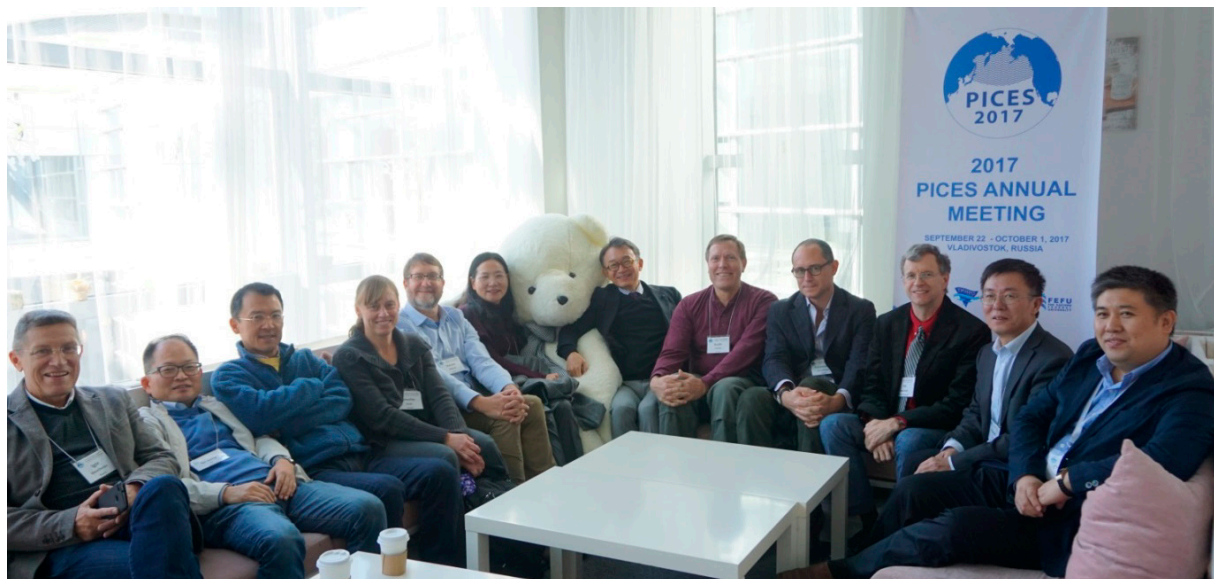


Report of Science Board

Science Board met in Vladivostok, Russia, from 09:00 to 1:00 on September 24, 2017. Science Board Chair, Dr. Hiroaki Saito, welcomed guests and members to the meeting and self-introductions were made (*SB-2017 Endnote 1*). A second half-day meeting was held after the Closing Session, from 13:50 to 18:00 on September 29 and a one-day meeting was held from 9:00 to 18:00 on September 30, 2017. Some agenda items were re-ordered to follow after items that were related to them, and to accommodate the times two invited observers would be available (*SB-2017 Endnote 2*).



Science Board, from left: Igor Shevchenko (representing Russia), Se-Jong Ju (BIO), Motomitsu Takahashi (representing Japan), Jennifer Boldt (MONITOR), Steven Bograd (FUTURE SSC), Sukyung Kang (FUTURE SSC), FEFU teddy bear, Hiroaki Saito (Science Board Chair), Keith Criddle (HD), Emanuele Di Lorenzo (POC), Harold (Hal) Batchelder (PICES Secretariat), Xianshi Jin (FIS), Chuanlin Huo (MEQ); (missing) Joon-Soo Lee (TCODE Chair).

Sunday, September 24, 2017

AGENDA ITEM 2

Procedures for Science Board Symposium and Session awards

Dr. Saito reviewed Committee/FUTURE instructions for the selection of awards to early career scientists. Clarifications were made on scoring. The Science Board Chair would chair the morning session, and POC Chair, Dr. Emanuele Di Lorenzo, would chair the first part of the afternoon session and MONITOR Chair, Dr. Jennifer Boldt, would chair the remainder of the afternoon. Dr. Motomitsu Takahashi was tasked with providing summaries of the morning session, Dr. Di Lorenzo was responsible for the early afternoon summaries and BIO Chair, Dr. Se-Jong Ju, was responsible for the later afternoon summaries. Every member was asked to notify his/her Committee of the S1 change in schedule where the last speaker of the afternoon would present after coffee break in place of the invited speaker who was unable to attend the meeting.

AGENDA ITEM 3

Template for Committee reports to Science Board

Deputy Executive Secretary, Dr. Harold (Hal) Batchelder, reviewed the Committee/Program template to be completed and sent to the Secretariat by Science Board members by lunch time on Thursday. Committee Chairs were asked, in particular to include any requests from their expert groups on changes in membership, including requests for additional members – these can be names of someone who is interested in joining or the Governing Council delegate can appoint someone.

Other clarifications included:

1. Keeping expert group meetings to the weekend schedule, prior to the Topic Sessions, in order that expert group requests and issues be submitted in time for the Wednesday meeting of their parent committees.
2. Any group wanting to hold a meeting for more than 1 day should indicate the reason (*i.e.*, to hold a “writing workshop” for its final report)
3. Rooms might be available if participants wanted to have a discussion after a Topic Session, but this request would need to be presented to the Secretariat.

Action: Secretariat to add comment for business meeting duration in Committee template.

AGENDA ITEM 4

Collaborations with international organizations/programs

AGENDA ITEM 4A

Strategic and other collaborations

A) ICES (International Council for the Exploration of the Sea)

See under Friday meeting, Agenda Item 4A.

B) NPAFC (North Pacific Anadromous Fish Commission)

Dr. Vladimir Radchenko’s (Executive Director, NPAFC) main focus was on the International Year of the Salmon (IYS) as a new bridge to strengthen ties between PICES and NPAFC. IYS was midway through its planning phase. The IYS North Pacific Steering Committee (PICES represented by Dr. Batchelder) met from March 30 to April 1, 2017 in Vancouver, Canada. Meeting recommendations included paring down from 45 to a small executive committee of 12–15 members, using results-based planning for outreach and IYS research themes, reaching an agreement on timing and scope of the IYS Symposium. 2019 will be the focal year for IYS with field work and data collection. Russia proposes conducting extensive winter surveys across the North Pacific, and all NPAFC member countries are invited to participate in the cruises. NPFC also strongly supports this cruise.

NPAFC will host the First IYS Workshop on “*Pacific salmon production in a changing climate*” to be held on May 26–27, 2018, in Khabarovsk, Russia.

Action: Secretariat to send workshop invitation to attend to Committee members.

In other PICES-NPAFC collaborations, NPAFC is a co-sponsor of the 4th International Symposium on “*The effects of climate change on the world’s oceans*” (June 4–8, 2018, Washington, DC, USA).

C) *ISC (International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean)*

Dr. Gerard DiNardo (Plenary Chairman, ISC) reported on ISC-PICES collaboration through the joint PICES/ISC Working Group on *Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish* (WG 34) of which he is the Co-Chair, representing PICES. The Working Group was formed because PICES and ISC shared the same area of interest in the North Pacific relating to albacore tuna distribution. The main goal of the WG is to understand highly migratory tuna species in the North Pacific ecosystem and how they are affected by climate change.

WG 34 is continuing the development of a Pacific blue fin habitat model in for the California Current ecosystem and North Pacific Ocean. Dr. DiNardo will be co-convening a topic session at the International Symposium on “Understanding changes in transitional areas of the Pacific” April 2018 in La Paz, Baja California Sur, Mexico, and WG 34 will convene a topic session at PICES-2018, the outcome of which is hoped to be published in a journal. He noted that the WG is still facing challenges. Fulfilling the third term of reference, on identifying data sets was taking more time than anticipated. Data sharing between organizations was limited. In terms of membership, there was also limited highly migratory species expert representation from PICES and there was no physical oceanographer in the WG.

Dr. DiNardo requested that the WG be extended to 2019 in order to coincide and help coordinate an ISC/PICES International Symposium in 2019, with publications in 2020.

Recommendation: Science Board recommends POC/WG 40 communicate with WG 34 to determine what physical oceanography needs are in WG 34.

D) *NOWPAP (Northwest Pacific Action Plan)*

Dr. Lev Neretin (NOWPAP Regional Co-ordinator) presented an overview of PICES-NOWPAP past and ongoing collaborations. Seven areas of potential activities between the two organizations were identified through the joint PICES-NOWPAP Study Group on *Scientific Cooperation in the North Pacific Ocean* (SG-SCOOP) at PICES-2014. Since the adoption of the framework for cooperation, the two main priority areas PICES and NOWPAP have focused on have been HABs through S-HAB and NOWPAP CEARAC, and WG 31 on *Emerging Topics in Marine Pollution*. Recently NOWPAP has been discussing potential collaboration with AP-CREAMS.

NOWPAP is developing a Medium-Term Strategy for 2018-2023 and the implementation plan is to work on regional sustainable development goals, focusing on supporting integrated coastal and river basin planning and management, assessing status of the marine and coastal environment, preventing and reducing land- and sea-based pollution, and conserving marine and coastal biodiversity. NOWPAP is looking to strengthen cooperation with various regional partners, including PICES. Any comments or suggestions from PICES on the Strategy would be welcomed before it is adopted at NOWPAP’s intergovernmental meeting in December 2017.

Action: Science Board to provide any comments or suggestions on Medium-Term Strategy Implementation Plan to NOWPAP before December.

Dr. Neretin stressed that it is important to continue holding joint NOWPAP-PICES meetings and workshops at PICES Annual Meetings, and on other occasions, where appropriate. Also important were joint capacity building efforts, such as summer schools. NOWPAP has expressed interest in co-sponsoring a topic session and workshop at PICES-2018, and will be involved with PICES in MSEAS II (2020).

NOWPAP will continue to work with PICES on HABs and marine pollution, but Dr. Neretin suggested five additional priority areas for NOWPAP-PICES cooperation in 2018 and beyond:

1. HABs and marine litter, including microplastics;
2. Collaboration on North Pacific Ecosystem Status Report (who can NOWPAP talk to?);
3. Marine/coastal biodiversity, with a focus on invasive species (HABs will be part of NIS – who can NOWPAP contact?);

4. Joint PICES-NOWPAP regular publications on emerging issues (to help policy makers use the information for planning);
5. Collaboration on climate change adaptation/resilience of socio-ecological systems (NOWPAP would provide the funding to PICES experts because NOWPAP lacks the expertise).

F) NPFC (North Pacific Fisheries Commission)

Dr. Alexandr Zavolokin (Science Manager, NPFC) gave a brief presentation on the background and motivation for the Commission. NPFC was formed to bridge the gap in the management of fisheries resources and ecosystems in the North Pacific. The Commission came into force in 2015. NPFC membership includes the same countries as in PICES and the area covered by NPFC and PICES is similar, so cooperation in mutual interests would be beneficial between the two organizations. NPFC co-sponsored the PICES/ICES International Symposium on “*Drivers of dynamics of small pelagic fish resources*” (March 2017, Victoria, Canada) and is co-sponsoring the PICES international Symposium on “*Understanding changes in transitional areas of the Pacific*” (April 2018, La Paz, Mexico). PICES was represented at NPFC’s Pacific Saury Stock Assessment Workshop in December 2016.

Dr. Zavolokin noted PICES’ strong interest in Vulnerable Marine Ecosystems (through Working Groups 19, 21, 28, 32 and the Study Group on *Biodiversity Conservation*). To further collaboration, NPFC invited PICES to:

1. Co-sponsor an NPFC/FAO Workshop on “*Protection of Vulnerable Marine Ecosystems in the North Pacific Fisheries Commission area*” (March 12–15, 2018, Yokohama, Japan);
2. Form a joint Study Group on scientific co-operation between NPFC and PICES (**SB-2017 Endnote 3**)

Action: Discuss travel support to the workshop and membership for the Study Group at the Saturday meeting.

G) FE-KAN (Future Earth Knowledge-Action Network)

Dr. Emanuele Di Lorenzo provided a brief overview of this network which is under the auspices of Future Earth. Dr. Di Lorenzo is a member of the Future Earth Ocean Development Team whose purpose is to give advice and feedback on activities and the development of the Future Earth Ocean Knowledge-Action Network (FE-KAN) under one of the UN’s sustainable development goals, Goal 14 (Life below Water). FE-KAN will hold its first meeting via web in November 2017.

