

# Workshop 1: TCODE/FUTURE/HD Topic Workshop

## Creating Concise and Compelling Fact Sheets to Amplify your PICES work

### **Convenors:**

Natsuko Nakayama (Japan), *corresponding*  
Tammy Norgard (Canada)  
Vera Trainer (USA)  
Sugimoto Aoi (Japan)  
Andrea White (Canada)  
Alexandra Davis (Canada)

### **Invited Speakers:**

Julie Claussen (Fisheries Conservation Foundation, USA)  
Maggie Mooney-Seus (Alaska Fisheries Science Center, AK, USA)  
Sayaka Sogawa (FRA, Japan)

Fact sheets, which are similar to Pamphlets, are an effective communication tool that can be used to describe the accomplishments and future plans of PICES Expert Groups in a clear and concise format. Preparation of these would provide an excellent opportunity to deliver an outstanding first impression, educate community members and target audiences and increase organizational recognition about the value and relevance of scientific work being conducted under PICES. Moreover, creating fact sheets will challenge PICES scientists to analyze the goals and objectives of their Expert Groups, and to efficiently describe their achievements concisely and clearly. With informative fact sheets, the interest in PICES Expert Groups will be aroused and end users will understand the key ideas and achievements of the Expert Groups, providing opportunities to promote and celebrate the science being conducted by PICES. It will also provide a simple way to communicate PICES science to potential collaborators and aid them in identifying with which Expert Groups they are most closely aligned, while at the same time sparking interest and encouraging them to ask for more information.

The proposed workshop builds upon the 2-day Science Communications workshop at PICES 2022 that had the primary goal of developing videos that describe the accomplishments, needs, and future plans of PICES Expert Groups. An expert writing coach and a visual layout expert will provide instruction to PICES members on:

Strategic design of unique fact sheets

Creating compelling headlines to highlight the value of your PICES work

Honing your result statements to a few key short bullet-points

Including and selecting testimonials about your work

Leverage visual information design and aesthetics to attract audiences, clarify the value of your work; spread your message, provide recommendations that can help decision-makers make informed decisions about our marine ecosystems

Communicate effectively to an international audience.

Participants will work together to develop summaries of PICES Expert Group work, highlighting primary accomplishments and their importance, without overwhelming the reader. Attention will be given to using appropriate language that is understandable and appealing to all participating PICES countries. In addition, the workshop provides an opportunity for participants to build their science communication skillset which they can take to their own work outside of PICES, thereby advancing the promotion of ocean science more broadly. These skills will be an asset to all participants.

The goal will be for completed/approved fact sheets to be posted on the PICES website.

**Friday, October 20, 2023 (9:00-4:30)**

<b>9:00</b>	<b>Convenors</b> Introductions and summary of workshop objectives
<b>9:30</b>	<b>Julie Claussen (Invited speaker)</b> Messaging for impact: How to design a Science Story
<b>10:30</b>	<i>Coffee Break</i>
<b>10:50</b>	Questions, discussions and start to work first draft of the text
<b>12:00</b>	<i>Lunch Break</i>
<b>1:45</b>	<b>Maggie Mooney-Sues (Invited speaker)</b> How to engage your audience with visual factsheets
<b>2:50</b>	<b>Sayaka Sogawa (Invited speaker)</b> From research to fact sheet: a case study of how to turn your research into a fact sheet
<b>3:20</b>	<i>Coffee Break</i>
<b>3:40</b>	Work on Fact Sheets with assistance from invited speakers

**Saturday, October 21, 2023 (9:00-12:30)**

<b>9:00</b>	Factsheet feedback session
<b>10:30</b>	<i>Coffee Break</i>
<b>10:50</b>	Final changes on fact sheets based on feedback
<b>12:00</b>	Final presentation of finished fact sheets

# Workshop 2: TCODE/FUTURE/HD Topic Workshop

## Sharing Capacity and Promoting Solutions for Marine Ecosystem Sustainability within the UN Decade of Ocean Science

**Co-sponsor:**  
ICES

**Convenors:**  
Steven Bograd (USA), *corresponding*  
Kirstin Holsman (USA)  
Hannah Lachance (USA)  
AP-SciCom, AP-ECOP members from western Pacific TBA

**Invited Speakers:**  
Hakase Hayashida (Application Laboratory, JAMSTEC, Japan)  
Khush Jhugroo (Hakai Institute, Canada)

The UN Decade of Ocean Science for Sustainable Development (UNDOS; 2021-2030) addresses challenges associated with ecosystem health, food security, and climate change through international Programmes, Projects and Activities. PICES, in partnership with ICES, leads the UNDOS-endorsed Programme called ‘Sustainability of Marine Ecosystems Through Global Knowledge Networks’ (SmartNet), which aims to leverage ICES and PICES infrastructure and long-term collaborations to advance global marine ecosystem research and sustainability. Related UNDOS-endorsed Programmes include SUPREME (advance ocean forecasts and projections to guide climate-informed resource management); FishSCORE (sustain fisheries, protect ocean ecosystems, and enhance equitable benefits); Marine Life 2030 (coordination to deliver actionable knowledge of ocean life and ecosystem restoration); and ECOP (empower early career ocean professionals and incorporate new thinking into ocean sustainability and stewardship). We propose a workshop to share knowledge and capacity amongst UNDOS programs, to establish collaborative networks to advance UNDOS goals, and to co-design transformative actions.

**Potential Outcome:** A ‘Food-for-Thought’ paper describing the capacities and key gaps of UNDOS activities around the climate-fisheries nexus, and recommendations for priorities of future UNDOS activities [follow-up from ECCWO-5 Workshop].

**Saturday, October 21, 2023 (9:00-5:30)**

<b>9:00</b>	<b>Convenors &amp; Participants</b> Introductions
	Ocean Decade Review and Updates
<b>9:10</b>	<ul style="list-style-type: none"><li>• Brief Decade introduction</li><li>• UNDOS Programme Introductions</li><li>• Review of ECCWO-5 workshop</li><li>• Workshop structure and goals</li></ul>
<b>9:50</b>	<b>Hakase <u>Hayashida</u> (<i>Invited speaker</i>)</b> Operational climate and ocean forecasting at the Application Laboratory, JAMSTEC
<b>10:10</b>	<b>Matthew <u>Savoca</u></b> Introduction to Global Plastic Ingestion Bioindicators Project
<b>10:30</b>	<i>Coffee Break</i>
<b>10:50</b>	<b>Kirstin <u>Holsman</u></b> Preview of Workshop 10: Toward climate-informed ecosystem-based fisheries management by building international collaborations and standardizing indicators
<b>11:05</b>	<b>Wonho <u>Yih</u></b> UNDOS Implementation Research Group: a new born program of Korea MOF for international cooperation
<b>11:20</b>	<b>Khush <u>Jhugroo</u> (<i>Invited Speaker</i>)</b> Ocean sustainability through collaboration: SmartNet, SIDS and Early Career Ocean Professionals perspectives
<b>11:45</b>	Discussion of breakout group themes and goals. For example: <ul style="list-style-type: none"><li>• Inventory of Decade-endorsed climate-fisheries activities (manuscript preparation)</li><li>• Capacity sharing and community engagement (e.g. ECOPs, SIDS, indigenous communities)</li><li>• Climate-informed management opportunities (e.g. marine spatial planning)</li></ul>
<b>11:50</b>	Breakout Groups on 2-3 themes
<b>12:30</b>	<i>Lunch Break</i>
<b>2:00</b>	Breakout Groups on 2-3 themes
<b>2:40</b>	Reconvene in <i>W2 Plenary</i> for Breakout Group reports and discussion
<b>3:20</b>	<i>Coffee Break</i>
<b>3:40</b>	<b>Rebecca <u>Martone</u></b> Review of Workshop 9: Indigenous and community-led approaches to support climate change adaptation and ecosystem resilience in the North Pacific and Arctic
<b>4:00</b>	Planning next steps & network development

