Deep-Sea Life

Issue 18, January 2022

It is such a joy to receive submissions for Deep-Sea Life from all over the world. Edition 18 of DSL is no exception, and you will be able to read about cruises to the Far-East Seas of Russia, the Arctic Ocean, and the Mid-Atlantic Ridge and new projects from Japan, Honduras, India, Australia and the SE Pacific. There are also many inspiring and diverse papers in our Hot off the Press section.

The photo of the issue is a beautiful figure of some of the deep-sea invertebrate fauna sampled during the IceDivA2 expedition (see P.4).

We have a new DSBS team joining Abigail Pattenden, Eva Ramirez-Llodra and I for the coming issues of DSL. We want to thank the outgoing DSBS team, Paris Stefanoudis (University of Oxford / Nekton Foundation, UK) and Adrian Glover (NHM, UK) for their contributions over the past few issues and welcome the new DSBS team – Bhavani Narayanaswamy (SAMS, UK), Michelle Taylor (University of Essex, UK) and Andrea Quattrini (Smithsonian National Museum of Natural History, USA).

Thanks again for your submissions!

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A DOSI and DSBS collaborative publication.

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DOSI
DEEP-OCEAN STEWARDSHIP INITIATIVE

DEEP-SEA BIOLOGY SOCIETY

Issue Contents

Cruise News

Multidisciplinary exploration of the Far-East Seas of Russia during the 93rd Cruise of RV *Akademik M.A. Lavrentyev*, 2021

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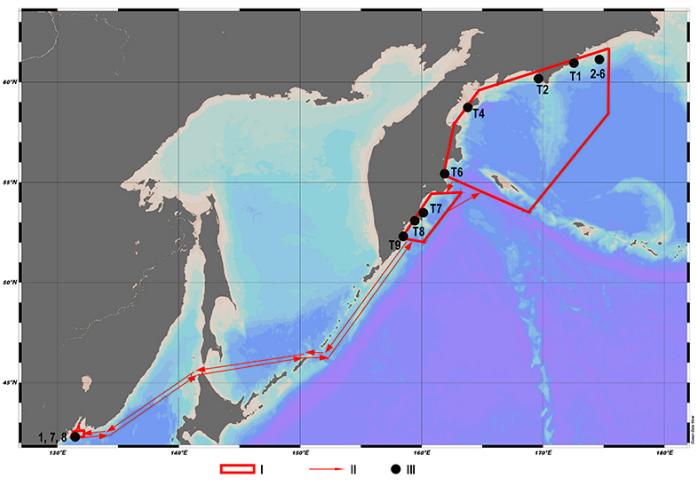
The Russian Far East Seas include diverse and productive marine ecosystems facing multiple human activities. Regular monitoring studies are urgently needed for understanding causes and dynamics of possible ecosystem transformations and sustainable management of the deep-sea resources.

On 31 May 2021 a multidisciplinary expedition onboard RV *Akademik M.A. Lavrentyev* conducted by the A.V. Zhirmunsky National Scientific Center of Marine Biology set out for a 38-day cruise to study communities of three target areas: the Gamov Canyon (Sea of Japan) as a potential monitoring site, the east coast of Kamchatka peninsula (north-west Pacific) where the "red-tide" was recorded in 2020, and the Koryak slope of Chukotka (Bering Sea) where methane seeps were recently discovered (Fig. 1, 2).

The main tool for exploration was the ROV *Comanche 18*. During the expedition three ROV dives were completed in the Gamov Canyon between 500 - 2050 m and five dives on the Koryak slope between 414 - 690 m. For sediment sampling of the microalgae spores and macro- and meiofauna along the east coast of the Kamchatka peninsula, we used a grab and multi-corer. Additionally, we collected data to study the sea-air mercury flux, and carried out atmospheric radon measurements and meteorological measurements.

Obtained data have shown the high potential of the Gamov Canyon as a model site for long-term monitoring studies. The Gamov Canyon is characterized by intensive sedimentation processes, the presence of various sediment facies, high diversity of fauna and community types (Fig. 3, 4) within a large depth range and a relatively small local area.



Left: Figure 1. RV *Akademik M.A. Lavrentyev* off the coast of Kamchatka; Right: Figure 2. RV *Akademik M.A. Lavrentyev*, 93rd cruise: study areas (I), the route (II) and station locations (III).

Left: Figure 3. The Gamov Canyon, app 700 m, lily garden (*Heliometra* spp, Comatulidae); Right: Figure 4. The Gamov Canyon, app 700 m, colony of brachiopods.

Additionally, we found bacterial mats at some sites at depths of 600 m; potential chemosynthesis-based habitats in the Gamov Canyon that deserve more attention.

Among preliminary results of the expedition was the observation of changes in the methane seep communities on the Koryak slope, 400 -700 m, discovered three years ago. The most significant changes were observed in the upper depth range (414 - 435 m), both in the background communities and in the methane seep zones where the abundance of species that were dominant in 2018 (sea feathers, *Halipteris cf. willemoesi*, its symbiont ophiuroid *Asteronyx loveni*, and echinoids *Brisaster latifrons*) have decreased by orders of magnitude. At the same time, at slightly greater depths (642 - 660 m) a new dominant species, *Delectopecten vancouverensis*, appeared. In 2018 it was represented only by empty valves. Across the whole gradient of depths, from 412 - 690 m, there was a significant increase in detritus thickness and coverage (Fig. 5, 6). Causes of this phenomenon, time scale, and periodicity require further study. Analysis of the data obtained will help to better understand short-term changes in methane seep communities.

The expedition was financed by the Federal Agency of Scientific Organisation of Russia, the Ministry of Science and Higher Education, Russian Federation (grant 13.1902.21.0012, contract no. 075-15-2020-796) with participation of Russian Foundation for Basic Research (projects no. 20-04-00919-a and 19-04-281-a).

Left: Figure 5. The Koryak slope, app 600 m, authigenic carbonates with attached *Delectopecten vancouverensis*, decapods, bryozoans; note the thick coat of detritus; Right: Figure 6. The Koryak slope, app 600 m, *Calyptogena* bed, coated by detritus.

IceDivA2 – Expedition to the abyssal plains west of the MAR

James Taylor, Jenny Neuhaus, Alexander Kieneke, Katrin Linse, Pedro Martinez Arbizu, Saskia Brix

Senckenberg Research Institute

With an international team of 27 scientists, led by Drs. Saskia Brix and James Taylor, **IceDivA2** (**Ice**landic marine Animals meets **Div**ersity along latitudinal gradients in the deep sea of the **A**tlantic Ocean 2) took place between 05.11-09.12.2021 and aimed to investigate the connectivity/biodiversity within key groups of the marine benthic abyssal habitats and their overlying planktonic communities. IceDivA2 built on the previous work completed during the first IceDivA expedition during January 2021 east of the Mid-Atlantic Ridge (MAR), an expedition connecting the **IceAGE** (**Ice**landic marine **A**nimals: **G**enetics and **E**cology) and **DIVA** (Latitudinal Gradients in Bio**DIV**ersity in the deep **A**tlantic) projects. In a rare case of "positive momentum" in a Covid-19 influenced world, IceDivA2 answered the second emergency pandemic call for the use of the German Research Vessel Sonne to "go west" of the MAR, closing the remaining gap in the deep-sea benthic and planktonic communities. Coinciding perfectly with the beginning of the UN Ocean Decade at the start of 2021, the IceDivA project has been a proud contributor as part of the Challenger 150 programme - officially endorsed by the Decade. IceDivA2 hosted the Satellite event "A floating classroom: Deep-sea science in action towards a clean ocean" for the UN Ocean Decade's Laboratory on 'A Clean Ocean'. This event was conducted live, via satellite, in the middle of the Atlantic Ocean, providing a rare insight to life, live on board a research vessel. For those who missed this event the VOD can be found at: https://bit.ly/3ETxZ4v.

"Spontaneous, creative, and multi-flexible" is a mantra we pushed to the extreme due to the testing nature of trying to conduct marine research in the North Atlantic during the winter months as we faced storm after storm attempting to cross the North Atlantic, the likes of which not even our captain had seen in his near two decades of experience on research vessels. Thankfully, due to the nature of our research questions we had the freedom to adapt the position of

Figure 1. Invertebrate fauna (2 mm-10 cm, ~3000 m) sampled with the EBS during the IceDivA 2 expedition. a. Amphipoda (Lysianassoidea) b. Amphipoda (Eusiridae) c. Copepoda (Calanoida) d. Copepoda (Calanoida) e. Asteroidea (Porcellanasteridae) f. Echinoidea g. Tanaidacea (Leviapseudinae) h. Amphipoda (Stegocephalidae) i. Tanaidacea j. Tanaidacea (Parakanthophoreus sp.) k. Isopoda (Dendrotionidae) l. Isopoda (Munnopsidae) m. Echinoidea n. Polychaeta (Phyllodocida) o. Polychaeta (Phyllodocida) p. Polychaeta (Phyllodocida) q. Decapoda (Penaeidae) r. Decapoda (Penaeidae) s. Isopoda (Ischnomesidae) t. Malacostraca (Mysida) u. Polychaeta (Eunicidae) v. Polychaeta (Phyllodocidae) w. Polychaeta (Syllidae) x. Ostracoda y. Bivalvia (Cuspidariidae) z. Cumacea (Diastylidae) aa. Porifera. Photography performed by Nicole Gatzemeier – DZMB Senckenberg

our research locations to find 3-4 days' worth of good weather as long as we located abyssal plain areas deeper than 3000m. This flexibility ultimately allowed us to complete 3.5 work stations out of the proposed five, despite station work being impossible for the first two weeks.

Our gear deployed included: CTD, EM122 Multibeam Surveying, Ocean Floor Observation System (OFOS, dives viewable at previous link & https://bit.ly/3HBvSUV), Bongo Net, Multinet, WP2 Net, Epibenthic Sledge (EBS), Large Box Corer (GKG), Neuston Catamaran, Multiple Corer (MUC), and Agassiz Trawl. Overall, we had a very successful and productive cruise, with our figure displaying some of the specimens sampled during our seven EBS deployments, in which we sampled 5000+ animals, with that number increasing daily as material is sorted. We were able to sample a wide variety of fauna through our sampling procedure, and for further information on the cruise/samples contact can be made to Saskia Brix (sbrix@senckenberg.de) or James Taylor (jtaylor@senckenberg.de).

The HACON21 expedition

First ROV exploration and sampling of the Aurora Vent Field, Gakkel Ridge, Arctic Ocean

Eva Ramirez-Llodra[1,2], Stefan Buenz[3] and the HACON21 cruise participants[4]

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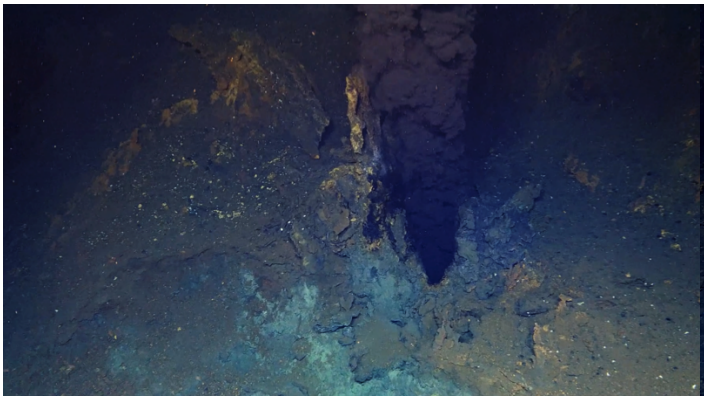
The HACON21 cruise was a major component of the FRINATEK HACON project, funded by the Research Council of Norway. The project aims to investigate the role of the Gakkel Ridge and Arctic Ocean in biological connectivity amongst

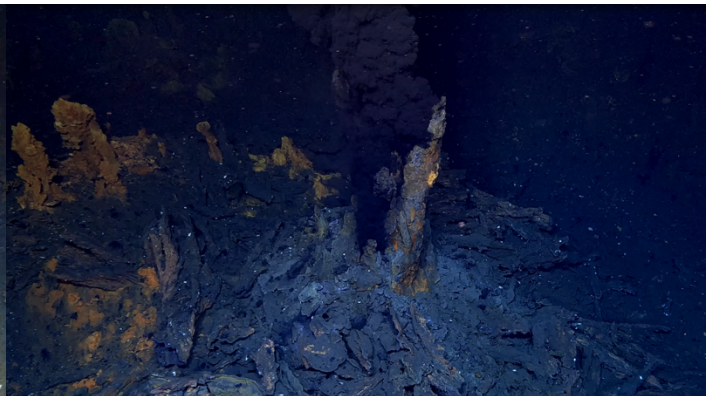
Figure 1. RV *Kronprins Haakon* over the Aurora Vent Field, Gakkel Ridge, Arctic Ocean. © L. Hislop/REV Ocean.

Figure 2. ROV *Aurora*. © L. Rolley/REV *Ocean*

ocean basins and global biogeography of chemosynthetic ecosystems. During the ChEss-Census of Marine Life programme (2000-2010), the Gakkel Ridge was identified as a key study area to contribute to the global biogeographic puzzle for hydrothermal vent communities (Ramirez-Llodra *et al*., 2007). Although the environmental, technological and economic challenges of working at great depths in complex topographic terrain under drifting Arctic ice has constrained exploration and investigation of the Gakkel Ridge for decades, each research cruise to this remote region provides new information to better understand the composition and functioning of ridge and its associated communities. The AMORE 2001 expedition located the Aurora vent field through the detection of the non-buoyant plume, the dredging of a fresh sulphide chimney and observations of shimmering water and fauna (Edmonds *et al*., 2003). In 2014, the Aurora cruise on RV *Polarstern* obtained the first brief visual confirmation of black smokers location and nature in the Aurora vent field at 82.5N – 6.15W and 3900 m depth, during an OFOS (Ocean Floor Observation System) towed camera transect (Boetius *et al*., 2014). This finding was based on a dedicated survey in almost 100% ice-cover, with RV *Polarstern* in drift mode deploying instruments in the ice. Geological, biological and oceanographical assessments showed a substantial buoyant hydrothermal plume. The data were immediately shared with the scientific community. In 2019, the HACON19 cruise returned to the Aurora vent field on board RV *Kronprins Haakon* and obtained new high-resolution OFOBS data (video, sidescan and bathymetry) of multiple black smokers across the Aurora Vent Field (AVF) (Bünz & Ramirez-Llodra, 2019).

In Sept-Oct 2021, the international and multidisciplinary HACON team re-visited the Aurora vent field (Bünz, Ramirez-Llodra *et al.,* 2021). We sailed from Longyearbyen (Svalbard) on board RV *Kronprins Haakon* and, after doing the first deep-water tests of the new REV *Ocean* ROV *Aurora*, we headed north into the ice, with most people on deck enjoying the beauty of entering the ice-covered Arctic Ocean. The ice conditions allowed us to progress rapidly towards the AVF on the first day and a half, and then the ice became thicker and we had to find good leads to progress north. We reached the AVF site on the third day, surrounded by large drifting ice floes (Fig. 1). The main challenge of this cruise was to dive safely with an ROV to almost 4000 m depth, on complex terrain (active vents on a volcanic seamount) in a poorly studied region while drifting on an ice floe. Thus, each dive had to be carefully planned with a thorough assessment of the ice drift direction and speed. We started by getting a good idea of the ice floes in the area through





Left: Figure 3. The Enceladus black smoker, Aurora Vent Field, Gakkel Ridge. © HACON21/REV *Ocean*; Right: Figure 4. The Ganymede black smoker, Aurora Vent Field, Gakkel Ridge. © HACON21/REV *Ocean*

Figure 5. A happy HACON21 team on the ice after the successful ROV dives on the Aurora Vent Field. © HACON21/REV *Ocean*

daily updates on the regional (360 km2) ice drift sent by Drift Noise, and the vessel ice radar (max range of 6 nm). We would then position the vessel at the edge of the drifting ice floe ahead of the vent and estimate drift speed and direction. Ice drift speeds of 0.2-0.3 knots were ideal. The ROV would then be launched at a distance from the vent that was far enough to allow for the ROV to descend to the seafloor (ca. 1.5 hours at 0.8 m/s descent speed) and fly ahead of the vessel towards the target.

During the HACON21 cruise, we conducted 6 successful dives on the active Aurora vent field with ROV *Aurora* (Fig. 2), with seafloor times ranging from 25 min to just over 2.5h on the vent field, which allowed us to comprehensively survey and sample this extremely remote ecosystem. The Aurora vent field is located on the flank of the Aurora seamount and is composed, currently, of 3 vigorously active black smokers. These were named Hans Tore Vent – in memory of our friend and colleague from the Uni. Bergen – and Enceladus and Ganymede – both named after 'Ocean World' moons in the Solar System, some of which may harbor under-ice hydrothermal activity, and therefore, possibly associated life (Figs. 3-4). Abundant inactive chimneys, chimney debris, and yellow/orange iron-oxide rich accumulations associated with lower-temperature diffuse venting occur near the active vents. During the dives, we collected pristine samples of vent fluids, plume waters, rocks/deposits, sediment samples and samples for microbiology and faunal taxonomy and ecology (from meio to megafauna). The active vent faunal communities include amphipods and small gastropods. All the samples are currently being analysed, and the results will allow the HACON researchers to understand the processes driving these vent systems and assess if the Aurora vent fauna has evolved in isolation in the Arctic, or is genetically connected to the Atlantic or Pacific Ocean fauna. The project will provide empirical robust data of a pristine system prior to expected climate-change variations and increased human activities in the Arctic region, contributing to the Decade of Ocean Science through the Challenger 150 programme (Fig. 5).

The cruise report can be found here: https://haconfrinatek.com/2020/01/20/hacon-cruise-report/

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Project Focus

Deep-sea anglerfishes (Lophiiformes: Ceratioidei) from the western North Atlantic

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The Ceratioidei is a suborder of fishes Lophiiformes characterized by the presence of an illicium (except for neoceratiids and some gigantactinids), the lack of pelvic fins, and extreme sexual dimorphism, with dwarf males that parasitize the females temporarily or permanently. This suborder currently comprises 11 families with 35 genera and about 169 species worldwide distributed. Taxonomic identification of ceratioid specimens is mainly based on the illicial apparatus of metamorphosed females, often damaged during capture, making positive identifications difficult. Integrative taxonomy, based on morphology and DNA barcoding, is an important tool for species delimitation and for a better understanding of the composition of deep-sea ichthyofauna. Integrative studies can highlight identification mistakes and incongruities between molecular and morphological results, helping to reveal cryptic species, the identification of immature specimens, and clarification of problems of synonymy. In our first integrative study of Ceratioidei found in the Flemish Cap and Grand Banks of Newfoundland, in the western north Atlantic (Bañón *et al*., 2019), we have described 20 ceratioid specimens, representing 12 species and six families with the addition of 18 new barcodes to the repositories. This analysis extended the ranges of some quantitative traits for certain species (e.g. a new maximum size of *Dolopichthys karsteni*), and the range of distribution for *Caulophryne polynema, Dolopichthys karsteni* and *Himantolophus albinares*. A new manuscript reporting more ceratioid species and COI sequences from the western North Atlantic is already in progress, which will allow a better understanding of this exciting suborder.

