REPORT OF OPENING SESSION

The Opening Session was called to order on October 13, 2003, at 9:00 a.m. The Chairman, Dr. Vera Alexander, welcomed delegates, observers and researchers to the PICES Twelfth Annual Meeting, and noted that due to unforeseen circumstances, the officials from the People's Republic of China were not present at the Opening Session.

Welcome address on behalf of the Government of the Republic of Korea

Dr. Alexander asked Mr. Young-Nam Kim, Acting Minister of the Ministry of Maritime Affairs and Fishery, to welcome participants on behalf of the host country (*OP Endnote 1*).

Remarks by representatives of Contracting Parties and the Chairman of PICES

Dr. Alexander called upon Dr. Laura Richards (Regional Director of Science, Pacific Region, Fisheries & Oceans Canada) to make a statement on behalf of the Canadian Government. Dr. Richards addressed the session and her remarks are appended to the report in *OP Endnote 2*.

Dr. Alexander invited Dr. Tokimasa Kobayashi (Director, Resources Enhancement Promotion Department, Fisheries Agency, Japan) to speak on behalf of the Japanese Government. Dr. Kobayashi addressed the session and his remarks are appended to the report in *OP Endnote 3*.

Dr. Alexander then asked Dr. Lev N. Bocharov (Director, TINRO-Center, State Committee of Fisheries, Russian Federation) to speak on behalf of the Russian Government. Dr. Bocharov addressed the session and his remarks are appended to the report in *OP Endnote 4*.

Dr. Alexander called upon Dr. Richard J. Marasco (Director, Resource Ecology & Fisheries Management Division, Alaska Fisheries Science Center, National Marine Fisheries Service, U.S.A.) to make a statement on behalf of the U.S. Government. Dr. Marasco addressed the session and his remarks are appended to the report in *OP Endnote 5*.

Dr. Alexander invited Mr. Choon-Sun Kim (Director General, Marine Policy Bureau, Ministry of Maritime Affairs and Fisheries, Republic of Korea) to speak on behalf of the Korean Government. Mr. Kim addressed the session and his remarks are appended to the report in *OP Endnote 6*.

Dr. Alexander thanked Mr. Young-Nam Kim, Mr. Choon-Sun Kim and all the delegates for their remarks and spoke on behalf of PICES. The text of her address is appended to the report in *OP Endnote 7*.

Wooster Award presentation ceremony

Dr. Alexander invited Dr. Ian Perry, the Science Board Chairman, to conduct the Wooster Award presentation ceremony.

Dr. Perry reminded the audience that in October 2000, PICES announced a new award that will be given annually to an individual who has made significant contributions to North Pacific marine science, such as understanding and predicting the role of human and climate interactions on marine ecosystem production. The award was named in honour of Dr. Warren S. Wooster, the principal founder and first Chairman of PICES, and world-renowned researcher and statesman in the area of climate variability and fisheries production. The award consists of a commemorative plaque and travel support to attend the following PICES Annual Meeting in order to receive the award. A permanent plaque identifying Wooster Award winners resides at the PICES Secretariat in Sidney, British

Columbia, Canada. Dr. Perry also noted that the late Professor Michael M. Mullin (U.S.A.) and Dr. Yutaka Nagata (Japan) were honoured with the Wooster Award in 2001 and 2002, respectively, and quoted the following citation from Science Board for the 2003 Wooster Award:

The Wooster Award is to be given annually to an individual who:

- *has made significant contributions to North Pacific marine science;*
- *has achieved sustained excellence in research, teaching, administration or a combination of these in the area of North Pacific;*
- *has worked to integrate the various disciplines of the marine sciences; and*
- *preferably someone who is, or has been, actively involved in PICES activities.*

PICES Science Board is pleased to confirm Dr. William (Bill) Pearcy as the recipient of the 2003 Wooster Award.

