Report of Science Board

Science Board held its first meeting of PICES-2019 from 14:00 to 17:00 on October 20, 2019 in Victoria, Canada. A half-day meeting was held after the Closing Session, from 14:00 to 18:00 on October 25 and a one-day meeting was held from 9:00 to 18:00 on October 26, 2019. Science Board Chair, Dr. Hiroaki Saito, welcomed guests and members to the meeting and self-introductions were made (***SB Endnote 1***). The agenda was re-ordered to accommodate the times invited observers were available to present (***SB Endnote 2***).

Science Board participants, top row, from left: Motomitsu Takahashi (representing Japan), Harold (Hal) Batchelder (PICES Secretariat), Sukyung Kang (FUTURE SSC), Rosalie Rutka (PICES Secretariat), Xianshi Jin (FIS), Keith Criddle (HD), Emanuele Di Lorenzo (POC). Front row, from left: Joon-Soo Lee (TCODE), Hiroaki Saito (Science Board Chair), Jennifer Boldt (MONITOR), Se-Jong Ju (BIO), Steven Bograd (FUTURE SSC), Vera Trainer (Science Board Chair-elect), Guangshui Na (MEQ), Oleg Katugin (representing Russia).

AGENDA ITEM 2

Procedures for Science Board Symposium and Session awards

Dr. Batchelder reviewed Committee/FUTURE instructions for the selection of awards to early career scientists (ECS). BIO, POC and MONITOR Chairs agreed that there should be flexibility in presenting more than one award if there were two strong candidates for ECS awards. This would apply to oral presentations as well as to posters. Dr. Saito granted permission for BIO to award up to two best presentations from its large pool of candidates if they were of equal quality.

For the Science Board Symposium, Dr. Saito would chair the morning session. He appointed Dr. Emanuele Di Lorenzo to chair the first half of the afternoon session and Dr. Boldt the second half. Dr. Boldt would provide Symposium summaries for the morning talks, and Drs. Trainer and Ju would summarize talks from the first half and second half of the session. Dr. Saito instructed Science Board to submit their evaluations of ECS oral and poster presentations from S1 and W7 directly to him. He also reviewed the responsibilities for documenting topic sessions and workshops, and the closing session. Dr. Jin was appointed to chair the Tuesday plenaries, and Dr. Se-Jong Ju the Thursday plenaries.

AGENDA ITEM 3
Template for Committee reports to Science Board

The Committee/Program template was described by Dr. Batchelder who asked that Committee Chairs send their completed templates to the Secretariat by lunch time on Thursday. Online topic session/workshop proposals were to be submitted by Tuesday evening and Committee ranking was to be completed by Wednesday. The submitted topic sessions and workshops would be compiled by the Secretariat and sent to the Committee Chairs in time for review at their Wednesday Committee meeting.

AGENDA ITEM 4
Update on SEAturtle project

Dr. Taewon Kim, Co-Chair of the PICES-Korea special project on "*Sea turtle ecology in relation to environmental stressors in the north pacific regions*" (SEAturtle), introduced this activity to Science Board. The project was approved at PICES-2018. The goal is to study the sea turtle population around Jeju Island to understand their habitat and ecology related to plastics pollution by attaching GPS/Iridium 2-way tags to them during their migration.

AGENDA ITEM 5
Current and potential collaborations with international organizations

Representatives from the International Council for the Exploration of the Sea (ICES), International Pacific Halibut Commission (IPHC), North Pacific Fisheries Commission (NPFC), North Pacific Research Board (NPRB), North Pacific Anadromous Fish Commission (NPAFC) and CPR Survey at the Marine Biological Association of the United Kingdom gave presentations on their activities and past, present and future collaborations with PICES. Specific requests to PICES included those from Dr. Anne Christine Brusendorf, General Secretary of ICES, who asked for:

- PICES support of an updated proposal for a Scientific Experts on Fish Stocks in the Central Arctic Ocean (FiSCAO) pilot study on data hosting and sharing protocols which will be a joint ICES/PICES contribution to the 3rd Arctic Science Ministerial on November 2020 in Japan 2020;
- PICES endorsement to hold a joint ICES/PICES Annual Meeting/Scientific Conference in 2022 in the US;
- PICES support to a joint ICES/PICES contribution to the UN Biodiversity Beyond National Jurisdiction through establishment of joint ICES/PICES expert groups to look at issues relevant to BBNJ.

Action: Secretariat to request a formal document from ICES on support for a joint ICES/PICES contribution to the 3rd Arctic Science Ministerial Japan 2020.

Dr. Alexandr Zavolokin, Science Manager for NPFC, identified the three areas described in the PICES-NPFC Framework on which progress could be made over the next 5 years:

- Support for stock assessment for priority species – this was supported by the holding of a FIS Workshop (W11) on "*PICES/NPFC collaborative research: The influence of environmental changes on the potential for species distribution shifts and population dynamics of Pacific saury*" at PICES-2019; a small pelagic fish topic session will be submitted for the next Annual Meeting;
- Vulnerable marine ecosystems – the Study Group on *Biodiversity Conservation* strongly advocated for NPFC-PICES cooperation on VMEs, the Working Group on *Biodiversity of Biogenic Habitats* was established in 2015, and PICES was represented at the 2018 NPFC/FAO VME workshop;

- Ecosystem approach to fisheries – NPFC co-sponsored the PICES/ICES International Symposium on "*Drivers of dynamics of small pelagic fish resources*" in 2017 in Victoria, Canada, and W11 at PICES-2019; NPFC will co-sponsor the next PICES/ICES small pelagic fish symposium scheduled for 2021. If a joint PICES/ICES Working Group on Small Pelagic Fish is approved at PICES-2019, NPFC would be interested in supporting it.

NPFC is a strong proponent of a PICES Working Group on Biodiversity of Seamounts, and is proposing holding an international school or training course on VME indicator taxa identification in the fall of 2020, but no formal request was made to PICES at this time.

Building a PICES ECS Professional Network

Drs. Stephanie Brodie and Erin Satterthwaite gave their perspectives for engaging ECS in PICES into a professional research network, similar to that of IMBeR's Interdisciplinary Marine Early Career Network (IMECaN). Ways to do this could be to establish an expert group dedicated to PICES Early Career Professionals (ECP), through a mentoring program, or by developing a communication platform to liaison between both ECS groups and established members. Dr. Satterthwaite had conducted informal interviewing at PICES-2019 to get a sense of ECP needs. Science Board was very supportive of having a formal ECP group involved in PICES.

UN Decade of Ocean Science for Sustainable Development

Dr. Steven Bograd, Co-Chair of FUTURE SSC, reported that the SSC is revising the FUTURE Implementation Plan to re-orient it towards the UN Ocean Decade. In response to a formal request from IOC Executive Secretary, Dr. Vladimir Ryabinin, for PICES input to the UN Decade of Ocean Science Action Plan, members of the SSC held an *ad hoc* meeting with representatives of ICES to draft a PICES/ICES statement of coordinated activities to send to the IOC in time to provide input to an Implementation Plan for the Ocean Decade. The goal is to have a PICES/ICES draft statement ready for review and feedback by both organizations by November, followed by a FUTURE/ICES inter-sessional workshop in 2020 to focus on what science issues could be mapped onto the Ocean Decade Action Plan.

Action: Science Board to send comments to Dr. Trainer and cc to Dr. Saito on Ocean Decade for draft revision by mid-November.

World Ocean Assessment II – Pool of experts

Dr. Chul Park, PICES Chair, provided a brief progress report on WOA II chapters. About half of the 31 chapters were sent for peer review. He expected the remainder would be ready for review by the time of this Meeting. Revision of the chapters was expected by first half of December after which time they will be copy-edited and sent for further review to the Member States. Authors will have another chance to address any comments. After final approval by the General Assembly in September, WOA II will be translated into six UN languages and published by the end of 2020.

AGENDA ITEM 6

Update on the PICES-MAFF project FishGIS

A proposal for a PICES-MAFF special project on "*The detection and human dimension of ciguatera fish poisoning in Indonesia*" was introduced by Dr. Mark Wells at Science Board's Sunday meeting. This new project builds on the tools developed and implemented during the PICES-MAFF project on "*Building capacity*

for coastal monitoring by local small-scale fishers" (FishGIS) which will complete its term March 2020. Using smartphone-based observation tools, the intention is to enable small-scale fishers and local communities in Indonesia to assess and detect the presence in the reef environment of toxin-containing algae that pose a threat to fisheries and human health. There was concern among Science Board members about the Indonesian government willingness to share data with PICES, and to make sure that PICES had a formal agreement to access the data and that the PICES Data Policy be built into the project initiatives. Science Board felt the project would be parented best by the MEQ and HD committees and asked these committees to discuss this at their meeting.

Recommendation: Science Board approves the project but wants clarification on access to data from Indonesian government, in regard to the PICES Data Policy.

AGENDA ITEM 7
Reports from expert groups reporting to Science Board

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

Dr. Sei-Ichi Saitoh, Co-Chair (PICES/Japan) of the joint PICES/ICES/PAME Working Group on *an Integrated Ecosystem Assessment for the Central Arctic Ocean* (WG 39) presented an overview of WG recent activities. At PICES-2018 the WG was extended for another 3 years to complete the first version of an Integrated Ecosystem Assessment of the Central Arctic Ocean report which will describe the CAO ecosystem, giving it a vulnerability characterization. The WG terms of reference were revised to reflect its new 3-year workplan (see *WG 39 Endnote 3* in the WG 39 2019 Annual Report). The report is now in its final stages of preparation and review and should be ready in very early 2020. To expand its work by including the impacts of human activities in the region, which will be in the second IEA, the WG wants to increase its membership. WG 39 convened a ½-day workshop (W7) on "*PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Third)*" at PICES-2019 and is proposing another workshop, at PICES-2020, as well as a fifth meeting of the WG in April 2020 in Tromsø, Norway.

- PICES-NPFC Study Group on *Scientific Cooperation in the North Pacific Ocean*

The PICES-NPFC Study Group on *Scientific Cooperation in the North Pacific Ocean* Framework for Enhanced Scientific Collaboration in the North Pacific Was approved by Science Board at ISB-2019. It will go to Governing Council for approval at PICES-2019.

- Study Group on *Impacts of Mariculture on Coastal Ecosystems (SG-IMCE)*

Due to scheduling difficulties for the Annual Meeting, the SG-IMCE meeting had to take place in advance of the MEQ Workshop (W19) on "*The impacts of mariculture to coastal ecosystems*". Consensus was not reached at the workshop on what direction to pursue for a working group.

Action: Secretariat to communicate with the Chair of SG-IMCE to determine the next step for the SG.

AGENDA ITEM 8
Collaborations with other international organizations/programs

Ocean KAN
Dr. Emanuele Di Lorenzo provided a brief update on his involvement in the development of Future Earth's Ocean KAN Strategic Plan.