Figure 1. Photos of Ceratioidei fishes

References: Bañón R, Barros-García D, Arronte J.C., Comesaña, Á.S., Sánchez-Ruiloba, L., de Carlos, A. 2019. Deep-sea anglerfishes (Lophiiformes: Ceratioidei) from the western North Atlantic: Testing the efficacy of DNA barcodes. Journal of Zoological Systematics and Evolutionary Research, 57: 606–622. https://doi.org/10.1111/jzs.12281

Aleutian Trench Biodiversity Studies (AleutBio), 2022: German-Russian deep-sea biodiversity studies in the Aleutian Trench and the eastern Kuril-Kamtchatka Trench

The AleutBio expedition is planned with RV *Sonne* from 17.7.2022 (Petropawlowsk Kamtschatski) to 6.9.2022 (Vancouver). German-Russian deep-sea biodiversity studies will be performed in the eastern Kuril-Kamtchatka Trench (KKT), the Aleutian Trench (AT), the Kuril Strait as well as in the Bering Sea at bathyal, abyssal and hadal dephts.

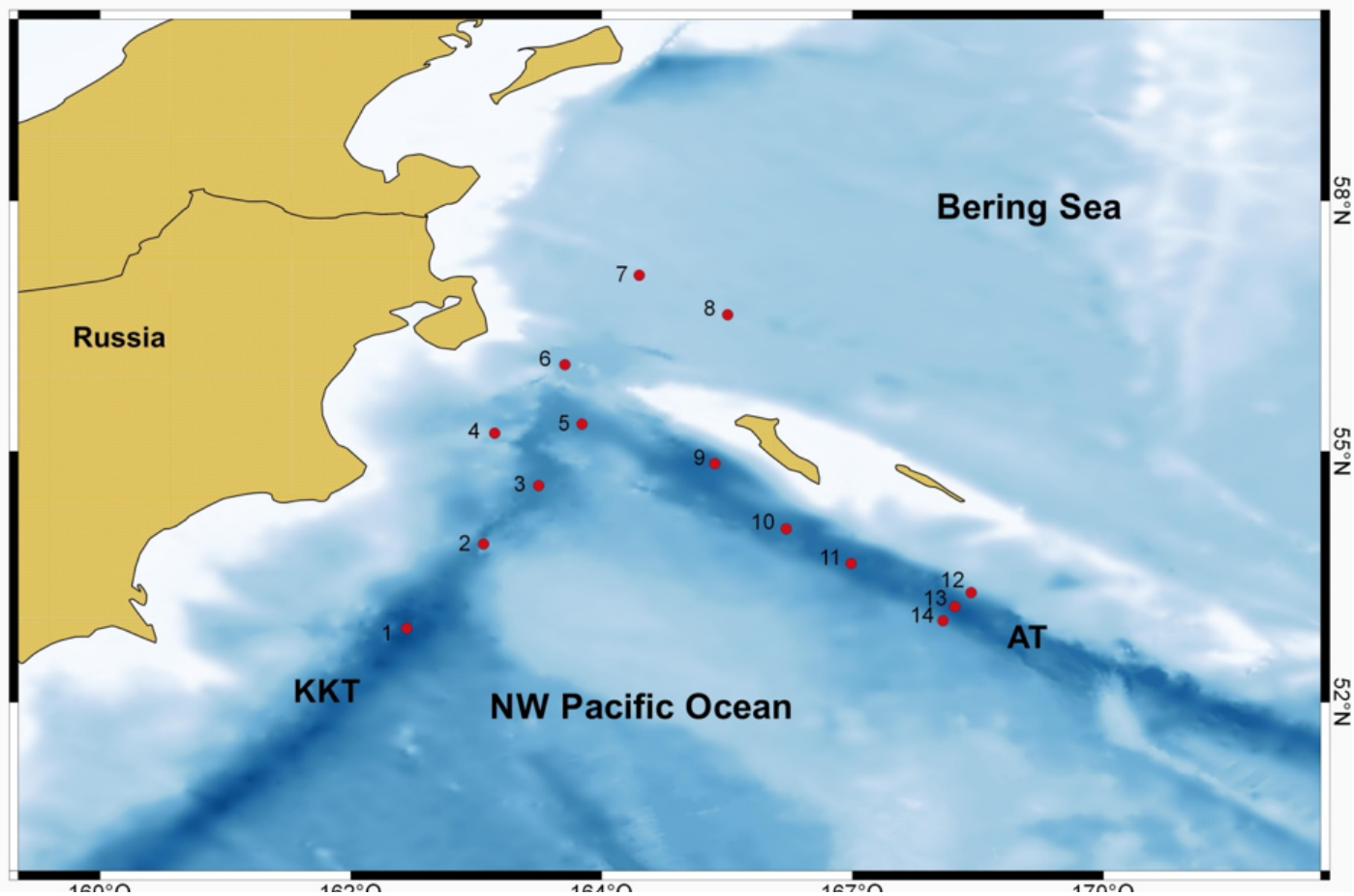

Figure 1: Stations planned during the AleutBio expedition with RV *Sonne*.

We aim to investigate an area where only few data have been published based on previous Russian expeditions. We will analyse the systematic composition, biodiversity and biogeography and evolution of fauna of all size classes from protists, via meio-, macro-, and megafauna in the eastern KKT and AT. We will extend the sampling area and gather material from stations sampled previously where the material is partly not available (lost) or fixed in formalin and inadequate for molecular analyses.

For an understanding of species ranges and turnover through the KKT and with the AT, we plan to compare the new material with that from the sample sites of the KuramBio I and II expeditions as well as previous Russian expedition performed from board of the RVs *Vityaz* and *Akademik Mstislav Keldysh* to the abyssal Kuril Strait and the western AT (Russian Territory). Moreover, we plan to sequence 16S, 18S, 28S and COI gene sequences for integrative taxonomy of abundant key species which may play a crucial role for understanding and resolving phylogenetic relationships. We will apply standard molecular approaches as baseline for phylogeography and connectivity studies (DNA barcoding) as well as state-of-the-art genomic approaches also to imbed the data into deep phylogeny analyses. For this aim, we depend on freshly frozen material from new samples.

We aim to test the following hypotheses during AleutBio:

- **Hypothesis 1:** The hadal of the Aleutian Trench is characterized by a similarly high number of species like the Kuril-Kamchatka Trench.
- **Hypothesis 2:** The hadal depths of the AT and eastern KKT isolate inbenthic and brooding benthic species from the Bering Sea, but not species with larval development.
- **Hypothesis 3:** The Kamchatka Strait acts as a filter for migration of species from the KKT and AT into the Bering Sea, whereas it serves as a corridor for species from the Arctic Ocean and Bering Sea into the KKT and AT and open northwest Pacific Ocean.

In the past decade, the biology of the bathyal, abyssal and hadal faunas of all size classes (meio-, macro-, and megabenthos) of the NW Pacific have been intensively investigated based on a total of four German-Russian and Russian-German expeditions with both RV *Akademik M.A. Lavrentyev* as well as RV *Sonne*. These expeditions have provided a wealth of faunistic data on the systematics, evolution and biogeography of benthic organisms from the Sea of Japan, Sea of Okhotsk, the NW Pacific abyssal plain and the KKT. The numbers of species collected during all these previous expeditions exceeded the numbers of known species for the areas by 6 to 20 times.

All data from our previous expeditions and from Russian literature were added to the OBIS database for AleutBio we plan to do this as well.

Importance of deep-sea abyssal environments as planetary analogues

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The deep-sea abyssal sediments of the Central Indian Basin (CIB) have been studied for more than three decades from perspectives of marine mineral mining of polymetallic nodules and concerned biodiversity issues. The project, funded by Ministry of Earth Sciences, New Delhi, India, has given us a massive scope to understand additional dimensions of great co-relevance. They include astronomical implications, climatic history and also serve as planetary analogues. The sediments of the CIB usually occur at an average water depth of 5,000 m are dominantly oxic, organic C-depleted, with suboxic/anoxic mineral cycling processes (Nath *et al.* 2008; Mascarenhas-Pereira *et al.*, 2010; Das *et al.*, 2011a, b; Sujith *et al.*, 2011; Naik *et al.*, 2016; Mascarenhas-Pereira *et al.*, 2016; Biche *et al.*, 2017; Singh *et al.*, 2019). The basin includes terrigenous sediments, siliceous oozes, pelagic red clays and occasionally calcareous oozes at shallower depths above calcite compensation depths of about 4,500 m. Of late, we started exploring the red-clays as Martian analogues (Singh *et al.*, 2019). The geomicrobial nature of these clays showed close proximity to probable Noachian-Hesperian Transition of Mars. During examinations it was also realized that the subtle sulphur oxidation and thiosulphate disproportionation could hold clues to Venusian analogy. Meteoritic impacts and Jovian processes are also being investigated in different mosaics of the basin matrix. In the earlier issue 17 of Deep-sea Life, we discussed our interest in mathematical quantifications of the deep-sea processes occurring here. Dynamic processes like rotation of sea-floor fluids, and close relation to various astronomically and climatically relevant cycles are being exposed steadily. Distinct mathematical patterns of rotational movements of seafloor fluid could be traced from various geomicrobial parameters. While the motion appears anticlockwise in most sediments below CCD, they are clockwise in rotation in calcareous oozes above CCD. An interesting issue has co-appeared which indicates an eco-succession from anaerobic microbes to more aerobic and finally diatom successions which is also geobiologically calculative in nature. It would be interesting to explore how much of these processes are stochastic or deterministic. Earlier it was thought that the siliceous oozes were the deposits from productive waters above. A closer look into the sedimentary geomicrobiology revealed a bio-reactor like system driven by hydrothermal energy in deep-seated rocks. We hypothesize and intend

to closely assess a biotic component vis-à-vis the inorganic carbonate-silicate interface in the deep-sediments, and investigate the microbe-diatom successions in such extreme biomes. These geobiological interactions are paramount in understanding potential planetary habitability.

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Diversity and time-series analyses of Caribbean deep-sea coral and sponge assemblages on the tropical island slope of Isla de Roatán, Honduras

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A new 'open-access' report in *Marine Biodiversity* details explorations of the Meso-American Reef in the western Caribbean Sea, the 'second longest' barrier reef in the world. The report describes 10 years of surveys to 700 m in *Idabel* submersible off the Isla de Roatán in Honduras.

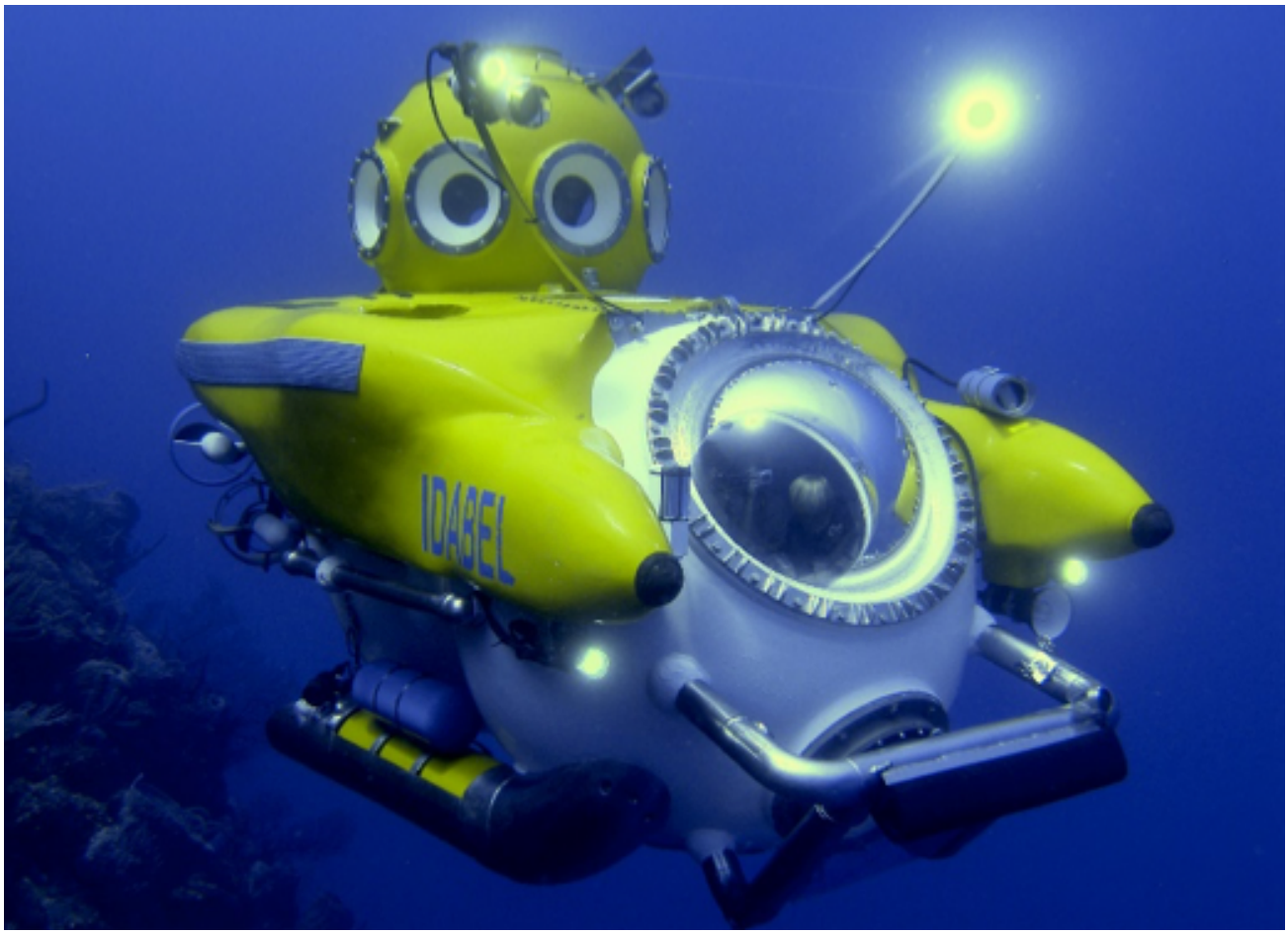


Figure 1. Photo by Annick McIntosh, as in Figure 2 of the paper.

The new report premieres a 14-year time series of deep-sea coral communities. The images show host fidelity, coral injury, regeneration, and subsequent decline in a pristine area, due presumably to natural causes of predation. The richly illustrated document shares images, data on the distribution and abundance, and notes on the invertebrate community of 'living fossils' like crinoids, sea stars, urchins, and deep-sea gastropod snails. The research is accompanied by a video highlight reel and two recent datasets from NOAA – a seafloor mapping survey from the research vessel RV *Falkor*, and a spatial database of submersible dives since 1964.

Partners in the research include Nova Southeastern Univ, Harte Research Institute, Texas A&M University Corpus Christi, Roatan Institute for Deepsea Exploration, Univ of Michigan, Schmidt Ocean Institute, Marine Science and Technology Foundation, and NOAA National Centers for Coastal Ocean Science.

ANNOUNCEMENT: New Deep-Sea Research Centre.

Minderoo-UWA Deep-Sea Research Centre:

MINDEROO FOUNDATION

THE UNIVERSITY OF WESTERN AUSTRALIA

Deep-Sea Research Centre

Exploring and mapping the deepest areas of the Indian Ocean and beyond

The University of Western Australia and Minderoo Foundation have joined forces to establish a new deep-ocean research centre, focussed on the deepest parts of the ocean. The Minderoo-UWA Deep-Sea Research Centre has been supported with a major five-year grant from Minderoo Foundation's 'Flourishing Oceans' initiative.

Professor Alan Jamieson joins the School of Biological Sciences and Oceans Institute at UWA as the Founding Director of the new Deep-Sea Research Centre. He is currently recruiting a multidisciplinary team of expertise spanning biology, ecology, genetics, geology, humanities and subsea technology. He is already joined by ecologist Dr. Todd Bond and geneticist Paige Maroni, with further appointments being made in January 2022.

This is a joint commitment to increase our understanding of the deep ocean biodiversity, seabed mapping, and charting deep-sea habitats, specialising in extreme marine frontiers at abyssal (3000-6000 m) and hadal (6000-11,000 m) depths. The team is supported by the RV *Pangaea Ocean Explorer* and will continue working with the DSSV P*ressure Drop* and the DSV *Limiting Factor* for the foreseeable future.

The multifunctional centre is supported by state-of-the-art facilities for bespoke full ocean depth-rated equipment,

image and sample processing, and two marine molecular biology laboratories hosted in the Indian Ocean Marine Research Centre on the UWA Crawley campus.

The DSR Centre has already completed its first major expedition, a joint mission between the Minderoo Foundation and Caladan Oceanic. This month-long Indian Ocean campaign dubbed 'Expedition: Indomitable' was to the Wallaby-Zenith Fracture Zone, Wallaby-Cuvier Escarpment, North Australian Basin and Perth Canyon. Between 600 and 6500 m they completed 14 submersible dives, 25 lander deployments and mapped over 20,000km² of deep-seafloor. The team successfully charted the soft sedimentary floor of the hadal fracture zone and recorded an extraordinary diverse benthic community across a dense manganese nodule field at 5000 to 6000 m deep.