H) NPRB (North Pacific Research Board)

Dr. Matthew Baker (Science Director, Long-term Monitoring Program, NPRB) provided a brief background of NPRB whose mandate is to understand the North Pacific ecosystems to enable effect management and sustainable use of marine resources. One of its major goals is to foster cooperation with other organizations such as PICES in conducting research and management in the North Pacific, and Dr. Baker cited past activities that PICES and NPRB have collaborated on (symposia co-sponsorship, *i.e.*, “*Climate change effects on fish and fisheries*” (2010), 5th International Zooplankton Production Symposium (2011), “*Drivers of dynamics of small pelagic fish resources*” (2017), publications, *i.e.*, NPESR (2005, 2010, PICES Special Publications 1 and 4), and capacity building initiatives such at the 2008, 2012 and 2017 PICES/ICES Early Career Scientist Conferences).

NPRB seeks to be more engaged with PICES – by coordination through PICES Committees and APs, and through OOSs (AOOS and CPR), workshops (NPRB was a co-sponsor for the Bering Sea workshops at PICES-2016 and PICES-2017) and data (NPRB is willing to promote the NPESR through its data portal; NPRB the author of Bering Sea data for NPESR).

Friday, September 29, 2017

AGENDA ITEMS 4A and B

Strategic and other collaborations (continued)

A) ICES (International Council for the Exploration of the Sea)

Dr. Cornelius Hammer (President, ICES) remarked that collaboration between ICES and PICES scientists was fruitful and thriving. He reviewed past PICES/ICES collaborations and current ones.

ICES will develop a new Strategic Plan in 2018, and he invited PICES to contribute to it. Dr. Hammer listed a number of international processes PICES and ICES could be/are linked to:

- Second Cycle of the UN regular Process for global reporting and assessment of the state of the marine environment – suggest that work already explored between the two Organizations be explored further during five regional workshops
- International Decade of Ocean Science and UN Sustainable Development Goals – PICES and ICES are in agreement with these goals
- The Arctic
 - 5th Meeting of Scientific Experts on Fish Stocks in the Central Arctic Ocean (FisCAO), October 2017, Ottawa, Canada – PICES and ICES were represented;
 - PICES was added to the ICES/PAME Working Group on an *Integrated Ecosystem Assessment for the Central Arctic Ocean* at PICES-2016;
- Marine litter
 - At ICES 2017 ASC, it was suggested that ICES and PICES form a working group on marine litter
- Aquaculture
 - Dr. Michael Rust (USA) is Chair of ICES aquaculture Steering Group. Would PICES be interested in collaboration?

ICES ASC 2018 will be held in Hamburg, Germany and Dr. Hammer invited PICES participation. (Theme session proposals for Science Board review were not available at this time.) He was pleased with the strong ties between the two organizations and encouraged continued cooperation and development. In particular, Dr. Hammer asked PICES to explore the possibility of holding a joint conference. If the conference was successful, it could become a regular event.

B) IOC (Intergovernmental Oceanographic Commission)

Dr. Salvatore Aricò (Head, Ocean Science Section, IOC) spoke about IOC's role in promoting international cooperation and coordinating programs in ocean research, services, education and capacity building to generate knowledge about the nature and resources of the ocean and its coastal areas. IOC works by subregions, such as WESTPAC. IOC has published a [Global Ocean Science Report](#) on blue carbon issues, marine pollution, harmful algal blooms, data gathered from its Member States. Dr. Aricò believed PICES could play a lead role in many of these issues, and proposed that there be IOC-PICES collaboration on such topics as microplastics, multiple stressors, ocean carbon, climate variability, ocean health, and arctic themes. Collaborations could take the form of expert groups, committees, symposia and meetings. IOC is a co-sponsor with PICES of the International Symposium on "*The effects of climate change on the world's oceans*". Dr. Aricò is one of the Symposium Coordinators.

In regard to Future Earth, Dr. Aricò explained that it is difficult currently to engage with the organization as it is still spinning up, and suggested PICES wait for Future Earth to get organized before deciding what projects it would be interested in. At present, IOC is working with Future Earth in co-designing an Ocean Knowledge-Action Network, and working with projects like SOLAS.

C) Scientific Committee on Oceanic Research (SCOR)

SCOR had its meeting September 4–6, 2017, in Cape Town, South Africa. A number of decisions were made relevant to PICES. SCOR will offer travel support for scientists from developing countries and countries with economies in transition to attend:

1. PICES International Symposium on “*Understanding changes in transitional areas of the Pacific*” (April 2018, La Paz, Mexico)
2. PICES/ICES/IOC/FAO International Symposium on “The effects of climate change on the world’s oceans” (June 4–8, Washington, DC, USA)

See Agenda Item 10 for Science Board recommendations for PICES affiliate membership in SCOR Working Groups for 2017.

D) Integrated Marine Biosphere Research (IMBeR)

Dr. Batchelder reported that IMBeR is in its final stage of developing its Science Plan and Implementation Plan under Future Earth. Dr. Cisco Werner is liaison between PICES and IMBeR and Dr. Sunny Chen is a HD liaison to IMBeR. See IMBeR’s Summer School request under Agenda Item 18.

AGENDA ITEM 4C

Status, trends and outlooks

PICES was represented at the EBSA (ecologically and biologically significant areas) workshop (2013, Moscow) through the UN Convention of Biodiversity. Due to time constraints, this topic was not discussed except to note that biodiversity on the sea floor in the high seas is beyond national jurisdiction. IOC is discussing this issue on a political level, and Dr. Aricò encouraged PICES to follow EBSA events.

AGENDA ITEM 5

Mid-year reports from expert groups reporting to Science Board

A) Study Group on *Marine Ecosystem Services* (SG-MES)

Dr. Keith Criddle presented a SG-MES proposal for a Working Group *Marine Ecosystem Services* for Science Board review (see ***SG-MES Endnote 7*** in [SG-MES report](#)). This would be the HD Committee’s first expert group, if accepted. Dr. Steven Bograd noted that the new WG could fill a potential gap between Marine Ecosystems and the Human System of FUTURE’s elements. Science Board discussed the terms of reference extensively, as they were thought to be too general. It was suggested that someone from the Ocean Health Index group could be involved with the potential working group since Ocean Health Index has spent a lot of time developing methodologies, and that the working group should engage with other PICES expert groups, *i.e.*, WG 36 and WG 40. FUTURE SSC agreed to act as a co-parent. Science Board agreed to support the establishment of this working group, pending revision of some terms of reference

Recommendation: SB recommends establishment of the WG-MES, that it work with WGs 35, 36 and 40 and seek collaboration with other organizations such as Ocean Health Index.

Action: Proponents of the working group to revise TORs and HD and FUTURE SSC to review them before sending to the Secretariat for inclusion in the High Priority report to Governing Council.

B) PICES/ICES/PAME Working Group on *Integrated Ecosystem Assessment for the Central Arctic Ocean* (WG 39)

Dr. Sei-Ichi Saitoh, WG 39 PICES Co-Chair, sent a report of the WG's meeting at PICES-2017 (see [WG 39 report](#) in the 2017 Annual Reports). Dr. Di Lorenzo suggested that a POC member could make a contribution in the activities of WG 39.

AGENDA ITEM 6

Report from FUTURE SSC

Dr. Steven Bograd, FUTURE SSC Co-Chair, provide an update of FUTURE activities. The SSC is continuing to develop a product matrix from PICES expert groups and an outline for a FUTURE synthesis paper. The SSC is currently a parent to WG 36 (*Common Ecosystem Reference Points across PICES Member Countries*) and a co-parent to WG 35 (*Third North Pacific Ecosystem Status Report*) and WG 40 (*Climate and Ecosystem Predictability*). The SSC needs to develop a better presence on the PICES website, and has identified items such as a liaison table, FUTURE schematic with web links, product matrix, links to the FUTURE Open Science Meeting, presentations from the FUTURE Mini Symposium. A link to an online survey for the next integrative science program should be a top priority for visibility.

FUTURE business could not be completed at PICES-2017, so the SSC will conduct more web calls inter-sessionally so that it can get a lot of its business done before the next Annual Meeting. Dr. Bograd gave a presentation on FUTURE and PICES to FEFU students during the Annual Meeting, as part of a PICES capacity building effort. As part of FUTURE outreach, the SSC is considering preparing a video of the FUTURE schematic for the PICES website, and handout as part of the registration package for the next Annual Meeting.

S-CC has requested funding for professional graphic design of 10k for its North Pacific Acidification and Deoxygenation Assessment report to come out of FUTURE budget. The SSC has not seen the report contents, and has no input to S-CC. Dr. Bograd requested guidance, if money is to come from FUTURE's budget, would this then be considered a FUTURE product, in which case the SSC would like to review the draft report and provide input. BIO and POC also fully support the publication.

Recommendations:

- Science Board to discuss the S-CC report at ISB-2018 after it S-CC provides a cost analysis and more report detail.
- Science Board does not recommend presenting S-CC's request to Governing Council.
- Funding amounts of large magnitude be discussed at the Committee level before being presented to Science Board.

Action: FUTURE, and BIO and POC co-parents to request a detailed cost analysis for graphics and examples from S-CC.

AGENDA ITEM 7

Discussion of an integrated science program: Beyond FUTURE

The FUTURE SSC discussed what the next integrated science program should be at its 2017 inter-sessional meeting. A survey was not prepared in time to circulate to early career scientists during the May 30–June 2 Early Career Scientist Conference in Busan, Korea. Dr. Ryan Rykaczewski agreed to prepare a draft of FUTURE Survey Thoughts for the broader scientific community, but that Dr. Criddle should be involved since there is a social aspect to preparing the questions. A draft will be circulated to Science Board for review before ISB-2018. The final survey will be web-based, and it was debated whether the mechanism to get maximum response should be through survey monkey or where an abstract could not be submitted until the survey was

completed. Based on the survey response, a writing team or evaluation subcommittee for the new program will be formed.

Dr. Boldt questioned whether, by having a survey now it would be valid by the time FUTURE finished. Science Board agreed that it was important to get the proper feedback for a program that would be sustainable for the next 5 to 10 years. Dr. Di Lorenzo added that the new program should be relevant to the UN's Sustainable Development Goal 14.

Actions:

- Drs. Saito, Bograd, Kang, Criddle, and Rykaczewski to formulate the survey;
- Draft survey to be circulated to Science Board prior to ISB-2018.

Saturday, September 29, 2017

AGENDA ITEM 8

Reports from Scientific and Technical Committees plus high priority requests

Progress reports of Committees and expert groups since PICES-2016 highlighting high priority items or those with financial implications are provided below.

Biological Oceanography Committee (BIO)

BIO Chair, Dr. Se-Jong Ju, reported that 7 members from all member countries except China and Russia attended the BIO meeting. Dr. Yingjie Liu, representing China, was a new member of BIO. Other membership additions or changes for BIO expert groups were noted below.

1. Section on *Marine Birds and Mammals* (S-MBM)

PICES Scientific Report No. 50 on "*Spatial ecology of marine top predators in the North Pacific*" was published in 2017. S-MBM held a BIO Topic Session (S12) on "*Seasonal and climatic influences on prey consumption by marine birds, mammals and predatory fishes*". The results from the session will contribute to the Section's 3–5 year project on "Trophic Ecology of Marine Birds and Mammals". The project is going well on the mammal side, but it is turning out to be more challenging for data compilation for birds. Therefore the timeline for completing the database has shifted from 2017 to 2018, and a report summarizing the diets of marine birds and mammals will be submitted by 2019. S-MBM is actively collaborating with WG 35 to contribute ETSO data, with WG 36 to identify indicators/reference points for ecosystem changes, and S-MBM participant, Dr. Robert Suryan was an Invited Speaker in WG 38's Topic Session on "*Meso-/submeso-scale processes and their role in marine ecosystems*" at PICES-2017.

There was no representation from China or Russia at the S-MBM meeting again this year. Dr. Chuanlin Hao reported that he will contact the Chinese national delegates to review Chinese membership.

Recommendation: Science Board recommends Governing Council to review S-MBM participation and membership.

2. Working Group on *Biodiversity of Biogenic Habitats* (WG 32)

WG 32 requested its term to be extended by one year, to 2018, in order to complete its terms of reference. The WG cancelled the Topic Session on "*Indicators for assessing and monitoring biodiversity of biogenic habitats*" at PICES-2017, and will resubmit for PICES-2018.

3. PICES/ICES Working Group on *Climate Change and Biologically-driven Ocean Carbon Sequestration* (WG 33)

WG 33 organized a series of activities in 2017, including an inter-sessional workshop in Qingdao and conference in Beijing. WG 33-related publications include a “Food for Thought” paper by Co-Chairs, Richard Rivkin, Nianzhi Jiao and Louis Legendre published in *ICES Journal of Marine Science* and three review papers have been submitted to *National Science Review*, and two special issues are being considered for *Science China-Earth Science*. Dr. Jiao will co-convene a Theme Session on “Carbon uptake, ocean acidification, and ecosystems and human impacts” at the PICES/ICES/IOC/FAO 4th International Symposium on “The effects of climate change on the world’s oceans” (June 4–8, Washington, DC, USA).

