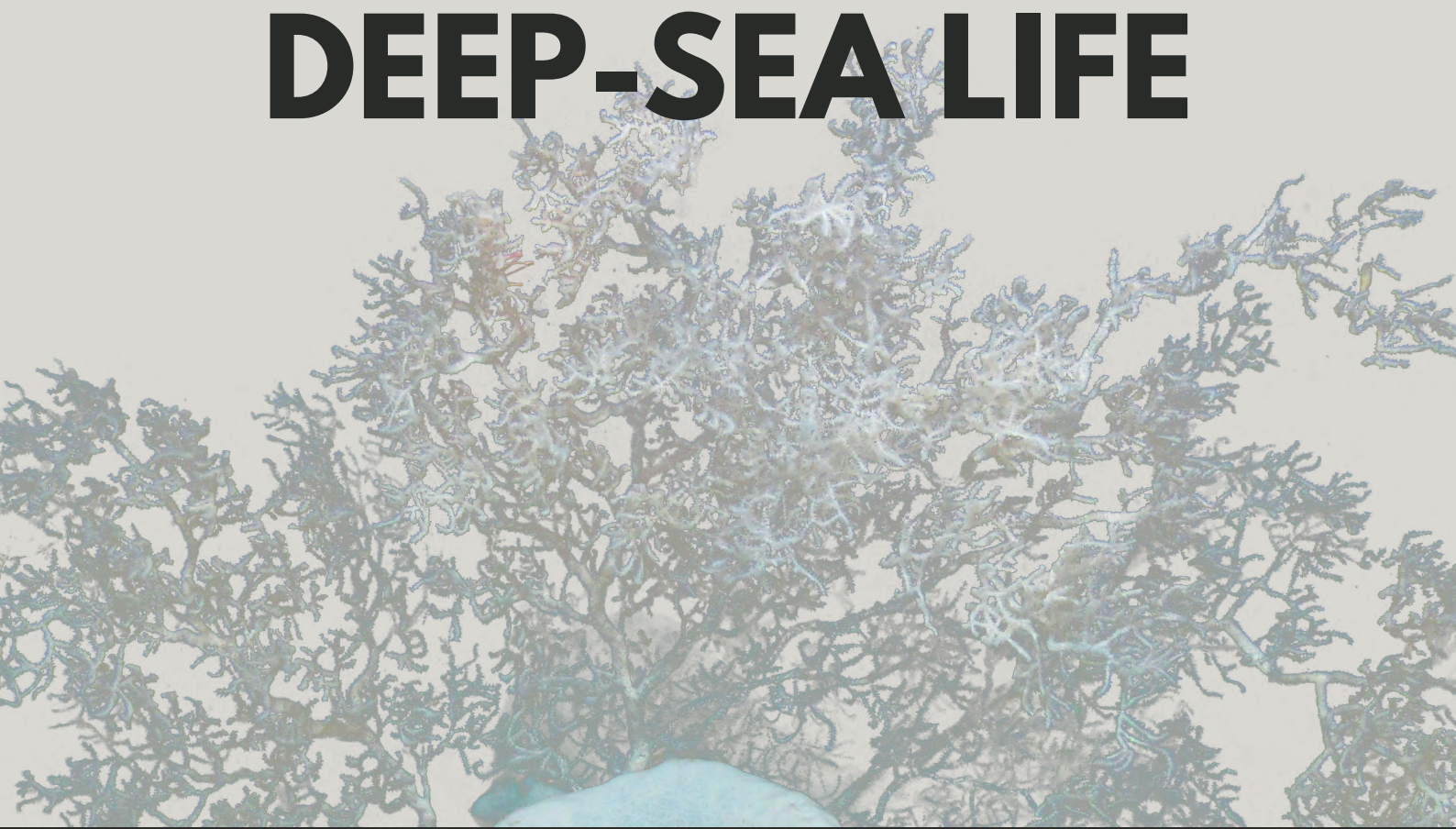


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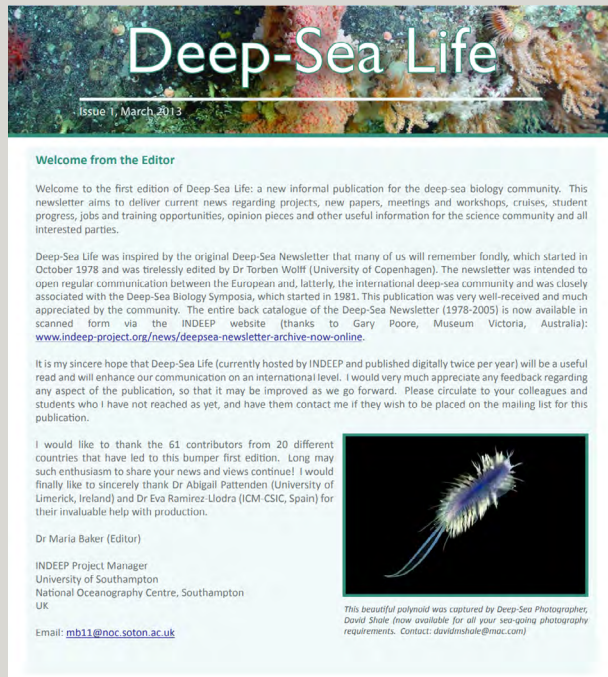
DEEP-SEA LIFE



IN THIS ISSUE...



In this edition, we dive into the forefront of ocean exploration and innovation. Discover REV Ocean's DSV *Aurelia* (above left) making a breakthrough in human-occupied research. Journey across the abyssal plains to meet the giant sponge (above middle) and its companions, and learn about the Unseen Ocean Collective (above right), where science, art, and storytelling unite to make the deep ocean accessible to all. With cruise reports, project features, and global updates, this issue celebrates the creativity and collaboration driving the next wave of deep-sea discovery.



DEAR READERS,

We're excited to unveil a brand-new look for Deep-Sea Life! After 12 years of sharing stories, discoveries, and updates from the deep, we felt it was time for a refresh.

We hope you agree that our redesigned newsletter brings an up-to-date layout, improved readability, and a more engaging experience—while continuing to deliver the same rich content you've come to expect. Whether you're a long-time supporter or a new subscriber, we hope this new format makes it even easier to explore the wonders of the deep ocean.

Thank you for being part of our truly

“A brand-new look for Deep-Sea Life!”

global community and congratulations on all you achieve. We look forward to diving into the next chapter with you!

Warm regards to all our contributors and to our excellent editorial team: Drs Abigail Pattenden (University of Limerick, Ireland), Eva Ramirez-Llodra (REV Ocean, Norway), Franck Lejzerowicz (University of Oslo, Norway), Bhavani Narayanaswamy (SAMS, UK) and Michelle Taylor (University of Essex, UK). And of course, to you, our readers – thank you.

Maria

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CRUISE NEWS



Figure 1. The POSEIDON-SEED 2025 research team on the R/V Gaia Blu

POSEIDON-SEED Research Expedition

The POSEIDON-SEED research expedition (Pelagic Organisms and Seamounts Enhancing diversity and Dynamic Offshore Networks - Shiptime opportunity for Enhancing biodiversity research by environmental DNA) took place from 12 to 23 June 2025 onboard R/V *Gaia Blu* run by the Italian National Research Council (CNR). This cruise was carried out to achieve the objectives of the NBFC - National Biodiversity Future Center (funds: National Recovery and Resilience Plan, European Union – NextGenerationEU).

The main aim was to characterise the biodiversity and vertical migrations of mesopelagic communities and the structure of the pelagic trophic web around the seamounts Marsili and Palinuro (south-eastern Tyrrhenian Sea - Mediterranean), which represent important areas for the ecology of large pelagic predators and for fishing activities. The scientific survey covered approximately 250 nautical miles and included over 30 sampling stations. A replicated sampling design was performed over a 24-hour cycle, with the objective of conducting a more comprehensive investigation into the circadian rhythm of vertical migrations exhibited by zooplankton and micronekton.

An extensive acoustic survey using EK60 echosounder (38 kHz, 120 kHz and 200 kHz) allowed monitoring of the circadian vertical movements of mesopelagic communities

across transects covering the above mentioned seamounts. Data on the biodiversity of zooplankton and micronekton were retrieved by using BONGO net (90 cm frame size) and by a pelagic trawl net (1 cm mesh size). The trawl survey was carried out by a fishing vessel operating in coordination with the main research vessel. The pelagic trophic web structure will be investigated through the stable isotope analysis (SIA), supplemented by stomach content analysis of some key species.

The CTD-Rosette was deployed to collect environmental data such as salinity, temperature, dissolved oxygen, and fluorescence and water samples from multiple depths. Water samples were filtered on board to gather data on nutrients and diversity of microbial and eukaryotic communities, using environmental DNA (eDNA) -metabarcoding technique.

The data gathered during the POSEIDON-SEED expedition will provide valuable insights to enrich knowledge on the biodiversity (including cryptic species), ecology and functioning of these seamounts ecosystems. The integration of biodiversity, stable isotopes and fishery data across seamounts transects and along depth profiles has the potential to shed light on the role played by seamounts providing new information that can be used to develop effective conservation and management strategies for these fascinating deep-sea environments.

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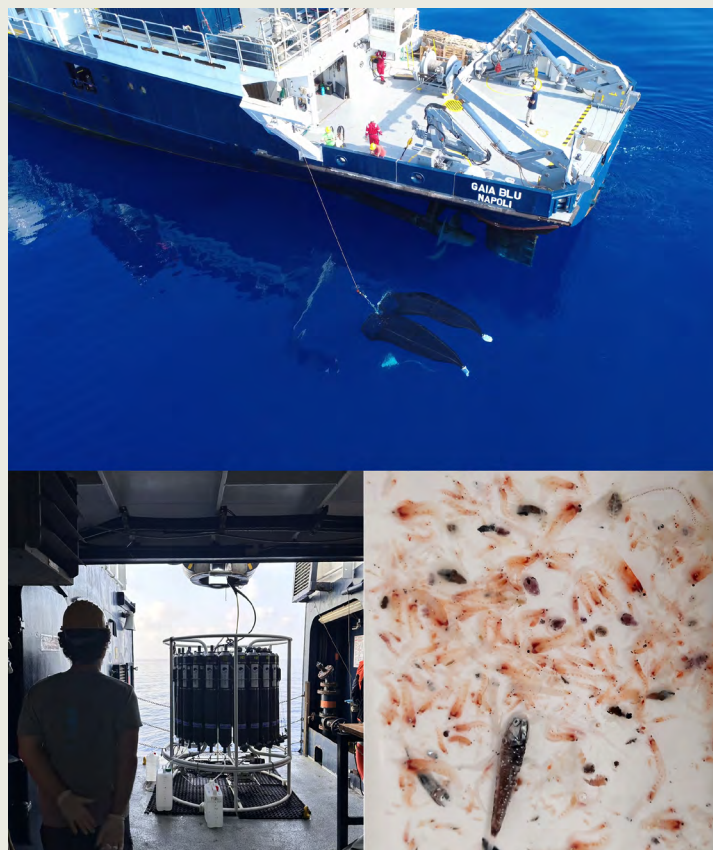


Figure 2. Bongo net deployment; CTD-Rosette for collection of water samples and environmental data; zooplankton and micronekton samples.

Tonga's 2022 eruption of the century: eruption, destruction and seafloor ecosystem recovery

19 August-23 September 2025, Hunga Volcano, Tonga

In January 2022, the Hunga volcano produced one of the largest volcanic eruptions in recent history. The event generated atmospheric shockwaves, tsunamis across the Pacific, and substantial changes to the seafloor. More than three years later, our multidisciplinary team aboard RV *Investigator* has returned to the site to document the geological and ecological changes that have occurred since the eruption.

This voyage brings together geoscientists, biologists, oceanographers, and marine surveyors to conduct a detailed resurvey of the volcano and surrounding seafloor. By integrating high-resolution bathymetric mapping with biological and geological sampling, we aim to understand the links between large-scale geological disturbance and

the recovery (or lack thereof) of deep-sea ecosystems.

Mapping Post-Eruption Seafloor Changes

The 2022 eruption of Hunga Tonga–Hunga Ha'apai displaced an estimated 10 km³ of volcanic material—around 6 km³ from within the caldera and a further 3.5 km³ from its outer flanks. Much of this material was redeposited within 20 km. Volcanic density currents then propagated more than 100 km across the seafloor, carving new channels, entraining older sediments, and building thick depositional lobes up to 22 m in relief. These powerful flows reshaped extensive areas of the seafloor and damaged subsea communication cables over nearly 200 km of their length, highlighting the regional-scale consequences of a single submarine eruption.

Our recent surveys demonstrate that seafloor change did not end with the eruption. Acoustic mapping shows continuing redistribution of sediments across a range of slopes, localised collapse of the volcanic edifice, and measurable alterations in gradient and morphology. This evolving geological framework provides essential context for understanding how benthic ecosystems respond to disturbance, and how recovery trajectories differ between impacted and undisturbed habitats.

High-resolution mapping combined with deep-towed camera footage reveals the structural template that underpins ecological responses is dynamic. The physical environment is still being reworked, meaning that benthic communities are not only recovering from a catastrophic event but are also adapting to an evolving seafloor.

Biological Response in a Dynamic Environment

The TAN2206 voyage (April–May 2022) offered the first glimpse of how benthic ecosystems were affected in the aftermath of the eruption. Along the flanks and slopes of Hunga, seafloor imagery revealed barren landscapes, where once-diverse habitats were smothered beneath thick blankets of ash and pumice. In stark contrast, nearby seamount summits—beyond the reach of the density currents—remained vibrant. These areas hosted rich assemblages of stylasterid and cup corals, glass sponges, gorgonians, seastars and shrimps.

Our present surveys build on this initial baseline by systematically revisiting both the impacted volcanic slopes and the neighbouring refugia, while also adding new reference sites located outside the disturbance footprint. This comparative framework allows us to ask a central question: are benthic communities beginning to recover from burial and disturbance, or do the lasting legacies of the eruption continue to shape ecosystem structure and function?



Figure 1. IN2025_V05 Science Team photo

Our 2025 seafloor observations

Three years after the initial observations of seafloor damage, signs of marine recovery and recolonisation are emerging.

Benthic habitats directly in the path of destructive volcanic density currents to the NW and SE of Hunga remain mostly desolate. But patchy signs of life are returning. Buried seascapes are being recolonised by a plethora of shrimp, filter-feeding hydroids (*Corymorphidae* purple sea cucumbers (Holothuriidae) (Figure 2), and tube-like agglutinated benthic foraminifera.

Only 14 km west of the volcano, a sea knoll that rises more than 850 m above the seafloor sheltered benthic communities from the density currents. Its summit of about 250 mbsl continues to host a diverse array of invertebrates, including sea pens, stalked anemones, hard coral cups, single stemmed gorgonians, starfish, crabs, shrimp, calcareous and agglutinated species of benthic foraminifera, and ostracods. This summit also has the highest abundance and diversity of fish in the vicinity of the volcano. In deeper water down to about 1000 m on the protected flank of the sea knoll, the benthic community remains dominated by gorgonian corals and some large hydroids, eel-like fish and shrimp.

The marine environment inside the Hunga caldera was distinct to the surrounding habitats with warmer water compared to cold water temperatures measured surrounding the volcano (18°C and 6°C respectively at approximately 800 m). Fine ash and sediment deposited

during a landslide from the rim of the caldera in 2024 submerged the seafloor, likely burying recovering benthic organisms. This results in a mostly barren, highly turbid seafloor. Many shrimps and opportunistic species of agglutinated benthic foraminifera are taking advantage of the reduced competition. An anglerfish known as the red Starry Seabat (*Halieutaea stellata*) was also observed on the seafloor.

While recovery is slow and successional dynamics are still being revealed, the proximity of relatively intact benthic communities on neighboring seamounts will assist in the recovery of decimated habitats for years to come.

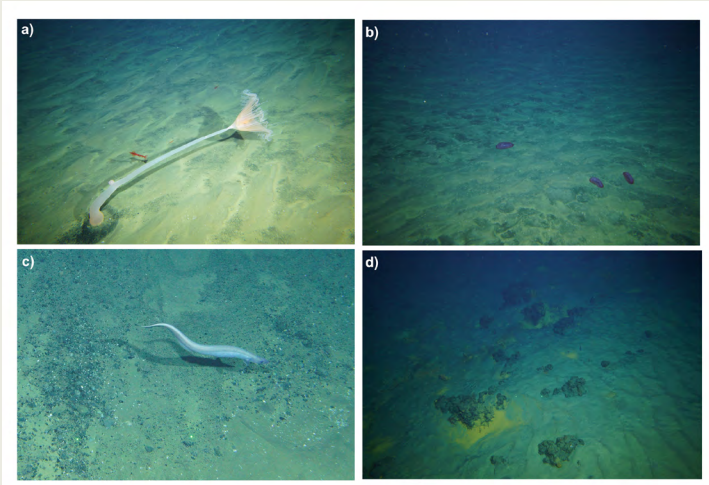


Figure 2a: At 880 mbsl, this beautiful Hydrozoan, *Branchiocerianthus* sp., stands approximately 1 metre tall. A shrimp swims by while others lay on the seabed. Figure 2b: East of Hunga, a pickle of sea cucumbers (*Benthodytes* sp.) sit at 1000 mbsl. Holothurians are 15 cm long. Figure 2c: A white eel swims past the camera at 1330 mbsl. Eel is 35 cm long. Figure 2d: Yellow

microbial mats coat rocks and sediment at the western knoll at 430 mbsl. White dots are 30 cm apart.

Significance

Submarine volcanic eruptions act as reset events, stripping away established habitats and reshaping ecosystems. At Hunga, the scale of geological disturbance was unprecedented, and biological observations suggest a system still in shock. Understanding how and when life returns is essential for managing vulnerable deep-sea habitats and informing management strategies in regions facing both natural and anthropogenic pressures.

Future Directions

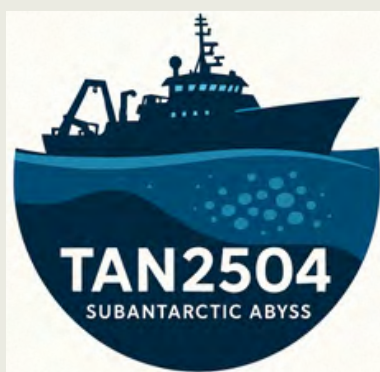
Following the voyage, datasets from mapping, seafloor imagery, biological samples, and chemical analyses will be integrated into a comprehensive assessment of post-eruption change. Results will be shared with the scientific community and interest-holders in Tonga, contributing to ongoing international collaborations on the resilience of deep-sea ecosystems in volcanic and tectonic settings.

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New Zealand Abyssal Biodiversity Voyage on the RV *Tangaroa*



TAN 2504, 28 June – 26 July 2025

Off New Zealand, southeast of the Campbell Plateau in the Southwest Pacific Ocean, lies an extensive abyssal plain that has never been subject to detailed biological study.

Covered in 4000 to 5000 m of Subantarctic waters, the large ferromanganese nodule field has only seen one dedicated geological investigation, in 1999. Subsequent publications described the nodule field in terms of hydrographic settings and the geology of the area, and the origins of the nodules themselves. In 2005, Wright and co-authors were the first to give an overview of what was thought to be the entire nodule field area and identified a highly heterogeneous seascape with a wide variety of ferromanganese nodules and concretions including encrusted boulders, fused nodule pavements, and ancient whale bones. Preliminary results from 26-year-old drop camera imagery indicate that there are likely environmental controls that act on the composition and diversity of the megafauna (Hewetson *et al.*, in prep.). With no other biological data available to describe the benthic environment, researchers from Earth Sciences New Zealand (formerly the National Institute of Water and Atmospheric Research) together with collaborating institutes in the USA and UK, and students undertook a one-month voyage on the RV *Tangaroa* to re-visit these legacy sites and conduct a comprehensive ecological study.

Despite the mood swings of Subantarctic winter weather, the new campaign successfully deployed a range of sampling equipment down to 5000 m depth, obtaining seabed samples to analyse for prokaryote and archaeal microbiology, foraminifera, meiofauna, and sediment and epifaunal macrofauna. In addition, high-definition video and still imagery of the nodule facies and seafloor megafauna was also obtained. This suite of sampling comfortably demonstrated ESNZ's effective multidisciplinary deep-ocean surveying capabilities of abyssal nodule systems. Samples and data from the voyage will provide insights into the biodiversity of seafloor communities in New Zealand's vast abyssal plain habitats, which until now had not benefitted from a dedicated abyssal expedition. Initial observations highlighted the heterogeneous nature of the seascape and nodule facies, shaped by nodule density and morphology, variable topography and bedforms, and hydrodynamic conditions. First biological insights show a rich fauna relative to general expectations for abyssal seafloor ecosystems. Future analyses will test whether the highly variable distribution of ferromanganese nodules across the study area influences the distribution of benthic organisms. Building on NIWA's legacy of deep-sea exploration, data obtained in other Pacific areas including seamounts in the Southwest Pacific, and New Zealand's EEZ (including the Kermadec and Puysegur trenches, and the recently explored Bounty Trough system), we will compare with faunal data from other Pacific regions and build a broader understanding of deep-sea biology and ecology in New Zealand's waters and the broader Pacific Ocean.

Author(s): Jeroen Ingels, Daniel Leduc, Sadie Mills, Rachel

Hale, Alan Orpin, Alicia Maurice, Caroline Chin, Nick Eton, Jacob Hall, Pamela Olmedo-Rojas, Stacy Deppeler, Erin Hewetson, Altan Ní Mhurchú, Loïc Van Audenhaege, Bryan O'Malley, Sam Davidson, Ashley Rowden, Felix Zareie-Vaux

Exploring Arctic's Deepest Abyss: Molloy Deep 5500 m



In June 2025, the RV *Polarstern* sailed into the Fram Strait, the ocean region between Svalbard and East Greenland. On board, members of the HADAL team from the University of Southern Denmark, were taking part in the multidisciplinary expedition PS148 with 45 scientists and led by Jennifer Dannheim (AWI) and supported by

the Helmholtz Research Programme Changing Earth – Sustaining Our Future and the Danish Center for Hadal Research (HADAL, DNR145). Together, we continued a long-term study on the impacts of climate change on Arctic ecosystems, spanning from the surface of the ocean to the deep seafloor. Since 1999, the LTER (Long-Term Ecological Research) HAUSGARTEN observatory has maintained 21 research stations along depth and latitude gradients in the Fram Strait. Among these, the Molloy Deep (station HG IX) at a depth of 5,500 meters, makes it the Arctic Ocean's deepest point.

Over the past two years, members of the HADAL team have joined the yearly cruise to focus on the Molloy Deep. Although slightly shallower than the conventional hadal threshold of 6,000 meters, we investigated whether the Molloy Deep could serve as a hadal analogue: a deep-sea depocenter facilitated by mass-wasting events and with intensified microbial activity. Our aim was to resolve

deposition dynamics, quantify carbon mineralization in the sediment and at a nearby, shallower reference site at 2,400 meters (station HG IV), identify key microbial processes and players, and compare process rates and microbial communities with other deep-sea and trench ecosystems.

To achieve this, we combined multiple approaches. A benthic lander system measured oxygen distribution, penetration, and uptake rates in sediments. Equipped with a total of nine oxygen electrodes, the lander collected high-resolution vertical oxygen profiles across 50-centimeter horizontal transects down to 25 centimeters depth. These data allowed us to quantify diffusive oxygen uptake, a proxy for microbial respiration. On board the ship, sediment cores were analyzed for porewater biogeochemistry and microbial process rates, including denitrification, anammox, and sulphate reduction, using 15N and 35S tracers. DNA was extracted for metagenomic sequencing, and additional parameters such as 210Pb, trace metals, mercury, and methylmercury were collected for future analyses.

Our results showed that, like hadal trenches, the Molloy Deep functions as a depocenter for organic material, sustaining high microbial activity and rapid carbon turnover. Anaerobic processes were particularly abundant at the Molloy Deep, and were comparable to rates observed in trench systems such as the Atacama Trench, but nearly absent at the shallower reference site. Our 210Pb measurements also revealed that, although the Molloy Deep differs from classic hadal trenches, being located on a spreading ridge rather than a subduction zone, mass-wasting events and downslope material transport appear to play a key role in sustaining the elevated microbial mineralization observed. To capture potential seasonal dynamics and material movement through the water column, we deployed a mooring system with sediment traps in the Molloy Deep during this year's expedition, which will provide continuous year-long measurements. Beyond the science, we experienced stunning Arctic landscapes and encounters with wildlife, including a curious polar bear visiting near the ship.

