

## SUMMARY OF SCIENTIFIC SESSIONS AND WORKSHOPS

### Science Board Symposium (S1)

#### *Understanding ecosystem dynamics and pursuing ecosystem approaches to management*

Co-Convenors: John E. Stein (SB), Michael J. Dagg (BIO), Mikhail Stepanenko (FIS), Glen Jamieson (MEQ), Hiroya Sugisaki (MONITOR), Michael G. Foreman (POC), Bernard A. Megrey (TCODE), Harold P. Batchelder (CCCC), Michio J. Kishi (CCCC), Fangli Qiao (China) and Sinjae Yoo (Korea)

#### Background

PICES undertakes a new science program, FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems), to understand the responses of marine ecosystems in the North Pacific to climate change and human activities, having the major questions: 1) How does ecosystem structure and function determine an ecosystem's response to natural and anthropogenic forcing? 2) How do physical and chemical processes respond to natural and anthropogenic forcing and how are ecosystems likely to respond to these changes in abiotic processes? 3) How do human activities impact coastal marine ecosystems and their interactions with offshore and terrestrial systems. We have only a limited ability to forecast how marine ecosystems will be affected by the changing global climate. Consequently, we still have limited knowledge on the assessment and management of marine ecosystems. Under this situation, it is necessary to improve our understanding of ecosystem structure and function, ecosystem stability and resilience, and to understand and quantify the impacts of human activities and climate on marine ecosystems. It is urgent that we develop and adopt a comprehensive ecosystem-based approach which will be required to manage depleted and deteriorated marine ecosystems. To this end, breakthroughs have to be made in many areas, including evaluation of ecosystem status.

#### List of papers

##### *Oral presentations*

##### **Chang Ik Zhang** (Keynote)

Ecosystem-based fisheries assessment and management: A step towards FUTURE implementation of ecosystem approaches to management

##### **John K. Pinnegar, Steven Mackinson, Kathryn Keeble and Georg H. Engelhard**

How does ecosystem structure and function determine the response to natural and anthropogenic forcing?

##### **Suam Kim, Ana L. Rosa, Sang-Wook Yeh, Chung I. Lee, Sukyung Kang, Sinjae Yoo, Hyunwoo Kang and Yasunori Sakurai** (Invited)

Effects of atmospheric and oceanographic variability on the common squid (*Todarodes pacificus*) in Korean and Japanese waters during the last 30 years

##### **William Crawford and James Irvine**

A group approach to understanding ecosystem dynamics in the northeast Pacific

##### **William J. Sydeman, Jarrod A. Santora, Stephen Ralston, Nandita Sarkar, Steven J. Bograd, and Robert M. Suryan**

Krill of the California Current: Predictive habitat modeling for ecosystem protection?

##### **Mitsutaku Makino, Chikako Watanabe, Masahito Hirota and Takumi Mitani** (Invited)

Understanding the interactions between ecosystem structure and fisheries structure: The case of the sardine, anchovy, chub mackerel, and purse seine fisheries in Japan

##### **Franz J. Mueter and Michael A. Litzow** (Invited)

The spatial footprint of biological re-organization in a demersal community

##### **Hiroshige Tanaka, Seiji Ohshimo and Yoshiaki Hiyama**

Long-term fluctuations in the biomass of sardine *Sardinops melanostictus* in the western Japanese waters (Sea of Japan and East China Sea) from 1953 to 2008, in relation to climate variability

##### **Chang Ik Zhang, Jennifer Boldt, Angie Greig, Anne B. Hollowed and Patricia Livingston**

An assessment of fisheries management strategies in Alaska relative to the goals of ecosystem approaches to management

## Session Summaries -2009

**Michael Sinclair** (Invited)

Ecosystem approach to management: The Scotian Shelf example

**Erlend Moksness**

Major human activities affecting Norwegian coastal marine ecosystems: Present status and challenges

**Tony Smith, Beth Fulton and David Smith** (Invited)

Ecosystem approaches to managing marine systems – the human dimension

**Wei Zheng, Zongling Wang and Min gyuan Zhu**

Impact of human activities on marine ecosystem services

**Peter S. Ross**

The pulse of the Pacific: Can science respond effectively to a changing ocean?

### Posters

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

Environmental assessment of the rivers of Peter the Great Bay basin (Japan/East Sea)

**Mayuko Tomida, Nobuyuki Miyazaki and Masahide Kaeriyama**

Biotransport of POPs by salmonids in the North Pacific

**Olga N. Lukyanova, Andrey P. Chernyaev, Nikolay V. Kolpakov and Anna S. Vazhova**

Environmental impact assessment in the estuarine ecosystems of Peter the Great Bay (Japan/East Sea)

**Sanae Chiba, Kazuaki Tadokoro, Akira Kuwata and Hiroya Sugisaki**

Bottom-up control of multi-decadal variation of the western North Pacific ecosystem revealed by stable isotope ratio analysis

**Shan Gao, Hui Wang, Guimei Liu and Liyin Wan**

Temporal and spatial distribution of marine primary production in the South China Sea (SCS)

**Hai Li, Jing Yang and Qin-Zheng Liu**

Numerical simulation study on primary production in the Bohai Sea in summer, 2006

**Hui Wang, Guimei Liu, Shan Gao and Hua Jiang**

Response of marine primary production to monsoon variations in the South China Sea

**Hyunju Seo, Hideaki Kudo and Masahide Kaeriyama**

Causal linkage among growth, survival, and intra-population interactions of Hokkaido chum salmon related to climate changes in 1945-2005

**Vladimir Krapivin and Ferdenant Mkrтчvan**

An adaptive technology for Nature/Society System biocomplexity assessments

**An-Yi Tsai, Kuo-Ping Chiang, Ciou-Jyu Wang and Gwo-Ching Gong**

The impact of the Changjiang River plume extension on the nanoflagellate community in the East China Sea

**Felipe Hurtado-Ferro**

The role of uncertainty in hypothetical top predator culling programs

**Pavel A. Saljuk, Oleg A. Bukin, Alexander Yu. Mayor, Andrey N. Pavlov and Konstantin A. Shmirko**

Atmosphere aerosol and marine ecosystems after Sarychev Peak volcano eruption of June 2009

**Joong Ki Choi, Jae Hoon Noh, Sung Hwan Cho, Seung Yoon Park and Youngju Lee**

Long term change of phytoplankton ecology in the eastern part of the Yellow Sea

**Seok-Hyun Youn, Yu-Mi Jun, Jae-Dong Hwang, Yong-Hwa Lee, Hyun-Gook Jin, Jung-Min Shim, Young-Suk Kim and Ki-Young Kwon**

Egg production of copepod *Acartia omorii* in the coastal waters of Korea

**Young-Sang Suh, Ki-Tack Seong, Jae-Dong Hwang, and Yeong Gong**

Mixed layer depth in the high production region off Korea

**Jae Bong Lee, Dong Woo Lee, Yeong Min Choi, Chang Ik Zhang, Myoung Ho Sohn, Sung Il Lee, Young Il Seo, Sang Chul Yoon, Yoo Jung Kwon, Jong Hee Lee, Hee Won Park, Young Jae Shin, Do Hoon Kim, In-Ja Yeon, Heui Chun An and Dae Soo Chang**

A comparative study on the ecosystem risk indices of Korean waters

**FIS Topic Session (S2)*****Ecosystem-based approaches for the assessment of fisheries under data-limited situations***

Co-Convenors: Yukimasa Ishida (Japan), Gordon H. Kruse (U.S.A.), Patricia Livingston (U.S.A.), Laura Richards (Canada), Mikhail Stepanenko (Russia) and Chang Ik Zhang (Korea)

Background

The World Summit on the Sustainable Development recommended implementation of the ecosystem-based management by 2010. Achievement of this goal will require holistic assessment and management of fisheries resources and their associated habitat and ecosystems. Therefore, consideration must be given to ecological interactions of target species with predators, competitors, and prey species, bycatch species, interactions between fishes and their habitat, and the effects of fishing on fish stocks and their ecosystems. The challenge associated with implementation of ecosystem-based management is the design of an approach that is capable of capturing the complexity of the system, while at the same time dealing with the varying quality and quantity of available information. The Ecological Risk Assessment for the Effects of Fishing (ERAEF) approach developed by Australia and the Marine Stewardship Council's Fisheries Assessment Methodology provide two examples of pragmatic approaches. This session encouraged contributions that: 1) describe the data and/or information requirements for the application of ecosystem-based assessments, 2) review existing and emerging ecosystem-based assessment methodologies, 3) describe indicators and reference points for these assessments, 4) identify research activities needed for developing an integrated framework for assessments, and 5) discuss indices for evaluating and assessing the ecosystem status and management. Selected oral and poster presentations from this session were to be considered for publication in a peer-reviewed journal.

Summary of presentations

During this session, 16 oral presentations were given and three posters were presented. Pursuant to the solicitation of papers, two presentations addressed data and/or information requirements for the application of ecosystem-based assessments, five papers addressed existing and emerging ecosystem-based assessment methodologies, four presentations described indicators and reference points for these assessments, four presentations identified research activities needed for developing an integrated framework for assessments, three presentations discussed indices for evaluating and assessing the ecosystem status and management, and one other presentation was given.

Invited speaker Tony Smith provided a pragmatic approach to conducting ecological risk assessments based on available information levels. A scale intensity consequences analysis (SICA) provided an approach for qualitative assessments for information-poor situations. For situations with somewhat more information, a productivity susceptibility analysis (PSA) provides a semi-quantitative approach. For situations with higher levels of information, a variety of approaches are available including SAFE, which is a quantitative version of PSA. A second invited speaker, Yimin Ye, discussed the justification for the ecosystem approach to fisheries and applied examples to two data-limited situations – the Gulf of Thailand and South China Sea.

Inja Yeon applied the IFRAME approach to the trammel net fishery for blue crabs in Korea. Jung Hyun Lim developed a size-based approach to assess the sustainability for IFRAME. In this approach, new size-based indicators were developed and applied to the Jacopever rockfish in a marine ranching area in Korea. Bern Megrey also provided an approach toward length-based assessments for data-limited situations, as reported by Zhang and Megrey (2006).

Anne Hollowed reported on the application of the PSA (introduced by Tony Smith) to U.S. fisheries, with particular application to Alaska. Vulnerability was assessed as a combination of productivity and susceptibility. Jae Bong Lee reported on an integrated ecosystem-based fishery management system and conducted a risk assessment of yellow goosfish, skate ray, and mackerel.

## Session Summaries -2009

Dohoon Kim gave a presentation on the development of socioeconomic indicators for fisheries, such as Maximum Economic Yield, income per person, profit per sale, employment rate and others. Chang Seung reported on a multi-attribute utility function approach to developing socio-economic indicators for fisheries in Alaska. These presentations represent significant developments on incorporation of socio-economics into ecosystem-based fishery management, and area requiring further research.

A presentation by Yukimasa Ishida described ecolabelling of fishery products in Japan, with a specific case study of the Kyoto Danish seine fishery. Masahi Nishimura presented additional information on the marine ecolabel program in Japan, which was launched in December 2007. This approach has only been applied to wild fisheries in Japan so far. It is similar to the Marine Stewardship Council's approach and has been applied thus far to a freshwater clam, red snow crab, and a shrimp fishery.

In her presentation, Laura Richards asked the question whether necessary data were being collected for ecosystem-based fishery management, and provided case studies from Canada, including Fraser River sockeye salmon, in which a change in behavior in the late (fall) run to earlier returns was observed, which was surprising, given higher mortality rates during in-river migrations during higher late summer temperatures. As another example, chronic overforecast of summer run returns was particularly acute in 2009. The record low marine survival was unexpected and followed record high freshwater survival.

Jon Schnute gave a thought-provoking talk on models, perceived reality, and real systems, as well as perspectives on approaches on the role of models and how we should understand and apply them in the future.

The role of climate and fisheries was examined in three studies. Yongjun Tian examined the role of climate changes and trawling effects in the Sea of Japan. Climate appeared to be responsible for primary effects, and trawling effects varied by climate regime. Sukgeun Jung examined climate-driven ecosystem shifts in Korean coastal waters fisheries, which target species, such as hairtail, mackerel, saury, croaker and anchovy. Finally, Reka Domokos presented an analysis of the effects of seasonal monsoons in Borneo on the set-up of coastal upwelling and the south equatorial counter current (SECC). This upwelling-derived current occurs in winter, and is manifested in the EEZ off American Samoa in spring (about 3 months later). CPUE of albacore tuna in the American Samoan EEZ was closely related to the intensity of the SECC.

In summary, this session attracted a good attendance of PICES participants during this full-day session. Papers presented covered a diverse array of topics related to the development of indicators, risk assessments, and case studies, including analyses of climate versus fishing effects.

### List of papers

#### *Oral presentations*

**Tony Smith, Alistair Hobday, Shijie Zhou, David Johnson and Keith Sainsbury** (Invited)

Ecological risk assessment for fisheries: Applications in Australia and in the Marine Stewardship Council

**Kozo Ishii, Atsushi Yamasaki and Yukimasa Ishida**

First Marine Stewardship Council (MSC) ecolabelling of fishery products from marine capture fisheries in Japan

**Inja Yeon, Chang Ik Zhang, M.H. Shon, H.J. Whang, Kwangho Choi, J.H. Lee and Yang-Jae Im**

Ecosystem-based approach for blue crab stock assessment and management strategies in the West Sea of Korea

**Masahi Nishimura, Ken Kobayashi and Yukimasa Ishida**

Marine Ecolabel Japan (MEL Japan): New ecolabelling of fishery products from marine capture fisheries in Japan

**Jung Hyun Lim, Jae Bong Lee and Chang Ik Zhang**

Using size-based indicators to assess the sustainability for IFRAME

**Laura Richards**

Research requirements for ecosystem-based assessments

**Jong Hee Lee, Jae Bong Lee, Chang Ik Zhang, Dong Woo Lee and Dae Soo Chang**

Determining indicators and compatible reference points to assess coastal marine ecosystem risks

**Chang Ik Zhang and Bernard A. Megrey**

A length-based stock assessment framework for data-deficient situations

**Kevern Cochran and Yimin Ye** (Invited)

Using ecological indicators in the context of an ecosystem approach to fisheries for data-limited fisheries

**Paul Spencer, Olav Ormseth, Anne B. Hollowed and Patricia Livingston**

Analyzing the vulnerability of fish stocks in the North Pacific Ocean

**Jon Schnute et al.**

Ecosystem models: Can we trust ourselves?

**Chang Seung and Chang Ik Zhang**

Multi-attribute utility function approach to developing socio-economic indicators for Alaska fisheries

**Yongjun Tian, Hideaki Kidokoro and Tadanori Fujino**

Interannual-decadal variability of demersal fish community in the Japan Sea: Impacts of climate regime shifts and trawl fishing with recommendations for ecosystem-based management

**Sukgeun Jung, Young Shil Kang, Dong-woo Lee, Young-Sang Suh, Sukyung Kang and Yeong**

**Gong**

Climate-driven ecosystem shifts indicated in fishery catch statistics from Korean coastal waters over 1968-2008

**Dohoon Kim and Chang Ik Zhang**

Developing socioeconomic indicators for an ecosystem-based fisheries approach

**Vladimir B. Darnitskiy**

Seamount ecosystems – oceanographic environment

### *Posters*

**Saang Yoon Hyun and Rishi Sharma**

Integrated forecasts of fall Chinook salmon returns to the Columbia River

**Hyeok Chan Kwon, Sang Chul Yoon, Sung Il Lee, Young Yull Chun, Jong Bin Kim and Chang Ik Zhang**

An ecosystem-based fisheries resource assessment for the gillnet fishery of the Uljin marine ranch ecosystem in Korean waters

**Young Jae Shin, Jae Bong Lee and Chang Ik Zhang**

A systematic approach for estimating potential fishery yields of data-deficient, small-scale coastal fisheries in Korea

## **FIS/BIO Topic Session (S3)**

### *Early life stages of marine resources as indicators of climate variability and ecosystem resilience*

Co-sponsored by ICES

Co-Convenors: Richard Brodeur (U.S.A.), Mark Dickey-Collas (The Netherlands), Douglas E. Hay (Canada), Suam Kim (Korea), Gordon Kruse (U.S.A.) Vladimir Radchenko (Russia) and Yoshiro Watanabe (Japan)

### Background

As management strategies become more ecosystem-based and climate-driven, there is a need for more information on the role of species interactions and oceanographic variability in regulating fisheries resources. The early life stage of fish and invertebrates has been shown to be critical in determining year-class success and subsequent recruitment to the fisheries. This session examined changes in the abundance, distribution, and ecological relationships of early life stages (eggs to juveniles) of important fish and invertebrate species in relation to climate fluctuations. Studies examining these stages in relation to adult recruitment and their use as indicators of ecosystem stress or variability were invited. Examples of the uses of ichthyoplankton or juvenile surveys in the assessment or management of stocks and in forecasting future trends in fisheries were highly encouraged. The session was especially interested in papers that examined the role of early life stage work relative to ecosystem structure and vulnerability of ecosystems to climate change, with particular reference to the processes of recruitment.

## Session Summaries -2009

### Summary of presentations

The papers presented in this session represented a broad geographical and topical spectrum of the work that is being done in the PICES area related to understanding recruitment variability and using larval indices to inform management decisions. The first invited talk gave examples from both sides of the North Atlantic (ICES area) on when early life history studies contributed to our understanding of recruitment dynamics. Despite a concerted effort over several decades, we only have a good understanding on just a few key species, and continual monitoring is necessary as relationships may change with climate variability. The second invited talk took a life history approach to understanding mechanisms related to recruitment variation. Additional talks took a comparative approach, using contrasting species, years, or even decades to illustrate linkages to physical forcing. In some examples, life stages from egg to juveniles showed good correlations with subsequent recruitment indices for different species. In our final invited talk, differing growth rates between species and years helped to explain why anchovies and sardines show inverse production regimes. In summary, much progress has been made in utilizing early life history information in the management of marine fish species but more progress needs to be made in transferring these data to managers.

NOTE: All papers were presented as in schedule except the one by Zhigalov *et al.*

### List of papers

#### *Oral presentations*

**Mark Dickey-Collas and Jonathan A. Hare** (Invited)

Ichthyoplankton surveys, great for assessment and day to day management but are they so relevant for understanding the future?

