

2025 Inter-sessional Science Board Meeting – Notes from the Science Board Chair

By Sukyung Kang



Credit: Toby Mathews/Ocean Image Bank

PICES holds an Inter-Sessional Science Board (ISB) meeting each year during the first half of the year, providing the Science Board with an opportunity to review scientific activities mid-term. ISB-2025 took place virtually via Zoom from May 7-9, 2025, one month before the One Ocean Science Congress (OOSC) and the United Nations Conference on the Ocean (UNOC3).

One of the primary purposes of the ISB-2025 meeting was to review the activities and progress of the PICES's committees and two programs: FUTURE (Forecasting and Understanding Trends, Uncertainty, and Responses of North Pacific Marine Ecosystems) and SmartNet (Sustainability of Marine Ecosystems Through Global Knowledge Networks). The FUTURE Scientific Steering Committee (SSC) reported on the progress of their synthesis paper, "On the Development of an Interdisciplinary International Science Program to Advance Ocean Sustainability: The PICES FUTURE Program," which they submitted to the

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ICES Journal of Marine Science. According to the editor's comments, the article's category was changed to "Quo Vadimus" instead of "Original Article." During the last annual meeting, FUTURE held the "FUTURE Symposium" to celebrate its contributions to PICES and the North Pacific marine science community. Since FUTURE is concluding its third phase (2021–2025), the SSC presented their transition plans for the period leading up to PICES-2026. These plans include preparing a final report, providing guidance for the next PICES Science Program, and overseeing expert groups such as the [Working Group on Climate Extremes and Coastal Impacts in the Pacific \(WG 49\)](#), the [Early Career Ocean Professionals \(ECOP\) Advisory Panel \(AP-ECOP\)](#), and the [Science Communications Advisory Panel \(AP-SciCom\)](#). The SSC also emphasized the importance of engaging ECOP members in the wrap-up process. For more details on FUTURE activities, see page 24 in this issue.

SmartNet is a joint ICES-PICES network initiative under the United Nations Decade of Ocean Science (UNDOS), facilitated by the Advisory Panel on United Nations Decade of Ocean Science (AP-UNDOS), and has contributed to papers on the climate-biodiversity-fisheries nexus and knowledge sharing in small island developing states (SIDS).

SmartNet has also conducted "The Ocean We Want" surveys in eight countries, including Japan, the United States, and Indonesia. The first paper based on Indonesian data has been published (see [Purnomo et al. 2025](#)). SmartNet scientists participated in OOSC, which is designed to align with the UNDOS. The overarching goal is to aid decision-making and the global discussions and negotiations scheduled for the upcoming UNOC3. SmartNet scientists organized or co-sponsored several workshops, including ones on climate-ready fisheries management, indigenous co-design, and evaluation approaches for ocean policy.

The activities of the PICES expert groups are at the core of PICES's scientific endeavors. Science Board also reviewed two new Expert Group proposals. The first is the PICES/ICES Joint Working Group on Best Practices for Using Deep Learning in Progressing Plankton Images. This working group will enhance the consistency of plankton image processing by integrating deep learning into plankton research in a standardized and transparent manner. It will also enable comparisons between different regions and contribute to a broader understanding of ocean health and the impact of climate change. This working group's outcomes will lay the groundwork for future advancements in AI-driven marine monitoring and ecosystem-based management. The Science Board commented that this new expert group should consider the data-sharing platform available to all PICES member countries and ensure that members from Korea and Russia are recruited, provided they have the necessary expertise.

The second proposal is for the Study Group on North Pacific Ecosystem Status Report (SG-NPESR IV). The NPESRs were initiated in the early 2000s to provide an integrated overview of the status and trends of marine ecosystems, including climate, oceanography, biology, and human dimensions. In 2024, the PICES External Review Recommendation Report encouraged PICES to transform in order to deliver "actionable science" more explicitly. The report emphasized the need for the next NPESR to evolve to provide meaningful information to users across PICES communities and beyond. The newly established Study Group will develop an implementation plan for the next NPESR. The plan will be based on a more coordinated and efficient framework that enhances comparability across regions, improves the detection of ecosystem-wide patterns, and integrates findings into management decisions in



PICES logo made from names of current Expert Groups.

a timely manner. The membership of this Study Group has not yet been finalized. I encourage interested scientists to participate and to contact the [PICES Secretariat](#) to explore involvement.

Capacity building is another high-priority activity for PICES. [AP-ECOP](#) is planning two capacity development events for the PICES-2025 Annual Meeting: a Mentor-Mentee Program and an Introduction to PICES. There will also be two side events: a beach cleanup and a site visit to local research institutes.

PICES partner organizations also organize capacity development opportunities for ECOPs. The Scientific Committee on Oceanic Research (SCOR) actively builds capacity for ocean science by focusing on developing scientists' skills and competencies. This is achieved through various programs and initiatives, including the SCOR visiting scholars' program and travel grants to attend scientific meetings. In June, the Asia-Pacific Network for Global Change Research (APN) held a training workshop on "Proposal Development" in Jeju, Korea. APN holds this workshop annually to teach ECOPs from APN countries how to develop successful proposals for APN research funds. A summary of the 2024 workshop is on page 4 of this issue. In 2025, PICES and APN jointly sponsored the travel of two ECOP participants from China and Russia through an open application process. The Intergovernmental Oceanographic Commission (IOC) is organizing the [GOOD-OARS Summer School 2025](#) in Penang, Malaysia, in November of this year. As one of PICES's largest partner organizations, the IOC regularly supports this summer school. These programs provide ECOPs with excellent training and networking opportunities with other parts of the scientific community.

PICES has a beautiful tradition of recognizing colleagues who have made significant contributions to PICES science. The Award Selection Committee, composed of Science Board members and the PICES Chair, chose the 2025 recipients of PICES [Wooster Award](#), PICES [Ocean Monitoring Service Award \(POMA\)](#), PICES [Open Data Excellence Award \(PODA\)](#), and the [Zhu-Peterson Early Career Scientist Award](#). The quality of every candidate was outstanding, which made the selection process very difficult for the committee. Please join us in congratulating this year's award winners at the opening ceremony of the annual meeting.

The Science Board has a Science Board Chair-elect position to enable a smooth transition into the duties of the Science Board Chair, and to provide continuity of Science Board business. The term for the Chair-elect is one year. Dr. Jennifer Boldt of Canada was elected Science Board Chair-elect at the 2024 PICES Annual Meeting, and will become the new PICES Science Board Chair at the close of PICES-2025. Dr. Boldt has been an active participant in PICES for many years through her roles as MONITOR

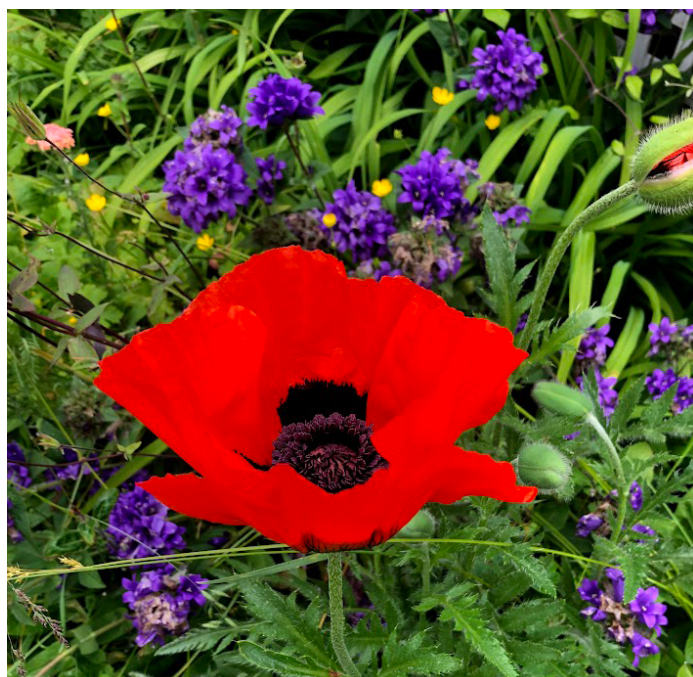
Chair, FUTURE SSC member, Science Board member, and Expert Group member, including WG53 on Sustainable Pelagic Forage Communities. Dr. Boldt is looking forward to facilitating a new phase of the PICES science program and addressing the recommendations from the recent external review of PICES. This will ensure that PICES continues to be a progressive marine science organization. Please show Dr. Boldt your interest and strong support.

Lastly, the [PICES-2025 Annual Meeting](#) will be held in Yokohama, Japan, from November 8-14. The theme is "Innovative Approaches and Applications to Foster Resilience in North Pacific Ecosystems." The plenary session (November 10) at PICES-2025 will include time for the Council to share its plans for the organization's evolution with the wider community and a Science Board symposium. The Science Board symposium will feature the winners of the Zhu-Peterson Award from 2023 and 2024, as well as the winner of the [FUTURE SEES award](#). Don't miss this opportunity to learn about the latest research from early-career ocean professionals. Many interesting sessions and workshops covering a wide range of topics are also planned. I look forward to seeing you in Yokohama, the largest port city and high-tech industrial hub in Japan's Greater Tokyo Area.

Sukyung Kang
Science Board Chair

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The Asia-Pacific Network for Global Change Research (APN) Proposal Development Training Workshop

Ziqin Wang



Group photo of 2024 APTN-PDTW participants.

The Asia-Pacific Network for Global Change Research (APN) Proposal Development Training Workshops' (PDTW) scoping purpose was to prompt regional and global research and collaboration around countries in the Pacific islands and to provide a cross-regional and interdisciplinary platform for Early Career Ocean Professionals (ECOPs) to develop necessary skills to write competitive scientific proposals for funding. This workshop had been successfully held many times around Pacific regions, including China, Thailand, and Indonesia. In 2024, it came to Suva, Fiji. I was thrilled to have had the opportunity to participate in this year's PDTW, which proved to be an invaluable experience for my professional growth.

Throughout the training workshop, I connected with numerous fellow ECOPs, fostering friendly, collaborative, and growth-oriented exchanges. These interactions underscored the importance of working with individuals from diverse regions and disciplines, significantly inspiring my vision for my future research career. The workshop also offered a unique platform where mentors from various regions and fields provided us with substantial guidance. Their insightful lectures illuminated critical aspects of research, such as how to effectively define the objectives and value of proposals, collaborate efficiently within teams, and approach tasks from the perspective of grant reviewers. They also shared valuable writing techniques that I am eager to implement in my work. Moreover, one of the most enriching aspects of PDTW was the opportunity to listen to and engage in discussions on scientific and philosophical topics led by our distinguished mentors. These conversations not only broadened my understanding, but also fueled my passion for inquiry and exploration within my field. Overall, this experience has left me more motivated and equipped for the challenges and opportunities that lie ahead in my research journey.

The workshop commenced with an overview of the event, followed by a vibrant and culturally rich welcome ceremony, which truly captured the spirit of the local Fijian culture (Figure 1). This warm and enthusiastic reception



Figure 1. Traditional welcome activity and rite in opening ceremony of APN-PDTW 2024.

set a positive tone for the rest of the workshop. After the opening ceremony on the first morning, Dr. Linda, along with other hosts, provided a brief introduction to the workshop's objectives and outlined the tasks we were expected to complete (Figure 2).



Figure 2. Dr. Linda delivering a introduction about the history, future plans of APN-PDTW, and purpose of this workshop.

In the afternoon, we participated in a round-table meeting within our group, where we engaged in discussions and finalized the topic for our proposal. Our group was assigned to the general topic *"Management of Pacific Island and ocean ecosystem services, resources, and circular ecological economy"*. Groups 4 – 5 were assigned to *"Enhancement of climate and disaster risk reduction, resilience, and adaptation in Pacific ecosystems and livelihoods"*, and group 6 was assigned to *"Pacific climate variability and downscaling observation, assessment, and innovation in global change research"*. After thoroughly considering each member's expertise and professional background, we decided on our group's proposal topic: *"Putting Communities in the Forefront of Enhancing Marine Protected Areas through Coral Focused Adaptation. Case Studies in Fiji, Kiribati and Papua New Guinea"*. In fact, prior to the workshop, our group had already conducted several video meetings to discuss potential topics and get to know each other. These preliminary discussions not only helped us in selecting a relevant and cohesive topic, but also allowed us to establish a solid foundation for collaboration during the workshop.

During our round-table group discussions (Figure 3), I was deeply impressed by the contributions of each member. Our group leader, Tebeio, demonstrated remarkable responsibility and leadership. He organized all our preparatory e-meetings and led every discussion during the workshop. Tebeio was also responsible for compiling the individual contributions from each member into the final proposal, which he submitted on our behalf. Susana, a highly energetic and friendly colleague, was another standout. Her expertise was a key factor in determining our topic, and her enthusiasm helped keep our group motivated. Nelson, though not very talkative, approached his work with meticulous attention to detail, ensuring that no issue, however minor, was overlooked. Matthew was the last to join our group, and his arrival brought a fresh wave of ideas and an invigorating atmosphere. Thanks to Matthew (and his thoughtful gesture of bringing ice cream and cake for the group, as shown in Figure 4), our discussions were always lively and productive. However, the person who left the most lasting impression on me was our mentor, Gilbert David. David, a Frenchman with a fantastic sense of

humor and a dynamic presence, was a master storyteller. He had a unique talent for weaving stories and insights together, making them come alive. Every coffee break and lunch became an immersive experience as I found myself captivated by his engaging narratives.

During the process of finalizing our research topic, David brought up a crucial consideration: feasibility. He emphasized that no matter how ambitious or innovative a research proposal might be, it is essential to have a practical plan and a capable team to execute it. This insight was particularly important as it reminded us to focus on the feasibility of our chosen topic during the proposal writing process. By doing so, we could avoid the pitfall of presenting a proposal that might seem grand in theory but lacks the necessary grounding in reality. The first day concluded with each group giving a brief presentation of our preliminary discussion results. It was an exhausting but immensely rewarding day. However, just as we were wrapping up, hosts announced that our proposal needed to be submitted online by 8 p.m. the following evening. This sudden deadline injected a sense of urgency into our work, making the timeline much tighter than we had anticipated. Despite having only a day left to finalize and polish our proposal, we were determined to rise to the challenge and deliver a strong submission.



Figure 3. Members in Group 1 (author's group), left to right is Tebeio (team leader), Nelson, Matthew, Susana, and Prof. David Gilbert.



Figure 4. Ice-cream time in Group 1 during coffee break of workshop funded by Matthew.

On the second day, Professor Chris Jacobson and Professor Lance Heath each delivered a keynote presentation on how to craft a successful proposal (Figure 5). Using a specific example, Professor Chris focused on the importance of aligning the objectives of your proposal with the aims of the funding source. She emphasized that matching these goals can significantly enhance the chances of securing the grant.

Professor Lance emphasized several key aspects: the feasibility of the proposal (echoing the points made by David earlier), the clarity of the objectives, and the proposal's policy return on investment. He reminded us that research grants are not merely acts of charity; they are investments in scientific projects. Therefore, as the team responsible for executing the scientific proposal, it is crucial not only to ensure the project's feasibility and well-defined goals but also to consider the potential policy impact. By doing so, we can enhance the proposal's return on investment, making it a more attractive option for funders. This perspective reinforced the idea that our proposal needed to be not only scientifically sound but also strategically aligned with broader policy goals, thus increasing its value and appeal to potential funders.

After the presentations, we fully immersed ourselves in the intense process of writing our proposal. Each group member took responsibility for different sections, collaborating efficiently to ensure every part was covered. Our group leader then meticulously compiled everyone's contributions into a cohesive final proposal. Thanks to our teamwork, we successfully completed the task and submitted the proposal before the deadline.

On the third day, we participated in an interactive session where the mentors addressed a range of questions that we had raised (Figure 6). Topics included ethics and respect in research, the importance of respecting local cultural customs, obtaining research permits and local community consent, the communication and dissemination of research findings, boarder linkages between researchers and policymakers, the relationship between indigenous knowledge and local and traditional knowledge, and how to integrate these elements respectfully into scientific work. The most impressive talks were delivered by David Gilbert on traditional knowledge (Figure 7). He thinks the local and traditional knowledge is a way of thinking about the world. Science is only a method for human beings to understand how the world works, rather than the truth per se. This session provided valuable insights into the broader impact of research



Figure 7. Dr. Gilbert David answering a question from the audience.



Figure 5. Professor Chris Jacobson (left) and Professor Lance Heath (right) delivering lectures on how to write a successful proposal.



Figure 6. Interactive session for answering questions from participants. From left to right: Dr. Linda, Dr. Lance Heath, Dr. Awnesh Singh, Dr. Gilbert David, Dr. Douglas Hills, Prof. Chris Jacobson.

and reinforced the importance of conducting studies in a way that is both ethically sound and culturally sensitive. It was a great opportunity to gain a deeper understanding of the challenges and responsibilities we face as researchers working across different regions and communities.

Following this, Professor Douglas Hill guided us through the process of how reviewers evaluate and recognize a well-crafted proposal. He provided us with valuable insights into what makes a proposal stand out from the rest and the key criteria that reviewers focus on when making their assessments.

Afterwards, we participated in an inter-group peer review session, during which each group evaluated the proposals of others. Additionally, the mentors held a closed-door review meeting where they assessed our proposals in detail, followed by a public feedback session. During the peer review activity, Groups 3 and 6 received relatively high scores, demonstrating a high level of completion and quality in their proposals.

On the final day, we discussed how to improve our group's proposal based on the feedback we received from other

groups and mentors. We also explored potential avenues for continued collaboration based on our proposal. After these discussions, the hosts led us through a reflection on the history of the APN's development and shared new aspirations for its future.



Figure 8. Host Naomi facilitating a feedback session.

Additionally, hosts conducted a live survey to gather feedback on participants' experiences and takeaways from the workshop (Figure 8). The survey results showed that the vast majority of attendees felt they had gained significant value from the workshop and believed they now had the foundational skills to complete a successful proposal. Interestingly, there was a slightly higher number of female participants compared to males, highlighting the workshop's

efforts toward gender equality. There was also a minor note from a few participants who were not entirely satisfied with the food—lol—but from my perspective, I thoroughly enjoyed the lunch and coffee breaks provided at the venue. In the afternoon, I took part in a walking tour of the University of the South Pacific (USP) campus, and it exceeded my expectations in terms of beauty. Unlike the bustling Suva city center, the USP campus boasts lush greenery, with beautifully designed buildings that are both stylish and visually appealing. The entire campus is clean and well-maintained, creating a serene and inviting environment (Figures 9 and 10). What impressed me most, however, was the energy and vibrancy of the students. Everywhere I looked, the students were lively and engaged, adding to the dynamic atmosphere of the campus.

