transport, biological productivity, and fisheries returns throughout the region influenced by the Columbia River plume. Anthropogenic impacts such as changes in land use, artificial river channelization, hydropower structures, and urbanization disrupt and alter the flow of ETMs thereby reducing the productivity in these coastal ecosystems. Furthermore, these alterations can lead to the manifestation of other stressors in coastal ecosystems such as jellyfish blooms, hypoxia events, and harmful algal bloom (HAB) outbreaks. This session will focus on: 1) how ETMs (*e.g.*, dissolved iron, carbon and other elements) are transported from upland ecosystems into coastal ones; 2) what mechanisms regulate the supply of ETMs and how the downstream transport of these impact the productivity (primary production) of coastal systems; 3) how anthropogenic impacts disrupt the ETM system and resulting changes downstream including increased ecosystem vulnerability; 4) how anthropogenic impacts directly reduce coastal productivity; and 5) exploration of potential adaptive management strategies based on the ecosystem-approach to protect the ETM system to ensure sustainability of coastal ecosystems and stability for the coastal societies depending on them.

List of papers*Oral presentations***Takayuki Shiraiwa** (Invited)

“Giant fish-breeding forest”: A new environmental system linking a continental watershed with open water

**Svetlana Belava and Petr Tishchenko**

Primary production of Amurskiy Bay (Japan Sea) in the winter season

**Yosuke Koshino, Masao Minagawa, Hideaki Kudou, Yuxue Qin and Masahide Kaeriyama**

Effect of salmon-derived nutrients and organic matter on riparian ecosystems in the Shiretoko World Natural Heritage area

**Neil S. Banas, Barbara M. Hickey, Eric P. Salathé and Parker MacCready**

Freshwater influences on productivity in the northern California Current System, present and future

**Thomas W. Therriault and Claudio DiBacco**

Does diet determine the impact of invasive tunicates in shellfish aquaculture?: Application of stable isotopes

**Steven Rumrill, Alicia Helms and Adam DeMarzo**

Detection of pH shifts in the South Slough estuary (Oregon, USA): Exploration of relationships between changing carbonate chemistry, eutrophication, and net estuary ecosystem metabolism

**Jennifer E. Purcell**

Jellyfish and ctenophore blooms coincide with human proliferations and environmental perturbations

**Peter S. Ross and Steven Jeffries**

Marine mammals provide an integrated measure of spatial and temporal trends in coastal food web contamination by persistent environmental contaminants

## Session Summaries-2011

**Vladimir Shulkin** (Invited)

The spatial dimension of the environmental problems existing in coastal zone due to land-sea interactions

**Pavel Tishchenko, Vladimir Zvalinsky, Tatiana Mikhajlik and Petr Tishchenko**

Assessment of eutrophication status of Amursky Bay (Japan/East Sea)

**Ichiro Imai, Mineo Yamaguchi and Yutaka Hori**

Long-term changes in eutrophication and harmful algal blooms in the Seto Inland Sea of Japan

**Tatiana L. Chizhova, Hisatoshi Nakase, Pavel Tishchenko and Kazuichi Hayakawa**

Distribution of polycyclic aromatic hydrocarbons in the North-western part of the Japan Sea

**Jing Zhang and NSFC Task Team** (Invited)

Remobilization of nutrients from watersheds and eutrophication in marine recipients

**Jianguo Du, Bin Chen, Qiulin Zhou, Quan Wen, Honghua Shi, Weiwei Yu and Hao Huang**

Strategies of marine biodiversity conservation based on integrated coastal zone management

**Vladimir Ostrovskii**

Factors controlling the pink salmon (*Oncorhynchus gorbusha*) juvenile abundance in the Isky River

**Sergey D. Ponomarev**

Influence of ecological factors on Pacific herring spawning efficiency

**Vera Valova**

Reactions by Amur sturgeon fingerling to pollution within the Amur River

**Satoshi Nakada, Yoichi Ishikawa, Toshiyuki Awaji and Sei-Ichi Saitoh**

Coupled land-ocean model for the coastal fisheries in a Region of Freshwater Influence (ROFI): A case study in Funka Bay

### *Poster Presentations*

**Lidiya T. Kovekovdova and Denis P. Kiku**

Assessment of levels of toxic elements (As, Hg, Pb, Cd) in the environment and commercial hydrobionts in coastal waters of the Russian zone of Japan/East and Okhotsk Seas

**Svetlana A. Irevkina**

Molecular biomarkers in monitoring of the coastal and estuarine zones of Peter the Great Bay (Japan/East Sea)

**Andrey P. Chernyaev and Anna S. Vazhova**

Petroleum hydrocarbon distribution in the Far Eastern Seas of Russia in 2010

**Anna S. Vazhova**

Wastewater pollutants discharge into Peter the Great Bay (Japan/East Sea) through estuaries of the rivers

**Aleksandra S. Kondakova and Andrey P. Chernyaev**

Levels of 4-NP in coastal waters in the Russian zone of Japan/East and Bering Seas

**Alexander Moshchenko, Tatyana Belan and Yuri Korostelev**

Long-term changes in the marine environment and benthic communities in the north part of Amursky Bay (Sea of Japan)

**Olga N. Lukyanova and Svetlana A. Ireykina**

Pollution of river-sea interaction areas in Peter the Great Bay (Japan/East Sea)

**T.P. Belova and Olga N. Selivanova**

Application of *Saccharina*-based sorbents for purification of sewage waters of metal mining industry

**Wang Yongzhi, Feng Aiping, Qiao Lulu, Yang Zuosheng and Bao Xianwen**

Research on the transport mechanism for suspended sediment along northeast Shandong Peninsula coast in summer and winter

**Irina R. Levenets and Anna V. Skriptsova**

Macrophyte seasonality in the Sobol Bay, Peter the Great Bay, Sea of Japan

**POC/FIS Topic Session (S8)*****Linking migratory fish behavior to end-to-end models***

Co-sponsored by: ICES

Co-Convenors: *Enrique Curchitser (PICES/U.S.A.), Geir Huse (ICES/Norway), Shin-ichi Ito (PICES/Japan), Michio Kishi (PICES/Japan) and Skip McKinnell (PICES)*

Background

In order to understand ecosystem response to climate impacts, End-to-End modeling (E2E) approaches are essential. One of the most difficult parts for E2E is the modeling of fish behavior migration. Fish behavior can be very complex; it is a consequence of genetics, physical, chemical and biological environments and their interaction. Learned behavior may also be a factor. Recently, new technology has been introduced to tagging equipment, and as a consequence data availability is vastly improved. Additionally, new technologies are used to investigate fish movements in laboratory settings. This new information is expected to improve our understanding of fish migration mechanism and contribute to the development of fish migration models. Furthermore, the development of high-resolution ecosystem models coupled to circulation models makes it possible to simulate fish migration in the context of realistic environmental fields. The purpose of this session is to understand the current state of development in modeling fish behavior and discuss future potential collaborations to improve fish migration models. This session anticipates presentations that discuss successes (and failures) in modeling migratory fish behavior. Presentations related to data availability for model evaluation of fish behavior are also welcome. Based on the results and opinions expressed at the session, the conveners would like to discuss the desirability of establishing a group that will focus its attention on developing and advancing the state of fish behavioral modeling.

Summary of Presentations

Dr. Shin-ichi Ito and Dr. McKinnell chaired the session and introduced the history of this difficult topic. Invited speaker, Prof. Kenneth Rose of Louisiana State University, described why there is a growing increase in migration modelling. He noted that traditional modelling methods are perceived as unsuccessful, how many management issues involve space, how climate change is expected to affect distributions and behaviours, that data collection is becoming very spatially-detailed, how computing power continues to increase, and that significant advances in hydrodynamics and upper trophic level modeling have been made recently. He described an approach that is being used with doctoral candidate Kate Shepard to validate fish behaviour. Movement algorithms (kinesis, neighbourhood search, event-based) were evaluated. They concluded that the results were encouraging, that the three methods successfully trained with the Genetic Algorithm produced realistic movement, and that total egg production was fairly constant across methods and grids. Jerome Fieschter, the second invited speaker, described the performance of their end-to-end model efforts directed at sardine and anchovy. He is using a 3-D ROMS for ocean circulation, NEMUROMS for NPZ, a multi-species IBM for fish, and a fishing fleet dynamics model. To date, they have solved many numerical and bookkeeping issues, implemented different behavioral cues for movement, and next is to add more realistic biology. They found that balancing food/dietary factors when compared with balancing SST gave different results. In future, they intend to increase biological realism, and investigate the causes of low-frequency cycles. Yu-Heng Tseng described a modelling study of Japanese anchovy in the East China Sea. Little is known about the oceanic migration of the adults but spawning is known to occur in Taiwan Strait. The ability of the adults to reach southern spawning grounds may depend on Changjiang River discharge. He described that when coastal discharge from the Chiangjiang is included in the model, its variability is expected to affect migration routes (and availability) of anchovy to local fishermen. Skip McKinnell speculated on how the factors responsible for contemporary fish behaviour may have been determined by selective forces affecting the species centuries ago. Migration timing in sockeye salmon is relatively invariant compared to other behavioural traits. At the southern extreme of their range in North America, they have much earlier run timing than is expected from their spawning dates. Arriving at the "normal" time for their relatively late spawning date appears to have been selected against in earlier times. Kjell Utne and Geir Huse discussed how they are using individual-based

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models (IBM), genetic optimization algorithms, and observational data in their migration models of herring, blue whiting and mackerel in the northern North Atlantic Ocean. It is embedded within the NORWECOM coupled model system to provide access to daily physical and prey fields. The additional complexity is increasing the demand for computational resources. Shin-ichi Ito and his colleagues ended the session with an interesting presentation showing how they had evaluated both Euler-type and an IBM of saury migration. Euler-type models are computationally efficient because they simply move biomass from place to place on a fixed grid, but there is no information about the migration pathways of individuals that is possible with IBMs. Scaling IBMs to represent biomass has huge computational costs. The Euler-type model was able to capture the general features of saury feeding migration, egg production, and body size, but was unable to capture the westward spawning migration and required a somewhat artificial mixture of body sizes. The convenors were encouraged by the better-than-expected turnout of attendees to the topic session, so a repeat session is planned for PICES-2012 in Hiroshima.

