PICES-2021

Science Board Report

A report on the PICES-2021 Science Board Meeting held online via Zoom, from October 11/12 (North America/Asia) to 13/14, 2021.

Prepared by Science Board Chair, Dr. Vera Trainer, and the PICES Secretariat

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SB Meeting Day One

Agenda Item 1: Welcome and Adoption of Agenda

Dr. Trainer called the meeting to order, reviewed call etiquette and Zoom technology instructions, and facilitated introductions of attendees. Those in attendance are listed below.

Science Board

• Vera Trainer	Science Board Chair
• Igor Shevchenko, rep. Russia	Science Board Vice-Chair
• Steven Bograd	FUTURE SSC Co-Chair
• Sukyung Kang	FUTURE SSC Co-Chair
• Akash Sastri	BIO Chair
• Xianshi Jin	FIS Chair
• Mitsutaku Makino	HD Chair
• Emanuele Di Lorenzo	POC Chair
• Sung Yong Kim	MONITOR Chair
• Jeanette Gann	TCODE Chair
• Guangshui Na	MEQ Chair

***Governing Council**

• Enrique Curchitser	PICES Chair
• Tetsuo Fujii	PICES Vice-Chair

PICES Secretariat

• Sonia Batten	Executive Secretary
• Sanae Chiba	Deputy Executive Secretary
• Alex Bychkov	Special Projects
• Lori Waters	Science Board Support

Invited Guests & Observers

• Jörn Schmidt	ICES
• Janelle Curtis	NPFC
• Alex Zavolokin	NPFC
• Patricia Miloslavich	SCOR
• Sinjae Yoo	SCOR
• Mark Saunders	BECI
• Matt Baker	NPRB
• Josep Planas (via video)	IPHC
• Kazuya Takahashi	
• Aoi Sugimoto	SB-SciCom
• Kaori Imai	Min. Foreign Affairs, Japan
• John Claydon (via video)	IMBeR

Agenda Item 2: FUTURE Science Program update

Dr. Bograd provided an update for Science Board on the recent activities of the FUTURE Scientific Steering Committee (SSC). Additional details can be found in the FUTURE Science Program Annual Report. Dr. Bograd thanked outgoing FUTURE member Dr. Guangshui Na, MEQ Chair, for his excellent contributions to the SSC over several years, and welcomed Dr. Chenjun Sun as a new member.

An overview of the FUTURE "product matrix" was provided by Dr. Bograd. This important product of the FUTURE Science Program aims to map all of PICES Expert Group scientific products to specific questions for which the FUTURE science program seeks answers. He explained the approach to completion of the matrix, and thanked PICES intern, Saeseul Kim, for her invaluable assistance with completing the Product matrix. Next steps for the product matrix will be for all current EG's to map the products of their work into the FUTURE Product Matrix. In addition to reviewing the results of this product at the annual meeting, the SSC will hold a virtual meeting in mid-November to outline a journal manuscript that will use the Product Matrix to highlight key achievements of the FUTURE program, identify knowledge gaps and the reasons they remain, and determine next steps for addressing FUTURE's goals. The final matrix will be added to the FUTURE website, appended to Phase II of the FUTURE final report, and discussed in a peer-reviewed manuscript.

Phase III of FUTURE has started, and the SSC intends to wrap up the last phase with a brochure, the journal paper, and

product updates. The SSC will then move forward with the recommendations from phase II. FUTURE will present its final report for Phase II Science at ISB-2022.

The FUTURE Schematic was briefly described for newcomers to PICES. As a representation of PICES Expert Groups in relation to FUTURE science study areas, it maps all of PICES Expert Groups onto the SEES schematic. This product helps to show the transition of Expert Groups and to identify gaps where additional groups maybe required. This product is in revision and will be added to the FUTURE webpage when complete.

FUTURE-SSC continues its planning for its Open Science Meeting. Because so many meetings have been postponed, planning has been more difficult. FUTURE intends to begin a planning session at PICES-2022, then will aim for an Open Science Meeting to occur in 2024, either in Jeju, Korea, or Hawaii. FUTURE will seek partnerships and co-sponsorship for this meeting, which aims to focus on ideation workshops to create solution roadmaps. There will also be a focus on ECOP activities and events, and plenary sessions. The SSC hopes that this meeting will attract between 150-200 participants.

The SSC worked on a proposal for the new WG-Extremes to be presented for SB consideration during PICES-2021.

FUTURE requested Science Board consider support for the following items. Decisions related to these are covered under related agenda items:

- online distribution of the revised FUTURE liaison table, product matrix & FUTURE SEES schematic;
- that all new Expert Groups contribute to Product Matrix upon completion of their work;
- FUTURE's plan to hold an Open Science Meeting (OSM) in 2023-24;
- FUTURE Phase II final report (to be presented to SB at ISB-2022)
- FUTURE SSC inter-sessional and annual meeting requests in 2022:
    - 3-day Inter-Sessional meeting in Apr-May 2022; in person if possible, likely associated with ISB-2022
    - 2-day business meeting at Oct 2022 Annual Meeting
- Postponement of FUTURE-supported Topic Sessions and Workshops to Oct 2022 Annual Meeting
- Recommendations from Children Expert Groups:
    - Support WG-36 publication costs ($2500 US)
    - Support WG-35 proposing new NPESR4 SG; FUTURE does not need to parent
    - Approve SG-ECOP engagement plan & AP proposal
    - Support SG-UNDOS extension
    - Support SG-SciComm AP proposal; postpone decision on FUTURE parenting
- Recommendations for New Expert Group proposals:
    - Support establishment of WG-Extremes; longer term; FUTURE to parent.

SB Recommendations for FUTURE Science Program

Following the presentation from FUTURE-SSC, Science Board supported FUTURE-SSC recommendations to:

- Distribute the following FUTURE products online: revised FUTURE liaison table, FUTURE product matrix & FUTURE SEES schematic;
- Require all new Expert Groups to contribute to Product Matrix;
- Continue planning a FUTURE Open Science Meeting to explore opportunities for coordination with SmartNet, either in conjunction with the 2023 PICES Annual Meeting or during the 2023-24 time period (Covid-dependent; in person meeting is critical);
- Continue ongoing communications between SmartNet, the endorsed UN Decade ICES/PICES program, and FUTURE to determine synergies.

Agenda Item 3: PICES Science during the United Nations Decade of Ocean Science for Sustainability (UNDOS)

Dr. Bograd summarized the current planning phase for PICES science during UNDOS, being undertaken by the joint ICES-PICES Study group championed by PICES one year ago, and its transition to the ICES-PICES Ocean Decade (IPOD) steering group formed recently. One of the key initiatives of the ICES/PICES UNDOS partnership is SmartNet: Sustainability of MARine ecosystems Through Global Knowledge NETworks. This was proposed as a program by the ICES/PICES UNDOS Steering Committee, to enhance networking and collaboration between scientific partner organizations, to meet UNDOS goals. In addition to outlining UNDOS plans, the Study Group is also proposing a longer-tern expert group to continue coordination of UNDOS activities during the decade. Discussions between ICES and PICES regarding the expert group and UNDOS initiatives are ongoing.

By way of an update, Dr. Bograd also mentioned that to date, since the UNDOS call for Actions, there have been 28 programs, 32 Contributions, and 6 UN-led Actions endorsed by the UN to proceed during the decade. PICES and ICES are leading several of these endorsed activities. A second call for actions will occur during late 2021, and the IOC is also developing a Global Stakeholder Forum, to serve as the "LinkedIn" of the Ocean Decade, and is expected to launch in the near-term. UNDOS is also organizing around Communities of Practice (COP).

Dr. Trainer thanked Dr. Bograd for the presentation, and led a brief discussion between Science Board members regarding coordination between the FUTURE Science Program and SmartNet. Phase III of FUTURE's science will change scope, moving beyond its conventional domain and countries, partners, and organizations with whom PICES normally works. The reorientation has parallels with PICES goals for UNDOS, and these synergies provide opportunities for re-thinking and/or re-structuring the PICES Science Program. Dr. Trainer summarized the discussions, emphasized the need for good communication between SmartNet and FUTURE science teams, and suggested that enhanced collaboration and cross-disciplinary work between these programs will help hone PICES scientific focus moving forward.

Dr. Schmidt from ICES was asked whether ICES was having similar discussions regarding structuring organizational science versus UNDOS scientific activities. As ICES structure is different than that of PICES, ICES is not having similar discussions. Rather, ICES envisions SmartNet as an enabling structure to establish more joint groups within organizations, and to provide a topical link to various programs.

Dr. Trainer thanked everyone for their contributions to the discussion, and candid opinions. Science Board is committed to continuing discussions on structure and synergies within PICES Science groups.

Agenda Item 4: PICES Partner Update Presentations

Science Board received update presentations from the following partner organizations, whose presentations are briefly summarized below. Additional materials received from PICES partners are available in Appendix F.

1. **ICES:** Jörn Schmidt
2. **SCOR:** Patricia Miloslavich
3. **NPFC:** Janelle Curtis
4. **NPAFC: BECI:** Mark Saunders
5. **IMBeR:** John Claydon (pre-recorded video)
6. **IPHC:** Josep Planas (pre-recorded video)

The International Council for the Exploration of the Sea (ICES): (Presented by Dr. Jörn Schmidt)

ICES/PICES cooperation primarily occurs through joint workshops, expert groups, symposia and conferences, and is aimed at making the best use of our respective organizational structures and networks, and identifying and leveraging synergies between complimentary expertise within the two scientific communities. ICES and PICES have several upcoming joint symposia, including the Early Career Scientist (ECS/ECOP) and the Small Pelagic Fish (SPF) symposia to be held in Canada and Portugal, respectively, in 2022, the ECCWO5 in Norway in 2023, and the Zooplankton Production Symposium in 2024. The MSEAS symposium is also a joint collaborative effort, but this has been postponed.

ICES core science activities include work on Climate Change (through ESSAS, SICCME, and others), Invasive Species, Harmful Algal Blooms, Integrated Ecosystem Assessment, Environmental Interactions of Mariculture, Small Pelagic Fish, and Ocean Negative Carbon Emissions. Currently, ICES and PICES have five joint working groups, and additional work is being conducted and coordinated between ICES and PICES to explore ways of increasing focus on the Central Arctic, as well as some coastal areas not yet covered by scientific organizations.

Dr. Schmidt expressed his thanks for the continued participation in and collaboration with PICES, and looks forward to the next decade of collaboration.

Special Committee on Oceanic Research (SCOR) (Presented by Dr. Patricia Miloslavich)

Dr. Miloslavich provided an overview of SCOR, which is comprised of 32 member countries who nominate members to the Executive Committee which directs SCOR science undertaken by approximately 700 scientists, on all continents. SCOR's mission to address global and multidisciplinary ocean issues through SCOR's research portfolio, which works to: plan and conduct research; solve methodological and conceptual problems; build capacity in developing countries; promote equity diversity and inclusion in ocean sciences; and to encourage the involvement of early career scientists. Dr. Miloslavich suggested that there may be synergies with PICES activities, and invited PICES members to review proposals of SCOR Working Groups, which contribute to PICES projects and publications. SCOR would also like to invite PICES members to participate in SCOR outreach activities via the SCOR newsletter, website posts, and social media, and to take advantage of funding opportunities for visiting scholars to conduct research in developing countries.

North Pacific Fisheries Commission (NPFC) (Presented by Dr. Janelle Curtis)

As Chair of the NPFC Scientific Committee, Dr. Janelle Curtis outlined the working relationship and activities currently underway between PICES and the NPFC, as part of the PICES–NPFC Framework for Enhanced Scientific Collaboration in the North Pacific ratified by the two organizations in 2019. Under this agreement, the NPFC and PICES: regularly attend each other's annual meetings and Scientific Committee meetings; take part in Joint Expert Groups (such as PICES WG-43: Joint PICES/ICES Working Group on Small Pelagic Fish); co-sponsor events (such as the PICES-ICES-FAO Small Pelagic Fish Symposium); jointly propose science sessions (such as the topic session on *Environmental Variability and Small Pelagic Fishes in the North Pacific Ocean*, proposed for PICES-2022); and financially sponsor Capacity Development opportunities (such as the PICES-NPFC joint international workshop on VME indicator taxa identification, for which each organization contributed $15,000.00USD). Dr. Curtis thanked everyone for their time, and looks forward to continued collaboration.

Basin Events to Coastal Impacts (BECI) (Presented by Dr. Mark Saunders, NPAFC)

Dr. Saunders described the BECI program, and advised that it had recently been endorsed by the IOC as a project under UNDOS. He provided the following outline of the program and requested that PICES provide names of specific scientists or partner organizations who might like to participate in the program. The North Pacific Anadromous Fish Commission (NPAFC) seeks PICES support for the BECI program. Discussions are underway to determine whether BECI could become a PICES Special Project.

Integrated Marine Biosphere Research (IMBeR) (Video Presentation by John Claydon)

Dr. John Claydon presented the recent IMBeR Science program update and recently identified Priority Research Areas, and provided an update on IMBeR activities related to the UNDOS, illustrating where research activities overlap with PICES activities and provide potential for collaboration. Dr. Claydon explained that the IMBeR Science Plan revolves around three main Grand Challenges:

1. **Grand Challenge I**: Understanding and quantifying the state and variability of marine ecosystems.
2. **Grand Challenge II**: Improving scenarios, predictions and projections of future ocean-human systems at multiple scales.
3. **Grand Challenge III**: Improving and achieving sustainable ocean governance.

The Grand Challenges are supported by Innovation Challenges, which include:

- Advancing understanding of ecological feedbacks in the Earth system
- Advancing and improving the use of social science data for ocean management, decision making, and policy development
- Interventions to change course of climate impacts
- Sustainable management of blue carbon ecosystems.

These Challenges, which are implemented through IMBeR's Regional Programmes and Working Groups, have strong overlap with PICES Scientific Program. IMBeR Regional Programmes include: Climate Impacts on Oceanic Top Predators; Ecosystem Studies of Sub-arctic and Arctic Seas; Integrating Climate and Ecosystem Dynamics; and Sustained Indian Ocean Biogeochemistry and Ecosystem Research. IMBeR has four Working Groups, which tackle scientific issues related to: Continental Margins; Human Dimensions; Integrated Ocean Carbon Research; and Ocean Acidification. In addition to these structures, IMBeR also has a number of Endorsed Projects, and an Interdisciplinary Marine Early Career Network (IMECaN), which has over 700 members from 96 countries. Like PICES, IMBeR holds conferences, workshops, summer schools, field schools, and early career events.

Through all of its activities and initiatives, IMBeR aims to have impacts on: Policy and Governance; Behavioural Changes; Ocean Literacy; and Capacity Building. To date, IMBeR has over 1500 publications in these subject areas. Recently, IMBeR reviewed its past five years of progress, and has identified Priority Research Areas within each of the Grand Challenges. Dr. Claydon highlighted that there is scope for collaboration between PICES and IMBeR within these priority research areas, shown at left.

Lastly, Dr. Claydon provided an overview of IMBeR's formal contributions to the UN Ocean Decade, which include:

- Contributions to the recent IOC Integrated Ocean Carbon Research publication
- Several IMBeR events:
  - ClimEco7 Summer School, August 2021
  - IMBIZO6
  - IMBeR West Pacific Symposium

Dr. Claydon concluded by stating that IMBeR appreciates its partnership with PICES and looks forward to future collaboration.

International Pacific Halibut Commission (IPHC) (Video Presentation by Dr. Josep Planas)

Dr. Planas thanked PICES for the opportunity to present to PICES Science Board, many of whom will already be familiar with the International Pacific Halibut Commission. For any newcomers, Dr. Planas provided a brief overview as follows: the IPHC is an international organization established by a Convention in 1923 between Canada and the USA. It is one of the oldest regional fisheries management organizations in the world today. Its mandate is to manage Halibut Stocks in the Convention area, in the Northeastern Pacific Ocean. The IHPC collects fisheries-dependent and independent data as well as environmental data, and collects biological data on halibut in order to assess Halibut stocks.

PICES and IPHC work together under a Memorandum of Understanding which describes the cooperative arrangement between the two organizations, designed for mutual benefit to achieve the objectives of both organizations via cooperation, with a view to strengthening the science-based decision-making processes of both organizations.

The IPHC and PICES previously held a FIS workshop at PICES-2019, entitled Integrating biological research, fisheries science, and management of Pacific halibut and other widely distributed fish species across the North Pacific in the face of climate and environmental variability. This workshop was featured in PICES Press, (Vol. 28, No. 1, page 16), and is currently the subject of a Special Publication in the Journal *Fisheries Research*.

Following on from this work, the main objective of future work between PICES and the IPHC is to address emerging issues on key fish species with broad distribution across the entire North Pacific Ocean through integrative approaches at an international level. This will include sharing information on biology and ecology of key species and on stock assessment and management strategies in countries along the North Pacific rim, and, to establish international collaborations with North Pacific rim countries in order to improve available information on connectivity and distribution changes of fish species in the fact of climate change. To achieve these goals, and as a step forward in addressing key areas of cooperation as described in the current MOU, both organizations intend to organize a PICES-2022 workshop entitled: *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*. An important outcome of this workshop is expected to be a proposal for a joint Study Group with Terms of Reference that address the issues outlined during the workshop. In addition, there are expected to be papers published as a result of the workshop, as a special issue, in a relevant peer-reviewed journal.

Dr. Planas thanked Science Board for their time and looks forward to future collaborative work.

Agenda Item 5: Promoting Environmental Sustainability within PICES

Dr. Trainer was happy to share progress PICES has made on increased environmental sustainability, as she has a keen interest in ensuring PICES makes progress in this area. Science Board recognizes that virtual meetings are not ideal and that there is no replacement for in-person meetings, but we must recognize our transition to all-virtual meetings has enabled us to make progress on our organizational goals as well as our environmental sustainability needs. One of the newer tools to assist with transitioning to virtual meetings is the ePosterBoards tool. Dr. Trainer summarized its use at PICES-2021 and described how the ePosterBoards application and its close-to-live experience is facilitated by allowing users to move around within a virtual space. She invited and encouraged Science Board members to attend the upcoming ePosterBoards session, and for

them to especially welcome PICES ECOP during the session, and to visit their posters.

Dr. Trainer requested that Lori Waters provide an update on the PICES carbon savings calculations. Ms. Waters explained that PICES is committed to reducing our Green House Gas emissions and to reducingnegative environmental impacts associated with PICES meetings. As PICES has switched to virtual meetings during the pandemic, it provides an opportunity to track the "carbon savings" realized as a result of virtual meetings. To date, by meeting virtually instead of in-person, PICES has not emitted the following carbon which would have been emitted as a result of air travel:

PICES Cumulative Carbon savings: 1057 tonnes (Details for each meeting shown below)

- **ISB-2020:** 70 tonnes
- **AP-CREAMS 2020:** 14 tonnes
- **MSEAS-2020:** 182 tonnes
- **PICES-2020:** 689 tonnes
- **ISB-2021:** 102 tonnes

These Cumulative savings are equivalent to:

- Taking 230 cars off the road for one year
- Not burning: 450,229L of gasoline, ~529,925 Kg of coal, or 2447 barrels of oil
- CO_2 taken up by 1295 acres of forest, or 17,478 tree seedlings over ten years

These calculations were arrived at using the Pacific Climate Solutions carbon calculation method, and the equivalencies are from the US Environmental Protection Agency carbon equivalencies calculator. PICES expert groups are encouraged to use the methodology published on PICES Carbon Savings Webpage to track their own carbon savings realized through virtual meetings, and share this information with Science Board.