This final day allowed us to consolidate what we had learned, refine our ideas, and look toward future opportunities for collaboration. The workshop not only enriched us with practical skills but also fostered an inclusive and supportive environment for early career researchers.

For me, the takeaways from this experience far exceeded my expectations. I genuinely gained a wealth of knowledge and skills that will be invaluable for my future career. Beyond that, one of the greatest benefits was establishing collaborative relationships with ECOPs from across the Pacific Island countries. I am eager to maintain and leverage these connections in my future research endeavors, as I believe they hold great potential for productive and meaningful collaborations. Moreover, fully immersing myself in the lectures and intellectual exchanges between mentors and students was not only an enjoyable experience but also incredibly enriching. I learned many new perspectives and ideas that will undoubtedly shape and guide my future research work. The knowledge

and inspiration I gained from this workshop will have immeasurable value as I move forward in my academic journey.

Finally, I would like to sincerely thank the organizers and all the people who worked hard to ensure the smooth progress of the workshop. Without their efforts, there would be no gains and convenience for all of us to attend the workshop.

Ziqin Wang
APN Workshop Participant



Figure 9. Beautiful natural environments in the University of South Pacific.



Figure 10. Group photo of the participants who joined the afternoon tour around the University of South Pacific.

SOLAS Open Science Conference 2024*Tanya Marshall, Karin Kvale, Douglas Hamilton, Yee Jun Tham*

India | SOLAS Open Science Conference 2024

The Surface Ocean - Lower Atmosphere Study (SOLAS) held its biannual Open Science Conference in Goa, India, in November 2024 to celebrate the 20th anniversary of SOLAS. The full event report can be found [here](#). The conference was graciously hosted by the National Institute of Oceanography, an international cornerstone for marine and atmospheric science. Over the course of a week, ~250 SOLAS scientists presented, engaged, and discussed key topics in the fields of ocean and atmospheric chemistry impacting the air-sea interface with a focus on a changing climate as well as policy and societal impacts.

The conference was enhanced by the coupling of side events, including a Science and Society workshop which preceded the conference and included a topical workshop on SOLAS-domain microplastics, and a Scientific Steering Committee meeting immediately after. Scientific discussion that arose during the microplastics workshop gained momentum during the conference, helped in part by Professor Peter Liss' plenary presentation on microplastics as aerosols and their transport across the air-sea interface. An immediate outcome of the workshop, conference, and steering committee meeting was a SOLAS statement on the Global Plastics Treaty, which highlighted the absence of consideration of air-sea microplastics exchange in the framework of the Treaty. This statement was published online just prior to the final scheduled Treaty negotiation, which ultimately failed to produce a binding agreement. However, negotiations continue, and our Statement may be valuable in the next negotiation. Beyond the Treaty Statement, Professor Liss' presentation also highlighted the scientific uncertainties, and relative lack of study, of microplastics aerosols to the SOLAS community. SOLAS intends to fill this research gap and has formed a working group on the topic, as a second outcome of the Science and Society microplastics workshop. Anyone interested in joining our working group should contact Karin Kvale (aotearoablueocean@gmail.com).

One of the integrated topics prioritised by SOLAS is research in the Indian Ocean. The modern Indian Ocean has been explored through numerous international sampling

campaigns, one of which is the International Indian Ocean Expedition (IIOE). The National Institute of Oceanography, the host of the SOLAS Open Science Conference, has strong ties to the IIOE and so being there in person was a wonderful experience. One of the conference session themes focussed on the Indian Ocean. During this session, four scientists presented new research based on the Indian Ocean region. The presentations ranged from ocean biogeochemistry and warming to marine aerosols and dust source attribution covering both model and observational approaches. The poster session was extremely successful and covered an even broader range of SOLAS-related science, including the verification of marine carbon dioxide removal strategies in the Indian Ocean with most contributions from early career researchers. Given that data on the Indian Ocean is limited relative to other ocean basins, the SOLAS Indian Ocean Implementation team would like to encourage researchers to share information on any sampling campaigns planned in this ocean basin, particularly where piggy-back projects are welcome (please contact an Implementation team lead should you wish to advertise an upcoming expedition). While the Indian Ocean is the least explored ocean basin, the Open Science Conference demonstrated that SOLAS scientists are contributing enormously to the research effort.

Another interesting topic discussed at the conference is coastal cities' air quality under the influence of the ocean. It is known that ocean emissions are affecting air quality in coastal cities, where the alternating influence of sea-land air masses make the formation, transport, and transformation processes of pollutants present significant coastal characteristics. In turn, the coastal cities' emissions, through changes in atmospheric composition affect the regional climate, contribute to deposition of pollutants, and thereby have a significant impact on the marine environment. One of the conference discussion sessions focussed on these issues. The discussion session attracted participation of scientists from various backgrounds, including early career scientists, to address the complex ocean-land-atmosphere interactions as well as the establishment of a systematic ocean-atmosphere observation network. This network intends to encourage SOLAS scientists to collaborate at an international scale and to share information on observations at coastal sites and ship campaigns sampling in the coastal ocean, to improve the monitoring of conditions in both seawater and air quality.

"SOLAS is a family" was not just a feel-good refrain at the 2024 Open Science Conference—it reflects an ever growing, tangible commitment to community-building across atmospheric and oceanic research disciplines. That

spirit was on full display during the Early Career Scientist Day, where interactive workshops, shared meals, and hands-on lab visits created opportunities for networking across career stages and disciplines. One exciting moment of the week was the formal introduction of the SOLAS Mentorship Program; a long-requested initiative now poised to launch at the upcoming 2026 Summer School in Brazil. Mentorship is more than guidance; it's one of the pillars of successful international scientific knowledge exchange and community building. While other Earth science networks already offer successful programs, SOLAS identified a clear need to build its own: one that reflects the interdisciplinary and transdisciplinary nature of SOLAS science, spanning physical, chemical, and biological processes across the air-sea interface, as well as the social dimensions of this research topic. During the conference, over 20 participants gathered for a dedicated session to help shape the program's structure. Ideas ranging from classical one-on-one mentorship to short-term, goal-specific partnerships and peer-to-peer models, were discussed. Participants also discussed cross-sector collaborations with communicators, artists, and policy experts. By nurturing a culture of mutual support and curiosity, the SOLAS Mentorship Program will serve as a launchpad—not only for individual careers, but for a stronger, more connected scientific community. It is this sense of family that transforms SOLAS from a unilateral research network into a collaborative, intergenerational ecosystem of learning and leadership that is exciting to be a part of. Anyone interested in participating in this mentorship program should contact solasecsc@xmu.edu.cn.

Experiencing a week of science discussion, communication, networking, and collaboration in-person undoubtedly left conference participants refreshed and inspired to continue the pursuit of excellent SOLAS science!

Early Career Professional's Personal Remarks

Tanya Marshall
Princeton University

Tanya Marshall's research explores nutrient supply and biogeochemical cycling in the modern ocean using geochemical tracers like nitrate isotopes and nutrient stoichiometry. She earned her Ph.D. from the University of Cape Town, South Africa, where her research focussed on characterising nitrogen cycling in the historically understudied South Atlantic and South Indian Oceans. More specifically, her work investigated how physical and biogeochemical processes, which occur over multiple spatial scales, impact surface ocean fertility and carbon export potential. Tanya is currently a Presidential Postdoctoral Research Fellow in the Department of Geosciences at Princeton University, where she is developing a new numerical framework for interpreting nitrogen isotope ratios in the ocean.

An ongoing research question being addressed by many SOLAS scientists is the mechanisms driving the occurrence of a sporadic, yet anomalous phytoplankton bloom located southeast of Madagascar in the southwest Indian Ocean, termed the "Southeast Madagascar Bloom". During Tanya's address, she presented the plethora of hypotheses put



SOLAS Open Science Conference participants at the 20th anniversary of SOLAS in Goa, India (November, 2024).

forward over the past two and half decades to explain this anomalous bloom, including a recent publication with other SOLAS scientist co-authors, many of which also attended the conference. This new perspective subsequently stimulated further exciting discussions between scientists on how to further address the drivers of the bloom. SOLAS scientists contribute a collection of expertise that are ideally suited to resolve this 25-year phenomenon, so watch the space!

Karin Kvale
Aotearoa Blue Ocean Research

Karin is an Earth System Modeller with an expertise in global biogeochemical cycles, paleoclimate, and microplastics fate, transport, and impacts. She got her PhD in Climate Science from the University of New South Wales Climate Change Research Centre in 2014 and subsequently moved to the GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany, where she worked until moving to New Zealand in 2021. Currently she runs her own research consultancy, conducting fundamental research for government and non-government entities.

A recurring point raised during the conference was the importance of biological surfactants in regulating air-sea gas exchange. This understanding of this process is accepted by the observational gas transfer community, yet remains largely unaddressed in numerical climate models. For Karin, this was an interesting and novel perspective that warranted further attention. Since the conference she has used satellite data products to produce a rough estimate of the potential impact of biological surfactants on CO₂ fluxes at global scale, which she presented in April at the European Geosciences Union meeting in Vienna, Austria. This work has led to further collaborations which will hopefully lead to a sensible implementation of surfactant regulation of gas transfer in a climate model to estimate the impact on ocean carbon distributions. Intellectual exchange at the SOLAS conference spawned this work, highlighting the value of SOLAS' interdisciplinary approach to building community around a common topic.

Douglas Hamilton
North Carolina State University

Douglas is an Assistant Professor in the Department of Marine, Earth, and Atmospheric Sciences at North Carolina State University. Douglas' research focuses on using Earth System models to explore how environmental change influences global biogeochemical cycles within the Anthropocene. Before joining North Carolina State University, Douglas earned a PhD from Leeds University (UK) and undertook postdoctoral research at Cornell University (USA). Past research includes identifying regions where pristine aerosol conditions may still persist in an increasingly polluted world, and the study of past and

future fire regime change and their cascading impacts on climate, ecosystems, and society.

How human activity is affecting ocean biogeochemical cycles is an increasingly urgent question, as land-use change, fossil fuel combustion, agricultural expansion and intensification, and changes to wildfire regimes accelerate the redistribution of key elements like nitrogen, phosphorus, and iron from the land to the sea. Deepening scientific understanding of how changes across the land-atmosphere-ocean continuum alter marine ecosystems and carbon cycles, however, requires interdisciplinary collaboration that spans disciplinary silos. The SOLAS OSC provides a vital platform to foster these connections, particularly for early-career researchers navigating the space between oceanography, atmospheric science, and environmental policy. For researchers like Douglas, working at the interface of modelling, aerosols, and biogeochemistry, SOLAS acts as both a scientific home and a launchpad for new ideas and collaborations that are essential for understanding and managing a rapidly changing Earth System.

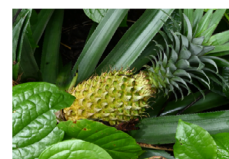
Yee Jun Tham
Sun Yat-sen University

Yee Jun is an Associate Professor in the School of Marine Sciences at Sun Yat-sen University, China. He got his PhD in atmospheric chemistry from The Hong Kong Polytechnic University and did his postdoctoral research at University of Helsinki, Finland, before joining Sun Yat-sen University. He is interested in the cycles of halogens (chlorine, bromine, and iodine) in the atmosphere and surface ocean. His research focuses on the field observation and laboratory simulation of biotic and abiotic emission of reactive halogens from the surface ocean, atmospheric processes of reactive halogens (including oxidation processes and heterogeneous cycling), as well as their environmental and climate impacts.

Ocean emissions of reactive gases are influencing the atmospheric photochemistry and oxidising capacity, air quality, and climate. However, complete reliable information is still missing on chemical characterisation of sea surface emissions of reactive gases such as reactive halogens, and their impacts remain a vital question to be addressed. It is a wonderful experience for me to share and discuss the recent advances of how the changing ocean is affecting the biogeochemistry of oceanic emissions and their environmental impacts with the SOLAS community during the conference. The exciting interactions with the SOLAS scientists of various expertise in the conference have brain-stormed new ideas and opened-up interdisciplinary collaborations to deal with the current scientific questions of ocean biogeochemical control on the emissions of reactive gases from the surface ocean.

The Honiara Summit

Sonia Batten



Credit: Honiara Summit Official Photographs



The Honiara Summit was held in February 2025, in Honiara, capital of the Solomon Islands, to discuss “*Delivering on Sustainable Development Goal 14.4: Achieving Sustainable Fisheries*” and was co-hosted by the Solomon’s Government, the Pacific Islands Forum Fisheries Agency and the Food and Agriculture Organization of the United Nations (FAO). It was designed as a global meeting to pave the way for Sustainable Development Goal (SDG) 14.4 at UNOC3 (the 3rd United Nations Ocean Conference later held in June 2025), but with a focus on Pacific Ocean fisheries, which provide 58% of all marine catches.

PICES was invited to participate in the Summit and speak on a Panel on “Advancing sustainable fisheries” because of our role in connecting scientists, managers, and organizations in the region. This was the second largest event ever held in the Solomon Islands and, although challenging to this Small Island Developing State’s resources, they rose to the occasion and made the approximately 300 visitors feel welcome and comfortable. Attendees included several Heads of State, the UN Secretary General’s Special Envoy for the Ocean (Peter Thomson), Ministers from multiple nations, representatives of Regional Fisheries Bodies and fisheries administrations, and other stakeholders. The Summit was organized as a series of Panels on topics that included supporting fisheries sustainability through science, the implementation of international

instruments, effective monitoring and surveillance, as well as the Pacific Islands regional response to SDG 14.4. An [Outcomes Communiqué](#) was published at the end of the Summit, which you can read in full using the link, but especially relevant to the PICES community are the following statement topics related to the role of regional organizations, and of science:

- 5a) *Regional Fisheries Bodies (RFBs) are instrumental in supporting the sustainable management and recovery of shared stocks*
- 5b) *Regional cooperation on data and science underpins sustainable management of shared stocks*
- 5c) *Collaboration at a regional level is necessary to address complex challenges*
- 5d) *RFBs engagement and participation in the BBNJ Agreement will be an important foundation to implementation*
- 9a) *Achieving SDG Target 14.4 requires robust science*
- 9b) *Effective mechanisms to facilitate the science-policy interface are needed*
- 9c) *Changing climate and ocean conditions are significant challenges to understanding and managing fisheries*

- 9d) *The scientific basis for decision-making processes needs to be strengthened, particularly in data-poor fisheries*
- 9e) *There is a need to support development of the next generation in science, technology, engineering and mathematics (STEM)*
15. *The Summit recognized the importance of partnering to implement SDG Target 14.4 to achieve the shared objective of maintaining global, regional and national fish stocks at sustainable levels.*

Cooperation and collaboration were emphasized throughout the week and the role of regional organizations as a place to exchange and share data and knowledge was also highlighted. The leadership example set by the Pacific Islands in sustainably managing offshore tuna fisheries through regional cooperation was clear. However, over 37% of global fish stocks are now considered over-fished, while changing climate and ocean conditions present significant challenges to understanding and managing fisheries. It was evident that there is much to do.

I found the event very thought-provoking for a number of reasons; Prime Ministers from several nations in the south pacific were present each day, clearly articulating their concerns and asking questions of panelists, and this drove home the importance of sustainable fisheries to the communities of the region. As did the fact that we were meeting and being hosted in a small, developing country with obvious reliance on the surrounding ocean. There are real challenges here. Plastic pollution, climate impacts, and food security were issues very apparent to the Summit attendees that week. Regional cooperation, particularly through the Forum Fisheries Agency, is strong and evident, and a model that other regions around the world could learn from. We were also treated to examples of the considerable local artistic talent in carving, painting, regional music, and dance. And, in addition, I was able to meet many of my counterparts from other Regional Fisheries Bodies and Regional Fishery Management Organizations - many of whom I had only met online before – and had good conversations about issues we all share, and approaches others are taking.

The organizers hope that the Summit will have accelerated progress towards achieving sustainable fisheries by facilitating discussions on status, good practices, and lessons learned. The importance of science and cooperation to achieving SDG 14.4 was emphasized, and the momentum generated will be carried to the UN Oceans Conference later this year, and beyond.

Sonia Batten
PICES Executive Secretary



Solomon Islands
Credit: Tracey Jennings / Ocean Image Bank

One Ocean Science Congress 2025

Choir of Ocean Scientists

Report on One Ocean Science Congress 2025 and the Third United Nations Ocean Conference

Sanae Chiba



Let Life Return, From Land To Sea

"...after living nearly 100 years on this planet, I understand that the most important place on Earth is not on land, but in the ocean." Sir Attenborough's latest movie, *Ocean*, was released worldwide on May 2025 on his 99th birthday. The line powerfully inspired the global ocean science community, calling for knowledge-based actions by world leaders gathering at the Third United Nations Ocean Conference (UNOC3), held on June 9–13, 2025, in Nice, France. Co-organized by the governments of France and Costa Rica, UNOC3 featured a series of concurrent special events to bring all stakeholders together: the One Ocean Science Congress (OOSC 2025) on June 3–6, the Ocean Rise & Resilience Summit of Coastal Cities and Regions on June 7, and the Blue Economy and Finance Forum (BFFF) on June 7–8 in Monaco.

Following UNOC1 held in New York, USA, in 2017, and UNOC2 in Lisbon, Portugal, in 2022, the third iteration of UNOC aims to accelerate and coordinate actions by global leaders to achieve Sustainable Development Goal 14 (SDG14): to conserve and sustainably use the ocean—one of the SDGs with the slowest progress. With Ifremer and the Centre National de la Recherche Scientifique (CNRS) as the organisers, the One Ocean Science Congress (OOSC) was planned as the scientific pillar of UNOC3, enabling ocean scientists to engage directly with policymakers on-site

and deliver fresh messages. I, Sanae Chiba, PICES Deputy Executive Secretary, was given the valuable opportunity to serve on the International Scientific Committee of OOSC. Here, I report on OOSC and UNOC3 based on my experience as a Committee member, ocean scientist, and representative of the PICES Secretariat.

OOSC 2025: Science for Thriving Ocean

The OOSC 2025 logo features a world map with one ocean placed at the centre—connecting, not dividing—all continents and islands on Earth. Over 2,200 ocean scientists and experts from 110 countries gathered in Nice. Research vessels, majestic tall ships, and racing yachts collaborating with oceanographers responded to the call from across Europe and assembled along-side one of the conference's main venues, the Blue Zone, at Nice's historic harbour, Port Lympia. The line-up of the ocean science fleet was both spectacular and uplifting. These ships—including Norway's tall ship *Statsraad Lehmkuhl* and Germany's *R/V Meteor*—served as venues for various side events throughout OOSC and UNOC3.



