2024 Report of Working Group on Ecology of Seamounts (WG47)

Janelle Curtis and Mai Miyamoto, the Co-Chairs of Working Group on Ecology of Seamounts (WG47) convened a virtual business meeting as well as an in-person hybrid business meeting at the PICES 2024 Annual Meeting in Honolulu, USA. The business meetings focused on introductions of national representatives and observers, discussions of WG47's terms of reference, exchange of information and ideas about participants' seamount research activities, and preparation of WG47's final report.

The virtual business meeting was chaired by Janelle Curtis, held on 23 September 2024 from 17:00-18:00pm PDT (*WG47 Endnote 2*), and there were three participants (*WG47 Endnote 1*). The in-person hybrid meeting was chaired by Janelle Curtis, held on 31 October from 8:50am – 12:30pm HST (*WG47 Endnote 2*) and there were 14 participants (*WG47 Endnote 1*), including nine WG47 members, one colleague from PICES FUTURE Program, one colleague from the PICES Secretariat, and two observers with expertise in the identification of vulnerable marine ecosystems (VMEs) on seamounts in the North Pacific Fisheries Commission's (NPFC) Convention Area. The meetings had similar agendas to the business meetings in 2022 and 2023, although there was also a focus on preparation of WG47's final report in 2025. The PICES Secretariat arranged for the business meeting in Honolulu to be a hybrid meeting and one WG47 member joined the meeting virtually.

During both meetings, participants introduced themselves after WG47 co-chair(s) welcomed everyone and shared their opening remarks. Meeting participants adopted the agenda at both meetings. A group photo was taken during the hybrid meeting on 31 October 2024 (*WG47 Endnote 3*).

Dr. Satoi Arai (Japan) is a new member of WG47 since the 2023 PICES meeting in Seattle.

Virtual meeting on 23 September 2024

AGENDA ITEM 2
Review achievements of WG47 against the Terms of Reference (WG47 TOR: https://meetings.pices.int/members/working-groups/wg47)

Meeting participants reviewed primary papers and other working papers that could be cited as evidence that WG47's TOR have been addressed.

AGENDA ITEM 3
Discuss any requests/proposals to the Biological Oceanography Committee and Science Board

No requests or proposals were identified during this meeting.

AGENDA ITEM 4
Identify relevant primary papers that have or will be completed, and if authors need financial support for open-access publications

Although Alexei Orlov was unable to participate in the meeting, he let participants know that he

is co-authoring two primary papers that focus on the distribution and biology of *Coelorhinchus gilberti* (Macrouridae, Gadiformes, Teleostei) from longline catches off the Emperor Seamounts, and a review of Soviet/Russian fisheries off the Emperor Seamounts.

AGENDA ITEM 5
Other Business

Participants discussed the formatting and content of WG47's final report and agreed to discuss this in more detail at the hybrid meeting during PICES-2024.

Hybrid meeting on 31 October 2024

AGENDA ITEM 2
Update on FUTURE (Jennifer Boldt)

Jennifer Boldt provided updates from PICES FUTURE SSC, which is an integrative Scientific Program to understand how marine ecosystems in the North Pacific respond to climate change and human activities, to forecast ecosystem status based on a contemporary understanding of how nature functions, and to communicate new insights to its members, governments, stakeholders, and the public.

AGENDA ITEM 3
Preparation of a PICES Fact Sheet for WG47 (Devon Warawa)

Devon Warawa provided information about how WG47 will prepare a Fact Sheet about its work. In response to questions from participants, Devon clarified that she would work with WG47 to prepare a Fact Sheet before WG47 submits its final report.

AGENDA ITEM 4
Update on member research and activities related to WG47 TOR

Some of the WG47 members updated others on research activities related to WG47's TOR and there were thoughtful comments and questions from meeting participants. As examples, Janelle Curtis updated participants on her program's work to use visual data to identify vulnerable marine ecosystems (or VMEs) on Cobb Seamount and predict the distribution of likely VMEs throughout the Cobb-Eickelberg Seamount Chain. Kota Sawada summarized his research with e-DNA and cameras on splendid alfonsino and North Pacific armorhead on the Emperor Seamount Chain. Mai Miyamoto described her research on sea-floor visual observation survey to determine the distribution of VME indicator species in the northern fishing area of Emperor Seamounts. And Amy Baco-Taylor described some of her research on the genetics and abundances of coral taxa on fished and unfished seamounts in the Emperor Seamount Chain and North Hawaiian Ridge. Les Watling also presented some of his research. Although Chris Rooper wasn't able to participate in this meeting, he did let participants know that he spent a few weeks surveying seamounts with randomly placed drop camera transects down to about 850 m in depth on seamounts in the Cobb-Eickelberg Seamount Chain.

