

REPORT OF OPENING SESSION

AGENDA ITEM 1

Opening by the Chairman of PICES

The Opening Session started at 09:00 hours on October 26, 2009. Dr. Tokio Wada, Chairman of PICES, welcomed delegates, observers and researchers to Jeju and formally declared that the PICES Eighteenth Annual Meeting (PICES-2009) was open. The session agenda is appended as *OP Endnote 1*.

AGENDA ITEM 2

Welcome addresses by representatives of the federal government and local government of the host country

Mr. Jong-Hwan Chung (Minister, Ministry of Land, Transport, and Maritime Affairs, Republic of Korea) welcomed participants on behalf of the host country (*OP Endnote 2*). Mr. Tae-Hwan Kim (Governor, Jeju Special Self-Governing Province, Republic of Korea) and Dr. Jung-Keuk Kang (President, Korea Ocean Research and Development Institute) addressed the session on behalf of the local government (*OP Endnote 3*), and the host organization (*OP Endnote 4*), respectively.

AGENDA ITEM 3

Remarks by the Chairman of PICES

Dr. Wada thanked Mr. Jong-Hwan Chung, Mr. Tae-Hwan Kim and Dr. Jung-Keuk Kang for their remarks, and addressed the participants on behalf of PICES. His comments are appended as *OP Endnote 5*.

AGENDA ITEM 4

Wooster Award presentation ceremony

Dr. Wada and Dr. John Stein, PICES Science Board Chairman, conducted the 2009 Wooster Award presentation ceremony. Dr. Wada introduced the award, and Dr. Stein announced the 2009 award recipient to be Professor Kuh Kim (Republic of Korea), a nationally and internationally distinguished physical oceanographer (*OP Endnote 6*). Reading of the Science Board citation of the 2009 Wooster Award was accompanied by a slide show dedicated to Dr. Kim.

A commemorative plaque was presented to Dr. Kim (a permanent plaque identifying all Wooster Award recipients resides at the PICES Secretariat), who accepted the award with the following remarks of thanks:

It is a great honor for me to receive the 2009 Wooster Award.

I would like to thank all of you who nominated me for this award, and the Science Board for selecting me. As I was on the Science Board as a member and later as its Chairman, I know well that very significant scientific contributions to the North Pacific and its marginal seas in research, education, and/or administration are required to receive this award. I am afraid that my record is short of meeting these criteria, as previous recipients of this award have left far-reaching footprints. So my guess is that this time the PICES Science Board probably decided to send a message that we oceanographers should continue to explore the sea as often as possible for more data to understand the oceans better and deeper as I did as a theoretician. We have a relatively good understanding on processes in the surface layer of the oceans, as large amounts of data are available from various platforms such as satellites, drifters and moorings. However, data from the deep ocean are very limited in space and time, and so is our understanding, despite the fact that it occupies most of the

oceans. For example, the understanding of climate change requires data from the whole water column of the oceans in time. Our approach should be multi-disciplinary and comprehensive. I like to emphasize that international collaboration is essential to make any progress in understanding the world ocean.

Without any exception, all my works are the results of collaborations at sea and in the laboratory with graduate students of the Ocean Circulation Laboratory at Seoul National University, and with friends and colleagues from PICES member countries for the last 30 years. My students had sleepless nights. I had selfless support from colleagues like Howard Freeland who helped me to start the Argo program in Korea. I would like to take this opportunity to thank great teachers like Henry Stommel and Peter Rhines, who taught me how to intertwine fluid dynamics and sea-going oceanography, and Kyung-Ryul Kim and Masaki Takematsu for their solid commitment and encouragement for science. Seoul National University has never had a research vessel, and I am deeply indebted to captains and crew of so many vessels ranging from a small chartered fishing boat, which lost its engine power and drifted for hours off the southern coast of Korea, to a Russian research vessel which had a serious CTD winch problem soon after sailing from Pusan Port for the first expedition of CREAMS in 1993, but where a replacement for its slip-ring was miraculously found. The first data of CREAMS were collected successfully on board this vessel, leading to the discovery of new water masses and changes in the thermohaline circulation in the Japan/East Sea. I am extremely lucky and fortunate to have met so many wonderful and dedicated people. I thank everyone who ever worked with me to reach the unknown.