The OOSC main venue located in Port Lympia.

OOSC's **10-Session Themes** (Figure 1a) were designed to align with the **10-Ocean Action Panels** of the UNOC3 agenda (Figure 1b), enabling recommendations from OOSC to be smoothly conveyed to the discussion tables at UNOC. The OOSC Scientific Committee also developed the themes with a focus on accelerating the adoption or implementation of ocean-related international treaties, including the Paris Agreement on Climate Change, the Kunming-Montreal Global Biodiversity Framework (GBF), the Treaty on Biodiversity Beyond National Jurisdiction (BBNJ), the Agreement on Illegal, Unreported and Unregulated (IUU) Fishing, and the International Plastic Treaty. Additionally, Theme 1 addresses the strengthening of stewardship for the integration of knowledge systems, while Theme 10 calls for support and investment in science. **Nine keynote speakers** representing Themes 1 to 9 gave inspiring talks each morning. Videos of their talks are [available online](#). Given the current global political climate, the enhancement of multilateralism in ocean science emerged as one of OOSC's key messages to UNOC. Now, there is an opportunity for every country to step up and share responsibility in advancing science for a thriving ocean.

PICEANs Here!

Several PICES scientists (a.k.a. PICEANs), including two ECOPs, participated in OOSC: Executive Secretary Sonia Batten; HD Committee Chair Mitsutaku Makino; MONITOR Committee Chair Sung-Yong Kim; former SB Chair Hiroaki Saito; two ECOPs, Mariana Bif and Talen Rimmer; and myself. Regrettably, FUTURE Co-Chair Steven Bograd had to withdraw his participation at the last minute. Below are some highlights of the activities of the PICEANs.

- Town Hall Meeting (SmartNet-convened event). [Moving towards integrated evaluation approaches in support of ocean policy](#). Convener: David Reid | Co-conveners: Furqan Asif, **Sonia Batten, Mitsutaku Makino**, Olivier Thebaud.
- Theme 2 contributed talk. [Marine Heatwaves Modulate Food Webs and Carbon Transport Processes](#), **Mariana Bernardi Bif** et al.
- Theme 3 contributed talk (SmartNet relevant). [Advancing the Climate-Biodiversity-Fisheries Nexus in the UN Decade of Ocean Science for Sustainable Development](#), **Steven J. Bograd** et al. *Claire Enterline

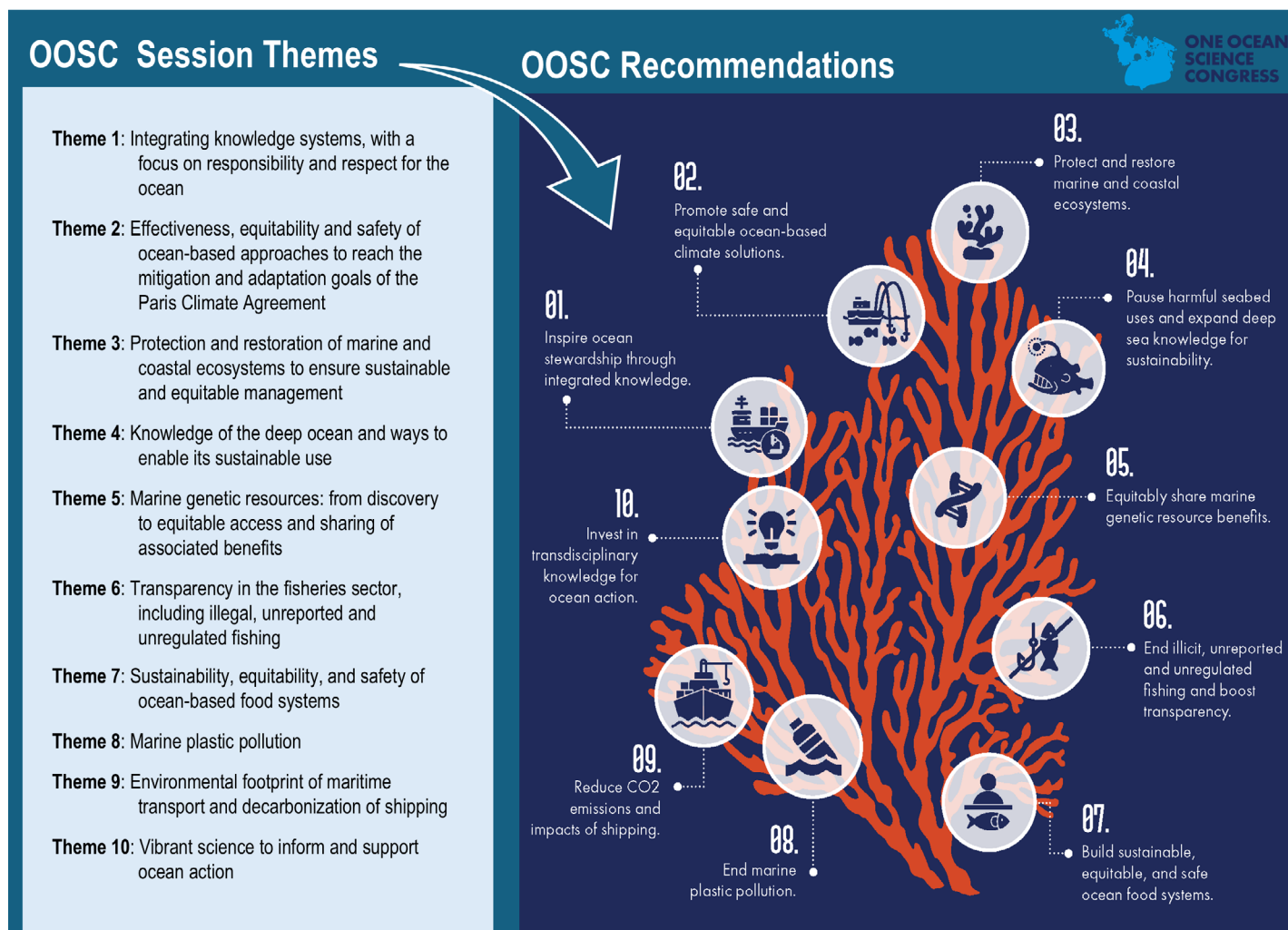
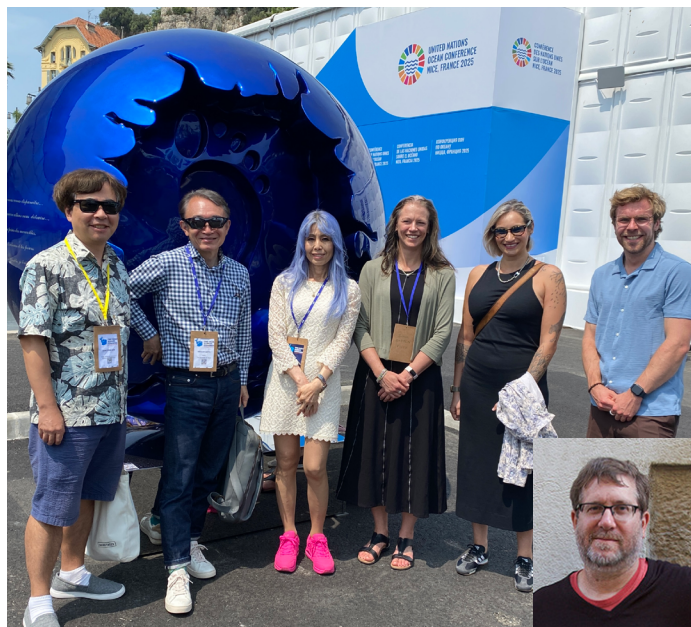


Figure 1a

from the Gulf of Maine Research Institute served as a presenter.

- Theme 3 contributed talk. [Applications of Computer Vision in Underwater Ecology: A Case Study from the Northeast Pacific](#), **Talen Rimmer** et al. *Talen was a co-author of two other talks in Theme 10 Sessions ([here](#) and [here](#)).
- Theme 10 contributed talk (SmartNet relevant). [The Ocean We Want International Survey Project: Season Two](#), **Mitsutaku Makino** et al.
- Theme 10 contributed talk. [Regional Digital Twins of the Ocean: the Opportunity for Effective Integration and Real Transformative Changes Through Fit for Purpose Multi-Platform Ocean Observing and Forecasting, Interoperability and Open Science](#), Joaquín Tintoré, Matthew Palmer, Di Wan, Anna Harimana, Avichal Mehra, **Sung Yong Kim**, et al.
- UNOC3 Side Event: Right Right Right! Widening ocean literacy to best support the ocean sustainability transition. Organised by the International Platform of Ocean Sustainability (IPOS) and the Global ECOP programme. **Sanae Chiba** as a panellist.

PICES did not attend the previous two UNOC events. For UNOC3, we managed to receive ad hoc UN accreditation, allowing us to participate. After a lengthy and exhaustive administrative process, Sung Yong Kim and I were able to attend the conference as PICES delegates. Although not a PICES delegate, AP-ECOP Co-Chair **Raphael Roman** was also present at UNOC, representing various Global ECOP activities. Even though PICES is the leading intergovernmental science organisation in the North Pacific, PICES does not (yet) have UN observer status, which would enhance our visibility and ensure our voice is heard. Let's look at the One Ocean map again—it reminds us of the vastness of our North Pacific Ocean.



PICEANs at OOSC (from left to right), Sung Yong Kim, Hiroaki Saito, Sanae Chiba, Sonia Batten, Mariana Bif and Talen Rimmer. Steven Bograd (bottom right) had to cancel his attendance.



Mitsutaku Makino and Sonia Batten at the Town Hall meeting.

UNOC3 Ocean Action Panels



- OAP1** : Conserving, sustainably managing and restoring marine and coastal ecosystems including deep-sea ecosystems
- OAP2** : Increasing ocean-related scientific cooperation, knowledge, capacity building, marine technology and education to strengthen the science-policy interface for ocean health
- OAP3** : Mobilizing finance for ocean actions in the support of SDG14
- OAP4** : Preventing and significantly reducing marine pollution of all kinds, in particular from land-based activities
- OAP5** : Fostering sustainable fisheries management including supporting small-scale fishers
- OAP6** : Advancing sustainable ocean-based economies, sustainable maritime transport and coastal community resilience leaving no one behind
- OAP7** : Leveraging ocean, climate and biodiversity interlinkages
- OAP8** : Promoting and supporting all forms of cooperation, especially at the regional and sub regional level
- OAP9** : Promoting the role of sustainable food from the ocean for poverty eradication and food security
- OAP10** : Enhancing the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the UNCLOS

Figure 1b. 10-Ocean Action Panels of the UNOC3 agenda.



Raphael Roman at the OOSC/UNOC exhibition venue, La Baleine (The Whale).

Research, Speak out, Action, Repeat: Science Policy Cycle

OOSC was held one year after the Barcelona Conference of the UN Decade of Ocean Science for Sustainable Development (UNDOS). The goal of UNDOS is to mobilise the scientific community and other stakeholders to achieve SDG 14 and other relevant SDGs. One may wonder why another major event with similar aims was needed so soon after. Is it not redundant, and are we not wasting limited resources and funds to organise events on this scale? To be honest, I was initially unsure about the reasoning and effectiveness of OOSC. However, I now understand the importance of sending resonating messages repetitively—again, again, and again—until world leaders begin to listen to science. Accordingly, OOSC has released multiple materials through various media to ensure our collective voices were heard: a media package/policy brief, [Recommendations](#) (Figure 1), a [Manifesto](#) (see photo below) for sign-up, a journal paper (in preparation),

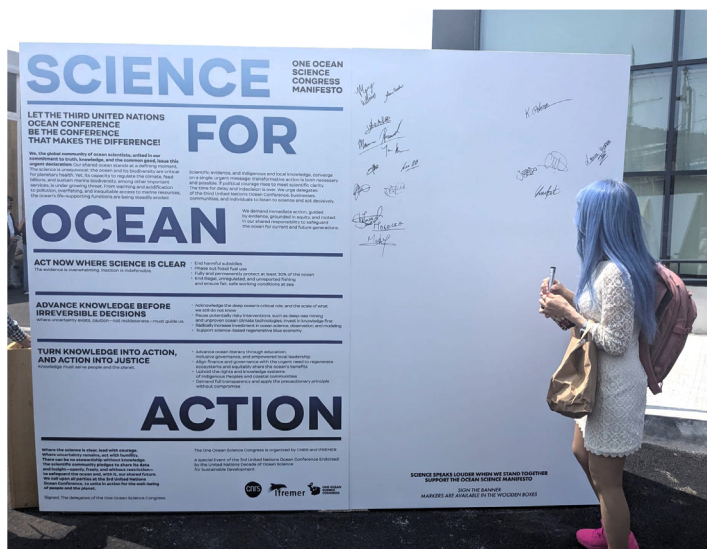
and an art-science special side event (see next section).

Whatever the issue, the science-policy cycle is a long, enduring, and iterative process. This is particularly true in the context of international policy-making. Scientific knowledge raises awareness of global threats—such as warming, biodiversity loss, and marine plastic pollution—which in turn prompts the development of legislation or treaties (Step 1). During the drafting process, science informs policymakers by providing reasonable options for action (Step 2). Once legislation is implemented, the effectiveness of the measures must be assessed through monitoring—e.g. evaluating the effectiveness of Marine Protected Areas (Step 3). If the assessment reveals knowledge gaps or that the measure is insufficiently effective, you return to Step 1.

In the second cycle, scientific knowledge is further advanced, amendments to legislation are called for, and the cycle repeats. The Paris Agreement, the Kunming-Montreal Global Biodiversity Framework, and all major international agreements have progressed over past decades through such iterative processes, building on lessons learned from previous cycles. Some may assume that UNDOS will conclude in 2030 with the deadline for the SDGs. However, as with many other international initiatives, this may merely mark the end of the first cycle—and the beginning of the second. The journey towards achieving the “ocean we want” will continue.

A Night at La Opéra de Nice

Among the many side events of OOSC, the most spectacular was the special Art-Science collaboration event, “For the Ocean,” held at the historic Nice Opéra House. Guided by two actors, audiences were invited on a journey of ocean stories with performances by an extraordinary panel



Demonstration of Manifesto sign-up (official signing up was done online), Day 1 (left) and Day 3 (right). More than 1,000 participants signed up by Day 3.

of artists, musicians, and opera singers. The storyline of the show was designed around the 10 themes of OOSC. Among the performers was Princess Lātūfuipeka Tuku 'aho of Tonga, representing a South Pacific Polynesian nation. She delivered a speech with a calm but strong voice on the deep and traditional relationship between the people of Tonga and humpback whales, as well as their collaboration with scientists to protect them. The Michelin three-star French chef and advocate for responsible fishing and marine ecosystem protection, Olivier Roellinger, spoke about the importance of being conscious of the source of seafood and urged support for small-scale fisheries. We, the Scientific Committee members, also stepped onto the stage to read out the message from ocean scientists, the "Choir of Ocean Scientists." Though our performance was quite amateur compared to those maestro artists, they are a group of powerful and enthusiastic ocean scientists, and it was my honour to have worked with the team for the past two years. The headline performance was a dramatic orchestral symphony, which closed this three-hour show to a standing ovation.



Tonga Princess (Photo by Alex Tiberghien)



Nice Opéra House and Artists (Photo by Alex Tiberghien)



The Michelin three-star French chef, Olivier Roellinger in his speech (top left) and Science Committee performing on the stage (top right). Photos by Alex Tiberghien.



Symphony orchestra (top) and closing the show (bottom). Photos by Alex Tiberghien.

That night, I was fortunate to be assigned the role of opening the show alongside Dr Sylvia Earle—the legendary oceanographer, deep-sea queen, also known as the “Ocean Royal.” I first met her years ago when she, then serving as National Oceanic and Atmospheric Administration’s (NOAA) Science Director, visited Japan Agency for Marine-Earth Science and Technology (JAMSTEC), where I was working as an administrative assistant. She was one of the people who encouraged me to return to school to become a marine biologist. I owe my career success to her. So, it was a wonderful surprise to meet her backstage at the Opéra. Mahé Butel from the OOSC Organising Team, Sylvia, and I—representing three generations of women scientists—stood side by side on stage to read selected lines from the OOSC Manifesto.

Here is my line:

We, the global community of ocean scientists, united in pursuit of truth, knowledge and common goods, issue this urgent declaration.

ACT NOW WHERE SCIENCE IS CLEAR – we know what must be done, action is overdue

ADVANCE KNOWLEDGE BEFORE IRREVERSIBLE DECISIONS – when uncertainty remains, we must lead with caution, not risk

TURN KNOWLEDGE INTO ACTION, AND ACTION INTO JUSTICE – science must serve people and planet, not only policy.



Sanae Chiba (right) opening the show with Sylvia Earle (middle) and Mahé Butel (left).

UNOC3: Time for Negotiation

On World Ocean Day, 8 June, the Recommendations from OOSC 2025 were officially delivered to global leaders during a special forum held at the exhibit venue La Baleine ("The Whale"). The President of France closed the ceremony with an impassioned speech, reaffirming France and the EU's commitment to protecting the ocean and humanity, pledging support for science, and urging multilateral collaboration. He reiterated this message during the UNOC Opening Plenary held the following day.

The mood around the venue and in the town had changed dramatically. Ties and suits replaced casual summer clothes, and breakfast conversations shifted to the political agenda to be discussed. The time for negotiation had begun. Over the following five days, while world leaders debated policy, the ocean science community, diverse stakeholders, and

non-government organisations (NGOs) continued to raise their voices to ensure they were reflected in the emerging policy agenda.

One of the ambitions of UNOC3 is to accelerate the ratification process of the BBNJ Treaty (High Seas Treaty), which aims for conservation and sustainable, and equitable use of marine biological diversity of areas beyond national jurisdiction (ABNJ). As of 3 June, the number of countries that had ratified the treaty stood at 30, 30 short of the 60 required for it to enter into force. However, today, 9 June, on the opening day of UNOC, that number has jumped to 49, leaving only 11 more needed. I am hopeful that the treaty will enter into force - if not by the end of UNOC3, then soon after. If achieved, this will be one of the major accomplishments of the conference. *(*As of June 13, the number of nations that ratified the agreement reached 50, 37 nations agreed for national-level commitments to a moratorium on deep-sea mining.)*

Another key expectation is progress towards the adoption of the Plastic Treaty. Intergovernmental negotiations on establishing a legally binding instrument to address plastic pollution have been ongoing for over two years, following the UN Environment Assembly resolution to end plastic pollution adopted in March 2023. As nations failed to reach an agreement at their last meeting in December 2024 as initially planned, the global community remains ambitious in its aim to move forward with adoption by the end of 2025, through negotiations taking place during UNOC3.