4. Working Group on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions* (WG 37)

Attendance was low at WG 37’s first meeting, with no representation from China, Korea, Russia and USA. ICES supports ICES member, Dr. Lidia Yebra, to be added as *ex officio* member to WG 37.

Recommendation: Science Board recommends Dr. Lidia Yebra as *ex officio* member, representing ICES.

5. Working on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* (WG 28)

Dr. Motomitsu Takahashi reported that a draft final report of Working on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* (WG 28) should be ready prior to PICES-2018.

For PICES-2018, BIO gave highest rank for potential sponsorship to Topic Sessions on:

- “Indicators for assessing and monitoring biodiversity of biogenic habitats”;
- “Fish production through food web dynamics in the boundary current systems”;
- “Ocean acidification and deoxygenation and their impact on ocean ecosystems: synthesis and next steps”;
- “Applying ecosystem considerations in science advice for managing highly migratory species”;
- “Ocean mixing processes and its impact on biogeochemistry, climate and marine ecosystems”.

For workshops:

- “Diets, consumption, and abundance of marine birds and mammals in the North Pacific”;
- “Synthesizing projected climate change impacts in the north Pacific”;
- “Regional evaluation of secondary production observations and application of methodology in the North Pacific”;
- “Ecological roles of gelatinous zooplankton: Evaluation, integration and future prospects in a more gelatinous ocean”.

Fishery Science Committee (FIS)

FIS Chair, Dr. Xianshi Jin, reported that he was elected Chair of FIS, replacing Dr. Elizabeth Logerwell (USA) who has completed two terms. Dr. Jacquelynne King (Canada) was elected as Vice-Chair of FIS, replacing Dr. Xianshi Jin (China).

1. Section on *Climate Change Effects on Marine Ecosystems* (S-CCME)

Dr. Jacquelynne King (Canada) was elected Co-Chair of S-CCME, replacing Dr. Anne Hollowed (USA). S-CCME held a 1-day Phase 3 planning workshop on in March 2017 in Victoria, Canada. The next phase (2018–2020) will add training, data storage and data exchange, emphasis on comparative analysis, synthesis and a greater emphasis on communication and outreach. S-CCME’s Implementation Plan will be updated accordingly and the Phase 3 report will be finalized soon. S-CCME also convened two workshops at the International Symposium on “Drivers of dynamics of small pelagic fish resources” at the same venue above. S-CCME members were also actively involved in other meetings and workshops, as well as preparing chapters for the IPCC AR6 WGII report and sections for an FAO Fisheries and Aquaculture Technical Paper.

S-CCME requested support to co-sponsor two theme sessions (“*Nordic seas and the Arctic – climatic variability and its impact on marine ecosystems, fisheries and policymaking*” and “*Future-oriented seafood markets: economic dimensions, ecological compatibility and social aspects of fisheries and aquaculture*”) at ICES ASC 2018. FIS supported these two requests, but gave the second theme session a lower priority.

Science Board recommended waiting until ICES made the list of theme sessions available to PICES before selecting sessions for sponsorship. Dr. Criddle remarked that many of S-CCME’s activities had a social aspect to them but no overture had been made to HD to coordinate with the Section. Dr. Di Lorenzo was also concerned that S-CCME activities did not overlap with WG 40.

Action: FIS/S-CCME and HD to communicate with each other regarding human dimension support.

2. Joint PICES/ICS Working Group on *Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish* (WG 34)

WG 34 has proposed a 1-day Topic Session on “*Applying ecosystem considerations in science advice for managing highly migratory species*” at PICES-2018, in the hopes that a topic session during the week will attract more participants than a workshop before the Annual Meeting. If the proposal is accepted, it will replace one of the workshops identified in the WG’s terms of reference.

The WG is approximately half way through its lifespan, but is still facing significant challenges. Membership is limited in highly migratory species representation from PICES. So far, there has been limited exchange of fisheries data, but sharing opportunities do exist; communication and exchange of information has been difficult. While the WG has made some progress as a result of two workshops, little progress has been made on product delivery items identified in the TORs. As such, the WG requests an extension of 1 year with an end date of fall 2019. FIS supports this request. Although Science Board found WG 34’s request for an extension coming in its second year to be unusual, it was also supportive.

Recommendation: Science Board recommends a 1-year extension for WG 34 to complete its terms of reference. *New Study Group on “Impacts of Mariculture on Coastal Ecosystems”*

Dr. Jin presented a proposal, supported by FIS, to establish a Study Group on “Impacts of Mariculture on Coastal Ecosystems” (see **FIS Endnote 3** in the [FIS report](#)). Science Board was supportive of the proposal in principle but found the terms of reference too broad, and suggested that the recommendations from WG 18 (Working Group on *Mariculture in the 21st Century - The Intersection between Ecology, Socio-economics and Production*) and WG 24 (Working Group on *Environmental Interactions of Marine Aquaculture*) be considered when revising the terms of reference. Science Board also recommended that BIO and HD have input.

Recommendation: Science Board supports the establishment of a study group on mariculture in principle.

Action:

- FIS/study group proponents to involve BIO and HD in revising terms of reference, and have suggested names for membership;
- Dr. Jin to present a revised proposal at ISB-2018.

For PICES-2018, FIS gave highest rank for potential sponsorship to Topic Sessions on:

- *Fish production through food web dynamics in the boundary current systems;*
- *Applying ecosystem considerations in science advice for managing highly migratory species.*

For workshops:

- *Synthesizing projected climate change impacts in the north Pacific;*
- *Identifying common reference points and leading indicators of ecosystem change.*

For inter-sessional workshops, FIS supported:

- *Quantifying thresholds in driver-response relationships to identify reference points;*
- NPESR3.

Marine Environmental Quality Committee (MEQ)

MEQ Chair, Dr. Chuanlin Huo, announced that Dr. Thomas Therriault (Canada) was elected Vice-Chair, replacing Ms. Darlene Smith (Canada). Member and observer attendance at the MEQ meeting was very good, but there was no representation from China and the USA. MEQ requests that U.S. members be more active.

1. Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (WG 30)

WG 30's final report is in progress and it is anticipated that it will be ready for submission at ISB-2018. Recommendations will include a proposal to establish a new Working Group on the "Distribution and Environmental Evolution of Radionuclides in the North Pacific" (see **MEQ Endnote 3** in the [MEQ report](#)). The WG is also revising a WG 30 outreach brochure. A potential reviewer from outside of PICES for the final report is Dr. Peter Kershaw (GESAMP), but Science Board recommended that Dr. Huo contact WG 30 member, Dr. John Smith, for a suggestions.

Actions:

- Dr. Huo to ask Dr. John Smith for a reviewer name for WG 30 final report;
- MEQ to request a draft of the brochure for Science Board review at ISB-2018.

2. Working Group on *Emerging Topics in Marine Pollution* (WG 31)

WG 31's final report is in progress and will be ready by ISB-2018. The reviewer for the report will be Dr. Thomas Therriault. WG 31 is proposing a new Study Group on *Marine Microplastics* (see **MEQ Endnote 4** in the [MEQ report](#)) at PICES-2017 although MEQ has urged the WG to finish its report with recommendations first. Science Board had some concerns that there could be overlap with other groups studying microplastics but overall considered it a good idea, especially as marine microplastics is an issue in some member countries.

WG 31 products include 15 peer-reviewed papers published in a special issue of "Ocean Spills and Accidents" in [Archives of Environmental Contamination and Toxicology 73\(1\): 1–169](#) (July 1, 2017) and 16 peer-reviewed papers published in the special issue of "Ocean Indicators of Pollution" in [Archives of Environmental Contamination and Toxicology 73\(2\): 171–347](#) (August 2, 2017). A third special issue for "Hydrocarbons in Marine Environments" was cancelled because of limited number of the submitted articles.

Recommendation: Science Board supports the establishment of a Study Group on *Marine Microplastics*.

Action: MEQ to ensure that proposed Study Group make clear in recommendations how a new Working Group would be unique from others.

3. Section on *Ecology of Harmful Algal Blooms in the North Pacific* (S-HAB)

No replacement has been decided yet for Dr. Vera Trainer who was required to step down after several terms as Co-Chair. Dr. Trainer remains an *ex officio* member of the Global HAB SSC, and was a co-author of a paper on "GlobalHAB: A new program to promote international research, observations, and Modeling of Harmful Algal Blooms in Aquatic Systems" in [Oceanography 30: 70–81](#). S-HAB members are contributing to HABMAP for the GlobalHAB status report. Dr. Mark Wells is chairing an editorial board tasked with reviewing a Best Practices Manual for Climate Change. Section members contributed chapters to the final report of the MarWeB project published in [PICES Scientific Report No. 52](#). [PICES Scientific Report No. 53](#) (Conditions Promoting Extreme *Pseudo-nitzschia* Events in the Eastern Pacific but not the Western Pacific) was published in September.

Action: Secretariat to search for Eastern Pacific member to replace Dr. Trainer as Co-Chair.

For PICES-2018, MEQ gave highest rank for potential sponsorship to Topic Sessions on:

- *Science communication for North Pacific marine science;*
- *The FUTURE of PICES: Next steps in understanding, forecasting and communicating climate impacts on North Pacific marine ecosystems.*

For workshops:

- *Development of a systematic approach to data management in PICES;*
- *Emerging blooms of toxic dinoflagellates in the Pacific: comparative analysis of their prevalence and ecological impacts in the eastern and western regions.*

For inter-sessional workshops, MEQ supported:

- NPESR3 Synthesis Workshop;
- *Regional ocean/climate forecasting and its application to HAB predictions in the North Pacific.*

Physical Oceanography and Climate Committee (POC)

POC Chair, Dr. Emanuele Di Lorenzo, reported that POC meeting attendance was good, with all member countries being represented. However, there was poor attendance at the POC Paper Session and it had a low number of submissions. In order to revive the Paper Session, POC members have suggested several innovations such as highlighting new papers and recognizing high profile works and activities, reviewing science advances and efforts contributed in POC, having lightning 5-minute talks from early career scientists, updating participants on upcoming POC-related activities and integration with FUTURE, and collecting input from the POC community.

1. Section on *Carbon and Climate* (S-CC)

S-CC is progressing in its synthesis report on basin-wide acidification of the North Pacific, but requests \$10k for graphics assistance in completing the report (see Agenda Item 8). S-CC requested that membership of *ex officio* member Dr. Chen-Tung Arthur Chen, representing the International Geosphere-Biosphere Programme, be terminated because the IGBP has ended. S-CC requests travel support for up to 3 early career scientists from PICES member countries to attend the 7th SOLAS Summer School (July 23–August 4, 2018) in Cargèse, France, and for one scientist from the western Pacific to attend a workshop on chemical sensing technology (February 2018) in Victoria, Canada.

Requests:

- Funding of \$10k for graphic design for synthesis report;
- Removal of *ex officio* member from S-CC membership;
- Support for up to 3 early career scientists from PICES member countries to attend the 7th SOLAS Summer School;
- Support for one scientist from the western Pacific to attend a chemical sensing technology workshop in Victoria, Canada.

Recommendation: Science Board recommends the removal of *ex officio* member, Dr. Chen, from S-CC membership.

2. Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (AP-CREAMS)

AP-CREAMS is contributing 3 chapters to the North Pacific Ecosystem Status Report (Lead authors: Y. Zuenko, region 17; V. Lobanov, region 19; Yu, region 21). AP Co-Chairs are encouraging members to also submit ETSOs. The Supplementary chapter to NPESR2 was completed, edited, and submitted to Governing Council for approval in 2016. AP-CREAMS is planning a Summer School on “*Satellite oceanography*” for 2018 in Seoul, Korea. Dr. David Checkley (USA) and Dr. Kyung-II Chang (Korea) have stepped down as AP-CREAMS member.

Requests:

- GC approval of the Supplement which needs to be published before NPESR3;
- A 1-year extension to complete the EAST-II report;
- Funding for 5 early career scientists from PICES member countries and 1 lecturer from a non-Asian country for PICES/AP-CREAMS Summer School;
- Dr. Ryan Rykaczewski (USA) to replace Dr. David Checkley and Dr. Guebuem Kim (Korea) to replace Dr. K.I. Chang.

Recommendation:

- Science Board recommends a 1-year extension to complete the EAST-II report;
- PICES/AP-CREAMS Summer School - See under Agenda Item 18.

Action: Secretariat to look into status of Supplementary chapter delay.