Dr. William Pearcy is a world-renowned authority on many aspects of biological oceanography, in particular his extensive work on fishes and squids in the North Pacific. He has made significant contributions to many areas of marine research, including fisheries oceanography, the ecology of deep-sea and open ocean fishes and squids, the trophic dynamics of marine fishes, and pollution and trace metals in the marine environment. He is perhaps best known recently for his contributions to understanding all aspects of Northeast Pacific salmon during their ocean phase. He has over 150 publications in many of the major scientific journals, including Science *and* Nature. *He has demonstrated sustained excellence in teaching during his years as a professor in the College of Oceanic and Atmospheric Sciences at Oregon State University, where he was major advisor for over 30 graduate students and a committee member for at least 50 more. He has served on numerous international committees, including those of PICES. He was involved with PICES and its committees very early on, and he gave the keynote address at the 1997 PICES Annual Meeting on his work on salmon in the North Pacific. Since his retirement, he has worked tirelessly on a State panel to examine ways to restore natural runs of salmon to Oregon. Science Board is very pleased to name him as the recipient of the PICES Wooster Award for 2003.*

Then Dr. Alexander read a note from Dr. Warren Wooster:

I cannot remember when I first met Bill Pearcy, but twenty years ago we first interacted on the question of environmental variability and its effects on fisheries. In May 1983, we convened a workshop at the University of Washington to review existing knowledge on ocean and fish variability and to develop a strategy for investigation of the interactions. In November that year, Bill Pearcy at Oregon State University held another workshop, on the influence of ocean conditions on the production of salmonids in the North Pacific. These two workshops and the resulting publications focused attention on the importance of environmental influence on marine ecosystems.

Bill Pearcy has been a pioneer in what I like to call "salmon oceanography". Students of these charismatic fish have had a curious fixation on the fresh water phase of their life, after which the fish just disappeared into the black box we call the ocean. As an oceanographer, Bill knew that life in the black box was important to salmon, and was interesting, and complex, as he, with his students and colleagues have successfully demonstrated. This work has exemplified the spirit of PICES where fishery science is intimately linked with the other disciplines necessary for ecosystem studies - meteorology and climatology, oceanography of the several flavors (physical, chemical, biological) and ecology in the broader sense. Of course, as the Science Board citation makes clear, Bill Peary's interests are by no way limited to salmon or even to fish. His scientific perspective, both broad and deep, makes him a worthy recipient of the PICES Wooster Award for 2003.

Dr. Alexander presented a commemorative plaque to Dr. George Boehlert who read a brief acceptance from Dr. William Pearcy.

This is indeed a great honor! And I deeply regret not being here. Grape harvest and a visit from distinct friends have intervened.

This is not just a prestigious honor for me - it is for all my colleagues, students and friends that have inspired, collaborated and helped me throughout my years in science. This includes many PICES scientists, including many here today. It includes colleagues on PICES and SCOR Working Groups, and my Japanese friends from the University of Tokyo and Hokkaido University, and the crews aboard many cruises of the Oshoro Maru.

And I especially thank my loyal friend, Papa Wooster, father of PICES, for this award and for a number of other reasons. Warren prompted me to give the lectures for his series on recruitment fishery oceanography at the University of Washington. This resulted in my little book on "Ocean Ecology of North Pacific Salmonids", published in this series by Washington Sea Grant. He also encouraged my participation in workshops and subsequent publications in "Interannual Variability of the Environment and Fisheries of the Gulf of Alaska and the Eastern Bering Sea" (1983) and "El Niño North, Niño Effects in the Eastern Subarctic Pacific Ocean" (1985). The 1982-83 El Niño was a nail in the coffin that the ocean had an unlimited carrying capacity for salmonids and as a result stimulated a surge in research on the importance of the ocean lives of anadromous salmonids—research that is prolific today.

I consider Warren to be the venerable, world renowned fishery oceanographers of the 20th and now the 21st centuries. He has made grand contributions to the world organization and community of oceanographers and marine biologists. He is an inspiration for all of us. Banzai, Warren!

PICES "Year-in-Review" 2003

Dr. Perry reviewed PICES' scientific accomplishments since the Eleventh Annual Meeting (*OP Endnote 8*).

