Deep-Sea Life

Issue 21, August 2023

Time for tools down, feet up - Deep-Sea Life Issue 21 is here! This issue is once again filled with news from our deep-sea colleagues and their work which takes us on journeys of exploration around the globe. Research expeditions include the study the methane seeps off Southern California, multiple investigations in the Gulf of Mexico, the NE Pacific seamounts, the northern Mid-Atlantic Ridge vents and remote Pacific Island seamounts. Enjoy reading about deep-sea projects including on the Ocean Twilight Zone, Coral restoration in the Gulf of Mexico and the new Ocean Census and KASEAOPE projects. Read the latest news on the High-Seas Treaty and learn about Ecocide law and the ocean and enjoy the beautiful story and poetry provided by our colleagues in the It's Your Opinion section. Get involved with the opportunities and wanted sections too and reach out to your colleagues who have inspired you in this issue – make new connections! And of course, the Deep-Sea Biology Society News patiently awaits your attention at the end!

This photo of the issue was selected from a submission from our Mexican colleagues and illustrates the critical importance and beauty of deep-sea science teamwork – in this case in the Gulf of Mexico where the Universidad Nacional Autónoma de México sponsors the enhancement of deep-ocean science capacity development in the region. Check out their Cruise News article on page 3.

Fig. 3. The cruise party (image credit Omar Venegas)

Thanks as always to the dedicated DSL editorial team – Drs. Abigail Pattenden (University of Limerick, Ireland), Eva Ramirez-Llodra (REV Ocean, Norway), Franck Lejzerowicz - University of Oslo and Michelle Taylor - University of Essex, UK. Although Bhavani Narayanaswamy (SAMS, Oban) couldn't be with our team for DSL21, we are looking forward to her returning for DSL22 ♥

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A DOSI and DSBS collaborative publication. (Please note: DOSI & DSBS do not necessarily endorse the views presented in the submissions herein)

DOSI DEEP-OCEAN STEWARDSHIP INITIATIVE

DEEP-SEA BIOLOGY SOCIETY

Issue Contents

Cruise News

Fate and footprint of methane on Pacific Continental Margins

M. Emilia Bravo[1] and Lisa Levin[2]

[1]National Council for Scientific and Technical Research, Argentina; [2]Scripps Institution of Oceanography, USA

The Challenger 150 cruise AT50-12 visited six methane seep sites in southern California with the RV *Atlantis* (WHOI) and DSRV *ALVIN* between July 16 and 29, 2023. Funded by the US National Science Foundation, the study examined the role of deep-sea microbes and animals in determining the fate and footprint of methane, a potent greenhouse gas, on Pacific continental margins. The all-women PI team, with complementary expertise on the Deep-ocean methanosphere, consisted of Lisa A. Levin (Scripps Institution of Oceanography, UCSD), Shana Goffredi (Occidental College), Victoria Orphan (CalTech), and Tina Treude (UCLA). The investigators are evaluating the deep-ocean methanosphere defined by the microbial communities that consume methane and the animals that directly feed on or form symbioses with methane-consuming microbes. They are also investigating animal communities that gain energy indirectly from methane, as well as those that take advantage of carbonate rocks, the physical manifestation of methane consumption in seafloor sediments. The study of methane seeps in the deep waters of Southern California (370-1020 meters) is enabling comparisons of the methanosphere under different food-limitation and oxygen regimes. By combining biogeochemical rate, isotopic, microscopic, and genetic analyses of seep sediments, microbes and fauna, this study is advancing understanding of the contribution of methane to deep-sea biodiversity and ecosystem function, information that can inform management and conservation actions in US waters. The HOV "DSV2 *Alvin*" photo transects, water, sediment, animal and carbonate rock samples revealed that each seep site hosts distinct biotic assemblages, microbial mats and carbonate formations. Dense salp or jellyfish aggregations were observed at some of the sites. Hydroids, arborescent foraminífera, pycnogonids, terebellid and ampharetid polychaetes, provannid snails and Pyropelta limpets featured prominantly in shipboard incubations with isotopically labeled methane and nitrogen compounds,

Fig. 1. AT50-12 Science Party and ALVIN group

Fig. 2. Santa Monica Seep (800 m)

designed to flesh out methanotrophic symbioses. Additional work involved recovery and deployment of wood, carbonate, bone and other colonization substrates, CTD casts, multicoring, and acoustic surveys for bathymetry and sub-bottom analyses.

Chief Scientist: Lisa A. Levin, Scripps Institution of Oceanography,University of California at San Diego, llevin@ucsd.edu

Factors defining the variability of the deep-sea benthic biodiversity and biomass in the Gulf of Mexico (SIGSBEE.23 cruise)

Elva Escobar

Universidad Nacional Autónoma de México

The Biodiversity and Macroecology Lab of UNAM's ICML conducted the SIGSBEE.23 cruise from June 3 - 8, 2023 in the Gulf of Mexico. This cruise, sponsored by UNAM, contributes regionally to the UN Ocean Decade Challenger 150 program and the IOCARIBE projects 136.2 - Enhancing capacity development in the TAC Region and 137.2 - Ocean Literacy in the TAC Region. Onboard UNAM's R/V *Justo Sierra*, we mapped 593 km² of abyssal seafloor with the Echosounders EA640, EM302 and EM2040. We profiled environmental variables of the whole water column with a CTD and collected water samples for pH, O2, pigments, microplastics, emergent pollutants and microorganism e-DNA. The sea-surface was warm, and pelagic *Sargassum* and filamentous algae aggregated in windrows. ADCP, thermosalinometry and meteorological data were logged during the whole cruise.

Sediment cores were collected with a multicorer (MUC-12) to study infaunal biodiversity and sediment Essential Ocean Variables (EOVs) at two LTER stations in the Sigsbee Deep, at 3800 m depth. Each core was sectioned into three levels, fixed onboard with cold 95% ethanol, transported to the lab, and sieved for future study. The information is integrated in repositories, reference collections, and institutional open access databases.

From the 18 cruise participants, 14 were women. Students (8 undergraduate, 3 graduate) were trained in data

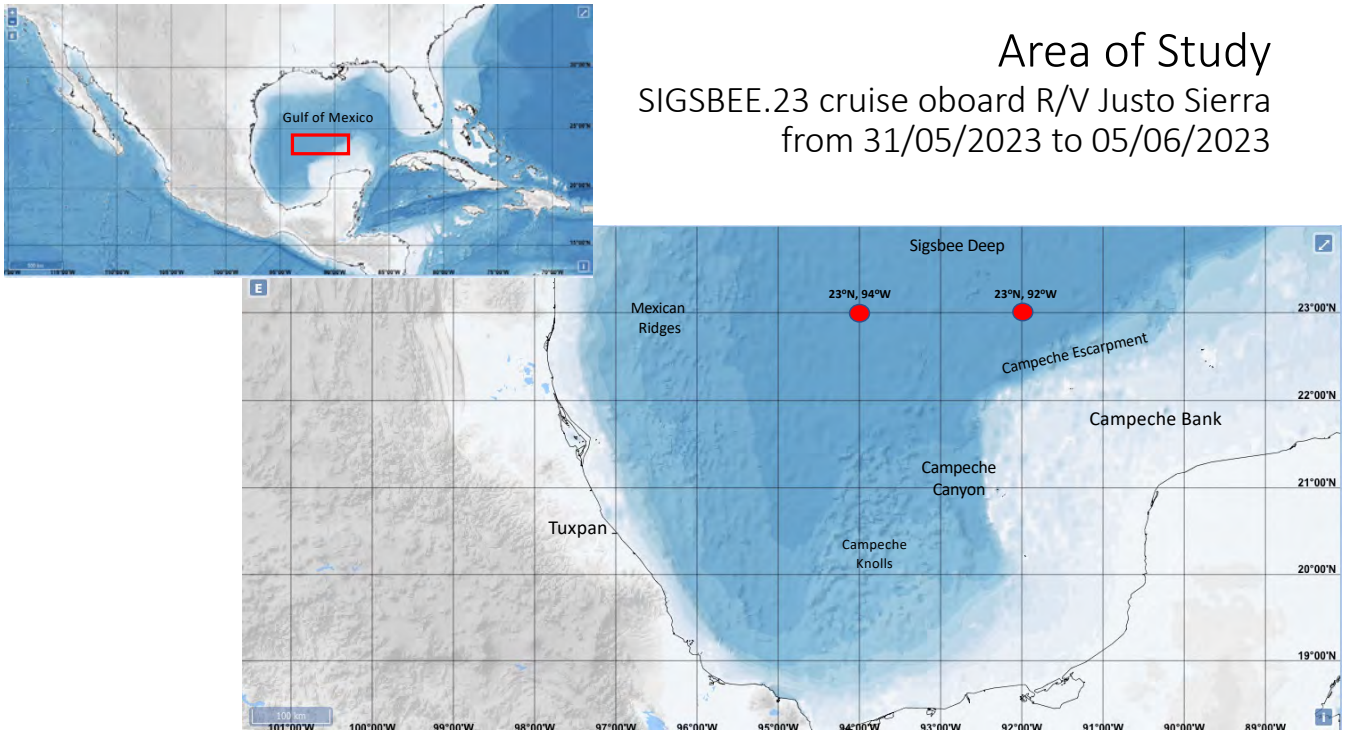


Fig. 1. Red lines and markers study area and LTER stations sampled at SIGSBEE.23 cruise

acquisition, seafloor mapping, EOVs recording, water and sediment sampling by the 7 scientists onboard. Early results were shared on Ocean's Day, ICML's social networks. The cruise blog can be found here.

Fig 2. Capacity building. A. Bathymetric data acquisition (image Jorge García). B. Sediment core processing (image Frida González)

Fig. 3. The cruise party (image credit Omar Venegas)

A Once-in-a-Life-Time Expedition

Cherisse Du Preez[1], Heidi Gartner[1], and the Northeast Pacific Deep-Sea Expedition team

[1]*Fisheries and Oceans Canada*

The 2023 Northeast Pacific Deep-Sea Expedition was unprecedented - our discoveries and encounters with deep-sea animals have left us speechless! We documented behaviours and ecosystems never before seen (in incredible detail, thanks to ***ROPOS***). We conducted 11 deep-sea dives at hydrothermal vents, seamounts, and cold seeps, accomplishing our most ambitious list of objectives to date, and collecting data to inform research and marine conservation planning. Highlights of the highlights:

- We returned to NEPDEP 58 Seamount to investigate the suspected skate nursery. In addition to documenting 100s of 1000s—possibly millions of eggs—we obtained the first-ever footage of a Pacific White Skate (*Bathyraja*

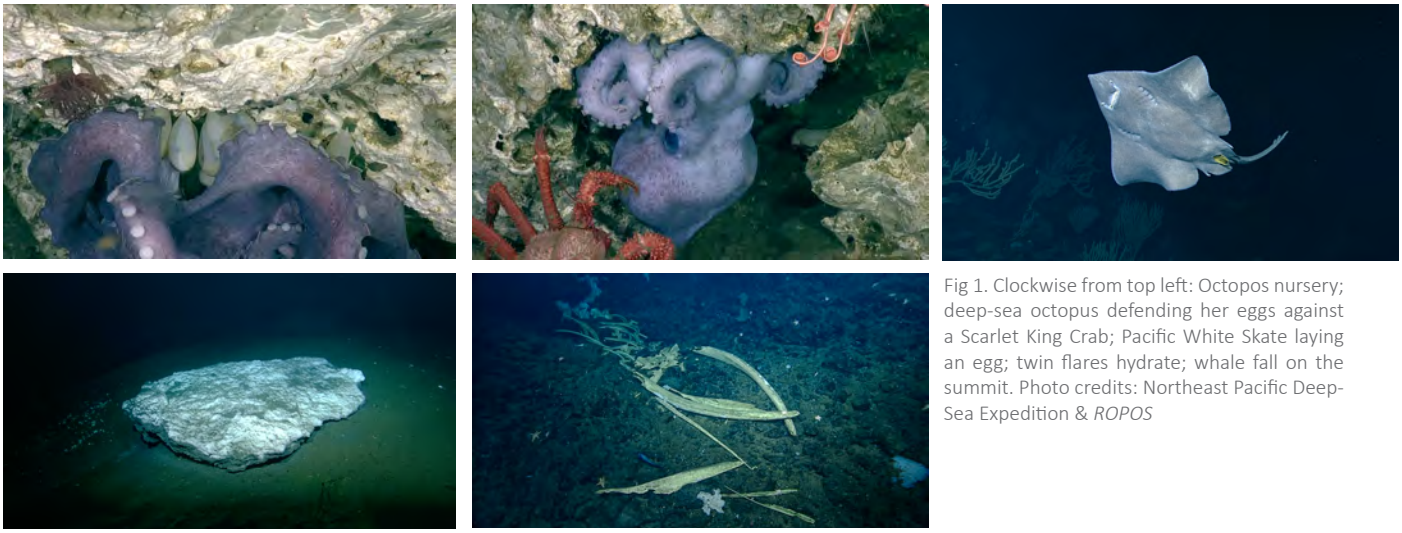


Fig 1. Clockwise from top left: Octopos nursery; deep-sea octopus defending her eggs against a Scarlet King Crab; Pacific White Skate laying an egg; twin flares hydrate; whale fall on the summit. Photo credits: Northeast Pacific Deep-Sea Expedition & *ROPOS*

spinosissima) laying an egg, and we now have evidence that more than one skate species utilize this nursery ground. We were also stunned to discover evidence of hydrothermal venting on the seamount, providing warmer water to the depths (likely aiding the successful development of the eggs, only the 2nd time ever documented). To top it off - We found a whale fall on the summit!

- What's the only thing better than a nursery ground? TWO nursery grounds! Believe it or not, we also discovered a deep-sea octopus (*Graneledone boreopacifica*) nursery at the newly discovered Hesquiaht slope cold seep field. The cold seep was characterized by 1400 m high bubble streams, large underwater icebergs of pure methane, and a 60 m high and 750 m diameter mound paved in seep-generated carbonate slabs and boulders. The rock piles at the mound's base turned out to be the perfect habitat for the octopus to lay and protect eggs. While we documented dozens, one mom, in particular, struck a cord: nearing the end of her 4.5-years of sitting on her eggs, she was still actively and successfully defending against Scarlet King Crabs.

- Twenty-one years after they were last explored, we returned to the hydrothermal vents of Explorer Ridge. We gathered important evidence of a dynamic system with vents shifting from inactive and "extinct" to active and vice versa.

- We returned to the whimsical Spongetopia and Coraltropolis on the supervolcano Explorer Seamount to circumnavigate its summit and resurvey two long-term monitoring sites (time-series data within the proposed MPA).

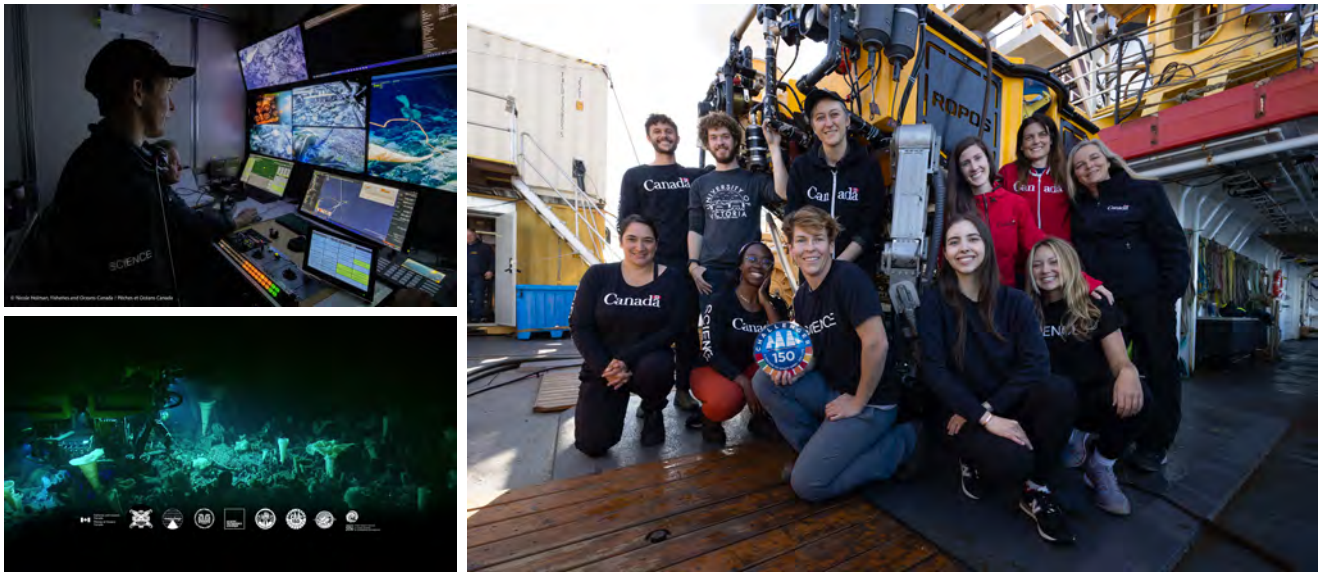


Fig. 2. Clockwise from top left: Monitoring the ROV footage; the Northeast Pacific Deep-Sea Expedition Team. Photo credits: Fisheries and Oceans Canada & Nicole Holman

- At the newly discovered Winona Basin cold seeps, we documented extensive fields of bubble streams on bathyal planes and a massive 500 m high and 25 km long ridge that appears to be created by carbonate rock. This seep hotspot supported a high abundance of chemosynthetic productivity and commercial fish and invertebrates but also showed signs of significant impacts from bottom-contact fishing.

- At 3200 m depth, we completed our deepest dive to date, where our taxonomists were ecstatic as we encountered and collected rare and likely undescribed species.

- Oceanographic sampling complemented our benthic work at each site – we completed 5 rosette casts, 12 bongo nets, 7 tucker casts, and 38 eDNA Niskin samples.

The expedition was streamed to a global audience and we hosted live outreach school, community, and public events.

The science was co-created by Fisheries and Oceans Canada, the Council of the Haida Nation, Nuu-chah-nulth Tribal Council, Pacheedaht First Nation, and Ocean Networks Canada, collaborating with partnering scientists worldwide. The expedition was a Northeast Pacific Deep-Sea Exploration Project (#NEPDEP) and UN Ocean Decade endorsed activity and will contribute to our global understanding of the deep through the Challenger 150 initiative.

Protatax 2023: Microbial Death at Axial Seamount cruise

Sarah K. Hu, Julie Huber and Maria Pachiadaki

Texas A&M University, USA; WHOI, USA

Fig. 1. Science party of Protatax 2023. Photo by Thompson AB Elena Wisecarver, ©Woods Hole Oceanographic Institution

The Protatax (Protists Attack at Axial Seamount) research cruise ran from July 17 - 27, 2023 on RV *Thomas G. Thompson* (University of Washington). Equipped with ROV *Jason* (WHOI NDSF), we spent nine days at Axial Seamount, a deep-sea volcano several hundred miles off the coast of Oregon on the Juan de Fuca Ridge. The expedition, sponsored by the National Science Foundation Awards 1947776, was endorsed by the UN Ocean Decade endorsed program Challenger 150. Protatax 2023 was led by Chief Scientist Julie Huber (WHOI), Maria Pachiadaki (WHOI) and Sarah Hu (TAMU).

Water-rock reactions at and below the seafloor support a diverse biosphere of microscopic life. Microorganisms in crustal ocean habitats provide critical ecosystem services, such as primary production to sustain deep-sea food

webs, nutrient and element recycling, and carbon sequestration. While we have learned a lot about bacteria and archaea ("prokaryotes"), we know much less about other components of the microbial food web, especially unicellular eukaryotes (protists). Our goal was to quantify the rate that microbial eukaryotes graze upon hydrothermal vent prokaryotic communities, and to characterize vent-associated microeukaryotic diversity, community structure, metabolic activity and cell abundances. Grazing incubations were performed with diffuse vent fluids and conducted both shipboard and in situ. During our time at Axial Seamount, we completed 8 ROV *Jason* dives - each one lasting up to 16 hours, enabling us to collect diffuse vent fluid for shipboard experiments, cultivation of thermophilic bacteria and archaea, samples for geochemistry, and filters for molecular analysis of the microbial communities. Concurrent with each dive, a submersible incubation device (SID) was deployed to conduct grazing experiments at the seafloor, enabling direct comparison of shipboard and in situ grazing rates. These are the first such in situ grazing experiments ever conducted on the seafloor, and coupled with quantification of biomass and community analyses, will contribute to a broader understanding of local carbon export and supply of nutrient resources in the deep ocean. You can read more about the expedition here at a blog written by WHOI Science Writer, Hannah Piecuch.

The cruise blog can be found here.