**Miriam J. Doyle** (Invited)

Responding to the call for Ecosystem Based Management of marine fisheries: Perspectives from fish early life history studies in the Northeast Pacific Ocean

**Elizabeth A. Logerwell, Janet Duffy-Anderson, Matt Wilson and Denise McKelvey**

Processes affecting the productivity of capelin and pollock in the Gulf of Alaska

**Sukgeun Jung, Dong-woo Lee, Yeonghye Kim, Hyung Kee Cha, Hak-jin Hwang and Jeongyong Lee**

Contrasting recruitment of two gadoid species (*Gadus macrocephalus* vs. *Theragra chalcogramma*) to Korean coastal waters in relation to climate change

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

Quantifying long-term variability in composition of the Strait of Georgia ichthyoplankton community

**Andrey Suntsov and Tony Koslow**

Nearshore ichthyoplankton communities off southern and central California

**Richard D. Brodeur, Toby Auth, Elizabeth A. Daly and William T. Peterson**

Ichthyoplankton as indicators of climate change and recruitment variability of marine fishes and salmon along the northwest coast of the US

**Jun Shoji, Yasuhiro Kamimura, Ken-ichiro Mizuno and Shun-ichi Toshito**

Fish production in seagrass habitat under global warming: Effects of temperature on early growth and production of a dominant species, black rockfish, in temperate waters of the western North Pacific

**John C. Field, Stephen Ralston and Keith Sakuma**

Rockfish (*Sebastes*) recruitment and ecosystem indicators for the Southern California Current

**Chiyuki Sassa and Youichi Tsukamoto**

Distribution and growth of chub mackerel *Scomber japonicus* and spotted mackerel *S. australasicus* larvae in the southern East China Sea (ECS) in response to oceanographic conditions

**David Checkley, Yoshioki Oozeki, Sam McClatchie, and Akinori Takasuka**

Comparison of spawning habitats of anchovy and sardine in the Pacific Ocean off Japan and North America

**Motomitsu Takahashi** (Invited)

Contrasting responses in growth rates between anchovy and sardine to changes in water structures in the eastern and western North Pacific

**Masahide Kaeriyama, Hideaki Kudo, and Hyunju Seo**

Global warming effects on the early ocean life of Hokkaido chum salmon

**Igor Zhigalov, Alexander Figurkin and Svetlana Ovsyannikova**

Oceanographic conditions and the distribution of walleye pollock eggs in the southern Kuril Islands region during March – April of 2006 and 2007

**Yoshiro Watanabe**

Linear response of growth rates to ambient temperature in larval round herring *Etrumeus teres* in the Pacific coastal waters off southern Japan

**Nam-II Won, Tomohiko Kawamura, Hideki Takami and Yoshiro Watanabe**

Food web structures in crustose coralline algae bed during early life stages of abalone *Haliotis discus hannai* in relation with recruitment process

**Tadanori Fujino, Hideaki Kidokoro, Tsuneo Goto and Yongjun Tian**

Effect of the oceanographic condition on the abundance of mesopelagic fish: *Maurolicus japonicus* in the Japan Sea

*Posters*

**Mikhail A. Zuev**

Distribution and abundance of juvenile long armed gonatid squid (*Gonatus madokai*) in the northern Sea of Okhotsk

**Chen-Yi Tu, Yu-heng Tseng, Tai-sheng Chiu and Chih-Hao Hsieh**

Use particle tracking simulation in hydrodynamic model to investigate spawning migration of Japanese anchovy *Engraulis japonicus* from the East China Sea to Taiwan

**Alexander A. Antonov, Irina Yu. Bragina and Elena M. Latkovskaya**

Nutrients transport, forage base and survival of juvenile pink salmon in Aniva Bay (south of Sakhalin Island)

**Ana L. Rosa, J. Yamamoto and Yasunori Sakurai**

Effects of environmental variability on the spawning areas, catch and recruitment of the Japanese common squid, *Todarodes pacificus*

**Heeyong Kim, D.H. Kim, Hakjin Hwang and Y.I. Seo**

Effect of Siberian High on the catch fluctuation of pacific cod, *Gadus macrocephalus*, in the Yellow Sea

**Yuji Okazaki, Hiroshi Kubota, Kaori Takagi, Hiroshi Itoh and Nobuhiro Saito**

Feeding ecology of larval and juvenile sardine (*Sardinops melanostictus*) and anchovy (*Engraulis japonicus*) in the western North Pacific

**MEQ Topic Session (S4)**

***Mitigation of harmful algal blooms***

Co-Convenors: Hak-Gyoon Kim (Korea) and Mark L. Wells (U.S.A.)

Background

Mitigation includes any method that can reduce the impact or severity of harmful algal blooms (HABs). These methods involve both physical means, such as dispersal of clay to cause flocculation of cells from surface waters, and preventative means, such as better monitoring of coastal waters, allowing selective closures of shellfish beds (in contrast to coast-wide closures). The capability for mitigation and the choice of mitigative tools depend upon the bloom-forming species, the severity of the event, and the frequency and intensity of monitoring in a region. Presentations represented the comprehensive nature of HAB mitigation within the Pacific Rim nations.

List of papers

*Oral presentations*

**J.E. Jack Rensel and Nicola Haigh** (Invited)

Fish aquaculture and Harmful Algal Bloom mitigation in marine waters of North America

**Hak-Gyoon Kim, Heon-Meen Bae, Chang-Kyu Lee, Yang-Soon Kang, Young-Tae Park, Wol-Ae Lim, Sook-Yang Kim, Jeong-Min Shim, Chang-Su Jung and Kyoung-Ho An** (Invited)

Recent approaches on the feasible mitigation and clay dispersal

## Session Summaries -2009

### **Ichiro Imai**

Promising prevention strategies for harmful algal blooms by utilization of seaweed- and seagrassbeds as huge sources of algicidal bacteria

### **Donald M. Anderson**

Suppression and control of harmful algal blooms: The slow pace of progress in an important area of HAB science

### **Eunhye Kim, Daeuk Kim, Hyungbeen Lee, Jungyul Na, Jee Woong Choi and Donhyug Kang**

A feasibility study on the acoustic monitoring of *Cochlodinium Polykrikoides* blooms and mitigation by ship-mounted cavitation generating system

### **Young Baek Son, Joji Ishizaka and Young-Sang Suh**

The spectral discrimination of surface harmful algal bloom in complicated coastal water conditions

### **Bum Soo Park, Rose Ann Cattolico, Seung Ho Baek, Jang Seu Ki, Yang Ho Yoon and Myung-Soo Han**

Improvement of quantitative real-time PCR assay based on SYBR green for Raphidophytes: A field applicability test

### **Goh Onitsuka, Naoki Hirose, Kazutaka Miyahara, Shuyo Watanabe, Hitoshi Semura, Reiko Hori and Tetsuya Nishikawa**

Monitoring and modeling of *Cochlodinium polykrikoides* bloom in the southwestern Sea of Japan

### **Takafumi Yoshida and Hidemasa Yamamoto**

HAB Integrated Website demonstration

### **Dongyan Liu, John K. Keesing, Zhijun Dong, Yu Zhen, Baoping Di, Yajun Shi and Ping Shi**

Coastal *Porphyr*a aquaculture as a nursery for large scale green tide events in the Yellow Sea

### *Posters*

#### **Marina S. Selina, Tatiana V. Morozova and Tatiana Yu. Orlova**

Species composition and seasonal changes in epiphytic dinoflagellates in Russian coastal waters of the Sea of Japan

#### **Chunjiang Guan, Fengao Lin and Xiutang Yuan**

Causes of 2008 green tide bloom in Yellow Sea and estimation for the absorption of C, N and H

## **MEQ Topic Session (S5)**

### ***The role of submerged aquatic vegetation in the context of climate change***

Co-Convenors: Ik-Kyo Chung (Korea) and Hiroshi Kawai (Japan)

### Background

This session focused on the practical measures utilizing submerged aquatic vegetation (SAV) such as seaweeds and sea grasses in coping with climate change in coastal regions. The intent was to discuss immediate and practical SAV measures that mitigate and adapt against global warming and sea level rise. Participants presented work highlighting their ideas on such practical measures against climate change and global warming as well as on other pertinent subjects.

### Summary of presentations

The Convenors welcomed participants with a brief introduction on ‘blue carbon, carbon captured by marine living organisms.’ This session included presentations that described:

- emphasis of the role of submerged aquatic vegetations (SAV), seaweeds and seagrasses as blue carbon, and their ecosystem services;
- seaweed (red algae) pulp and paper as a practical mitigation measure, by reducing deforestation and producing bio-ethanol from the by-product of pulping;
- the estimation of carbon sequestration by seaweed beds and development of a pilot seaweed Clean Development Mechanisms;
- the construction of a seaweed farm on artificial reefs with bioslag as a mitigation and adaptation measures in the context of climate change;
- the assessment of climate impacts in aquaculture activities and development of managing tools using modeling techniques;



- research on the basic knowledge of SAV such as their productivities, seasonal variation, grazing, *etc.*;
- the introduction of the Asian Network for Using Algae as a CO<sub>2</sub> Sink, a working group of the Asian Pacific Phycological Association;
- an introduction of draft strategies for climate change adaptation in Korea.

### List of papers

#### *Oral presentations*

**Xuelei Zhang, X.J. Zhang and J.W. Wang**

Restoration of seagrass/algal beds as a measure to abate climate change

**Kwang-Seok Park, Hyung-Suek Kim, Heon-Woo Park, Gun-Mok Sohn and Hyeon Park**

Climate change adaptation using seaweed beds of BioSlag in marine environment

**I Nyoman Radiarta, Sei-Ichi Saitoh and Toru Hirawake**

The impact of climate change on the development of marine aquaculture: a case study on Japanese scallop aquaculture in Funka Bay, Hokkaido, Japan

**Seokjin Yoon and Michio J. Kishi**

Estimation of the role of eelgrass and associated epiphytic algae on the carbon cycle in Akkeshi Lake, Japan

**Taehee Na, Ik-Kyo Chung and Tongsup Lee**

Estimation of carbon sequestration by seaweed beds

**Hack-Churl You, Munho Sohn and Grevo Gerung**

Red-algae pulp and paper, bio-ethanol

**Sang Yong Lee and Yong-Gun Gong**

Seasonal variation in  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values for the temperate seagrass *Zostera marina* and its relation to leaf production

**Tatyana N. Krupnova, Vladimir A. Pavlyuchkov, and Vera V. Agarkova**

Resource management of sea urchins *Strongylocentrotus intermedius* on the basis of its biotic relations with brown alga *Laminaria Japonica*

#### *Posters*

**Jin Ae Lee, Jung Hyun Oak and Siew-Moi Phang**

The Asian Network for Using Algae as a CO<sub>2</sub> Sink of the Asian Pacific Phycological Association

**Sang Rul Park and Kun-Seop Lee**

Growth and photosynthetic characteristics of three *Zostera* spp. (*Z. japonica*, *Z. marina* and *Z. caespitosa*) along vertical gradient: implications for seagrass zonation

**Ik Kyo Chung, Kwang-Seok Park, Hyung-Suek Kim, Jin-Hwan Hwang, Jae-Young Lee and Jung Hyun Oak**

Research and development roadmap for climate change adaptation and CO<sub>2</sub> mitigation in the Korean maritime & fisheries sector

**Miryang Kim, Jeong Chan Kang, Jong Chul Lee and Myung Sook Kim**

Subtidal macroalgal species diversity during wintertime in Jeju Island, Korea

**Seong Cheol Kim, Mi Sook Hwang, Jae Min Baek, Seock Jung Han, Nack Joong Choi, Mi kyung Choe, and Moon Ho Yang**

Management of artificial coastal CO<sub>2</sub> removal belt in Korea

**Yoon seok Choi, Choankoo Jung and Min-woo Park**

The effect of geochemical characteristics and environmental factors on the growth of cultured Ark shell *Scapharca broughtonii* at several shellfish-farming bays on the south coast of Korea

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

#### ***Marine spatial planning in support of integrated management – tools, methods, and approaches***

Co-Conveners: Glen Jamieson (Canada), Vladimir Shulkin (NOWPAP, Russia) and Chang-Ik Zhang (Korea)

Marine spatial planning (MSP) is being used in an increasing number of jurisdictions as part of a strategic approach to achieving sustainable development in the marine environment. While the concepts of integrated management (IM) and MSP are now often included in marine policy, it is still unclear how they will be practically implemented and to what end. Conservation, conflict resolution to address multiple human uses,

and implementation of an ecosystem approach to oceans management are all important drivers for MSP. The most obvious elements of MSP include marine protected or spatially regulated areas designed to meet one or more objectives of IM, and assessment of the interactions between multiple sectors. PICES science has a role to play in the development of methods to support MSP.

This session explored developments in MSP under three topics: the role of MSP in achieving IM objectives, criteria for identifying, mapping and assessing cumulative impacts of multiple human activities, and guidelines for the planning of MPAs to meet cross-sectorial IM objectives, using case studies to describe recent experiences of MSP.

A number of presentations in this session identified the importance of a defined set of objectives to guide the planning process. It was generally recognised that ecosystem objectives (also referred to as environmental or conservation objectives) and their associated reference levels to ensure ecosystem sustainability should be determined by scientists and should be non-negotiable, while determination of socio-economic objectives will require significant input and consultation to address the competing interests of different stakeholders. The need to evaluate multiple and potentially conflicting objectives, and the role that society will play in the resolution of these interactions, will involve the increased use of interactive web-based tools to communicate to a wider community.

Identifying the appropriate ecosystem components for conservation can be a challenging task. In Norway, particularly valuable areas are identified based on their importance to biological production, biodiversity or as key habitats to threatened or vulnerable species. Use of risk assessments to identify priority activities and components for management action was also highlighted.

Another approach was the use of spatial tools and analysis to investigate the response of species and habitats to both human and natural disturbance and to explore concepts of sensitivity, vulnerability, and recoverability. For example, models incorporating spatially defined marine parameters such as depth, substrate type, and bottom temperature were used to characterize benthic habitats and predict the sensitivity of these habitats to human disturbance (including potential rates of recovery). These types of tools are now being used to identify priority areas for conservation, and may have future application elsewhere. Spatial tools can also be used to help maximize ecosystem benefits (i.e. maintain ecosystem function or goods and services) while minimising societal costs, thereby optimising the provision of relevant management measures.

While much of the session focussed on the use of spatial planning to address fisheries impacts and issues, spatial considerations were also demonstrated for aquaculture, eutrophication, ocean ranching, and other coastal management concerns. The integration of information from a broad range of human pressures is essential for successful cumulative effects assessment. Several talks provided examples of the different types of management tools that can be applied within the marine environment, including area-based and seasonal closures, as well as gear-based technical measures applicable for mobile species with no fixed spatial location. The extensive use of geo-referenced data to produce maps, develop models and tools, and identify and assess habitats and/or sectoral interactions is now common, and will become increasingly important as plans become more multisectoral and complex.

The development of MPA networks continues to be a key focus for many scientists and technical experts. While MPA network design and evaluation (*e.g.*, determining the degree of connectivity, representativity, or coherence of sites) remains an ongoing challenge, a number of case studies and approaches (*e.g.*, site-selection algorithms such as MARXAN) demonstrated significant progress. However, site-selection algorithms such as MARXAN and related software can generate multiple solutions to the same set of objectives, and it is important to clarify objectives and related input criteria at the start of the process. Rather than being used in a prescriptive manner, these tools can also be used to generate discussion among stakeholders regarding the costs and benefits of various management options, leading to more informed decision-making.

Examples of how MSP has worked in different regional seas or national waters highlighted the importance of clarifying its purpose, and to get acceptance of the process from all key stakeholder groups. Although the focus of the session was marine ecosystems, it was noted that land-use plans that manage important watersheds must also be accounted for when developing marine plans, particularly in coastal areas. There was a general feeling that integrated planning in both terrestrial and marine ecosystems is increasingly necessary in many nearshore areas in particular, and that the necessary datasets, tools and approaches to allow this are in place. Required next steps must be political and legislative support, and broader stakeholder engagement.

### Conclusions

This session was the first opportunity in PICES to discuss integrated, multi-sectoral issues in the context of marine planning. As expected from this largely ICES audience, many of the presentations explored the interaction between the ecosystem and fishing. As the single largest impact in many of our regional seas, this is understandable and the emphasis is to be expected. In the future, however, PICES will increasingly be required to assess ecosystem impacts of many competing sectors simultaneously; the implications for how science addresses these issues are considerable.

### List of papers

#### *Oral presentations*

**Erik Olsen and Fanny Douvere** (Invited)

Marine spatial planning: A practical approach to ecosystem-based management

**Michio J. Kishi, Ayaka Sakamoto and Kenta Awa**

Basic idea on ecosystem based management for aquaculture and artificially released chum salmon

**Brett R. Dumbauld**

Managing estuarine resources at the landscape scale in Willapa Bay, Washington and similar U.S. West Coast estuaries

**Jong-Deuk Bang, Jung-Pyo Hong, Sang Un Park, Jung-Yeong Lee, Jae-Yeong Lee, Im-Gi Jeon and Jong-Hun Na**

Marine enhancement program in Korean Peninsula: Introduction of marine ranching programs

**Hidemasa Yamamoto**

Procedures for assessment of eutrophication status developed by NOWPAP CEARAC

**Ivan S. Arzamastsev**

Zoning of Far Eastern Seas for integrated nature management

**Blake E. Feist, Carolina Parada, Kevin E. See and David A. Armstrong**

Using ROMS ocean circulation models to predict the range expansion of non-indigenous European green crab (*Carcinus maenas*) along the west coast of North America

**Anatoly Kachur** (Invited)

Marine spatial planning in support of integrated management in North West Pacific Region – tools, methods, and approaches

**David Nicolson, Natalie Ban, Julie Beaumont, Karin Bodtker, Christopher Bos, Tanya Bryan, Andrew Day, Glen Jamieson, Lynn Lee, Greg MacMillan, Glen Rasmussen, Charlie Short, Bruce Turris and Karen Topelko**

Generating information to support integrated marine planning: Advantages and challenges of a collaborative approach

**Ian M. Dutton, Kerrie Wilson and Hedley Grantham**

Making marine spatial planning real: Bridging the gap from planning to action

**Robinson Mugo, Sei-Ichi Saitoh, Akira Nihira and Tadaaki Kuroyama**

Spatial prediction of skipjack tuna catch rates from remote sensing and geo-statistical approaches: Some tools for fisheries spatial planning and management in the western North Pacific

**Vladimir Shulkin**

Spatial zoning of the sea coastal areas by the land-based influences as a part of ICARM

**Ning Lin, Nanyan Huang, Wenbin Xu and Qian Wang**

Evaluation of marine function zoning: Research and practice in China

**Li-Feng Lu, Yasumasa Miyazawa, Kazuo Nadaoka, Sergey M. Varlamov and Aditya R. Kartadikaria**

Responses of surface current and temperature to the local wind and tidal forcing within Sekisei Lagoon, Japan and their application to the regional coral reef connectivity

**Erik Olsen**

Marine spatial planning in Norway: Lessons learned from developing and implementing integrated management plans for the Norwegian and Barents seas

**MONITOR Topic Session (S7)**

***State of the art of real-time monitoring and its implication for the FUTURE oceanographic study***

Co-Convenors: Jack Barth (U.S.A.), Dake Chen (China), David L. Mackas (Canada), Vyacheslav Lobanov (Russia), Young Jae Ro (Korea) and Hiroya Sugisaki (Japan)

Background

As the technology for the Ocean Sciences and Engineering is advanced rapidly, the real-time data production will revolutionize the field investigation and laboratory analysis in many ways which will have the impact over the entire oceanographic paradigm in the end. This session reviewed the state of art technology for the ocean investigation on a real-time and/or near real-time basis and discussed the impact on the research and educational horizons made possible by it. Each PICES member country demonstrated its ocean monitoring network and application. Exhibits from ocean monitoring companies were set up in conjunction with this session.

Summary of presentations

The morning session began with an invited presentation by Howard Freeland (S7-5645) who described the current status of the Argo program, ongoing since October 1999. The total number of floats are exceeding 3300 and 90% of profiles are available in near real-time. He discussed the experiences of success and failure from over the last decade. The Japanese monitoring experiences were introduced by Tsuyoshi Kitamoto (S7-5765) to address the concerns of pollutants around Japan in the deep marine waters down to 4000 m and 100 miles offshore. His and co-authors' results showed the concentrations of dioxins in coastal sediments are higher near big cities than in offshore areas. Elena Shtraikhert (S7-5593) spoke about the seasonal variation of chlorophyll-*a* concentrations in Peter-the-Great Bay by using satellite imageries. Springtime maxima were found and wind-induced upwelling caused the increase at the northeastern part of the bay. Young Baek Son (S7-5665) introduced a method for classification of water type and red tide in complex coastal water conditions using MODIS remote sensing data which was successfully applied to the South Sea of Korea where *Cochlodinium polykrikoides* blooms and there are various water types.

The second half of the morning session began with an invited presentation by Kelly Benoit-Bird (S7-5649), who described intense trophic and spatial interactions among phytoplankton and zooplankton thin layers, and migratory micronekton (myctophids) and top predators (dolphins), as revealed by a diverse and sophisticated array of acoustic moorings and profilers. This talk was very lively and interesting, stimulated many audience questions, and was later voted as the 2009 "best presentation" for a topic session sponsored by MONITOR. Hiro Sugisaki (S7-5611) next described integration of a profiling echosounder with a stereo video system (J-QUEST), and the utility of this combined system for adding species composition to the biomass distribution data provided by acoustics. The color spectrum for the video light source is an important engineering choice in this and other underwater video applications. Dmitry Stroykin (S7-5740) spoke on a multiplex send-receive acoustic array, and how inverse analysis of acoustic travel times can be used to reconstruct variability of temperature stratification and internal waves in coastal environments. The final talk of the morning session was by Natheer Alabsi (S7-5929). This lab study described new ways to monitor the swimming behavior of Alfonsino (*Beryx splendens* - a seamount-resident fish very vulnerable to intense fishing pressure). Acceleration data was from miniaturized data-loggers attached to the fish, and provided good estimates of diel variability of swimming rate and body orientation.