3. Working Group on *Mesoscale and Submesoscale Processes* (WG 38)

WG 38 held its first meeting at PICES-2017. Ten members from all PICES member countries were represented except for China. The WG also held a Topic Session on “*Meso-/submeso-scale processes and their role in marine ecosystems*” at PICES-2017. The Group is discussing advanced plans for a synthesis paper on the regional and temporal characterization of meso/submesoscale circulations in the PICES region and their impact on the marine ecosystem.

4. Working Group on *Climate and Ecosystem Predictability* (WG 40)

WG 40 held its first meeting at PICES-2017 and has proposed an inter-sessional workshop on “*Regional ocean/climate forecasting and its application to HAB predictions in the North Pacific*” in May 2018 in Qingdao, China.

For PICES-2018, POC gave highest rank for potential sponsorship to Topic Sessions on:

- *Ocean acidification and deoxygenation and their impact on ocean ecosystems: Synthesis and next steps;*
- *Seasonal to interannual variations of meso-/submeso-scale processes in different areas of the North Pacific and regional characterization of the ecosystem response;*
- *Ecological responses to variable climate changes and their applicability to ecosystem predictions*
- Merge “*Ocean Mixing processes and its impacts on biogeochemistry, climate and marine ecosystems*” with “*Internal tides and nonlinear internal waves in North Pacific shallow seas: observations, modeling, and implications for coastal marine ecosystems*”

For workshops:

- *PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Second);*
- *Synthesizing projected climate change impacts in the North Pacific;*
- *Identifying common reference points and leading indicators of ecosystem change.*

For inter-sessional workshops, POC supported:

- *PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (First);*
- *Census of marine ecosystem forecasting efforts in the North Pacific;*
- *Regional ocean/climate forecasting and its application to HAB predictions in the North Pacific;*
- *NPESR3 Synthesis Workshop.*

The Final Reports of WG 27 (*Climate Variability and Change*) was reviewed in May by POC members Drs. James Christian and Hiromichi Ueno. Reviewer comments were acted on and the report was submitted to the

Secretariat. The final report of WG 29 (*Regional Climate Modeling*) was finalized in March and was reviewed by Dr. Di Lorenzo. Both reports are with the Secretariat for technical editing.

Action: Dr. Di Lorenzo to finalize the SG-SEES report by ISB-2018.

Technical Committee on Monitoring (MONITOR)

MONITOR Chair, Dr. Jennifer Boldt, reported that 11 members were in attendance from all countries except the USA. No replacement has been found yet for Dr. Jeffrey Napp (USA) who has stepped down. The North Pacific Continuous Plankton Recorder program is in its 18th year of operation. The autumn trans-Pacific transect is uncertain owing to the shipping company transferring its ships to other regions, a replacement ship is being sought but may not be fitted with towing gear before 2018. Funding is reasonably secure through 2018 for sampling operations and analysis of the eastern Pacific samples, but funding to analyze the western Pacific samples has come to an end, and a replacement source needs to be found. Dr. Sonia Batten (*ex officio* representing SAHFOS) was first author for a paper published in the *ICES Journal of Marine Science* and a co-author of a paper published in *Deep-Sea Research II*, in 2017.

Request: Look for a U.S. replacement for Dr. Jeffrey Napp.

1. Advisory Panel on *North Pacific Coastal Observing Systems (AP-NPCOOS)*

AP-NPCOOS activities includes a set of papers in a special issue of the *Journal of Ocean Technology* to be published in spring 2018 and a PICES Summer School on “*Coastal ocean observing systems and ecosystem monitoring*”, hosted by Ocean Networks Canada, to be held July 9–13, 2018, in Victoria, Canada. Between 25 and 30 early career scientists will attend a series of lectures and lab and at-sea demonstrations.

Dr. Jack Barth will be an Invited Speaker at Topic Session (S3) on “*Challenges in observing and modeling Pacific transitional areas*” at PICES international Symposium on “*Understanding changes in transitional areas of the Pacific*”, April 24–26, 2018, in La Paz, Mexico and will co-convene workshop (W8) on “*Connecting climate, ocean and ecosystem observation – Ocean observation futures*” at the 4th International Symposium on “*The effects of climate change on the world’s oceans*”, June 4–8, 2018, in Washington, DC, USA.

2. Working Group on *Third North Pacific Ecosystem Status Report (WG-NPESR3/WG 35)*

WG 35 reported that lead authors for regional assessments of NPESR are in place, but that Environmental Time Series Observations (ETSOs) have not been submitted online in the numbers expected. ETSO coordinators will continue to try to get ETSOs, using a hybrid approach: lead authors will write assessments with the support of contributing authors and will continue to promote the ETSOs database. The current timeline is to submit regional assessments to the Editorial Board by Fall 2017, which will be reviewed and submitted to MONITOR and FUTURE. WG 35 anticipates holding a Synthesis Workshop in spring 2018 in conjunction with ISB-2018, FUTURE SSC, or both.

For PICES-2018, MONITOR gave highest equal rank for potential sponsorship to Topic Sessions on:

- *Internal tides and nonlinear internal waves in North Pacific shallow seas: observations, modeling, and implications for coastal marine ecosystems;*
- *Influence of climate and environmental variability on pelagic and forage species.*

For workshops on:

- *PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Second);*
- *Identifying common reference points and leading indicators of ecosystem change.*

For inter-sessional workshops, MONITOR supported:

- NPESR3 Synthesis Workshop
- *PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (First).*

Human Dimension Committee

HD Chair, Dr. Keith Criddle, reported that 9 members from 5 PICES members countries were in attendance at HD's first meeting as a Standing Committee. There was no representation from Canada yet and only one member from Japan was in place. The incomplete membership is holding back Committee business, especially in contributing to NPESR3. Dr. Criddle gave a brief history of the Committee's former structure as a Section.

HD's workplan for 2018 and beyond includes working closely with ICES' Strategic Initiative on Human Dimensions and there will be an opportunity to do so for MSEAS II in Yokohama, Japan in 2020 and contributing a chapter to the North Pacific Ecosystem Status Report. A new PICES-MAFF project on "*Building capacity for coastal monitoring by local small-scale fishers*" is being considered. If it is approved by Governing Council, the project team will consist of Drs. Mitsutaku Makino (HD Vice-Chair), Shion Takemura (SG-MES), Mark Wells (S-HAB) and Hal Batchelder (PICES).

HD strongly supports Study Group on *Marine Ecosystem Services*' proposal for a Working Group on *Marine Ecosystem Services* (see **HD Endnote 5** in the [HD report](#)).

For PICES-2018, HD gave highest equal rank for potential sponsorship to Topic Sessions on:

- *Integration of science and policy for sustainable marine ecosystem services*
- *Science communication for North Pacific Marine Science*

For inter-sessional workshops, HD supported:

- *Taking Stock of Marine Ecosystem Services in the North Pacific—exploring examples and examining methods;*
- *Regional ocean/climate forecasting and its application to HAB predictions in the North Pacific.*

Technical Committee on Data Exchange (TCODE)

Dr. Igor Shevchenko, reported for TCODE Chair, Dr. Joon-Soo Lee, who was unable to attend the Science Board meeting. PICES Executive Secretary, Mr. Robin Brown, drafted a Data Management Policy and an inventory of data and data products that PICES has the responsibility to manage, and circulated them to TCODE members for comment prior to PICES-2017. TCODE added an item, and will continue to improve the Policy. To manage the inventory of PICES data and data products, TCODE drafted a proposal for a workshop at PICES-2018 that will identify the PICES data and data products and to seek appropriate management measures. TCODE will analyze the data holdings of PICES and report back to Science Board at ISB-2018.

Dr. Yutaka Michida, IODE Co-Chair, and is a proponent of TCODE to become an ADU member. TCODE would like Dr. Michida to be an *ex officio* member of the Committee. IODE will send a letter to PICES first asking for permission to be added to TCODE's membership.

Action: TCODE to send a questionnaire regarding data holdings to Science Board prior to ISB-2018.

For PICES-2018, TCODE gave highest equal rank for potential sponsorship to Topic Sessions on:

- *The FUTURE of PICES: Next Steps in Understanding, Forecasting and Communicating Climate Impacts on North Pacific Marine Ecosystems;*
- *Ecological responses to variable climate changes and their applicability to ecosystem predictions;*
- *Influence of climate and environmental variability on pelagic and forage species.*

SB-2017

For a workshop on:

- *Development of a systematic approach to data management in PICES.*

For inter-sessional workshops, TCODE supported:

- NPESR3 Synthesis Workshop

Science Board recommendations for 2018

The theme for PICES-2018 is “*Toward integrated understanding of ecosystem variability in the North Pacific*”. The Annual Meeting will be held from October 25 to November 4, 2018, in Yokohama, Japan. The following topic sessions and workshops were recommended by Science Board (final descriptions can be found in **SB-2017 Endnote 4**):

$\frac{3}{4}$ -day Science Board Symposium

Toward integrated understanding of ecosystem variability in the North Pacific

$\frac{3}{4}$ -day FIS Topic Session

Fish production through food web dynamics in the boundary current systems

$\frac{1}{2}$ -day FUTURE Topic Session

Science communication for North Pacific marine science

$\frac{3}{4}$ -day BIO Topic Session

Indicators for assessing and monitoring biodiversity of biogenic habitats

$\frac{3}{4}$ -day POC Topic Session

Seasonal to interannual variations of meso-/submeso-scale processes in the North Pacific

$\frac{1}{2}$ -day FUTURE Topic Session

The FUTURE of PICES: Next steps in understanding, forecasting and communicating climate impacts on North Pacific marine ecosystems

$\frac{3}{4}$ -day FUTURE Topic Session

Ecological responses to variable climate changes and their applicability to ecosystem predictions

$\frac{3}{4}$ -day POC Topic Session

Internal tides, nonlinear internal waves, and their impacts on biogeochemistry, climate and marine ecosystems via ocean turbulent mixing processes [merging of “Internal tides and nonlinear internal waves in North Pacific shallow seas: observations, modeling, and implications for coastal marine ecosystems” and “Ocean Mixing processes and its impacts on biogeochemistry, climate and marine ecosystems”]

$\frac{1}{2}$ -day HD Topic Session

Integration of science and policy for sustainable marine ecosystem services

$\frac{3}{4}$ -day BIO Topic Session

Ocean acidification and deoxygenation and their impact on ocean ecosystems: Synthesis and next steps

$\frac{3}{4}$ -day MONITOR Topic Session

Influence of climate and environmental variability on pelagic and forage species

$\frac{3}{4}$ -day FIS Topic Session

Applying ecosystem considerations in science advice for managing highly migratory species

½-day BIO Paper Session

½-day FIS Paper Session

½-day HD Paper Session

½-day MEQ Paper Session

½-day POC Paper Session

1-day BIO Workshop

Ecological roles of gelatinous zooplankton: Evaluation, integration and future prospects in a more gelatinous ocean

½-day FIS Workshop

PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Second)

1-day TCODE Workshop

Development of a systematic approach to data management in PICES

1-day POC Workshop

Synthesizing projected climate change impacts in the North Pacific

1-day MONITOR Workshop

Identifying common reference points and leading indicators of ecosystem change

1-day BIO Workshop

Regional evaluation of secondary production observations and application of methodology in the North Pacific

1-day BIO Workshop

Diets, consumption, and abundance of marine birds and mammals in the North Pacific

1-day BIO Workshop (co-sponsored by NOWPAP and GlobalHAB)

Emerging blooms of toxic dinoflagellates in the Pacific: comparative analysis of their prevalence and ecological impacts in the eastern and western regions [will take place at the 18th International Conference on Harmful Algae, October 21–26, 2018]

Other Science Board recommendations

Proposed new expert groups

- Study Group on *Marine Microplastics* (SG-MMP);
- Joint PICES-NPFC Study Group on *Scientific Cooperation in the North Pacific Ocean* (SG-PICES-NPFC)
- Working Group on *Marine Ecosystem Services* (WG 41)

Expert groups to be disbanded upon completion of their final reports

- Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (WG 30);
- Working Group on *Emerging Topics in Marine Pollution* (WG 31)

Amendments to existing expert groups

- Working Group on *Biodiversity of Biogenic Habitats* (WG 32) to be extended 1 year.

