Implementation Plan for Phase 5 (2025-2030)
PICES-ICES Section on
Climate Change Effects on Marine Ecosystems

S-CCME/SICCME Vision

PICES and ICES will become the leading international organizations providing science and advice related to the effects of climate change and variability on marine resources and ecosystems.

PICES and ICES will develop the scientific basis for evaluating the vulnerability, status and sustainability of marine systems under changing climate conditions. Collaborative research within PICES and ICES will facilitate the development, maintenance and evolution of a network of regional interdisciplinary research teams. The network of S-CCME teams will share research approaches on a global scale to foster laboratory, field and modelling activities that will provide data and understanding at the spatial and temporal scales needed to monitor, assess and project climate change impacts on marine ecosystems.

S-CCME's (updated) Goals:

1. **Identify, coordinate, and integrate the research activities** needed to understand, assess and project climate change impacts on marine ecosystems to support delivery of actionable advice.
2. **Review various strategies for sustaining the delivery of ecosystem goods and services** based on predictions that quantify estimates of uncertainty;
3. **Advance efforts to define and quantify the vulnerability and sustainability of marine ecosystems to climate change,** including the cumulative impacts and synergetic effects of climate and marine resource use;
4. **Support global ocean prediction frameworks**, through international collaborations and research, building on ICES and PICES monitoring programs.

UNDOS Alignment

PICES and ICES continue to be well positioned to be leading organizations participating in the UN Decade of Ocean Science for Sustainable Development ("Decade" 2021-2030). The Decade is intended to provide a common framework for international collaboration on ocean scientific research and innovative technologies in support of ocean sustainability. The Decade will contribute to the UN 2030 Agenda for Sustainable Development by fostering international cooperation aligned with 7 main societal goals:

1. A clean ocean where sources of pollution are identified and removed;
2. A healthy and resilient ocean where marine ecosystems are mapped and protected;
3. A predictable ocean where society has the capacity to understand current and future ocean conditions;
4. A safe ocean where people are protected from ocean hazards;
5. A sustainably harvested ocean ensuring the provision of food supply;
6. A transparent ocean with open access to data, information and technologies;
7. An inspiring and engaging ocean - where society understands and values the ocean in relation to human wellbeing and sustainable development.

The goals of S-CCME align well with all the Decade objectives, particularly a predictable ocean. PICES and ICES intend to participate in the Decade through actions, and S-CCME can support these through coordination and collaboration (e.g., through SmartNet).

5 Year Implementation Plan Activities & Milestones

Since the inception of S-CCME in 2011, there have been significant advancements in the tools and methods used to understand and respond to climate-driven changes to marine ecosystems and fisheries. Increasingly, these tools and information form the basis for implementing climate-informed fisheries and ecosystem management. Integration of EBM tools and ocean forecast and prediction models forms the foundation of expert advice and decision making that helps support vibrant coastal communities, ecosystems and economies. S-CCME/SICCME are well positioned to coordinate and streamline advice and tools towards operational implementation and help advance scenario planning and decision making with the best available science and information.

Support an interdisciplinary community of practice for exchange of information

S-CCME will collaborate with ICES and PICES working groups and advisory bodies to define the future direction of the joint Section/Initiative, emphasizing sustained coordination of climate change research, integration of climate information into advice products, participation in the UN Decade of Ocean Science for Sustainable Development (UNDOS), and empowerment of early-career scientists within the community of practice. In particular, S-CCME will identify focal sub-areas and points of contact for integration across sub-groups within ICES and PICES. These focal areas may include themes such as climate-informed Ecosystem Based Management, climate-linked spatial modeling, scenario and adaptation planning, tipping point analyses, risk assessments, and ensemble approaches.

Communicate and advance understanding

Through information-sharing networks, regular meetings, and interdisciplinary workshops, S-CCME will advance understanding of climate impacts and adaptation in marine ecosystems. Joint ICES–PICES theme sessions and workshops will provide a forum for scientific exchange and dissemination to the broader research and policy communities. In Phase V we aim to hold annual business meetings as well as 10-12 (roughly monthly) meetings of the chairs and sub-group leads and a semi-annual Spring working meeting to identify and advance products, tools, and frameworks to support actionable climate-informed EBM advice. At each annual business meeting, S-CCME members participating in UNDOS activities will share relevant projects and discuss ways in which S-CCME does or can support UNDOS efforts.