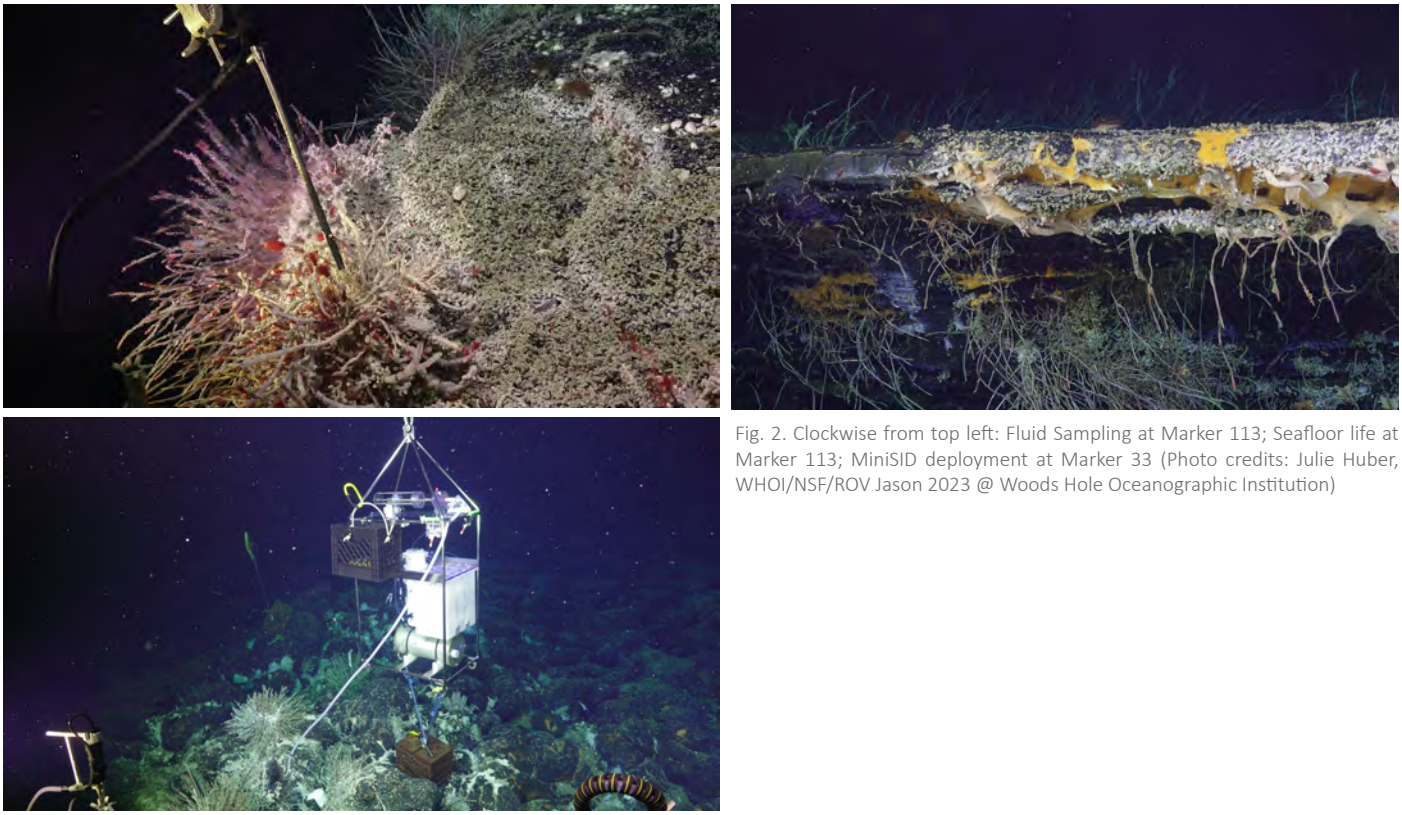


Fig. 2. Clockwise from top left: Fluid Sampling at Marker 113; Seafloor life at Marker 113; MiniSID deployment at Marker 33 (Photo credits: Julie Huber, WHOI/NSF/ROV Jason 2023 @ Woods Hole Oceanographic Institution)

Explore the 2022 Gulf of Mexico Mesophotic and Deep Benthic Communities Restoration Cruises StoryMap

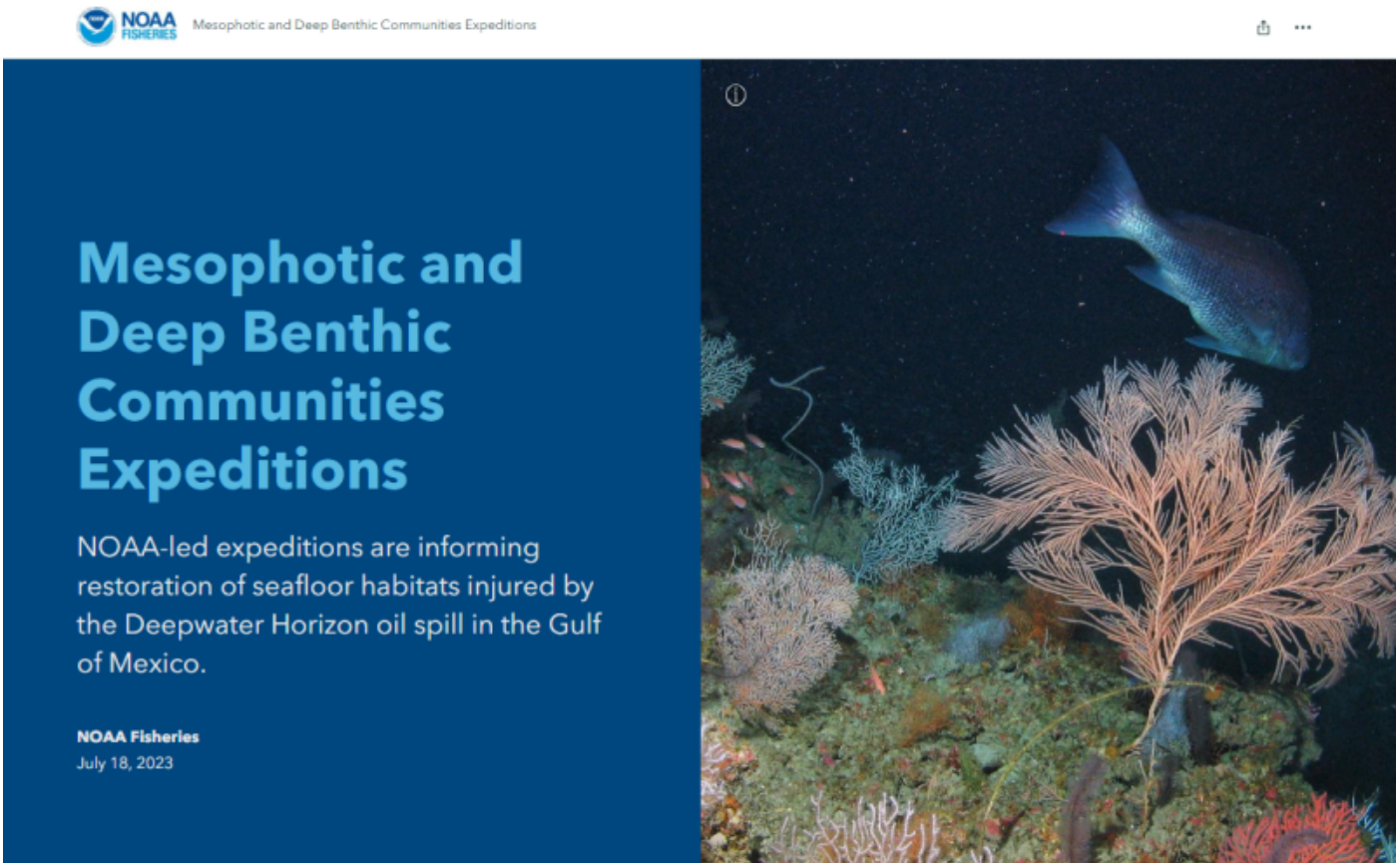
Kelly Martin[1] and Danielle Weissmann[2]

[1]NOAA Office of National Marine Sanctuaries, USA; [2]NOAA National Marine Fisheries Service, USA

The 2010 *Deepwater Horizon* oil spill injured deep-sea habitats over a large area in the Gulf of Mexico. These complex ecosystems include corals, fish, anemones, sponges, and sea cucumbers—but our knowledge about these habitats is limited, creating challenges for their restoration.

From April through October 2022, the National Oceanic and Atmospheric Administration (NOAA) and many collaborators

embarked on eight scientific expeditions in some of the Gulf of Mexico's deeper waters in the vicinity of the oil spill. The data gathered during these expeditions will advance restoration in some of the Gulf's most inaccessible yet important habitats.



Explore the StoryMap "Mesophotic and Deep Benthic Communities Expeditions" to learn more about this innovative work. The 2022 field season was the first of five planned for the *Deepwater Horizon* Mesophotic and Deep Benthic Communities restoration projects.The 2023 field season is now underway; we will update the StoryMap as more information on this year's expeditions becomes available.

A challenging but successful cruise!

Jozée Sarrazin & Marjolaine Matabos

Ifremer, France

The Momarsat 2023 cruise was held from July 9 - 28, 2023 onboard the French research vessel *L'Atalante* with the ROV *Victor6000* at the Lucky Strike vent field - northern Mid-Atlantic Ridge - to carry out the yearly maintenance of the EMSO-Azores observatory.

Once again, we ensured the turnover of the full platform and sensor array and started another year of data acquisition! Led by Marjolaine Matabos, the team of 18 scientists from Ifremer, CNRS (IPGP, GET, MIO), University of Western Brittany (UBO) and University of the Azores worked together to achieve the substantial sampling plan paramount to the long-term monitoring of the vent field. Despite delayed departure of the ship, numerous breakdowns and technical issues with the submersible and the observatory infrastructure, all objectives were achieved. This success would not have been possible without the adaptability, support and flexibility of all teams and more particularly the ship crew, which had to adapt continuously to a changing program.

Fig. 1. The Momarsat 2023 great team on the R/V ***L'Atalante*** on the Lucky Strike vent field. © Eloi de L'Estourbeillon/Momarsat 2023

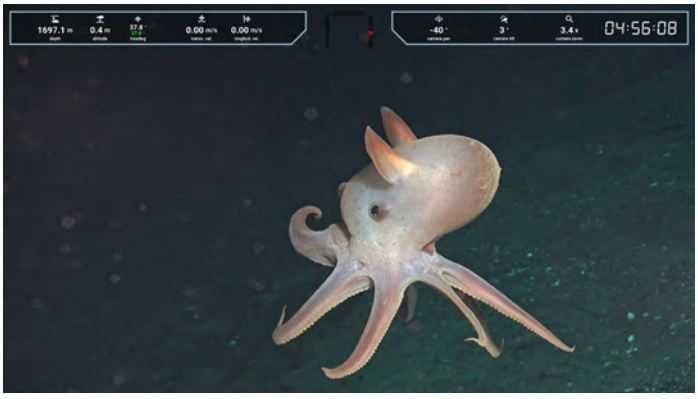


Fig. 2. Above left: Marjolaine Matabos, Jozée Sarrazin and Ana Colaço giving a conference for the general public at the Fabrica Baleia on July 30th 2023. Fig. 3. Above right: The encounter of Victor6000 with a ***Grimpotheutis*** octopus at 1697 m depth. ©Victor6000/Momarsat 2023

This year, as part of the Deep-Rest project, we conducted new experimentations. The deposition of sulphide particles on vent assemblages using the SPIDER benthic chamber was used to examine their impacts on vent faunal biodiversity and physiology. On-board and in-situ incubations of the *Bathymodiolus azoricus* mussel to a fluorochrome aimed to assess their growth rate. Moreover, a new diffuse-flow site spotted to the south of the Cimendef sulphide structure appears promising for future integrated multidisciplinary studies. Marine life accompanied us all along the cruise with dolphins, sharks, tuna and whales. On the bottom, we had a nice and rare encounter... On the way back to Horta in the Azores, cruise participants Jozée Sarrazin and Marjolaine Matabos, with Ana Colaço, were invited by the Azorean government to give a conference following the exhibition of Damien Roudeau drawings (from Momarsat 2022 cruise) at the Fabrica Baleia.

The EMSO-Azores observatory is part of the One Ocean Network for Deep Observation action of Ifremer endorsed by the UN Ocean Decade program.

Fig. 4. Drawings from the Momarsat 2022 cruise by the artist Damien Roudeau were shown at the Fabrica Baleia in Horta during the whole month of July. © J. Sarrazin/Momarsat 2023

Oceanographic Cruise CIMAR 28 will explore the Southeast Pacific

Dr Eulogio Soto

Universidad de Valparaíso, Chile

During October of this year the Oceanographic Cruise CIMAR 28 (Marine Research Cruise in Remote Areas) will study the areas of Nazca-Desventuradas and Juan Fernández islands in the Southeast Pacific.

Onboard RV *Cabo de Hornos*, belonging to the Chilean Navy, 11 research projects from several Chilean universities will study different aspects of oceanography, marine biology, deep-sea benthic ecology and biodiversity, geology, neuston, plankton, water and sediment chemistry and nutrients and pollutants.

From these projects Dr Eulogio Soto from COSTAR Center, Universidad de Valparaíso and DOSI, will develop the project "Soft-bottom benthic communities associated to seamounts and oceanic islands: Exploring biodiversity, biogeography and connectivity" in collaboration with Dr Americo Montiel (Universidad de Magallanes) and Dr Matthew Lee (Universidad de Los Lagos).

The main goal of this research is to study the macrofauna, meiofauna, microbial communities and sediment geochemistry living in the seafloor around seamounts and oceanic islands, providing scientific knowledge in terms of composition, abundance, diversity; biogeographic distribution patterns between areas and beta connectivity related with different deep-sea ecosystems, productivity and depth.

Results of this research will contribute to improve the high biological ignorance that exist for this part of the ocean in terms of deep-sea benthic communities

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DEEPEND Cruise DP09, May 2023

Tracey Sutton[1] (Chief Scientist), Kevin Boswell, Heather Bracken-Grissom, April Cook, Tammy Frank, Heather Judkins, Jon Moore, Pedro Peres, Isabel Romero, Mike Vecchione

[1]*Nova Southeastern University, USA*

The 9th cruise of the DEEPEND (Deep Pelagic Nekton Dynamics) Program was conducted aboard the R/V *Pt Sur* to survey the epi-, meso- and bathypelagic fauna of the northern Gulf of Mexico. This was the 16th overall cruise in the ONSAP-DEEPEND series.

Fair weather and excellent shipboard services made for a 100% successful cruise. We conducted midwater trawling (120 samples) concurrently with multifrequency hydroacoustics. Four Simrad EK-series splitbeam echosounders

(18, 38, 70, and 120 kHz) collected data covering 3000 m (18 kHz), 3000 m (38 kHz) and ~ 400 m (70 and 120 kHz) of the water column. Both narrowband and wideband (at 38 and 120 kHz) data were collected opportunistically to examine the potential to use frequency spectra to further describe the scattering responses of mesopelagic fauna. Over 400 GB of acoustic backscatter data were collected, as well as 52 GB of data from the Wide Band Autonomous Transceiver (WBAT) and about 50 GB of data was collected from the M3, a multibeam imaging sonar. We conducted 19 CTD deployments, with water samples taken for eDNA analysis. 369 liters of water were filtered across seven stations, each with two scattering layers targeted. We also collected tissues samples from pelagic fishes, shrimps, and squids for pollutant (PAH) analysis. In all, sampling collected over 12,000 fishes, over 8000 crustaceans, and over 1000 molluscs.

Highlights of the cruise include a potentially new species of dragonfish and the sighting of a single orca (pictured) in the Gulf, our first sighting of this species since 2011.

But the most remarkable finding was probably the collections of extraordinarily high numbers of pelagic shrimp over a deepwater coral feature at midslope depths. While we collected 24 individuals of the sergestid shrimp *Challengerosergia hansjacobi* (pictured) in 26 offshore tows above 1000 m, we collected 2004 individuals in three tows in the area of corals at ~350 m depth. This made for an extremely busy Team Crusty (pictured). This speies may prove to be an indicator of enhanced benthic-pelagic coupling along abrupt topographic features of the Gulf, the first finding of its kind. We will be back at it next year to study this fascinating phenomenon in more detail.

Exploring deep-sea habitats near Kingman Reef & Palmyra Atoll

Adam Soule[1], Brian Kennedy[2], Dwight Coleman[3], Pablo Sobron, Deborah Smith, Megan Cook, Jamie Zaccaria and Daniel Wagner

[1]NOAA Ocean Exploration Cooperative Institute, USA; [2]Ocean Discovery League, USA; [3]University of Rhode Island, USA

From May 16 - June 13, 2023, the Ocean Exploration Trust and partners conducted a telepresence-enabled expedition to explore the deep-sea biology and geology in US waters surrounding Kingman Reef and Palmyra Atoll. Supported by NOAA Ocean Exploration via the Ocean Exploration Cooperative Institute, the expedition used the E/V *Nautilus*' remotely operated vehicles (ROVs) and acoustic sonars to survey unexplored areas located north of the Kingman/Palmyra Unit of the

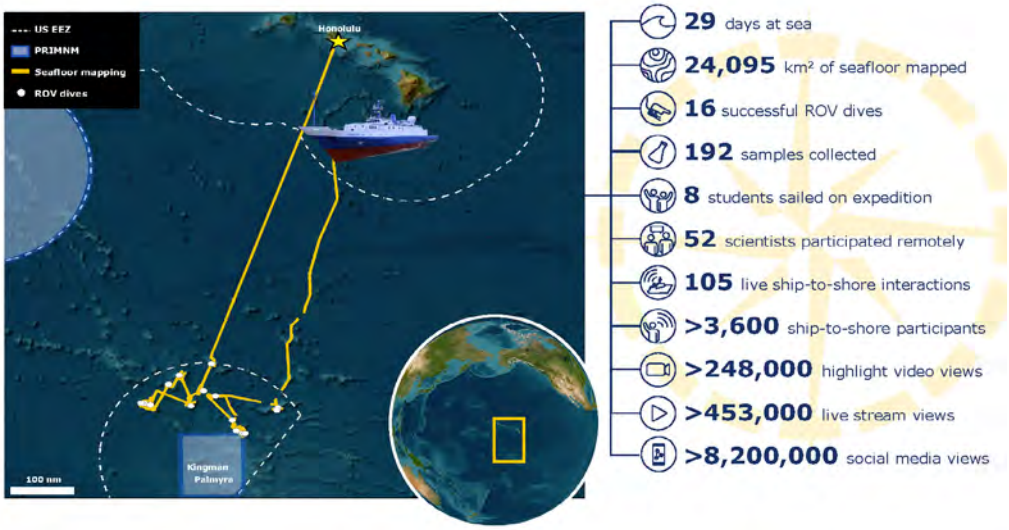

Fig. 1. Map and infographic summarizing the accomplishments of the recent E/V Nautilus expedition that explored the deep-sea biology and geology in US waters surrounding Kingman Reef and Palmyra Atoll.

Pacific Remote Islands Marine National Monument (PRIMNM), in an area that has been proposed as a National Marine Sanctuary.

Over 24,095 km² of seafloor were mapped over the course of the expedition, covering ten different seamounts. This mapping data was key to the successful execution of 16 ROV dives at depths ranging from 1,087-3,111 meters, all of which surveyed areas that had not previously been explored. Noteworthy ROV observations included two undescribed species of jellyfish and a likely significant range extension of bone-eating *Osedax* worms. The expedition also documented three high-density coral communities, which mark the first ever high-density coral communities documented in the region outside the Monument.

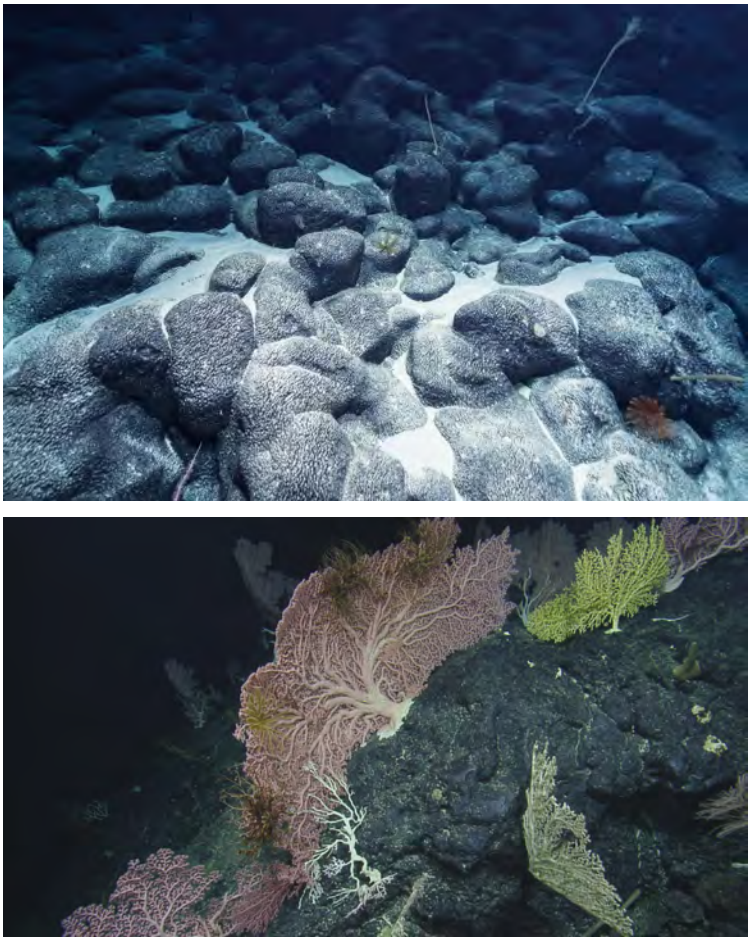

Fig. 2. (Top): A garden of deep-sea corals recorded at ~1700 meters on an unnamed seamount located northwest of Palmyra Atoll. (Bottom): Rounded cobbles with botryoidal texture documented at ~2600 meters on an unnamed seamount located north of Kingman Reef.

In addition to exploring previously unsurveyed areas, six ROV dives included the first-time integration of the Laser Divebot Raman and fluorescence spectrometer. *In situ* data collected by the spectrometer will be compared to lab-based analyses of collected samples, and thereby help develop important new tools for ocean exploration.

A diversity of different rock type were recovered from across ten seamounts, nearly all of which were coated with ferromanganese oxyhydroxide crusts. Basalt samples ranged from highly altered to unaltered, and displayed a range of vesicularity that may reveal their original depth of eruption. Sedimentary rocks, including volcaniclastic deposits and cemented breccias of basalt and carbonate, were recovered on the lower slopes of seamounts. On the seamount summits, uplift exposed sedimentary rocks that formed in the lagoons of the former atolls.

A total of 95 biological, 59 geological, and 38 eDNA water samples were collected during the ROV dives, which will support studies on the biodiversity, geological age, and volcanic history of the region. Data and samples collected during the expedition, including video and environmental data collected on every ROV dive, physical samples, and seafloor mapping data have been sent to various repositories for archiving and public distribution.

Like all E/V *Nautilus* expeditions, the mission included a large focus to engage the public, including live ship-to-shore broadcasts with classrooms and public events, promotion of expedition content on the web and on social media, and live streaming of expedition footage, which collectively reached over 9 million views. As of June 18, expedition content was featured in 142 media stories published in 27 countries and 15 different languages, including coverage on BBC News, the Weather Channel, Canada Today, and Science Daily. A total of 31 mission personnel sailed on the expedition, including 8 students and 3 educators, who were supported by 52 professionals from 39 institutions that participated remotely via telepresence technology.

Project Focus

The Deep-Ocean Stewardship Initiative celebrates its 10th anniversary

Christopher Barrio Froján

DOSI Programme Officer

The deep ocean has held a place in our psyche and folklore for thousands of years, but it was not until the early 16th century that anyone attempted – albeit unsuccessfully – to probe the bottom. Despite a handful of hauls of mesopelagic creatures after that, it would take another 350 years for explorers on the Challenger expedition (1872-1876) to plumb the ocean's depth and achieve what Ferdinand Magellan failed to do. A few decades later, in 1930, humans had their first in-person glimpse of the deep ocean aboard a steel Bathysphere, and in 1956 the whole world got to share in the beauty and wonder of deep-sea life thanks to Jacques-Yves Cousteau releasing the first full-length colour film documentary. Since then, in the dark briny depths we've discovered ecosystems sustained by chemical energy instead of solar energy, mapped coarsely the entire ocean floor using satellite technology, visited the deepest point on the planet, and made extensive and growing use of deep-ocean resources while learning to recognise the intangible benefits we all derive from the still mysterious abyss.

By 2013, global environmental protection and governance efforts to help regulate our resource use, such as the twin Conventions on Biological Diversity (CBD) and on Climate Change (UNFCCC; both hatched in Rio de Janeiro in 1992), had come of age, and negotiations on a new High Seas Treaty were already in their 9th year, with another 10 years to go before its approval. Yet the deep ocean specifically, with all its vastness, richness and potential, was markedly absent from much of the substance of these international agreements. Meanwhile, the International Seabed Authority – with its dual mission of safeguarding the international deep sea and overseeing activities that might threaten biological diversity and harm the marine environment – had been operational for 19 years, by which time it had approved several deep-sea mining exploration contracts in the Atlantic, Pacific and Indian Oceans.

At the same time, many observers, marine scientists and lawmakers in particular, were concerned that at a time of increasing awareness of global environmental degradation, insufficient attention was being given to issues specific to the deep ocean and its safeguarding, especially as so little was known about this ecosystem relative to shallow-water and terrestrial ecosystems. Seeing that humanity's track record on sustainable environmental management in areas it purportedly understood well was at best shaky, worries about the potential effects of inflicting broadscale irreversible harm to the world's largest and least understood ecosystem – the deep ocean – were not unfounded. Consequently, a meeting was convened in Mexico in 2013 by a handful of those same concerned observers to bring the deep-ocean research community together to discuss ways in which the deep ocean could be better served by its experts.

Behold the birth of bonny DOSI! In April 2013, the Deep-Ocean Stewardship Initiative – "a global union of experts from across disciplines and sectors who pool research, skills and expertise to inform and advise on sustainable deep-ocean

governance and management of resources, working to safeguard the marine environment for current and future generations" – came into being thanks to the initiative, cooperation, commitment and dedication of its founding members. It was agreed that DOSI's vision is for "a healthy deep ocean able to contribute to the wider Earth system, through its sustainable management informed by independent science", and to realise that vision, DOSI experts would "utilise independent scientific findings about the deep ocean to support its ecosystem-based management and integrate other fields of expertise in the development of deep-ocean strategies and solutions".

Since that fateful genesis in Mexico ten years ago, DOSI has gone from strength to strength, injecting independent science-based expertise directly into the various international environmental governance processes through the sponsorship of dedicated DOSI ambassadors and production and publication of pertinent, timely literature. In doing so, DOSI has come to be known in those circles as a reputable source of such vital information, and the expert ambassadors are recognised as respected, authoritative commentators whose input is valued. The latest DOSI Annual Report to its principal funder provides a summary of DOSI's recent interventions and activities in the ongoing deep-ocean-related intergovernmental processes, spanning topics from marine genetic resources, through deep-sea mining, fisheries and new technologies, to biodiversity conservation and climate change.