### List of Papers

#### *Oral Presentations*

**Kenneth A. Rose, Katherine Shepard, Haosheng Huang, Sean Creekmore, Paul Venturelli, Jerome Fiechter, Enrique N. Curchitser, Kate Hedstrom, Matthew Campbell and Dubravko Justic** (Invited)

Modeling movement of fish over spatial and temporal scales: If fish were dumber and people were smarter

**Jerome Fiechter, Kenneth A. Rose, Enrique N. Curchitser, Kate Hedstrom, Miguel Bernal and Alan Haynie** (Invited)

Behavioral cues for small coastal pelagic species in the California Current: Results from a fully-coupled end-to-end ecosystem model

**Shin-ichi Ito and Takeshi Okunishi**

Comparison of migration algorithms for Japanese sardine (*Sardinops melanostictus*) in the western North Pacific

**Chen-Yi Tu, Yu-Heng Tseng, Tai-Sheng Chiu, Mao-Lin Shen and Chih-Hao Hsieh**

Using coupled fish behavior-hydrodynamic model to investigate spawning migration of Japanese anchovy, *Engraulis japonicus*, from Taiwan to the East China Sea

**Skip McKinnell**

Evolution's challenge to modeling sockeye salmon spawning migration

**Kjell Rong Utne and Geir Huse**

Towards end-to-end modeling with a special focus on planktivorous fish

**Shin-ichi Ito, Masatoshi Sato, Takeshi Terui, Michio J. Kishi, Daisuke Ambe, Takahiko Kameda, Satoshi Suyama, Masayasu Nakagami and Yasuhiro Ueno**

Euler-type and Individual Based modeling approaches for fish migration: An example of Pacific saury

### **MONITOR/POC/FUTURE Topic Session (S9)**

*How well do our models really work and what data do we need to check and improve them?*

Co-Sponsored by: *IMBER*

*Co-Convenors: Jack Barth (U.S.A.), Dake Chen (China), Michael Foreman (Canada), Philip Mundy (U.S.A.), Young-Jae Ro (Korea), and Sei-Ichi Saitoh (Japan)*

### Background

Given the importance of models to FUTURE, it is crucial to examine their skill and utility through comparison with data. Models are being used to study and forecast physical (atmospheric and oceanic circulation and mixing), chemical (air-sea fluxes, dissolved oxygen), biological (primary production, trophic dynamics) and fisheries (individual based modeling, migration pathways) processes. Climate forcing and coupling between processes is of prime importance. Presentations are invited over the range of modeling scales, from local to global, and from hours to decades. Contributions are also welcome identifying data sets that we currently have that are helpful for assessing model skill and what new data sets are needed and might be obtained through

ocean observing efforts. Discussions of uncertainty in model predictions and ways to reduce that uncertainty are also invited.

### Summary of presentations

This session was held to stimulate a review of a variety of models, especially how they compare with available data sets and what data are needed to improve the models. This is a timely topic as models are an important part of the PICES FUTURE Science Plan. An audience of about 50-60 people heard 18 oral presentations, five of which were invited. The posters were presented in the PICES poster session Thursday evening.

The invited speakers presented a series of stimulating talks on global scale physical modeling including downscaling to the Pacific marginal seas (Nikolay Diansky, Russia), on the dynamics of the Oregon continental shelf circulation using a data-assimilating model (Alexander Kurapov, U.S.A.), on end-to-end physics to fish and fishers models (Kenneth Rose, U.S.A.), on secular trends in a new global gridded phosphate and dissolved oxygen data base useful for comparing with global-scale numerical models (Shoshiro Minobe, Japan), and on an operational system to forecast fishery-resource variability using a circulation model and satellite data (Yoichi Ishikawa, Japan).

Throughout the talks and poster presentation, there was a consistent theme about the importance of long-term data sets for not only generating hypotheses about physical and biological variability, but for providing critical tests for the output generated by a range of numerical models. On the global and ocean basin scale, the value of the surface drifter velocity fields, the north-south heat flux as a function of latitude, and the subsurface hydrographic and velocity fields from Project Argo were noted. On the regional and coastal scale, the importance of satellite data (sea-surface temperature, surface height from altimetry, chlorophyll), surface velocities from high-frequency, land-based radar, subsurface data from moorings, and subsurface hydrographic and velocity data from the growing number of underwater gliders was noted. Several speakers noted that while the satellite data are invaluable, it is difficult to detect decadal variability since satellite data with global coverage are only about 30 years long. It was also commented on that we need at least 20 years of data before a trend can be detected in the presence of decadal variability.

For the more sophisticated bio-physical models, including end-to-end “climate-physics-fish-fisher” models, the need for quantitative data about the vertical distributions of both plankton and fish, and about fish populations over multiple generations are critical. In coastal waters, it is important to have data about yearly cycles of the vertical structure of the hydrographic, nutrient, phytoplankton and zooplankton fields. Several talks described models of water quality (pH, dissolved oxygen, turbidity) and water-borne diseases, especially those affecting aquaculture activities around the North Pacific, emphasizing the need to expand further our data collection efforts.

Two notable comments from the talks included Shoshiro Minobe’s nice analogy between preparing food for dinner from raw ingredients to preparing biogeochemical data sets (phosphate, dissolved oxygen) from world ocean data bases for use in model evaluation. He emphasized the care needed in data (food) preparation, in particular checks on data quality and careful attention to time and space gridding. In the context of the need for large, interdisciplinary teams to develop, analyze and apply ever-more sophisticated models and model-data comparisons, Kenneth Rose presented a very stimulating discussion about how humans interact and how we behave in groups. He suggested that we need changes in how we learn in groups and how best to make use of the range of ways we interact with each other. He emphasized the importance of face-to-face collaboration to balance our increasing reliance on electronic communication.

The Co-Convenors judged that the best oral presentation by a young scientist was by Naoki Yoshie (Japan) who spoke about “*Phytoplankton and nutrient dynamics in the western Seto Inland Sea, Japan, based on observation and a modified NEMURO model.*” Dr. Yoshie’s talk was praised for his clear description of the time- and space-varying biophysical water properties and plankton distributions, and his use and testing of a numerical model to explain the observed variability. The best poster presentation was by Vladimir Kulik

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(Russia) on a “North Pacific database of pelagic and bottom trawl surveys from Russian EEZ applicable to Ecosystem Based Management.” Dr. Kulik reviewed recent progress on assembling important biological data sets and making them available for potential application in fisheries management.

### List of Papers

#### *Oral Presentations*

**Nikolay A. Diansky and Vladimir Zalesny** (Invited)

Numerical simulation of the large-scale ocean circulation with a multi-component splitting method

**Alexander Kurapov** (Invited)

Oregon coastal ocean data assimilation system: Model performance and assimilated data assessment

**John A. Barth, Sangil Kim, Christopher A. Edwards and Patrick T. Drake**

To where the currents flow - Larval dispersal and connectivity along the U.S. West Coast

**Kenneth A. Rose** (Invited)

Combining hydrodynamic, NPZ, and fish models into climate-physics-fish-fisher models: Can the biology and people keep up with the computers?

**Angelica Peña and Diane Masson**

Modelling lower trophic level ecosystem dynamics in the Strait of Georgia

**Youngjae Ro, Kwangyoung Jung and Baekjin Kim**

Ecosystem monitoring/modeling project in the Chunsu Bay, Yellow Sea, Korea

**Xiangnan Wang, Changlei Ma, Songtang Liu, Jianjun Shi, Rui Zhu and Chuan Tian**

Development and application of marine ecological and environmental monitoring system in the Yellow Sea and Polar region

**Jerome Fiechter, Jeremiah Brown, Williams Leeds, Radu Herbei, Ralph Milliff, Christopher Wikle, Andrew Moore, Thomas Powell and Mevin Hooten**

Parameter uncertainty in marine ecosystem models: What can we learn from ensemble calculations and Bayesian models?

**Shoshiro Minobe and Utaka Hosoya** (Invited)

Regional secular trends in a new global gridded phosphate and oxygen dataset

**James R. Christian**

Effects of natural variability on biogeochemical processes in climate models

**Takashi Mochizuki, Masahide Kimoto, Masayoshi Ishii, Yoshimitsu Chikamoto, Hiroaki Tatebe, Yoshiki Komuro, Takashi T. Sakamoto, Masahiro Watanabe and Masato Mori**

Decadal prediction using recent series of MIROC global climate model

**Yoichi Ishikawa, Toshiyuki Awaji, Masafumi Kamachi, Shuhei Masuda, Hiromichi Igarashi, Yoshihisa Hiyoshi, Yuji Sasaki, Shiro Nishikawa, Toshimasa Doi, Nozomi Sugiura, Norihisa Usui, Yosuke Fujii, Takahiro Toyoda, Sei-Ichi Saitoh, Mitso Sakai, Yoshiki Kato and Shin-ichi Sato** (Invited)

Forecasting ocean circulation and fishery-resource variabilities for operational use

**Mohamed Rawidean MohdKassim**

Fish Forecasting System using Sea Surface Temperature and Chlorophyll satellite images: A statistical model approach

**Michael Foreman, Kyle Garver, Dario Stucchi, Ming Guo and Darren Tuele**

Uncertainties in modeling water-borne disease transmission among salmon farms in the Discovery Islands, British Columbia

**Xiutang Yuan, Zhifeng Zhang, Chuanlin Huo and Gengchen Han**

Environmental monitoring and assessment of mariculture zones in China: Status and prospects

**V.F. Mishukov, V.V. Kalinchuk, V.V. Plotnikov and A.V. Voytsytskiy**

Using satellite images for testing simulation models of contaminant transport in the Peter the Great Bay of the Sea of Japan

#### *Poster Presentations*

**Shin-ichi Ito, Naoki Yoshie, Takeshi Okunishi, Tsuneo Ono, Yuji Okazaki, Akira Kuwata, Taketo Hashioka, Kenneth A. Rose, Bernard A. Megrey, Michio J. Kishi, Miwa Nakamachi, Yugo Shimizu, Shigeo Kakehi, Hiroaki Saito, Kazutaka Takahashi, Kazuaki Tadokoro, Akira Kusaka and Hiromi Kasai**

Application of an automatic approach to calibrate the NEMURO nutrient-phytoplankton-zooplankton food web model in the Oyashio region

**Vladimir V. Kulik and Igor V. Volvenko**

North Pacific database of pelagic and bottom trawl surveys from Russian EEZ applicable to Ecosystem Based Management

**Naoki Yoshie, Xinyu Guo, Naoki Fujii and Tomohiro Komorita**

Phytoplankton and nutrient dynamics in the western Seto Inland Sea, Japan based on observation and a modified NEMURO model

**Bunmei Taguchi, Hisashi Nakamura, Masami Nonaka, Nobumasa Komori, Akira Kuwano-Yoshida, Koutarou Takaya and Atsushi Goto**

Seasonal evolutions of atmospheric response to decadal SST anomalies in the North Pacific subarctic frontal zone: Observations and a coupled model simulation

## BIO paper session

Co-Conveners: *Atsushi Tsuda (Japan) and Michael Dagg (U.S.A.)*

### Background

This session invites oral and poster presentations on all aspects of biological oceanography in the North Pacific and its marginal seas that are not covered in Topic Sessions sponsored by the Biological Oceanography Committee (BIO).

