

Report of the Opening Session

AGENDA ITEM 1

Opening by the Chairman of PICES

The Opening Session started at 09:00 hours on October 20, 2014. Dr. Laura Richards, Chairman of PICES, welcomed delegates, observers and researchers to Yeosu and formally declared that the PICES 23rd Annual Meeting (PICES-2014) was open. The session agenda is appended as *OP Endnote 1*.

AGENDA ITEM 2

Welcome address on behalf of the host country

Mr. Young-Suk Kim (Vice-Minister, Ministry of Oceans and Fisheries), Mr. Cheol-Hyeon Ju (Mayor of Yeosu) and Dr. Gi-Hoon Hong (President, Korea Institute of Ocean Science and Technology) welcomed participants on behalf of the host country (*OP Endnotes 2–4*).

AGENDA ITEM 3

Remarks by the Chairman of PICES

Dr. Richards thanked the Korean officials for their remarks, and addressed the participants on behalf of PICES (*OP Endnote 5*).

AGENDA ITEM 4

Wooster Award presentation ceremony

Dr. Thomas Therriault, Chairman of Science Board, and Dr. Richards conducted the Wooster Award presentation ceremony. Dr. Therriault introduced the award and announced that the 2014 award was being given to Dr. Fangli Qiao (First Institute of Oceanography, State Oceanic Administration, People's Republic of China) for a career of sustained excellence in marine science research that has spanned more than 20 years (*OP Endnote 6*). Reading of the Science Board citation was accompanied by a slide show dedicated to Dr. Qiao. A commemorative plaque was presented to Dr. Qiao (a permanent plaque identifying all Wooster Award recipients resides at the PICES Secretariat), who accepted the award with the following remarks:

Thank you! What a surprising and amazing honor! There are so many outstanding scientists in the PICES community; I am humbled in receiving the Wooster Award, but also very happy for this recognition. PICES is a big family; I have learned a lot from this family during the past ten years. As you know, improving simulation and forecasting of the ocean and climate has been one of PICES' top priorities. However, all ocean circulation and climate models face common problems, that is, a lack of vertical mixing in the upper ocean. Where is the missing energy? At last, we have found that surface waves play a dominant role in the upper ocean, which is not only important for improving ocean and climate models, but is also relevant for the marine ecosystem. I would like to acknowledge that the above achievements are the result of contributions from many wonderful colleagues and mentors; I am truly grateful to the collaborations. Ladies and gentlemen, I would like to share the Wooster Award with all of you. It could not happen without your full support. Thank you again, and I hope to meet all of you in Qingdao in 2015.

AGENDA ITEM 5

PICES Ocean Monitoring Service Award presentation ceremony

Drs. Therriault and Richards also conducted the presentation ceremony of the PICES Ocean Monitoring Service Award (POMA). Dr. Therriault introduced the award and announced that the 2014 award was being given to the Trans-Pacific Volunteer-Observing-Ship (VOS) Survey Program of the National Institute for

Environmental Studies of Japan (*OP Endnote 7*). Reading of the Science Board citation was accompanied by a slide show dedicated to the Program. A commemorative plaque (a permanent plaque identifying all POMA recipients resides at the PICES Secretariat) and a certificate were presented to Dr. Yukihiro Nojiri (National Institute for Environmental Studies of Japan). Dr. Nojiri provided the following remarks of appreciation:

First, I want to express my gratitude to the late C.S. Wong (Institute of Ocean Sciences, Department of Fisheries and Oceans, Canada). NIES VOS observations were started by his proposal for collaboration. His laboratory people were on-board members in our first VOS, the Skaugran surveys. I visited him in March 2013, before he passed away in June. He was something like my father in oceanography, and he also took care of many Japanese oceanographers.

When we started pCO₂ observations in 1995, we were not familiar with data exchange among ocean CO₂ scientists. However, now we have the global open data exchange network, SOCAT. We developed this system under many international organizations, and PICES is an important supporter for the North Pacific. The PICES support for ocean CO₂ scientists started in the mid-1990s, which was coincident with our VOS observations.

