

## 2022 Report of the Section on *Climate Change Effects on Marine Ecosystems*

The Section on *Climate Change Effects on Marine Ecosystems* (S-CCME) held a virtual meeting on September 8, 2022. Fifteen participants attended from 5 countries (*S-CCME Endnote 1*). The meeting was chaired by Dr. Kirstin Holsman (USA) and Dr. Xiujuan Shan (China). Two new members were appointed to S-CCME, Drs. Takuya Nakanowatari (Japan) and Elliott Hazen (USA). The group welcomed the new members and thanked past members. Brief introductions were made to help orient new members to the group.

### AGENDA ITEM 2

#### **Adoption of agenda**

The agenda was adopted by all members (*S-CCME Endnote 2*).

### AGENDA ITEM 3

#### **S-CCME Phase IV (2021–2025) Implementation Plan overview**

Dr. Holsman provided a brief overview of the S-CCME Implementation Plan, including an in-depth discussion of Phase IV goals and activities that will continue Phase 1–3 initiatives:

- Provide forums for communication and coordination between national climate research nodes modeling teams, including S-CCME meetings during the PICES and ICES annual meetings;
- Evaluate and compare ecosystem projections and outcomes based on CIMP6 projections and IPCC AR6 results released in 2021 (decade relevant);
- Continue to expand core research activities, including:
  - Laboratory and field activities toward synthesis of climate change impacts,
  - Define and quantify climate vulnerability of marine ecosystems and key living marine resources,
  - Quantify cumulative impacts and synergetic effects of climate and marine resource use.
  - assess research gaps (decade relevant);
- Convene dedicated S-CCME topic sessions for PICES and ICES Annual Meetings (decade relevant);
- Hold joint theme or topic sessions and workshops at international symposia, including the 5th Climate and Oceans Symposium (ECCWO5) (decade relevant);
- Integrate with the PICES Human Dimensions Committee and the ICES Strategic Initiative on Human Dimensions through joint theme or topic session and workshops;
- Publish regional summaries for IPCC Assessment Reports.

### AGENDA ITEM 4

#### **PICES-2023 Session, workshop, and business meeting proposals**

Drs. Steven Bograd and Kathy Mills gave a brief overview of potential sessions or workshops for 2023, including those proposed for PICES-2023 and ICES ASC 2023. Additional upcoming meetings and workshops in 2023 and 2024 were discussed, including an open workshop at PICES-2023:

- a. 1-day Topic session and 1-day workshop on “*Sharing capacity and promoting solutions for marine ecosystem sustainability within the UN Decade of Ocean Science*” (Co-Convenors: Steven Bograd (USA), Kirstin Holsman (USA), Hannah Lachance (USA), AP-ECOP members from western Pacific (TBD) (see [AP-UNDOS proposal](#) in 2022 Annual Meeting reports)
- b. 1.5-day S-CCME/SICCME Workshop on “*Towards climate-informed ecosystem-based fisheries management*” (Co-Convenors: Kirstin Holsman (PICES/USA), Alison L. Deary (USA), Xiujuan Shan (PICES/China), Kathy Mills (ICES/USA), Alan Baudron (ICES/Scotland)) (*S-CCME Endnote 3*)

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Proposed Theme Session at ICES ASC 2023

- c. Theme session on “*Towards climate-informed ecosystem-based fisheries management*” (Co-Convenors: Alan Baudron (ICES/Scotland), Kathy Mills (ICES/USA), Kirstin Holsman (PICES/USA))
- d. Theme session on “*Predictions of top predator habitat change to inform management*” (Co-Convenors: William Sydeman (PICES/USA) and Patrick O’Hara (PICES/Canada))

### AGENDA ITEM 5

#### S-CCME activities and events of interest in 2023

Dr. Holsman facilitated a discussion on upcoming activities and events. A new spreadsheet database was shared prior to the meeting to help identify activities of interest (*S-CCME Endnote 4*). That database was discussed and the goal of updating the spreadsheet for future meetings was accepted by the group. Additional upcoming sessions at ECCWO5 and PICES were discussed.