I am proud of being part of PICES. Thank you again.

AGENDA ITEM 5

PICES Ocean Monitoring Service Award presentation ceremony

Drs. Wada and Stein also conducted the presentation ceremony of the PICES Ocean Monitoring Service Award (POMA). Dr. Wada introduced the award, and Dr. Stein announced that the 2009 award be given to Dr. Bernard A. Megrey of NOAA-Fisheries' Alaska Fisheries Science Center and Mr. S. Allen Macklin of NOAA's Pacific Marine Environmental Laboratory for their sustained efforts, vision, and leadership in building an inventory of biophysical data for the North Pacific, and creating the PICES Marine Metadata Federation (*OP Endnote 7*). Reading of the Science Board citation of POMA-2009 was accompanied by a slide show dedicated to all experts involved in the project. A commemorative plaque (a permanent plaque identifying all POMA recipients resides at the PICES Secretariat) and a certificate were presented to Dr. Megrey, who accepted the award with the following remarks of appreciation:

I want to thank PICES and the TCODE and MONITOR committees for selecting the PICES Metadata Federation Project for this year's PICES Ocean Monitoring Service Award. My colleague, Allen Macklin, could not be here today as he recently retired and is living the good life. I know he would want me to extend his thanks for this very special recognition.

The PICES Metadata Federation Project was not accomplished by two people. Rather, it is the product of the collective effort of many individuals representing national contributions coordinated and solidly supported by TCODE and PICES. The names and pictures of the individuals making up each national team are being displayed for you right now. It is gratifying to see emphasis given to data management activities within PICES. PICES scientists strive to answer difficult questions, especially as we begin a new science program. I am confident that the metadata tools provided by the project will help move the FUTURE scientific program forward in significant ways. This is your resource. Please use it and contribute to it.

Now I would like to invite my collaborators to join me on the stage if they are in the audience. I believe I see Robin Brown from Canada, Igor Shevchenko from Russia, Toru Suzuki from Japan, Ruguang Yin from China, and Kyu-Kui Jung from Korea. Please join me in accepting this award on behalf of the PICES Metadata Federation Project.

Certificates were also given to representatives of all national teams that participated in the Metadata Federation.

After the Annual Meeting, Dr. Macklin sent the following note to the PICES Secretariat:

I am sorry that I was unable to be with you to accept this award personally. Through the voice of my colleague, Bern Megrey, I expressed my thanks and appreciation to the Science Board and the TCODE and MONITOR committees of PICES for recognizing the value of this contribution to marine science.

Information management is a basic and unstated underpinning of the Scientific Method. As scientists we pose questions about the world, seek background knowledge, develop ideas about how things work, test those ideas through observation, analyze data from such tests, validate our ideas, and communicate the results. Clearly, the more information available at any step of the process should increase the overall advance of science. In this modern era, it is imperative that the information be well managed, valid and discoverable.

This project began with the intent to reveal more information about the Bering Sea. With the support of PICES and cooperation of its member countries, the PICES Metadata Federation Project now addresses a much wider geographic area, serves a greater user community and is a tool for international cooperation in guiding our understanding and use of marine areas. I urge you to use and contribute to this tool to continue its development and increase its value.

Finally, I wish for you know how rewarding and exciting working with PICES was to my career. It truly brought a new scope and understanding of the international world of science and our responsibility to guard our planet. To my many friends, Kom Bei!

AGENDA ITEM 6

PICES “Year-in-Review” 2009

Dr. Stein reviewed PICES’ scientific accomplishments since the Seventeenth Annual Meeting (PICES-2008) in Dalian, People’s Republic of China. An article on the state of PICES science for 2009 will be published in the next issue of PICES Press in January 2010 (Vol. 18, No. 1).