Keynote lecture

The Science Board Chairman introduced the keynote speaker, Prof. Suam Kim (Pukyong National University). Prof. Kim gave a keynote lecture titled "Application of otolith chemistry to interpret some issues on oceanic variability and fisheries". The abstract of his presentation is appended to the report in *OP Endnote 9*.

The Opening Session closed at 11:00 a.m.

OP Endnote 1

Welcome address on behalf of the Government of the Republic of Korea by Mr. Young-Nam Kim

Madam Chairman, distinguished delegates, ladies and gentlemen:

I am honored to make this welcoming address to you at the Twelfth Annual Meeting of PICES. On behalf of the Government of the Republic of Korea, let me extend a warmhearted welcome to each and every one of you participating in this event.

The importance of the oceans is emphasized in the 21st century, because the oceans are regarded as the solution to humankind challenges, such as possible scarcities of food and resources and threats to the environment. It goes without saying that we should continue to conduct research on the oceans and develop marine science and technology. At the same time, we need to manage our marine affairs in order to reduce pollution levels and ecological destruction. This involves instituting proper controls over the use and development of marine resources.

Also, we need to establish a system that facilitates joint international research and cooperation. That is essential if we are to efficiently manage oceanic issues such as protecting the environment, and conserving and developing marine resources. But we can be optimistic about these challenges when we reflect on the activities fostered by PICES since its establishment in 1992. The Organization has set examples for others to follow.

The PICES member countries have come a long way in collecting and exchanging information on the marine environment in the North Pacific. At the same time it has collected valuable information through joint international research on marine life, ecological system and changes in the global climate.

I would like to take this opportunity to express my sincere respect and gratitude for the member countries and scientists. They have made many valuable contributions to the development of PICES, despite many difficulties that came along with that progress.

My Ministry plans to continue to increase our investment in the marine science sector and push ahead with diversified policies conducive to sustainable use and conservation of the oceans. We are also committed to faithfully fulfilling our obligations as a member country by positively taking part in the various activities of PICES, including joint international research. I hope that this Annual Meeting will facilitate the exchange of useful information and ideas.

Finally, I would like to thank the officials concerned, including the PICES Secretariat, who spared no effort in setting up this Annual Meeting.

I hope your stay in Korea will be a pleasant and rewarding experience. Thank you.

OP Endnote 2

Remarks at the Opening Session by Dr. Laura Richards (Canada)

Madame Chairman, distinguished guests and colleagues:

On behalf of Canada and the Canadian delegation, I would like to thank the Government of the Republic of Korea, the Ministry of Maritime Affairs and Fisheries and the Korea Ocean Research and Development Institute (KORDI) for inviting us here to Seoul.

It is my great pleasure to offer best wishes to KORDI on the occasion of KORDI's 30th anniversary. This is a special year since it marks the 40th anniversary of Canada's formal diplomatic relations with the Republic of Korea. We also look forward to working with Korea as a new member this year of the Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean.

Last week, I had the honor of visiting Pukyong National University and the National Fisheries Research and Development Institute in Busan, where I was able to see, first hand, Korea's remarkable progress in marine science. This progress bodes well for our continuing work together within PICES.

International collaboration is essential for addressing global problems like climate change and the sustainability of marine ecosystems. I know that all of you are aware of the need for strong international collaboration. The progress that PICES has made on the North Pacific Ecosystem Status Report is a testament to the willingness to collaborate within PICES.

Earlier this year at the interim Governing Council meeting, we agreed to develop a strategic plan to help us prepare for an organization well placed for the future. I look forward to these discussions over the next week. Let's build on our successes to ensure a vibrant PICES organization!

OP Endnote 3

Remarks at the Opening Session by Dr. Tokimasa Kobayashi (Japan)

Chairperson, distinguished delegates, guests, colleagues, ladies and gentlemen:

First of all, on behalf of the Japanese delegation, I would like to express sincere thanks to the Government of the Republic of Korea, the Ministry of Maritime Affairs and Fisheries, the Local Organizing Committee, and all those who have worked so hard to host this meeting and organize all the events. We are sure that all your diligent and excellent efforts will make this meeting a great success.