As well as delivering deep-ocean expertise where it is needed and where it can be most effective, DOSI serves as a hub for aspiring and likeminded advocates of deep-ocean research. An ever-growing membership constantly strives to engage with each other and promote fruitful collaborations to address emerging issues. The Challenger 150 programme, for instance, was itself created by a group of DOSI members (the DOSI Decade Working Group), who identified a need for a global collaborative scientific network dedicated to the acquisition of data, synthesis of knowledge, and communication of findings on the biology and ecology of the deep ocean. Challenger 150 has since gone on to be endorsed by the Intergovernmental Oceanographic Commission (IOC-UNESCO) as an action under the UN Decade of Ocean Science for Sustainable Development. Similarly, DOSI has served as a launchpad for a number of self-motivated, high-profile experts in their field, who now enthusiastically encourage early-career ocean professionals to follow in their footsteps or furrow their own path to meaningful science-policy engagements. Mutual support, inclusivity, equity and representation remain at the core and forefront of DOSI's modus operandi. As the DOSI membership has grown, so has its support staff, now consisting of four dedicated persons – the DOSI Office – scattered but working collaboratively across the world.

To mark its first decade, DOSI is planning a celebratory webinar series, to be launched in October 2023 and consisting of six topic-led monthly webinars. More information on this will soon be published and disseminated through DOSI platforms, including DOSI's weekly 'Deep-Sea Round-Up' newsletter, website and dedicated social media channels. Subscription to the Deep-Sea Round-Up and DOSI membership are both completely free, so anyone interested in becoming a part of this thriving community striving to make a difference to the welfare of the planet and all who live on it is welcome! Seeing DOSI's achievements in its first 10 years of existence, who knows what it will achieve in the next 10 – to be part of that story, why not sign up and take part? The deep ocean awaits.

Exciting 4-Year Deep-Sea Coral Initiative Concludes off the U.S. West Coast

Dani Weissman

NOAA, USA

NOAA's Deep Sea Coral Research and Technology Program and partners have recently released the final report for their second West Coast Deep-Sea Coral Research Initiative. Initiative highlights include: new observations of habitats with high densities of deep-sea corals and sponges; further documentation of a petrale sole spawning area in the

proposed Chumash Heritage National Marine Sanctuary; the discovery of vast mounds of glass sponges and their skeletons in Channel Islands National Marine Sanctuary; new tools and products; and many creative public engagement opportunities. The initiative ran from 2018 through 2021. It was designed to better understand deep-sea corals and sponges off the coasts of California, Oregon, and Washington, particularly within the five U.S. West Coast national marine sanctuaries. Read the web story to learn more.

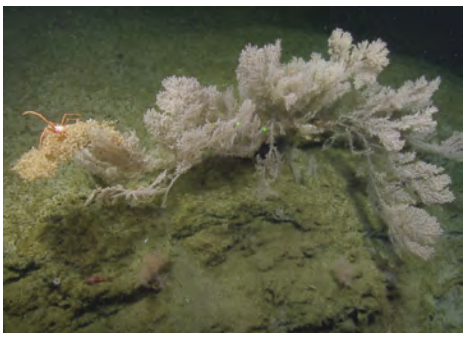

Fig.1. (Above left): A colony of the deep-sea coral *Parastenella* supporting a cluster of orange zoanthids and a deep-sea crab, extends from a ledge deep in Quinault Canyon off the coast of Washington State. Credit: Ocean Exploration Trust, NOAA Sanctuaries. Fig. 2. (Above centre): A 3D resin coral model printed from a digital scan. In collaboration with the California NanoSystems Institute, staff at Channel Islands National Marine Sanctuary and undergraduates ("workshop wizards") are scanning and printing deep-sea coral and sponge specimens at University of California's Santa Barbara's Innovation Workshop. Credit: NOAA. Fig. 3. (Above right): Autonomous underwater vehicle images of petrale sole gathered together in groups at Santa Lucia Bank in Channel Islands National Marine Sanctuary. Credit: Ocean Exploration Trust, NOAA

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Introducing the "Ocean for Ecocide Law" Network

Antoinette Vermilye

Gallifrey Foundation

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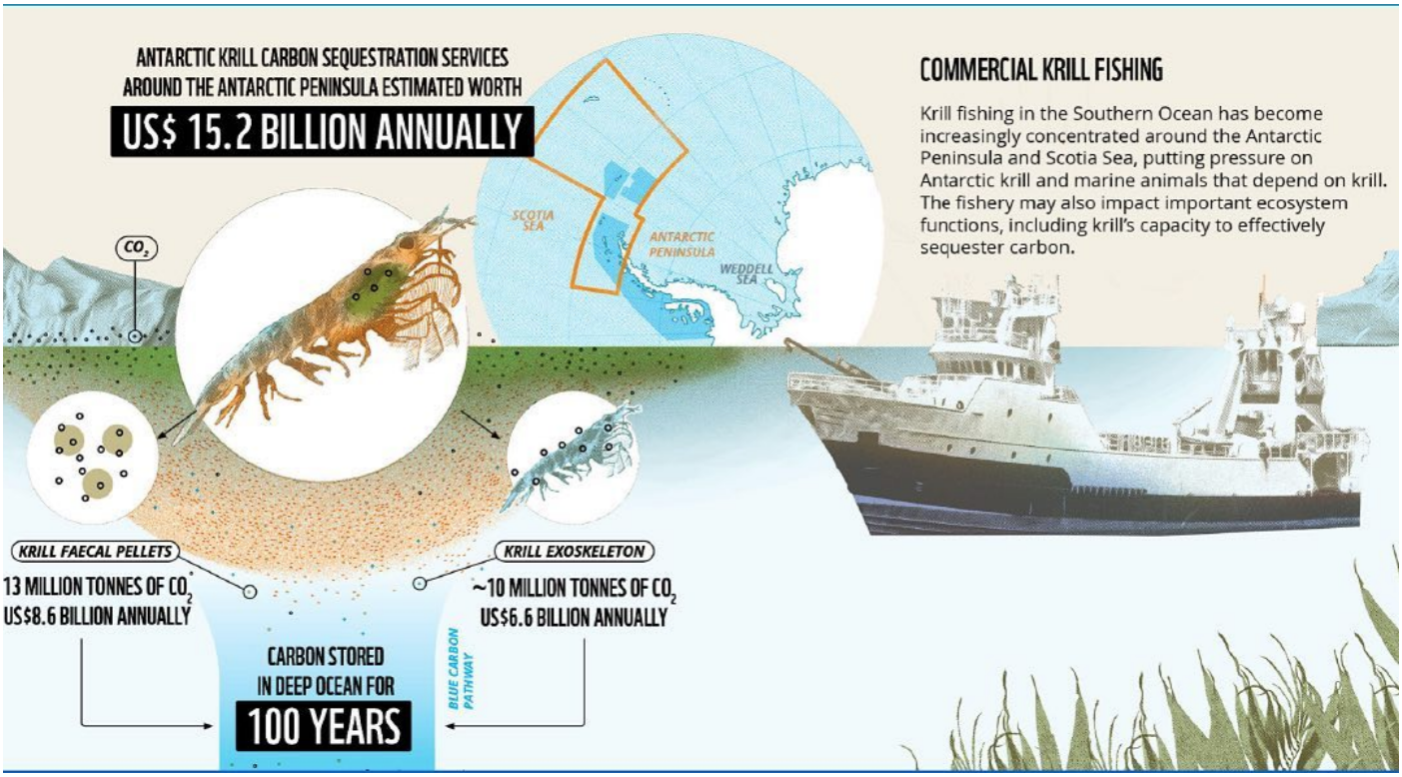
This year more than ever, the ocean is taking a brutal beating due to unprecedented human-induced global warming. Temperatures in both poles have broken records and extreme weather events combined with El Nino have worried ocean scientists as they realise their models can no longer keep up with the exponential rate of change.

The ocean is so symbiotic to climate but its role in climate change and marine ecosystem health is often overlooked. Yet it has been a dumping ground for decades of bomb testing, munitions dumping, agricultural and industrial run off, marine plastic and chemical pollution, overfishing, habitat destruction - which are now converging to cause irreparable harm to marine ecosystems. All this while absorbing 90% of our anthropogenic generated heat from GHG emissions. (The world's ocean is now heating at the same rate as if five Hiroshima atomic bombs were dropped into the water every second). But for how long?

In the meantime, those bodies that should be protecting it continue to endorse practices that harm it, such as fishing rules and regulations, government subsidies, bottom trawling, deep seabed mining and shipping emissions, and overfishing. Action is promised with long faraway deadlines while the ocean is crumbling under the weight of this abuse.

It is therefore clear that what is in place now is not working and that urgent action is needed to protect the ocean. One such area of action lies in multipronged legal measures as a practical and pragmatic solution. There is a growing case for Ecocide law.



What is Ecocide law:

Ecocide law will provide a much-needed legal framework to protect ocean wildlife and marine ecosystems by recognizing the intrinsic value of the ocean and its ecosystems. This law aims to hold corporate decision-makers accountable for their actions and ensure ocean regulation and protection are taken far more seriously at the highest level, driving better due diligence, and stimulating strategic positive change.

The campaign for Ecocide law is to have it accepted as the 5th Crime in the International Criminal Court. It has an international working definition that is being taken very seriously by politicians and governments and is gaining huge traction.

Its definition is based on consequences of the severity of the act:

The unlawful or wanton acts committed with the knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts.

We can think of several examples in the ocean where this would be the case. Shark tournaments that brutally kill protected species; the Grind in Faroe which pointlessly kills over 600 pilot whales over a summer; 40% of bycatch discards killing necessary living biodiversity to catch a tiny portion of a target species.

But where is the deterrent or the accountability?

In the same way homicide or genocide doesn't encourage murder, it makes us think twice before committing it because we know there are consequences. Ecocide has no consequences right now.

We are reaching out to Ocean people: those who live off, work with, and understand the ocean, such as indigenous and coastal people, small island states and beyond to create awareness and support for Ecocide Law in their national legislation and to support Ecocide as the 5th Crime in the International Criminal Court.

Ten ways in which an Ecocide Law can help protect the ocean.

1. Ecocide law adds to a growing comprehensive legal framework (such as Advisory Opinions, BBNJ and other

tangential legal solutions) specifically addressing environmental damage, including in the ocean. This will help fill gaps in existing legislation that may not adequately protect marine ecosystems. Currently laws that protect the ocean have been sliced and diced up into specific areas that render them less effective than they need to be. Ecocide law can advocate for a more comprehensive approach to environmental protection and highlight the need for specific legal mechanisms to prevent and address ecologically damaging activities in marine environments.

2. **Deterrence and Accountability:** The threat of criminal penalties under an Ecocide law can act as a powerful deterrent against harmful and destructive activities in the ocean. It holds individuals and corporations accountable for their actions and encourages responsible behaviour. Businesses have been keen to endorse this as it gives them a yardstick against which to determine what is too much/too bad. Without accountability we have seen massive destruction to the ocean in forms of bycatch, toxic blooms caused by agricultural runoff, and 'traditional' whale hunting to name a few.

3. **Recognizing the Value of the Ocean Ecological Services:** By acknowledging the ocean's inherent value and the ecological services it provides, an Ecocide law can foster a shift in society's perspective towards a more sustainable approach to stewarding the ocean. Marine Protected Areas (MPAs) and sustainable fishing practices enable biodiversity, fishes and marine systems to recover, reproduce and start to thrive to become stronger and more resilient. An Ecocide law adds more weight in putting these protections in place.

4. **Protecting Biodiversity:** The ocean is home to a vast array of marine species, many of which are threatened by human activities such as overfishing, pollution, and habitat destruction. An Ecocide law can help safeguard biodiversity by discouraging these harmful practices. For example, bottom trawling is a totally destructive practice that bulldozes ecosystems for small gains, but it also has been shown to release more greenhouse gas emissions than aviation emissions!

5. **Mitigating Climate Change:** A healthy ocean plays a crucial role in mitigating climate change by absorbing carbon dioxide and regulating global temperature, but as mentioned above, this is approaching an alarming tipping point. Ecocide law can assist in putting policies in place to curb activities that harm marine ecosystems and compromise their ability to sequester carbon or to provide a healthy living environment for those creatures that sequester carbon. For example, increased krill fishing in the Antarctic to feed aquaculture farms, deprives a keystone species from their environment – leading to population decline in whales, seals and penguins that feed on them, but also losing the incredible amount of carbon sequestration that their moulting and faecal pellets provide (23 million tons of CO_2 sequestration annually (IUCN))

6. **Preventing Pollution:** The ocean faces multiple forms of pollution, including plastic debris, oil spills, and chemical contaminants. These combine into toxic soups that severely affect the environment in which marine wildlife can thrive or even survive. An Ecocide law can foster stricter regulations and enforcement mechanisms to reduce pollution, preserving the integrity of marine ecosystems. The Global Plastic Pollution Treaty is underway. Plastics are insidious (microplastic smog "rains" in the ocean which are ingested by virtually all micro and macro fauna) but also the toxics they comprise and attract. These leach into the flesh of marine wildlife particularly up to apex predators such as tuna, salmon, sharks and whales – nearly of which have been found to have high levels of methylmercury.

7. **Protecting Coastal Communities:** Many communities around the world rely on the ocean for their livelihoods and cultural identity. By safeguarding the health and integrity of marine ecosystems, an Ecocide law can help protect these vulnerable communities from the impacts of environmental degradation particularly due to sea rise and extreme weather events due to climate change.

8. **Restoring Ecosystems:** On the other hand, in cases where the ocean has already suffered significant damage, an Ecocide law can facilitate efforts to restore and rehabilitate affected ecosystems. Restoration projects can help revive biodiversity, improve resilience, and enhance the overall health of the ocean. Examples would be sea grasses, corals, and mangrove restoration.

9. **International Cooperation:** Ecocide law would contribute to encouraging global cooperation and collaboration among nations to address environmental crimes in the ocean. It would promote the sharing of best practices, information, and resources, fostering a collective effort towards protecting this shared resource. An Enduring

10. **Legacy for Future Generations:** Finally an Ecocide law would help secure a healthier and more sustainable ocean for future generations, ensuring they can enjoy its benefits and continue to explore its wonders. It aligns with the principles of intergenerational equity and the rights of future generations to a clean and healthy environment.

Right now, Ecocide law is gathering momentum but it is imperative we make ecocide a mainstream topic in ocean discussions to gather support.

What can I do?

Any organization, business and/or community that lives and works with the ocean can call on all governments to support the inclusion of ecocide into the Rome Statute of the International Criminal Court, and to positively engage in the growing global conversation to make this a reality. See here for various networks supporting Stop Ecocide.

FOR THE OCEAN

Sign and share this open letter calling on all governments to support the inclusion of ecocide into the Rome Statute of the International Criminal Court and to positively engage in the growing global conversation to make this a reality.

Ensure you **talk about ecocide** in all ocean discussions as described above. This is an urgent existential issue and in concert with other legal efforts, will corral in better practices and protection for the ocean for the long term.

Ocean Census: Accelerating Marine Species Discovery

Alex Rogers[1], Denise Swanborn[2] and the Ocean Census Team.

[1]REV Ocean and University of Oxford; [2]Ocean Census

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About Ocean Census

Ocean Census is a new Large-Scale Strategic Science Mission aimed at accelerating the discovery and description of marine species, launched April 27th 2023. This mission addresses the knowledge gap of the diversity and distribution of marine life, whereby an estimated 1 million to 2 million species of marine life between 75% to 90% remain undescribed to date[1].

Ocean Census is initially funded by The Nippon Foundation and implemented by the Nekton Foundation. It is organised as an open network with the aim to promote inclusivity and equity across the global community of marine taxonomists, taxonomy support specialists and trainee or early career researchers, anchored by Biodiversity Centres in developed countries and low- and middle-income countries (LMICs).

Approach

Through a collaborative approach, including co-production of science with LMICs, and by working with funding partners, Ocean Census will focus and grow current efforts to discover ocean life globally, and permanently transform our ability to document, describe and safeguard marine species.

Specifically, Ocean Census aims to accelerate the rate of ocean species discovery by: 1) employing consistent standards for digitisation of species data to broaden access to biodiversity knowledge and enabling cybertaxonomy; 2) establishing new working practices and adopting advanced technologies to accelerate taxonomy; 3) building the capacity of stakeholders to undertake taxonomic and biodiversity research and capacity development, especially targeted at LMICs so they can better assess and manage life in their waters and contribute to global biodiversity knowledge; and 4) increasing observational coverage on dedicated expeditions (Fig. 1).

Expeditions will be undertaken in poorly surveyed areas to discover marine species from surface to full ocean depth. The first expeditions have taken Ocean Census scientists to the Barents Sea with the Uni. Tromsø AKMA3 project (Fig. 2), and an Ocean Census Science Network Scientist has joined the first Ocean Census participant expedition aboard the E/V *Nautilus*. Ocean Census also recognises that large collections of undescribed and, in many cases, uninvestigated samples from past expeditions exist in museums and other institutions. Ocean Census will also include these specimens in efforts to describe marine species.

Joining Ocean Census

Ocean Census is an open network of partners uniting resources and expertise to discover and protect Ocean Life. If you, your organisation or expedition is involved in

Fig. 1. (top): Crustacea collected as epifauna on a submersible dive during the Nekton Maldives Mission. Image credit: Nekton. Fig. 2. (bottom): Sample processing and student training during the AKMA3 Cruise. Image credit: Valentina Lanci

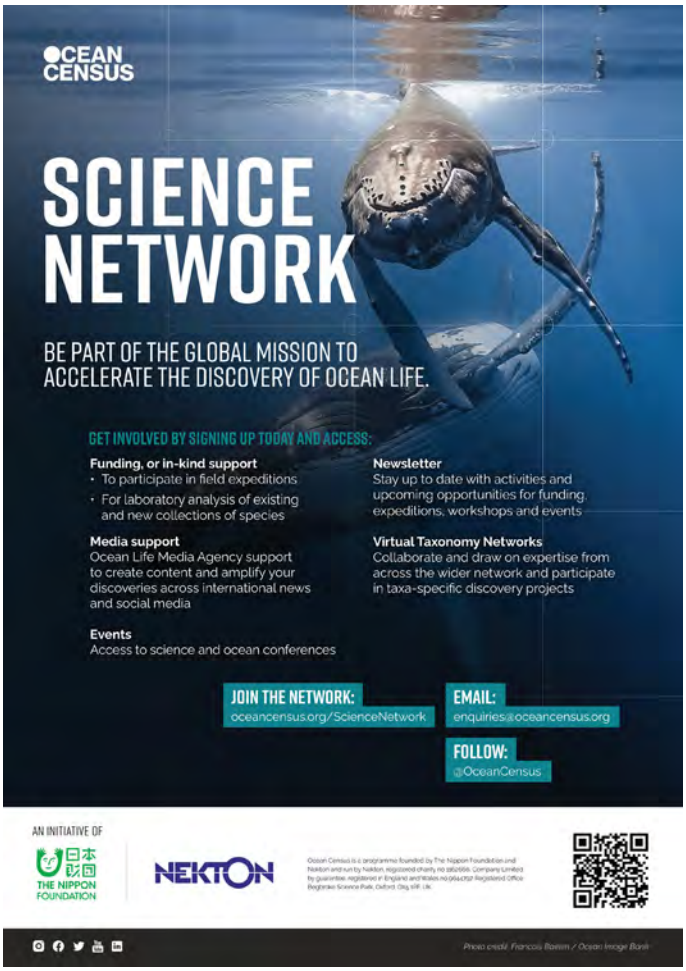

Fig. 3. Additional information on the Ocean Census Science Network, including how to sign up.

the discovery of new species, you can contribute to the global mission to find and protect species by partnering with Ocean Census or becoming part of the Ocean Census Science Network (Fig. 3). We have set up the Ocean Census Science Network to connect and offer support to taxonomists and people and organisations involved in marine species discovery around the globe, and keep in touch with a monthly newsletter to advertise opportunities.

You can also speak to us if you have a planned expedition that Ocean Census may be able to partner on, are interested in developing a joint scientific expedition or collaborating as part of a shared mission. Likewise, we would be very interested in details on any existing collections that require further analysis to discover new species.

You can submit these details and sign up to the Ocean Census Science Network through this form.

Learn more:

Visit us at www.oceancensus.org for additional information, and make sure you're following us on LinkedIn, Instagram, Facebook and Twitter and subscribe to our YouTube channel @OceanCensus.

1. Rogers, Alex D., et al. "Discovering marine biodiversity in the 21st century." Advances in Marine Biology 93 (2022): 23-115. https://doi.org/10.1016/bs.amb.2022.09.002

Woods Hole Oceanographic Institution Ocean Twilight Zone Project

Philip G. Renaud

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In July 2023, the Woods Hole Oceanographic Institution (WHOI) Ocean Twilight Zone (OTZ) Project team advanced the technological capabilities of the OTZ Observation Network with the successful deployment of three bioacoustics moorings during an R/V Neil Armstrong research cruise. The OTZ Observation Network is located in the Northwest Atlantic Ocean and is comprised of several different technologies that work synergistically: moored buoys equipped with acoustic survey systems and sediment traps, optical and geochemical sensors, and fish-tracking tags (ROAM) that continuously record the position of major predators such as sharks, swordfish and tuna. With the successful deployment of three new moorings, the team has achieved continuous acoustic imaging capability throughout the entire mesopelagic water column from 200-1000 m depth range. A bespoke video-camera system was installed near one of the acoustic transponders which will provide optical evidence of the dominant types of fish species generating the sonar echoes. Underwater Vision Profiler (UVP) optical systems were installed on two of the moorings that include traditional sediment traps. These advanced UVP systems image particulate matter (i.e. marine snow) facilitating the characterization of sources of carbon that descend to the deepest depths of the ocean, sequestered there for centuries or longer. The OTZ Observation Network enables extensive studies of the role diel vertical migration (DVM) plays in carbon flux in the Northwest Atlantic, and the relationship of carbon to ecosystem dynamics and fish vertical migration behavior. The new moorings of the OTZ Observation Network have sufficient power for approximately seven months of continuous data collection. When they are retrieved in 2024, OTZ scientists will be rewarded with a rich time-series of data covering the entirety of the ocean twilight zone water column at a single location.

Coral Restoration Project in the Gulf of Mexico Reaches New Propagation Milestone

Kelly Martin[1], Sasha Francis[1] and Michelle Donahue[2]

[1]NOAA Office of National Marine Sanctuary Foundation, USA; [2]NOAA National Marine Fisheries Service, USA

A curious conveyor has been at work in the Gulf of Mexico this summer, busily shuttling pieces of mesophotic corals to new homes on the seafloor. These corals are trailblazers: they represent the first direct outplanting efforts to restore mesophotic and deep-sea coral communities damaged by the 2010 *Deepwater Horizon* oil spill in the Gulf of Mexico. They are also part of an effort to better understand the corals themselves—these particular coral species' biology and mode of reproduction are mostly unknown.

Transplanting fragments of corals onto the seafloor is part of the *Deepwater Horizon* restoration program's Mesophotic and Deep Benthic Communities Coral Propagation Technique Development (CPT) project. The CPT project is working to determine the most effective way to restore deep coral communities injured by the oil spill. These transplanting tests will help determine whether the technique helps corals grow and reproduce, replacing the individual corals and ecological functions they provide that were lost to injury.