For more information, visit https://www.uwa.edu.au/oceans-institute/Partnerships/Deep-Sea-Research-Centre

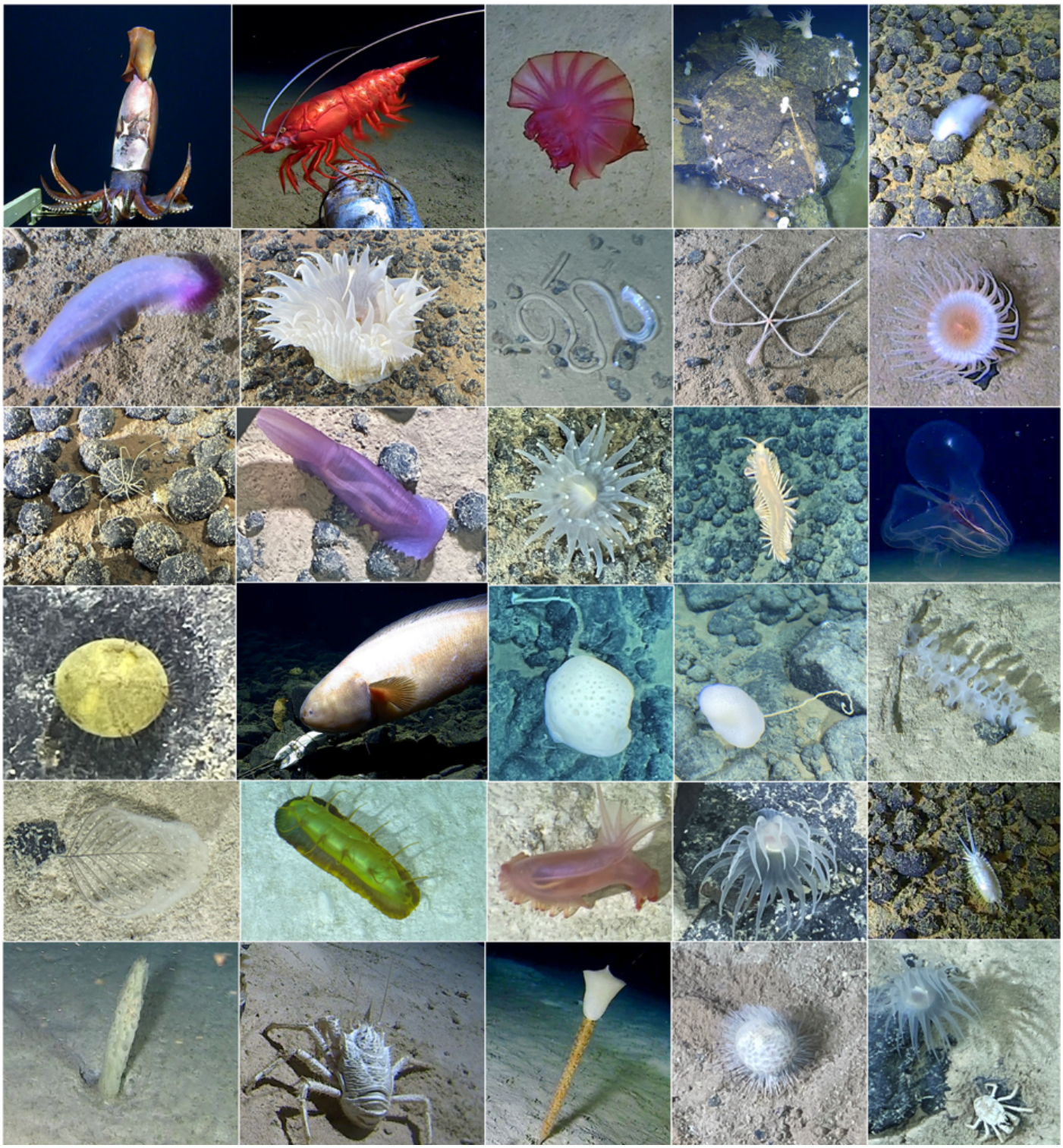


Figure 1. Deep-sea biodiversity from the abyssal and hadal Indian Ocean as found during the Minderoo-Caladan joint mission Expedition: *Indomitable*.

The Deep Ocean Observing Strategy (DOOS) is an international, community-based group that coordinates deep ocean observing to understand the state of the global deep ocean with respect to baseline conditions, response to climate change, and response to human disturbance. It is a GOOS project and was recently endorsed as a UN Ocean Decade Programme. It is a network of networks (including programs such as Challenger 150, DOSI, iAtlantic). In 2021, funding was awarded through the U.S. National Science Foundation AccelNet program for implementing DOOS (iDOOS).

The overarching goal of DOOS is to promote a deep ocean community that facilitates collaboration across disciplines and fields, elevates a diverse cohort of early career researchers into future leaders, and bridges scientific advancements to societal needs and challenges, in line with DOSI goals.

Several DOOS initiatives are outlined below, please contact the DOOS representatives provided if you are interested in engaging in any of these or learning more about DOOS:

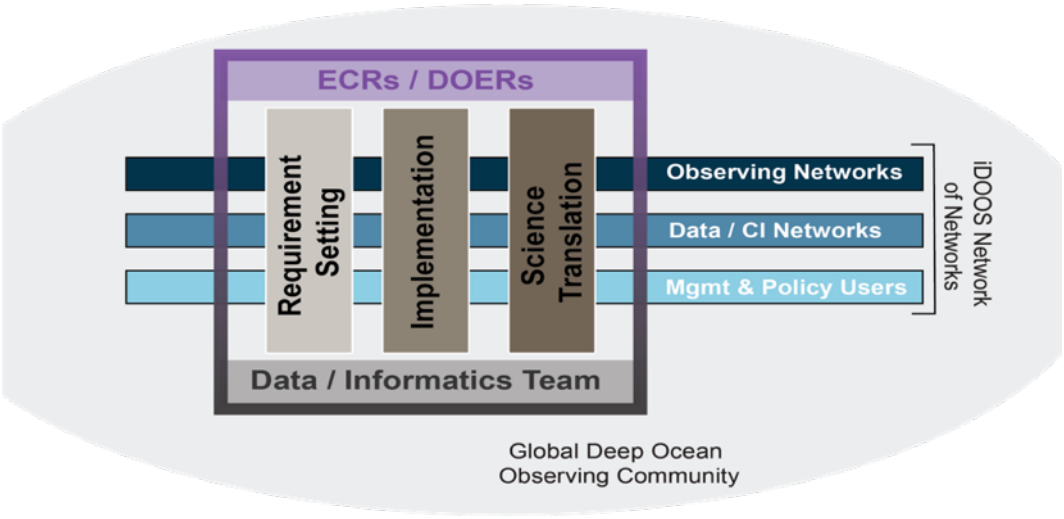
- **Improving and maturing (existing and new) deep EOVs** - EOVs span physics, biology, biogeochemistry. info@deepoceanobserving.org
- **Developing data stream planning to optimize data delivery for end user needs** - Diana LaScala-Gruenewald dianalg@mbari.org
- **Assessing observational gaps for understanding climate change** - Laura Cimoli lcimoli@ucsd.edu
- **Determining needs for interconnected physics/BGC/ecosystem modeling** - conducted in collaboration with CLIVAR. Helen Pillar helen.pillar@utexas.edu
- **Technology development and readiness levels** - Brennan Phillips brennanphillips@uri.edu
- **Developing shared best practices** - Justin Stopa stopa@hawaii.edu
- **SeaFAIRers** - Making deep ocean data more Findable, Accessible, Interoperable, and Reusable. Karen Stocks kstocks@ucsd.edu
- **Science-based conservation actions** - e.g., marine protected areas, deep sea mining, fisheries. Lisa Levin llevin@ucsd.edu
- **Translating science to stakeholders/end users and to inform policy and management decisions**. Lisa Levin llevin@ucsd.edu
- **Capacity development for developing and middle income countries** - conducted in collaboration with the Ocean Discovery League. Katy Croff Bell katy@oceandiscoveryleague.org

In addition to these efforts, one of the key thrusts of DOOS is the creation of demonstration projects that seek to demonstrate the feasibility of sustained, deep ocean observing integrated across disciplines, new technologies, and/or the impact and utilization of deep ocean observations for industry, policy, and management.

Azores Demonstration Project focuses on assessing biodiversity in deep-sea benthic communities in a changing ocean. It is being developed in collaboration with AtlantOS, the University of the Azores, and several other observing networks and UN Ocean Decade programs. Contact Maria Pachiadaki mpachiadaki@whoi.edu.

Clarion Clipperton Zone Demonstration Project is in early stages of development in collaboration with the ISA. The goal is to integrate and focus sustained observing efforts (related to climate, mining, fishing and other interests) with industry- and researcher-generated observations. Contact info@deepoceanobserving.org.

The Deep Ocean Early-career Researchers (**DOERs**) Program is a collaborative mentoring program designed to bring together early-career researchers from across the global deep-sea community. It seeks to foster a new generation of diverse and inclusive leadership that is capable of guiding future deep-ocean observing and research. Contact Leslie Smith leslie.smith@youroceanconsulting.com



Monterey Bay Aquarium illuminates the wonders of Earth's largest living space and most mysterious habitats when its new exhibition, Into the Deep: Exploring Our Undiscovered Ocean, opens on April 9, 2022.

Into the Deep, a collaborative exhibition developed with the Aquarium's research and technology partner MBARI (Monterey Bay Aquarium Research Institute), offers an unparalleled descent from the ocean's surface through the dark abyss of the midwater to the seafloor. Along the journey, the deep-sea exhibition — a fully bilingual experience in English and Spanish — offers a rare look at the animals that thrive in the least explored area of the planet, including species being displayed for the first time anywhere and some that are so new to science they have yet to be named.

"Connecting people with the astounding diversity of life found beneath the waves and inspiring conservation of the ocean is what Monterey Bay Aquarium was created to do," said Julie Packard, executive director of the Aquarium. "This unprecedented exhibition tells the story of the deep sea and reveals the many ways the deep ocean sustains our lives on the surface."

Into the Deep is only possible thanks to a generous $15 million donation from The Grainger Family Fund. The gift, which supported the full cost of developing Into the Deep, allowed the Aquarium team to continue work on the exhibition during the Aquarium's 14-month pandemic closure.

"We are so grateful to the Grainger Family Fund for its vision and generosity, so we could complete the exhibition in such challenging times," Julie Packard said.

Into the Deep transports visitors into the largest living space on Earth, telling stories of the creatures that live there, and the people and discoveries that are illuminating the last unexplored reaches of our planet. It highlights how the survival of all life on Earth is linked to the deep and the critical role it plays in sustaining a healthy ocean and stable climate. The exhibition also shows how deep-sea habitats face the same threats as the rest of the ocean — fishing pressure, habitat destruction, plastic pollution, and climate change — and why they need protection.

Into the Deep takes people on an exploration through exhibits of living deep-sea animals, interactive exhibits, and multimedia experiences:

- **Entering Into the Deep:** The exhibition starts with a transition from light-filled surface waters to a darker, deeper realm below.
- **"Diving" down to the deep**, guests discover how life at the surface depends on life far below, explore the geography of Monterey Bay's spectacular underwater canyon, and meet the scientists, engineers, marine operators, and communicators at MBARI, which is a global leader of deep-sea exploration. Guests are then introduced to many of the unique animals of the deep sea through an immersive 4K video experience.
- **The Midwater:** Moving into a world of twilight, then midnight, visitors encounter delicate and beautiful animals that are perfectly evolved to survive in a world without light or boundaries, including the bloody-belly comb jelly and bioluminescent animals. Guests can immerse themselves in a bioluminescence experience with never-before-seen video footage and play an interactive video game that educates about midwater survival along with the serious problems plastic pollution causes animals that make their home here.
- **The Seafloor:** Finishing their "descent," visitors come face-to-face with species that make their home in the seafloor habitats, including giant spider crabs, bone-eating worms, and giant isopods and get up close to hydrothermal vent and whalefall communities.
- As visitors metaphorically **return to the "surface,"** they see the questions researchers still have about the deep sea and how much scientists are still learning with updates from MBARI explorations.

"For most people, this is the first time they've ever seen a living deep-sea animal," said Beth Redmond-Jones, vice president of exhibitions and facilities. "We want visitors to understand that these habitats, seemingly so distant from our lives and so different from the ocean we're familiar with, are critically important to the health of our planet. We're confident that Into the Deep makes that connection and inspires people to learn more about the deep sea and support its conservation."

The team at Monterey Bay Aquarium spent more than five years developing the 10,000-square-foot exhibition, the largest in North America to focus on deep-sea life. It's an achievement built on the expertise and innovations of MBARI,

whose scientists and engineers have been studying the deep ocean for more than three decades – from Monterey Bay to the Earth's poles. The proximity of the mile-deep Monterey submarine canyon and the combination of resources and expertise led to several advancements necessary to realize Into the Deep.

The exhibition represents a breakthrough in aquarium animal care and life support. Innovations — like the most sophisticated water treatment system the Aquarium has ever designed — replicate the varied conditions needed by deep-sea animals. While all the animals on exhibit can survive at surface pressure, the life support systems created for the exhibition lower water temperatures, adjust pH, and reduce oxygen levels to sustain animals.

Discover more about Into the Deep and plan a visit on the Monterey Bay Aquarium website. Purchase single-day tickets or become Monterey Bay Aquarium members to see the exhibit first, have unlimited visits for a year, and support the nonprofit Aquarium's conservation, education and research programs.

A preliminary assessment of the distribution of the black coral *Triadopathes triadocrada* (Opresko, 1999) (Anthozoa : Antipatharia) in Thoothukudi coast of Gulf of Mannar, southeast coast of India (08° 21.111'n 78° 22.477'e) 230 m

Vaitheeswaran Thiruvengadam

Project Manager, LuLu Fish Farm, International University of East Africa, Uganda, East Africa

Contact: vaitheeswaranthiruvengadam69@gmail.com

A contemporary collection of deep-sea black coral specimens *Triadopathes triadocrada* (Opresko, 1999) was made via accidental by-catch at 08° 21.111'N 78° 22.477'E at a depth 230 m, Thoothukudi, off the South-east coast of India. Black corals are important structural and complex organisms of the deep-sea benthic communities. The present investigation of black corals and the geographical distribution of these corals in this location is reported for the first time. Further, the deep-sea research investigation of fauna and flora and its geographical distribution is still at the discovery stage.

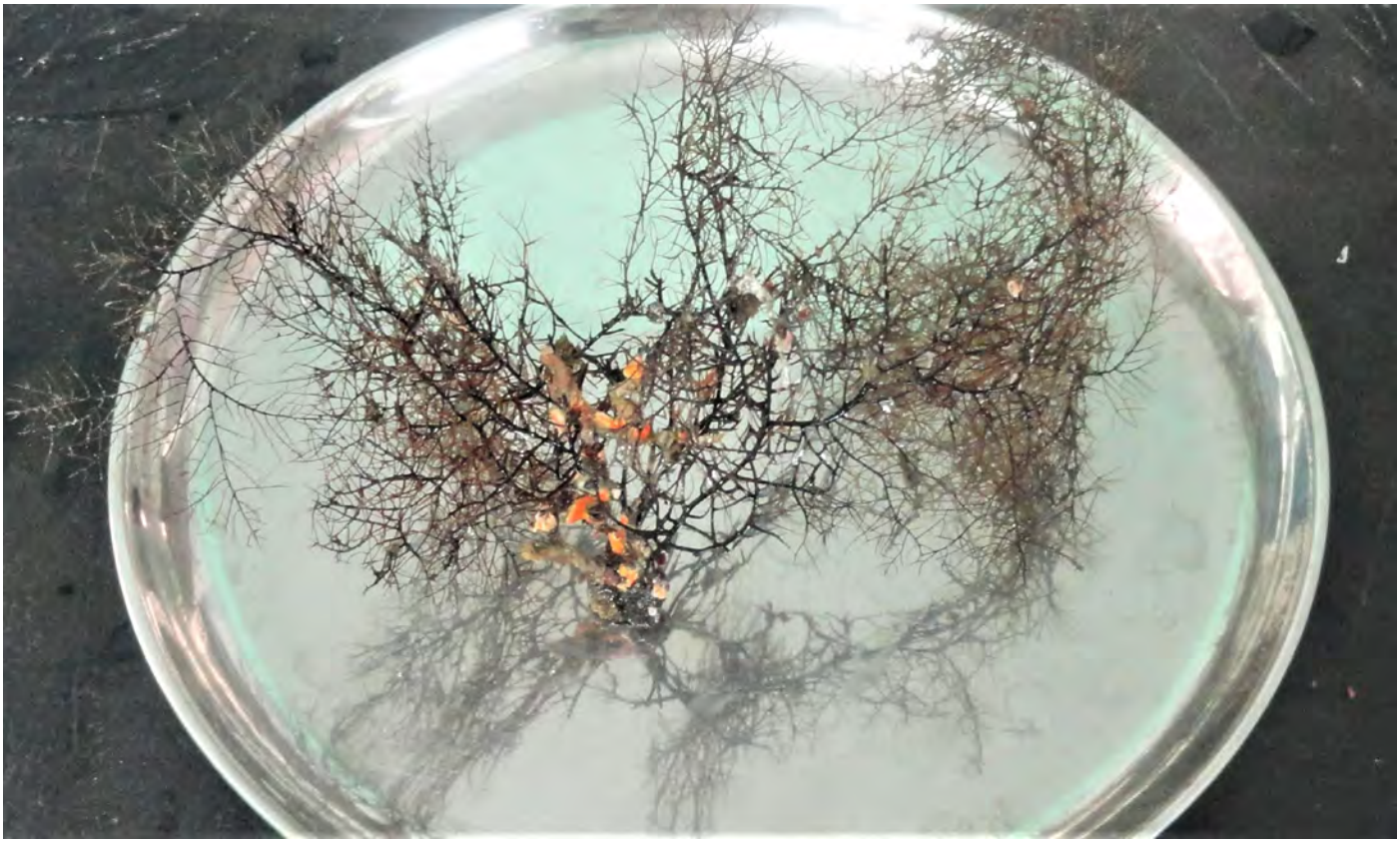


Figure 1. *Triadopathes triadocrada* (Opresko, 1999). Specimen around 18cm tall with several vertically extending branches up to 15cm in length.