AGENDA ITEM 5
Report on Deep Ocean Stewardship Initiative (DOSI) Seamount Science Summit (Les Watling)

Les Watling provided an update on the Deep Ocean Stewardship Initiative's (DOSI) Seamount Science Summit that was convened in Honolulu just before PICES 2024 began. Four members of WG47 (Les Watling, Amy Baco-Taylor, Chris Rooper and Janelle Curtis) participated in that seamount summit. Don Kobayashi, one of the observers during WG47's business meeting, also participated in DOSI's Seamount Science Summit. Janelle Curtis was invited to the summit specifically to update DOSI members on the workplans of WG47 and the North Pacific Fisheries Commission's (NPFC) Scientific Committee. There were also discussions about WG47 including a proposal for a new working group to focus on VMEs and/or significant adverse impacts (SAI) on seamounts and the potential for merging a new PICES working group on seamounts with an NPFC scientific group.

AGENDA ITEM 6
Discussion of collaboration on primary papers

There was no discussion of collaboration on primary papers.

AGENDA ITEM 7
Discussion of preparation of WG47's final report, including recommendations for future research

WG47 members discussed their contributions to achieving WG47 TOR, including making data available through the Ocean Biodiversity Information System (OBIS https://obis.org/), the Government of Canada Open Data Portal (Cobb Seamount Visual Survey 2012 (AUV) - Open Government Portal, Cobb Seamount Visual Survey 2012 (ROV) - Open Government Portal), and data in the supplemental sections of primary papers. Members also identified potential publications to cite related to indicators for assessing seamount biodiversity and data that could potentially be used to document ecological interactions among seamount taxa.

Topics related to one or more proposals for a new PICES working group were explored again. Apart from a proposal for a new working group to focus on VMEs and/or significant adverse impacts (SAI) on seamounts, participants expressed an interest in a working group that was able to focus on life history of seamount taxa, with an emphasis on reproduction and connectivity, and a better integration of biology and physics. Another topic to explore was the improvement of science communication with stakeholders and the general public.

Members also agreed on a general timeline for preparing and submitting WG47's final report in the spring of 2025.

WG47 Endnote 1

WG47 virtual meeting (23 September 2024) participation list

Members
Janelle Curtis (Co-Chair, Canada)
Kota Sawada (Japan)
Hye-Won Moon (Korea)
Satoi Arai (Japan)
Mai Miyamoto (Japan)
Kenji Taki (Japan)
Seonock Woo (Korea)
Sung Yong Kim (Korea)
Alexei Orlov (Russia)
Tatiana Dautova (Russia)
Amy Baco-Taylor (USA
Samuel Georgian (USA)
Les Watling (USA)

Members unable to attend
Anders Knudby (Canada)
Chris Rooper (Canada)
Kuidong Xu (China)
Zijun Xu (China)

WG47 hybrid meeting (31 October 2024) participation list

Members
Janelle Curtis (Co-Chair, Canada)
Mai Miyamoto (Co-Chair, Japan)
Satoi Arai (Japan)
Kota Sawada (Japan)
Sung Yong Kim (Korea)
Hye-Won Moon (Korea)
Seonock Woo (Korea)
Amy Baco-Taylor (USA)
Les Watling (USA)

Members unable to attend virtual and/or hybrid meetings
Canada: Anders Knudby, Chris Rooper
China: Kuidong Xu, Zijun Xu
Japan: Kenji Taki
Russia: Tatiana Dautova, Alexei Orlov
USA: Samuel Georgian

Observers
Don Kobayashi (USA)
Hiroe Yutaka (Japan)
Alex Zavolokin (North Pacific Fisheries Commission, NPFC)

PICES
Jennifer Boldt (FUTURE)
Devon Warawa (PICES Secretariat)