The afternoon session was opened with an invited presentation by Tomowo Watanabe (S7-5932) who, on behalf of his co-authors, introduced an ocean monitoring system operated by fisheries institutes of Japan. It is based on the ocean forecast model FRA-JCOPE, developed in cooperation with JAMSTEC, with capability to assimilate real-time oceanographic data obtained by fisheries institutes, which is especially important for coastal areas where Argo drifters and satellite data are not available. The next was a talk by John Calder (who was a replacement for the canceled presentation by John Barth *et al.* (S7-5949)). He described the concept of

the regional ocean observing system for the Arctic Ocean and the challenges for its implementation. The system would cover not only physical and biogeochemical aspects of the ocean but could be expanded to include human dimensions. Tomoharu Senjyu (S7-5894) spoke on joint Japanese-Korean research on monitoring Changjiang Diluted Water around Jeju and Tsushima Straits using fisheries trap-nets. In spite of a rather simple approach, it was possible to trace transport of this water, which has a lower salinity signal and affects primary production through effects on light and nutrients and its entering through the Tsushima Strait and distribution in the Japan Sea. Kwang-Soon Park (S7-5992) spoke on the development of a real-time ocean observing system in Korea which included quite an extensive coastal monitoring network (89 real-time monitoring systems) integrated with remote sensing data and numerical modeling. KORDI implemented this 10-year plan in 2009 through the partnership with other governmental agencies. One of key points of the project is a development and installation of comprehensive ocean observing platforms and buoys in the East-China, Japan and Yellow Seas.

Co-convener's Report: Phil Mundy for Jack Barth (U.S.A.)

The second half of the afternoon session opened with the invited presentation of Dong-Young Lee (S7-5984) who described the concept of the regional ocean observing system and the challenges for its implementation. Data exchange across national boundaries presents a challenge that is to be overcome in implementing the regional GOOS. Shin-ichi Ito (S7-5808) spoke on behalf of his research team regarding a novel application of mooring and glider technologies for collecting observations of the mixed layer formation in the Transition Region Mode Water (TRMW) at a time of year when observation from vessels is very difficult. Yasumasa Miyazawa (S7-5729) spoke on behalf of his research team about the substantial improvements in eddy-resolving reanalysis made possible by assimilation of observations from Japanese fishery research agency sources. David Foley (S7-5953) spoke on behalf of his co-authors on the use of real-time ocean observations off California to forecast the locations and densities of multiple species of marine mammals. Marine mammal forecasts allow naval operations to minimize risk of harm to protected species. Chang S. Kim provided a special presentation on behalf of his research team regarding implementation of the ocean observing system on the recently completed Saemangeum dike and land reclamation area. Extensive ocean and atmospheric observations support model forecasting of ocean conditions to guide management of the reclamation area.

**Table 1** Number of presentations by participating nations.

Member country	# of orals
Japan	7
Korea	4
USA	3
Russia	2
Canada	1
China	0
Sum	17

Table 1 shows the number of presentations by participating member countries. Table 2 categorizes the authors with their titles according to subject.

**Table 2** List of titles and authors for S7 presentations.

Name	Title	Subject
Elena A. Shtraikhert	Some features of chlorophyll-a concentration distribution in the north-western part of Sea of Japan on the near real-time data	analysis
Young Baek Son	Detecting of <i>Cochlodinium polykrikoides</i> blooms using spectral classification at the South Sea of Korea (SSK)	analysis
Kelly J. Benoit-Bird	Trophic cascades in Hawaii's nearshore ecosystem: Using observing technology to understand ecological interactions	analysis
Tomoharu Senjyu	Monitoring of the Changjiang diluted water around the Jeju and Tsushima Straits using fisheries trap-nets	analysis
Yasumasa Miyazawa	Roles of in-situ profile data obtained by Japanese fishery research agencies in quality of the eddy-resolving ocean reanalysis data: FRA-JCOPE2	analysis
Howard J. Freeland	The state of the art of real-time monitoring – The Argo experience	monitor
Tsuyoshi Kitamoto	Has pollution of the sea around Japan become better?: A discussion based on more than 10 years of monitoring at depths up to 4000m.	monitor
Hiroya Sugisaki	Real-time monitoring for mesopelagic fish abundance using J-QUEST integrated system of echosounder and stereo TV cameras	monitor
Dmitry S. Stroybin	Acoustic monitoring of hydrophysical processes in ocean shelf zones	monitor
Tomowo Watanabe	Ocean monitoring system operated by fisheries institutes at waters around Japan	monitor
John A. Calder	Sustaining Arctic Observing Networks - An international process to follow the International Polar Year prototype trials in the Sea of Okhotsk	program
K.S. Park	Development of real-time coastal monitoring network and operational oceanographic system in Korea	program
Dong-Young Lee	Status of real-time data exchange and strategy for the development of regional GOOS	program
Shin-Ichi Ito	A profiling mooring buoy to observe mixed layer formations in the western North Pacific and its combination with a deeper type underwater glider.	program
Chang S.Kim	Long-term monitoring and prediction system for Saemangeum coastal waters in Korea	program
D.G. Foley	Integrating ocean observing data to enhance protected species spatial decision support systems	service
Natheer M. Alabsi	Measurement of swimming behavior of alfonsino <i>Beryx splendens</i> in experimental tank using micro-data logger	Lab Exp.

The MONITOR-sponsored session had a total of 17 oral and 9 poster presentations. We did not receive any submission from China. This needs to be changed in future MONITOR activity. Ten presentations were categorized in MONITOR/Program and 5 presentations were devoted to the analysis of the monitoring activities (Table 2).

- 1) Most of the presentations (10 out of 17) were devoted to describing and/or addressing on-going monitoring programs in regions of interest spanning from basin to near-shore area. Two presentations (Kim, Park) introduced state-of-art real-time monitoring activities in Korea.
- 2) Invited presentations of particular interest were made by Kelly Benoit-Bird and Dong-Young Lee. Dr. Benoit introduced state-of-the-art instrumentation for monitoring the ecosystem over the Hawaiian seamount where she monitored micro-necton and plankton abundance along with the physical structure such

as density discontinuity and/or layer formation. Dr. Lee introduced recent Near-GOOS activity in which he explained the current status of data exchange among nations and its obstacles before future improvement can be made.

- 3) David Foley's (NOAA, USA) presentation was a new one for our session. It dealt with decision support systems based on a wide range of information from climatology, remote sensing imagery and numerical model products to predicting or giving advice for public services such as courses of action and asset allocation. This kind of approach seems plausible and is worth looking into to complement our MONITOR session.
- 4) Another interesting presentation was made by Natheer Alabsi who performed lab experiments to study fishbehavior.

### List of papers

#### *Oral presentations*

**Howard J. Freeland** (Invited)

The state of the art of real-time monitoring – The Argo experience

**Tsuyoshi Kitamoto, Hirotaka Hamanaka, Asako Toyozumi, Satoshi Tanaka, Hiroko Arataki, Yoichiro Ishibashi, Yukio Kishimoto, Hideaki Nakata, Satoru Futatsumachi, Joji Ishizaka, Hideaki Maki, Shuhei Nishida, Yukihiro Nojiri, Haruo Ogi, Yoshihisa Shirayama and Shinsuke Tanabe**

Has pollution of the sea around Japan become better? A discussion based on more than 10 years of monitoring at depths up to 4000m

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

Some features of the distribution chlorophyll *a* in the north-western part of the Sea of Japan based on near real-time data

**Young Baek Son, Joji Ishizaka and Young-Sang Suh**

Detection of *Cochlodinium polykrikoides* blooms using spectral classification in the South Sea of Korea (SSK)

**Kelly J. Benoit-Bird** (Invited)

Trophic cascades in Hawaii's nearshore ecosystem: Using observing technology to understand ecological interactions

**Hiroya Sugisaki and K. Sawada**

Real-time monitoring for mesopelagic fish abundance using J-QUEST integrated system of echosounder and stereo TV cameras

**Yury N. Morgunov, Yury A. Polovinka and Dmitry S. Stroybin**

Acoustic monitoring of hydrophysical processes in ocean shelf zones

**Natheer M. Alabsi, Hideaki Tanoue, Teruhisa Komatsu, Isamu Mitani, Mitsuhiro Kato, Toyomitsu Horii, Ichiro Aoki and Nobuyuki Miyazaki**

Measurement of swimming behavior of alfoncino *Beryx splendens* in experimental tank using micro-data logger

**Tomowo Watanabe, Manabu Shimizu, Takashi Setou, Hiroshi Kuroda, Masachika Masujima and Makoto Okazaki** (Invited)

Ocean monitoring system operated by fisheries institutes at waters around Japan

**John A. Barth, Justin Brodersen, Francis Chan, Anatoli Y. Erofeev, Murray D. Levine, Kim Page-Albins, Stephen D. Pierce, Craig Risien, Laura Rubiano-Gomez, R. Kipp Shearman and B. Walton Waldorf**

An expanding observatory to monitor hypoxia off the Oregon (U.S.A.) coast

**Tomoharu Senjyu, Takeshi Matsuno, Sang-Hyun Kim and Ig-Chang Pang**

Monitoring of the Changjiang Diluted Water around the Jeju and Tsushima Straits using fisheries trap-nets

**Kwang-Soon Park, Dong-Young Lee, Jae-Il Kwon, Kwan Chang Lim, Sang-Ik Kim and Ki-Chun Jun**

Development of real-time coastal monitoring network and operational oceanographic system in Korea

**Dong-Young Lee** (Invited)

Status of real-time data exchange and strategy for the development of regional GOOS

**Gennady A. Kantakov, Viktor S. Tambovsky, Alexey O. Bobkov and Evgeny G. Lunev**

Surface currents new data collected during 2008-2009 Argo's ice/ocean drifters. Prototype trials in the Sea of Okhotsk

**Yasumasa Miyazawa, Ruo Chao Zhang, Sergey M. Varlamov, Takashi Setou, Daisuke Ambe and Tomowo Watanabe**

Roles of *in situ* profile data obtained by Japanese fishery research agencies in quality of the eddyresolving ocean reanalysis data: FRA-JCOPE2

**David G. Foley, Elizabeth A. Becker and Karin Forney**

Integrating ocean observing data to enhance protected species spatial decision support systems

## Session Summaries -2009

### Posters

**Sirajuddin M. Horaginamani and M. Ravichandran**

A study on impacts of anthropogenic CO<sub>2</sub> on oceans

**Howard J. Freeland and the Argo Steering Team**

Argo – An ocean observing system for the 21st century

**Xiutang Yuan, Aihua Chen, Yibing Zhou, Haiying Liu and Dazuo Yang**

The influence of cadmium on the antioxidant enzyme activities in polychaete *Perinereis aibuhitensis* Grube (Annelida: Polychaeta)

**Jingfeng Fan and Hongxia Ming**

Fecal coliform and typical enteric virus in representative bathing beaches of China

**Zhen Wang, Zhengxian Yang, Dongmei Zhao and Ziwei Yao**

Sources and deposition of heavy metals, nutrients and PAHs in the atmosphere of the North Yellow Sea

**Shin-ichi Ito, Yugo Shimizu, Shigeho Kakehi, Fumitake Shido, Taku Wagawa, Kazuyuki**

**Uehara, Toshiya Nakano and Masafumi Kamachi**

A profiling mooring buoy to observe mixed layer formations in the western North Pacific and its combination with a deeper type underwater glider

**Koji Kakinoki, Tatsuro Watanabe, Katsumi Takayama and Osamu Katoh**

Behavior of the cold water area off the Sado Island in the Japan Sea detected from satellite altimeter data

**Hisashi Yamaguchi, Young Baek Son, Eko Siswanto, Joji Ishizaka, Sinjae Yoo, Yu-Hwan Ahn, Sang-Woo Kim, Junwu Tang, Hiroshi Kawamura and Yoko Kiyomoto**

Development and validation of a new satellite chlorophyll *a* algorithm in the Yellow and East China Seas with relation to suspended sediment concentration

**Yoshiyuki Nakano, Tetsuichi Fujiki and Shuichi Watanabe**

Development of compact drifting buoy for sea surface pCO<sub>2</sub> monitoring

### POC/BIO Topic Session (S8)

#### *Anthropogenic perturbations of the carbon cycle and their impacts in the North Pacific*

Co-Convenors: James Christian (Canada) and Toshiro Saino (Japan)

#### Background

Accumulation of anthropogenic carbon and associated changes in ocean chemistry (“ocean acidification”) affect all of the world’s oceans. Anthropogenic CO<sub>2</sub> has multiple feedbacks to ocean chemistry and biology, such as reduction of calcification, shifts in phytoplankton species composition, and dissolution of particulate or sedimentary carbonates. The carbon system can also be affected by other anthropogenic factors such as changes in river flow and aeolian dust deposition. Carbon and nutrient biogeochemistry will be affected both directly and indirectly by ocean acidification. This session invites papers that address the biogeochemistry of anthropogenic carbon (processes controlling its distribution, processes by which it alters ocean chemistry), other anthropogenic impacts on carbon and nutrient cycles, acidification impacts on marine biota, and feedbacks among these.

#### Summary of presentations

Topic session S8 was held at the Jeju International Conference Center, Jeju, Korea on October 27, 2009. There were 12 oral presentations and 7 posters. The oral session was extremely well attended (80 people signed the attendance sheets) and generated stimulating discussion. A special section of the *Journal of Oceanography* based on the session is planned and a call for papers was issued, with a submission deadline of January 31, 2010.

Topics ranged from estimating the rate of ocean uptake and accumulation of anthropogenic CO<sub>2</sub> to ocean acidification effects on abalone. Dr. Richard Zeebe (U.S.A.) was the invited speaker and gave an excellent



introduction to ocean carbon chemistry and ocean acidification that provided context for subsequent presentations. Many of the presenters referred back to this talk for context and background, giving them more time to talk about their own specific results. Dr. Richard Feely (U.S.A.) reported on upwelling of ‘corrosive’ CO<sub>2</sub>-rich waters onto the North American continental shelf and methods for estimating carbonate saturation states indirectly from temperature, salinity, and oxygen, greatly enlarging the number of cruises and profiles for which these parameters can be estimated. Dr. Shu Saito (Japan) reported on changes in saturation states in the northwestern Pacific since WOCE, and Dr. Tae-Wook Kim (Korea) examined historical trends in the saturation state of the Japan/East Sea. Drs. Jim Christian (Canada) and Keith Rodgers (U.S.A.) looked at future trends in ocean CO<sub>2</sub> uptake and saturation state using global climate models. Dr. Steve Rumrill (U.S.A.) reported on monitoring programs in U.S. estuaries, and the particular vulnerabilities of estuarine organisms. The final block of talks focused on biological topics including impacts on abalone (Dr. Ryu Kimura, Japan), interactions between photosynthesis and calcification in coccolithophorids (Dr. Yoshihiro Shiraiwa, Japan), and effects on ocean acidification on phytoplankton community structure (Dr. Takeo Hama, Japan).

Overall, there was a variety of topics and excellent interactions among presenters of diverse interests including biologists and geochemists, modelers and observationalists. This session lays the groundwork for productive interactions in the FUTURE, between scientists interested in the climatic and biogeochemical processes underlying ocean acidification and those focused on the biological impacts.

### List of papers

#### *Oral presentations*

**Richard E. Zeebe (Invited)**

The future ocean: More acid, less calcifying, and more transparent to sound?

**Shu Saito and Akihiko Murata**

Decadal changes in CaCO<sub>3</sub> saturation state along 179°E in the Pacific Ocean

**Christopher L. Sabine, Richard A. Feely, François M.M. Morel, Eric S. Egleston and Dana Greeley**

Past and present trends in ocean carbon uptake and storage in the North Pacific

**Andrey G. Andreev**

Inorganic carbon parameters change in the surface waters of the subarctic North Pacific

**Tsuneo Ono and A-line monitoring team**

Interannual variation of DIC in the Oyashio region along the A-line transect

**Lauren W. Juranek, Richard A. Feely, William T. Peterson, Simone R. Alin, Jay Peterson, Kitack Lee, Christopher L. Sabine and Burke Hales**

A novel method for determining seasonal variations in aragonite saturation state in the eastern North Pacific continental shelf using multi-parameter analysis

**James R. Christian**

The future ocean carbon cycle: Projections with the Canadian Earth System Model CanESM1

**Keith B. Rodgers, Laurent Bopp, Olivier Aumont, Daniele Iudicone, Jorge L. Sarmiento, Anand Gnanadesikan and John Dunne**

Changes in North Pacific  $\Delta p\text{CO}_2$  and air-sea CO<sub>2</sub> fluxes over the 21st century in coupled models

**Steven S. Rumrill, Alicia R. Helms and Adam S. DeMarzo**

Long-term pH shift in a Pacific Northwest estuary: Potential relationship between ocean acidification and alkalinity within the South Slough (Coos Bay, Oregon, USA)

**Tae-Wook Kim, Kitack Lee, Richard A. Feely, Christopher L. Sabine, Hae Jin Jeong and Kwang Young Kim**

Prediction of East/Japan Sea acidification over the past 40 years using a multiple-parameter regression model

**Ryo Kimura, Hideki Takami, Tsuneo Ono, Toshihiro Onitsuka and Yukihiro Nojiri**

Effects of elevated  $p\text{CO}_2$  on early development of the Ezo abalone *Haliotis discus hannai*

**Shinya Fukuda, Iwane Suzuki, Takeo Hama and Yoshihiro Shiraiwa**

Control of seawater pH by the coccolithophorid, *Emiliania huxleyi* (Haptophyceae)

**Takeo Hama, Shoko Kawashima, Yuhi Satoh, Koich Shimotori, Yuko Omori, Taiki Adachi, Shun Hasegawa, Hiroko Endoh, Takeshi Nakayama, Isao Inoue, Takashi Midorikawa, Masao Ishii, Shu Saitoh and Daisuke Sasano**

Experimental study on the effect of ocean acidification on microbial structure and bioelemental cycles

## Session Summaries -2009

### Posters

**Jae Hoon Noh, Dong Han Choi, Charity Lee and E.J. Carpenter**

Spatio-temporal variations of N<sub>2</sub> fixation rates and abundance of N<sub>2</sub>-fixers in the northwestern Pacific

**Guimei Liu, Fei Chai, Huijie Xue and Lei Shi**

Primary productivity and pCO<sub>2</sub> variations in the China seas during 1990-2004: A three-dimensional physical-biogeochemical modeling study

**Zhongyong Gao, Liqi Chen and Heng Sun**

Transport of the Bering Slope Current and its effects on the carbon cycle in the Bering Sea and the western Arctic Ocean

**Toshiya Nakano, Kazuhiko Hayashi, Yuichi Sasaki, Masao Ishii and Takashi Midorikawa**

Estimation of the dissolved inorganic carbon inventory in the western North Pacific

**Jeong-Hee Shim, Dong-Jin Kang, Chun Ok Jo, Young-Keun Jin, Pavel Ya. Tishchenko, Anatoly Obzhirov and Kyung-Ryul Kim**

Distribution of surface pCO<sub>2</sub> and its controlling factors at the eastern shelf of the Sakhalin Island in the Sea of Okhotsk

**Hyung Chul Kim, Yiming Wang, Seong Heo and Pyoung Joong Kim**

Long-term variations and autumn distribution of inorganic nutrients in the Yellow Sea

**Yukihiro Nojiri, Shin-ichiro Nakaoka, Chihiro Miyazaki, Andrew G. Dickson and Inter-comparison Participants**

Indoor seawater pool inter-comparison of ocean surface pCO<sub>2</sub> systems developed for underway and buoy operation

### POC/FUTURE Topic Session (S9)

*Outlooks and forecasts of marine ecosystems from an earth system science perspective: challenges and opportunities.*

Co-sponsored by IMBER

Co-Convenors: Harold P. Batchelder (U.S.A.), Michael Foreman (Canada), Anne B. Hollowed (U.S.A) and Hiroaki Saito (Japan)

### Background

The prediction of responses of marine ecosystems to future climate scenarios is an important objective of PICES' new science program, FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems). However, the marine ecosystem is part of the earth system and its prediction needs integrated knowledge from physical, chemical, and biological perspectives. Earth system science is an interdisciplinary approach that integrates anthropology, atmospheric science, biology, oceanography, geophysics and policy to provide predictions of ecosystem response to climate change. The earth system is complex with non-linear feedbacks, threshold responses, and, in some cases, irreversible change. Understanding the mechanisms controlling these system properties is critical to accurately forecasting future states of nature in a changing climate. Moreover, conducting large-scale experiments on the earth system is impossible. Therefore, regional marine ecosystem models should include the earth system science links that are essential for producing better predictions of marine ecosystem response to future climate scenarios. This session focused on multidisciplinary coupled models and theoretical, observational and experimental studies designed to provide outlooks and/or forecasts of marine ecosystems. Outlooks and forecasts differ in that outlooks are qualitative with (often) unbounded uncertainties, while forecasts are often quantitative, but must have bounded certainties. Presentations that focus on both long-term and short-term predictions, and that link two or more disciplines (such as physical oceanography, climate, ecosystem dynamics, marine resource management, or socio-economic systems), were welcome, especially presentations that explore what additional information or data are needed to provide outlooks and forecasts, and especially to transition from providing outlooks to providing forecasts.