I want to say how pleased we are to participate in this PICES Twelfth Annual Meeting in Seoul, and to give our thanks for providing us with this wonderful opportunity to interact with all PICES colleagues.

Over the time past, since PICES was established in 1992, the Organization has been challenging important issues on marine science by establishing the functional standing scientific committees, task teams, working groups, and *ad hoc* groups. The activities of PICES have multiplied and extended in depth through developing collaborations with many international scientific organizations. And of course, I would like to emphasize that the efforts of member countries of PICES have pushed up its activities and make PICES a splendid and flexible body.

Last year, in the opening remarks, I mentioned that the role of fisheries production is getting bigger and bigger for human beings, and more suitable and sustainable utilization of marine living resources is required. Recently a shocking report was released that marine living resources, particularly industrially important species have decreased to one tenth in the last fifty years in the world. Under this situation PICES is expected to lead the scientific investigation on this issue to clarify the mechanism of fluctuation of marine living resources from the scientific view, particularly based on the relationship between the ocean environmental change and the marine ecosystem in the North Pacific and its adjacent seas. And it is also expected to promote the research on the human activities that may affect marine ecosystem and living resources such as over fishing or excessive protection. I believe that to grapple with these issues will be a scope of PICES activities when we consider the PICES Strategic Plan.

In Japan, reformation of the national scientific organization has been proceeding, and national universities are going to be outstanding executive agencies, independent from direct connection with the government, from next April. And just 12 days ago, the Japan Fisheries Research Agency has combined two corporations, such as the Japan Marine Resources Developing Center and the Japan Sea Farming Association. By taking advantage of this opportunity, Japan would also like to encourage the mutually beneficial collaboration through many joint activities with PICES member countries.

Finally, I am sure this Twelfth Annual Meeting will be highly successful through the efforts of all of the participants who will be working together. Thank you for your attention.

OP Endnote 4

Remarks at the Opening Session by Dr. Lev N. Bocharov (Russian Federation)

Distinguished Acting Minister, Mr. Young-Nam Kim, distinguished Madam Chairman, Vera Alexander, esteemed participating national representatives, esteemed members of the local Meeting organizing committee, participants, ladies and gentlemen:

First of all let me thank you on behalf of the Russian delegation for the opportunity to take part in this Annual Meeting, and also for the opportunity to visit Seoul once again, in this beautiful country of Morning Freshness.

I would like to emphasize the excellent work of the Local Organizing Committee (Ministry of Maritime Affairs and Fisheries and KORDI), and appreciate their tremendous efforts made to successfully host this meeting.

Over the past eleven years, the scope of PICES activities has multiplied. Extensive and elaborate work is being done now even between the Annual Meetings. PICES is being more and more attentively regarded by the international scientific community. The proof is the presence of many observers from international scientific and public organizations concerned with the exploration of the Oceans, who are here today.

I am very glad to see here the scientists who recently visited Vladivostok in June 2003, and took part in the Third PICES Workshop on "The Okhotsk Sea and adjacent areas". More than a hundred scientists from Russia, Canada, United States of America and Japan participated in it. During this last workshop, many questions about the recent state of the Okhotsk Sea's ecosystems were discussed.

I would like to make a special note of the tight cooperation between PICES and the North Pacific Anadromous Fish Commission. Complex research work in areas including the Bering Sea is conducted under NPAFC's BASIS Program, and I believe close cooperation between PICES' CCCC Program and NPAFC's BASIS Program will be mutually beneficial to both organizations.

In the opinion of the Russian delegation, the integration of scientists' efforts from various countries in important ocean research projects is very crucial. It is also essential to integrate efforts of international organizations in this context. The World Ocean is great and many-sided. Here is enough work for everyone.

We have a lot of tasks to accomplish during this Annual Meeting. It will take too much time to list them now. Let's keep the time and our strength for finding successful solutions. Good luck to the Meeting and thank you.

OP Endnote 5

Remarks at the Opening Session by Dr. Richard Marasco (U.S.A.)

Chairperson, distinguished delegates, ladies and gentlemen:

On behalf of the United States and the United States delegation, I would like to thank the Government of the Republic of Korea, MOMAF and KORDI for inviting us to Seoul. The United States delegation is very appreciative of both our hosts' efforts to organize this meeting and their wonderful expressions of hospitality.