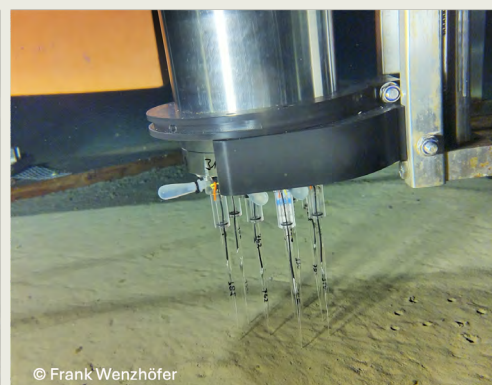


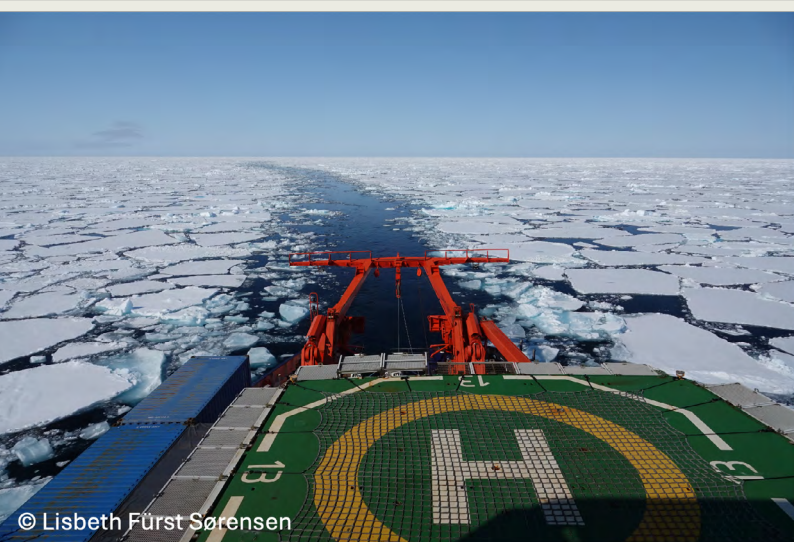
Figure 1: From left: Lander with oxygen sensors; oxygen profile transect; oxygen microelectrodes in sediment in the Molloy Deep.



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Figure 2: Clockwise from left: Expedition team; sediment cores from the Molloy Deep; Polarstern in sea ice; polar bear.

Want to dive deeper into our research? Check out our HADAL website (<https://www.sdu.dk/en/forskning/hadal>) or follow updates on the official Polarstern app (<https://follow-polarstern.awi.de/?lang=en>).

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The Momarsat 2025 cruise

The Momarsat 2025 cruise, whose main objective was to maintain the EMSO-Azores observatory (<https://www.emso-fr.org/Azores>), which has been in place for 15 years.

The cruise took place aboard the research vessel *L'Atalante* with the *Nautil* Human Operated Vehicle (HOV), from August 12 to September 4, 2025. A total of 30 scientists, including the *Nautil* team, participated alongside 30 crew members. This was a particularly fruitful mission, marked by 18 *Nautil* dives, numerous CTD profiles, the recovery of deep-sea seismometers as well as multibeam echo sounder and shipboard profiles.

The EMSO-Azores observatory is located atop an active volcano that hosts Lucky Strike, one of the largest active hydrothermal vent fields. It is dedicated to the integrated study of slow-spreading mid-ocean ridge processes, spanning from the seafloor to the overlying water column. Its main scientific goals are to investigate: (1) hydrothermal heat and chemical fluxes released into the ocean in relation to seismicity, volcanic activity, and ground deformation at a divergent plate boundary; (2) the influence of telluric, climatic, and human-induced changes on deep-seafloor ecosystems and vent faunal communities; and (3) the dynamics of water masses shaped



Figure 1. The Nautilie working on the Seamon East station at 1700 m depth (photo Ifremer/Momarsat2025)

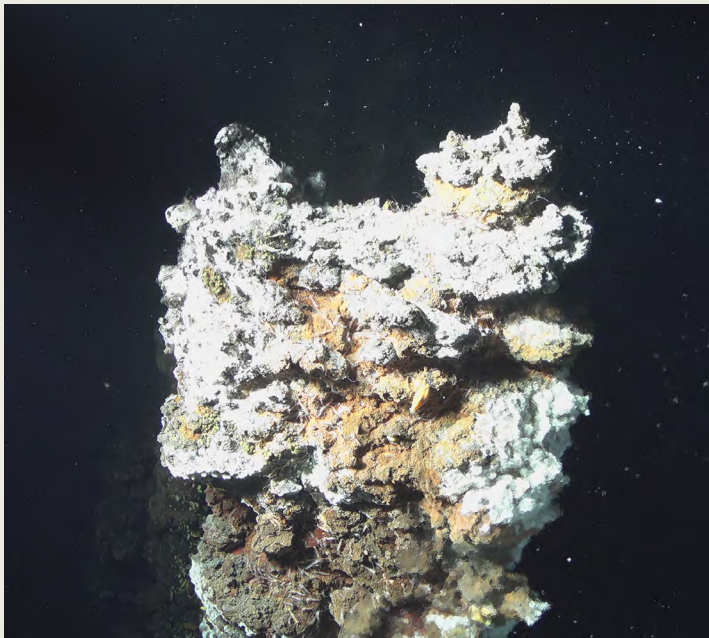


Figure 2. Credit Ifremer/Momarsat 2025/Nautilie

by the steep axial valley topography, including their role in dispersing hydrothermal plumes and organisms.

To meet these objectives, provide ground truth data to sensors and complement the observatory data, a series of annual operations were carried out, including fluid and microbial/faunal sampling, seafloor experiments, autonomous sensor deployments, optical imagery

acquisition and physico-chemical characterization of habitats. This year we also gathered 1,5 tons of dead weights in a dedicated dumpster that will be recovered next year!

The cruise logbook, illustrated with superb photos of life on board and the seabed (down to 1,700 meters), is available here: <https://www.facebook.com/CampagneMomarsat/>

See you next year, mid-August for the next one!

Author(s): Jozée Sarrazin & Marjolaine Matabos

DSV *Aurelia*: a cutting-edge submersible to support *REV Ocean*'s quest for a healthy ocean

REV Ocean is a not-for-profit organisation with an ambitious yet simple mission: 'One Healthy Ocean'. The goal is to reverse the negative environmental conditions in the ocean by acquiring new knowledge and developing concrete solutions.

At the centre of the organisation is *REV Ocean*, a 194 m research and expedition vessel equipped with state-of-the-art scientific vehicles (ROV, submersible, AUV, helicopter, small boats), acoustic sensors (multibeam, fisheries sonars,



Figure 1. Rendering of the REV Ocean vessel.

sub-bottom profiler), sampling equipment (mesopelagic trawl, coring), 9 laboratories and educational and meeting spaces (auditorium, classroom, board room, media room). *REV Ocean* and all its equipment will be made available, at no cost, to regional ocean experts around the world.

One of the main assets on board *REV Ocean* is DSV *Aurelia*, a Triton 7500/3 crewed submersible designed specifically for deep-sea science and exploration. Its most critical feature is the large, transparent acrylic sphere that serves as the passenger compartment, providing a 360-degree panoramic view for its three occupants: one pilot and two scientists. The all-electric vehicle is rated to a depth of 2,286 meters (7,500 feet). It is equipped with a T4 manipulator



Figure 2. DSV *Aurelia* on its first science mission studying meso-photic ecosystems in Chagos, Indian Ocean, in 2022.

biological, geological, chemical and physical sampling and observing bathyal ecosystems.

The DNV (international accredited registrar and classification society) certification of DSV *Aurelia* represents the culmination of a multi-year process, ensuring the submersible meets the highest global standards for safety and engineering. This involved continuous DNV oversight from initial design approval and material testing through to the final fabrication and commissioning. This entire effort recently concluded with a one-week sea trial, including the final certification dive, which was successfully conducted from the Solstad-operated vessel *Normand Sapphire*. With a DNV surveyor witnessing the event, DSV *Aurelia* was taken to its nominal diving depth of 2,286 meters where all her normal and emergency systems were tested under ambient pressure, proving their flawless performance and integrity. The successful completion of these DNV-witnessed trials is a landmark achievement. It formally certifies DSV *Aurelia* for scientific operations and provides the highest level of independent assurance of the vehicle's safety and reliability. This certification officially makes *REV Ocean*'s submersible the deepest-diving transparent-hulled submersible currently in service anywhere in the world.

For scientific research, DSV *Aurelia*'s primary advantage is providing scientists with direct, in-person presence in the environment they are studying, down to bathyal depths. This allows for unparalleled situational awareness and real-time, adaptive decision-making. DSV *Aurelia* is fitted with an extensive suite of specialized sampling tools that

enable scientists to collect a wide variety of biological, geological and chemical samples with precision. Its high-dexterity hydraulic T4 7functions manipulator arm with wrist camera, T4 can also be equipped with coral cutter and a gas sampling trigger, this allows delicate handling of specimens and substrates. An innovative, streamlined science skid houses a sampling suction pump with a rotary carousel, a sampling drawer, blade- and push-corers, Niskin bottles, and D-samplers. For visual documentation, the submersible features flood lights and spotlights on pan and tilts, forward and downward-facing scaling lasers, three 4K cameras, a transect camera, and advanced imaging sonar. A CTD sensor provides essential environmental data, while a high-accuracy positioning system georeferences all collected samples. DSV *Aurelia* also employs acoustic and laser communications to relay imagery, sensor data and operational updates to the surface in real time. The sub's precise maneuverability enables delicate tasks, such as sampling fragile marine life or placing sensors on the seabed. By combining human expertise directly with advanced sampling and imaging technology, DSV *Aurelia* functions as a mobile deep-sea laboratory, facilitating more efficient and insightful exploration of the ocean's twilight and midnight zones.

The *REV Ocean* vessel will start operations Q1 2027. Follow developments on our website and social media for opportunities on board and the first call for proposals in 2026.



Figure 2. DSV *Aurelia* after the certification dive. From left to right: Stig Vågenes (Subsea Manager, REV Ocean), Øystein Mikelborg (Operations Director, REV Ocean), Kelvin Magee (*Aurelia* sub pilot, Triton Submarines), Ionel Darie (DNV Surveyor), Hector Salvador (*Aurelia* sub pilot, REV Ocean) and Patrick Lahey (CEO & Co-Founder, Triton Submarines).

Author(s): Leighton Rolley, Hector Salvador and Eva Ramirez-Llodra

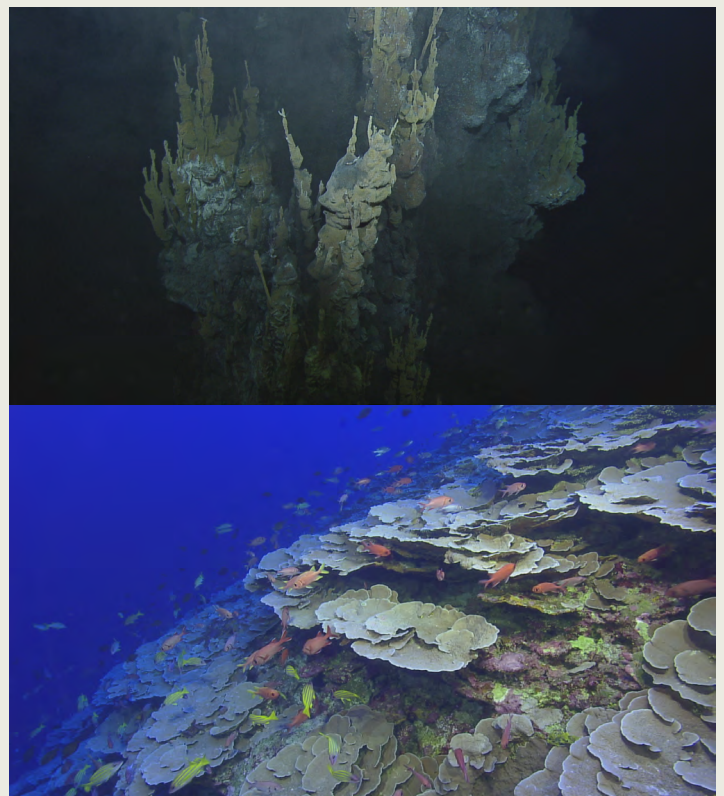
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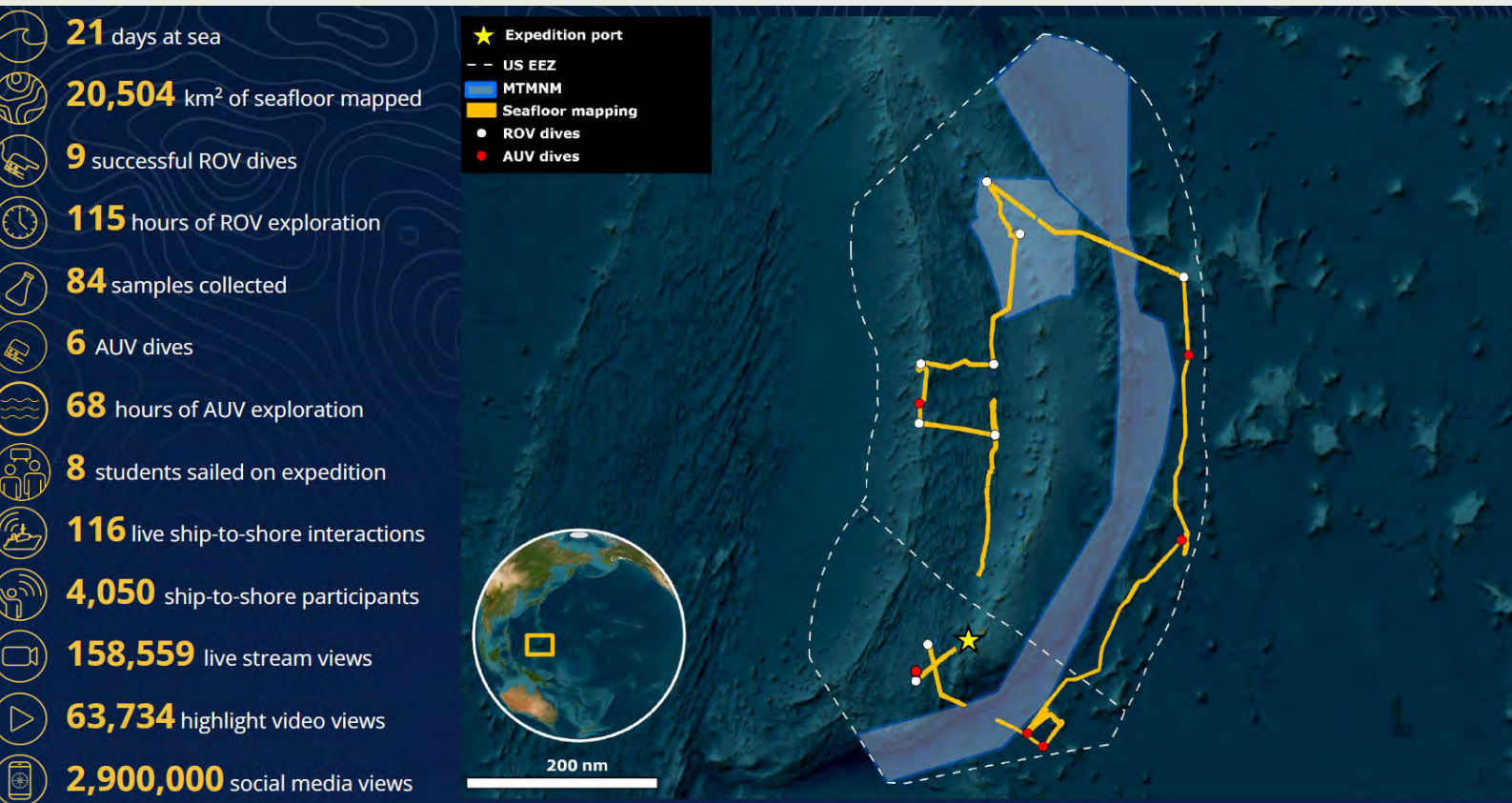
2025 Mattingan Expedition: Mariana Arc Volcanic Exploration (NA171)

Between May 7-28, the Ocean Exploration Trust (OET) and partners conducted a telepresence-enabled expedition to explore offshore areas around the Mariana Islands. This [21-day expedition](#) utilized the ROV, mapping, and telepresence systems of E/V *Nautilus* in combination with the Orpheus AUV to explore priority areas identified by the management and science community, including sites that had evidence of recent volcanism, abyssal plain habitats, bottomfish habitats, and mesophotic coral reef ecosystems.

A total of 20,504 square kilometers of seafloor were mapped over the course of the expedition, all within the US Exclusive Economic Zone, including 4,170 square kilometers inside the Mariana Trench Marine National Monument. The expedition completed 6 [Orpheus AUV dives](#) for a total dive time of 68 hours and 16.6 hours of exploring the seafloor at depths between 2,400-5,700 meters, including 4 dives to image previously unexplored abyssal plain habitats.

The expedition completed 9 successful ROV dives for a total dive time of 115 hours and 85 hours of seafloor exploration at depths between 47-3,713 meters. These dives explored a wide range of underwater features, including a seamount east of the Mariana Trench on some of the world's oldest seafloor (Vogt), two seamounts in the northern part of the Mariana Arc with shallow summits (Daikoku and Ahyi),





two deep sites along the Mariana Backarc (the Burke and Hafa Adai hydrothermal vent fields), and two previously unexplored mesophotic coral reefs on the Western Mariana Ridge.

At [Ahyi Seamount](#), the ROVs explored a recently formed lava cone and found that it was still intensely degassing over a very large area. At [Daikoku Seamount](#), the ROVs [documented substantial changes](#) since this feature was last surveyed in 2016, including that the molten sulfur pond near the summit was no longer present. [ROV surveys of the Hafa Adai hydrothermal vent field](#) discovered that its large black smoker chimney had toppled over since it was first discovered in 2016, and that a new smaller chimney was re-growing in its place. The ROVs also documented several chimneys, some of which were *Nautilus* up to 35 meters tall. Two shallow seamounts on the Western Mariana Ridge were explored for the first time, and [discovered to host healthy coral reefs at depths between 50-100 meters](#), expanding the known range of coral reef habitats in the region to far offshore seamounts located 240 kilometers west of the Mariana Islands.

A total of 84 primary samples were collected during the ROV dives, including 42 biological and 42 geological and geochemical fluid samples to support studies on the biodiversity, biogeography, and geological context of the region.

Over the course of the expedition, live-stream video feeds received over 158,000 views and highlight videos garnered close to 64,000 views. Expedition content on OET's social

media channels attracted over 2.9 million impressions. While at sea, the team created 21 new [education and outreach products](#) and hosted 116 live ship-to-shore interactions with schools, community events, and professional meetings, reaching over 4,000 people across the Commonwealth of the Northern Mariana Islands, Guam, American Samoa, 18 US States, and 6 other countries. Data collected during the expedition will be sent to [repositories for archiving and public distribution](#).

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The Underwater Oases of the Mar del Plata Canyon

The Underwater Oases of the Mar del Plata Canyon: Talud Continental IV expedition, conducted in July–August 2025, marked the first deployment of an ROV in Argentina's Mar del Plata Submarine Canyon. Aboard the R/V *Falkor (too)* and led by Argentinian scientists from the Deep-Sea Studies Group of Argentina (GEMPA), the mission characterized biodiversity between 800 m and 4,000 m using ROV *SuBastian*. The team combined animal, sediment, and water collections with high-definition acoustic and visual surveys of benthic habitats, as well as state-of-the-art environmental DNA (eDNA) and zooplankton sampling.

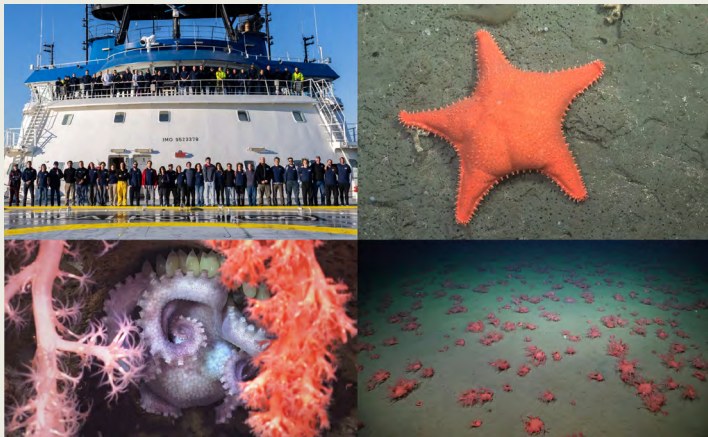


Figure 1. Top left to bottom right. (1) FKt250712 crew and scientists. (2) This seastar (*Hippasteria phrygiana*) was seen at 1194 meters. It ignited the immersive public engagement with the campaign due to its resemblance to the *SpongeBob* character, Patrick Star (Patricio Estrella). (3) This brooding mother octopus shelters her eggs behind two different types of corals at 2433 meters. (4) At 1500 meters, a sprawling field of red *Anthomastus* sp. (soft coral known as a mushroom coral) was discovered.

Unlike earlier expeditions that lacked *in situ* visualization, this mission provided direct observations of deep-sea environments, revealing dense cold-water coral reefs, extensive soft-coral fields, and a diverse assemblage of organisms, including over 40 species probably new to science. The mission revealed compelling human-environment interactions, with anthropogenic debris, such as plastics, fishing gear, and footwear, present even in the canyon's deepest zones, underscoring the urgent need to integrate legacy human impacts into management plans. The expedition achieved record-breaking public engagement, with average livestream views soaring to ~500,000 per dive (versus a typical 4,000), totaling over 17.5 million views over three weeks, with nearly 75% of viewers from Argentina. This immersive outreach sparked widespread curiosity, reaching homes, classrooms, and public venues, and inspired emerging scientists, particularly youth, thereby effectively bridging scientific discovery with societal engagement. This pioneering ROV-based expedition lays a critical foundation for future deep-sea research, biodiversity assessment, and resource management on Argentina's Atlantic margin and associated deep sea, demonstrating how modern exploration technologies, combined with broad public access, can catalyze scientific advancement and environmental stewardship.

SOI Cruise Website: <https://schmidtocean.org/cruise/underwater-oases-of-the-mar-del-plata-canyon/>

GEMPA Instagram Page: <https://www.instagram.com/gempa.ar/>

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Visualizing the Deep off Uruguay (FKt 250812)



On August 22, the [Visualizing the Deep off Uruguay Expedition](#) commenced aboard the RV Falkor (too) from the Schmidt Ocean Institute, led by Dr. Alvar Carranza and Dr. Leticia Burone from Universidad de la Republica (Udelar). This four-week expedition is divided into two legs and contributes to the United Nations program Challenger 150. The scientific team, comprising 36 researchers primarily from Uruguay and including scientists from Argentina, Brazil, Chile, France, and Germany, was partially exchanged after the first leg. The primary goal of the survey is to explore the deep waters of Uruguay, to gather the first underwater imagery of the region, and to identify and characterize vulnerable marine ecosystems (VMEs).

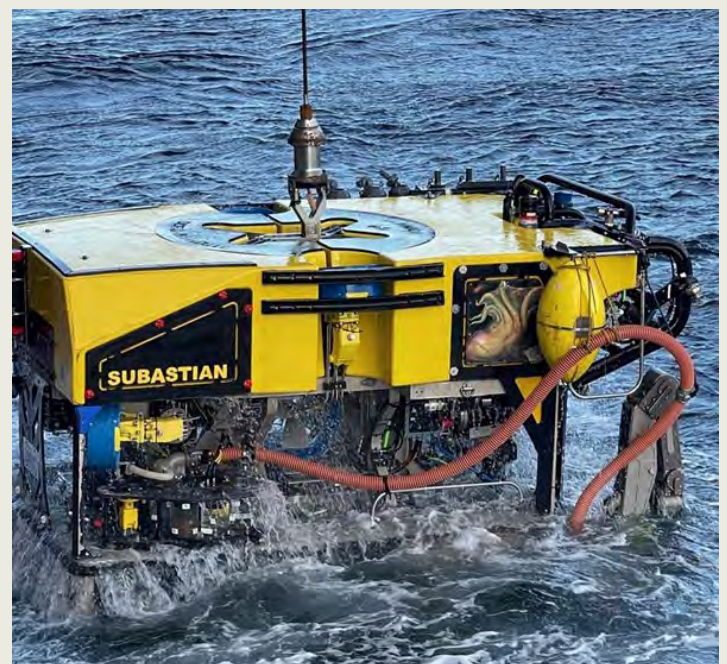


Figure 1: ROV SuBastian returning on board of RV Falkor too



Figure 2: ROV control room on board of RV Falkor too.

For the first time for Uruguay the seafloor is being studied using the advanced technologies available on R/V Falkor (too) and the remotely operated vehicle ROV SuBastian, which is outfitted with a suite of sensors and scientific equipment to support scientific data and sample collection, including high-definition cameras.

The scientific team has sampled 15 stations, located in continental margin and several submarine canyons at depths between 150-3200 m.



Figure 4: Colony of the scleractinian coral *Desmophyllum pertusum* observed in a reef during Dive S0844 of the ROV SuBastian at 215 meters depth in the Uruguayan EEZ.

Soft bottoms, coral mounds, chemosynthetic environments, and hundreds of benthic organisms including the mobile fauna have already been observed and collected. During leg 1, we surveyed the wreck of a ship that belonged to the Uruguayan army; it served in joint exercises with the U.S. and other South American navies until it was decommissioned in 1980. In 1990, the ship was used as a target ship and sunk.

It was first recognized using the multibeam echosounder and then discovered with the ROV (<https://www.instagram.com/reel/DN80S08D8l9/?igsh=NHFsyjdYhW8xdTJq>).



Figure 3: Screens from Control room displaying ROV work and public engagement.