AGENDA ITEM 9

Status of venue for PICES-2020, China

PICES-2020 will take place in Qingdao, China. The venue is not fixed yet, but would probably be the Shangri-la Hotel. Funding was in place and Dr. Yafeng Yang, of the International Cooperation Division, First Institute of Oceanography, MNR, was identified as the local contact. Revisions to the Meeting theme "*How does 30 years of research on changing North Pacific ecosystems inform the UN Decade of Ocean Science for Sustainable Development Goals (SDGs)*?" abstract were prepared by the Secretariat and sent to Science Board on August 25 for comments. No suggestions were received, but the Chinese Administration provided feedback prior to PICES-2019. See ***SB Endnote 3*** for the latest version.

AGENDA ITEMS 10 AND 11

Report from FUTURE SSC and the next integrative science program

Dr. Steven Bograd, FUTURE SSC Co-Chair, provided an update of FUTURE activities. Workshop (W1) on "*Learn to effectively communicate your science*" held at PICES-2019 was very successful. Workshop recommendations were for PICES to develop an Outreach Strategy that connects science to the public. It was noted at the workshop that PICES is an anomaly among modern science organizations in that it lacks a social media presence. It should consider a Twitter account and/or Blog, both aimed at the general public. PICES should hold annual science communication training workshops with each Annual Meeting. The topic of the workshop should reflect the host country's interests or needs, and should be organized and facilitated by science communication experts. A SEES approach, bringing certain expert groups together, *e.g.*, WGs 36, 40, 41, could also be considered for the workshop.

The SSC discussed one way of applying the SEES framework would be through an ECS SEES competition. This could be done at the Annual Meeting when an ECS submitted an abstract. There would be a field in the online submission that would show how the submitter's research fits into the SEES approach. The FUTURE SSC would evaluate the submissions and the award would involve travel support and an invited talk at the S1 plenary at the following Annual Meeting (see ***SB Endnote 5***). The definition of ECS was revisited, with the suggestion that an ECS be less than 38 years old or less than 5 years post-PhD, but the SSC will check to see if this is consistent with other organizations' definition.

Action: Executive Secretary to work with PICES webmaster on how to implement the process of submitting.

FUTURE is near the end of its Implementation Plan phase (Phase 2). A final report is expected to be completed by ISB-2020. It is expected that FUTURE can provide a great deal of leverage to the UN Ocean Decade, so the SSC is revising its Implementation Plan to align with the Decade (see UN Decade subsection in Agenda Item 5). FUTURE Phase 3 Science and Implementation Plan revisions and finalization of the FUTURE products matrix are also expected to be completed in April 2020. A 1-day inter-sessional meeting and a 2-day workshop to map activities around the UN Ocean Decade are requested. The workshop should include representatives from ICES, ECS and AP-NPCOOS, and consist of not more than 20 people.

There was general agreement amongst Science Board that FUTURE was producing very strong momentum and that it should stay the course to complete Phase 3. Plans for the next integrative science program could be undertaken by a study group as Phase 3 is completed.

Action: Science Board to think of ideas to develop a new study group for the next phase at ISB-2020.

Dr. Bograd presented the current and new FUTURE liaisons with expert groups and suggested that the liaisons be added to their respective expert group mailing list to enhance communications.

Action: Add FUTURE liaisons automatically to email list of their expert groups.

Dr. Bograd recommended holding a second FUTURE Open Science Meeting, potentially in early 2021 in Hawaii. The Meeting will highlight and synthesize FUTURE accomplishments since its last OSM in 2014. It would also kick off FUTURE's input to the UN Ocean Decade. The FUTURE SSC will act as the organizing committee and Drs. Bograd and Sukyung Kang will act as co-convenors, in addition to a representative from ICES and IOC.

Request: funding similar to that for the 2014 OSM.

FUTURE SSC expert group recommendations:

- PICES/ICES WG on Small Pelagic Fish – general support, but defers to FIS; support for a regular SPF symposia series;
- PICES/ICES Ocean Negative Carbon Emissions WG – proposal too vague; recommends better articulation of ToRs, clearer description of implementation, and what makes it different from WG 33; defers to BIO;
- PICES/ICES EBFM Evaluation WG – general support and approval;
- Bering/Chukchi Sea IEA WG – general support, but concerns on Russian participation; not comfortable with a PICES Committee parenting.

FUTURE SSC recommendations to Science Board:

- PICES to create a consistent definition of an Early Career Scientist;
- An Early Career Scientist 'orientation' page to be created on PICES homepage;
- PICES to develop a social media presence, possibly through a ToR for an ECS expert group;
- PICES to hold an annual science communication workshop.

Requests:

- 1-day FUTURE business meeting and 2-day FUTURE/ICES UN Ocean Decade WS at ISB-2020;
- A 1-year extension for the Working Group on *Common Ecosystem Reference Points across PICES Member Countries* (WG 36) to write 2 papers and finalize its report (no business meeting required at PICES-2020).

AGENDA ITEM 12
Venue and date for ISB-2020

No decision was reached.

AGENDA ITEM 13
Report of elections of new Committee Chairs and Vice-Chairs

BIO

- Dr. Akash Sastri was elected Chair of BIO, replacing Dr. Se-Jong Ju (Korea)
- Dr. Wongyu Park (Korea) was elected Vice-Chair of BIO, replacing Dr. Sastri (Canada)

HD
- Dr. Mitsutaku Makino (Japan) was elected Chair of HD, replacing Dr. Keith Criddle (USA)
- Dr. Karen Hunter (Canada) was elected Vice-Chair of HD, replacing Dr. Mitsutaku Makino (Japan)

MONITOR
- Dr. Sung Yong Kim (Korea) was elected as Chair of MONITOR, replacing Dr. Jennifer L. Boldt (Canada)
- Dr. Lisa Eisner (USA) was elected Vice-Chair, replacing Dr. Sanae Chiba (Japan)

TCODE
- Dr. Jeanette Gann (USA) was elected Chair, replacing Dr. Joon Soo Lee (Korea)
- Mr. Peter Chandler (Canada) was re-elected Vice-Chair for a 1-year term (from Oct. 2019-Oct. 2020)

POC
- Dr. Emanuele Di Lorenzo (USA) was re-elected for a second term (from Oct. 2019-Oct. 2022)
- Dr. Yury Zuenko (Russia) was re-elected for 2 more years (from Oct. 2019-Oct. 2021)

S-CCME
- Dr. Xiujuan Shan (China) was elected Co-Chair, replacing Dr. Shin-ich Ito (Japan)

- **S-CC**

Dr. Alex Kozyr (USA) was elected Co-Chair, replacing Dr. Jim Christian (Canada)

AGENDA ITEM 14
Election of Science Board Vice-Chair

Science Board
- Dr. Vera L. Trainer (USA) succeeded Dr. Hiroaki Saito (Japan) as Chair
- Dr. Igor Shevchenko (Russia) was elected as Vice-Chair for 1-year term.

AGENDA ITEM 15
Reports from Scientific and Technical Committees plus high priority requests

Details of expert group highlights and requests since ISB-2019 can be found in expert group/Committee reports in Annual Report 2019 as well as on their homepages. A progress report by WG 35 Co-Chair, Mr. Peter Chandler, was provided directly to Science Board at its Sunday meeting and is presented below.

Working Group on the *Third North Pacific Ecosystem Status Report* (WG 35)

Mr. Peter Chandler, Co-Chair of WG 35, gave a progress report on NPESR. The two key objectives of the WG are to publish the next version of NPESR (consistent with the previous two reports, which include regional chapters and a synthesis chapter) by the end of 2019 and establish an online system to develop a database of Ecosystem Time Series Observations. Data submissions were initially with the Alaska Fisheries Science Center's system, but was now through a cloud-based submission management system. WG 35 was behind in its timeline because many lead authors were still waiting for ETSO submissions and because there was a delay in feedback from the editorial board to the authors. There were many reasons for the delay, or lack of ETSO submissions, including that the submission of data was too new a concept for many scientists, submissions came straight to the authors with no filtering, or there tended to be a bias in what was being submitted, *i.e.*,

ETSOs submitted were self-selected by the contributor. Therefore, the synthesis report was progressing in advance of the regional reports. The Region 19 report was not yet submitted but the other regional reports were under review by the editorial board. The regionals will live on the website and the synthesis will be an ISBN report. However, if both were small enough, there was the possibility of combining the two.

Requests:
- Clarification from Governing Council that publication of the NPESR3 synthesis chapter prior to the regional chapters will not be impeded, and that NPESR3 will be published in a timely manner;
- 1-year extension to publish the synthesis chapter;
- ½-day meeting at PICES-2020 to generate recommendations for NPESR4.

Recommendation: publish NPESR3 in a timely manner accompanied by supplementary material that will be web-based.

Other Science Board recommendations:

Expert group extensions
- 1-year extension for WG 35 (NPESR3) to PICES-2020 to publish the NPESR synthesis chapter;
- 1-year extension for WG 36 (*Common Ecosystem Reference Points across PICES Member Countries*) to PICES-2020 to complete its ToRs;
- 1-year extension for WG 37 (*Zooplankton Production Methodologies, Applications and Measurements in PICES Regions*) to complete its ToRs;
- 1-year extension for WG 38 (*Mesoscale and Submesoscale Processes*) to PICES-2020 to complete a synthesis review paper and its ToRs;
- 5-year extension for the Advisory Panel for a *CREAMS/PICES Program in East Asian Marginal Seas* (AP-CREAMS).

Expert groups to be disbanded upon completion of their final reports
- Joint PICES/ISC Working Group on *Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish* (WG 34);
- Working Group on *Common Ecosystem Reference Points across PICES Member Countries* (WG 36);
- Working Group on *Mesoscale and Submesoscale Processes* (WG 38).

Publications

Primary journals (2019–2020)
- WG 38 synthesis review paper to be submitted to *Progress in Oceanography* December/January

PICES Special Publication series (2020)
- WG 35 (NPESR3) synthesis report*

---

* Science Board recommends the printed publication of the NPESR3 synthesis report in a timely manner, in addition to the publication of web-based regional chapters; Science Board requests Governing Council to make a decision on the publication of the technically edited (in 2016) AP-CREAMS NPESR2 Supplementary Chapter.

PICES Scientific Report series
- WG 34 final report;
- WG 36 final report;
- WG 38 final report.

Revisions to expert group terms of reference

- Section on *Marine Birds and Mammals* (see *S-MBM Endnote 4* in its 2019 Annual Report);
- Section on *Ecology of Harmful Algal Blooms in the North Pacific* (see S-HAB 2019 Annual Report);
- WG 42 (see Agenda Item 4 in WG 42 Annual Report);
- WG 39 (see *WG 39 Endnote 3* in its 2019 Annual Report);
- AP-CREAMS (see *AP-CREAMS Endnote 3* in its 2019 Annual Report).