Synthesize and share knowledge with relevant bodies

S-CCME will co-develop open-science resources, including code packages and data templates, to enable transparent and reproducible synthesis of climate-related information. Regional summaries and synthesis products will be coordinated with ICES and PICES communities and submitted to regional, national and international assessments (e.g., IPCC AR7, IPBES) and advisory processes.

Recurring Annual Activities (All Goals)

Annual Cycle	Purpose	Outputs

Monthly S-CCME Leads Meetings	Coordination, monitoring, and communication among S-CCME/ SICCME and deliverable leads.	Quarterly updates and shared action logs.
Spring Working Meeting	Planning, training, and synthesis around annual deliverable themes.	Workshop report, refined deliverable plans, "State of Progress" summary.
Business Meeting (Sept/Oct)	Annual review, alignment with ICES/PICES committees, and approval of next-year priorities.	S-CCME Annual Report, coordination and communication across regions, updated implementation schedule.
Final Year (2030)	Phase V Symposium replaces Spring Meeting or is in coordination with the fall Business Meeting.	S-CCME Legacy Report, synthesis outputs, and Phase VI plan.

Cross-Cutting Metrics (All Goals)

- **Governance:** Regular meetings, participation rates, and timely reporting.
- **Science Outputs:** Frameworks, inventories, publications, and synthesis contributions.
- **Advice Outputs:** Uptake of frameworks and products in ICES/PICES and member nation processes.
- **Capacity Building:** Number and diversity of member nations and early-career scientists engaged.
- **International Alignment:** Documented contributions to UNDOS, IPCC, and national and regional climate initiatives.
- **Open Science and Communication:** Inventories, shared data, code, and communication products.

Milestones and Progress Metrics (2026–2030)

Goal	Key Activities	Milestones	Progress indicators
Goal 1: Identify, coordinate, and integrate the research activities needed to understand, assess and project climate change impacts on marine ecosystems.	Coordinate interdisciplinary research on marine ecosystem responses to climate change. Facilitate information exchange across ICES and PICES expert groups and regional initiatives. Support early-career scientist engagement in integrated climate–ecosystem research.	**Monthly Theme Leads Meetings:** Maintain monthly coordination between S-CCME co-chairs, ICES SICCME leads, and theme group leads to track progress and emerging science priorities. **Annual Spring Workshop:** Focus on defining and refining interdisciplinary research priorities and deliverable themes (e.g., EBM, stock assessments, oceanographic projections). **Annual Business Meeting (Sept/Oct):** Review coordination outcomes, finalize annual report, and align next year's priorities with PICES and ICES committees.	10–12 coordination meetings held annually with bi-annual summaries. Annual workshop report and progress statement included in S-CCME annual report. Increased cross-membership and collaboration across ICES and PICES expert groups.
Goal 2: Review various strategies for sustaining the delivery of ecosystem goods and services based on predictions that quantify estimates of uncertainty.	Review state of the art tools and methods that integrate climate projections into ecosystem-based management (EBM). Lead deliverable theme groups producing operational templates and guidance for management uptake. Collaborate with ICES and PICES advisory bodies and working groups to align outputs with management and	**Deliverable Themes Established (2026):** Launch working groups for climate-informed EBM, Ecosystem Overview templates, and climate-ready stock assessments. **Annual Spring Workshop:** Review and refine deliverable progress and ensure connection to management applications.	At least three active deliverable theme groups by 2026. At least one guidance document, template, or synthesis paper per theme by 2030. Documented use of S-CCME deliverables in ICES and PICES advice processes.

	regional priorities, supporting delivery of actionable advice.	**Annual Business Meeting:** Evaluate EBM implementation outcomes and integration into advice frameworks.	
Goal 3: Advance efforts to define and quantify the vulnerability and sustainability of marine ecosystems to climate change, including the cumulative impacts and synergetic effects of climate and marine resource use.	Advance regional and thematic synthesis to identify vulnerabilities under climate scenarios. Facilitate integration of physical, biological, and human dimensions through coordination among scenario and risk modeling. Engage in regional international assessments (UNDOS, IPCC AR7, IPBES) to communicate findings around ecosystem impacts and changes as well as effective adaptation and mitigation approaches.	**Annual Spring Workshop:** Feature focused sessions on vulnerability assessment methods and applications. **Annual Business Meeting:** Synthesize progress toward IPCC AR7 inputs and regional synthesis products. **Deliverable Themes:** Develop standardized "Climate Assessment Framework" for ICES/PICES regions.	Contributions submitted to IPCC AR7 and UNDOS projects. Regional climate assessment frameworks (and where applicable, climate summaries) completed and shared with PICES/ICES committees. Published synthesis products (e.g., fact sheets, special issues) highlighting regional vulnerability trends.
Goal 4: Support global ocean prediction frameworks, through international collaborations and research, building on ICES and PICES monitoring programs.	Advance coupled physical– biological modeling, AI-based forecasting, and open-science tool development. Promote international collaborations linking PICES/ICES to UNDOS networks and SmartNet initiatives. Support the creation of reproducible code and data-sharing frameworks.	**Deliverable Themes:** Launch theme groups focused on coordination among ICES and PICES groups working on oceanographic and AI modeling and marine CDR (carbon dioxide removal). **Annual Spring Workshop:** Report progress on predictive modeling deliverables and cross-regional synthesis. **Final Symposium (2030):** Present S-CCME Phase V outcomes, including predictive framework prototypes and global stocktake contributions.	Open-access modeling and synthesis tool inventory launched by 2028. At least one PICES/ICES-endorsed synthesis of predictive frameworks completed. S-CCME Phase 5 Report or special volume published and endorsed by both organizations.