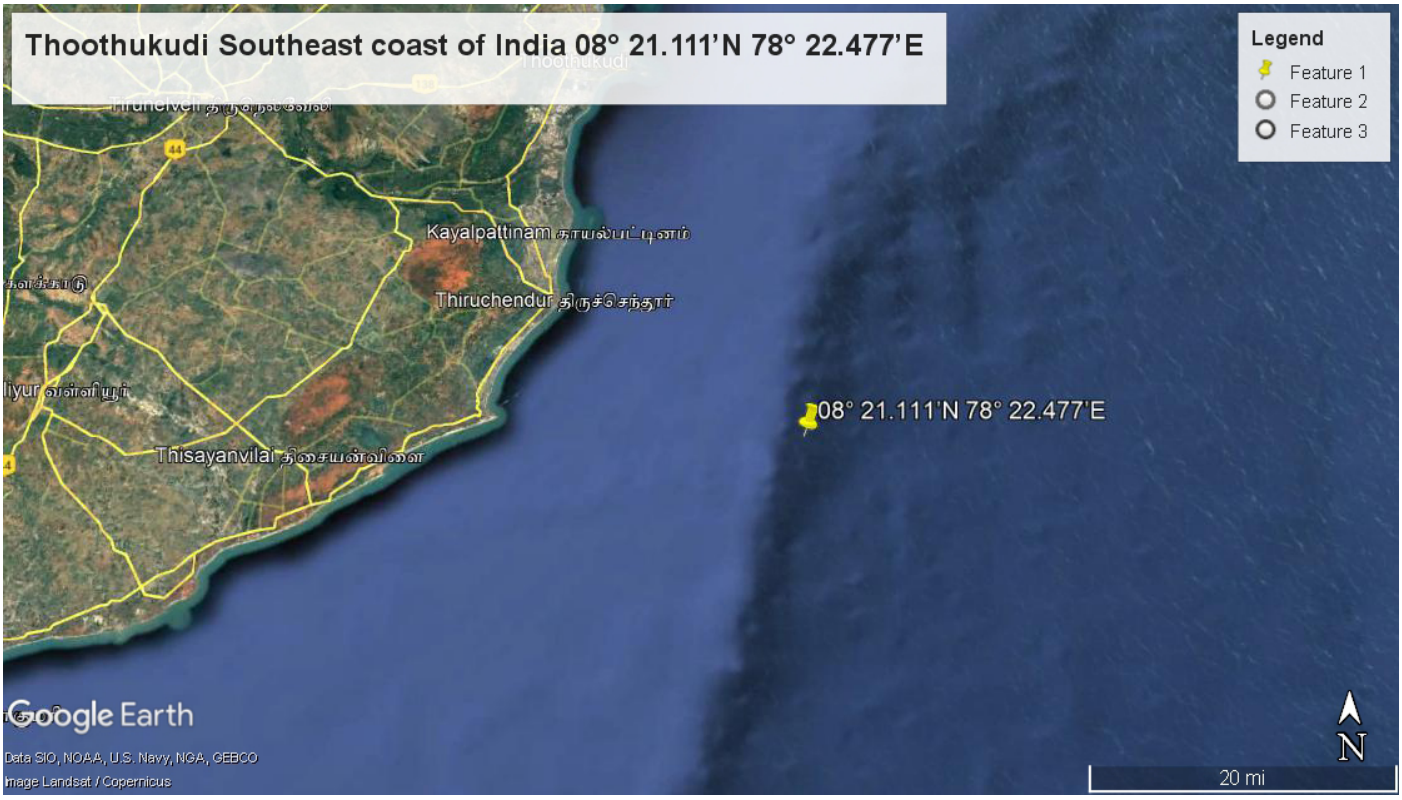


Figure 2. Thoothukudi South-East Coast of India

Wagner *et al.* (2012) have reviewed that the antipatharian order currently encompasses over 235 described species, which are divided into 42 genera and seven families. Antipatharians, or black corals, are colonial corals that form non-calcareous skeletons composed of protein and chitin that are quite flexible, spiny, tree-like, unbranched or branched. Unbranched colonies are straight and whip-like, curved irregularly, or corkscrew in shape. Branched colonies are bushy, or fan-shaped, or very symmetrically branched like a feather or bottlebrush.

The collection of deep-sea black coral specimens *Triadopathes triadocrada* (Opresko, 1999) (Fig 1) via accidental by-catch at 08° 21.111'N 78° 22.477'E (Fig 2) at a depth 230 m Thoothukudi, South-east coast of India suggests that further investigations of black corals and associated rich biodiversity are important as these corals provide structural habitats for complex organisms of the deep-sea benthic communities.

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Wagner, D., Luck, D.G. & Toonen, R.J. (2012) The biology and ecology of black corals (Cnidaria: Anthozoa: Hexacorallia: Antipatharia). Advances in Marine Biology, 63, 67–132

Salas y Gómez & Nazca ridges: a unique high seas region of natural and cultural significance

Daniel Wagner

Conservation International

The Coral Reefs of the High Seas Coalition is a multidisciplinary alliance of partners that aims to generate the science, strategic communication, and support that is necessary to conserve coral reefs in areas beyond national jurisdiction, commonly known as the high seas. Since its inception in 2019, the coalition has regularly convened experts in ocean science, policy, law, and communications to advance its work. Specifically, the coalition conducts scientific studies to generate the knowledge needed to guide policy recommendations, and engages with organizations that regulate

activities on the high seas to better position coral reefs for increased protection.

To date, the coalition has mostly focused its efforts on international waters surrounding the Salas y Gómez and Nazca ridges, two seamount chains that stretch across over 2,900 km in the Southeastern Pacific. Isolated by the Humboldt Current, the Atacama Trench, and an extreme oxygen minimum zone, this region is home to one of the most unique collections of biodiversity on Earth. For many groups of organisms, nearly half of the species are endemic to the region and found nowhere else on our planet. Not only is this region a biodiversity hotspot, it is also culturally significant as Polynesians and others have recognized its importance for centuries.

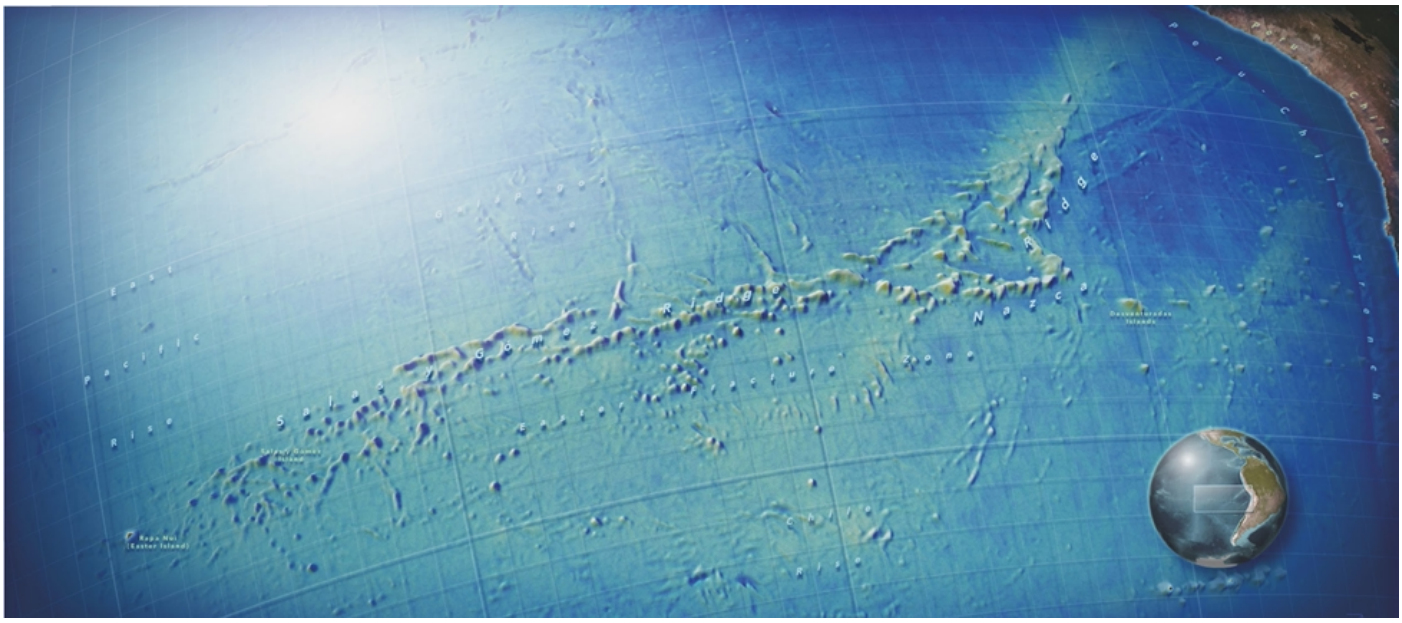


Figure 1. Map showing the Salas y Gomez and Nazca ridges, which stretch across over 2,900 km in the Southeastern Pacific. Over 73% of these ridges are located on the high seas, where they are unprotected and under threat from overfishing, plastic pollution, and climate change,with seabed mining looming in the near future (credit: John Nelson, ESRI).

Last year the coalition published several scientific studies focused on the Salas y Gómez and Nazca ridges including:

- A comprehensive review of the scientific rationale and policy recommendations for protecting the ridges, which summarizes information from close to 250 studies that have been conducted in this region, as well as over 10 years of fishing and vessel traffic data.
- A review of the maritime heritage and cultural significance of the Salas y Gómez & Nazca ridges, which synthesizes information on the 1,000-year old human history of seafaring across the ridges, as well as provides practical recommendations on how this information should be integrated into the design and eventual management of a protected area.
- A review of various global datasets on biodiversity and human use, which shows that the Salas y Gómez and Nazca ridges are one of the most promising places to protect on the high seas globally.
- Deep-water surveys conducted on both ends of these ridges, which recorded over 120 species, many of which are extremely fragile or not known to exist anywhere else on Earth.
- Deep-water surveys of seamount communities in the Nazca Desventuradas Marine Park, which recorded 118 benthic organisms from the Nazca Ridge, as well showed that these environments are still relatively pristine.
- Habitat suitability models for deep-water corals and sponges, which show that these habitat-forming species are widespread across the Salas y Gómez and Nazca ridges.

- Surveys of back coral gardens found on the Salas y Gómez Ridge, which included some of the densest aggregations ever reported for these types of corals, and were shown to provide critical habitat for a wide variety of fishes and invertebrates.

- Descriptions of the complete mitochondrial genomes of two black corals from the Salas y Gómez Ridge, which have potential implications for future biomedical research.

Collectively, these scientific assessments underscore the importance of protecting the natural and cultural resources in high seas waters of the Salas y Gomez & Nazca ridges, which represent the largest and most threatened portion of the ridges. This could be achieved by:

- closing this region to industrial fishing activities regulated by the South Pacific Regional Fisheries Management Organization and the Inter-American Tropical Tuna Commission;

- closing the region to seabed mining activities regulated by the International Seabed Authority; and

- establishing a high seas marine protected area once the United Nations Agreement on Marine Biodiversity Beyond National Jurisdiction is finalized and comes into force.

Figure 2. Top left: Due to its exceptional water clarity, the Salas y Gómez and Nazca ridges are home to some of the deepest photosynthetic reefs on Earth (credit: Matthias Gorny, Oceana). Top right: The biodiversity of this region is marked by the highest levels of endemic species on Earth, such as the endemic Rapa Nui butterfish (credit: Matthias Gorny, Oceana). Bottom left: The ridges provide critical migration corridors for many mobile species, such as humpback whales (credit: Rodolphe Holler). Bottom right: The Salas y Gómez and Nazca ridges represent the easternmost corner of the Polynesian Triangle, a region with an exceptionally rich and long history of seafaring cultures (credit: Pond5).

For more information visit www.coralreefshighseas.org or contact DWagner@conservation.org.

Designation of Offshore Seafloor Natural Environment Conservation Area in the Japanese EEZ

Hiromi Kayama Watanabe[1], Takehisa Yamakita[2]

[1]X-STAR, Japan Agency for Marine-Earth Science and Technology (JAMSTEC); [2]RIGC, JAMSTEC

About a year ago, the Ministry of the Environment of Japan designated four offshore seafloor natural environment conservation areas on December 3, 2020: 1) Izu-Ogasawara Trench, 2) Northern Mid-Ocean Ridge / West Mariana Ridge (northern part of the East and West Mariana Ridges), 3) West Seven Island Ridge (Nishi-Shichito Ridge), and 4) Northern Mariana Trench. Together, these comprise about 5% of Japanese EEZ. These areas were selected to include a large network of key deep-sea habitats including seamounts (with or without hydrothermal vents), trenches, and submarine canyons, among 31 deep-sea regions identified as Ecologically or Biologically Significant Areas (EBSA). In these areas, the exploration and exploitation of mineral resources as well as the collection of benthic fauna or flora will be restricted, and environmental monitoring will be carried out for a decade in order to fill the ecological knowledge gap in the ecosystems. This means the Japanese government has placed 13.3 % of the Japanese EEZ in marine conservation areas by 2020, achieving the Aichi Target 11 – placing at least 10% of coastal and marine areas under conservation – declared in the 10th Meeting of the Conference of the Parties (COP10) of the Convention on Biological Diversity (CBD). Nevertheless, over half of the offshore conservation areas are managed by the Fisheries Agency of Japan with the goal to protect fisheries resources, whose selection criteria and vision are not necessarily in line with those of EBSA or the CBD. The Aichi Target 11 also places emphasis on the protected areas being effectively and equitably managed. We expect that the EBSA concept and quantification of relevant indicators will be introduced in the deep-sea areas over the next few years, to evaluate and ensure the new MPAs are being properly managed.

NOAA Completes a Successful Multi-Year Effort to Study Deep-Sea Corals and Sponges in the Southeast U.S.

Dani Weissman, Tom Hourigan, Heather Coleman, Peter Etnoyer

NOAA Deep Sea Coral Research and Technology Program

Contact: danielle.weissman@noaa.gov

The National Oceanic and Atmospheric Administration (NOAA) Deep Sea Coral Research and Technology Program recently completed its multi-year highly collaborative effort to explore and characterize deep-sea coral and sponge ecosystems in the federal waters of the U.S. South Atlantic, Gulf of Mexico, and U.S. Caribbean. Researchers completed 21 expeditions to survey deep-sea coral and sponge ecosystems using ships, remotely and autonomously operated vehicles, and other equipment. Complementary research projects conducted in partnership with universities focused on seafloor mapping, species identification, habitat suitability modelling, environmental and oceanographic monitoring, and data analysis. Major accomplishments of the initiative include the following:

- Expeditions resulted in a 450 percent increase in the number of coral and sponge observations in the West Florida Wall, an area of particular interest to the Gulf of Mexico Fishery Management Council due to its significant coral aggregations. These records informed the Council's decision to combine three small proposed protected areas into one much larger and more effective one.

- Mapping revealed that the central Blake Plateau, which was originally thought to be soft sediment, is actually covered with extensive mound features composed primarily of *Lophelia pertusa* coral communities. Researchers

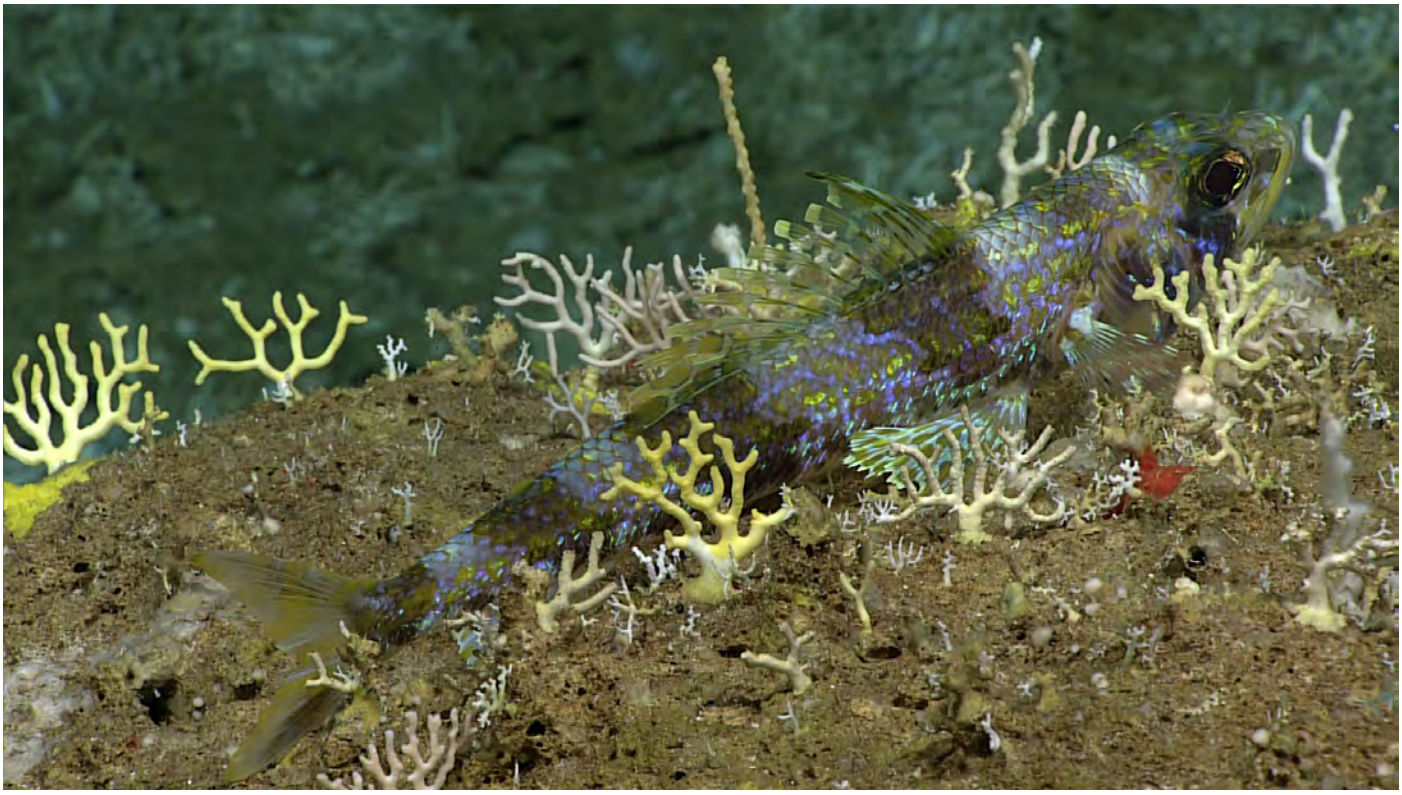


Figure 1. Researchers discovered thriving *Lophelia pertusa* reefs in a region further offshore and in deeper water than other known Lophelia reefs in the U.S. Atlantic. This image of "Million Mounds" shows healthy habitat with extremely high live coral cover. Credit: NOAA Ocean Exploration.