Changes in Committee/Expert Group Chairmanship/Vice-Chairmanship (as result of elections)

FIS

- Dr. Xianshi Jin (China) elected as Chair of FIS, replacing Dr. Elizabeth Logerwell (USA);
- Dr. Jacquelynne King (Canada) was elected as Vice-Chair of FIS, replacing Dr. Xianshi Jin (China)

S-CCME

- Dr. Jacquelynne King (Canada) was elected Co-Chair of S-CCME, replacing Dr. Anne Hollowed (USA)

MEQ

- Dr. Thomas Therriault (Canada) elected as Vice-Chair of MEQ, replacing Dr. Darlene Smith (Canada);
- Dr. Vera Trainer's (USA) term as Co-Chair of S-HAB has ended. A North American replacement has not been identified yet

Additional changes/additions in expert groups recommended by Science Board

- WG 32 recommends a Russian expert (Dr. Tatiana Dautova (Russia) from FEFU) be added to its membership;
- WG 33 recommends Dr. Pavel Tishchenko (Russia) be added to its membership;
- WG 37 recommends the addition of Korean experts, Drs. Hyung Ku Kang and Min Chul Jang be added to its membership;
- S-MBM recommends Drs. Rob Suryan and Jaime Jahncke (USA) be added to its membership;
- S-HAB recommends Dr. Polina Kameneva (Russia) to be added to its membership;
- MONITOR recommends Dr. Tetjana Ross (Canada) to replace Dr. Charles Hannah;
- AP-CREAMS recommends Dr. Guebuem Kim (Korea) to replace Dr. K.I. Chang;
- AP-CREAMS recommends Dr. Ryan Rykaczewski (USA) to replace Dr. David Checkley;
- *Ex-officio* membership of Prof. C.T.A. Chen (who represented IGBP) in S-CC be terminated;
- WG 32 recommends Dr. Takeo Kurihara (Japan) to replace Dr. Go Suzuki;
- BIO requests more active participation of members from China and Russia;
- MEQ requests more active participation of current US members;
- MONITOR recommends the USA replace Dr. Jeffrey Napp (USA) who has stepped down;
- approval of ICES member, Dr. Lidia Yebra, as *ex-officio* member of Working Group on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions* (WG 37) for the duration of WG 37.

The following are business meeting requests for PICES-2018:

- 3-hour overture meeting, ½-day meeting, and a 1-day meeting of Science Board;
- 1-day FUTURE SSC meeting;
- 2-hour overture meetings and ½-day meetings of Standing Committees
- 1-day meeting of the joint PICES-NPFC Study Group on *Scientific Cooperation in the North Pacific Ocean* (SG-PICES-NPFC);
- 1-day meeting of the Study Group on *Marine Microplastics* (SG-MMP)
- 1-day meeting of the Section on *Carbon and Climate* (S-CC);
- 1-day meeting of the Section on Ecology of *Harmful Algal Blooms in the North Pacific* (S-HAB);
- 1-day meeting of the Section on *Marine Birds and Mammals* (S-MBM);
- ½-day meeting of the joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems* (S-CCME)*
- 1-day meeting of the Working Group on Working Group on *Biodiversity of Biogenic Habitats* (WG 32);

- ½-day meeting of the joint PICES/ICES Working Group on *Climate Change and Biologically-driven Ocean Carbon Sequestration* (WG 33);
- ½-day meeting of the joint PICES/ISC Working Group on *Oceanographic Conditions and the Distribution and Productivity of Highly Migratory Fish* (WG 34);
- 1-day meeting of the Working Group on *North Pacific Ecosystem Status Report* (WG 35);
- 1-day meeting of the Working Group on *Ecosystem Reference Points as Common Currency across PICES Member Countries* (WG 36);*
- ½-day meeting of the Working Group on *Zooplankton Production Methodologies, Application and Measurements in the PICES Regions* (WG 37);
- 1-day meeting of the Working Group on *Mesoscale and Submesoscale Processes* (WG 38);
- 1-day meeting of the joint PICES/ICES/PAME Working Group on an *Integrated Ecosystem Assessment for the Central Arctic Ocean* (WG 39);
- 1-day meeting of the Working Group on *Climate and Ecosystem Predictability* (WG 40);*
- 1-day meeting of the Working Group on *Marine Ecosystem Services* (WG 41);
- 1-day meeting of the Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (AP-CREAMS);
- ½-day meeting of the Advisory Panel on North Pacific Coastal Ocean Observing System (AP-NPCOOS);
- 1-day meeting of the Advisory Panel on Marine Non-indigenous Species (AP-NIS).

*request that WG 36 and WG 40 share 2 hours of their business meetings to identify synergies and collaborations

Joint ICES/PICES theme sessions at the ICES Annual Science Conference, September 24–27, 2018, Hamburg, Germany

Due to the overlap between the ICES and PICES meetings, the list of ICES ASC theme sessions for the 2018 ASC was not available for discussion at the Science Board meeting. Committee rankings of theme sessions for PICES co-sponsorship were done by correspondence after PICES-2017.

- *Tipping points complex nature and implications to marine socio-ecological systems management* (Theme Session I: PICES Co-Convenor: Mary Hunsicker);
- *Sustainability thresholds and ecosystem functioning: the selection, calculation, and use of reference points in fishery management* (Theme Session Q: PICES Co-Convenor: Xiujuan Shan).

SCOR

The three SCOR Working Group proposals for 2017 that Science Board rated as “Must fund” for were selected by SCOR:

1. FLOTSAM (Floating Litter and its Oceanic Transport Analysis and Modelling),
2. EBUS (Eastern Boundary Upwelling Systems),
3. P-OBS (Integration of Plankton-Observing Sensor Systems to Existing Global Sampling)

Science Board recommended affiliate membership for Dr. Ryan Rykaczewski in EBUS and for Dr. Sonia Batten in P-OBS, both to be partially funded by PICES.

Inter-sessional symposia/sessions/workshops/meetings

- NPESR3 International Synthesis Workshop, spring 2018, with ISB-2018, FUTURE, or both
- FUTURE SSC meeting, April 10-12, 2018, Honolulu, USA;
- 3-day inter-sessional Science Board meeting (May 8–11, 2018, Sidney, Canada);

SB-2017

- 2-day WG 36 inter-sessional workshop on “*Quantifying thresholds in driver-response relationships to identify reference points*” (June 2018, Washington, DC);
- 1-day WG 40 inter-sessional workshop on “*Census of marine ecosystem forecasting efforts in the North Pacific*” (June 2018, Washington, DC) [later cancelled];
- 3-day POC/ WG 40/HD/FUTURE inter-sessional workshop on “*Regional ocean/climate forecasting and its application to HAB predictions in the North Pacific*” (May 15–18, 2018, Qingdao, China);
- 2-day WG 41 inter-sessional workshop on “*Taking stock of marine ecosystem services in the North Pacific—exploring examples and examining methods*” (April or May, 2018, Qingdao, China);
- 1½-day inter-sessional workshop on “*PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (First)*” (spring 2018, Sapporo, Japan or Incheon, Korea).

Capacity building

- PICES AP-NPCOOS Summer School on “*Coastal ocean observing systems and ecosystem monitoring*” (July 9–13, 2018, Victoria, Canada);
- 7th International SOLAS Summer School (July 23-August 4, 2018, Cargèse, Corsica, France)
- IMBER ClimEco6 Summer School on “*Interdisciplinary approaches for sustainable oceans*” (August 1–8, 2018, Yogyakarta, Indonesia);
- PICES/AP-CREAMS Summer School on “*Satellite oceanography*” (August 2018, Seoul, Korea) [Cancelled later due to time constraints; deferred to 2019.];
- Pacific Ecology and Evolution Conference (PEEC 2018) (February 23-25, 2018, Bamfield, Canada);
- S-CC Workshop on “*Chemical sensing technology*” (February 2018, Victoria, Canada).

Priority items with funding implications

Inter-sessional events

Travel support for:

- 1 scientist to attend GlobalHAB meeting, March 2018, TBD, China;
- 1 scientist to attend GlobalHAB Best Practices meeting, March 2018, Naples, Italy;
- 1 scientist from the eastern Pacific and 1 scientist from the western Pacific to attend NPFC/FAO workshop, March 2018, Yokohama, Japan;
- 2 scientists to attend an inter-sessional AP-CREAMS meeting, May 2018, Hangzhou, China;
- 2 convenors to attend ICES ASC 2018 Theme Sessions I and Q, September 2018, Hamburg, Germany.

Publications

Special issues in primary journals (2018–2019)

- Special issues resulting from the 2017 Small Pelagic Fish Symposium (March 2017) in *Deep-Sea Research II* and *Marine Ecology Progress Series*
- Special issue in *Deep-Sea Research II* resulting from the Pacific Transitional Areas Symposium (April 2018)
- Special issue in *Progress in Oceanography* dedicated to the memory of Dr. William Peterson

PICES Special Publication series

- ADRIFT Report

Other

- MarWeB Advisory Report as an outreach brochure;
- ADRIFT Factsheet;
- ADRIFT Videoscribe.

PICES Scientific Report series (2018–2019)

- Report on “Oceanography of the Yellow and East China Seas (EAST-II region)” by the Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (Editors: J. Ishizaka, T. Matsuno, J. Zhang, J.-H. Lee, S. Kim, D. Xu, Y. Fei, S.-M. Liu and V. Lobanov; approved at PICES-2013);
- MarWeB Scientific Report;
- Final Report of the Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (Editors: K.A. Higley and Y. Zheng);
- Final Report of the Working Group on *Emerging Topics in Marine Pollution* (Editors: Wonjoon Shim, Peter S. Ross, Olga Lukyanova);
- Final Report of the Working Group on Emerging Topics in Marine Pollution (Editors: W. Shim, P.S. Ross and O.N. Lukyanova).

AGENDA ITEM 9

PICES Annual Meeting structure

All topic sessions and workshops accepted by Science Board were able to be accommodated in up to four concurrent sessions. There was room for most business meetings, with potential for some meetings to take place on Sunday morning. FUTURE would hold a Plenary on one of the weekdays. The majority of Science Board agreed to schedule Paper Sessions on Tuesday.

AGENDA ITEM 10

Schedule for PICES-2018 and inter-sessional workshops

There was no consensus on the location and date for a FUTURE inter-sessional meeting, but Science Board agreed that it needed to be finalized within the next two months. Options were to have it in conjunction with ISB-2018, and perhaps the NPESR3 workshop. Venue options were Jeju, Korea, or Russia.

Action: Secretariat to work with Governing Council to fix venue and time for FUTURE inter-sessional meeting and ISB-2018 as soon as possible.

AGENDA ITEM 11

Venue and date for ISB-2018

Science Board agreed that inter-sessional Science Board meetings were integral for keeping on top of science business and that they should be a yearly event, unless specified otherwise. ISB-2018 will take place in Sidney, Canada at the Institute of Ocean Sciences.

AGENDA ITEM 12

Status of venue for PICES-2018

Dates for PICES-2018 in Yokohama, Japan were changed to October 25 to November 4, 2018.

AGENDA ITEM 13

Proposed new expert groups

Science Board reviewed proposals for expert groups received during PICES-2017 and recommended the establishment of the following:

- Joint PICES-NPFC Study Group for Scientific Cooperation in the North Pacific Ocean (SG-PICES-NPFC);

SB-2017

- Study Group on Study Group on *Marine Microplastics* (SG-MMP);
- Working Group on *Marine Ecosystem Services* (WG-MES/WG 41).

AGENDA ITEM 14

Status of PICES publications

Dr. Batchelder reported on journal publications needing Science Board approval.

Science Board approved:

- A special issue dedicated to the memory of Dr. William Peterson (*Progress in Oceanography*); (Managing Editor: Hal Batchelder; Review Editors TBD);
- A special issue resulting from the 2017 Small Pelagic Fish Symposium (Victoria, BC, March 2017; *Deep-Sea Research II*); (Guest Editors: Jürgen Alheit, Manu Di Lorenzo, Ryan Rykaczewski, Svein Sundby);
- A special issue resulting from the 2017 Small Pelagic Fish Symposium (Victoria, BC, March 2017; *Marine Ecology Progress Series*); (Guest Editor: Jürgen Alheit)

A review paper on “*The legal and regulatory foundations of fisheries management in PICES member countries*”. Lead author: K. Criddle was approved at PICES-2014.

Action: Science Board to review all non-peer reviewed publications before approving them for on-line publication.

AGENDA ITEM 14A

PICES publications requiring Science Board approval

Recommendations for publication:

- Final Report of the Study Group on *Socio-Ecological-Environmental Systems* (SG-SEES); approved at PICES-2014;
- Final Report of the Working Group 28 on *Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors* (Editors: I. Perry and M. Takahashi); approved at PICES-2014;
- Final Report of the Working Group on *Assessment of Marine Environmental Quality of Radiation around the North Pacific* (WG 30) (Editors: Yusheng Zhang, Kathryn Higley);
- Final Report of the Working Group on *Emerging Topics in Marine Pollution* (WG 31) (Editors: Peter Ross, Won Joon Shim, Olga Lukyanova).