WG47 Endnote 2

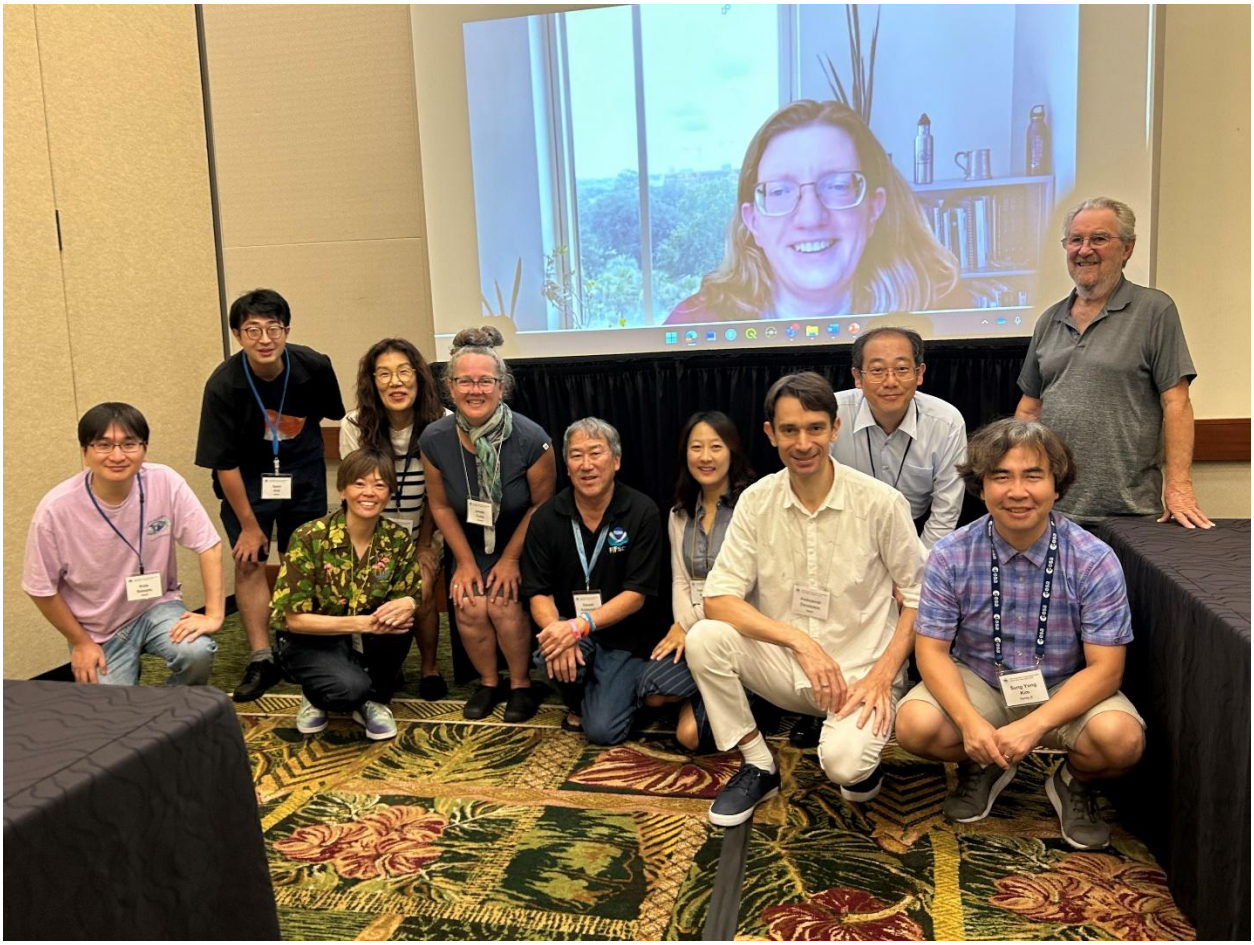
WG47 meeting agenda (virtual meeting on 23 September 2024, 17:00-18:00 PDT)

1. Welcome and opening remarks
2. Review achievements of WG47 against the Terms of Reference (WG47 TOR: working-groups - PICES - North Pacific Marine Science Organization)
3. Discuss any requests/proposals to the Biological Oceanography Committee and Science Board.
4. Identify relevant primary papers that have or will be completed, and if authors need financial support for open-access publication(s).
5. Other business.

WG47 meeting agenda (hybrid meeting on 31 October 2024)

1. Round of introductions and group photo
2. Update on FUTURE (Jennifer Boldt)
3. Preparation of a PICES Fact Sheet for WG47 (Devon Warawa)
4. Updates on member research and activities related to WG47 TOR
5. Break – 10:15am to 10:50am
6. Report on Deep Ocean Stewardship Initiative (DOSI) Seamount Science Summit (Les Watling)
7. Discussion of collaboration on primary papers
8. Discussion of preparation of WG47's final report, including recommendations for future research

WG47 Endnote 3



WG47 hybrid meeting (31 October 2024) photo of participants. On the screen (virtual participant): Amy Baco-Taylor. From left to right in person: Kota Sawada, Satoi Arai, Mai Miyamoto, Seonock Woo, Janelle Curtis, Don Kobayashi, Hye-Won Moon, Alex Zavolokin, Hiroe Yutaka, Sung Yong Kim, and Les Watling.