# Workshop 3: TCODE/MEQ Topic Workshop

## GlobalHAB International Workshop on Solutions to Control HABs in Marine and Estuarine Waters

### Co-sponsors:

GlobalHAB  
NOWPAP  
SCOR

### Convenors:

Vera Trainer (USA), corresponding  
Quay Dortch (USA)  
Marc Suddleson (USA)  
Pengbin Wang (China)  
Natsuko Nakayama (Japan)  
Don Anderson (USA)  
Mark Wells (USA)  
Heather Raymond (USA)  
Hae Jin Jeong (Korea)  
H. Dail Laughinghouse (USA)

### Invited Speakers:

Nobuharu Inaba (Chemicals Evaluation and Research Institute, Japan)  
Jorge Mardones (Center for Harmful Algal Studies, Instituto de Fomento Pesquero, Chile)  
Tae Gyu Park (National Institute of Fisheries Science (NIFS), Korea)  
Kathryn Coyne (University of Delaware, USA)  
Heather Raymond (College of Food Agricultural and Environmental Sciences, Ohio State University, USA)  
Zhiming Yu (Key Laboratory of Marine Ecology & Environmental Sciences, Institute of Oceanology, Chinese Academy of Sciences (IOCAS), China)

Harmful algal blooms (HABs) are a ubiquitous problem that affect marine and estuarine waters around the world. Advances in our understanding of bloom dynamics, improved HAB detection, and increased monitoring in many regions have enabled explorations of promising approaches to prevent and mitigate coastal blooms at multiple geographical scales. However, only a few approaches are available and most have not been fully tested for cost effectiveness and unintended environmental impacts. Therefore, effective and scalable marine and estuarine HAB control remains an elusive goal for many global regions. For example, spraying clay from ships has been used as a physical mechanism to control active *Margalefidinium* (*Cochlodinium*) blooms in Korea, as well as *Phaeocystis*, *Aureococcus* and other HAB species in China, and the use of naturally occurring bacteria or their exudates is being explored as a biological/chemical method to control raphidophyte blooms and some dinoflagellates in the United States. Some other examples of control include the use of oxidizing agents such as peroxide, percarbonate, ozone, and UV irradiation, as well as direct biomass removal, water column mixing, native seagrass or macroalgal planting, barley straw application, and direct application of algacides, mostly in smaller-scale freshwater systems.

The societal desire to have access to a greater variety of safe and effective bloom control options has become more urgent given the continued development of coastal regions for aquaculture, tourism, and other uses that are impacted by HABs. An international workshop to explore approaches to HAB control in marine and estuarine waters will stimulate an international dialogue, foster in situ experimentation, and support assessments of social, economic and environmental costs and benefits of various approaches. A discussion of different strategies for navigating environmental compliance will highlight the processes used in different countries to overcome the complexities of rules and regulations and may highlight ways that national regulatory policies could be adjusted to quicken the pace of developing safe and effective HAB control approaches.

The workshop will specifically focus on HAB control mechanisms that have been tested in the field, and not prevention or mitigation. The following definitions are provided for clarification. Control efforts focus on the organisms themselves, either killing them or removing cells and/or toxins from the water. An

example is the use of clay spray to control fish-killing HABs. Prevention approaches focus on stopping blooms from occurring or minimizing and limiting their extent. An example is reducing nutrient inputs to water bodies to reduce HAB growth. Mitigation focuses on relieving the impacts of blooms. Examples of mitigation are the use of phytoplankton monitoring and forecasts to provide early warning of HABs. Early warning allows multiple actions to minimize the impacts, such as closure of shellfish harvesting before they become too toxic for human consumption or identifying whether red tide conditions are expected to be present on particular beaches.

The international workshop will engage participants with expertise in research, development, and implementation of promising estuarine and marine HAB control approaches. We encourage the participation of early career ocean professionals and scientists from under-represented communities. Participants will discuss technical, environmental compliance and public perception challenges and explore solutions to these common barriers. In depth discussions of existing control methods and strategies used in different regions/countries will be fostered. The workshop findings will summarize the worldwide approaches in HAB control as a scientific report or as a collection of papers in a special issue of Harmful Algae.

However, only a few approaches are available and therefore effective and scalable marine and estuarine HAB control remains an elusive goal for many global regions. For example, spraying of clay from ships has been used as a physical mechanism to control active *Margalefidinium* (*Cochlodinium*) blooms in Korea, as well as *Phaeocystis*, *Aureococcus* and other HAB species in China, and the use of naturally-occurring bacteria or their exudates is being explored as a chemical method to control raphidophyte blooms and some dinoflagellates. Some other examples of control include the use of oxidizing agents such as peroxide, percarbonate, ozone, and UV irradiation, as well as direct biomass removal, water column mixing, native seagrass or macroalgal planting, barley straw application, direct application of algicides.

The societal desire to have access to a greater variety of safe and effective bloom control options has become more urgent given the continued development of coastal regions for aquaculture, tourism, and other uses that are impacted by HABs. An international workshop to explore approaches to HAB control in marine and estuarine waters will stimulate an international dialogue, foster in situ experimentation, and support assessments of social, economic and environmental costs and benefits of various approaches. A discussion of different strategies for navigating environmental compliance will highlight the processes used in different countries to overcome the complexities of rules and regulations and may highlight ways that national regulatory policies could be adjusted to quicken the pace of developing safe and effective HAB control approaches.

The workshop will specifically focus on HAB control mechanisms, and not prevention or mitigation. The following definitions are provided for clarification. Control efforts focus on the organisms themselves, either killing them or removing cells and/or toxins from the water. An example is the use of clay spray to control fish-killing HABs. Prevention approaches focus on stopping blooms from occurring or minimizing and limiting their extent. An example is reducing nutrient inputs to water bodies to reduce HAB growth. Mitigation focuses on relieving the impacts of blooms without direct action on HAB cells and their toxins. An example of mitigation is the use of phytoplankton monitoring to provide early warning of HABs. Early warning allows multiple actions to minimize the impacts, such as closure of shellfish harvesting before they become too toxic for human consumption.