Figure 5: Science Party, Leg 2 FkT250812 crew onboard Falkor (too)

This expedition provides crucial insights to climate change and anthropogenic impacts. The Uruguayan deep sea is an area strongly influenced by the cold and nutrient-rich Antarctic bottom water flowing northwards along the Argentine and Uruguayan slope. Consequently, we anticipate discovering strong biogeographic connections and species connectivity between the fauna of the Southern Ocean's deep sea and those of Argentina and Uruguay, while also improving our understanding of physical and biogeochemical variability and associated carbon fluxes in deep-sea ecosystems.

At the same time, anthropogenic impacts are clearly evident: plastic bags, glass bottles, cans, fishing lines, and other debris have already been recorded hundreds of kilometers offshore. These findings highlight the widespread presence of human-derived pollution even in remote deep-sea environments.

Public outreach is a key component of the expedition. All ROV dives are streamed live on the Institute's [YouTube channel](#), allowing the public to explore deep-sea ecosystems in real time alongside scientists. Additionally, [ANTEL](#), Uruguay's National Administration of Telecommunications, broadcasts live streams, and the [CEIBAL](#) initiative — Uruguay's program to implement the "One Laptop per Child" model — incorporates ICT into primary and secondary education to promote technological literacy.

As a result, public engagement has been extraordinary, with thousands of followers actively interacting and posing insightful questions that reflect a strong interest and fascination with deep-sea life. (<https://uruguaysub200.vercel.app/>). The expedition is expected to yield over 100 hours of video footage and a wealth of scientific data, which will be stored in the scientific collection of the Museo Nacional de Historia Natural de Montevideo.

Author(s): Alvar Carranza (Chief Scientist), Leticia Burone (Co-chief scientist), Angelika Brandt, Brenda Doti, Fabrizio Scarabino, Claudia Piccini, Sergio N. Stampar, Eduardo Hajdu, Sebastian Horta and shipboard party (<https://schmidtocean.org/cruise/visualizing-the-deep-off-uruguay/#team>)

Scientific Expedition to Assess the Oceanographic and Benthic Mesophotic Ecosystems of the Malpelo Fauna and Flora Sanctuary

A recent multidisciplinary [scientific expedition to the Malpelo Fauna and Flora Sanctuary](#) (SFF Malpelo), conducted from 27 February to 16 March, 2025, represents a significant advancement in Colombia's efforts to explore and conserve its deep marine protected areas (MPAs). The expedition was part of a national initiative called *Advancing Deep-Water Research for Conservation in the Eastern Tropical Pacific Seascape: Colombia*, which is part of the "[Deep Ocean Alliance](#)" through the CMAR (Eastern Tropical Pacific Marine Conservation Corridor). The alliance involves scientific collaborative participation from Costa Rica, Panama, Ecuador, and Colombia.

The focus of the expedition was to characterize the mesophotic zones (30–166 m depth) of SFF Malpelo through integrated oceanographic, biological, and geospatial approaches. Submerged geomorphological features—including ridges, hills, and mounds—were identified and 3D-modeled using multibeam echosounder and side-scan sonar systems. These features were investigated through 20 ROV dives that provided high-resolution video transects and in situ observations of benthic communities and macro habitats (Figure 1), yielding key data on biodiversity patterns, habitat structure, and species presence. Three hills stand out and were named by INVEMAR researchers as the triplets or the Moirae, in reference to the Greek personifications of destiny and fate (Clotho, Lachesis and Atropos). The Clotho hill, the shallowest of the three, was first explored using SCUBA diving at depths between 30 and 45 meters and with the ROV *Eloy V* at depths between 33 and 86 meters.

In addition to benthic characterization, the expedition analyzed the oceanographic dynamics around Malpelo Island, particularly focusing on nutrient concentrations and chlorophyll-a distribution in relation to the island's geomorphological features. This involved CTD profiling, water sampling for nutrient and pigment analysis, and satellite data validation. The presence and behavior of large marine vertebrates, including seabirds, marine mammals,

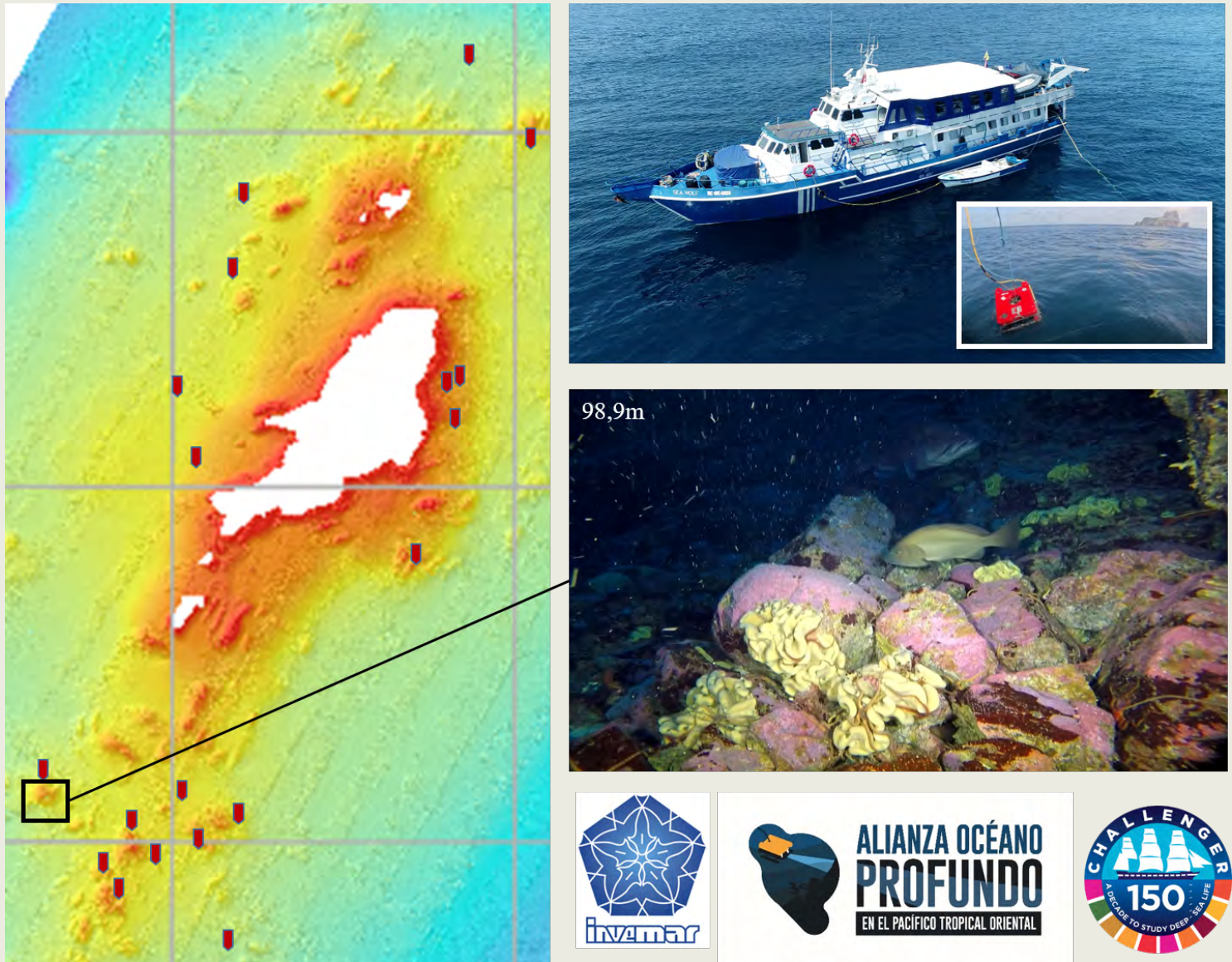


Figure 1. Map of hills, ridges, and mounds between 30 and 166 meters deep of the Malpelo Flora and Fauna Sanctuary. Drone picture by Johan Casadiego: Seawolf. Megafauna recorded in the mesophotic seascape.

sea turtles, and pelagic fish, was documented through direct visual surveys and environmental DNA (eDNA) analysis from water. Finally, the expedition allowed for the determination of the taxonomic composition, abundance, and spatial distribution of plankton communities within the sanctuary. Sampling was conducted using vertical and oblique plankton tows, across different depth strata, allowing analysis of both phytoplankton and zooplankton assemblages.

Preliminary results reveal a high degree of habitat heterogeneity and biodiversity concentration in areas with submerged topographic features. These findings highlight the urgent need for continued and coordinated research to support the long-term management of the SFF Malpelo's deep and mesophotic ecosystems, especially in light of growing environmental pressures and the ecological importance of this UNESCO World Heritage Site. The biological data produced by this expedition will

be published in open-access biodiversity platforms such as the Ocean Biodiversity Information System (OBIS) and the Global Biodiversity Information Facility (GBIF). This effort supports Colombia's expanding commitment to open science, regional collaboration, and evidence-based marine conservation.

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PROJECT FOCUS

Contributing to a genetic reference library of deep-sea DNA barcodes in the Colombian Eastern Tropical Pacific

Despite its strategic location within a biodiversity hotspot, deep-sea environments from the Colombian Eastern Tropical Pacific (ETP) remain one of the least explored regions globally. The absence of comprehensive genetic databases severely limits our ability to characterize biodiversity, understand evolutionary processes, and assess ecosystem resilience. Without baseline genomic data, it is harder to detect cryptic species, monitor genetic connectivity, or evaluate the impacts of anthropogenic pressures, using robust cost-efficient methods such as eDNA metabarcoding.

The creation of marine genetic databases is not just a scientific necessity, but a fundamental step towards implementing evidence-based management. Updated genetic libraries improve taxonomic classification of

poorly described or new species through DNA-barcodes, and provide functional insights into adaptations to high-pressure, low-temperature, and chemosynthetic environments. Given the rapid advancement of sequencing technologies and bioinformatics, Colombia has been developing national capacity for the past five years to lead regional efforts in marine genomics. However, this is only possible if investment in expeditions, capacity building and data infrastructure is coordinated. Collaborative frameworks involving academia, the government, and international partners are essential to ensure that genetic data is collected, stored and shared in an ethical and secure manner. Therefore, INVEMAR opted for cost-effective solutions, including the production of COI, 12S and 18S DNA-barcodes from zooplankton (0-200m), tissue samples from pelagic fisheries, and mesophotic benthic fauna (80m). This approach also involved eDNA metabarcoding from seawater (100-200m), and deep-sea (>2000m) sediment samples.

To date, INVEMAR has created a genetic database from ETP comprising 309 fish, 245 plankton specimens and 30 benthic

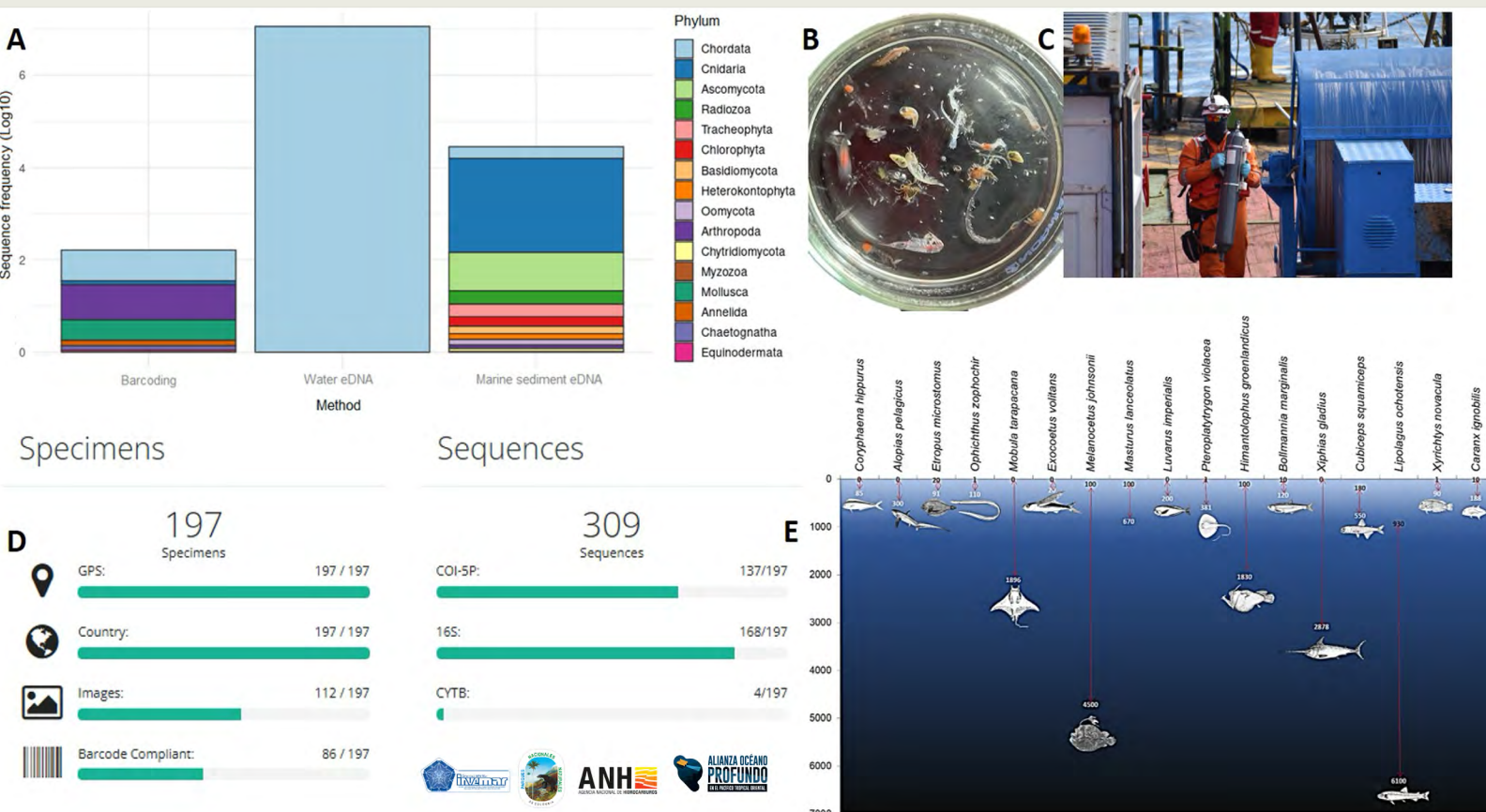


Figure 1. A. Distribution of phyla detected with different methods in the Colombian Pacific. B. Zooplankton sample obtained at 200m in the Colombian Pacific. C. eDNA collection using Niskin Bottles. D. BOLDSYSTEMS database with 309 fish sequences from the ETP. E. Vertical distribution of marine fish in the Colombian ETP based on DNA-derived data. These results were made possible thanks to the following financiers, to whom the authors extend their gratitude: The Friends of the Charles Darwin Foundation for the Galapagos Islands (through Bezos Earth Fund), the National Hydrocarbon Agency of Colombia, the National Parks of Colombia, and the Colombia en Paz Fund.

fauna sequences from the mesophotic environments of the SFF Malpelo. In addition, active contributions have been made towards BOLDSystems and OBIS repositories, together with their metadata in the public domain. Furthermore, eDNA in seawater has revealed a rich barcode diversity of over 45,120 sequences assigned to 252 MOTUs, the majority of which belong to bony fishes and elasmobranchs, including migratory oceanic species. The distribution of habitats assigned based on DNA ranged from the upper layers of the ocean (epipelagic zone) to the deepest parts (hadal-pelagic zone). The majority (41%) of lineages were bathypelagic, followed by 18% neritic and 17% oceanic epipelagic lineages. The remaining lineages were mesopelagic (7%) and hadalpelagic (6%). This indicates a system that is connected vertically, dominated by deep-water species.

On the other hand, preliminary results of the analysis of sedimentary eDNA tells a different story. Over 15,000 sequences were detected, including eight taxonomic groups: fungi, microalgae, tunicates, cnidarians, echinoderms, sponges, protists and fish. These findings reflect the connection between the coastal zone and the deep sea (Figure 1). Organic material trapped in the deep-sea acts as a natural archive of biodiversity, recording both current and historic biodiversity. These findings are exciting and serve as evidence that establishing marine genetic databases for the Colombian ETP is an urgent and strategic priority, that could also support Colombia's commitments under the BBNJ treaty by unlocking hidden biological wealth and informing sustainable ocean governance in the Eastern Tropical Pacific Marine Corridor-CMAR within the goals of the "[Deep Ocean Alliance](#)".

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Tiny Architects of the Deep

Benthic foraminifera—tiny, single-celled organisms with shells—are among the ocean's most diverse inhabitants. In shallow waters, such as continental shelves, we find species specially adapted to life close to the coast. But once we look deeper, the story becomes far more complex.

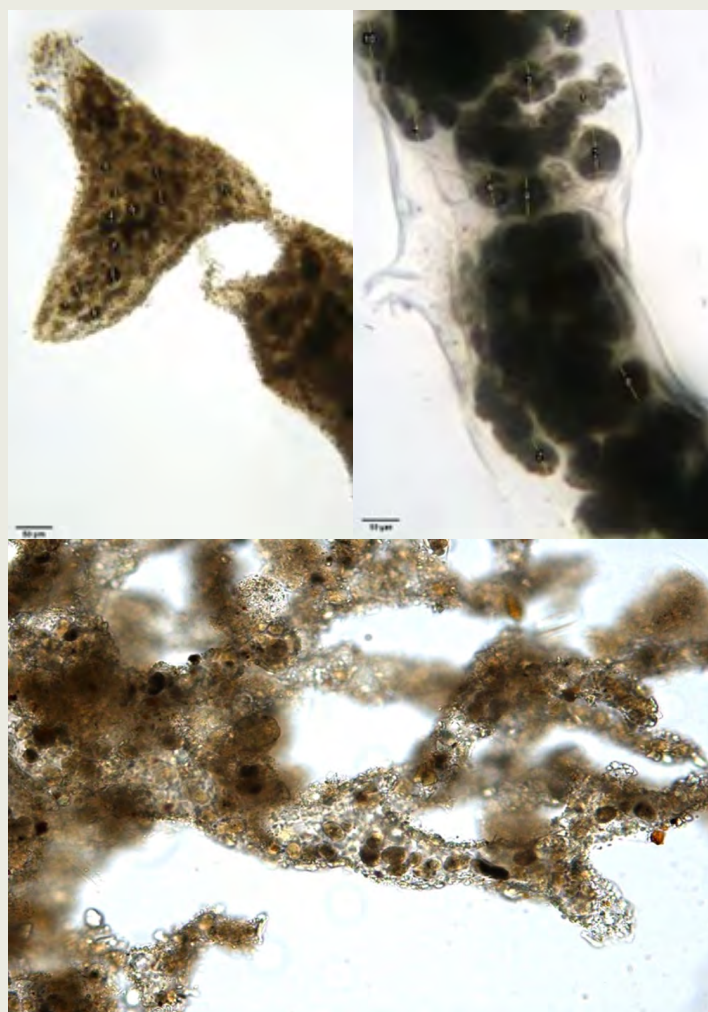


Figure 1. Light microscopic images showing the interior of the soft-bodied monothalamiid from the CCZ A. Pyriform chambers of *Neocatena pyriformis*, B. Transparent tube whose interior is filled with *Stercomata*.

In the deep sea, foraminifera come in a stunning variety of shapes and sizes. Some are so small they fit into the category of meiofauna, while others are large enough to be considered macro- or even megafauna. Scientists usually classify them into two main groups: monothalamiids, with just one chamber, and multichambered species. Yet there are also unusual forms that live encrusted on rocks and other hard surfaces of the seafloor which are rarely explored.

Multichambered species often form intricate spiral or linear arrangements of chambers, while monothalamiids may appear as simple tubes, spheres, or chains. Some attach to hard substrates, creating encrusted, irregular forms, while others drift across the sediment with delicate, flowing tests. Agglutinated species form their tests by binding detrital sediment particles, occasionally incorporating minerals such as iron. The incorporation of iron imparts a reddish tint to some tests. "Mudballs" and soft-bodied types reveal even more complexity, containing internal pellets (*Stercomata*) and tubular structures that hint at specialized feeding or reproductive strategies.

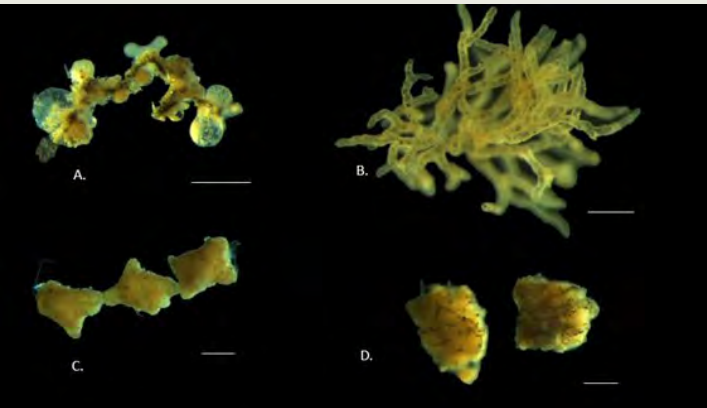


Figure 2. Examples of shape diversity of soft bodied monothalamiids in the CCZ A. *Rhizammina* sp. studded with radiolarians, B. *Septuma* sp. C. *Chain* sp. D. "Mudballs" ramified with tubules (scale 250 μ m)

What makes them even more intriguing is that more than half of the deep-sea monothalamiids have not yet been formally described. Their biology and ecology remain largely a mystery. Some, like the allogromiids, are so simple in shape that researchers can only classify them broadly. Others are given informal nicknames such as "chains," "flasks," and "spheres" because their soft bodies don't fit neatly into scientific categories. Despite being rarely studied, these little-known forms actually dominate deep-sea life, making up ~85% of foraminiferal individuals in areas like the Clarion–Clipperton Zone (CCZ).

Below the carbonate compensation depth (CCD), calcareous foraminiferal tests dissolve, and agglutinated foraminifera dominate. In the CCZ, genera such as *Hyperammina*, *Cribrostomoides*, *Cyclammina*, *Glomospira*, and *Cystammina* frequently incorporate polymetallic nodule fragments into their tests. These particles range from fine mineral grains to small lithic fragments derived from the surrounding sediment and nodules, demonstrating the ability of these species to utilize locally available mineral material for test.

Soft-bodied forms are just as fascinating. Species like *Neocatena pyriformis*, *Baculella globofera*, *Baculella hirsuta*, and *Normanina conferta* drift across the seafloor with their delicate, flowing tests. There's also an odd group nicknamed "mudballs." At first glance, they look like harmless clumps of sediment. But under the microscope, they reveal tiny black particles (Stercomata) and intricate tubular structures. Some of these belong to the genus *Edgertonina*, though many others still await discovery.

Functionally, deep-sea foraminifera play a key role in the benthic trophic web by recycling organic matter and serving as prey for larger organisms. Their abundance and diversity help sustain microbial communities and higher trophic levels, making them essential engineers of deep-sea ecosystems.

Despite decades of research, deep-sea foraminifera

remain largely mysterious. They are abundant, vital to marine ecosystems, and yet much about their biology and diversity is still unknown. By constructing intricate tests from sediment and mineral particles, they shape microhabitats, stabilize sediments, and modify the seafloor environment on a microscopic scale. In doing so, they quietly engineer the deep ocean, earning their title as true architects of the deep.

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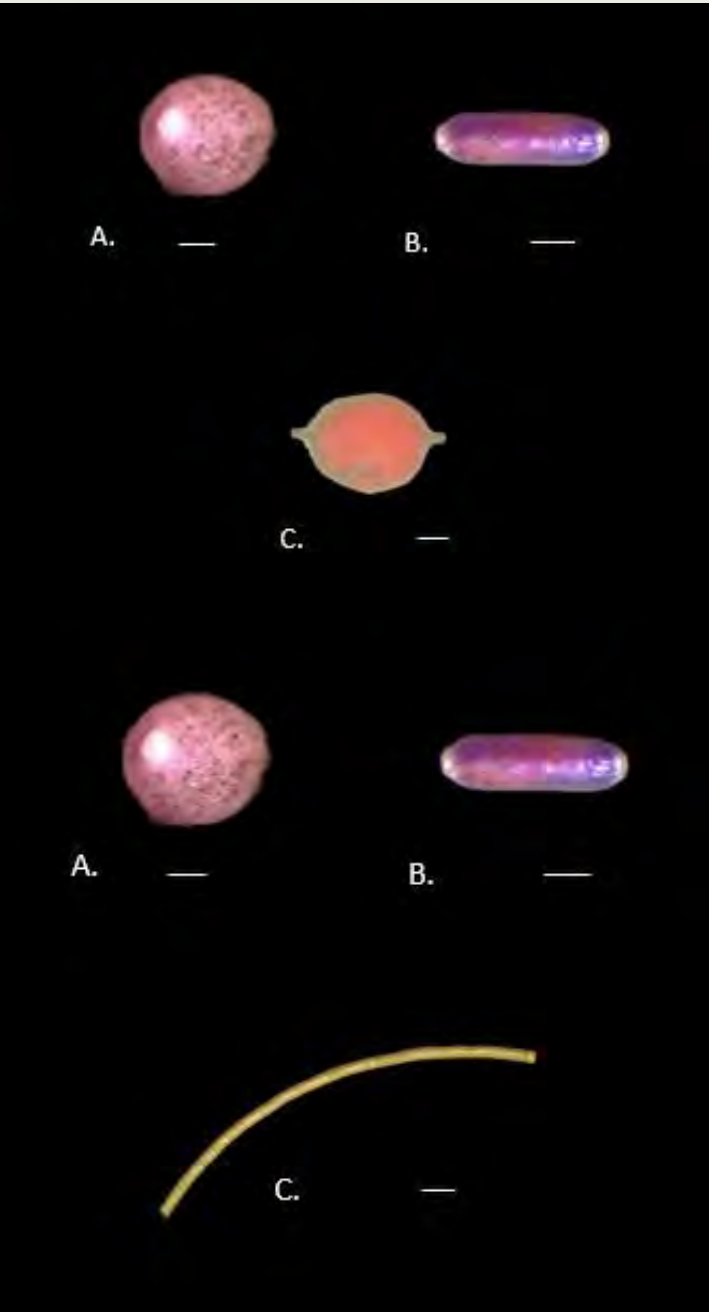


Figure 3. Allogromiids (A, B and C) (scale 100 μ m)

Accessing the Deep: Building a Global Community of Practice



The deep ocean presents unique opportunities and challenges, especially for individuals in low- and middle-income countries and Small Island Developing States, who often face limited access. Recognizing the need to democratise deep-sea exploration and research, the “Accessing the Deep” (ATD) training program by [Ocean Discovery League](#) recently completed a comprehensive 12-week online course to prepare a new generation of ocean explorers and help bridge this gap.