Dr. Trainer thanked Ms. Waters for the presentation, and introduced the idea of a Study Group to analyze PICES meetings and how they could be made more environmentally sustainable, and suggested that the acronym Ms. Waters suggested in an earlier meeting might be a starting point: Study Group on **G**enerating **R**ecommendations to **E**ncourage **E**nvironmentally-friendly **N**etworking (SG-GREEN). Dr. Trainer stated that she was not proposing this to take place during PICES-2021, but would like this to be a grassroots effort that brings together a proposal for the upcoming ISB-2022. This SG could look at ideas, for example, such as: Not having single-use plastics at meetings – reusable mugs or water bottles only; holding virtual business meetings with short 1-2 hour follow-up meetings during the Annual Meeting; reducing carbon through exploring the potential for hybrid or satellite annual meetings. Dr. Trainer explained that some of these ideas may also help to reduce the overall duration of PICES meetings, which some participants have stated are too long. Other options for a potential Study Group to consider may be: purchase of carbon offsets as part of PICES registration fees; purchase of carbon offsets as an organization, etc. Dr. Trainer invited Science Board to consider the ideas set out in their briefing materials, and to reach out to her, with the aim of proposing a Study Group at ISB-2022. Several SB members concurred with the initiative and Dr. Trainer agreed to continue working on solutions for increased sustainability of PICES meetings.

Agenda Item 6: Encouraging and rewarding PICES Participation

Dr. Trainer provided background information and a Sample Letter (See Appendix A) relating to a proposal to create a process for encouraging and rewarding participation in PICES. The idea resulted from the SB Chair listening in on the ICES Science meeting, and she invited Jörn Schmidt to provide feedback or guidance. ICES acknowledges its Expert Group Chairs and provides letters of thanks to Expert Group, and PICES Executive thought that this might be a helpful for PICES Expert Group chairs as acknowledgement of their important work within the organization. Dr. Trainer provided the example of a letter provided to her by Cisco Werner, in acknowledgement of her appointment as Chair of PICES Science Board. Dr. Trainer invited SB members to provide feedback, all of which was positive.

Science Board unanimously recommended that PICES Secretariat develop a template of information to be submitted to Employer supervisors of PICES Expert Group chairs to recognize their contributions within PICES.

Dr. Trainer thanked the guests to the Science Board meeting for their contributions, and guests were requested to leave the meeting ahead of the following in-camera (closed meeting) item.

Agenda Item 7: Election / Confirmation

Dr. Sanae Chiba confirmed that Dr. Igor Shevchenko will serve a new one-year term as Science Board Vice-Chair, and Dr. Sukyung Kang, who was nominated to serve for one year as Science Board Chair-Elect, stepped out of the meeting in order for Science Board to vote on the appointment. Following the vote, Dr. Chiba confirmed that Science Board unanimously elected Dr. Sukyung Kang as Science Board Chair-Elect, to serve for one year. Science Board congratulated both appointees on their posts.

Elections – Expert Groups:

Dr. Chiba advised Science Board of the results of the recent Committee Chair elections held during PICES-2021, as follows.

MEQ:

- Chair: Guangshui Na (2nd term) (China)
- Vice-Chair: Andrew RS Ross (2nd term) (Canada)

TCODE:

- Vice-Chair: Fangfang Wan (China)

POC:

- Vice-Chair: Jennifer M. Jackson (Canada) (Dr. Yury I. Zuenko stepped down at the conclusion of his 5th yr.)

//End of Day One of Science Board meeting 2021.

SB Meeting Day Two

Dr. Trainer led a brief round of introductions.

Agenda Item 8: Scientific and Technical Committee Reports

Highlights of Expert Group achievements can be found on the homepages of each Expert Group, and in their annual reports. Below is a summary of Expert Group requests to Science Board which were received at PICES-2021, and forwarded to Governing Council. Publications and new proposals for Expert Groups are found under separate agenda items.

Expert Group Extensions:

Science Board recommends extension of the following existing Expert Groups:

- **6-month Extension of SG-UNDOS: Study Group on *United Nations Decade of Ocean Science (FUTURE)***
  - SG-UNDOS requests a 6-month extension of the SG to (a) complete development of SmartNet Implementation Plan and (b) develop a proposal for a follow-on PICES Expert Group.

- **1-year Extension of WG-39: Joint PICES/ICES/PAME Working Group on an Integrated Ecosystem Assessment for the Central Arctic Ocean (SB)**
  - WG-39 requests a one-year extension to complete its TOR and create a plan and proposal to address future research in this area.

- **1-year Extension of WG-42: Indicators of Marine Plastic Pollution (MEQ)**
  - WG-42 requests a one-year extension to PICES-2022, to finalize the final and synthesis reports, and to create a plan and proposal to address future research needs in this area.

- **1-year Extension of WG-43: Joint PICES/ICES Working Group on Small Pelagic Fish (FIS)**
  - WG-43 Requests a one-year extension to PICES-2023, to complete two manuscripts for peer-reviewed journals, and to facilitate completion of the SPF Symposium this group has organized (now delayed to) November, 2022, and to publish the results / products resulting from the symposium.

Expert Groups to be disbanded upon completion of their final reports:

- **WG-35:** Working Group on *Third North Pacific Ecosystem Status Report (WG-NPESR3)*
- **WG-36:** Working Group on *Common Ecosystem Reference Points across PICES Member Countries*
- **WG-37:** Working Group on *Zooplankton Production Methodologies, Applications and Measurements in PICES Regions*
- **WG-38:** Working Group on *Mesoscale and Submesoscale Processes*
- **WG-40:** Working Group on *Climate and Ecosystem Predictability*
- **WG-41:** Working Group on *Marine Ecosystem Services*

Expert Group Plans

Science Board Recommends the Revised ToR and renewal of the term (2022-2027) for S-CC: Section on Carbon and Climate:

1. Coordinate and encourage ongoing and planned national and international syntheses of research studies regarding biogeochemical cycles of carbon, oxygen, and nutrient in the North Pacific and, where necessary and appropriate, for the larger Pacific basin;

2. Ensure effective two-way communication with other international scientific groups that have a responsibility for the coordination of ocean carbon-related biogeochemical studies, such as the International Ocean Carbon Coordination Project (IOCCP), Ship of Opportunity Project (SOOP/VOS), GO-SHIP/CO_2 Repeat Hydrography and the SOLAS/IMBER implementation group for carbon research;

3. Review the existing information on biogeochemical cycles of carbon, oxygen, and nutrient in the North Pacific, including anthropogenic carbon, the biological pump, impacts of ocean acidification and deoxygenation on marine biota, and possible feedbacks to atmospheric greenhouse gases; identify gaps in our knowledge, and make prioritized recommendations for future research;

4. Periodically review the status of the methodology of measurements for ocean carbon system, oxygen and nutrients, including the preparation of standards and reference materials, and sensor development, and advise on inter-calibration and quality control procedures;

5. Identify suitable data sets on the oceanic biogeochemical system including carbon, oxygen and nutrient in the Pacific region as they become available, and recommend the mechanisms of data and information exchange;

6. Carry out and publish basin-scale syntheses of biogeochemical cycles of carbon, oxygen, and nutrient in the North Pacific, including new data whenever appropriate, and encourage scientific interpretation of these evolving data sets;

7. Organize symposia, workshops, or Annual Meeting sessions on the biogeochemical cycles of carbon, oxygen, and nutrient, ocean acidification, ocean deoxygenation, and other climate studies in the North Pacific.

8. Enhance cross-disciplinal collaboration between climate, ocean biogeochemistry and biology/fisheries for the issues such as biological effect of ocean acidification and/or deoxygenation.

Expert Group Membership Requests

Science Board submitted the following membership requests to Governing Council for their action:

- SG-UNDOS: Requests members from China
- SG-ECOP: Requests more members from Russia and Korea and hopes for members from other sectors, such as NGOs, Industry.
- SG-PICES-APN: requests members from all member countries.
- SG-SciCom: Increased participation is encouraged particularly from our Korean and Chinese colleagues.
- WG-43: Requests members from Russia; seeks additional engagement from members with expertise in human communities and small pelagic fish, as the membership is currently "heavy on ecologists." WG-43 also seeks additional ECOP engagement - especially before SPF2022. SB notes below.
    - If the AP-ECOP is approved, WG-43 is requested to engage with the AP-ECOP.
    - HD has recommended Dr. Minling Pan, NOAA Hawaii, (USA) who has agreed to join WG-43, if GC USA representatives will consider this appointment.

- WG-45: WG-45 1) Requests the replacement Sukjeun Jung with Saang-Yoon Hyun for Korea; 2) Nominates Natalia Yaragina as the Russian representative (and potentially Yury Kovalev); and 3) Nominates Christine Stawitz and Melissa Haltuch from the U.S.A. FIS notes: The Korean membership request has gone to Governing Council, when approved will be updated on website. WG-45 Chair will send email to Russian Committee members to discuss internally. US Committee Members were able to confirm internal discussions nominating Drs. Stawitx and Haltuch. FIS supports these US nominations. Pending national internal discussion, FIS supports the nomination of the Russian membership for Science Board to discuss and approve.
- WG-47: May be less likely to achieve its TOR without the active commitment and participation of colleagues with the knowledge, expertise, and interest in developing models to predict the distribution of taxa associated with seamounts and climate-induced changes to their distributions. Key colleagues with these skills that were proposed as members of WG-47 last year include Chris Rooper and Jackson Chu. We recommend that Chris Rooper (chris.rooper@dfo-mpo.gc.ca) and Jackson Chu (jackson.chu@dfo-mpo.gc.ca) be added as Canadian members given their research interests and expertise. Jackson Chu would also be a second ECOP, in addition to Mai Miyamoto (WG-47 co-chair).
- WG-48: Requests members from USA and China. Requested are appointments for: David Kimmel (USA, NOAA) Julie Keister (USA, UW), Mark Benfield (USA, LSU), Rob Campbell (USA, Prince William Sound Science Center), Xuemin Cheng (PRC, Tsinghua Shenzhen International Graduate School), Haiyong Zheng (PRC, Ocean University of China), Haifeng Gu (PRC, State Oceanic Administration No.3 Ocean Institute)
- S-CC: Dr. Akihiko Murata (Japan) has to step down. He recommended his successor (Dr. Masahide Wakita). Japanese GC member has this information for discussion at GC.
- S-MBM: Request BIO to find participation for S-MBM from China or Russia
- S-CCME: On-going need for broad regional membership. There is currently only 1 member from Russia.
- S-HAB: We have had contact with only one member from Russia over the last two years. We request that the Russian membership in HAB be reviewed to see whether individuals have retired or have been transferred to other duties.
- AP-NIS: USA Governing Council delegates requested to consider a replacement for Jeanette Davis as soon as possible.
- MEQ: MEQ need replacement the member from Russia.
- TCODE: Canada wishes to add: Brett Johnson (Hakai institute) to replace Eric Peterson; Add Di Wan (Department of Fisheries and Oceans). USA wishes to add: Jill Prewitt (Alaska Ocean Observing system). Russia: new members are requested.
- MONITOR: New members are requested from China, as there has been no Chinese participation in MONITOR in 2020 or 2021.

Rules of Procedure Amendment

During the discussions related to Expert Groups, Dr. Bychkov pointed out that some of the discussions related to Chairing and Parenting of Expert Groups reflected current practices, but not the original structure envisioned within and embodied by the Rules of Procedure. He suggested that Science Board consider recommending that GC revise the Rules of Procedure to enable Expert Groups to have more than one Chair, and for Expert Groups to enable reporting to Parent Groups other than SB, GC, or F&A. SB Recommended that the Executive Secretary work with GC to revise the Rules of Procedure as required.

As there was not enough time remaining in the meeting, Agenda Item 9 was deferred to Day 3 of Science Board.

// End of meeting Day 2.

SB Meeting Day Three

Agenda Item 9/10: Proposals for new Expert Groups

Dr. Sanae Chiba introduced the proposals for new Expert Groups, which included:

- SG-SCPSC
- WG-Extrememes
- WG-Submesoscale
- AP-SciCom
- AP-ECOP

Science Board reviewed the proposals.

Science Board recommended establishing Expert Groups as follows:

1. **SG-SCPSC:** Joint PICES-Pacific Salmon Commission Study Group on Scientific Cooperation in the North Pacific Ocean – Appendix B
2. WG-**Extremes –** Working Group on Climate Extremes and Coastal Impacts in the Pacific. Proposed Terms of Reference – Appendix B
    - **The following EG's expressed a strong interest in being a part of this WG:**
        - MONITOR
        - AP-NPCOOS
        - S-HAB (has provided nominations)
        - Dr. Bograd from FUTURE has agreed to collect nominations.
3. **WG-Submesoscale –** Working Group on Submesoscale Process and Ecosystems
    - *Science Board Recommends a three-year term WG.*
4. **AP-SciCom** – Advisory Panel on Science Communications – Appendix B
5. **AP-ECOP** – Advisory Panel on Early Career Ocean Professionals – Appendix B

Expert Group Parent – revision

Science Board Recommends adding the HD Committee as a parent committee for WG-43.
Note: This request didn't reach GC 2021, and will be add to the recommendation items of ISB 2022.

Agenda Item 11: Special Project Reports

Science Board received reports from PICES SEAturtle and Ciguatera Special Projects, which are briefly summarized below.

PICES/MAFF-Japan Project: The Detection and Human Dimension of Ciguatera Fish Poisoning (CFP) in Indonesia

Dr. Mitsutaku Makino provided an overview of PICES Ciguatera Project, scheduled to run from April of 2020 to March of 2023, funded by the Ministry of Agriculture, Forestry and Fisheries of Japan. All PICES member countries are represented in this Special Project, as well as Indonesia. CFP is a major human health problem – especially in tropical ecosystems, including in Indonesia. A practical way to monitor for the poisoning is to measure the presence or absence of the causative phytoplankton species (*Gambierdiscus* sp.). This project aims to build the capacity of local populations – especially small-scale fishers and communities – to monitor their coastal ecosystems and to gain knowledge about CFP as the range of the causative organism grows due to climate change. This project builds upon the smartphone-based technologies developed

by the previous PICES-MAFF FishGIS project (2017 – 2020). The software developed allowed local communities to conduct environmental monitoring and reporting using smartphones.

Unfortunately, due to the Covid-19 pandemic, the Ciguatera Project Team has not been able to visit the field, but has held four Project Science Team (PST) meetings in 2021. During this time, the Smartphone App and the database were upgraded to incorporate the additional functions required to facilitate the Ciguatera Project. The theoretical framework of the project was further developed and summarized as a Japanese International Cooperation Agency (JICA) Project Design Matrix (PDM).

The Ciguatera Project Science Team wishes to continue to make progress with the project despite the limitations of the pandemic. To do so, the PST, with assistance from HAB specialists in Indonesia, have begun data mining to gain knowledge of benthic HAB and water quality of coral reefs in Indonesia. The PST also plans to establish special task teams of fishers who will be specially trained by the Indonesian government to monitor the environment for HAB. Lastly, planning has begun for a workshop and training course for Indonesian fishers in Spring or Summer of 2022, either as virtual or in-person sessions, depending on pandemic circumstances.

PICES SEAturtle Project: Sea turtle ecology in relation to environmental stressors in the North Pacific region

Dr. Taewon Kim provided an update on PICES SEAturtle project, which is also experiencing difficulties as a result of the Covid-19 pandemic. The SEAturtle Project Science Team (PST) held an intersessional meeting in March. Tagging of sea turtles has been largely delayed for the project. Of the five tags imported into Korea for this year, only one tag has been attached to a sea turtle so far. The interview research plan was also delayed by the pandemic. Discussions are continuing on the genetic study of the Jeju Island population of sea turtles. Previously, the group did some dive research around Jeju Island to investigate sea turtle stranding, and to correlate the frequency of strandings to the amount of derelict fishing gear (DFG) found. The group investigated two sites on the northwest coast of Jeju Island (Gwideok-ri and Sinchang-ri) where there is the greatest reporting of bycatch of sea turtles. Because there is greater stranding pressure at Gwideok-ri (20 strandings) versus Sinchang-ri (3 strandings), the group predicted that there would be more DFG found at Gwideok-ri. The samples found during the surveys are currently being analyzed. Initial results show that fishing line and lures make up the bulk of the materials found during the surveys. The group thinks that the results show great impacts of fishing line and other DFG on sea turtles. SEAturtle published its initial tagging results in PICES press. The SEAturtle PST continues to monitor the tagged individuals, and have noted that they are not migrating during the winter near Jeju Island. The diving behaviour of individuals is also monitored, along with the impacts of temperature on this behaviour.

Dr. Trainer thanked the Special Project presenters for their presentations.

Agenda Item 12: PICES-2022

Dr. Chiba provided an update on the proposed structure and format of PICES-2022, and the sessions as ranked by Science Board. Science Board Recommendations for PICES-2022 follow.

PICES-2022 Workshops:

Science Board Recommends the following workshops for PICES-2022. See Appendix C for full details.
Please see Science Board Notes where applicable.

- **2-day Workshop:** Distributions of pelagic, demersal, and benthic species associated with seamounts in the North Pacific Ocean and factors influencing their distributions.

- **1-day Workshop**: Integrated Ecosystem Assessment (IEA) to understand the present and future of the Central Arctic Ocean (CAO) and Northern Bering and Chukchi Seas (NBS-CS).
(Convenors requested to consider including other partners (such as PAME). Dr. Batten to follow up with ICES to determine if they wish to co-sponsor this workshop).

- **1-day Workshop**: SmartNet: Promoting PICES and ICES Leadership in the UN Decade of Ocean Science for Sustainable Development.
(Convenors requested to consider collaborating with APN (maybe a speaker from APN) and other organizations that might enhance the opportunity for inclusion/diversity, and please consider collaboration with proposed ECOP WS).

- **1-day Workshop**: Establishing a North Pacific ECOP node of the global ECOP program to increase inter-regional early career engagement and partnerships during the Ocean Decade.
(Convenors requested to explore the opportunity to collaborate with proposed SmartNet workshop, and possibly integrate the two.)

- **1-day Workshop**: 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 requested to review PICES Expert Groups to identify additional collaboration for this workshop).

- **1-day Workshop**: Bridging Multiple Ways of Knowing within an Integrated Ecosystem Assessment to understand the social and ecological changes in the Northern Bering and Chukchi Seas.

- **1-day Workshop**: Anthropogenic stressors, mechanisms and potential impacts on Marine Birds, Mammals, and Sea Turtles.