Additional changes/additions in expert groups recommended by Science Board

- BIO requests additional members from China and Russia;
- MEQ requests additional members from Russia and the US, and a member from WG 42;
- S-HAB requests a Russian member to replace Dr. O. Lukyanova (deceased);
- S-CCME requests the addition of a Russian member from BIO or a Russian member from FIS;
- Science Board formally approves S-CCME Phase 3 Implementation Plan (2018–2020);
- Science Board approves the request from S-CCME to have 5-year phase Implementation Plan (2021–2025).

AGENDA ITEM 16

New expert groups/projects

Science Board reviewed proposals for expert groups/projects received during PICES-2019 and recommended the establishment of the following:

- Joint ICES/PICES Working Group on *Small Pelagic Fish* (WG-SPF);
- Working Group on *Integrated Ecosystem Assessment of the Northern Bering Sea – Chukchi Sea* (IEA-NBS)*
- Joint PICES/ICES Working Group on *Ocean Negative Carbon Emissions* (WG-ONCE)**
- Joint ICES/PICES Working Group on *Impacts of Warming on Growth Rates and Fisheries Yields* (WG-GRAFY)**
- PICES-MAFF special project on "*The detection and human dimension of ciguatera fish poisoning in Indonesia*"***

* Science Board recommended establishing this group, but seeks guidance from Governing Council over concerns on data sharing between countries, national balance, and engagement with Indigenous peoples.
** Science Board recommended deferring until ISB-2020 pending clarification/completion of proposals.
*** Science Board approves the project but wants clarification on access to data from the Indonesian government, in regard to the PICES Data Policy.

- *Study Group on Correlating Habitats using Artificial Intelligence, Numerical models and Gathered Empirical Data (SG-CHANGE)*

Dr. Di Lorenzo recommended that instead of a proposal for a Study Group, a session or workshop at PICES-2020 could lead straight to a Working Group. Science Board agreed with his suggestion.

Action: Dr. Di Lorenzo to re-work terms of reference with ECS Dr. Erin Satterthwaite in anticipation of a Working Group.

- *Request for endorsement of a Marine Ecosystem-based Management Progress Evaluation Group*

Endorsement: Science Board endorses this group.

AGENDA ITEM 17
Schedule for PICES-2020 and inter-sessional workshops

Science Board recommendations for 2020

The theme for PICES-2020 is "*How does 30 years of research on changing North Pacific ecosystems inform the UN Decade of Ocean Science for Sustainable Development Goals (SDGs)?*". The Annual Meeting will be held from October 22 to November 1, 2020, in Qingdao, China. The following topic sessions and workshops were recommended by Science Board (final descriptions can be found in ***SB Endnote 4***):

- ¾-day Science Board Symposium

How does 30 years of research on changing North Pacific ecosystems inform the UN Decade of Ocean Science for Sustainable Development Goals (SDGs)?

- 1-day Topic Session

Global warming patterns and multiscale climate variability in the North Pacific

- 1-day Topic Session

How the studies on human dimensions can contribute to meet the six societal needs of the Decade of Ocean Science?

- 1-day Topic Session

Upper ocean energetics from mesoscale, submesoscale to small-scale turbulence in the North Pacific

- ½-day Topic Session (co-sponsored by SOLAS)

Atmospheric nutrient deposition and microbial community responses, and predictions for the future in the North Pacific Ocean

- 1-day Topic Session (co-sponsored by NPFC)

Environmental variability and small pelagic fishes in the North Pacific: exploring mechanistic and pragmatic methods for integrating ecosystem considerations into assessment and management

- 1-day Topic Session

Managing for pathways of resilience in a changing climate: recent examples and emerging approaches

- ½-day Topic Session

Marine Ecosystem Services – Connecting science to decision making

- 1-day Topic Session

Applications of artificial intelligence to advance the understanding of North Pacific ecosystems

- ½-day Topic Session

The effect of ocean acidification on harmful algal species growth and toxicity

- 1-day Topic Session

Impacts of climate change on aquaculture

- 1-day Topic Session

Using environmental indicators to assess baselines, targets, and risk of plastic pollution in the North Pacific

- 1-day Topic Session

Predictions of extreme events in the North Pacific and their incorporation into management strategies

- 1-day Topic Session

Using eDNA to assess and manage non-indigenous species in the North Pacific

- 1-day Topic Session

Implementing a collaborative, integrated ecosystem high seas survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean

- 1-day Topic Session

Species migration and shifts responding to climate change: linking physics, plankton dynamics and fish ecology

- 1½-h FUTURE plenary on PICES' role in the UN Decade of Ocean Science
- 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
- General Poster Session
- 1-day Workshop

The Expansion *of Harmful Algal Blooms (HABs) from lower to higher latitudes*

- 1-day Workshop

Can we *link zooplankton production to fisheries recruitment?*

- 1-day Workshop (co-sponsored by IPHC)

Integrating biological research, fisheries science and management of broadly distributed flatfish species across the North Pacific Ocean in the face of climate and environmental variability

- ½-day Workshop

How does the Pacific Arctic gateway affect the marine system in the Central Arctic Ocean (CAO)?

- 1-day Workshop

Pelagic and forage species – predicting response and evaluating resiliency to environmental variability

- ½-day Workshop (co-sponsored by ICES, IOC, NPFC)

Research priorities for understanding the population dynamics of small pelagic fish in the North Pacific

- 2-day Workshop

The social-ecological-environmental dynamics of climate extremes in Pacific coastal systems

- 1-day Workshop

Sea turtles and environmental stressors in the North Pacific

- 1-day Workshop

Building a PICES early career professional network
Other Science Board recommendations

Business meeting requests for PICES-2020:

- 3-h Sunday, 5-h Friday, and 1-day Saturday meetings of Science Board;
- 1-day FUTURE SSC meeting;
- 2-hour overture meetings and ½-day meetings of Standing Committees;
- 1-day – joint ICES/PICES Working Group on *Small Pelagic Fish* (WG-SPF), pending GC approval;
- 1-day – Working Group on *Integrated Ecosystem Assessment of the Northern Bering Sea – Chukchi Sea* (IEA-NBS), pending approval;

- ½-day – Section on *Carbon and Climate* (S-CC);
- 1-day – Section on Ecology of *Harmful Algal Blooms in the North Pacific* (S-HAB);
- ½-day – joint PICES/ICES Section on *Climate Change Effects on Marine Ecosystems* (S-CCME);
- ½-day – Section on *Marine Birds and Mammals* (S-MBM);
- ½-day – Working Group on *North Pacific Ecosystem Status Report* (WG 35);
- ½-day – Working Group on *Zooplankton Production Methodologies, Application and Measurements in the PICES Regions* (WG 37);
- ½-day – joint PICES/ICES/PAME Working Group on an *Integrated Ecosystem Assessment for the Central Arctic Ocean* (WG 39);
- 1-day – Working Group on *Climate and Ecosystem Predictability* (WG 40);
- 1-day – Working Group on *Marine Ecosystem Services* (WG 41);
- 1-day – Working Group on Marine Microplastics (WG 42)
- ½-day – 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 Systems* (AP-NPCOOS);
- 1½-day meeting of the Advisory Panel on *Marine Non-indigenous Species* (AP-NIS);
- ½-day – PICES-MAFF FishGIS special project;
- 1-day – PICES-MoF SEATurtle special project;
- 1-day – PICES-MAFF Ciguatera fish poisoning special project, pending GC approval.

Inter-sessional workshops
- Fifth meeting of ICES/PICES/PAME Working Group for *Integrated Ecosystem Assessment of the Central Arctic Ocean* – WGICA (WG39), 3 days, April 27–29, 2020, Tromsø, Norway;
- Small Pelagic WG inter-sessional kick-off meeting, 2 days, TBD, Europe.

Theme sessions at ICES ASC 2020 PICES agreed to co-sponsor
- #1-Top predators, food webs and ecosystem-based fisheries management;
- #10-Advances and challenges in marine litter pollution.

AGENDA ITEM 18
PICES-sponsored conferences/symposia in 2019 and beyond

Science Board recommended support for:
- PEEC 2020, February 2020, Bamfield, Canada;
- ESSAS Annual Science Meeting, June 1–3, 2020, Hokkaido, Japan;
- 7th Zooplankton Production Symposium, March, 2022, Hobart, Tasmania;
- Travel for a S-HAB member to attend an ICES WGHABS meeting, April 2020, Europe;
- NPFC-PICES workshop on VMEs (Science Board supported in principle, but no request was made by NPFC at this time).

Actions:
- Secretariat to contact Dr. Makino to request a meeting room at MSEAS for May 30, 2020 for S-CMME Phase 4 meeting
- Revisit 5th International Symposium on "*The effects of climate change on the world's oceans*", May 2023, Bergen, Norway, at ISB-2020.

Science Board did not support funding for:

- ECS to attend SCOR Summer School on "*Changes in coastal upwelling systems and their impact on marine resources*", May 2020, Dakar, Senegal;
- ECS to attend IMBeR ClimEco7, June 2020, Cabo Verde;
- One PICES SPF scientist to attend an SPF meeting at ICES ASC 2020, September 2020, Copenhagen, Denmark.

AGENDA ITEM 19

Status of PICES publications

Science Board did not discuss due to limited time, but see Agenda Item 15

AGENDA ITEM 20

Capacity building/plan for PICES summer schools

PICES Summer Schools

Science Board recommends supporting:

- PEEC 2020, February, 2020, Bamfield, BC, Canada;
- Early Career Scientist Conference (ECSC-4) in 2022, Europe TBD.
- AP-NPCOOS/WG 37 Summer School on "*Understanding marine ecosystem responses to climate change*", March 2020, Kagoshima, Japan.

- PICES/AP-CREAMS Summer School on "*Ocean turbulence: From observing to research*" – postponed.

AGENDA ITEM 21

Implementation of Science Board recommendations and Governing Council decisions from PICES-2018 and ISB-2019

Science Board had no comments.

AGENDA ITEM 22

Recruiting early career scientists to PICES

Recruitment was briefly discussed at Sunday's meeting by Drs. Stephanie Brodie and Erin Satterthwaite. Also, see Agenda Items 10 and 11, 16, and 23.

AGENDA ITEM 23

New ECS award and revision of POMA

A FUTURE Early Career Scientist Travel Award to highlight the SEES framework and a Zhu–Peterson Early Career Scientist Award for innovative research at the frontier of science relevant to the PICES were created and will be given and each will be given to an individual at PICES-2020 (see ***SB Endnote 5*** and ***SB Endnote 6***).

Members of MONITOR and TCODE were tasked by Science Board to revise the PICES Ocean Monitoring Service Award to broaden the scope of the award to increase the pool of nominations. Although there was initially some disagreement in the wording, both Committees agreed to include "new technology" which will extend services such as remote sensing. MONITOR and TCODE agreed that the POMA needs to be broadcast more effectively to the widest audience possible. The revised POMA can be found in ***SB Endnote 7***.