Most essential support was from shipping companies, captains, chief engineers and ship crews of the volunteer ships, and port authorities. The efforts of staff from NIES, GEF, Kimoto Electric Co., MIRC and many collaborators in Japan were inevitable. Finally, I want to acknowledge our partners such as IOS (Canada), NIWA (New Zealand), CSIRO (Australia), NOAA (USA), IOCCP and many other international supporters.

AGENDA ITEM 6

PICES “Year-in-Review” 2014

Dr. Therriault reviewed PICES’ scientific accomplishments since the Twenty-Second Annual Meeting (PICES-2013) in Nanaimo, Canada. An article on the state of PICES science for 2014 will be published in the 2015 winter issue of PICES Press (Vol. 23, No. 1).

AGENDA ITEM 7

Closing remarks and announcements

The session was adjourned at 10:10 a.m., after announcements related to the logistics of the Annual Meeting made by Dr. Harold (Hal) Batchelder, Deputy Executive Secretary of PICES.

OP Endnote 1**Opening Session agenda**

1. Opening by Dr. Laura Richards, Chairman of PICES
2. Welcome addresses on behalf of the Republic of Korea
 - Mr. Young-Suk Kim (Vice-Minister, Ministry of Oceans and Fisheries)
 - Mr. Cheol-Hyeon Ju (Mayor of Yeosu)
 - Dr. Gi-Hoon Hong (President, Korea Institute of Ocean Science and Technology)
3. Remarks by Dr. Laura Richards, Chairman of PICES
4. 2014 PICES Wooster Award presentation ceremony
5. 2014 PICES Ocean Monitoring Service Award presentation ceremony
6. *PICES “Year-in-Review” 2014* by Dr. Thomas Therriault, Chairman of Science Board
7. Closing remarks and announcements

OP Endnote 2**Welcome address by Mr. Young-Suk Kim (Vice-Minister, Ministry of Oceans and Fisheries)**

Honorable Madame Chair, Dr. Laura Richards, Science Board Chair, Dr. Thomas Therriault, Executive Secretary, Dr. Alexander Bychkov, distinguished marine scientists from member countries, Mayor Ju Chul-Hyeon of the City of Yeosu, the host of the 23rd Annual Meeting of PICES, President Hong Gi-Hoon of the Korea Institute of Ocean Science and Technology, the key supporter of the meeting, ladies and gentlemen:

I would like to extend my sincere appreciation to all of you for kindly taking the time to join us here today. First, please allow me to congratulate you most warmly on the opening of the 2014 Annual Meeting of PICES. I believe it is all the more meaningful that this year’s meeting is taking place here in Yeosu, which hosted an international expo on the theme of the ocean and climate change, “*The Living Ocean and Coast*”, two years ago.

Since its inception in 1992, the North Pacific Marine Science Organization has come a long way and made significant achievements in the field of climate change and marine ecosystems in the North Pacific Ocean, facilitating the robust exchange of expertise and contributing to the conservation of the marine environment and the rebuilding of fisheries stocks. Korea joined the Organization in 1995, and ever since has maintained its active participation every year through a large delegation of about 50 marine experts and aspiring young scientists. I believe they have played an important role in demonstrating their talent in the field of marine science and technology. I would also like to take this opportunity to convey my heart-felt appreciation to the PICES Secretariat and Member States for your dedication and efforts. It is your tireless and constant efforts that such excellent works as the North Pacific Ecosystem Status Report and the FUTURE Program can be paid attention to by the global marine science community.

Distinguished delegates, ladies and gentlemen, I believe these achievements do not only belong to the individual scientists and researchers themselves, but they are also thought to be common assets for the international community. It is because the studies on weather patterns, sea-level rise, and the habitats and population of marine species certainly provide us common principles that must be taken into account for both humankind and nature, sustainability, the stewardship of humankind, ecosystem-based management, and principles of globe-leveled responsibilities, all of which should be shared and implemented through proper governance. In this sense, I am fully convinced that the world sufficiently recognizes and acknowledges the strenuous efforts made in PICES over the last two decades that have significantly contributed to the recovery and restoration of the ecosystems on the planet. And I believe the theme of this year’s Annual Meeting, “*Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*” will appropriately serve to promote the robust exchange of ideas and experience. I hope that all of you will make the most out of this 11-day meeting, sharing the research outcomes and achievements with one another to build on, and find new opportunities for further studies.