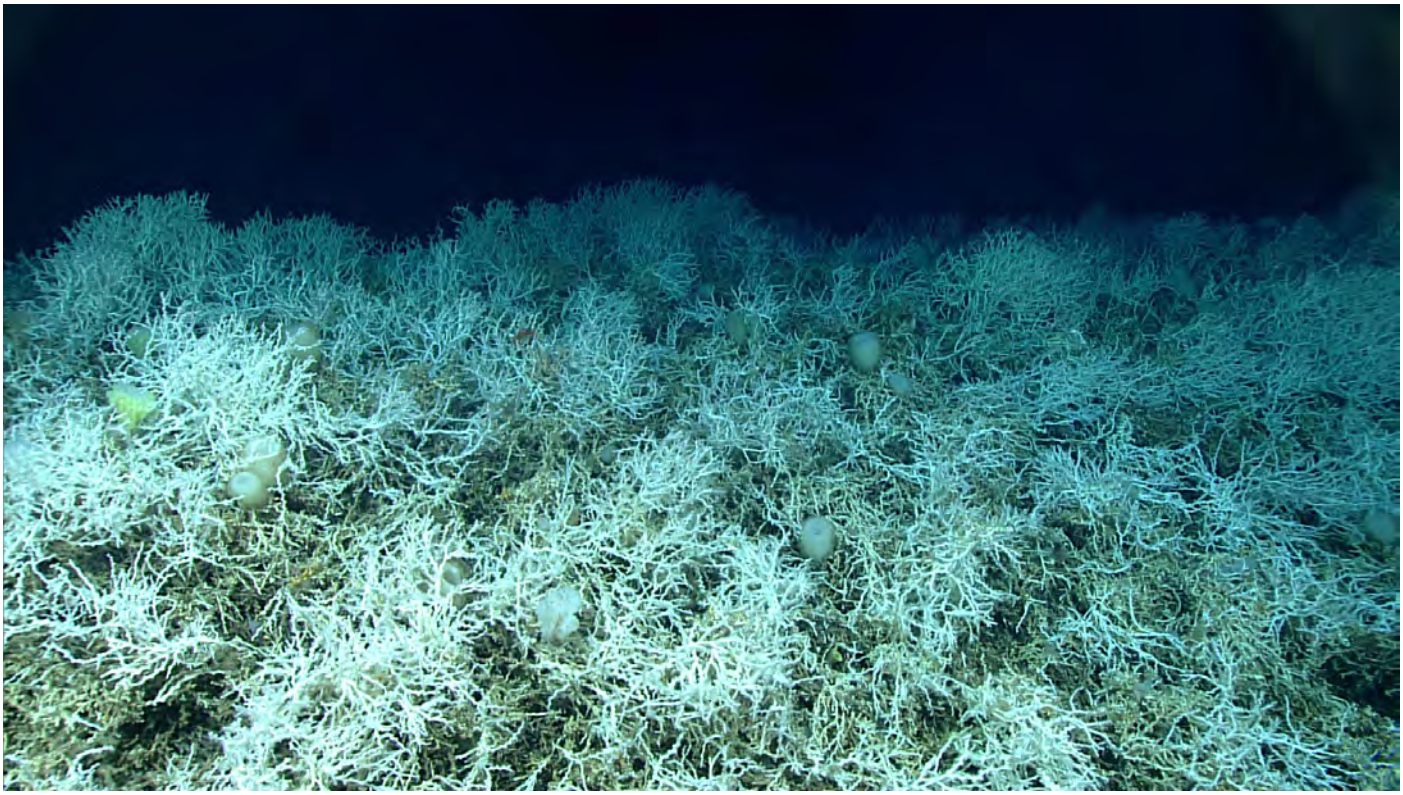


Figure 2. This yellowfin flagfish was photographed between a colony of lace corals during a 2018 expedition to collect information on unknown and poorly understood deep water areas surrounding Puerto Rico and the U.S. Virgin Islands. Credit: NOAA Ocean Exploration.

have named this ecosystem "Million Mounds" and it contains some of the thickest Lophelia aggregates in the region.

- In a collaborative research project in Puerto Rico, local anglers deployed GoPro drop cameras to record video of deep-sea habitats. The project improved the understanding of relationships between commercially important snappers and coral and sponge communities.

- Successful telepresence-enabled expeditions allowed real-time participation from shore. Scientists involved more than 45 students, from the high school to Ph.D. level, by inviting them to viewings and holding laboratory classes to give the students hands-on experience with deep-sea corals.

- Researchers developed a web-accessible public geodatabase to share habitat suitability models, coral and sponge observations, submersible dive locations, and managed area boundaries.

These collective efforts provided important information needed to support the management of fishing and other activities that may affect deep-sea coral ecosystems throughout the region.

The program recently published its final report for the Southeast Deep Coral Initiative, which began in 2016 and was led by NOAA's National Centers for Coastal Ocean Science, in collaboration with NOAA Fisheries, NOAA Ocean Exploration and the Office of National Marine Sanctuaries. This effort was made possible through a variety of funding sources, and extensive local, academic, and federal partners.

Meetings & Workshops

Protecting deep-seabed ecosystems – A multi stakeholder workshop

Catherine Blanchard

Contact: c.blanchard@uu.nl

On 13-15 December 2021, the Netherlands Institute for the Law of the Sea (NILOS), the Utrecht Centre for Water, Oceans and Sustainability Law (UCWOSL) of Utrecht University, and the Netherlands Ministry of Foreign Affairs, in collaboration with The Royal Netherlands Institute for Sea Research (NIOZ), organized the workshop "Protecting deep seabed ecosystems under the future Agreement on the Conservation and Sustainable Use of BBNJ and by the ISA – Perspectives of Government, Civil Society, Stakeholders, and Law and Science". The workshop aimed to create a forum for discussion for different stakeholders, including decision-makers, academics, NGO representatives, scientists and representatives from the industry. Speakers looked at the interactions between processes of the International Seabed Authority (ISA) and the process on marine biodiversity beyond national jurisdiction (BBNJ) for the protection of deep seabed ecosystems, with a focus on the role of area-based managements tools. The workshop is linked to the Utrecht University-NIOZ project "Protecting deep seabed hydrothermal vent fields through area-based management tools".

Lively exchanges took place among speakers and participants. The main takeaways include the need for more and better science, considering the important role that science plays in policy and decision-making, as well as the importance of connectivity, both at the ecological/biological level, but also at the level of governance and institutions. We hope that the workshop will form the basis for further collaborations and discussions among all stakeholders involved in both the ISA and the BBNJ processes.

Some of the slides prepared by the speakers, as well as a workshop report are available on the NILOS and NIOZ websites.

Marine Imaging Workshop 2022

3 - 7 October 2022

The fourth Marine Imaging Workshop will be held from October 3rd to October 7th 2022 in Brest, France, with both on-site and online attendance available. More information will be arriving in the coming weeks and will be made available on the workshop's website.

Marine imaging with cameras is a major method in the science, policy and public understanding of the world's oceans.

The topic is developing rapidly, driven by the technological evolution and increasing application of marine imaging in all oceans. Photos and videos are used to explore unseen ocean habitats, to motivate designation of marine conservation areas, for assessing environmental baselines and monitoring of human impacts and to communicate ocean narratives.

The international Marine Imaging Workshops assemble around 100 scientists and engineers from different disciplines to push the boundaries of marine imaging. Biologists, ecologists, computer scientists, end-users and stakeholders discuss the methods and procedures for optimising the ways we harvest information through images. Topics cover everything from the start to finish of marine image analysis: acquisition planning, image collection, processing of images prior to annotation, still/video annotation, the future of annotation, FAIR image data management and much more.

Challenger 150: The Challenger Society Conference 2022 in London

Conference: 6, 7, 8 September 2022

Side Events: 5 & 9 September 2022

Session Proposal Deadline 31 January 2022

The Challenger Society Conference 2022 will mark the 150th anniversary of the Challenger Expedition. It will be an opportunity to take stock of where we have come in our science, in the way we do science, and will also be the opportunity to discuss, imagine and design the future of open, international, collaborative, inclusive and diverse marine science. The meeting will be held in person at the Royal Geographical Society, Natural History Museum & Imperial College in South Kensington, London. UK and international marine scientists are invited to propose sessions that are interdisciplinary and international in scope to honour the pioneering scientific spirit and global nature of the Challenger Expedition. More info here.

Deepwater Horizon Natural Resource Damage Assessment Program Advances Understanding of the Restoration Needs of Gulf of Mexico Mesophotic and Deep Benthic Communities

In November and December 2021, lead scientists, project managers, and other subject matter experts participated in a series of workshops and focus groups to further understanding of Gulf of Mexico mesophotic and deep benthic communities that were injured by the Deepwater Horizon oil spill to identify best practices for their restoration. Under the Natural Resources Damage Assessment program, a suite of restoration projects are planned to support restoration of these injured resources, including three that address mesophotic and deep benthic communities; the projects will be implemented by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Interior (DOI) for the Open Ocean Trustee Implementation Group:

- Habitat Assessment and Evaluation
- Mapping, Ground-truthing, and Predictive Habitat Modeling
- Coral Propagation Technique Development

On November 15 & 17 and December 1 & 2, NOAA and DOI invited experts to a workshop to seek information about Gulf of Mexico habitats and biological communities. The November workshop, which focused on fish and mobile invertebrates, saw participation by 44 experts. In December, 51 experts participated in a workshop focusing on sessile invertebrates and infauna. Results of these workshops will help identify gaps in information needed for restoration and inform field work beginning in 2022. Proceedings of each workshop, including conclusions and next steps, will be published in spring of 2022. Contact: Randy Clark, NOAA National Ocean Service.

Figure 1. A squat lobster resides on an octorcoral. In the background you can see a colony of *Lophelia*, the predominant coral in this area of the West Florida Escarpment. Image courtesy of NOAA Okeanos Explorer Program, Gulf of Mexico 2014 Expedition.

On December 7-9, NOAA and DOI hosted a workshop of subject matter experts to receive recommendations for current practices and innovations in mapping, ground-truthing and predictive habitat modeling for deep coral ecosystems. Over 150 participants contributed to the 3 days of discussion. The organizers are preparing a workshop report and

will use the information in planning for five years of work to map the distribution and abundance of deep corals in the northern Gulf of Mexico beginning in Spring 2022. Contact: Stacey Harter, NOAA Fisheries.

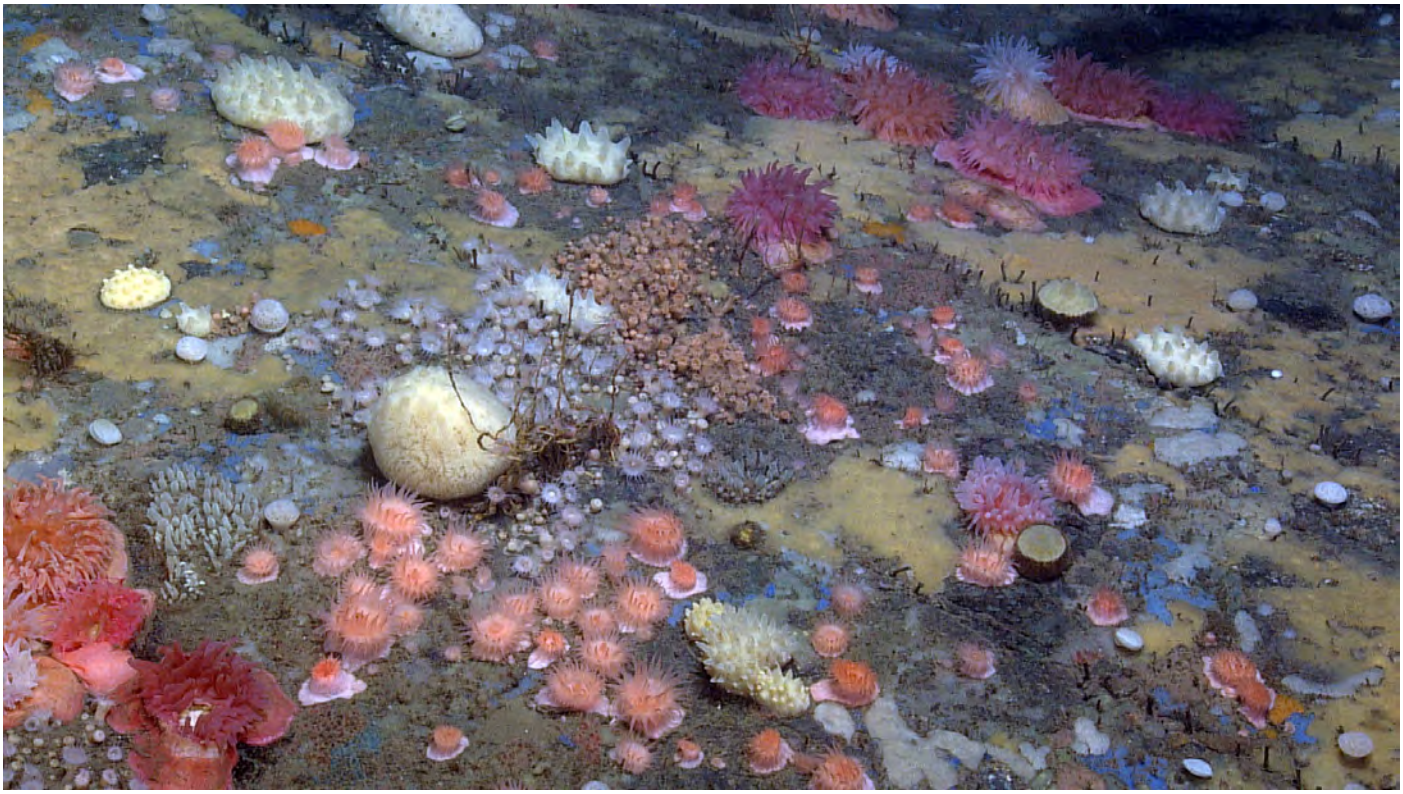
On December 3 & 9, NOAA and DOI convened two groups of subject matter experts to gather information to support development of techniques for propagation of deep-sea corals, a key component of the restoration efforts. Several world-class research and academic institutions were represented, including aquaria and universities, U.S. Navy, Smithsonian Institution, Woods Hole Oceanographic Institution, Monterey Bay Aquarium Research Institute, and more. An experienced group of shallow and deep coral biologists focused on evaluating species priorities for propagation and genetic assessment. A second talented group focused on evaluating substrates for deep-water restoration. The combined participants included deep-sea biologists, technical divers, engineers, and state authorities. Both groups made recommendations for propagation of corals and deployment of substrates in deep water. Reports and plans are forthcoming. Contact: Peter Etnoyer, NOAA National Ocean Service.

DOSI
DEEP-OCEAN STEWARDSHIP INITIATIVE

DOSI Task Force for the Conservation of Deep-Ocean Biodiversity

Leadership: Anna Metaxas & Diva Amon

The focus of this Task Force is the conservation of biodiversity and identification of nature-based solutions to the biodiversity crisis. DOSI has the expertise to provide deep-sea science that specifically guides conservation decision-making. Our Task Force will seek to proactively address and communicate the science directly relevant to conservation issues, such as that of biodiversity conservation or designing effective MPAs.



Since integrity of biodiversity is a core element of every DOSI Working Group, this Task Force can incorporate knowledge, conservation issues and solutions across Working Groups into broadly applicable actions that can then be modified as needed by individual Working Groups (e.g. design and implementation of protected areas). To achieve integration across Working Groups, the Task Force will establish a liaison from each working group who would maintain a two-way exchange of knowledge and expertise.

Some talking points for the Task Force:

- Knowledge is limited but should not limit stewardship
- The deep sea supports the health of our planet
- The deep sea is connected to the surface and the coasts
- The deep sea is being impacted
- Spatial protection and management are needed - 3D highly-protected large-scale MPAs that are climate smart
- Capacity transfer is urgently needed to address scientific and policy-related knowledge inequities to achieve global impact and effect transformative change.

Would you like to join the discussions? If so, please contact: Anna Metaxas (metaxas@dal.ca); Diva Amon (divaamon@gmail.com); Brandon Gertz (dosicomms@gmail.com); Maria Baker (mcb3@soton.ac.uk).

Scientist Profiles

Jenny Neuhaus

PhD student

German Centre of Marine Biodiversity Research (DZMB) Hamburg, Senckenberg am Meer

Contact: jenny.neuhaus@senckenberg.de

My fascination for marine life since a young age set the stage for my academic journey as a marine biologist. It did not take long until I discovered my passion for the immense diversity of invertebrate species and their taxonomy during my studies (BSc and MSc) at the University of Bergen in Norway. In my masters thesis, I used an integrative taxonomic approach combining morphological examination with genetic analysis to study a species complex in a shallow-water nudibranch, which led to the discovery and description of a new species in the North-east Atlantic.

Currently, I am enrolled as a PhD student in the IceDivA project (Icelandic Marine Animals meets Diversity along latitudinal gradients in the deep sea of the Atlantic Ocean) led by Dr. Saskia Brix who is a specialist in epifaunal communities of the deep sea. I was very lucky to start off my PhD with the IceDivA 2 research expedition that took place in the period of 04.11. – 08.12.2021, sampling deep-sea basins west of the mid-Atlantic ridge. In my project, I am aiming to resolve distribution and connectivity across adjacent deep-sea basins in the North Atlantic using invertebrate taxa as surrogates. The study will be done by applying a combination of morphological identification, DNA barcoding, RAD sequencing, and proteomics, utilising samples collected on former research expeditions of the IceDivA and IceAGE (Icelandic Marine Animals: Genetics and Ecology) projects. In the choice of taxa, the focus will be laid upon different modes of reproduction (brooders vs. planktotrophic larvae) and locomotion (sessile vs. mobile) in order to address their connectivity and distribution pathways comparatively within and across deep-sea basins, also seen in the light of population dynamics.

Alongside Dr. Saskia Brix and the fantastic team of Senckenberg, IceAGE, and IceDivA, I am thrilled to be a part of the deep-sea science communtiy and yield input on some of the many questions that remain to be answered. Please do not hesitate to get in touch if you want to know more about the epifaunal research that is carried out at the DZMB Hamburg!

Biogeography:

- 2022 – PhD in Marine Biology, DZMB Hamburg, Senckenberg am Meer
- 2020 - 2021 – Scientific Assistant, DZMB Hamburg, Senckenberg am Meer
- 2018 - 2020 – MSc in Marine Biology, University of Bergen, Norway
- 2015 – 2018 – BSc in Biology, University of Bergen, Norway

Dr Natascha M Bergo

Postdoctoral Researcher (deep-sea microbiology)

Oceanographic Institute at Universidade de São Paulo, Brasil

Contact: nataschabergo@usp.br

I have been fascinated by the oceans since my childhood. My curiosity was awakened with each trip to the beach. I wanted to understand what happened in the oceans that defined their colors, movements and allowed life. So, I knew that I wanted to work in the sea or with the sea. During oceanography college, I decided to study the microscopic life responsible for so many biological processes in the oceans. Indeed, I was very curious about the formation of ferromanganese (Fe-Mn) crusts. At that time, studying mineral microbiome from the deep-sea was only a dream, that I realized when I started my Ph.D. to study the microscopic life associated with Fe-Mn crusts. Admittedly, my curiosity is not only with the deep-sea microbiome but also with the pelagic microbiome. I am an oceanographer and for me, the ocean is always connected, especially by microorganisms.

Biography:

- 2020 – Postdoctoral Researcher, Universidade de São Paulo
- 2015 -2019 - PhD in Biological Oceanography, Universidade de São Paulo
- 20012-2015 – MSc in Biological Oceanography, Universidade de São Paulo
- 2005-2010 – B.S. in Oceanography, Universidade do Vale do Itajaí

Jesse van der Grient

Postdoctoral Researcher

Department of Oceanography, University of Hawai'i at Mānoa

Contact: grientj@hawaii.edu

The ocean has always been important in my family – my parents met each other under water! It was no surprise then when I announced I was going to study the ocean. I fell in love with the deep sea after listening to a lecture by Alex Rogers, which was my first introduction to these wonderful habitats. I have enjoyed working with benthic and pelagic, shallow- and deep-sea animals and ecosystems, investigating macroecological patterns including body-size changes, community structure, and bottom-trawling impacts for my PhD with Alex Rogers (University of Oxford), antagonistic and synergistic effects of multiple anthropogenic and climatic stressors on ocean systems (California Current and Chukchi Sea) with Richard Bailey (University of Oxford), and now I am (sadly) finishing up my postdoc working on the potential effects of deep-sea mining on midwater communities with Jeff Drazen (University of Hawai'i). My current work

has really gotten me curious about the potential effects of suspended sediment plumes on biological communities, especially midwater communities, and how these potential effects may have wider ecological consequences and even ecosystem services impacts, such as reduced fisheries support. This curiosity also led me to apply for the position as co-lead of the DOSI Mineral Working Group. I am very keen to continue working on these and other issues and I am looking for opportunities with new and potential collaborators to do so. So, if you are looking for a quantitative marine ecologist that dreams about the deep sea, do not hesitate, and contact me on grientj@hawaii.edu.