The international workshop will engage participants with expertise in research, development, and implementation of promising estuarine and marine HAB control approaches. We encourage the participation of early career ocean professionals and scientists from under-represented communities. Participants will discuss technical, environmental compliance and public perception challenges and

explore solutions to these common barriers. In depth discussions of existing control methods and strategies used in different regions/countries will be fostered. The workshop findings will summarize the worldwide approaches in HAB control as a scientific report or as a collection of papers in a special issue of Harmful Algae.

**Saturday, October 21, 2023 (9:00-6:00)**

<b>9:00</b>	<b>Marc Suddleson &amp; Vera Trainer</b> Introductions, welcome and goals for workshop
<b>9:20</b>	<b>Don Anderson</b> “Turning back the harmful red tide” revisited
<b>9:30</b>	<b>Heather Raymond &amp; Dail Laughinghouse (Invited Speaker)</b> Lessons learned from freshwater harmful algal bloom mitigation and control strategies
<b>10:00</b>	<b>Tai-Gyu Park (Invited Speaker)</b> Control of <i>Margalefidinium polykrikoides</i> blooms using clay dispersal in Korea
<b>10:30</b>	<i>Coffee Break</i>
<b>11:00</b>	<b>Jorge Mardones (Invited Speaker)</b> Mitigation of harmful algal blooms by the Chilean salmon industry revisited
<b>11:30</b>	<b>Nobuharu Inaba (Invited Speaker)</b> Enhancing the supply capability of growth-limiting bacteria against HAB species through artificially introduced macroalgal beds
<b>12:00</b>	<b>Natsuko Nakayama</b> Enhancing the supply capability of growth-limiting bacteria against HAB species through artificially introduced macroalgal beds
<b>12:30</b>	<i>Lunch Break</i>
<b>2:00</b>	<b>Kathy Coyne (Invited Speaker)</b> Evaluation of novel mini in-situ algicidal bioreactors (DinoSHIELD) to control red tide: Moving from the bench to the field
<b>2:30</b>	<b>Don Anderson</b> Logistical considerations in mesocosm and field studies of <i>Karenia brevis</i> red tide control in Florida
<b>3:00</b>	<b>Zhiming Yu (Invited Speaker)</b> Technology and progress of using modified clay to control HABs in China
<b>3:30</b>	<i>Coffee Break/Group Photo</i>
<b>4:00</b>	<b>West Bishop (remote presenter)</b> Industry perspectives on viable HAB control technologies
<b>4:15</b>	Discuss breakout groups and potential outcomes: <ul style="list-style-type: none"><li>• An update to 1997 Nature Journal paper</li><li>• In-depth review of field demonstrations</li></ul>
<b>4:30</b>	<i>Case Study Breakout Group Discussion</i> Breakout group discussions on evaluating impacts: Looking back <sup>1</sup>

**5:30** Collective considerations from breakouts, recap of plans for next day

**6:30** *Happy hour & Group Dinner*

**Sunday, October 22, 2023 (9:30-6:00)**

### ***Mitigation Strategies***

**9:00** **Mandy Michalsen**  
Lessons learned that benefit efforts to expand marine and estuarine HAB control in the U.S. and abroad

**9:15** **Kevin Claridge**  
Incubators as Catalysts for Advancing HAB Control Tools and Technologies

**9:30** Breakout group discussions on mitigation strategies: Looking forward<sup>2</sup>

**10:30** *Coffee Break*

**11:00** Continue Breakout group discussions on mitigation strategies

**12:00** *Lunch Break*

**1:30** Break out group reports / plenary discussions on barriers and strategies to overcome. Identify commonalities

**4:00** *Coffee Break*

**4:30** Outline of writing assignment, discussion of two publications

### **Breakout Group Discussions:**

<sup>1</sup> Looking back. This breakout will focus on historical HAB control methods.

Questions: What is the demand for HAB control and has that demand changed over the last 5-10 years? What are the success stories? What are the roadblocks? How has the scaling from small to large worked?

<sup>2</sup> Looking forward. This session will focus on how to identify and value effective control strategies for the future by learning from past examples.

Questions: What types of control strategies are available and are being (or could be) used to offset the impacts of HABs? Are there any emerging/promising technologies? What is the cost of control strategies? What are strategies to overcome roadblocks/barriers to implementing control strategies (e.g., policy, cost)? Are new partnerships/outreach efforts needed?



# Workshop 4: FUTURE/HD/POC Topic Workshop

## Changing social-ecological-environmental system of the North East Asian Marginal Seas: New challenges for integrative marine science

**Co-sponsor:**  
NOWPAP

**Invited Speaker:**  
Hiroaki Saito (AORI, Tokyo University, Japan)

**Convenors:**  
Vyacheslav Lobanov, Russia (AP-CREAMS, MONITOR), corresponding  
SungHyun Nam, Korea (AP-CREAMS, POC)  
Mitsutaki Makino, Japan (HD)  
Takafumi Yoshida, Japan (MEQ)

The western North Pacific, one of the areas of the global ocean most affected by climate change and anthropogenic activities, consists of several marginal seas. Many international programs initiated in this area including CREAMS (Circulation Research of East Asian Marginal Seas) have contributed to significant advances in understanding of physics and biogeochemistry of North East Asian Marginal Seas. The UN Decade however requires comprehensive research programs connecting science and communities for sustainable seas. We expect this workshop would provide a forum to discuss all aspects of marine science (physical, chemical, biological oceanography and fishery science) focusing on the North East Asian Marginal Seas and its changing social-ecological-environmental system. It is especially important to identify links between marine sciences and socio-economic requirements in the area to develop an integrative program for future research in this region to correspond the UN Decade targets. Presentations covering success of integrative marine science approach in other regions of the World Ocean are welcomed. The workshop outcome should clarify a vision of international comprehensive marine research in the North East Asian region that meets the current needs of society.