### Summary of presentations

The session consisted of 17 oral presentations distributed over two days from scientists in 5 countries. This was the first session at a PICES Annual Meeting that was formally considered a FUTURE topic session. The

intent of the session was to focus on multi-disciplinary models and observational studies designed to provide outlooks and forecasts—two types of forward-looking predictions. Topics varied from relatively small-scale investigations of coastal lagoons to global-scale data synthesis, and included socioeconomic impacts of climate change and other anthropogenic forcing at local (Chesapeake Bay) to global scales. Four presentations were invited (Okunishi, Murtugudde, Barange, Dalton).

Several presentations described the results of coupled biophysical models. In an invited talk, Takeshi Okunishi described the results of simulation models of small pelagic fish in the western North Pacific and found that the agreement between observations and models was best when predation by skipjack tuna was included in the dynamics of the small pelagics. Fei Chai and colleagues were able to link physical, lower trophic level ecosystem and IBM models of anchovy off Peru to provide 9-month forecasts arising from NCEP-predicted atmospheric conditions that had some skill at capturing larger-scale responses of anchovy to large forcing (El Niño, La Niña). Enrique Curchitser described some progress and challenges encountered in expanding lower trophic level biophysical modeling frameworks to not only fish, but fishing fleet behaviors. Keiji Kiyomatsu described the use of OFES ocean hindcasts of SST and velocities to estimate transport, growth and survival of Japanese sardine into the Kuroshio extension region.

Several presentations discussed reanalysis or new analyses of historical data sets. Yury Zuenko examined climate and ocean conditions in relation to productivity and transfer of production to higher trophic levels in the Japan/East Sea. V.S. Labay documented the evolution of benthic species in small Sakhalin coastal lagoons, and found bio-invasions from the sea. When lagoon openings became seasonal or restricted, this led to changed benthos structure, and to a prevalence of species having warmer affinities.

Masahiko Fujii and colleagues used projected temperatures from the MIROC IPCC climate scenario (global warming) model of the 21<sup>st</sup> century to examine temperature related bleaching of coral reef systems near Japan. Though the northward extent of coral habitat was projected to extend northward by about 200 km, bleaching events were forecast to occur nearly every year during the decade beginning 2060 compared to no events in the decade beginning in 2000.

Hiroaki Saito reported on the importance of composition and ballasting of particles for the vertical export of organic matter from the euphotic zone. Compositional changes can strongly influence the sinking rate and rate of remineralization, complicating simple vertical export models.

In an invited talk, Raghu Murtugudde described an end-to-end Earth system model of the Chesapeake Bay (East Coast of USA) system. The model is used to provide nowcasts and forecasts at daily to decadal time scales. Oxygen conditions, harmful algal blooms and sea nettle blooms are skillfully predicted at short time scales (few days) and with quantified levels of uncertainty. In another invited talk, Manuel Barange described the Quest-Fish project which is using global climate models to estimate primary production through trophic relationships and assumptions of fish production. The model framework also considers other anthropogenic stressors, including economic policies and variable geographic and temporal exploitation. The focus is on shelf-sea systems, and on the consequences of the stressors on market based fish commodities.

Anne Hollowed described a framework for downscaling Bering Sea climate indices applied to the walleye pollock and flatfish, with designs for constructing a management strategy evaluation (MSE) for some key species. Akihiko Yatsu described the results of a CCCC-CFAME Task Team exploration of the possible climate and global warming effects from IPCC scenarios on several key species (chum salmon, walleye pollock, sardine, anchovy, saury, squid) in the Kuroshio-Oyashio region. Information on the species biology (lifespan, prey types) and expected changes from IPCC scenarios were used to construct outlooks for several of these species.

In an invited talk, Michael Dalton described a population-environment-technology (PET) model applied to 9 regions worldwide. PET is multisector, multiregional and includes five production sectors and four types of consumer goods (energy, food, transport, other). The value of such models is that by being based on market information, it allows the model to span spatial scales.

## Session Summaries -2009

Harold (Hal) Batchelder described approaches to, and results of, quantitative skill assessments of earlier and later implementations of ROMS physical models to the California Current and northern Gulf of Alaska regions. The results showed sensitivity of the stratification to the controlling influence (temperature in the south; salinity in the north) in the earlier model, and greater robustness/fidelity of the later model to observed temperature and salinity. Highly skillful physical models are useful as the basis for ecosystem models; models lacking physical skill should not be the basis for coupled ecosystem models. Jie Shi used a Princeton Ocean Model and coupled ecosystem and kelp models to examine the production of kelp and its control by nutrient fluxes from outer Sungo Bay, China. The model suggests that reduced kelp density at the mouth of the bay would increase yield significantly in the whole bay, since greater nutrient fluxes would be supplied to the inner region.

The recently released version of the World Ocean Atlas 2009 and World Ocean Database 2009 were described by Hernan Garcia. WOA-2009 and WOD-2009 are the largest quality controlled collections of ocean profile data available online. Steve Bograd documented strong correlations between retrospective analysis of climate records, growth chronologies of rockfish and seabird egg laying and fledging data. Good years for rockfish and seabirds were associated with strong high pressure systems, strong upwelling and cooler SSTs. Correlations of the biological metrics were seasonally highest with winter (JFM) conditions, indicating the importance of wintertime ocean conditions for ecosystem productivity.

Overall, this rather diverse collection of talks was well attended, and presented a number of different approaches that might be used for creating outlooks and forecasts within the Advisory Panel on *Status, Outlooks, Forecasts and Engagement* (SOFE-AP) of the new PICES scientific program, *Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems* (FUTURE). It was an auspicious beginning to FUTURE topic sessions.

### List of papers

#### *Oral presentations*

**Takeshi Okunishi, Shin-ichi Ito, Atsushi Kawabata, Hiroshi Kubota, Taketo Hashioka, Hiroshi Sumata and Yasuhiro Yamanaka** (Invited)

A multi-trophic level ecosystem model for understanding mechanisms of small pelagic fish species alternation

**Fei Chai, Francisco Chavez, Yi Chao, Lei Shi, Hongchun Zhang and Richard Barber**

Using remote sensing and modeling in operational forecasting of fisheries

**Keiji Kiyomatsu, Takuji Waseda and Yasumasa Miyazawa**

Reconstruction of high-resolution historical February SST in the northwestern Pacific and its application to larval dispersion

**Yury I. Zuenko**

How trends, shifts, and interdecadal fluctuations in climate reconstruct the ecosystem of the Japan/East Sea

**Raghu Murtugudde** (Invited)

Marine ecosystem forecasting with an Earth System Prediction model

**V.S. Labay**

Evolution of a benthos of coastal lagoons of Sakhalin Island: Causes and consequences

**Yumiko Yara, Masahiko Fujii, Yasuhiro Yamanaka, Naosuke Okada, Hiroya Yamano and Kazuhiro Oshima**

Projected effects of global warming on coral reefs in seas close to Japan

**Hiroaki Saito**

Modeling of organic matter dynamics in the mesopelagic zone: A perspective on modeling and ecosystem studies

**Enrique N. Curchitser, Kenneth A. Rose, Kate Hedstrom, Jerome Fiechter, Shin-ichi Ito, Salvador Lluch-Cota and Bernard A. Megrey**

Development of a climate-to-fish-to-fishers model: Progress, issues, and some solutions

**Manuel Barange, Icarus Allen, Eddie Allison, Marie-Caroline Badjeck, Julia Blanchard, James Harle, Robert Holmes, Jason Holt, Simon Jennings, Gorka Merino, Christian Mullon and Emma Tompkins** (Invited)

Predicting the impacts and socio-economic consequences of climate change on global marine ecosystems and fisheries: The QUEST\_Fish framework

**Anne B. Hollowed, Nicholas A. Bond, James E. Overland and Thomas Wilderbuer**

Future conditions in the Bering Sea: Applications to walleye pollock and flatfish

**Akihiko Yatsu, Sanae Chiba, Yasuhiro Yamanaka, Shin-ichi Ito, Yugo Shimizu, Masahide Kaeriyama and Yoshiro Watanabe**

Future of Kuroshio/Oyashio ecosystems: An outcome of the CFAME Task Team and WG20

**Michael Dalton** (Invited)

Climate change and marine ecosystems: Demographic and economic implications under IPCC scenarios

**Harold P. Batchelder, Enrique N. Curchitser and Kate Hedstrom**

Modeling physical processes in the Northeast Pacific: model-data comparisons for assessing when model skill is sufficient as a basis for ecosystem simulation

**Jie Shi, Hao Wei and Liang Zhao**

Numerical study of the aquaculture carrying capacity in a typical raft culture bay of China

**Hernan Garcia, Sydney Levitus, Tim Boyer, Ricardo Locarnini, John Antonov, Daphne Johnson, Olga Baranova, Alexey Mishonov, Dan Seidov, Igor Smolyar, Melisa Zweng and Evgeney Yarosh**

The World Ocean Database and Atlas 2009

**Steven J. Bograd, Bryan A. Black, William J. Sydeman, Isaac Schroeder and Peter Lawson**

Wintertime ocean conditions synchronize rockfish growth and seabird reproduction in the California Current

### Posters

**Licheng Feng, Baochao Liu, Yi Cai, Zhanggui Wang, Jiping Chao and Jianping Li**

Numerical simulation of the Changjiang estuary ecosystem

## BIO Paper Session

Co-Convenors: Michael J. Dagg (U.S.A.) and Sinjae Yoo (Korea)

### Background

The theme of PICES-2009 is “*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*”. In this session, we welcomed papers on biological aspects of the PICES-2009 theme as well as papers on other aspects of biological oceanography in the North Pacific and its marginal seas (except S3 and S8 topics). Early career scientists were especially encouraged to submit papers to this session.

### Summary of presentations

This session received a large number of applications (approximately 65) for oral and poster presentations and it ended with a full day of talks (19 total) and 42 posters. Presentations were given by members of all PICES countries, and 8 of the 19 oral presentations were given by early career scientists. As indicated in the Book of Abstracts, topics ranged widely and all were of interest to the PICES community of Biological Oceanographers. Both morning and afternoon sessions were well attended. Bryan Black received the BIO award for best presentation by an early career scientist for his talk in this session titled, “*Growth-increment chronologies reflect ecosystem responses to climate variability in the northeastern Pacific*”.

### List of papers

#### *Oral presentations*

**David Mackas, Sonia Batten, Ken Coyle and Russ Hopcroft**

Perspectives on a decade of change in the Alaska Gyre: A comparison of three Northeast Pacific zooplankton time series

**Bryan A. Black**

Growth-increment chronologies reflect ecosystem responses to climate variability in the northeastern Pacific

**Seung-Hyun Son, Meng-Hua Wang and Jae Hoon Noh**

Satellite-observed chlorophyll *a* data in the dump site of the Yellow Sea

**Shinji Shimode and Atsushi Tsuda**

Geographical distribution and ontogenetic migration of *Eucalanus californicus* (Johnson) in the western North Pacific Ocean

## Session Summaries -2009

### **Mi Hee Chung and Won Duk Yoon**

Variation of the epiphytic community and biomass on *Zostera marina* (eelgrass) related to the host plant and environmental factors

### **Tatyana N. Krupnova and Yury I. Zuenko**

Development *Laminaria japonica* early stages in the coastal waters of Primorye caused by climate change

### **Hongyan Bao, Ying Wu, Lixin Tian, Jing Zhang and Guiling Zhang**

Sources and distributions of terrigenous organic matter in a mangrove-dominant small tropical estuary, South China

### **Evgenia E. Vekhova, Michael I. Kusaykin and Konstantin V. Kiselev**

The phytoplankton contribution to the common mussel diet (Bivalvia: Mytilidae) of the Sea of Japan

### **Anastasia Dolganova**

Modern condition of fauna of Polychaeta in the Amur Bay (Peter the Great Bay, Sea of Japan)

### **Toru Kobari, Haruko Mori and Hitomi Tokushige**

Nucleic acid and protein contents of ontogenetically migrating copepods in the subarctic Pacific Ocean as influenced by development stage and depth

### **Young-Ok Kim, Pung-Guk Jang, Eun-Jin Yang, Seung-Won Jeong and Kyoungsoon Shin**

Tintinnid species as biological sensors for monitoring the Kuroshio Extension in Korean coastal waters

### **Yuichiro Nishibe, Shuhei Nishida and Atsushi Yamaguchi**

Vertical distribution, population dynamics and lipid storage of the cyclopoid copepod *Oithona similis* in the Oyashio region, western subarctic Pacific

### **Julie E. Keister, Emanuele Di Lorenzo, Cheryl A. Morgan, William T. Peterson, Vincent Combes and Neri Mariani**

Zooplankton species composition is linked to ocean transport in the Northern California Current

### **Elena Dulepova and Anatoly Volkov**

East-west contrasts in production of zooplankton communities in the Bering Sea

### **Naoki Tojo, Ryuichi Matsukura, Hiroki Yasuma, Kenji Minami, Akira Nishimura, Orio Yamamura, Tetsuichiro Funamoto, Satoshi Honda and Kazushi Miyashita**

Environmentally driven seasonal distribution of zooplankton along the Pacific coast off eastern Hokkaido, Japan

### **Yugo Shimizu, Kazutaka Takahashi, Shin-ichi Ito, Shigeo Kakehi, Hiroaki Tatebe, Ichiro Yasuda, Akira Kusaka and Tomoharu Nakayama**

Transport of large subarctic copepods from the Oyashio area to the mixed water region by the coastal Oyashio intrusion

### **C. Tracy Shaw, Leah R. Feinberg and William T. Peterson**

Population dynamics of the euphausiids *Euphausia pacifica* and *Thysanoessa spinifera* off Newport, OR, USA in relation to environmental conditions

### **Andrey Suntsov, Richard D. Brodeur and Jason Phillips**

Interannual variability and spatio-temporal characteristics in populations of three dominant myctophid species in the northern California Current System

### **Olga Yu. Tyurneva, Yuri M. Yakovlev and Vladimir V. Vertyankin**

Photographic identification of the Korean-Okhotsk gray whale (*Eschrichtius Robustus*) offshore northeast Sakhalin Island and southeast Kamchatka Peninsula (Russia), 2008

### **Tabitha C.Y. Hui, Rowenna Flinn, Edward J. Gregr, Ruth Joy and Andrew W. Trites**

Are Steller sea lions (*Eumetopias jubatus*) affected by prey availability in the western Gulf of Alaska and Aleutian Islands?

## Posters

### **Andrey P. Chernyaev and Alexandra S. Petrova**

Determination of n-nonylphenol in the coastal waters of Vladivostok

### **Chun-Yi Chang, Pei-Chi Ho, Akash R. Sastri and Chih-Hao Hsieh**

Development and application of an automatic mesozooplankton image classification system in the East China Sea, a region of complicated hydrography

### **Evgeniya A. Tikhomirova**

Distribution of biogenic substances in waters of Amursky Bay (Peter the Great Bay, Japan/East Sea)

### **You-Ree Jun, Akash R. Sastri and Chih-Hao Hsieh**

Field estimates of size-based ingestion rate of zooplankton using FlowCAM in the subtropical western Pacific

### **Wei-Hsuan Teng, Akash R. Sastri and Chih-Hao Hsieh**

Investigation of size-trophic level relationships of zooplankton in different ocean environments - A stable isotope approach

### **Atsushi Tsuda, Hiroaki Saito and Hiromi Kasai**

Vertical distribution of large suspension feeding copepods in the Oyashio region during the growing period

**Atsushi Yamaguchi and Yoshimi Matsumoto**

Life history and production of the chaetognath *Eukrohnia hamata* in the Oyashio region, western subarctic Pacific

**Guo Ying Du and Ik Kyo Chung**

Estimating areal production of intertidal microphytobenthos based on spatio-temporal community dynamics and laboratory measurements

**Seung Ho Baek, Kyoungsoo Shin, Shinji Shimode, Myung-Soo Han and Tomohiko Kikuchi**

The role of vertical migration and cell division on dinoflagellates *Ceratium furca* and *C. fusus*

**Hong-Bo Li and Fengao Lin**

Relationships between bacterioplankton and virioplankton in coastal areas of Hebei, China

**Min-Chul Jang, Kyoungsoo Shin, Woo-Jin Lee and Ok-Myung Hwang**

Grazing impact of calanoid copepods on phytoplankton size-fractions in Jangmok Bay, South Coast Korea

**Pung-Guk Jang, Kyoungsoo Shin, Min-Chul Jang, Woo-Jin Lee and Hyun-Su Kim**

The succession of phytoplankton assemblage by nutrient property on summer in the coastal area

**Masato Minowa, Toru Kobari, Hiroyasu Akamatsu and Toshihiro Ichikawa**

Impacts of small copepods on sinking particles in a semi-enclosed and deep embayment

**Evgeniy A. Sigida, Svetlana S. Musko, Lidia I. Titova and Alexandra A. Dvornik**

Sakhalin's shelf pelagic marine bacteria *Pseudoalteromonas* sp. and *Pseudomonas* sp. as prospective destructors of ocean oil pollution

**Bonggil Hyun, Kyoungsoo Shin, Min-Chul Jang, Woo-Jin Lee, Jeongmi Song and Seung Ho Baek**

The survival possibility of introducing phytoplankton via ships ballast water

**Yulia V. Zavertanova, Larisa E. Vasilyeva, Olesya A. Sharova and Vladimir A. Rakov**

Species composition of ichthyoplankton in Alekseeva Bay (Peter the Great Bay, Japanese Sea) in 2006 – 2009

**Bo-Bae Lee, Jae-Suk Choi, Yu-Mi Ha, Kee Hun Do and In Soon Choi**

Inhibitory effects of seaweed extracts on *Helicobacter pylori* growth and urease activity

**Yu-Mi Ha, Jae-Suk Choi, Kee Hun Do, Bo-Bae Lee, Su Hwa Shin and In Soon Choi**

Inhibitory effects of *Sargassum sagamianum* extracts on the growth of several oral pathogens and collagenase activity

**Zhisong Cui, Li Zheng, Li Tian, Ping Han, Xiaoying Zhang, Qian Liu, Xiaoru Wang and Frank S.C. Lee**

Characterization of polycyclic aromatic hydrocarbons-degrading *Cycloclasticus* strains isolated from Yellow Sea sediment of China and their syntrophic effects with crude oil degraders *Alcanivorax* strains

**Goh Onitsuka, Masatoshi Moku, Toru Kobari, Tetsutaro Takikawa, Akihiko Morimoto, Atsushi Watanabe, Yutaka Yoshikawa and Tetsuo Yanagi**

Distribution of nutrients and plankton around the lee eddy of the Tsushima Islands

**Li Zheng, Baijuan Yang, Junhui Chen, Jiaye Zang and Xiaoru Wang**

Primary source identification of the invasive *Enteromorpha prolifera* in Qingdao based on hierarchical cluster analysis of fatty acids

**Takeshi Terui and Michio J. Kishi**

A Lagrangian ensemble model of Copepoda (*Neocalanus cristatus*) in the northwestern subarctic Pacific

**Seung-Hyun Son and Meng-Hua Wang**

Marine environmental responses to the Saemangeum Reclamation Project in South Korea

**Seung-Hyun Son and Meng-Hua Wang**

Temporal and spatial variability of water turbidity derived from satellite ocean color in the Yellow Sea and East China Sea

**Natalia P. Fadeeva, Marina S. Selina, Elena V. Smirnova and Inna L. Stonik**

Communities of sandy beaches: What factors influence their diversity and zonation patterns in shallow subtidal environments of the northwestern part of the Sea of Japan?