The theme of this PICES Twelfth Annual Meeting "Human dimensions of ecosystem variability" is a very timely one. That humans are components of the ecosystems they inhabit and use seems obvious, but it is often overlooked. Frequently, in discussions of ecosystems the world is divided into "the ecosystem" and "the users of the ecosystem". Such a division is artificial and can lead to the absurd conclusion that the best way to achieve sustainability of an ecosystem is to keep people out of it. Humans are integral parts of the ecosystems they inhabit and use. Their actions on land and in the oceans affect the ecosystems, just as changes in those ecosystems affect humans.

Society over the last two decades has increasingly recognized the importance of marine ecosystems, the need to sustain them, and the vital links between terrestrial and marine

systems. The value of the world's ecosystem services has been estimated at 16 to 54 trillion dollars U.S. per year, with over half of the value being derived from marine ecosystems.

During the first decade of the 21st century, a large challenge will be to implement a truly integrated ecosystem management approach for living marine resources. Within this context, the United States is working to achieve a balance between the use and protection of coastal and marine resources to ensure their health, sustainability, and vitality for today's and tomorrow's generations. To achieve this difficult goal, it is necessary to predict how the levels of goods and services provided by an ecosystem might change when a variety of ecosystem characteristics change naturally or are altered by human action. Such predictions need more field information and better models.

The PICES Science Board Symposium this year directly addresses this theme of "human dimensions of ecosystem variability" and highlights the scientific efforts the international community is making to understand and separate climate variability from human-induced sources. Other topic sessions and workshops will also provide more detailed examinations of various aspects of human and climate influences on ecosystems of the North Pacific. The North Pacific Ecosystem Status Report will provide an important summary of the status and trends of our marine ecosystems and will help us move towards a common understanding of the factors influencing ecosystem change. It is important that PICES scientists continue these efforts to provide advice that will assist PICES member nations in designing management strategies that take ecosystem factors into account. A traditional Asian coastal proverb used to guide traditional fishing activities still applies today, "Where there is water there is fish; if we take care of the water, the fish will take care of us.

Thank you.

OP Endnote 6

Remarks at the Opening Session by Mr. Choon-Sun Kim (Republic of Korea)

Chairperson, distinguished delegates, ladies and gentlemen:

I am deeply honored to speak on behalf of the Korean delegation. As you may know, this is the second Annual Meeting of PICES to be held in Korea.

I would like to express a warmhearted welcome to all of you on behalf of the Government of the Republic of Korea and the Korean delegation. And I would like also to thank those at the PICES Secretariat for their efforts in setting up this Annual Meeting.

In the past decade, PICES has made great strides in enhancing the marine research conducted by its member countries. Much good work has been done through the Annual Meetings, workshops and symposia, as well as the facilitation of international cooperation in marine affairs. Through such activities of PICES, humankind is now in a much better position to understand the oceans and matters related to them.

However, this summer, as typhoon "Maemi" inflicted severe damage on Korea's southeastern coast, I realized how the sea remains a mostly unknown world. Korea suffered considerable loss of life and property, despite our best efforts to minimize the losses. This experience makes us remember that we have a long way to go in understanding marine phenomena and taking proper measures to deal with them.

In this regard, the future activities of PICES should be carried out so that we can meet the new demand for marine research. We will need to set up programs to ensure sustainable marine development. We will need to focus on the sector of operational oceanography that

comprises the provision of oceanic and meteorological materials.

I want to take this opportunity to promise, on behalf of the Government and the people of the Republic of Korea, that we will actively participate in the Annual Meeting and programs dealing with the future directions and activities of PICES. I sincerely hope that this Annual Meeting in Seoul will be an arena for all of you to freely exchange your opinions and information.

Again, I welcome each and every one of you to Seoul and hope you will have opportunities to enjoy the best season of the year in Korea. Thank you.