The outcomes of UNOC3, [The Nice Ocean Action Plan](#), was released on 13 June, the final day of the conference.



Jean-Pierre Gattuso and Mere Takoko, representing OOSC International Scientific Committee, delivered Recommendations to the world leaders at the conference exhibition venue, La Baleine (The Whale).



Entrance of La Baleine (The Whale).

"A Race We Must Win"

Throughout OOSC and UNOC3, I repeatedly heard the words "win" and "fight." "A race we must win" is the slogan of the collaboration between ocean scientists and sailing communities to close the ocean data gap and enhance ocean literacy. It speaks to the race against the challenges facing the ocean and humanity, including climate change and the degradation of ocean health, and the fight against societal and political barriers that undermine these efforts. Though it is a long and enduring journey, we, ocean scientists, race side by side with the global community, with truth and knowledge as our swords and shields. I would like to close this article by again referring to Sir David Attenborough's message in the film *Ocean*: "The ocean can recover faster than we had ever imagined. It can bounce back to life... it may not just recover, but thrive beyond anything anyone alive has ever seen." Commitments are in our hands, and we will never walk alone.

Sanae Chiba
PICES Deputy Secretary

One Ocean Science Congress 2025

Mind the Gap: The Urgent Need for Global Ocean Sustained Observations

Reflections from the One Ocean Science Congress 2025 and the Future of Global Ocean Monitoring

Mari Bif

The Weight of a Decade

Between June 3–6, 2025, nearly 2,000 scientists, policymakers, and ocean stakeholders gathered in Nice, France, to discuss immediate priorities for the future of ocean research. The event, framed as part of the United Nations Decade of Ocean Science, preceded the third UN Ocean Conference to be held the week after, where world leaders will convene to chart the next phase of global ocean action. For scientists, this week marked a crucial opportunity to set the tone and deliver a unified message to political decision-makers. That message was clear: **we cannot protect the ocean if we do not observe it.**



The congress venue at the Port of Nice.

I arrived at the conference to help amplify the call for a globally coordinated and sustained program to deploy Argo floats and ensure comprehensive ocean observations. The Argo program is a proven success. Over the past two decades, it has generated millions of ocean profiles measuring temperature and salinity in the upper 2,000 meters of the water column. These data have dramatically improved our estimates of ocean heat uptake and enhanced the performance of ocean models.

Since then, Argo has expanded its reach. Deep-Argo platforms allow scientists to detect bathymetric features and monitor temperature changes in the abyssal ocean. Meanwhile, Biogeochemical Argo (BGC-Argo) floats equipped with chemical sensors track indicators of ocean health, such as oxygen, chlorophyll, pH, nitrate, and carbon.

Together, these platforms form the Global Argo Array, a multinational collaboration powered by diverse institutions and funding streams. All data are quality-controlled and made freely available in near-real time, reflecting a commitment to open-source, equitable science. This unprecedented alliance across nations and disciplines has enabled ocean monitoring at scales once unimaginable. Now, this scientific community is gathering around a new vision: a unified, fully implemented **OneArgo system by 2030**. However, its success will depend on long-term global commitment and sustained investment from multiple governments, which is yet to be achieved.

No Baseline, No Breakthrough

A common thread running through sessions, from coral reef health to deep-ocean circulation, was the sobering realization that the ocean remains dangerously undersampled and understudied. In coastal regions, particularly around vulnerable tropical islands, communities are already experiencing the impacts of sea-level rise and coral bleaching. Yet, without locally tailored observing systems, it's nearly impossible to track the extent or pace of change, let alone predict future conditions. Establishing site-specific monitoring networks is essential to document present-day baselines and detect long-term transformations.

In the open ocean, observing changes in ocean volume is equally critical not just for tracking sea level rise, but for parsing the relative contributions of thermal expansion versus ice melt. These estimates rely on the integration of satellite altimetry with in situ measurements. The accuracy of climate projections, and by extension, our ability to adapt, hinges on these foundational data.

Despite these immense stakes, the scientific community has pressed forward with resolve, even in the face of precarious funding. Much of the ocean observing enterprise is held together by slim budgets, intermittent grants, and an unwavering commitment from a global network of researchers. Deploying instruments in remote regions of

the Pacific, for example, may sound like an adventure—and in many ways it is—but in practice, these operations demand logistical acumen, international cooperation, and deep technical expertise.

At the heart of this effort are the people—scientists, technicians, data analysts, engineers, and early-career researchers—who make the system work. Valuing this human infrastructure is as essential as funding the hardware. Knowledge transfer between generations, across disciplines, and different institutions is what sustains excellence in ocean measurements and ensures that the next decade of ocean science builds on a foundation of continuity and trust.

We Can't Remove What We Don't Understand

Another prominent theme at the conference was the responsible use of **marine carbon dioxide removal (mCDR)**, a rapidly emerging, and often polarizing, strategy for climate mitigation. From enhancing alkalinity to the efficiency of the biological carbon pump, these interventions aim to increase the ocean's carbon uptake. But amid the ethical, ecological, and logistical debates, one point of consensus emerged across disciplines: **without robust observational systems, we cannot evaluate whether these techniques will work, nor can we track their unintended consequences.**

The ocean is not a blank slate. Its chemistry is already shifting due to anthropogenic CO₂ emissions, ocean acidification, deoxygenation, and nutrient imbalances. If we fail to rigorously monitor the ocean state before, during, and after deployment of mCDR strategies, we risk mistaking natural variability or cumulative stressors for engineered success. Worse, we may overlook ecological disruptions entirely.



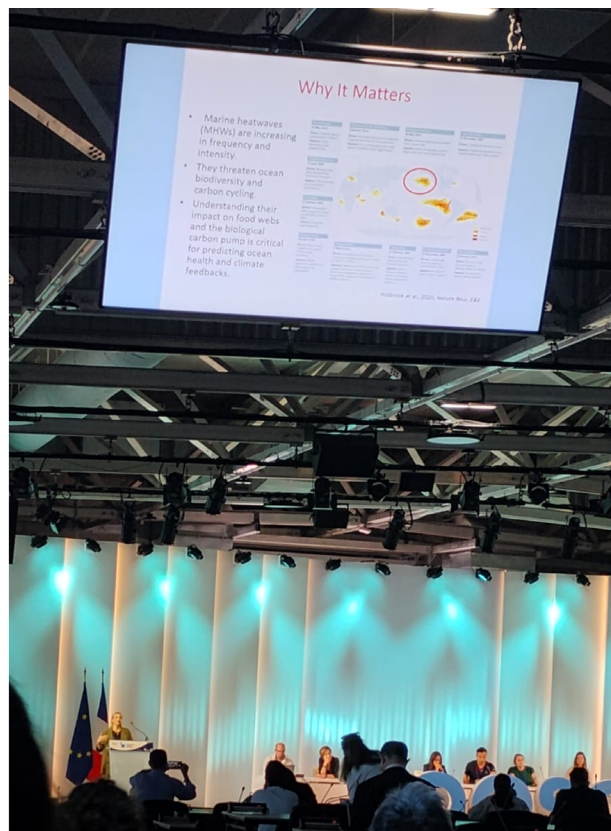
The largest conference room held an important town hall on the responsible use of marine carbon dioxide removal (mCDR) as a tool to mitigate atmospheric carbon concentrations.

This reinforces the case for sustained, high-resolution ocean surveying, not only to understand how the ocean is changing, but also to safeguard the integrity of the solutions we may soon be scaling up.

Bridging Science and Policy

The One Ocean Conference also served as a reminder that ocean science does not exist in a vacuum, it must inform and influence policy to drive meaningful change. Yet, the gap between knowledge and action remains a recurring challenge. While scientists present increasingly refined measurements and forecasts, translating that knowledge into governance still lags behind.

Several sessions highlighted successful examples of policy engagement, particularly where scientists were embedded in advisory roles or working alongside regional management bodies. But these collaborations are still the exception, not the norm. In many parts of the world, scientific capacity is unevenly distributed, and access to reliable, real-time records remains a luxury rather than a given.



I presented research on the impacts of marine heatwaves on carbon cycling and microbial communities at the base of the ocean food web. My work integrates over a decade of BGC-Argo float and shipboard measurements. The ability to observe and attribute ecosystem changes to these extreme events was made possible by sustained biogeochemical observations in the Northeast Pacific, which endured two consecutive marine heatwaves within a short time span.

For observation-based policies to take root, governments must be not only informed, but equipped. This includes building local capacity to access, interpret, and act on ocean data in real time. Global observing networks like the Argo program offer a powerful model: internationally coordinated, openly accessible, and scientifically transformative. Yet, without concurrent investment in infrastructure and science-policy interfaces, the full potential of these systems remains underutilized, undervalued and, at worse, may cease to exist.

This sentiment was voiced repeatedly during Q&A sessions. For instance, despite its contributions to ocean health and climate science, Argo's role in supporting decision-making has not been adequately recognized in the policy realm. Securing funding to maintain its operations in the coming years remains uncertain, despite its proven success.

Still, momentum is growing. The UN Decade of Ocean Science is catalysing new partnerships, and there is cautious optimism that the upcoming UN Ocean Conference will foreground ocean observation as a non-negotiable foundation for global ocean health. Scientists are ready, but meaningful policy engagement requires that the listening continues long after the conference lights dim.

What's Next?

If the Decade of Ocean Science is to live up to its promise, it must be built on continuity, courage, and collaboration. Continuity, through long-term observing systems that outlast political cycles. Courage, to invest in efforts that may not yield immediate headlines. And collaboration, across disciplines, countries, and generations, to sustain momentum and bridge global gaps.

Boldness may not be the first word we associate with scientists. Yet perhaps it should be. If we hope to drive change at the scale the ocean demands, we must begin to equip ourselves with the confidence and urgency to speak louder, deliver clear messages, reach further, and act faster.

The One Ocean Conference reminded us that the ocean binds us ecologically, climatically, even philosophically. But it also reminded us that we are still far from understanding it. We are just beginning to unravel its many intricacies, and we cannot afford to keep doing so without consistent and reliable funding.

To observe is to care. To observe is to be accountable. And to observe is to build the knowledge we need to protect what is and recover what may still be. There is no climate solution, no food security, no blue economy without an ocean that is deeply, intentionally, and globally acknowledged. The scientists are ready. The tools are ready. The moment is now.



Leticia Barbero (left), Co-chair of the GO-SHIP program, an essential initiative coordinating long-term global research cruises that serve as reference measurements for ocean monitoring. On the right: myself, an early-career scientist inspired by a cohort of remarkable oceanographers like Leticia, who are building a long-lasting legacy of knowledge for future generations.



Mariana Bernardi Bif

Mariana is an Oceanographer and Assistant Professor at the University of Miami's Rosenstiel School of Marine, Atmospheric, and Earth Science (RSMAES). Her research combines multiplatform ocean observations to study carbon and nutrient cycling in dynamic marine environments, focusing on the biogeochemical response of the ocean to extreme events such as deoxygenation, marine heatwaves, and ENSO conditions. Prior to joining the faculty at RSMAES, she worked at the Monterey Bay Aquarium Research Institute (MBARI), where she contributed to sensor development, production, and deployment of BGC-Argo floats. She is a strong advocate for integrated ocean observing systems as the foundation of ocean science.

FUTURE Scientific Steering Committee's 11th Inter-Sessional Meeting Highlights

By Hanna Na and Steven J. Bograd



The FUTURE Scientific Steering Committee (SSC) held its 11th inter-sessional meeting since 2014. FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems) is PICES' second integrative science program, which was launched at PICES-2009 and is currently in Phase III. This year's virtual meeting on April 30 was led and hosted by FUTURE SSC Co-Chairs Steven J. Bograd and Hanna Na. It was attended by ten SSC members and one guest.

Review of 2024-25 Activities and Upcoming FUTURE Activities

The SSC reviewed FUTURE activities since its last meeting at PICES-2024 and discussed upcoming FUTURE activities, as described below.

The SSC held the full-day plenary FUTURE Symposium at PICES-2024. It came a full decade after the first FUTURE Open Science Meeting, which launched FUTURE's new vision to investigate and understand the climate and anthropogenic impacts on North Pacific marine ecosystems, with an emphasis on the synergy of social, ecological, and environmental systems (SEES) and processes. A summary of the FUTURE Symposium was presented in [PICES Press Volume 33, No. 1](#) (Winter 2025).

The FUTURE Synthesis Paper was prepared to assess how PICES science has evolved over time, starting from the first flagship Science Program, Climate Change and Carrying Capacity Scientific Program (CCCC) (1995–2009), through the two phases of the FUTURE Program (Phase I from 2010 to 2015 and Phase II from 2016 to 2020). This paper presents how an integrative SEES approach facilitated interdisciplinary work, identifies research 'bright spots', and discusses areas for future work. The paper provides valuable lessons learned, including best practices for planning large-scale integrated science programs. The manuscript was prepared by Dr. Shion Takemura, all the SSC members, and others, and is expected to be published in the ICES Journal of Marine Science before PICES-2025.

FUTURE Phase III priorities include further engaging Early Career Ocean Professionals (ECOPs) in FUTURE activities and planning to instill new ideas and enthusiasm. FUTURE

SSC has welcomed new ECOP members over the past two years, including Dr. Mackenzie Mazur (Canada), Dr. Hitomi Oyaizu (Japan), Dr. Seongbong Seo (Korea), and Dr. Erin Vera Satterthwaite (USA). As FUTURE is in the process of finalizing its last phase, the SSC will make sure to engage our ECOP members in the wrap-up process.

Future of FUTURE

As FUTURE Phase III is scheduled to wrap at PICES-2026, the SSC is actively considering how to advance PICES science to be more actionable and impactful. Based on the active and fruitful discussions among the SSC members and during the FUTURE Symposium, FUTURE SSC envisions that a new PICES Science Program should focus on science-based solutions and operational products, informed by emerging themes identified in the UN Decade of Ocean Science for Sustainable Development. Over the next year, FUTURE SSC plans to work on preparing its final report and providing strategic guidance for developing the next Science Program.

FUTURE ECOP Award for PICES-2025

The FUTURE ECOP Award provides FULL travel support for an ECOP to attend the PICES Annual Meeting. It has been established to encourage recognition and application of the SEES approach and engage ECOPs in PICES activities. Selections will be made from the abstracts submitted to the PICES Annual Meeting. The abstracts should describe the SEES approach taken for the study. Details on who is eligible and how to apply can be found at: <https://meetings.pices.int/awards/FUTURE-ECS-Award>.



Data Democracy - The Power of Community in Environmental Monitoring

Svetlana Esenkulova and Haley Tomlin

Citizen Science: A Community-Driven Approach to Ecological Monitoring

Citizen science is a research practice that enlists members of the public to gather data and samples for scientific purposes, a practice that has been remarkably successful in providing vast quantities of data that would otherwise be unobtainable at similar spatiotemporal scales. While the term may seem modern, citizen participation in scientific research dates back to the early 20th century, with community-led bird counts and meteorological observations. This approach democratizes science by engaging non-professionals in data collection across broad geographic areas and over long periods—tasks that would be too costly or logistically challenging for traditional research teams.

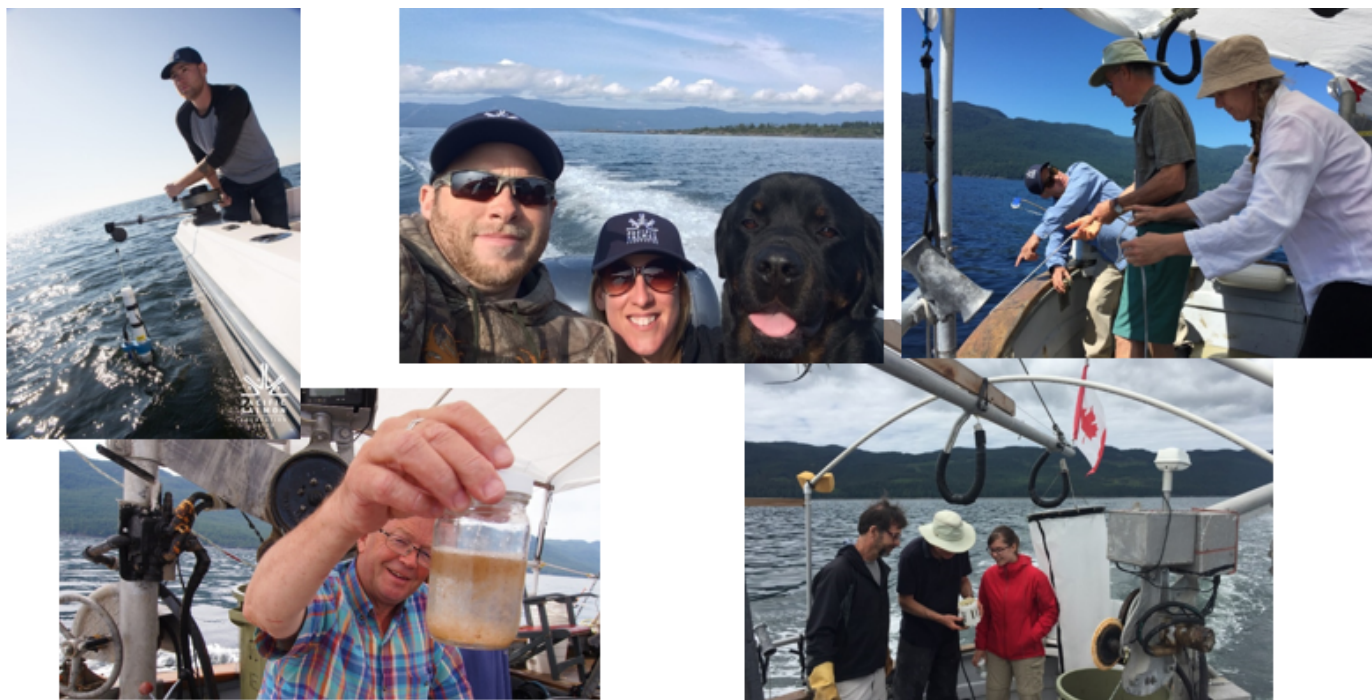
Citizen science involves members of the public in specific scientific activities, such as data or sample collection, often working in collaboration with or under the guidance of professional scientists. This practice is highly valued for its capacity to collect large volumes of data in a cost-effective manner while also enhancing community understanding and stewardship of local environmental issues. As citizen science becomes increasingly used in research, sharing lessons learned from long-term, successful programs can provide valuable insights for emerging initiatives.