### Summary of Presentations

The BIO Paper Session at PICES 2011 had a total of 14 talks and 19 posters and was well attended with a minimum of 20 attendees in the audience. There were a variety of talks focusing on the zooplankton (11 papers), phytoplankton (6), jellyfish (6), benthos (4) and other aspect of BIO from molecular microbiology to marine mammals. The convenors recognized that this regular session provides very important opportunities for working groups to present their results and for young scientists to participate.

### List of Papers

#### *Oral Presentations*

**Xiuning Du and William T. Peterson**

Seasonal cycle of phytoplankton community composition in the coastal upwelling system off central Oregon in 2009

**Elena A. Shtraikhert, Sergey P. Zakharkov, Tatyana N. Gordeychuk and Julianna V. Shambarova**

About the mechanism of the winter-spring phytoplankton bloom in Peter the Great Bay (Sea of Japan)

**Tatyana Belonenko and Alexey Koldunov**

Non-stationary cycles of primary productivity in the Northeastern Atlantic

**Jingfeng Fan, Lili Li, Jiangyu Li, Hao Guo and Xinzheng Lin**

Diversity and structure of bacterial communities in Fildes Peninsula, King George Island

**Kyung-II Chang and Heemang Park**

Time-series measurements of biogeochemical and physical parameters in the southwestern East/Japan Sea during the spring transition in

**Sang-Rae Lee, Jee Eun Lee, Jung Hyun Oak, Jin Ae Lee and Ik Kyo Chung**

Metagenomic analysis reveals cryptic plankton biodiversity in the Nakdong River Estuary in Korea

**Sayaka Matsumura, Hiroya Sugisaki, Hiroaki Saito, Yuji Okazaki and Tomohiko Kikuchi**

Vertical distribution of euphausiids in the Oyashio to Oyashio-Kuroshio Transition Region of the western North Pacific

**Rui Saito, Atsushi Yamaguchi, Ichiro Imai, Atsushi Tsuda and Ichiro Yasuda**

Spatial and temporal changes in the zooplankton community around the Aleutian Islands during the summer of 2009

**Kohei Matsuno, Atsushi Yamaguchi and Ichiro Imai**

Body chemical contents and gut pigments of copepods in the western Arctic Ocean during summers of 2008 and 2010

**Marina Yurieva, Artyom Lazhentsev, Aleksey Pavlovsky and Konstantin Gorbatenko**

The biochemical composition and energy content of zooplankton of the Okhotsk Sea

**Natalia T. Dolganova**

Euphausiids from Far-Eastern Russian waters: Composition, distribution, and seasonal dynamics

**Se-Jong Ju, Jinho Chae, Dongju Lee, Ah-Ra Ko, Hyungbeen Lee and Donhyug Kang**

Importance of the bottom cold-water mass as an over-summering refuge for *Euphausia pacifica* in the Yellow Sea

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**Atsushi Yamaguchi, Jumpei Fukuda, Kohei Matsuno and Ichiro Imai**

Inter-annual and latitudinal changes in zooplankton abundance, biomass and size composition along the 180° transect in the North Pacific during summers: Analyses with an Optical Plankton Counter

**Akira Okuno, Tatsuro Watanabe, Naoto Honda and Katsumi Takayama**

Forecast of the giant jellyfish *Nemopilema nomurai* appearance in the Japan Sea

**Changhoon Han and Wonduk Yoon**

Distribution and density of *Aurelia aurita* polyps on Saemangeum dike, Korea

**Elena A. Shtraikhert, Sergey P. Zakharkov, Tatyana N. Gordeychuk and Julianna V. Shambarova**

Influence of environment factors on phytoplankton blooms in Peter the Great Bay (Sea of Japan) in winter- spring

**Harold P. Batchelder, Jennifer Fisher and Alexander Kurapov**

Potential larval connectivity among nearshore marine reserves in Oregon: The importance of temperature dependent pelagic durations and vertical distribution

**Vjacheslav S. Labay**

Elements of seasonal dynamics of the macrobenthos on a shelf of northeast Sakhalin (Sea of Okhotsk)

**Anastasia S. Dolganova and R.G. Bezrukov**

Composition and distribution of macrobenthos in some coastal-estuary systems in Ussury Bay (Japan/East Sea)

### Poster Presentations

**Kyoungsoo Shin, Minchul Jang, Pungguk Jang and Woojin Lee, Bonggil Hyun and Seungho Baek**

Annual change in the mesozooplankton community of the western channel of the Korea Strait from 2006 to 2010

**Yongjiu Xu and Joji Ishizaka**

Abundance of giant jellyfish (*Nemopilema nomurai*) and spring sea surface temperature variability in the northern East China and Yellow Seas

**Tatyana Belan, Boris Borisov, Ludmila Belan, Alexander Moshchenko and Tatyana Konovalova**

Long-term dynamics of some plankton and benthic characteristics at the Piltun-Astokhskoye field (NE Sakhalin Island Shelf)

**Alexander V. Zavolokin**

Jellyfish blooms in the Far Eastern Seas of Russia: Significance for ecosystems and social economic consequences

**Kristin Cieciel, Jim Murphy, Lisa Eisner and Bruce Wing**

A comparison of trawl caught jellyfish in the eastern Bering Sea

**Jung-Hoon Kang, MinHo Seo, OhYoun Kwon and Woong-seo Kim**

Vertical distribution of the copepod *Calanus sinicus* before and after formation of Yellow Sea Bottom Cold Water (YSBCW) in the Yellow Sea

**Seungmok Roh, Joongki Choi and Youngju Lee**

Distribution and community structure of phytoplankton in the offshore waters around Korean Peninsula during autumn season

**Sungeun Ju, Jiho Seo and Joongki Choi**

The distribution of Kuroshio indicator zooplankton around the IEODO Ocean Research Station in the East China Sea

**Yuji Okazaki and Kazuaki Tadokoro**

Biomass estimates of *Euphausia pacifica* using MOHT in the Oyashio region

**OhYoun Kwon, Woong-seo Kim, Jung-Hoon Kang, Kyunwoo Lee and Jin Hwan Lee**

Temporal and spatial variation of size-fractionated phytoplankton communities in the Yellow Sea, Korea

**Kaoru Aoki, Takuya Sirokiya, Kazuya Takeda Satoshi Yamada, Masaya Toyokawa and Tomohiko Kikuchi**

Spatiotemporal distribution and biomass of two abundant jellyfish in Ise and Mikawa Bay, Japan

**Seokgwan Choi, Kyumjoon Park, Hyunwoo Kim, Youngran Lee, Jieun Park, Daeyeon Moon and Yongrock An**

Finless porpoise, *Neophocaena phocaenoides*, Distribution in the South Sea of Korea

**Elena Dulepova and Natalya Kuznetsova**

Zooplankton production in the western zone of the Subarctic front in winter-spring 2011

## FIS Contributed Paper Session

Co-convenors: *Mikhail Stepanenko (Russia) and Gordon H. Kruse (U.S.A.)*

### Background

This session invited papers addressing general topics in fishery science and fisheries oceanography in the North Pacific and its marginal seas, except those covered by Topic Sessions sponsored by the Fishery Science Committee (FIS).

### Summary of presentations

The session consisted of 18 oral presentations (one of which was cancelled) and 22 posters that covered a wide variety of species and topics from all six PICES member countries. Oral presentations were given during two morning sessions on October 18 and 19. On the first day, there were two talks on reproduction, the first on reproductive biology of kuro shrimp off Korea and the second on spawning migrations of chum salmon in the northwestern Sea of Okhotsk. Studies of recruitment considered walleye pollock in the Japan Sea and jack mackerel in the East China Sea. One presentation addressed different methods for estimating age and growth of largemouth bass. A second salmon talk addressed the contribution of Amur River salmon to the total biomass of salmon in the North Pacific Ocean. The remaining talks on the first day addressed population parameters of elkhorn sculpin in Korea, stock and fishery dynamics of the pollock and their relations to climate variability in the North Pacific, and nearshore fish community dynamics inferred from herring surveys off British Columbia. Talks during the second day included three talks on species interactions, including nekton species composition and abundance in the northwest Pacific, predator-prey interactions of pollock and arrowtooth flounder in the eastern Bering Sea, and dynamics of the demersal fish community on the west Kamchatka shelf. Three fishery management presentations addressed analyses leading to a reduced minimum size limit for Tanner crab in the eastern Bering Sea, concerns with the design of the management system for pollock fisheries in the eastern Bering Sea, and management strategies for a marine ranching system including risk analysis off Korea. The session was concluded with the presentation of a conceptual model for determining oil fate on habitat and wildlife in the Arctic Ocean and an analysis of temperature on hatching and advection of larval neon flying squid off Japan. Poster presentations spanned an even more diverse set of topics, including population genetics, distribution and migration, abundance and stock assessment, reproductive biology, age and growth, environmental and climate effects on species, trawling effects, fishery economics, and fishery management. The FIS Contributed Paper Session continues to be one of the most popular sessions at PICES Annual Meetings. Based on the number and high quality of oral presentations and posters, diversity of species, mix of topics, and level of attendance, the FIS Contributed Paper Session at PICES 2011 was deemed to be very successful.

### List of Papers

#### *Oral Presentations*

**Hyemin Park, Youngseok Seo and Chulwoong Oh**

Reproductive biology of *Argis lar* from the East Sea of Korea

**Sergey E. Kulbachny and Sergey F. Zolotukhin**

Chum spawning migration in the north-western part of the continental coastline of the Okhotsk Sea

**Masayuki Chimura, Yuuho Yamashita and Satoshi Honda**

Why did the northern Japan Sea walleye pollock stock experience high survival in 2006?