OP Endnote 7

Welcome Address by Dr. Vera Alexander, Chairman of PICES

Acting Minister, Mr. Young-Nam Kim, distinguished participants, ladies and gentlemen:

I am here to welcome the PICES community to the Organization's Twelfth Annual Meeting, to thank our hosts for their hospitality and hard work, and to celebrate the progress that PICES has been making in advancing our understanding of the North Pacific Ocean system.

I feel very humble. The confidence and trust placed in me by the PICES delegates requires, in turn, a high degree of responsibility. Not only to them, but also to our PICES ancestors. Let me spend a few minutes on this topic. Even since the celebrated Tenth Anniversary Meeting, PICES has been making progress. For example, we are about to produce a Status of the North Pacific Ecosystem report, a living document that will evolve along with PICES scientific advances. We are developing a Strategic Plan. Yet it all hangs on the momentum afforded by the founders, and, in particular, Dr. Warren Wooster, who had the dream. It is now up to us to fulfill this dream. Let me put it into my own words:

The vast Pacific Ocean laps against the shores of all PICES nations, which are magically united together to pursue its secrets – the details on how and why it functions. This powerful union produces results far beyond the reach of individual nations, and yet produces the information each and every one will need to manage its marine affairs.

Herein lies the relevance of PICES. Our understanding of the factors that control fish stocks, recruitment, ecosystem structure and function, responses to climatic variability and the driving forces and scales of change themselves is being turned upside down. We are undergoing a regime shift in knowledge - essential knowledge to our contracting parties. The human and economic benefits are enormous. I separate the two, because they are not always synonymous.

Dr. Warren Wooster and many others, some with us today, spent more than ten years incubating and hatching PICES, and as the first Chairman, he guided it through its early development. His excellent leadership was followed by Chairmen who perpetuated and advanced the development – first Dr. William Doubleday, and, most recently, Dr. Hyung-Tack Huh. PICES has been blessed with excellent leaderships at all levels – Governing Council, Science Board, F&A, Committees, Working Groups. We have an excellent Secretariat. The future looks rosy.

PICES is a scientific organization, and I believe that the most important activities are those carried out by the Scientific Committees, their Working Groups, but also the proceedings during the scientific sessions at the Annual Meeting. The Science Board plays the role of consolidating this activity as well as leading it. The job of the Governing Council is to make these activities possible through oversight and

responsible management. It is our responsibility to see that the work of PICES proceeds smoothly and effectively. Delegates must work together towards this end, always keeping in mind the purpose of PICES.

As we continue developing strategy for the future, we will keep in mind that the contracting parties, the PICES nations, deserve an organization that is responsive and relevant, one that provides knowledge and understanding in a timely way.

OP Endnote 8

PICES "Year-in-Review" 2003 by Dr. Ian Perry, Chairman of Science Board

PICES continued its high rate of productivity in 2003, with publications, meetings, and extended contacts with other international marine science organizations. Primary publications were produced with papers presented at PICES meetings over the past two years: in the *Canadian Journal of Fisheries and Aquatic Sciences* from the 2001 FIS Topic Session on "Migration of key ecological species in the North Pacific Ocean"; in *Deep-Sea Research II* on "North Pacific biogeochemical processes"; in *Journal of Oceanography* from the 2002 Symposium on "North Pacific transitional areas"; in *Progress in Oceanography* from the 2001 BIO Topic Session on "Plankton size classes, functional groups and ecosystem dynamics" which was dedicated to the memory of the late Prof. Michael Mullin; and in *Marine Environmental Research*, with the studies from the 1999 MEQ Practical Workshop on "Interdisciplinary assessment of marine environmental quality in Vancouver Harbour". Two reports were published in the PICES Scientific Report Series, from Working Group 13 on *CO_2 in the North Pacific* to summarize the research and technical activities that have been conducted by member nations of PICES, and to synthesize CO_2 data and provide a comprehensive picture of the anthropogenic CO_2 distribution in the North Pacific; and from BASS and MODEL Task Teams of the CCCC Program to summarize efforts on trophic modelling of the Subarctic Pacific Basin ecosystems. An external review of the PICES publication program counted 65 publications (14 peer-reviewed) in six different publication series over the history of PICES, and concluded that this was exceptional, in particular for such a small Secretariat staff.