Launched in 2024 and expanded globally in 2025, the ATD program this year welcomed Early-Career Researchers and Ocean Professionals from 20 different countries and locations, with 22 participants anticipated to complete the training. This diversity enriched the learning experience and provided valuable insights for refining the program. The foundational curriculum covers topics like deep-sea science, ocean technologies, human impacts, expedition planning, data management, proposal writing, and policy frameworks. Participants leave not only with technical understanding and knowledge, but also with a renewed sense of purpose and confidence in pursuing their deep-sea interests.

Accessing the Deep prioritises low-cost, accessible technology, encouraging participants to leverage their ingenuity and adapt local tools. This approach is especially beneficial for those transitioning from shallow-water research. By including regionally relevant perspectives and featuring speakers and mentors from local and Indigenous communities, the program addresses the unique challenges faced in various contexts and equips participants to make meaningful contributions in their communities and engage in local and regional research and conservation efforts.

Beyond the technical knowledge and skills, the program facilitates significant personal growth. Participant feedback highlights that a good scientist isn't only someone who excels in data and tools; they are also individuals who listen, adapt, and lead with curiosity, empathy, and vision. We are already seeing tangible outcomes from the program - for instance, one participant used their knowledge and skills from the program to create the deep-sea section for

a museum exhibit in Guam. Another participant described their journey from wondering, “Is this possible for me?” to confidently asking, “How can I begin?” This shift in mindset reflects how participants are embracing the collaborative spirit that drives deep-sea exploration and are moving beyond feeling isolated in their work.

The program's focus on collaboration and community-building cultivated a vibrant global community of practice. Participants connected with experts and peers from around the world, centering the people behind the science and adding a human element to their scientific endeavours. Breakout rooms were a particular highlight, providing a space for more personal connections and allowing participants to appreciate the shared passion of their peers.

As the program moves into a four-month mentorship phase, 15 participants will apply their newly acquired skills under the guidance of experienced deep-sea and marine professionals. This is an exciting continuation of their journeys, as they will build on the knowledge, confidence, and enthusiasm gained during the course, channeling it into meaningful contributions to deep-sea research and exploration.

For more information, contact Nadiah Rosli, Capacity Development Program Manager, ODL at community@oceandiscoveryleague.org

Author(s): Nadiah Rosli, Capacity Development Program Manager

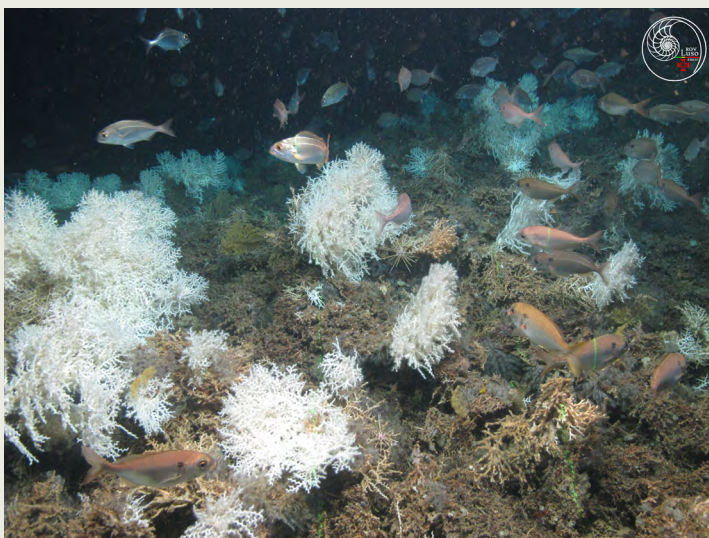
Affiliation: Ocean Discovery League

Characterizing the pristine communities in the Alboran Sea: Beyond species composition



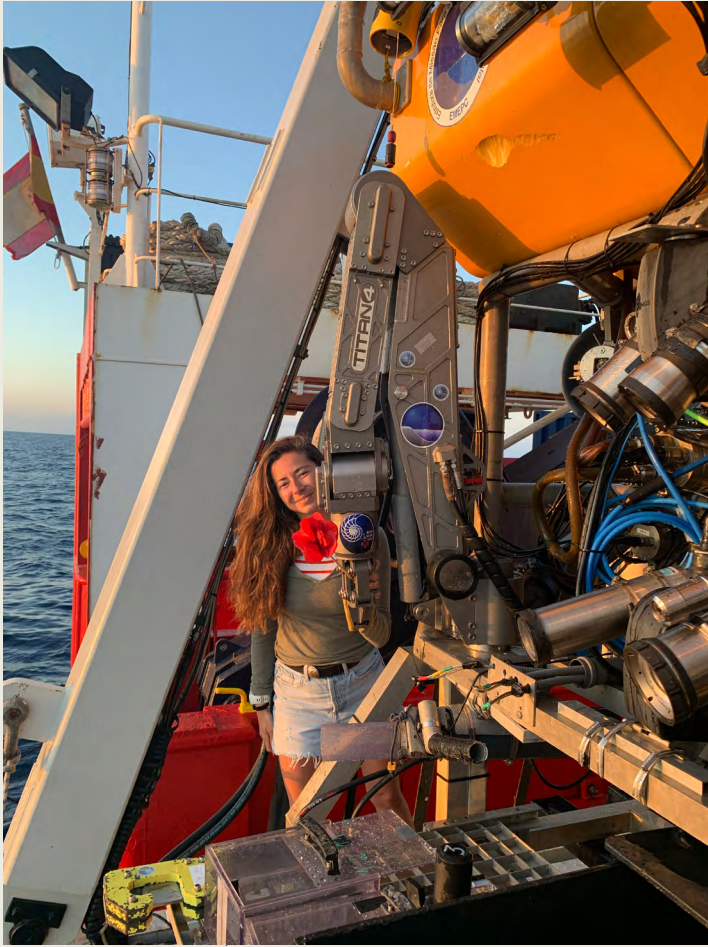


The deep-sea had long been considered the largest desert on Earth; and while some areas of the World's Ocean are indeed almost devoid of life, highly diverse habitats are increasingly being discovered – challenging this long-standing paradigm. Even intensively studied areas such as the Mediterranean Sea, are home to new discoveries, like the Cabliers and Catifas Banks (Alboran Sea, W Mediterranean).



Contrary to the norm of small and scattered Cold-Water Coral Mediterranean populations, extensive and exceptionally thriving reefs formed by *Madrepora oculata* and *Desmophyllum pertusum* are found in Cabliers and Catifas Banks. Remarkable gardens of the golden gorgonian *Acanthogorgia hirsuta* colonise the surrounding framework,

accompanied by other iconic octocorals *Callogorgia verticillata*, *Muriceides lepida*, *Switia rosae* and *Nicella granifera*. From time to time, scattered *Dendrophyllia cornigera* colonies speck the framework with touches of fluorescent yellow, and the bottle-brush black coral *Parantipathes larix* stands tall from the landscape. Where the slope is gentle and fine sediments settle, we found extensive fields of the hexactinellid sponge *Asconema setubalense* whose distribution in the Mediterranean basin is restricted to the Alboran Sea, along with *Phakellia ventilabrum* and *Poecillastra compressa* demosponges, and the filiform octocoral *Viminella flagellum*. Equally impressive are the jaw-dropping 100m high walls, home to gigantic *Leiopathes glaberrima* forests, large *Placogorgia* sp. colonies, combined with the giant oysters *Neopycnodonte zibrowii*. This kaleidoscope of substrates and habitats support highly functional ecosystems, teeming with life. To our surprise, we observed dense schools of the Blackspot seabream (*Pagellus bogaraveo*) swarming the reefs, an overexploited species, nearly at the brink of extinction in the Mediterranean Sea. Large lobular *D. pertusum* colonies were often guarded by Wreckfish (*Polyprion americanus*), Slender rockfish (*Scorpaena elongata*), and a squad of *Munida* crabs. These ecosystems serve as important feeding grounds for keystone oceanic species such as *Mola mola*, and the sharks *Oxynotus centrina*, *Scyliorhinus canicula*, *Galeus melastomus* or *Galeus atlanticus*. Undoubtedly, Cabliers and Catifas Banks are a unique biodiversity hotspot in the Mediterranean Sea and a place of environmental significance, leading to



By analyzing species composition and size structure I was able to better characterize benthic diversity and organization. I used Cumulative Abundance Profiles, which revealed marked interspecific variation in the distribution of organism sizes, allowing for the identification of five distinct size-structured assemblages. What's more, they revealed distinct life strategies and population rhythms of the dominant species — *Acanthogorgia* spp., *D. pertusum*, *A. setubalense*, and *P. larix*. For instance, *Acanthogorgia* spp. and *D. pertusum* displayed a truncated profile consistent with size-skewed populations dominated by high density of small to medium colonies and fewer large individuals. The glass sponge *A. setubalense*, by contrast, showed a balance of generations — from tiny newcomers to towering elders, a true multi-generational community, while the black coral *P. larix* was almost entirely represented by large, mature colonies.

When we zoomed out to look at the spatial patterns of these assemblages, some fascinating trends emerged, revealing that such organization is not random. Our analysis revealed that large-scale spatial scales (on the order of tens of kilometers) play a big role in who lives where, and in what organism sizes. But when we set aside these spatial effects and focused instead on the environment, we saw another story unfold. About 4% of the variation could be linked to environmental differences in seafloor complexity. Altogether, features like slope, orientation, and

seafloor complexity are crucial in creating the patchwork of habitats that support different communities. For instance, assemblages that contained largest individuals across species were most often found in complex, sloping areas facing north, whereas assemblages with smallest individuals tended to settle in east-facing areas. Still, the full model explained only about 12% of the variation — meaning much of the mystery remains unsolved. We suspect that other powerful forces are at play: from biotic processes like recruitment, competition, and mortality, to stochastic events like sudden environmental shifts. In other words, what we see on the seafloor is the result of both landscape architecture and the unpredictable rhythms of life and chance.

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BAIT Knowledge Exchange Fellowship: Adaptive Low-Cost Drop-Cam System

As part of the BAIT Knowledge Exchange Fellowship 2024–2025, African marine researchers trialled a low-cost drop-camera system for mesophotic habitat mapping in São Vicente, Cape Verde (March 2025). The system uses action cameras (e.g., GoPro-style) mounted on a simple frame, with a topside monitor, basic winch deployment and enforced cable of up-to 1000m. Image processing is simply done post-survey using R, QGIS and BIIGLE software. This affordable setup is enhanced to work on small boats with a winch system and at least four operators.

During a five-day expedition aboard the *Jairo Mora Sandoval*, fellows from Kenya, Nigeria, Namibia, and Cape Verde were taught how to deploy the system up-to 30 m depths delivering high-resolution seafloor imagery essential for benthic biodiversity assessments, proving both cost-effective and efficient. Training emphasised transferable skills, enabling adaptation to local settings.

In studying sedimentary carbon fluxes of coastal and estuarine areas prone to frequent disturbances such as storms or bottom trawling, the adaptive low-cost drop-camera system offers invaluable ground truthing for sediment sample data explaining flux patterns. Video evidence provides visual observation of disturbances, helping rationalise the lasting impacts of bottom trawling. For example, in Kenyan coastal areas like Mida Creek, which has been confirmed as a hotspot for juvenile sea turtles, these techniques will be used to inform on the ecological importance of underlying habitats. This paves the way

for revising fishing regulations, policy, and conservation initiatives such as seasonal closures that aid in curbing sea turtle and elasmobranch bycatch in local artisanal fisheries.

As part of subsequent outreach, Charles Lucas Makio was invited to speak at a mini-symposium during the [13th Western Indian Ocean Marine Science Association \(WIOMSA\) Scientific Symposium](#) (28 September–4 October 2025, Mombasa), organised by the [African Network of Deepsea Research \(ANDR\)](#). With many coastal conservation groups attending, there is strong potential for local adoption in long-term Marine Protected Area (MPA) monitoring.

This initiative bridges financial and technological gaps in mesophotic research, equipping regional scientists with tools for ecosystem observation. Looking ahead, fostering partnerships with regional universities and technology providers, the drop-cam system could evolve into a low-cost modular deep work toolkit. Incorporating environmental DNA (eDNA) samplers and acoustic sensors alongside cameras to offer complementary datasets for holistic habitat characterisation. Open-access data portals and standardized protocols (access to ID key in BIIGLE) can democratize deep sea research, empowering coastal communities and policy makers with evidence to advocate for climate resilience and biodiversity protection in mesophotic ecosystems.

Great appreciation to the BAIT Knowledge Exchange organising team from the University of Plymouth,



University of Aveiro, University of Cape Verde (UniCV), and Biosfera, and to Dr Teresa Amaro and Dr Amelia Bridges for facilitating this knowledge exchange fellowship.

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WormFEST: Worm Forest EcoSysTems in Arctic hydrothermal vents and cold seeps



Earlier this year, we launched the WormFEST project, which is funded by the Research Council of Norway (FRIPRO program). It's a 4-year project in collaboration between the University of Bergen (Departments of Biological Sciences, Earth Science and the University Museum), UiT- The Arctic University of Norway, Universidade de Aveiro, CIIMAR and FSU Jena.

Tubeworm aggregations at hydrothermal vents and cold seeps are often called “worm forests” because they generate a three-dimensional structure comparable to the trees in a forest, which is inhabited by many other organisms such as molluscs, crustaceans and annelids. In contrast to the giant tubeworms found in other parts of the world, Arctic worm forests are formed by the thin and hair-like tubeworms *Sclerolinum contortum* and species in the genus *Oligobrachia*. Recent exploration of the Arctic Mid-Ocean Ridges and adjacent continental margins have

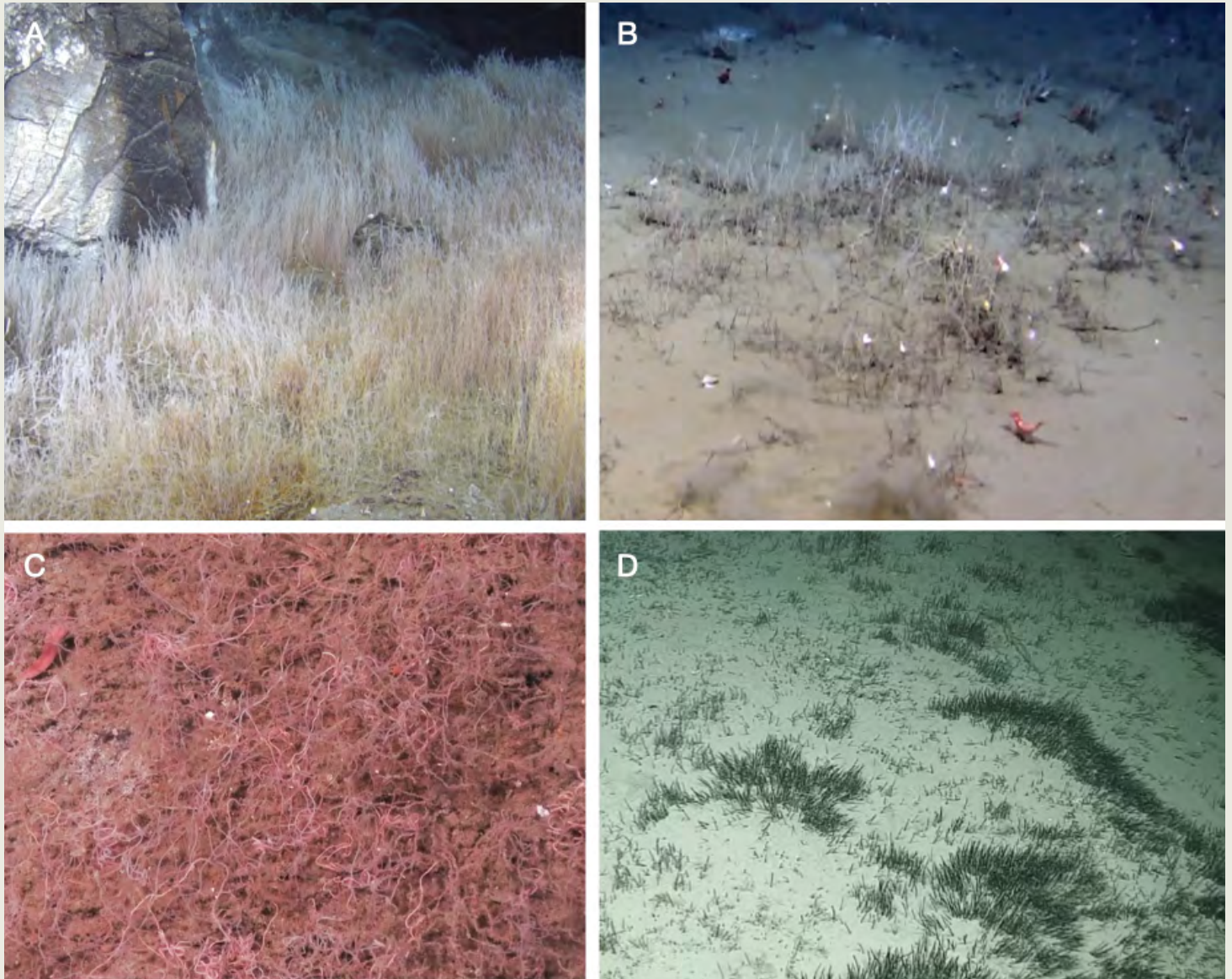


Figure 1: Arctic worm forests at hydrothermal vents and cold seeps. A – Loki's Castle vent field (2300 m), B – Svyatogor Ridge cold seep (1900 m), C – Ægirs Kilde vent field (2200 m), D – Vestbakken cold seep (1300 m). Images: Centre for Deep Sea Research, UiB (A, C), AKMA project, UiT (B, D).

revealed many new vent and seep sites hosting worm forests, but the worm forest ecosystem has only been characterized from a few sites such as the [Lokis Castle vent field](#).

The main objective of the WormFEST project is to characterize the diversity, community composition and ecosystem functioning of worm forests in Arctic deep-sea hydrothermal vents and cold seeps, providing critical baseline knowledge about these unique ecosystems. The focus area of the WormFEST project is the Arctic Mid-Ocean ridges and nearby continental slopes in the Nordic Seas.

Using an interdisciplinary approach, the WormFEST project aims to:

- Characterize the community composition and biodiversity of worm forests at hydrothermal vents and cold seeps.

- Identify the main environmental drivers allowing worm forests to form and how these parameters influence the community within the worm forest.
- Characterize the ecosystem functioning of the worm forest community by combining observational data, food web reconstruction and functional trait analyses.
- Engage relevant stakeholders and inform management and conservation frameworks.

The WormFEST project will be central to the activities of the [CBE Arctic Team](#), a research team at the University of Bergen focusing on chemosynthesis-based ecosystems in the Arctic deep sea. The team currently includes Kristoffer Nilsen (MSc student), Tone Ulvatn (technician), Brenda L. Esteban Vazquez and Christian Nilsson (PhD students) and Mari H. Eilertsen (PI) and is based at the Department of Biological Sciences at the University of Bergen in Norway. The team is part of the [Deep Sea Biology Research group](#)

and the multidisciplinary [Centre for Deep Sea Research](#).

More information on the WormFEST project and chemosynthesis-based ecosystems (CBEs) in the Arctic can be found at: <http://www.cbearctic.com/>

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DEEPEND celebrates 10th anniversary with two cruises in 2025



The DEEPEND ([Deep Pelagic Nekton Dynamics](#)) research team is celebrating its 10th year as a consortium with its 10th research cruise, as well as the second science cruise of its sister effort, [Deep-Sea Benefits](#), in the last six months. Through initial funding from the Gulf of Mexico Research Initiative and currently from the NOAA RESTORE Science Program, DEEPEND has developed an extensive meso- and bathypelagic faunal and acoustic time series centered on fishes, cephalopods, and pelagic shrimps, in addition to studying ecosystem drivers, biophysical coupling, genetic diversity, organismal ecology (feeding, reproduction, age & growth), and anthropogenic contamination (petrochemicals and microplastics). DEEPEND's activities are reflected in its 94 publications and 103 open-access databases to date, as well as its 100+ current and former graduate students.

The Deep-Sea Benefits project, funded by the *Deepwater Horizon* Open Ocean Trustee Implementation Group, is examining mesopelagic faunal interactions with continental slope habitats between 70 and 800 m depth, including deepwater coral, canyon, and mound/trough habitats. Deep-Sea Benefits runs parallel to, and integrates data from, DEEPEND's sustained sampling further offshore. This combination allows for the elucidation of mesopelagic boundary communities along slope habitats, with distinct assemblages of mesopelagic species that are rarely, if ever, found further offshore. We are also utilizing benthic lander observations and concurrent oceanic cetacean studies (e.g., passive acoustic monitoring) to detect and describe ecological interactions between surface-oriented, midwater, and deep-demersal communities.

Additional ongoing efforts, such as marine mammal visual surveys and ROV surveys, will also add context to

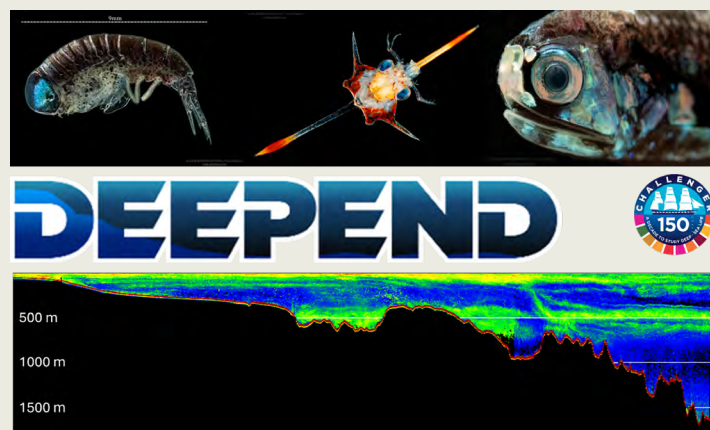
the findings from this work. Preliminary results to date have identified hotspots of deep-pelagic nekton (e.g., lanternfishes, hatchetfishes, and decapod shrimps) and top predator (e.g., oceanic sharks, cetaceans) abundances. We anticipate the end goal to be an integrated assessment of vertical and horizontal connectivity between the continental slope and open-ocean waters of the northern Gulf of Mexico.

This assessment will help quantify benefits from *Deepwater Horizon* restoration activities. The DEEPEND and Deep-Sea Benefits cruises have also provided samples and data for many other academic and agency-led science initiatives and would be happy to continue doing so (email tsutton1@nova.edu). Cruises in 2025 and 2026 are badged under the Challenger 150 project (challenger150.world) North Atlantic Working Group.

As always, we welcome input and will be happy to support as many collaborative efforts as possible.

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Affiliations: ¹Nova Southeastern University, ²Florida International University, ³San Antonio Zoo, ⁴Scripps Institute of Oceanography, ⁵University of South Florida, ⁶National Oceanic and Atmospheric Administration, ⁷Florida Atlantic University, ⁸University of South Carolina



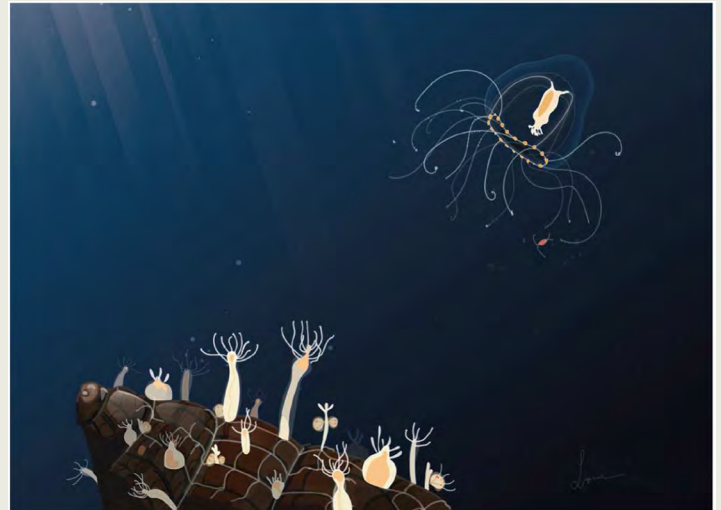
Introducing the Unseen Ocean Collective!