**Motomitsu Takahashi, Chiyuki Sassa and Youichi Tsukamoto**

Growth-selective recruitment from pelagic to demersal habitats for juvenile jack mackerel in the East China Sea: Implications for year-class strength

**Ming-Ming Zhang, Chulwoong Oh, Wanok Lee, Jaemin Back and Jonghun Na**

Comparison of scales, whole otoliths and sectioned otoliths for estimating age and growth of largemouth bass, *Micropterus salmoides*

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### **Sergey F. Zolotukhin**

Contribution of Pacific salmon from the Amur River to the total salmon biomass of the North Pacific Ocean

### **Soojeong Lee, Jaebong Lee, Hyeokchan Kwon and Changik Zhang**

Population ecological parameters of elkhorn sculpin (*Alcichthys alcicornis*) along the Uljin area of Korea

### **Oleg A. Bulatov**

Walleye pollock: Fishery and stock dynamics

### **Jennifer L. Boldt, Thomas W. Therriault, Douglas E. Hay, Jacob Schweigert and Matthew Thompson**

Nearshore fish community dynamics in the Strait of Georgia: Information from juvenile herring surveys

### **Alexey A. Khoruzhiy**

Species composition and abundance of the nekton community in the upper epipelagic layer of the Northwest Pacific Ocean during summer 2004-2010

### **Mary E. Hunsicker, Lorenzo Ciannelli, Kevin M. Bailey and Stephani Zador**

The influence of climate and demography on predator-prey interactions between walleye pollock and arrowtooth flounder in the eastern Bering Sea

### **Nadezhda L. Aseeva, Andrey B. Savin and Marina B. Shedko**

Dynamics of demersal fish community structure on the shelf of West Kamchatka

### **William R. Bechtol, Gordon H. Kruse, Joshua Greenberg and Hans Geier**

Reduced minimum size limits improve Tanner crab fishery management in the eastern Bering Sea

### **Keith R. Criddle and James Strong**

Dysfunction by design: Consequences of limitations on transferability of catch shares in the Alaska pollock fishery

### **Heewon Park, Jaebong Lee, Youngil Seo and Changik Zhang**

Management strategies in a marine ranching ecosystem based on an integrated fisheries risk analysis method for ecosystems (IFRAME) framework

### **Elizabeth A. Logerwell and Mary Campbell Baker**

A conceptual model for determining oil fate and effects on habitat and wildlife in the Arctic

### **Yoshiki Kato, Mitsuo Sakai, Takaya Namba, Toshie Wakabayashi, Shuhei Masuda, Hiromichi Igarashi, Yoichi Ishikawa, Masafumi Kamachi and Toshiyuki Awaji**

Effect of water-temperature transition on hatching in the neon flying squid and numerical simulation of larval migration

## *Poster Presentations*

### **Victor F. Bugaev**

Correlation between the distribution of plerocercoid *Diphyllbothrium* sp. in sockeye salmon *Oncorhynchus nerka* smolts and adults with the abundance of parental stocks in the Kamchatka River

### **Ekaterina V. Golovashchenko and Oleg Z. Badaev**

Efficiency increase of marine bioresources usage based on the example of some trades

### **Ekaterina V. Golovashchenko**

Efficiency increase of marine bioresources usage based on the example of some trades economic value of ecosystem services of Eastern and Western Sakhalin fishery zones' shelf

### **Peng Sun and Zhenlin Liang**

The effect of the trawl selective parameters on the phenotypic traits of fish stocks

### **Anna V. Dakus, Helen V. Kashchenko, Sergey D. Ponomarev and Evgeny Denisenko**

The use of molecular techniques for population genetic analysis of the Pacific herring (*Clupea pallasii*) in the Okhotsk Sea

### **Chiyuki Sassa, Seiji Ohshimo, Hiroshige Tanaka and Youichi Tsukamoto**

Reproductive biology of *Bentosema pterotum* (Pisces: Myctophidae) in the shelf region of the East China Sea

### **Jaebong Lee, Jonghee Lee, Kwangho Choi, Inja Yeon and Dongwoo Lee**

Recent distribution and migration patterns of Pacific cod (*Gadus macrocephalus*) in Korean waters

### **Changik Zhang, Heewon Park, Youjung Kwon, Jaebong Lee, Youngil Seo, Heeyong Kim, Inja Yeon and Dongwoo Lee**

Fisheries risk assessment in a marine ranching ecosystem based on integrated fisheries risk analysis method for ecosystems (IFRAME) framework

### **Changik Zhang, Jaebong Lee and Soojeong Lee**

Stock assessment of elkhorn sculpin (*Alcichthys alcicornis*) along the Uljin area of Korea

### **Wongyu Park, Yujin Jeon, Junghwa Choi and Dongwoo Lee**

Spatial and temporal variations of sea surface temperature, zooplankton abundance and anchovy harvest in western waters of the Korean Peninsula during the last three decades

**Jungnyun Kim, Junghwa Choi, Kangseok Hwang, Taegyun Oh, Kwangho Choi and Dongwoo Lee**

Seasonal variations of species composition and abundance in the decapod crustacean assemblage in the coastal waters of Geoje Island and Namhae Island, Korea

**Alexander V. Lysenko**

Snow crab (*Chionoecetes opilio*) in the western Kamchatka: A new target fishery?

**T.A. Shatilina and A.A. Goryainov**

Climatic changes above the Far East and returning of chum salmon into the South Primorye rivers

**Ming-Ming Zhang, Chulwoong Oh, Wanok Lee, Jonghun Na and Jaemin Back**

Aging method comparison and growth of Amur barbell, *Hemibarbus labeo* from Goe-san Lake in Korea

**Andrew N. Deminov**

Occurrence of deep snow crab *Chionoecetes japonicus* on the shelf of the northwestern Sea of Japan

**Alexei M. Orlov**

Northwestern Pacific and southeastern Asia chondrichthyan fishes: Major threats and conservation status

**Minkyong Shin, Wongyu Park, Changuk Park and Thomas Shirley**

Distribution and timing of larval Tanner crab *Chionoecetes bairdi* in Glacier Bay and neighboring strait in southeastern Alaska, USA

**Sachihiko Itoh, Toshiro Saruwatari, Haruka Nishikawa, Ichiro Yasuda, Kosei Komatsu, Atsushi Tsuda, Takeshi Setou and Manabu Shimizu**

Exploring impacts of environmental history on larval growth: Combination of otolith microstructure analyses and particle-tracking experiments

**Jinho Bae, Hyemin Park, Hyeonggi Kim and Chulwoong Oh**

Age and growth of Conger eel *Conger myriaster* (Brevoort) using UV light from Korean waters

**Graham E. Gillespie, Tammy Norgard, Sean MacConnachie, Lily Stanton and Jessica Finney**

Program to assess the conservation status of the Olympia oyster, *Ostrea lurida*, in Canada

**Suzanne Kohin, Heidi Dewar, John Childers, Karen Nieto, Eric Prince, Barbara A. Block and Rosa Runcie**

Movements of albacore, swordfish and shortfin mako sharks in pelagic environments: Electronic tagging reveals the influence of oceanography on vertical and horizontal behavior

## POC Paper Session

Co-Convenors: *Kyung-Il Chang (Korea) and Michael G. Foreman (Canada)*

### Background

Papers are invited on all aspects of physical oceanography and climate in the North Pacific and its marginal seas, except those covered by Topic Sessions sponsored by the Physical Oceanography and Climate Committee (POC).

### List of Papers

#### *Oral Presentations*

**Elena I. Ustinova, Yury D. Sorokin and Svetlana Yu. Glebova**

Regional and seasonal inhomogeneity of climatic variability in the Far-Eastern Seas

**Alexander Lazarvuk, Boris Burov and Vladimir Ponomarev**

Evolution of the thermohaline structure of water under ice of Amurskii Bay

**Anastasiya Abrosimova, Igor A. Zhabin and Igor M. Belkin**

Distribution of the Amur River discharge in the Okhotsk and Japan seas

**Pavel A. Fayman, Vladimir Ponomarev and Vyacheslav Dubina**

Simulation of the mesoscale circulation in the Peter the Great Bay and adjacent Japan Basin area

**Igor A. Zhabin**

Tidally driven system around the Shantar Islands (the Sea of Okhotsk)

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**Oleg Zaitsev, Cuauhtemoc Turrent-Thompson and Jean Linero Cueto**

Intense sea-breeze currents in the coastal zone of the southern Baja California peninsula, Mexico

**Hanna Na and Kwang-Yul Kim**

Decadal variability of the upper-ocean heat content in the Northwestern Pacific

**Takao Kawasaki, Hiroyasu Hasumi and Masao Kurogi**

A modeling study of the North Pacific shallow overturning circulation

**Talgat R. Kilmatov and Olga I. Trinko**

Modeling the subarctic–subtropical boundary and possible climatic changes

**Tatyana Belonenko, Victor Foux, Victor Koldunov, Alexey Koldunov and Dmitriy Staritsyn**

Sea-surface levels in the Northwestern Pacific as indicators of local and global tendencies in climate change

**Howard J. Freeland**

An analysis of the time-varying heat, salt and volume budget in an oceanic control volume

**Michael Foreman, Wendy Callendar, Diane Masson, John Morrison, Badal Pal and William Merryfield**

A regional climate model for the British Columbia continental shelf

**Enrique N. Curchitser, Justin Small, Kate Hedstrom, Mike Alexander and Brian Kaufman**

Regional and global ramifications of eastern boundary upwelling

**Rong-shuo Cai, Hong-jian Tan and Rong-hui Huang**

The impacts of thermal anomalies in the East China Sea and its adjacent seas on East Asian atmospheric circulation and climate change in East China

**Fangli Qiao, Guansuo Wang, Xingang Lv and DeJun Dai**

Drift characteristics of green macroalgae in the Yellow Sea in 2008 and 2010

**Taewook Park, Chan Joo Jang, Minho Kwon, Hanna Na and Kwang-Yul Kim**

Sea surface salinity variability in the Yellow and East China Seas and its relation to ENSO

**Yanzhou Wei, Daji Huang and Xiaohua Zhu**

Temporal and spatial variability of the Kuroshio at PN/TK sections during 1955–2010

**Wang Rong, Xiao Yuzhang, Yang Fan, Song Pingping and Wang Hefeng**

Analysis and forecasting of wind field characteristics on the northern and open-ocean borders of the South China Sea

**Xiaomeng Wang and Jianbo Han**

An overview of the development of technical and legal issues of carbon dioxide ocean storage and the progress in China

### *Poster Presentations*

**Hong-jian Tan and Rong-shuo Cai**

Possible impact of tropical El Niño Modoki on SST of China's offshore and its adjacent waters

**Larisa S. Muktepavel**

Special features of spatial-temporal distribution of ice in the basic commercial zone and spawning areas of the Okhotsk Sea in 2006-2010

**T.A. Shatilina, G.Sh. Tsitsiashvili and T.V. Radchenkova**

Intrinsic features of regional circulation and climate above the Far East in the summer period of 1980–2009

**Elena I. Yaroshchuk**

The study of patterns of energy transformation of surface wind sea waves into energy of microstrains of the Earth's crust