The 2009 keynote lecture entitled “*Ecosystem-based fisheries assessment and management: A step towards FUTURE implementation of ecosystem approaches to management (EAM)*” was given by Dr. Chang Ik Zhang (Pukyong National University) as a part of the Science Board Symposium on “*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*”. The abstract of his presentation is appended to the report as *OP Endnote 8*.

AGENDA ITEM 7

Closing remarks and announcements

After the closing remarks by Dr. Wada, Dr. Stewart (Skip) McKinnell, PICES Deputy Executive Secretary, made announcements related to the logistics of the Annual Meeting. The session was adjourned at 10:00 a.m.

OP Endnote 1

Opening Session agenda

1. Opening by the Chairman of PICES, Dr. Tokio Wada
2. Welcome addresses by representatives of the federal government and local government of the host country
 - Mr. Jong-Hwan Chung (Minister, Ministry of Land, Transport, and Maritime Affairs, Republic of Korea)
 - Mr. Tae-Hwan Kim (Governor, Jeju Special Self-Governing Province, Republic of Korea)
 - Mr. Jung-Keuk Kang (President, Korea Ocean Research and Development Institute)
3. Remarks by the Chairman of PICES, Dr. Tokio Wada
4. 2009 PICES Wooster Award presentation ceremony
5. 2009 PICES Ocean Monitoring Service Award presentation ceremony
6. PICES “Year-in-Review” 2009 by the Chairman of Science Board, Dr. John Stein
7. Closing Remarks/Announcements

OP Endnote 2

**Welcome address on behalf of the federal government of the host country by Mr. Jong-Hwan Chung
(Minister, Ministry of Land, Transport and Maritime Affairs, Republic of Korea)**

Honorable Chairman Tokio Wada, Science Board Chairman John Stein, Executive Secretary Alexander Bychkov, and marine scientists from overseas including Canada, China, Japan, Russia, and the United States! I welcome you to Korea.

Governor Tae-Hwan Kim of Jeju, President Jung-Keuk Kang of the Korea Ocean Research and Development Institute, and distinguished guests from Korea! Thank you for joining us despite your busy schedule.

I would like to congratulate you on the opening of the 2009 PICES Annual Meeting. I am especially delighted to be with world-renowned experts in this beautiful island of Jeju, one of UNESCO’s world heritages.

Since its foundation in 1992, PICES improved research on climate change and the ocean ecosystem of the Pacific, especially above 30 degrees north latitude, and facilitated international cooperation in marine science. In particular, between 1996 and 2006, you have successfully conducted the Climate Change and Carrying Capacity Program. Moreover, the FUTURE science program to be implemented over the next decade is very timely and meaningful. It will become a significant opportunity for PICES to make another leap forward.

Distinguished guests! Global warming is becoming a greater threat to the survival of humankind every day. Under the circumstances, the importance of marine science is increasing. In this regard, the Ministry of Land, Transport and Maritime Affairs is utilizing the ocean to develop zero-carbon energy and CO₂ storage technologies. We are also studying marine plants as a new source of bio-energy. In addition, the Ministry is leading efforts to fight climate change by observing the ocean. In this sense, I hope this event provides a venue for active exchange between Korean and overseas marine experts.

Before closing my remarks, I would like to thank our organizers, including the PICES Secretariat, Jeju Province, the Korea Ocean Research and Development Institute, and the National Fisheries Research and Development Institute, for your preparation and support.

Once again, I would like to thank the participants who have come so far to join the Annual Meeting. I wish for your health and luck. Thank you.

OP Endnote 3**Welcome address on behalf of the local government of the host country by Mr. Tae-Hwan Kim
(Governor, Jeju Special Self-Governing Province, Republic of Korea)**

Honorable Chairman Tokio Wada, Minister Chung Jong-Hwan of Land, Transport and Maritime Affairs, government representatives, and marine scientists! I welcome you to Jeju Island, one of UNESCO's world heritages.