How do you bring the deep sea to people who may never see it? In 2025, four women - three artists and one scientist - founded the Unseen Ocean Collective to answer that question through a vibrant and exciting mix of art and science.

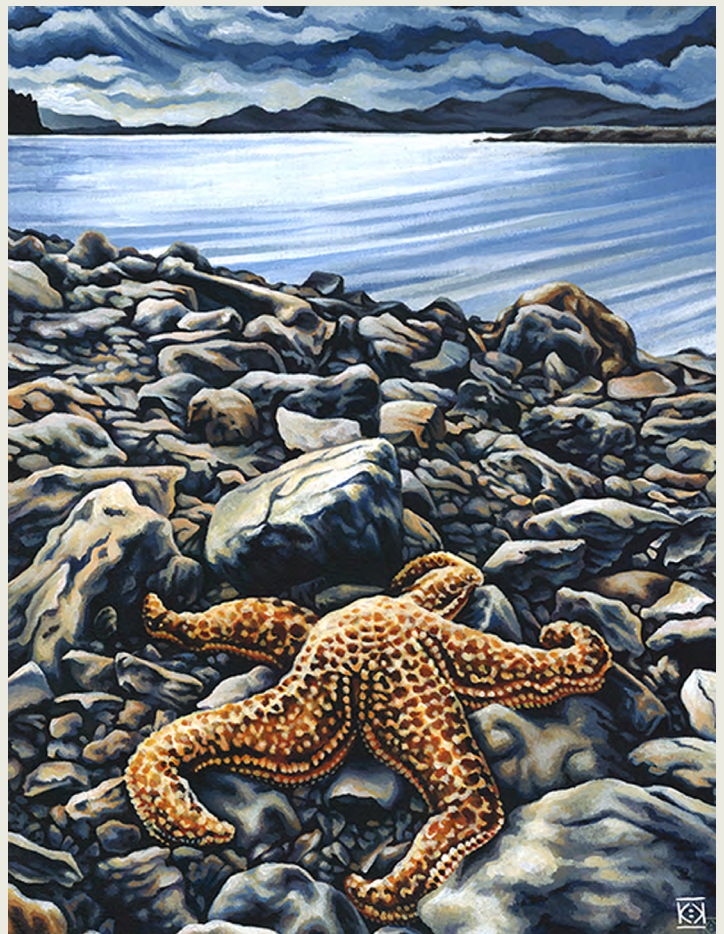
With fine art paintings, sculptures, video installations, and interactive lectures, the collective is redefining the scope of science communication and reaching audiences that traditional outreach cannot. In a political season where science is being obscured in the public eye, the group is committed to revealing the beauty and value of the unseen deep.

For their 2025-2026 program, the collective is working with footage from a 2023 NOAA Ocean Exploration mission off Alaska. This expedition revealed more than 170 hours of thriving coral and sponge gardens - a vibrant source of inspiration. The NOAA footage that inspires the collective's art also forms the basis of the recent preprint (Beckmann *et al.*, 2025), which maps deep-sea coral and sponge communities in the Gulf of Alaska and Aleutian Islands, highlighting the diversity, ecological importance, and



vulnerability of these hidden ecosystems - knowledge that both guides conservation, sparks storytelling, and inspires art.

Following their debut exhibit at the Swedish Biodiversity Symposium in October 2025, the collective will exhibit at the Juneau Arts and Heritage Center, in February of 2026. This fine-art exhibit will showcase coral gardens and sponge grounds, and encourage local communities to experience the deep sea's hidden ecosystems, showing how they underpin the oceans and resources people depend on. In April 2026, the program moves to Spokane, Washington, with a month-long series including a City Hall



exhibition, grade school field trips, university and library talks, and hands-on workshops.

Art creates an emotional connection in ways that facts and figures alone often cannot. As Anderson *et al.* (2025) argue, humans are “storytelling apes,” and translating science into a powerful visual narrative can engage hearts as well as minds, delivering transformative outcomes. The Unseen Ocean Collective embraces this principle, using fine art to connect new audiences to the unseen deep - inviting curiosity, empathy, and care for these hidden ecosystems.

Learn more at www.unseenoceancollective.com, or follow along on Instagram ([@unseenoceancollective](https://www.instagram.com/unseenoceancollective)) and BlueSky ([@unseenocean.bsky.social](https://bsky.app/profile/unseenocean.bsky.social)).

The collective thanks the British Ecological Society and the Spokane Arts Grant Awards for supporting its 2025 - 2026 projects.

Author(s): Meghan Jones, Artist and Author

Artist's film responds to the potential impacts of deep sea mining

In response to the growing global pressure to begin industrial extraction from the ocean floor, UK based artist Emma Critchley has created an exhibition titled *Soundings* which features a three-screen film exploring our relationship to the deep sea.

Soundings offers an urgent and poetic reflection on what's at stake beneath the waves. Exploring the deep ocean as both a shared commons and an ecological mystery, the film and exhibition draws on scientific research, Indigenous knowledge, and activist voices, including those opposing seabed mining across the Pacific. A live dance performance created in collaboration with choreographer **Siobhan Davies**, brings the film's themes into embodied motion.

Visitors to the exhibition can also pick up a copy of *Rights of the Deep* an open letter co-authored by ocean activists, ocean law experts and the artist calling for legal recognition of deep-ocean ecosystems. A digital version of the letter can be viewed via Science Gallery London's website here: <https://london.sciencegallery.com/vs-artworks/rights-of-the-deep>

The exhibition at Tate St Ives (UK) follows a two-year long process of public engagement and research supported by UK based partners **Attenborough Centre for the Creative Arts, Brighton Festival, John Hansard Gallery, and Quay Arts**. Each phase invited the public into conversations with marine biologists, oceanographers, legal scholars, and



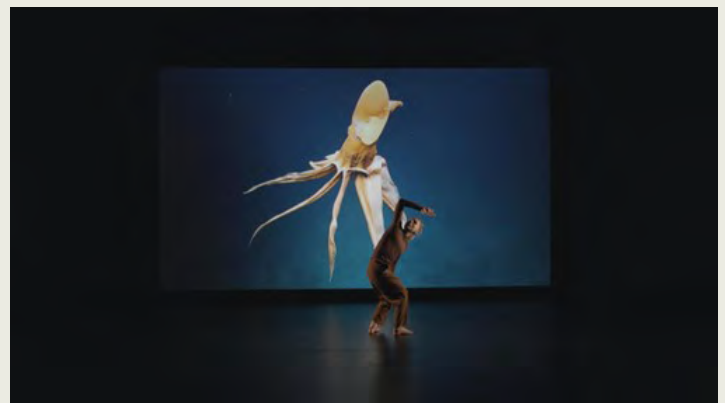
Emma Critchley, *Soundings*, Installation view, John Hansard Gallery, 2025. Courtesy the artist. Photo: Reece Straw

Pacific-based activists; these conversations informed the development of the subsequent film and exhibition. The film premiered at John Hansard Gallery, Southampton in spring this year and then toured to Attenborough Centre for the Creative Arts for Brighton Festival 2025 prior to its current location at the Tate St Ives.

Soundings seeks to offer a vital space for reflection, resistance, and reimagining our place within the planet's largest ecosystem.

Read more about the exhibition here: <https://www.tate.org.uk/whats-on/tate-st-ives/emma-critchley-soundings>

Our Collective Seabed exhibition at National Gallery of Jamaica, during the International Seabed Authority



Emma Critchley, *Sirens* (film still) 2023, exhibited at The National Gallery of Jamaica during the International Seabed Authority meetings July 2025. Courtesy the artist. Photo: Rosie Powell.

Our Collective Seabed was a group exhibition held at The National Gallery of Jamaica, Kingston, 21 July - 21 August 2025, Co-curated by Chief Curator O'Neil Lawrence, Senior Curator Monique Barnett and the Deep Currents Collective.

Taking place adjacent to the Jamaica Conference Centre's International Seabed Authority annual meeting, the



Emma Critchley, *Sunless Sea* (2025), at Soundings, John Hansard Gallery, 2025. Courtesy the artist. Photo: Reece Straw

exhibition explored the potential of arts and culture to be the driving force within the Caribbean regional context to address timely concerns on the future of ocean stewardship for deep ocean governance.

The exhibition included international artists Emma Critchley (UK), Patty Chang and David Smith (US), Hefrani Barnes (Fiji), Orchestras of Awe / dacity (ocean citizens), Enar de Dios Rodríguez (Spain). Caribbean artists from the Gallery's collection included Nadia Huggins, Colin Garland, Albert Huie, Archie Lindo, and Barrington Watson.

Emma Critchley's *Rights of the Deep* co-written open letter advocating for the protection of the deep sea bed was also presented at a Deep Sea Conservation Coalition event during the ISA.

The Deep Currents Collective are an international group of scholars, activists, lawyers and artists engaging with the deep ocean from cultural and more-than-human perspectives. Instagram: <https://www.instagram.com/deepcurrentscollective/>

Author(s): Emma Critchley

Newly endorsed UN Ocean Decade Program: Global Subseafloor Ecosystem and Sustainability

The Global Subseafloor Ecosystem and Sustainability (GSES) is a newly-endorsed Ocean Decade Program, spearheaded by the International Center for Deep Life Investigation (IC-DLI, <https://icdli.sjtu.edu.cn>). Established in 2018 at Shanghai Jiao Tong University as a continuous effort from the deep life community of Deep Carbon Observatory (DCO, which ended at 2019), IC-DLI has flourished at Shanghai with support from the university, and Government of Hainan Province. It currently has ~250 subscribed members from 17 countries across Asia, Europe, America, Africa, and Oceania. The successful launch of GSES represents the fruition of IC-

DLI's enduring scientific partnerships, particularly with leading research institutions and universities in Germany, France, Japan, South Africa, and India. Expanding beyond its founding consortium, GSES has mobilized a network of 40+ international partner institutions, establishing an unprecedented Asia-Africa-Europe+X mega-science framework for deep-sea exploration. GSES invites more partners, collaborators globally, to converge knowledge, capacity, and efforts to decode the mysteries of microbial life in deep-sea environments, and to advance sustainable stewardship of these invisible yet vital ecosystems.

Subseafloor environments (Fig.1) hold Earth's largest organic carbon reservoir, harbor nearly half of the ocean's microbial cells (~ 2.9×10^{29} cells in marine sediments, while cell abundance in the vast rock environments is yet to be constrained). As an interface between the hydrosphere and lithosphere, the subseafloor, moreover, links the fast carbon cycle on the surface, that drives present-day Earth system dynamics, with the slow, or geologic, carbon cycle of the deep Earth which sets boundary conditions for Earth's climate. Subseafloor microbiomes play vital roles in these links by being crucial engines behind the fast and slow carbon cycle through their profound influence on chemical processes and fluxes. The latter include the transformation of organic compound pools, the production of greenhouse gases, the complementary roles in carbon sequestration, and the release of nutrients that support oceanic food webs. Subseafloor microbiomes thus serve as a vital link between the dynamic hydrosphere, which today is strongly influenced by human activities, and the geologically active deep Earth.

Meanwhile, the subseafloor functions as a reservoir for essential biological resources. The subseafloor microbiome harbors genetic resources conducive to the development of new medicines, antibiotics, and molecular biology-required enzymes. Notably, subseafloor microorganisms also exhibit significant potential in mitigating the harmful effects of pollutants from human activities, including organic pollutants, microplastics, and heavy metals,



Figure 1. Cartoon showing the seafloor and subseafloor structures and the ecosystem.



Figure 2. Goals and expected outcome of GSES

thereby alleviating their impact on various marine life forms. This wealth of biological assets offers innovative solutions for addressing ocean pollution, playing a crucial role in advancing towards a sustainable blue economy. However, the subseafloor habitat is susceptible to current and impending human activities which put mounting pressures on this vulnerable environment.

Moreover, significant knowledge gaps remain in understanding the subseafloor ecosystem and its development: 1) Limited understanding on the origin, connectivity, functions of microorganisms in marine sediments and crust and their interactions with the overlying marine ecosystem; 2) Inadequate quantification of subseafloor microbiome contributions to Earth’s elemental cycling and geochemical processes; 3) Poorly established knowledge on how core microbial functional groups in subseafloor ecosystems contribute to carbon cycling at different temporal scales; 4) Poor understanding on how subseafloor life sustain and evolve at extreme harsh conditions; 5) Limited understanding of factors influencing the buildup and sustainability of the subseafloor ecosystem. These knowledge gaps jeopardize our understanding of Earth’s largest organic carbon

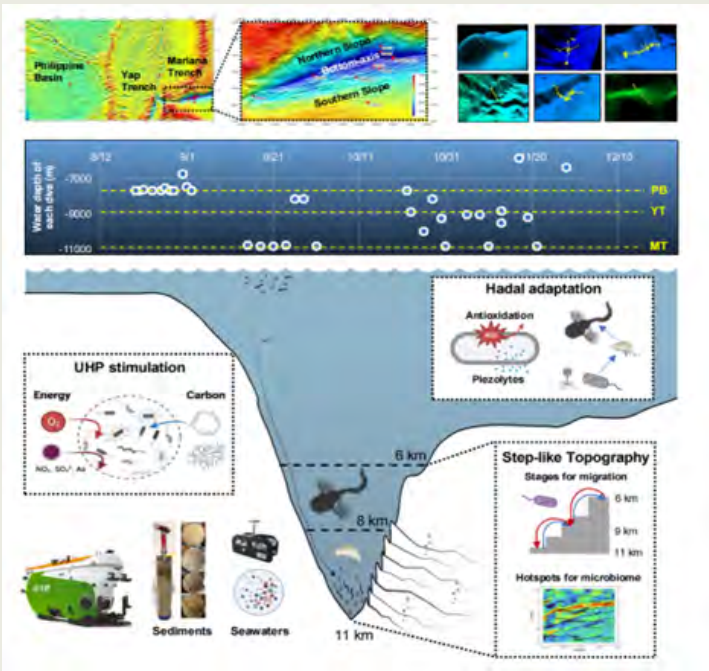


Figure 3. Overview of the MEER project

reservoir and the dynamic biosphere connecting various subsystems.

Hence, GSES was initiated to generate new systematic insights into subseafloor ecosystems and transform them into predictive capabilities for typical subseafloor habitats. GSES delves into microbial life, carbon dynamics, and historical records in this critical but vulnerable ocean environment. With global efforts, capacity-building, and inclusive co-design and collaboration, GSES is committed to developing international standard protocols, novel investigation platforms and tools, and ecological indices to facilitate the exploration, monitoring, and management of the subseafloor environment (Fig.2). GSES aims to contribute to ocean science and governance, addressing gaps in the Decade actions with temporal perspectives

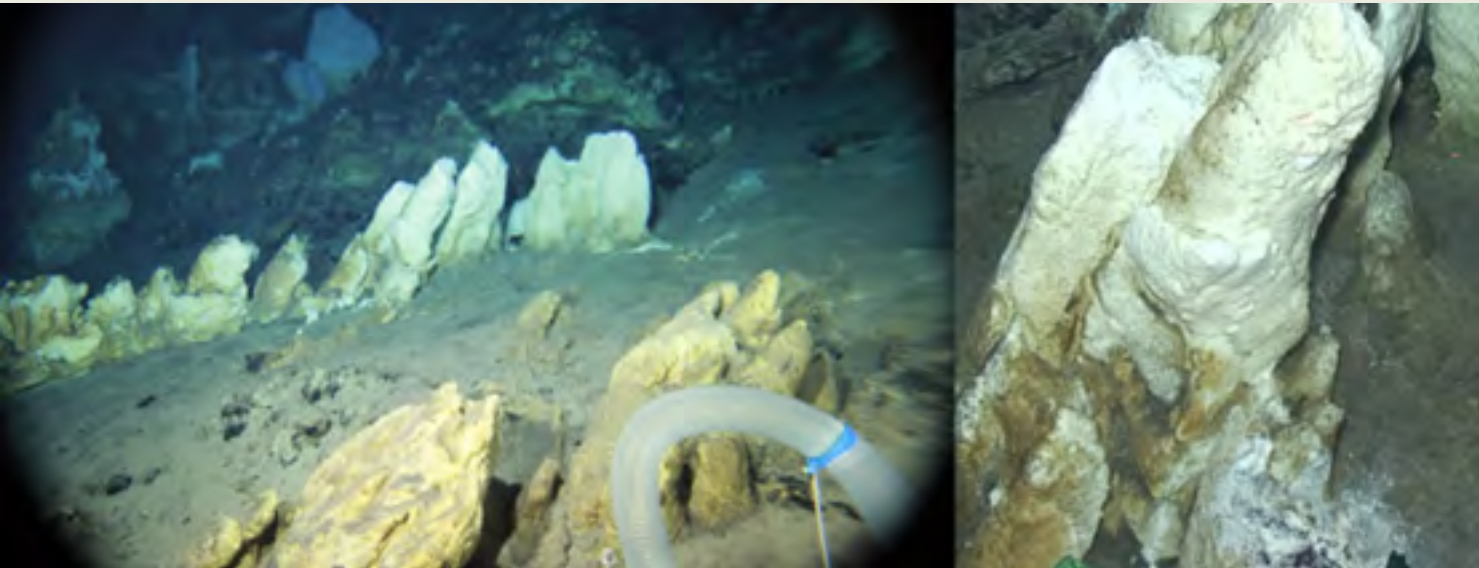


Figure 4. Active chimneys that host relatively fresh serpentinization-driven fluid flows in Conical Seamount of the Mariana forearc region. Photo was taken by Shinkai6500. Photo credit: JAMSTEC

and environmental threat mitigation, providing innovative solutions for a sustainable blue economy.

Although a newly-launched program, GSES has already set up two pilot projects, namely the MEER project and the CRUS-Bio Project.

The Mariana Trench Environment and Ecology Research (MEER) Project was led by Professor Xiang Xiao, dean of IC-DLI, in collaboration with researchers from the Institute of Deep-Sea Science and Engineering, CAS, BGI and others. Utilizing the full-ocean-depth HOV “Fendouzhe”, 1,648 sediment samples from the Mariana Trench (6-11 km deep), Yap Trench (9 km deep), and Philippine Sea Basin

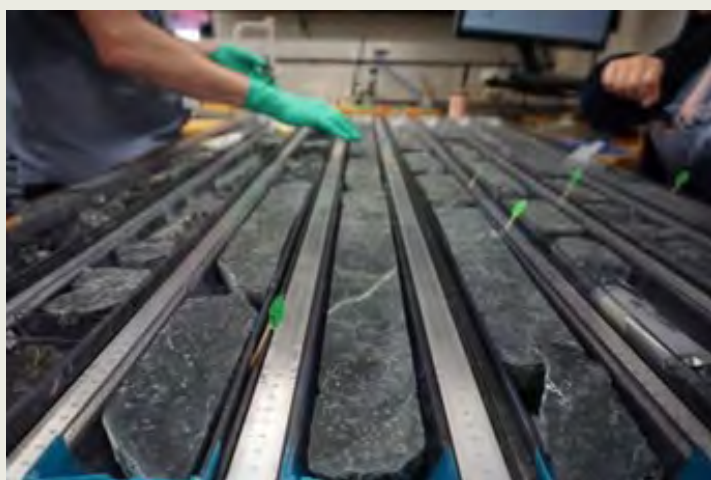


Figure 5. Retrieved serpentinized peridotites in the core catcher on the desk of R/V Joides Resolution from IODP Exp399. Photo credit: Johan Lissenberg / Cardiff University & IODP

(6-9 km deep) have been collected, with a total of 1,209 samples from Mariana Trench, providing an important basis for studying the vertical distribution characteristics of hadal ecosystems (Fig.3). Through project training, a young scientific research team has been established mainly composed of students and postdocs who can tackle tough challenges and venture to the forefront of deep-sea science and technology. The large sample size and data volume generated by the project have continuously driven the development and iteration of new technologies. Currently, four papers from the first phase of the MEER project have been accepted by Cell and are pending publication.

The Crustal Biosphere (Crus-Bio) project is a joint international project targeting Earth's most expansive yet least understood ecosystem - the deep crustal biosphere. In 2023, ICDLI researchers Dr. Fengping Wang, Dr. Susan Lang, and others participated in the IODP Expedition 399 to interrogate life in the serpentinized peridotites (Fig. 4) at Atlantic Masif. In the same year, Dr. Fengping Wang and Dr. Ken Takai co-led a Sino-Japan collaborative cruise targeting deep life in serpentinized mud volcanoes of the Mariana forearc region (Fig.5), and in the sediments of the Southern Mariana. These coordinated efforts are now

yielding critical datasets through state-of-the-art genomic and biogeochemical analyses.

GSES is looking forward to establishing new partnerships with global researchers, decision-makers, innovators, local communities and organizations. Any suggestions and comments are more than welcome.

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Discovery of the unique Karambusel vent field in Papua New Guinea

During research cruise SO299 DYNAMET (geoDYNAmics & METallogeny) with the German RV *Sonne* in June-July 2023, we discovered an active hydrothermal vent field on the western flank of Conical Seamount in the Tabar-Lihir-Tanga-Feni (TLTF) island chain of Papua New Guinea. The Karambusel vent field is remarkable in being the first site of deep-sea hydrothermal activity known from the area. It combines features of a magmatic-hydrothermal vent with that of a hydrocarbon seep and by that creates a distinct ecological niche that supports a highly endemic chemosymbiotic fauna. The discovery and significance of the vent field are described and discussed in a newly published article in *Scientific Reports* by Brandl *et al.* (2025).

The Karambusel vent field at 1,300 m below sea-level is located on the western flank of the gold-mineralized but hydrothermally inactive Conical Seamount south of Lihir. Radiometric age dating and isotope geochemistry indicates that a magmatic event at ~89 ka triggered the gold-rich mineralization at the top of the 287 ka-old Conical Seamount and at Karambusel. The active Karambusel vent field features the simultaneous discharge of warm hydrothermal fluids (up to 51°C) and cooler hydrocarbon-rich fluids and gases. The proportion of methane in the dry gas phase at Karambusel exceeds that of any other known hydrothermal system globally. We interpret methane and other hydrocarbons to be of thermogenic origin linked to the rapid degradation of organic matter due to the high heat gradient near the magmatic-hydrothermal system. However, the vent field is characterized by a multi-stage mineralization history, with high-temperature ore stages linked to magmatic events and low-temperature stages associated with the current venting. The enrichment of



elements such as arsenic, antimony, mercury, and thallium in the vent fluids is thought to reflect contributions from both magmatic and sedimentary sources.

The Karambusel vent field is a key site in understanding the distribution of vent-specific fauna in the western Pacific. A previous study by Tunnicliffe *et al.* (2024) found that the vent fauna of the TLTF island chain shows a high level of system endemism despite its proximity to the Manus Basin that acts as a network hub for the western Pacific vent fauna. However, several taxa identified at Karambusel had not been previously described from nearby (seep) sites such as Mussel Cliff and Edison Seamount. Detailed taxonomic, microbiological, and genomic studies are required to fully explore the diversity of vent fauna along the TLTF island chain and its connectivity to other vent systems in the region.

In Brandl *et al.* (2025), we suggest that the presence of both hydrothermal and hydrocarbon-rich fluids creates a distinct ecological niche that supports a highly endemic chemosymbiotic fauna. Urgent and intensified efforts in scientific research, marine spatial planning, and environmental protection are needed to mitigate the threats posed by growing economic interests and activities, including current exploration activities for minerals and hydrocarbons.

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DOSI Elevates Deep Ocean Issues on the Global Agenda



It has been another busy period for DOSI, pulling focus to the deep ocean at several high-profile international events. Perhaps the most intense period was in June, when the One Ocean Science Congress, the Third UN Ocean Conference, the SB62 Climate Meetings, and IOC-UNESCO's 33rd Assembly were stacked back-to-back in Europe, leading to several dedicated DOSI Ambassadors not returning home for over three weeks. Thankfully, their efforts, as well as those of all others involved, were not wasted, as DOSI's light was shining bright for all to see at these and all other events our Ambassadors attended. Of particular note was the praising of DOSI's efforts by government representatives from Canada and Costa Rica, as well as from heads of IOC-UNESCO and IUCN, during our prestigious Side Event at the UN Ocean Conference. In addition, it was heartening to see how DOSI's influence was visible, acknowledged and appreciated by so many other actors and stakeholders in various presentations at all meetings. Internal reports on DOSI's participation at all these meetings are available on request to the DOSI Office.



Figure 1. DOSI ambassadors out and about on mission.

Also high on the DOSI agenda in the past six months have been the two BBNJ Preparatory Commission meetings in New York during April and August, alongside a workshop supported by DOSI on implementing the BBNJ Agreement, held in Aberdeen in July. Again, DOSI Ambassadors went the extra mile to not only represent the interests of the deep ocean at those meetings, but also to showcase and explain the intricate detail of the processes and negotiations taking place at those meetings to a wider audience. Their efforts, including several Policy Briefs, Information Sheets and explainer videos, are on DOSI's [website](#) and social media channels ([BlueSky](#), [X](#), [Youtube](#), [Instagram](#), [Facebook](#), [LinkedIn](#)) for all to see.