### AGENDA ITEM 6

#### S-CCME activities and events in 2021–2022

Dr. Mills reported on SICCME activities which included a SICCME/SIHD joint session on human dimensions of climate change in marine ecosystems: from mitigation to adaptation held Monday 19<sup>th</sup> September 2022, 17:00–18:30 at the ICES ASC 2022, Dublin, Ireland (and remotely). The aim of the joint session was to use attendee expertise to (i) hear about what initiatives are currently underway to address climate change in marine ecosystems and associated human systems, (ii) get an overview of how human elements of fishery systems are adapting to current and future climate change, (iii) and identify the obstacles to climate-ready human dimensions of marine fisheries and how to address them. From this session, SICCME and SIHD chairs sought to identify topics of interest to ICES participants that may be further discussed and explored in future workshops or conference sessions.

Dr. Mills also gave a brief update on SICCME activities that include:

- Reconsidering TORs to better align with S-CCME,
- Inventory of member projects and activities,
- Expand / re-invigorate membership and activities with an eye towards connections with key groups,
- Upcoming sessions and workshops at ECCWO5, ICES ASC 2023, PICES 2023 Annual Meeting

Dr. Holsman gave a brief overview of WKCLIMAD, the ICES workshop on climate change and management held during 2021–2022. Dr. Jonathan Reum (guest) gave a brief overview of FishMIP, the climate change and fisheries intercomparison project. Dr. Ito and Holsman gave an update on the IPCC AR6 reports including the WGII report they co-authored along with scientists, including some from ICES and PICES. Dr. Bograd gave an overview of the FUTURE science program. Following this numerous UN Decade program overviews were given, including an overview of:

- SG-UNDOS and SmartNet and SUPREME by Dr. Bograd,
- UNDOS Fish SCORE (Fisheries Strategies for Changing Oceans and Resilient Ecosystems) by Dr. Mills
- UN Decade Program: Ocean Negative Carbon Emission by Dr. Zhang
- UN Decade Program: Ocean to climate Seamless Forecasting System, by Dr. Zhang
- UN Decade Network: Decade Collaborative Centre on Ocean-Climate Nexus/Coordination Amongst Partners in P. R. China (DCC-OCC), by Dr. Zhang.

## AGENDA ITEM 7

**Updates on relevant national climate change research projects of interest**

The final activity for the meeting was to review and share regional integrated modeling activities. From the US, Drs. Hollowed, Haynie, Werner, Hazen, Mueter, Holsman, Mills, and Woodworth-Jefcoats provided slides and overviews of integrated modeling projects EcoCast, Future Seas, the Alaska Climate Integrated Modeling project (ACLIM), Gulf of Alaska-CLIM, the 5th US National Climate Assessment, NMFS-DFO Climate Change working groups, the NOAA Climate, Ecosystem, and Fisheries Initiative, NMFS regional action plans for climate change and the newest high resolution ocean modeling system for the US and globe, MOM6.

From Japan Drs. Ito, Nakanowatari, and Takahashi provided an overview of integrated modeling efforts, including the Sentan Program (Advanced Research Program for Climate Change Prediction) (2022–2026), the Macro Coastal Oceanography (2022–2026), Marine Life Tag (2022–2024), and 2 national projects: 1) Prediction of Sea Ice and Ocean Variations and Climate Change Risk Assessment on Marine Ecosystems in the Southern Sea of Okhotsk including Shiretoko, a World Natural Heritage (4-2102) and 2) Macro coastal oceanography: integrated simulation for the material dynamics from the land through the open ocean as well as A03: Evaluation of the utilization of terrestrial origin nutrients in coastal marine ecosystem in the subarctic North Pacific and the Arctic Challenge for Sustainability II projects.

Drs. Lee, Jung, and Kang provided an overview of integrated projects in Korea and Drs. Shan and Zhang provided overviews of projects in China. More information can be found in *S-CCME Endnote 4* (database of projects).

## AGENDA ITEM 8

**Proposed workshops and future meetings**

Proposals were discussed briefly for PICES-2023 and it was suggested that blue carbon could be a component or discussion topic at the 2023 full-day S-CCME meeting. It was also suggested that a full day replace the proposed half day due to time. However, following this meeting further adjustments were made to the proposed workshop meeting; see the final PICES-2023 agenda for details.