Your proactive support and participation has led to the successful opening of the 2009 PICES Annual Meeting, and I am very pleased to see this. I and the Jeju residents have keen interest in this event being held under the theme "*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*". This is because Jeju Island, which is surrounded by the sea, is focusing on the ocean for the future and is to realize our vision.

During your stay, if you are lucky, you will be able to listen to a sound that cannot be heard anywhere else on earth. The sound is called "Sumbi sound". Korean female divers gather seafood underwater, keeping their breath. As soon as they come out of the water, they exhale. And this is the Sumbi sound. As such, Jeju's ocean is very unique. The Jeju Special Self-Governing Province is making a challenge to turn the ocean into an ocean full of hope. However, Jeju is not free from the change in the marine ecosystem due to global warming. Compared to the 1930s, Jeju's average temperature has increased by 1.5 degrees. The sea level is also rising 0.5 centimeters yearly. As a result, the promenade in Yongmeori, Seoguipo-city, is now submerged during high tide. Jeju is one of the North Pacific regions that shows clear changes in the sea level and the marine ecosystem. In response, Jeju signed a convention to become the showcase city for climate change response with the central government, in line with the global trend for sustainable green growth.

Distinguished guests, you are the most prominent experts in marine science. Your research will greatly contribute to preserving the marine ecosystem of Jeju and the world. Right now, Jeju is in its most beautiful season, autumn. During your stay, I hope you can feel the warm hospitality of Jeju residents, and make many good memories. Moreover, I wish for the development of PICES, and your health and success. Thank you.

OP Endnote 4**Welcome address on behalf of the host organization by Dr. Jung-Keuk Kang (President, Korea Ocean Research and Development Institute)**

Distinguished Dr. Tokio Wada, Chairman of PICES, Dr. John Stein, PICES Science Board Chairman, Mr. Jong-Hwan Chung, the Minister of Land, Transport and Maritime Affairs, Mr. Tae-Hwan Kim, the Governor of Jeju Special Province and honored guests, ladies and gentlemen. On behalf of the Korea Ocean Research and Development Institute, I would like to welcome all the participants to the Eighteenth Annual Meeting of PICES (PICES-2009), and especially welcome participants from abroad who, in many cases, must have travelled quite a long distance to come to Jeju Island.

We are very pleased and proud to host this Annual Meeting where FUTURE, the new science program of PICES, will be officially inaugurated. The anticipated global changes threaten the future of humanity and call for large-scale studies of ocean ecosystems. In this direction, PICES has been preparing a new science program during the past years and now we are about to witness its beginning. Aiming to understand and to make predictions of the ecosystem changes in the North Pacific, the FUTURE program will be one of the leading marine science programs of the world. The theme for this Annual Meeting of PICES, "*Understanding ecosystem dynamics and pursuing ecosystem approaches to management*", addresses two of the fundamental issues of FUTURE. The issues you are going to discuss and debate in this Jeju meeting will set the direction of the FUTURE program and therefore, will be very critical for the success of FUTURE. I wish you all luck.

I would like to add that Jeju is not only the most popular tourist destination, but also a UNESCO World Natural Heritage Site. Therefore, I suggest that you take the opportunity to enjoy the beautiful scenery of the southern island of Korea.

Once again, I sincerely express my warmest welcome to all the participants, and wish you a very pleasant stay here on Jeju Island. Thank you.

OP Endnote 5

Welcome address by Dr. Tokio Wada (Chairman of PICES)

Mr. Jong-Hwan Chung, Mr. Tae-Hwan Kim, Dr. Jung-Keuk Kang, distinguished delegates, guests, ladies and gentlemen, welcome to the 2009 Annual Meeting of our Organization.

First of all, on behalf of PICES and all the participants, I would like to express our sincere thanks to the Ministry of Land, Transport, and Maritime Affairs of Korea, the Jeju Special Self-Governing Province, the Korea Ocean Research and Development Institute, and the National Fisheries Research and Development Institute, for their warm-hearted hospitality and hard work in organizing this Annual Meeting at such a wonderful venue.