Juliana Correa Neiva Ferreira

Masters degree in Oceanography (Biological Oceanography)

University of São Paulo, Brazil (2021)

Contact: ju.conefe@gmail.com

I have always been in love with the oceans, and even though I didn't study anything related to this area in my undergrad I knew I wanted to try to work with the sea. When applying for the master's degree I realized I could join my passion for microbiology, bioinformatics and the ocean and knew I was in the right path. I was and still am fascinated with the deep-sea microbiome and I want to keep studying and contributing with this field.

Biography:

- 2021: Data Scientist
- 2019-2021: MSc in Biological Oceanography, Universidade de São Paulo
- 2015-2019: B.S in Biomedical Sciences, Universidade de São Paulo

Opportunities

MARINE INSTITUTE

MEMORIAL UNIVERSITY

Postdoctoral research assistant position in Arctic marine ecology and modelling

Project

Arctic and subarctic Ecologically and Biologically Significant Areas usually comprise strong pelagic-benthic coupling. Currents, nutrient recycling, primary production, as well as excretion from pelagic zooplankton and fish all contribute to carbon export at depth which, in turn, is exploited by the benthic fauna. On Arctic and subarctic shelves, this export is limited by shallow depths, but is greater in deeper areas with warmer nutrient-rich waters. Hence, the advection of deep ocean water in the numerous glacial troughs crossing the continental shelves likely provides favourable habitats for pelagic and benthic organisms. In contrast to submarine canyons, the importance of glacial troughs for harbouring biodiversity hotspots remains largely unknown, especially in Arctic regions.

We seek a highly motivated postdoc to lead a project on the importance of glacial troughs in Arctic and subarctic regions. The successful candidate will:

1) Use large datasets comprising seafloor mapping and imagery, acoustic-trawl surveys, paleoceanography, and moorings to quantify the abundance and biodiversity of pelagic and benthic organisms in glacial troughs;

2) Develop a coupled biophysical model based on general circulation models to forecast changes in abundance and biodiversity in Arctic and subarctic troughs.

These objectives will be supported by both existing datasets and opportunities to collect new data aboard Canada's research icebreaker CCGS *Amundsen* www.amundsen.ulaval.ca/home.php.

The Postdoctoral Research Assistant will join the laboratories of Drs. Maxime Geoffroy and Evan Edinger at Memorial University and will work in close collaboration with experts from Fisheries and Oceans Canada, Natural Resources Canada, the Nunatsiavut Government, the University of Bergen (Norway), the University of New Brunswick, and the Farallon Institute (USA).

Qualifications

- A PhD in ecological modelling, marine ecology, biology, oceanography, or a related discipline.
- Abilities to develop biophysical models.
- A strong publication record in relevant fields.
- Experience with seafloor mapping, fisheries acoustics, benthic ecology, Arctic ecology, or paleoceanography will be considered an asset.

ASSEMBLE
ASSOCIATION OF EUROPEAN MARINE BIOLOGICAL LABORATORIES EXPANDED

Ninth call announced for free research access to European marine research facilities

A ninth call for free access to over 30 of Europe's best marine research facilities and services has been announced as part of the EU-funded **ASSEMBLE Plus** project.

Researchers are invited to apply now for access between April and July 2022. **ASSEMBLE Plus** programme supports marine researchers to carry out their own projects using resources not available in their home institutes. The initiative helps participants to enhance their skills, create new collaborations and contribute to scientific understanding.

Since January 2018, the **ASSEMBLE Plus** Transnational Access (TA) programme has received more than 600 applications, with access granted to more than 500 groups of European and international researchers from 46 different countries! Projects have covered a range of marine research, including molecular biology, ecology and biochemistry. The many success stories emerging from these projects highlight their value.

Kate Schoenrock-Rossiter, National University of Ireland (NUI) Galway in Ireland, received an ASSEMBLE Plus TA award to work with the Centre for Marine Sciences, Portugal (CCMAR):

"During my two weeks at CCMAR, we created a calibration metric for microsatellite data generated for a cold-water kelp, Laminaria hyperborea. We were able to expand the project to Station Biologique de Roscoff (SBR). Our work was eventually published in the European Journal of Phycology. Three labs from CCMAR, SBR and NUI Galway/University of Alabama at Birmingham continue to hone this calibration and work together to generate EU wide data sets, a key output of this transnational access."

Kate Schoenrock-Rossiter, NUI Galway

Applications are now open for this TA programme call. The award covers access costs for up to 30 days, in addition to travel, accommodation and meal expenses for up to two researchers per project.

The deadline to apply is 13 February 2022. This is expected to be the last call for the TA programme and therefore the final opportunity for researchers to benefit.

For more information about the programme, please visit assembleplus.eu/access/transnational-access or email assembleplus_ta@embrc.eu. Follow @ASSEMBLE_Plus on Twitter for regular updates from the project.

This project has received funding from the European Commission's Horizon 2020 research and innovation programme under grant agreement No. 730984 (ASSEMBLE PLUS). This output reflects only the author's view and the European Commission cannot be held responsible for any use that may be made of the information contained therein.

Image source: NOAA OER

Travel Grants for Deep-Sea Experts: Applications Now Open

Available through December 31, 2022

DOSI is delighted to partner with the High-Seas Alliance to offer grants for deep-sea experts to attend key meetings, conferences, workshops and events. Funding is open to all scientists and social scientists who are members of the DOSI network. Applications by members of all underrepresented groups are encouraged. Please contact Travis Aten at travisgaten@gmail.com with any questions.

https://www.dosi-project.org/travel-grants-for-deep-sea-scientists/

Register for the NOAA Science Seminar >>

Register for the FathomNet Workshop >>

Learn more about FathomNet >>

SENCKENBERG
world of biodiversity

The Senckenberg Research Institute and Museum (Frankfurt, Germany) is starting a new, large scale project dedicated to the discovery of marine invertebrates, conservation, and outreach activities: the Senckenberg Ocean Species Alliance (SOSA). Senckenberg has a strong focus on biodiversity and taxonomy, and substantial expertise in deep sea biology, but SOSA represents an important expansion of this mission. http://sosa.senckenberg.de/en/

We are now hiring the first positions in a large team for SOSA. In addition, jobs are currently open for the associated PHENOME project studying molluscan genomics, and a permanent (tenure-track) researcher / curator position in marine invertebrates (deadline for the curator position is 31 January).

Current vacancies – deadline 27 Feb 2022

- **Taxonomist and team leader of discovery unit** (SOSA, 2 years initially, plus a further contract until Dec 2031)
- **Office/project manager** (SOSA, 2 years + until Dec 2031)
- **Bioinformatician** for molluscan genomics (PHENOME)
- **PhD studentships:** (full funding for international students)
- holothurian biodiversity (SOSA)
- deep-sea isopod biodiversity (SOSA)
- chiton biodiversity (SOSA)
- evolution of adaptations in molluscs (PHENOME)

We welcome applications from everyone and offer a stimulating and professional environment in which to work. We look for staff who can work according to our values: diversity, creativity, connection and evidence-based thinking. These jobs are based in Frankfurt, Germany, a vibrant international hub (N.B. the working language within our international team is English).

Deadline for application is February 27. Most positions will use an anonymous first-stage assessment to reduce potential bias. You are welcome to contact us informally before submitting your application.

For more info on the jobs and application procedures, see http://sosa.senckenberg.de/en/jobs

Contact: Julia Sigwart & Torben Riehl

UNIVERSITY OF Southampton

Lecturer in Marine Biology

Applications due 31 January 2022

The University of Southampton is seeking a full-time, permanent faculty member to join its Ocean and Earth Science graduate school. The ideal candidate will be an outstanding marine biologist with interests in whole-animal biology and ecophysiology or related areas of research that speak to the challenges of marine conservation, management and food security.

https://jobs.soton.ac.uk/Vacancy.aspx?ref=1648421HN

Wanted

Wanted dead or alive (but drunk with alcohol 95%)!

Architectonica karsteni (Rutsch, 1934)

In 2016, CIMAR 22 oceanographic cruise was made to seamounts near the Desventuradas Islands, Chile. Among the gastropod species we found was *Architectonica karsteni* Rutsch 1934, a species of Architectonicidae found in deep waters and about which little is known. This finding represented an extension of the current geographic distribution range, but not for that recorded by this species during the Miocene (Asorey *et al.*, 2020). We want to know if the individuals that we find in the seamounts are related to populations of the eastern tropical Pacific or if they could be remnants of the populations that were found on the coast of Chile during the Miocene. That is why we are looking for a sample (or several) of this species to be able to sequence DNA and be able to compare it with our samples. We have searched museum collections, but there are very few and most have undergone formalin fixation and, as we would like to sequence the entire mitogenome, it is preferable to have a sample fixed directly in 95% alcohol. In case you know of any sample, please contact the following email: cynthiaasorey@gmail.com.

Reference:

ASOREY, C.M., SELLANES, J., EASTON, E.E., BIELER, R. & MECHO, A. 2020. Architectonica karsteni Rutsch , 1934 (Gastropoda : Architectonicidae) in seamounts of the Nazca-Desventuradas Marine Park : First record in Chilean waters since the Miocene. *The Nautilus*, 134: 61–70.

Whatever Your Terms, We Want Your Worms!

WANTED! DEEP-SEA TELEOSTS AND/OR THEIR GI TRACTS

Good Wishes Colleagues & Fellow Members of the Deep-Sea Community:

I am a Parasitologist and Permanent Scholar in Residence in the Natural History Collections at the Corpus Christi Museum of Science & History in Corpus Christi, Texas (U.S.A.). For 30 years my main research focus has been describing new taxa of deep-sea helminth (worm) parasites including digeneans, cestodes, nematodes, monogeneans and acanthocephalans infecting teleosts collected at 200+ m depths.

I am looking for deep sea benthic and benthopelagic teleosts and/or their GI tracts which I can examine to collect, describe and publish new taxa of parasitic helminths to document deep-sea parasite biodiversity. I am happy to reimburse mailing costs as well as include you as a co-author on all publications produced from your material.

Please contact me and I would be happy to discuss with you in more detail my ongoing research, project logistics and desired teleost taxa of interest. You may also keyword

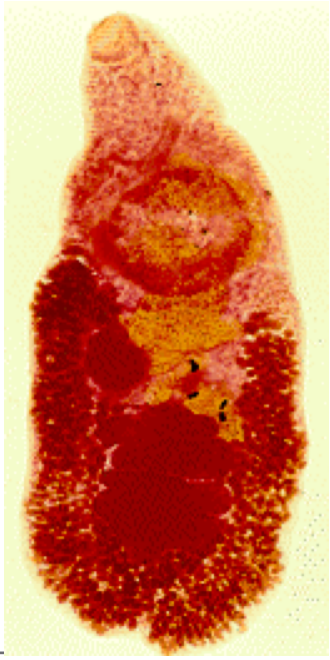


Figure 1. Podocotyle nimoyi Blend, Dronen & Armstrong, 2016 (Trematoda: Digenea: Opecoelidae) from the pugnose grenadier, *Sphagemacrurus grenadae*, and the common Atlantic grenadier, *Nezumia aequalis* (Gadiformes: Macrouridae), from the deep Gulf of Mexico.

search “Charles Blend” and “parasites” on Google Scholar to sample, see and learn more about my work.

With Sincere Thanks,

Charles (Chuck) Blend Ph.D., M.S., B.S. (Email: ilovethesea@att.net; Phone/Voice Mail: 011-1-361-218-5276)

Corpus Christi Museum of Science & History (Website: www.ccmuseum.com)
Laboratory of Parasitology, Biodiversity & Teaching Collection, Texas A&M University, College Station, Texas

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Using Your Photos to Inspire Deep Ocean Stewardship

Deep Ocean Stewardship Initiative (DOSI)

Do you have any interesting photos from research or expeditions that you wish more people would see?

At its heart, DOSI has always been about harnessing the power of deep-sea expertise to support effective policy. But to make that possible, our work needs to be about communication, too. For science to influence the rules, the people who those rules impact have to care.

We have all seen how pictures and videos can challenge the common perception of the deep sea as a desolate and alien place. Amazing strides have been made by the people behind Nautilus Live, Schmidt Ocean Institute, and many more projects to bring the deep closer to the public. But we believe that DOSI, as a global coalition of deep-sea experts who have had all manner of fascinating experiences, can and should contribute to that change as well.

If you would like to inspire more people with your work, we would be very grateful for the chance to share your favorite

deep-sea visuals through DOSI. Deep-sea creatures, technology, scientists going about their research—anything goes. Our hope is that our new page on Flickr, a photo-sharing website, will serve as a place for people to appreciate the most exciting pictures and videos from our entire deep-sea community. All work that you share through us will be fully credited each time it is used so that everyone who sees your pictures can learn more about your research.

To share your work, or if you have any questions, please reach out to Brandon Gertz at DOSIcomms@gmail.com. As always, thank you for your support and for your dedication to deep ocean stewardship.

Image courtesy of the NOAA Office of Ocean Exploration and Research, Gulf of Mexico 2012.

Special Issue “Deep-Sea Fish and Fisheries” - An invitation from Guest Editor

Dear Colleagues,

This is to let you know that the open access journal, Journal of Marine Science and Engineering (IF: 2.458, ISSN 2077-1312) is pleased to announce the launching of a new Special Issue entitled “Deep-Sea Fish and Fisheries”, for which I am serving as Guest Editor. For further reading, please visit the Special Issue Website.

The submission deadline is **10 May 2022**. You may send your manuscript now or up until the deadline. Submitted papers should not have been published previously, nor be under consideration for publication elsewhere.

Manuscripts should be submitted through the online manuscript submission and editorial system. Each new submission will be processed as quickly as possible and published on acceptance. In case of questions, please feel free to contact us. We look forward to hearing from you.

Kind regards,

Dr. Alexei M. Orlov
Guest Editor

Short description of the issue:

Deep-sea fishes are a very diverse group of chondrichthyans and teleosts widely distributed in the world's oceans from the Arctic to Antarctic and inhabiting the water column and seabed of continental slopes, seamounts and high seas at depths greater 400 m. Despite the long period of studies of deep-sea fishes and commercial exploitation of their resources, their importance in the ecosystems is still poorly understood. Our knowledge of their taxonomy, zoogeography, evolution, phylogeny, basic biological traits, and conservation needs remain scarce. This Special Issue will provide an overview of the current status of knowledge on the variety of topics related to deep-sea fish and fisheries, including taxonomy, zoogeography, phylogeny, molecular biology, evolution, life history, role in the ecosystem, conservation, stock assessment, fisheries and management worldwide. The present Special Issue will comprise collected papers, the majority of which provide new or previously unpublished data. This collection will give readers the opportunity to find a lot of useful information on deep-sea fish and fisheries in a single reference.

Brief bibliography of the Guest Editor:

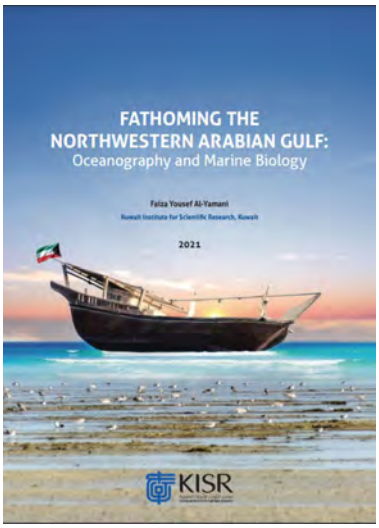
Dr. Alexei Orlov, is a head of the Laboratory in the P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences (IO RAS), Moscow, Russia. From 1977-1982, he attended the Faculty of Fisheries, Astrakhan State Technical University (Astrakhan, Russia), specializing in Ichthyology and Pisciculture. After leaving university, he began work as an engineer for the Pacific Department of Fishery Survey and Research Fleet (Vladivostok, Russia), where he remained until 1986. During over 30 years at the Russian Federal Research Institute of Fisheries and Oceanography (VNIRO, Moscow, Russia), he gained a wealth of field experience. He is a member of the BIO Committee of the North Pacific Marine Science Organization (PICES), was a member of ICES working group on the biology and assessment of deepsea fisheries resources (WGDEEP) and was the participant of the International Scientific Project "Patterns and processes of the ecosystems of the northern Mid-Atlantic (MAR-ECO)". He has participated in more than 50 International Scientific events and is the author of over 650 publications. His scientific interests include distribution, stock assessment, ecology, general biology, zoogeography and taxonomy of demersal and midwater fishes of the North Pacific and North Atlantic oceans. He is a member of 8 professional societies, serves as editors for journals "Journal of Ichthyology", "Acta Ichthyologica et Piscatoria", "Water Biology and Security", and "Trudy VNIRO".

Hot off the Press

Fathoming the Northwestern Arabian Gulf: Oceanography and Marine Biology

Faiza Al-Yamani (2021)

Kuwait Institute for Scientific Research



This (open access) book is written for all stakeholders with the principal objective to promote ocean literacy and to provide adequate knowledge of the marine environment of the north-western Arabian Gulf, its different ecosystems and their biodiversity, human activities impacting its environment and its current health state. This knowledge is important in order to understand the marine ecosystems' responses to various stressors and pressures, to predict the consequences of change, to develop appropriate management policies and action plan, design mitigation measures, conserve and support efforts to reverse the trend of decline in the health of the marine environment, and to create improved conditions for sustainable utilization of Kuwait's marine resources and services.

This author offers a unique perspective and important voice.

Link to book: https://www.kisr.edu.kw/media/filer_public/d7/f7/d7f77a5e-9ab4-4339-b3f3-057c990d45e1/fathoming_book_20_sep_optimized.pdf

Safe working environments are key to improving inclusion in open-ocean, deep-ocean, and high-seas science

Diva Amon, Zoleka Filander, Lindsey Harris, Harriet Harden-Davies (2022)

Marine Policy Vol 137, 104947

Despite growing global acknowledgement of the importance of the ocean and its biodiversity, there are significant disparities in the capacities to undertake open-ocean, deep-ocean and high-seas science worldwide. This is due to the high level of resources needed and that these types of ocean research have and continue to largely occur in non-inclusive and inequitable ways. Companies, intergovernmental, governmental, and nongovernmental organisations, and academic institutions have launched numerous global initiatives, including the United Nations Decade of Ocean Science for Sustainable Development, to make ocean exploration and science more inclusive, equitable, and accessible at various levels. Participation in offshore research cruises has emerged as a primary training activity, however the lack of a corresponding rise in measures to ensure that such opportunities are safe, especially for underrepresented groups, hinders the advancement of open-ocean, deep-ocean, and high-seas science globally. The experiences of underrepresented groups in offshore science show there needs to be a step change in approaches to ensure safety and inclusion. Instances where discrimination, bullying, harassment, and assault occur do not build capacity; instead, they perpetuate the fundamental inequities that should be addressed. Yet we do not hear about these experiences, and there is a need for conversations about how to ensure safe working spaces at sea. The deep-sea science community has a critical leadership role to play in this conversation, working together with other sectors. We propose steps to support

inclusion and safety for underrepresented groups within offshore science towards a truly inclusive global ocean.