**Kanako Toge, Masaaki Fukuwaka, Orio Yamamura and Yutaka Watanuki**

Biennial change of pink salmon biomass and the body condition of a pelagic shearwater: Evidence of competition between fish and bird

**Hiroshi Koshikawa, Hironori Higashi, Masanobu Kawachi, Toru Hasegawa, Kazumaro Okamura, Yoko Kiyomoto, Kou Nishiuchi, Hideki Akiyama, Kunio Kohata and Shogo Murakami**

Dominance of the dinoflagellate *Prorocentrum dentatum* on the central continental shelf of the East China Sea in early summer, 2007

**Yuji Okazaki and Kazuaki Tadokoro**

Comparison of sampling gear (MOHT vs. BONGO net): Implication for euphausiid abundance

**Evgeniya A. Tikhomirova**

Spatial and temporal variability of primary production in Amursky and Ussuriysky Bays (Japan/East Sea) from modelling results

## Session Summaries -2009

**Tetsuichi Fujiki, Kazuhiko Matsumoto, Shuichi Watanabe, Takuji Hosaka and Toshiro Saino**

Time-series observation of phytoplankton productivity in the western subarctic gyre of the North Pacific

**Keiko Yamada, Sang-Woo Kim and Ji-Suk Ahn**

Interannual variability of primary production in the East/Japan Sea estimated by satellite data, in consideration of influence of atmospheric aerosol

**Yuya Yamamoto, Yasuyuki Kishi, Hirotada Moki and Kisaburo Nakata**

A model study to predict zooplankton biomass in intermediate and deep water

**Jiyeon Kim, Chaewoo Ma and Wongyu Park**

Spatio-temporal variability of epifaunal distributions caused by the Hebei Spirit oil spill in the surf zone on the Hakampo beach on the west coast of Korea

**Toshikazu Suzuki, Hisako Mori and Daisuke Nakatsugawa**

Spatial distribution of filamentous cyanobacteria, *Trichodesmium* spp., in spring in the East China Sea

**Hye Seon Kim, Ah-Ra Ko and Se-Jong Ju**

A comparative study of the lipid dynamics of the euphausiid, *Euphausia pacifica*, from Korean seas (East/Japan Sea, South Sea, and Yellow Sea)

**In Joon Hwang and Hea Ja Baek**

Acute exposure of waterborne polycyclic aromatic hydrocarbon, benzo[a]pyrene during ovarian recrudescence in a marine fish, *Chasmichthys dolichognathus*

**Oh Youn Kwon, Jung-Hoon Kang, Yong Hwan Cha and Man Chang**

Environmental factors affecting dynamics of the phytoplankton community in port baseline surveys in Korea

**Joji Ishizaka, Hisashi Yamaguchi, Sarat Tripathy, Takashi Makino, Takeshi Matsuno and Takahiro Endoh**

Short term variability of primary production in the Changjiang River Plume in the East China Sea observed in summer 2008

**Soo-Jung Chang, Donghyun Lim, Won Duk Yoon and Suam Kim**

A phylogenetic study of Medusozoa (Scyphozoa, Hydrozoa) in Korean waters

**Young Shil Kang, Weol Ae Lim, Young Sik Lee and Yang-Soon Kang**

Ecosystem consequence of a *Noctiluca scintillans* bloom in the southern coast of the Korean Peninsula

**Ji-Woong Ko, M. Sidharthan, Sung Hwan Cho, Seock Jung Han and Hyun Woung Shin**

Climate change triggered fecundity of the solitary ascidian, *Herdmania momus* in the Jeju coast, Korea: Implications for benthic community structure and artificial reef function

## FIS Paper Session

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

### Background

Papers addressing general topics in fishery science and fisheries oceanography in the North Pacific and its marginal seas were invited (except S2, S3 and S6 topics).

### List of papers

#### *Posters*

**Victor F. Bugaev, A.V. Bugaev and V.A. Dubynin**

Biological characteristics of commercial stocks of sockeye salmon *Oncorhynchus nerka* in East Kamchatka, Koryak Plateau and some adjacent areas

**Elena V. Gritsay**

Seasonal and interannual variations in the age structure of walleye pollock in commercial catches in the western Bering Sea

**Tetsuichiro Funamoto**

Effects of spawning stock biomass and environmental conditions on walleye pollock (*Theragra chalcogramma*) recruitment in the northern Japan Sea

**Margarita D. Bovarova and Olga N. Lukyanova**

Organochlorine pesticides in marine and freshwater organisms from the Russian Far East



**Réka Domokos**

Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone

**Kevin Thompson, Grant Thompson and OSU Qualitative Analysis Group**

Precautionary management may destabilize a fishery: Examples using loop analysis

**Liudmila S. Dolmatova and Olga A. Zaika**

Seasonal- and age-dependent activities of antioxidant enzymes in holothurian *Eupentacta fraudatrix*

**Yugo Shimizu and Yoji Narimatsu**

Relationship in temporal variability between temperature and recruitment of Pacific cod (*Gadus macrocephalus*) off the northeast coast of Japan

**Alexei M. Orlov, Eugeny F. Kulish, Alexander O. Shubin and Ilyas N. Mukhametov**

New data on age and growth of spiny dogfish *Squalus acanthias* in the northwestern Pacific Ocean

**Galina S. Borisenko**

The artificial radionuclides Sr-90 and Cs-137 in commercial fishes and sea water of Japan Sea

**Chul-Woong Oh and Jong-Hun Na**

Population biology of Korean pomfret *Pampus echinogaster* (Basilewsky, 1855) (Perciformes: Stromateidae) on the Western Coast of Korea, Yellow Sea

**Alexei M. Orlov, Vadim F. Savinykh, Dmitry V. Pelenev and Eugeny F. Kulish**

Distribution and size composition of spiny dogfish in the North Pacific

**Naoki Tojo, Akira Nishimura, Tetsuichiro Funamoto, Orio Yamamura, Hiroki Yasuma and Kazushi Miyashita**

Ecologically driven spatial dynamics in pre-wintering juvenile walleye pollock (*Theragra charcogramma*) in the coastal sea off northeastern Hokkaido, Japan

**Svetlana A. Ireykina**

Biotransformation and oxidative stress biomarkers as useful tools in assessment of pollution effects in estuaries of Peter the Great Bay (Japan/East Sea)

**Seock-Woo Jang, Seong-Gil Kim, Ok-In Choi, Seong-Soo Kim and Zang-Geun Kim**

Concentration of trace metals in the tissues of common dolphins (*Delphinus delphis*) on the east coast of Korea

**Nadezhda L. Aseeva**

Myxozoa parasites in fishes of the northwest Japan Sea

**Wongyu Park, Chaewoo Ma, Miyoung Song, Myoung-Ho Sohn, Hakjin Hwang, Jong-Bin Kim, Kwangho Choi and In-Ja Yeon**

Seasonal occurrence and distribution of Japanese mantis shrimp *Oratosquilla oratoria* larvae off Yeonpyeong-do near the Korean coast in the Yellow Sea

**Myoung-Ho Sohn, Miyoung Song, Hakjin Hwang, Yang-Jae Im, In-Ja Yeon, Wongyu Park, Chaewoo Ma and Jae-Won Kim**

Larval occurrence and distribution of swimming crab *Charybdis japonica* (Milne Edwards, 1860) off Yeonpyeong-do near Korean coast in the Yellow Sea

**Jong Hee Lee, Jae Bong Lee, Jung Nyun Kim, Dong Woo Lee and Dae Soo Chang**

Seasonal species composition of marine organisms collected by a shrimp beam trawl in the Nakdong River estuary, Korea

**Hyoungsum Han, Chaewoo Ma and Wongyu Park**

Differences of growth and density in *Ruditapes philippinarum* in the intertidal area in Tae-an on the west coast of South Korea

**Hae-Won Lee, Byung-Kyu Hong, Young-Min Choi and Dong-Woo Lee**

Gonadal maturation and spawning in the Pacific herring, *Clupea pallasii*, in the East/Japan Sea of Korea

**Tatiana Tunon and Gottfried Pestal**

Using classification trees to capture a manager's interpretation of Bayesian projections

**Jung Hwa Choi, Bong Jun Sung, Jung Nyun Kim, Taeg-Yun Oh, Dae Soo Chang and Hyung Kee Cha**

Feeding habits of yellow goosfish, *Lophius litulon*, and John Dory, *Zeus faber* in the northern part of the East China Sea

**Wen-Bin Huang**

Comparisons of spatiotemporal variations in abundance and size composition of Pacific saury between the high-seas and coastal fishing grounds in the Northwestern Pacific

## POC Paper Session

Co-Convenors: Michael Foreman (Canada) and Ichiro Yasuda (Japan)

### Background

Papers were invited on all aspects of physical and biogeochemical oceanography and climate in the North Pacific and its marginal seas (except S8 and S9 topics).

### Summary of presentations

The session consisted of 19 oral presentations and 32 posters covering a wide range of physical and biogeochemical oceanographic research. Ichiro Yasuda, Yury Zuenko, and Steven Bograd, and Michael Foreman chaired sub-sessions over the 1-day presentation period. The morning portion included interesting talks related to: 1) Indo-Pacific climate variability and Indonesian Through Flow impacts (Chen, Ro), 2) climate variability teleconnections and ecosystem impacts in the Northern Hemisphere (Alheit), 3) North Pacific mixed layer depth projections from IPCC models (Jang), 4) steric contributions to sea level rise as computed from Argo data (Freeland), 5) fully coupled dynamical climate model downscaling in the Northeast Pacific (Curchitser), 6) warm intrusions in the Yellow Sea (Wang), 7) interannual variability of Korea Strait bottom cold water (Na), and 8) variability in the Japan/East Sea (Trusenkova, Kaplunenko).

The afternoon session started with a series of Arctic presentations: John Calder described a synthesis of recent data assembled by the Pacific Arctic Group, Victor Kuzin described dissolved methane in Arctic waters, and Eduard Spivak described observations from a September 2006 cruise in the Laptev Sea. Humio Musidera then described the dynamics behind the cold water belt along the Soya Warm Current, and Jinhee Yoon described the Kuroshio Extension response to an El Niño. In the final sub-session, Michael Foreman described the dynamics behind salinity variations in Knight Inlet, Anastasiya Abrosimova described dynamics in the Amur River estuary, Hitoshi Kaneko described turbulence measurements along 155°E, and Elena Vilyanskaya described water temperature changes in Aniva Bay.

The best POC-related poster was awarded to Satoshi Osafune for “*Numerical study of bidecadal water mass variations in the subarctic North Pacific related to the 18.6-year tidal cycle*” and the best early career scientist presenter award was given to Xiaohui Tang for “*Influence of reducing weather noise on ENSO prediction*”.

### List of papers

#### *Oral presentations*

##### **Dake Chen and Tao Lian**

A theoretical framework for tropical Indo-Pacific climate variability

##### **Jürgen Alheit**

Impact of climate variability on northern hemisphere marine ecosystems: Regime shifts and teleconnection patterns

##### **Chan Joo Jang**

North Pacific mixed layer depth projections from IPCC AR4 models

##### **Howard J. Freeland and Denis Gilbert**

A new estimate of the steric contribution to global sea-level rise

##### **Enrique N. Curchitser, William Large, Kate Hedstrom and Jon Wolf**

Downscaling climate simulations in the North Pacific Ocean using a fully coupled multi-scale model

##### **Young Jae Ro**

Impact of the Indonesian Through Flow on the water characteristics in western Pacific marginal seas

##### **Fan Wang and Chuanyu Liu**

A warm tongue intrusion into the Yellow Sea in winter and its inter-annual variability

##### **Olga O. Trusenkova, Timofei Gulenko, Dmitry D. Kaplunenko and Vyacheslav B. Lobanov**

Large-scale patterns of the Japan/East Sea sea level and its dynamic forcings

**Dmitry D. Kaplunenko, Vyacheslav B. Lobanov and Olga O. Trusenkova**

Effects of variability 'separation' for the northern Japan/East Sea obtained from satellite data

**Hanna Na, Kwang-Yul Kim, Kyung-II Chang and Kuh Kim**

Relationship between the interannual variability of the Korea Strait Bottom Cold Water, upper water temperatures and surface heat fluxes in the East Sea

**John Calder and Jackie Grebmeier**

Synthesis of recent ocean data from the Pacific sector of the Arctic by the Pacific Arctic Group

**Victor Kuzin, Valentina Malakhova and Elena Golubeva**

Dissolved methane transport in the Arctic water: Observed data and simulation

**Eduard A. Spivak, Nina I. Savelieva and Anatoly N. Salyuk**

Summer hydrography of the southeastern part of the Laptev Sea – Results from the Pacific Oceanological Institute expedition in September 2006

**Humio Mitsudera, Keisuke Uchimoto and Tomohiro Nakamura**

Mechanisms of the cold water belt formation off the Soya Warm Current

**Jinhee Yoon, Sang-Wook Yeh, Young Ho Kim and Jong-Seoung Kug**

The characteristic response of the Kuroshio Extension region to a warm pool El Niño

**Michael Foreman, Piotr Czajko and Dario Stucchi**

Simulating spring–neap salinity variations in Knight Inlet, Canada

**Anastasiya A. Abrosimova and Igor A. Zhabin**

Interaction of sea and river waters in the estuary of the Amur River

**Hitoshi Kaneko, Ichiro Yasuda and Sachihiko Itoh**

Direct measurement of turbulence mixing along a meridional transect in the western North Pacific

**Elena A. Vilyanskaya, G.V. Shevchenko, O. Kusaylo and A. Kato**

Water temperature changes in the nearshore zone of Aniva Bay from mooring observations

#### *Posters*

**Svetlana P. Shkorba**

Research on the influence of the thermal regime of water on ice cover in the Japan Sea

**Nadezda M. Vakulskaya**

Analysis of spatio-temporal distribution typizations of ice areas and ice volumes according to ice thicknesses in the Bering Sea

**Ekaterina Potalova**

Estimation of wind stress curl on Far-Eastern seas from tropical cyclone movements

**Valentina V. Moroz**

The thermohaline structure and temperature anomaly dynamics in the Kuril Islands area

**Talgat R. Kilmatov and Elena Dmitrieva**

The climatic trend of non-homogeneous SSTs in the northern Pacific Ocean and stability of the Kuroshio Extension jet

**Yury I. Zuenko**

One-dimensional model of water productivity changes because of convective regime reconstruction

**Elena Dmitrieva, Vladimir Ponomarev and Nina I. Savelieva**

Classification of the meteorological–hydrological time series of the Asian-Pacific region using cluster analysis

**Galina A. Vlasova, Svetlana U. Glebova and Gleb S. Vlasov**

Seasonal variability of the water circulation in the Sea of Okhotsk under the influence of synoptic processes in 2003–2004

**Galina A. Vlasova, Bui Hong Long, Antonina M. Polyakova, Nguyen Ba Xuan, Gennady I. Yurasov and Le Dinh Mau**

Preliminary results of the seasonal variability of water circulation in the South China Sea under the influence of the synoptic processes

**Antonina M. Polyakova**

Destructive tsunamis near the coast of Primorye

**Antonina M. Polyakova**

Atmospheric circulation over the South China Sea

**Gennady I. Yurasov**

Upwelling and its influence on ice conditions in Peter the Great Bay

**Vladimir B. Darnitskiy and Maxim A. Ishchenko**

On the differentiation of thermohaline processes in the Sea of Japan to the south of the Subarctic Front: Part I

**Vladimir B. Darnitskiy and Maxim A. Ishchenko**

On the differentiation of thermohaline processes in the Sea of Japan to the south of the Subarctic Front: Part II

## Session Summaries -2009

### **Cai Yi, Zhanggui Wang and Licheng Feng**

The Numerical Simulation of the effects of global warming on ocean ecosystems in Bohai Sea

### **Boris S. Dyakov**

Large-scale fluctuations in the salinity of the Tsushima Current in the second half of the 20th century

### **Fedor Khrapchenkov and Nadezda Dulova**

Influence of eddies and tides on the vertical structure of acoustic speed field on the east coast of Kamchatka and the Kuriles

### **Fedor Khrapchenkov**

Dynamics of the runoff lenses of the Amur River in summer of 2005–2008

### **Liyang Wan, Hui Wang and Jiang Zhu**

A “Dressed” Ensemble Kalman Filter method using different seasonal ensembles in the Pacific

### **Kwang Young Jung and Young Jae Ro**

Stratification induced by Nam-Gang Dam water releases based on a numerical model in the Kangjin Bay, South Sea, Korea

### **Vladimir B. Darnitskiy and Maxim A. Ishchenko**

Synoptic and long-term dynamics of water in the vicinity of the junction of Hawaii and the Imperial submarine ridges

### **Larissa A. Gavko**

Variability of water and air temperature in the coastal zone of the northwestern Sea of Japan

### **Valentina V. Moroz**

Thermohaline structure peculiarities in the South Kuril Straits zone

### **Vladimir Ponomarev, Vera Petrova and Elena Dmitrieva**

Changing climate and linkages of surface heat fluxes in the North Pacific

### **Vladimir B. Darnitskiy and Maxim A. Ishchenko**

Long-term thermohaline dynamics in the region of the northwestern Hawaiian Ridge Seamounts

### **Tatsuro Watanabe, Daisuke Simizu, Kou Nishiuchi, Toru Hasegawa and Osamu Katoh**

Surface current structure and its variability in the southwestern Japan Sea derived by satellite tracked surface drifters

### **Satoshi Osafune and Ichiro Yasuda**

Numerical study of bidecadal water mass variations in the subarctic North Pacific related to the 18.6-year tidal cycle

### **Hironori Higashi, Hiroshi Koshikawa, Kunio Kohata, Shogo Murakami and Motoyuki Mizuochi**

Relationship between water quality trend and climate change in Ise Bay, Japan

### **Takeshi Matsuno, Takahiro Endoh, Eisuke Tsutsumi, Ken-ichi Fukudome, Joji Ishizaka, Hisashi Yamaguchi, Sarat Tripathy, In-Seong Han, Jae-Hak Lee, Sang-Tae Jang and Sang-Hyun Kim**

Vertical transport of subsurface nutrients in the East China Sea shelf for primary production

### **Oleg A. Bukin, Alexey V. Bulanov, Alexey A. Ilin, Sergey S. Golik and Ekaterina B. Sokolova**

Femtosecond laser-induced breakdown spectroscopy for the detection of marine water and elemental composition of phytoplankton cells

### **Joon-Soo Lee, Hye-Hyun Lee, Won Duk Yoon, Joon-Yong Yang, and Sang Ok Chung**

Analysis of the long-term temporal variations in the Yellow Sea using the cluster method

### **Vladimir V. Plotnikov**

Estimation of ice cover conditions in the Japan Sea

### **Hui-wang Gao, Gu Ming, Ren-lei Wang and Yu-huan Xue**

Characteristics of atmospheric turbulence of the marine-atmospheric boundary layer over the north Yellow Sea

## **BIO Workshop (W1)**

### ***Natural supplies of iron to the North Pacific and linkages between iron supply and ecosystem responses***

Co-sponsored by SOLAS

Co-Convenors: Fei Chai (U.S.A.), William R. Crawford (Canada) and Shigenobu Takeda (Japan)

### **Background**

In the subarctic North Pacific Ocean, iron plays a central role in regulating phytoplankton productivity and pelagic ecosystem structure. There are several processes that supply iron from land, shelf sediment and deep waters to pelagic ecosystem. The goal of this workshop was to examine the relative importance of these iron

supply processes that includes atmospheric deposition of mineral aerosols and combustion substances, lateral transport of coastal iron-enriched waters by eddies and boundary currents, and deep vertical mixing during winter or by strong tidal current at narrow strait. Such knowledge will be used to identify key biogeochemical pathway that should be introduced into the ecosystem models and to plan international scientific programs for better understandings of marine ecosystem responses to changing iron supplies in the North Pacific.

### Summary of Presentations

The workshop, sponsored by the BIO Committee, was the first workshop organized by the Working Group on *Iron Supply and its Impact on Biogeochemistry and Ecosystems in the North Pacific Ocean* (WG 22). The 1-day workshop was held on October 25, and consisted of two parts. The first part included a total of 9 oral presentations and one poster, and it lasted from 9:00 to 15:30 h. The second part was WG 22's first business meeting, which was conducted from 16:00 to 18:00 h. The workshop had more than 30 participants representing all PICES member countries. Six talks in the morning focused on the field studies that related to iron sources, distribution, and iron impacts on phytoplankton dynamics in both the eastern and western subarctic Pacific. Three modeling presentations summarized the latest development of iron and biogeochemical modeling at regional and global scales.