- **1-day VIRTUAL Intersessional Workshop:** -CCME/SICCME Virtual Workshop on Integrated Climate Modeling to identify thresholds, limits, and tipping points in marine ecosystems: current progress and future needs.

- **1-day Workshop**: Science Communication Training Workshop 2022: Learn how to Share our PICES Science with the World in an engaging way.

- **1-day Workshop**: The Expansion of Harmful Algal Blooms (HABs) from lower to higher latitudes.

- **1-day Workshop**: Openly Discoverable, Accessible, and Reusable Data and Information in the U.N. Decade.
(Convenors requested to collaborate with SmartNet and ECOP workshops).

PICES-2022 Topic Sessions

Science Board Recommends the following Topic Sessions for PICES-2022. See Appendix D for full details.
Please see Science Board Notes where applicable.

1. ½ **Day Session:** Marine Ecosystem Services – Connecting Science to Decision Making.

2. **1 Day Session:** Realizing scalable artificial intelligence in marine science.
   SB requests that Convenors explore combining this with proposed Machine Learning session, or collaborating with that session.

3. **1 Day Session:** Application and best practice of imaging technologies for plankton and ecosystem monitoring.

4. **1 Day Session:** Environmental variability and small pelagic fishes in the North Pacific: exploring mechanistic and pragmatic methods for integrating ecosystem considerations into assessment and management.

5. **1 Day Session:** Forecasting and projecting climate variability and change on northern hemisphere marine ecosystems using coupled next generation biophysical models.

6. **1 Day Session:** Recognizing the importance of zooplankton to fisheries research.

7. ½ **Day Session:** The effects of ocean acidification and climate change stressors on the ecophysiology and toxicity of harmful algal species.

Science Board CONDITIONALLY Recommends the following topic sessions be held at PICES-2022 (See conditions in italics):

1. **1 Day Session:** Using eDNA to assess and manage Non-indigenous species in the North Pacific.
   Science Board notes that this looks very similar to the 2020 Session (S13) on eDNA.
   The Recommendation for this session is conditional upon there being new information and novel presentations to advance the science beyond that which was presented in 2020.

2. **Session duration unknown**: Machine Learning for the North Pacific Environment
   The Recommendation for this session is conditional upon the AI and Machine Learning Convenors speaking with one another to determine if there is an opportunity for collaboration.

PICES-2022 Business meeting requests

2Business meetings should be held virtually when possible. The following requests are from EG who specifically requested Business Meetings. Those EG who did not specifically request Business meetings will be encouraged to hold them virtually.

Science Board Recommends 1/2-day Business Meetings for the following Expert Groups and **requests that these groups hold these as virtual meetings if possible**:

- WG-47
- AP-NPCOOS
- AP-CREAMS

Science Board Recommends 1-day Business Meetings for the following Expert Groups and **requests that these groups hold these as virtual meetings if possible**:

- WG-43
- WG-44
- WG-45

Science Board Recommends Business Meetings for the following Expert Groups:

- FUTURE-SSC requests an in-person two-day business meeting at PICES-2022.
- WG-Extremes (if formation of group approved by GC). requests a one-day business meeting.
- S-CCME: **1 day business meeting** for S-CCME as follows:
    - **Morning:** Room and logistics support for a meeting at the 2022 PICES Annual Meeting. Morning business meeting as per 2021 to review recent progress and activities
    - **Afternoon:** Afternoon coordination meeting to discuss S-CCME's role in SUPREME and links to ICES; planning for coastal high resolution ocean model grid for North Pacific, Chukchi and Beaufort.

Paper Sessions:

Science Board recommends that the following paper sessions be held at PICES-2022:

- BIO-P: Biological Oceanography Committee Paper Session
- FIS-P: Fisheries Science Committee Paper Session
- MEQ-P: Marine Environmental Quality Committee Paper Session
- POC-P: Physical Oceanography and Climate Committee Paper Session
- HD-P: Human Dimension Committee Paper Session
- GP: General Poster Session

Intersessional Meeting Requests

Science Board also considered and made recommendations for the following intersessional meeting requests:

- FUTURE-SSC requests a 3-day Inter-Sessional meeting in Apr-May 2022; in person if possible, likely associated with ISB-2022. **Science Board recommends that this be a virtual meeting.**

- S-CCME requests a one-day virtual meeting in conjunction with virtual intersessional meeting – Secretariat support for WebEx may be required.

- S-CCME requests two half-day meetings to review and summarize observed and projected ecosystem tipping points and thresholds in marine systems using case studies from S-CCME member projects. Outcomes anticipated include publication(s) to inform upcoming climate assessments, github repository of shared code and outputs (doi through Zenodo), and workshop report.

- WG-39 Inter-sessional meeting (1)
  Sixth Annual Meeting of the ICES/PICES/PAME Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA). Activities: 6th annual meeting, Venue: Virtual, Period: October 12-14, 2021. Sponsors: ICES, PAME, PICES, Cost: none.

- WG-39 Inter-sessional meeting (2)
  Spring Meeting of the ICES/PICES/PAME Working Group on Integrated Ecosystem Assessment for the Central Arctic Ocean (WGICA). Activities: Spring meeting of WGICA, Venue: TBD (Physical or Virtual), Period: Middle April, 2022 (TBC), Sponsors: ICES, PAME, PICES, Cost: co-chair travel expense (If physical meeting). **Science Board recommends that this be a virtual meeting.**

- WG- Extremes requests a virtual one-day business meeting (if formation of group approved by GC).

Agenda Item 13: PICES-Sponsored Conferences and Symposia

Science Board reviewed plans for the following Symposia. Information on each follows, along with SB recommendations where applicable:

1. Ocean Sciences Meeting (OSM 2022)
2. Effects of Climate Change on the World's Ocean (ECCWO5)
3. International Year of the Salmon Symposium (IYS2022)
4. ICES/PICES Zooplankton Production Symposium 2024 (ZPS2024)
5. MSEAS "Teaser event", 2021
6. ICES/PICES/FAO International Symposium on Small Pelagic Fish (SPF) 2022
7. Expo2025 (Japan)

1. Ocean Sciences Meeting 2022

- 27 February - 4 March, 2022
- Honolulu, Hawaii, virtual (initially planned as virtual-in-person hybrid, but decided as full virtual in October 2021).
- For more information, visit oceansciencesmeeting.org
- PICES is a co-sponsor and has been represented on the SSC by Libby Loggerwell.
- Abstract submissions closed on Sept 29th
- PICES members can register at the member rate.

Science Board members are to let the Secretariat know of any PICES participation (such as special sessions, convenors, invited speakers) for the Secretariat to track PICES Participation and contributions to sessions.

2. Effects of Climate Change on the World's Ocean 5 (ECCWO5)

- **Local Host:** Institute of Marine Research, Norway
- **Venue:** Bergen, Norway
- **Dates:** 17-21 April 2023
- **Principal local host contact:** Geir Huse (Geir.Huse@hi.no)
- **Theme and scope:** **Key topics for Ecosystem Effects of Climate Change on the World's Ocean 5:**

Characterization of ocean changes in the global climate system

- The role of oceans in the global climate system in the past, present and future
- Large-scale physical changes in the ocean.
- Detection and attribution of climate change -related impacts on physical properties and consequences for CO2 and heat uptake.

Impacts of changing climate on ocean physical, chemical and biological conditions in the Anthropocene

- Impacts of changing climate on physical and chemical ocean conditions.
- Impacts of changing climate, ocean acidification and ocean deoxygenation on ocean productivity, biogeography, populations, communities and ecosystems.
- Understanding how climate change modify the vulnerability of species, communities, foodwebs and ecosystems to other anthropogenic pressures.
- Climate change impacts on high latitude ecosystems.

Extreme and abrupt changes in ocean systems

- Occurrence of extreme events such as tropical storms, polar lows and marine heat-waves, attributed to climate change.
- Impacts of extreme events on marine biodiversity and oceanic and coastal ecosystems and communities.
- Abrupt responses to gradual changes; tipping points and regime shifts.

Advancing methods to predict and project climate drivers and impacts in ocean ecosystems

- Progress towards a global ocean ecosystem observational and modelling network.
- Data mobilisation and accessibility challenges and solutions.
- Ocean climate predictions near and medium term.

Impacts of changing climate on ocean-dependent sectors, societies and economies

- Impacts of changing climate on ecosystem services, ocean-dependent sectors, societies and economies.
- Near and long-term risks to sustainability.
- Ecosystem based management for a sustainable and equitable ocean economy.

Responding to climate-related changes in ocean conditions through societal, institutional and sectoral adaptations

- Adaptation solutions that increase robustness and resilience of coupled biological and social systems; trade-offs and synergies.
- Valuation of ecosystem services.
- Scales and effectiveness of adaptation options.
- Climate adaptive management for sustainable and equitable ocean economy.

Using the ocean to mitigate climate change

- Ocean-based solutions to mitigate climate change through carbon sequestration and storage.
- Ecosystem based management of blue carbon ecosystems.
- Ecosystem restoration and geoengineering solutions for climate change mitigation.

- In person, some hybrid components TBC
- The organizers (PICES, ICES, IOC, FAO and Institute of Marine Research, IMR Bergen) have been meeting frequently and have recently been inviting Steering Committee members. Some additional invitations may be sent to provide a balanced SC (balanced gender, region and disciplines is sought as much as possible). The SC should be in place by mid-October and then the website will be updated with key information over the next few months.
- Sessions: Themes & chairs: Will be open for proposals later in 2021 and then selected by steering committee and conveners.

3. IYS Symposium Sept 2022

- **Symposium to be held in Vancouver, Canada, October 4 – 6, 2022, at the Westin Bayshore Hotel.** As the IYS approaches its final year in 2022, it has been working with the Symposium Steering Committee, which includes members from the North Atlantic Salmon Conservation Organization (NASCO), to plan a Concluding IYS Symposium, which will take place in Vancouver, Canada from October 4–6, 2022. It will assess what was learned during the IYS and most importantly describe the future requirements for salmon research and management to support salmon in a rapidly changing world.
- https://yearofthesalmon.org/progress/
- The International Year of the Salmon (IYS) is a five-year initiative which began in 2018 and will run until the end of 2022. The IYS has been involved in implementing 3 signature projects and expanding communication and outreach to advance the generation of knowledge through international participation, workshops and symposia.
- 2022 Pan-Pacific Winter High Seas Expedition - "coming soon."
- **The Likely Suspects Framework (LSF):** is a novel approach to assess survival bottlenecks affecting salmon across their life history cycle and linking freshwater, coastal and marine influences. In essence, the LSF is a tool to identify the candidate mortality factors (the Likely Suspects) within an overall spatio-temporal framework

(the Likely Suspects Framework), which can be used by managers and policy makers to make impactful decisions regarding salmon sustainability and harvest, such as determining priority habitat restoration/protection. The Likely Suspects Framework is already well underway in the Atlantic basin led by a group of UK NGOs and the project in its early stages in the Pacific with a series of virtual workshops currently being planned to guide the development of this framework.

- **Data Mobilization:** To link the information generated by the High Seas Expeditions and the Likely Suspects Framework, in addition to other data relevant to salmon, the IYS is working on a Signature Project called Data Mobilization. Arguably, one of the largest barriers to salmon research is rapid access to standardized data. Data Mobilization plays an important role in bringing together salmon data and resources into one easily accessible framework. The IYS is working on the implementation and management of case studies, and working with partners to develop a strategy to mobilize data using a federated approach to standardizing data that can be rapidly discovered and synthesized by a diversity of groups. A graph database is being considered as the ultimate tool to house the data as well as the network of organizations and individuals associated with the case-use studies, allowing salmon researchers and those that rely on salmon, to have readily available access to the most up to date information available and access to ongoing research projects and programs.

4. ICES/PICES Zooplankton Production Symposium 2024 (ZPS2024)

- Local Host: Anthony Richardson, CSIRO, Tasmania
- Venue: Hotel Grand Chancellor, Hobart
- Proposed dates: ***postponed to March 2024.***
- Principal local host contact:
- Since the meeting was postponed until 2024 there has been little activity. The venue is secured and the timeframe of March 2024 has been confirmed but otherwise activities have been put on hold.

5. MSEAS-2021 Marine Socio-Ecological Systems (Teaser event Dec 2021, conference TBD)

- MSEAS Team plans to hold a virtual "MSEAS Teaser event" during the week of December 6 – 10, 2021 (exact day to be confirmed). The team hopes to confirm the speakers and date shortly, and will make an announcement when details are finalized.
- Local Host Chair / Vice Chair: Toyomitsu Horii / Mitsutaku Makino
- Venue: Yokohama Port Opening Memorial Hall (Jack's Tower) TBC
- Proposed dates: This was originally scheduled for May 2020 and was postponed at a very late stage in planning because of the pandemic. The date of the physical MSEAS is still undetermined and is dependent on the local hosts in Yokohama. Additionally, the original venue is now undergoing an 18-month renovation.
- A small, virtual, "teaser" event is planned for early December 2021 with approximately 4 speakers plus a moderated panel Q/A discussion. We are waiting on confirming a high-level speaker which will set the date, before confirming the remainder.
- Updates available on MSEAS website

6. ICES/PICES/FAO International Symposium on Small Pelagic Fish (SPF 2022)

- Theme: "Small Pelagic Fish: New Frontiers in Science for Sustainable Management" https://meetings.pices.int/meetings/international/2022/pelagic/program
- Sponsors: PICES, ICES, and UNFAO (United Nations Food and Agriculture Organization)
- UNDOS Endorsement was granted (Sept 10, 2021)
- Local Host: Susana Garrido susana.garrido@ipma.pt
- Venue: Calouste Gulbenkian Foundation Congress Area, Lisbon, Portugal
- Proposed dates: November 7-11, 2022
- SPF 2022 Purpose: Highlighting state-of-the-art advancements related to the ecology and sustainable management of small pelagic fish (SPF) in both marine and inland ecosystems. Sharing these developments and assessing long-term patterns are critical for ocean resource management in order to evaluate the consequences of the changing ocean on marine ecosystems and global food sources. Reflecting on the scientific knowledge gained over the last

five years since the last SPF symposium in 2017 will facilitate discussion, collaboration, and training to further improve science-based advice required to sustainably manage SPF in an ecosystem context. The symposium complements collaborative research conducted by the joint ICES/PICES Working Group on Small Pelagic Fish (WGSPF/WG 43) and is relevant to the goals of UNDOS, particularly "to bolster scientific research for a sustainably harvested ocean ensuring the provision of food supply," and is part of the UNDOS-endorsed "SmartNet" activity led by ICES and PICES ("Sustainability of Marine Ecosystems through Global Knowledge Networks)."

- SPF Symposium's Scientific Program is online, with 7 Topic Sessions and 6 Workshops.
- A 3-day meeting of WGSPF is planned immediately after the symposium, with separate and joint sessions of all three Task Forces (**TF on Ecological Process Knowledge, TF on Translating Process Knowledge, and TF on Social-Ecological Approaches)** established under this working group.
- The SSC has formed 3 task teams to handle Publications, Mentoring of ECOPs, and Awards.
- Plenary and Invited Speakers represent 11 countries (Australia – 2, France – 2, Germany – 2, Japan – 3, Norway – 1, Peru – 1, Portugal – 2, South Africa – 1, Spain – 2, Tanzania – 1, and USA – 4) from 6 continents (Africa, Asia, Australia, Europe, N. America and S. America) and 2 organizations (PFA and Worldfish/CGIAR)
- SPF Symposium SSC plans to publish several special issues in primary journals, and its Publications Task Team is exploring journal options (Marine Ecology Progress Series, Fisheries Research, Progress in Oceanography, Frontiers in Marine Science). Some symposium workshops are aimed at developing topically-focused synthesis manuscripts and working papers.

7. Expo 2025

Dr. Alex Bychkov provided a verbal update to Science Board regarding EXPO-2025, along with the following written update.

World Expo-2025: Designing Future Society for Our Lives
Osaka, Kansai, Japan
April 13 – October 13, 2025
https://www.expo2025.or.jp/en/

At the 2021 inter-sessional meeting (ISB-2021), Science Board was informed about an invitation from the Japanese government for PICES to participate in the World Expo, to be held April 13 – October 13, 2025, in Osaka, Kansai, Japan (Expo-2025; https://www.expo2025.or.jp/en/). This global event under the theme "Designing Future Society for Our Lives" has a goal to showcase "a society that achieves the Sustainable Development Goals (SDGs) set by the United Nations" and is projected to host around 28,000,000 visitors. Thus, Expo-2025 could be an excellent opportunity to promote PICES to the public.

Two ideas have been proposed by the PICES Secretariat for consideration at ISB-2021:

1. An academic event to fit the theme and the goal of Expo-2025 to be organized in conjunction with the World Expo;

   The idea of an academic event is attractive as that is the type of event that PICES is most familiar with, and performs well. This approach has been used almost a decade ago when PICES convened, jointly with ICES and IOC, the 2nd International Symposium on "*Effects of climate change on the world's oceans*" (http://www.pices.int/climatechange2012.aspx) as the first academic event related to the 2012 Ocean Expo on "The Living Ocean and Coast" held May 12 – August 12, 2012, in Yeosu, Korea.

2. A multi/cross-disciplinary public display linked to the PICES ADRIFT (Assessing the Debris Related Impact From Tsunami) project (https://meetings.pices.int/projects/adrift), weaving, for the first time, the many scientific, academic, and cultural (literature, music, arts) threads that have memorialized the Great East Japan Earthquake and Tsunami of March 11, 2011.This project had striking implications for ocean conservation science world-wide and resulted in many enduring connections across the North Pacific Ocean. The ADRIFT display fits well to the "Connecting Lives" subtheme under the overall theme of Expo-2025 and might be of great interest to public as the tsunami had a large impact on Japanese society.

At the time of ISB-2021, it was not known whether there are any tentative plans for academic events to be held alongside the activities in the pavilions during Expo-2025. Thus, discussion has centered predominantly on the potential PICES display.

Dr. Bychkov presented the display concept, developed in collaboration with Dr. Jim Carlton (USA), who was one of leaders of the ADRIFT project and the first author of the major scientific outcome from the project – a paper in *Science* titled *"Tsunami-driven rafting:* Transoceanic species dispersal and implications for marine biogeography". The display was proposed to be comprised of three components that would: (1) reflect the scientific results from the project and technologies which were used to achieve the results; (2) demonstrate (either digitally or by displaying physical objects) numerous articles that, after rafting across the Pacific Ocean, landed at different locations on the west coast of North America and the Hawaiian Islands, and were preserved in various kinds of memorials in the US and Canada, with some returned to Japan; and (3) relating to the human dimensions, showcase significant global literature and musical/artistic responses to the Great Japan Tsunami of 2011 which were produced, and would be a way of including cultural impacts.

After considering the presentation and seeking clarification from Dr. Bychkov on proposal details, Science Board recommended to support PICES participation in Expo-2025 in principle, with the proviso that Science Board be included in planning a broad display of PICES science in cooperation with and input from its Science Communication Expert Group.