The Korean government is also strongly committed to its full support for PICES, and I would like to ask you to join hands with us in this great endeavor. I can only imagine how difficult it would be to organize an Annual Meeting of this scale, attended by around 500 scientists every year. This makes me even more impressed with

the capable hands of the Chair, Executive Secretary and the Secretariat, who have always worked to keep the meetings successful. On behalf of the Korean government, I would like to once again express my deepest gratitude to you in this regard.

The name of the City, Yeosu, means the “Beautiful Sea” in English. I hope you can find some slots out of your tight schedules to take a look around the Expo site and indulge yourselves in the beauty of the scenic Yeosu bay, surrounded by 365 sister islets.

Last but not least, I sincerely hope that the 23rd Annual Meeting of PICES will be as successful as it always has been, and I whole-heartedly wish all of you good health and more blessings to come. Thank you!

OP Endnote 3

Welcome address by Mr. Cheol-Hyeon Ju (Mayor of Yeosu)

Ladies and gentlemen, it is my great pleasure to see you. I am Ju Cheol-Hyeon, the representative mayor for ‘beautiful Yeosu, happy citizens’ of Yeosu. I am very delighted to hold 2014 Annual Meeting of PICES here in Yeosu.

Honorable Chairman, Ms. Laura Richards, government delegates from the six North Pacific countries and oceanography experts, Mr. Young-Suk Kim, Vice-Minister of the Ministry of Oceans and Fisheries, and all distinguished domestic and foreign guests, including Mr. Gi-Hoon Hong, the President of Korea Institute of Ocean Science and Technology! With 300,000 citizens, I sincerely welcome you all to our beautiful city of the ocean, Yeosu.

As it is held in Yeosu, the place that proposed the vision of a future for mankind with the ocean through the successful hosting of the 2012 World Exposition, I expect this Annual Meeting will be a great chance to find a solution for the mutual development of the North Pacific region with fishery science and environmental research on the ocean, the last reservoir of resources for human beings.

As located in the southernmost tip of the Korean peninsula, our city, Yeosu, is a beautiful ocean city on the gateway to the Pacific Ocean. It is proud of its heavenly blessed marine resources on Gamak Bay and Yeoja Bay, 365 jewel-like islands and a warm and neat climate. The historic sites of Admiral Yi Sunshin, a legendary hero in the history of naval warfare, great food and scenic views attract many tourists and visitors. And judging by the success of the 2012 World Exposition, our city is stepping forward to be the center of international marine tourism. In this deepening autumn, I hope you develop deep friendships and take away great memories of our excellent foods and wonderful night scenery.

My honorable government delegates of the North Pacific region and oceanography scholars: For decades, you have been contributing to advances in scientific knowledge about the ocean not only in the North Pacific region but also on a global scale. Under the theme of “*Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*”, I expect that this Annual Meeting will also become a great success through the sharing and exchanging of experiences and information among member countries, generating notable achievements on ocean science and research and leading the advance of the North Pacific regions.

Welcoming you once again, I hope you to take in our city, Yeosu’s great tastes, delights and love for all in your heart in this green autumn weather. Our citizens will do our best for your convenience! I wish you a comfortable and enjoyable time during your stay. Thank you!

OP Endnote 4

Welcome address by Dr. Gi-Hoon Hong (President, Korea Institute of Ocean Science and Technology)

Honorable Mr. Kim Yeong-Suk, Vice-Minister of the Ministry of Oceans and Fisheries of the Republic of Korea, Dr. Laura Richards, Madam Chair of the North Pacific Marine Science Organization (PICES), Mayor Mr. Ju Cheol-Hyeon of Yeosu City, and other distinguished scientists and guests:

I am very much honored to join you this morning to open the 23rd Annual Meeting in Yeosu, Republic of Korea.