**Nadezda M. Dulova and Fedor F. Khrapchenkov**

Short-term variability of currents and sea level fluctuations in the coastal zone of the Posyet Bay (the Sea of Japan/East Sea)

**Galina Pavlova and Pavel Tishchenko**

Alkalinity of the Japan Sea: A new look

**Vadim V. Novotryasov and Anatoliy E. Filonov**

Observations of highly nonlinear internal tidal waves in the Northern Gulf of California

**Polina Lobanova and Dmitriy Staritsyn**

On a possibility to forecast interannual variability of sea level in the Japan and Okhotsk Seas

**Evgeniya Tikhomirova and Vladimir Luchin**

Typical distributions of oceanographic parameters in Peter the Great Bay (Japan Sea)

**Valentina V. Moroz**

The intermediate water hydrology-acoustical characteristics forming peculiarities in the Kuril-Kamchatka area

**Alexandr Figurkin**

Variability of thermohaline characteristics in the 0-1000 m water layer of the deep part of the Okhotsk Sea

**Svetlana Shkorba and Elena Dmitrieva**

Linkages between anomalies of ice extent in the Japan/East Sea, Pacific SST and atmospheric indices

**Irina Mashkina**

Multi-scale variability of water structure in the northwestern part of the Sea of Japan using Argo drifters

**Pungguk Jang, Kyoungsoo Shin, Okmyung Hwang, Minchel Jang, Woojin Lee, Bongkil Hyen and Dongchll Jeon**

Seasonal effect of Tsushima Current Warm Water in the South Sea of Korea

**Svetlana N. Taranova and Igor A. Zhabin**

Seasonal and interannual sea surface temperature variability in the Japan/East Sea

**Kwangyoung Jung, Youngjae Ro and Baekjin Kim**

Impact of the freshwater release on the tidal circulation in the Chunsu Bay, Yellow Sea, Korea based on numerical modeling

**Eduard A. Spivak and Anatoly N. Salyuk**

Winter hydrography and periodic shallow water dynamics in the southeastern part of Laptev Sea—Results of the POI FEB RAS expedition in April 2011

**Yongchao Pang and Zhuoying Zhao**

On research status and application of China Standard Seawater

**Kirill Kivva, Anna S. Vazhova and Sergey Dudkov**

Influence of eddy structures on nutrients distribution in the western Bering Sea from September-October 2010

**Vladimir Ponomarev, Pavel A. Fayman and Vyacheslav Dubina**

Simulation of mesoscale circulation over the continental slope of the Northwest Japan/East Sea

**Taewook Park, Chan Joo Jang, Johann H. Jungclaus, Helmuth Haak, Wonsun Park and Im Sang Oh**

Changjiang freshwater effects on summer sea surface warming in the Yellow and East China Seas

**Rosa Runcie, Jonathan Phinney and Harold P. Batchelder**

Pacific Coast Ocean Observing System (PaCOOS) scientific objectives and recent activities

**Dongfeng Xu and Mingquan Xu**

The improvement of the Kuroshio path in Luzon Strait by assimilation of Argo data into numerical modelling

**BIO Workshop (W1)**

***MEMIP-IV: Quantitative comparison of ecosystem models applied to North Pacific shelf ecosystems—humble pie or glee?***

Co-Convenors: *Hal Batchelder (USA), Shin-ichi Ito (JPN), Angelica Pena (CAN) and Yvette Spitz (USA)*

**Background**

The objective of the Marine Ecosystem Model Inter-comparison Project (MEMIP) is to compare the performance of various lower trophic level marine ecosystem simulation models at predicting the abundance and distribution of coastal zooplankton functional groups. During the series of workshops, three test beds (Newport, Seward, and A-Line) were selected, and eight potential ecosystem models (NPZD+, NAPZD+, NEMURO, COSINE, NPZD-Fe, Nemuro-Fe, Nemuro-K5 and Biology) were identified to be embedded in ROMS-2D models. The focus of this 4th MEMIP workshop will be quantitative model-model and model-data analysis and comparison of the results of the simulations. Prior to this workshop, different ecosystem models embedded in ROMS-2D will have simulated several 3-4 specific years at each test bed. At the workshop, the results of different ecosystem models within each test bed will be compared. The combination of different years, multiple ecosystem models and three regions should provide sufficient runs to enable ensemble-based estimates of the uncertainty of ecosystem hindcasts, which will provide information needed for assessing FUTURE coupled ecosystem-physical forecast products.

**Summary of Workshop**

The 1.5 day workshop was convened on 14-15 October in Khabarovsk, Russia immediately prior to the PICES-2011 Annual Meeting. The workshop was co-convened by Harold Batchelder (USA), Shin-ichi Ito (Japan), Angelica Peña (Canada) and Yvette Spitz (USA). All of the convenors were in attendance for most of

the workshop. Unfortunately, Dr. Ito had conflicts with meetings of two other PICES expert groups (one on Friday afternoon, and one on Saturday morning), so he was not able to participate in the entire workshop. We had arranged for two invited presentations (by Yvette Spitz and Jerome Fiechter, both of the USA), and one contributed presentation by Dr. Guimei Liu of China. Dr. Liu's presentation, originally scheduled for Friday was rescheduled to Saturday as she was unable to arrive in Khabarovsk until late Friday. An introduction to the workshop provided by Batchelder reminded the group of the workplan established at the MEMIP-2010 workshop in Portland, OR, USA, and updated the participants on the status in achieving those objectives. We expected to implement the physical test beds for the Gulf of Alaska and the A-Line prior to the PICES-2011 workshop, but were unable to do so. Batchelder briefed the group on the progress that was made when Dr. Ito spent a week in March 2011 at Oregon State University, working with Spitz and Batchelder. Model domains and bathymetric profiles were developed for both physical test beds, but forcing and boundary files (especially freshwater) were not completed during this visit. Consequently, the set of ecosystem simulations that were to be run on the set of Newport, Gulf of Alaska and A-Line circulation set-up were not accomplished prior to the PICES-2011 meeting. Thus, the primary objective of the 2011 workshop, which was to be quantitative skill assessment of the ecosystem models, could not be achieved. Instead, we focused on determining the best approach for re-tooling to accomplish the MEMIP objectives (which we detail below).

Jerome Fiechter provided an invited talk on how ecosystem model complexity, model parameterization and data assimilation affected the robustness and reliability of ecosystem predictions in coupled biophysical models. Using 3D-ROMS examples from the coastal Gulf of Alaska (CGOA) or California Current, several different lower trophic level ecosystem models were compared and assessed by comparing the modeled chlorophyll concentrations to observed SeaWiFS satellite patterns. The ecosystem models had different levels of complexity spanning simple to complex: 4 component NPZD; 11 component NEMURO; each of these with addition of Fe limitation; and a 90 component Darwin model. The CGOA models without assimilation of ocean physics exhibited poor agreement and bias of chlorophyll-*a* compared to SeaWiFS in the slope and basin regions. Data assimilation of SST, SSH and vertical section physics greatly improved the agreement of the modeled chlorophyll with the observations in regions where mesoscale activity affects the biology. Ensemble calculations also illustrated the spatial and temporal control exerted by the biological parameters (*e.g.*, phytoplankton light response, zooplankton grazing) on the NPZD model solution.

Yvette Spitz provided two presentations during the workshop. The first compared 2D and 3D simulations of the Oregon Shelf region and the second discussed approaches and issues to consider in skill assessment. Comparison of cross-shelf patterns from a 2D model with an extracted section from a 3D model of the Oregon shelf indicate that phytoplankton and zooplankton concentrations in the 2D simulation are higher than in the 3D simulation because of greater upwelling of nitrate near shore in the 2D simulation. Other conclusions from the comparison are that tuned parameters from a 2D simulation may not be appropriate for a 3D simulation, and that temporal and spatial patterns in a cross-shelf section are controlled by both the strength of upwelling and mesoscale features, which depend on topography, and that the time scale of the ecosystem response to upwelling dynamics may not be fully understood from 2D simulations.

Spitz explained why skill assessment of marine ecology is difficult. There are numerous metrics, univariate and multivariate, some of which are redundant, some complementary. Also results of coupled models are sensitive to the formulation and unknowns of ecosystem models, details of the circulation model, specific atmospheric forcing used, lack of data, and incomplete and uncertain data. She concluded that it is important to do quantitative skill assessment, but noted that large misfits of model and data, or differences among several models, may be due to factors other than differences in, say, the ecosystem models, and that it is important to control for as much of the variability as possible. Using a consistent physical test bed for comparison of multiple ecosystem models is one way to accomplish this for model-model comparisons. Model-observation comparisons are more difficult as it is impossible to exactly reproduce all of the observed forcing and natural variations that are responsible for the real-ocean observations, especially when the models are 2D and the real ocean 3D.

Based on the Pacific basin-wide physical-biogeochemical model (ROMS-CoSINE), Guimei Liu estimated the primary productivity and sea-to-air CO<sub>2</sub> flux in the South China Sea, the East China Sea, and the Yellow Sea.

It shows that the sea surface temperature (SST) controlled the spatial and temporal variations of the oceanic  $p\text{CO}_2$  in the three marginal seas. Moreover, the role of the Pacific Decadal Oscillation, SST, and biological activity on the control of  $p\text{CO}_2$  changes are examined in the China seas.

#### Future Work Plan for MEMIP (2011-2012)

To achieve comparisons of different ecosystem models within a single physical framework, we have re-examined what is feasible to accomplish prior to and at the PICES-2012 MEMIP workshop. We have eight relatively established ecosystem models ready to run within a 2D physical model framework. These include several variations of NPZD, NEMURO and the CoSINE model. Versions of NEMURO and NPZD with and without Fe control are part of this comparison. This is important because the role of Fe in coastal ecosystems is thought to vary. A ninth model, a modification of NEMURO with a stage-structured model of krill, is being developed and will be included in the comparison if available by February. The three model domains, Newport, GAK and A-Line are still planned, and data sets from the time-series collections along those lines have allowed us to identify 3 years in the early 2000s, when data are most complete, to perform model-data comparison in each system. This will allow the evaluation of the sensitivity of a model, often tuned to one year, to be examined for two other years within the same location. The years of interest for each region are: Newport (2000-2002), GAK (2001-2003) and A-Line (2001-2003). In all three regions, the period from late-winter to late summer is the seasonal period of interest. We developed the following strategy and timeline for making progress on these tasks. First, most of the MEMIP team will meet for 1 week in Corvallis, OR in March 2012. This will provide an opportunity to cross-compare model fields from multiple ecosystem models run within the Newport physical test bed, and to finalize the configuration and run simulations of the ecosystem models in the GAK and A-Line test beds. We assigned tasks to MEMIP team members to prepare for the March meeting. Batchelder, Spitz and Peña will be responsible for configuring and running the Newport model with as many of the ecosystem models that are ready in mid-January. Concurrently, Fiechter and Ito will develop 2D physical testbeds for the GAK and A-Line sections, respectively. Assuming all of this is accomplished prior to the March workshop, we expect to conduct model-model comparisons at the March workshop. Ideally, following the workshop each individual ecosystem model formulation (defined by state variables and parameter values) will be run for all three years in all three domains. Assessment will be done by comparing model results to both field observations of state variables, and by comparing model results from multiple years at one site, across sites, and across models. The MEMIP workshop proposed for PICES-2012 (Hiroshima) will be used to finish the skill assessment, and outline one or several papers for preparation.