AGENDA ITEM 24
Other business

None.

SB Endnote 1

Science Board participation list

Members

Hiroaki Saito (Science Board Chair)
Vera L. Trainer (Chair-elect)
Steven Bograd (Co-Chair, FUTURE SSC)
Jennifer Boldt (Chair, MONITOR)
Keith Criddle (Chair, HD)
Emanuele Di Lorenzo (Chair, POC)
Xianshi Jin (Chair, FIS)
Se-Jong Ju (Chair, BIO)
Sukyung Kang (FUTURE SSC)
Oleg Katugin (representing Russia; Oct. 26)
Joon-Soo Lee (Chair, TCODE)
Georgiy Moiseenko (representing Russia)
Guangshui Na (Chair, MEQ)
Motomitsu Takahashi (representing Japan)

Secretariat

Robin Brown (Executive Secretary, Oct. 20)
Harold (Hal) Batchelder (Deputy Executive Secretary)
Rosalie Rutka (Administrative Assistant)

Observers/Expert Group Chairs

Betsy Baker (NPRB; Oct. 20)
Matthew Baker (NPRB; Oct. 20)
Stephanie Brodie (IMECaN; Oct. 25)
Anne Christine Brusendorf (ICES; Oct. 20)
Peter Chandler (WG 35; Oct. 25)
Ellen Johannesen (ICES; Oct. 20)
William Karp (ICES; Oct. 20)
Taewon Kim (SEAturtle project; Oct. 20)
Mitsutaku Makino (FishGIS project; Oct. 20)
Josep Planas (IPHC; Oct. 20)
Vladimir Radchenko (NPAFC; Oct. 25)
Erin Satterthwaite (Future Earth; Oct. 25)
Sei-Ichi Saitoh (Co-Chair WG 39; Oct. 25)
Mark Wells (FishGIS project; Oct. 20)
Willie Wilson (CPR at MBA; Oct. 20)
Alexander Zavolokin (NPFC; Oct. 20)

PICES

Chul Park (Chair)

SB Endnote 2

Science Board meeting agenda

Sunday, October 20, 2019

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. Update on SEAturtle project (Kim)
5. Current and potential collaborations with international organizations/programs (Saito/Invited Guests)
6. Update on the PICES-MAFF project FishGIS (Makino/Wells)

Friday, October 23, 2019

5. Current and potential collaborations with international organizations/programs (Saito/Invited Guests), *continued*
7. Reports from expert groups reporting to Science Board (Saito)
8. Collaborations with other international organizations/programs (Saito, Batchelder)
9. Status of venue for PICES-2020, Qingdao, China (Secretariat)
10. Report from FUTURE SSC (Kang/Bograd)
11. The next integrated science program: Beyond FUTURE (Bograd/Kang)
12. Venue and date for ISB-2020 (Saito/Secretariat)
13. Report of elections of new Committee Chairs and Vice-Chairs (Batchelder)
14. Election of Science Board Vice-Chair (Batchelder)
15. Reports from Scientific and Technical Committees plus high priority requests (Committee Chairs)
16. Review/decision of proposed new expert groups/projects (Jin/Saito)
17. Schedule for PICES-2020 and inter-sessional workshops (All)
18. PICES-sponsored conferences/symposia in 2019 and beyond (Secretariat/Saito)

Saturday, October 23, 2019

19. Status of PICES publications (Batchelder)
20. Capacity building/plan for PICES summer schools (Batchelder)
21. Implementation of Science Board recommendations and Governing Council decisions from PICES-2018, Yokohama and ISB-2019, Yokohama (Brown)
22. Recruiting early career scientists to PICES
23. New ECS award and revision to POMA
24. Other PICES business

SB Endnote 3

Theme of PICES-2020
Qingdao, China
October 22–November 1, 2020

"How does 30 years of research on changing North Pacific ecosystems inform the UN Decade of Ocean Science for Sustainable Development Goals (SDGs)?"

- What has PICES learned from recent multidecadal investigations of the North Pacific, and how does what we have learned inform and advance future activities of the Sustainable Development Goals (SDGs) of the UN Ocean Decade?
- Based on what we have learned already, what are the big and most important North Pacific science questions remaining to address with respect to SDGs? This is what the Global and Regional Workshops of the Ocean Decade are supposed to address, but PICES views this as a longer conversation and likely to require more than a single decade.
- Are there critical science-based SDGs that PICES is NOT currently addressing, but perhaps could through a coordinated effort to provide a better or more complete understanding, particularly with regard to issues of concern in the North Pacific? What are they and how should PICES proceed in their engagement with the Ocean Decade? This could include new priorities and new activities for PICES.
- For the upcoming 10 years of the UN Ocean Decade, what kind of blueprint is needed to facilitate coordinated ocean observation, prediction and ecosystem and social service systems for the North Pacific, so that the diverse interests of the PICES science community can significantly contribute to the Ocean Decade goals.
- In all likelihood, a single decade focused on improving the conditions of the World's Oceans is not long enough to solve or significantly improve the conditions of the oceans to a healthy status. However, a concerted effort towards better stewardship from all ocean sectors, stakeholders, and geographical regions over the decade could provide a blueprint for ongoing future remediation of ocean ecosystems into future decades.

SB Endnote 4

Approved Topic Sessions and Workshops for PICES-2020

1 How does 30 years of research on changing North Pacific ecosystems inform the UN Decade of Ocean Science for Sustainable Development Goals (SDGs)?

Convenors: Science Board
Duration: ¾ day

For 29 years, PICES has conducted investigations of North Pacific ecosystems. There has been a significant focus on multidecadal ecological processes and a more recent emphasis on the impacts of changes in the ocean on the human societies that rely on the North Pacific. The FUTURE Science Plan has identified several important science questions about the status and future of North Pacific marine ecosystems. As a result, PICES scientists are well-positioned to contribute to the United Nations Decade of Ocean Science for Sustainable Development. It is now urgent for PICES scientists to identify the most important science questions which must be answered to achieve the objectives of the Sustainable Development Goals and to suggest effective ways to answer these questions, mobilizing the coordination within PICES and collaborations with other partners.

We welcome submissions for topic sessions and workshops that address these issues, including : 1) What are the greatest issues of concern regarding the status and health of the North Pacific Ocean, 2) Are there critical science issues for ocean Sustainable Development Goals that PICES is not addressing? and 3) What kind of blueprint is necessary to facilitate the coordinated ocean observation, prediction and ecosystem and social service systems for the North Pacific, so that the diverse interests of PICES significantly contribute to the goals and objectives of the UN Ocean Decade.

2 Global warming patterns and multiscale climate variability in the North Pacific

Convenors: Jian Ma (China), Vladimir Ponomarev (Russia), Kyong-Hwan Seo (Korea), Emanuele Di Lorenzo (U.S.A.)

Duration: 1 day
Invited speaker: Shang-Ping Xie, U.S.A.

In spite of a globally uniform increase in greenhouse gas concentrations, the radiatively forced surface warming is accompanied by significant spatial variations. The warming patterns result from pre-existing climate states and drive robust responses of the tropical hydrological cycle with global-scale feedbacks. Climate variability on multiple timescales would change in global warming accordingly. For instance, interannual variability is overall expected to strengthen in the Pacific Ocean. Monsoon rainfall around the North Pacific is projected to increase and the wet season to lengthen despite a slow-down of the atmospheric circulation. Strong variations among monsoon regions would emerge depending on surface conditions. Interdecadal climate variability modulates the globally averaged surface temperature change with pronounced anomalies in the equatorial and polar Pacific, leading to prolonged periods of enhanced or reduced warming, e.g., the recent global warming hiatus. Advanced global observations, regional simulations, and process-level investigations are essential for improvements in understanding, predicting, and projecting the modes of climate variability, monsoon sensitivity, and energetic fluctuations in and around the warming North Pacific Ocean. Responses of the North Pacific marine ecosystems to changes in both mean climate and its variability are of great concern by the adjacent human societies. Therefore, we call for a topic session about the impacts of global warming patterns on multiscale climate variability in the North Pacific. This session should not only present the latest research progresses to identify the most important science questions, but also discuss the most promising outlooks to suggest effective ways to answer them. Our proposed assembly would also promote national research and international collaboration with domestic and worldwide experts on regional climate and implications for ecosystem changes. The outcome will contribute to UN Ocean Decade by addressing the question “What are the greatest issues of concern regarding the status and health of the North Pacific Ocean?”

3 How the studies on human dimensions can contribute to meet the six societal needs of the Decade of Ocean Science?

Convenors: Mitsutaku Makino (Japan), others TBD

Duration: 1 day

The UN Decade of Ocean Science says that “the Decade will bolster scientific research and innovative technologies to ensure science responds to the needs of society”, and indicates the following six specific needs

from the society to the ocean science; 1) A clean ocean where sources of pollution are identified and removed, 2) A healthy and resilient ocean where marine ecosystems are mapped and protected, 3) A predictable ocean where society has the capacity to understand current and future ocean conditions, 4) A safe ocean where people are protected from ocean hazards, 5) A sustainably harvested ocean ensuring the provision of food supply, and 6) A transparent ocean with open access to data, information and technologies. Clearly, each need includes the academic questions/issues closely relating to the human dimensions. For example, what is the "clean" or "healthy" ocean? Who will decide it? What kind of "predictability" or "safety" do we need? How can "transparency" be achieved? Are they different among countries or societies? What is the cross-scale compatibility from the human community level to the Pacific Basin level? How much can the society pay for that?, etc., etc. This Topic Session welcomes studies about these questions/issues. Based on the oral presentations, we will have discussions about how the human dimension researches can link and add values to the natural science research activities to meet above six societal needs. The outcome of this Topic Session is expected to show the direction of PICES HD Committee activities in the next decade.

4 Upper ocean energetics from mesoscale, submesoscale to small-scale turbulence in the North Pacific

Convenors: Yisen Zhong (China), Bo Qiu (U.S.A.), Sung Yong Kim (Korea), Yusuke Uchiyama (Japan)

Duration: 1 day

The ocean circulation is characterized by turbulence on a wide range of scales from a few centimeters to thousand kilometers. The energy balance is achieved by transferring energy from planetary-scale forcing to microscale dissipation. One of the major efforts that have been made during the recent decades is to understand how the energy is transferred from mesoscale, submesoscale to small-scale turbulence. In particular, a full spectrum of oceanic submesoscale works bridge the gap between mesoscale and small-scale by discovering forward energy cascade at this range. The submesoscale dynamics are most active in the upper ocean. They are spawn in the mesoscale eddies generated by large-scale flow instability, or near the ocean front including plume front in the coastal water. The predictability and sensitivity of the numerical forecast models that include such processes is still unclear. This session invites all studies from mesoscale, submesoscale to small-scale (including surface/internal waves, boundary layer processes, etc) that contribute to the understanding of energy cascade in the PICES region as well as their applications in the ocean prediction system. We also welcome research about the impact of those processes on the transport of heat, carbon or other biologically or climatically important tracers in the upper ocean.