Appendix A: Background

In the spring of 2011, PICES and ICES agreed to move forward on the Science Plan for a PICES-ICES Section on Climate Change effects on Marine Ecosystems (S-CCME IP). This project is known within ICES as the Strategic Initiative on Climate Change Impacts on Marine Ecosystems (SICCME). As stated in the Science Plan the goal of S-CCME was to:

1. Define the research activities needed to understand, assess and project climate change impacts on marine ecosystems with sufficient spatial and temporal resolution to plan strategies for sustaining the delivery of ecosystem goods and services and the preservation of biodiversity. When possible projections should quantify estimations of uncertainty.

2. Define and quantify the vulnerability of marine ecosystems to climate change, including the cumulative impacts and synergetic effects of climate and marine resource use.

3. Build global ocean prediction frameworks, through international collaborations and research, building on ICES and PICES monitoring programs.

The PICES and ICES co-chairs published an initial Science Plan and a 2012-2014 Implementation Plan (IP) for this initiative (Hollowed et al, 2013: Appendix 4, S-CCME IP). A phased implementation approach was proposed, and at the PICES Annual Meeting in 2019, S-CMME requested that IP Phase durations be extended to 5 years; this request was approved by the Governing Council. Within the IP, both organizations recognized that while the specific activities of S-CCME may change overtime three activities of the S-CCME IP were expected to be continuous:

1. Synthesis of existing knowledge,
2. Advancement of new science and methodology, and
3. Communication of research findings.

Phase 2 (2015-2017) IP included:

- Continue to advance new science focused on climate change effects on marine ecosystems through theme/topic sessions and workshops;
- Update and improve forecasts with IPCC AR5 scenarios;
- Convene an international symposium in 2016;
- Develop regional synthesis reports;
- Initiate inter-sessional training for projecting climate change impacts on marine ecosystems;
- Continue collaboration with global climate change research community.

Phase 3 (2018-2020) IP included:

- Continue to advance new science focused on climate change effects on marine ecosystems through theme/topic Sessions and workshops;
- Update and improve predictions with IPCC AR6 scenarios;
- Develop regional synthesis reports;
- Convene an international symposium in 2018.

Phase 4 (2021-2025) IP included those of phases 1-3 as well as :

- Provide forums for communication and coordination between national climate research nodes modeling teams. A key element of this process will be to propose investigator meetings during the PICES and ICES annual meetings.

- Evaluate and compare ecosystem projections and outcomes based on CMIP6 projections and IPCC AR6 results released in 2021.
- Continue to expand core research activities, including laboratory and field activities, needed to advance the global synthesis of climate change impacts on marine ecosystems for sustaining the delivery of ecosystem goods and services, and define and quantify the vulnerability of marine ecosystems and key living marine resources to climate change. [Decade relevant]
- Convene dedicated S-CCME topic sessions for PICES and ICES Annual meetings. [Decade relevant]
- Provide a forum for the assessment and synthesis of existing projections of climate change impacts on marine ecosystems through joint theme or topic sessions and workshops at international symposia including the 5th Effects of Climate Change on the World's Oceans Symposium (tentatively scheduled for June 2023 in Bergen, Norway). [Decade relevant]
- Encourage integration with the PICES Human Dimensions Committee and the ICES Strategic Initiative on Human Dimensions through joint theme or topic sessions and workshops.
- Publish regional summaries in a timely manner to allow their consideration by the relevant IPCC Assessment Reports. This effort will facilitate international collaboration and will provide a vehicle to communicate our current knowledge to stakeholders and the broader scientific community.