Friday October 20, 2023 (9:00-12:30) (Last update Oct. 18)

9:00	<b>Convenors</b> Introduction
9:10	<b>Hiroaki Saito (Invited Speaker)</b> Marine ecosystems in Southeast Asia: Status, emerging issues and scientific contribution for the sustainable use
9:30	<b>Saranya JS</b> Unraveling the types and dynamics of marine heatwaves in the East Sea (Japan Sea)
9:50	<b>Zeyu Zeng</b> Climate change alters social-ecological trade-offs in achieving ocean futures' targets Climate change alters social-ecological trade-offs in achieving ocean futures' targets
10:10	<b>Hanna Na</b> Potential predictability of skipjack tuna ( <i>Katsuwonus pelamis</i> ) catches in the Pacific Island countries
10:30	<i>Coffee Break</i>
10:50	<b>Peng Sun</b> The Effects of Selective Harvest on Exploited Population and Economic Benefits
11:10	Overall Discussion
12:30	<i>Lunch Break</i>

*Poster:*

**Jayaraju Nadimikeri**

Carbon foot printing of Blue food and Blue people, East Coast of India: Implications to Anthropocene

# Workshop 5: BIO/MEQ Topic Workshop

## Bio-indicators of meso to global scale marine pollution: techniques for integration and standardization

### Convenors:

Yutaka Watanuki (Japan), *corresponding*  
Patrick O'Hara (Canada, DFO)  
Mirian Kim (Korea)  
Andrew Ross (Canada)

### Invited Speaker:

Jennifer C. Hoguet (National Institute of  
Standards and Technology (NIST), USA)

Rates of discharge of pollutants including heavy metals, persistent organic pollutants (POPs), and plastics are increasing despite concerted effort to control them. Many of these pollutants are transported through air and water currents from a diversity of sources, then deposited in remote regions, including Arctic and Antarctic Seas, impacting ecosystem health in these regions. During past PICES meetings, MEQ and BIO (MBM-AP, which is now S-MBM) co-convened workshops and symposia in relation to the status and impacts of marine pollution. This workshop aims to develop standardized techniques to monitor the level of pollution in the remote regions where conventional sampling is difficult by using bioindicators (MBMs, Sea Turtles, Fish, Squid, Mussels, and species from other taxa that can be used potentially as a pollution bioindicator) as in situ samplers, producing indicator data of ecosystem health. For example, MBMs are useful bio-indicators of marine pollution as they bio-accumulate and magnify the low concentration of pollutants found in water to levels that are more easily detectable and measurable. As well, pollutant concentrations measured in MBM species can be considered average pollution levels integrated across a range of spatial scales, from meso to global, depending on life-history traits of the bio-indicator species. However, using MBMs as bioindicators for various pollutants requires the standardization of techniques for measuring and reporting concentration of each pollutant in each tissue for each species, as a suite of magnification factors, as well as differing half-lives among toxins, affect concentrations. Not all possible sentinel species occur in all subregions of the North Pacific, and for this reason we need to integrate further the concentration of pollutants in various tissues from various species. For example, plastic loading in stomachs of Northern Fulmar has been used successfully as indicator of plastic pollution in Europe and northern North Pacific, but this species does not occur in the south central N Pacific. In this workshop, we plan to review and compare approaches used for detecting and measuring pollutants in different tissues in various species. We also welcome original works on multiple tissues of a single species or those on a single tissue from multiple species. We will discuss the approach for standardization and integration of the concentration of pollutants in the tissue of MBMs and other possible sentinel organism for the North Pacific.

Friday October 20, 2023 (9:00-4:30)

9:00 **Yutaka Watanuki, Patrick O'Hara, Mirian Kim**  
Introduction

10:10 **Jennifer C. Hoguet (*Invited Speaker*)**  
Seabird Tissue Archival and Monitoring Project (STAMP) as an example of a long-term standardized specimen collection

*Coffee Break?*

10:40 **Jennifer Provencher**  
An ecosystem-scale litter and microplastic monitoring plan under the Arctic Monitoring and Assessment Programme (AMAP)

11:00 **Stephanie Avery-Gomm**  
Towards a North Pacific Ocean long-term monitoring program for plastic pollution: A review and recommendations for plastic ingestion bioindicators

11:20 *Lunch Break*

14:00 **Soojin Jang**  
External morphology monitoring of wild marine mammals using Photo-id and UAVs

14:20 **Miran Kim**  
Assessing plastic debris ingestion of seabirds using invasive and non-invasive methods in Korea

14:40 **Yutaka Watanuki**  
Feather mercury of a pelagic seabird can be useful indicator of marine pollution

15:00 *Coffee Break*

15:30 **Fernanda Ferreira Paula Landim**  
An improved standardisation method for characterising plastics ingested by marine megafauna and those in their environment

15:50 **Lauren Roman**  
Harmonisation in the context of management – Reporting on marine debris in the environment and interactions with megafauna

16:10 **Yutaka Watanuki, Patrick O'Hara, Mirian Kim**  
Discussion

# Workshop 6: MEQ Topic Workshop

## Developing an integrative conceptual framework of urban impacts on marginal ocean ecosystems

### **Convenors:**

Brian Hunt (Canada), *corresponding*  
Julie Keister (USA)  
Kathryn Sobocinski (USA)  
Yoonja Kang (Korea)

### **Invited Speakers:**

Angela Danyluk (City of Vancouver, BC, Canada)  
Emily Howe (The Nature Conservancy, WA, USA)

Coastal oceans are global hotspots for marine productivity, reflected in high primary producer biomass and fisheries yields. Contributing to this productivity is land-ocean connectivity, including freshwater and material contributions from land that can modify hydrodynamics and enhance micro and macronutrients concentrations. Among marine environments, coastal oceans are also uniquely vulnerable to human impacts. Approximately 40% of the human population lives within 100 km of the coast. The anthropogenic impacts associated with human settlement and development can disrupt critical land-ocean linkages. Urbanization, a pervasive form of land use change, has wide ranging effects, including shoreline modification, pollution, and changes to freshwater runoff and the quantity and quality of material flux to the ocean. However, while localized studies have examined specific urban impacts, a unified concept of urban oceans is lacking. Such a concept needs to take into account the interacting effects of the geographic, climatic and oceanographic setting of the urban environment, history of urbanization and associated impacts, and the backdrop of climate change and sea level rise. In this workshop we aim to: 1) review the state of the knowledge of urban oceans through presentations from diverse knowledge holders that specifically address the interactions between cities and coasts, focusing on case studies from the North Pacific; 2) discuss and develop an integrated conceptual framework for urban ocean ecosystems that is inclusive of different knowledge types. Such a framework is envisioned to allow for strategic solutions to healthy urban oceans, and improved communication and connection between science and communities; 3) initiate development of an urban oceans concept paper that builds off the workshop discussions. We broadly welcome presentations and participation in discussions, particularly by those whose research focuses on the ocean impacts of urbanization, whose communities are affected by coastal degradation, or whose management efforts center on mitigating these effects.