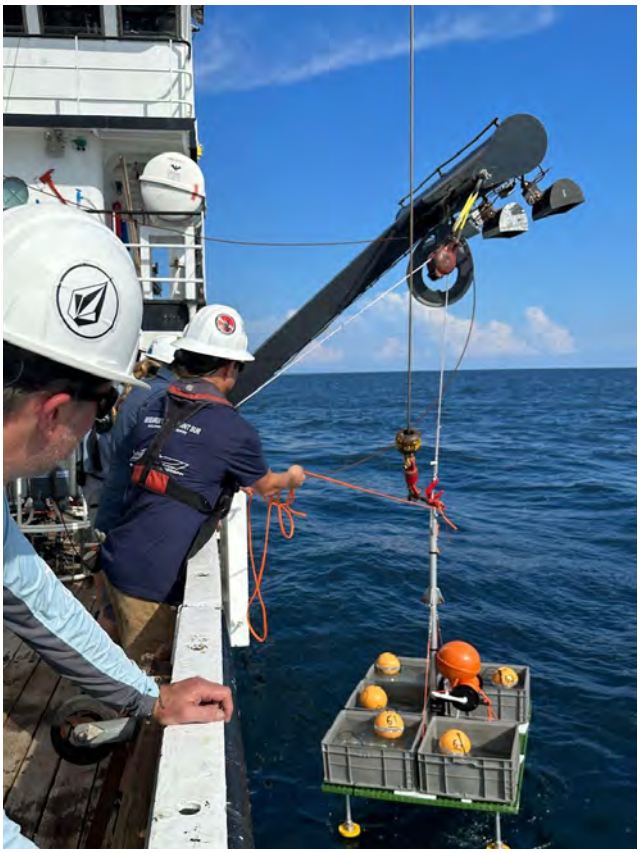


Fig. 1. Crew lowers the "deep-sea elevator" gently into the water before its 230 feet descent. Photo credit: Peter Etnoyer/NOAA

This past May, nearly 200 fragments of three octocoral species, *Thesea nivea, Muricea pendula*, and *Swiftia exserta* took a ride 230 feet (70 m) below the surface on a "deep-sea elevator" designed by the National Oceanic and Atmospheric Administration's (NOAA) Southeast Fisheries Science Center for outplanting trials. A video of the elevator and ROV in action is included in a recent NOAA Fisheries webstory.

The project's numerous partners are one of the keys to its success. The expedition and science mission, run by NOAA's National Centers for Coastal Ocean Science, explored and worked in deep water sites with the ROV *Beagle*, owned and operated by Marine Applied Research and Exploration. Operators used the *Beagle* to collect fragments from healthy octocoral colonies and return them to the ship.

Once aboard, collaborators from the University of Rhode Island and University at Buffalo affixed the fragments to custom-made racks in temperature controlled environments to prepare them for outplanting at the trial site. The outplanting racks were lowered onto the deep-sea elevator, then transferred by ROV to the sea floor. Temperature and current meters were also deployed, and water samples collected to monitor the local environment. Smaller coral samples were also preserved for genetic and reproduction studies.

At the end of July, a team of technical divers coordinated by Moody Gardens Aquarium, NOAA, and California Academy of Sciences returned to the outplanting sites to check on the corals. The divers discovered 95 percent of the corals placed in May had survived over the last 2 months and appeared healthy.

A key element of the coral propagation project has included efforts to fill in knowledge gaps about the growth,

feeding, reproduction, and microbiology of these mesophotic species in the Gulf of Mexico. Field activities since 2021 successfully located and collected octocorals from the mesophotic zone of the northern Gulf of Mexico for transport to three federal labs. There, aquarists care for, study, and support reproduction studies that are informing restoration efforts in the field as well as improving octocoral knowledge across the science community.

A new agreement for biodiversity of areas beyond national jurisdiction (BBNJ)

Christine Gaebel

Co-Lead DOSI BBNJ Working Group, University of Edinburgh

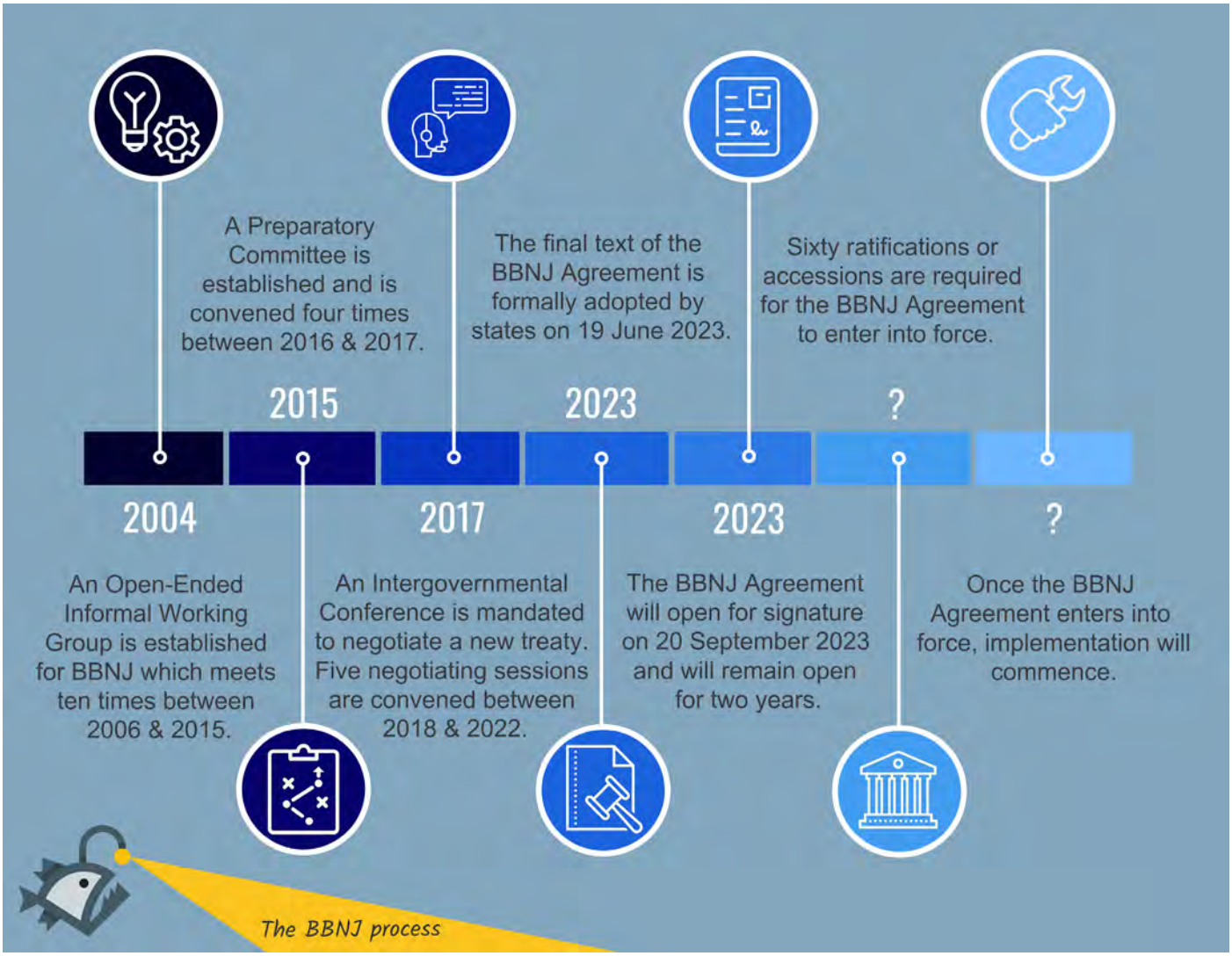
Referring to the seabed and water column outside coastal state jurisdiction, areas beyond national jurisdiction (ABNJ) comprise over two-thirds of the global ocean and provide habitats to diverse and unique marine biodiversity. Despite growing recognition of the importance of the habitats and species within ABNJ, increasing evidence shows mounting pressures on deep-sea sustainability within a changing ocean. In response to this exigency, the global community came together to develop an international legally binding instrument for the conservation and sustainable use of BBNJ. After five years of formal negotiations and almost two decades of efforts (Figure 1), the United Nations adopted a BBNJ Agreement on 19 June 2023 at the UN Headquarters in New York City.

The BBNJ Agreement focuses on four main areas: 1) Marine genetic resources, including requirements around access to these resources and the equitable sharing of benefits derived from them; 2) Area-based management tools, including implementing marine protected areas in ABNJ; 3) Environmental impact assessments for activities in ABNJ which may cause significant and harmful changes to the marine environment; and, 4) Capacity building and transfer of marine technology to help strengthen the scientific capacity of parties and support global implementation. From providing a legal framework to realise cross-sectoral area-based management tools, to supporting scientific and technological capacity building efforts at a transcontinental scale, this monumental agreement marks a significant step in supporting sustainability of deep-sea ecosystems.

However, adoption of the agreement is not the final destination, but merely a waypoint on the journey to develop and implement a new agreement for BBNJ. For the agreement to enter into force, states must formally agree to be bound by it - a process known as ratification or accession. Ratification is the next hurdle for BBNJ, because the BBNJ Agreement requires ratification from sixty countries before it can enter into force. After entry into force, the real work will then begin – putting its principles and provisions into specific action. Successful implementation will necessitate resources, resolute political commitment, and sustained support from all stakeholders, including the scientific community. Indeed, the scientific and research community have played an important role in the BBNJ process thus far, such as the Deep-Ocean Stewardship Initiative's BBNJ Working Group's ongoing work to support delegations through the provision of relevant scientific information and advice. This support and input will remain crucial as BBNJ transitions from adoption to ratification and implementation.

Implementation of the BBNJ Agreement will be a knowledge-intensive undertaking and will require global collaboration and cooperation. Facilitating capacity building will therefore be pivotal to ensure that implementation is guided by the voices of scientists from all over the world. As such, the adoption of the BBNJ Agreement serves as a clarion call to the

scientific community, to assess our existing knowledge, identify and fill knowledge gaps, and earnestly support capacity building efforts, in order to "hit the ground running" when the BBNJ Agreement enters into force.

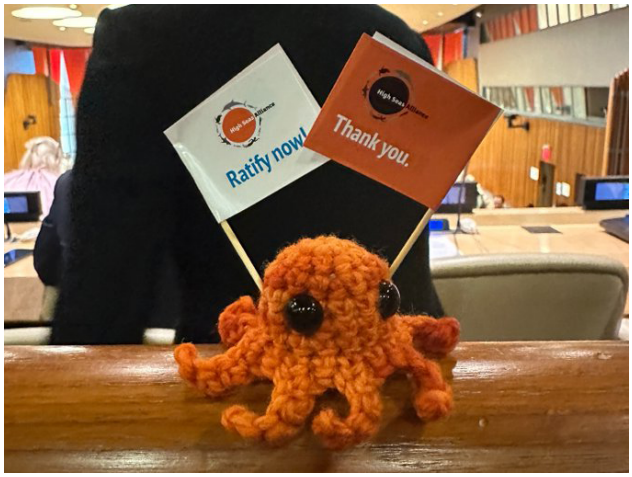


High Seas Treaty: Agreed, Adopted and Racing for Ratification!

Rebecca Hubbard

Director, High Seas Alliance

After almost twenty years of tenacious hard work by many different players, the new High Seas Treaty - or Agreement under the UN Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (BBNJ) - was adopted by consensus on 19th June 2023 in New York by UN Member States.



The High Seas covers half the planet and almost two-thirds of the global ocean. Home to some of the largest reservoirs of biodiversity on Earth, this vast ocean area has been over-exploited, under-protected and plagued by poor governance for decades. Until now.

Once it enters into force, the Treaty will finally give us the chance to establish High Seas marine protected areas, have a greater say over how we regulate harmful activities through comprehensive environmental impact assessments, and equitably share access to, and benefits from, marine genetic resources. It is ground-breaking. But this is just the start of the journey.

The Treaty will open to signatures by UN Member States on 20th September 2023. To speed up ocean protection, the High Seas Alliance is challenging States to join the Race for Ratification, with the goal of securing the 60 plus ratifications required for the Treaty to enter into force by 2025.

Thank you to all of you for your collaborative, persistent and passionate work in reaching this extraordinary moment. I look forward to working with you all as we Race for Ratification!

KASEAOPE: The onset of long-term deep-sea observation in the South Pacific

Karine Olu[1], Takeshi Toyofuku[2], Nan-Chin Chu[1], Hélène Leau[1], ScInObs[1a] project team & crew from the KASEAOPE-1[2a]

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The KASEAOPE (SEAmount Observatory Project and Ecosystem study in New Caledonia) is a series of research cruises that aims at deploying underwater observation devices on the seamounts of the Natural Park of the Coral Sea, which covers the entire EEZ of New Caledonia. The Park is one of the largest marine protected areas in the world and is a candidate for the IUCN Green List of Protected and Conserved Areas. The committees of the Park have identified more than a hundred seamounts to be protected, in particular some of them are known to be critical habitats for species such as humpback whales. Trawling has been banned since 2014, with a moratorium on deep-sea mining in process, but sightseeing cruises by tourists are frequent. The scientific knowledge on the functioning of the seamounts to explain and predict the high variability of their benthic communities through a long-term and multidisciplinary observation is therefore crucial for their management.

The project took shape from a co-design workshop in Nouméa in September 2019, which gathered international researchers and stakeholders from New Caledonia, France, Japan and more. Thanks to the financial contributions from Ifremer (project ScInObs) and JAMSTEC, the project kicked into action in 2021, starting with the design of a mooring system to allow an assemblage of sensors and samplers to collect data and samples over a period of ~18 months. The system consists of an 800 m-long mooring line equipped with sensors: temperature probes, CTD, colonization device and associated cameras, sediment trap. It also comprises a mid-depth apparatus, designed by Ifremer, gathering sensors with high-energy consumption such as biomass echo-sounder and ADCPs and their energy and electronics controller[3] for energy supply, data logging and sensors synchronization. Colleagues from JAMSTEC designed an eDNA sampler that

1a: ScInObs is the leading action of the Decade Programme One Ocean Network of Deep Observation, the action is funded by Ifremer to design long term observatories in the South Pacific and Indian Ocean.
2a: Participants of the KASEAOPE-01 are researchers, engineers and technicians from Ifremer, JAMSTEC, IRD, Okamoto Glass (engineering support for Edokko), and ship's crew from Genavir.
3: COSTOF2 (communication and storage front-end second generation) is a system developed by Ifremer to manage the large variety of sensors for a long-term monitoring.

is set close to the sediment trap with synchronized sampling frequency. In addition to this pilot mooring line, JAMSTEC deployed an autonomous benthic structure (Edokko) that is equipped with several high-resolution cameras and other sensors like a CTD, STD and a hydrophone.

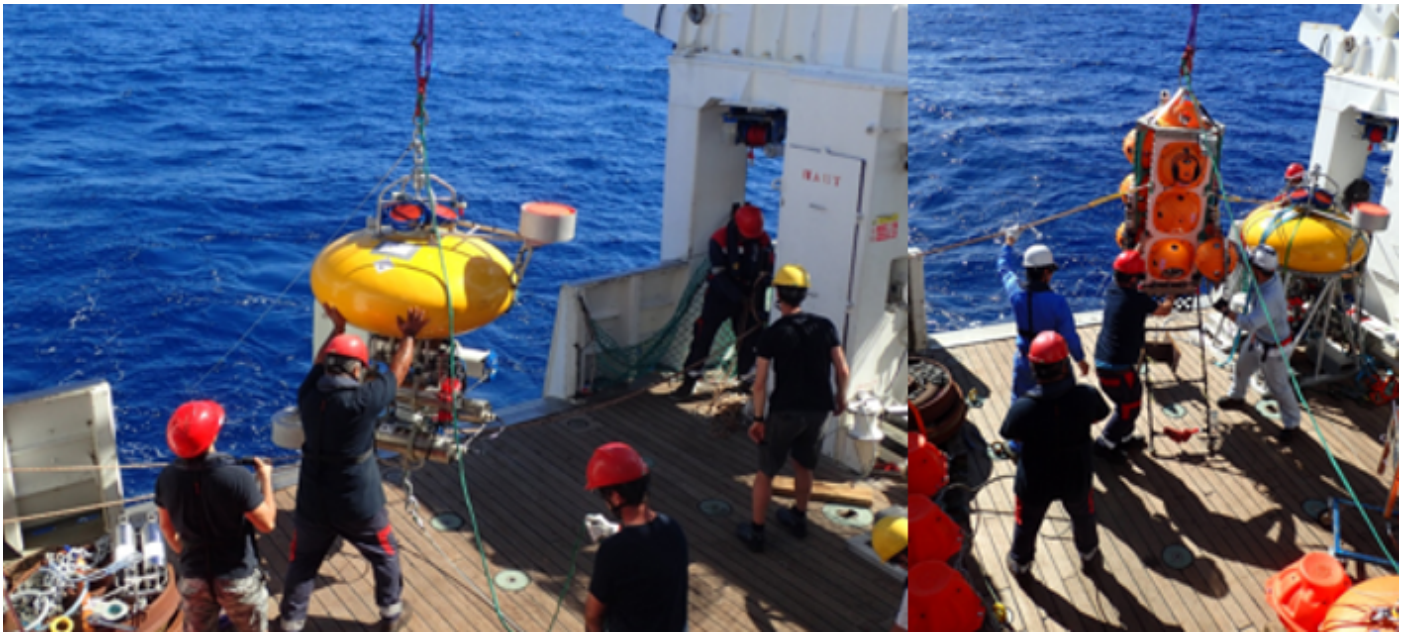

Fig. 1. Images show the deployment of the mid-depth apparatus (left) and the Edokko station (right) during the cruise KASEAOPE-1, May 2023, on board RV *Antea* offshore New Caledonia.

The deployment of this first set of underwater observation systems took place during 3-5 May 2023 on board the French research vessel *Antea*. The mooring line and Edokko were set up on the side and top of seamount Stylaster, between 500 and 1,200 m depth. More cruise information and video footage can be found at the following websites

https://www.onedeepocean.org/Our-actions/South-Pacific/KASEAOPE-1-cruise

https://www.onedeepocean.org/

The next KASEAOPE cruise will be dedicated to recover this system and to deploy a benthic station. Throughout the ScInObs project, we will develop a yo-yo system that profiles the water column along a fixed wire with one single set of sensors, that will be deployed in the Park when operational. The cruise is part of the UN Ocean Decade endorsed programme "One Ocean Network for Deep Observation (OneDeepOcean)" aiming to join forces from global ocean observatory networks to promote technology innovation and have greater leverage in tackling societal challenges.

Deep-Oceanic Analogues of Terrestrial Wetlands: Local, Global and Planetary Significances

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Undersea rivers and canyons are explored to limited extents [1,2]. Occurrence of meander- or ox-bow structures and

submarine analogues of terrestrial wetlands are largely under-explored. Wetlands hold a multitude of biogeochemical significance including climate modulation and carbon-budgets. They serve as water filtration systems, recharge ground water, buffer over-flooding, protect shorelines and storm-surges, wildlife resting places, and provide feeding and breeding ground for animals, natural products, recreation, and aesthetics [3]. Lack of awareness and increasing habitation pressures contribute to neglecting them as fallow lands forcing reclamation. Although substantial wetland conservation efforts exist globally, the planetary-scale significance of wetlands is often overlooked by researchers and almost unknown to civilians. Neotectonics and seismicity play a major role in formation and modulation of wetland geo-structures by changing courses of rivers and restructuring flowing bodies. Thus, if traced back carefully, the wetlands can derive their origins at the faults and fractures that twist and shear the landscapes over time. While making efforts to conserve the wetlands, it is thus important to understand their remote deep-oceanic and tectonic lineages which have evolved significantly over time, making them appear insignificant discontinuous water-bodies. Several major tectonic faults and lineaments serve as architects of river catchment zones that have created the vast wetlands of Ganga-Brahmaputra-Meghna, Amazon, Mississippi and St John [4]. These faults are often remnants of geo-catastrophic events like continental break-up or asteroid impacts affecting land and oceans alike.

Many wetlands are markers of these environmental events and natural desiccation and water acidification cycles. Understanding their ancient roots or tectonic governing factors might be important to decide future township and habitation plans. The time-scale of wetland formations might be in 100-500-year time-span while tectonic activities might be on larger temporal ranges. A step-wise compartmentalized modelling approach might be needed to understand the progress of land erosion and deposition, water acidification and desiccation cycles. While hydrological changes in water quantity and quality are natural events, unplanned habitation and interferences may accelerate the process in an uncontrolled manner, making landscapes more susceptible to environmental disasters.

Exploration of wetland-like structures/submarine lakes/ox-bows in the ocean floors may be vastly important in modulating oceanic diversity and biogeochemical balance. On land, artificial wetlands like pit-lakes have formed in open-cast mining sites, altering biodiversity over time. Such cases could be expected in upcoming deep-sea mining impacts too. If assessed adequately, such structures might be biodiversity remediation patches for deep-sea mining. It therefore necessitates the merging and exchange of scientific and technological expertise among deep-sea oceanographers and wetland scientists to understand, conserve and substantially utilize the submarine lakes and wetland-analogues.

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Meetings & Workshops

OCEAN / UNI Fall 2023: Culturing the Deep Sea – Towards a common heritage for all kind

October 11 – December 6, 2023

Fiona Middleton

TBA21-Academy and University of Southampton

What can art and culture bring to the debate around deep-sea mining, and representations of the deep sea? The next semester of OCEAN / UNI, TBA21–Academy's free online educational programme, interrogates the idea of the deep sea as a commons and a space of shared value through an interdisciplinary, culture-led approach.

Through a series of 5 live online lectures and interactive "activations" held with diverse speakers - from scientists to artists, from lawyers and policymakers to activists and Indigenous leaders - "*Culturing the Deep Sea: Towards a common heritage for all kind"* aims to think around the constructions and representations that shape human–Ocean relations, and look to art and critical thinking to raise alternatives. Through collective unlearning as a radical act of deep ocean literacy, we hope to empower ourselves as a community to intervene in dynamic decision-making environments.

OCEAN / UNI is an initiative dedicated to art, activism,and science that invites fluid thinking with the Ocean as a way to move beyond the binaries of land and sea. OCEAN / UNI's curriculum provides students, researchers, and the public access to wide-ranging ideas and explorations through regular live sessions, reading groups, small-scale workshops or activations, and other online material, free and accessible to everyone on Ocean-Archive.org.

The online programme is free to attend and open to all. Find out more and register at www.tba21.org/oceanuniculturingthedeepsea. Contact fiona@tba21-academy.org with questions or enquiries.

Artivism Workshop on Deep Sea Mining Aboard Peace Boat's 114th Voyage.

Kneyone Murray

Trinidad and Tobago

Peace Boat Youth for SDGs Scholar

Contact: kneyzusenergy@gmail.com

In pursuit of raising awareness and fostering action on the critical issue of deep-sea mining, an Artivism Workshop led by Kneyone Murray was conducted on board Peace Boat's 114th voyage as part of the Youth for SDGs program in conjunction with Sustainable Ocean Alliance representatives Khadija Stewart and Daniel Caceres Bartra. Deep-sea mining involves the extraction of mineral deposits from ocean depths exceeding 200 m (about 656.17 ft), including polymetallic nodules, polymetallic sulfides, and cobalt-rich ferromanganese crusts.

The workshop shed light on the environmental repercussions of deep-sea mining, emphasizing its potential irreparable damage to biodiversity. The process involves the use of cutting-edge tools to extract minerals such as massive seafloor

sulfides and cobalt-rich crusts. Polymetallic nodules, likened to colossal vacuum cleaner collections, raise concerns due to their significant sediment plumes, which can adversely affect marine life throughout the water column. This unsettling phenomenon has far-reaching implications for marine ecosystems and species, directly impacting our planet's delicate balance.

The importance of this issue was highlighted within the context of the UN Ocean Decade of Ocean Science for Sustainable Development. The workshop embraced the concept of "Artivism," wherein artistic expression was harnessed to advocate for meaningful change. The session aimed to showcase the dangers of deep-sea mining and highlight the importance of protecting our deep ocean and its role in addressing climate change.

Sincere gratitude was extended to sponsors such as Blue Planet Alliance and Sustainable Ocean Alliance, whose generous support made the realization of this advocacy-driven event possible. Recognition was given to Emilie McGlone from Peace Boat US for granting the platform for Artivism and the photographer James Rodriguez for capturing the essence of the workshop.

A special mention was made to Roberto Cerda for facilitating a firsthand encounter with the vessel, aptly named "The Hidden Gem," that is poised to embark on deep-sea mining operations. The workshop's collective commitment echoed the sentiment of creating sustainable ripples of change, pledging to safeguard our oceans for a prosperous and ecologically balanced future. Through the fusion of art and activism, the Artivism Workshop on Deep Sea Mining aboard Peace Boat's voyage left an indelible mark on the participants, inspiring them to become unwavering advocates for our planet's most precious resource- the oceans.

