2025 Report of Advisory Panel on North Pacific Coastal Ocean Observing Systems (AP-NPCOOS)

Purpose of Annual Reports: Since PICES-2022, Committees/FUTURE are requested to hold **at least one virtual business meeting before the Annual Meeting**. Committees/FUTURE (mandatory) and Expert Group (optionally upon request) will have **an in-person business meeting during the Annual Meeting**. This Annual Report is to record the discussion items and outcomes of these business meetings.

1. Overview

The Advisory Panel on North Pacific Coastal Ocean Observing Systems (AP-NPCOOS) continued its role in 2025 as a coordination and synthesis platform for long-term coastal and shelf ocean observations across the North Pacific. Activities in 2025 focused on strengthening information sharing on mooring-based time-series observations, advancing collaborative analysis of subsurface marine heatwaves (MHWs), and enhancing coordination with related PICES, including BECI.

A combination of online meetings and in-person workshops was used to facilitate sustained collaboration among member countries, culminating in the W10 workshop at the PICES-2025 Annual Meeting in Yokohama.

2. Meetings Held in 2025

Online meetings

- February 13, 2025
  Sharing of information on mooring observations and long-term time-series stations from each participating country.
- May 9, 2025
  Discussion of progress in compiling time-series station information, refinement of the W10 workshop program, and consideration of additional invited speakers.
- October 1, 2025
  Pre-W10 online meeting focused on early sharing of preliminary analyses of subsurface marine heatwaves using mooring data.

In-person meetings

- November 9, 2025
  W10 Workshop: “Shelf Data Collected by Moorings: Subsurface Marine Heatwaves and Their Implications” at the PICES-2025 Annual Meeting, Yokohama.
- November 12, 2025
  AP-NPCOOS business meeting held during the PICES-2025 Annual Meeting.

3. Summary of Major Activities

3.1 W10 Workshop on Subsurface Marine Heatwaves

The W10 workshop brought together experts from Canada, the United States, Japan, South Korea, and other regions to examine the characteristics, mechanisms, and observational challenges of marine heatwaves in shelf and coastal environments. A central motivation was the recognition that while surface MHWs are relatively well documented using satellite-derived SST, subsurface MHWs—particularly over continental shelves—remain poorly understood despite their strong ecological relevance.

The invited keynote presentation by Dr. Amandine Schaeffer (University of New South Wales, Australia) demonstrated the critical value of long-term, high-frequency shelf mooring observations, using a 28-year in situ temperature record from the Australian continental shelf. Her analysis identified multiple vertical classes of MHWs (surface, subsurface, and vertically extensive events), each associated with distinct physical drivers such as atmospheric forcing, wind-driven downwelling, and boundary-current intrusions.

National presentations highlighted:

- Canada presented results from moorings along the west coast, highlighting the loss of cold winters as a dominant signal and distinguishing between moderate and extreme MHWs.
- United States presented analyses from multiple shelf and offshore moorings, revealing depth-dependent MHW intensity and coherence across regions.
- South Korea presented subsurface MHW characteristics derived from long-term mooring observations along the eastern coast, demonstrating links with current variability and large-scale climate indices.

Discussions emphasized the need for consistent methodologies, shared data inventories, and coordinated synthesis across regions.

- Widespread occurrence of subsurface MHWs across the North Pacific shelves;
- Strong sensitivity of MHW detection to baseline and climatology choices;
- Long persistence of subsurface MHWs revealed through mooring data;
- The importance of integrating temperature observations with circulation and climate indices.

3.2 Early Analysis Sharing and Data Inventory

AP-NPCOOS will initially focus its data inventory efforts on long-term mooring observations, recognizing their critical importance for resolving subsurface processes and marine heatwave (MHW) dynamics on continental shelves. As a first step, metadata for available long-term mooring datasets will be compiled and shared using a Google Drive–based platform (https://docs.google.com/document/d/1aIT03DXdo36DGDB0FzOvRs1j81pjn2CO138KQwHw0ms/edit?usp=sharing), enabling efficient information exchange among participating countries.