Discussion following these talks focused on the gaps and issues related to experimental and modeling activities on iron biogeochemistry and its impact on ecosystem structures and carbon cycle. Here are some highlights of our discussion: 1) atmospheric dust input and Fe solubility associated with different types of dusts, including volcanic Fe input; 2) the role of eddies and coastal currents in transporting Fe, and sedimentary sources of different forms of Fe; 3) both dissolved Fe and leachable particulate Fe are important, residence time of particulate Fe; 4) improving model parameterizations of iron supplies from various sources, treatment of Fe removal and recycling in models; 5) physiological response of phytoplankton groups to Fe, and community structure changes to Fe supplies. Most of presenters had submitted an extended abstract before the workshop, so their key findings and recommendations on iron biogeochemistry research will be summarized in the WG 22 final scientific report.

### List of papers

#### *Oral presentations*

**Kenneth W. Bruland** (Invited)

Reactive iron in the subarctic North Pacific; natural iron enrichments

**Jun Nishioka, Tsuneo Ono, Hiroaki Saito, Takeshi Nakatsuka, Shigenobu Takeda, Wm. K. Johnson and C.S. Wong**

Comparison of iron distribution between the western and the eastern subarctic Pacific

**Eric Roy, Mark Wells and Fei Chai**

The role of Haida eddies in iron transport to the eastern subarctic Pacific Ocean

**Hiroaki Saito, Kazutaka Takahashi, Yoshiko Kondo, Jun Nishioka, Tomonori Isada, Akira Kuwata, Miwa Nakamachi, Yuji Okazaki, Yugo Shimizu and Koji Suzuki**

Factors controlling the spatial variability of spring bloom dynamics in the Oyashio Region

**Roberta C. Hamme, Sonia Batten, William Crawford, Kathleen Dohan, Steven Emerson, Karina Giesbrecht, Jim Gower, Maria Kavanaugh, Deirdre Lockwood, Christopher L. Sabine and Frank Whitney**

Natural volcanic iron fertilization of the Subarctic North Pacific

**Ai Hattori-Saito, Tomonori Isada, Natsuko Komazaki, Hiroshi Hattori, Kenshi Kuma, R. Michael L. McKay, Tsutomu Ikeda and Koji Suzuki**

Fe nutrition in micro-sized diatoms in the Oyashio region of the NW subarctic Pacific during spring

**Keisuke Uchimoto, Tomohiro Nakamura, Jun Nishioka, Humio Mitsudera, Michiyo Yamamoto-Kawai, Kazuhiro Misumi and Daisuke Tsumune**

A simulation of chlorofluorocarbons in the Sea of Okhotsk

**Kazuhiro Misumi, Daisuke Tsumune, Yoshikatsu Yoshida, Takeshi Yoshimura, Keisuke Uchimoto, Tomohiro Nakamura, Jun Nishioka, Humio Mitsudera, Frank O. Bryan, Keith Lindsay, J. Keith Moore and Scott C. Doney**

Numerical simulation of iron export from the Sea of Okhotsk to the North Pacific

## Session Summaries -2009

**Yasuhiro Yamanaka, S. Lan Smith, Hiroshi Sumata, Naoki Yoshie, Taketo Hashioka, Takeshi Okunishi, Masahiko Shigemitsu, Maki N. Noguchi and Naosuke Okada (Invited)**

New NEMURO-based model incorporating the iron cycle

**Stephanie Dutkiewicz, Fanny Monteiro and Mick Follows (Invited)**

Interplay between ecosystem structures and iron availability in a global marine ecosystem model

### *Poster*

**Youngju Lee and Joong Ki Choi**

Effect of Asian dust on the picophytoplankton growth rate and cell cycle

## **BIO Workshop (W2)**

***Standardizing methods for estimating jellyfish concentration and development of an international monitoring network***

Co-Convenors: Hideki Akiyama (Japan), Richard Brodeur (U.S.A.) and Young-Shil Kang (Korea)

### Background

Large high-density jellyfish blooms are becoming increasingly common in many marginal seas in the North Pacific and in other regions of the world's oceans, and may be important regulators of marine ecosystems. These blooms may have direct effects on fish recruitment through predation on vulnerable early life stages of marine fishes, or indirect effects competing for limited food resources with exploited species. In addition, high concentrations of jellyfish influence humans in other ways like economic losses in tourism through beach closures, impeding commercial fishing through net clogging, and loss of energy production through clogging of power plant intakes. If jellyfish populations continue to increase in the coming decades, their impacts on human populations are also likely to increase. However, our understanding of these blooms is hindered by a lack of standardization in sampling and insufficient monitoring. The goals of this workshop were to 1) understand the problems and develop techniques for estimating concentrations of jellyfish, 2) evaluate the status of national monitoring systems, 3) emphasize why standard methods and international monitoring are needed, and 4) develop an implementation plan and schedule for improving abundance and distribution information on jellyfish blooms.

### Summary of presentations

The session consisted of 1 invited and 9 contributed oral presentations. The invited talk specifically focused on the advantages and deficiencies of the various methods that have been used to estimate the abundance of gelatinous zooplankton in a number of systems around the world. These included using by-catch in fishery surveys, acoustics, aerial surveys, underwater cameras, shore-based surveys, ships of opportunity, and predictive modeling. For non-quantitative patterns of spatial and temporal abundance, these large-scale methods can effectively be used to monitor jellyfish populations but each has its own bias. To measure ecological effects we also need to: 1) calibrate large-scale methods against quantitative methods, 2) determine numbers and biomass, and 3) estimate trophic importance. Also discussed was how physiological parameters such as respiration rates can be used to measure trophic impacts of jellyfish populations.

Many of the contributed papers discussed particular case studies in different regions of the world, with a substantial emphasis on the giant jellyfish that has been appearing in East Asian waters in the last decade. Two contributed talks discussed acoustic methods (echo counting) and compared these estimates from other methods. Another talk focused on using regularly scheduled ferries between Japan and China to estimate jellyfish abundance visible from the deck. Three talks used video surveys to examine vertical and spatial distribution of smaller medusae off Japan and the west coast of the U.S. in comparison to trawl or sighting surveys. The latter also included using models to predict habitat and interannual catches of jellyfish. One talk used a sonar (DIDSON) system to examine the finer-scale distribution of jellyfish and provided density

estimates three times as high as net sampling. The last talk used numerical particle-tracking models to predict the arrival time of giant jellyfish to Japanese waters. Numerical circulation models were shown to be effective means of examining jellyfish dispersal in coastal waters but best results were obtained if vertical migration was incorporated into the models. It became apparent that many novel techniques have been applied and some effort has gone into the efficacy of the different systems for estimating jellyfish abundance.

The final part of the workshop focused specifically on the jellyfish problem confronting the Asian east marginal seas with the yearly occurrence of the giant jellyfish blooms. The scale of the problem requires a substantial dedication of resources that may be beyond the ability of one laboratory or even one country to provide and it was broadly accepted that an international effort, coordinated by PICES, should be implemented. One way to accomplish this may be to assemble an international team of experts familiar with different sampling methods to participate on a PICES cruise to intercalibrate these methods to choose the best standard sampling to implement in all regions. Ship time would have to be contributed by the affected countries, but PICES could assist in coordinating research and help to disseminate results by sponsoring followup workshops. In the following years, cruises using multiple sampling gears and methods could be conducted in other jellyfish bloom 'hotspots'. The participants felt strongly that monitoring efforts in place now, including using ships of opportunity, should be continued and expanded where possible, and information on the magnitude and movement of on-going blooms should be expeditiously disseminated to all countries that may potentially be affected.

#### List of papers

##### *Oral presentations*

**Jennifer E. Purcell** (Invited)

Broad-scale research on jellyfish

**Kazuhiro Sadayasu, Yoshimi Takao and Ryuichi Matsukura**

Echo trace counting method for estimating the giant jellyfish *Nemopilema nomurai* density and distribution using a quantitative echosounder

**Kyoung-Hoon Lee, Soo-Jeong Jang, Won Duk Yoon, Chang-Doo Park and Seong-Wook Park**

Density estimates of *Nemopilema nomurai* jellyfish in Yellow Sea during 2006-2009

**Hideki Ikeda, Hiroko Okawachi, Atsushi Yoshida, Miwa Hayashi and Shin-ichi Uye**

Spatio-temporal distribution of the giant jellyfish *Nemopilema nomurai* in East Asian waters by sighting survey from a ferry

**Haruto Ishii, Yasuyuki Nogata and Noriaki Endo**

Horizontal and vertical distribution of jellyfish, *Aurelia aurita* medusae, and estimation of its abundance with underwater video system in Tokyo Bay

**Richard D. Brodeur, Cynthia L. Suchman, Elizabeth A. Daly and Lanaya N. Fitzgerald**

Habitat and ecology of large medusa in the northern California Current: An overview of recent studies

**Naoki Fujii, Shinya Magome, Atsushi Kaneda and Hidetaka Takeoka**

Monitoring method for moon jellyfish abundance in the western Seto Inland Sea, Japan

**Hao-Hsien Chang, Chang-Yu Lai, and Wen-Tseng Lo**

A study on the ecological significance of the box jellyfish, *Carybdea rastonii* Haacke (Cnidaria: Cubozoa), from the east coast of Taiwan

**Chang-Hoon Han and Shin-ichi Uye**

Quantification of the abundance and distribution of the common jellyfish *Aurelia aurita* s.l. with a Dual-frequency IDentification SONar (DIDSON)

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

Jellyfish transport simulation taking the diurnal vertical migration into account

### BIO Workshop (W3)

#### *Integrating marine mammal populations and rates of prey consumption in models and forecasts of climate change-ecosystem change in the North Pacific and North Atlantic Oceans*

Co-sponsored by ICES

Co-Convenors: Hidehiro Kato (Japan), Begoña Santos (Spain/ICES) and William Sydeman (U.S.A.)

#### Background

Marine mammals are showing considerable changes in abundance. In general, cetaceans, recovering from historical exploitation, are increasing, whereas some pinniped species are declining regionally while others are increasing. Models of marine mammal prey consumption indicate that ~20–60% of secondary production may be taken by these top consumers. Mammals may exert top-down control on food webs, as well as function as competitors to fish, seabirds, and humans for mid-trophic level food resources. One of the goals of PICES and ICES science is to enhance forecasts of ecosystem change attributable to climate and anthropogenic forcings. Given this goal, the workshop reviewed and assessed rates of marine mammal population and prey consumption changes in the North Pacific and North Atlantic. Discussion focused on how to best integrate this information into models of ecosystem dynamics, with and without climate change and fishing impacts.

#### Summary of presentations

A total of 9 oral presentations and 10 poster presentations were made covering diverse topics from marine mammal population trends to diet and estimates of prey consumption to models of trophic impact in disparate ecosystems. A total of 50 participants from all disciplines represented (physical and biological oceanographers, modelers, marine bird and mammal specialists). A number of challenges are currently limiting the accuracy and utility of models of marine mammal prey consumption and ecosystem impacts. These include variation in life histories, foraging distribution, physiology, regional variation in population trends, macro-scale movements between ecosystems, stock and genetic structure, and variability in prey quality and characteristics such as size. These variables and others will be to be incorporated into ecosystem models of trophic impact. Understanding climate impacts on marine ecosystems is made more difficult by the partial recovery of marine mammals from prior over-exploitation and their trophic interactions. It is therefore, of importance to further develop methods and models to estimate ecosystem change brought about by new fluctuations in marine mammal populations.

#### List of papers

##### *Oral presentations*

**Andrew W. Trites** (Invited)

Marine mammals in multi-species models: Assumptions, limitations and theoretical considerations

**Frank A. Parrish**

Top-down pressure of foraging monk seals on subphotic fish communities; a possible symptom of a marine mammal population at carrying capacity

**Rolf Ream and Lowell Fritz**

Pinniped population changes in the North Pacific: Recent trends in northern fur seal and Steller sea lion abundance

**M. Begoña Santos and Graham J. Pierce** (Invited)

Integrating marine mammal populations and rates of prey consumption in models and forecasts of climate change-ecosystem change in the North Atlantic Ocean

**Hiroshi Okamura, Hiroshi Nagashima, and Shiroh Yonezaki** (Invited)

Quantitative assessment of impacts on the sandlance population by consumption of minke whales

**Hiroto Murase, Tsutomu Tamura, Tatsuya Isoda, Ryosuke Okamoto, Hidehiro Kato, Shiroh Yonezaki, Hikaru Watanabe, Naoki Tojo, Ryuichi Matsukura, Kazushi Miyashita, Hiroshi Kiwada, Koji Matsuoka, Sigetoshi Nishiwaki, Denzo Inagake, Makoto Okazaki, Hiroshi Okamura, Yoshihiro Fujise and Shigeyuki Kawahara**

Prey preferences of common minke (*Balaenoptera acutorostrata*), Bryde's (*B. edeni*) and sei (*B. borealis*) whales in the western North Pacific



**Jarrold A. Santora, William J. Sydeman and Christian S. Reiss**

Of whales and krill: Investigating the patch dynamics between foraging whales and krill

**Valeriy I. Fadeev**

Benthos and food supply studies in feeding grounds of the Okhotsk-Korean gray whale population off the northeast coast of Sakhalin Island (Russia), 2004-2008

**Kyung-Jun Song, Zang Geun Kim, Seok-Gwan Choi, Yong-Rock An and Chang Ik Zhang**

Stomach contents of bycaught minke whales (*Balaenoptera acutorostrata*) in Korean waters

#### Posters

**Sergey I. Kiyashko, Svetlana A. Rodkina, Vladimir I. Kharlamenko and Valeriy I. Fadeev**

Macrobenthos trophic relationships in western grey whale feeding areas (northeast coast of Sakhalin Island, Okhotsk Sea)

**Natalia L. Demchenko and Valeriy I. Fadeev**

Quantitative distribution and species composition of amphipods from the feeding ground of western gray whales on the seashore near the Chayvo Bay (northeastern coast of Sakhalin Island, Okhotsk Sea)

**Kenji Konishi, Hiroshi Kiwada, Koji Matsuoka, Toshihide Kitakado, Takashi Hakamada and Tsutomu Tamura**

Modeling prediction of temporal and spatial distribution of Bryde's whales in the western North Pacific

**Elena Ieno, M. Begoña Santos, Alex Edridge, Paul M. Thompson and Graham J. Pierce**

Long-term variation in seal diet and relationships with fish abundance

**Hyun Woo Kim, Zang Geun Kim, Seok-Gwan Choi and Yong-Rock An**

Estimating the population size of Indo-Pacific bottlenose dolphins, *Tursiops aduncus*, in coastal waters off Jeju Island

**Ah-Ra Ko, Zang Geun Kim, Seok-Gwan Choi, Kyung-Hoon Shin and Se-Jong Ju**

Understanding the feeding ecology of minke whales, *Balaenoptera acutorostrata*, in Korean Seas using trophic lipid markers

**Kristen Ampela**

The diet of gray seals (*Halichoerus grypus*) in United States waters, estimated from hard remains and blubber fatty acids

**Hyun Woo Kim, Zang Geun Kim, Seok-Gwan Choi and Yong-Rock An**

First record of the Indo-Pacific bottlenose dolphins, *Tursiops aduncus*, in Korean waters, by means of skull morphometry and external morphology

**Kyum Joon Park, Seok-Gwan Choi, Yong-Rock An, Zang Geun Kim, Ji Eun Park, Hyun Woo Kim, Tae-Geon Park, Young Ran Lee and Dae-Yeon Moon**

Abundance estimation of minke whales (*Balaenoptera acutorostrata*) in the East Sea, using the sighting survey in 2009

**Valeriy A. Vladimirov, Sergey P. Starodimov, Alexey G. Afanasyev-Grigoryev and Vladimir V. Vertyankin**

Distribution and abundance of western gray whales off the northeast coast of Sakhalin Island, Russia, 2008

## BIO Workshop (W4)

### *Marine ecosystem model intercomparisons (II)*

Co-sponsored with ESSAS

Co-Convenors: Harold Batchelder (U.S.A.), Shin-ichi Ito (Japan) and Bernard Megrey (U.S.A.)

### 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 zooplankton functional groups. Models with high performance and broad generality will be priority candidates for examining the state of marine ecosystem's response to future global climate change. This workshop will be technical, "hands-on", and focus on beginning to parameterize, execute and calibrate various 1-D versions of biogeochemical lower trophic level (LTL) marine ecosystem models. Multiple ecosystem models will be configured to three Pacific Ocean "location testbeds". The 1-D physical forcing for each site will be fixed (*e.g.*, to enforce a common physical environment) so that differences observed among simulations at a single site are due only to differences in ecosystem models. The three testbeds will be selected based on the availability of data sets suitable for this exercise—data for multiple years, good seasonal coverage, and breadth of state variables spanning inorganic nutrients, chlorophyll (or preferably phytoplankton carbon or nitrogen), and zooplankton biomass measures are needed. We plan to apply LTL models to Oyashio locations

such as stations along Japan's A line, the middle shelf of the eastern Bering Sea (*i.e.*, at mooring M2), and a shelf station on the Newport line to represent the California Current upwelling system. The models will be used to identify mechanisms that are important controls on the level and variability of secondary production and to bound the levels of uncertainty in model predictions by calculating ensemble statistics. Comparisons of identical ecosystem model formulations (*e.g.*, not tuned to each specific location) at multiple locations will provide information on the spatial-temporal robustness of particular model structures and parameterizations.

### Summary of presentations

The MEMIP Working Group met for 2 days on October 24 and 25. Twenty-six participants attended the meeting. The first day consisted of invited presentations by Yvette Spitz (U.S.A.), Angelica Peña (Canada), and Nakoi Yoshi (Japan). Yasuhiro Yamanaka (Japan) presented an update on the goals and progress of the MAREMIP project, which is an ecosystem model intercomparison focusing on hindcasting phytoplankton as measured by the ocean color sensors SeaWiFS and MODIS. This goal seemed complementary (and not redundant or duplicative) of the planned MEMIP investigations. Presentations were also made on the physical and biological characteristics and availability of data for the three coastal test bed locations, the A-line off Hokkaido Island, Japan, the Seward or GAK line off of Alaska and the Newport line off the coast of Oregon.

Lengthy discussions took place with regard to procedures to conduct controlled execution of the ecological models at the 3 test bed locations and issues related to configuring the 2-dimensional ROMS model for each location. We also discussed what would be the goal of MEMIP, and concluded that an assessment and comparison of the generality (portability) of several state-of-the-art ecosystem models would constitute a significant contribution to the goals of FUTURE, and to marine pelagic ecology more generally.

There are several unique aspects of the MEMIP project. These include specifically looking at coastal regions of the North Pacific; using zooplankton abundance and distribution as the metric of model skill – providing a direct food-web link to upper trophic levels and using model investigations as a strong focus on evaluation of the ability of the various models to hindcast biomasses and distributions of zooplankton, in addition to nutrients and phytoplankton chlorophyll. The products of the comparison will contribute to estimation of the uncertainty and the limits of forecasting. In this meaning, MEMIP will contribute to FUTURE. A current version of the ROMS model code was retrieved from the ROMS distribution site and 6 marine ecosystem models of varying complexity were selected for the comparison. A list of tasks was prepared and 7 individuals agreed to take responsibility for the various identified tasks. A timeline was established for the completion of specific tasks and to maintain progress toward achieving the goal of MEMIP. Work will progress inter-sessionally. A proposal was prepared to hold a follow-up 2-day workshop immediately prior to the PICES-2010 meeting in Portland, U.S.A., which was submitted to the BIO Committee for their consideration.

### List of papers

#### *Oral presentations*

##### **Yvette H. Spitz** (Invited)

Considerations and challenges inherent to the intercomparison of pelagic ecosystem models

##### **Naoki Yoshie, Shin-ichi Ito, Kosei Komatsu, Takahiko Kameda, Tsuneo Ono, Kiyotaka Hidaka, Toru Hasegawa, Akira Kuwata, Miwa Nakamachi, Yuji Okazaki, Takeshi Okunishi, Kazuaki Tadokoro, Hiroaki Saito and Yasuhiro Yamanaka** (Invited)

Comparison of two marine ecosystem models NEMRUO and eNEMURO in the western North Pacific

##### **Angelica Peña** (Invited)

Comparing the responses of simple plankton ecosystem models to alternate formulations and increasing complexity

**FIS Workshop (W5)*****Understanding the links between fishing technology, bycatch, marine ecosystems and ecosystem-based management***

Co-Convenors: Heuni Chun An (Korea), Kaoru Fujita (Japan) and Craig Rose (U.S.A.)