In addition to the Twelfth Annual Meeting in Korea this year, PICES co-sponsored 5 "significant" other meetings (in which "significant" is defined as lasting more than 3 days). These included a MODEL workshop to "Embed NEMURO and NEMURO.FISH into a 3-D circulation model", which took place in Japan and was co-sponsored by the Nakajima Foundation; a 5-day inter-comparison workshop on "Underway and drifting/moored pCO_2 measurement systems" also in Japan, which was co-sponsored with other Japanese agencies; a major symposium on "The role of zooplankton in global ecosystem dynamics: comparative studies from the world oceans", held in Spain with the co-sponsorship of GLOBEC and ICES; the 3rd PICES workshop on "The Okhotsk Sea and adjacent areas", held in Russia; and a workshop on "The development of the North Pacific Ecosystem Status Report", held in Canada. In addition, a number of shorter workshops were convened, several in conjunction with the Annual Meeting in Seoul. These are identified in the Report of Science Board later in this Annual Report.

The North Pacific Ecosystem Status Report Working Group continued to develop its report, and a draft was presented at the Annual Meeting for review and comments by the various PICES Scientific Committees and CCCC Program, and PICES scientists at large. One of the issues identified in this report is that of data availability and exchange. TCODE has been active in this regard, supporting and encouraging scientists to submit information about their data ("meta-data") to the North Pacific Ecosystem Metadata Base (http://www.pmel.noaa.gov/np).

In April 2003, PICES held its first ever joint meeting of Science Board and Governing Council. The report of this meeting is published elsewhere in this Annual Report. To highlight two items: the position of Vice-Chairman of Science Board was created, with the duties of assisting the Science Board Chairman in representing PICES at meetings, preparation of meeting materials, and in decisions that must be made between meetings of Science Board. Dr. Vladimir Radchenko (Russia) was elected as the first Vice-Chairman of Science Board. A Study Group on *PICES Strategic Issues* was formed consisting of members from both Science Board and Governing Council, and charged with developing a draft Strategic Plan which will map the future directions for PICES, and eventually lead to development of an Action Plan. This draft Strategic Plan is noteworthy by advocating an "advice" function for PICES: not advice about "tactical" short-term issues such as fisheries management quotas, but advice about "strategic" issues such as productivity regimes. In fact, PICES received a formal request for such advice in September of this year.

PICES continues to build strong relationships with other international marine science organizations by attending their meetings and promoting collaborative activities. These include the International Council for the Exploration of the Seas (ICES), the Intergovernmental Oceanographic Commission (IOC), the International Geosphere-Biosphere Program (IGBP), the Scientific Committee on Oceanic Research (SCOR), the North Pacific Anadromous Fish Commission (NPAFC), and the Climate Variability (CLIVAR) program of the World Climate Research Program (WCRP).

The current success of PICES is built upon

scientific excellence such as publications, working group activities, workshops and symposia;

scientific capacity, including the willingness and commitment of the scientists and others interested in the North Pacific (and elsewhere) to devote time and effort to the work of PICES, and a strong PICES Secretariat; and

scientific advice which, as mentioned, is not short-term advice on fisheries management issues such as quotas, but advice on broad issues of concern to North Pacific marine science, whether specifically requested or not.

A PICES built fully on these three pillars will be a substantial, active, and exciting organization now and into the future.

OP Endnote 9

Application of otolith chemistry to interpret some issues on oceanic variability and fisheries
Extended abstract of the keynote lecture by Prof. Suam Kim (Pukyong National University)

Recently, the issues on climate change become not only scientific interests but also societal, economical and political importance. In the last 50 years, air-temperature in Seoul has increased. The rate of increase was 0.23 degree Celsius per decade, and the sharpest increase is since the 1980s. Temperature increase is not a phenomenon confined to Korea only. The temperature record since the mid-19th century indicated the increasing pattern of world air-temperature. Such climate changes have caused the changes in terrestrial as well as marine ecosystems. For example, growth, species composition, distribution, and abundance are always changing due to abiotic variability. Scientists have searched any evidence for detecting climate and ocean changes, and fish otolith was regarded as one of the best tools to interpret oceanic variability.