The benefits of citizen science are undeniable: it harnesses community involvement to collect large-scale data, boosts public engagement in scientific inquiry and provides a cost-effective solution for long-term monitoring. However, it is not without complexities. Ensuring data reliability can be challenging, particularly when volunteers lack formal training, making quality assurance and control crucial. Sustaining volunteer-driven projects over time also requires strong community commitment and ongoing support. Nevertheless, a growing number of successful citizen science programs have shown that with proper structure and community investment, long-term ecological monitoring and conservation goals are both achievable and impactful. The following sections highlight programs in British Columbia, Canada that demonstrate the power of community involvement in generating valuable scientific insights and supporting resource management.

Pacific Salmon Foundation Citizen Science Oceanography Monitoring Program

The first example is the Citizen Science Oceanography Monitoring Program (CSOMP), led by [Pacific Salmon Foundation \(PSF\)](#). Founded in 1987, PSF is an independent, non-governmental organization dedicated to the conservation and restoration of wild Pacific salmon and their habitats in British Columbia (BC) and Yukon. Through

We thank Citizen Scientists for collecting data and samples and being good stewards of your waters.



Pacific Salmon Foundation (PSF) citizen scientists.

partnerships with First Nations, governments, and local communities, PSF advances habitat restoration, scientific research, and community-driven conservation efforts.

The CSOMP was launched in 2015 by PSF to address critical data gaps identified by the Salish Sea Marine Survival Project (SSMSP) (<https://marinesurvivalproject.com>)—a multimillion-dollar international research initiative that brought together over 60 organizations to understand the factors limiting salmon and steelhead survival in the Salish Sea. One of the key findings of the SSMSP was the significant impact of bottom-up processes on juvenile salmon survival. However, the oceanographic data required to fully evaluate these factors were sparse. In response, the CSOMP was established to fill these gaps through systematic, long-term monitoring.

Inspired by Dr. Eddy Carmack's vision of community-driven oceanography, the program was developed with support from Fisheries and Oceans Canada (DFO) and Ocean Networks Canada (ONC). Citizen scientists, trained members of different communities throughout the Strait of Georgia, collected data on hydrography, nutrients, and harmful algae, with additional sampling elements introduced or adjusted over time. With technical support from PSF, ONC, DFO, and the Universities of Victoria (UVic) and British Columbia (UBC), the program leveraged local community involvement to scale data collection far beyond the capacity of traditional scientific surveys, achieving unprecedented spatiotemporal coverage.

To maintain data reliability, the program implemented a clear separation of roles: trained citizen scientists focused on standardized data collection, while professional scientists managed processing and analysis. Local volunteers, all of whom had strong ties to the Strait of Georgia, collected oceanographic samples under regular oversight from PSF biologists. Experts performed data analysis to ensure high scientific standards. Volunteers received modest compensation for fuel and mileage but largely participated out of a commitment to marine conservation. This community-focused model fostered long-term engagement, with most volunteers returning year after year. All data collected are hosted on the PSF Marine Data Center (<https://marinedata.psf.ca/atlas/es/oceanographic-conditions/>), making it publicly accessible for research and policy development.

Over its ten-year history, CSOP has made a significant contribution to marine science and public awareness. Volunteers collected over **60,000 samples**, including nutrients, phytoplankton, chlorophyll, zooplankton, and biotoxins, and conducted thousands of Conductivity, Temperature, and Depth (CTD casts and Secchi depth readings. Crews travelled nearly 80,000 km during 1,400 vessel trips—an impressive achievement for a community-led initiative.

One of the program's standout achievements is its comprehensive analysis of harmful algae. Through the collection of over a thousand phytoplankton samples annually, CSOP has provided unprecedented insights into the prevalence and distribution of harmful algal blooms (HABs) in the Strait of Georgia. This dataset has been instrumental in revealing spatial and temporal patterns of HAB occurrences and their correlation with environmental factors. Findings from the program have been published in a peer-reviewed journal (Esenkulova et al., 2021), regularly featured in DFO's annual State of the Pacific Ocean reports (<https://www.dfo-mpo.gc.ca/oceans/publications/soto-rceo/2021/technical-technique-eng.html>), and included in Canada's national reports to PICES, underscoring the program's sustained contribution to regional and international marine science.

Beyond data collection, CSOP has played a pivotal role in scientific outreach and education. Its community-focused approach has inspired local stewardship and heightened public awareness through interactive story maps, reports, newsletters, and social media engagement. By empowering communities to contribute directly to marine research, CSOP has not only filled crucial data gaps but also enhanced collective understanding of complex marine ecosystems.

Tire Wear Toxicant Monitoring on Vancouver Island

Another example of a citizen science-driven program is the Mitigating Inputs of Tire Wear Toxicants to Protect Salmonid Habitat on Vancouver Island, co-led by BC Conservation Foundation's Aquatic Research & Restoration Centre (BCCF ARRC) and Vancouver Island University's Centre for Health & Environmental Mass Spectrometry (VIU CHEMS).

6PPD-Quinone (6PPD-Q), a toxicant formed from the tire additive 6PPD, was identified in 2020 as the cause of urban



Citizen science training.

runoff mortality syndrome (URMS) in coho salmon (Tian et al. 2020). 6PPD has been used since the 1960s to extend the lifespan of tires and other rubber products. Coho mortality events were first noted in the late 1990s during post-restoration monitoring in Puget Sound urban creeks, with pre-spawn mortality rates estimated at 60–100% (Scholz et al. 2011). Further studies have shown that other salmonids, including cutthroat trout, lake trout, rainbow trout/steelhead, brook trout, and Chinook salmon, are also susceptible to 6PPD-Q at varying concentrations (Lo et al. 2023; Tian et al. 2022; Brinkmann et al. 2022; French et al. 2022; Roberts et al. 2025a,b).

In response, BCCF ARRC and VIU CHEMS launched a program to monitor 6PPD-Q in streams along the east coast of Vancouver Island. A GIS analysis identified over 10,000 potential sampling locations where roads intersect fish-bearing streams, excluding stormwater outfalls. Given the link between 6PPD-Q and rainfall, sampling windows depend on weather, making it clear that additional help was needed to cover this complex system. The program began in 2021–2022 with about 10 groups, each sampling one or two locations. This phase focused on method development, with VIU CHEMS creating a condensed phase membrane introduction mass spectrometry (CP-MIMS) method for rapid, simplified analysis which processes hundreds of samples in minutes. Once validated, sampling expanded. By 2023, 38 groups, including local First Nations and stewardship organizations, were involved, contributing **~4,500 samples** from 62 waterways at over 150 locations. Without their support, this level of sampling would have been impossible. BCCF ARRC monitors weather and contacts citizen scientists with as much notice as possible (typically three to four days). Volunteers collect samples three times per rain event: before, during, and ~24 hours after. A custom data collection app with QR codes for locations and samples streamlines entry and reduces

errors. Data are submitted directly to the VIU CHEMS lab, reviewed, and then shared publicly.

To sustain engagement, the program maintains a website (<https://www.tireweartoxins.com>), bi-annual newsletters, and an online dashboard (<https://experience.arcgis.com/experience/597c33d27da84f1789bc41a36e37253d/page/Tire-Wear-Toxins>) where data are uploaded within weeks of collection. Annual workshops bring together researchers, First Nations, citizen scientists, and government to share research findings, policy updates, and mitigation strategies.

Other Long-Standing Citizen Science Programs in British Columbia, Canada

These two programs—PSF's Citizen Science Oceanography Monitoring and BCCF's 6PPD-quinone monitoring—are part of a broader landscape of citizen science efforts that have made meaningful contributions to salmon science in British Columbia. Another long-standing initiative is the Avid Angler Program, established in 2013 by a group of experienced recreational fishers determined to fill critical data gaps in salmon research. Since then, Avid Anglers have contributed more than **45,000 samples**. Their efforts span key conservation areas across the Strait of Georgia, Juan de Fuca Strait, and Queen Charlotte Strait, providing data that is critical for understanding salmon stock composition, migration patterns, and survival rates. By integrating volunteer-collected samples into DFO science assessments, the Avid Angler Program demonstrates how community-driven efforts can provide data at a scale and resolution that would be unachievable through standard monitoring programs alone.

Other PSF-led initiatives highlight the diversity of citizen science approaches and partnerships that support salmon conservation. The Adult Salmon Diet Program, a collaboration between PSF and UVic's Juanes Lab, engages recreational anglers to collect stomach samples and associated capture data from retained salmon, providing valuable insights into salmon feeding habits and contributing to a deeper understanding of salmon marine ecology, particularly during the poorly understood winter months. This work has revealed the importance of key prey species, such as sand lance and anchovy. Analysis of prey size distributions, particularly Pacific herring, is also shedding light on migration life-history diversity, with potential implications for ecosystem-based fisheries management.

The Bottlenecks to Survival Project (<https://www.survivalbottlenecks.ca>), a large-scale passive integrated transponder (PIT) tagging program co-led by PSF and BCCF, also benefits from citizen scientists. Local anglers along the east coast of Vancouver Island assist in catching and tagging juvenile Chinook and Coho salmon in the Strait of Georgia. Their participation greatly expands the spatial



Water sampling.

and temporal coverage of sampling, increasing the number of tagged fish, and providing critical data to help identify when and where salmon mortality occurs.

Other community-based efforts include the Pender Harbour Coastal Waters Monitoring Program, led by the Loon Foundation in partnership with PSF, where volunteers collect long-term data on water quality, juvenile salmon habitat use, and escapement. The PSF's Community Salmon Program supports a wide array of volunteer-driven conservation and restoration projects across the province, empowering local groups to engage in habitat restoration, stream monitoring, and educational outreach.

Taken together, these examples underscore the remarkable breadth and impact of citizen science efforts in British Columbia. They do more than generate high-quality, actionable data – they foster a deeper connection between people and place. Citizen science builds capacity in communities, develops skills in scientific observation and data collection, and helps translate local knowledge into evidence-based conservation. These programs also break down traditional barriers between scientists and the public, making science more inclusive, transparent, and responsive to local needs. By engaging citizens as partners in research, these initiatives strengthen the social fabric of conservation, bringing together diverse voices, fostering stewardship, and creating a shared sense of responsibility for the future of wild salmon.

Lessons Learned and Key Ingredients for Success

Long-term citizen science programs offer valuable insights into effective community-based monitoring. From the experience of successful initiatives in British Columbia, several key themes emerge that can guide future programs.

Clear Roles, Training, and Support

Successful programs are built on clear expectations, practical training, and ongoing support. Structured onboarding through workshops, supervised fieldwork, or detailed protocols ensures volunteers have the skills and confidence to contribute meaningfully. Regular communication, such as newsletters, group emails, or annual workshops, helps maintain engagement and connection to broader scientific goals.

Flexibility and Practical Tools

Field conditions are often unpredictable. Programs that adapt to weather, sampling windows, and volunteer availability can streamline workflows, reduce errors, and ensure data quality, even in challenging environments.

Shared Ownership and Community Connection

A sense of ownership among volunteers is critical for long-

term success. Involving participants in decisions about sampling locations or protocols leverages local knowledge and builds trust. Volunteers are not just data collectors; they are partners in research, offering unique insights that strengthen program design and relevance.

Timely Feedback and Transparency

Sharing results and demonstrating how data informs research, and decision-making reinforces the value of participation. Programs that provide regular feedback (through dashboards, newsletters, or story maps) help volunteers see the impact of their efforts, enhancing motivation and retention.

Stable Funding and Scientific Oversight

Sustained funding is essential for covering logistical costs and maintaining operations. Equally important is scientific oversight through collaborations with universities, agencies, or other experts to ensure data quality, research integrity, and alignment with broader conservation goals.

People Are the Heart of Citizen Science

Ultimately, the success of any citizen science program depends on the passion and commitment of its volunteers. Across oceanography, tire wear monitoring, and other initiatives, dedicated individuals from diverse backgrounds (retired fishermen, biologists, stewardship groups, and First Nations communities) have contributed invaluable time, knowledge, and enthusiasm. Their collective efforts make large-scale, long-term monitoring possible.

As environmental challenges intensify (including harmful algal blooms, emerging contaminants, and climate change impacts) community-based monitoring is more important than ever. The lessons learned from citizen science programs in British Columbia can serve as a guide for others seeking to build resilient, collaborative, and scientifically robust initiatives that advance both ecological knowledge and community stewardship.



Pacific Salmon Foundation Citizen Science Symposium 2025.

As Beamish (2023) observed, scientific discovery is essential, but *"informing the public was a partnership that expanded the reach of the science beyond the practitioners and into a stewardship. Governments will make better decisions when the public are better informed, but governments do not do a good job of informing the public... It is not just telling people what we discovered, but it is an honest communication about what we know, do not know, and need to know."* Those who live and work on the ocean are often its best stewards, and citizen science provides a platform for them to contribute directly to scientific understanding. By bridging the gap between research and community, citizen science empowers people to become informed caretakers of the ecosystems they rely on ensuring that scientific knowledge is not only generated, but also shared, understood, and used to inform action.

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Svetlana Esenkulova

Svetlana has been a Biologist at the Pacific Salmon Foundation (PSF) since 2014. Her research focuses on marine ecology, particularly the influence of plankton communities and oceanographic processes on salmon survival and ecosystem dynamics. She has contributed to major international initiatives, including the International Year of the Salmon and the Salish Sea Marine Survival Project. For the past decade, she has been an integral part of PSF's Citizen Science Oceanography Monitoring Program, a long-term initiative focused on monitoring oceanographic conditions and plankton communities in the Strait of Georgia. Svetlana has attended PICES meetings since 2012 and is an appointed member of the Section on Harmful Algal Blooms (S-HAB).



Haley Tomlin

Haley is a Biologist at the BC Conservation Foundation (BCCF). She grew up in the Yukon, where she began her studies at Yukon College before transferring to Vancouver Island University to complete her Biology degree. She has worked as a biologist for eight years and joined the BCCF team in 2022. Haley co-leads the British Columbia Salmon Restoration and Innovation Fund (BCSRIF)-funded Tire Wear Toxin Monitoring Program and contributes to a variety of the Aquatic Research and Restoration Centre's (ARRC) other research and restoration initiatives.

PICES-2025 Annual Meeting*PICES Secretariat***PICES-2025**

Nov 8-14, 2025 | Yokohama, Japan

Innovative Approaches and
Applications to Foster Resilience
in North Pacific Ecosystems



The Secretariat is looking forward to welcoming the PICES Community to our Annual Meeting in Yokohama, Japan!

PICES-2025 will serve as a crucial platform for exploring innovative approaches to understanding North Pacific ecosystems and helping to chart a path toward climate resilience and sustainable development. Experts from diverse fields—including marine science, environmental conservation, engineering, economics, and social science—will discuss integrating the latest scientific findings and technologies, such as artificial intelligence, remote sensing, and biotechnology, across the Pacific.

The scientific program includes 11 workshops, 16 Topic Sessions, and an evening poster session. Sessions will begin with a Science Board Symposium.

While the PICES Community is 'serious' about science, PICES Annual Meetings are a friendly, inclusive, and collaborative environment to discuss and share ideas. We welcome and celebrate everyone in our community, from Early Career Ocean Professionals (ECOPs) to Senior Scientists, breaking barriers for interdisciplinary research, and representation from numerous countries and cultures. Our annual meetings are a perfect opportunity for members to build relationships, get new perspectives, and develop collaborations in their work.

For more information, visit the PICES 2025 meeting website at: <https://meetings.pices.int/meetings/annual/2025/pices/scope>.

The PICES-2025 website will be updated regularly, and a detailed timetable of events will be posted soon.

Scientific Program and Schedule

Date	Sessions and Workshops	Business Meetings
Nov 8 - Saturday	Parallel Workshops (x4)	Day: EG meetings & Evening: Committee meetings
Nov 9- Sunday	Parallel Workshops (x4)	Day: EG meetings & Evening: Committee meetings
Nov 10 - Monday	Opening Ceremony & Science Board Symposium Evening: Welcome Reception	
Nov 11 - Tuesday	Parallel Topic Sessions (x4)	EG meetings & F&A meeting
Nov 12 - Wednesday	Parallel Topic Sessions (x4) Evening: Poster Session	EG meetings & F&A meetings
Nov 13 - Thursday	Parallel Topic Sessions (x4)	EG meetings
Nov 14 - Friday	Parallel Topic Sessions (x4) Noon: Closing Session	PM: Science Board Day 1
Nov 2 - Saturday		Science Board meeting Day 2 & Governing Council Day 1
Nov 3 - Sunday		Governing Council meeting Day 2

PICES-2025 Workshops

W1: Climate-Ready Fisheries Management: Reviewing Effective Strategies for Developing Decision Support Tools

W2: Intercomparison of North Pacific Zooplankton Time Series

W3: Present and future pressures and human activities in the Arctic Ocean and Pacific Gateways

W4: Building framework for cross-community conversation between natural carbon cycles and marine carbon dioxide removal

W5: Basin-scale processes linking western and eastern Pacific dynamics and biogeochemistry

W6: Effective strategies across ocean data lifecycles: Enhancing ocean data management & mobilization

W7: Response of top predators to unusual oceanographic, climatic and anthropogenic events in the North Pacific

W8: Engaging with Local & Traditional Knowledge Holders to Co-Design Ocean Science in Pacific Small Island Developing States

W9: Applying a cumulative effects framework to explore actionable, social-ecological solutions for climate extreme event impacts across the North Pacific

W10: An examination of shelf data collected by moorings and other fixed stations in the North Pacific Ocean

W11: Harnessing Environmental DNA (eDNA) for Early Detection and Monitoring of Marine Invasions in the Face of Climate Change

PICES-2025 Sessions

S1: Science Board Symposium: Innovative Approaches and Applications to Foster Resilience in North Pacific Ecosystems

S2: Changing ecosystem structure under global climate change: monitoring, detecting, modeling, and socio-ecological impacts

S3: Interactions of variability and change in the North Pacific

S4: Responses of small pelagic fish communities to recent climate regime shifts and climate extremes

S5: Climate Extremes and Coastal Impacts in the Pacific

S6: Incorporation of climate and ecosystem impacts in stock assessment advice: Discussion of current approaches and challenges, and charting a path forward

S7: The impact of oceanographic processes on ecosystems supporting fisheries production in boundary current regions

S8: How can ecosystem-scale information be used to improve our understanding of climate change impacts, and support management and conservation in the North Pacific?