Background

The methods and gears used to capture fish affect unintended mortalities (bycatch, discards and unobserved mortalities) and damage to other ecosystem components. Bycatch and discards significantly impede the sustainable use of living marine resources that are captured by commercial fisheries. To minimize unintended impacts on the environment, commercial fisheries should strive to improve selectivity to reduce the bycatch and discards of non-target species, as well as undersized commercial species. Research is exploring other effects of fishing gears on ecosystems such as habitat damage and ghost fishing of derelict fishing gear, and developing new technologies to minimize such unintended impacts. This workshop focused on the linkages between fishing technologies, ecosystems and ecosystem based management, as well as on recent technologies to reduce unintended effects of fishing. Particular emphasis was placed on studies that have changed commercial fishing practices.

Summary of presentations

The workshop met on Friday, October 23 and received 7 oral presentations and one poster presentation. One scheduled presentation (Maria Rebecca Campos) was not given. The initial presentation, from the invited speaker (Tatsuro Matsuoka) provided an extensive orientation to the issues of unwanted mortality of aquatic organisms resulting from fishing operations, including bycatch and discard research and the study of derelict gear and ghost fishing mortality. It also proposed a model for estimating mortalities from ghost fishing of derelict gear.

As a workshop on the interaction of fishing and marine ecosystems, the remaining presentations divided into two broad categories: how fishing affects ecosystems, particularly finding ways to reduce those effects, and how ecosystem states affect fishing. The later category included a presentation (Jong-Hun Na) of the variation of shrimp trawl catches due to seasonal and tidal effects and consideration of this information in risk analyses. Environmental effects were shown to affect the inter-annual and spatial variability of albacore catches in the American Samoa EEZ through oceanographic influences on forage density (Réka Domokos). Finally, in the environment effects fishing group, a poster (Ji Hyun Lee) examined how benthic different communities developed on artificial reefs placed to aggregate fish.

Four presentations demonstrated that fishing technology and methods can be altered to reduce fishing's unintended effects on ecosystem components. A review of three studies (Craig Rose) described trawl modifications to reduce salmon bycatch in pollock fisheries, changes to herding devices for flatfish trawls to reduce damage to sessile epifauna and estimation of mortality rates for crabs that encounter trawls but are not captured (unaccounted mortality). Mesh size and mouth openings of conger eel traps were shown (Seong Hun Kim) to determine selectivity and catch rates for these devices and studies responding to harvester feedback identified specifications that both reduced bycatch and allowed effective harvest. The importance of the interaction of fish behavior and fishing gear characteristics was highlighted in a study (Yonghae Kim) of the effect of twine visibility in codends on whether fish escape through available openings. High contrast twines inhibited escape because the fish saw and oriented to the netting; a difference that disappeared at light levels too low for effective vision. The importance in the adoption of new gears of balancing bycatch reduction while retaining effective capture of wanted fish was highlighted in a presentation (Kaoru Fujita) describing a trawl using multiple devices to separate components of a multi-species fishery and a high-opening trawl to selectively harvest off-bottom species.

## Session Summaries -2009

The variety of studies and methods in this workshop demonstrated that, while the application of methods and designs must be specific to any study, the field would benefit from better communication of such tools within the region. The workshop agreed with the recommendation of the 2007 survey standardization workshop that the FIS Committee should consider options for continuing communication on fishing gear research. Fishing technology research can improve understanding across many critical fields, including bycatch reduction, discard assessments, survey standardization, reduction of habitat effects, understanding of the relationships of catch and effort, and energy savings. Wider representation and participation should be sought in developing proposals for further PICES activities in this area.

### List of papers

#### *Oral presentations*

##### **Tatsuro Matsuoka** (Invited)

Negative impacts in capture fisheries: Bycatch, discards, derelict fishing gear, and ghost fishing

##### **Craig S. Rose**

Fishing gear technology to reduce bycatch and other ecosystem effects of Alaska trawl fisheries: Cooperative research with the fishing industry

##### **Jong-Hun Na, Chul-Woong Oh and Sung-Tae Kim**

Variations in species composition, biomass, and density in shrimp trawl bycatch across seasons and tidal phases in southern Korean waters: Developing a fisheries risk management approach

##### **Heui Chun An, Bong Jin Cha, Seong Hun Kim, Chang-Doo Park, Kyoung-Hoon Lee, Seong-Wook Park and Jong Keun Shin**

Modification of white-spotted conger eel *Conger myriaster* net trap for reducing bycatch of nontarget species

##### **Réka Domokos**

Environmental effects on forage and longline fishery performance for albacore (*Thunnus alalunga*) in the American Samoa Exclusive Economic Zone

##### **Yonghae Kim and Daesung Whang**

The effect of netting twine contrast on escape of juvenile sea bream in model trawl cod-ends

##### **Kaoru Fujita, Yoshiki Matsushita and Seizo Hasegawa**

Development of bycatch reduction trawl nets to have benefits for fishermen

#### *Poster*

##### **Ji Hyun Lee, Wan Ki Kim, M. Sidharthan, Sang Mok Jung, Hyun Woung Shin and Chae Sung Lee**

Comparison of benthic assemblages and associated fish communities on two artificial reef types deployed along the Pohang coast, South Korea

## **MEQ Workshop and a Laboratory Demonstration (W6)**

### ***Review of selected harmful algae in the PICES Region: V. Cyst forming HAB species and HAB-S Meeting***

Co-Convenors: Changkyu Lee (Korea) and Charles Trick (Canada)

### Background

Analogous to the seeds of terrestrial plants, phytoplankton cysts are the hardy resting forms that allow phytoplankton (usually flagellates) to survive during extreme environmental conditions. These cysts fall out of the water column into sediments often after large blooms, thereby forming seed beds. Characterization of the distribution of seed beds in coastal waters can assist with forecasting the intensity of HAB events. However, proper identification is often difficult as many cysts can look alike. This workshop focused on new methods for identification of cysts as well as findings on their ecology and physiology. Presentations were encouraged on known distributions of cysts in coastal waters (cyst mapping), and studies on their ecophysiology.

List of papers

*Oral presentations*

**Kazumi Matsuoka** (Invited)

Modern dinoflagellate cyst study

**Ruixiang Li, Jun Pan, Yan Li and Ping Sun**

Distribution of dinoflagellate cysts in surface sediments in the Yellow Sea in autumn

**Tatiana V. Morozova and Tatiana Yu. Orlova**

Resting stages of HAB species in recent marine sediments from Peter the Great Bay, Sea of Japan (East Sea)

**Hyeon Ho Shin, Yang Ho Yoon and Kazumi Matsuoka**

Dinoflagellate cyst assemblages as an indicator of changed nutrient levels in Korean and Japanese coastal areas

**Donald M. Anderson, B.A. Keafer, K. Norton, D.J. McGillicuddy, R. He, C.H. Pilskaln, D. Couture and J. Martin**

Toxic blooms of *Alexandrium fundyense* in the Gulf of Maine: The role of cysts in population dynamics and long-term patterns of shellfish toxicity

**Ichiro Imai, Shigeru Itakura and Mineo Yamaguchi**

Cyst dynamics and occurrences of red tides of *Heterosigma akashiwo* and *Chattonella* spp. in temperate coastal waters

**Ken-ichiro Ishii, Mitsunori Iwataki, Kazumi Matsuoka and Ichiro Imai**

Species identification of resting spores of *Chaetoceros* (Bacillariophyceae)

**Vera Trainer and Hak-Gyoon Kim**

Welcome, goals of HAB Section meeting

**Country Reports (2008-09) and HAE-DAT (year 2004) reports**

**Korea (Yangsoon Kang)**

**Japan (Shigeru Itakura)**

**China (Jinhui Wang)**

**Canada (Charles Trick)**

**U.S.A. (Vera L. Trainer)**

**Tatiana Yu. Orlova**

Current situation and perspective for HABs monitoring on the Russian Pacific coast

**Mingyuan Zhu and Zongling Wang**

The study on the occurrence of green tide in Yellow Sea in 2009

**Donald Anderson**

Report on ICES HAB working group and potential areas of collaboration

Discussion of future workshops, special sessions, special PICES report on HAB species

**Takafumi Yoshida**

Integrated harmful algal bloom website demonstration

**Monica Lion**

The joint Harmful Algal Bloom Programme and International Oceanographic Data and Information Exchange Harmful Algae Information System: An update

**Vera L. Trainer**

PICES Seafood Safety Project

**William P. Cochlan**

Report on GEOHAB Open Science Meeting on HABs and Eutrophication

**John K. Keesing, Dongyan Liu, Qianguo Xing, Ping Shi and Peter Fearn**

Recurrent large scale macroalgal blooms in the Yellow Sea

**MEQ/FIS Workshop (W7)**

***Interactions between aquaculture and marine eco-systems***

Co-Convenors: Katsuyuki Abo (Japan), Kevin Amos (U.S.A.), Galina Gavrilova (Russia) and Hyun Jeong Lim (Korea)

Background

Open-water marine aquaculture has ongoing interactions with its surrounding environment. Some of these interactions have the potential to cause negative and positive effects on the other. For example, pathogens may be transmitted from wild reservoirs to cultured animals and *vice versa*, with the consequence of disease and mortality. Another example is the dispersal of nutrients from a farm site which in some instances negatively impacts the benthos while in other areas may enhance a nutrient-deficient marine zone or contribute to the culture of another aquatic species. Also, changing marine environments, including those impacted by global warming and ocean acidification, have the potential to affect these ecosystem interactions so as to investigate the culture of new farmed species - species that may perform better in altered environments. The PICES Working Group on *Environmental Interactions of Marine Aquaculture* (WG-EIMA; WG 24) has been charged with evaluating existing and potentially new interactions and to develop models that assess the risk of these interactions to include escapes of farmed marine animals (considerations for genetics, competition, and pathogen transfer), discharge of effluent from culture facilities, use of non-native species in culture, and the exchange of pathogens between farmed and wild aquatic animals. Major goals of this workshop included: 1) discussion of tools and models currently used by member countries to assess types of interactions and risks posed by them; 2) developing consensus on aquaculture technologies and indicators of interactions that will be used in completing the terms of reference and preparing the final report of WG-EIMA to include species and methods of culture; and 3) identifying the process by which the work will be carried out under the terms of reference.

List of papers

*Oral presentations*

**Dario Stucchi, Michael Foreman, Ming Guo and Piotr Czajko (Invited)**

A coupled biophysical sea lice model for the Broughton Archipelago

**Tamiji Yamamoto, Hajime Maeda, Osamu Matsuda and Toshiya Hashimoto (Invited)**

Effects of culture density on the growth and fecal production of oyster *Crassostrea gigas*

**Xuelei Zhang**

Challenges and opportunities of environmental issues faced by coastal aquaculture in China

**Galina S. Gavrilova**

Some ecological aspects of invertebrate mariculture in semi-closed bights

**Jill B. Rolland and Lori L. Gustafson**

A model to exclude endemic pathogens from semi-open or open aquaculture facilities: Utilizing compartmentalization to promote epidemiologic separation in shellfish hatcheries

**Lori L. Gustafson and Jill B. Rolland**

Marine reservoirs for infectious salmon anemia virus in pen-reared Atlantic salmon: Do they play a role in the U.S.?

**Kevin H. Amos**

A review of infective doses of viral and bacterial pathogens for modeling interactions between marine pen-reared salmon and wild cohorts

**J.E. Jack Rensel, Dale A. Kiefer and Frank O'Brien (Invited)**

Aquaculture modeling using a GIS-integrated simulation model

**Katsuyuki Abo and Toshinori Takashi**

Assessing nutrient environments of Nori (*Porphyra*) aquaculture area by using numerical model

**Brett R. Dumbauld and Jennifer L. Ruesink**

Evaluating the effects of bivalve shellfish aquaculture and its ecological role in the estuarine environment in the United States

**Edward A. Black**

Aquaculture risk assessments and ecosystem-based management

**Motoyuki Hara and Toyomitsu Horii**

Evaluation of the impacts of seedlings on abalone reproduction by genetic approach

**Qtae Jo, Su-Kyoung Kim, Chae Sung Lee, Jin Yeong Kim and Victor D. Dzizyurov**

Production of healthier *Patinopecten yessoensis* seeds for aquaculture on the Korean and Russian coasts of the East Sea

*Posters*

**Larissa A. Gavko**

The long-term physical-statistical method for the forecast of mollusks' yield at marine farms in Primorye (Sea of Japan)

**Larissa A. Gavko**

Interrelation between hydrometeorological and biological parameters of marine farms in Primorye (Sea of Japan)

**Arthur A. Kos'vanenko**

The distribution of commercially important species of sea squirts (Ascidians) in Alekseeva Bay of Peter the Great Bay

**Liping Jiao, Gene J. Zheng, Tu Binh Minh, Liqi Chen and Paul K.S. Lam**

Persistent toxic substances in remote lake and coastal sediments from Svalbard, Norwegian Arctic: Levels, sources and fluxes

**Valeria E. Terekhova**

Effect of the prophylactic antibacterial treatment on the intestinal microflora of cultivated sea cucumber, *Apostichopus japonicus*

**Gary H. Wikfors**

Flow-cytometric applications for bivalve hemocytes: Tools for assessing mollusc/ecosystem interactions

**April N. Croxton, Gary H. Wikfors and Richard D. Gragg, III**

An evaluation of hemocyte profiles from oyster populations located in two Florida bays

**POC Workshop (W8)**

***Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales***

Co-sponsored by CLIVAR

Co-Convenors: Emanuele Di Lorenzo (U.S.A.) and Shoshiro Minobe (Japan)

Background

Understanding the dynamics that control climate variability in the Pacific basin is essential for exploring the degree of predictability of the ocean-atmosphere and sea-ice climate systems of the North Pacific. The goal of this workshop was to improve the conceptual and quantitative frameworks used by the PICES community to interpret low-frequency climate variability in the Pacific basin, ranging from interannual to multi-decadal timescales. Contributions were invited on a broad range of topics including: (1) studies that link regional to basin scale dynamics; (2) investigations of "regime shift", specifically the extent to which sharp transitions in the climate system are predictable and connected with low-frequency variations in the ocean-atmosphere and sea-ice systems; (3) studies that separate the stochastic and deterministic components of low-frequency climate fluctuations; (4) analysis of long-term observations collected in regional environments across the Pacific, specifically their relationship to large-scale climate processes as opposed to local-scale dynamics; (5) climate change and how it may impact the statistics of Pacific climate (*e.g.*, frequency of "regime shifts"); and (6) more generally studies that propose new mechanisms underlying low-frequency Pacific climate variability.

List of papers

*Oral presentations*

***Topic 1: Pacific Large-scale dynamics and variability***

**Sumant Nigam and Bin Guan** (Invited)

Ocean-atmosphere structure of Pacific decadal variability

**Curtis Deutsch and Taka Ito** (Invited)

Oxygen variability in the North Pacific

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**Sang-Wook Yeh, Yune-Jung Kang, Yign Noh and Arthur J. Miller**

Characteristics in the North Pacific mean SST and its variability in climate transition periods

**Skip McKinnell and Nate Mantua**

Regimelettes – PDO variability in the 21st Century

**Muyin Wang, James E. Overland and Nicholas A. Bond**

A means for reducing projection uncertainty of climate models on regional scale

### *Topic 2: Tropical / Extratropical connections*

**Lixin Wu** (Invited)

A unified teleconnection mechanism between extratropical and tropical oceans

**Michael Alexander, Daniel J. Vimont, Ping Chang and James Scott** (Invited)

The impact of extratropical atmospheric variability on the tropical Pacific: Testing the seasonal footprinting mechanism

**Daniel J. Vimont** (Invited)

The role of thermodynamic coupling in connecting subtropical and tropical Pacific climate variations

**Xiaohui Tang, Ping Chang and Fan Wang**

Influence of reducing weather noise on ENSO prediction

### *Topic 3: Western North Pacific dynamics and variability*

**Bo Qiu, Shuiming Chen and Niklas Schneider** (Invited)

Forced versus intrinsic variability of the Kuroshio Extension system on the decadal timescales

**Shoshiro Minobe, Jiaxu Zhang and Miho Urasawa**

Kuroshio Extension variability during the last 50-years and its predictability

**Rong-shuo Cai, Qi-long Zhang and Hong-jian Tan**

The long-term transport variation of Kuroshio and its adjacent currents in the western North Pacific Ocean

**Masami Nonaka, Hisashi Nakamura, Bunmei Taguchi, Youichi Tanimoto and Hideharu Sasaki** (Invited)

Decadal variability in the oceanic frontal zones in the western North Pacific Ocean

**Elena I. Ustinova and Yury D. Sorokin**

Low-frequency fluctuations of thermal conditions in the Far-Eastern Seas and large-scale climate processes

**In-Seong Han, Young-Sang Suh, Jae-Dong Hwang and Joon-Soo Lee**

Long-term change of thermal structure in the surface layer due to wind-induced conditions around the Korean Peninsula

**Konstantin A. Rogachev and Natalia V. Shlyk**

Surface freshening and mid-depth warming in the Pacific Western Subarctic since 1950s

### *Topic 4: Air Sea interaction and coupled structures*

**Bunmei Taguchi, Hisashi Nakamura, Masami Nonaka, Nobumasa Komori, Akira Kuwano-Yoshida, Hideharu Sasaki, Koutarou Takaya and Shang-Ping Xie** (Invited)

Decadal variability of the Kuroshio/Oyashio Extension fronts and their atmospheric influences

**Niklas Schneider, Yoshinori Sasaki, Axel Lauer, Bo Qiu, Arthur J. Miller and Detlef Stammer**

Extratropical ocean to atmosphere coupling via atmospheric Ekman pumping

### *Topic 5: Discussion/Synthesis*

**Emanuele Di Lorenzo, Niklas Schneider, Kim M. Cobb, Jason Furtado and Michael Alexander**

ENSO and the North Pacific Gyre Oscillation: An integrated view of Pacific decadal dynamics

**Arthur J. Miller, Emanuele Di Lorenzo, Shoshiro Minobe and Niklas Schneider**

North Pacific decadal variability: Current understanding and unresolved issues

### *Posters*

**Rong-shuo Cai, Qi-long Zhang and Qing-hua Qi**

Spatial and temporal oscillation and long-term variation in sea surface temperature field of the South China Sea

**Yuri Nikonov**

Description of seasonal water circulation variability in Tatar Strait in the Japan Sea by numerical method

**Ling Ling Liu, Rui Xin Huang and Fan Wang**

The role of diurnal cycle and mixed layer depth perturbations in ventilation: Subduction and obduction

**Gennady V. Khen**

Variability of the Kamchatka Current transport in the Kamchatka Strait



**In-Seong Han, Takeshi Matsuno, Tomoharu Senjyu, Young-Sang Suh and Joon-Soo Lee**  
Behavior of low salinity water mass from Northern East China Sea to Korea Strait

### **POC/BIO Workshop (W9)**

#### *Mesoscale eddies and their roles in North Pacific ecosystems*

Co-Convenors: Kyung-Il Chang (Korea), William Crawford (Canada), Shin-ichi Ito (Japan) and Vlachoslav Lobanov (Russia)

#### Background

Mesoscale eddies move through the ocean carrying physical, biological, and chemical anomalies. They translate over space scales of hundreds to thousands of kilometers and exist for periods lasting from months to years. Eddies are found throughout the North Pacific Ocean in association with strong boundary currents like the Kuroshio and Oyashio and the Alaskan Stream, and also with North Pacific eastern boundary currents like the California and Alaska Currents. They are also prevalent in marginal seas. Generation and evolution of eddies are thought to be related to the shear instability of boundary currents like the Kuroshio, and topographic features in the California and Alaska Currents. Mesoscale eddies affect the structure of marine plankton in various ways. Horizontal advection and vertical mixing by eddies contribute to the generation of high chlorophyll concentration off the coast. They draw shelf water containing nutrients and planktons into the deep offshore waters. Mesoscale eddies are also important for survival of larvae. Eddy pumping also plays a role in episodic nutrient injections into the photic zone resulting in enhanced primary production inside the eddy for cyclonic eddies. For anticyclonic eddies, ageostrophic upwelling and divergent Ekman pumping due to winds over the eddies yield upwelling within the eddy. This workshop addressed: 1) dynamical characteristics of mesoscale eddies in different parts of PICES domain, focusing on their similarity and difference; 2) influences of eddies in constituting the dominant physical forcing on the ecosystems; and 3) expected future eddy activities and their possible impacts on North Pacific ecosystems.