Communication with the Expo organizers (via the Japanese national delegates) after ISB-2021 indicated that:

- The Expo-2025 Association is willing to work with PICES in order to assist, to the degree possible, with the implementation of our plans. If needed, a zoom meeting with an Association representative could be scheduled after PICES-2021, when we know the ideas and recommendations from SB and GC.
- Though the Expo-2025 organizational details are currently under consideration, holding an academic event is possible, especially if its topic is relevant to the goals of the UNDOS.
- A display linked the ADRIFT project is welcome, however expansion into a broader context is recommended, highlighting PICES approach to address global scientific issues through some projects likely to be of interest to the public (*e.g.*, climate change and UNDOS). The PICES display could be part of the Japanese Pavilion or the "Ocean Science" Pavilion", if a special area devoted to the oceans will be set by the organizers. The details though should be discussed with the Expo-2025 Association.

Specific questions for SB to address:

- Should PICES propose an academic event?
- If "yes", which of the following two options would be preferable: (a) an international symposium on an UNDOS-related topic at the start of the Expo in mid-April or (b) our own Annual Meeting in mid-October under the theme "Connecting Lives" (one of three Expo-2025 subthemes) at the closing of the Expo? [Note: If we return to our normal 6-year rotation cycle starting from PICES-2022 in Korea, then PICES-2025 is going to be in Japan.]
- Considering that, even with a good media coverage, an academic event will not fully serve the purpose of promoting PICES to the public, should PICES involvement be limited by only organizing such an event or it would be desirable to explore the possibility of having both – an academic event and a display?

Science Board received a follow-up presentation on EXPO-2025 from Dr. Alex Bychkov, and supports in principle a PICES display as set out at ISB-2021, and the idea of PICES organizing an academic event with an UNDOS theme at EXPO-2025. Science Board is open to the possibilities but requires more information in order to make a decision. Science Board recommends further exploration to set out options for an UNDOS-themed inter-sessional academic event in association with a PICES EXPO-2025 display.

Agenda Item 14: Capacity Development

Dr. Sanae Chiba provided Science Board with an update on requests of PICES to hold Capacity Development events. Additional information is available in Appendix E. Science Board Recommended support for the following Capacity Building activities.

Requesting Group	Request	Cost
AP-CREAMS (MONITOR)	**2021 summer school of data analysis of satellite observations (webinar) - Nov 30-Dec 2; Dec 14-Dec 16** **Virtual**	No funding request *originally submitted as an in-person event at 2019 SB
AP-CREAMS	Request that SB endorse postponing of the **summer school on Ocean turbulence** (Prof. Yu Fei, Qingdao, China, Summer **2022**) which was already approved by SB and GC for 2020 and 2021 but has not been organized yet because of COVID-19 pandemic.	$9000USD *originally approved at 2020 SB/GC, but deferred.
AP-NPCOOS	Ocean big data **virtual** summer school (Aug. 2022) Pre-recorded lectures relevant to data sets contributed from individual member countries; ONC hosts the datasets and virtual machine On line materials to present analytic methods and tools Real-time tutorials groups	$15,000 CAD *approved as in-person event at 2019 SB/GC and deferred.

Requests with funding implications

Travel Support Requests:

Science Board Recommends the following Travel Support Requests:

EG	Date	Meeting detail & location	PICES' Role*	Support (cost)	Participants
WG-42	Feb 2022	Ocean Sciences Meeting in Honolulu, HI, USA	Lead a session, speak in a session, and organize a meeting for the UN Ocean Decade	$3030USD: • Abstract fee: $75; • Registration Fee (ECS): $465 • Flight: $600; • Hotel: $150*7 = $1050; • Per diem = 120*7 = $840	Dr. Matthew Savoca

Science Board Does Not Recommend supporting the following travel funding request:

- WG-45 Requests $7000 for two members from PICES member countries and Australia to travel to the ICES-ASC to attend the WG-GRAFY session. FIS supports one member travel only. Science Board does not recommend this request, 6:4.

Other Requests with funding implications

- Science Board noted that it requires more detail from an Expert Group on Science Communications in order to properly respond to the SG-SciCom request for an estimated $10,000 USD funds to produce 2 PICES Science Videos in 2021-2022 (2@$5K/5Min video). Science Board requested that an AP-SciCom (if formed) work with other Expert Groups to produce science communication videos and provide more details about what video content (video length, content, editing capability) the funding will provide to PICES.

Agenda Item 15: PICES/ICES Conference, 2023

Dr. Trainer provided a brief overview of plans for the upcoming PICES/ICES conference, currently proposed for Seattle, USA, in October of 2023. Details of this conference are still under development, and will be shared with Science Board in due course. To date, the known details are as follows.

- Dates: October 2023, dates TBC.
- Location: Seattle, WA, USA – TBC.
- Details: Partnership science conference with ICES, details TBC.

Agenda Item 16: Publications Update

Open Access Publication costs

Dr. Chiba provided an overview of PICES Open Access Publication Support policy for Science Board, which is reproduced here for convenience of PICES members. Science Board continues to receive requests for Open Access funding without being provided with manuscripts to consider. Committee Chairs were reminded that Expert Groups submitting requests for Open Access funding must submit manuscripts at the time of their funding request so that Science Board can consider the request in light of the Open Access Policy.

2016/A/13: Policy regarding funding support for Open Access Publication

i. Is the paper/volume of very broad interest in the scientific community? Science Board to make this determination.
ii. Does the paper/volume represent time-sensitive information that is sought after by a broad scientific community? Science Board to make this determination.
iii. Is the paper/volume a key output product of an Expert Group or PICES sponsored activity? Science Board to make this determination.
iv. Is the paper/volume a key output product of an activity carried out in collaboration with one of our strategic partners? Governing Council to make this determination, with input from Science Board.
v. Is this a high priority for funding? Science Board shall assign a numeric priority to any requests.
vi. Is this affordable? Finance and Administration Committee to make this determination, in consultation with the Executive Secretary.

Dr. Batten also noted that WG scientific outcomes are normally published in-house in the PICES Scientific Report series (If there has been a Symposium or other event with its own dedicated funding then some of these funds may have been used towards special issue publication costs resulting from that event). PICES have a limited publication budget for such requests. However, PICES recognizes that the pandemic has impacted the ability of Expert Groups to fully share their work since there have been no in-person workshops or topic sessions for two years. Under these exceptional circumstances SB can consider partial support for a few open access publications that reflect the WGs scientific findings, at a level consistent with equivalent costs of an invited speaker to a workshop or topic session. Total requests this year should not exceed $10,000. This is not to set a precedent, rather to reflect the extraordinary situation we are in.

Science Board Recommended publication funding as follows:

- $2500USD for Open Access funds for: **Jennifer L. Boldt et al: https://doi.org/10.1016/j.ecolind.2021.108232**

List of Publications

Science Board Recommended publication of the following:

- (WG-37) Final Report, to be published as a PICES Scientific Report.

Science Board Recommended to endorse the following peer reviewed paper as the PICES Expert Groups' outcomes:

- Hallegraeff, G.M., Anderson, D.M., Belin, C. et al. Perceived global increase in algal blooms is attributable to intensified monitoring and emerging bloom impacts. Nature Commun, Earth Environ 2, 117 (2021). https://doi.org/10.1038/s43247-021-00178-8

- (WG-36) Jennifer L. Boldt, Elliott L. Hazen, Mary E. Hunsicker, Caihong Fu, R. Ian Perry, Xiujuan Shan. Quantifying ecosystem responses to environmental and human pressures in the marine ecosystem off the west coast of Vancouver Island. Ecological Indicators,Vol. 132, 2021. https://doi.org/10.1016/j.ecolind.2021.108232
-
- (WG-43) Peck, MA, J Alheit, A Bertrand, IA Catalán, S Garrido, M Moyano, RR Rykaczewski, A Takasuka, and CD van der Lingen. 2021. Small pelagic fish in the new millennium: a bottom-up view of global research effort. Progress in Oceanography 191:102494, doi:10.1016/j.pocean.2020.102494.
-
- (FIS) Carsten Hvingel, Bernard Sainte-Marie, Gordon H Kruse, Cold-water shellfish as harvestable resources and important ecosystem players, ICES Journal of Marine Science, Volume 78, Issue 2, March 2021, Pages 479–490. https://doi.org/10.1093/icesjms/fsab005

[***From Gordon Kruse <ghkruse@alaska.edu>: PICES co-sponsored a symposium, titled Shellfish – Resources and Invaders of the North, with the International Council for the Exploration of the Sea (ICES), and the Northwest Atlantic Fisheries Organization (NAFO). The symposium was held from November 5–7, 2019 in Tromsø, Norway. I was the PICES convenor of the symposium and also delivered the symposium keynote address. The symposium proceedings have now been published as a special issue of the ICES Journal of Marine Science. This issue may be of interest to FIS committee members and PICES may wish to include this special issue in its online list of Primary Journals. https://academic.oup.com/icesjms/issue/78/2**]

Adjournment

Dr. Trainer thanked all members of Science Board and all participants for their attention, input, and contributions that helped to make this Science Board meeting successful. A doodle poll will be sent out in the near future to determine dates of the next Science Board meeting, ISB-2022, proposed for Spring of 2022.

//End of meeting.

APPENDICES

APPENDIX A: Encouraging and Rewarding participation in PICES

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, Maryland 20910

1 December 2020

Vera Trainer, PhD
Environmental Chemistry Program
Northwest Fisheries Science Center
vera.l.trainer@noaa.gov

Re: Appointment as PICES' Science Board Chair

Dear Vera,

It is a pleasure to recognize your being named as PICES' Science Board Chair for a three-year term, through 2022. In your role as Chair of PICES' Science Board you will help guide, promote and coordinate PICES' marine scientific research to advance scientific knowledge of the North Pacific and of its living resources, including research of the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and its interactions with human activities.

Congratulations on your Chairmanship. While it comes with a great deal responsibility, it is a recognition of the respect and high regard in which you are held by the international community of your science peers.

Sincerely,

Francisco (Cisco) Werner, PhD
Director of Scientific Programs
and Chief Science Advisor
Past US Government Delegate to PICES
NOAA National Marine Fisheries Service

Cc: Kevin Werner, Director NWFSC
Mark Strom, Deputy Director NWFSC

APPENDIX B: New Expert Group Proposal

Proposed SG-PSC- Joint PICES-PSC Study Group on Scientific Cooperation in the North Pacific Ocean

Acronym: SG-SCPSC
Parent Committee: SB
PICES Co-Chair:
PSC Co-Chair:

Background:

The North Pacific Marine Science Organization (PICES) and Pacific Salmon Commission (PSC) are Intergovernmental Organizations with a shared interest in Pacific salmon productivity and overlapping geographic areas of focus. A more formal relationship would be mutually beneficial; PICES could provide access to relevant marine ecosystem science through platforms such as workshops and topic sessions at Annual meetings and the PSC can provide a salmon research focus and access to salmon data for PICES scientists. Improvements in our understanding of climate change and marine factors affecting Pacific Salmon population dynamics can lead to advancements in population modeling and stock assessment research. The improved collaboration should allow PICES and PSC scientists to add value to their science, provide synergies on regional and global issues, and enhance the visibility of both Organizations.

The collaboration would contribute to the success of both Organizations by:

- enhancing the current understanding of Pacific Salmon status and trends, climate change impacts and associated management implications;
- promoting the collection of, and access to, data, models and other information; and
- identifying gaps in knowledge and needs that should be addressed.

At the PICES 2020 Annual Meeting, the FIS Committee recommended pursuing the development of a PICES–PSC Framework for collaborative research opportunities. To undertake this development, a Study Group is proposed. At its 36th Annual Meeting in February 2021, the PSC supported the PICES concept to form a Joint Study Group.

Statement of Purpose:

The purpose of a joint PICES-PSC Study Group on *Scientific Cooperation in the North Pacific* is to develop a framework of enhanced collaboration between the two Organizations to achieve a greater understanding of coastal and high seas ecosystem structure and variability, and its effect on the dynamics and production of Pacific Salmon populations. The Study Group will review each organization's scientific needs and identify where similar key questions or scientific issues might be explored jointly by both organizations specified as follows.

Terms of Reference:

The following are the Terms of Reference (TOR) of the joint ISC-PICES Study Group (hereafter, SG):

1. Review existing and planned scientific activities of each organization;
2. Develop a list of potential priority areas of cooperation;
3. Identify potential collaborative mechanisms such as reciprocal consultations, representation at each other's meetings, joint workshops and symposia, and joint Working Groups;
4. Propose practical steps for cooperation between the organizations in the near future;
5. Draft the Framework for Collaborative Research Opportunities or Memorandum of Understanding between PICES and PSC and its duration (e.g. open-ended or for a renewable 5 years).

Process and Timelines:

The PSC has endorsed the SG and nominated members. This SG is proposed to PICES for approval and membership designation at the 2021 (October) Annual Meeting. The SG will conduct the majority of the work described in the TOR through email correspondence (November – September 2022), and with a virtual meeting (summer 2022 if required). The Framework and recommendations will be submitted in September 2022 to the PICES Secretariat for

consideration by Science Board and Governing Council at the PICES October 2022 Annual Meeting, and to the PSC for consideration at its October 2022 Meeting.

Proposed Membership:

PICES Members

Jackie King Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, British Columbia Canada, V9T 6N7 jackie.king@dfo-mpo.gc.ca	China Declines membership	**Satoshi Honda** Fisheries Resources Institute, Japan Fisheries Research and Education Agency 2-4-1Nakanoshima-nijo, Toyohira-ku, Sapporo, Hokkaido Japan 062-0922 honda_satoshi21@fra.go.jp
Korea	Russia	**Ed Farley** Alaska Fisheries Science Center, NOAA Fisheries, Juneau, Alaska USA, 99801 ed.farley@noaa.gov

PSC Members

John Field Pacific Salmon Commission 600-1155 Robson St. Vancouver, BC V6E1B5 field@psc.org	**Catherine Michielsens** Pacific Salmon Commission 600-1155 Robson St. Vancouver, BC V6E1B5 michielsens@psc.org	**Shannon Balfry** Fisheries and Oceans Canada 401 Burrard Street Vancouver, BC V6C 3S4 Shannon.balfry@dfo-mpo.gc.ca
Diana Dobson Fisheries and Oceans Canada 3225 Stephenson Point Rd. Nanaimo, BC V9T 1K3 Diana.Dobson@dfo-mpo.gc.ca	**Bill Templin** Alaska Dept. of Fish and Game PO Box 115526 Juneau, AK 99811-5526 Bill.templin@alaska.gov	**Scott Rumsey** NOAA Fisheries Regional Directorate Portland, OR 97232 Scott.Rumsey@noaa.gov

Proposed WG-EXTREMES

Proposal for a Working Group on
'Climate Extremes and Coastal Impacts in the Pacific'
(WG-Extremes)

Parent Committees: FUTURE (possibly POC, BIO, HD)
Requested Term: October 2021 – October 2026

GOALS

(1) Increase our understanding of climate extreme events with a focus on their drivers, predictability, and the impacts on coastal communities and marine ecosystem services.

(2) Facilitate partnerships between PICES, the Asia Pacific Network (APN), CLIVAR, WCRP and other organizations in the Pacific.

(3) Contribute to PICES activities supporting the UN Decade of Ocean Science for Sustainable Development, including the SMARTNET, CoastPredict, and GEOS Programs.

MOTIVATION

There is recognition of increased risk of **more frequent and more severe extreme events within the Pacific domain**. For example, a series of Marine Heat Waves (MHW) has occurred in the eastern North Pacific over the past 5 years, with substantial ecological and socioeconomic impacts on the west coast of North America. The 2015 MHW resulted in one of the largest harmful algal blooms ever recorded, leading to lost shellfish harvest, marine mammal deaths and lasting impacts on coastal communities (McCabe et al. 2015). In the western North Pacific Ocean near Japan, another long-term MHW occurred in the Oyashio region from 2010 to 2016, with significant impacts on local communities through changes in fish species available for catch (Miyama et al. 2021). There is a clear need to better understand the physical drivers and assess the predictability of MHWs and other extreme events, such as heavy rainfall, typhoons, and coastal inundation, and to be more prepared to resolve the socioeconomic impacts resulting from these events. Coastal communities around the Pacific Rim, which are highly reliant on coastal ecosystem services, are particularly vulnerable to these extreme events and in need of a suite of potential solutions to these climate-driven changes.

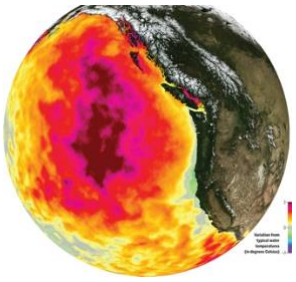

Fig 1: Marine Heat Wave in the eastern North Pacific.

The PICES FUTURE Science Program has implemented a **Social-Ecological-Environmental Systems framework** to facilitate transdisciplinary exchange of information within the organization. When applied to 'crisis' case studies, this framework proved effective in understanding large-scale ecosystem change and resulting impacts on coastal communities (Bograd et al., 2019). The FUTURE Science Program has also taken a central role in planning PICES' **leadership and engagement within the UN Decade of Ocean Science for Sustainable Development** (UNDOS). FUTURE's *Phase III* Science and Implementation Plan positions PICES to provide the scientific and organizational infrastructure to implement the activities of UNDOS in the Pacific. A key objective of these efforts is to identify and facilitate **engagement of partner organizations** to implement joint UNDOS activities that will enhance communication and outreach to diverse stakeholders. Several key partner organizations participated in recent PICES meetings in which ideas for collaborative work, including within the context of UNDOS, were discussed. In particular, we have identified significant interest in and high potential for collaboration around the theme of 'Climate Extremes and Coastal Impacts in the Pacific' with APN and CLIVAR.

WORKSHOP DECISIONS

PICES held a Workshop on June 23rd, 2021, to strategize on developing an Expert Group proposal on 'Climate Extremes and Coastal Impacts'. There was general agreement among the ~40 participants on several key points:

1. We will develop a single transdisciplinary PICES Working Group proposal for Science Board/Governing Council consideration at PICES-2021 (WG-EXTREMES).

2. We will begin reaching out to partner organizations, stakeholders, and other communities (including indigenous communities) to ensure early participation.

3. The first year of the WG-EXTREMES will have a focus on continued scoping for additional partnerships, as this is a major undertaking and will require additional time and effort amongst partner organizations, stakeholders, and other communities. To facilitate progress on the issue of climate extremes, we prefer to begin the work as a Working Group rather than a Study Group.

4. We will frame the Working Group proposal in the context of contributions to the UN Decade of Ocean Science (including the SMARTNET and GEOS Programs), with anticipation of continued work on climate extreme events beyond the timeframe of WG-EXTREMES.

5. We strongly encourage Early Career Ocean Professionals (ECOPs) to take a leading role in proposal development and eventual implementation of the WG.