AGENDA ITEM 14B

Update on other PICES publications

No update was discussed.

AGENDA ITEM 14C

Developing guidelines around open access for PICES

Dr. Saito recommended that authors publish in paper journals when possible rather than Open Access, which is very expensive. He asked that every Committee urge to their expert groups to try to publish as cheaply as possible, and if they have a specific request for Open Access, to contact the PICES website.

Action: Secretariat to make a prominent place on the PICES website for instructions on Open Access publishing.

AGENDA ITEM 15

Policies regarding the development and approval of special projects

Action: Science Board to defer to ISB-2018.

AGENDA ITEM 16

Implementation of Science Board recommendations and Governing Council decisions from PICES-2016 and ISB-2017

Science Board had no comments.

AGENDA ITEM 17

PICES-sponsored conferences/symposia

Pacific Ecology and Evolution Conferences (PEEC) are usually held in February/March, so the Secretariat did not receive a request for support yet. Science Board recommended support for PEEC 2018 on the order of \$1,500, as has been done since 2015. Since PEECs are primarily eastern Pacific-focused, Science Board members were urged to recommend similar meetings on the western side for PICES sponsorship in the future.

Recommendation: Science Board recommends supporting PEEC 2018, contingent on receiving a request and PEEC preparing an article for PICES Press. See Agenda Item 18 for monetary support.

Action: Secretariat to send PICES poster to PEEC, and ask PEEC convenor to show Anniversary video.

Science Board briefly discussed the upcoming Ocean Obs19 conference and how PICES could contribute. Dr. Sanae Chiba is on the Program Committee.

Action: revisit at PICES contribution to Ocean Obs19 at ISB-2018.

AGENDA ITEM 18

Capacity building/plan for PICES Summer Schools*PICES Summer Schools*

PICES Summer School on “*Coastal ocean observatory science*” was approved at PICES-2016.

Recommendation: Science Board recommends supporting a PICES/CREAMS Summer School on “*Satellite oceanography*” (August 2018, Seoul, Korea; see POC/AP-CREAMS’ request in Agenda Item 8). [Cancelled later due to time constraints; deferred to 2019.]

Summer Schools co-sponsored by PICES

Recommendations: Science Board recommends supporting:

- PEEC 2018 at \$1,500 (February/March 2018, Bamfield, Canada);
- 7th SOLAS Summer School (July 23–August 4, 2018, Cargèse, France), support for up to 3 ECS from PICES member countries;
- IMBeR ClimEco6 (August 1–8, 2018, Yogyakarta, Indonesia), support for up to 3 ECS from PICES member countries.

AGENDA ITEM 19

Extramurally-funded PICES special projects

Recommendations:

- MarWeB Scientific Report to be published in the PICES Scientific Report series,
- MarWeB Advisory Report to be published as an outreach brochure,
- ADRIFT Report to be published in the PICES Special Publication series,
- PICES co-sponsorship of 6th International Marine Debris Conference.

AGENDA ITEM 20

Other business

Recommendation: Science Board recommends Dr. Lidia Yebra be appointed as *ex officio* member (representing ICES) to WG 37.

Day 3 meeting adjourned at 5:00 pm.

SB-2017 Endnote 1

Science Board participation list

Members

Steven Bograd (Co-Chair, FUTURE SSC)
Jennifer Boldt (Chair, MONITOR)
Keith Criddle (Chair, HD)
Emanuele Di Lorenzo (Chair, POC)
Chuanlin Huo (Chair, MEQ)
Xianshi Jin (Vice-Chair, FIS)
Se-Jong Ju (Chair, BIO)
Sukyung Kang (FUTURE SSC)
Joon-Soo Lee (Chair, TCODE)
Hiroaki Saito (Science Board Chair)
Igor Shevchenko (representing Russia)
Motomitsu Takahashi (representing Japan)

Observers/Expert Group Chairs

Salvatore Arico (IOC-UNESCO, Sep. 29)
Cornelius Hammer (ICES; Sep. 29)
Lev Neretin (NOWPAP; Sep. 24)
Gerard DiNardo (ISC; Sep. 24)
Vladimir Radchenko (NPAFC; Sep. 24)
Alexander Zavolokin (NPFC; Sep. 24)
Matthew Baker (NPRB; Sep. 24)
Sei-Ichi Saitoh (Co-Chair WG 39; Sep. 29)

Secretariat

Robin Brown (Executive Secretary, Sep. 24, 29)
Harold (Hal) Batchelder (Deputy Executive Secretary)
Rosalie Rutka (Administrative Assistant)

SB-2017 Endnote 2**Science Board meeting agenda***Sunday, September 24, 2017*

1. Welcome and adoption of agenda (Saito)
2. Review of procedures for Science Board Symposium and Session awards, and Closing Session (Saito, Batchelder)
3. Review template for Committee reports to Science Board (Saito, Batchelder)
4. Current and potential collaborations with international organizations/programs (Saito/Invited Guests)
 - 4A Strategic collaborations

Friday, September 29, 2017

- 4B Other collaborations
- 4C Status, trends and outlooks
5. Mid-year reports from expert groups reporting to Science Board (Saito)
6. Report from FUTURE SSC (Kang/Bograd)
7. Discussion of an integrated science program: Beyond FUTURE (Saito)

Saturday, September 30, 2017

8. Reports from Scientific and Technical Committees (Chairs)
9. Discussion of PICES Annual Meeting structure (Saito)
10. Schedule for PICES-2018 and inter-sessional workshops (All)
11. Venue, and dates for ISB-2018 (Saito/Secretariat)
12. Status of venue for PICES-2018, Yokohama, Japan (Secretariat)
13. Review/decision of proposed new expert groups (Saito)
14. Status of PICES publications (Batchelder)
 - 14A PICES publications requiring Science Board approval (Saito)
 - 14B Update on other PICES publications (Batchelder)
 - 14C Developing guidelines around open access for PICES (Saito)
15. Policies regarding the development and approval of special projects (Saito)
16. Implementation of Science Board recommendations and Governing Council decisions from PICES-2016, Yeosu and ISB-2017, Honolulu (Batchelder)
17. Update on PICES-sponsored conferences/symposia (Secretariat)
18. Update on capacity building/plan for PICES summer schools (Batchelder)
19. Update on extramurally funded PICES special projects (Batchelder)
20. Other PICES business

SB-2017 Endnote 3

**Proposal for
a joint PICES-NPFC Study Group for *Scientific Cooperation in the North Pacific Ocean***

Parent Committee: Science Board

Duration: 1 year

Description

The purpose of a joint PICES-NPFC Study Group for Scientific Cooperation of PICES and NPFC is to develop a framework of enhanced collaboration between the two organizations to achieve a greater understanding of pelagic ecosystem structure and variability, and its effect on the dynamics and production of fisheries target species, for sustainable use of high seas fish production. The Study Group will review each organization's scientific needs and identify where similar key questions or scientific issues might be explored jointly by both organizations.

Terms of Reference

1. Review the scientific interests and objectives of each organization;
2. Identify potential areas and specific topics for scientific cooperation;
3. Identify potential collaborative methods (such as representation at each other's meetings, holding of joint workshops or symposia, development of a Memorandum of Understanding (MOU) between the organizations or other formal agreements, establishment of joint working groups);
4. Clarify practical steps to advance the cooperative activities identified above;
5. Provide advice on how information produced by PICES can be shared and applied in NPFC;
6. Make a specific proposal to each organization for further consideration.

Proposed Co-Chairs: TBD (PICES), TBD (NPFC)

Suggested members:

Eddy Kennedy, Canada (Eddy.Kennedy@dfo-mpo.gc.ca)

Yong Chen, China (cheny@shou.edu.cn)

Wei Yu, China (wyu@shou.edu.cn)

Toshihide Iwasaki, Japan (tiwasaki@affrc.go.jp)

Seok-Gwan Choi, Korea (sgchoi@korea.kr),

Eunjung Kim, Korea (eunjungkim@korea.kr)

Vladimir Kulik, Russia (vladimir.kulik@tinro-center.ru)

Tatiana Semenova, Russia (tatiana.semenova@tinro-center.ru)

Chih-Hao Hsieh, Chinese Taipei (chsieh@ntu.edu.tw)

Kari Fenske, USA (Kari.Fenske@noaa.gov)

Aleksandr Zavolokin, NPFC Secretariat (azavolokin@npfc.int)

Products

PICES-NPFC Framework for Scientific Cooperation in the North Pacific Ocean

PICES Press article

Annual Report

Other Publications (if desired)

SB-2017 Endnote 4**Topic Sessions and Workshops approved for PICES-2018****1 Fish production through food web dynamics in the boundary current systems**

Convenors: Motomitsu Takahashi (Japan); Yuji Okazaki (Japan); Akash Sastri (Canada)

Duration: 1 day

Invited speakers: Chih-hao Hsieh, Chinese Taipei

Trophic interactions from nutrient to fish are variable spatially and temporally in the North Pacific ecosystems. Fish production has been recognized generally as the grazing food chain: diatom-calanoïd copepod-fish. In addition, microbial food chain and jelly-associated chain also work for maintaining biological production. Comparative studies on trophic interactions between the western boundary current (Kuroshio and Kuroshio Extension) and the eastern boundary current (California Current) would reveal biogeochemical characteristics in the North Pacific marine ecosystems. This session aims to reveal trophic interactions through nutrient supply to fish production and to compare the structures and function between the different boundary systems in the North Pacific. Interaction examples of nutrient supply, community structures of phyto- and zooplankton, food availability for fish larvae and the synergistic model in the ecosystem are highly encouraged. We also seek presentations on trophic interactions revealed using not only traditional approaches based on observations but also contemporary approaches including stable isotopes and DNA bar-coding analyses.

2 Science communication for North Pacific marine science

Convenors: Toyomitsu Horii (Japan), Ekaterina Kurilova (Russia), Mitsutaku Makino (Japan), Jacquelynne King (Canada)

Duration: 0.5 day

Invited speakers: Alan Haynie, USA (Alaska Fisheries Science Center, National Marine Fisheries Service) TBD, Japan, Korea or China

Science communication between researchers and society is increasing in importance for PICES' integrated marine science. For example, natural scientific information about sustainable uses of ecosystems cannot be meaningful if the social and economic expectations of the users are not considered. The goal of ecosystem conservation activities, or sustaining "a good ecosystem", cannot be decided without deliberate discussions that include society. In addition, each country or society has a specific view of "a good ecosystem" which could benefit from larger-scale coordination and comparison within the North Pacific basin. Conducting multi-disciplinary integrated marine ecosystem studies, such as those supporting the FUTURE Science Program, requires close and effective interaction of concepts, methodologies, models, and data, from various disciplines. Dissemination of that complex scientific information to society can be difficult. The PICES' scientific community would benefit from hearing examples of successful scientific communication. An example of communication to society includes providing scientific information about the fish stock sustainability and is often used by fish consumers with impacts on market demand which can ultimately decide the fishing pressure on the marine resources. A better understanding by stakeholders of the scenarios of future ecosystem states is an important step towards a society resilient and adaptable to global changes. This Topic Session invites

studies about science communications such as those above. Theoretical studies, case studies, experiences, and perspectives for better science communication for the PICES activities are encouraged.

3 Indicators for assessing and monitoring biodiversity of biogenic habitats

Convenors: Anya Dunham (Canada); Hye-Won Moon (Korea)

Duration: 1 day

Invited speakers: Mary Yoklavich (NOAA, USA); Peter Mumby (University of Queensland, Australia); Peter Houk (University of Guam)

Biogenic habitats formed by corals, sponges, and other structure-forming taxa support high species abundance and biodiversity, including socio-economically important fishes and invertebrates. These habitats are also known to be vulnerable to disturbances from human impacts and climate change. Predicting, assessing, and monitoring shifts in habitat-forming species and associated communities in response to natural and anthropogenic forcing require suites of measurable indicators. The goal of this session is to improve our understanding of ecologically relevant, sensitive, observation-based indicators for assessing and monitoring biogenic habitats. We invite presentations on indicators encompassing single or compound metrics of the marine biota in a broad sense (from physiological to species, community and habitat levels) which could be measured to indicate the condition of biogenic habitats and monitor changes to the habitats and communities they support. Empirical studies and literature reviews on indicator development, assessment, and/or application are invited. WG32 members and collaborators will present a literature review of documented functional associations between commercially important fish and invertebrate species and biogenic habitats and address methods to incorporate these associations into indicator development. This session will help improve our understanding and ability to identify and characterize changes in biogenic habitats, as well as their recovery potential. The results of this session will help inform management and policy decisions and marine spatial planning processes that can maintain ecosystem biodiversity, structure, and function.