DOSI's presence and influence at the International Seabed Authority has also been felt in recent months, as DOSI Ambassadors attended the first and second sitting, in March and July, respectively, of the 30th Session of the ISA Council and Assembly. While making timely and pertinent interventions during the negotiations on the draft regulations for the exploitation of deep-sea minerals, DOSI hosted a number of Side Events, highlighting a decade of scientific discoveries (e.g., dark oxygen) that preempt a regime shift in the way we should manage the deep ocean. Also, in collaboration with DEEP REST, DOSI delivered the immersive theatre experience SPLUJ to Jamaica, performed by the Piba theatre group. Again, reports and social media coverage of these events are available via the DOSI digital channels.

Other notable events over the past six months where DOSI has played a significant role include the organisation and delivery of a research symposium in Sydney in May to develop a deeper understanding of [Lord Howe Rise and the Tasman Sea](#), the IOCARIIBE Technical Science Meeting in April, and the Virtual Informal Exchange of Views on the Preparation for the Ocean and Climate Change Dialogue

2025, also in April.

On the home front, the DOSI Office has complemented everyone's efforts by producing a [series of explanatory videos](#) on how to engage with the various governance processes that have an ocean remit, as well as a podcast series '[Think Deep!](#)' featuring deep-ocean experts explaining how their work aligns with the DOSI mission. See the next article in this issue for further podcast news.

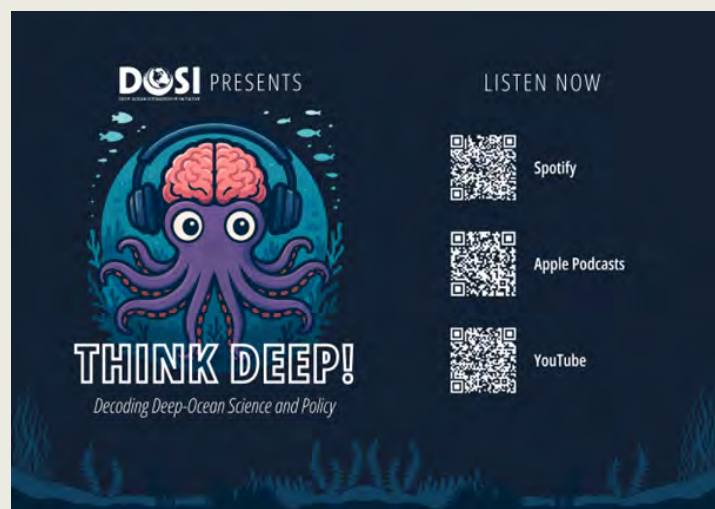
We may be heading towards the end of the year, but this does not mean the DOSI agenda is any less hectic, with participation planned in several upcoming international meetings, including the IUCN World Conservation Congress in Abu Dhabi, the Convention on Biological Diversity's SBSTTA 27 in Panama City, and the GESDA Annual Meeting in Switzerland, all in October alone! Be sure to keep up to date with all of DOSI's activities via its several digital channels, and if you would like to take part, do make your intentions known to any of the leads of the relevant DOSI Working Groups, or the DOSI Office.

Author(s): DOSI Office

DOSI is supported by grants from Arcadia, Synchronicity Earth and Benioff who make our work at the science-policy interface possible.



Think Deep! Decoding Deep-Ocean Science and Policy



The Deep-Ocean Stewardship Initiative ([DOSI](#)) have launched a new 6-part podcast series, [Think Deep! - Decoding deep-ocean science and policy](#). The podcast uncovers the connections that tie us to the deep ocean and demystifies the governance frameworks that strive to protect it – from climate to biodiversity, from UNCLOS to the BBNJ Agreement. Whether you're a student, scientist, policy professional, or just someone who cares about the ocean, join DOSI as we explore the deep ocean's mysteries, confront its challenges, and shape its future together!

You can find the entire series on [Spotify](#), [Apple Podcasts](#) and [YouTube](#). Check out the series trailer and the episode breakdown below for a taste of what the podcast is all about.

Episode 1: The story of deep-ocean governance, with Prof Jon Copley

Episode 2: Biodiversity in the deep ocean - who protects it?, with Prof Anna Metaxas

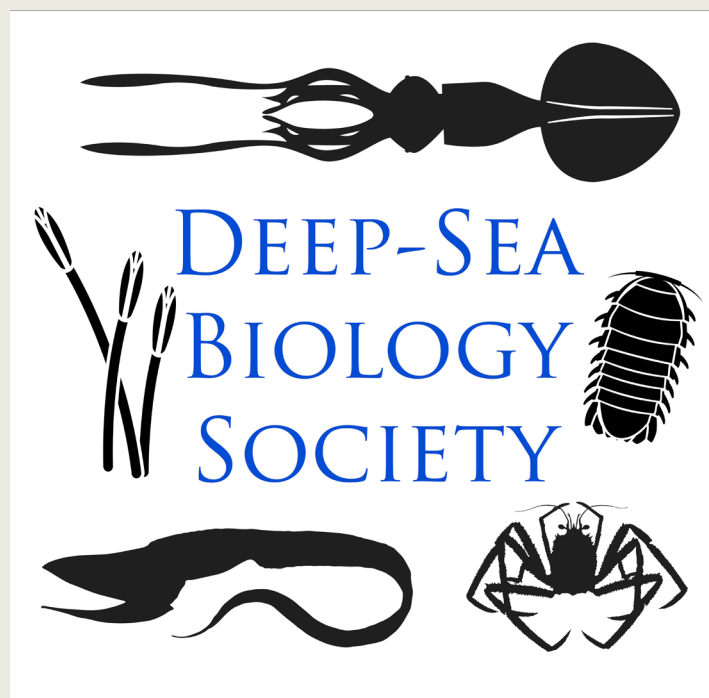
Episode 3: Climate change and the deep ocean, with Dr Natalya Gallo

Episode 4: Governance in the High Seas, with Pradeep Singh

Episode 5: Ecosystems to species - the importance of scale, with Prof Kerry Sink

Episode 6: The deep ocean and us, with the creators of *Think Deep!*

Deep-Sea Biology Society News



DSBS Trustees held the Annual General Meeting (AGM) in September which highlighted the range of activities the society is undertaking with the deep-sea community. The mentoring network remains very active, and we welcome all new-comers - be they mentors or mentees.

The new ArtSea Matching making initiative, matching deep-sea scientists with artists to spread knowledge about the deep sea has a kick off event in mid-October. And of course one of our grant giving Conference award round just closed; we are assessing applications now. If anyone is interested in giving a seminar please email early_career@dsbsoc.org with a tentative title and overall research topic - we will be collating a new seminar series soon. And we are here to promote our members and their amazing research and activities so please email socialmedia@dsbsoc.org or tag our social media accounts if you want us to repost / highlight you on our channels.

Our DSBS community membership is steady and we are looking for exciting development opportunities right now... more to come soon.

HOT OFF THE PRESS

Prioritisation of ocean biodiversity data collection to deliver a sustainable ocean

Bridges, A.E.H. & Howell, K.L.

Communications Earth & Environment 6, 473

Fundamental ecological questions about the distribution of ocean life remain unanswered, hindering both the effective management of the ocean, and our comprehension of life on this planet. The benthic and pelagic realms are subject to different methods of study, and to understand where to best focus effort, a thorough understanding of existing information is required, allowing identification of critical knowledge gaps. Open-access data repositories provide a valuable means to identify such gaps; however, these repositories are subject to challenges in separating benthic from pelagic data. Here we demonstrate an automated data pipeline for extracting and separating benthic from pelagic data in open-access repositories. By stratifying data against essential ocean variables in a critical gap analysis, we show that large spatial and taxonomic biases exist in both the benthic and pelagic global datasets, favouring depths shallower than ~100 m, the northern hemisphere, and vertebrate species. The newly compiled, cleaned, and classified dataset is used to identify areas of chronic under sampling and high-priority regions for exploration. We argue that coordinated strategic prioritisation of sampling is needed to support modelling and prediction, enabling us to better manage our oceans and comprehend life on Earth.

Link to article: <https://www.nature.com/articles/s43247-025-02442-7>

Developing and Reframing the LOSC in Changing Circumstances: The Practice of Small Island Developing States on the Consent Regime for Marine Scientific Research

Coelho, L. F.

The International Journal of Marine and Coastal Law, 2025

Abstract: This article examines the State practice of thirty-one small island developing States (SIDS) in implementing

the consent regime for marine scientific research (MSR) under the 1982 United Nations Convention on the Law of the Sea (LOSC) from 2005 to 2020. By analysing domestic legislation and questionnaire responses from government officials, research vessel operators, and research institutes, the study identifies trends in the interpretation of rights and obligations within the MSR consent regime and challenges to its implementation. The findings indicate that the framework remains operational, with SIDS adapting the framework to developments in other areas of international law. The article concludes by offering recommendations to enhance the framework's implementation.

Link to article: <https://doi.org/10.1163/15718085-bja10220>

A first look at xenophyophores (Rhizaria, Foraminifera) in the lower bathyal Bering Sea and abyssal areas adjacent to the Aleutian Trench.

Gooday, A.J., Holzmman, M., Pawlowski, J..

Progress in Oceanography 232, 10341, 2025

Xenophyophores are an abundant component of the megafauna in parts of the equatorial and temperate North Pacific, but few records exist of these giant agglutinated foraminifera in northern North Pacific and adjacent waters. Here, we present a preliminary survey of xenophyophores from the bathyal Bering Sea (~3500 m depth) and at abyssal depths (4294–6555 m) adjacent to the Aleutian Trench, based on collected material, mainly fragments, and seafloor images. The dominant xenophyophore in the Bering Sea is a reticulated form that yielded DNA sequences identical to those obtained from *Syringammina limosa*, a species described from > 2700 km to the west in the Sea of Okhotsk. Also visible in seafloor photographs were various plate-like forms, often with upturned, undulating rims, but also branching plates and other more complicated morphotypes that probably represent distinct species. At stations close to the Aleutian Trench, core and epibenthic sledge samples yielded xenophyophores at seven of the 16 sampling sites. At least eleven morphospecies were recognised among those collected, none of which resembled *S. limosa* or the plate-like Bering Sea forms. Seafloor images revealed 16 fairly distinct domed or plate-like morphotypes three of these are possibly represented among the collected specimens, making a total of around

24 morphotypes or morphospecies. A few images show morphotypes similar to those seen in the Bering Sea. Our results suggests that xenophyophores are as diverse in the northern North Pacific as they are elsewhere in the Pacific Ocean.

Link to article: <https://doi.org/10.1016/j.pocan.2024.103411>.

Integrative taxonomy of new xenophyophores (Rhizaria, Foraminifera) from the abyssal northwest Pacific.

Gooday, A.J., Ishitani, Y., Chen, C., Holzmänn, M., Richirt, J., Seike, K., Yamashita, M., Tsuchiya, M., Nomaki, H.

European Journal of Taxonomy 1004: 144–189, 2025

Xenophyophores dominate the abyssal megafauna across many areas of the Pacific Ocean. These giant agglutinated foraminifera have been studied mainly in the tropics, including within the Clarion-Clipperton Zone (CCZ), from where the majority of recently described taxa have originated. Here, we describe three new species, one of them assigned to a new genus, from an area further north (30–32.5° N) near the Japanese Archipelago. Specimens were collected in pushcores during dives of the manned submersible *Shinkai 6500* and preserved in the cores after removal of fragments for genetic analyses, allowing them to be examined in life position using X-ray micro-computed tomography (μCT). The three species have basically plate-like tests composed largely of mineral grains. Two, both from 32.5° N, are assigned to the genus *Psammmina*. They are closely related to each other and to *P. tenuis* from the western CCZ. In *Psammmina yokosukae* sp. nov., the test comprises curved plates, whereas in *Psammmina contorta* sp. nov., it comprises a confusing array of contorted plates and other poorly defined structures. The third new species, *Laminarena variabilis* gen. et sp. nov., is genetically distinct from the others. In typical specimens from 30° N, the plates are large, curved or sinuous, relatively thin, and marked by a distinct surface pattern of concentric zones, traversed by closely spaced, radial ridges that correspond to internal partitions. A form from 32.5° N is shown to be conspecific with the 30° N specimens based on molecular evidence but is morphologically more complex, comprising elongate bar- and plate-like elements, some with fan-like terminations. A fourth taxon, resembling a bumpy pebble and occupied by bubble-like internal compartments, is described informally. These new taxa enhance our knowledge of Pacific xenophyophores, as well as our understanding of the morphological diversity

of xenophyophores in general.

Link to article: <https://doi.org/10.5852/ejt.2025.1004.2973>.

Xenophyophore associated mitogenomes: genomic investigations of two specimens from the Clarion-Clipperton Zone.

Gastineau R., Mianowicz K., Dabek P., Otis C., Lemieux C., Turmel M., Wawrzyniak-Wydrowska B., Stoyanova V., Krawcewicz A., Wrobel R.J., Abramowski T., Gooday A.J.

Frontiers in Marine Science 12:1582660

Introduction: Xenophyophores are large benthic agglutinated Foraminifera that are a major component of the Clarion-Clipperton Zone megafauna.

Methods: Two xenophyophore specimens were obtained and submitted to genomic investigations.

Results: For both specimens, it was possible to obtain a ca. 25 kb circular xenophyophore-associated mitochondrial genome (XAM) showing similar gene contents with other Retaria, with which they are associated by a maximum likelihood multiprotein phylogeny. One of the specimens yielded a complete cluster of nuclear rRNA genes, the first to be obtained from a xenophyophore. Another full cluster of rRNA, likely belonging to Endomyxa parasites, was found within both specimens.

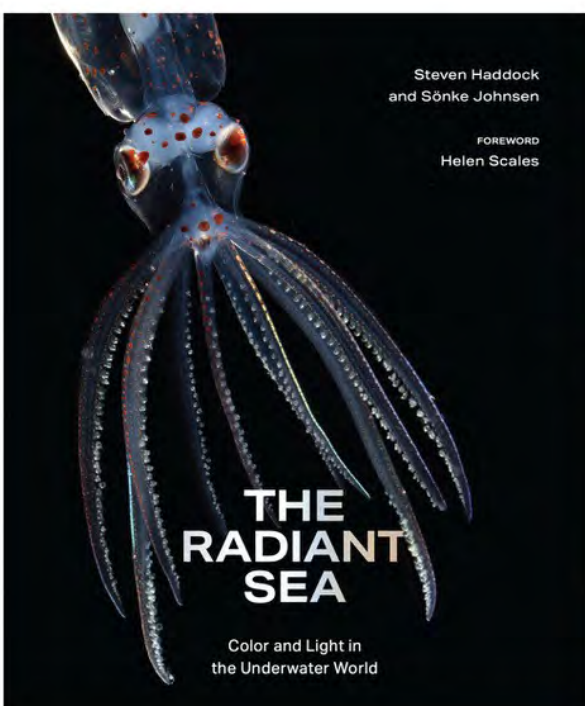
Discussion: Although the agglutinated nature of xenophyophores currently prevents a definitive conclusion, the mitogenomes obtained may represent the first to be obtained from those foraminifera. Deeper enquiries are required in order to properly ascribe these genomes to their host organism and to clarify the nature of the possibly parasitic Rhizaria associated with the xenophyophores.

Link to article: <https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2025.1582660/full>

The Radiant Sea

Haddock, S. & Johnson, S.

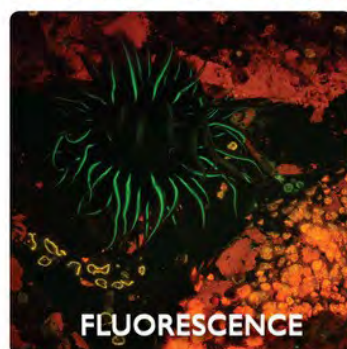
A new “coffee-table” book called *The Radiant Sea* by Steve Haddock and Sönke Johnson is coming out in this autumn. In a series of essays and about 200 photographs, it explores how animals use and interact with light in the



PIGMENTS



BIOLUMINESCENCE



FLUORESCENCE



IRIDESCENCE

ocean. Five subsections show images of Transparency, Pigmentation, Iridescence, Fluorescence, and of course Bioluminescence. Short essays lead off each section by explaining the physics behind the phenomenon, and then there are image galleries showing mostly never-published pictures of live, mostly deep-sea animals. The authors hope that these perspectives can help people appreciate the beauty of the deep, rather than fear its “ugly” and “scary” inhabitants.

The book should be available from your preferred bookseller, many of which are linked from the publisher's page. (Translations for France, Spain, Germany, Italy, Japan, Korea, and China are in the works.)

Out of sight, but not out of mind: Key issues regarding seafloor macrolitter monitoring

Hanke, G., Canals, M., Nakajima, R. *et al.*

Marine Pollution Bulletin, Volume 221, December 2025, 118500

Following a number of meetings devoted to knowledge sharing, identification of key issues, and discussing the best ways to move forward, a wide international expert community is now able to provide recommendations regarding the monitoring of seafloor macrolitter through observation and imaging. As the seafloor constitutes a major sink for marine litter including plastics, it is important to acquire robust and extensive data on litter distribution, abundance, types and size ranges across marine habitats. This should be done through widely agreed, harmonised,

and non-destructive methods encompassing advanced technologies. Training and capacity building are essential elements in this endeavour. Both new and legacy imagery are needed to establish baseline assessments and trends. Informing policy-making is indispensable for effective action through upstream and targeted measures, with seafloor macrolitter (and megalitter) being a vital part of the evidence base for global mitigation measures.

Link to paper: <https://doi.org/10.1016/j.marpolbul.2025.118500>

Across trench and ridge: Description of five new species of the *Haploniscus belyaevi* Birstein, 1963 species complex (Isopoda, Haploniscidae) from the Kuril-Kamchatka Trench region

Knauber, H., Schell, T., Brandt, A. & Riehl, T.

Zoosystematics and Evolution, 101 (2): 813-853

Contact: henry.knauber@senckenberg.de

After the successful delineation of six distinct deep-sea isopod species using integrative taxonomy that form the *Haploniscus belyaevi* Birstein, 1963 (Isopoda: Haploniscidae) species complex (see Knauber *et al.*, 2022), this study features the formal description of these novel taxa. The eponymous *Haploniscus belyaevi* is redescribed

alongside new descriptions of the five closely related species *Haploniscus apaticus* sp. nov., *H. erebus* sp. nov., *H. hades* sp. nov., *H. kerberos* sp. nov., and *H. nyx* sp. nov. Any morphological differences between these species are most prominent in the rostral and pleotelson morphology of the adult males. Alongside light-microscopical drawings, CLSM scans, and 16S and COI barcodes, these species descriptions are complemented by the first genomic data of deep-sea haploniscid isopods. Geometric morphometrics were utilized to further quantify interspecific and intraspecific morphological differences of the pleotelson considering the pronounced sexual dimorphism in haploniscid isopods. The distributional ranges of the *Haploniscus belyaevi*-complex member species are quite distinct from one another and cover a large geographical area, extending from the open Northwest Pacific beyond large-scale geomorphological barriers such as the Kuril-Kamchatka Trench and its adjacent Kuril Island Ridge into the Sea of Okhotsk.

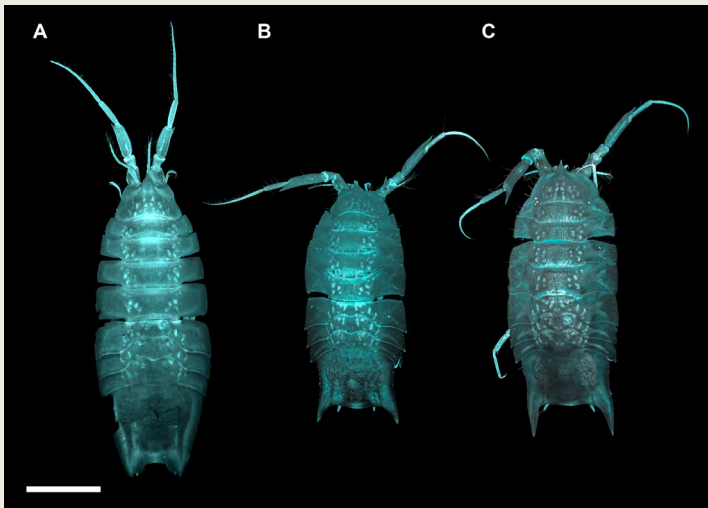


Figure 1: Morphological plasticity of adult males within the *Haploniscus belyaevi* species complex from Knauber et al. (2022). Dorsal habitus CLSM scans of *H. hades* sp. nov. (A), *H. belyaevi* (B), and *H. erebus* sp. nov. (C). Scale bar: 1 mm.

Link to article: <https://doi.org/10.3897/zse.101.137663>

Climate Change Drives Bathymetric Shifts in Taxonomic and Trait Diversity of Deep-Sea Benthic Communities

Rakka, M., Metaxas, A., & Nizinski, M.

Global Change Biology, Volume 31, Issue 8, Aug 2025

Climate-induced changes in environmental gradients can cause shifts in ranges of organisms and community composition, with concomitant effects on ecosystem

functions. Throughout geological time, deeper depths have been highlighted as refugia for biodiversity and ecosystem functions under a warming climate. Although the deep ocean provides several important ecosystem services, contemporary research on climate effects at the community and ecosystem levels has been limited to the upper 200 m of the water column. As a result, our knowledge of climate-induced impacts on the functions of deep-sea ecosystems is scarce. In this study, we examined climate-induced changes in deep-sea communities at a climate-change hotspot, the Gulf of Maine and adjacent continental slope in the Northwest Atlantic. We focused on deep-water coral communities, which are among the most diverse in the deep sea. Using a joint species distribution model, we projected and examined community composition, taxonomic diversity, and trait diversity of deep-water coral communities under two climate scenarios for the end of the century (2100). We found extensive shifts of suitable habitat for several coral genera from 500–1000 to 1500–2000 m, mostly attributed to warming in the upper 1000 m. This led to substantial reduction (30%–60%) in the existing taxonomic and functional richness at the upper continental slope, alongside gains in richness (10%–15%) at the lower continental slope and bathyal zone. Our study is the first to report extensive shifts in biodiversity from mesopelagic to bathyal depths, which will inevitably cause redistribution of ecosystem functions and services. These results showcase that climate change impacts at the ecosystem level are not restricted to shallow depths and highlight that further knowledge of them is essential for efficient conservation, planning, and management.

Link to article: <https://doi.org/10.1111/gcb.70407>

How little we've seen: A visual coverage estimate of the deep seafloor

Bell, K.L.C., Johannes, K.N., Kennedy, B.R.C. & Poulton, S. E.

Science Advances

Despite the importance of visual observation in the ocean, we have imaged a minuscule fraction of the deep seafloor. Sixty-six percent of the entire planet is deep ocean (≥ 200 m), and data show that we have visually observed less than 0.001%, a total area approximately a tenth of the size of Belgium. Data gathered from approximately 44,000 deep-sea dives indicate that we have also seen an incredibly biased sample. The majority of all in situ visual seafloor observations in the dataset were within 200 nm of only three countries: the United States, Japan, and New Zealand. Ninety-seven percent of all dives we compiled have been conducted by just five countries: the United



States, Japan, New Zealand, France, and Germany. This small and biased sample is problematic when attempting to characterize, understand, and manage a global ocean. These findings underscore the urgent need for a more comprehensive and global effort to explore the deep ocean, ensuring that scientific research and conservation efforts accurately reflect the true extent of the seafloor. As noted in the study, if the scientific community were to make all assumptions about terrestrial ecosystems from observations of only 0.001% of that total area, they would be basing their assessments of all land-based life on Earth on an area roughly the size of Houston, Texas. To address these challenges, the researchers call for expanding exploration efforts and utilizing emerging technologies to increase access to the deep ocean. With advancements in smaller, more affordable deep-sea tools, there is an opportunity to broaden the scientific community's reach, including low- and middle-income nations in ocean exploration and research.

Link to article: <https://www.science.org/doi/10.1126/sciadv.adp8602>

New report of the rare *Sciadonus alphacrucis* Melo et al., 2022 (Teleostei, Ophidiiformes, Bythitidae), DNA barcoding, and range extension in the western South Atlantic

dos Reis Júnior, M. R., De Cia Caixeta, H., Oliveira, C.,

Marcelo, Roberto Souto de Melo, R.

Journal of Fish Biology 2024,1-5.

Contact: mandepromarcos@usp.br

Sciadonus alphacrucis Melo, Gomes, Møller & Nielsen, 2022 is a rare deep-sea species, previously known from only two specimens collected off São Paulo State, southeastern Brazil, in the western South Atlantic. Herein, we report a new specimen of *S. alphacrucis* collected on the continental slope off Santa Catarina State, southern Brazil, thereby extending its known distribution by 420 km. Additionally, we provide the new meristic and morphometric data, the molecular identification using sequences of the cytochrome c oxidase subunit I (COI), an updated distribution map, and a discussion of troglomorphic traits.

Link to article: <https://doi.org/10.1111/jfb.15896>

The essential role of large research vessels in marine ecosystem observations and ocean sustainability

Satterthwaite, E.V., Field, J.C., Fassbender, A.J. et al.