Transferable knowledge in deep-sea expedition leadership

Take-homes from the 2023 COBRA Master Class

Patricia (Trish) Albano[1], Laura Anthony[2], Sandra Antonio[3], Kelsey Barnhill[4], Erin Frates[5], Andrian Gajigan[6], Mani Sai Suryateja (Teja) Jammalamadaka[7], Tanika Ladd[8], Franck Lejzerowicz[9], Yakup Niyazi[10], Georgina Ramírez Ortiz[3], Johanna Weston[11]

Co-lead: Randi Rotjan[12], Julie Huber[11], Andrew T. Fisher[13], C. Geoff Wheat[14], Rosalynn Sylvan[15], and Beth N. Orcutt[15]

[1]NOAA Ocean Exploration, [2]Florida State University, National Autonomous, [3]National Autonomous University of Mexico (UNAM), [4]University of Edinburgh, [5]Boston University, [6]University of Hawaii at Manoa, [7]Massachusetts Institute of Technology, [8]Western Washington University, [9]University of Oslo, [10]University of Western Australia, [11]Woods Hole Oceanographic Institution, [12]Department of Biology, Boston University, [13]Department of Earth and Planetary Sciences, University of California, Santa Cruz, [14]College of Fisheries and Ocean Sciences, University of Alaska Fairbanks, [15]Bigelow Laboratory for Ocean Sciences

Contacts: cobra@bigelow.org

The second virtual COBRA Master Class took place from February 14 - May 16, 2023, to train early career COBRA Fellows in deep-sea expedition planning from start to finish. The Fellows acquired skills and tools to successfully design, propose, and execute deep-sea oceanographic field research, with a collaborative, just, equitable, diverse, and inclusive approach. The Fellows followed the Octopus Odyssey expedition of the Schmidt Ocean Institute's RV *Falkor* (too) via WhatsApp, to get real-world exposure to daily cruise operations and planning. They contributed to developing an open-access "how to" manual and as a teaser, they listed take-home messages that may help aspiring deep-sea expeditions leaders to start planning successfully, and early!

Assets:

- Identify the simplest, essential assets to answer your research questions.
- Different organizations manage different assets for different regions.
- Get in touch early to secure access to equipment and to share specifications with ship crews.
- Find out which functioning costs can be assumed by ship time vs research grants.
- PLAN EARLY!

Team Science:

- Draw on the full diversity of the personnel in scientific teams to harness the breadth of experience and expertise.
- Diversity hides: recognize that everyone is diverse in their own way.
- Build your team with different skills, personalities, and backgrounds.
- Do not hesitate to handle problems early when arising before it gets too complicated or toxic.
- Communicate abundantly and transparently to the extant team.
- Make sure everything is clear to everyone, incl. responsibility such as first authorships.
- Write formal Collaboration Agreements, dated, and signed by all parties.
- COORDINATE EARLY!

Proposals and Funding:

- Deep-ocean research is expensive, and it requires a lot of proposal writing and submissions.
- While seemingly obvious, proofread your proposal, trying to not anger reviewers.
- Think bigger and establish a long-term strategy: international agencies and philanthropic organizations may finance your project(s).
- Applying without immediately available funds can be perilous: secure fund contributions from team members.
- COOPERATE EARLY!

Respectful Concept Development:

- 78% of countries have the deep sea within their EEZ, but little access for scientific study.
- Unlearn parachute science practices, by co-creating ideas with local partners.
- Work with foreign collaborators by including their visions, opinions, and backgrounds.
- Contact potential collaborators early so everyone can actively and significantly contribute.
- Respectful exchange strengthens the project.
- COMMUNICATE EARLY!

Cruise Preparation:

- The chief scientist has big (administrative) responsibilities and full-time leadership roles.
- Besides your science, consider logistics, conflicts, permits, operations, and coordinating people.
- Break up tasks and deadlines into smaller, manageable goals.

- Don't hesitate to delegate.
- Plan well ahead of time.
- Stay organized.
- PREPARE EARLY!

At-sea Operations:

- Months to years of planning becomes realized when at sea.
- Create daily logs for all participants (dives and sample logs).
- Focus on the main priorities.
- Have a daily plan but be flexible.
- Be kind to the crew.
- Prioritize safety.
- Make sure everyone gets enough sleep.
- Have fun!
- SCHEDULE EARLY!

Unwritten Rules:

- From authorship to data sharing to naming seafloor features, unwritten rules exist.
- Anticipate challenges to minimize their impact but leave space for feedback and forgiveness.
- Deep-sea research is excellent to spread diversity, equity, justice, and inclusion.
- DON'T WORK TOO LATE :)

Intro to Deep Data:

- Deep-sea science largely focuses on getting new data, but funders push for open data, which might already be publicly available.
- Repositories can be tricky to navigate but you can be lucky and find existing or preliminary data.
- Explore different databases and all available information for your study area.
- Potential collaborators may be interested in sharing data with you.
- KNOW DATA NEEDS EARLY!

Data Management Plan to Cruise Report:

- Solid DMPs lead to better results.
- DMPs demonstrate commitment to quality assurance and quality control and assure long-term archiving and accessibility of information.
- May sound like loads of work but saves time for your future self.

REPORT EARLY!

Outreach:

- Choose an outreach style or event that speaks to you, to do with love and joy.
- Engage with the public or define specific target audiences.
- Contact societies, journals, and potentially interested initiatives.
- Consider artistic and educational channels.
- EXPLORE EARLY!

Ocean Law:

- Permits are additional steps but protect national interests.
- Multinational ventures can lead to surprising legal situations.
- Talk to a legal expert.
- INQUIRE EARLY!

Scientist Profiles

Andreu Santín Muriel

CIIMAR – Interdisciplinary Centre of Marine and Environmental Research, Portugal

Early Career Researcher

Contact: santin@icm.csic.es

My career as a marine researcher started by a chance encounter as, while in need to complete some practical training for my degree, I knocked at Dr. Josep-Maria Gili's office door at the Institute of Marine Science in Barcelona, and I did not leave until 10 years later!

It was there that in January 2022 I finalized my PhD, which focused on the characterization of deep-sea sponge assemblages occurring in two previously unexplored Mediterranean areas, the Menorca Channel Site of Community Interest and the Cold-Water Coral reefs of the Catalan Coast. Yet, sponge taxonomy and ecology are far from the only things I dedicated my last years to! In parallel, I have been developing cost-effective methodologies for the mitigation of the impacts of fishing practices onto deep-sea benthic communities as well as the restoration of those that had been impacted, through scientists-fishers collaborations, with the overarching goal of ensuring the long-lasting conservation of these habitats.

Yet, my sponge and conservation research lines were working rather on parallel than in conjunction so, much as the one ring when it abandoned Gollum, I too perceived my time had come. Thus, I packed my stuff, said goodbye, managed after a long struggle to get the dog in the car and I drove the ca. 13h separating one side of the Iberian Peninsula to the other to join the Deep-Sea Biodiversity and Conservation Research Team, led by Joana Xavier, at CIIMAR, the Interdisciplinary Centre of Marine and Environmental Research (Matosinhos, Portugal). I am now a PostDoc on the SponBIODIV project, which will establish a diversity and distribution baseline, and deliver tools to improve management, conservation, and restoration of sponge habitats across the Atlantic and Mediterranean, from coastal areas to mesophotic and deep-sea ecosystems.

Here I am enjoying life by the Atlantic, learning Portuguese, and developing new skills and competences to further my career. I am always happy to establish new collaborations so feel free to reach out or, even better, visit me at CIIMAR!

Samuel Clough

Auckland University of Technology, New Zealand

PhD Student

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After completing my Masters at the University of Glasgow, I had several exchanges with Dr Kat Bolstad, the head

Fig. 1. Samuel holding an *Architeuthis dux* beak from the NIWA collections

of the AUT Laboratory for Cephalopod Ecology & Systematics (ALCES) at the Auckland University of Technology (AUT) about doing a PhD on the trophic ecology of several deep-sea cephalopods in Aotearoa New Zealand – and here I am as part of ALCES at AUT as a 1st year PhD student. Two cephalopod species whose trophic ecology is poorly understood within the waters of Aotearoa New Zealand are the Angolan flying squid (Todarodes angolensis) and the Southern flying squid (*Todarodes filippovae*), two ecologically similar species whose distributions overlap in the Chatham Rise, a large submarine plateau off New Zealand's South Island.

In this region, numerous congeneric deep-sea species pairs overlap geographically, and we suspect that for many of these, resource partitioning is occurring. Yet studying the diet of cephalopods is hard because their radula masticates prey into small fragments that are difficult to identify visually. This project complements traditional morphological analysis with DNA barcoding, which is the usage of short regions of DNA to identify species of their stomach contents. To build a longer-term picture of these species trophic interactions, we are planning to include biochemical analyses of the squids' tissues including compound specific isotope analysis and fatty acid analyses, to see whether different primary producers are more important to them and be used to infer the trophic position of an animal, and can even be used to identify sharks if squalene is present in the squids' digestive gland.

Fig. 2. Beak of an Amphitretus spp. (Telescope octopus) that was identified from a ***Todarodes angolensis*** stomach that was collected from the Chatham Rise by the RV *Tangaroa*.

Johanna Behrisch

GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany

Masters Student

Contact: johanna.behrisch@t-online.de

I'm pursuing a master's in Biological Oceanography at GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany. Despite growing up inland in Germany, I've always been captivated by marine life and aspired to be a marine biologist. During my BSc in Biology, I worked and studied in Greenland and on Svalbard, igniting my passion for polar marine and terrestrial biology. Understanding the interactions between these ecosystems, their importance to humans, and conservation in the face of global change became my focus. Starting my masters two years ago exposed me to diverse marine research areas. Since then, I've been particularly interested in marine biogeochemistry and ocean carbon cycling.

Recently, I connected with the Greenland Climate Research Centre (GCRC) for my thesis project. That's where I met the benthic researcher Dr. Nadescha Zwerschke and Dr. Sandra Maier. Currently they are evaluating the blue carbon potential and susceptibility to fishing of benthic communities on the Greenlandic continental shelf. This project excites me as it combines carbon cycling and conservation in polar regions. I was thrilled to receive an offer to contribute to this project, which involved assessing blue carbon in benthic communities and studying fishery effects in South-East Greenland.

A few months later, I found myself in Nuuk at the GCRC, where we prepared for the field trip in July 2023 aboard their

research vessel Tarajoq, bound for 23 days in South-East Greenland. On the cruise I worked together with marine researchers, Dr. Chris Yesson and Dr. Bede Davies. Together, we gathered valuable data using various methods. To determine species' presence and community structure, we deployed a video sledge at 27 stations down to 300 - 700 m to capture footage of the benthic organisms in areas with different levels of fishing effort. The powerful equipment we worked with impressed me. Retrieving the sledge from the seafloor was exciting, hoping for intact gear and footage of life in the deep. Equipment challenges, which appeared occasionally, were creatively tackled as a team, supported by the helpful and skilled crew.

In parallel, we utilized trawls at 201 stations to collect benthic samples, which will be used to measure the carbon content of various benthic species. These measurements can then be extrapolated to estimate the total carbon content of benthic communities at each site. In addition to fish, the trawls also brought up many benthic organisms. It was impressive to see organisms adapted to live at depth up close, but also concerning to see what's accidentally caught in fishing nets. This trip was my first time on a scientific ship. It taught me that field research can be tough. However, teaming up with different people and discovering various life forms make it incredibly rewarding. I'm really happy about the wonderful experience I had over the past few weeks.

The goal of data we collected on the cruise is to provide insights into the blue carbon potential, ecological and anthropogenic dynamics impacting local benthic ecosystems. Our results aim to contribute to conservation efforts and sustainable fisheries management.

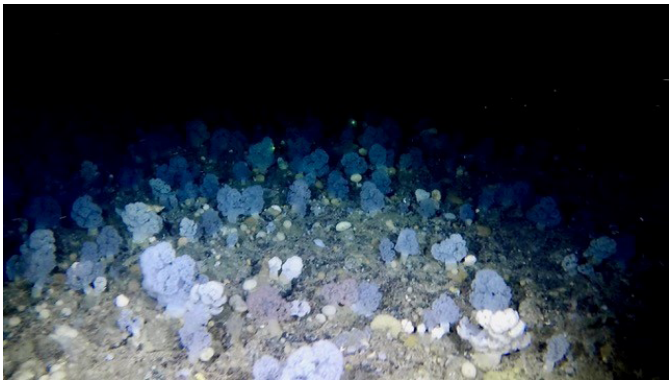

Fig. 1. Still taken from video sledge footage showing a soft coral community; Fig. 2. Image of our video sledge; Fig. 3. Image from video sledge footage showing a feather star- sponge community; Fig. 4. Picture of a retrieved basket star on the cruise in South-East Greenland.

Opportunities

Dear colleagues,

I would like to raise your attention to our Senckenberg Global Fellowships Program as the application window for the second call for applications will open on September 1st 2023. The deadline for applications is September 30th 2023.

Eligible are PhD-students and Postdoc scientists from countries of the Global South. Scholarships are awarded for a research stay of 3 months (up to 6 months in individual cases) at a Senckenberg Institute.

Please check for more details on our website: **https://www.senckenberg.de/en/career/global-fellowships/**

Please don't hesitate to forward this message to your networks and cooperation partners.

Looking forward to many interesting applications,

Angelika Brandt & Klement Tockner

Call for Papers – Progress in Oceanography (July 2023)

Biodiversity and biogeography of the abyssal and hadal Aleutian trench and adjacent N Pacific deep-sea regions.

The AleutBio (Aleutian Trench Biodiversity Studies) expedition was conducted from 24.7.-6.9.2022 with RV *SONNE* to the Northeast (NE) Pacific into the Bering Sea as well as the Aleutian Trench (SO293).

We aimed to detect changes in species composition between the North Pacific and Bering Sea into the Arctic Ocean during times of rapid climate change by sampling the eastern Aleutian Trench. We used our samples and data sets to analyze seafloor topography (bathymetry), biogeochemistry, and microbiology, as well as to analyze the systematic composition, species diversity, biogeography, and evolution of fauna of all size classes from protists to meio-, macro-, and megafauna in the Aleutian Trench.

In the proposed special volume "Biodiversity and biogeography of the abyssal and hadal Aleutian trench and adjacent N Pacific deep-sea regions" we aim at documenting our results from the AleutBio expedition and will try to integrate – where possible and feasible - also new data from the biogeographic area as well as historic data.

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Short Course: Introduction to Ocean Governance

7-8 September 2023

Have you ever wondered how your science can connect with ocean policy development? Or how ocean policy is developed and informed by science and scientists? This virtual event (2 half-days, 7-8 September 2023) aims to provide a general introduction to ocean governance for scientists and other stakeholders, and will cover key policy processes and ongoing discussions in selected policy fields relevant to ocean science.

Topics covered in the event include:

1. The United Nations Convention on the Law of the Sea (UNCLOS)
2. The Convention on Biological Diversity (CBD)
3. United Nations Framework Convention on Climate Change (UNFCC)
4. Fisheries including key global and regional processes
5. Deep-sea mining and the International Seabed Authority
6. The global agreement covering biodiversity in areas beyond national jurisdiction (the BBNJ Agreement).

In addition, the event will offer insights into capacity development and scientific outreach, as well as opportunities for engagement by early career professionals.

Learn more and register >>

Wanted

Specimens of *Notacanthus* and *Gaidropsarus* fish wanted

Rafael Bañón

Notacanthus bonaparte

Gaidropsarus gallaeciae

We seek specimen samples of the genera *Notacanthus* and *Gaidropsarus* to understand the taxonomic relationships between species from around the world. Our work aims to carry out taxonomic revisions and investigate the links between Atlantic and Indo-Pacific species. To advance our studies we are looking for new specimens from the Indo-Pacific and South Atlantic for integrative taxonomic studies combining morphology and molecular analysis.

Especially valuable for our project would be collected specimens preserved frozen or in ethanol, but not in formalin. If you already have specimens that may be suitable for this purpose, or have upcoming cruises/expeditions planned where notacanthid or gaidropsarid species may be encountered, we would love to hear from you to discuss possible collaborations and/or collecting opportunities.

Please do not hesitate to contact us by sending an email to Rafael Bañón: anoplogaster@yahoo.es

For a detailed description of our findings so far, please see the following references:

Bañón, R., Baldó, F., Serrano, A., Barros-García, D., de Carlos, A. (2022) *Gaidropsarus gallaeciae* (Gadiformes: Gaidropsaridae), a new Northeast Atlantic rockling fish, with commentary on the taxonomy of the genus. Biology, 11, 860. https://doi.org/10.3390/biology11060860

Barros-García, D., Bañón, R., Arronte, J. C., Fernández-Peralta, L., García, R., & de Carlos, A. (2016). DNA barcoding of deep-water notacanthiform fishes (Teleostei, Elopomorpha). Zoologica Scripta, 45, 263–272. https://doi.org/10.111/zsc.12154

Hot off the Press

Drivers behind the diversity and distribution of a widespread midwater narcomedusa

Gerlien Verhaegen*, Mehul Naresh Sangekar, Bastian Bentlage, Henk-Jan Hoving, Allen G. Collins, Dhugal Lindsay

Limnology and Oceanography (2023)

Narcomedusae play a key role as top-down regulators in the midwater, the largest and most understudied biome on Earth. Here, we used ecological niche modeling in three-dimensions (3D), ecomorphology, and phylogeny, to answer evolutionary and ecological questions about the widespread narcomedusan genus *Solmissus*. Our phylogenetic

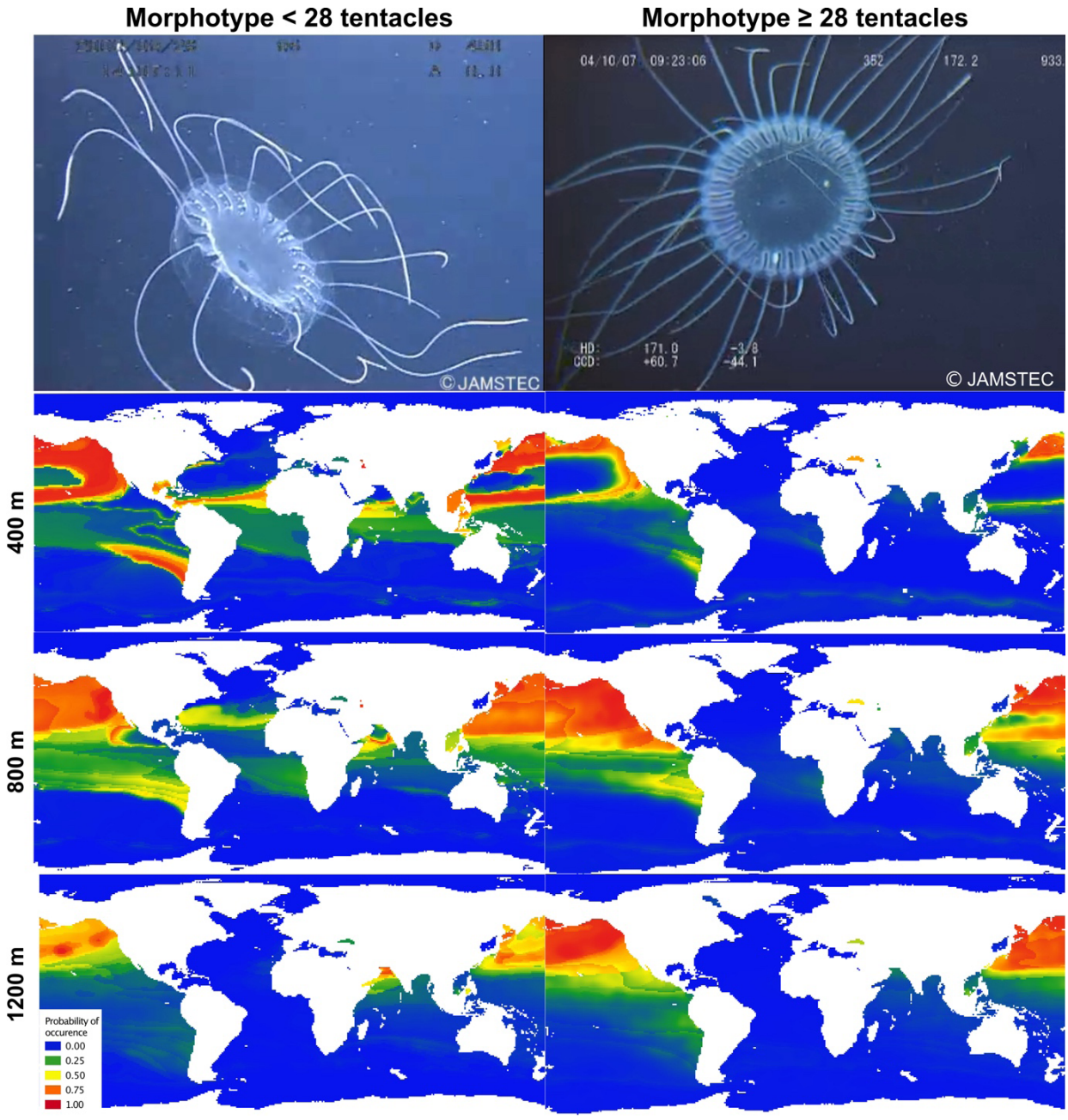


Fig. 1. Distribution maps at different depths for the *Solmissus* morphotypes “less than 28 tentacles” (left) and “more than or equal to 28 tentacles” (right). The maps were obtained by projecting the Maxent models and represent the probability of occurrence. Figure modified from Verhaegen et al. (2023).

analyses confirmed that *Solmissus incisa* represents a complex of several cryptic species. Both the different genetic clades and tentacle morphotypes were widespread and often overlapped geographically the main difference in their distribution and ecological niche being depth. This demonstrated the importance of including the third dimension when modeling the distribution of pelagic species. Contrary to our hypothesis, we found the modeled distribution of the *Solmissus* genus (n = 1444) and both tentacle morphotypes to be mostly driven by low dissolved oxygen values and a salinity of 34, and slightly by depth and temperature. *Solmissus* spp. were reproducing all year round, with specimens reproducing in slightly warmer waters (up to 1.25°C warmer). Our results suggest that *Solmissus* spp. will likely come out as climate change winners by expanding their distribution when facing ocean deoxygenation and by increasing their reproduction due to global warming. However, because most available midwater data comes from the northern Pacific, this sampling bias was undoubtedly reflected in the output of our ecological niche models, which should be assessed carefully. Our study illustrated the value of online databases including imagery and videography records, for studying midwater organisms and treating midwater biogeographic regions as 3D spaces.

Link to article: https://aslopubs.onlinelibrary.wiley.com/doi/10.1002/lno.12408#

Long distance dispersal and oceanographic fronts shape the connectivity of the keystone sponge *Phakellia ventilabrum* in the deep northeast Atlantic

Taboada Sergi, Whiting Connie, Wang Shuangqiang, Ríos Pilar, Davies Andrew J., Mienis Furu, Kenchington Ellen, Cárdenas Paco, Cranston Alex, Koutsouveli Vasiliki, Cristobo Javier, Rapp Hans Tore, Drewery Jim, Baldó Francisco, Morrow Christine, Picton Bernard, Xavier Joana R., Arias Maria Belén, Leiva Carlos, Riesgo Ana

Sec. Deep-Sea Environments and Ecology, Volume 10 (2023)

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, Taboada et al. (2023) combined population genomics and oceanographic modelling to understand how Northeast Atlantic populations (Cantabrian Sea to Norway) of the deep-sea sponge *Phakellia ventilabrum* are connected. The analysis comprised SNPs of 166 individuals collected from 57 sampling stations from 17 different areas, including two Marine Protected Areas, one Special Area of Conservation and other areas with different levels of protection. The 4,017 neutral SNPs used indicated high connectivity and panmixis amongst the majority of areas (Ireland to Norway), spanning ca. 2,500-km at depths of 99–900 m. This was likely due to the presence of strong ocean currents allowing long-distance larval transport, as supported by migration analysis and by 3D particle tracking modelling. On the contrary, the Cantabrian Sea and Roscoff (France) samples, the southernmost areas in our study, appeared disconnected from the remaining areas, probably due to prevailing current circulation patterns and topographic features, which might be acting as barriers for gene flow. Despite this major genetic break, Taboada *et al.* (2023) suggest that all protected areas studied are well-connected with each other. However, the relatively low genetic diversity observed along the study area highlights the potential fragility of this species to changing climates, which might compromise resilience to future threats.