WG PROPOSAL

We propose a PICES Working Group to address multi-disciplinary aspects of climate extreme events, including their physical drivers, attribution to climate change, predictability on seasonal to interannual time scales, and impacts on coastal marine ecosystems and the coastal communities that are reliant on their ecosystem services. The principal objectives will be to (a) gain a better understanding of the drivers and impacts of extremes under changing climate conditions, (b) assess the predictability of different climate extreme events, and (c) explore potential solutions to mitigate their societal impacts. We seek to engage partner organizations in this Working Group, including APN and CLIVAR, to expand the scope and impact of the work, in support of PICES' engagement in UNDOS, in particular the Decade-endorsed ICES-PICES SMARTNET Program. We seek to leverage the organizational infrastructure of PICES as well as the APN network and its history of capacity development across Pacific developing countries.

We would also work closely with the PICES Study Groups on Early Career Ocean Professionals (SG-ECOP) and on Science Communications (SG-SCICOMM), or subsequent Expert Groups, with the aim of training ECOPs in multi-disciplinary ocean research, organization of multi-partner collaborations, and communication of WG activities and products to diverse stakeholders. The partnerships fostered by this WG will bring together diverse networks to increase the overall capacity to conduct ocean science research in support of sustainable development and to foster the range of skills necessary to support broad and overarching marine science goals. This Working Group will facilitate transformative science and address several UNDOS key societal objectives as well as incorporate strategies to facilitate UNDOS cross-cutting inclusivity themes relating to gender equality, early career ocean professional engagement, and significant involvement of Indigenous communities and developing nations in the planning and implementation of joint activities.

TERMS of REFERENCE

1. Develop a census of historical climate extreme events around the Pacific Rim to describe their characteristics, identify potential climate and ocean drivers, and catalog the ecological and socioeconomic consequences.
2. Focus on case studies (e.g., MHWs) for full exploration: drivers, predictability, ecological and societal impacts, and dissemination of information for actionable solutions.
3. Assess the predictability of climate extremes and establish leading indicators to mitigate impacts on coastal communities.
4. Develop models to predict how existing ecosystem services may be affected by climate extremes and what effects those would have on different human communities.
5. Identify a set of social, economic, and cultural indicators that account for the suite of human dimension impacts from climate extremes.
6. Work with experts in science communications and participants in the UN Decade of Ocean Science (e.g., SMARTNET) to develop and disseminate information and products related to the drivers, predictability and impacts of climate extremes.

7. Identify and engage partners in the prioritization of activities and deliverables.

PROPOSED INTERNAL and EXTERNAL ORGANIZATIONAL PARTNERS

CLIVAR (Pacific Panel); WCRP (lighthouse activities "explaining and predicting earth system change," "my climate risk," and "WCRP academy"); APN

Joint PICES-APN Study Group on Scientific Cooperation in the Pacific Ocean
PICES Expert Group on Early Career Ocean Professionals (ECOPs): to provide WG leadership
PICES Expert Group on Science Communications: to assist communication of WG activities and products to the PICES community, the broader scientific community and the general public
PICES Expert Group on UN Decade of Ocean Sciences: to coordinate with SMARTNET and other Decade activities

PROPOSED MEMBERSHIP

1. Seek to maintain regional, expertise (natural and social sciences), gender and career-stage balance, including involvement of ECOPs.
2. Seek representation from the Indigenous community.
3. Seek representatives from the partner organizations (CLIVAR, WCRP, APN).
4. Include members who participated in the June 2021 Workshop on Climate Extremes.
5. Given cross-disciplinary and cross-organizational nature of WG, anticipate relatively large membership and an extended lifetime.

References

Bograd, S.J., S. Kang, E. Di Lorenzo, T. Horii, O.N. Katugin, J.R. King, V.B. Lobanov, M. Makino, G. Na, R.I. Perry, F. Qiao, R.R. Rykaczewski, H. Saito, T.W. Therriault, S. Yoo, H. Batchelder, 2019. Developing a social-ecological-environmental system framework to address climate change impacts in the North Pacific. *Frontiers in Marine Science*, 6:333, doi.org/10.3389/fmars.2019.00333.

McCabe, R.M., Hickey, B.M., Kudela, R.M., Lefebvre, K.A., Adams, N.G., Bill, B.D., Gulland, F.M.D., Thomson, R.E., Cochlan, W.P., Trainer, V.L. 2016. An unprecedented coastwide toxic algal bloom linked to anomalous ocean conditions. *Geophysical Research Letters*. 43: doi:10.1002/2016GL070023

Miyama, T., S. Minobe, and H. Goto, 2021, Marine Heatwave of Sea Surface Temperature of the Oyashio Region in Summer in 2010–2016. *Frontiers in Marine Science*, 7:576240, doi: 10.3389/fmars.2020.57624.

Proposed WG-Submesoscale: Working Group on Submesoscale Processes and Marine Ecosystem

Background

To improve the understanding on the ocean physical processes that relate to living marine resources is one of the main goals of POC. To this end, much effort has been made towards the ocean mesoscale dynamics and its impact on the marine ecosystem, while the submesoscale processes, of one or two orders smaller in spatial scale, have received comparatively few attentions. The submesoscale process is a ubiquitous phenomenon over the entire ocean and has been a front edge of oceanography during past decade. The PICES Working Group 38 (WG38) on Mesoscale and Submesoscale Processes ended this year. While WG 38 has done a detailed and thorough work on the mesoscale processes on the North Pacific, the submesoscale processes were not focused on sufficiently and completely due to the large volume of mesoscale studies. It is therefore timely to transition from mesoscale to submesoscale at this moment on the basis of the results of WG38.

Motivation and Goals

Submesoscale processes are relevant to ocean primary productivity because they support large vertical velocity with timescale similar to the phytoplankton growth, which will ultimately influence the upper trophic levels and food chain. This new group aims to *"improving our essential knowledge on the submesoscale processes by integrating the submesoscale-permitting observation dataset, developing and evaluating the high-resolution coupled model in the North Pacific, particularly in the coastal areas and others with important living resources".* The establishment of this group helps address the FUTURE goal on the variability of marine ecosystem under natural and anthropogenic forcings across scales. The working group will also develop tight collaboration with national and international work groups and promote more studies on this topic.

Proposed Terms of Reference (TOR)

Below we detail the Working Group goals in a set of terms of reference.

1. **Review the recent progress on the submesoscale observation techniques and model skills in the North Pacific**
   Thanks to the advance of computer and instrument technology, the observation and simulation of submesoscale processes have made a huge progress during past decades. The WG will carry on a thorough review on previous submesoscale studies in the North Pacific by regions. Particular interest will be paid on different submesoscale dynamics that dominate in different regional seas and in the open ocean such as the western boundary current (Kuroshio) and its extension, eastern boundary current and associated upwelling, the North Pacific Transition Zone as well as the equatorial areas etc.
2. **Review the current studies on the ocean submesoscales and their role in the marine ecosystem in the North Pacific**
   The impacts of submesoscales on the local marine system is one of the main focuses in this work group. Comparing with the Atlantic Ocean, less has been done in the Pacific. In view of this, we will review the role of submesoscale dynamics in regulating the marine ecosystem not only in the Pacific but also over the other world oceans. We will identify which and how the submesoscale processes influence the local primary productivity and other living creatures such as zooplankton, fish and even sea birds.
3. **Identify how and which submesoscale processes interact with local marine ecosystem in the regional areas**
   The results of the TOR 1 and 2 will be very instructive to our submesoscale-ecosystem studies in the North Pacific. We will identify the major submesoscale process in the regional areas of the North Pacific using the existing numerical simulations (e.g., MITgcm *llc4320*) and/or building our own regional high-resolution models. Combined with the observed data like nutrients, chlorophyll and/or coupled biological model, we will be able to determine the role of submesoscale processes in the local ecosystem and clarify the bio-physical interaction across scales.
4. **Evaluate the integrated effects of submesoscale physics on the ocean primary production in the North Pacific**
   The integrated effects of submesoscale processes that the WG proposes to evaluate include both the overall long-term variability of primary production and regional ecosystem structure change under the climate forcings during past decades and future projections. This goal also serves as an effort towards the UN decades of Ocean Sciences for sustainable development and the UN SDG 14 (Life below water).
5. **Promote the national research on ocean submesoscales and the international collaboration with worldwide experts**
   As mentioned above, the submesoscale studies have received much less attention even in PICES countries. The WG

will engage in the activities to promote the national research on ocean submesoscales as well as international collaboration with renowned research groups in this field. By means of this new impetus, we anticipate expanding the influence of our WG and PICES and attracting more scientists to join in. We have summoned an onsite and online submesoscale workshop in June this year.

Examples of Submesoscale impacts on marine ecosystem

Submesoscale processes modulating the phytoplankton growth rate

One important feature of submesoscale processes that makes them particularly relevant to phytoplankton growth is that they drive strong local vertical velocities at fronts and filaments. The upwelling velocities may drive enhanced nutrient fluxes into the euphotic zone, while the downwelling may take the phytoplankton away from light exposure into the dark ocean interior (e.g., Levy et al., 2012; Mahadevan, 2016; Zhong and Bracco, 2013). The net effect remains unclear though many studies have shown good correspondence between submesoscale fronts and chlorophyll maximum (Figure 1). Since the temporal scales of submesoscale currents are often of the same order to those of phytoplankton growth time scales, it is thus expected that the coupling between the submesoscale dynamics and phytoplankton growth may be subject to large regional variability.

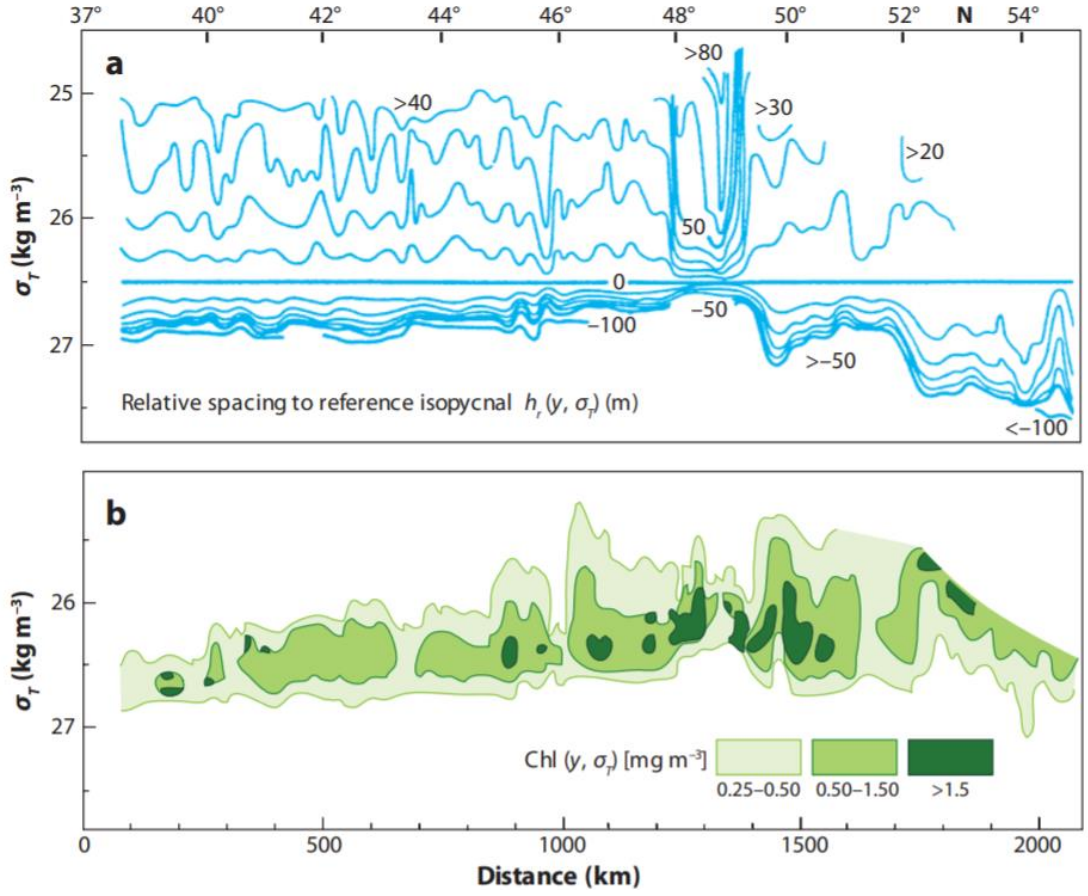

Figure 1: Isopycnal distributions along a section from the Azores toward Cape Farvel, Greenland of (a) the spacing of isopycnals relative to 26.5 kg m^{-3}, and (b) the chlorophyll concentration. High chlorophyll concentrations are observed in submesoscale fronts. This figure is taken from Klein et al. (2009).

Submesoscale processes redistributing the phytoplankton patches

The surface distribution of phytoplankton or other passive tracers is strongly regulated by the submesoscale currents. The elongated filaments or patches with complex structure are often identified in the satellite images (e.g., Zhong et al., 2012). The submesoscale stirring usually occurs in the eddy active regions, where the mesoscale eddies distort the large-scale phytoplankton landscape into submesoscale patches delineated by sharp gradients (e.g., McWilliams, 2016; Levy et al., 2018).

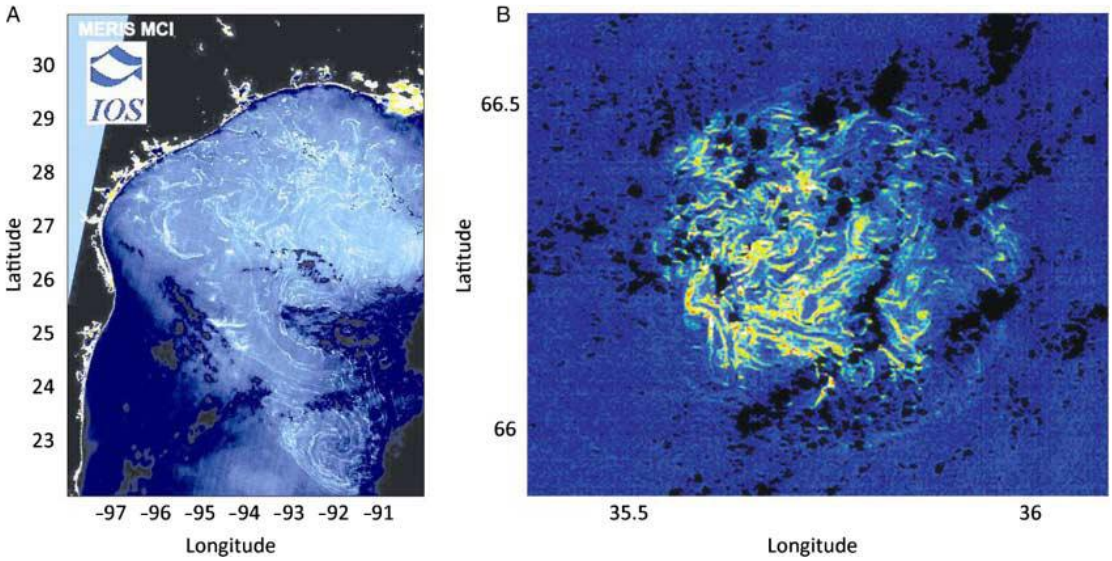

Figure 2: Ocean color satellite images of Sargassum. (A) Sargassum lines in a MERIS maximum chlorophyll index (MCI) image on 2 June 2005 (courtesy European Space Agency,). (B) A patch observed by the same satellite in the North Atlantic on 4 September 2008 (courtesy European Space Agency,). The center of the patch is located at 35°45'N and 66°21'W, and its diameter is
approximately 45 km. This figure is taken from Zhong et al. (2012).

Proposed Membership

PICES Co-Chairs: Yisen Zhong & Bo Qiu

Yisen Zhong (China): Associate professor at the School of Oceanography, Shanghai Jiao Tong University. Primary research focus is on mesoscale and submesoscale physical processes and dynamics in the ocean, particularly in the western Pacific. His research efforts mainly rely on high-resolution regional ocean numerical models (including physical-biological coupled models), and also use satellite and ship-based observation data.

Bo Qiu (USA): Professor of oceanography in SOEST, University of Hawaii. His scientific interests include large-scale ocean circulation variability, mid-latitude air-sea interaction, geophysical fluid dynamics, and satellite oceanography. Recently he was honored with the Henry Stommel Research Medal by the AMS for his seminal contributions using observations, models, and theory to understand the dynamics of the North Pacific Ocean circulation and its role in the climate system.

Suggested PICES Members

1. Sung Yong Kim (Korea)
2. Yusuke Uchiyama (Japan)
3. Annalisa Bracco (USA)
4. Fangli Qiao (China)

Cited References

Klein, P., Lapeyre, G. The oceanic vertical pump induced by mesoscale and submesoscale turbulence. Annu. Rev. Mar. Sci. 1, 351–375 (2009).

Levy, M., Ferrari, R., Franks, P. J. S., Martin, A. P. & Rivière, P. Bringing physics to life at the submesoscale. Geophys. Res. Lett. 39, L14602 (2012).

Levy, M., Franks, J. S. P. & Smith, K. S. The role of submesoscale currents in structuring marine ecosystems. Nature Communications. 9, 4758 (2018).

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Zhong, Y., Bracco, A., Villareal, T. A. Pattern formation at the ocean surface: *Sargassum* distribution and the role of the eddy field. Limnology and Oceanography: Fluids and Environments. 2, 12-27 (2012).

Zhong, Y., Bracco, A. Submesoscale impacts on horizontal and vertical transport in the Gulf of Mexico. Journal of Geophysical Research: Oceans. 118, 5651-5668 (2013).

Proposed AP-SciCom: Advisory Panel on Science Communications

Proposed Parent Committees: Science Board, FUTURE

Assumptions:

- Effective Science Communications are critical to PICES successful delivery of its mission.
- Clear and targeted messaging will enhance uptake of PICES Science, will demonstrate its value to a broader community outside of PICES scientific community, and may provide increased opportunities for collaboration, support, and funding.
- PICES Science is full of compelling stories, and important work. It is imperative that these stories reach a broad and appropriate audience. To do so, a framework for collection, creation, and regular dissemination of PICES Science content must be developed by a dedicated Science Communications Expert Group. It can then be implemented by PICES Expert Groups and the Secretariat as appropriate. Capacity building within the organization is a key element that will ensure that PICES is able to communicate its scientific achievements and recommendations broadly and be equipped to evolve its communication plan.

Proposed Terms of Reference:

PICES Strategic Communications Planning and Implementation:

- Create and maintain a PICES Strategic Science Communication Plan to share the findings and importance of PICES Science. Include short and long term communication goals to reach target audiences and specify a timeline for delivery.
- Review and develop best practices for Science Communications and provide recommendations for media and messaging within PICES.
- Determine and document measures of success of PICES Science Communications.
- Review PICES brand and communication tools, especially the PICES website. Develop a plan for improvement, updates and long-term maintenance.
- Develop and practice a scheme to more effectively and regularly share the scientific results and achievements of PICES Expert Groups via the website, social media, and other available tools.

PICES Science Communications Training and Capacity Building:

- Develop an annual Science Communication Training Plan, including workshops, sessions, and symposia related to Science Communications.
- Develop a Science Communications Training section of the PICES website to share Science Communication resources, opportunities, and potentially Science Communication case studies.
- Create a PICES Science Communications Award, to be awarded by the Advisory Panel on Science Communications, to encourage all expert groups to share the results of their PICES work in a clear and compelling fashion.