#### List of papers

##### *Oral presentations*

**Jerome Fiechter, Christopher A. Edwards, Andrew Moore, Nicole Goebel and Kaustubha Raghukumar** (Invited)

How accurately can we predict chlorophyll concentrations in the Northeast Pacific: The role of ecosystem model complexity and data assimilation?

**Yvette H. Spitz** (Invited)

Intercomparison of pelagic ecosystem models for the Oregon Shelf: "The devil is in the details"

**Guimei Liu, Fei Chai and Hui Wang**

Comparison of air-sea CO<sub>2</sub> flux and biological productivity in the South China Sea, East China Sea, and Yellow Sea: A three-dimensional physical-biogeochemical modeling study

**Harold Batchelder and Shin-ichi Ito**

Updates on data progress since PICES-2010

**Yvette Spitz and Shin-ichi Ito**

Physical test bed updates

**Guimei Liu**

Ecosystem models

**Angelica Peña**

Ecosystem models

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### **Yvette Spitz**

Ecosystem models

### **Jerome Fiechter**

Ecosystem models

### **Shin-ichi Ito**

Ecosystem models

### **Harold Batchelder**

Ecosystem models

### **Individual/small group work**

Ecosystem model results and analysis

### **Yvette Spitz**

A skill assessment primer

## **FIS Workshop (W2)**

### ***Remote sensing techniques for HAB detection and monitoring***

Co-sponsored by: *NOWPAP*

Co-conveners: *Tatiana Orlova (Russia), Yoshida Takafumi (CEARAC), Vera Trainer (U.S.A.)*

### Background

Monitoring harmful algal blooms (HABs) and the environmental factors associated with their occurrence can often be improved by remote sensing. Satellite imagery can be used to help: (1) detect and identify HAB species or the oceanic features in which they reside, and (2) in mitigation of damage to fisheries and human health by HABs. However, the effective use of the data from these sensors is often hindered by a lack of skills to acquire, process, and interpret them. The goal of the workshop is to teach the basic skills needed to work independently with data from a variety of satellite sensors (*e.g.*, SeaWiFS, MODIS, MERIS, AVHRR, and CZCS). This workshop may also include such themes as the fundamentals of bio-optics, pigment algorithms, primary production algorithms and, to a lesser extent, the underlying physical principals leading to the measurement of sea surface temperature, ocean wind speed and ocean topography. A series of lectures will describe research and monitoring efforts that currently use remote sensing for the study of HABs. The workshop will take place following the NOWPAP/PICES/WESTPAC young investigator training course on "Remote sensing data analysis" held on October 8-12, 2011 in Vladivostok, Russia.

### Summary of Workshop

This workshop featured 5 presentations including 2 keynote speakers, Dr. Joji Ishizaka and Dr. Raphael Kudela. The speakers highlighted the utility of satellite remote sensing as a useful tool for the study of harmful algal blooms, but pointed out the technical limitations, including inability to discriminate among individual phytoplankton species and the inability to detect low concentrations of phytoplankton which are needed to study the initiation of harmful algal blooms. In the afternoon a series of technical web-based demonstrations were given to show available remote sensing data such as NOAA's satellite sites, Indian, Korean and the newly-launched European satellite remote sensing websites. Analysis software was described including valuable freeware. Dr. Kudela demonstrated NASA's SeaDas software and demonstrated its utility with SeaWiFS imagery. There were 19 scientists in attendance: Japan (7), Korea (2), USA (4), Russia (4), China (2), Canada (0).

List of papers*Oral presentations*

**Raphael M. Kudela, Mati Kahru, John P. Ryan and David G. Foley** (Invited)

Linking changes in dinoflagellate blooms along the US west coast to short and long term restructuring of the California Current System

**Sergey P. Zakharkov, Tatyana N. Gordeychuk, Elena A. Shtraikhert and Julianna V. Shambarova**

Study of diatom succession in the Sea of Japan based on satellite and ship data

**Lijian Shi, Bin Zou, Yingni Shi and Maohua Guo**

The application of HJ-1A/1B CCD data to *Enteromorpha Prolifera* monitoring over the Yellow Sea and East Sea

**Joji Ishizaka, Kazuyoshi Miyamura, Ken Furuya and Shigeru Itakura** (Invited)

Status and perspective remote sensing data use to reduce the damage caused by red tides (Harmful Algal Bloom) in Japan

**Chao Liang**

A preliminary study on the application of the wave degree of polarization in marine oil spill monitoring

**MEQ Workshop (W3)*****Pollutants in a changing ocean: Refining indicator approaches in support of coastal management***

Co-sponsored by: *GESAMP, ICES and IOC*

Co-Convenors: *Kris Cooreman (ICES/Belgium), Peter Kershaw (GESAMP/UK), Olga Lukyanova (PICES/Russia) and Peter Ross (PICES/Canada)*

Background

Many anthropogenic pollutants impact marine environmental quality, with coastal zones being particularly vulnerable. Persistent organic pollutants (POPs) are a concern because they magnify in food webs and present health risks to humans and wildlife. Other chemicals are less persistent, but may nonetheless impact the health of biota. While some pollution indicators are ensconced into monitoring and management regimes in different nations over space and time, new pollutant concerns may not yet be captured by existing protocols. These include “micro-plastics”, the breakdown products of debris and other forms of structural pollutants, which can clog the gills of invertebrates and fish, and asphyxiate seabirds and marine mammals. In addition, these micro-plastics may adsorb some of the other chemical contaminants and transfer them to marine organisms. This workshop reviewed ways in which chemical and structural pollutants enter the marine environment, are transported through ocean currents and/or biological transport, and impact marine biota. The workshop reviewed several examples of pollution indicators used by different nations, as a basis for improving and/or expanding indicator approaches in the North Pacific Ocean. These examples also critically evaluate the extent to which changing baselines (*e.g.*, climate variability) may impact on source/transport/fate processes and effects on biota, and recommend means of improving the utility and reliability of current indicator/ monitoring approaches in a changing world.

The objectives of this workshop were to:

- (1) Critically review 3–5 examples of currently used indicators of marine contamination in different PICES member countries (*e.g.*, shellfish monitoring of PAHs, metals, persistent organic pollutants, fecal bacteria; POPs in seabird eggs and marine mammals); list advantages and disadvantages for each, and describe management/policy linkages; Consider the influence of changing climate on indicator performance and ways to address this.
- (2) Review emergent pollutant concerns and in particular, examine the topic of plastics and micro-plastics as structural pollutants and as mechanisms for the transfer of contaminants to marine biota; examine existing and/or new opportunities to establish indicator approaches to plastic pollution, and review sampling and analytical methods.

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(3) From these applied examples/case studies, identify opportunities for future PICES activities on the topic of marine pollution:

- evaluate feasibility of establishing Study Group on Marine Contaminants, including terms of reference, membership, and deliverables;
- describe the scope of PICES/FUTURE activities that focus on contaminants in the North Pacific marine environment;
- update and revise MEQ Action Plan elements on marine contaminants;
- identify potential interactions with IOC/ICES/GESAMP/NOWPAP/NOAA programs that focus on contaminants in the marine environment.

### Summary of Workshop

Dr. Peter Kershaw (United Kingdom) described the mandate and activities of the United Nations-sponsored Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), which provides expert advice on priority topics, as well as assessments of regional and global environmental concerns. One activity that is relevant to PICES is the GESAMP effort to identify pollution indicators for the United Nations Transboundary Waters Assessment Programme (TWAP) in groundwater, rivers, lakes, Large Marine Ecosystems (LMEs) and open oceans. In addition, GESAMP has a number of Working Groups that are active in relevant areas, including 'mercury, cadmium and lead' (WG37), 'the historical inputs of contaminants into coastal ecosystems' (WG39), 'source, fate and effects of micro-plastics in the marine environment' (WG40). In addition, a new Correspondence Group is being established to evaluate the 'biomagnification of pollutants in top predators'.

Dr. Kris Cooreman (Belgium) described the aim within the ICES realm for integrated science in support of management. Dr Cooreman stressed that fisheries regulations were ineffectual when the root causes of reduced fish stocks are unrelated to fishing. In addition to a recent example of a population-level impact related to a single chemical (the antifoulant tributyltin and reduced shrimp stocks), other European examples include the effects of PCBs and DDT on reproduction and health of seabirds and marine mammals. A long history of interest in the area of marine pollution positions ICES well to partner with PICES on subjects of mutual interest into the future.

Dr. Joel Baker (USA) led discussions and activities on the topic of micro-plastics, which provided a basis for the field trip on the Amur River the following day. This pollutant category encompasses a wide variety of types, sizes, shapes, colours and origins for 'structural pollutants', highlighting the need for improved standardization of assessment methods. Major challenges, and hence opportunities for collaboration in the North Pacific, include: methods to detect and quantify, distribution over space, and effects on biota (including invertebrates, fish, turtles, seabirds and marine mammals).

Dr. Annamalai Subramanian (Japan) delivered an overview of POPs and metals in the Asia-Pacific region. The concentrations of different contaminants of concern have been quantified in some of the hundreds of invertebrate, fish, seabird and marine mammal species for which samples have been stored at the Environmental Specimen Bank for Global Monitoring at Ehime University, Japan. Results reveal widespread environmental responses to the use, disposal and regulation of many of the POPs. Of note was the influence of the biology of the species selected on the contaminant message: sessile mussels provided evidence of 'local' contamination, while migratory albatross and northern fur seals provided a more regional or 'global' contaminant signal.

Local participants, including Olga Lukyanova, Mikhail Simokon and Vasilij Tsygankov, described some of the priority concerns along the coastline of the Russian Far East and adjacent waters. While human population density is relatively low in this region, there exist concerns about offshore oil and gas exploration and development in the Sea of Okhotsk, metals related to local industrial activity, radioactive releases, and POPs and biological pollutants from global sources.