**Sunday, October 22, 2023 (9:00-5:30)**

<b>9:00</b>	<b>Convenors</b> Introduction
<b>9:10</b>	<b>Angela Danyluk (<i>Invited Speaker</i>)</b> Sea2City Design Challenge: An example of value based coastal adaptation planning
<b>9:30</b>	<b>Emily <u>Howe</u> (<i>Invited Speaker</i>)</b> Introducing the Puget Sound Stormwater Heatmap: a foundational tool for visualizing stormwater interventions
<b>9:50</b>	<b>Kate <u>Menzies</u> (Tsleil-Waututh Nation)</b> Tsleil-Waututh Nation's approach to understand urban impacts on Burrard Inlet
<b>10:10</b>	<b>Jacques <u>White</u></b> The Salish Sea Marine Survival Project – a model program for evaluating challenges in marine resource stewardship in an urbanizing coastal marine ecosystem
<b>10:30</b>	<i>Coffee Break</i>
<b>10:50</b>	<b>Hyeong Kyu <u>Kwon</u>, Dilan <u>Sunthareswaran</u>, Sadie <u>Lye</u> &amp; Yoonja <u>Kang</u></b> Poster Speed Talks <sup>1</sup>
<b>11:10</b>	<b>Hem Nalini <u>Morzaria-Luna</u></b> Effect of multiple pressures on early marine survival of juvenile salmon in Puget Sound
<b>11:30</b>	<b>Junsung <u>Noh</u></b> Living shoreline and sustainable saltmarsh planting in the Green-living tech, South Korea
<b>11:50</b>	<b>Eliza C <u>Heery</u></b> Does the luxury effect occur in urban marine ecosystems?
<b>12:10</b>	<b>Kathryn <u>Sobocinski</u></b> Urban Seas are hotspots of stress in the Anthropocene ocean
<b>12:30</b>	<i>Lunch Break</i>
<b>2:00</b>	Introduce discussion section structure
<b>2:20</b>	Break out session
<b>2:40</b>	Break out session
<b>3:00</b>	Breakout feedback
<b>3:20</b>	<i>Coffee Break</i>
<b>3:40</b>	Break out session
<b>4:00</b>	Break out session
<b>4:20</b>	Breakout feedback
<b>4:40</b>	Next Steps
<b>5:00</b>	Wrap up
<b>5:20</b>	Wrap-up Discussion

**<sup>1</sup> Poster Presentations:**

**Hyeong Kyu  
Kwon** Significant contribution of fish-farm activities to the distributions of nutrients and trace elements in the coastal water off Jeju Island, Korea

**Dilan  
Sunthareswaran** Using fatty acids to profile organic matter from urban sources and measure its uptake into the food web in Vancouver, B.C

**Sadie Lye** Using Stable Isotopes to distinguish between naturogenic and anthropogenic source of organic matter to the urban ocean in Burrard Inlet, Vancouver B.C.

**Yoonja Kang** Coastal warming heightens direct impacts of seawater temperature on nutrients near aquaculture farms in Korea

# Workshop 7: FIS Topic Workshop

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

**Co-sponsor:**  
IPHC

**Convenors:**  
Josep Planas (USA), *corresponding*  
Mackenzie Mazur (Canada)  
Naoki Tojo (Japan)  
Roman Novikov (Russia)

**Invited Speakers:**  
Philina English (Pacific Biological Station,  
Fisheries and Oceans Canada, DFO, BC, Canada)  
Allan Hicks (International Pacific Halibut  
Commission (IPHC), Seattle, WA, USA)  
Noëlle Yochum (Fishing Innovation and  
Sustainability, Trident Seafoods, Seattle, WA,  
USA)

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 flatfish species of great ecological, cultural and economic importance. Many of these species have wide distribution ranges and undergo significant ontogenetic and seasonal migrations, and, therefore, are particularly susceptible to climate and environmental variability. In order to address key issues related to flatfish species, from basic aspects of their biology to population management and conservation efforts at an international level, two FIS-sponsored PICES workshops have been held at PICES Annual Meetings. The first workshop was co-sponsored by the International Pacific Halibut Commission (IPHC) at the 2019 PICES Annual Meeting (W2) and focused on important topics on 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 (highlighted in PICES Press, 2020, Vol. 28(1)). This workshop highlighted the need to apply integrative approaches to improve our understanding of the biology and management of widely-distributed flatfish species in the North Pacific Ocean, requiring a high level of cooperation at the international level. One of the deliverables of this workshop was the publication of several papers as part of a special issue in the journal Fisheries Research edited by the convenors. The second workshop will take place at the 2022 PICES Annual Meeting (W5) and will focus on addressing emerging issues in key flatfish species with broad distribution across the North Pacific Ocean related to their biology, environmental impacts on their distribution, and management. In order to capitalize on the gains of the first two workshops, the convenors are proposing a third workshop during the 2023 PICES Annual Meeting that will aim at 1) devising strategies for data sharing on fishing efforts and management of flatfish species across the North Pacific Ocean, and 2) promoting 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.

**Sunday, October 22, 2023 (9:00-4:50)**

**9:00**      **Convenors**  
Introduction

**9:10**      **Philina English (Invited Speaker)**  
Identifying the impacts of warming waters on British Columbia's groundfish productivity

**9:40**      **Allan Hicks (Invited Speaker)**  
Managing the Pacific halibut (*Hippoglossus stenolepis*) fishery while considering historical and future changes in the environment



<b>10:10</b>	<b>Raymond Webster</b> Environmental conditions on the Pacific halibut fishing grounds obtained from a decade of coastwide oceanographic monitoring, and the potential application of these data in stock analyses
<b>10:30</b>	<i>Coffee Break</i>
<b>10:50</b>	<b>Szymon Surma</b> Investigating food web and groundfish community structure in the eastern Gulf of Alaska
<b>11:10</b>	<b>Nathan Wolf</b> Exploring the relationship between diet and size-at-age in Pacific halibut
<b>11:30</b>	<b>Cynthia Yeung</b> Will a warming subarctic Bering Sea favor yellowfin sole production?
<b>11:50</b>	<b>Andrew Jasonowicz</b> Whole-genome sequencing to investigate population structure and dynamics of Pacific halibut in the northeast Pacific Ocean
<b>12:10</b>	<b>Anita Kroska</b> Exploring the relationship of Ichthyophonus exposure to infection prevalence and severity in wild-caught Pacific halibut
<b>12:30</b>	<i>Lunch Break</i>
<b>14:00</b>	<b>Noelle Yochum (Invited Speaker)</b> Conservation engineering approaches for mitigating Pacific halibut ( <i>Hippoglossus stenolepis</i> ) bycatch: biology, behaviour, and technology
<b>14:30</b>	<b>Gregory Christie</b> Testing of a semi-demersal longline to reduce yelloweye rockfish bycatch in a U.S. West Coast Pacific halibut longline fishery
<b>14:50</b>	<b>Claude Dykstra</b> Gear-based approaches to protecting Pacific halibut captured on longline gear from removal by marine mammal depredation
<b>15:20</b>	<i>Coffee Break</i>
<b>15:40</b>	<b>Todd TenBrink</b> Delineating yellowfin sole ( <i>Limanda aspera</i> ) reproduction in the northern Bering Sea provides information across the eastern Bering Sea continental shelf
<b>16:00</b>	<b>Colin Jones</b> Update of maturity-at-size and -age for Pacific halibut ( <i>Hippoglossus stenolepis</i> ) using histological analysis
<b>16:20</b>	General Discussion

**Poster:**

**Vladimir Kulik**

Management of Greenland turbot (*Reinhardtius hippoglossoides*) and the Pacific halibut (*Hippoglossus stenolepis*) using JABBA in Russian Far-East