With the advance of instrumental technology, chemical analysis of fish otolith has been in the spotlight of ocean sciences. Otolith is the stone-like material in the inner ear that plays a role in the balancing and hearing sense of animals. The major component of an otolith is calcium carbonate, but some minor and trace elements including stable isotopes occupy around 3% of

the otolith. It grows continuously from birth. Because its components, mainly derived from water, are chemically inert after formation, scientists use the micro-chemistry of the otolith as a chronological recorder. Thus otolith contains information about the whole life of the animal as an environmental recorder and timekeeper. The changes in chemical composition might reflect the environmental variability of the animal's habitat and its behavioral characteristics.

Otolith chemistry research can be broken down into two fields: isotope analysis and trace element analysis. Stable carbon isotopes are generally precipitated in isotopic disequilibrium with the ambient seawater, but are influenced by metabolic processes, somatic growth and food changes. It is well known in marine science that the difference in stable isotope contents in otolith indicates the difference in oceanic productivity, status in trophic level, spawning grounds, and habitat temperature. Also, stock identification, fish migration route, and physiological changes with age can be inferred by the changes in the trace element ratios. In particular, strontium has a good potential to reveal information about fish habitats. Recent advances in Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) have allowed fine scale examination of trace elements in otolith. Pacific salmon are noted for their extensive ocean migrations and successful homing to their natal rivers. Salmon are important to the economies, cultural activities, and heritage of the people of the North Pacific Rim. Chum salmon otoliths were collected from four sites along the Pacific Rim: Korea, Japan, Canada, and the USA during 1997-1999. Whole otoliths of adult salmon were ground, and the oxygen and carbon stable isotope analysis indicated that those four stocks had different values of stable isotopes. In general, the Asian and the American salmon can be separated by isotope values. The Asian salmon always shows a high oxygen stable isotope and a low carbon stable isotope. Because the high oxygen stable isotope means low habitat temperature, the habitat temperature of Asian salmon is lower than that of American salmon. For carbon stable isotope, there are some different views in interpreting. However, if we could accept its difference as productivity difference, we might say that the habitat of American salmon is more productive than that of Asian salmon. Also, the content of stable isotope varies with life stage. In addition to the adult salmon otolith, we collected fry otolith at hatchery and juvenile otolith from scientific cruises at sea. Stable isotopes tend to increase as they grow.

The laser-beam technology with ICPMS shows the profiles of elemental concentration in otolith. Profile starts from the nucleus of the otolith to the rim. From this profile, the age and residence areas of salmon might be identified. Some elements showed the increasing trend with age, but others were in opposite. For chum salmon, strontium and zinc showed the reverse way in cyclic pattern.

Research results at spawning areas indicated that each hatchery's water has a different concentration of trace elements, and the chemical composition of water seemed to influence fry otolith. The relationship between strontium concentrations in freshwater and otolith at each hatchery was noted. Also, some amounts of otolith extracted from the nucleus of adult chum salmon were chemically analyzed. The result of statistical test with 23 elements on otolith nuclei identified each stock.

Walleye pollock, as a single species, is the most abundant commercial species in the world, therefore important ecologically and economically. Pollock otoliths were collected during the early winters of 1997-2000. Whole ground otolith showed different values of oxygen stable isotope. Otolith collected in 1998 had the highest, and those from 1997 had the lowest values. The water temperature at the resident area of pollock population was high in 1997, and low in 1998, which correspond with the isotopic values. Chemical analysis with fractions detached from each age-band of otolith also indicated the same result: the cold

temperature of 1998 caused the higher oxygen isotope, and vice versa.

As a concluding remark, otolith chemistry has only just started, however it shows a lot of promise for ocean and fishery sciences. Through micro-chemistry research of otolith, as Professor Warren Wooster said, we might find meaningful ways to bring oceanography and fisheries together, and the meaningful way developed in the form of studying the effect of climate variation on marine ecosystem inhabited by fish.

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