S9: Marine plastic and microplastic pollution in the North Pacific

S10: Multiscale physical, biological and ecosystem dynamics under conventional and carbon-dioxide removal based climate scenarios

S11: Applying innovative and established approaches to assess the resilience of the early life stages of North Pacific fishes to changing oceanographic conditions

S12: Understanding the linkages between forage species and top predators and how they may affect resilience in North Pacific ecosystems

S13: (postponed to PICES-2026) Shifting institutional culture to develop climate solutions with Open Science and Open Data

S14: The status and future of urban oceans of the North Pacific pathways to resilient and sustainable coastal cities

S15: The rise of bibliometric analyses to address sustainability solutions through a human dimension lens

S16: Radiocarbon studies in the North Pacific and its marginal seas

S17: What can we learn about the occurrence of *Karenia* spp. blooms in the North Pacific?



Diver with a school of fish in Yonaguni, Japan . Credit: Masayuki Agawa / Ocean Image Bank

Regional Reports

Western North Pacific: Current Status and Developments

Sea Surface Temperature and Sea Ice in the Sea of Okhotsk During the 2024/2025 Cold Season

Sugimoto Satoshi

The western North Pacific was characterized by positive sea surface temperature (SST) anomalies over a wide area between 35°N and 45°N throughout the cold season (December 2024 – March 2025) (Figure 1). Positive SST anomalies have continued at these latitudes since 2022. The magnitude of anomalies during the season was generally lower than that of the 2024 warm season.

In areas east of Sanriku and southeast of Hokkaido, anomalies of SST and ocean interior temperature exhibited a significant positive bias from 2023 (see PICES Press Vol. 32, No. 1 and Vol. 33, No. 1) to February 2025 due to a

considerable northward shift of the Kuroshio Extension and a warm eddy that detached from it. In March, positive SST anomalies shrank both in area and magnitude, with a reduction of the significant northward shift to 40°N of the Kuroshio Extension.

The winter maximum sea ice extent in the Sea of Okhotsk was 0.88 million km² in early March, which was around 79% of the 30-year average (1.12 million km²). The seasonal maximum exhibits a long-term decreasing trend of 0.054 million km² per decade, which corresponds to 3.4% of the Sea of Okhotsk's total area (Figure 2).

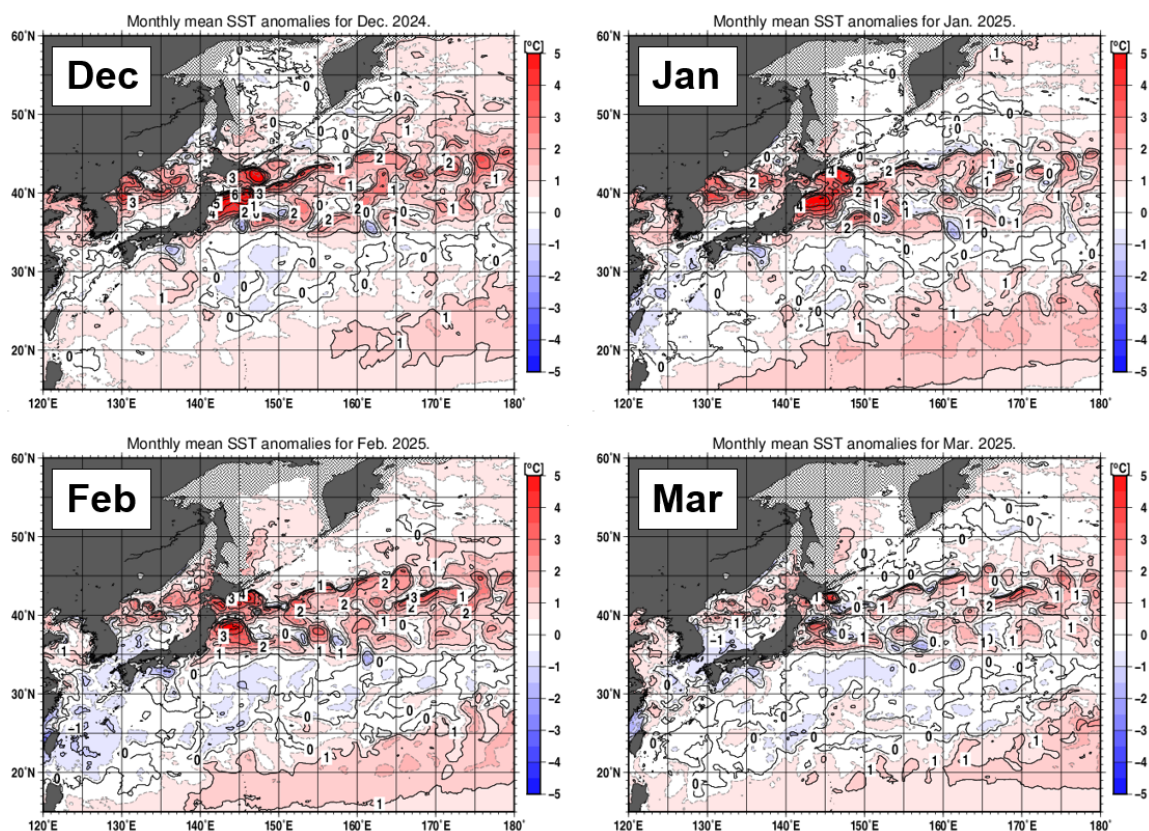


Figure 1. Monthly mean SST anomalies from December 2024 to March 2025 based on JMA HIMSST (High-resolution Merged satellite and in-situ data on Sea Surface Temperature). Anomalies are deviations from the 1991 – 2020 climatology.

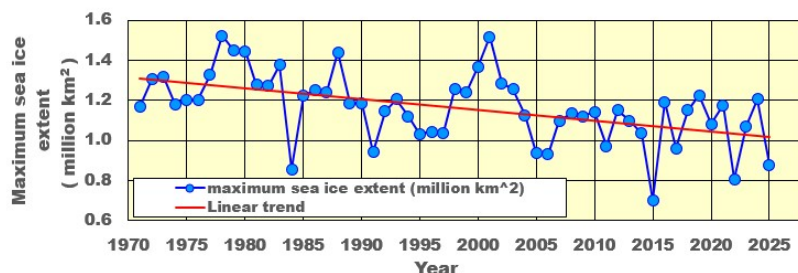


Figure 2. Time-series representation of winter maximum sea ice extents in the Sea of Okhotsk for 1971 – 2025. The red line denotes the long-term linear trend.



Mr. Sugimoto is a senior engineer at the Office of Marine Prediction within the Atmosphere and Ocean Department at the Japan Meteorological Agency in Tokyo, Japan.

Regional Reports

The Northeast Pacific: Updates On Surface Marine Heatwave Status And Zooplankton Community*Andrea Hilborn, Charles Hannah, Moira Galbraith, Akash Sastri, Tetjana Ross, Lu Guan and Di Wan*

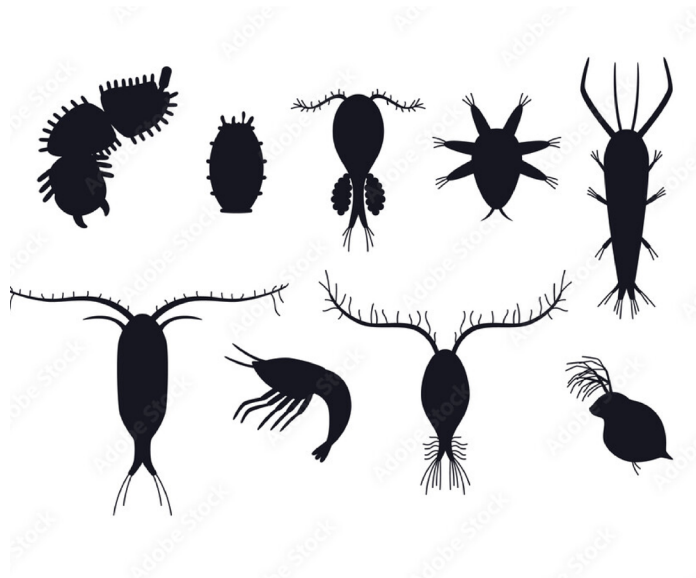
Two thousand twenty-five has seen the end of the weak La Niña that developed in late 2024. Sea-surface temperatures (SSTs) throughout the Northeast Pacific (NEP) have hovered at or slightly above normal. Neutral El Niño-Southern Oscillation (ENSO) conditions are expected throughout the remainder of the year (with estimates showing a greater than 50% chance of ENSO neutral condition until the end of October, see Becker, 2025), though forecasts also suggest a chance of a return to La Niña conditions towards 2026.

For much of 2025 thus far, most of the NEP surface waters have had SSTs slightly warmer ($\sim 1^{\circ}\text{C}$) than climatology (1991-2020). For a couple weeks in mid-February, cool surface anomalies extended along the West Coast of North America as far north as the Alaska panhandle, with coolest waters ($< -2^{\circ}\text{C}$ anomaly) concentrated in the Juan de Fuca Strait and West Coast of Washington State, as identified by Optimum Interpolation SST (Figure 1a). Marine Heatwave (MHW) waters have been consistently present at the surface south of 35°N , with a recent westward shift in their distribution. Cool surface waters along the West Coast of North America have also redeveloped over the last month, with the onset of seasonal upwelling beginning on approximately May 1 (Figure 1b).

Currently, predictions for NEP MHWs show modest likelihood of development (NOAA PSL, 2025). Much of the NEP shows a 20-40% probability of MHWs developing in the coming summer, particularly closer to the coast. These estimates remain stable or decline to 10% or less in the autumn or early 2026. Further offshore, towards the central North Pacific, the chance of MHWs developing this summer is generally higher, hovering at 30-40% for the summer and decline slightly with the approach of autumn and winter. Additionally, ENSO neutral or La Niña conditions suggest a summer ahead with ocean surface temperatures near climatological values. While these predictions are not alarming, further west in the central and western North Pacific, MHW status has been much more frequent in recent years and currently sits at 90-100% probability within the next month. Over the coming year, MHW status it is likely above 60% probability. The NEP has also experienced a different regime of temperature anomalies since late 2013, followed by the “Blob” MHW event (Figure 1c). A consistently larger area of NEP surface waters has temperatures exceeding the 90th percentile of their climatology, consistent with the increase in MHW frequency, duration, and days per year observed globally (Oliver et al., 2018).

Zooplankton sampling from oceanographic cruises can help indicate water sources and circulation. From the most recent *La Perouse* and *Line P* surveys off of the west coast of Vancouver Island and offshore to the central Gulf of Alaska (Ocean Station Papa), preliminary results suggest that the zooplankton community is returning to a sub-Arctic and boreal species mix, with persistence of southern species. For higher trophic levels, this is a good sign, with greater availability of lipid-rich northern copepods. Zooplankton samples from the shelf break west of Vancouver Island show *Neocalanus flemingeri*, an open-ocean species, mixed with *N. cristatus* and *plumchrus*. The presence of salps and *Velella velella* at the surface, with fewer doliolids, suggest waters originating from westward in the central Pacific, rather than from directly south. This is further backed up by observations of much larger than usual *Limacina helicina*, which are observed when originating from offshore areas, or areas further north, rather than along the shelf.

In recent years, low-oxygen (hypoxia) conditions have also been observed in bottom waters at multiple locations along the British Columbia coast and other locations in the Pacific Northwest. In the summer of 2021 hypoxic conditions extended along the continental shelf of Oregon, Washington, and southern B.C. (Barth et al., 2024; Franco et al., 2023). Observations in the spring of 2025 suggest the potential for a low oxygen event in the summer of 2025, similar to the 2021 event (Figure 2). Numerous stations during the 2025 *La Perouse* survey in May observed bottom dissolved oxygen (DO) values lower than 1.4 ml/L, in a spatial pattern similar to that observed in May 2021.



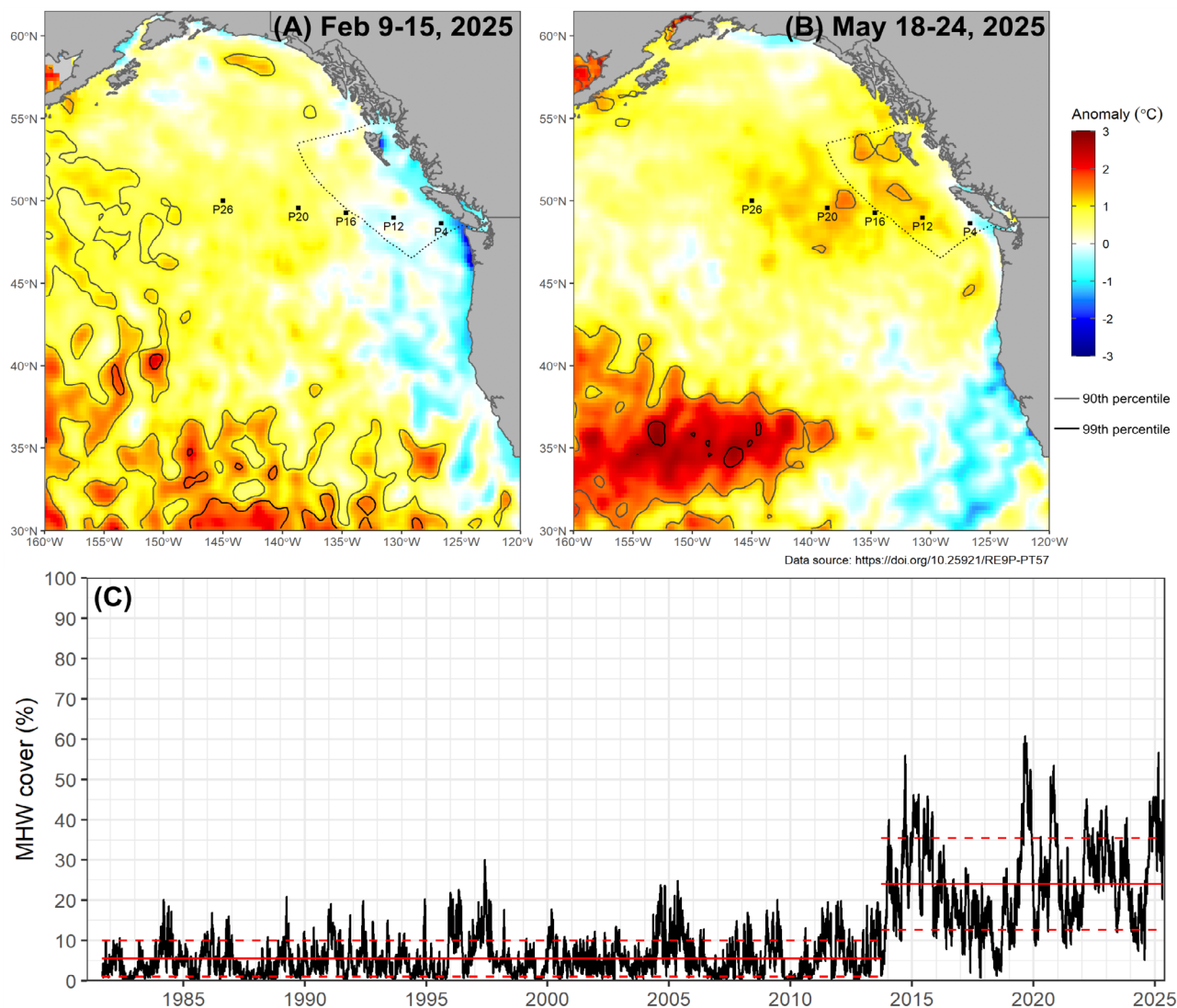


Figure 1. NOAA Optimum Interpolation Sea Surface Temperature (OISST) anomaly averaged from the week of February 9 (A) and May 18, 2025 (B). Standard deviations corresponding to the 90th and 99th percentiles (black contours) from the 1991-2020 climatology are indicated. Selected stations along Line P are labeled as black squares, and the British Columbia Exclusive Economic Zone is indicated with a dashed line. The percentage of Northeast Pacific (NEP) pixels with Marine Heatwave-level (MHW-level) temperature from the beginning of the record in September, 1981 to June, 2025 is indicated in black (C). The mean value of MHW-level SST coverage of the NEP before and after September, 2013 is indicated with a red line, with the standard deviation bounds indicated with dashed lines. Data sourced from <https://doi.org/10.25921/RE9P-PT57> and analyzed by the authors. These plots update weekly at https://github.com/ios-osc-dpg/Pacific_SST_Monitoring.

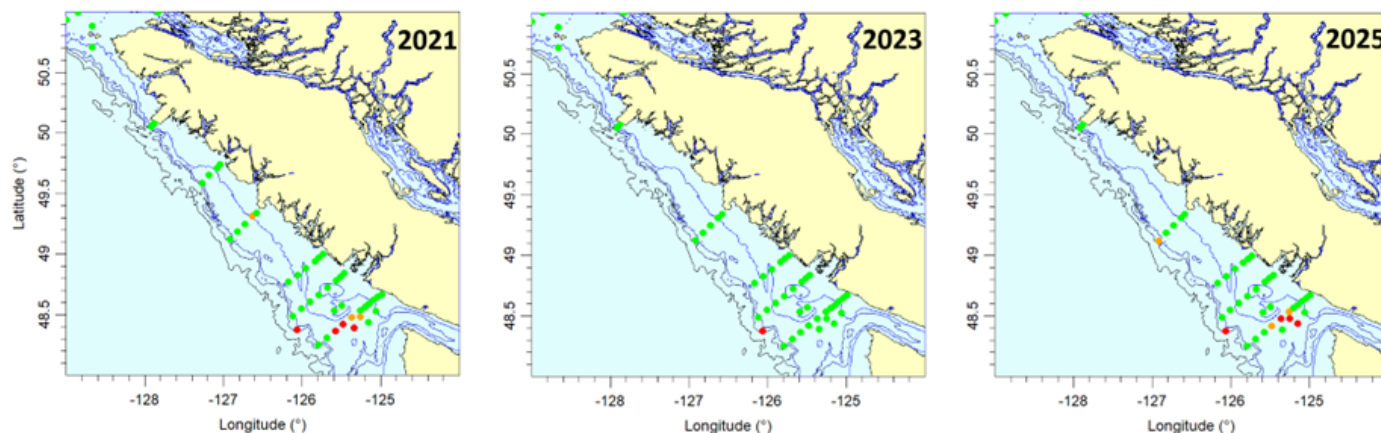


Figure 2. Map of La Perouse monitoring stations along the West Coast of Vancouver Island. In each map panel (data from May 2021, left; May 2023, middle; May 2025, right), the station locations are coloured based on the observed bottom dissolved oxygen (DO) values (green, DO > 1.4 ml/L; orange DO = 1.4 ml/L; red, DO < 1.4 ml/L).