## Workshop 8

### Nurturing future generation in fisheries and marine environment science: Collaboration with PICES and Asia Fisheries and Marine Environment Leaders Program (AFIMA Leaders Program)

**Convenors:**

Sangchoul Yi (South Korea), *corresponding*  
Raphael Roman (ECOP, Canada)  
Dohoon Kim (South Korea)  
Liu Yang (China)  
Shigenobu Takeda (Japan)

**Invited Speaker:**

Nadiah Wan Rasdi (Faculty of Fisheries and Food  
Science, Universiti Malaysia Terengganu (UMT),  
Malaysia)

Asian waters are an important sea area with a relatively small area intensively used by Korean, Chinese, and Japanese fishing boats, which is exposed to overfishing of fishery resources and severe marine pollution. For the sustainable use of fishery resources and the protection of the marine environment, the understanding of the joint management by all countries concerned and the formation of a consensus for cooperation are necessary. With such recognition, leading universities in the field of fisheries and marine environment in Korea, China and Japan came together to create a joint education program for future young scientists. The program is Asia Fisheries and Marine Environment Leaders Program (AFIMA Leaders Program), aiming to nurture future professionals for the joint management of fishery resources and the marine environment in Asian waters. During upcoming session, we will introduce PICES to session participants (representatives from our partner universities and graduate students), connecting the global scientific community and AFIMA leaders program universities (i.e., faculty of Pukyong National University in Korea, Ocean University of China, and Nagasaki University in Japan, University of Malaysia, Terengganu).

**Saturday October 21, 2023 (2:10-5:30)**

**14:10**     **Convenors**  
Introduction

**14:20**     **Nadiah Wan Rasadi (*Invited Speaker*)**  
Sustainability management of plankton fishery resources of Asian waters in preserving the marine environment

**14:40**     **Hee-Jin Kim**  
Light wavelength and intensity effects on phototactic behavior of pediveligers in the Pacific oyster *Crassostrea gigas*

**15:00**     **Hee Eun Woo**  
Improvement of groundwater flow and benthic environment in tidal flat by application of granulated coal ash

**15:20**     *Coffee Break*

**15:40**     **Yun-Je Kim**  
Stock assessment and management strategies of Small yellow croaker (*Larimichthys polyactis*) in the Northwest Pacific region using CMSY and BSS models

**16:00**     **Gitae Nam**  
Investigating Coastal Tourism Demand in the COVID-19 Era through Big Data Analytics: Focusing on Korean Beach Tourists' Trip

**16:20**     **Ji Min Oh**  
Estimating factors affecting to fishing boat transaction prices using an hedonic price model in South Korea

**16:40**     **Dong-Hun Go**

**17:00**     Wrap-up Discussion

# Workshop 9: TCODE/HD Topic Workshop

## Indigenous and Community-Led Approaches to support climate change adaptation and Ecosystem Resilience in the North Pacific and Arctic

### Co-sponsors:

ICES, PSC

### Convenors:

Rebecca Martone (Canada), *corresponding*

Kathryn Sheps (Canada), *corresponding*

Sarah Wise (USA), *corresponding*

Natalie Ban (Canada)

Sanae Chiba (PICES Secretariat)

Kirstin Holsman (USA, S-CCME, AFSC-NOAA)

Kathy Mills (USA, SICCME, GMRI)

Steve Alexander (Canada, DFO)

Coastal communities are on the frontline of climate change. Supporting resilience and community determined climate adaptation requires strong relationship building, trust, and collaborative knowledge production that bridges multiple knowledge systems. The UN Decade of Ocean Science (2021-2030, UNDOS) has a major emphasis on co-design of science and co-production of knowledge to achieve the “ocean we want”, weaving traditional western science, with local and Indigenous knowledges to arrive at sustainable solutions for the challenges facing the oceans and coastal communities. The North Pacific and Arctic have long histories of Indigenous and Community leadership in promoting and defending coastal resilience, fisheries and ecosystem management, ecosystem health and protection of species at risk. Drawing from these experiences, this workshop and session aim to provide space for dialogue and knowledge sharing.

The workshop has three main objectives: 1) Bring together marine and coastal knowledge holders (including climate scientists, Indigenous and traditional knowledge holders, resource managers, and ocean practitioners) to showcase examples of successful partnerships, as well as new opportunities, and ongoing challenges in community-led approaches to support climate ready decision-making and ecosystem resilience. 2) Identify lessons learned from transdisciplinary and community-led work rooted in co-production. 3) Facilitate a cross regional knowledge network of coastal community leaders and ocean practitioners to provide continued support outside of the PICES annual meeting.

The first one-day agenda will include invited Indigenous speakers and transdisciplinary science practitioners. The structure will allow for interactive discussion, topical breakout sessions, and time allocated for collaborative creation. We will support a dialogue with participants to address the following questions:

Q: What are some examples/ways that communities and scientists are weaving Indigenous knowledge and western science to inform climate adaptation and coastal and ocean stewardship?

Q: What are the challenges and opportunities to bridge the gaps between community-based knowledge and management/decision making?

Q: What are some lessons learned for co-designing and co-producing knowledge with communities to foster locally determined and resilient and coastal ecosystems?

The following half-day workshop will provide an opportunity for reflection on the workshop and individual presentations on key points that emerged in the workshop. We will also invite experts from outside of the North Pacific and Arctic region to participate in this workshop to extend our scope within the Ocean Decade.

Outcomes of the workshop will include a report highlighting examples and lessons learned. Additionally, this work will inform a peer-reviewed publication on diverse methodological approaches to transdisciplinary work. Other outcomes based on discussion among participants on ways to bring together multiple ways of knowing and multiple types of knowledge, expertise, and experience to inform decision-making will be decided collaboratively by workshop participants. This interactive workshop and session build on the ongoing work from several related working groups including: Joint ICES/PICES WG44; SICCOME, and GMRI, and complements a proposed S-CCME open meeting and both the S-CCME and Joint ICES/PICES WG44 business meetings at the 2023 Annual Science meeting in Seattle.