Link to article: https://www.frontiersin.org/articles/10.3389/fmars.2023.1177106/full

Chloeia rozbaczyloi, a new species of polychaete (Archinominae: Amphinomidae) and first record of the family for the Nazca Ridge, southeastern Pacific Ocean

Juan I. Cañete, María S. Romero, Erin E. Easton, Ariadna Mecho, Javier Sellanes

Deep Sea Research Part I: Oceanographic Research Papers, Vol. 199 (2023)

The amphinomid polychaete *Chloeia rozbaczyloi* sp. nov., collected from seamounts of the Nazca Ridge (NR), northwest of Desventuradas islands, southeastern Pacific Ocean, is described. The new species was observed on only two of seven seamounts surveyed in the area (25.079°S, 82.006°W, and 25.408°S, 81.769°W, ~220 m depth), being abundant on one of them. Specimens were observed under optical and scanning electron microscopes, and DNA was sequenced (COI, 16S, 18S, and 28S nucleotide alignment). *Chloeia rozbaczyloi* sp. nov. belongs to the venusta group of *Chloeia* and is distinguished mainly by: (i) the chromatic pattern of the dorsum (with a single middorsal dark band) and the caruncle (with 16–20 vertical folds and 12 to 14 black spots posteriorly decreasing in diameter), (ii) by the biannulated dorsum of the first ten chaetigers, each with a bean-shaped anterior pseudosegment, (iii) long neuropodial cirri, with a short ceratophore, at chaetiger 2 and reaching chaetiger 6, and (iv) bipinnate branchiae from chaetiger 4, with seven to nine lateral branches arising from the primary axis, each possessing five pinnules; branchiae change progressively in size to the posterior end. The ciliated margin of the accessory dorsal cirri suggests a respiratory function that might be relevant considering that both seamounts in which the species was observed could be influenced by low-oxygen waters. DNA results further support that *C. rozbaczyloi* sp. nov. differs from the other five congeneric taxa (*C. bimaculata*, *C. flava*, *C. parva*, *C. pocicola*, and *C. viridis*) for which genetic information is available. This finding constitutes the first report of the genus for Chilean waters, increasing the number of species of Amphinomidae in this area to seven. It also confirms the presence of the family in the NR and increases the number of *Chloeia* species in the world to 43. The seamounts where the new species have been collected are within the newly created offshore Nazca-Desventuradas Marine Park. Information on potentially unique and endemic species, such as the one discussed here, is of utmost importance to preserve special ecological units, address ecosystem services, and implement management measures in the area.

Link to article: https://doi.org/10.1016/j.dsr.2023.104110

A new deep-water cone from the southeastern Pacific: description of *Profundiconus motirohivanus* new species (Gastropoda: Conoidea)

Manuel J. Tenorio, Jan M. Tapia-Guerra, William J. Fenzan, Javier Sellanes

The Nautilus 137(2):45–51 (2023)

Profundiconus motirohivanus new species is described from material collected in deep water at Sala y Gómez Ridge (Motu Motiro Hiva), Nazca Ridge, and other nearby localities off Chile. The new species has been previously misidentified as *Profundiconus smirna* (Bartsch and Rehder, 1943). It is compared to other related species of *Profundiconus*. Part of the seamounts where the new species has been collected are within the newly created offshore Motu Motiro Hiva Marine Park. Information on potentially unique and endemic species, such as the one presented here, is relevant for the implementation of properly informed management measures in this poorly explored area

Link to article: https://www.researchgate.net/publication/46220883_Defining_a_Clade_by_Morphological_Molecular_and_Toxinological_Criteria_Distinctive_Forms_related_to_Conus_praecellens_A_Adams_1854

First Data on the Age and Growth of Schmidt's cod *Lepidion schmidti* (Moridae) from Waters of the Emperor Seamounts (Northwestern Pacific)

N.B. Korostelev, I.V. Maltsev, A.M. Orlov

Journal of Marine Science and Engineering 11 (6): 1212 (2023)

This study presents the first data of growth and age of Schmidt's cod *Lepidion schmidti*, a rare and poorly studied member of the Moridae family (Gadiformes, Teleostei). The research was focused on the Emperor Seamounts area with the aim of investigating the age, growth rates, and longevity of this species. The analysis involved examining annual growth increments on sagittal otoliths. Data were taken from longline catches in 2014 and 2016, resulting in the collection of 140 individuals and the use of 70 otoliths for age determination. The results revealed that Schmidt's cod can live for up to 49 years, with a mean age of 31.5 years in the catches. The relationship between body weight and total length was described by a power function, indicating positive allometric growth. The most suitable growth model for this species was determined to be the Von Bertalanffy growth equation. These results provide valuable insights to add to the limited knowledge of growth and age in the Moridae family and emphasize the long lifespan and slow growth of Schmidt's cod.

Link to article: https://doi.org/10.3390/jmse11061212

First Record of the Northern Wolffish *Anarhichas denticulatus* Krøyer, 1845 (Anarhichadidae: Zoarcoidei: Perciformes) in the Siberian Arctic: Further Evidence of Atlantification?

A.M. Orlov, S.Y. Orlova , M.O. Rybakov, O.R. Emelianova, E.V. Vedishcheva

Climate 11 (5): 101 (2023)

A single specimen of the northern wolffish *Anarhichas denticulatus* Krøyer, 1845, 393 mm in length, was documented for the first time in the Siberian Arctic (Laptev Sea, Russia). Species identification was confirmed by an integrative taxonomic approach that included examination of external morphology and DNA barcoding using the *COI* mtDNA gene. This species is widely distributed in the North Atlantic, but records in the Arctic Ocean are limited to the Canadian and US coasts. This record might represent a significant range extension of about 7500 km for the species and may be associated with the eastward transport of a pelagic juvenile specimen from the Northeastern Atlantic to the Laptev Sea by the North Atlantic current, consistent with the hypothesis of Atlantification of the Arctic Ocean. X-ray images of the Laptev Sea specimen and photographs showing ontogenetic variations of species' coloration are provided for reference. The Laptev Sea specimen had a more elongated shape, longer preorbital distance, and longer pectoral, dorsal, and anal fins, as well as a larger eye and wider caudal fin compared to North Atlantic samples. The size differences are likely associated with conditions experienced as a juvenile during the pelagic stage of the lifecycle.

Link to article: https://doi.org/10.3390/cli11050101

Genetic analyses reveal a non-panmictic genetic structure in the sablefish *Anoplopoma fimbria* in the northern Pacific

A.M. Orozco-Ruiz, C. Galván-Tirado, A.M. Orlov, S.Y. Orlova, F.J. García-De León

ICES Journal of Marine Science 80 (5): 1319-1328 (2023)

The sablefish *Anoplopoma fimbria* is distributed on the continental shelf of the North Pacific, has a high commercial value for both fisheries and aquaculture, and represents a shared resource between countries in the North Pacific basin. In the present study, we extend the geographic range surveyed in previous studies and reexamine the population's genetic structure by integrating phylogeographic patterns of mitochondrial DNA and microsatellite DNA markers. Our results contradict the proposal that sablefish constitute a single population throughout their distributional range. We observed a signal of ancient divergence in mtDNA that differentiates the North Pacific West Coast from the rest of the sample sites, and microsatellite markers reveal a contemporary isolation of Mexican sablefish. Our findings show genetic differences between localities that should be explored in more detail to fully understand the interconnectedness that appears to exist between populations.

Link to article: https://doi.org/10.1093/icesjms/fsad058

Effects of sediment pulses on the deep-sea coral *Goniocorella dumosa*

Valeria Mobilia, Dianne M. Tracey, Vonda Cummings, Malcolm R. Clark, Lisa Woods & James Bell

New Zealand Journal of Marine and Freshwater Research (2023)

Seabed-contact activities operating in the deep sea can generate sediment plumes that pose varying levels of threat to benthic fauna. Corals are important components of deep-sea ecosystems and can be particularly sensitive to elevated suspended sediment concentrations. In this study, we exposed colony fragments of the New Zealand deep-sea scleractinian *Goniocorella dumosa* to four-day pulses of four target sediment concentrations: 0 mg l^{-1} (representing control conditions) and 45, 102 and 435 mg l^{-1} (targeting concentrations expected from mining and trawling disturbance). All coral fragments survived. Oxygen consumption rates were not affected by treatments and time. No visible detrimental effects on coral health were noted after the first pulse of sediment exposure. However, both a loss of coenosarc and instances of polyp mortality were observed on fragments exposed to suspended sediments during the following sediment pulses. This observed decline in coral health over time indicates that *G. dumosa* could cope with sediment disturbance from human activities that disturb the seafloor for periods of up to four days, but that repeated, or prolonged sediment exposure could cause a deterioration in the health condition of this species. This hypothesis should be further investigated in following studies.

Link to article: https://doi.org/10.1080/00288330.2023.2230154

Exciting Discovery Reveals Link Between Deep-Sea Fish and Changing Seawater Temperatures

Chien-Hsiang, Lin; Chih-Lin, Wei; Sze Ling, Ho and Li, Lo

Science Advances, 9: eadf0656 (2023)

In a groundbreaking interdisciplinary research effort spanning over three years, a team of talented scientists has unveiled a significant breakthrough. Assistant Research Fellow Dr. Chien-Hsiang Lin from the Biodiversity Research Center at Academia Sinica, along with Assistant Professor Dr. Li Lo from the Department of Geological Sciences at National Taiwan University, and Associate Professor Dr. Chih-Lin Wei and Assistant Professor Dr. Sze Ling Ho from the Institute of Oceanography at National Taiwan University, have made a remarkable discovery. Their findings shed light on the

intricate relationship between the structure of tropical deep-sea fish communities and fluctuations in seawater temperature.

Utilizing exceptionally well-preserved fossil fish otoliths (Fig. 1) extracted from a deep-sea core obtained from the Solomon Sea in the southwest edge of equatorial Pacific Ocean, the research team meticulously reconstructed the composition of deep-sea fish communities throughout the past 460,000 years. By conducting comprehensive analyses that combined ancient seawater temperature records with fish diversity and abundance, the team uncovered intriguing insights.

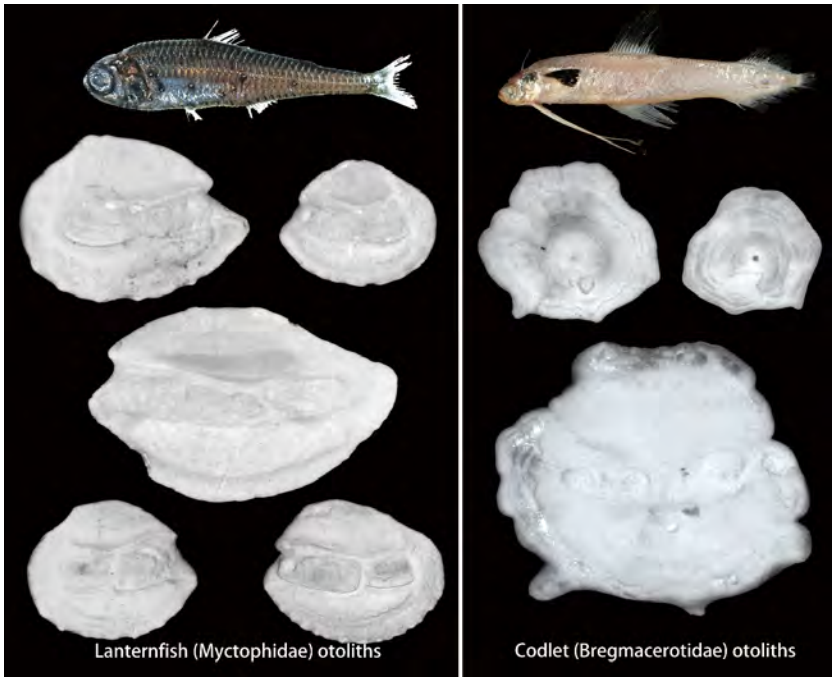


Fig. 1. The most abundant fish otoliths found in ODP 1115B, a deep-sea core from the Solomon Sea.

The study primarily revealed a strong correlation between various fish species in the mid-ocean zone and seawater temperature. During the cooler ice ages, fish diversity soared while their overall abundance decreased. Conversely, during the warmer interglacial periods, fish diversity declined while their abundance increased. Remarkably, the team observed that only a select few heat-tolerant fish species, such as Myctophidae and Bregmacerotidae (Fig. 1), managed to thrive in larger numbers. However, the most significant finding emerged when the researchers discovered a substantial decrease in both fish diversity and abundance in the Super interglacial environment, where seawater temperatures surpassed present-day levels. Intriguingly, the study revealed distinct temperature adjustment gradients for fish diversity and abundance, with a notable difference of approximately 2 degrees in the threshold value (Fig. 2).

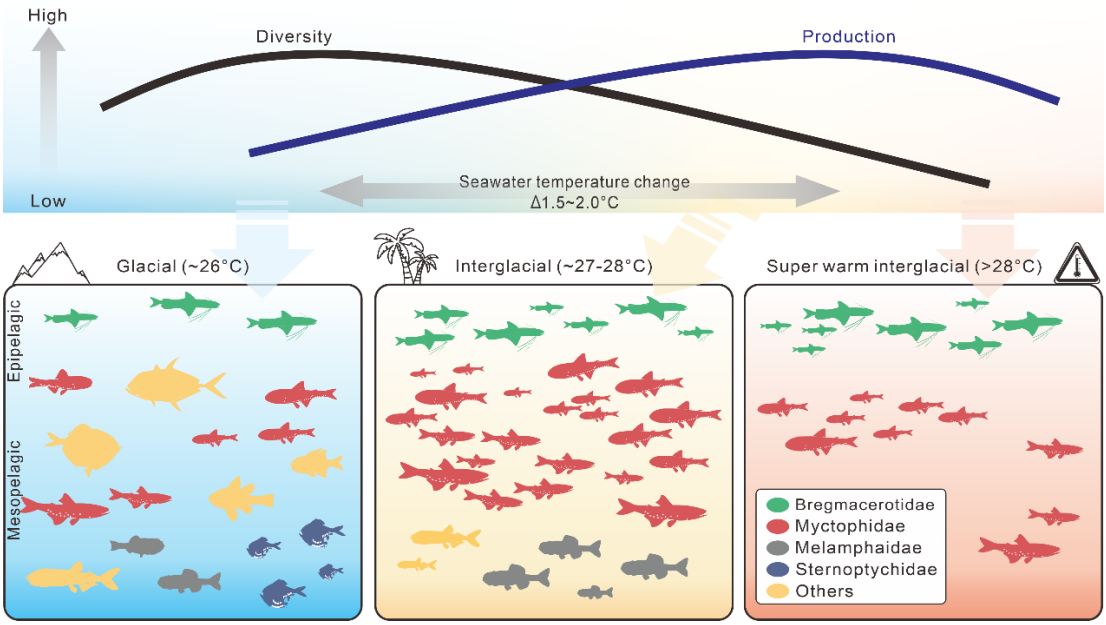


Fig. 2. Linkage of deep-sea fish abundance and diversity and seawater temperature on glacial/interglacial time scales.

This groundbreaking research represents the first fossil record of fish on such a long timescale and with such high time resolution. Furthermore, it establishes the crucial link between deep-sea fish community and seawater temperatures in the tropics on glacial and interglacial timescales. These findings emphasize the profound sensitivity of deep-sea fish in both oceanic and mesopelagic regions to warming seawater, underscoring the ecological challenges they may face. By enhancing our understanding of the ecosystem impacts resulting from ocean warming, this study serves as an

essential and pressing warning for assessing potential repercussions on fish in the future.

Link to article: https://www.science.org/doi/10.1126/sciadv.adf0656

Website: http://www.oc.ntu.edu.tw/oceng/?teacher=sze-ling-ho

Special Issue of Records of the Australian Museum (RV "*Investigator*"—Abyssal Annelida)

Edited by Elena Kupriyanova and Laetitia Gunton

Dedicated to new species of annelids collected during the pioneering 2017 "Sampling the Abyss" expedition.

The voyage was the first ever dedicated survey of deep-sea life along Australia's eastern continental margin. The samples were collected at 124 stations from Tasmania to Southern Queensland from 1000 to 4000 m depth. In total, 33 annelid species new to science from families Cirratulidae, Dorvilleidae, Hesionidae, Melinnidae, Nereididae, Onuphidae, Orbiniidae, Scalibregmatidae, Serpulidae, and Siboglinidae have been described, these include species found on the first natural whale fall from Australian waters. All papers are open access.

Gunton, L. M., W. Zhang, E.K. Kupriyanova, and P. A. Hutchings. 2023. New species of *Melinna* (Melinnidae, Annelida) from the Australian abyss with comments on *M. albicincta*, *M. cristata* and *M. elisabethae*. In RV 'Investigator'—Abyssal Annelida, ed. E. K. Kupriyanova and L. M. Gunton. Records of the Australian Museum 75(3): 125–154.

Link to article: https://doi.org/10.3853/j.2201-4349.75.2023.1803

Kupriyanova, E.K., and B. Flaxman. 2023. A new species of the mysterious genus *Spirodiscus* (Annelida: Serpulidae) of the eastern Australian abyss. In RV 'Investigator'—Abyssal Annelida, ed. E. K. Kupriyanova and L. M. Gunton. Records of the Australian Museum 75(3): 155–166.

Link to article: https://doi.org/10.3853/j.2201-4349.75.2023.1801

Georgieva, M.N., H. Wiklund, D.A. Ramos, L. Neal, C.J. Glasby, and L.M. Gunton. 2023. The annelid community of a natural deep-sea whale fall off eastern Australia. In RV 'Investigator'—Abyssal Annelida, ed. E. K. Kupriyanova and L. M. Gunton. Records of the Australian Museum 75(3): 167–213.

Link to article: https://doi.org/10.3853/j.2201-4349.75.2023.1800

Paxton, H., N. Budaeva, and L.M. Gunton. 2023. Amazing diversity of *Nothria* (Annelida, Onuphidae) in the Australian deep sea. In RV 'Investigator'—Abyssal Annelida, ed. E. K. Kupriyanova and L. M. Gunton. Records of the Australian Museum 75(3): 215–247.

Link to article: https://doi.org/10.3853/j.2201-4349.75.2023.1802

Blake, J.A. 2023. New species of Cirratulidae (Annelida) from continental slope and abyssal depths off eastern Australia. In RV 'Investigator'—Abyssal Annelida, ed. E. K. Kupriyanova and L.M. Gunton. Records of the Australian Museum 75(3): 249–270.

Link to article: https://doi.org/10.3853/j.2201-4349.75.2023.1799

Blake, J. A. 2023. New species of Scalibregmatidae (Annelida) from slope and abyssal depths off eastern Australia. In RV 'Investigator'—Abyssal Annelida, ed. E. K. Kupriyanova and L. M. Gunton. Records of the Australian Museum 75:

271-298.

Link to article: https://doi.org/10.3853/j.2201-4349.75.2023.1827

Deep sea nature-based solutions to climate change

Nathalie Hilmi, Michael Sutherland, Shekoofeh Farahmand, Gunnar Haraldsson, Erik van Doorn, Ekkehard Ernst, Mary S. Wisz, Astrid Claudel Rusin, Laura G. Elsler, Lisa A. Levin

Front. Clim., Vol. 5, 2023. Sec. Negative Emission Technologies

The deep sea (below 200 m depth) is the largest carbon sink on Earth. It hosts abundant biodiversity that underpins the carbon cycle and provides provisioning, supporting, regulating and cultural ecosystem services. There is growing attention to climate-regulating ocean ecosystem services from the scientific, business and political sectors. In this essay we synthesize the unique biophysical, socioeconomic and governance characteristics of the deep sea to critically assess opportunities for deep-sea blue carbon to mitigate climate change. Deep-sea blue carbon consists of carbon fluxes and storage including carbon transferred from the atmosphere by the inorganic and organic carbon pumps to deep water, carbon sequestered in the skeletons and bodies of deep-sea organisms, carbon buried within sediments or captured in carbonate rock. However, mitigating climate change through deep-sea blue carbon enhancement suffers from lack of scientific knowledge and verification, technological limitations, potential environmental impacts, a lack of cooperation and collaboration, and underdeveloped governance. Together, these issues suggest that deep-sea climate change mitigation is limited. Thus, we suggest that a strong focus on blue carbon is too limited a framework for managing the deep sea to contribute to international goals, including the Sustainable Development Goals (SDGs), the Paris Agreement and the post-2020 Biodiversity Goals. Instead, the deep sea can be viewed as a more holistic nature-based solution, including many ecosystem services and biodiversity in addition to climate. Environmental impact assessments (EIAs), area-based management, pollution reduction, moratoria, carbon accounting and fisheries management are tools in international treaties that could help realize benefits from deep-sea, nature-based solutions.

Link to article: https://doi.org/10.3389/fclim.2023.1169665

Photogrammetry of Antarctic biogenic reefs: A reproducible workflow for assessing structural complexity.

Juan C. Montes-Herrera, Nicole Hill, Vonda J. Cummings, Glenn J. Johnstone, Jonathan S. Stark,and Vanessa Lucieer

Remote Sensing in Ecology and Conservation. Published online July 25 2023.

Habitat-forming organisms increase local and regional biodiversity, but quantifying their influence on other species remains challenging, especially in the deep and polar benthos. While underwater imaging technologies and structure-from-motion photogrammetry (*SfM*) are widely used for studying three-dimensional (3D) biogenic structures in shallow-water coral reefs, there are limited examples of their application in deep and high-latitude benthos. In this new open-access study, we utilize high-resolution imagery collected with small remotely operated vehicles (ROVs) and action cameras to quantify the structural complexity of a unique Antarctic biogenic reef formed by dense aggregations of the tube-forming polychaete *Serpula narconensis*. Serpulids are calcifying organisms widespread across the Southern Ocean; nonetheless, reef formations have only been reported at three contrasting locations and depths: Ellis Fjord,

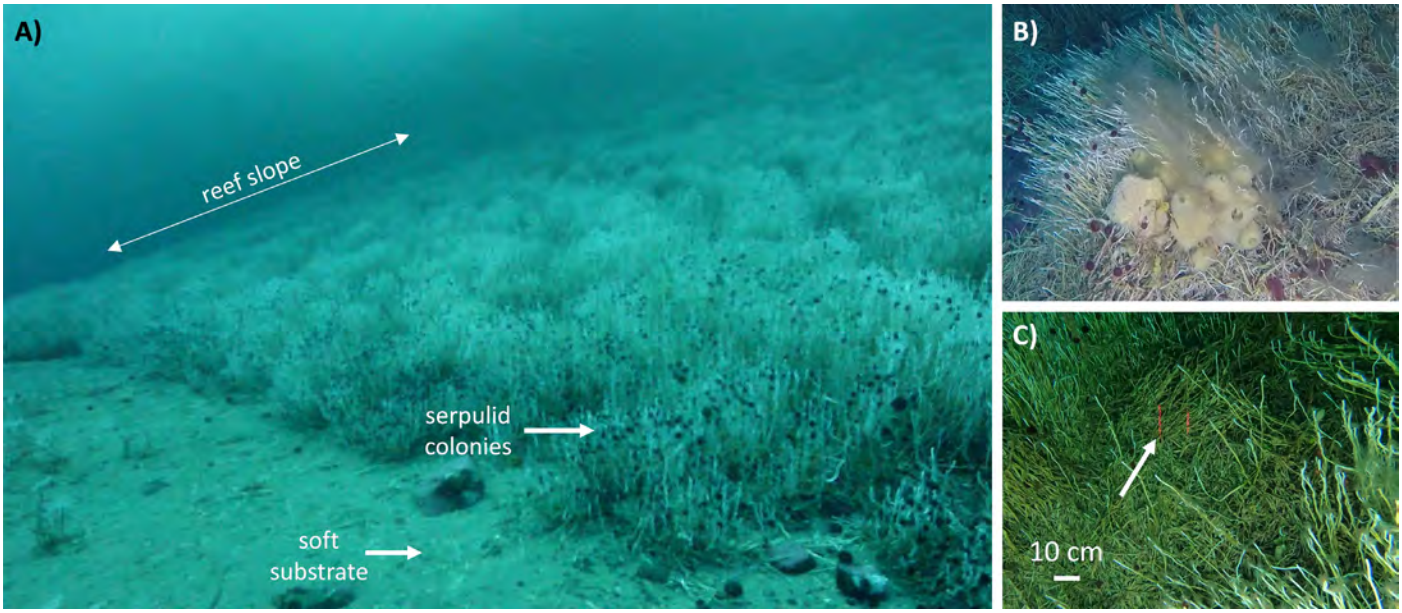


Figure 1. ROV imagery of Ellis Fjord polychaete reef. (A) Depicts a scene from the ROV frontal camera. (B, C) Present nadir images acquired with the GoPro camera that were used for 3D model reconstruction. Reference laser scale (10cm) over a broken patch of polychaete tubes is pointed with a white arrow in (C).