Link to paper: https://www.sciencedirect.com/science/article/pii/S0308597X21005583?via%3Dihub

Abundance and microbial diversity from surface to deep water layers over the Rio Grande Rise, South Atlantic

Correa Neiva Ferreira*, Natascha Menezes Bergo*, Pedro Marone Tura, Mateus Gustavo Chuqui, Frederico P. Brandini, Luigi Jovane, Vivian H. Pellizari

Progress in Oceanography

*These authors contributed equally to this work

Marine microbes control the flux of matter and energy essential for life in the oceans. Until now, the distribution and diversity of planktonic microorganisms above Fe-Mn crusts have received relatively little attention. Future deep-sea mining is predicted to affect microbial diversity. Here, we studied the ecology of picoplankton among epipelagic, meso- and bathypelagic zones of a Fe-Mn deposit region, at Rio Grande Rise, Southwestern Atlantic Ocean. We investigated microbial community composition using high-throughput sequencing of 16S rRNA genes and their abundance estimated by flow cytometry.

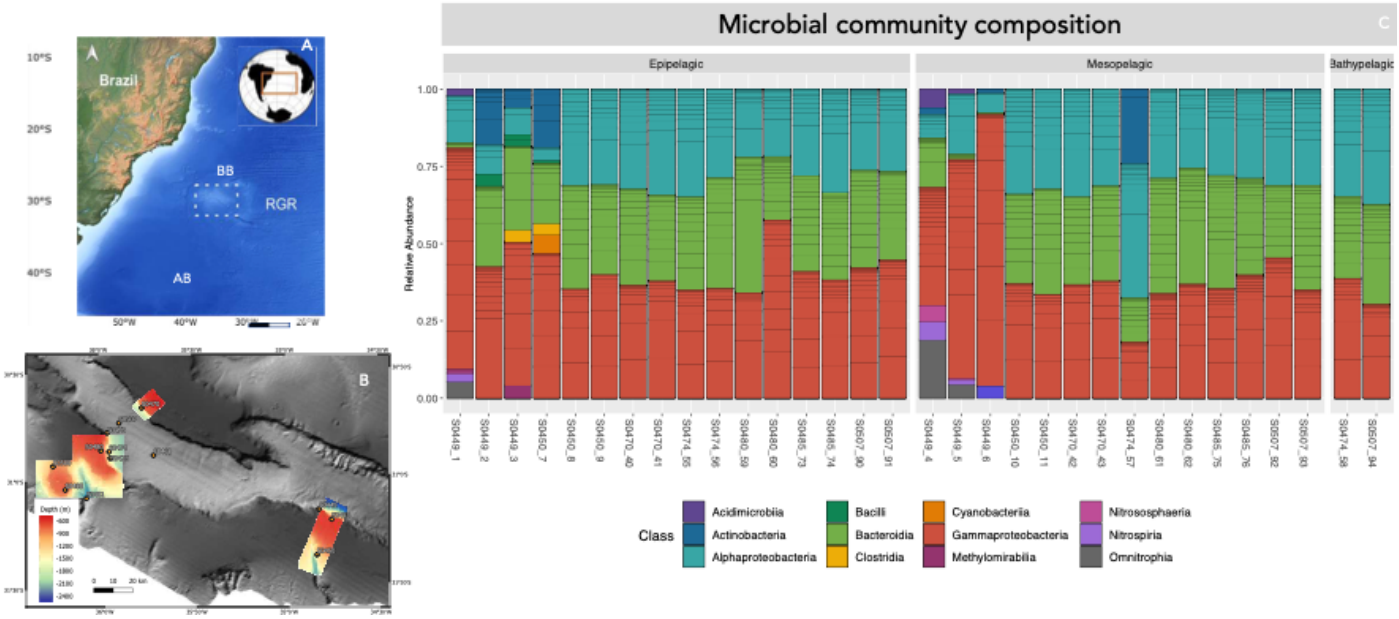


Figure 1. Sampling map showing the location of the Rio Grande Rise area, South Atlantic Ocean. AB, Argentine Basin; BB, Brazilian Basin. (B) Distribution of oceanographic stations with high resolution bathymetry, numbers refer to stations. (C) General overview of microbial composition.

The picoplankton populations were more abundant in epi- and mesopelagic waters, corresponding to the Tropical and South Atlantic Central Water masses. Bacterial groups related to heterotrophy, such as *Oceanospirillales* (Gammapoteobacteria), SAR11 (Alphapoteobacteria), *Flavobacteriales* (Bacteroida), and *Rhodobacterales* (Alphapoteobacteria), were the main representatives of the pelagic microbial community. Additionally, we detected abundant assemblages belonging to acetate-oxidizing manganese reducers, i.e., *Alteromonas*. No differences were observed in microbial community diversity among pelagic zones and water masses. These results provide the first insights into the picoplankton abundance, taxonomy and diversity, and ecological processes in the Rio Grande Rise of the Atlantic Ocean. This may also support draft regulations for deep-sea mining in the region.

Link to the article: https://www.sciencedirect.com/science/article/pii/S0079661121002196?dgcid=author

Seascape Genomics Reveals Metapopulation Connectivity Network of *Paramuricea biscaya* in the Northern Gulf of Mexico

Galaska, M., Liu, G., West, D., Erickson, K., Quattrini, A., Bracco, A., & Herrera, S. (2021)

Frontiers in Marine Science, 8, 790929

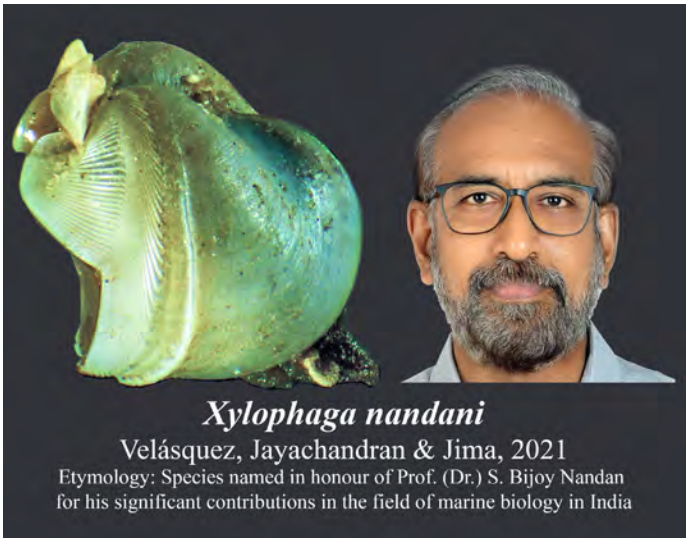
The degree of connectivity among populations influences their ability to respond to natural and anthropogenic stressors. In marine systems, determining the scale, rate, and directionality of larval dispersal is therefore, central to understanding how coral metapopulations are interconnected and the degree of resiliency in the event of a localized disturbance. Understanding these source-sink dynamics is essential to guide restoration efforts and for the study of ecology and evolution in the ocean. The patterns and mechanisms of connectivity in the deep-sea (>200 m deep) are largely understudied. In this study, we investigated the spatial diversity patterns and metapopulation connectivity of the octocoral *Paramuricea biscaya* throughout the northern Gulf of Mexico (GoM). *Paramuricea biscaya* is one of the most abundant corals on the lower continental slope (between 1,200 and 2,500 m) in the GoM. The 2010 Deepwater Horizon oil spill (DWH) directly impacted populations of this species and thus are considered primary targets for restoration. We used a combination of seascape genomic analyses, high-resolution ocean circulation modelling, and larval dispersal simulations to quantify the degree of population structuring and connectivity among *P. biscaya* populations. Evidence supports the hypotheses that the genetic diversity of *P. biscaya* is structured by depth, and that larval dispersal among connected populations is asymmetric due to dominant ocean circulation patterns. Our results suggest that there are intermediate unsampled populations in the central GoM that serve as stepping stones for dispersal. The data suggest that the DeSoto Canyon area, and possibly the West Florida Escarpment, critically act as sources of larvae for areas impacted by the DWH oil spill in the Mississippi Canyon. This work illustrates that the management of deep-sea marine protected areas should incorporate knowledge of connectivity networks and depth-dependent processes throughout the water column.

Link to paper: https://doi.org/10.3389/fmars.2021.790929

A new species of wood-boring bivalve (Mollusca: Xylophagaidae) from the Eastern Arabian Sea

Jayachandran, P.R., Velásquez, M. & Jima, M. (2022)

Marine Biodiversity. 52(1):7



A new species of deep-sea wood-boring bivalve *Xylophaga nandani* sp. nov. is described based on material obtained from floating woods collected with a bongo net on the eastern Arabian Sea during FORV *Sagar Sampada* cruise 380. The new species is named after eminent marine biologist in India, Prof. (Dr.) Bijoy Nandan, Dean, Faculty of Marine Sciences, Cochin University of Science and Technology (CUSAT), Kerala, India. The new species is morphologically closest to the members of the genus *Xylophaga* sensu stricto (cf. "Clade 4" of Romano *et al.* 2020), and can be distinguished from all of them by a combination of morphological characters, such as the

laterally pointed, triangular mesoplax; siphon with a simple row of large, coarse papillae placed immediately next to the furrow on the lateral incurrent siphon; and an oval concentration of numerous white cone-shaped granules with pointed, slightly curved tips on lateral siphon distal to excurrent opening. Additionally, previous records of species of the family Xylophagaidae Purchon, 1941 from the Indian Ocean and neighbouring areas were discussed in this paper.

Link to paper: https://doi.org/10.1007/s12526-021-01245-1

Ethical opportunities in deep-sea collection of polymetallic nodules from the Clarion-Clipperton Zone

Steven Katona, Daina Paulikas, and Gregory S. Stone (2021)

Integrated Environmental Assessment and Management (IEAM) 2021:1–21

For the past two years we, along with other colleagues, have been studying the environmental, social and economic impacts of supplying some of the metals needed to transition societies from dependence on fossil fuels to reliance on renewable energy. In particular we have focused on metals currently needed to make batteries for electric vehicles—manganese, nickel, cobalt and copper —and comparing the impacts of sourcing them from polymetallic nodule ores vs. ores from mines on land. In this paper, which is part of the IEAM special series entitled "Implications of Deep-sea Mining on Marine Ecosystems," we discuss ethical considerations relevant to the question of whether nodules should become a source for battery metals. Among them is the need to evaluate not only the negative impacts to the marine environment likely to occur if nodules are collected, but also the negative impacts to terrestrial environments if they are not. Primary metals cannot be obtained from either realm without causing adverse impacts, but gaining them with minimum harm to people and nature is imperative. We urge a path forward that meets the physical and intangible needs of humans, while equally representing the interests of nature and the support systems on which we all depend. If nodule collection does commence, the industry should take every opportunity to incorporate ethics and sustainability throughout its decisions, operations and supply chain in order to produce the fewest negative impacts on air, water, land, sea, people, nature, and species, while providing the most broadly equitable suite of benefits across those categories.

Link to paper: https://doi.org/10.1002/ieam.4554

Role of deep-sea equipment in promoting the forefront of studies on life in extreme environments

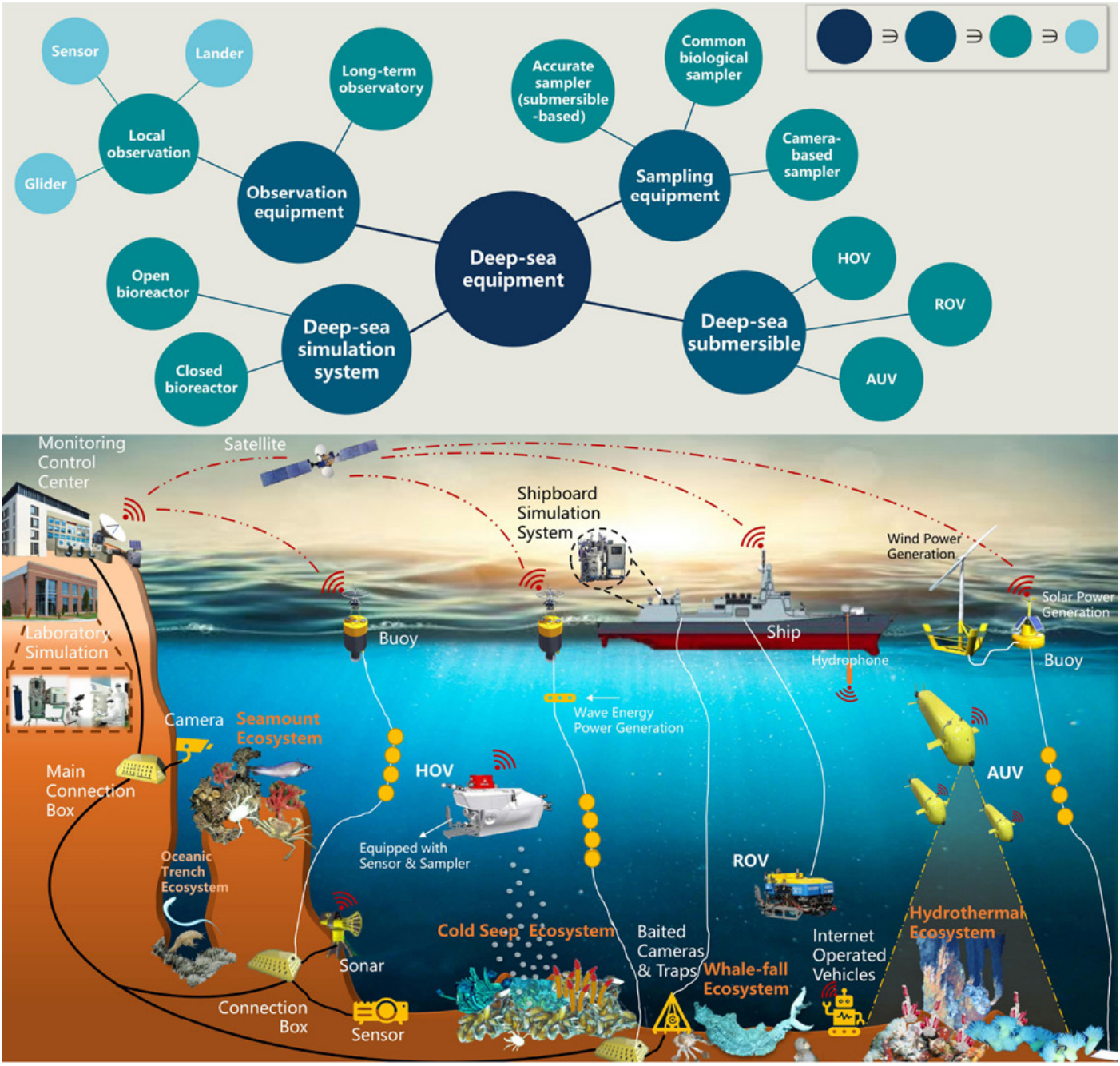
Jianzhen Liang, Jing-Chun Feng, Si Zhang, Yanpeng Cai, Zhifeng Yang, Tian Ni, Hua-Yong Yang (2021)

iScience, Volume 24, Issue 11

The deep-sea environment creates the largest ecosystem in the world with the largest biological community and extensive undiscovered biodiversity. Nevertheless, these ecosystems are far from well known. Deep-sea equipment is an indispensable approach to research life in extreme environments in the deep-sea because of the difficulty in obtaining access to these unique habitats. This work reviewed the historical development and the state-of-the-art of deep-sea equipment suitable for researching extreme ecosystems, to clarify the role of this equipment as a promoter for the progress of life in extreme environmental studies. Linkages of the developed deep-sea equipment and the discovered species are analyzed in this study. In addition, Equipment associated with researching the deep-

sea ecosystems of hydrothermal vents, cold seeps, whale falls, seamounts, and oceanic trenches are introduced and analyzed in detail. To clarify the thrust and key points of the future promotion of life in extreme environmental studies, prospects and challenges related to observing equipment, samplers, laboratory simulation systems, and submersibles are proposed. Furthermore, a blueprint for the integration of in situ observations, sampling, controllable culture, manned experiments in underwater environments, and laboratory simulations is depicted for future studies.

Link to paper: https://doi.org/10.1016/j.isci.2021.103299



Phylogenetically and functionally diverse microorganisms reside under the Ross Ice Shelf

Clara Martínez-Pérez, Chris Greening, Sean K. Bay, Rachael J. Lappan, Zihao Zhao, Daniele De Corte, Christina Hulbe, Christian Ohneiser, Craig Stevens, Blair Thomson, Ramunas Stepanauskas, José M. González, Ramiro Logares, Gerhard J. Herndl, Sergio E. Morales & Federico Baltar (2022)

Nature Communications Vol.13, Article number: 117

Throughout coastal Antarctica, ice shelves separate oceanic waters from sunlight by hundreds of meters of ice. Historical studies have detected activity of nitrifying microorganisms in oceanic cavities below permanent ice shelves. However, little is known about the microbial composition and pathways that mediate these activities. In this study, we profiled the microbial communities beneath the Ross Ice Shelf using a multi-omics approach. Overall, beneath-shelf microorganisms are of comparable abundance and diversity, though distinct composition, relative to those in the open meso- and bathypelagic ocean. Production of new organic carbon is likely driven by aerobic lithoautotrophic archaea and bacteria that can use ammonium, nitrite, and sulfur compounds as electron donors. Also enriched were aerobic organoheterotrophic bacteria capable of degrading complex organic carbon substrates, likely derived from in situ fixed carbon and potentially refractory organic matter laterally advected by the below-shelf waters. Altogether, these findings uncover a taxonomically distinct microbial community potentially adapted to a highly oligotrophic marine environment and suggest that ocean cavity waters are primarily chemosynthetically-driven systems.