### Friday, October 20, 2023 (9:00-5:30)

9:00	<b>Opening and Introductions</b> What do we want to accomplish with this workshop?
10:00	Discuss Workshop structure & Day 2 plans
10:30	<i>Coffee Break</i>
11:00	<b>Break out session 1: Sharing experiences of collaboration</b> What are some examples/ways that communities and scientists are weaving Indigenous Knowledge and western science to inform climate adaptation and coastal and ocean stewardship?
12:30	<i>Lunch Break</i>
2:00	<b>Break out session 2: Common threads</b> What are some things that you think are important for successful collaboration? What does that look like? What are some things that led you there? What kinds of support are needed for different actors to show up in collaboration?
3:20	<i>Coffee Break</i>
3:40	<b>Return to Plenary</b> Gain consensus on co-created plan & tasks and roles for Day 2
5:00	Day 1 closing comments

**Saturday, October 21, 2023 (9:00-12:30)**

*If Day 1 participants agree to open Day 2 of the workshop, we will co-create an agenda with them.*

Ideas for Day 2:

- Create knowledge circle where people have come up with the discussion questions, open to audience but they can choose whether to take questions from audience
  - Focusing on ideas, guidance moving forward
- Shared presentation
- Other ideas generated on Day 1

**9:00**    Opening and Introductions

**9:45**    Knowledge Circle Summary of Day 1 or Presentations from Day 1 participants

**10:30**    *Coffee Break*

**10:50**    Knowledge circle: Continuing discussion

**11:50**    Day 2 closing comments

# Workshop 10: FIS/BIO/POC/TCODE/FUTURE Topic Workshop

Towards climate-informed ecosystem-based fisheries management by building international collaborations and standardizing indicators

**Co-sponsor:**  
ICES

**Convenors:**

Kirstin Holsman (S-CCME; USA, AFSC - NOAA), *corresponding*

Alison L. Deary (NOAA, USA), *corresponding*

Lewis Barnett (NOAA, USA)

Xiujuan Shan (S-CCME, China)

Kathy Mills (ICES, SICCME, USA, GMRI)

Alan Baudron (ICES, SICCME, Scotland)

Sukgeun Jung (Jeju National U, Korea)

**Invited Speakers:**

Kathy Mills (Gulf of Maine Research Institute, GMRI, USA)

Kalei Shotwell (Alaska Fisheries Science Center, NOAA, USA)

Climate change is having profound impacts on marine ecosystems and fisheries. According to the latest IPCC assessment, climate change is intensifying, and some changes are irreversible on the scale of human lifetimes. Marine ecosystems and associated fisheries will therefore continue being impacted by climate change in decades to come, posing a growing risk for global food security and socioeconomic benefits. Additionally, high latitude ecosystems such as the Arctic, are experiencing unprecedented changes in ocean conditions (e.g., ocean heating, loss of sea ice, rising sea levels) that have impacted biological and ecological processes, societal and traditional uses of Arctic natural marine resources, and economic activity including tourism, shipping, and oil and gas exploration. Despite the clear need to mitigate climate-induced risks and to adapt to future climate change, accounting for climate impacts when developing fishery management plans and policies remains challenging. For instance, despite ongoing efforts the EU's Common Fisheries Policy still has a low adaptability to climate change.

The emergence of ecosystem-based fisheries management (EBFM) has shown that it is possible to account for external drivers such as environmental conditions and/or predation when managing a fishery. A challenge to detecting, monitoring, and communicating changes in environmental conditions in an EBFM framework is that sampling methodology is not often standardized, which complicates regional and international syntheses. Stakeholders are also increasingly involved in the management process and can provide hands-on knowledge crucial in shaping policies to manage marine resources. By connecting science among international collaborators and Indigenous communities, we are better poised to detect, monitor, and respond to changing environmental conditions. These recent advances towards holistic fisheries management provide stepping stones towards climate-informed EBFM. In coordination with a proposed ICES ASC session, we will hold an interactive workshop to discuss emerging issues around climate-informed EBFM, build relationships with international partners, and promote cross-fertilization especially when generating robust indicators to monitor climate change.

The 1.5 day workshop will include a mix of spark presentations and discussion sessions on the following topics:

- Case studies of accounting for climate impacts in management measures & showcasing policies applied 'in practice'

- Best practices and approaches for considering large-scale and long-term climate impacts
- Reconciling long-term projections and short-term tactical management
- Advances needed for climate-ready fisheries management to be widely adopted
- Data standardization, its application to ecosystem-based management, and the optimization of sampling platforms to monitor climate change across a variety of ecosystems and trophic levels

**DAY ONE:** Saturday, October 21 · 1:00 – 4:40 pm PDT

**DAY TWO:** Sunday, October 22 · 8:30am – 5:25pm PDT

Connect remotely via Zoom:

<https://us02web.zoom.us/j/5130095105>

## Agenda

### Part A: Climate Informed EBFM modeling and coordination

**Motivation:** Despite the clear need to mitigate climate-induced risks and to adapt to future climate change, accounting for climate impacts when developing fishery, protected species, and ecosystem management plans and policies remains challenging. However, recent advances towards holistic fisheries management provide stepping stones towards climate-informed EBFM.

**Goals:** In coordination with a proposed ICES ASC session, we will hold an interactive workshop to discuss emerging issues around climate-informed EBFM, build relationships with international partners, and discuss challenges and successes in using integrated climate modeling to support climate informed decision support tools and advice.

### Day 1: Oct. 21, 2023

14:00 PM - 14:15 PM Welcome, introductions, and workshop overview

14:15 PM - 14:40 PM Kathy Mills (invited)

14:40 PM - 16:20 PM Selected talks on climate-informed EBFM

- **14:40 pm - 15:00 PM: Guimei Liu**

- With Xuanliang Ji, Shan Gao, Ecological and carbon cycling response to the climate change in the South China Sea: a three-dimensional physical-biogeochemical modeling study

- **15:00 pm - 15:20 PM: Isa O. Elegbede**

- Climate Resilience in Blue Sustainable Fisheries: Inclusion and Ecosystem-Based Management for Short and Long-Term Success

- **15:20 pm - 15:40 PM Break and Networking**

- **15:40 pm - 16:00 PM: Takuya Nakanowatari**

- With Tomohiro Nakamura, Humio Mitsudera, Jun Nishioka, Hatsumi Nishikawa, Hiroshi Kuroda, and Keisuke Uchimoto, Numerical study on decadal-scale change in primary production in the subarctic North Pacific and the Sea of Okhotsk



- **16:00 pm - 16:20 PM: Kelly Kearney**
  - Oceanographic modeling

16:20 PM - 16:50 PM: spark talks (10 min)

- Talk 1: Al Hermann (16:20)
- Talk 2: Wei Cheng - MOM6 (16:30)
- Talk 3: Darren Pilcher - OA index (16:40)
- Discussion

16:50 PM - 17:00 PM Wrap up and next day discussions

## Day 2: Oct. 22, 2023 AM

9:00 AM - 9:30 AM : Kalei Shotwell (ESPs & EBFM on -ramps (Invited; virtual)

9:30 AM - 9:50 AM : Ivonne Ortiz (ESRs & Climate informed EBM on- ramps)

9:50 AM - 10:10 AM : Kirstin Holsman & Diana Stram (Climate Change Task Force & ACLIM)

10:10 AM - 10:30 AM Discussion & Q&A

10:30 AM - 10:50 AM Break

### Part B: EBFM data standardization

**Motivation:** A challenge to detecting, monitoring, and communicating changes in environmental conditions in an EBFM framework is that sampling methodology is not often standardized, which complicates regional and international syntheses.