Limnology & Oceanography, July 2025

Our understanding of marine ecosystems and ability to manage them sustainably has come from multidisciplinary observations made repeatedly over long periods of time. These long-term ecosystem observations depend on the capabilities of large research vessels, which play an essential role in the collection of global ocean observations. Research vessels serve as large, stable platforms for collecting high volume samples from the surface to the seafloor that provide uniquely valuable in situ marine ecosystem information. Additionally, they serve as mobile laboratories enabling the collection, preservation, processing, and analysis of unique samples and data, such as chemical, biogeochemical, and biological parameters. Given their capacity for, and repeated use in, collecting comprehensive marine ecosystem observations—across geology, physics, chemistry, and biology—large research vessels provide insight into long-term regional ecosystem dynamics. They also act as platforms-of-opportunity for testing, refining, and comparing technologies, enabling innovation and the evolution of the observing system. High-quality observations from large research vessels serve as the backbone for many other components of the global ocean observing system through their use in calibrating autonomous sensors and predictive modeling. Moreover, large research vessels function as mobile, experiential training and exploration platforms that

facilitate discovery, education, and collaboration. An effective, modular marine ecosystem observing system will depend on large research vessels to sustain and augment existing observing programs and to deploy, service, and validate the growing array of autonomous platforms that contribute to it. Achieving this vision will likely require maintaining and upgrading ship-based infrastructure and personnel, integrating emerging technologies, leveraging the unique capabilities of large research vessels in conjunction with other platforms, strengthening collaborative partnerships, and building social capital for marine ecosystem observations through training, knowledge sharing, and effective governance.

Link to article: <https://doi.org/10.1002/lno.70110>

Connectivity and adaptation patterns of the deep-sea ground-forming sponge *Geodia hentscheli* across its entire distribution

Taboada, S., Díez-Vives, C. Turon, M. *et al.*

Molecular Biology and Evolution, Volume 42, Issue 7, July 2025

Contact: sergio.taboada@mncn.csic.es

Little is known about dispersal in deep-sea ecosystems, especially for sponges, which are abundant ecosystem engineers. Understanding patterns of gene flow in deep-sea sponges is essential, especially in areas where rising

pressure from anthropogenic activities makes it difficult to combine management and conservation.

In their recently-published paper, authors Taboada *et al.* (2025) combined population genomics, transcriptomics, metatranscriptomics, microbial analyses and oceanographic modelling to understand how North Atlantic and Arctic populations of the deep-sea sponge *Geodia hentscheli* are connected. The analysis comprised SNPs of 115 individuals collected across the species’s entire distribution, from a wide bathymetric range (few meters to ca. 3.000 m depth). The 1,115 neutral SNPs used identified long-distance genetic connectivity among regions separated 1,000s of km, but strong genetic structure segregating populations by depth at ca. 1,300 m, in line with the microbial analyses. Coalescent analyses inferred the split of these depth-related genetic entities ~10 KYA, coincident with the last postglacial maximum. Analyses of SNPs under selection, combined with transcriptomic and metatranscriptomic data highlighted the presence of several sponge genes and microbial metabolic pathways involved in adaptation to depth, including heat shock proteins and fatty acids. The physiological plasticity of the sponge and its microbiome as a function of depth suggest the existence of a host-microbiome metabolic compensation for *G. hentscheli*. This study provides a multiscale paradigmatic example of the depth-differentiation hypothesis, a phenomenon mainly caused by changes in environmental conditions at different depths, mainly related to the presence of water masses with different characteristics that drive local adaptations.

Link to paper: <https://academic.oup.com/mbe/article/42/7/msaf145/8157728#526641627>



Figure 1. New specimen of male *Sciadonus alphacrucis*, MZUSP (130244), 72.4 mm SL, western South Atlantic, Santa Catarina State, off Florianopolis, 930–950 m depth, 03 Apr. 2022, R/V Alpha Crucis. (a) body in lateral view; (b) a detail of the head in lateral view in detail; (c), a detail of male reproductive apparatus in lateral view. pictures of preserved specimen; (d) known distribution of *Sciadonus alphacrucis* in the western South Atlantic, including type locality (yellow star), and the new record (yellow circle) along the southeast Brazilian coast; (e) heatmap of K2P distances between sequences of *Sciadonus* available on BOLD Systems. Scale bar equals 10 mm.

MEETINGS & WORKSHOPS

A Volcanic Lost World

Proceedings of the Lord Howe Rise and South Tasman Sea Research Symposium May 2025 —
Sydney, Australia

High Seas Alliance, WWF-Australia & Deep-Ocean Stewardship Initiative



Excerpt from the Foreword: The Tasman Sea – connecting Australia and New Zealand, south of New Caledonia – is a wondrous example of how oceans connect cultures, communities, ecosystems, economies and histories. Within the Tasman Sea lie several true biodiversity hotspots, including the South Tasman Sea and associated seamount chains, and the Lord Howe Rise. These areas comprise a volcanic lost world punctuated by towering seamounts, home to a plethora of unique and special species. Nonetheless, no truly comprehensive and contemporary account of these extraordinary places currently exists.



In May 2025, around 70 leaders, scientists, policymakers and advocates came together in Sydney, Australia, to address this gap over two days. This uniquely multidisciplinary initiative explored the ecological, geological, and cultural significance of the Lord Howe Rise and South Tasman Sea, as well as their uses. Collectively, around 30 scientific papers, two discussion panels, a collaborative large-scale mural and many conversations built a rich picture of these areas and took an important step towards identifying

knowledge gaps and conservation opportunities. This Proceedings Report provides a summary of the papers presented at the symposium and the panel discussions within. In doing so, it brings together ecological data, cultural perspectives, and policy insights from eminent scientists and policy specialists from around 10 countries.

Link to Proceedings: [A Volcanic Lost World](#)



3D Photogrammetry in the Deep Sea: A Hands-On Workshop

David M. Price^{1,2} & Loïc Van Audenhaege³

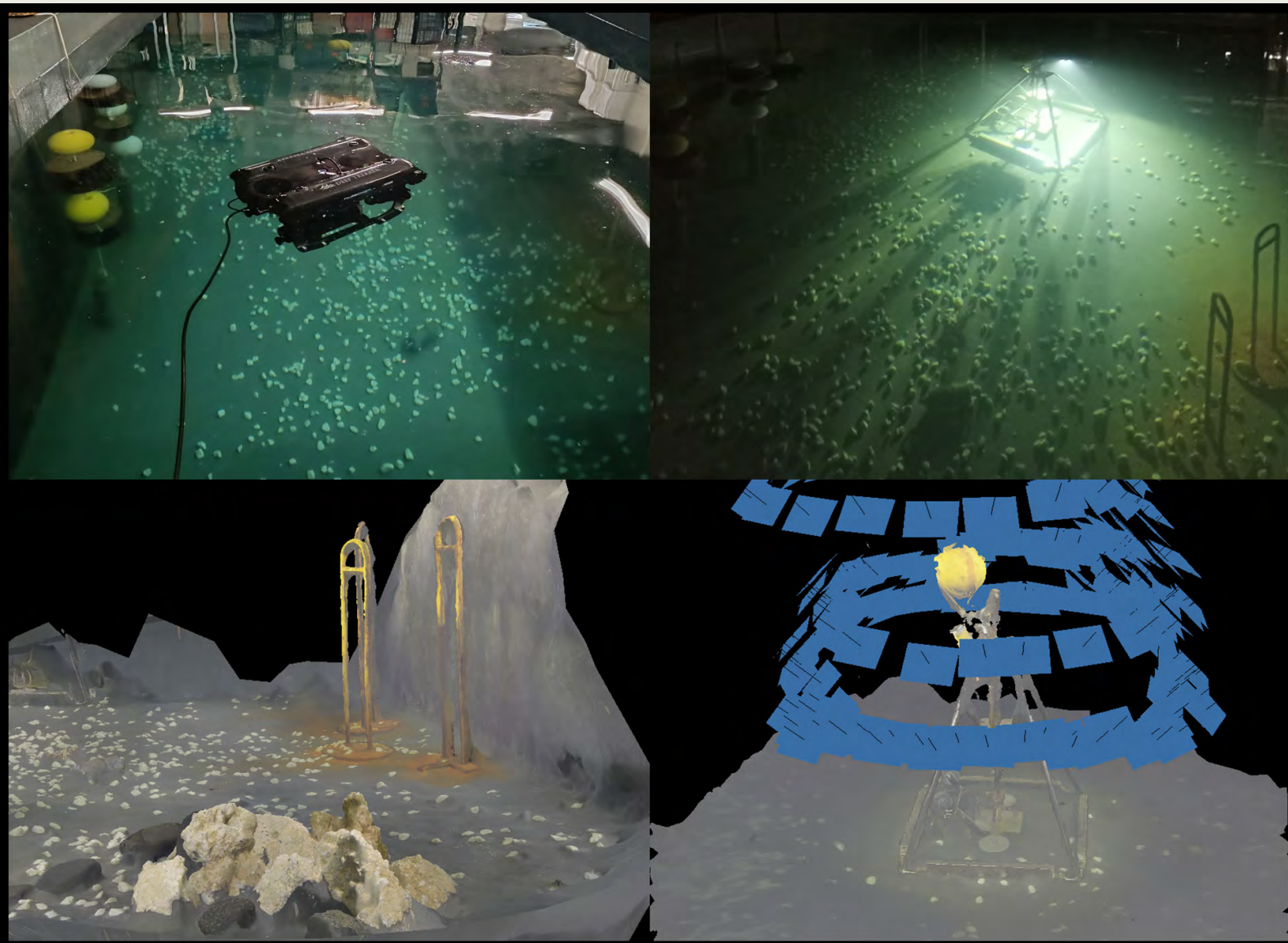
¹Institut de Ciències del Mar, Spain; ²Okeanos, Universidade dos Açores, Portugal; ³National Oceanography Centre, UK

Contact: dmprice@icm.csic.es, loic.van.audenhaege@noc.ac.uk

Structure-from-Motion (SfM) photogrammetry—turning overlapping 2D images into 3D reconstructions—is becoming a mainstream tool in ecology. Widely adopted through drones and coastal surveys, it is increasingly applied to the deep sea, where it offers unprecedented opportunities: generating high-resolution maps, making accurate measurements of organisms, and visualising/quantifying complex habitats that were previously difficult to study.

SfM has already been used in shallow-water environments and more recently cold-water coral reefs, sponge grounds to hydrothermal vents, but the deep sea poses unique challenges. Lighting, navigation, limited fields of view, and unpredictable terrain make it far more complex than surface applications. Protocols exist, but deep-sea researchers often face a steep learning curve when starting from scratch.

To address this, we were invited by Dr. Claudio Lo Iacono (Institut de Ciències del Mar, Barcelona) to develop a new workshop format tailored specifically to deep-sea SfM. Building on earlier workshops that we had created for the marine habitat mapping community (Van Audenhaege *et al.*, 2023), we created a one-day, hands-on course that combined theory, practice, and real ROV-based data collection. The workshop ran on 12 June 2025 at the Institut



de Ciències del Mar, as a pre-conference event for the International Network for submarine Canyon Investigation and Scientific Exchange conference (INCISE). Twenty-eight participants took part in the workshop with varying backgrounds (geology, biology and oceanography).

The workshop was designed around four sessions: Theory & Case Studies; Hands-On Practical: Data Collection; Tutorial and Hands-On: Processing 3D Models; and Analysis Demonstration. This blended a lecture style approach and a hands-on practical. To bring the deep sea into the classroom, we used a Deep-Trekker ROV (courtesy of Prof. Andrea Gori, University of Barcelona) in a large seawater pool. Equipped with lasers and a 4K camera, it simulated real survey conditions. Participants piloted the ROV, designed survey strategies, and collected image data from targets mimicking natural seafloor features. Afterwards this data was disseminated to the participants to build 3D models based on the previous tutorials given.

The ROV performed well and most participants successfully generated high quality 3D models thanks to temporary licenses kindly provided by the photogrammetry software

company Agisoft. The workshop aimed to give participants insight into real-world challenges of collecting data in deep-sea environments and encouraged other deep-sea researchers to adopt this method more widely, which we believe we achieved the best we can from a landside environment. However, if there is an institute willing to lend a research vessel and ROV for the next workshop, we are all ears...

References:

Van Audenhaege, L., Mahamadaly, V., Price, D., Sneessens, A., Cawthra, H., Delamare, C., Danet, V., Delsol, S., Devillers, R., Gazis, I.Z. and Urbina-Barreto, I., 2023. Workshop on 3D mapping of habitats and biological communities with underwater photogrammetry. Research Ideas and Outcomes, 9.

Connecting Science and Policy for the Deep Sea in New York

The Agreement for the conservation and sustainable use of marine biological diversity of areas beyond national

jurisdiction (BBNJ) has just reached the necessary threshold of 60 ratifications and will enter into force on January 17th, 2026. Until then, some outstanding issues remain to be resolved. Over two weeks, between 18th-29th August 2025, negotiators gathered for the second meeting of the Preparatory Commission for the entry into force of the BBNJ Agreement (BBNJ PrepCom 2).

on interactions between BBNJ and Regional Fisheries Management Organisations by Dr. Ina Tessnow-von Wysocki.

DOSI continues to connect science and policy for the deep ocean in the intersessional period and towards the upcoming meeting of the PrepCom in March and following Conference of the Parties meetings.



Figure 1. DOSI delegation at PrepCom2: Aderito Miranda, Beatriz Naranjo Elizondo, Ina Tessnow-von Wysocki, Muriel Rabone, Christine Gaebel, Paul Snelgrove (f.l.t.r)



14 DOSI ambassadors from Institutes across Africa, Central America, Europe, and Oceania closely followed these negotiations that prepared the implementation of the new Ocean Treaty. Working in the fields of marine biology, political science and law, the DOSI ambassador's expertise ranges from understanding species of the deepest parts of the ocean to multilateral policy discussions on regional and global levels. Themes of their research cover deep-sea science and marine genetic resources, Indigenous Knowledge and ocean governance.

Over the two weeks, the DOSI ambassadors most closely followed the discussions on the Clearinghouse mechanism, the Scientific and Technical Body and the relationship to other instruments, frameworks and bodies.

DOSI informed the negotiations with policy briefs on the topics of marine genetic resources and benefit-sharing, as well as on how to engage marine scientists in the BBNJ process and contributed with short video briefs on key points of discussions of PrepCom 2 and on BBNJ interaction with other instruments, frameworks and bodies.

The ambassadors were co-hosts and panellists of side events held over the course of the conference. Their presentations included a panel on the knowledge of Indigenous Peoples and local communities with Alumita Talei Sekinairai and Renee Hill-Lewenilovo and inputs

SCIENTIST PROFILES

Derya Laila Akdogan

MSc Student

Georg-August University Göttingen & Senckenberg Research Institute and Natural History Museum Frankfurt, Germany



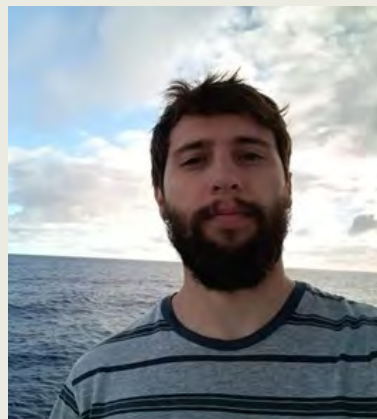
Biodiversity has always been a passion for me, even as a child, it motivated me to pursue a bachelor's degree in biology at the Goethe University in Frankfurt as well as a master's degree focused on biodiversity, ecology, evolution and conservation (BEEC) at the university of Göttingen. Work on my bachelor's thesis at the crustacean section at the Senckenberg Research Institute and Natural History Museum in Frankfurt made me fall in love with marine invertebrates. Describing a new deep-sea isopod species from the family of Nannoniscidea under the supervision of Prof. Dr. Angelika Brandt and Dr. Stefanie Kaiser unlocked a passion for taxonomy in me that made me come back to the institute two years later to dedicate my master's thesis to deep-sea isopods as well. Under the supervision of Dr. Torben Riehl, Prof. Dr. Angelika Brandt and Henry Knauber I am focused on using integrated methods of morphology and molecular biology in order to disentangle the *Haploniscus hydroniscoides* species complex. Occurring between the Japan Trench and the Aleutian Trench, this highly abundant group offers a unique opportunity for deeper insight into the influence of bathymetric factors on speciation, while serving as an important step in reworking the genus.

I am highly interested in biodiversity and taxonomy (especially crustacean), the combination of classic taxonomy with molecular methods and quantitative approaches such as geometric morphometrics fascinates me. I am always on the lookout for PhD opportunities that would allow me to keep researching in these fields.

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Lucas Gavazzoni

Universidade do Vale do Itajaí (Itajaí, Santa Catarina, Brasil)



Lucas Gavazzoni is an oceanographer with a master's degree in Science and Environmental Technology from the University of Vale do Itajaí (UNIVALI). He is currently a researcher at the Laboratory of Applied Marine Studies (LEMA – lema.acad.univali.br), working

under the supervision of Dr. Jose Angel Alvarez Perez. His research focuses on deep-sea ecosystems, with particular emphasis on deepwater shrimp fisheries (*Aristeidae*) along the Brazilian continental slope.

He investigates habitat distribution in relation to seafloor geomorphology and oceanographic dynamics, as well as the impacts of bottom trawling on deep-sea environments. His work integrates Lagrangian modeling of sediment plumes, spatial analyses linking trawl scars to fishing activity, and estimates of sedimentary organic carbon release caused by seabed disturbance from artisanal and industrial fisheries in southern and southeastern Brazil.

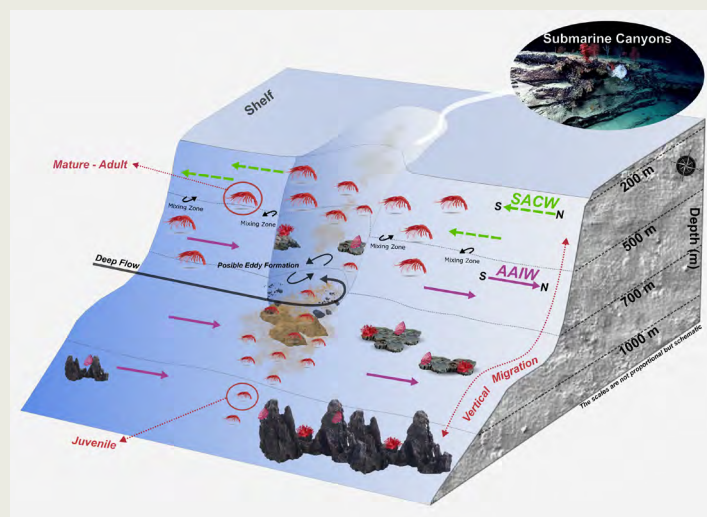


Figure 1. Towed Oceanographic Sled and Video Frame Capture

Lucas also contributes to the development of seafloor imaging technologies, including a towed oceanographic sled designed to capture video across continental shelf habitats. More recently, his work has focused on how benthic species patterns are shaped by geomorphological and oceanographic features, combining high-resolution

mapping, seascape metrics, and in situ physical data (CTD/LADCP) to examine the interactions between geomorphology, deepwater currents, and water masses in structuring habitats on slope environments, with particular emphasis on terraces and submarine canyons.



Figure 2. Conceptual framework of the deep-sea ecology of the scarlet shrimp (*Aristaeopsis edwardsiana*) in submarine canyons of the Brazilian continental slope.

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Researchgate: researchgate.net/profile/Lucas-Gavazzoni

Liang Wu, Ph.D.

Cornell University

Liang Wu, Ph.D. is a Postdoctoral Associate at Cornell University, an interdisciplinary and engaged scholar of social oceanography, blue humanities, maritime economy, and marine policy. He is a former Visiting Assistant Professor at Bates College where he initiated courses, activities, and events for advancing ocean literacy and engagement in Maine in the U.S. He is also a former Marine Policy and Science Communication Specialist at the U.S. National Oceanic and Atmospheric Administration (NOAA) Ocean Exploration where he served as the first international social scientist to sail on *Okeanos Explorer* for a deep sea expedition, and prolifically generated public-facing deliverables on topics ranging from marine archaeology to microbiology, coral habitat, biomedicine, robotics, autonomous systems, and fiscal policy. Wu thus supported federal efforts of sea expeditions and science communication, and also grant administration and multistakeholder engagement to fulfill national and international policy goals.

At Cornell, Wu is affiliated with the Department of

Science and Technology Studies, Mario Einaudi Center for International Studies, and the interdepartmental consortium Cornell Oceans of ocean researchers and scholars who collectively study the totality of the sea, including its ecology, biogeochemistry, technology, and policy. Building on his doctoral dissertation that explores the social and environmental dimensions of shipping containerization, Wu's postdoctoral research examines the deep decarbonization of short-sea and deep-sea shipping that involves the developments of alternative fuels, digital technologies, and green corridors as part of the "4th Propulsion Revolution" and the United Nations Ocean Decade. Wu is looking at the socio-environmental politics and dynamics of such endeavors onboard and overseas, and above and below water, bridging natural and social sciences, and academia, industry, society, and policy.

Wu looks forward to furthering communications and collaborations within and across disciplines and sectors, for he believes in the power and necessity of holistic and comprehensive actions and solutions in tackling issues as complex and multifaceted as climate change, energy transition, technological innovation, and oceanic future.



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Charles Lucas Makio

PhD Researcher

Atlantic Technological University (ATU), Ireland

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LinkedIn profile: <https://www.linkedin.com/in/charles-lucas-makio-682979131/>

I am a Kenyan marine biogeochemist and PhD researcher at Atlantic Technological University, Ireland. My work focuses



on understanding sedimentary carbon fluxes in Ireland's bays and estuaries—natural blue carbon sinks that play a critical role in mitigating climate change. Through geochemical analysis and disturbance modelling, I explore how storms and bottom trawling affect

carbon storage and the health of benthic ecosystems.

A central aim of my research is to bridge the gap between science, policy, and conservation action. I study how seabed carbon stocks are disturbed by human activities such as bottom trawling and dredging and advocate for their inclusion in climate policy frameworks. This research has direct relevance to Ireland's Marine Protected Area strategies and climate mitigation goals and is grounded in a transdisciplinary approach—combining fieldwork, modelling, and stakeholder interviews as well as potential for application in other similar settings.

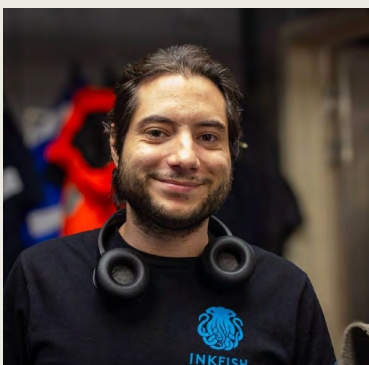
Beyond carbon dynamics, I am also involved in assessing invasive species impacts (e.g. *Magallana gigas* in Lough Swilly), fisheries management, and ecological restoration. I believe in making marine science accessible and applicable to communities, with experience in participatory monitoring projects and low-cost field methods (e.g. drop-cam deployments).

I'm particularly passionate about mentoring African marine researchers and building global collaborations that centre equity and ocean sustainability.

Alfredo Marchio'

Minderoo-UWA Deep Sea Research Centre, School of Biological Sciences and the Ocean Institute, University of Western Australia

Alfredo Marchio' is a Ph.D. candidate at the Minderoo-UWA Deep Sea Research Centre, at the University of Western Australia, based in Perth. Starting his academic education in Pisa and Genoa, he completed an internship at the Ionian University in Greece, before moving to Australia for his doctorate. His project



focuses on abyssal habitats, particularly the effect of ecosystem engineers on abyssal communities, with a special interest in glass sponges. He's analyzing biodiversity patterns at different increasing scales, from a single dive to comparing different oceans. He's also interested in how different sponge morphologies can be found in different environments, and how those morphologies can influence associated fauna.

Contact: alfredo.marchio@research.uwa.edu.au

Dr. Ranju Radhakrishnan

ISA-IFREMER Post-Doctoral Fellow, Bretagne, France

Contact: ranju.radhakrishnan@ifremer.fr, write2ranjur@gmail.com

I am deeply passionate about exploring the hidden diversity of the oceans, with a special focus on the taxonomy, systematics, biodiversity, and biogeography of benthic foraminifera. For more than a decade, my research has taken me from the coastal waters of India to the deep abyssal plains of the Pacific, where I seek to understand how these tiny but vital organisms reveal the health, history, and future of marine ecosystems. After completing my Ph.D. in Marine Biology at Cochin University of Science and Technology in India, I am now a Postdoctoral Fellow at Ifremer, France, studying the diversity and biogeographic patterns of foraminiferal assemblages from the Clarion Clipperton Zone. My work, supported by prestigious fellowships, has resulted in peer-reviewed publications, international presentations, and opportunities to mentor the next generation of marine scientists. I am eager to continue this journey and contribute to global efforts in advancing foraminiferal research and deep-sea biodiversity conservation.

Key Expertise and Research Interests:

- Passion for uncovering the biodiversity and biogeography of benthic foraminifera across coastal and deep-sea ecosystems
- Extensive experience in taxonomy, systematics, and species-level identification, including the description of new species
- Research on the ecological role of foraminifera as indicators of environmental change and human impacts on marine life
- Strong involvement in international collaborations and scientific forums on deep-sea taxonomy and conservation
- Dedicated to mentoring and training young researchers in foraminiferal taxonomy and marine biodiversity

studies

- Committed to using science to bridge knowledge and conservation, especially in the context of global climate change and deep-sea resource management

Vaishak G S, Kasaragod

Kerala, India-671121

Contact: vaishakgs68@gmail.com | +91 6282765406 |
LinkedIn: Vaishak G S



Vaishak G S is a marine scientist and data analyst with a Master’s degree in Marine Geology from Mangalore University, India. His work spans ocean science, environmental monitoring, and renewable energy systems, with a focus on integrating satellite remote sensing, geospatial analysis, and field-derived datasets to

better understand climate impacts on marine and coastal environments.