WG47 Endnote 4

Working Group Achievement against TORs.

* This information was submitted to SB-2024

List of TOR Items	How did you achieve the TOR items?
Year 1: Gather data on the distribution and life history of pelagic, demersal, and benthic taxa, including fish and invertebrate assemblages associated with seamounts in the North Pacific Ocean and facilitate their submission to appropriate biodiversity databases, e.g., Ocean Biogeographic Information System (OBIS)	Canada has autonomous underwater vehicle (AUV) and remotely operated vehicle (ROV) data from Cobb Seamount in international waters that were recently published on Canada's Open Government Portal. So those two datasets are now publicly available.
Year 1: Gather data on key environmental variables (e.g. temperature, depth, steepness, substratum, current velocity, isolation, ocean acidification) hypothesized to influence the distribution and diversity of species associated with seamounts.	Sam Georgian updates the World Ocean Atlas data that Working Group 32 on the Biodiversity of Biogenic Habitats used to predict the distributions of benthic taxa. These environmental data are now available throughout the North Pacific Ocean, and available for use in analyses or predictive models of seamount taxa.
Year 1: Convene a 2-day workshop on "Distributions of pelagic, demersal, and benthic species associated with seamounts in the North Pacific Ocean and factors influencing their distributions."	This 2-day workshop was convened during PICES 2022 in Busan, South Korea.
Year 2: Identify environmental and ecological predictors of patterns in the distribution and biodiversity of pelagic, demersal, and benthic taxa associated with seamounts in the North Pacific Ocean.	Analyses suggest that dissolved oxygen, photosynthetically active radiation, Omega calcite, and particulate organic carbon were correlated with and potentially influence the predicted habitat suitability of black corals. Analyses also suggest that sea surface temperature, roughness, chlorophyl-A, and current velocity are correlated with the habitat suitability of stony corals. Slope, eastness, omega calcite and Chlorophyl-A are correlated with the habitat suitability of gorgonian corals, and the habitat suitability of other soft corals is correlated with roughness, chlorophyl-A, and topographic Position Index.
Year 2: Apply one or more modeling approaches (e.g. MaxEnt, Boosted Regression Trees, or high-resolution bathymetry-based models) to predict the distribution of pelagic, demersal, and benthic biodiversity associated with seamounts in the North Pacific Ocean.	WG47 built MaxEnt models that did not include any true absence data. These have since been updated to include absence data from NOAA and DFO trawls surveys. Sam Georgian also constructed ensemble models using Random Forest, Boosted Regression Trees, and Generalized Additive Models (or GAMs)for black corals, stony corals, and gorgonian and non-gorgonian soft corals. Canada has also predicted the distribution of areas that are likely to be VMEs in the Cobb-Eickelberg Seamount Chain in the northeast Pacific Ocean using a generalized additive model or a GAM.
Year 2: Use available data to predict climate induced changes in the distributions of seamount fauna.	This term of reference (TOR) will not be completed by WG47 because of limited data, capacity and expertise within our group.

Year 2: Convene a topic session on the pelagic, demersal, and benthic species associated with seamounts at the PICES Annual Meeting	This topic session was held during PICES 2023 in Seattle.
Year 3: Identify potential indicators for assessing and monitoring the biodiversity of pelagic demersal, and benthic taxa associated with seamounts.	WG47 members concluded that the density of North Pacific Fisheries Commission indicators (corals and sponges) can be used to identify vulnerable marine ecosystems (VMEs) on seamounts. Members also agreed that eDNA can also be used to assess and monitor seamount biodiversity.
Year 3: Use cluster analysis and/or association analysis to review and document ecological interactions among seamount taxa.	Canada undertook a cluster analysis of species associated with structurally complex habitats, or what was identified as VMEs based on the density of structure forming deep sea corals. Compared was the community of species that are associated with those structure-forming corals and the community of species not associated with those deep-sea corals. The two communities are significantly different from each other in terms of both the number and type of species.
Year 1-3: Annual WG business meetings, both virtual meetings and those in association with the PICES Annual Meeting	Annual business meetings were held virtually in 2021 and 2022, in person during PICES 2022 and 2023 and virtually on 23 September 2024.