**Goals:** Data standardization, its application to ecosystem-based management, and the optimization of sampling platforms to monitor climate change across a variety of ecosystems and trophic levels

10:50 - 11:30: Modelling and ecosystem synthesis (40 minutes) (10-minute talks)

- Arctic research prioritization and updates from AFSC (NOAA; James Thorson)
- AI for rapid data processing (NOAA; Catherine Berchok)
- Climate-ocean models, community connections (NOAA/NSF; Jenny Bigman)
- eDNA and biodiversity standardization efforts (NOAA/PMEL; Zachary Gold)

11:30-12:00: Modelling and ecosystem synthesis Discussion (30 minutes)

12:00-14:00: Lunch

14:00-14:40: Benthos (40 minutes) (10-minute talks)

- Standardizing and combining US-Canada transboundary bottom trawl data from the North Pacific (NOAA; Eric Ward)
- Alaska bottom trawl survey public data products (NOAA; Emily Markowitz)
- Temperature indicators for the Bering Sea, with applications for adaptive sampling (NOAA; Lewis Barnett)
- ~~The potential for eDNA to detect distribution shifts across geographic boundaries (NOAA; Andrew "Ole" Shelton) (WITHDRAWN)~~

14:40-15:20: Benthos Discussion (40 minutes)

15:20-15:40: Break

15:40-16:20: Fish (40 minutes) (10-minute talks)

- i. US-Canada Arctic Trawl Comparison and catchability assumptions (NOAA; Duane Stevenson)
- ii. US-Russia transboundary bottom trawl standardized abundance indices combining surveys (NOAA; Cecilia O'Leary; virtual)
- ~~iii. Fish Ageing techniques and collaboration in support of EBFM (University of Melbourne; Jessica Randall) (WITHDRAWN)~~
- iv. Emergent issues- how to standardize an approach across facilities, regions, and agencies (FWS; Ali Deary)

16:20-16:50: Fish Discussion (30 minutes)

16:50-17:25: Closing statements and next steps (35 minutes)

## Workshop 10 Agenda at a glance

PDT	<b>October 21, 2023 Day 1</b>
1400 - 1400	Welcome & introductions
1410 - 1440	<b>Invited speaker Kathy Mills: Integrated Climate Modeling for Fisheries Advice</b>
1440 - 1620	Selected 20 min presentations (3 x TBD): Climate Integrated modeling and advice
1520- 1540	Break and Networking
1620- 1650	Lightning talks (5 x 8 mins; TBD): Climate Integrated modeling and advice
1650 - 1700	Discussion
PDT	<b>October 22, 2023 Day 2</b>
0830 - 9000	Coffee and networking
0900 - 9030	<b>Invited speaker EBFM and Climate</b>
0930 - 0950	EBM on-ramps: Ecosystem Status Reports
0950 - 1010	EBM on-ramps: Stock Assessment ESPs
1010 - 1030	Discussion
1030 - 1050	Break and Networking
1050- 1200	Data Standardization talks and discussion
1200 - 1400	Lunch
1400- 1520	Data Standardization talks and discussion
1520- 1540	Break and Networking
1540- 1655	Data Standardization talks and discussion
1650- 1725	Closing statements and next steps

# Workshop 11: SB

## Science advances needed to understand our “new ocean”

### Convenors:

Francisco Werner (NOAA Fisheries, USA),  
*corresponding*  
Shin-ichi Ito (Japan)  
Salvador E. Lluch Cota (Mexico)

### Invited Speakers:

TBA

Oceanic environments are changing rapidly in response to climate forcing. During the past two decades we have witnessed unprecedented and perhaps sustained or irreversible modifications of ocean physics (e.g., occurrence of marine heat waves, stratification), biogeochemistry (e.g., changes in pH levels, oxygen minimum zones), populations' redistribution (e.g., latitudinal shifts, migration patterns), as well as ecosystem structure and function (e.g., changes in the food web and energy flows related to shifts in planktonic communities). In some ways, these changes have resulted in a “new ocean”.

Our oceans have also become more crowded through the growing presence of multi-sectoral uses (e.g., commercial and recreational fisheries, aquaculture, renewable energy, etc.). As such, we are at a point where not only do we need to study and understand our “new ocean”, but we also need to develop novel ways of sampling, observing, and quantifying it. Fortunately, significant advances in our ability to sample and quantify our ocean's new states have resulted from a robust evolution in observational (e.g., uncrewed systems, molecular approaches, satellite/remote sensing) and analytical (e.g., high performance computing, artificial intelligence/machine learning, etc.) capabilities. Such advances provide an opportunity to reevaluate the questions and approaches our scientific communities have undertaken and reassess (global and regional) science efforts as appropriate.

The workshop will focus on framing questions that can help define the next levels of understanding of our “new ocean”, as well as identifying the challenges in doing so. We aim to prioritize (e.g., a “top 5”) questions that we need to take on as a scientific community, and discuss our capabilities to address these. Included in our discussions (and implied in a prioritization or a triage) are foreseeable challenges that we might not be able to address given present or even future capabilities. Questions guiding the discussion include:

What should our science foci be in the study of our rapidly evolving “new ocean” (and its integration in the broader Earth system)?

Do we have the necessary observational and analytical capabilities - either existing, or within reach?, and if not, where should we direct our investments?

Do we have the necessary human capabilities/training to address these challenges, and if not, where should we direct our investments?

What are the biggest obstacles to be solved to address these challenges?

How could PICES and partner scientific communities contribute/engage? How do we sustain needed efforts beyond the present UN Decade of Ocean Science?

The workshop will be one full day. The first half-day will be (4 to 5) invited presentations on the state of our science to help identify and focus future questions and needs. The second half-day will build on opening discussions and aim to identify science priorities, supporting rationale, and needed next steps.

Outcome: a perspectives/white paper for peer-reviewed publication TBD.

**Sunday, October 22, 2023 (8:30-5:00)**

**8:45**      **Convenors**  
Welcome, introductions and “new ocean” workshop objectives

**9:10**      **Fei Chai**  
*The new ocean:* Physics and biogeochemistry

**9:30**      **Sukyung Kang**  
*The new ocean:* Living marine resources

**9:50**      **Jan Newton**  
*The new ocean:* Modernizing our observational capabilities

**10:10**     **Charles Hannah**  
*The new ocean:* Modernizing our methods of analysis

**10:30**     *Coffee Break*

**10:50**     **Momoko Ichinokawa**  
*The new ocean:* Modernizing our management advice

**11:10**     **Charlie Stock**  
*The new ocean:* Prediction within an Earth System context

**11:30**     **Hana Matsubara**  
*The new ocean:* ECOP perspectives

**11:50**     Summary and discussion

**12:30**     *Lunch Break*

**2:00**      **Afternoon Open Discussion**  
Facilitated open discussion, summary and assessment of ideas for a possible perspectives paper

**3:20**      *Coffee Break*

**3:40**      **Afternoon Open Discussion**  
Facilitated open discussion, summary and assessment of ideas for a possible perspectives paper

**4:00**      **Meeting Report Draft**  
A small team prepares the draft report for submittal to PICES