4 Seasonal to interannual variations of meso-/submeso-scale processes in the North Pacific

Convenors: Annalisa Bracco (USA); Sachihiko Itoh (Japan); Elena Ustinova (Russia)

Co-sponsor: OMIX (<http://omix.aori.u-tokyo.ac.jp/en/>)

Duration: 1 day

Recent observations and model simulations suggest that the ocean currents and biogeochemistry at and near the ocean surface undergo prominent seasonal variability at the submesoscales (scales of 0.1–10 km). The submesoscale seasonal variability is a function of the ratio of lateral to vertical density gradients and, in the open ocean, depends primarily on the mesoscale activity of the flow. Consequently, in the open ocean numerous submesoscale cyclonic eddies can form in winter and the vorticity distributions are skewed towards positive values typical of cyclonic structures. This skewness is highly reduced from spring to fall. In coastal areas, on the other hand, density gradients can be forced not only by mesoscale circulations but also by freshwater fluxes from rivers or melting glaciers, resulting in a seasonal cycle that may differ significantly from region to region, and in interannual variability controlled in part by hydrological and cryospheric processes. Implications of such variability for the ocean biogeochemistry and nutrient distributions are poorly understood. This session aims at characterizing the variability of mesoscale and submesoscale circulations and

its linkages with the marine ecosystem in the PICES region at seasonal-to-interannual scales. We welcome as well contributions about future changes in mesoscale variability or in mixed-layer depth and its buoyancy, and therefore in submesoscale variability, in warming climate scenarios.

5 The FUTURE of PICES: Next steps in understanding, forecasting and communicating climate impacts on North Pacific marine ecosystems

Convenors: Sukyung Kang (Korea); Steven Bograd (USA)

Duration: 0.5 day

Invited speakers: TBD

‘Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems’ (FUTURE) is the flagship integrative Scientific Program undertaken by the member nations and affiliates of PICES. Since its inception in 2009, FUTURE has contributed to guiding PICES science to understand how marine ecosystems in the North Pacific respond to climate change and human activities, to forecast ecosystem status based on a contemporary understanding of how nature functions, and to communicate new insights to its members, governments, stakeholders and the public. FUTURE is scheduled to conclude in 2019, so this is a good time to reflect on its accomplishments, to identify remaining gaps in fulfilling its research objectives, and to contemplate new directions for PICES science. In this session, we will conduct a FUTURE ‘Mini-Symposium’ to update the PICES community on FUTURE progress and to coordinate activities amongst the PICES Expert Groups. Each Expert Group will provide a brief review of their past, current and planned activities as they relate to the FUTURE Science Program, which will be followed by a plenary discussion on the future path of PICES science in the coming years.

6 Ecological responses to variable climate changes and their applicability to ecosystem predictions

Convenors: Ryan Rykaczewski (USA); Akinori Takasuka (Japan); Chan Joo Jang (Korea)

Duration: 1 day

Invited speaker: Won Moo Kim (Korea), Susan Allen (Canada), Takeshi Doi (Japan)

In the North Pacific, regional and large-scale climate forcing impacts a range of physical and ecological characteristics including temperature, stratification, ocean circulation, upwelling, biogeochemical properties, and primary and secondary production. These characteristics, in turn, can impact the distribution, composition, and productivity of fisheries resources. However, the accuracy of many climate-ecosystem relationships derived from historical observations deteriorates when faced with new observations. Reducing the uncertainty associated with climate-ecological relationships requires an understanding of the mechanisms that govern empirical correlations. In this session, we seek presentations focused on climate-ecosystem relationships and whether such relationships can be expected to persist under future (*e.g.*, months to decades) climate conditions. Many regional and large-scale properties of the physical ocean state can be skillfully predicted over scales of seasons (and years for some properties), and we hope that such ability, with further clarification of predictable properties in different regions on different timescales, can be used in combination with understanding of robust climate-ecosystem relationships to provide forecasts of marine ecosystems that will be useful to resource management and utilization. The objectives of this topic session are directly relevant to the foci of the 2018 Annual Meeting, namely improving understanding of “mechanisms of ecosystem responses to natural and anthropogenic forcing across the spectrum of time and space scales in the North Pacific, as well as monitoring, retrospective analysis, and forecasting ecosystem variability.” PICES WG-40 (Climate and Ecosystem

Predictability) aims to identify, diagnose, and quantify predictable response in North Pacific marine ecosystems that arise from regional and large-scale climate processes. One of the more significant challenges to accomplishing this task is to identify robust climate-ecosystem relationships that persist over time and permit skillful forecasting. We hope that this session provides some insights to this challenge. We will also seek to include participation of ECS in this topic session.

7 Ocean mixing processes and its impacts on biogeochemistry, climate and marine ecosystems

Convenors: Shin-ichi Ito (Japan); Annalisa Bracco (USA); Sen Jan (Chinese-Taipei); Daisuke Hasegawa (Japan)

Co-sponsor: OMIX

Duration: 1 day

Invited speakers: Eric Kunze (USA); Ichiro Yasuda (Japan)

Ocean diapycnal mixing is a fundamental physical process that regulates ocean vertical circulations of water, nutrients, carbon and heat, thus key to controlling ocean biogeochemistry and climate. However, since observations are still limited the distribution and generation mechanisms of vertical mixing are not well understood. Strong ocean mixing is generated around rough bottom topography such as straits, ocean ridges, and island chains with ocean tides. Recently, a periodic fluctuation of seawater properties, nutrients and oxygen concentrations synchronous with the 18.6-year nodal tide has been observed in the subarctic and subtropical oceans in the North Pacific. Some studies have suggested that the 18.6-year nodal tide might regulate a basin wide climate mode in the North Pacific. Such climate mode has the potential to accelerate climate warming when its phase implies stronger mixing. Combining with the global climate change, it is our urgent task to elucidate mechanism of ocean diapycnal mixing processes and its impacts on climate, ocean biogeochemistry, and the marine ecosystems. We propose a topic session that involves participation from multiple PICES committees and focuses on ocean mixing processes and their impacts on biogeochemistry, climate and marine ecosystems. Specifically, we would welcome presentations on topics such as (a) observational and theoretical approaches to understand ocean mixing processes and their distribution, (b) diapycnal mixing impacts on biogeochemistry, climate and marine ecosystems, (c) future projections of North Pacific considering 18.6-year nodal tide, and (d) implications for fisheries management.

8 Integration of science and policy for sustainable marine ecosystem services

Convenors: Shang Chen (China), Daniel K. Lew (USA), Jungho Nam (Korea), Mitsutaku Makino (Japan), Keith Criddle (USA)

Co-sponsor: IMBeR

Duration: 0.5 day

Invited speaker: Pushpam Kumar (Chief, Ecosystem Services Economics Unit, Division of Environmental Policy Implementation, UNEP)

The provisioning, cultural, regulating and supporting services are the major benefits people obtain from the coastal and marine ecosystems. The identification, quantification, valuation and management of ecosystem services are key scientific questions, and have attracted more concerns from both the major intergovernmental

organizations (such as PICES, ICES, IMBeR, IPBES) and the environmental organizations (such as WWF, TNC, ESP). The goals of this session are: (1) to provide a venue for marine scientists and social scientists to exchange results from research on identification, quantification, valuation and management of ecosystem services, and (2) to provide a platform to share and discuss the integration of ecosystem service science into policy-making of marine affairs. This session will continue providing strong support to the TORs of HD committee and contribute a greater understanding of social and economic status of the North Pacific ecosystem and fill the gaps to achieve the FUTURE Objectives.

9 Ocean acidification and deoxygenation and their impact on ocean ecosystems: synthesis and next steps

Convenors: Jim Christian (Canada) Tsuneo Ono (Japan)

Co-sponsor: ICES

Duration: 1 day

Studies of ocean acidification (OA) are showing progress, in particular, monitoring of oceanic acidification status (ca. pH, $p\text{CO}_2$ and Ω aragonite, Ω calcite) in the various PICES countries has significantly progressed in recent years. Progress has also been achieved in the field of biological OA impact. The importance of interactions with other stressors (temperature, deoxygenation, etc.), interspecific interaction (*e.g.*, OA effects on prey species), and biological ability to adapt to OA stress, are increasingly recognized. We welcome presentations from the fields of OA monitoring and impact experiments, to construct new perspective on present OA status in the North Pacific. Presentations on future projections are also welcome. We also welcome presentations about plans for further progress in our understanding, such as continuous carbon system monitoring by new technologies, new experimental studies for OA adaptation, and field observation of biological responses to existing OA and deoxygenation events.

10 Internal tides and nonlinear internal waves in North Pacific shallow seas: Observations, modeling, and implications for coastal marine ecosystems

Convenors: SungHyun Nam (Korea); John Barth (USA); Sung Yong Kim (Korea)

Co-sponsor: ICES

Duration: 1 day

Internal tides (ITs) and nonlinear internal waves (NLIWs) are commonly found in the North Pacific, particularly shallow seas such as slope, outer and inner shelves, and nearshore zones. The ITs and NLIWs play an important role in redistributing heat, momentum, and energy often via turbulent mixing, and most importantly affect marine ecosystem via poorly known processes. This session invites papers related to remote sensing, in-situ observation, and numerical modeling of ITs and NLIWs in the North Pacific shallow seas. The main objective of this session is to promote discussions and collaborations of PICES scientists across countries to study the processes relevant to the evolution of ITs and NLIWs as they propagate into shallow water and to better quantify the implications for biology (*e.g.*, nutrient and larval transport) and chemistry.

11 Influence of climate and environmental variability on pelagic and forage species

Convenors: Matthew Baker (USA); Sei-Ichi Saitoh (Japan); Mary Hunsicker (USA)

Duration: 1 day

Climate and environmental variability have profound effects on pelagic ecosystems from zooplankton to fish and invertebrate stocks. The dynamics of fish species within the pelagic environment may be particularly responsive to environmental drivers, including temperature and salinity, as well as biological drivers, such as prey production and phenology. In addition, differential species responses to environmental and biological drivers may alter fish condition and interactions. Understanding the mechanisms that drive pelagic fish dynamics is important for estimating fish survival and recruitment. This session aims to integrate research that elucidates mechanisms linking climate with recruitment, survival and condition of forage species, larval and juvenile pelagic stages of ground fish, and pelagic fishes more generally. Papers are encouraged in a wide range of topics relevant to environmental and biological conditions and pelagic species or stages, particularly those in the following areas: biophysical interactions; recruitment fluctuations in response to climate and environmental conditions; shifts in species dynamics, distribution and behavior related to environmental forcing; research on critical life history stages in the pelagic environment; and modeling approaches to improve understanding of environmental effects using climate hindcasts and time series analyses and/or forward projections and climate forecasts.

12 Applying ecosystem considerations in science advice for managing highly migratory species

Convenors: Steve Teo (ISC USA); Carolina Minte-Vera (IATTC); Gerard DiNardo (PICES USA)

Co-sponsor: ISC

Duration: 1 day

This topic session will be convened by WG-34: Joint PICES-ISC Working Group on Oceanographic Conditions and the Distribution and Productivity of Highly Migratory Fish. Large-scale oceanographic processes and bioenergetic requirements determine the distribution and productivity of many pelagic fish populations in the North Pacific. For example, highly migratory species (HMS), such as albacore tuna (*Thunnus alalungus*) and Pacific sardine (*Sardinops sagax*), have environmental thresholds and preferences, as well as energetic requirements to sustain growth and survival that drive their distribution and productivity. Managing HMS has traditionally focused on maintaining the sustainability of targeted stocks and, as such, comprehensive data sets on the catches, biology and ecology of many exploited stocks exists. In many cases, there are limited quantitative data describing ecosystem impacts on HMS, social and economic impacts on HMS fisheries due to ecosystem variability, and limited formal consideration of the roles of external drivers (*e.g.*, oceanographic variability) in the context of sustainability and governance. Beyond these limitations there is also the challenge to identify linkages and important relationships both within ecosystems (including exploited stocks), and across social, economic and governance facets of fisheries management. This workshop will provide an overview of contemporary research on the topic, including the identification of statistical modeling approaches that link spatially explicit environmental data (*e.g.*, satellite derived SST) to distributional fish data (*e.g.*, fishery-dependent and fishery-independent), methods to assess impacts of oceanographic variability on fish productivity and socioeconomic decision making, methodologies that explicitly incorporate environmentally driven dynamics into HMS stock assessments, and challenges facing governance when applying ecosystem considerations. Group discussion will help facilitate identification by the Joint Working Group of suitable methodologies for advancing fish stock assessment procedures and methodologies, as well as strategies for applying ecosystem considerations to HMS management.