One of the mandates of PICES is to advance scientific knowledge about the ocean environment and climate change, living resources and their ecosystems, and the impacts of human activities on these marine systems. This mandate is also one of the main activities of the Korea Institute of Ocean Science and Technology that I am currently representing in this meeting.

Some of you may recall that the Republic of Korea has hosted four Annual Meetings: in Busan in 1997, Seoul in 2003, Jeju in 2009, and today in Yeosu in 2015, every 6 years since 1995 when our country joined PICES, thanks to the warm support from the other member countries. Our national community has benefitted tremendously from the various activities of PICES, and we look forward another opportunity to do so.

You may also remember that in 1992, the first meeting was held in Victoria. Now, more than two decades have passed, and we have seen a number of great achievements and the momentum to advance marine scientific information in the North Pacific. This year's theme, "*Toward a better understanding of the North Pacific: Reflecting on the past and steering for the future*", is very timely as we are about to move onto another stage of human civilization, for example, the Internet of Things and other Information and Communication Technologies. This week will also provide an opportunity to reflect where the gaps are and how to narrow those gaps by mobilizing collective resources from all Member States.

I would like to propose that we need to take advantage of these emerging scientific and technological innovations to tackle many challenges confronting us, such as risks posed by ongoing climate change and an apparent increased tectonic activity related to a growing coastal population and marine industry.

As you are well aware, Yeosu is a special place rich in history and high quality traditional seafood dishes, and is also a birth place of the Yeosu Declaration of 2012 to develop ocean sustainably to steward "*The Living Ocean and Coast*." The scientific activities of PICES are believed to be well fitted into the Declaration.

Finally, I trust you all to harvest this meeting to yield many great fruits and enjoy the natural and cultural atmosphere and food served in Yeosu during your stay. Thank you for your attention.

OP Endnote 5

Welcome address by Dr. Laura Richards (Chairman of PICES)

On behalf of PICES, I would like to thank the Ministry of Oceans and Fisheries (MOF) for hosting this meeting, working in conjunction with the PICES Secretariat. A meeting of this size also requires a considerable effort by local staff. I would like to thank Yeosu City, the Korea Institute of Ocean Science and Technology (KIOST), and the National Fisheries Research and Development Institute (NFRDI) for their assistance with the local arrangements.

I would also like to especially welcome those of you for whom this is your first PICES meeting. PICES may be seen daunting at first because of the large numbers of sessions with strange-sounding names, (which are all explained on pages viii and ix of the Abstract Book). I encourage you to attend a variety of sessions and participate in the various working group meetings. All of the scientific sessions and committee meetings are open to everyone, except for a very few related to the overall management or administration of the Organization. PICES needs you to take part, to contribute your ideas and to discuss different points of view. We all come from different backgrounds and have ideas to contribute. By working together I hope that we can discover that the sum is worth more than the individual parts. In the process, you will make new friends and meet wonderful people who share your enthusiasm for marine science.

Last year, I suggested three challenges for participants to accomplish by the end of the meeting. I would like to repeat those today. The first challenge is to attend a scientific presentation in a field of study which is different from your own. For example, if you are a physical oceanographer, then you could attend a presentation in a session sponsored by the Fishery Science Committee. Similarly, a fishery biologist could attend a presentation in a session sponsored by the Physical Oceanography Committee. This should be easy to accomplish since many of the sessions are jointly sponsored by different committees. The second challenge is

to attend at least one scientific presentation by a scientist from each of the six nations within PICES. The third challenge is to meet and get to know one scientist from each of the six nations within PICES, ideally someone that you had not previously met.

The past year has been a busy one for PICES. We are now at the mid-term of our flagship science program called FUTURE. Following best practices, we commissioned a review of the program which acknowledged the excellent science and strengthened collaborations developed in the first five years of the program. The review also pointed to a number of changes that the review panel recommended in order for the program to achieve its full potential. We will be considering those recommendations here in Yeosu. You will hear more about the review and the work of PICES over the past year when the Science Board Chairman gives his report in a few minutes.