5 Atmospheric nutrient deposition and microbial community responses, and predictions for the future in the North Pacific Ocean

Convenors: Jun Nishioka (Japan), Guiling Zhang (China), Huiwang Gao (China), Kitack Lee (Korea), Santiago Gassó (USA), Maurice Levasseur (Canada)

Co-sponsor: SOLAS
Duration: ½ day

Atmospheric deposition is an important nutrient source for marine ecosystems, with consequences for local, regional, and global biogeochemical cycles, as well as the climate system. This session focuses on natural and anthropogenic atmospheric nutrient inputs to the North Pacific Ocean. Microbial communities respond to

changing atmospheric inputs, which may result in significant effects on the marine carbon and nitrogen budgets, as well as on atmospheric carbon dioxide uptake. Key questions to be addressed within this theme are: How do biogeochemical and ecological processes interact in response to natural and anthropogenic material input from the atmosphere across costal and open ocean regions? How do global warming, ocean acidification, and other anthropogenic stressors synergistically alter the uptake of atmospheric nutrients and metals by marine biota in different oceanic regions? What is the prognosis for the future? We welcome new interdisciplinary presentations and active discussions on physical, chemical, and biological sciences both from the ocean and atmospheric fields in this session.

6 Environmental variability and small pelagic fishes in the North Pacific: exploring mechanistic and pragmatic methods for integrating ecosystem considerations into assessment and management

Convenors: Chris Rooper (Canada), Bai Li (USA), Vladimir Kulik (Russia) Toshihide Kitakado (Japan)

Co-sponsor: NPFC
Duration: 1 day
Invited speaker: Taiki Fuji, Japan

Small pelagic fish species are a key component of North Pacific ecosystems. They are a prey species for large bodied fishes, marine mammals and birds and an important predator of zooplankton and phytoplankton production. In addition, there are substantial commercial fisheries that exploit small pelagic species. Small pelagics are often short-lived and respond strongly to environmental changes. This makes these species particularly difficult to manage, as changes in productivity caused by environmental changes can precede management responses. This also creates an opportunity, in that environmental changes can have impacts on the species distribution and abundance over shortened time scales that are relatively easily detected. For example, Pacific Saury is a species with a 2-year life cycle, with distribution and abundance known to be strongly correlated to temperature and ocean conditions. Abundance and productivity are likely to change over very short time scales. The species also supports a large multi-national commercial fishery in international waters. However, the linkages to environmental conditions are not parameterized in the existing stock assessment or management strategy. This proposed session will focus on methods to incorporate the environment into stock assessment and management of small pelagics. We will solicit contributions under three broad categories, 1) contributions that hypothesize and apply mechanistic approaches to relating growth, recruitment and productivity to environmental changes in the North Pacific Ocean, 2) methods for monitoring and predicting ocean conditions that have implications for population status and can assist in projecting future changes in the abundance of small pelagic fishes and 3) examination of environmental relationships that can contribute to understanding the implications for management measures such as biological reference points and harvest control rules.

7 Managing for pathways of resilience in a changing climate: recent examples and emerging approaches

Convenors: Xiujuan Shan (China), Kirstin Holsman (USA), Jennifer Boldt (Canada), Mary Hunsicker (USA)

Duration: 1 day
Invited speakers: Angelica Peña (Canada), Shin-ichi Ito (Japan), Manu Di Lorenzo (USA), Anne Solomon (Canada; SES; potential Keynote), Lisa Pfeiffer (economics; USA), Christoph Heinze (U. Bergen, EU tipping points project)

Climate change and compounding anthropogenic pressures pose a risk to marine social-ecological systems. Of increasing concern is the potential for systems to rapidly shift (often irreversibly) to new states in response to pressures. In some cases, such shifts can occur abruptly without much warning, despite years of mounting pressure and apparent system resilience. These nonlinear inflection points in pressure-response relationship, – i.e. "tipping points"–, are defined by the IPCC SR15 as "critical thresholds in a system that, when exceeded, can lead to a significant change in the state of the system, often with an understanding that the change is irreversible." Identifying singular or compound, nonlinear, or contextual tipping points is of paramount importance to the IPCC as the likelihood of crossing tipping points increases with atmospheric carbon, climate instability, and ecological sensitivity, posing a significant risk for ecological and human wellbeing. Tools and methods for managing systems prone to tipping points are important for national, regional, and local resource management and climate adaptation. While identifying tipping points is challenging, there are multiple recent approaches that advance this objective, especially in terms of multivariate tipping points. We propose a topic session that will a) explore emergent tools and approaches for identifying multivariate thresholds and tipping points, 2) explore existing and potential social and ecological tipping points and responses, and 3) review approaches for managing systems prone to tipping points. This topic session will bring together international experts from oceanographic, ecological, and social sciences to compare methodologies and synergies across systems. Of particular focus will be methods to promote adaptation and resilience to climate change in marine systems increasing pushed towards extremes and tipping points.

8 Marine Ecosystem Services – Connecting science to decision making

Convenors: Sarah Dudas (Canada), Jingmei Liu (China)

Duration: ½ day

Marine Ecosystem Services provide a conceptual framework to understand and communicate the value our coastal and marine ecosystems have from ecological, economic, and socio-cultural perspectives. All species and habitats provide ecosystem functions and produce 'services'. This session seeks to bring together natural scientists (ecologists, biologists, oceanographers, etc.) studying species and habitats that provide these services with the social scientists (economists, anthropologists, sociologists, etc.), policy makers, managers, and others that use the concept of MES to affect decision making. The session will include discussions on ecological, economic, and socio-cultural metrics to identify synergies between them. An objective of this session will be to help bridge the gaps in communication and understanding about ecosystem services between natural and social scientists in PICES nations and to illustrate the range of applications studying marine ecosystem services.

9 Applications of artificial intelligence to advance the understanding of North Pacific ecosystems

Convenors: Charles Hannah (Canada), Naoki Yoshe (Japan), Igor Shevchenko (Russia), Jinkun Yang (China)

Duration: 1 day

The development and application of artificial intelligence (AI) and machine learning to marine science issues is advancing rapidly. The combination of modern instrumentation with real time delivery, satellite data streams, biogeochemical model output, and shipboard data collection, means that many marine ecosystems are data rich but information poor. AI offers the opportunity to speed up the process of turning data into information that

can be used for decision making, but also has advantages over more traditional statistics for detecting patterns and offers the potential to find meaningful ecological relationships between ecosystem state variables for which there is no theoretical framework to connect them. For this session we encourage submissions that use AI for investigating the important drivers/variables in ecological datasets, as well as computer vision applications dealing, for instance, with satellite imagery, acoustics, plankton, and corals/sediment. We invite submissions at all levels of biological organization (individuals to ecosystems), and are particularly interested in studies that integrate different types of observation technology and data types. Papers focusing on methodological advancements, ecosystem applications and the data management processes required to get ecosystem related data into forms that make it easy to use the new tools. Other information. Support: POC, TCODE, FUTURE This session is not focused on a particular problem but rather seeks to have a lively session that would help identify more practitioners of these modern tools who are already working on PICES related problems. The proposed science session is an outcome from the very successful PICES 2019 Workshop on Application of Machine Learning to Ecosystem Change Issues in the North Pacific. This Science session would continue the process of building an AI community within PICES This session is a contribution to 2 of the PICES Strategic goals • Goal 4: Advance methods and tools. Machine learning and AI are new tools with enormous potential that should be explored in the PICES context. • Goal 6: Engage with early career scientists to sustain a vibrant and cutting edge PICES scientific community. Big data and AI represent the cutting edge of the process to convert data into information in the modern world, therefore encouraging the development and application of these new tools is one way to attract early career scientists to PICES.

10 The effect of ocean acidification on harmful algal species growth and toxicity

Convenors: William Cochlan (USA), Pengbin Wang (China), Mark L. Wells (USA)

Co-sponsors: GlobalHAB, IOC UNESCO, ICES WGHABD, ISSHA (potential)
Duration: ½ day
Invited speaker: Dedmer B Van de Waal (Netherlands/GOA-ON Representative)

Increasing atmospheric pCO2 over the past few decades has generated measurable decreases in the pH of surface waters in offshore, coastal and upwelling marine regions. This decrease in pH leads to greater carbon availability for plankton photosynthesis, less need for metabolically costly carbon concentrating mechanisms, and changes other aspects of cellular physiology—all changes that may alter the competitive interactions among species of harmful and non-harmful phytoplankton. In addition to altering the growth rates, decreasing pH may influence the cellular toxicity of some HAB species, such as with the diatom Pseudo-nitzschia, and affect the swimming abilities of others, such as the fish-killing raphidophyte Heterosigma akashiwo, both of which have the potential to substantially amplify HAB impacts. There have been significant advances over the past few years in understanding how ocean acidification influences various aspects of phytoplankton physiology and growth responses, however, there is considerable variation in how HAB species respond to pH change, challenging the ability to project how ocean acidification may influence the frequency or intensity of HABs. The recent PICES Special Publication on Ocean Acidification and Deoxygenation in the North Pacific Ocean provides a framework for identifying regions and times where ocean acidification stress is dynamic and increasing, and the newly established Global Ocean Acidification Observation Network (GOA-ON) is now beginning to incorporate co-observations of biological parameters that include HAB events and indicators. The confluence of these research resources provides new opportunities to study the mechanistic basis for, and outcomes of, ocean acidification-HAB species interactions. This Topic Session welcomes papers that address all aspects of ocean acidification effects on planktonic cellular physiology and HAB species toxicity in laboratory and field-based studies.

11 Impacts of climate change on aquaculture

Convenors: Dr. Cody Szuwalski (U.S.A), Dr. Shan Xiujuan (China)

Co-sponsors: GlobalHAB, IOC UNESCO, ICES WGHABD, ISSHA (potential)
Duration: 1 day
Invited speaker: Will contact Myron Peck (PI, ICES) for Climate and European aquatic Resources (CERES) program. This program has a strong aquaculture component.
Publication: yes

Aquaculture is becoming an increasingly integral part of global seafood production. In 2016, 80 million tons of seafood was produced via aquaculture and the fraction of total seafood produced by aquaculture (compared to wild-capture fisheries) increased to 47% from 40% in 2011. Expansion and improvements in aquaculture can serve to address Sustainable Development Goals (SDGs) #2 (Zero Hunger) and potentially #14 (Life below water). However, a changing climate could impact the ability of aquaculture to contribute towards these goals. We hope to present field, laboratory, and modeling studies that: 1) illustrate the historical impacts of changing environmental conditions on aquaculture, 2) use historically observed relationships between environmental conditions and aquaculture production to project potential futures for aquaculture production under climate change scenarios, and 3) identify and explore relationships between fished and unfished wild populations and cultivated species, particularly under a changing climate. The outcomes of this symposium could be useful in strategic allocation of resources under projected environmental change toward progress of the UN's SDGs.