Proposed membership (*Proposed leadership)

<table>
<tr>
<td>Canada:
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Proposed AP-ECOP: Advisory Panel on Early Career Ocean Professionals

Acronym: AP-ECOP

Parent Committee(s): Science Board & FUTURE

Rationale & Goals of AP-ECOP

To remain vibrant and relevant over the long-term, professional organizations must attract, integrate and retain diverse perspectives, especially of early career professionals. The connection between organizations and early career professionals is mutually beneficial. Engaging ECOPs in PICES promotes diversity, initially generationally, but eventually by incorporating a greater number of disciplines and sectors and by developing and strengthening relationships with countries and organizations located in different ocean basins; provides expertise in new research techniques and greater emphasis on science communication, outreach, and enhances organizational capacity. Complementary to this, ECOPs benefit by engaging in knowledge sharing, training, and mentorship and getting direct experience in relevant professional skills such as international collaborations, intergovernmental engagement, science communication, and conference organization, as well as employment, funding, or other professional opportunities. A survey conducted by the previous SG-ECOP demonstrated how willing and keen both ECOPs and later career ocean professionals (LCOPs) were towards the institution of a mentorship program and towards greater inclusion and engagement of ECOPs within PICES organizational development, scientific agenda, communication strategy and multi-stakeholder partnerships.

The goal of the proposed Advisory Panel is to facilitate the incorporation and engagement of diverse early career ocean professionals (ECOPs), across regions, sectors, disciplines, and other axes of diversity into the PICES scientific activities and organizational structure, including expert groups and the Secretariat. This includes identifying opportunities for participation, recruiting diverse ECOPs, and sustaining their engagement. The AP will support and direct ECOP engagement within PICES and the North Pacific, as well as encourage ECOP participation in organizations, programs, and activities of interest to the PICES community, such as associated with the UN Decade of Ocean Science for Sustainable Development (e.g., SMARTNet).

Proposed Terms of Reference

1. **Explore opportunities for ECOP representation in PICES through enhanced demographic data collection & assessment.** The AP will continue to assess opportunities to enhance representation in PICES expert groups and organizational structures and ensure that there is cross fertilization among the existing Expert Groups, such as the proposed Science Communication Advisory Panel. This could include identifying reasonable, quantitative benchmarks for ECOP participation, both within PICES as a whole and in specific expert groups, decision-making bodies, and other key organizational structures and improving demographic information to track the demographics of the PICES annual meeting & community.
2. **Recruit diverse ECOPs through revitalized communications & existing networks.** The AP will actively work to recruit diverse ECOPs, from different regions, sectors, and disciplines, into PICES by revitalizing communication and connecting with existing networks. This could include supporting with the PICES website, developing an ECOP section on the PICES website, and asking existing PICES members & national members of expert groups to actively invite ECOPs to the annual meeting and expert group meetings.
3. **Engage ECOPs through professional opportunities in expert groups, programs, & other aspects of PICES structure.** Incorporate ECOPs into all levels of PICES including participation in expert groups and the Secretariat and ultimately leadership roles within the organization. For example, this could include post-docs or interns that support Expert Groups or the Secretariat. In addition, ECOPs could see which Expert Groups (EGs) align with their areas of interest, join the EG meetings, and contact the EG chair.
4. **Foster inter-generational exchange through mentorship programs and activities.** The AP will continue to foster inter-generational exchange and mentorship between experienced PICES members, ECOPs, and emerging

ECOPs (e.g. youth), such as by encouraging later career ocean professionals (LCOPs) to mentor ECOPs that are eager to participate in expert groups and other organizational bodies.

5. **Collaborate with partners to develop and advance inclusive engagement in the North Pacific and internationally.** The AP will work with other international, regional, and national organizations, initiatives and/or countries to further ECOP engagement, especially those related to mentorship, diverse engagement, and early career professional recruitment, retention, and participation. This could include developing a North Pacific ECOP network to connect within and across regions globally and within the context of international processes, like the UN Decade of Ocean Science for Sustainable Development (2021-2030), and across the associated programs (e.g., SMARTNet, GEOS, ECOP).

Proposed/recommended chair(s):
We would like to propose 4 chairs (ideally two from West and East Pacific) that will rotate after 2 years with staggered service (e.g., to start co-chairs 1E/2W serves 2022-2024, co-chairs 3E/4W serves 2023-2025, co-chairs 5E/6W serves 2024-2026). This structure will allow for increased coordination and productivity while bridging gaps in learning curves and allowing for some flexibility in the event that a co-chair has to leave their term early due to unforeseen circumstances (i.e. job changes occur at a higher frequency at the early career stage).

Raphael Roman (Japan) - raphael.roman@alumni.ubc.ca *(tentative)*
Cameron Freshwater (Canada) - cameron.freshwater@dfo-mpo.gc.ca
Alex Davis (Canada) - acdavis@ualberta.ca
co-chair 4- TBD

Proposed/recommended full members:

Erin Satterthwaite (USA) – esatterthwaite@ucsd.edu Matthew Savoca (USA) - msavoca13@gmail.com Hannah Lachance (USA) - hannah.lachance@noaa.gov	Alex Davis (Canada) - acdavis@ualberta.ca Cameron Freshwater (Canada) - cameron.freshwater@dfo-mpo.gc.ca Cherisse Dupreez (Canada)- cherisse.dupreez@dfo-mpo.gc.ca
Raphael Roman (Japan) - raphael.roman@alumni.ubc.ca Aoi Sugimoto (Japan) - aois@affrc.go.jp Hiroki Wakamatsu (Japan) - hwakamatsu@affrc.go.jp (*pending- interested*)	Kirill Kivva (Russia) - kirill.kivva@gmail.com Anna Vazhova (Russia) - anna.vazhova@gmail.com Anna A. Ponomareva (Russia) - anna_andreevna7@mail.ru
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Vera Trainer (USA- mentor) - vera.l.trainer@noaa.gov Steven Bograd (USA- mentor) - steven.bograd@noaa.gov Hanna Na (Korea- mentor) - Hanna.ocean@gmail.com Pengbin Wang (China- mentor) - algae@sio.org.cn Shin-ichi Ito (Japan- mentor)- goito@aori.u-tokyo.ac.jp Andi White (Canada- mentor) - Andrea.White@dfo-mpo.gc.ca Alex Bychkov (Russia- mentor) - bychkov@pices.int	**Proposed/recommended ex-officio members:** ICES - Fedor Lishchenko- filiusferro@gmail.com APN- Yukihiro IMANARI - yimanari@apn-gcr.org ECOP Programme- Evgeniia Kostiania - evgeniia.kostianaia@gmail.com ECOP Asia - Karina Higa - ninahiga@yahoo.com.br IEEE Oceanic Engineering society- Hari Vishnu - harivishnu@gmail.com

APPENDIX C: PICES-2022 Proposed WORKSHOPS

[Please note: Duplicate submissions have been removed, keeping the most current submission. Because of this, submission numbers may appear to be missing. Workshops will be re-numbered for scheduling, but are left as-is here to ensure agreement with the PICES-2022 submission database.]

PICES-2022 Workshop Submission #1		
Title		Number of Days
Distributions of pelagic, demersal, and benthic species associated with seamounts in the North Pacific Ocean and factors influencing their distributions		2
Committee	Convenors	Co-Sponsors (if applicable)
BIO, WG-47	Akash Sastri (akash.sastri@dfo-mpo.gc.ca) Chris Rooper (Canada, chris.rooper@dfo-mpo.gc.ca) Mai Miyamoto (Japan, miyamoto-mi@janus.co.jp, corresponding convenor) Janelle Curtis (Canada, janelle.curtis@dfo-mpo.gc.ca, corresponding convenor)	North Pacific Fisheries Commission (convenors will seek approval in early 2022)
Invited Speakers		
Seamount ecology: Dr. Telmo Morato (Portugal, t.morato@gmail.com) Biological oceanography and plankton ecology: Dr. Russ Hopcroft (USA, rrhopcroft@alaska.edu) Environmental drivers of seamount biodiversity: Dr. Peter Miller (UK, pim@pml.ac.uk)		
Description		
Changes in the marine environment influence distribution patterns of marine organisms in pelagic, demersal, and benthic ecosystems associated with seamounts. Biogenic habitats formed by some of these organisms support a range of biodiversity and provide critical habitats for some socioeconomically important fishes and invertebrates that attract commercial fishing and other anthropogenic activities. This workshop aims to improve our understanding of factors influencing the diversity and distributions of species associated with seamounts in the North Pacific Ocean, identify and begin applying models to understand the ecology and distribution of species associated with seamounts, and predict how they are likely to respond to natural and anthropogenic forcing, including climate change. In preparation for the workshop, participants will build on the work of WG-32 by compiling new and existing data on pelagic, demersal, and benthic seamount species in the North Pacific Ocean as well as the marine environment to improve model predictions and interpretations based on a multi-model approach. This workshop builds on quantitative approaches developed in a similar workshop convened by WG-32 in 2016. Applying habitat suitability models for the pelagic, demersal, and benthic biodiversity of seamounts in the North Pacific Ocean will be made for the collective biodiversity in these three ecosystems and for individual taxa, when plausible. Participants will be invited to discuss, compare, and evaluate the influence of predictor variable data, and different modelling approaches on results. This will help identify potential ecological and physiological mechanisms influencing seamount ecology and provide insight into the potential for changes in species distribution under different climate change scenarios. An anticipated novel outcome will be the first habitat predictions for seamount biodiversity at a basin-wide scale in the North Pacific Ocean. Workshop participants will synthesize lessons learned from the modelling exercise, future tasks to further improve predictive accuracy, and possible applications for supporting marine spatial planning processes. Potential Co-sponsoring organization: North Pacific Fisheries Commission (NPFC, convenors will seek approval from NPFC in early 2022) Publication: a scientific peer-reviewed paper		
Publication?	Yes	
SB NOTES	n/a	

PICES-2022 Workshop Submission #3		
Title		Number of Days
Integrated Ecosystem Assessment (IEA) to understand the present and future of the Central Arctic Ocean (CAO) and Northern Bering and Chukchi Seas (NBS-CS)		1
Committee	Convenors	Co-Sponsors (if applicable)
WG-39, WG-44	Sei-Ichi Saitoh, Japan, ssaitoh@arc.hokudai.ac.jp (corresponding); Hyoung Chul Shin, Republic of Korea, hcshin@kopri.re.kr; Libby Logerwell, USA, libby.logerwell@noaa.gov; Yury Zuenko, Russia, zuenko_yury@hotmail.com ;	ICES – SB requests that Convenors consider including PAME or others as sponsors for this Workshop.
Invited Speakers		
Lee Cooper (DBO, SAS), USA, cooper@umces.edu Lis Lindal Jørgensen (IMR), Norway, lis.lindal.joergensen@hi.no		
Description		
The target LMEs of WG 39 and WG 44 are the Central Arctic Ocean (CAO) and the Northern Bering Sea-Chukchi Sea (NBS-CS), that are geographically and dynamically connected. CAO is in rapid transition, driven by North Pacific environmental changes in significant part, has become accessible to a range of activities. Rapid loss of sea ice cover has opened up the CAO for potential fishing opportunities. In this context, the agreement to Prevent Unregulated High Seas Fisheries in the CAO has been signed and entered into force, which will necessitate joint research and monitoring. NBS-CS is also experiencing unprecedented warming and loss of sea ice as a result of climate change. Declines of seasonal sea ice and warming temperatures have been more prominent in the northern Bering and Chukchi seas as in most portions of the Arctic. Chronic and sudden changes in climate conditions in this Arctic gateway are clearly reshaping the system and its food-webs, and enlarging opportunities for commercial activities (shipping, oil and gas development and fishing), with uncertain and potentially wide-spread cumulative impacts. An integrated ecosystem assessment (IEA) is a useful approach in this circumstance, particularly with substantial science and policy challenges emerging in the Arctic, and this renders a coordinated IEA of the CAO and NBS-CS a priority task. The main objectives for the workshop are to describe and discuss present ecosystem processes (sources, signals, significance) in the CAO and the NBS-CS based on achievements from existing and future research programs such as MOSAiC and SAS, numerous NBS-CS programs, and Indigenous Knowledge. In addition, it is of particular significance to developing future approaches for The United Nations Decade of Ocean Science for Sustainable Development in these oceans, where science for resilience and sustainability is more important than anywhere else and the relevant, regional UN program is yet to be properly initiated.• Duration: 1.0 day (0.5 day + 0.5 day); There will be two sessions with focus on CAO and NBS-CS, and a session for joint deliberation will be prepared. Budget request; USD 3000 (travel for one or two invited speaker at the workshop and miscellaneous)		
Publication?	None mentioned.	
SB NOTES	SB requests that Convenors consider including PAME or others as sponsors for this Workshop.	

PICES-2022 Workshop Submission #5		
Title		Number of Days
SMARTNET: Promoting PICES and ICES Leadership in the UN Decade of Ocean Science for Sustainable Development		1
Committee	Convenors	Co-Sponsors (if applicable)
SB, POC, FUTURE-SSC WG-35, SG-PICES-APN, SG-ECOP, SG-UNDOS	Steven Bograd, U.S.A., Steven.bograd@noaa.gov (corresponding) Sanae Chiba, PICES Secretariat	ICES
Invited Speakers		
TBD		
Description		
On World Oceans Day, June 8th, 2021, the Intergovernmental Oceanographic Commission announced the first set of activities endorsed as part of the UN Decade of Ocean Science for Sustainable Development (UNDOS; 2021-2030). The program submitted jointly by PICES and ICES, Sustainability of MARine ecosystems Through knowledge NETworks (SMARTNET), was endorsed as an UNDOS Program, ensuring that ICES and PICES will play a leading role in the development of UNDOS from its inception. The aim of SMARTNET is to support and leverage ICES, PICES, and member countries' priorities and initiatives related to the UNDOS, by emphasizing areas of mutual research interest and policy needs, including climate change, fisheries and ecosystem-based management, social, ecological and environmental dynamics of marine systems, coastal communities and human dimensions, and communication and capacity development. SMARTNET will also incorporate strategies to facilitate UNDOS cross-cutting inclusivity themes relating to gender equality, early career ocean professional engagement, and involvement of indigenous communities and developing nations in the planning and implementation of joint activities. In this workshop, we will provide updates on SMARTNET and other UNDOS activities and facilitate a broad discussion within the PICES community and amongst partners on methods and priorities for implementing SMARTNET.		
Publication?	None mentioned.	
SB NOTES	SB requests that Convenors consider collaborating with APN (maybe a speaker from APN) and other organizations that might enhance the opportunity for inclusion/diversity, and that Convenors please collaborate with proposed ECOP WS.	

PICES-2022 Workshop Submission #6		
Title		Number of Days
Establishing a North Pacific ECOP node of the global ECOP program to increase inter-regional early career engagement and partnerships during the Ocean Decade		1
Committee	Convenors	Co-Sponsors (if applicable)
SG-ECOP	Raphael Roman, Japan, raphael.roman@alumni.ubc.ca (corresponding); Erin Satterthwaite, U.S.A., esatterthwaite@ucsd.edu; Hannah Lachance, U.S.A., hannah.lachance@noaa.gov	ICES Global ECOP Program, ECOP Asia
Invited Speakers		
Evgeniia Kostianaia, Russia, evgeniia.kostianaia@ocean.ru; Karina Higa, Japan, ninahiga@yahoo.com.br. Others TBD		
Description		
The global early career ocean professional (ECOP) movement has been gathering significant momentum since the launch of the UN Decade. Officially endorsed as one of the first Ocean Decade Actions, the ECOP programme aims to promote and consolidate the regionally, culturally and professionally diverse perspectives brought by the next generation of ocean leaders. The establishment of inter-connected regional ECOP networks that can co-create, co-design and integrate knowledge, share expertise, as well as sponsor training and professional development opportunities is an important building block towards sustaining inclusive and cross-cutting engagement between both early- and late-career communities. As such, we propose a workshop that will bring together the North Pacific ECOP group(s) to discuss and brainstorm: 1) the key needs (trainings, resources, etc.) of ECOPs to ensure proper career development and 2) what ECOPs see as the key priority areas for the North Pacific to engage on through the UN Decade (e.g., through SMARTNET). We will be inviting ECOP representatives and mentors from national, regional and global organizations or initiatives that specialize in interdisciplinary marine sciences and ocean policy (e.g., ICES, IOC, APN, ECOP Asia). The invited speakers will introduce their ECOP network and key goals, early career engagement plans and current integration and partnerships within Ocean Decade activities, while highlighting the opportunities and shared goals for a North Pacific ECOP node. A proposal developed by PICES ECOPs will be presented to the audience and feedback will be sought via interactive dialogues and participatory activities. While the primary aim of this workshop is to convene and initiate discussions with key partners and stakeholders from the global ECOP movement, a concrete set of recommendations will also be delivered to PICES and IOC-ECOP secretariats and could also inform the SMARTNET workshop discussions, as well as other Ocean Decade endorsed actions.		
Publication?	None mentioned.	
SB NOTES	*Convenors requested to explore the opportunity to collaborate with proposed SMARTNET workshop, and possibly integrate the two.*	

PICES-2022 Workshop Submission #7		
Title		Number of Days
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		1
Committee	Convenors	Co-Sponsors (if applicable)
	Josep Planas, USA, josep.planas@iphc.int (corresponding); Chris Rooper, Canada, Chris.Rooper@dfo-mpo.gc.ca; Naoki Tojo, Japan, n.tojo.raven@fish.hokudai.ac.jp; Roman Novikov, Russia, novikov.r.n@kamniro.ru.	IPHC
Invited Speakers		
TBD		
Description		
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 current 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, in addition to the publication of papers resulting from this workshop as a special issue in a relevant peer-reviewed journal, a key outcome of W2 of the 2019 PICES Annual Meeting.		
Publication?	Yes.	
SB NOTES	*Convenors requested to review PICES Expert Groups to identify additional collaboration for this workshop.*	