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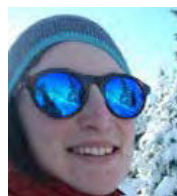
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Photo by Silas Baisch on [Unsplash](#)



Ms. Andrea Hilborn

Andrea is a remote sensing biologist who has been working for Fisheries and Oceans Canada since 2019 with the operational remote sensing group at the Bedford Institute of Oceanography in Halifax, NS. She's currently collaborating with the Institute of Ocean Sciences in Sidney, BC and living in Victoria. Her current projects focus on evaluating and implementing ocean colour satellite algorithms in the Beaufort Sea, and satellite monitoring of temperature and productivity in the northeast Pacific. Outside of the office she is usually found cycling, snorkeling and exploring Vancouver Island.



Dr. Charles Hannah

Dr. Hannah is a senior Research Scientist for Fisheries and Oceans Canada based at the Institute of Ocean Sciences in Sidney, BC. His research program is focused on the oceanography of the central and north coast of British Columbia and he is currently leading a program of moored observations along the British Columbia continental shelf. Within PICES he is member of the Advisory Panel on North Pacific Coastal Ocean Observing Systems (AP-NPCOOS).



Dr. Tetjana Ross

Dr. Ross is a Research Scientist at the Institute of Ocean Sciences, Fisheries and Oceans Canada, in Sidney, BC. She is an ocean physicist who develops new ways to observe the ocean – from observing ocean mixing using sound to taking photographs of zooplankton in turbulence. Nowadays, she rarely goes to sea, sending robots out to do the work for her: both gliders and Argo floats (i.e., she currently leads the Pacific component of DFO's Argo and glider programs). In PICES she is member of the Technical Committee on Monitoring and the Working Group on Submesoscale Processes and Marine Ecosystems. (WG 50). In PICES she is member of the Technical Committee on Monitoring and the Working Group on Submesoscale Processes and Marine Ecosystems (WG-50).



Lu Guan

Zooplankton Taxonomist & Aquatic Ecologist
Fisheries and Oceans Canada, Institute of Ocean Science.

Regional Reports

The Bering Sea: Current Status and Recent Trends

Emily Lemagie and Elizabeth Siddon

Climate and Sea Surface Temperature

There is a striking incongruity between the spring 2025 conditions over the Eastern Bering Sea, with strong warm anomalies over the Southeastern Bering Sea shelf contrasting near-mean conditions observed over the North Bering Sea from March–April, 2025.

In autumn of 2024, conditions appeared favourable for a cold winter with cool sea surface temperature (SST) anomalies and near-average timing of sea ice arrival (Figure 1a). However, the cool surface conditions were due to the deep summertime mixed layer rather than a low water column heat content (Figure 2). As the onset of seasonal winds mixed the water column, the cool SST over the shelf, as low as 2° below the historical mean, transitioned to warm SST anomalies of greater or equal magnitude by January 2025 (Figure 1b).

A deep wintertime Aleutian Low pressure anomaly accelerated surface winds over the Arctic, Northern Bering Sea, and Gulf of Alaska associated with southern storm tracks that progressed along the Aleutian Island chain towards the Alaskan Peninsula. This circulation anomaly is consistent with a strong coastal current and increased heat transport from the Gulf of Alaska into the Bering Sea, which likely augmented the depth-averaged heat anomaly over the Southeastern Bering Sea shelf. In the Northern Bering Sea, mean winter winds were anomalously southward, a pattern that typically drives a rapid sea ice advance across the Bering Sea shelf. Instead, two primary factors contributed to an unusual sea ice distribution (which is described in more detail in the following section): first, warm waters over the shelf melted the ice edge and halted the wind-driven advection around 60°N; second, two wind reversal events in mid-December and mid-February caused significant ice retreat.

The asymmetry of cooling from ice coverage over the Northern Bering Sea and heat advection from the North Pacific onto the Southeastern Bering Sea shelf led to contrasting patterns in conditions between these two regions. For example, regional mean SST over the Northern Bering Sea oscillated between slightly warm and near-climatological mean conditions into the spring of 2025 while the Southeastern Bering Sea experienced prolonged marine heatwave conditions throughout a majority of the most recent winter and spring (Figure 3). This included reaching a daily record-high SST in February. However, the National Multi-Model Ensemble (NMME) forecasts moderate conditions across much of the Eastern Bering Sea shelf by summer (Figure 1c).

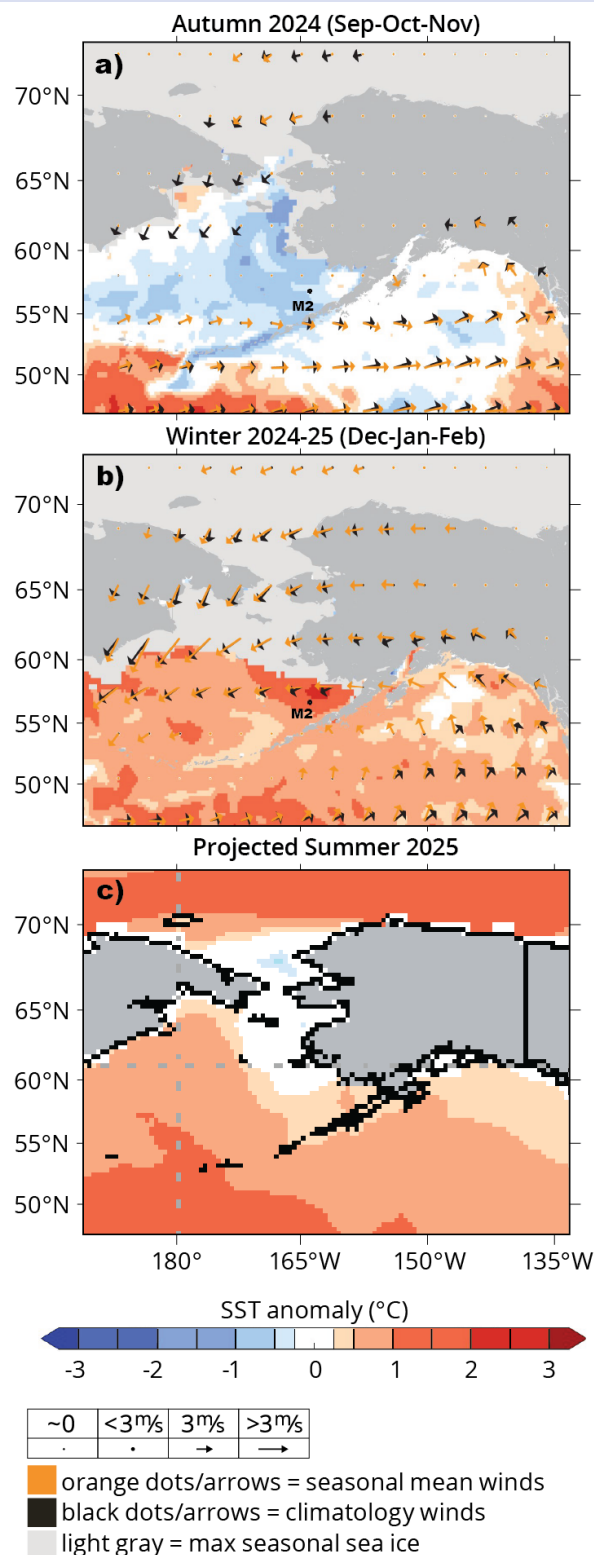


Figure 1. Mean SST anomalies (°C) and 10-m wind vectors for autumn (September–November 2024) through winter (December 2024–February 2025), and August 2025.

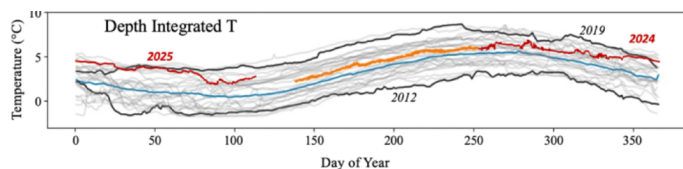


Figure 2. Depth-integrated ocean temperature from NOAA mooring M2 (see Figure 1). Black lines are temperatures from 2012 and 2019. The blue line is the climatology over the 30-year record. Orange and red lines are depth-integrated temperatures from summer 2024 to spring 2025.

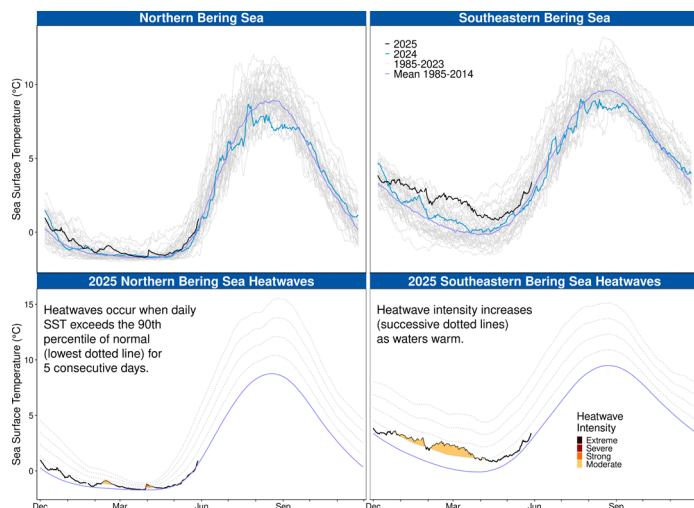


Figure 3. Sea Surface Temperature (SST) and Marine Heatwave (MHW) indices in the Northern and Southeastern Bering Sea. Top panels show SST in 2025 (black) compared to 1985–2023 (gray) and 2024 (blue). The smooth purple line represents the mean SST from 1985–2014. In the bottom panels, dotted lines illustrate MHW thresholds. MHW periods are shaded by intensity. Figure from <https://connect.fisheries.noaa.gov/ak-sst-mhw/>.

Sea Ice Extent

Sea ice extent in the Bering Sea was below the 1991–2020 median for virtually the entire 2024–25 season, which was significantly modulated by prevailing winds (Figure 4). In mid-December and again in mid-February, ice extent briefly ranked in the lowest five for the date in the 47-year satellite record. The maximum Bering Sea ice extent was reached on March 26, the latest since 2016 and was effectively tied for the fourth lowest in the satellite era. North winds dominated across the Eastern Bering Sea in April and early May, leading to ice reaching its farther south extent in Central Bering Sea the first days of May. This resulted in a very unusual spring sea ice distribution. In early May large areas of low concentration ice and open water were found in the northern Bering Sea while a belt of higher concentration ice remained between St. Matthew Island and St. Paul Island as well as Nunivak Island to the east of St. Lawrence Island (Figure 5). The unusual nature of this distribution was well illustrated by the sea ice concentration anomaly during this time with below normal concentration in the north and above normal farther south (Figure 6).

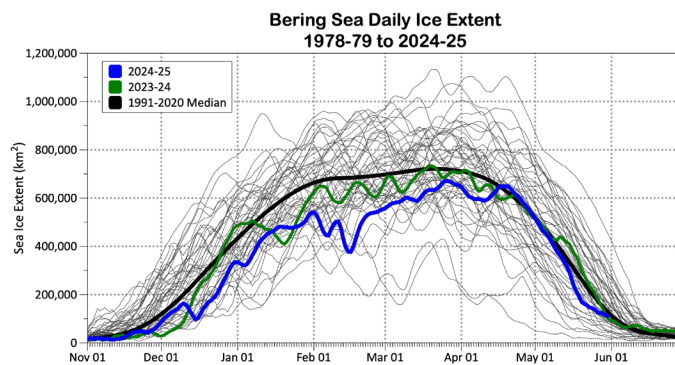


Figure 4. Daily estimates of sea-ice extent in the Bering Sea. Winter 2024/2025 updated to 31 May is shown in blue. Data from National Snow and Ice Data Center. Figure courtesy of Rick Thoman, UAF/ACCAP.

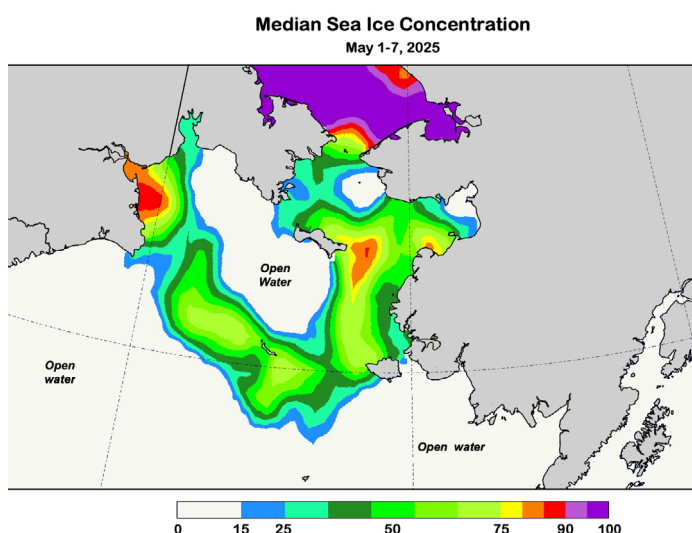


Figure 5. Median sea-ice concentration in the Bering Sea from 1–7 May 2025. Data from ERA courtesy of ECMWF/Copernicus. Figure courtesy of Rick Thoman, UAF/ACCAP.

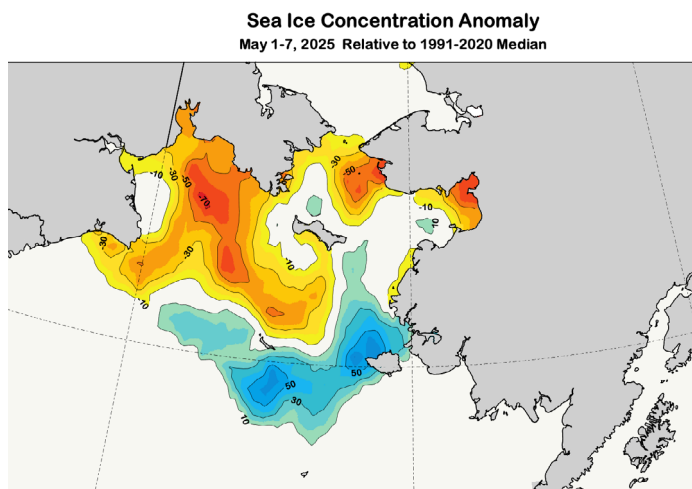


Figure 6. Sea ice concentration anomaly in the Bering Sea from 1–7 May 2025. Data from ERA courtesy of ECMWF/Copernicus. Figure courtesy of Rick Thoman, UAF/ACCAP.

Climate and Sea Surface Temperature Projections

Following extreme low sea ice and marine heatwave conditions that characterized 2014 through 2019, temperature anomalies were mild-to-cool from 2020 through 2024. La Niña conditions that were projected last summer did not fully develop following the 2024 El Niño. As of this writing current projections are for ENSO-neutral conditions to remain through summer 2025 and North American Multi-Model Ensemble (NMME) forecasts warm summer SST anomalies of up to 2°C.

Preview of Ecosystem and Economic Conditions

NOAA's Alaska Fisheries Science Center hosted the annual Preview of Ecosystem and Economic Conditions (PEEC) meeting on May 6-8, 2025. The goal of the meeting is to exchange information on the early physical, biological, and economic conditions to inform the upcoming federal fisheries assessment cycle for crab and groundfish. In the Bering Sea, ecosystem impacts of the unique ocean conditions this year (described in contributions here, and noted by communities like Nome, Alaska [<https://www.nomenugget.com/news/shocking-first-sea-ice-breaks-mid-february>]) will be monitored and evaluated by ongoing data analyses and field surveys through the fall. For example, it was too cloudy every day in April to get a satellite view of chlorophyll-a in order to examine the spring bloom, but subsurface measurements from moorings and field surveys will provide a synopsis.

Bottom Temperatures from MOM6

For this year's Spring PEEC meeting, the regional modeling team debuted results from the new Northeast Pacific implementation of the Modular Ocean Model v6 (MOM6-NEP). The development of this model is part of the Changing Ecosystem and Fisheries Initiative (CEFI), which aims to provide nation-wide operational model simulations across a variety of timescales, including historical hindcasts, seasonal- and decadal-scale forecasts, and long-term projections. The spring 2025 update represented an early test case for using the MOM6-NEP results in a management

context. A custom simulation was run from 1992–Apr 12, 2025. The model configuration followed the standard configuration for the MOM6-NEP reanalysis-forced hindcast (Drenkard et al., 2025) with the exception of the ocean boundary conditions in the final month. At the time of simulation, ocean boundary forcing from the Global Ocean Reanalysis and Simulation (GLORYS) data product only extended through March 25, 2025, so climatological boundary conditions with nudging toward the previous month's anomaly were used to close the gap in the last month.

Results from this simulation indicated historically warm conditions across all Alaska management regions except the Northern Bering Sea shelf (Figure 7). While the northern Bering Sea shelf bottom temperatures were near average, with cooler than average conditions in the western (Russian) portions of the shelf, the remaining regions (southeastern Bering Sea, Aleutian Islands, and Gulf of Alaska) all showed the highest anomalies in the 35-year simulation, up to 3°C above the climatological mean for mid-April (Figure 8). Surface temperature anomalies also

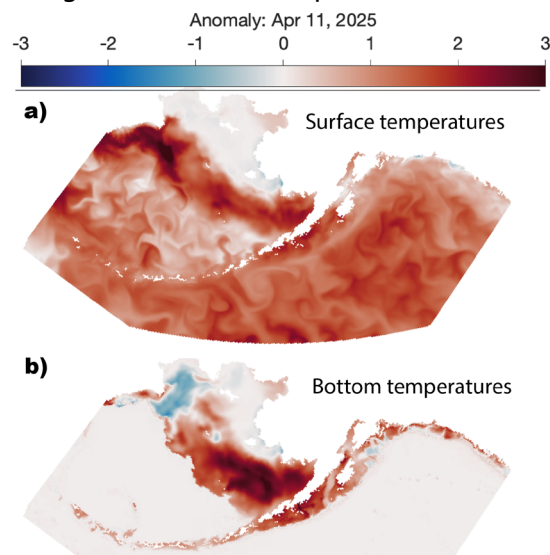


Figure 7. MOM6-NEP April 11, 2025 anomalies from the 1993-2022 climatological mean.