But before I close, I would like to make some announcements. This is a time of major transition for the Secretariat. I would like to begin by offering a warm welcome to Dr. Hal Batchelder in his first PICES meeting as Deputy Executive Secretary. Dr. Batchelder replaced Dr. Skip McKinnell who retired from the Secretariat early this year.

In addition, Dr. Alexander Bychkov will step down as PICES Executive Secretary when his term expires in a few months at the end of December. Dr. Bychkov has served as Executive Secretary since 1999 and has overseen the maturation of PICES as an Organization. PICES has truly benefited by Dr. Bychkov's leadership. He deserves to be proud of his efforts and his vision. I am very pleased that Dr. Bychkov has agreed to stay on with PICES to assist with a number of special projects, along with ensuring a smooth transition to a new Executive Secretary.

Over the past year I coordinated a process to re-staff the PICES Executive Secretary position. Final interviews were held yesterday and I hope to be able to announce the results in the near future.

OP Endnote 6

Science Board citation for the 2014 Wooster Award

In 2000, PICES Governing Council approved the establishment of an award named in honour of Professor Warren S. Wooster, a principal founder and the first Chairman of PICES, and a world-renowned researcher and statesman in the area of climate variability and fisheries production. The award is given annually to an individual who has made significant scientific contributions to North Pacific marine science, such as understanding and predicting the role of human and climate interactions on marine ecosystems.

It is my great pleasure to announce that the recipient of the 2014 Wooster Award is Dr. Fangli Qiao of the First Institute of Oceanography (FIO), State Oceanic Administration, People's Republic of China, for a career of sustained excellence in marine science research that has spanned more than 20 years.

Fangli was born in a small Chinese village in 1966 and entered the Ocean University of China in 1984 with the highest score. In 1988, he was recommended as a Master's candidate, and received his PhD in 2003. Dr. Qiao was promoted to his full professor position within six years after starting at FIO due to his excellence in ocean research. He has more than 200 publications in peer-reviewed journals, two published books, and serves on the editorial boards of three international journals.

His most cited publication clarified the crucial importance of surface waves in large-scale circulation through vertical mixing, which is now used as the theoretical basis for ocean model improvement. This theory has been confirmed by laboratory experiments and field observations. Numerical experiments show that this mixing scheme is much more important than traditional shear-induced mixing. Previous ocean circulation models produced insufficient vertical mixing, under-predicting surface mixed layer depth and over-predicting sea surface temperature. These improvements are important for modeling the climate system, and he shared this with IOC/WESTPAC member states through the development of an operational wave-tide-circulation coupled Ocean Forecasting System, which was launched in May 2012 and will benefit coastal populations in Southeast Asia.

Fangli provided important scientific support for several public health issues, including identifying the causes of algal blooms and accumulations in the Qingdao coastal area of the Yellow Sea in 2008, and the spread of radiation from the damaged Fukushima nuclear plant in March 2011. In addition to his scientific achievements, Fangli has made substantial contributions to administration of science and professional service. As Deputy Director General and more recently, Director General, he has been in charge of international cooperation for FIO for nearly 10 years.

Dr. Qiao assisted in the founding of the UNESCO/IOC Regional Training and Research Center on Ocean Dynamics and Climate (UNESCO/IOC-ODC) and has served as Director since its establishment in June 2011. To date, 169 trainees from 26 countries have participated in ODC training courses.

He has been active in PICES as a member of Science Board from 2005–2012 and currently serves as a member of POC, WG 29, and Governing Council. He has encouraged a number of early career scientists from China to become engaged in PICES.

Ladies and gentlemen, please join me in congratulating Dr. Fangli Qiao as the 2014 recipient of the Wooster Award.

OP Endnote 7

Science Board citation for the 2014 PICES Ocean Monitoring Service Award

The PICES Ocean Monitoring Service Award (POMA) recognizes organizations, groups and outstanding individuals that have contributed significantly to the advancement of marine science in the North Pacific through long-term ocean monitoring and data management. The award also strives to enlighten the public on the importance of those activities as fundamental to marine science. It draws attention to an important aspect of the PICES Convention that is less appreciated: “to promote the collection and exchange of information and data related to marine scientific research in the area concerned”.