- ½-day S-CCME business meeting at PICES-2023,
- 1 full day open S-CCME (workshop) meeting at PICES-2023 to support proposed topic session a below, -> e.g., Blue Carbon, participatory science, SUPREME
- Proposed for PICES-2023
  - Topic Session: Wise *et al.*: *Participatory and knowledge sharing approaches to support climate change adaptation and social-ecological system resilience*
  - Topic Session and workshop: Bograd *et al.*: *Sharing capacity and promoting solutions for marine ecosystem sustainability within the UN Decade of Ocean Science*
  - Workshop: Holsman, Shan, Mills, Baudron: S-CCME/SICCME ICES/PICES workshop: *Towards climate-informed ecosystem-based fisheries management (S-CCME Endnote 3)*
- Proposed for ICES ASC 2023
  - Theme Session: Mills *et al.*: *Towards climate-informed ecosystem-based fisheries management*
  - Theme Session: Sydeaman and O'Hara: *Predictions of top predator habitat change to inform management*

## AGENDA ITEM 9

**Adjourn**

The meeting was brought to a close by Dr. Holsman.

***S-CCME Endnote 1***

**S-CCME participation list**

Members

Kirstin Holsman (USA, Co-Chair/PICES)  
Xiujuan Shan (China, Co-Chair/PICES)  
Kathy Mills (USA, Co-Chair/ICES)  
Xuelei Zhang (China)  
Shin-ichi Ito (Japan)  
Takuya Nakanowatari (Japan)  
Motomitsu Takahashi (Japan)  
Sukgeun Jung (Korea)  
Sukyung Kang (Korea)  
Yury I. Zuenko (Russia)  
Elliott Hazen (USA)  
Franz Mueter (USA)

PICES members unable to attend

Canada: Angelica Peña  
China: Guimei Liu, Chuanxin Qin, Jinhui Wang,  
Korea: Chung Il Lee  
USA: Anne B. Hollowed, Cisco Werner, Phoebe  
Woodworth-Jefcoats

Observers

Steven Bograd (USA/FUTURE SSC Co-Chair)  
Jonathan Reum (USA)  
Paul Spencer (USA/WG 45 Co-Chair)

***S-CCME Endnote 2***

**S-CCME meeting agenda**

1. Introductions and welcome to new members
2. Adoption of agenda
3. S-CCME Phase IV (2021–2025) Implementation Plan overview (Holsman)
  - a. Review of Phase IV goals and activities  
Business items (*e.g.*, nomination of new members)
4. PICES-2023 Session, workshop, and business meeting proposals
  - a. Discussion: potential joint sessions or workshops for 2023 (Holsman)
    - 1) PICES-2023 (Bograd)
    - 2) ICES ASC 2023 (Mills)
  - Upcoming meetings and workshops in 2023 / 2024
  - Other
5. Upcoming S-CCME activities and events of interest in 2023
  - a. ICES ASC 2022 and SICCME (Mills)
  - b. PICES-2022 SC, S-CCME, S7 (Holsman)
  - c. 5<sup>th</sup> International Symposium on “*The Effects of Climate Change on the World’s Oceans*”, April 17–21, 2023, Bergen, Norway (Mills)
  - d. ICES 2023 Meeting (All)
  - e. PICES 2023 Meeting (All)
  - f. Other (All)
6. Reports on S-CCME activities and events of interest in 2021–2022
  - a. Report from ICES SICCME (Mills)
  - b. Spark updates (Holsman)
  - c. WKCLIMAD (ICES) (Holsman)
  - d. FishMIP (Reum)
  - e. IPCC WG II AR6 (Ito)
  - f. FUTURE science program (Bograd)
  - g. UN-Decade of Ocean Science activities
    - SG-UNDOS and SmartNet (Bograd)
    - SUPREME (Bograd)
    - UNDOS Fish SCORE (Mills)
    - UN Decade Program: Ocean Negative Carbon Emission (Zhang)