From early times, we have received various benefits from the ocean, especially from its ecosystems. Food and raw materials from marine bio-resources are essential ecosystem services of the ocean, and these are indispensable for human life. CO₂ absorption and water purification through bio-chemical processes are also significant functions of the ocean ecosystems. On the other hand, anthropogenic effects on the ocean ecosystems have increased with the recent enhancement of our socioeconomic activities in the ocean. Climate change is also a big factor affecting the structure and functions of the ocean ecosystems. Therefore, under the current situation, to keep the structure and functions of the ocean ecosystems, and to sustain their services, is an urgent issue for the world beyond the North Pacific Ocean.

Since 2004, PICES has been developing a new integrative scientific program called FUTURE, an acronym for *Forecasting and Understanding of Trends, Uncertainty and Responses of North Pacific Marine Ecosystems*. Its Science Plan was adopted by Governing Council in 2008, and the Implement Plan was approved last June. At this Annual Meeting, we will make an actual start on the FUTURE program. FUTURE is quite a comprehensive program, including a variety of PICES scientific activities ranging from physical oceanography to fish biology, as well as socioeconomic studies on ecosystem-based management. Its ultimate goal is to provide the scientific knowledge for sustainable use of the ecosystem services of the North Pacific Ocean which will be requested by policy makers, interested parties and the public of the Contracting Parties. A tight collaboration among the standing committees and the expert groups of PICES, and the integration of their products, are key elements of the implementation of FUTURE. Furthermore, promoting collaboration with other international organizations and programs, and intensifying communication with the Contracting Parties are also important factors for the success of FUTURE. The overall theme of this Annual Meeting, *“Understanding ecosystem dynamics and pursuing ecosystem approaches to management”*, is a very timely one for the beginning of the FUTURE program.

Finally, I expect that this meeting will achieve many fruitful results, and will be a memorable event in the history of PICES. Thank you very much.

OP Endnote 6**2009 Wooster Award**Introduction of the Wooster Award (Dr. Tokio Wada)

In 2000, PICES established an annual award for scientists who have made significant contributions to North Pacific marine science; have achieved sustained excellence in research, teaching, administration, or a combination of these in the area of the North Pacific; have worked to integrate the various disciplines of the marine sciences; and preferably, all of these in association with PICES. The award was named in honor of Professor Warren S. Wooster, a principal founder and the first Chairman of PICES, a world-renowned researcher of climate variability and fisheries production. Prior recipients of the Wooster Award were Michael Mullin (2001), Yutaka Nagata (2002), William Percy (2003), Paul LeBlond (2004), Daniel Ware (2005), Makoto Kashiwai (2006), Kenneth Denman (2007), and Charles Miller (2008).

To our deep regret Professor Wooster passed away last October. He was not only a distinguished scientist, but also an ambassador of international scientific cooperation. We will no longer be able to see him among the participants at the Annual Meetings. However, his spirit will be living in our minds through this Award.

Science Board citation for 2009 Wooster Award (Dr. John Stein)

Today, it is a great pleasure to present to you Professor Kuh Kim, the recipient of the 2009 Wooster Award. Professor Kim has been active in PICES, serving first as a member of the Physical Oceanography and Climate (or POC) Committee since 1996, as Chairman of this Committee from 2001 to 2004, and as Chairman of the PICES Science Board from 2004 to 2007.

In addition to Professor Kim's international scientific leadership in PICES, his collaborative research in the western Pacific was pivotal in the initiation and success of the regional program on "Circulation Research in East Asian Marginal Seas" (CREAMS). The scientific foundation for CREAMS arose from his landmark papers entitled "*Characteristics of physical properties in the Ulleung Basin*" and "*Identification of water masses in the Yellow Sea and the East China Sea by cluster analysis*". CREAMS is now in its third phase. The PICES Science Board endorsed the CREAMS/PICES Program at the 2004 Annual Meeting as one of the key POC and PICES activities, and following this endorsement, the Korean government initiated the Korean CREAMS/PICES Program in 2006, which was the product of significant efforts by Professor Kim and his colleagues, and it is anticipated that the CREAMS/PICES Program will continue to be one of the regional projects of PICES' new integrative science program, FUTURE.