PICES-2022 Workshop Submission #8		
Title		Number of Days
Bridging Multiple Way of Knowing within an Integrated Ecosystem Assessment to understand the social and ecological changes in the Northern Bering and Chukchi Seas		1
Committee	Convenors	Co-Sponsors (if applicable)
WG-44	Sarah Wise, USA, sarah.wise@noaa.gov (corresponding); Mellisa Johnson, USA, director@beringseaelders.org (TBC); Nadia Steiner, Canada, Nadja.Steiner@dfo-mpo.gc.ca (TBC); Yutaka Watanuki, Japan, ywata@fish.hokudai.ac.jp (TBC)	
Invited Speakers		
Elder Richard Slats, Chevak, AK, USA, rbslats@yahoo.com (to be confirmed) Lauren Divine, St. Paul Island, AK, USA, lmdivine@aleut.com (to be confirmed)		
Description		
WG 44 workshop proposal for PICES 2022 Title: Bridging Multiple Way of Knowing within an Integrated Ecosystem Assessment (IEA) to understand the social and ecological changes in the Northern Bering and Chukchi Seas (NBS-CS) Duration: 1.0 day Co-conveners Sarah Wise, USA, sarah.wise@noaa.gov (corresponding) Mellisa Johnson, USA, director@beringseaelders.org (to be confirmed) Nadia Steiner, Canada, Nadja.Steiner@dfo-mpo.gc.ca (to be confirmed) Yutaka Watanuki, Japan, ywata@fish.hokudai.ac.jp (to be confirmed) Workshop description: The target LME of WG 44 is the Northern Bering Sea-Chukchi Sea (NBS-CS) which is undergoing rapid transition caused by climate change. Declines in seasonal sea ice, increased storm events, and warm temperatures are driving substantial changes in socio-ecological systems. New commercial opportunities such as shifting fisheries, oil and gas exploration, increased vessel traffic (shipping and access to land-based natural resources), and Arctic tourism will have uncertain cumulative impacts on coastal communities in the Northern Pacific and beyond. The NBS-CS Integrated Ecosystem Assessment will improve understanding of critical interconnected systems processes and inform decision-making and management. Including Indigenous Knowledge in the IEA provides best available expert knowledge to understand the past, present, and future socio-ecological conditions of the region. Indigenous Peoples across North Pacific communities have relied on marine resources for food security, social cohesion, economic livelihood, and cultural continuity for millennia. Including Indigenous Knowledge in the IEA process will enhance understand of changing social-ecological conditions while offering a longitudinal perspective across generations of ecological experience and observations. Employing a co-production approach, this workshop will generate a collaborative understanding of the multiple ways of knowing, experiencing, using, and valuing the North Pacific ecosystem. The main objectives for the workshop are to 1) describe linkages and knowledge pathways among regional organizations across scale (e.g., Indigenous communities, government agencies, NGOs, research networks, academic institutions) in the NBS-CS, and 2) document meanings, relationships, processes, and values associated with the NBS-CS ecosystem using a framework rooted in Indigenous Knowledge and designed to coordinate diverse perspectives. The results of the workshop will inform the regional NBS-CS IEA process while offering an innovative model for broader knowledge synthesis and co-production. Budget Travel Elder from Chevak, Alaska, USA to Busan, Korea Estimated airfare $1,858 Per diem ($373 per day – 4 days with travel) $1,492 Invited Speaker from Washington DC, USA to Busan, Korea Estimated airfare $1,529 Per Diem ($373 per day – 4 days with travel) $1,492 Honorarium for elder for participation in workshop and other input $700_ Total $7,071		
Publication?	Yes	
SB NOTES	n/a	

PICES-2022 Workshop Submission #9		
Title		Number of Days
Anthropogenic stressors, mechanisms and potential impacts on Marine Birds, Mammals, and Sea Turtles		1
Committee	Convenors	Co-Sponsors (if applicable)
S-MBM	Miran Kim, Korea, ruddyduck318@gmail.com Patrick O'Hara,Canada, Patrick.OHara@ec.gc.ca (corresponding) Yutaka Watanuki, Japan, ywata@fish.houdai.ac.jp	
Invited Speakers		
TBD		
Description		
Anthropogenic stressors, such as climate change, plastic pollution, discharged toxins, fishery interaction, noise pollution, ship-strike, aquaculture, disturbance, and offshore wind farms impact marine birds, mammals and sea turtles, affecting their distributions and abundances. These stressors can act directly or indirectly on marine birds and mammals, and can pose a considerable challenge for marine conservation. Understanding how stressors affect marine birds and mammals is an important step in estimating and mitigating against these threats. The aim of this workshop is to improve our understanding of anthropogenic stressors, and how they affect marine birds and mammals throughout the North Pacific Ocean. One of the main outcomes of the workshop will be the development of a Pathways of Effects style heuristic or conceptual model describing how stressors act on marine birds and mammals. Workshop participants will be invited to discuss a PICES region-by-region assessment of stressor importance, and how mechanisms of impact may differ among regions.		
Publication?	Yes.	
SB NOTES	n/a	

PICES-2022 Workshop Submission #10: VIRTUAL WORKSHOP – INTER-SESSIONAL		
Title		Number of Days
S-CCME/SICCME Virtual Workshop on Integrated Climate Modeling to identify thresholds, limits, and tipping points in marine ecosystems: current progress and future needs.		1
Committee	Convenors	Co-Sponsors (if applicable)
S-CCME SG-UNDOS WG-44	Kirstin Holsman, Kirstin.holsman@noaa.gov (S-CCME co-chair, corresponding), Xiujuan Shan, shanxj@ysfri.ac.cn (S-CCME co-chair, WG36), Elliott Hazen, Elliott.hazen@noaa.gov (WG36, PICES), Kathy Mills, kmills@gmri.org (ICES SICCME chair)	ICES
Invited Speakers		
TBD, could include: M Hunsicker, mary.hunsicker@noaa.gov, Anne Hollowed (Anne.hollowed@noaa.gov), Sarah Cooley, Sarah Cooley, scooley@oceanconservancy.org		
Description		
Marine ecosystems are increasingly impacted by multiple climate change and non-climate stressors. In some systems, cumulative impacts are pushing systems towards or towards system thresholds and limits, beyond which collapse is more likely and recovery is more difficult. Climate change also increases the risk of traversing system tipping points,-- i.e., critical points where a small change in a pressure or driver can induce a disproportionate, self-reinforcing, and often irreversible large-scale changes in system dynamics. While multiple studies point to the potential for cascading changes associated with tipping points and thresholds in marine systems, few documented examples exist outside of physical or cryosphere tipping points (e.g., loss of sea ice). The goal of this workshop is to draw upon recent PICES working group efforts to apply new methods for tipping point and threshold analyses to findings and outputs from recent integrated modeling projects across the ICES/PICES Strategic Initiative on Climate Change Effects on Marine Ecosystems. In particular, the workshop will synthesize evidence and case studies for historical and future tipping points and thresholds in marine ecosystems and help inform regional management advice around climate change risk, adaptation and mitigation.		
Publication?	Yes.	
SB NOTES	n/a.	

PICES-2022 Workshop Submission #11		
Title		Number of Days
Science Communication Training Workshop 2022: Learn how to Share our PICES Science with the World in an engaging way (updated on 4th October)		1
Committee	Convenors	Co-Sponsors (if applicable)
HD WG-41 SG-ECOP SG-SciCom	Aoi Sugimoto, Japan, aois@affrc.go.jp (corresponding); Vera Trainer, USA, vera.l.trainer@noaa.gov Jack Barth, USA, jack.barth@oregonstate.edu Tammy Norgard, Canada, tammy.norgard@dfo-mpo.gc.ca	We would like to invite partners to help us develop skills for creating communication materials.
Invited Speakers		
Randy Olson (for creating stories), USA, randyolsonproductions@gmail.com Cherisse Du Preez (SNS communication), Canada, Cherisse.DuPreez@dfo-mpo.gc.ca ALRAS SNS Expert (https://www.alrasdigital.com/sms-mobile-messaging)		
Description		
Ocean scientists, including PICES members, usually do amazing science, and often feel that their results speak for themselves. But, they are not always very good at communicating about their work in a way that is compelling and interesting for all audiences. This workshop is the first in a series organized by the Science Communications Expert Group. Participants will become familiar with the proven ABT (And, But, Therefore) method of communicating science, and skills needed to broaden our scientific, and social impact through social networking services (SNS) as one of the most popular methods for science communication all over the world. This first session of a series of workshops will provide participants with 1) general introduction highlighting important communication skills for ocean scientists, 2) tools for communicating the written word through the ABT method, and 3) online communication skills using SNS. During the first part of the workshop, participants will learn theories and concrete techniques related to the above three elements, and during the second part, will be given an opportunity of “on the job” practice: actually to create, share the communication outputs and receive a critique of their work. Stories will be shared with the broader community through various online channels such as PICES Twitter and Website, as real outputs of this workshop. NOTE: We are expecting 2 invited speakers from North America, with estimated cost of $6,000 if both will be presenting offline. However we will try to encourage remote participation, given the uncertainty of Covid-19 restrictions as well as the budget consideration. It should be also considered that some professional communication company (such as Randy Olson) could cost for providing with the training (around $5,000, for one instance)		
Publication?	Yes	
SB NOTES	n/a.	

PICES-2022 Workshop Submission #12		
Title		Number of Days
The Expansion of Harmful Algal Blooms (HABs) from lower to higher latitudes		1
Committee	Convenors	Co-Sponsors (if applicable)
S-HAB	Natsuko Nakayama, Japan (nnakayama@affrc.go.jp)(corresponding convenor), Yoichi Miyake, Japan (miyakey1@affrc.go.jp), Mark L. Wells, USA (mlwells@maine.edu)	GlobalHAB, IOC UNESCO, ICES WGHABD, NOWPAP, ISSHA
Invited Speakers		
Potential Invited Speakers: Masafumi Natsuike (Japan), Don Anderson (USA and ICES WGHABD representative), Vera Trainer, Kathi Lefebvre (USA), Charles Trick (Canada), plus an early career scientist from a PICES nation.		
Description		
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.		
Publication?	Yes.	
SB NOTES	n/a.	

PICES-2022 Workshop Submission #13		
Title		Number of Days
Openly Discoverable, Accessible, and Reusable Data and Information in the U.N. Decade		1
Committee	Convenors	Co-Sponsors (if applicable)
SB TCODE WG-35	Jeanette Gann, USA,jeanette.gann@noaa.gov (corresponding); Hernan Garcia, USA, Hernan.Garcia@noaa.gov;Brett Johnson(ECOP), Canada, brett.johnson@hakai.org; Wan Fangfang, China, fangfww15@sina.cn	
Invited Speakers		
Description		
Ocean data in all forms contribute to understanding and informing management and sustainability of the world's oceans and its ecosystems. Open sharing of that data and information across international boundaries remains a formidable challenge. The overarching motto of the U.N. Decade of Ocean Science is 'the science we need for the ocean we want'. To obtain this, we need to share data openly across all regions, continents, and countries. There are many efforts at regional, national, and international levels working towards this goal. As the international community works towards this goal, it is unclear where redundant efforts may be occurring. For example, there are many organizations working towards the same goal of data sharing under the 'transparent and accessible ocean' theme for the U.N. Decade (examples listed at the end of this proposal). PICES is in a unique position to engage scientists and data managers from countries around the north Pacific to help facilitate open data sharing. In addition, some institutions may have data to share that don't have ready access to usable data-sharing platforms. TCODE could facilitate a conversation about open data sharing and promote the connection of new data suppliers with known public data repositories. Inviting a wide range of participants, we will share histories, successes, and challenges of open data. This workshop will guide TCODE to an actionable role in facilitating data sharing between PICES member nations for the U.N. Ocean Decade. We will discuss potential areas of redundancy and identify entities that could be approached by TCODE for inclusion in broader data-sharing platforms. TCODE will identify suitable points of contact and summarize the national data archival strategies and data sharing policies for each member nation and expand upon this during the workshop. TCODE seeks to develop a set of recommendations for further discussion and action. Objectives: The specific objectives of the workshop are to: 1) Assess the potential for a new study group to recommend improvement strategies on data sharing between member nations, including creating a framework for data sharing for the future and open data sharing among PICES countries 2) Develop a recommended list of available data as well as repositories for open access to data. 3) Develop recommendations for updated TCODE data policy to include more specific information on data sharing. 4) Investigate barriers to open data sharing and exchange		
Publication?	No.	
SB NOTES	*Convenors requested to collaborate with SMARTNET and ECOP workshops.*	

APPENDIX D: PICES-2022 Proposed SESSIONS

[Please note: Duplicate submissions have been removed, keeping the most current submission. Because of this, submission numbers may appear to be missing. Workshops will be re-numbered for scheduling, but are left as-is here to ensure agreement with the PICES-2022 submission database.]

PICES-2022 Session Submission #2		
Title		Number of Days
Marine Ecosystem Services – Connecting Science to Decision Making		½ day
Committee	Convenors	Co-Sponsors (if applicable)
WG-41 WG-42	Sarah Dudas, Canada, Sarah.Dudas@dfo-mpo.gc.ca (corresponding) Jingmei Liu, China, jingmeili66@163.com	
Invited Speakers		
Description		
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.		
Publication?	None listed.	
SB NOTES	n/a.	

PICES-2022 Session Submission #3		
Title		Number of Days
Realizing scalable artificial intelligence in marine science		1
Committee	Convenors	Co-Sponsors (if applicable)
POC, TCODE, FUTURE	Di Wan, Canada, Di.Wan@dfo-mpo.gc.ca (corresponding) Igor Shevchenko, Russia, igor.shevchenko@tinro-center.ru Hernan Eduardo Garcia, USA, Hernan.Garcia@noaa.gov	
Invited Speakers		
Description		
Exploratory projects in applications of artificial intelligence (AI) to marine science issues have been advancing rapidly in recent years, and these projects so far have been limited in scope and not been made scalable. This session brings together the scientists, developers, and leaders who are interested in advancing scalable AI applications. We will discuss the knowledge gaps, priorities, infrastructure requirements, feasibilities in realizing scalable AI in marine science. More importantly, we will welcome innovative, future oriented and actionable solutions. We invite a wide range of submissions, including but not limited to real-time and delayed-mode QC and anomaly detection using AI and data infrastructure that allows scalable operations. Other information: 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.		
Publication?	None listed.	
SB NOTES	SB requests that Convenors explore combining this with proposed Machine Learning session, or collaborating with that session.	

PICES-2022 Session Submission #4		
Title		Number of Days
Application and best practice of imaging technologies for plankton and ecosystem monitoring		1
Committee	Convenors	Co-Sponsors (if applicable)
WG-48, BIO	Hongsheng Bi, U.S.A., hbi@umces.edu David G. Kimmel, U.S.A., david.kimmel@noaa.gov Julie Keister, U.S.A., jkeister@uw.edu Akash Sastri, Canada, akash.sastri@dfo-mpo.gc.ca	
Invited Speakers		
Description		
Traditional plankton monitoring programs often involve field sampling and sample processing techniques that are high cost, time consuming, and labor intensive. These limitations restrict the potential to use planktonic communities as indicators of environmental change. However, recent developments in plankton imaging systems and machine algorithms provide a unique opportunity to move plankton monitoring programs from net-based techniques to either fully imaging-based or a hybrid of net-based and imaging-based plankton monitoring approaches. It is important to understand the strength and limitations of imaging systems and a need to develop broadly applicable taxonomic identification algorithms. This session focuses on plankton imaging systems and image processing methods. Our session seeks contributions that provide examples of imaging systems are applied to plankton monitoring and discuss how captured images are processed using automated recognition and enumeration methods. Our goal is to share state-of-the-art science that serves to facilitate the deployment and use of imaging systems for plankton monitoring worldwide.		
Publication?	Yes.	
SB NOTES	n/a	

PICES-2022 Session Submission #5		
Title		Number of Days
Environmental variability and small pelagic fishes in the North Pacific: exploring mechanistic and pragmatic methods for integrating ecosystem considerations into assessment and management		1
Committee	Convenors	Co-Sponsors (if applicable)
FIS WG-43	Toshihide Kitakado (Japan), Bai Li (USA), Vladimir Kulik (Russia), Chris Rooper (Canada) Corresponding convenor: Chris Rooper (Canada)	North Pacific Fisheries Commission, possibly ICES (linked to PICES-ICES WG 47)
Invited Speakers		
Description		
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.		
Publication?	None listed.	
SB NOTES	n/a.	

PICES-2022 Session Submission #6 – CONDITIONALLY RECOMMENDED – SEE CONDITION BELOW.		
Title		Number of Days
Using eDNA to assess and manage Non-indigenous species in the North Pacific=		1
Committee	Convenors	Co-Sponsors (if applicable)
MEQ FUTURE-SSC AP-NIS	Thomas Therriault (Canada); Keun-Hyung Choi (Korea); Satoshi Nagai (Japan)	NOWPAP
Invited Speakers		
Description		
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.		
Publication?	None listed.	
SB NOTES	*Science Board notes that this looks very similar to the 2020 Session (S13) on eDNA.* ***The Recommendation for this session is conditional upon there being new information and novel presentations to advance the science beyond that which was presented in 2020.***	

PICES-2022 Session Submission #7		
Title		Number of Days
Forecasting and projecting climate variability and change on northern hemisphere marine ecosystems using coupled next generation biophysical models.		1
Committee	Convenors	Co-Sponsors (if applicable)
S-CCME SG-UNDOS WG-44	Kirstin Holsman, kirstin.holsman@noaa.gov (corresponding);Xiujuan Shan, shanxj@ysfri.ac.cn, Sukyung Kang, sukyungkang@korea.kr, Shin-ichi Ito, goito@aori.u-tokyo.ac.jp, Kathy Mills, kmills@gmri.org	ICES
Invited Speakers		
potential: Dr. S. Lan Smith; lanimal@jamstec.go.jp, Mike Jacox, michael.jacox@noaa.gov, or Kelly Kearney michael.jacox@noaa.gov		
Description		
The completion of the Intergovernmental Panel on Climate Change Sixth Assessment Reports in 2021 and 2022 provides a global update on past, current and future implications of climate change on marine ecosystems. In preparation for, and in response to, these global assessments of climate impacts and adaptation, scientists throughout the northern hemisphere have utilized coupled models to assess the implications of changing climate on marine ecosystems and fishery-dependent communities. This session seeks contributions on innovative new methods for ocean model simulations, improvements in seasonal to decadal forecasting skill, biogeochemical model enhancements, impacts and risk assessments, and evaluations of fishery adaptation strategies to short-term and long-term climate change within contrasting ocean management systems. The session will provide a forum for the exchange of emerging science, advanced methods and synthesis of climate change impacts and adaptation approaches throughout the northern hemisphere.		
Publication?	None listed.	
SB NOTES	n/a.	

PICES-2022 Session Submission #8		
Title		Number of Days
Recognizing the importance of zooplankton to fisheries research		1
Committee	Convenors	Co-Sponsors (if applicable)
WG-37	Karyn Suchy, Canada, ksuchy@eoas.ubc.ca (corresponding); Hui Liu, USA, liuh@tamug.edu; Lidia Yebra, Spain, lidia.yebra@ieo.es; Toru Kobari, Japan, kobari@fish.kagoshima-u.ac.jp	
Invited Speakers		
Potential invited speaker: Jennifer Boldt, Canada, Jennifer.Boldt@dfo-mpo.gc.ca		
Description		
Zooplankton play a key role in the transfer of energy from primary producers to higher trophic levels and are thus highly relevant to fisheries dynamics and to the overall function of ocean ecosystems. Despite their key role, routine estimates of zooplankton production remain rare, resulting in a knowledge gap with respect to how variations in zooplankton may impact the growth and survival of larval and juvenile fishes. Further, the current development of ecosystem based management of fisheries may benefit from the incorporation of zooplankton data. Built upon the recent effort of PICES WG37, the main goal of this session is to bring diverse researchers together on topics ranging from zooplankton to fisheries management in order to better understand the knowledge gap of the critical link between secondary producers and fisheries dynamics in light of climate change. Studies linking zooplankton productivity to fish larvae and recruitment dynamics are especially encouraged. Contributions from experimental, observational, and modeling approaches are welcomed.		
Publication?	None listed.	
SB NOTES	n/a.	