- UN Decade Program: Ocean to climate Seamless Forecasting System (Zhang)
  - UN Decade Network: Decade Collaborative Centre on Ocean-Climate Nexus/Coordination amongst Partners in P. R. China (DCC-OCC) (Zhang)
  - h. WG 45: WGGRAFY joint PICES/ICES Working Group on *Impacts of Warming on Growth Rates and Fisheries Yields* (Spencer)
  - i. OSM 2022 ME10 Evaluating changing ocean conditions for marine social-ecological systems including applications for fisheries, aquaculture, and ecosystem-based management (Holsman)
  - j. Other
7. Roundtable for updates on relevant national climate change research projects of interest
- a. US: EcoCast, Future Seas, ACLIM and GOA-CLIM, NCA5, NMFS-DFO CC working groups, CEFI, RAPs, MOMS6 (Hollowed, Haynie, Werner, Hazen, Mueter, Holsman, Mills, Woodworth-Jefcoats)
    - 5th US National Climate Assessment (Mills)
    - US NOAA Fisheries Climate Science Strategy (NCSS)
    - Fisheries Integrated Modeling System (FIMS)
    - OAR/GFDL/PMEL collaboration
    - NOS–West Coast Operational Forecast System (WCOFS)
    - Climate and Fisheries Initiative (CFI)
  - b. Canada (Peña)
  - c. Japan (Ito, Nakanowatari, Takahashi)
  - d. Korea (Lee, Jung, Kang)
  - e. China (Liu, Qin, Shan, Wang, Zhang)
  - f. Russia (Zuenko)
8. Wrap-up

### ***S-CCME Endnote 3***

**Proposal for a Workshop on  
“Towards climate-informed ecosystem-based fisheries management”  
at PICES-2023**

[later merged with “*International collaborations to monitor and respond to changing Arctic ecosystems*”  
and “*Standardizing indicators to monitor changing ecosystems*” and renamed as  
“*Towards climate-informed ecosystem-based fisheries management by building international  
collaborations and standardizing indicators*”

Co-Convenors: Kirstin Holsman (USA), Alison L. Deary (USA), Xiujuan Shan (China), Kathy Mills (ICES/USA), Alan Baudron (ICES/Scotland)

Co-sponsor: ICES

Duration: 1.5 day

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:

1. Case studies of accounting for climate impacts in management measures & showcasing policies applied ‘in practice’
2. Best practices and approaches for considering large-scale and long-term climate impacts
3. Reconciling long-term projections and short-term tactical management
4. Advances needed for climate-ready fisheries management to be widely adopted
5. Best practices to synthesize the impact of climate change throughout the Arctic, regardless of geopolitical domain, and engage with local and Indigenous communities on research outcomes
6. 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

This workshop will provide an opportunity to showcase how climate-informed EBFM can be implemented in practice and actions needed to get there. Outcomes of the workshop will include two peer-reviewed publications and report on best practices and example case studies of climate-informed EBFM and a decade of change paper that brings together biological, physical, and socio-economic datasets.

**S-CCME Endnote 4**

**Relevant S-CCME/SICCME activities for 2022–2023**

Point of Contact (POC)	Email	S-CCME or SICCME Member?	Activity & Achievements	Activity POC	Description	Project Start Date	End date
Kirstin Holsman	kirstin.holsman@noaa.gov	S-CCME	Ocean Sciences Meeting Session	K Holsman	K Holsman (S-CCME co-chair), helped plan and lead the OSM ME10 Evaluating changing ocean conditions for marine social-ecological systems including applications for fisheries, aquaculture, and ecosystem-based management on 3/3/2022 at 5:00 PM (EST).		