12 Using environmental indicators to assess baselines, targets, and risk of plastic pollution in the North Pacific

Convenors: Chengjun Sun (China), Matthew Savoca (USA), Sanghee Hong (Korea)

Duration: 1 day
Invited speakers: Jennifer Provencher (Canada) Anela Choy (USA) Sarah-Jeanne Royer (USA)

The North Pacific and its marginal seas are heavily polluted with plastics. It is important to develop environmental indicators of plastic pollution to determine baselines, set targets, and project risk to species and ecosystems. The goal of this session is to continue to identify indicators – both biotic and abiotic – of plastic pollution, and to move beyond the development of indicators to determine how we can use indicators to determine baselines in the North Pacific. Environmental indicators will also prove important to project risk from plastics to the ecosystem. Risk may be assessed by the quantity or abundance of plastic particles, or as the concentration of plastic associated pollutants in organismal tissues. Research presented in this topic session will help us elucidate the status and trends of plastic pollution and their environmental impacts in the North Pacific to better allow comparisons to other regions globally. This science-informed approach will allow us to make informed decisions for plastic usage and litter management policies.

13 Predictions of extreme events in the North Pacific and their incorporation into management strategies

Convenors: Samantha Siedlecki (USA), Ryan Rykaczewski (USA), Jing-Jia Luo (China)

Co-sponsor: CLIVAR
Duration: 1 day
Invited speakers: Clarissa Anderson (USA), Alistair Hobday (Australia), Feng Zhou (China), Debby Ianson (Canada)
Publication: PICES Press article

Description including background and objectives Marine ecosystems of the North Pacific are susceptible to episodic, extreme events of various types, including marine heatwaves, periods of hypoxia/anoxia or corrosive conditions, and harmful algal blooms (HABs). There is rising concern that these events may become more common and/or severe in the future. Extreme events can have a marked impact on ecosystem resources and societal use of the coast environment with consequences for recreation, human and ecosystem health, aquaculture productivity, and the distribution, composition, and productivity of marine fisheries. While our ability to predict ecosystem changes and societal impacts has improved in recent years with improved understanding of coupled physical, biological, and social dynamics, the episodic nature of extreme events and the rarity at which they have been observed challenge attempts to forecast their occurrence. However, the severe ecological and societal consequences of these extreme events make them desirable targets for predictions that enable proactive management. PICES WG-40 aims to identify, diagnose, and quantify predictable response in North Pacific marine ecosystems that arise from regional and large-scale climate processes. In this session we will seek contributions that highlight advances in the prediction of extreme events (e.g., temperature, oxygen, pH, HABs), the characterization or identification of mechanisms responsible for their individual or co-occurrence, and the strategies to incorporate those predictions into management. This topic is relevant to the first three ToR of WG40, but also to ToR #4 (exploring integration of predictions in the management of ecosystem services), which has received somewhat less attention in our previous activities. This proposed session is intended to advance the terms of reference of WG-40 and build on strong momentum from (1) the ECCWO session “From prediction to projection: the role of seasonal to decadal forecasts in a changing climate”, (2) the PICES 2018 session “Ecological responses to variable climate changes and their applicability to ecosystem predictions”, (3) the CLIVAR-PICES 2019 workshop “Towards an integrated approach to understanding ecosystem predictability in the North Pacific,” (4) the PICES 2019 sessions “Marine heat waves in the North Pacific: Predictions and impacts in coastal regions,” “Coastal ocean modelling in the North Pacific,” and “Advances in North Pacific marine prediction”, and (5) a planned FUTURE-sponsored workshop on social impacts of extremes at the 2020 PICES annual meeting. Outside of PICES-associated meetings, this proposed session also leverages efforts of NOAA’s Marine Prediction Task Force (MPTF) whose lifespan matches that of WG-40 (2017-2020) and whose intent is to improve seasonal forecasts for management of living marine resources. Co-sponsorship We seek POC and FUTURE co-sponsorship for this session. We envision this session being offered in coordination with a FUTURE-sponsored workshop exploring the social impacts of extreme events in the context of the SEES framework.

14 Using eDNA to assess and manage non-indigenous species in the North Pacific

Convenors: Jeanette Davis (USA), Keun-Hyung Choi (Korea), Thomas Therriault (Canada)

Duration: 1 day

Non-indigenous species (NIS) cause ecological and/or economic harm and are a threat to biodiversity. The spread of aquatic NIS has increased in the last decade due to globalization and other related human activities and preventing all introductions is not possible. Thus, early detection is the most valuable cost-effective control and eradication option, yet many species are difficult to detect using traditional survey techniques, especially over large spatial areas. The use of environmental DNA (eDNA) as a new and rapidly growing tool to detect, monitor, and quantify species for biodiversity and conservation management is of considerable interest. In comparison to traditional methods, eDNA sampling is more sensitive, less harmful to the environment, cost-effective, safer for both species and field staff, and more targeted for identifying species of interest. Therefore, eDNA is a promising tool for early detection of NIS. However, the effectiveness for this technique across many NIS taxonomic groups and habitat types is unexplored and could have important management implications. This topic session will explore the use of eDNA to detect and assess NIS status in the North Pacific. The goal is to evaluate the landscape of how eDNA monitoring is being applied in the NIS community globally and to share information relevant to management and policy. Since different environments and species will require different sampling standards, there are potential opportunities for lessons learned and shared methodologies for data collection, analyses, and comparison.

15 Implementing a collaborative, integrated ecosystem high seas survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean

Convenors: Mark Saunders (NPAFC), Hal Batchelder (PICES), Suam Kim (Pukyong National University), Alex Zavolokin (NPFC), Brian Wells (NMFS), Motomitsu Takahashi (Japan Fisheries Research and Education Agency)

Duration: 1 day

The high-seas pelagic ecosystems spanning the entire North Pacific Ocean north of 33 degrees N, support five species of Pacific salmon and Steelhead trout as well as associated species such as Pacific saury. Salmon spend the majority of their lives in these high-seas ecosystems. While considerable effort by Russian and Japanese scientists has been directed to ecosystem surveys of the western North Pacific Ocean over the past 30 years, the central and eastern North Pacific remain poorly studied. As a result, the scientific community is not well positioned to provide explanation and advice to decision makers regarding the implications of an increasingly uncertain environment where changing marine conditions in the high seas are implicated in reductions in salmon productivity that are having severe social and economic impacts. To begin addressing this gap, the North Pacific Anadromous Commission (NPAFC) and partners conducted a high seas expedition in the Gulf of Alaska with scientists from around the Pacific rim in winter 2019. If successful it could provide a template for a broader and potentially on-going pan-Pacific expedition A workshop (PICES W16 2019) reviewed the findings to date and found the expedition was a considerable success. There were novel observations of the winter distribution of salmon and the associated ecosystem structure along with the development and application of new technologies. Just as importantly it demonstrated the effectiveness of a multi-national collaboration. The expedition findings, while not yet fully complete, informed plans for a 2021

expedition to use up to five vessels to synoptically survey the full breadth of the North Pacific pelagic ecosystem to a depth of 100m. In addition to the broad synoptic sampling of the oceanography and biota, fine spatial scale studies are being considered to test hypotheses relating to mechanisms regulating the production of salmon. A PICES session is proposed to inform the further development of the 2021 expedition. Researchers from the 2019 expedition will be invited to present recent findings of the 2019 expedition. Experts on life history modelling will be invited to speak on approaches that can combine the results of freshwater, coastal and high-seas ecosystem surveys to generate meaningful advice to managers. Additionally, researchers with expertise in hydroacoustics and Autonomous Underwater Vehicles will be invited to inform the development of fine scale studies to test hypotheses related to the mechanisms affecting winter distribution and productivity.

16 Species migration and shifts responding to climate change: linking physics, plankton dynamics and fish ecology

Convenors: Shin-ichi Ito (AORI, the Univ. of Tokyo), Jackie R. King (Fisheries and Oceans Canada, Canada), Sukyung Kang (National Institute of Fisheries Science, Korea)

Duration: 1 day

Invited speaker: Chia-Hui Wang (National Taiwan Ocean University); Ignacio A. Catalán (Mediterranean Institute for Advanced Studies)

Ontogenetic migration of marine species is one of the most important life strategy of them. However, marine species behavior and migration are complex. It is a consequence of genes, physical, chemical and biological environment and their interaction, and perhaps even from learned behavior. Therefore, marine species change their ontogenetic migration route responding climate variabilities. Now, the influence of global climate change is emerging in many places around the Earth and many marine species show distribution shifts. It is an urgent task for us to elucidate the mechanism of the species migration and linkage between physical condition, prey plankton phenology and production, and inter-species interaction. It is essential to enable future projections of marine species shift. Recently, 1) technological advances in bio-logging, otolith chemistry analysis, stable isotope analysis in tissue and amino acids, 2) developments of high resolution models and 4-D ocean hindcasts, 3) availability of high resolution satellite data, have been realized. The ability to study marine species migration responding climate variability and change has been increased. We propose a topic session that involves participation from multiple PICES committees and focuses on marine species migration and shift responding to climate variability ad global climate change. Papers to elucidate linkage between physical condition, prey plankton phenology and production, inter-species interaction, and species migration and shift are welcome.