W1 Ecological roles of gelatinous zooplankton: Evaluation, integration and future prospects in a more gelatinous ocean

Convenors: Shin-ichi Uye (Japan); Chaolun Li (China); Brian Hunt (Canada) Richard Brodeur (USA)

Duration: 1 day

Invited speakers: Dhugal Lindsay (Japan), Russell Hopcroft (USA), Evgeny Pakhomov (Canada), Jonathan Houghton (Ireland)

Gelatinous zooplankton, consisting of taxonomically diverse groups such as cnidarians, ctenophores and pelagic tunicates, represent a conspicuous component of the zooplankton communities throughout the pelagic zone. Owing to their characteristic reproductive methods and high somatic growth rates, they can rapidly build a large population biomass, as typically demonstrated by recurrent blooms of cnidarian jellyfish (*e.g.*, *Aurelia*, *Chrysaora* and *Nemopilema*) in the PICES region. Recent studies on their biology and ecology, particularly to elucidate the mechanisms of their problematic blooms, have enhanced our knowledge, yet there is still a large gap in understanding potential ecological roles of gelatinous zooplankton in pelagic ecosystems. Although it is inherently difficult to determine their biomass, spatio-temporal distributions and physiological rates, they may play important roles in transferring materials and energy from picoplankton and zooplankton up to commercially-important fish and other top trophic levels. This workshop seeks contemporary studies on gelatinous zooplankton to evaluate their functional roles. We invite contributions on diverse taxonomic groups and from diverse ecosystems. Studies using new technologies, such as acoustic and optical instruments, remotely-operated and autonomous vehicles, biochemical markers, and molecular approaches, are encouraged. We will discuss future trends of gelatinous zooplankton in the North Pacific region under observed and predicted environmental changes in the context of their ecological roles, and hope to facilitate international research collaborations on gelatinous zooplankton in the North Pacific and elsewhere.

W2 PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Second)

Convenors: Sei-Ichi Saitoh (Japan); Hyoung Chul Shin (Korea); Lisa Eisner (USA); Gordon Kruse (USA)

Duration: 0.5 day

Invited speaker: Hein Rune Skjoldal (ICES)

The Central Arctic Ocean (CAO) is in rapid transition, largely driven by North Pacific change, has become accessible to a range of activities. Rapid loss of sea ice cover has opened up the Central Arctic Ocean (CAO) for potential fishing opportunities. Debate and policy initiatives have been launched for regulating fisheries that are anticipated to begin in the CAO. Scientific research in the CAO, however, remains scarce in contrast to an abundance of research in the neighboring North Pacific. To inform and support policy decisions in the CAO, an integrated ecosystem assessment is the foremost task. PICES joined with ICES and PAME for such an assessment by forming WG 39 with its mission period ending 2018. WG 39, despite its late start, intends to provide significant Pacific input for the assessment at the third meeting of the Joint Group in May 2018, and also to the final report expected toward the end of 2018. We propose two workshops in 2018. The first one, which is technical in nature and for experts, will be organized February/March in 2018 and this is mostly in preparation for the third meeting of the Joint Group. As a follow-up to this, a half day workshop is proposed to take place at PICES-2018 to consolidate our findings and advice, connect it to those from ICES and to report to the wider PICES community. The major theses of the second workshop at PICES-2018 will be: key locations in the Pacific Arctic and the critical processes to determine biological production; characterization of

major changes for recent decades; ramifications for ecosystem monitoring and management in the region. One of the tasks for WG 39 in doing this will be to explore for and make use of a pool of databases, aided by the general findings of previous reports and literature survey.

W3 Development of a systematic approach to data management in PICES

Convenors Joon-Soo Lee (Korea); Peter Chandler (Canada); Igor Shevchenko (Russia); Toru Suzuki (Japan); Yutaka Michida (IOC/IODE)

Co-sponsor: IOC/IODE

Duration: 1 day

Invited speaker: Robin Brown (PICES Executive Secretary), Canada (proposed); Others (TBD)

Since its establishment in 1992, PICES has produced observation data, experimental data, and model data for scientific purposes through expert group activities and projects, and analyzed the results to produce papers, reports, and data products. Some of the data are also available online. However, PICES data and data products have not been systematically managed and are expected to increase more and more in an unmanaged status in the future. In this regard, there is an urgent need to discuss how to manage the current PICES data and data products as well as how to manage them in the future. Therefore, this workshop aims to identify problems in the sustainable management and use of PICES data and data products, to seek better management structure and system, and to improve the linkage among PICES data producers, scientists and data managers.

W4 Synthesizing projected climate change impacts in the north Pacific

Convenors: Anne Hollowed (USA); Shin-ichi Ito (Japan), Jacquelynne King (Canada)

Co-sponsor: ICES

Duration: 1 day

Scientists have endeavored to project the implications of climate change on marine ecosystems throughout the North Pacific. We expect that many researchers will complete these projections by June 2018 in anticipation of the 4th Effects of Climate Change on the World's Oceans symposium. A workshop is needed to compare and synthesize results from this international projection modeling effort. The workshop will provide a forum for discussions of: a) Projection outcomes under different modeling approaches; b) Opportunities for comparative studies looking at projected impacts on selected species or fisheries in different LMEs; c) How modeling teams addressed the uncertainty landscape including issues of scenario, parameter and model uncertainty; and d) The range of potential harvest strategies selected and their performance relative to different national value systems. We anticipate that a manuscript will be generated from this session that will be submitted to a peer reviewed journal.

W5 Identifying common reference points and leading indicators of ecosystem change

Convenors: Xiujuan Shan (China); Mary Hunsicker (USA); Vladimir Kulik (Russia)

Duration: 1 day

Invited speakers: 1) Gavin Fay, USA, 2) Steve Munch, USA, 3) Jin Gao, USA, 4) Beth Fulton, Australia, 5) Michael Litzow, USA

Abrupt nonlinear change in ecosystem structure and function can dramatically alter human-derived benefits from the system and can have negative impacts on people's livelihoods and well-being. A growing number of driver-response relationships in marine ecosystems are being identified as strongly nonlinear, indicating that they are potentially prone to inflection points and threshold dynamics. Better knowledge of where such thresholds occur can advance our ability to anticipate future conditions and critically inform what management actions can maximize ecological, social or economic benefits. Moreover, thresholds common across analogous systems can be used to develop robust sets of reference points to prevent ecosystem components from tipping into undesirable states. A major goal of WG-36 CERP is to 'determine shapes or functional forms of driver - response relationships from available datasets, and quantify thresholds to identify potential ecosystem reference points' in North Pacific ecosystems (TOR 4). The proposed workshop is an important step for completing this goal and for making comparisons among the focal ecosystems selected for WG-36 activities. The workshop will also allow WG-36 to make progress in 'identifying ecosystem components that respond earliest to changes in biophysical drivers and could potentially serve as leading indicators of loss of resilience and ecosystem change' (TOR 5). In addition, the proposed workshop will give WG-36 members an opportunity to work together to ensure that the methods and R code generated for the WG activities can be easily used by PICES member nations as well as other nations to identify potential target or limit reference points and early warning signs of ecosystem change. The specific objectives of the workshop are to: 1) Conduct analyses for TOR 4 to 'determine shapes or functional forms of driver-response relationships from available datasets, and quantify thresholds to identify potential ecosystem reference points' in North Pacific ecosystems. 2) Identify differences and commonalities among thresholds / ecosystem reference points in the focal ecosystems of WG-36 activities. 3) Select common methods for system-wide comparisons to identify leading indicators of ecosystem 4) Develop, test and share R code via shared GitHub repository that is generalizable for other ecosystems. 5) If time allows, begin applying leading indicator analyses to focal ecosystems of PICES member nations (TOR 5).

W6 Regional evaluation of secondary production observations and application of methodology in the North Pacific

Convenors: Akash Sastri (Canada); Toru Kobari (Japan)

Duration: 0.5 day

Zooplankton production represents a quantitative proxy for the functional response of marine ecosystems to regional and global climate change, because material and energy scattering in the lower food web is integrated by zooplankton communities. Although a variety of methodologies for measuring zooplankton production have been developed and applied over the last half century, our knowledge of which approaches are applicable to a diverse range of organisms and habitats remains limited. Recent advances in biochemical methods for measuring zooplankton production have been reviewed, however, such information is still lacking for the traditional methodologies. This workshop will share the current status on zooplankton production methodologies and measurements, to be reported by the working group members representative of each PICES

nation. In addition, we also encourage presentations and discussion on advantages, applications and limitations of traditional methodologies on zooplankton production applicable to natural zooplankton populations and communities.

W7 Diets, consumption, and abundance of marine birds and mammals in the North Pacific

Convenors: Andrew Trites (Canada); Tsutomu Tamura (Japan); Yutaka Watanuki (Japan); Robert Suryan (USA)

Duration: 1 day

Invited speakers: Jerome Spitz (University of La Rochelle, France); Robert Furness (University of Glasgow, UK)

The S-MBM of BIO is midway through a 5-year program to update the 2000 PICES Scientific Report on Predation by Marine Birds and Mammals in the Subarctic North Pacific Ocean. To date, we have held a successful workshop (2016) to frame the program and agree on general modelling approaches, spatial boundaries, time scales and other considerations (see PICES W6 Workshop Report: Consumption of North Pacific forage species by marine birds and mammals). Since our 2016 workshop, we initiated the agreed upon databases to estimate prey consumption, and will continue to add and verify data over the coming 12 months in anticipation of our workshop, when invited experts will review the compiled information. Obtaining this expert consensus on model input parameters through the proposed workshop process is a necessary and critical next step to ensure the success of our program to estimate the amounts of prey consumed by seabirds and marine mammals in the North Pacific. The workshop participants will advance finalizing our databases of diets, abundances, distributions, and energy requirements of 135 species of seabirds, and all 47 species of marine mammals in the 12 PICES eco-regions. During the workshop, the invited holders of data and knowledge on the feeding ecology of seabirds and marine mammals in the North Pacific will 1) review the data summaries compiled by S-MBM members, 2) identify data gaps and sources of missing information, and 3) assist in framing appropriate educated guesses on possible values for missing data. The workshop will be structured with two breakout groups (birds and mammals), where data are presented by individual species and consensus is obtained on their accuracy and completeness. This process will result in near-complete databases of diets, abundances, and energy requirements of marine birds and mammals in the North Pacific.

W8 Emerging blooms of toxic dinoflagellates in the Pacific: comparative analysis of their prevalence and ecological impacts in the eastern and western regions [re-scheduled to take place at the 18th International Conference on Harmful Algae, October 21–26, 2018]

Convenors: Vera Trainer (USA) and Douding Lu (China)

Co-sponsors: NOWPAP, GlobalHAB

Duration: 1 day

Invited speakers: 2 TBD

There is clear evidence of contrasting occurrences and impacts of toxin-producing dinoflagellates in the eastern and western North Pacific. In particular, three genera – *Dinophysis*, *Gymnodinium* and *Cochlodinium* – show contrasting historical and habitat preferences, and have potentially distinct consequences to the ecology

and downstream health impacts. For example, over the past several decades *Dinophysis* has caused repeated shellfish closures and human illnesses from diarrhetic shellfish poisoning (DSP) in Japan, China, and Korea. Whereas in the eastern Pacific, *Dinophysis* has been recorded at a high abundance without corresponding DSP events – until 2011. These data will provide a unique opportunity for east–west Pacific comparisons to identify and rank putative environmental factors that promote harmful algal bloom (HAB) success.

The recent PICES-funded workshop on ‘HABs and Climate Change’ emphasized the importance of studying such contrasting events to further our understanding of climate impacts. This workshop will be an extension of the current dataset to the 1990s and earlier where available, with PICES participants pre-submitting available data on: HAB species presence, maximum abundance, toxicity, optimal conditions for growth, time of year, temperature range, salinity range, water clarity, nutrients, wind, river flow (flooding), and upwelling indices.

Workshop participants will evaluate the trends and patterns in these data to develop hypotheses for development into outlook products on day 1, and develop a detailed outline for manuscript preparation on day 2, including writing assignments and submission deadlines. The manuscript will be targeted for an appropriate peer-reviewed journal. These goals align closely with those of GlobalHAB and NOWPAP, and the International Society for the Study of Harmful Algae (ISSHA), all seeking to strengthen data collection, analysis and communication of findings on climate change and HABs. Representatives from GlobalHAB, NOWPAP and ISSHA will participate in the workshop, both to contribute to the workshop outcome, and to reinforce ties with other international partners.