The metadata inventory will include key information such as station location, deployment period, depth range, measured variables, and data availability. This approach is intended to establish a clear overview of existing observational assets across the North Pacific and to facilitate coordinated analyses.

In subsequent phases, AP-NPCOOS plans to share MHW-related analysis results and analysis tools among members. By exchanging methodologies, scripts, and diagnostic approaches, the panel aims to promote the use of common and consistent methods for detecting and characterizing MHWs, particularly subsurface events. This coordinated framework will support intercomparison across regions and contribute to a more integrated understanding of MHW characteristics in the North Pacific. Participants discussed the scope of datasets to be included in a shared inventory, agreeing to prioritize mooring data while keeping open the possibility of incorporating CTD, glider, and survey data in future synthesis efforts.

3.3 Collaboration with BECI and Related Initiatives

AP-NPCOOS discussed collaboration with the BECI project, particularly through the development and maintenance of a shared data inventory that can serve as a connection point between observing systems and user communities. Participants agreed that updates to the inventory should be communicated to the PICES Secretariat to facilitate broader visibility and coordination.

Linkages with CoastPredict and WG-49 were also discussed, especially in relation to potential follow-up workshops and synthesis activities focused on extreme ocean events.

4. Future Plans and Action Items

- Continue regular online meetings (approximately quarterly) to support sustained collaboration.
- Refine and expand the shared inventory of long-term mooring observations across the North Pacific.
- Pursue synthesis activities, including potential multi-regional publications on subsurface marine heatwaves.
- Coordinate follow-up workshops and writing efforts in collaboration with WG-49 and other relevant PICES expert groups.
- Explore opportunities to integrate subsurface MHW findings with ecosystem and impact-focused studies.

5. Concluding Remarks

Activities in 2025 strengthened AP-NPCOOS's role as a coordinating body for shelf and coastal ocean observations in the North Pacific. The W10 workshop and associated discussions highlighted the critical importance of long-term mooring observations for understanding subsurface marine heatwaves and provided a foundation for future synthesis and collaborative research.

AP-NPCOOS Endnote 1

Proposal for a Workshop on "*Understanding shelf marine heatwaves through long-term mooring observations across the North Pacific*" at PICES-2026

AP-NPCOOS workshop proposal for 2026

Title: Understanding Shelf Marine Heatwaves Through Long-Term Mooring Observations Across the North Pacific

Duration: 0.5 days

Co-conveners:

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Workshop description:

Coastal and shelf regions are critically important due to their direct influence on human societies, yet they exhibit highly complex physical and biogeochemical variability across a wide range of spatial and temporal scales. This inherent complexity makes it challenging to assess long-term trends and diagnose extreme events, including marine heatwaves (MHWs). To address these challenges, several North Pacific nations have established and maintained long-term (>20 years) mooring networks and other fixed-platform observational systems. These platforms collect high-frequency measurements—typically at minute- to hourly-scale intervals—providing essential information for understanding processes occurring across multiple temporal scales, from tidal and synoptic variability to interannual and decadal change.

Marine heatwaves (MHWs) are becoming increasingly common in the North Pacific, profoundly altering marine ecosystems and affecting climate indicators such as ENSO and PDO. While the drivers of open-ocean MHWs are relatively well understood, the mechanisms that generate, sustain, or advect extreme thermal anomalies in shelf and coastal waters remain poorly understood due to the heterogenous variability, tidal processes, wind events, freshwater inputs, and rapid water mass transitions, all of which complicate the detection and interpretation of extreme events. Notably, subsurface MHWs can persist for years after open-ocean events, underscoring the need for coordinated investigation using long-term mooring records.

The first half of the workshop will bring together updates from participating member countries, with the goal of completing an overview of available coastal and shelf mooring data—both surface and subsurface—and diagnosing regional sub/surface MHW characteristics. Building on these discussions, the workshop will develop a framework that integrates coastal and shelf MHW characteristics across the North Pacific. Such a framework would provide a foundation for basin-scale synthesis, improve scientific understanding of extreme coastal ocean conditions, and support ecosystem assessment and climate-resilience planning.

PICES Expert Groups: POC, TCODE, MONITOR