17 FUTURE plenary on PICES' role in UN Decade

Convenors: Steven Boagrad (USA), Sukyung Kang (Korea), ECS TBD

Duration: 1½ hours

W1 The Expansion of Harmful Algal Blooms (HABs) from lower to higher latitudes

Convenors: Mark L. Wells (USA), Setsuko Sakamoto (Japan), Natsuko Nakayama (Japan)

Co-sponsors: GlobalHAB, IOC UNESCO, ICES WGHABD, NOWPAP, ISSHA
Duration: 1 day
Invited speakers: Masafumi Natsuike (Japan), Don Anderson (USA and ICES WGHABD representative), Vera Trainer, Kathi Lefebvre (USA), Charles Trick (Canada)

High latitude regions are experiencing the fastest rates of climate change, with impacts on marine biodiversity and plankton diversity. The rapid changes in physical and chemical conditions are affecting the biodiversity of plankton communities, which includes the new appearance of Harmful Algal Blooms (HABs). For example, very recent observations show for the first time the appearance of paralytic shellfish toxin containing plankton far north of the Arctic Circle— a condition that would not have been possible with the very short planktonic growing season only two decades earlier. Indeed, northward moving Pacific warm waters are shown to now carry Alexandrium blooms as far north as the Chukchi Sea. The importance of higher latitude regions as sentinels for changes in biodiversity related to future HABs is highlighted in published proceedings from at least two international meetings co-sponsored by PICES, yet there are no organized efforts to develop the research and observational datasets essential to capture the anticipated regime transitions in higher latitude biodiversity and planktonic communities. This international workshop will bring together PICES and non-PICES experts from several nations to present their current findings on the distribution of HABs species and events in higher latitude waters. The morning session will be devoted to presentations on physical, chemical and biological changes, in terms of HAB species, in higher latitude waters. These presentations will provide the framework for the collaborative afternoon discussions summarizing our state of knowledge, identifying the most important information gaps, and charting the near- (5 year) and longer-term (10 year) research priorities. The goal will be to develop a multi-author position paper summarizing the state of current knowledge, identify the key research questions, and to develop a consensus plan on the path forward that will best accelerate our understanding of these rapidly emerging problems. Location: Qingdao, China Date: October 23, 2020 Invited Speakers: Masafumi Natsuike (Japan), Don Anderson (USA and ICES WGHABD representative), Vera Trainer, Kathi Lefebvre (USA), Charles Trick (Canada) Co-sponsors (unconfirmed but likely): GlobalHAB, IOC UNESCO, ICES WGHABD, NOWPAP, ISSHA Outputs: The output of this workshop will depend upon the breadth and depth of observations, datasets and collaborative interactions. The goal is to generate a participant-lead publication that combines established case studies with identifying a framework of research priorities for submission to a high-profile scientific journal (e.g., Nature Climate Change). Outputs also will include publications in PICES Press, and potentially brochures and educational modules that communicate the linkages between climate drivers and Harmful Algal Blooms in higher latitude regions. Why now?: The rates of change in higher latitude physical, chemical, and ecological systems is unprecedented in recorded human history, and is being accompanied by an equally rapid transition of planktonic communities that include the emergence of HABs in previously “HAB-insulated” coastal regimes. There is a high level of awareness and impetuous for high latitude research among PICES nations, which offers a unique opportunity to enhance understanding of HAB expansion with adequate planning. This workshop will provide a foundation for this planning process.

W2 Can we link zooplankton production to fisheries recruitment?

Convenors: Hui Liu (USA), Toru Kobari (Japan), Karyn Suchy (Canada), Russ Hopcroft (USA)

Duration: 1 day
Invited speaker: Xianshi Jin (China)

Sustainability of fisheries requires a better understanding of stock dynamics and resilience to environmental and anthropogenic forcing. Zooplankton play a vital nexus between primary producers and higher level consumers and are thus highly relevant to fisheries production and ecosystem functions. Understanding the impact of trophic relationships on the nutrition of larvae and foraging fishes is a critical step needed to forecast the stock response and resilience to environmental changes. However, limited attention has been paid to the role of zooplankton in sustaining fisheries production, which is largely because routine measurements of secondary production remain rare. This workshop will discuss prospective ways for understanding functional and structural roles of secondary production on fisheries dynamics and production. In particular, we encourage presentations and discussions on research using experimental, observational and modeling approaches linking zooplankton productivity and fish larvae and foraging fishes.

W3 Integrating biological research, fisheries science and management of broadly distributed flatfish species across the North Pacific Ocean in the face of climate and environmental variability

Convenors: Chris Rooper (DFO/Canada), Naoki Tojo (Hokkaido University/Japan), Roman Novikov (VNIRO/ Russia), Josep V. Planas (IPHC/U.S.A.)

Co-sponsor: IPHC
Duration: 1 day

The North Pacific Ocean is a large and productive ecosystem that is characterized by strong interdecadal climate variability. This Ocean basin supports a number of fish species of great ecological, as well as economical, importance. A successful PICES FIS-Workshop, that was co-sponsored by the International Pacific Halibut Commission (IPHC) at the 2019 PICES Annual Meeting (W2), focused on important current topics related to the biology and fishery of Pacific halibut and interacting species by bringing together researchers, scientists and managers from countries that are invested in this resource. An important outcome of this workshop was the need to increase the application of integrative approaches to improve our understanding of the biology and management of widely-distributed species, such as Pacific halibut, in the North Pacific Ocean, requiring a high level of cooperation at the international level. Therefore, to achieve these goals and as a step forward in addressing key areas of cooperation between PICES and IPHC as described in the recently signed MoU between the two organizations, we are proposing a workshop that focuses on addressing emerging issues in key flatfish species with broad distribution across the entire North Pacific Ocean. Specifically, this workshop is intended to 1) improve the sharing of information on fishing efforts and management strategies across the North Pacific Ocean, and 2) promote international collaborative studies to improve our knowledge on movement of flatfish populations and potential distribution changes of flatfish and other interacting species in the face of climate variability. One important outcome of this workshop may be the proposal of a joint IPHC-PICES Study Group with terms of reference that address these issues.

W4 How does the Pacific Arctic gateway affect the marine system in the Central Arctic Ocean (CAO)?

Convenors: Sei-Ichi Saitoh (Japan), Hyoung-Chul Shin (Korea), Guangshui Na (China), Lisa Eisner (USA), Libby Logerwell (USA)

Duration: ½ day
Invited speakers: Jacqueline M. Grebmeier (PAG)

The Central Arctic Ocean (CAO) is in rapid transition, largely driven by North Pacific environmental change, allowing it to become accessible to a range of activities. Rapid loss of sea ice cover has opened up the CAO for potential fishing opportunities. The agreement to Prevent Unregulated High Seas Fisheries in the Central Arctic Ocean (CAO) has been signed and is expected to enter into force soon. Scientific research in the CAO to inform and support policy decisions, however, remains scarce in contrast to a dearth of research in the neighboring North Pacific Ocean. With substantial science and policy challenges occurring in the Arctic, an integrated ecosystem assessment of the CAO is a priority task. PICES joined forces with ICES and PAME for such an assessment by forming the WGICA/WG 39 with its mission period ending 2021. The goals of the Pacific Arctic Gateway activity in the WGICA are to describe the status and trends of ecosystem components in the region and the connection of these parameters to the Central Arctic Ocean. The Pacific Arctic Gateway has experienced rapid environmental change in recent years due to reduced sea ice extent and seawater warming that can impact shelf-basin exchange of water mass components and biological taxa into the offshore Arctic basin. The main objective for the workshop is to describe and discuss ecosystem processes in the Pacific Arctic Gateway and how physical and biological components extend into the CAO, with spatial focus on the outer shelf/slope regions to the basin.

W5 Pelagic and forage species – predicting response and evaluating resiliency to environmental variability

Convenors: Matthew Baker (USA), Elizabeth Siddon (USA), Hui Liu (USA), Brian Hunt (Can)

Duration: 1 day
Invited speakers: Yongjun Tian (China), Ric Brodeur (USA), Jennifer Boldt (Canada)

Climate and environmental variability influence pelagic ecosystems with direct and indirect impacts on pelagic and forage fish populations. These species are particularly responsive to shifts in the physical environmental and the production and phenology of biological production at lower trophic levels. Forage fish are also the link between planktonic food webs and higher trophic levels in the global ocean. Despite their critical role in North Pacific ecosystems, forage fish have remained understudied due to the majority of research resources and effort being focused on the predatory species that they support. This knowledge gap is increasingly pressing as the North Pacific advances into new climate and ocean modes. We propose to host a workshop that builds on the 2018 Session in Yokohama, Japan and related collaborations to share results on trends in pelagic and forage fishes in the North Pacific PICES region, including work using experimental, observational and modeling approaches. We intend to use the North Pacific as a case study for global response to warming and determine the attributes important in understanding how different populations respond in similar or divergent ways to common drivers. We also aim to examine two overarching themes (1) adaptation/resiliency and (2) forecasting) to better define our 'current state of knowledge' and use this workshop to further identify data gaps, research needs, and useful tools and models to further research in this area. This workshop aims to bring forage fish researchers from around the North Pacific. The workshop will use regional presentations as a springboard for discussion on common ecosystem drivers and similarities / dissimilarities among regions. Priority data gaps will be ranked as a step towards focusing direction for short and long-term research objectives.

W6 Research priorities for understanding the population dynamics of small pelagic fish in the North Pacific

Convenors: Ryan Rykaczewski (USA), Akinori Takasuka (Japan)

Co-sponsors: ICES, IOC, NPFC
Duration: ½ day
Invited speakers: Chris Rooper, Canada, Yongjun Tian, China

Small pelagic fish (SPF) are critical components of marine ecosystems in the North Pacific and in coastal systems worldwide. SPF are the target of major commercial fisheries that provide necessary diets for the world's rapidly expanding aquaculture operations. These fish are also vital to the diets of higher predators, playing a role in the transfer of energy and organic matter from zooplankton to seabirds, marine mammals, and other piscivores. However, another common characteristic of SPF populations is their high degree of temporal variability, with biomasses that can fluctuate by several orders of magnitude at decadal or multidecadal timescales. In various ecosystems, these fluctuations have been attributed to changes in climate and ocean properties, interactions with predators, shifts in distribution or migration behavior, or variable sensitivity to commercial harvesting. The need for a forum to synthesize new findings and coordinate multi-disciplinary research efforts is the motivation for a new joint ICES/PICES working group on SPF. As part of this effort, we are requesting support for two workshops in 2020. An initial workshop will take place intersessionally in spring 2020 with members from both ICES and PICES communities and scientists from non-ICES and -PICES regions. The Terms of Reference for the joint working group will be discussed and revised. At this initial meeting, emphasis will be on summarizing ongoing work in various regions and scoping of joint research activities such as comparative analyses to be conducted by participants (current working group ToRs #1 and #3). A resolution for an international symposium on small pelagic fish (progress towards ToR #5) will be submitted to ICES prior to the kick-off meeting.