CREAMS is but one international program that Professor Kim has been a key participant of. Korea is an important contributor to the global Argo array, and this is largely through the efforts and initiative of Prof. Kim. He represented Korea on the Argo Steering Team from the moment it was created until 2008, and was the one who helped to make the free and open data policy work. Without the free and open data policy, Argo would have had a short history.

Professor Kim's international leadership is matched, if not exceeded, by his scientific achievements and development of the next generation of physical oceanographers and marine scientists. He has mentored many students and colleagues who have gone on to productive careers, and he has published more than 70 scientific papers, including a contribution to the 4th Assessment Report of the Intergovernmental Panel on Climate Change.

Professor Kim's accomplishments are many, and he continues to be strongly involved with his science career. Recently, he has moved from Seoul National University to Pohang University of Science and Technology to lead the establishment of a world-class graduate school of oceanography. This will be the last challenge in his exemplary research and education career. But given his stellar record as a scientist and educator, and his enthusiasm, there is little doubt that he will be successful.

Please join me in congratulating my predecessor as Science Board Chairman, Professor Kuh Kim, as the 2009 Wooster Award recipient.

OP Endnote 7

2009 PICES Ocean Monitoring Service Award

Introduction of the PICES Ocean Monitoring Service Award (Dr. Tokio Wada)

Progress in many aspects of marine science is based on ocean observations, monitoring, and management and dissemination of data provided by these activities. However, these activities are often behind the scenes and so inconspicuous that they are seldom evaluated appropriately. To remedy this, a PICES Ocean Monitoring Service Award (POMA) was established in 2007 to recognize the sustained accomplishments of those engaged in monitoring, data management, and communication. This award aims to acknowledge organizations, groups and outstanding individuals who have contributed significantly to the advancement of marine science in the North Pacific through long-term ocean monitoring and data management. The first award was presented in 2008 to the training ship T/S *Oshoro-maru* of Hokkaido University, Japan, for her long-term ecological monitoring activities in the northern North Pacific.

Science Board citation for 2009 PICES Ocean Monitoring Service Award (Dr. John Stein)

Researchers studying marine ecosystems need access to information on multiple ecosystem processes spanning everything from the seabed to the atmosphere. Metadata, or data describing what, when and how data were collected, help researchers choose information relevant to their project without acquiring the actual data. Metadata make data “discoverable”. Even if data collectors provide metadata, there is no centralized repository of metadata contributed from different sources.

For the past 5 years, Dr. Bernard A. Megrey of NOAA-Fisheries’ Alaska Fisheries Science Center and Mr. S. Allen Macklin of NOAA’s Pacific Marine Environmental Laboratory led an initiative within PICES to federate marine metadata collections from all member countries into one integrated resource, the PICES Marine Metadata Federation. With this tool, a user has the ability to search for data catalogued by any and all participating countries with a single search request. Using modern data management standards and techniques to cross-search separate metadatabases has the advantages of shared metadata without compromising national ownership, data integrity, or the security of national metadata products. This task was accomplished by interacting with a large collaborative team consisting of data users and experts within PICES, practicing scientists trying to solve multi-national problems within the Pacific Rim, data providers and computer IT staff at international laboratories in Japan, China, Russia, Korea and Canada. Over the course of the project, separate meetings were held with each international team in the United States, and then the U.S. team visited the cooperating laboratory to meet their staff and leadership.

Bernard and Allen actively wrote proposals to secure funding, coordinated the expansion of the Federation by locating new partners, visited international laboratories, contacted participants, promoted the Federation within the PICES community, served as a point of contact, and supplied technical support on issues related to establishing a federated metadata node. They also provided capacity building within PICES by organizing training workshops and metadata training.