PICES-2022 Session Submission #9		
Title		Number of Days
The effects of ocean acidification and climate change stressors on the ecophysiology and toxicity of harmful algal species		½
Committee	Convenors	Co-Sponsors (if applicable)
S-HAB	William Cochlan (corresponding, USA), cochlan@sfsu.edu; Pengbin Wang (China), algae@sio.org.cn; Mark L. Wells (USA), mlwells@maine.edu	GlobalHAB, IOC UNESCO, ICES WGHABD, ISSHA
Invited Speakers		
Dedmer B Van de Waal (Netherlands/GOA-ON Representative)		
Description		
The responses of Harmful Algal Bloom (HAB) species to climate-change induced environmental factors (stressors) is largely unknown. This is particularly true for phytoplankton responses to ocean acidification and the concomitant changes in temperature, vertical stability and light availability, and biologically available chemical species. The primary environmental stressor – the decline in pH resulting from increased partial pressure of CO2 (pCO2) in surface waters – 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, including both diatoms (Pseudo-nitzschia spp.), and dinoflagellates (Alexandrium spp.), and alter the swimming abilities of others, such as the fish-killing raphidophyte Heterosigma akashiwo, as well as other physiological responses such as rates of photosynthesis and nutrient uptake - all of which have the potential to substantially influence 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 how climate change affects HAB species, in particular the understudied consequences of ocean acidification on the cellular physiology and toxin production of HAB species in both laboratory and field-based studies.		
Publication?	None listed.	
SB NOTES	n/a.	

PICES-2022 Session Submission #10 – CONDITIONALLY RECOMMENDED – SEE CONDITION BELOW.		
Title		Number of Days
Machine Learning for the North Pacific Environment		Unknown
Committee	Convenors	Co-Sponsors (if applicable)
	Thomas Y. Chen, USA, thomaschen7@acm.org (corresponding)	
Invited Speakers		
potential: Jonathan Bamber, UK, j.bamber@bristol.ac.uk; Lauren Bertino, Norway, laurent.bertino@nersc.no; Igor Zakharov, Canada, igor.zakharov@c-core.ca; Robert Grumbine, USA, Robert.Grumbine@noaa.gov		
Description		
Harnessing machine learning in the Northern Pacific will become an increasingly important tool to monitor and understand ecosystems and ecology in the future. Approaches ranging from linear regression to neural networks and computer vision have emerged recently as assets for tracking trends in biodiversity, the remote sensing of the physical ocean, and expanding knowledge on the impact of climate change on the marine environment and the cryosphere. In this session, we welcome any and all contributions relating to the intersection between the Northern Pacific and machine learning, including techniques involving classification, clustering, dimensionality reduction, ensemble methods, gradient-boosting algorithms, neural networks, etc. We particularly emphasize the importance of real-world deployment for AI solutions. We seek to highlight the contributions of early-career scientists who are setting paradigms at this exciting nexus of research.		
Publication?	Yes.	
SB NOTES		

APPENDIX E: Capacity Building

AP-NPCOOS Virtual Summer School, August 15-19, 2022 (TBC)

At the AP-NPCOOS Business Meeting in 2020, AP-NPCOOS requested that PICES defer funds set aside from the cancelled 2020 Spring School in Yokohama, Japan, to support the hosting of the Virtual Summer School by Ocean Networks Canada. Since that time, there have been three developments that have us on track to make the Ocean Big Data Virtual Summer School a reality:

1. A PICES Governing Council decision 2021/S/4 approved deferral of financial support (CND$15,000) for the 2020 Spring School to the 2022 Virtual Summer School, to cover "some support staff costs" but not lecture staff. Quotations from September 2, 2021 email from Sonia Batten.
2. At the 2021 AP-NPCOOS Business Meeting on Oct5/6, members agreed to offer datasets, and volunteered to prepare related, pre-recorded lectures and to contribute to real-time, online tutorials with summer school participants.
3. The Ocean Networks Canada Executive met yesterday and agreed to contribute in-kind staff support and server capacity for the August 2022 Ocean Big Data Summer School, provided that PICES contribute CND$15,000, in partial support of the salary for an additional staff member who would be hired as a Virtual Summer School Coordinator.

Additional details:

- **Contributed Data Sets** – AP-NPCOOS members from Japan, Korea, Russia, Canada and the USA offered large multivariate datasets from the North Pacific, for the summer school and would contribute pre-recorded lectures that would explain the context of the datasets and identify goals for their analysis and interpretation. Some countries offered more than one large dataset, and final choices will be made as planning progresses.
    - Japan – a 40-year times series from a North-South oceanographic transect along the 137E longitude line from the Japan to the equator. (Naoki Yoshie to lead)
    - Canada – a similar time series, but along the East-West trending Line P, from the Juan de Fuca Strait to Ocean Station Papa. (Charles Hannah to lead)
    - Korea – time-series CODAR data from Korean waters. (Sung-Yong Kim to lead).
    - Canada – time-series CODAR data from the Strait of Georgia. (Sung-Yong Kim to lead).
    - Korea – Long-term dataset from a mooring in the East China Sea (Sung-Yong Kim or Jae-Hak Lee to lead).
    - Russia –multi-year, multi-variable datasets from west-east oceanographic transects in the Sea of Japan. (Vyacheslav Lobanov to lead).
    - Russia – depending on obtaining permissions, a multi-year, multi-variable dataset from a mooring in the Sea of Japan. (Vyacheslav Lobanov to lead).
    - USA – time-series, multi-variate glider datasets from the east-west glider lines off Oregon (Jack Barth to lead).
- **ONC in-kind contributions** – Ocean Networks Canada will contribute staff time from the Systems, Data, Science, Communications, and Learning and Engagement teams to prepare the Virtual Summer School. ONC will also contribute server capacity to provide summer school participants with Virtual Machine access to the data sets, lectures and other teaching materials.
- **Coordinator Position** - With partial support from PICES ($15,000), ONC will hire a Virtual Summer School Coordinator for a 6-month contract, beginning in March 2022. This person will be the single point of contact for summer school applicants and participants, and will coordinate the contributions of AP-NPCOOS members and ONC staff.
- **Number of Participants** – Based on ONC's experience hosting the virtual component of the 2018 PICES Summer School, we expect to be able to accommodate up to 30 participants in the Virtual Summer School. As planning proceeds, we will explore the possibility of hosting a larger group, in the event of a large number of suitable applicants.
- **Announcements** – if SB agrees, I will prepare a slide with a preliminary announcement that could be shared during the Science Board symposium. The announcement would include provision dates for the Virtual Summer School, likely August 15-19, 2022.

Request: SB to confirm that PICES will contribute the $15,000 that has been deferred from the 2020 Spring School, to partially support the salary of the Virtual Summer School Coordinator?

APPENDIX F: PICES Partner materials:

- **ICES (None supplied)**
- **PICES Science Board Briefing on BECI PROGRAM**
- **SCOR (None supplied)**
- **NPFC Report on the joint NPFC-PICES activities in 2020-2021**
- **IMBeR (None supplied)**
- **IHPC (None supplied)**

PICES Science Board Briefing on BECI PROGRAM

- **Presenter:** Mark Saunders. North Pacific Anadromous Fish Commission (NPAFC). Director of the International Year of the Salmon, North Pacific
- **Date:** October 11, 2021.
- **Objective:** Brief the PICES Science Board on the Basin Events to Coastal Impacts (BECI) Project and raise considerations regarding PICES involvement.

Changing climate and anomalous events, such as marine heat waves, are progressively exposing ecosystems of the North Pacific Ocean (NPO) to conditions outside past norms. For socially and economically important and iconic species like salmon and Pacific saury, critical research at the scale of whole basins and an understanding of the complete ecosystem/food web is urgent. Marine heatwaves in recent years (2014–2020) have imposed temperature extremes greater than El Niño phenomena which have represented past extremes. During 2019 and 2020, the Pacific saury fishery of the western NPO declined to record lows. In 2020 alone, the total catch of Pacific salmon across the NPO crashed by 40%. While billions of dollars have been invested in conservation and restoration efforts, there continues to be insufficient investment to fully understand the impacts of climate change on the ocean, which is a crucial habitat for many fishery resources that Indigenous Peoples and coastal communities depend on. Further, we lack the institutional capacity required to study large marine ecosystems and provide timely information and advice to decision-makers. To avoid blindly reacting to change in an increasingly volatile environment, we must invest in developing an integrated and intelligence-based approach to rapidly understand and adapt our management regimes to changes occurring in climate, oceans, and fishery resources across basins.

In response to this challenge the NPAFC and PICES submitted a concept proposal for a program called BECI (Basin-scale Events to Coastal Impacts) to the UN Decade of Ocean Science for Sustainable Development in early 2021, with the aim of developing a new ocean intelligence system over of the period of the Ocean Decade (2021–2030). The system will provide integrated data derived from satellite, ship-based operations, moorings, floats and uncrewed autonomous vessels driving analyses and models to inform a spectrum of management decisions: from regional high-seas international treaty-based organizations to the managers of localized subsistence fisheries.

Specific outcomes include:

- A sustainable international ocean monitoring program of the epipelagic ecosystems of the North Pacific Ocean
- An international analytical/modelling framework to synthesize current and future states of open ocean and coastal ecosystems
- Regional governance arrangements including Indigenous Peoples and local communities (IPLCs) that inform management/decision-making bodies (domestic and international)
- Baseline data for the BBNJ process and impacts of future ocean resource extraction — mining and harvest of lower trophic levels
- A socio-ecological graph database that facilitates the rapid connection of ocean-related knowledge holders and decision-makers with information about events, people, activities, ideas and data.

A guiding principle of the BECI project is that generational, gender and geographic diversity is reflected in all elements of the ocean intelligence system. In particular it is important that early career scientists contribute to the project to ensure that changes are implemented and endure. An additional principle is to ensure that Indigenous knowledge and Western science

are utilized together to inform resulting management systems.

A project of BECI's scale and scope cannot be accomplished by a single agency or country. Using the proof-of-concept developed for Pacific salmon (Salish Sea and the planned 2022 basin-wide multinational survey), a consortium formed of intergovernmental organizations, NGOs, academic, Indigenous, and private sector partners will fund and direct the project. The PICES Science Board is asked to consider supporting the continued development of BECI. While the project will cover the period of the ocean decade resources are being sought for an initial one year project worth approximately USD $1.2M to plan and assemble the consortium of partners. The full plan would be submitted in one-years time. Engagement of PICES scientists, Committees and Programs will contribute to the success of this transformational project.

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Report on the joint NPFC-PICES activities in 2020-2021

Summary
The intent of this document is to report on the recent joint activities between PICES and NPFC and plans for future collaborative work as required by the *Framework for Enhanced Scientific Collaboration in the North Pacific*. The Framework identified three broad areas of joint interest to PICES and the NPFC: (i) support for stock assessment for priority species; (ii) vulnerable marine ecosystems; and (iii) ecosystem approach to fisheries.

In 2020-2021, NPFC and PICES representatives attended each others' meetings (2020 PICES annual meeting and NPFC's Scientific Committee meeting) and an NPFC representative took part in the PICES-ICES joint Working Group on Small Pelagic Fish (WGSPF). NPFC has made a contribution of 15,000USD to the PICES/ICES/FAO international symposium on "Small Pelagic Fish: New Frontiers in Science for Sustainable Management"

NPFC and PICES agreed to hold a joint international course/workshop on VME indicator taxa identification, with financial contribution of 15,000USD from each organization (postponed to 2022). NPFC members expressed interest in following the work of the PICES Working Group on Ecology of Seamounts (WG-47) which started in 2020.

1.0 Background

In 2019, the North Pacific Fisheries Commission (NPFC) and the North Pacific Marine Science Organization (PICES) endorsed the *NPFC–PICES Framework for Enhanced Scientific Collaboration in the North Pacific*. The Framework was developed by the joint PICES-NPFC Study Group for Scientific Cooperation in the North Pacific Ocean to enhance collaboration between the two organizations.

The Framework identified three broad areas of joint interest to PICES and the NPFC on which progress could be made over the next five years. These areas were (i) support for stock assessment for priority species; (ii) vulnerable marine ecosystems; and (iii) ecosystem approach to fisheries. The first two areas were ranked highest for both PICES and NPFC, and the third area was ranked lower.

The Framework identified various mechanisms for implementing enhanced collaboration between PICES and NPFC including workshops and joint working groups as the key ones in the near term, but also theme sessions at PICES annual meetings, representation at meetings and/or workshops, and coordination of science plans.
The NPFC and PICES are inter-governmental organizations with overlapping geographical areas and common scientific interests in the sub-Arctic regions of the North Pacific Ocean.

NPFC is a Regional Fisheries Management Organization (RFMO) which came into force on 19 July 2015 after ratification of the Convention on the Conservation and Management of the High Seas Fisheries Resources in the North Pacific Ocean. The objective of the Convention is to ensure the long-term conservation and sustainable use of the fisheries resources in the convention area while protecting the marine ecosystems of the North Pacific Ocean in which those resources occur. The fishery resources covered by the Convention are all fish, mollusks, crustaceans and other marine species caught by fishing vessels within the Convention area, excluding (i) sedentary species insofar as they are subject to the sovereign rights of coastal states, and indicator species of vulnerable marine ecosystems as listed in, or adopted pursuant to the NPFC Convention, (ii) catadromous species, (iii) marine mammals, marine reptiles, and seabirds, and (iv) other marine species already covered by pre-existing international fisheries management instruments within the area of competence of such

instruments. The Commission has several committees that provide information and advice to the Commission for decisions, and is supported by a Secretariat. These committees include the Scientific Committee, the Technical and Compliance Committee, and the Finance and Administration Committee.

PICES was established in 1992 (1) to promote and coordinate marine scientific research in order to advance scientific knowledge of the area concerned and of its living resources, including but not necessarily limited to research with respect to the ocean environment and its interactions with land and atmosphere, its role in and response to global weather and climate change, its flora, fauna and ecosystems, its uses and resources, and impacts upon it from human activities; and (2) to promote the collection and exchange of information and data related to marine scientific research in the area concerned. The Organization receives recommendations on the science program from the Science Board, which is supported by a number of permanent scientific and technical committees, along with an assemblage of "expert groups." The PICES Convention Area is defines as "the temperate and sub-Arctic region of the North Pacific Ocean and its adjacent seas, especially northward from 30 degrees North Latitude, hereinafter referred to as the "area concerned". Activities of the Organization, for scientific reasons, may extend farther southward in the North Pacific Ocean."

The present PICES members are Canada, Japan, People's Republic of China, Republic of Korea, the Russian Federation, and the United States of America, which are also members of NPFC (note: Chinese Taipei and Vanuatu are also members of NPFC).

2.0 Objective

The objective of this document is to report on the recent joint activities between PICES and NPFC and plans for future collaborative work as required by the *Framework for Enhanced Scientific Collaboration in the North Pacific*.

3.0 Joint NPFC-PICES activities in 2019-2020

3.1 Support for Stock Assessments for priority species

In 2019, PICES and ICES formed a joint Working Group on Small Pelagic Fish (WG 43, WGSPF), and NPFC designated its representatives in the WGSPF, Dr. Toshihide Kitakado and Dr. Oleg Katugin. Dr. Toshihide Kitakado attended virtual meetings of the WGSPF in 2020-2021.
The WGSPF aims to:

- Review recent progress on understanding how various drivers (environmental and/or anthropogenic) impact the population dynamics of SPF in different ecosystems and whether and how potential drivers shift with changes in ecosystem state.
- Create a networking environment for international and multidisciplinary collaboration to foster the establishment of similar study frameworks and comparative analyses of SPF across different social-ecological systems based on updated time-series data sets of climate indices, environmental factors and tipping points, fisheries biology, ecophysiological information (e.g. feeding, growth and survival), and inter-model comparisons.
- Identify, prioritize, and coordinate research most needed to advance our knowledge and capacity to predict the population dynamics of SPF at both short (seasonal to inter-annual) and long (decadal to centennial) time scales.
- Provide recommendations for strategies of marine ecosystem monitoring and fisheries management of SPF which will contribute to sustainable ecosystem-based fisheries management, through biophysical, ecosystem and/or socio-economic models.
- Organize a joint ICES/PICES symposium on SPF, tentatively scheduled for late 2021, that builds upon the 2017 symposium in Victoria, Canada, and showcases integrative analyses of this working group. Additionally, working group members will propose, coordinate, and convene topic sessions at PICES Annual Meetings and ICES Annual Science Conferences focused on key questions and recent advances in SPF science.

NPFC has made a contribution of 15,000USD to the PICES/ICES/FAO international symposium on "Small Pelagic Fish: New Frontiers in Science for Sustainable Management" which will be held on 7-11 November 2022 in Lisbon, Portugal. Dr. Toshihide Kitakado represents NPFC in the Steering Committee of the symposium.

3.2 Vulnerable Marine Ecosystems (VMEs)

In 2020, PICES established a Working Group on Ecology of Seamounts (WG-47), with a focus on understanding the distribution of benthic, demersal, and pelagic species that are associated with seamounts. The proposed 3-year Working Group will advance the understanding of the distribution of the biodiversity of seamounts in the North Pacific Ocean. This effort would build on the contributions of WG-32 on Biodiversity of Biogenic Habitats by mapping the distribution of seamount biodiversity and expands research in some of the unique and abundant ecosystems of the North Pacific Ocean for PICES. WG-32's focus on biogenic habitat provided a proof of concept on how to undertake collaborative biodiversity research in the North Pacific Ocean. Major applications of the science products developed by the Working Group on Ecology of Seamounts would be the provision of further technical guidance on the development and application of species distribution models, maps of known and predicted distributions of the benthic, demersal, and pelagic taxa associated with seamounts, and the development of seamount biodiversity indicators.

NPFC members expressed interest in following the work of the Working Group-47 on Ecology of Seamounts. Even though NPFC is not formally represented in the WG-47, some NPFC scientists are involved in its work. The Chair of the NPFC Scientific Committee co-Chairs WG-47 with a key participant of NPFC's Scientific Committee meetings who has expertise in the identification of VMEs.

NPFC and PICES agreed to hold a joint international course/workshop on VME indicator taxa identification, with financial contribution of 15,000USD from each organization. The course is aimed at capacity building and sharing knowledge on the identification of coral species in the North Pacific. It will include both theory and practice such as lectures on the taxonomy, physiology and geographical distribution of the VME indicator taxa and training on the identification of coral specimens. The course was originally scheduled for 2020 but is postponed to 2022 because of the covid-19 pandemic.

3.3 Other collaborative activities

NPFC representatives took part in the 2020 PICES annual session and attended business meetings of the Science Board, Biological Oceanography Committee, Fishery Science Committee and WG SPF.

PICES representative attended the NPFC's Scientific Committee meeting in November 2020 and gave a presentation on joint activities between the organizations.

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