W7 The social-ecological-environmental dynamics of climate extremes in Pacific coastal systems

Convenors: Jennifer Jackson (Canada), Tetjana Ross (Canada), Tom Okey (USA), Emanuele DI Lorenzo (USA), Thomas Therriault (Canada)

Co-sponsors: Ocean Networks Canada
Duration: 2 day

Over the last 5-10 years the North Pacific has experienced a sequence of extreme events associated with the consecutive occurrence of land and marine heatwaves, acidification and hypoxia events, and tropical storms. While there is a growing level of certainty that these extremes will become more frequent and intensify, their impacts on the social-ecological-environmental dynamics of coastal communities around the Pacific rim remain uncertain. Yet these communities are most vulnerable and many aim to develop and implement effective resilient and adaptation strategies. In 2019, the FUTURE science program published a Social-Ecological-Environmental System (SEES) framework to address climate change impacts in the North Pacific. Building on this framework, and recognizing how this framework is useful to understand, predict, and plan the response coastal communities to effects of ocean climate extremes, we propose a workshop in order whose goals are two-fold. The first goal is to gain broader understanding of the physical, biological, and chemical processes impacted by marine heatwaves in coastal regions. The second goal is to work towards applying the SEES framework to the development of the adaptation strategies in coastal communities. The specific

objectives and components of this workshop are: 1) - Review current progress on understanding and modeling the SEES dynamics in coastal systems around the Pacific rim. (Invited Keynotes and Contributed Talks, Day 1); 2) - Develop case studies that use the SEES narrative approach developed by FUTURE to understand and describe the impact of selected coastal extremes. (e.g. 2019 marine heatwave in Alaska, 2019 tropical storm in Japan, ocean acidification extremes, strong hypoxia events, and others). (Four breakout group discussion and reporting, one group per case study, Day 1); 3) - Explore technical advances that allow the collection and modeling of SEES data (e.g. LEO Network, machine learning approaches, mathematical modeling of systems maps, data informatics, etc.) to understand and predict the response of coastal SEES to extreme events and climate variability. (Invited Technical Talks and Presentations, Day 2); 4) - Draft Terms of References (TORs) for a PICES Working Group on Climate Extremes and Coastal Social-Ecological-Environmental Systems (WG-SEES) (Group discussion, Day 2).

W8 Sea turtles and environmental stressors in the North Pacific

Convenors: Taewon Kim (Korea), George Balazs (USA), Hideaki Nishizawa (Japan)

Duration: 1 day
Invited speakers: George Shillinger (USA)

Most sea turtles are endangered species designated by IUCN. They are now receiving threats from multiple stressors induced by anthropogenic activities such as climate change, pollution and plastic trashes. In 2019, PICES special project on the sea turtle has launched to elucidate migration routes and threats to sea turtles in North Pacific areas through collaboration of scientists of PICES member countries. In this workshop, we encourage scientists who are studying or interested in sea turtles join together and discuss various issues such as habitat use and migration of sea turtles influenced by climate changes or human activities, and the magnitude of threats of plastic debris to sea turtles.

W9 Building a PICES early career professional network

Convenors: Erin Satterthwaite (USA) and TBD (China)

Duration: 1 day

The new SEAS early career scientist awardee and other early career scientists who receive PICES funding are other likely participants

For several years, PICES has provided support for the participation of early career scientists in workshops and symposia and has recognized excellence of presentations by early career scientists at its annual meetings. It has been suggested that early career scientists should help PICES play a leading role in the UN Decade of the Ocean by bringing fresh ideas to the next chapter of scientific discovery. This workshop will explore the possibility of formalizing the role of early career scientists in PICES, including strategies for revitalizing communications, outreach, and engagement with other international organizations. We propose a workshop that will bring together the next generation of scientists to discuss the formalization of a PICES early career scientist group (e.g., study group or working group). This workshop will include an “ice breaker” activity, conversations with PICES mentors, and development of a mission and vision for a proposed early career scientist group.

SB Endnote 5

FUTURE Early Career Scientist Travel Award

Early Career Travel Award and Invited Presentation Highlighting the SEES Framework

Objective:
Encourage recognition and application of the SEES approach, and engage early career scientists in PICES activities

Strategy:
Provide some travel support to an early career scientist (or scientists) who demonstrate application of the SEES approach in the framing of his or her research and are willing to present this work at the Science Board (or other plenary) Symposium

Blurb to advertise this opportunity:
PICES provides a forum for young scientists from around the North Pacific to share knowledge and build collaborations that cross both disciplinary and international boundaries. The goal of the scientific program of PICES is to understand and communicate present conditions and projected future states of North Pacific ecosystems and the potential responses to human use and climate change.

To further increase the capacity of the PICES community to understand and communicate the processes that link climate processes and human activities to multi-scale ecosystem responses, a Social-Ecological-Environmental Systems (SEES) framework has been developed and highlighted in a recent manuscript (Bograd *et al*., 2019).

The FUTURE Scientific Steering Committee (SSC) seeks to inspire early career scientists to consider the application of the SEES approach in their work. We encourage PICES scientists to bear in mind the following questions as they consider research to be shared at the next PICES Annual Meeting:

- How has your work spanned disciplinary boundaries?
- How does the issue addressed by your research incorporate understanding of the climate system, ocean physical or biogeochemical processes, and characteristics of the marine ecosystem?
- What are resulting impacts on coastal communities, and how might these consequences influence management strategies?

The FUTURE SSC will provide funds (~3,000 CAD) to support the travel costs of early career scientist(s) to participate in the following PICES Annual Meeting. The young scientist (or team of young scientists) will be invited to present the work in the Science Board (or other plenary) Symposium to highlight the application of the SEES approach. This travel award is independent of the standard PICES pool of travel support offered to early career scientists.

To apply for this travel award, you must be an early career scientist (under 38 years of age OR less than 5 years from reception of PhD) conducting inter-disciplinary research on marine ecosystems.

Selections will be made based on a (a) submitted abstract and (b) brief description (~1 page) of the proposed SEES approach submitted online (www.pices.int) by the Annual Meeting abstract deadline.

SB Endnote 6

Zhu-Peterson Early Career Scientist Award

Created 2019

In 2019, the Science Board recommended the establishment of a new PICES award, the Zhu-Peterson Early Career Scientist Award. The award is named in honor of Professor Zhu and Dr. Peterson, two marine scientists who strongly encouraged early career scientists to become engaged in PICES. Professor Mingyuan Zhu of the First Institute of Oceanography, State Oceanic Administration, China, trained many graduate students and young scientists, who carry on his rich legacy of honest enthusiasm for cooperative approaches to marine science research. He led many national and international projects, including studies of environmental carrying capacity, eutrophication and shellfish toxins, and sustainable mariculture. Dr. Bill Peterson of the Northwest Fisheries Science Center of NOAA, USA, was cherished by his students, technicians, and PICES early career scientists who regarded him as "a great teacher, and a fun, humble and inspiring mentor". For many, the greatest benefit of working with Bill was expanding their research vision and expertise into areas such as zooplankton ecology, fisheries oceanography, and climate change. Both Zhu and Peterson passed away far too early during their careers in ocean science. PICES honors the memories of their contributions with this Award.

The Zhu-Peterson ECS Award may be given annually to an individual who has performed innovative research at the frontier of science relevant to the PICES mission. The award consists of a plaque with the recipient's name and year engraved on it. A large plaque will be maintained at the PICES Secretariat with the names of all the Zhu-Peterson ECS Award winners over the years. Each winner will be highlighted in PICES Press and on the PICES website. The recipient will also receive financial support to attend the PICES Annual Meeting at which the Award is given.

Nomination Qualifications

The nominee must be in the beginning of his or her independent research career which is defined as: (1) less than 5 years since finishing graduate school or postdoctoral training, whichever comes later, and (2) less than or equal to 38 years of age on the date of nomination. The main criterion for selection is innovative research at the frontiers of ocean science relevant to the mission of the North Pacific Marine Science Organization and society. The individual must be performing research in the PICES region. Special consideration will be given to nominees who have worked in integrating the disciplines of marine science. Individuals who were or are currently actively involved in PICES activities are preferred. Nominations are accepted annually from the PICES community although the award may not be given every year if a suitable candidate is not found. The Selection Committee consists of the PICES Science Board and the PICES Chairman, and the Award will be presented to the recipient during the Opening Session of the PICES Annual Meeting. Individuals nominated but not chosen for the Zhu-Peterson Award are eligible to be re-nominated, providing that the nomination documents are updated.

SB Endnote 7

Revision of the PICES Ocean Monitoring Service Award (POMA)

by MONITOR and TCODE

Background

Progress in many aspects of marine science is based on ocean observations, monitoring, and the management and dissemination of the data provided by these activities to serve the ocean observing community. Long-term monitoring observations are particularly critical to detecting and understanding ecosystem changes. In addition to long-term monitoring, there are new innovative observation methods that are being developed alongside technological advancements, such as robotics, autonomous vehicles, remote data collection, ocean observing systems, new sensors and techniques and algorithms, which would contribute to implementation of sustainable observation. It is widely recognized that these fundamental activities often lack the glamour and respect that typically accompanies scientific achievements that rely on monitoring and observation. Unfortunately, the consequences are that monitoring activities are often taken for granted or even targeted for budget cuts when PICES member countries experience financial constraints. With this in mind, it was proposed at the 2006 Annual Meeting in Yokohama, Japan, that a new PICES award be established to acknowledge monitoring and data management activities that contribute to the progress of marine science in the North Pacific. The principles of the award were approved at the 2007 inter-sessional Science Board/Governing Council meeting, also in Yokohama, and the name and description of the award were finalized at the 2007 Annual Meeting in Victoria, Canada.

Aims

The PICES Ocean Monitoring Service Award (POMA) aims to recognize organizations, groups and outstanding individuals that have contributed significantly to the advancement of marine science in the North Pacific through long-term ocean monitoring, data management, innovative advances in ocean monitoring and service. The award also strives to enlighten the public on the importance of those activities as fundamental to marine science. It draws attention to an important aspect of the PICES Convention that is not so much in the limelight: “to promote the collection and exchange of information and data related to marine scientific research in the area concerned.”

Eligibility

The award is given for significant contributions to the progress of marine science in the North Pacific through long-term monitoring operations, management of data associated with ocean conditions and marine bio-resources in the region, development of advanced and innovative technologies for ocean monitoring and service or all categories. Recipients may include, for example, research vessels, research or administrative institutes or portions thereof, or technical groups involved in monitoring, data management and dissemination, or the development of tools or technologies that have been shown to enhance ocean monitoring and service, or a combination of these activities. Outstanding individual efforts may also be recognized.

Nomination and Selection

Nominations from individuals or groups from PICES member countries should be sent with supporting documentation to the Executive Secretary (Robin.Brown@pices.int) by the deadline specified in the Call for Nominations at the PICES website. The Technical Committee on Monitoring (MONITOR) and Technical

Committee on Data Exchange (TCODE) will evaluate independently the documents submitted with each nomination, and recommend some or all of the nominations for consideration by SB. Evaluations will include the relevance, duration and balance of activities (ocean observation, resource monitoring, data management, etc.). If more than one nomination is considered worthy of recognition by MONITOR or TCODE, rank preferences will be provided to SB by each Technical Committee. A maximum of one award will be given each year. To keep a large pool of potential candidates, SB will reserve any surplus of recommendations for review in two subsequent years and will be reactivated if nominator gives approval.

Award and Presentation

The award consists of a certificate signed by the PICES Chair and the PICES SB Chair, which will be presented to the recipients (or their representative) at the Opening Session of the PICES Annual Meeting. No financial support from PICES will be provided to the recipient to attend the Annual Meeting where the award is given. Should any representative be unable to attend the Annual Meeting, a Delegate of the recipient's country will be asked to accept the award on behalf of the recipient.