All nodes of the PICES Marine Metadata Federation offer English metadata records in a standard format through a standard communication protocol. Access to the portal is through a metadata clearinghouse that supplies search and delivery functions to the user who does not have to worry about which country or institution collected the data. In the process of developing the project, a PICES Technical Report was written providing instructions to each country regarding how to establish a node. Numerous PICES Press articles and over 15 oral presentations were given at PICES scientific meetings, Standing Committee and Working Group meetings.

This was NOT an easy job. Although many people and agencies had long recognized the ‘need’, there were no good models of exactly how to satisfy this need. Bern and Allen led the team which showed PICES how to do this and then made it happen! The success of the project required support from members of the PICES Technical Committee on Data Exchange (TCODE), Kimberly Bahl, and close international collaborations with Kyu-Kui Jung and Hae-Seok Kang (Korean Oceanographic Data Center), Toru Suzuki (Marine Information Research Center, Japan Hydrographic Association), Ruguang Yin and Jixiang Chen (National Marine Data and Information Service, State Oceanic Administration of the People’s Republic of China), Igor Shevchenko, Olga Vasik and Igor Burango (TINRO-Centre, Russia) and Robin Brown and John Holmes (Fisheries and Oceans Canada). Throughout the long development and implementation period, Bern and Allen provided important leadership and vision, in addition to acquiring the resources to complete the job.

I am very pleased to announce that the PICES Ocean Monitoring Service Award for 2009 is given to Dr. Bernard A. Megrey and Mr. S. Allen Macklin for their sustained efforts, vision, and leadership in building an inventory of biophysical data for the North Pacific and creating the PICES Marine Metadata Federation.

OP Endnote 8

“Ecosystem-based fisheries assessment and management: A step towards FUTURE implementation of ecosystem approaches to management (EAM)”

Abstract of the keynote lecture by Dr. Chang Ik Zhang (Pukyong National University, Republic of Korea)

North Pacific marine ecosystems in the PICES region have been utilized in a variety of ways. In the western North Pacific, large coastal populations, with a long history of full exploitation of most harvestable renewable resources, are confronted with overfishing and habitat degradation. In the eastern North Pacific, coastal population growth and economic development have proceeded at a much slower pace, exerting less pressure on fishery resources. Marine living resources exploited by fisheries are part of complex marine ecosystems where many species interact. Ecosystem-based management is becoming a global theme of marine science in the 21st century. The World Summit on Sustainable Development (WSSD) recommended the implementation of the ecosystem approach by 2010. This holistic approach should consider fisheries resources and their associated habitats by examining ecological interactions of target species with predators, competitors, and prey species, interactions between fishes and their habitats, and the effects of fishing on these processes. A pragmatic ecosystem-based approach has been developed for the assessment of fisheries resources involving four management objectives: maintaining sustainability, biodiversity, habitat quality, and socio-economic benefits. It is a two-tier analytical system. Tier 1 is designed for situations where sufficient information is available to allow for a quantitative evaluation of the status of the system, whereas Tier 2 is designed for situations where only a semi-quantitative or qualitative assessment is possible. A number of indicators are used to assess ecosystem status. Target and limit reference points were chosen for each indicator to assess the status of species, fisheries and ecosystems. The approach was applied to several ecosystems, and found to be useful in comparing the status of species, fisheries and ecosystems spatially and temporally using an ecosystem perspective. A forecasting version of this approach is in the process of development with an aim to forecast the impacts of fishing activities and climate changes on the ecosystem. PICES has undertaken a new science program, FUTURE, with a goal to develop an understanding of the responses of marine ecosystems in the North Pacific to climate change and human activities, and to forecast ecosystem status based on an understanding of ecosystem functions. Implementation of the FUTURE program will enhance the limited understanding of ecosystem structure and function, and improve the ability to forecast the impacts of human activities and climate on marine ecosystems.