## Workshop Recommendations

To recommend establishing a one-year Study Group on *Marine Pollutants* to:

- Identify novel approaches to operational marine pollution assessment by developing a list of priority pollutant concerns in each PICES nation; identifying indicators of status, trends and effects; harmonizing methods to evaluate their effects on biota; and describing case studies which illustrate the effectiveness of indicators in informing the success of remedial actions.
- Identify interactions within PICES scientific committees and expert groups that will complement the SG-MP, and be consistent with FUTURE.
- Explore potential partnerships with other organizations which could lead to joint activities, improve efficiencies and strengthen scientific outcomes.
- Develop recommendations for a PICES expert group on marine pollutants.

## List of papers

### *Oral presentations*

**Peter J. Kershaw** (Invited)

Pollution indicators in the marine environment – A GESAMP perspective

**Kris Cooreman, Roel Smolders, Yves Verhaegen, Koen Parmentier, Patrick Roose and Guy Smagghe** (Invited)

Building expert knowledge to reach integrated scientific advice for marine management

**Annamalai Subramanian and Shinsuke Tanabe** (Invited)

Contamination by persistent organic pollutants in the Asia-Pacific region

**Joel E. Baker, Julie Masura, Gregory Foster and Courtney Arthur** (Invited)

Abundance, distribution, sources and potential implication of microplastic particles in coastal waters of the North Pacific region

### *Poster Presentations*

**Natalia Pichugina and Vladimir Goryachev**

The radioactive pollution of hydrobionts at the place of nuclear accident in the Chazhma Bay, the Japan Sea

**Vasiliy Yu. Tsvgankov, Margarita D. Boyarova, Peter A. Tyupelev and Olga N. Lukyanova**

Persistent organic pollutants (POPs) and mercury (Hg) in organs of the grey whale (*Eschrichtius robustus*) from the Bering Sea

**Mikhail V. Simokon and Lidiya T. Kovekovdova**

Mercury in the bottom sediments of Peter the Great Bay (Japan/East Sea)

**Mikhail V. Simokon**

Environmental pollution monitoring of Far Eastern Seas

**Zou Ya-Rong, Zou Bin and Liang Chao**

Multiple index marine oil spill information extraction research

**Zou Ya-Rong, Zou Bin and Liang Chao**

Using the SAR to analyze marine oil spill polarization characteristics

## **POC/MONITOR/TCODE Workshop (W4)**

### ***Recent advances in monitoring and understanding of Asian marginal seas: 5 years of CREAMS/PICES EAST-I Program***

Co-Convenors: *Kyung-Il Chang (Korea), Toshitaka Gamo (Japan), Young-Shil Kang (Korea), Kyung-Ryul Kim (Korea), Vyacheslav Lobanov (Russia), Toru Suzuki (Japan) and Yury Zuenko (Russia)*

## Background

Under the auspices of the EAST-I program initiated and supervised by the CREAMS/PICES Advisory Panel, scientists from Japan, Korea and Russia have carried out many successful cruises in the East Asian marginal seas over the last 5 years. With the active discussion and promotion by CREAMS/PICES of a new EAST-II

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program focusing on the Yellow and East China Seas, it is timely to have a forum summarizing some important results obtained by the international cooperative efforts of EAST-I. This workshop welcomed studies on hydrography, circulation, biogeochemistry, and ecology and their variability in East Asian marginal seas in the PICES area and on effects of climate and long-term changes in the abiotic and biotic environments of this region.

### Summary of Workshop

Workshop co-sponsored by Physical Oceanographic and Climate Scientific Committee (POC), Technical Committees on Monitoring (MONITOR) and Data Exchange (TCODE) was held on Friday, October 14, 2011 and consisted of 13 oral presentations (including 2 invited talks) plus 7 posters. It focused on 5 year advances in monitoring and understanding of Asian marginal seas related with CREAMS/PICES EAST-I Program initiated and supervised by the Advisory Panels for a CREAMS/PICES Program in East Asian Marginal Seas (CREAMS-AP), November 2005–October 2011.

The workshop started with a presentation by Kuh Kim on the progress of CREAMS-AP ad hoc committee to complete PICES Report on Marine Ecosystems of the North Pacific Ocean: 2003-2008. He explained that the Science Board of PICES 2010 charged the CREAMS-AP with the task to complete the chapter not included in the Report. The CREAMS-AP then formed an *ad hoc* committee to carry out this task and 6 members of the committee had 2 meetings to develop the content of the chapter, identify the leading and contributing authors and discuss the first draft of the report. He presented an overview of the report prepared by the *ad hoc* committee under a tentative working title of “Marine Ecosystems of the North Pacific Ocean 2003-2008: Japan/East Sea” and asked for comments and discussion on it from the workshop participants.

Kyung-Ryul Kim reviewed the results of Korea EAST-I (East Asian Seas Time-series I) program which was supported by Ministry of Land, Transportation and Marine Affairs of Korea in 2006 to identify, quantify and model the dynamic processes governing the climate variability and their linkage to change in marine ecosystem. Through this program integrated monitoring of various spatio-temporal scales was successfully performed in the sea and extensive international collaboration on joint cruises and scientific workshops was promoted. He briefly presented some important results of the Korean EAST-I program and expressed the hope that it would continue to serve as an important forum for international collaboration in the area for next five years.

Dong-Jin Kang presented preliminary results of EAST-I Real-time Automatic Profiler in the Ulleung Basin which was newly developed by the CREAMS/PICES program and had been deployed since May through September 2010. The system provided a large amount of data including daily profiles (and twice a day since June) of temperature, salinity, dissolved oxygen and fluorescence sent in real time mode through inductive modem and wireless telecommunication system.

Tomoharu Senjyu presented an invited talk on the linkage system among the East Asian seas and the atmosphere. He pointed out two examples of linkages. One of them is bidecadal variability of the Japan Sea Proper Water properties synchronized with cold air outbreaks in winter synchronized with atmospheric disturbances developed over the East China Sea. The second is interannual variation of salinity of the water transported through the Tsushima Strait which is connected with atmospheric and oceanographic conditions in the Yellow Sea and East China Sea.

Vyacheslav Lobanov reviewed the scientific activities of POI (V.I. Il'ichev Pacific Oceanological Institute, Russia) under the CREAM/PICES program over the past 5 years. Two collaborative cruises with Korea using R/V Akademik M.A. Lavrentyev were successfully conducted in 2007 and 2009 for monitoring over-turning circulation and biogeochemical processes in the Japan Sea. They observed a trend of bottom water warming since 2001 and further weakening of convective mixing. Strong hypoxia due to increased eutrophication was found in the bottom layers of the inner part of Peter the Great Bay in the northwestern Japan Sea.

Taekeun Rho presented an original result on vertical and spatial distribution patterns of transparent exopolymer particles (TEP) for better understanding the biological pump in the East Sea/Japan Sea. Strong positive relationship observed between TEP and chlorophyll-*a* in the chlorophyll maximum layer was regarded as evidence that TEP plays an important role in dynamic processes by phytoplankton.

Dmitry D. Kaplunenko showed vertical profiles of nitrate, temperature, salinity, fluorescence (chlorophyll-*a*) and dissolved oxygen in the northern Japan Sea, which were measured using a CTD SBE 9 profiler attached with an in situ ultraviolet spectrophotometer (ISUS). The linkage among variations of chlorophyll-*a*, nitrate and dissolved oxygen was well interpreted based on dynamic and biogeochemical processes in the Japan Sea.

Olga Trusenkova *et al.* developed a profound discussion on intense mesoscale dynamics with seasonal variability, by using eddy kinetic energy (EKE) values calculated from satellite altimetry data for almost two decades in the Japan/East Sea. EKE variations off Primorye coast were analyzed in detail by taking into account mesoscale structures in thermal contrasts on the satellite images, and patterns of wind stress and curl from satellite scatterometry were discussed as additional EKE forcing.

Junheon Jang, Kyung-II Chang (presenter) reported interesting results of spatially dense and high-resolution time series records of subsurface temperature and current velocity in the Ulleung Basin of the southwestern East/Japan Sea. Offshore intermediate waters as well as those at the continental slope were shown to have had a tendency of temperature decrease, accompanied with a decreasing trend of southward flow along the continental slope. Effects of these physical changes were discussed from ecological points of view.

Junghyun Kwak *et al.* presented seasonal variations of summer primary productivity (PP) and phytoplankton community structure in the East/Japan Sea in 2008-2010. In the Ulleung Basin, PP decreased gradually from spring to winter and then increased again to spring. Such seasonal variation corresponded to nutrients dynamics with the lowest concentration in November. Picophytoplankton was the main size fraction of phytoplankton that produced the largest portion of PP in the East/Japan Sea, but micro- and nanophytoplankton contributed over 60% of integrated PP in the Ulleung Basin in summer. Spatial variation of PP was closely associated with water column structure and vertical distribution of physicochemical parameters.

Andrey G. Andreev presented changes of physical and chemical parameters and chlorophyll *a* concentration in the central and southern Japan Sea, which were considered in relation to the ocean climate variability. Enhanced water volume transport of the East China Sea through the Tsushima/Korean Strait leads to dissolved oxygen depletion and increases stratification in the surface layer in pre-winter season that is one of the main reasons of dissolved oxygen reducing and temperature rising in the intermediated and deepwater.

Sukgeun Jung and Ilsu Choi presented updated analytical results on relationships of fluctuation of dominant commercial fisheries species in the southwestern Japan/East Sea (SJES) with respect to oceanographic conditions in the SJES vs. the Korea Strait, which is under the influence of the Tsushima Warm Current and the counteractive episodic intrusions of cold water from the SJES. They suggested that oceanic conditions in the Korea Strait, rather than the Japan/East Sea, seemed to be more important in recruitments of the dominant fish species.

Yury Zuenko *et al.* presented recent climatic changes in the Japan/East Sea ecosystem on the tri-national data set. The abiotic and biotic parts of the data set are processed by Principal Component Analysis: 57-58% of both subsets variability are explained by the sum of PC-1 and PC-2. An increasing tendency of the PC-1 in the late 1980s, with a well-known regime shift depends on winter monsoon intensity that could be described by the Siberian High Index. The PC-2 decreased until the mid 1990s then had a shift to higher scores. These changes are possibly related to processes in the Pacific, more important for summer season in the Japan/East Sea.

After the all oral presentation, several questions and answers, and discussion were performed, and an alternate delegate of Japan commented that the name “Japan Sea” is the internationally recognized and established name so that Japan cannot accept “Japan/East Sea” in the current draft report by CREAMS-AP *ad hoc* committee.

## Session Summaries-2011

Seven poster presentations were accepted in this workshop.