It is my great pleasure to announce that the recipient of the 2014 POMA award is the National Institute for Environmental Studies (NIES) of Japan for their Trans-Pacific Volunteer-Observing-Ship (VOS) Survey Program.

To understand global carbon budgets requires broad spatial and temporal *in situ* observation of oceanic CO₂ partial pressure ($p\text{CO}_2$). The atmosphere–ocean difference of $p\text{CO}_2$ controls the flux and efflux of oceanic CO₂. While many historical $p\text{CO}_2$ observations were obtained from oceanographic research vessels, it was recognized that the need for more complete spatial and temporal coverage could be satisfied partially using volunteer observing ships (VOS). This approach was pioneered in 1985 by the late Dr. C.S. Wong of the Institute of Ocean Sciences in Canada. He installed a gas-chromatographic $p\text{CO}_2$ instrument on board a cargo ship sailing between the west coast of Canada and Oceania that allowed repeated observations of $p\text{CO}_2$ over the equator until 1988 when the ship route changed. Communication between Dr. Wong and Dr. Yukihiro Nojiri called for a new VOS program, and in 1994 a $p\text{CO}_2$ VOS survey was revived using the *Skaugran*, a lumber and car carrier sailing between the U.S. west coast and Japan. Following negotiations with the Captain, Chief Engineer, and operator and owner, NIES prepared the on-board system and technical staff, usually students.

A second VOS, *Alligator Hope*, a container carrier operating between Tokyo and Seattle/Vancouver was outfitted. Dr. Nojiri obtained special funding to improve the on-board $p\text{CO}_2$ system that was more automated and able to be operated by a one of the ship’s crew. After 16 round trips, *Alligator Hope* had a route change to Oceania so the NIES project looked for a new candidate ship for the North Pacific. Since car carriers belong to the manufacturers, they appeared to offer longer-term stability for the Program.

The shipping companies, Toyofuji Shipping and Kagoshima Senpaku, having strong connections with Toyota Motors exporting Japanese cars to North America, Asia and Oceania, have been helping the NIES VOS project since 2001. They graciously allowed $p\text{CO}_2$ systems to be installed on several ships, including the third VOS for the North Pacific, the *Pyxis*. Due to the efforts of NIES, Global Environmental Forum Foundation, Kimoto

Electric Company, and the shipping companies, the *Pyxis* made 86 round trips, which must be a record for a single VOS in the world's $p\text{CO}_2$ observations.

Dr. Hitoshi Mukai of NIES secured funding for an Oceania $p\text{CO}_2$ line and, with cooperation from Toyofuji Shipping, designed an atmospheric and oceanic $p\text{CO}_2$ observation space on the *Transfuture 5*, which is now in its ninth year.

The three VOS in the North Pacific achieved 148 trans-Pacific round trips from 1995 to 2013. It amounts to about 30 trips around the globe. This project has been encouraged and supported by PICES member countries and contributed to Working Groups 13 and 17, and now the Section on *Carbon and Climate*. The project has resulted in 17 scientific publications on North Pacific biogeochemistry, 8 on global ocean $p\text{CO}_2$ database and analysis, and 18 on atmospheric sciences through the on-board sampling and measurement of atmospheric components. Additional results and details are available on the project's web page [<http://soop.jp>].

In 2007, world experts on ocean surface $p\text{CO}_2$ determined that an integrated observational Surface Ocean CO_2 Atlas, SOCAT, should be compiled. The NIES VOS data set contributed 14% of the total global $p\text{CO}_2$ data in SOCAT. The SOCAT database demonstrated the value of VOS surveys in providing better geographic and seasonal $p\text{CO}_2$ data, thanks in large part to NIES VOS Program.

Ladies and gentlemen, please join me in congratulating NIES, who is represented here by Dr. Yukihiro Nojiri, as the 2014 recipient of the PICES Ocean Monitoring Service Award.