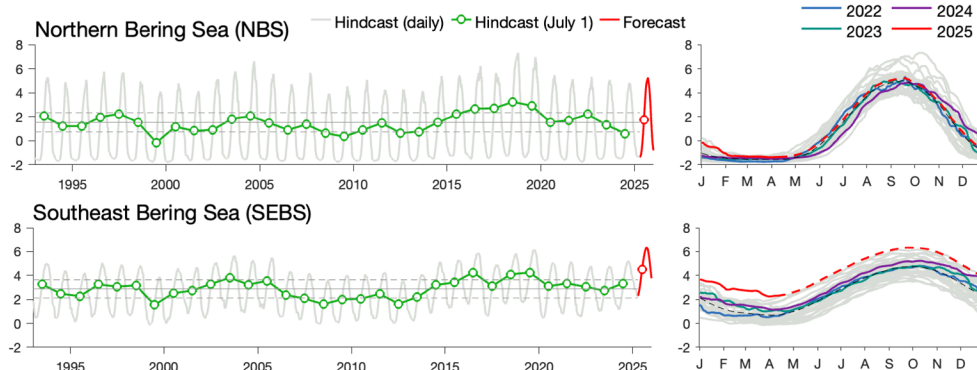


Figure 8. MOM6-NEP regional mean bottom temperatures for the Northern and Southeast Bering Sea shelves. In the left panels, daily hindcasts are in gray, with the persistence-based forecast extending from the end of the hindcast through summer 2025 in red; July 1 values are highlighted in green, with a corresponding red circle for the 2025 July 1 forecast. To the right, recent years are colored, with dashed lines indicating forecast data. MOM6-NEP April 11, 2025 anomalies from the 1993-2022 climatological mean.

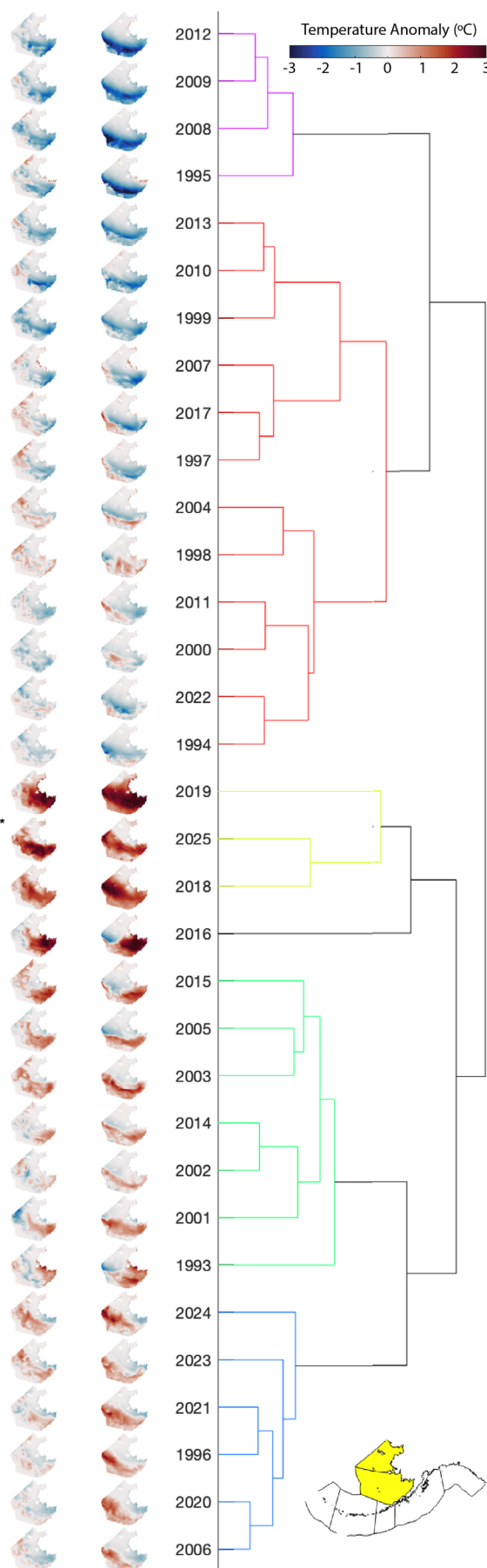


Figure 9. Cluster analysis of the MOM6-NEP-simulated Bering Sea bottom (leftmost column) and surface (second column) spring (Apr 15) temperature anomalies in the Bering Sea shelf region. 2025 is marked with an asterisk, and clusters most closely with 2018 followed by 2019.

fell in the upper quartile of years for all regions except the Northern Bering Sea (which again was very close to the climatological mean). In the Bering Sea, these warm southern and average northern conditions most closely resembled similar extreme events in 2018 and 2019 (Figure 9), while in the Gulf of Alaska, the heat distribution was more similar to the "blob"-influenced years of 2015 and 2016 (figure not shown). In the Aleutian Islands, 2025 stands apart as the most dissimilar (and warmest) year within the hindcast (figure not shown).

Acknowledgments

Many thanks to the scientists who helped create this report: Dr. Rick Thoman at the International Arctic Research Center and University of Alaska Fairbanks provided the sea ice summary; Dr. Kelly Kearney at UW-CICOES and NOAA-AFSC provided information on estimates of bottom temperature from the Northeast Pacific implementation of the Modular Ocean Model v6 (MOM6-NEP).

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Emily Lemagie

Emily (emily.lemagie@noaa.gov) is a physical research scientist at NOAA's Pacific Marine Environmental Laboratory (PMEL) studying ocean dynamics and the impacts on marine ecosystems in the North Pacific Ocean, Bering Sea, and U.S. Arctic. She is a PI for the EcoFOCI program leading studies of the dynamic relationships among climate, fisheries, and the marine environment.



Elizabeth Siddon

Elizabeth (elizabeth.siddon@noaa.gov) is the Lead for Ecosystem-Based Fisheries Management at the Auke Bay Laboratories, NOAA Fisheries, Alaska Fisheries Science Center, in Juneau, Alaska. Elizabeth helps connect fisheries ecosystem science to management and leads the Ecosystem Status Report for the Eastern Bering Sea. The Ecosystem Status Report is used by regional fisheries managers at the North Pacific Fishery Management Council to inform fishing quotas each year.

In Memoriam

Professor Ichiro Imai

January 6, 1953 – April 21, 2025



Professor Ichiro Imai (January 6, 1953 – April 21, 2025) was a Harmful Algal Blooms (HABs) researcher in Japan. He passed away on 21 April 2025 due to pancreatic cancer. Professor Imai worked on HABs and reducing red tides for over 40 years, and continued to attend conferences and academic events until recently. Initially, his work focused on understanding and predicting the mechanisms behind red tide occurrences. In the later stages of his career, his attention shifted to developing prevention strategies. His primary objective was to create environmentally-friendly control methods against HABs to reduce the hardships faced by fishermen.

Ichiro received his Ph.D. in Agricultural Science from Kyoto University in 1989. In 1980, he joined the Nansei National Research Institute, Fisheries Agency of Japan. He moved to Kyoto University in 1994, and to Hokkaido University in 2009, where he continued to work as Professor Emeritus from 2018-2025. His studies focused broadly on the life cycle of microalgae, physiology and ecology of harmful algae, and mitigation strategies for HABs. Ichiro was the chair of the Seto Inland Sea Wide Area Fisheries Coordination Committee (Fisheries Agency), and the chair of Osaka Sea Area Fisheries Adjustment Commission (Osaka Prefecture). His research included studies of the life cycle strategies of the fish-killing raphidophytes *Chattonella* and *Heterosigma akashiwo* in temperate coastal seas and their bloom dynamics related to life cycle, cyst physiology, and seed-population dynamics. He investigated the biological control of HABs by promoting the growth of nutrient-competing diatoms through artificial perturbation and

lifting sediments in coastal sea. Applications in 2020 to 2023 in Osaka Bay were successful in suppressing the occurrences of *Alexandrium* blooms. Finally, he centred his attention to preventing HABs using algicidal bacteria that inhabit the surface of seaweeds and seagrasses. Through this work, he promoted the idea that restoration of seaweed and seagrass beds were environmentally-friendly biological control methods for HABs.

Internationally, he contributed to advancing HAB research as a committee member of the HAB section (S-HAB) of the North Pacific Marine Science Organization (PICES) from 2000 to 2019. Ichiro served as a Council member of the International Society for the Study of Harmful Algae (ISSHA) from 2008 to 2012 and again from 2016 to 2025. In November 2023, he chaired the 20th International Conference on Harmful Algae (ICHA) in Hiroshima, an event involving many researchers from around the world.

He received numerous honours throughout his career, including the Achievement Award for Young Scientist in Fisheries Science from the Japanese Society of Fisheries Science (1992), the Japanese Society of Fisheries Science Award from the Japanese Society of Fisheries Science, and the Marine Biology Contribution Award at the 3rd Asian Marine Biology Symposium (2017). He also received an Academic Award from the Japanese Society of Phycology (2021), the Yasumoto Lifetime Achievement Award from the International Society for the Study of Harmful Algae (2023), and was recognized as a Harmful Algal Bloom Trailblazer by the International Society for the Study of Harmful Algae (2023).



Professor Imai receiving the Yasumoto Lifetime Achievement Award presented by Professor Yasumoto.

Ichiro has also supervised many students in the study of harmful algae, including 44 Master's students, 11 Ph.D. students, and 7 thesis-only Ph.D. students, totalling an estimated more than 100 students over his approximately 40-year career. He was once quoted as saying, "I have a great job and am blessed with the opportunity to do exciting research, supported by a long list of smart, talented, and hard-working students and collaborators. My successes are theirs as well." His colleagues remember him as a profoundly intelligent man, deeply knowledgeable of his subject but also with great humility and a wonderful sense of humour. We offer our sympathy to his family, friends and colleagues.

His major papers include the following:

Imai I, Inaba N, Yamamoto K. (2021) Harmful algal blooms and environmentally friendly control strategies in Japan. *Fisheries Science* 87: 437-464.

Miyashita Y, Hagiwara T, Imai I. (2019) The existence of cyanobactericidal bacteria and growth-inhibiting bacteria on water plants in Lake Ohnuma, Japan. *Limnology* 20: 39-53.

Tsukazaki C, Ishii KI, Matsuno K, Yamaguchi A, Imai I. (2018) Distribution of viable resting stage cells of diatoms in sediments and water columns of the Chukchi Sea, Arctic Ocean. *Phycologia* 57: 440-452.

Inaba N, Trainer VL, Onishi Y, Ishii KI, Wyllie-Echeverria S, Imai I. (2017) Algicidal and growth-inhibiting bacteria associated with seagrass and macroalgae beds in Puget Sound, WA, USA. *Harmful Algae* 62:136-147.

Natsuike M, Nagai S, Matsuno K, Saito R, Tsukazaki C, Yamaguchi A, Imai I. (2013) Abundance and distribution of toxic *Alexandrium tamarense* resting cysts in the sediments of the Chukchi Sea and the eastern Bering Sea. *Harmful Algae* 27: 52-59.



Ichiro, Nobuharu Inaba, Professor Watanabe (left to right) at a PICES conference.

Imai I, Fujimaru D, Nishigaki T. (2002) Co-culture of fish with macroalgae and associated bacteria: A possible mitigation strategy for noxious red tides in enclosed coastal sea. *Fisheries Science* 68 (Supplement): 493-496.

Imai I, Itakura S. (1999) Importance of cysts in the population dynamics of the red tide flagellate *Heterosigma akashiwo* (Raphidophyceae). *Marine Biology* 133: 755-762.

Imai I, Ishida Y, Hata Y. (1993) Killing of marine phytoplankton by a gliding bacterium *Cytophaga* sp., isolated from the coastal sea of Japan. *Marine Biology* 116: 527-532.

Imai I, Itoh K. (1988) Cysts of *Chattonella antiqua* and *C. marina* (Raphidophyceae) in sediments of the Inland Sea of Japan. *Bulletin of the Plankton Society of Japan* 35: 35-44.

Imai I, Itoh K. (1987) Annual life cycle of *Chattonella* spp., causative flagellates of noxious red tides in the Inland Sea of Japan. *Marine Biology* 94: 287-292.



Council members of the International Society for the Study of Harmful Algae (ISSHA) in 2023.

In Memoriam**Adi Kellermann***January 6, 1953 – February 2025*

Friend of PICES, Adi Kellermann, passed away in February 2025 after a long career in marine science that began with Antarctic research at the Alfred Wegener Institute in Germany, then working in Hawaii before returning to Europe. He was Head of The International Council for the Exploration of the Sea (ICES) Science Programme from 2004 to 2016 and in this capacity worked with the PICES Secretariat to develop closer cooperation between the two organizations. PICES was then in its early days and had not yet established many mechanisms for inter-organization collaboration. A major outcome from Adi's efforts was the initiation, with PICES Deputy Executive Secretary Skip McKinnell, of the ICES-PICES Early Career Scientist Conference series that began in Baltimore, USA in 2007.

ICES remembers Adi as an advocate for open dialogue and scientific progress and was passionate about their Annual Science Conference as a place to exchange ideas and develop partnerships. He remained involved in marine science and conservation even after retirement and kept in touch with many colleagues. As Skip said after hearing about Adi's passing *"In hindsight, I found that there were people in our business that you worked with because you had to and people you worked with because you wanted to. Adi fell among the latter"*.

We extend our condolences to his family, friends, and colleagues.



A photo of Adi with his grandson, sent to Skip as they shared news about the arrival of grandchildren in their retirements.



Hawaiian Coast
Credit: Kimberly Jeffries / Ocean Image Bank

In Memoriam

Dan Lew

September 23, 1972 — March 22, 2025

PICES was immensely saddened to hear of the unexpected death of Dan Lew, following a short illness. Dan graduated from the University of California, Davis, with a B.S. in Environmental Policy Analysis and Planning and a M.S. and Ph.D. in Agricultural and Resource Economics. He was an applied economist with NOAA at the Alaska Fisheries Science Centre since 2003. <https://www.smith-funerals.com/obituaries/daniel-lew>

Dan was an active member of PICES, serving as the co-Chair of WG41 *on Marine Ecosystem Services* from 2017 to 2021 and a member of the currently active WG49 *Climate Extremes and Coastal Impacts in the Pacific*, which began in 2021. He was also active in promoting PICES and ICES leadership in the UN Decade. His colleagues at PICES remember a warm and inspiring colleague, hard working, and encouraging and supportive of early career scientists and co-Chairs alike. His significant contributions will be remembered. Below are some of the messages that his PICES colleagues shared with the Secretariat, on hearing the news.

"Dan was one of my closest colleagues in the PICES communities. From 2017 to 2023, we served as co-chairs of WG41-MES. He played a pivotal leading role in organizing multiple working meetings and drafting the technical reports of WG41, from 2020 to 2023. Despite the heavy workload of WG-41, he never once complained. I'm truly and deeply grateful to him for his hard work. Dan has left us, but his contributions will always be remembered. We will miss him forever." Sunny Chen



Dan Lew (second from the right) at the PICES-2024 workshop.

"I cannot believe that Dan has passed away. I believe his loss is immense, not only for WG49 but also for NOAA and every community he was a part of. My deepest condolences." Hiroki Wakamatsu

"I am devastated by this, Dan was a wonderful person, as well as a deeply thoughtful expert and highly encouraging colleague. We were very lucky to have spent the time with him that was made possible. Sending my deepest condolences to Dan's family and friends". Karen Hunter

"This is very sad news. Dan has been an excellent colleague in PICES and beyond and he will be sorely missed. My condolences to Dan's family." Steven Bograd

"Dan was a very active and inspiring member of WG-49, and a wonderful person. I very much enjoyed meeting him in person at the PICES meeting in Hawaii. This is a great loss for our working group and for the scientific community at large. My sincere condolences to his family." Antoniette Capotondi -

"Dan has been a very active member of our working group, taking on leadership roles and providing mentoring to ECOP members, in addition to being a beloved colleague and friend. During the last PICES meeting, Dan spent at least half a day discussing next steps in a content analysis project with a group of ECOPs, including myself. Dan, who was an expert in these kinds of analyses, was so patient with us as we tried to wrap out minds around the project. He also encouraged us to take on important parts of the work, providing his expertise as a support for us. Dan easily could have led the whole thing, but he was clearly trying to support our development as scientists by allowing us to lead. I'm so grateful to have had a chance to learn from and work with Dan." Helen Killeen



Dan (left) with the Human Dimensions Committee.

PICES Events Calendar**GOOD-OARS Summer School 2025**

(Global Ocean Oxygen Decade - Ocean Acidification Research for Sustainability)

Penang, Malaysia

November 4-11, 2025

<https://penangsummerschool2025.usm.my>**PICES-2025 Annual Meeting**

Innovative Approaches and Applications to Foster Resilience in North Pacific Ecosystems

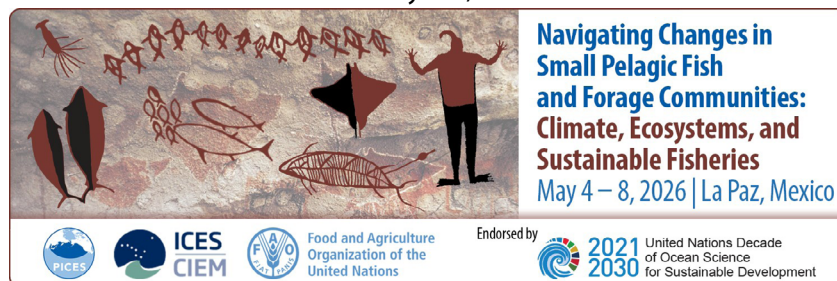
Yokohama, Japan

Nov 8–14, 2025

<https://meetings.pices.int/meetings/annual/2025/pices/scope>**SPF-2026****"Navigating Changes in Small Pelagic Fish and Forage Communities: Climate, Ecosystems, and Sustainable Fisheries"**

La Paz, Mexico

May 4-8, 2026

<http://www.pices.int/smallpelagics2026>

Open Call for PICES Press Submissions

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Please see [submission guidelines](#) and [previous issues](#) on our website.

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Thank you for your contributions!



Seas lions at Hornby Island, British Columbia
Credit: Jett Britnell/ Ocean Image Bank

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