#### Summary of presentations

The session started with a brief introduction of the session; the topic of mesoscale eddies is one of overarching problems which engaging physics to biology. About 50 persons attended and 16 presentations were made. An invited talk by Carol Ladd reviewed characteristics and impacts of eddies in the Gulf of Alaska, and 4 following talks (by William Crawford, Vincent Combes, Hiromichi Ueno and Sonia Batten) showed its details. There are three eddy formation areas in the Gulf of Alaska; Haida, Sitka, and Yakutat. In addition to these, eddies generated in the Alaskan Stream region were introduced by Hiromichi Ueno, giving a fourth generation region. All are anticyclonic. Eddy formation and propagation patterns change according to gyre strength and hence to atmospheric forcing. These eddies contribute to water exchanges between shelf (less nutrient and rich iron) and offshore (rich nutrient and less iron) regions. Offshore primary production depends on upwelling process made by eddies, including 1) spin down of anti-cyclonic eddy, 2) westward movement of anti-cyclonic eddies into regions of denser waters, and 3) eddy-wind interaction. Influences of these eddies on zooplankton production and fish larval transport were also shown. It was noted that impacts on biota depend on location, age and season of each eddy. The Gulf of Alaska eddies are labeled as “floaters” (refer to process 2 above) to distinguish them from westward-moving cyclonic eddies of the California Current that sink below less dense waters of the sub-tropical gyre.

Eddies in California Current were introduced by Emanuele Di Lorenzo and a clear relation between wind forcing and eddy activity was shown. Wind stress curl gradients control the strength of California Current and hence eddy activity. However, eddies have a 1- to 2-year life time and modulate the atmospheric forcing to low-frequency signals.

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Eddies in the western side of North Pacific were shown in 8 talks. Vyacheslav Lobanov presented anticyclonic eddies in the seas between Korea, Japan and Russia. The eddies in the west region and east region showed different characters and some eddies showed multi-structured cores, which suggests merging and splitting processes of eddies. Svetlana Ladychenko introduced anticyclonic eddies along the Primorye coast and Peter the Great Bay. Sang-shin Byun showed an impressive observation of the Ulleung eddies by a mooring system that captured near-inertial wave reflections in the upper thermocline layer, revealing a region of enhanced mixing near 350 m depth. Sergey Zakharkov described characteristics of eddies in the confluence zone between the cold Primorye and warm East Korean current. Sachihiko Ito showed three eddy propagation routes of mesoscale eddies in the Kuroshio-Oyashio Extension: Japan Trench, Subarctic Front, and Subarctic Boundary. Natalya Luk'vanova introduced anticyclonic eddies in the Soya Warm Current region and Xiaohua Zhu showed eddies in southeast of Okinawa Island and its baroclinic mechanism.

Shoshiro Minobe and Hiroshi Sumata showed global eddy activities. Shoshiro Minobe introduced two additional upwelling processes of anticyclonic eddies: 4) intensification of wind-eddy interaction by vertical momentum transfer induced by warm SST on anticyclonic eddies and 5) intensification of wind-eddy interaction by pressure adjustment on anticyclonic eddies. Hiroshi Sumata showed a state-of-art product of global eddy resolving ecosystem model. Additionally, eddies in the East India Coastal Current region were shown by Prescilla Kurien.

After these oral presentations, a group discussion focused on eddy mechanisms and their impact on ecosystems. It was noted that the PICES oceans and seas contain most of the types of eddies observed globally. Discussion focused on many aspects of eddies and their impacts: a) importance of eddies on global transport of carbon, b) impacts of eddy effects on global climate (up-scaling), c) importance of human dimension of eddies (*e.g.*, sea level rise), d) importance of development and encouragement of observations of eddies, e) continuous efforts to investigate mechanisms of nutrient supply by eddies, and f) close partnership with FUTURE's Advisory Panel on *Climate, Oceanographic Variability and Ecosystems* (COVE-AP) were encouraged.

### List of papers

#### *Oral presentations*

**Carol Ladd, Elizabeth Atwood, William Crawford, Phyllis Stabenog and Frank Whitney (Invited)**  
Eddies in the Gulf of Alaska

**William Crawford and Nick Bolingbroke**  
Cross-shelf exchange by mesoscale eddies in the northeast Pacific Ocean

**Vincent Combes, Emanuele Di Lorenzo and Enrique N. Curchitser**  
Interannual and decadal variations in eddy-induced cross-shelf transport in the Gulf of Alaska

**Hiromichi Ueno, William Crawford and Hiroji Onishi**  
Impact of Alaskan Stream eddies on chlorophyll distribution in the central subarctic North Pacific

**Sonia Batten, William J. Sydeman, Mike Henry, David Hyrenbach and Ken Morgan**  
Ship of opportunity observations of mesoscale eddies in the Gulf of Alaska

**Vyacheslav B. Lobanov**  
A census of anticyclonic eddies in the northern Japan/East Sea

**Svetlana Y. Ladychenko and Vyacheslav B. Lobanov**  
Mesoscale eddies near the Primorye coast in the northwestern Japan/East Sea

**Sang-Shin Byun, Jong Jin Park, Jae-Hun Park and Kyung-Il Chang**  
Observation of near-inertial waves in an anticyclonic mesoscale eddy in the southwestern East/Japan Sea

**Sergey P. Zakharkov, Tatyana N. Gordeychuk and Elena A. Shtraikhert**  
Variations of the production phytoplankton parameters of mesoscale anticyclonic eddy in the northwestern part of Sea of Japan

**Shoshiro Minobe, Kunihiko Aoki, Youichi Tanimoto, Yoshinori Sasaki and Yoshikazu Sasai (Invited)**  
Meridional eddy heat transport estimations using satellite data and eddy resolving OGCM

**Sachihiko Itoh and Ichiro Yasuda**  
Characteristics of mesoscale eddies in the Kuroshio-Oyashio Extension Region detected in the distribution of the sea surface height anomaly

**Hiroshi Sumata, Taketo Hashioka, Maki N. Aita, Naoki Yoshie, Tatsuo Suzuki, Takashi T. Sakamoto, Naosuke Okada and Yasuhiro Yamanaka**

Effects of eddy transport on the nutrient supply into the euphotic zone simulated in an ocean ecosystem model

**Xiao-Hua Zhu, Jea-Hun Park and Daji Huang**

Observation and dynamics of baroclinic eddies southeast of Okinawa Island

**Jianping Gan and Anson Cheung**

Vertically varying cyclonic eddy in the southwestern South China Sea

**Prescilla Kurien, Motoyoshi Ikeda and Vinu K. Valsala**

Mesoscale variability along the east coast of India in spring and fall revealed in satellite data and OGCM

**Natalya B. Luk'yanova and Igor A. Zhabin**

The interaction of Soya Warm Current waters with the anticyclonic eddies in the southern Sea of Okhotsk

## **POC/BIO Workshop (W10)**

### ***Carbon data synthesis workshop***

Co-Convenors: Masao Ishii (Japan) and Robert Key (U.S.A.)

#### Background

This workshop was a major step forward in the implementation of the North Pacific carbon data synthesis. Investigators who submitted data to the synthesis collectively reviewed the progress of the QA/QC process, and discussed the degree of success of the techniques applied and whether different or additional approaches were necessary. This was a highly 'hands-on' activity that involved data originators who submitted data to the synthesis and investigators participating in the synthesis processes, and which will lead directly to value-added data products and collective publications.

#### Summary of presentations

After the introduction of the goals and the agenda of this workshop by Masao Ishii and some discussions about what we will do in this workshop by participants, the following topics regarding our activity for Pacific data synthesis were presented.

#### *Related activities*

Robert Key talked about CARINA and some early scientific products from it. CARINA is the carbon database in the water columns in the Arctic, Atlantic and the Southern Ocean which was initiated by L. Mintrop and D. Wallace and developed as one of the activities of the EU-integrated project CARBOOCEAN. It was recently finalized and many papers describing how they conducted a 2nd-level quality control (QC) have been submitted to the journal *Earth System Science Data* and are now under review. We will synthesize the Pacific carbon data in a manner consistent with CARINA.

Michio Aoyama introduced activities toward preparing reference materials for nutrients in seawater (RMNS) and establishing the "International Nutrient Scale System". He also discussed their global nutrient data synthesis based on RMNS.

#### *Datasets*

- Toru Suzuki gave an overview of the datasets collected so far for our synthesis. He has collected data from 193 cruises including 30 WOCE cruises with 7545 stations since 1991. Data formats have been transformed into the "WOCE exchange format". Cruise information has been tabulated on the website <http://cc-s.pices.jp/table>.
- Akihiko Murata introduced JAMSTEC activities on their Repeat Hydrography/CO<sub>2</sub> and datasets they have provided. All their datasets have already been stored in MIRC.

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- Chris Sabine introduced the activities of US CLIVAR Repeat Hydrography/CO<sub>2</sub> and datasets they have provided. All datasets have already been stored in CDIAC.
- Masahide Wakita introduced the data from repeat-lines on 155°E and the time-series stations KNOT and K2 in the western subarctic gyre that have been occupied by Hokkaido University and JAMSTEC Mutsu Institute of Oceanography. All these datasets have been submitted to MIRC.
- Jim Christian talked about the data from Line-P in the eastern subarctic gyre. The data have been submitted to CDIAC; some revisions will be made to the first QC following discussion among the group.
- Tsuneo Ono talked about the data from the repeat line “A-line” in the Oyashio region. This dataset has been submitted to MIRC.
- Masao Ishii talked about data sets from the Japan Meteorological Agency’s repeat lines along 137°E and 165°E. The datasets have been submitted to MIRC but there are outstanding questions about the CFC data that are to be fixed soon. He also talked about the data set of the Meteorological Research Institute–JAMSTEC collaborative studies in the western equatorial Pacific.
- Ken’ichi Sasaki stood for the CFCs group in the Pacific and introduced the data and some potential methods of 2nd-level QC of CFC data.

### Discussion about the implementation of the 2nd-level QC

Toru Suzuki introduced the method of a 2nd-level QC using the Matlab scripts provided by Toste Tanhua and Steven van Heuven from the CARINA group. Then we discussed the following issues regarding the implementation of the 2nd-level QC.

#### *Working Groups*

We decided to make two working groups, one for the open ocean and the other for marginal seas. These working groups are divided into sub-working groups as follows. The Open Ocean Group will be subdivided by data type while the Marginal Seas Group will be subdivided by region. We define the border between the East China Sea and East/Japan Sea as the Tsushima Strait.

#### Open Ocean Working Group:

- CO<sub>2</sub> system (TCO<sub>2</sub>, TA, pH, discrete pCO<sub>2</sub>): \*M. Ishii, M. Wakita, C. Sabine, L. Miller<sup>†</sup>
- Oxygen and nutrients: \*T. Ono, M. Aoyama, J. Christian, H. Garcia
- CFCs and other transient tracers: \*K. Sasaki, J. Bullister
- Salinity: \*T. Kawano, M. Aoyama, H. Freeland

#### Marginal Seas Working Group:

- East/Japan Sea: \*K. Lee
- Sea of Okhotsk: \*Y. Watanabe, A. Andreev<sup>†</sup>
- Bering Sea: \*A. Murata, J. Mathis<sup>†</sup>
- South and East China Sea: \*M. Dai<sup>†</sup>, A. Chen<sup>†</sup>

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\*Group leader, <sup>†</sup> name put forward by colleagues, confirmation pending

#### *Submission of new datasets*

The deadline for data submission was January 2009. We agreed to accept additional data over the next few months, as these are important datasets and we are still early enough in the 2<sup>nd</sup>-level QC process. Datasets that were identified and promised are:

<u>Area</u>	<u>Provider</u>	<u>Expected time of submission</u>
East/Japan Sea	K. Lee	> MIRC within a month
West coast of America	R. Feely	> CDIAC within a month
Everything in CCHDO	R. Key	> CDIAC by end of 2009
K2 and others	M. Wakita	> MIRC by end of 2009

Additional potential datasets were identified and individuals volunteered to follow up to see if the data could be obtained in time.

Sea of Okhotsk	Y. Watanabe	contact by T. Ono.
East China Sea (SEATS)	A. Chen	contact by T. Saino.
Unsubmitted Russian data	A. Andreev	contact by A. Kozyr
Russian Arctic	R. Key	CD exists
Arctic nutrient data	L. Codispoti	contact by R. Key
137°E and 165°E	JMA	contact by M. Ishii

#### *Correspondence to RECCAP*

Chris Sabine introduced the GCP program RECCAP (REgional Carbon Cycle Assessment and Processes) for the synthesis of knowledge of the global carbon cycle. We discussed our potential role in RECCAP. The conclusions are:

- Because of the time table planned for RECCAP, it will be difficult to include the results of the Pacific data synthesis in RECCAP. We will proceed with our data synthesis activity in parallel with RECCAP.
- The chapter on carbon storage in the Pacific in the RECCAP report will be led by A. Murata with contributions from C. Sabine, M. Ishii and others using selected datasets from GLODAP, CLIVAR/CO<sub>2</sub> and time-series lines and stations.

#### *Time table*

We discussed the future timetable of our activity and decided as follows:

- We will hold an inter-sessional workshop in June 2010 in Japan (Tokyo or Tsukuba) or in the U.S. (Seattle).
- We will have our final workshop (2 full days including parallel sessions) in October 2010 as part of the PICES Annual Meeting in Portland, U.S.A.. At this workshop we will finalize the 2nd-level QC, and work on manuscripts to submit to ESSDD.

#### *Potential scientific products*

We discussed potential scientific products, including a list of papers potentially arising from the analysis. Likely authors were identified or volunteered. Topics include:

- Changes in the carbonate saturation state (R. Feely, A. Murata, L. Miller<sup>†</sup>)
- Alkalinity change (carbonate dissolution) in the water (K. Lee, J. Christian, R. Feely)
- Decadal change in anthropogenic carbon inventory (entire group).
- Regional decadal trends in water column carbon inventory at 137°E, 155°E, 165°E, equator K2 (M. Ishii, M. Wakita)
- Changes in oxygen and nutrient concentrations (T. Ono, M. Aoyama, J. Christian, , H. Garcia, R. Key, T. Saino, S. Emerson<sup>†</sup>, C. Deutsch<sup>†</sup>, D. Sasano<sup>†</sup>)
- Basin-integrated meridional carbon transport (A. Murata, A. McDonald<sup>†</sup>)
- North-east Asian marginal seas (K. Lee)
- Relationship to GLODAP versions 2 and 3 (R. Key, A. Kozyr, T. Suzuki)
- Relation to climate change and climate variability (J. Christian, K. Rodgers)
- Investigation of mapping techniques (R. Key)
- CFCs (K. Sasaki, J. Bullister<sup>†</sup>)
- Tritium and Helium (R. Key)
- CDIAC-MIRC data package NDP (A. Kozyr, T. Suzuki)

<sup>†</sup> name put forward by colleagues, confirmation pending

#### *Name of our dataset*

It was decided that our project and dataset requires a name and/or acronym, and it was proposed that we choose one soon so that interim or tentative names do not get into many documents. Candidates proposed by participants are:

## Session Summaries -2009

- CARP (CARbon in the Pacific): Carp is the name of a Japanese professional baseball team, as well as a fish, which someone pointed out is actually a *freshwater* fish.
- CIPOC (Carbon In the Pacific Ocean)
- CARIPOC (CARbon In the Pacific Ocean)
- CARIPAC (CARbon In the PACific ocean)
- PCDS (Pacific Carbon Data Synthesis)

Masao Ishii will poll participants for their preference and decide the new name within one month following the workshop.

### List of papers

#### *Oral presentations*

##### **Masao Ishii**

Introduction: Background and goal of the workshop

##### **Related activities**

**R.M. Key, S. Jutterström, M. Hoppema, A. Olsen, T. Tanhua and D.W.R. Wallace** (Invited)

The CARINA data product

##### **M. Aoyama**

Global nutrient data synthesis for WOCE and CLIVAR data based on Reference Material for Nutrients in Seawater

##### **Overview of the datasets**

##### **Toru Suzuki**

Overview of the Pacific carbon data collected

##### **Christopher Sabine**

US CLIVAR Repeat Hydrography/CO<sub>2</sub>

##### **Akihiko Murata**

JAMSTEC's Repeat Hydrography/CO<sub>2</sub>

##### **Wakita**

Western North Pacific repeat-lines and time-series stations by Hokkaido University, and JAMSTECMIO

##### **Masao Ishii**

Western North Pacific repeat-lines by MRI/JMA

##### **Masao Ishii**

Equatorial Pacific

##### **Sasaki** (or Bullister)

CFCs in the Pacific

##### **Toru Suzuki**

Method of the 2nd-level QC using Matlab and the role of each WG. The working group web portals (created by T. Suzuki).

#### *Poster*

##### **Chihiro Mivazaki, Shin-ichiro Nakaoka and Yukihiro Nojiri**

NIES ocean *p*CO<sub>2</sub> measurement of VOS over the Western Pacific

## Best Presentations for Committee/Program-sponsored Topic Sessions or Workshops at PICES-2009

### *Science Board Best Oral Presentation*

**Erlend Moksness** (Institute of Marine Research, His, Norway) on “Major human activities affecting Norwegian coastal marine ecosystems: Present status and challenges”

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

**Bryan A. Black** (Hatfield Marine Science Center, Oregon State University, Newport, U.S.A.) on “Growth-increment chronologies reflect ecosystem responses to climate variability in the northeastern Pacific”

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

**Tetsuichi Fujiki** (Mutsu Institute for Oceanography, Japan Agency for Marine-Earth Science and Technology, Mutsu, Japan) on “Time-series observation of phytoplankton productivity in the western subarctic gyre of the North Pacific”

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

**Hyunjung Kang** (National Fisheries Research and Development Institute, Busan, Korea) on “Maturity and spawning of small yellow croaker, *Larimichthys polyactis*” co-authored with Yeonghye Kim, Jinkoo Kim, Sungyeon Kim, Sukgeun Jung, Dongwoo Lee and Dae Soo Chang

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

**Tatiana Tunon** (SOLV Consulting Ltd., Vancouver, Canada) on “Using classification trees to capture a manager’s interpretation of Bayesian projections” co-authored with Gottfried Pestal

### *Best Oral Presentation by an early career scientist for the MEO-sponsored Topic Session on “The role of submerged aquatic vegetation in the context of climate change”*

**I Nyoman Radiarta** (Graduate School of Fisheries Sciences, Hokkaido University, Hakodate, Japan) on “The impact of climate change on the development of marine aquaculture: A case study on Japanese scallop aquaculture in Funka Bay, Hokkaido, Japan” co-authored with Sei-ichi Saitoh and Toru Hirawake

### *Best Poster for the MEO-sponsored Topic Session on “The role of submerged aquatic vegetation in the context of climate change”*

**Sang Rul Park** (Pusan National University, Busan, Korea) on “Growth and photosynthetic characteristics of three *Zostera* spp. (*Z. japonica*, *Z. marina* and *Z. caespitosa*) along vertical gradient: Implications for seagrass zonation” co-authored with Kun-Seop Lee

### *Best Oral Presentation by an early career scientist for the MONITOR-sponsored Topic Session on “State of the art of real-time monitoring and its implication for the FUTURE oceanographic study”*

**Kelly J. Benoit-Bird** (Oregon State University, Corvallis, U.S.A.) on “Trophic cascades in Hawaii’s nearshore ecosystem: Using observing technology to understand ecological interactions”

### *Best Poster for the MONITOR-sponsored Topic Session on “State of the art of real-time monitoring and its implication for the FUTURE oceanographic study”*

**Shin-ichi Ito** (Tohoku National Fisheries Research Institute, FRA, Shiigama, Japan) on “A profiling mooring buoy to observe mixed layer formations in the western North Pacific and its combination with a deeper type underwater glider” co-authored with Yugo Shimizu, Shigeo Kakehi, Fumitake Shido, Taku Wagawa, Kazuyuki Uehara, Toshiya Nakano and Masafumi Kamachi

### *Best Oral Presentation by an early career scientist for the POC-sponsored Workshop on “Exploring the predictability and mechanisms of Pacific low frequency variability beyond inter-annual time scales”*

**Xiaohui Tang** (Institute of Oceanology, Chinese Academy of Sciences, Qingdao, China) on “Influence of reducing weather noise on ENSO prediction” co-authored with Ping Chang and Fan Wang

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

**Satoshi Osafune** (Ocean Research Institute, University of Tokyo, Tokyo, Japan) “Numerical study of bidecadal water mass variations in the subarctic North Pacific related to the 18.6-year tidal cycle” co-authored with Ichiro Yasuda