Kirstin Holsman	kirstin.holsman@noaa.gov	S-CCME	K Holsman (S-CCME co-chair), helped plan and lead the OSM ME10 Evaluating changing ocean conditions for marine social-ecological systems including applications for fisheries, aquaculture, and ecosystem-based management on 3/3/2022 at 5:00 PM (EST).	K Holsman	M Dickey-Collas, K Holsman, and M Rust co-chaired WKCLIMAD, an ICES workshop aimed at exploring how can the short-, medium-, and long-term influences of climate change on aquaculture, fisheries, and ecosystems be accounted for in ICES Advice. More information about WKCLIMAD can be found at : <a href="https://www.ices.dk/community/groups/Pages/WKCLIMAD.aspx">https://www.ices.dk/community/groups/Pages/WKCLIMAD.aspx</a>		
Kirstin Holsman	kirstin.holsman@noaa.gov	S-CCME	IPCC AR6 WKII report was finalized and released to the public early in 2022.	S Ito; K Holsman	The IPCC's 6th Assessment report WKII (impacts and adaptation) was finalized and released in 2022. Multiple S-CCME and SICCME authors contributed to this important report, in addition the report features publications from S-CCME members across WKI-III reports.		
Steven Bograd	steven.bograd@noaa.gov	S-CCME	SmartNet & SUPREME	Steven Bograd	Update and engagement with SmartNet and SUPREME for PICES member nations		
Elliott Hazen	elliott.hazen@noaa.gov	S-CCME	PICES 2023 proposed session	Elliott Hazen	Workshop on predicted change in predators and prey		
Kathy Mills	kmills@gmri.org	SICCME and S-CCME	US 5th National Climate Assessment	Kathy Mills; Kirstin Holsman	K Mills (SICCME co-chair) and K Holsman (S-CCME co-chair) are authors on the 'Oceans and Marine Resources' chapter of the 5th US National Climate Assessment, which will be finalized in fall 2023.	August 2021	Nov. 2023
Kathy Mills	kmills@gmri.org	SICCME and S-CCME	ICES Symposium on Decadal Variability of the North Atlantic and its Marine Ecosystems	Kathy Mills; Kirstin Holsman	K Mills (SICCME co-chair) convened a session on 'Trends and Drivers of Decadal Variability in Fish and Invertebrates' at the ICES Decadal Variability symposium. Anne Hollowed (S-CCME) served as the session's keynote speaker.	June 20, 2022	June 22, 2022
Kathy Mills, Kirstin Holsman, Alan Baudron	kmills@gmri.org	SICCME and S-CCME	Joint SICCME/SIHD session at ICES ASC	Kathy Mills; Kirstin Holsman	SICCME and SIHD (Human Dimensions) will host a joint session at the ICES ASC on Human Dimensions of Climate Change in Marine Ecosystems: From Mitigation to Adaptation.	Sep. 19, 2022	Sep. 19, 2022
Kirstin Holsman	kirstin.holsman@noaa.gov	S-CCME and SICCME	ECCWO workshop	Kirstin Holsman	K Holsman (S-CCME co-chair), K Mills (SICCME co-chair) and Elliott Hazen (SICCME) will convene a workshop on integrated modeling to identify climate change tipping points in marine ecosystems.	April 17, 2023	April 21, 2023

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Kathy Mills	kmills@gmri.org	SICCME	ECCWO session	Kathy Mills	K Mills (SICCME co-chair) is one of the conveners for a session on responses of marine social-ecological systems to climate extremes.	April 17, 2023	April 21, 2023
	kirstin.holsman@noaa.gov	S-CCME	ECCWO session	Kirstin Holsman	K Holsman (S-CCME co-chair), Steven Bograd (S-CCME), and Phoebe Woodworth-Jefcoats (S-CCME) will help convene a session on advances in coupling regional climate and social-ecological models to improve climate-ready ecosystem management.	April 17, 2023	April 21, 2023
	alan.haynie@ices.dk	S-CCME	ECCWO session	Alan Haynie	Alan Haynie (SICCME) is a convener of a session on coupling social science and economics in integrated marine climate modeling.	April 17, 2023	April 21, 2023
Phoebe Woodworth-Jefcoats	phoebe.woodworth-jefcoats@noaa.gov	S-CCME and SICCME	FishMIP Workshop	Phoebe Woodworth-Jefcoats	FishMIP will be holding a workshop in St. John's, Canada (with free online participation optional) on 3 - 7 October 2022.		
Franz Mueter	fmueter@alaska.edu	S-CCME	ECCWO session	Franz Mueter	Co-convenor of session on 'Cumulative anthropogenic impacts on key Arctic species'	April 17, 2023	April 21, 2023
Franz Mueter	fmueter@alaska.edu	S-CCME	ESSAS Annual Science Meeting	Franz Mueter	Organizer, with B. Planque and N. Harada (co-chairs of Ecosystem Studies of the Subarctic and Arctic Seas) of the Annual Science Meeting in Bergen, Norway, on the impacts of climate change on coastal marine ecosystems and people in coastal communities	June 2023	
Shin-ichi Ito	goito@aori.u-tokyo.ac.jp	SICCME and S-CCME	ECCWO session	Shin-ichi Ito	Manuel Hidalgo ,Rebecca G. Asch, Lorenzo Ciannelli, Shin-ichi Ito, Lauren Rogers will convene "S10: Beyond species on the move: emerging climate change impacts on the spatial dynamics of marine species, from detecting to forecasting and projecting".	April 17, 2023	April 21, 2023