Vestfold Hills (8 to 30 m depth); Clerke Rocks, South Georgia island (90 to 105 m depth); and Terra Nova Bay, Ross Sea (200 to 500 m depth). Consequently, serpulid reefs have the potential to form in both shallow coastal and deep-sea waters, providing insights into reef biology and evolution.

The reproducible *SfM* workflow presented in this study not only enhances our understanding of Antarctic marine ecosystems but also paves the way for standardised monitoring efforts. By sharing open-source code and Jupyter notebooks, this study aims to foster collaboration and data sharing among benthic research campaigns. This collaborative approach will enable researchers and conservation practitioners to assess and monitor seafloor ecosystems consistently and comparably, helping to determine essential 3D habitat features important for conservation and marine protected area designation, which could have been overlooked by two-dimensional photographs. We encourage the use and modification of the open-source code to build databases of the structural complexity provided by different biogenic structures across depths and latitudes.

Link to article: https://doi.org/10.1002/rse2.358

A glimpse into the trophic ecology of deep-water sharks in an important crustacean fishing ground

Sofia Graça Aranha, Alexandra Teodosio, Vânia Baptista, Karim Erzini, Ester Dias

Fish Biology, 102: 547-735 (2023)

We are pleased to share our paper on deep-sea sharks that won this year's **Huntingford medal** from the Fisheries Society of the British Islands on the **best early career paper**.

Deep-water sharks are among the most vulnerable deep-water taxa because of their extremely conservative life-history strategies (i.e., late maturation, slow growth, and reproductive rates), yet little is known about their biology and ecology. Thus, this study aimed at investigating the trophic ecology of five deep-water shark species, the birdbeak dogfish (*Deania calcea*), the arrowhead (*D. profundorum*), the smooth lantern shark (*Etmopterus pusillus*), the blackmouth catshark (*Galeus melastomus*) and the knifetooth dogfish (*Scymnodon ringens*) sampled onboard a crustacean bottom-trawler off the south-west coast of Portugal. We combined carbon and nitrogen stable isotopes

Fig. 2. Left: Opening of the codend of a crustacean bottom trawler net; Middle: Deep-water sharks among the catch of a crustacean bottom trawler (sp. *Scymnodon ringens*); Right: *Centrophorus* sp. Photo credits: DELASMOP

with RNA and DNA (RD) ratios to investigate the main groups of prey assimilated by these species and their nutritional condition, respectively. Stable isotopes revealed overall small interspecific variability in the contribution of different taxonomic groups to sharks' tissues, as well as in the origin of their prey. *S. ringens* presented higher δ15N and δ13C values than the other species, suggesting reliance on bathyal cephalopods, crustaceans and teleosts; the remaining species likely assimilated bathy-mesopelagic prey. The RD ratios indicated that most of the individuals had an overall adequate nutritional condition and had recently eaten. This information, combined with the fact that stable isotopes indicate that sharks assimilated prey from the local or nearby food webs (including commercially important shrimps), suggests a potential overlap between this fishing area and their foraging grounds, which requires further attention.

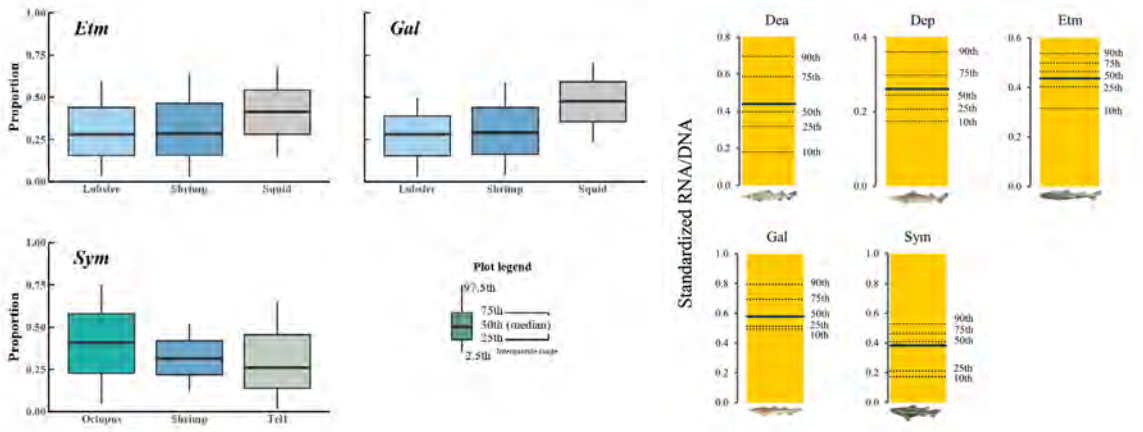
Link to article: https://onlinelibrary.wiley.com/doi/epdf/10.1111/jfb.15306

Miles down for lunch: deep-sea in situ observations of Arctic finned octopods *Cirroteuthis muelleri* suggest pelagic-benthic feeding migration

Alexey V. Golikov, Julian B. Stauffer, Sophie V. Schindler, James Taylor, Lilian Boehringer, Autun Purser, Rushan M. Sabirov, Henk-Jan Hoving

Proceedings of the Royal Society B: Biological Sciences (2023)

Cephalopods (squids, cuttlefishes and octopods) include several taxonomic groups highly represented in deep-sea ecosystems. They are ecologically diverse, important as prey and predator, but still poorly understood. One such group is Cirrata, the deep-sea gelatinous finned octopods. These charismatic megafauna organisms are easily recognized by a pair of fins on the body, resembling the ears of the flying elephant in the Disney movie, which has resulted in their common name 'dumbo' or 'jumbo' octopus. The cirrates are among the deepest cephalopods ever recorded. Their natural feeding behaviour remains undocumented. Using underwater robots and towed camera systems during several expeditions in the Arctic, Arctic cirrate *Cirroteuthis muelleri* were observed *in situ*. The cirrates were encountered with



their web spread wide, motionless, and drifting in the water column 500 to 2600 m from the seafloor. They were also repeatedly observed on the seafloor where they exhibited a repeated behavioural sequence interpreted as feeding. The sequence (11–21 s) consisted of arm web spreading, enveloping, and retreating. Prey capture happened during the enveloping phase and lasted 5–49 s. Numerous traces of feeding activity were also observed on the seafloor. This migration is unknown for cephalopods, but known from deep-sea gelatinous fishes and holothurians. It may have evolved to take advantage of seafloor nutrients, while drifting in the water column helps to conserve energy and avoid predators. *In situ* observations are indispensable to discover the behaviour of abundant megafauna, and the energetic coupling between the pelagic and benthic deep sea.

Link to article: https://royalsocietypublishing.org/doi/10.1098/rspb.2023.0640

Related video at GEOMAR youtube channel: https://www.youtube.com/watch?v=sX5PaX1rTjA

Otoliths of marine fishes record evidence of low oxygen, temperature and pH conditions of deep Oxygen Minimum Zones

Leticia Maria Cavole, Karin E. Limburg, Natalya D. Gallo, Anne Gro Vea Salvanes, Arturo Ramírez-Valdez, Lisa A. Levin, Octavio Aburto Oropeza, Andreas Hertwig, Ming-Chang Liu, Kevin D. McKeegan

Deep-Sea Research Part I 191 (2023)

The deep sea is rapidly losing oxygen, with profound implications for marine organisms. Within Eastern Boundary Upwelling Systems, such as the California and the Benguela Current Ecosystems, an important question is how the ongoing expansion, intensification and shoaling of Oxygen Minimum Zones (OMZs) will affect deep-sea fishes throughout their lifetimes. One of the first steps to filling this knowledge gap is through the development of tools and techniques to track fishes' exposure to hypoxic (< 45 µmol kg^{-1}), low-temperature (~ 4-10°C) and low-pH (~ 7.5) waters when inhabiting OMZs. Here, we examine if the otoliths of deep-sea fishes living in OMZs exhibit distinct patterns of elemental and isotopic composition, which could be used to monitor their exposure history to severely hypoxic and low-pH waters. We hypothesize that the unique biogeochemistry of OMZs (i.e., low-oxygen, low-pH, and the presence of dissolved elements) will impart unique elemental and isotopic signatures upon the otoliths of both long-lived and short-lived deep-sea fishes living within it. We analyzed the otoliths of six deep-sea fish species from three OMZ regions: the Southern California Bight and the Gulf of California in the Northeast Pacific Ocean, and the Namibian shelf in the Southeast Atlantic Ocean. Three complementary techniques were applied: laser ablation inductively coupled plasma mass spectrometry, secondary ion mass spectrometry and scanning X-ray fluorescence microscopy. We observed that deep-water OMZ-dwelling fishes spanning a range of life-history traits (e.g., longevity, maximum size, growth rate, parental investment and thermal history inferred by $\delta^{18}O$) exhibited a common elemental fingerprint (with respect to Sr:Ca, Mn:Ca, Ba:Ca, Cu:Ca and Mg:Ca) when compared to a

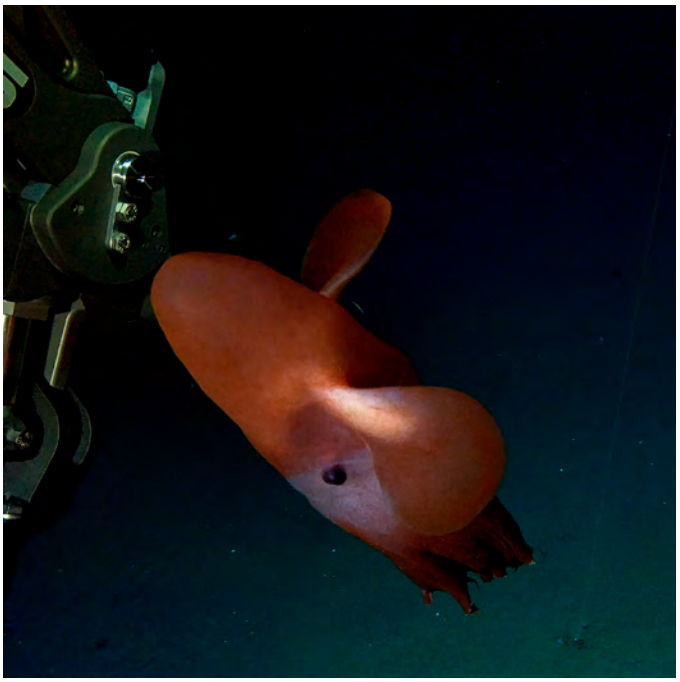


Fig. 1. Arctic finned octopod (*Cirroteuthis muelleri*) swims towards ROV '*Aurora Borealis*' in the Fram Strait, High Arctic, depth 3714 m. Image credits: Dr. Eva Ramirez-Llodra (REV Ocean; NIVA) and HACON21 Research Cruise participants (funded by the Norwegian Research Council, grant № 274330)

shallow-water marine fish from better-oxygenated waters. Our findings suggest that the underlying mechanism for the common elemental fingerprinting of otoliths of OMZ-dwelling fishes is attributed to the unique biogeochemistry found on the margins of these highly productive upwelling systems as well as the physiological constraints resident organisms are perennially exposed to, including low oxygen, pH and temperature conditions.

Link to article: https://doi.org/10.1016/j.dsr.2022.103941

FUN Azores: a FUNctional trait database for the meio-, macro-, and megafauna from the Azores Marine Park (Mid-Atlantic Ridge)

Campanyà-Llovet N, Bates AE, Cuvelier D, Giacomello E, Catarino D, Gooday AJ, Berning B, Figuerola B, Malaquias MAE, Moura CJ, Xavier JR, Sutton TT, Fauconnet L, Ramalho SP, Neves BdM, Machado GM, Horton T, Gebruk AV, Minin K, Bried J, Molodtsova T, Silva MA, Dilman A, Kremenetskaia A, Costa EFS, Clarke J, Martins HR, Pham CK, Carreiro-Silva M and Colaço A

Front. Ecol. Evol. (2023)

Trait-based approaches that complement taxonomy-based studies have increased in popularity among the scientific community over the last decades. The collection of biological and ecological characteristics of species (i.e., traits) provides insight into species and ecosystem vulnerability to environmental and anthropogenic changes, as well as ecosystem functioning. Here, we present the FUN Azores trait database, describe our approach, evaluate its scope, compare it to other marine trait databases, and explore the spatial distribution of its traits with "functional maps." While most of the available trait databases to date contain essential information to understand the functional diversity of a taxonomic or functional group, our ecosystem-based approach provides a comprehensive assessment of diverse fauna (i.e., meio-, macro-, and megafauna) from benthic and pelagic environments in the Azores Marine Park; including ridges, seamounts, hydrothermal vents, and the overlying water column. We used a collaborative approach involving 30 researchers with different expertise to develop the FUN Azores database, which contains compiled data on 14 traits representing morphological, behavioral, and life history characteristics for 1,210 species across 10 phyla. The "functional maps" show a distinct distribution of the two most common size classes, suggesting different communities

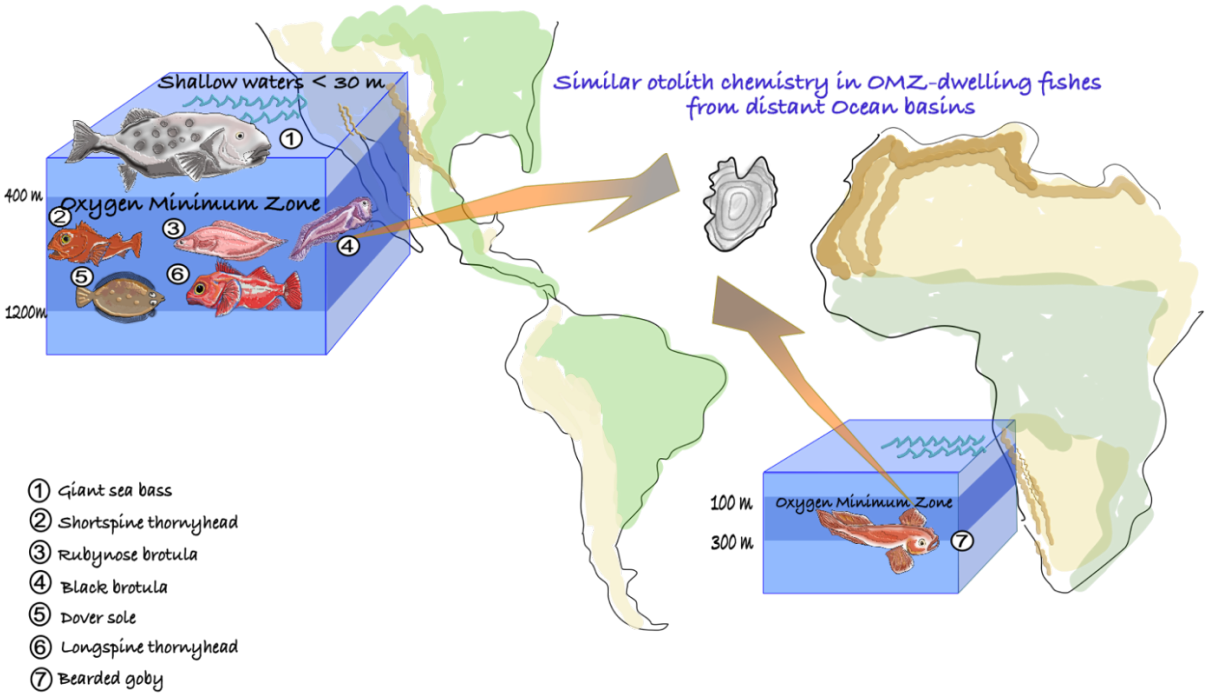


Fig. 1. Fishes from the Oxygen Minimum Zones in the Northeast Pacific Ocean and Southeast Atlantic Ocean exhibited similar otolith chemistries.

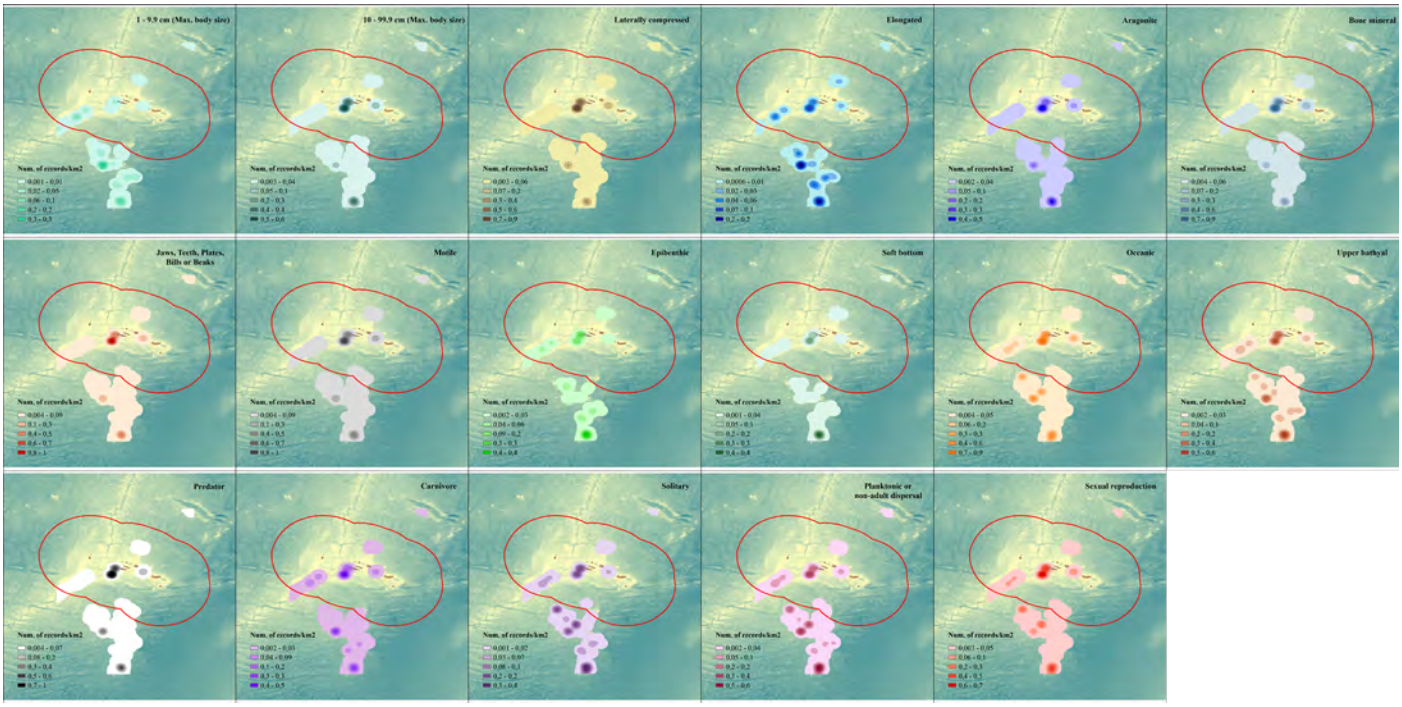


Fig. 1. Kernel distribution of the modal functional entities of the FUN Azores database within each MPA of the Azores Marine Park.

with different functionalities. The following traits had the best scoring coverage (i.e., >95% of the species scored): maximum body size, body form, skeleton material, feeding structure, motility, environmental position, substratum affinity, distribution, and depth range; while traits related to species behavior (e.g., sociability or aggregation tendencies) and life history (e.g., developmental mechanism) had lower scoring coverage, highlighting the need for further research to fill these knowledge gaps. We found a larger number of species in the benthic compared to the pelagic environment and differing species composition between areas within the Azores Marine Park resulting from varying biodiversity, ecosystem types, sampling effort, and methodologies used. The FUN Azores database will foster and facilitate trait-based approaches in the area, develop a framework for expansion of cross-ecosystem and cross-taxa trait databases elsewhere, and improve our ecological understanding of the Azores Marine Park and its conservation requirements.

Link to article: https://www.frontiersin.org/articles/10.3389/fevo.2023.1050268/full

Microplastic ingestion by deep-pelagic crustaceans and fishes

Ryan P. Bos, Shiye Zhao, Tracey T. Sutton, and Tamara M. Frank

Limnology and Oceanography, 68: 1595-1610 (2023)

A size-selective loss of smaller microplastics (< 1 mm) from surface pelagic waters has been reported, yet few surveys have studied biological ingestion by deep-pelagic organisms as a sink for the “missing” plastic. Here, 557 individuals representing 35 species of vertically migrating and non-migrating mesopelagic crustaceans and fishes were collected in the Gulf of Mexico from discrete-depth intervals (0–200 m; 200–600 m; 600–1000 m; 1000–1200 m; 1200–1500 m) and analyzed for microplastic ingestion. We observed that 29% and 26% of crustacean and fish individuals, respectively, ingested microplastics, with an average plastic length of 0.59 ± 0.2 mm. A subsample of ingested polymers was identified using Fourier Transform Infrared Spectroscopy, revealing that alkyd resin (density 1.6 g cm^{-3}) and cellophane (density 1.42 g cm^{-3}) were mainly consumed. Our data indicate that non-migratory crustaceans had significantly higher levels of microplastic ingestion than migratory crustaceans at all depths available for comparison. While migratory fishes ingested microplastics at higher frequencies (0.28) than non-migratory fishes (0.23), the frequency of microplastic

ingestion by non-migratory fishes increased with depth and was highest at depths of 1200–1500 m (0.40). Paired with the data for crustaceans, these observations suggest that plastic ingestion may be higher at deeper depths. Feeding strategy also appeared correlated to microplastic ingestion, as species that rely on gelatinous materials and marine snow for energy had the highest levels of ingestion. Altogether, our data highlight a largely undescribed temporary reservoir and implicate important biological transport pathways for the smaller plastic size fractions in the open ocean.

Link to article: https://aslopubs.onlinelibrary.wiley.com/doi/abs/10.1002/lno.12370

Range extensions of Pacific bone-eating worms (Annelida, Siboglinidae, *Osedax*)

Gabriella H. Berman, Shannon B. Johnson, Charlotte A. Seid, Robert C. Vrijenhoek, Greg W. Rouse

Biodiversity Data Journal 11: e102803 (2023)

First described in 2004 off California, *Osedax* worms are now known from many of the world's oceans, ranging from 10 to over 4000 m in depth. Currently, little is known about species ranges, since most descriptions are from single localities. In this study, we used new sampling in the north-eastern Pacific and available GenBank data from off Japan and Brazil to report expanded ranges for five species: *Osedax frankpressi*, *O. knutei, O. packardorum, O. roseus* and *O. talkovici*. We also provided additional DNA sequences from previously reported localities for two species: *Osedax priapus* and *O. randyi*. To assess the distribution of each species, we used cytochrome c oxidase subunit I (COI) sequences to generate haplotype networks and assess connectivity amongst localities where sampling permitted. *Osedax frankpressi, O. packardorum, O. priapus, O. roseus* and *O. talkovici* all had one or more dominant COI haplotypes shared by individuals at multiple localities, suggesting high connectivity throughout some or all of their ranges. Low Φ values amongst populations for *O. packardorum, O. roseus* and *O. talkovici* confirmed high levels of gene flow throughout their known ranges. High Φ values for *O. frankpressi* between the eastern Pacific and the Brazilian Atlantic showed little gene flow, reflected by the haplotype network, which had distinct Pacific and Atlantic haplotype clusters. This study greatly expands the ranges and provides insights into the phylogeography for these nine species.