Dmitry V. Stepanov showed low-frequency variability of the circulation in the central part of the Japan Sea by numerical simulations using Numerical Mathematics Ocean Model (INMON). Initial conditions were based on the World Ocean Database 2009 and CORE atmosphere data from 1958 to 1990. The results indicated the main feature of large-scale circulation and its seasonal variability, and for spectral analysis of relative vorticity at the depth of 200m, 500m and 800m, 4 and 8 years period were dominated.

Pavel Semkin showed the results of observation of chemical parameters at surface and near bottom in Ussuriyskiy Bay, Japan Sea, from 2008 to 2011. The low oxygen, low pH and high pCO<sub>2</sub> water formed in the bottom in summer, and this water were upwelled by summer monsoon at the beginning of autumn. The high oxygen, low pCO<sub>2</sub> and low nutrients water formed in whole of the Bay in late winter, and temperature, nutrients and pCO<sub>2</sub> increased and oxygen decreased at near bottom in spring.

Kyung-II Chang showed wind-induced coastal upwelling and offshore movement of the upwelled cold and nutrient-rich water in the flow at the east of Korean Peninsula. He identified three events of significant temperature decrease in 19 events by ocean buoy observations in 2003-2009 and considered that the three events were caused by not only wind stresses but also a northern thick cold water was dominant.

Gennady Kantakov showed three experiments on surface current observations by newly-designed Argos drifters developed in the Okhotsk Sea the West Kamchatka and East Sakhalin in 2009–2011, and these Argos drifters survived in the pack ice and among drifting ice fields. He also demonstrated the Argos drifters and tracking system at the presentation.

The other 3 poster presentations were cancelled.

TCODE was responsible to select a Best Oral and Poster Presentation for TCODE within W4 presentations. A Best Oral Presentation Award did not apply because there was no oral presentation by early career scientist who is no more than 5 years into his/her Ph.D., and Kyung-II Chang was awarded a Best Poster Presentation for TCODE.

### List of papers

#### *Oral Presentations*

**Toshitaka Gamo, Joji Ishizaka, Changkeun Kang, Kuh Kim, Vyacheslav Lobanov and Yury Zuenko**  
Progress report of CREAMS-AP ad hoc committee to complete 2010 North Pacific Ecosystem Status Report

**Kyung-Ryul Kim, Kyung-II Chang, Tongsup Lee, Changkeun Kang and Dong-Jin Kang**  
A report on Korea EAST-I (East Asian Seas Time-series I) program

**Dong-Jin Kang, Hee-Mang Park, Cho-Rong Moon, Kyung-II Chang and Kyung-Ryul Kim**  
Preliminary results of E-RAP (EAST-I Real-time Automatic Profiler) in the Ulleung Basin, the East/Japan Sea

**Tomoharu Senjyu** (Invited)

The East Asian Marginal Seas System; Connectivity between the Japan Sea and the East China Sea

**Vyacheslav Lobanov, Pavel Tishchenko, Alexander Sergeev, Dmitry D. Kaplunenko, Vladimir Ponomarev and Svetlana Ladychenko**

Overview of POI activities under the CREAMS/PICES program

**Taekeun Rho, Tongsup Lee, Hyunduck Jeon, Dong-Jin Kang and Kyung-Ryul Kim**

Vertical and spatial distribution patterns of transparent exopolymer particles (TEP) in the East Sea during summer 2009

**Dmitry D. Kaplunenko, Vyacheslav Lobanov, Pavel Tishchenko and Mariya Shvetsova**

Vertical in situ profiles of nitrate and oxygen in the northern Japan Sea

**Olga Trusenkov, Dmitry D. Kaplunenko, Svetlana Ladychenko and Vyacheslav Lobanov**

Non-linear patterns of eddy kinetic energy in the Japan/East Sea

**Junheon Jang, Kyung-II Chang, Seungtae Yoon and Hanna Na**

Long-term variation of subsurface temperature in the Ulleung Basin of the East/Japan Sea

**Junnghyun Kwak, Yunsook Kim, Daesung Lee, Jeomshik Hwang, Kyung-Ryul Kim and Changkeun Kang**

Summer primary productivity and phytoplankton community structure in the East/Japan Sea

**Andrey G. Andreev**

Year-to-year changes of pre-winter environmental conditions and chlorophyll a concentration in the central and southern Japan Sea

**Sukgeun Jung and Ilsu Choi** (Invited)

Alternations of dominant fisheries species in the southwestern Japan/East Sea since 1968 in relation to climate change

**Yury Zuenko, Yongjun Tian, Sukgeun Jung and Rabea Diekmann**

Recent climatic changes in the Japan/East Sea ecosystem on the tri-national data set

*Poster Presentations*

**Dmitry V. Stepanov and Nikolay A. Diansky**

Study of the low-frequency variability of the Japan/East Sea circulation by numerical Simulations

**Pavel Semkin, Pavel Tishchenko, Vyacheslav Lobanov, Alexander Sergeev, Ruslan Chichkin, Galina Pavlova, Sergey Sagalaev, Elena Shkirknikova, Mariya Shvetsova, Petr Tishchenko, Tatyana Volkova and Vladimir Zvalinsky**

Seasonal and spatial variability of hydrochemical parameters in the Ussuriyskiy Bay (Japan Sea)

**Jaehyung Park and Kyung-II Chang**

Characteristics of anomalous summertime coastal upwelling events off the east coast of Korea during 2003-2009

**Gennady Kantakov, Victor Tambovsky, Alexey Bobkov and Evgeny Lunev**

Recent surface currents observations in the Okhotsk Sea by Argos drifters

**Best Presentations for Committee/Program-sponsored Topic Sessions or Workshops at PICES-2011**

*Science Board Best Oral Presentation*

**Mitsuo Uematsu** (The University of Tokyo, Japan) on “Potential importance of volcanic emissions on marine biogeochemical cycles and clouds over the North Pacific” co-authored with Shigenobu Takeda, Hiroshi Furutani and Itsushi Uno

*Science Board Best Poster*

**Chan Joo Jang** (Korea Ocean Research and Development Institute,) on “Projected changes in the North Pacific Ocean mixed layer depth and their impacts on primary production” co-authored with Jisoo Park, Taewook Park and Sinjae Yoo

*Best Oral Presentation by an early career scientist for the BIO-sponsored BIO/POC Topic Session on “Mechanisms of physical-biological coupling forcing biological “hotspots”(S2)*

**Robinson M. Mugo** (Hokkaido University, Japan and Kenya Marine and Fisheries Research Institute) on “When, where and why skipjack tuna, red flying squid and pacific saury potential fishing zones are likely to overlap in the western North Pacific: A proof of concept” co-authored with Sei-Ichi Saitoh, Fumihiro Takahashi, Akira Nihira and Tadaaki Kuroyama

*Best Poster for the BIO-sponsored Contributed Paper Session*

**Alexander V. Zavolokin** (Pacific Research Institute of Fisheries and Oceanography (TINRO-Center), Russia) on “Jellyfish blooms in the Far Eastern Seas of Russia: Significance for ecosystems and socioeconomic consequences”

*Best Oral Presentation by an early career scientist for the FIS-sponsored Contributed Paper Session*

**Soojeong Lee** (Pukyong National University, Korea) on “Population ecological parameters of elkhorn sculpin (*Alcichthys alcicornis*) along the Uljin area of Korea” co-authored with Jaebong Lee, Hyeokchan Kwon and Changik Zhang

*Best Poster for the FIS-sponsored Contributed Paper Session*

**Chivuki Sassa** (Seikai National Fisheries Research Institute, Fisheries Research Agency, Japan) on “Reproductive biology of *Bentosema pterotum* (Pisces: Myctophidae) in the shelf region of the East China Sea” co-authored with Seiji Ohshimo, Hiroshige Tanaka and Youichi Tsukamoto

## Session Summaries-2011

*Best Oral Presentation by an early career scientist for the MEQ-sponsored MEQ/FUTURE Topic Session on “Land-sea interactions and anthropogenic impacts on biological productivity of North Pacific Ocean coastal ecosystems” (S7)*

**Yousuke Koshino** (Hokkaido University, Japan) on “Effect of salmon-derived nutrients and organic matter on riparian ecosystems in the Shiretoko World Natural Heritage area” co-authored with Masao Minagawa, Hideaki Kudou3, Yuxue Qin and Masahide Kaeriyama

*Best Poster for the MEQ-sponsored MEQ/FUTURE Topic Session on “Land-sea interactions and anthropogenic impacts on biological productivity of North Pacific Ocean coastal ecosystems” (S7)*

**Aleksandra S. Kondakova** (Far Eastern Federal University, Vladivostok, Russia) on “Levels of 4-NP in coastal waters in the Russian zone of Japan/East and Bering Seas” co-authored with Andrey P. Chernyaev

*Best Oral Presentation by an early career scientist for the POC-sponsored Contributed Paper Session*

**Hanna Na** (Seoul National University, Korea) on “Decadal variability of the upper-ocean heat content in the Northwestern Pacific” co-authored with Kwang-Yul Kim

*Best Poster for the POC-sponsored POC-sponsored Contributed Paper Session*

**Rong-shuo Cai** (Third Institute of Oceanography, China) on “Possible impact of tropical El Niño Modoki on SST of China’s offshore and its adjacent waters” co-authored with Hong-jian Tan

*Best Oral by an early career scientist for the MONITOR-sponsored MONITOR/POC/FUTURE Topic Session on “How well do our models really work and what data do we need to check and improve them?” (S9)*

**Naoki Yoshie** (Ehime University, Matsuyama, Japan) on “Phytoplankton and nutrient dynamics in the western Seto Inland Sea, Japan based on observation and a modified NEMURO model” co-authored with Xinyu Guo, Naoki Fujii and Tomohiro Komorita

*Best Poster for the MONITOR-sponsored MONITOR/POC/FUTURE Topic Session on “How well do our models really work and what data do we need to check and improve them?” (S9)*

**Vladimir V. Kulik** Pacific Research Institute of Fisheries and Oceanography (TINRO-Center), Vladivostok, Russia) on “North Pacific database of pelagic and bottom trawl surveys from Russian EEZ applicable to Ecosystem Based Management” co-authored with Igor V. Volvenko

*Best Poster or the TCODE-sponsored Workshop on “Recent advances in monitoring and understanding of Asian marginal seas: 5 years of CREAMS/PICES EAST-I Program”(W4)*

**Kyung-Il Chang** (Seoul National University, Korea) on “Characteristics of anomalous summertime coastal upwelling events off the east coast of Korea during 2003-2009” co-authored with Jaehyung Park