Currently a Data Analyst at Zeitview, Vaishak specialises in assessing the operational performance and environmental impacts of offshore and onshore wind turbines, as well as solar panel systems. This involves fault analysis, large-scale dataset optimisation, and workflow automation - skills that have sharpened his ability to connect environmental conditions with engineering performance in renewable energy infrastructure.

In addition to his professional work, Vaishak has developed interactive WebGIS platforms to visualise coral bleaching events in the Indian Ocean, incorporating parameters such as SST climatology, bleaching HotSpots, and Degree Heating Weeks from satellite imagery. This work, which leverages NetCDF datasets, Apache Tomcat servers, and Leaflet JS mapping tools, underscores his technical ability to translate complex climate data into accessible decision-support tools.

Vaishak’s research interests sit at the intersection of ocean-atmosphere processes, climate change impacts, and technological solutions for environmental resilience. He is particularly passionate about deep-sea stewardship and sees the deep ocean as an essential frontier for understanding Earth’s climate system and safeguarding marine biodiversity. Participation in global networks such

as the Deep-Ocean Stewardship Initiative (DOSI) offers him the opportunity to contribute to collaborative science-policy dialogues while staying engaged with cutting-edge deep-sea research.

With strong skills in Python, JavaScript, HTML, CSS, and satellite data processing, and a deep enthusiasm for climate-ocean interactions, Vaishak aims to advance research that bridges science, technology, and sustainable ocean management. His goal is to continue contributing to interdisciplinary efforts that integrate big data, AI, and field observations to support climate adaptation and informed stewardship of the world’s oceans - from shallow reefs to the most remote deep-sea habitats.

OPPORTUNITIES

COBRA Early Career Accelerator Awards

COBRA
CRUSTAL OCEAN BIOSPHERE
RESEARCH ACCELERATOR

COBRA are continuing to accept applications for their small accelerator awards to accelerate the training of early career participants. These

funds can be used for any type of training activity, and are expected to establish direct linkages among individuals to result in a more well-connected community and the development of future COBRA researchers and leaders. Note: Funding selection may take up to 3 months following submission, so plan to apply at least 4 months prior to beginning your proposed activity. COBRA are accepting applications through March 2026 for activities to be completed by June 2026. Apply now



rely on members of the ocean science and technology communities to recommend exploration priorities, share knowledge during ship-to-shore science conversations, and add annotations to video data. If you haven't participated in those processes before, you can learn more about them on our website.

Expert input will be especially valuable for next year's expeditions due to their key role in the *Beyond the Blue: Illuminating the Pacific* campaign. This multi-year, multi-platform and collaborative campaign is focused on raising collective knowledge and understanding of United States and international waters in the Pacific Islands region, which has been identified as a priority for exploration and characterization. Submitting recommendations is a great way to support the campaign while potentially advancing your own scientific goals in the areas to be explored.

In 2026, NOAA Ocean Exploration is proposing operational areas near the Hawaiian Islands, Jarvis Island, American Samoa, and the Cook Islands**. Specific expedition paths will be chosen within these broad regions using data collected from our Call for Input, regional gap analyses, and priorities established by local communities. If you are interested in recommending areas for acoustic mapping or exploration operations, please review our proposed operational areas and provide your recommendations through NOAA Ocean Exploration's Survey123 Call for Input form. For help developing and submitting your recommendations, review the instructions for using Survey123 as well as *Okeanos Explorer's* operational capabilities (pdf, 8.11 MB). **The deadline for recommendations is October 15, 2025.**

If your request contains sensitive underwater cultural heritage data or information, please email it directly to archaeology.oceanexploration@noaa.gov.

Share Your Input: 2026 *Okeanos Explorer* Expeditions

NOAA Ship Okeanos Explorer docked at the NOAA Daniel K. Inouye Regional Center on Oahu's Ford Island in June 2024. Image courtesy of NOAA Ocean Exploration.

NOAA Ocean Exploration is planning a busy expedition schedule for 2026, and we're excited for the scientific community to participate. As part of our community-driven exploration model, we invite experts to view our proposed operational areas* for NOAA Ship *Okeanos Explorer* next year and to submit recommendations for **acoustic mapping targets and ROV dive sites in the Pacific Islands region.**

Widespread participation has always been critical to the success of NOAA Ocean Exploration's work: We

Please note that submission does not guarantee that NOAA Ocean Exploration will be able to act on your recommendations. Recommendations will be distributed across the expedition schedule and will be refined during collaborative planning conference calls. NOAA Ocean Exploration also encourages anyone who submits recommendations to join expeditions of interest as a member of the shore-based science team.

If you need help with your submission, please contact Logan Kline (logan.kline@noaa.gov). If you wish to further discuss science interests, please contact *Beyond the Blue* Executive Secretary Gretchen Spencer (gretchen.spencer@noaa.gov).

* All proposed operational areas for 2026 are notional and are subject to change.

** Any proposed expeditions in areas under foreign State jurisdiction will be coordinated, as necessary, through the U.S. Department of State.

Job Opportunity: IUCN World Commission on Protected Areas



We are pleased to announce the call for applications for the Executive Officer of the IUCN World Commission on Protected Areas (WCPA). This is a unique paid opportunity to contribute to advancing the Commission's global mandate and support the Chair's Office in

coordinating WCPA's diverse programs, partnerships, and initiatives. The position is remote and global in scope. The job posting is open to both WCPA members and non-members, and we warmly encourage you to share this opportunity widely within your professional networks. For application instructions, including the role description and requirements, please see the Call for Applications here. Applications will be accepted until **September 30, 2025**.

Related files: https://portals.iucn.org/uapp100/web/sites/commissions/files/massmailing/attachment/IUCN_WCPA_Executive_Officer_Call_for_Applications.docx.pdf

The Deep- Sea Podcast; a Punk Take on a Science Podcast, wants to hear from you!

Are you a researcher specialising in the deep ocean? Do you have some fascinating research that you would like to share with the world?



The Deep-Sea Podcast is always seeking fun and informative guests who want to share their expertise about anything related to the deep sea.

Apply to join Prof. Alan Jamieson and Dr. Thomas Linley on their fun and engaging monthly show, it's a little silly, a lot interesting,

and 100% deep sea. Featuring topics as wide-ranging as Nutrient Cycling in the deep ocean, Mythbusting Hoaxes, Deep-Diving Beaked Whales, Addressing Eco-anxiety, and so much more. This Renaissance podcast has something for every deep-ocean enthusiast.

Our audience is mostly early-career scientists and students, but also includes artists, later-in-life learners and the generally interested. We are rated in the top 30 Marine Biology podcasts from 2023 onwards and are in the top 2% of global podcasts, regularly charting in the life sciences category.

We would love to hear about your deep-sea research, whether that involves leaving a short one-minute message on our answerphone, or applying for the entire hour interview. Drop us a line and let us know what you are up to!

You can apply for the show here <https://tinyurl.com/ynuc39pk> or visit our answerphone at www.speakpipe.com/deepseapodvoicemail and record a message - we can't wait to hear from you!

Find out more information at www.deepseapod.com

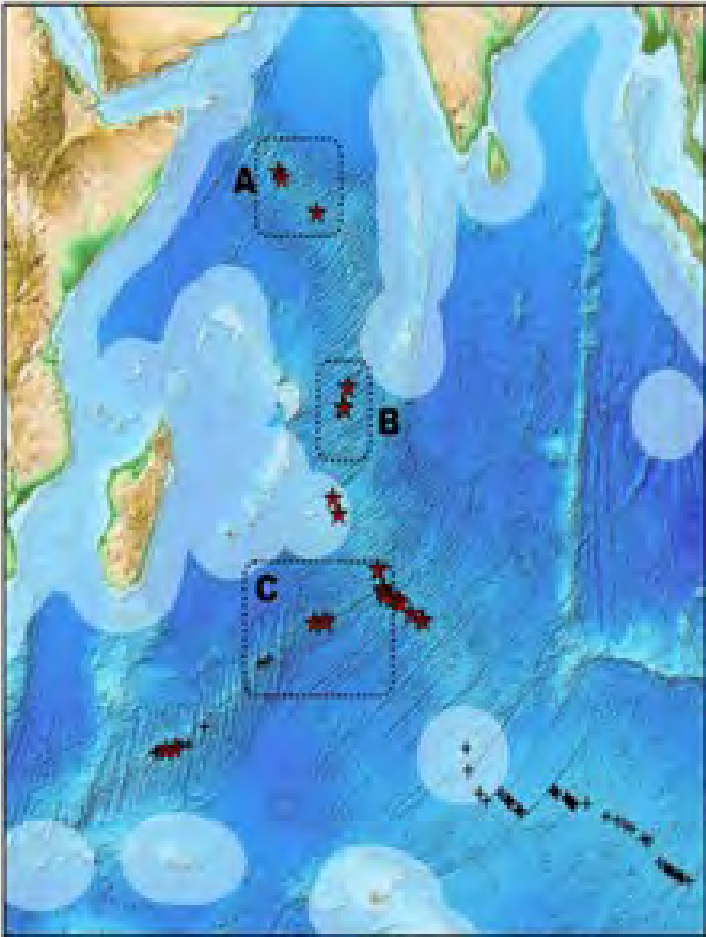


Call for Expression of Interest



Digital DEPTH

Digital DEPTH will organize its second international cruise in late 2026, targeting the Indian Ocean Ridge and nearby areas, with primary foci of 1) characterizing biodiversity hotspots which have great ecological importance within the study area, such as seamount, plateau, and/or others; 2) characterizing and digitalizing one or two vent ecosystems of most interest, such as Old City, Daxi, Onnuri, Kairei and others; 3) studying population connectivity of dominant vent organisms and other fauna.



Tentative Cruise Time: October to December, 2026

Duration of Cruise Time: 50-55 days

Tentative Port: TBD

R/V: Shen-Hai-Yi-Hao + Jiaolong HoV

Number of overseas scientists on board: around 10

The cruise will be sponsored by China Deep Ocean Affairs Administration (leading institution of Digital DEPTH).

Whoever is interested in participating in this upcoming

cruise, please send his/her EOI to the Director of the Digital DEPTH Center of International Cooperation at Hong Kong University of Science and Technology, Professor Pei-Yuan Qian at boqianpy@ust.hk by Oct 31, 2025.

The EOI shall briefly state 1) key scientific questions, 2) personal objectives for attending the cruise, 3) expected deliverables, 4) equipment required for achieving personal objectives, 5) supports already secured, and 6) supports required from Digital DEPTH program.

Apply for 2025 POGO Shipboard Training Fellowship Opportunities



The NF-POGO Shipboard Training Programme offers early-career researchers from developing nations the opportunity to train aboard research vessels between May and December 2025. Fellows gain hands-on experience in oceanographic data collection, instrumentation, and seagoing science. Applications are accepted in advance to match candidates with short-notice opportunities. Open to postgraduate students, technicians, and postdocs interested in contributing to global ocean observation. Apply Here: 2025 NF-POGO Open Call for Shipboard Training Fellowships - Ocean Training Partnership

Deadline: December 2025 (rolling)

WANTED

WANTED: Signatures on an open letter calling for urgent protection of deep-sea ecosystems from destructive fishing practices

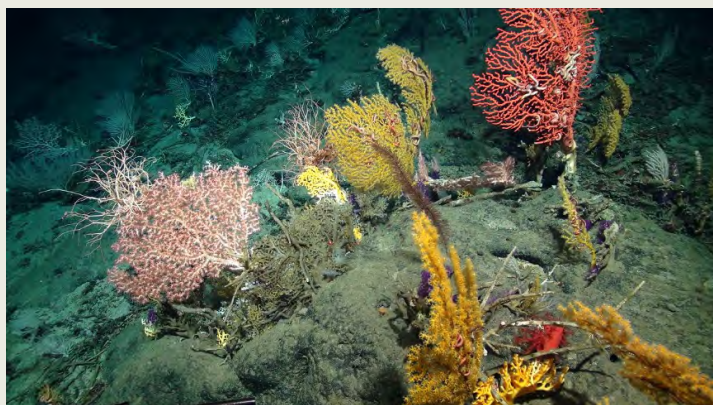


Figure 1. JC094/ ROV ISIS Cold-water coral garden at Annan Seamount in the Equatorial Atlantic.

A new open letter is mobilizing the global scientific community to ensure governments deliver on their promises to protect deep-sea biodiversity after nearly 20 years of delay.

In 2006, the United Nations General Assembly (UNGA) adopted Resolution 61/105, committing nations to “protect VMEs, including seamounts, hydrothermal vents and cold-water corals from destructive fishing practices”. Two decades later, implementation remains incomplete while scientific understanding on the importance of seamounts has rapidly advanced.

Seamounts are now recognized as biodiversity hotspots, home to ancient, slow-growing corals and sponges, nurseries for commercially important fish, and migratory-way stations for sharks, marine mammals, and turtles. Yet destructive fishing practices, still permitted by a handful of States, continue to devastate these fragile habitats.

In 2004, over 1,400 scientists from 69 countries signed a global statement urging governments to protect deep-sea biodiversity from destructive fishing, which led to the existing UNGA resolutions. Today, we are building on that legacy. Our aim is to exceed that number of signatories ahead of the 2026 UN General Assembly’s review of whether its resolutions are being implemented to manage deep water fisheries on the high seas. This will send a powerful, united message grounded in the best available science urging governments to act without delay.

This open letter from scientists to the UN is calling on States to take immediate action to fully implement UNGA Resolution 61/105 and subsequent commitments and as such, halt destructive bottom-contact fishing on seamounts and all VMEs.



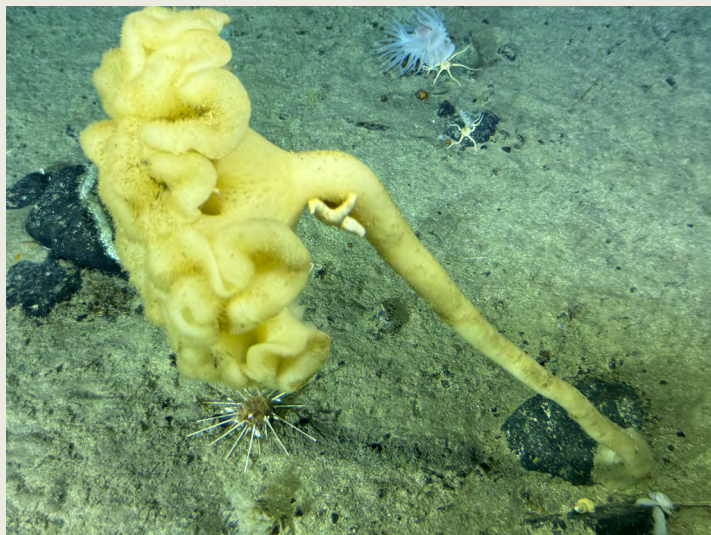
By signing, you will join researchers around the world in sending a united message: the time to act is now.

Scan the QR code or visit to sign: <https://stateoftheocean.org/seamountsproclamation/>

The letter has been coordinated by the Deep Sea Conservation Coalition Global Seamounts Campaign and Marine Conservation Institute

WANTED: Hexactinellids samples and information

I am seeking your collaboration for my Ph.D. project focusing on deep-sea hexactinellids. As a Ph.D. student specializing in abyssal ecosystems at the Minderoo-UWA



Deep-Sea Research Centre, I am particularly interested in specimens and data from the Pacific Ocean, if possible from areas outside the Clarion-Clipperton Zone (CCZ).

Figure 1. A glass sponge belonging to the order Lyssacinosa (likely *Caulophacus*) was observed during a submersible dive near the South Shetland Trench, at a depth of 2800 m. The specimen, nearly one meter in height with a main body diameter of approximately 30 cm, hosted an unidentified sea star that climbed its stalk.

I am looking for:

Samples: If you have preserved specimens of unidentified deep-sea glass sponges from your expeditions, I would greatly appreciate the opportunity to carry out taxonomic identification of them. These specimens will be handled with the utmost care, and I am open to discussing any conditions or requirements for their use.

Information: Any data, observations, or pictures you can share regarding these organisms: depth, coordinates, ID, environmental parameters, morphologies, and presence of epibionts/associated fauna.

Please contact me at alfredo.marchio@research.uwa.edu.au. Your contributions will greatly enhance the impact and the quality of Ph.D. project. I am excited about the potential for collaborative research, and I am open to discussing possible collaborations to increase the current knowledge of abyssal communities.

OPINIONS

A Living Framework for a Lasting Deep-Ocean Community

Titus Cañete¹, Olusola Adeoye², Pavanee Annasawmy³, Narissa Bax⁴, María Emilia Bravo⁵, Amelia Bridges⁶, Sergio Cambronero-Solano⁷, Laura Cimoli⁸, Paige Maroni⁹, Kirsty McQuaid¹⁰, Breanna Motsenbocker¹¹, Sheena Talma^{12,13}, Yosmina Tapilatu^{14,15}

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Introduction

The deep ocean is often described as Earth's final frontier: vast, largely unexplored, and filled with mysteries that spark scientific curiosity and fuel imagination. As well as the technologies and data we collect, deep-ocean science relies on the "ecosystem of people" that drives it: the scientists, policymakers, innovators, managers, communicators, and communities.

The Deep Ocean Observing Strategy (DOOS) Deep Ocean Early-career Researchers (DOERs) first leadership summit asked a simple but challenging question: What makes a deep-ocean community impactful, and how can we build it? Through collaborative reflection and open discussion, a Community Framework was created, based on the principles of Safe Spaces, Strategy, and Authentic Leadership.

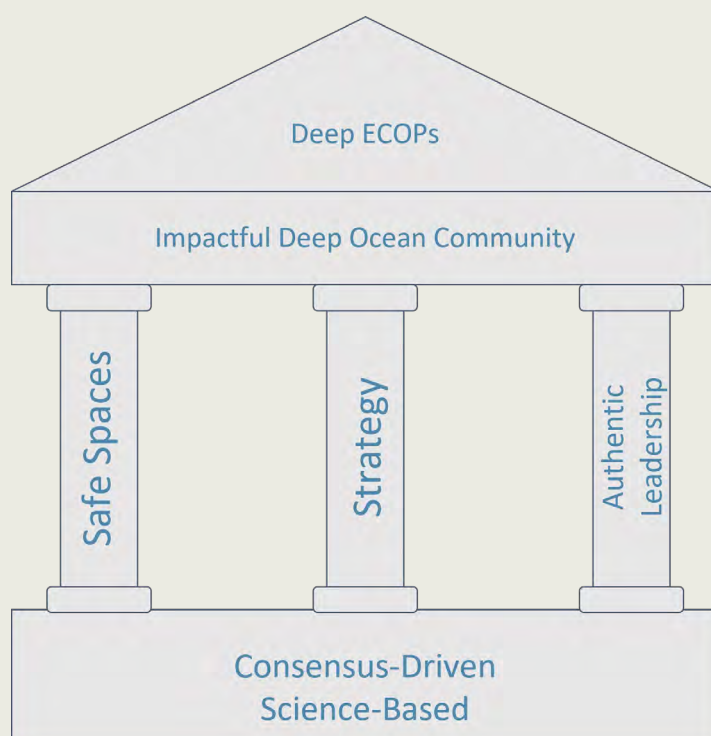


Figure 1. The DOOS Community Framework: Three pillars, Safe Spaces, Strategy, and Authentic Leadership, supporting an impactful deep-ocean community, built on a foundation of consensus-driven, science-based collaboration and elevating Deep ECOPs (Early-Career Ocean Professionals).

The Foundation: Consensus-Driven, Science-Based

An effective deep-ocean community relies on a consensus-driven, science-based foundation. Statistical evidence, traditional knowledge, and expert opinion must guide us. The social system in which knowledge is constructed affects its accessibility, quality, and extent, as does the effective use of scientific tools and approaches. Trust, respect, and agreement across disciplines, cultures, and geographies strengthen this. Without this solid base, safe spaces drift, strategies lose direction, and leadership weakens.

Pillar 1: Safe Spaces

Deep ocean life thrives due to unique conditions, and the same is true for our community. Safe spaces mean inclusion over gatekeeping and psychologically safe, respectful environments where everyone can speak up, learn, and contribute, regardless of career stage, region, or discipline. This improves open dialogue and equitable participation (Edmondson, 1999; Woolley *et al.*, 2010; Frazier *et al.*, 2017) and builds collaborative teams with diverse perspectives that produce more novel, high-impact work (Uzzi *et al.*, 2013; National Research Council, 2015).

Leadership within safe spaces supports emerging voices from historically under-represented regions, disciplines, and peoples to challenge longstanding unspoken hierarchies that often limit participation. Subsequent open dialogue leads to more productive environments, innovative solutions, and efficient problem-solving. In practice, this could mean rethinking where and how meetings are run and who is invited (e.g., virtual/hybrid access and captioning) to broaden geography, gender, and career-stage participation (Skiles *et al.*, 2022), ensuring equitable and safe field opportunities (e.g., Clancy *et al.*, 2014; Amon *et al.*, 2022), and creating structured mentorship pathways with clear codes of conduct (Cazé *et al.*, 2023).

Pillar 2: Strategy (Not Just Plans)

Strategies, often defined in business terms, are an integrative set of choices that shape how an organisation operates and achieves its goals (Martin, 2022). A plan, by contrast, is a list of activities (what, when, and who does what) that may be intended to pursue a goal but lacks a unifying logic for how to actually achieve that goal. Focusing on strategy ensures that logic efficiently and effectively guides actions and allows for adaptation as conditions change.

An individual's or project's strategy can be nested within a global strategy without being mutually exclusive. The vision of a global community (e.g., championing science to inform sustainable management) is linked to large research program-level goals (e.g., filling key global data gaps, Levin *et al.*, 2019), project outcomes (e.g., collecting baseline data in a specific region), and individual career goals. Importantly, an inclusive strategy is a resilient one: if people feel that their priorities are aligned within the strategy, they are more likely to stay engaged and keep working towards a shared vision, and progress accelerates.

Pillar 3: Authentic leadership

Authentic leadership focuses on values in action. "*Living into our values means that we do more than profess our values, we practice them*" (Brown, 2018). Authentic leaders embrace their own strengths and create environments where others can thrive. We often think of a leader as an authoritative person who makes every decision, but there are other, sometimes more effective, styles based on kindness, empathy, and inclusion. Leading effectively and authentically means leaning into one's core values, putting purpose over position, and serving the community over elevating one's status.

An Impactful Deep Ocean Community

Within this framework, the strong science foundation and pillars support a trusting, collaborative community where challenges are shared and turned into opportunities

for creativity, growth, innovation, and impact (Smith *et al.*, 2022). This community promotes exploration and discovery while removing barriers to bring together the best ideas from around the world. As an interconnected network of people committed to the sustainable future of the ocean's greatest depths, this Community Framework invites us to rethink how we interact.

Community Feedback

The Community Framework was presented and discussed at the DOOS Annual Meeting (May 27–29, 2025). Attendees affirmed its value and requested clearer application pathways in real projects and careers. Concrete leadership opportunities for ECRs, clear processes and guidelines with feedback for equitable behaviour, avoiding "parachute science", knowledge inclusivity, and co-creating science with technicians/engineers were identified as key implementation mechanisms along with grants for multi-year positions, deployments, and maintenance.

Discussion also focused on adding meaning to the framework by applying it to diverse metaphors to span multiple worldviews. For instance, replacing the pillars with streams, currents, or braided ropes, which, when brought together, would strengthen the community.

Acknowledgements

This collective work was developed during the DOERs (Deep Ocean Early-career Researchers) Leadership Summit, held from 6-9 May 2025 at the Woods Hole Oceanographic Institution in Massachusetts, USA. The Summit was convened by Leslie Smith (Deep Ocean Observing Strategy) and Marisa A. Rinkus (Toolbox Dialogue Initiative Center, Michigan State University) and made possible through the generous support of the Schmidt Ocean Coalition. Additional support from the Crustal Ocean Biosphere Research Accelerator (COBRA) helped make participation possible for one of the contributors by providing travel support. DOOS and COBRA both receive funding from the US National Science Foundation. We are deeply grateful for this generosity, which not only enabled the gathering but also fostered an environment where ideas could be shared openly, leadership skills could be nurtured, and lasting connections could be built. We hope that this work inspires others to create similar spaces that grow and sustain communities committed to stewarding the deep ocean.

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OBITUARIES

Andrew (Drew) Galbraith Carey, Jr.

May 2025



Drew grew up outside of Baltimore on an equestrian farm and happily spent summers on Bridge Street in Chatham running about with his sister and cousins. He attended the Gilman School and then Millbrook for his high school years. He was a Biology major at Princeton (1951-55) and received a PhD in Zoology-Marine Ecology from Yale (1956-61). He spent much time in Chatham over the years which influenced his career in Oceanography. After graduate school, Drew accepted a professorial position at Oregon State University, Corvallis, Oregon and taught there from 1961-1987. He published 40 papers on his research, specializing in Ecology of Invertebrate Animal Communities and the Continental Shelf to Abyssal Plains in the NE Pacific and Arctic Oceans. Drew taught graduate school and led many research expeditions to the Arctic. He also studied seeps off of the Oregon Coast, using a naval research submersible.

Full obituary: <https://tinyurl.com/AndrewGalbraithCareyJrObit>