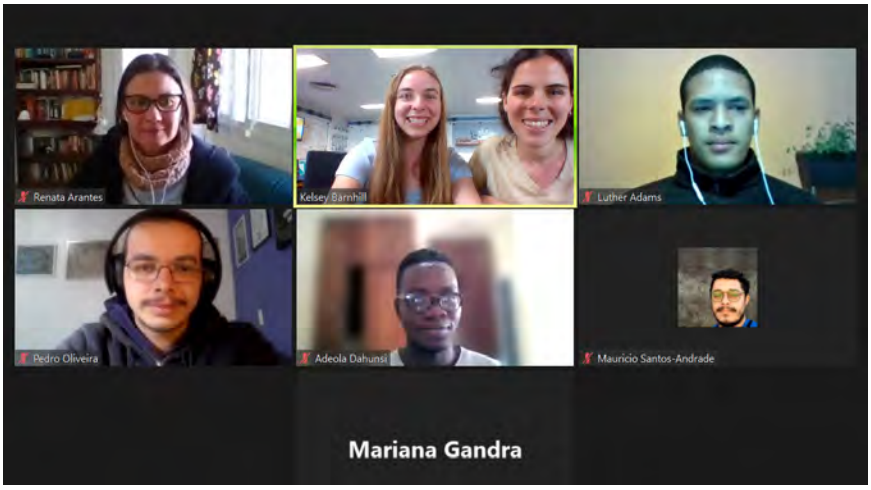
Link to article: https://bdj.pensoft.net/articles.php?id=102803

Ship-to-shore training for active deep-sea capacity development

Kelsey Archer Barnhill*, Beatriz Vinha, Alycia J Smith, Daniëlle S W de Jonge, Daniela Y Gaurisas, Roger Mocholí Segura, Pedro Madureira, Mónica Albuquerque, Veerle A I Huvenne, Covadonga Orejas, Vikki Gunn

ICES Journal of Marine Science, 2023 fsad088 (2023)

Sailing on scientific expeditions as an early career researcher (ECR) offers the opportunity to gain field experience and training. However, the number of berths on an expedition limits the number of onboard participants. Telepresence and remote learning can be utilized to increase the number of active participants, broadening the reach of capacity development. The 2021 iMirabilis2 expedition used telepresence to virtually involve 18 ECRs from several countries in deep-sea science. One year post-expedition, a survey of onshore participants was conducted to assess and quantify the effectiveness of the peer-to-peer ECR ship-to-shore scheme. During the expedition, live, interactive training via WhatsApp and Zoom was utilized by onshore ECRs more than traditional static, unidirectional methods of blog posts and pre-recorded videos. All respondents either agreed or strongly agreed that the scheme provided an inclusive



and accessible platform to share deep-sea science. These results suggest similar schemes could be used to supplement shorter-duration at-sea-training, used prior to a seagoing experience to better prepare ECRs, or to allow members of the science community unable to join an expedition in person to actively participate remotely, increasing inclusivity. To improve at-sea outreach and capacity development, we make the following recommendations: (1) Add two-way communication into your expedition plan early on in the cruise-planning process for quick and effective real-time engagement between your offshore team and onshore ECRs. (2) If possible, have a dedicated onboard outreach liaison during your expedition for effective communication. (3) Determine capacity development training alongside participating ECRs to co-develop targeted deep-sea learning outcomes.

Link to Article: https://doi.org/10.1093/icesjms/fsad088

Climate change to drive increasing overlap between Pacific tuna fisheries and emerging deep-sea mining industry

Diva J. Amon, Juliano Palacios-Abrantes, Jeffrey C. Drazen, Hannah Lily, Neil Nathan, Jesse M.A. van der Grient, Douglas McCauley

npj Ocean Sustain 2, 9 (2023)

New research published in npj Ocean Sustainability reveals that Eastern Pacific tuna fisheries will increasingly overlap with projected deep-sea mining contract areas as climate change shifts migration patterns in bigeye, skipjack, and yellowfin tuna. The study focuses on the Clarion-Clipperton Zone (CCZ), a Pacific region stretching between Hawai'i and Mexico containing 1.1 million square kilometers of deep-sea mining exploration contacts.

Under two different climate-change scenarios (RCP 4.5 & 8.5), the researchers found that total biomass for all three tuna species modeled are forecasted to increase relative to current levels. Increases ranged from 10% to 31% across all species and scenarios. There was little variation between RCPs, indicating that tuna will likely move to the CCZ regardless of climate-change intensity. This research was motivated by an earlier study finding that the equatorial Eastern Pacific may become a future climate refugia for these three economically-important seafood species.

If deep-sea mining proceeds in the CCZ, conflict between the fishing and mining industries may arise given their substantial spatial overlap, alongside various impacts mining operations could have on fisheries. Sediment plumes discharged by mining vessels could extend hundreds of kilometers horizontally and thousands of meters vertically, disrupting the feeding and breathing of both tuna and their prey. These return-water discharge plumes are also likely to contain elevated concentrations of toxic heavy metals, presenting an increased risk of bioaccumulation in the seafood supply. Noise and light pollution from mining operations may also lead to physiological and behavioral impacts on tuna and other nearby marine life they interact with.

Further research is needed to understand to what extent deep-sea mining operations may harm fisheries, especially

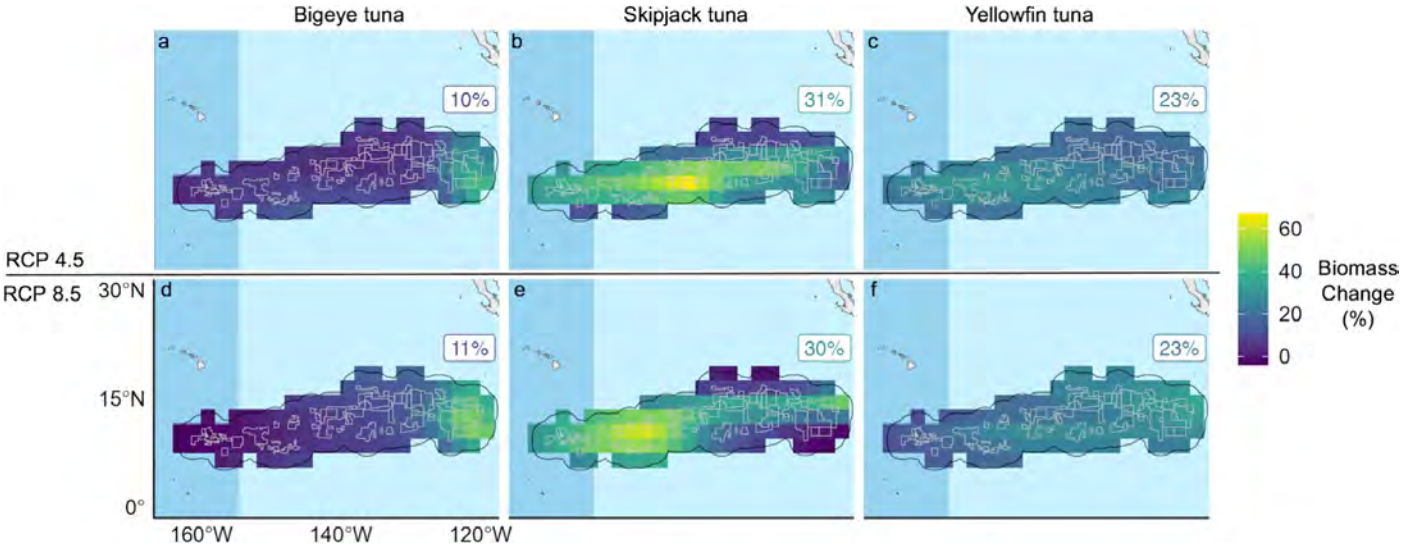


Fig. 1. Percentage change in the biomass of tuna for the Clarion-Clipperton Zone by the mid-21st century (average of 2044 to 2053) relative to present (average of 2009 to 2018). Three species of tuna are included from left to right: bigeye tuna (*Thunnus obesus*), skipjack tuna (*Katsuwonus pelamis*), and yellowfin tuna (*T. albacares*). The black line around the CCZ denotes 200 kilometers from deep-sea mining exploration contract-area boundaries. This buffer was used as several modeling studies have suggested that midwater sediment plumes may spread over such distances. All maps are split into the two relevant RFMOs: the Western and Central Pacific Fisheries Commission (dark blue) and the Inter-American Tropical Tuna Commission (light blue). Percentage values on the top right of the CCZ in each panel represent the percentage changes in tuna biomass for the entire CCZ. a–c are under RCP 4.5 and d–f represent RCP 8.5.

as the interactions between mining, fish populations, and climate change are complex and unknown. However, these projected increases in overlap indicate that the potential for conflict and resultant environmental and economic repercussions will be exacerbated in a climate-altered ocean. This has implications for the holistic and sustainable management of this area, with pathways suggested for closing these critical gaps.

The study was released alongside a statement from seafood industry groups calling for a pause on deep-sea mining until the impacts are better understood and scientifically-grounded regulations are in place. Among the signers are the Global Tuna Alliance, whose 48 industry partners account for 32% of the global tuna trade, and the Sustainable Seafood Coalition, which represents 45 U.K. seafood organizations.

In addition to the growing support for a moratorium exhibited by several countries at the recent meeting of the International Seabed Authority, these developments demonstrate increased concern from the global fishing sector and a need to engage their voices in the ongoing ISA negotiations.

Link to article: https://www.nature.com/articles/s44183-023-00016-8

It's Your Opinion

Swim Down: Finding Neurodivergent Identity in the Depths

Lilianna Watson

Scripps Institution of Oceanography

I've always been different than other people. Lights are too bright. Noises are too loud. I don't like to look at other people's faces. I don't like it when they look at me. And I really don't like it when they touch me. But underwater, everything is different. The ocean fills my ears and drowns out all the white noise I hear on land. And I hear something clearly in the water. An echoing song ringing out from the depths, and maybe from somewhere inside of me, too:

SWIM DOWN

Facing the surface, the light still burns through my eyelids. So, I listen to the voice, turn my face to the darkness, open my eyes, and swim down.

As part of her Master's coursework at Scripps Institution of Oceanography, Lilianna Watson completed a graphic novel in collaboration with scientists Dr. Lisa Levin, Dr. Charlotte Seid, and Dr. Peter Franks. In this story, a neurodivergent teenager's underwater journey through Monterey Submarine Canyon reveals that her sensory differences are powerful adaptations, exploring how her sensitivities to light, noise, and touch correspond to deep-sea conditions such as darkness, quiet, and pressure. The digital graphic novel is hosted online as a website, and includes a fully narrated, sound mixed, and captioned video version of the underwater arc of the story. By combining narrative, art, emotion, personal perspective, and science, Lilianna highlights the link between the deep sea and neurodivergence, aiming to deepen understanding of both.

Video: https://youtu.be/ROQr1uYBvaA

Symposium Presentation: https://www.youtube.com/watch?v=bwqA1Zp0ehk

Website: https://swimdown.neocities.org

Lilianna can be reached directly at lmwatson@ucsd.edu

Closing the Regulatory Gap: How Third-Party Regulations Could Complement the Forthcoming Deep-Sea Mining Regulatory Scheme

Gabriella Berman (ghberman@miami.edu)[1,2], Katie Geddes (katie.geddes@earth.miami.edu)[1]

[1]Rosenstiel School of Marine, Atmospheric and Earth Science, [2]University of Miami School of Law

Deep sea mining regulations, if and when they are completed, should be complemented by third party regulatory schemes to promote adherence to environmental and ethical targets. Regulatory frameworks which implement treaties and legislation are often complemented with external, third-party regulations in the form of certifications, assessments, and campaigns to protect consumer interests and increase the efficacy of the treaty's or legislation's targets–often setting stricter standards. For example, when the Marine Mammal Protection Act of 1972 failed to protect dolphins from perishing in purse seine nets deployed by tuna fishers in the Eastern Tropical Pacific, an NGO developed a "Dolphin-Safe Tuna" campaign in the 1980s which ultimately contributed to the passage of the U.S. Dolphin Protection Consumer Information Act in 1990, ushering in stricter standards for dolphin takes by the tuna industry[1]. Similarly, deep sea mining regulations could and should be complemented by third party regulatory schemes. Although the International Seabed Authority (ISA) is the intergovernmental organization established under UNCLOS to oversee the exploration and exploitation of minerals in the high seas[2], some experts have expressed that ISA may fall short of providing adequate protection for the marine environment[3]. In June 2021, Nauru triggered a two-year deadline at the International Seabed Authority (ISA) to finalize regulations for the exploitation of metals from the high seas by July 2023[4]. However, the two year deadline expired on July 9 without finalization of the rules, regulations, and procedures by the ISA Council. [5]As discussions continue, this may be an appropriate time to develop external governance schemes to regulate deep-sea mining through private actors. For example, the ISA requires mining companies to complete Environmental Impact Assessments (EIAs) following the recommendations of the ISA's Legal and Technical Commission[6], but while the EIA is an important tool, the recommended testing, the delay between the exploratory period and the mining action, and the lack of any clearance system to partake in exploration are notable gaps in the efficacy of the system[7]. Even after the new regulatory framework is complete, a third party regulatory scheme could hold deep sea mining companies to higher standards by integrating a greater number of environmental and social indicators. This would increase protection for environmentally conscious consumers by influencing supply chains to be more compliant with ISA mining rules, regulations, and procedures, and promote a standard of compliance that is more stringent than the ISA framework. If the deep-sea conservation community cannot prevent deep sea mining from occurring, third party mechanisms could promote adherence to higher environmental and ethical guidelines.

Howl et al et al…

by Robert Blasiak

I saw the best minds of my generation distracted, disconnected, despairing,
sensitive, sensitized, outraged, and emptied out, in need of a recharge,

dragging themselves to the next meeting, to the next call, to the daycare to
pick up the kids, sick again,

superhuman jugglers, juggling, juggling, juggling, and pretty good at admin too,

who stayed one step ahead so long – so very long – until they themselves got lost,

who signaled virtue, stated privilege, judged, tweeted and click-baited,

who were offensive and offended until they stood alone, angry in the crowd,

who accepted every invitation, answered every mail, used up all their hours,

who interpreted, mis-interpreted, over-interpreted until words meant
nothing more,

who promised to set a better example and became just another example instead,

who were under-represented, unheard, closed out, condescended to,

whose kind hearts grew angry and distracted,

who lowered their heads and charged,

who lowered their heads, exhausted,

who lowered their heads in sorrow.

I'm with you in academia-land, Reviewer #2,

I'm with you in academia-land, manel-mansplainer-man,

I'm with you in academia-land, guest editor of predatory journal number seven today,

I'm with you in academia-land, territorial know-it-alls, shaking deep inside,

I'm with you in academia-land, proud highly-cited researchers, brand names
on a thousand author lists,

I'm with you in academia-land, bitter, relieved quit-lit friend,

I'm with you in academia-land, angry, embarrassing tropes, past, present and future.

Once – I may be wrong – but once there was a dream,

That whole communities emerged,

And all the dust and grit,

And all that tight proximity,

wore down the sharp rough edges of a million clustered egos
yearning for room
yearning for notice
yearning for light.

That years of this made polished stones of all

That it was so much better so

And no other way would do

Contact: robert.blasiak@su.se

Note: *In the mid-1950s, Allen Ginsberg wrote Howl, a despairing poem of youth destroyed by conformity, materialism, and their own excesses (and the basis for this poem). In my little place in academia, I look around and see colleagues and friends stretched to their limits and beyond, worn out and faltering, and I recognize the same exhaustion in myself on many days. But I have also experienced the support and understanding of close friends and relative strangers, and it convinces me that academia can be a kind space. That each of us has a responsibility to do our best to foster this. That we can make things better for one another. And that this matters as much as anything else.*

Deep-Sea Biology Society News

President's remarks

It has been an exciting six months for the deep-sea research world and the Deep-Sea Biology Society as the updates below will show. I will start with an update about our trustees. It is with a heavy heart we heard that Prof. Bhavani Narayanaswamy was stepping down as a trustee. Bhavani is a founding member of the society, presenting the idea with Prof Craig McClain at the 13th DSBS in December 2012. We literally wouldn't be here without her. We are eternally grateful for the initiative, time, care, and dedication Bhavani has given to this community. We know we'll see you at the next meeting but we will very much miss your ideas and advice at our trustee meetings. We wish you safe sailing and smooth seas.

Bhavani's stepping down left a gap in our ranks. We were lucky enough to secure Dr Julia Johnstone to become one of our roving trustees – on call to support the many and varied tasks that supporting the deep-sea research community invariably throws up. Julia is a self-confessed deep-sea coral geek who studies the mysteries of coral reproduction and the impacts our ever-changing world may have on these processes and the coral themselves. We are delighted she is joining as a trustee and we, as I know our community does, offer her a warm welcome.

Some other highlights include one of the three conferences / symposia that the society traditionally supports - the 8th International Symposium of Deep Sea Corals in Edinburgh. To say the symposia was a success doesn't feel like it gives it the justice it deserves. A whole week of deep-sea coral research updates, a banquet with dancing I'm frankly still recovering from, and all in a beautiful location. Our heartfelt thanks go out to the organising team – you rocked. Looking ahead, please contact Seb Henninge in the next two weeks if you are interested in hosting the 9th ISDSC: s.hennige@ed.ac.uk.

Excitingly, as we go to press, one of the other two supported meetings will be kicking off in Brazil (14-18th Aug): the 7th International Symposium on Chemosynthesis-Based Ecosystems (CBE7). Our Early-Career Officer, Dr Pierre Methou could be present in person and coordinate for members to highlight our presence at the event. There at CBE7 on Thursday, the 17th of August was held our Annual General Meeting, co-led by Pierre on-site and by Prof. Erik Cordes online. I wish I could say I'd you there but I was on the R/V *Nansen* doing offshore benthic surveys off Mozambique so I left you in the capable hands of Erik, Pierre, and all the Trustees (thank you, team!). This AGM was a success - thanks to all present for your enthusiasm and questions about our past and future activities.

Looking ahead further still, I'm happy to report that Prof Qian and the amazing organisers of the 17th Deep-Sea Biology Symposium at Hong Kong University of Science and Technology, Hong Kong SAR, in China, are pulling together incredible plans for the symposium (13-17th January 2025). Sessions are being finalised, the 18 strong academic committee is set, and the local organisation committee with its 12 members and helping with polishing a website that's almost ready for launch while sites and plans are being secured. More to come soon!

Earlier this year, the trustees met to discuss and outline our short-, mid- and long-term goals for the society, leading on to an updated plan of action. A flurry of conferences established deeper thoughts on how diversity, equity, inclusion, and accessibility (DEIA) can be addressed at such events. Our Diversity trustee Alycia Smith led the creation of our first draft DEIA strategy and guidelines for public events. This is a live document that we hope will improve and expand over time. It has already been circulated to organising committees of this year's symposia, and feedback has been very positive. The draft is available online on the DSBS website, and comments from society members - stay tuned! In the

meantime, if you have ideas and/or suggestions for improvements we'd love to hear from you: diversity@dsbsoc.org.

As someone without an artistic bone in their body (my poor sketches of coral can attest to this…) I'm always in awe of the delicate skill and new perspective that artists bring to art and science initiatives. Excitingly the society has commenced reaching out to artists who may be interested in deep-sea science in an effort to foster closer links with this important community. Over 30 individuals have already proffered interest. Meetings with this embryonic grouping will commence in the coming months. During the AGM, we showcased the graphical production of eight talented scientists as well as professional artists. More art pieces, including music and other media will be shared as rich portfolios for artists to find retribution, for scientists to impact more broadly, and much more as interactions develop. There is a lot of enthusiasm already and we will do out best to consolisate this bridge between art and acience, at events and elsewhere in cooperation with you - again there is still the possibility to join. Stay tuned around here or please reach out to develoment@dsbsoc.org and communications@dsbsoc.org.

And lastly, but certainly not least, our seminar series will re-start next month (September). With our summer of science symposia reaching its end, the seminars are a great opportunity to get your research out into the world. If you are interested please contact: early_career@dsbsoc.org.

As always our community can be reached via Slack or by sending emails to our trustees who will include your news, ideas, questionnaires, new outputs, exciting opportunities, jobs etc in our regular updates. I hope this finds everyone happy and well, enjoy the rest of the summer!

All my best,

Michelle.

Trustees reports

Early Career - Pierre Methou

I realized that it has already been almost two years since I have joined the trustee board after the 16th DSBS symposium in Brest. It has been a wonderful experience and a great honor for me to work with the great team we have and I hope I am serving the society in the best possible way.

Regarding our activities for early career, we continued our series of seminars in September and October 2022 and a final one in February 2023 to compensate for the absence of conference between the 17th DSBS and the 8th ISDSC. I am again very grateful to all the speakers, Belén Anais Franco Cisterna, Victor le Layec, Margherita Toma, Otis Brunner, Takuya Yahagi & Petra Hribovsek who volunteered to join us on this adventure. They all had wonderful discussions about their latest work and we had good attendance and participation overall. The start of 2023 was then relatively busy with support for the organization of the 8^{t}h ISDSC coral conference and especially for me the 7th edition of the CBE in Sao Paulo, which I will be joining next week as I write these lines. We also reorganized the groups of our mentoring network early this year which are now continuing with new faces.

I look forward to continuing my role with the society and expanding the activities and opportunities for early career researchers. If you have any ideas or things you would like to see improved, please feel free to reach me!

Membership - Erin Easton

Membership is holding steady at ~340-370 active members. To facilitate long-term membership and to account for increasing administrative costs, three-year membership rates were reduced (14th December 2022) and one-year

membership rates were increased (1st May 2023). We continue to offer one-year membership waivers for those in financial need; contact membership@dsbsoc.org if you are in need of a waiver.

Finances - Neus Campanyà-Llovet

Over the last six months, the society has given £9,000 in awards and prizes and assisted with the donation from the U.S. Geological Survey to the ISDSC8 (International Symposium on Deep-Sea Corals). We have prepared the annual accounts for the year ended in 31st of December 2022 for them to be approved at the AGM by the members of the Society. You can find the Accounts on the AGM webpage.

To contact us, please email the Trustees:

President, Dr. Michelle Taylor (University of Essex, UK): president@dsbsoc.org

Secretary, Dr. Alexis Weinnig (Temple University, USA): secretary@dsbsoc.org

Membership and Data Protection, Dr. Erin Easton (University of Texas Rio Grande Valley, USA): membership@dsbsoc.org

Diversity Officer, Alycia J. Smith (Heriot-Watt University, Edinburgh): diversity@dsbsoc.org

Conference Officer, Prof. Pei-Yuan Qian (Hong Kong University of Science and Technology, China): conferences@dsbsoc.org

Students Officer, Katharine T. Bigham (Victoria University of Wellington, New Zealand): students@dsbsoc.org

Early-Career Officer, Dr. Pierre Methou (Ifremer / JAMSTEC): early_career@dsbsoc.org

Treasurer, Dr. Neus Campanyà-Llovet (University of the Azores): treasurer@dsbsoc.org

Development Officer, Prof. Erik Cordes (Temple University, USA): development@dsbsoc.org

Communications Officer, Dr. Franck Lejzerowicz (University of Oslo, Norway): communications@dsbsoc.org

Social Media team, Janet Ferguson-Roberts and: socialmedia@dsbsoc.org

Best wishes,

The Trustees of the Deep-Sea Society