Link to paper: https://www.nature.com/articles/s41467-021-27769-5

A Global Red List for Hydrothermal Vent Molluscs

Elin A. Thomas, Aoife Molloy, Nova B. Hanson, Monika Böhm, Mary Seddon and Julia D. Sigwart (2021)

Frontiers of Marine Science Vol.8

With the accelerating development of direct and indirect anthropogenic threats, including climate change and pollution as well as extractive industries such as deep-sea mining, there is an urgent need for simple but effective solutions to identify conservation priorities for deep-sea species. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species is an effective and well-recognized tool to promote the protection of species and presents an opportunity to communicate conservation threats to industry, policy makers, and the general public. Here, we present the Vent Red List for molluscs: a complete global assessment of the extinction risk of all described molluscs endemic to hydrothermal vents, a habitat under imminent threat from deep-sea mining. Of the 184 species assessed, 62% are listed as threatened: 39 are Critically Endangered, 32 are Endangered, and 43 are Vulnerable. In contrast, the 25 species that are fully protected from deep-sea mining by local conservation measures are assessed as Least Concern, and a further 45 species are listed as Near Threatened, where some subpopulations face mining threats while others lie within protected areas. We further examined the risk to faunas at specific vent sites and biogeographic regions using a relative threat index, which highlights the imperiled status of vent fields in the Indian Ocean while other vent sites within established marine protected areas have a high proportion of species assessed as Least Concern. The Vent Red List exemplifies how taxonomy-driven tools can be utilized to support deep-sea conservation and provides a precedent for the application of Red List assessment criteria to diverse taxa from deep-sea habitats.

Link to paper: https://doi.org/10.3389/fmars.2021.713022

Understanding the Impacts of Blue Economy Growth on Deep-Sea Ecosystem Services

Nezha Mejjad and Marzia Rovere (2021)

Sustainability 2021, 13(22)

Contact: mejjadnezha@gmail.com

The deep sea is the vastest environment on Earth and provides many services and goods. Understanding the services and goods of deep-sea ecosystems would enable better resource governance and decision-making. In the present study, we reviewed and assessed deep-sea ecosystems services using the Ma conceptual framework, which incorporates ecosystems services and goods with human welfare. We also analyzed and measured the scientific production between 2012 and 2021 using the Dimension dataset. The bibliometric analysis showed a lack of studies related to deep-sea ecosystem services, which suggest the urgent need to overcome the existing knowledge gap regarding deep-sea components. However, the current knowledge revealed the crucial role that these ecosystems provide to the planet. Furthermore, we highlighted that there are common services and goods, and every ecosystem service feeds into another one. Developing actions and policies based on approaches that combine all deep-sea ecosystems services and goods are needed for the sustainable growth of the deep-sea economy in accordance with the United Nations Development Goal 14: Life Below Water.

Link to paper: https://www.mdpi.com/2071-1050/13/22/12478/htm

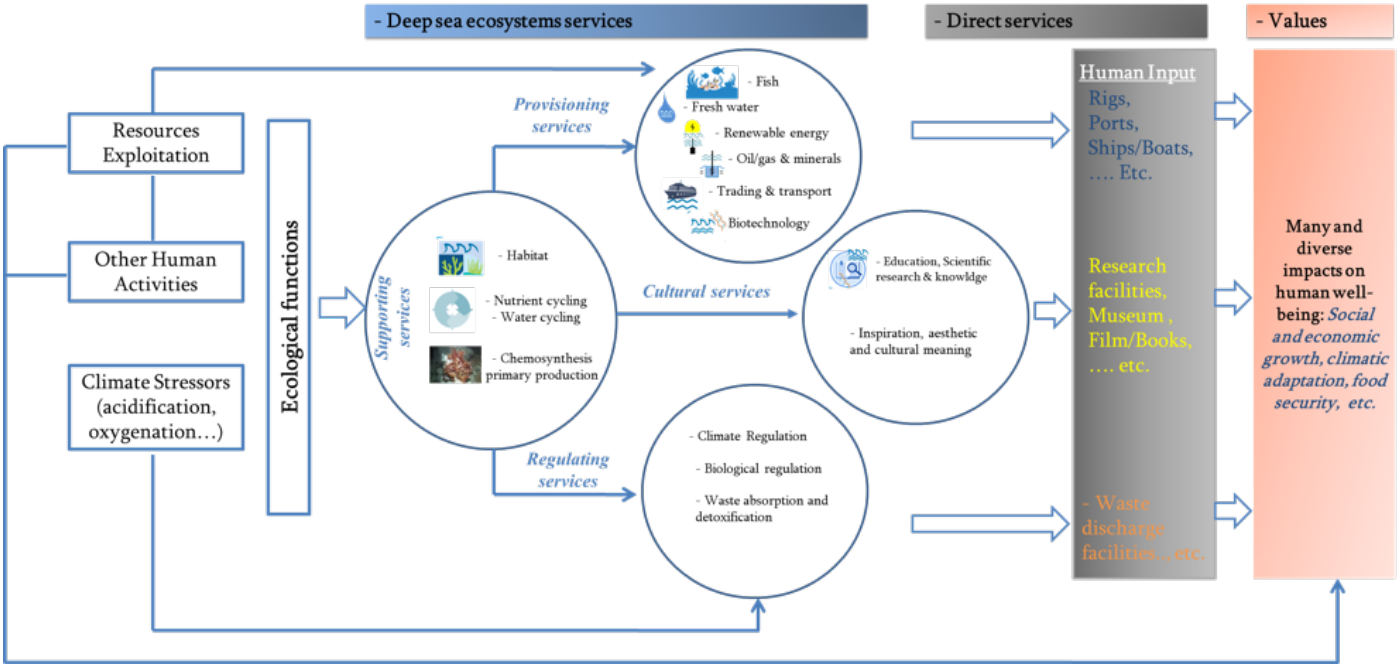


Figure 1. Deep-sea ecosystem goods and services

Kilometer-Scale Larval Dispersal Processes Predict Metapopulation Connectivity Pathways for *Paramuricea biscaya* in the Northern Gulf of Mexico

Liu, G., Bracco, A., Quattrini, A., & Herrera, S. (2021)

Frontiers in Marine Science, 8, 790927

Fine-scale larval dispersal and connectivity processes are key to species survival, growth, recovery and adaptation

under rapidly changing disturbances. Quantifying both are required to develop any effective management strategy. In the present work, we examine the dispersal pattern and potential connectivity of a common deep-water coral, *Paramuricea biscaya*, found in the northern Gulf of Mexico by evaluating predictions of physical models with estimates of genetic connectivity. While genetic approaches provide estimates of realized connectivity, they do not provide information on the dispersal process. Physical circulation models can now achieve kilometer- scale resolution sufficient to provide detailed insight into the pathways and scales of larval dispersal. A high-resolution regional ocean circulation model is integrated for 2015 and its advective pathways are compared with the outcome of the genetic connectivity estimates of corals collected at six locations over the continental slope at depths comprised between 1,000 and 3,000 m. Furthermore, the likely interannual variability is extrapolated using ocean hindcasts available for this basin. The general connectivity pattern exhibits a dispersal trend from east to west following 1,000 to 2,000-m isobaths, corresponding to the overall westward near-bottom circulation. The connectivity networks predicted by our model were mostly congruent with the estimated genetic connectivity patterns. Our results show that although dispersal distances of 100 km or less are common, depth differences between tens to a few hundred meters can effectively limit larval dispersal. A probabilistic graphic model suggests that stepping-stone dispersal mediated by intermediate sites provides a likely mechanism for long-distance connectivity between the populations separated by distances of 300 km or greater, such as those found in the DeSoto and Keathley canyons.

Link to paper: https://doi.org/10.3389/fmars.2021.790927

Deep-sea nodules versus land ores: A comparative systems analysis of mining and processing wastes for battery-metal supply chains

Daina Paulikas, Steven Katona, Erika Ilves, Saleem H. Ali (2022)

Journal of Industrial Ecology 2022; 1– 24.

To meet UN Sustainable Development goals, a clean-energy transition with minimal ecological impact from its raw-material supply chain is essential. Polymetallic nodules lying unattached on the abyssal seafloor of the Pacific Ocean's Clarion Clipperton Zone contain four critical metals (nickel, cobalt, manganese, copper) in large quantities, and the International Seabed Authority may soon enact regulations to allow their commercial exploitation. There are complex global ecological implications of doing so. Nodule exploitation would damage abyssal habitats and may impact midwater-column organisms; but in the absence of nodule exploitation, terrestrial mining's environmental and social impacts would intensify. This paper adds to the growing systems-based literature on nodule collection by contributing a preliminary material flow analysis of global-average cradle-to-gate waste streams using either nodules or terrestrial sources as part of a preliminary life cycle assessment, as well as integrated risk assessments of those waste streams. System endpoints are battery precursors (nickel sulfate, cobalt sulfate, manganese sulfate), copper cathode, and a 40% or 75% manganese product. Overburden, tailings, and processing and refining wastes from terrestrial mining are compared to the nodule industry's anticipated offshore and onshore wastes, including sediment disrupted by nodule-collection machines. Robustness to offshore technology assumptions is tested using Monte Carlo simulation, while onshore mass-flow scenarios incorporate a "negligible-waste" flowsheet and high-waste flowsheets where manganese is not recovered. A billion-electric-vehicle scenario incorporates the effects of declining terrestrial copper and nickel ore grades. Results imply that metal production from nodules may produce less waste of lower severities, caveated by uncertain impacts of disrupted sediment.

Link to paper: https://doi.org/10.1111/jiec.13225

Figure 1. Qualitative and quantitative comparison of solid waste streams for billion-EV scenario. Impact-risk assessment summaries presented alongside billion-EV-battery waste-stream quantities including sensitivity analysis results. Terrestrial waste streams include ore-grade dynamics.

Microbial perspective on the giant carbonate ridge Alpha Crucis (Southwestern Atlantic upper slope)

Amanda Gonçalves Bendia, Camila Negrão Signori, Fernanda Mancini Nakamura, Ana Carolina de Araújo Butarelli, Júlia Gasparini Passos, Raissa Basti Ramos, Luiza Ferreira Soares, Michel Michaelovitch de Mahiques, Paulo Yukio Gomes Sumida and Vivian Helena Pellizari (2021)

FEMS Microbiology Ecology, Volume 97, Issue 8

The Alpha Crucis Carbonate Ridge (ACCR) was recently described in the upper slope of the Southwestern (SW) Atlantic Ocean based on interpretation of multibeam bathymetry and high-resolution seismic data. It is the first megastructure of carbonate ridge described along the SW Atlantic margin, probably fed by fluids escaping from the subsurface through fractures generated by intense halokinesis. The acoustic data suggest the presence of gas chimneys and recent to sub-recent seepage activity (likely methane); however, this activity has not yet been confirmed by in-situ geochemistry analyses and description of chemosynthetic fauna.

To characterize the ACCR from a microbial perspective, we performed 16S rRNA gene sequencing and calculated in situ-simulated rates of dark carbon fixation of seawater and sediment samples to determine the bacterial and archaeal structure and diversity, taxonomic composition and chemosynthetic activity.

We found that the sediment communities at the top of ACCR were related to oxic sediments and are probably mostly involved with chemoheterotrophy and nitrification processes, besides not presenting stratification at 0–15 cm, probably due to the current influence (IWBC) on the deposition and mixing of sediments in higher regions of the mound. At the base of ACCR, sediment communities at 5–15 cm were composed mainly of taxa found in anoxic deep-sea benthic ecosystems, such as uncultivated and recently described archaeal members assigned within Bathyarchaeia, Nanoarchaeota and Asgardarchaeota.

The description of microbial diversity associated with these carbonate features adds new information to help formulate and implement future conservation and management strategies for vulnerable marine ecosystems.

Link to the article: https://academic.oup.com/femsec/article-abstract/97/8/fiab110/6329682?redirectedFrom=fulltext

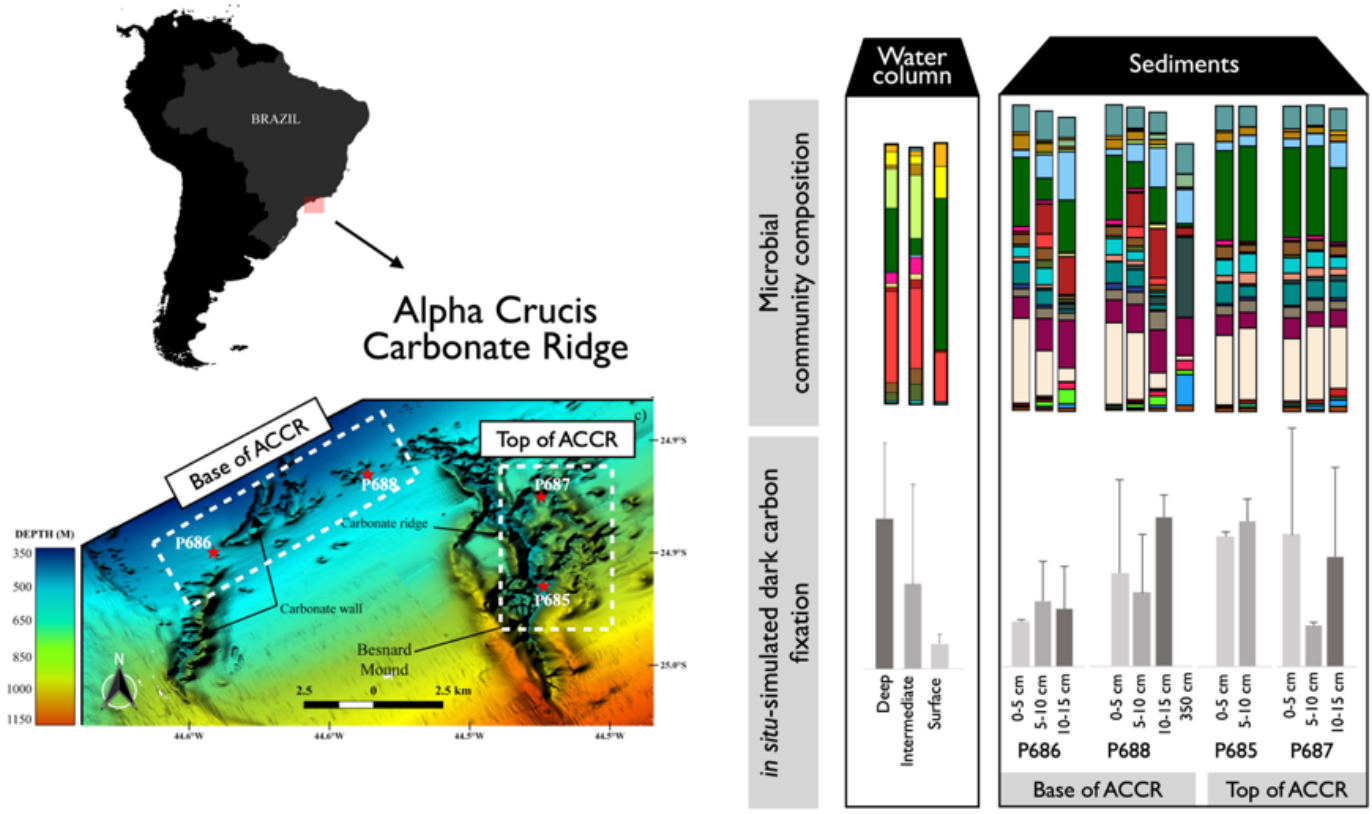


Figure 1. Sampling map showing the location of the Alpha Crucis Carbonate Ridge area, its geomorphological provinces and the sampling sites at the top and at the base of the mound. General overview of microbial composition and in-situ simulated dark carbon fixation are also shown.

A vast icefish breeding colony discovered in the Antarctic

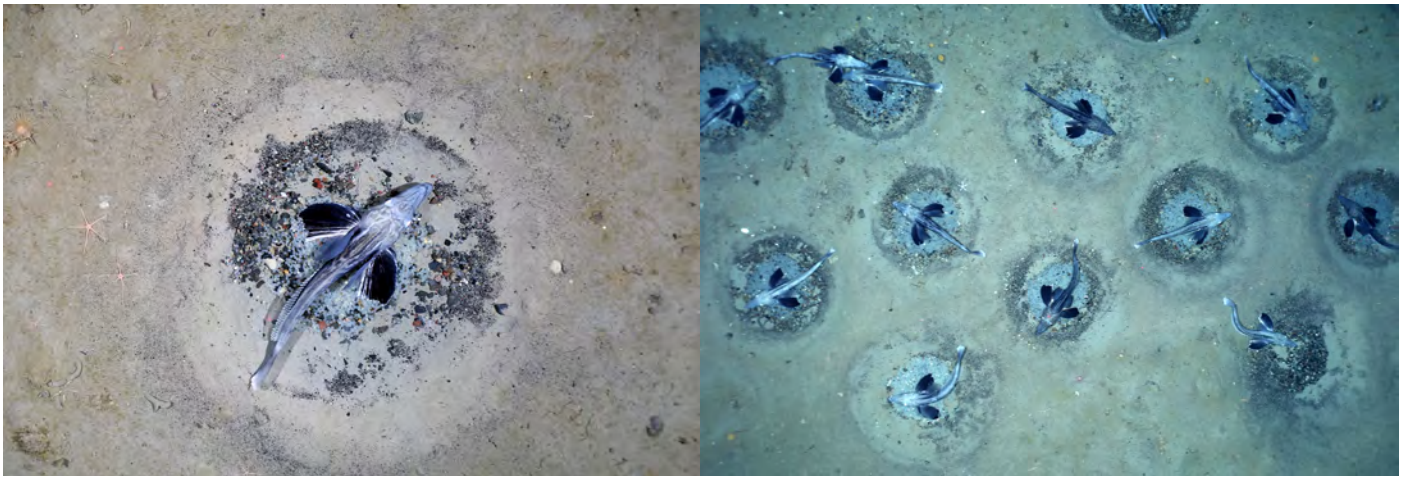
Autun Purser, Laura Hehemann, Lilian Boehringer, Sandra Tippenhauer, Mia Wege, Horst Bornemann, Santiago E. A. Pineda-Metz, Clara M. Flintrop, Florian Koch, Hartmut H. Hellmer, Patricia Burkhardt-Holm, Markus Janout, Ellen Werner, Barbara Glemser, Jenna Balaguer, Andreas Rogge, Moritz Holtappels, Frank Wenzhoefer (2022)

Current Biology, 32, 1-9.

During the RV *Polarstern* expedition to the southern Weddell Sea, in Feb 2021, a breeding colony of notothenioid icefish (*Neopagetopsis ionah*, Nybelin 1947) of globally unprecedented extent has been discovered. The colony, at time of survey, covered at least ~240 square kilometres of the eastern flank of the Filchner Trough and was comprised of fish nests at a density of 0.26 nests per square metre, representing an estimated minimum total of ~60 million active nests, and an associated fish biomass of > 60,000 tonnes. The majority of nests were each occupied by 1 adult fish guarding 1735 eggs (±433 SD). Bottom water temperatures adjacent to the nests were up to 2 °C warmer than the surrounding bottom waters, indicating a spatial correlation between the modified Warm Deep Water (mWDW) upflow onto the Weddell Shelf and active nesting. Historical and new seal movement data collected during the cruise indicated that this concentrated fish biomass may be utilized by predators such as *Leptonychotes weddellii* (Lesson 1826). To our knowledge, the breeding colony represents the most spatially expansive continuous fish breeding colony discovered to date globally at any depth, as well as an exceptionally high Antarctic seafloor biomass. The establishment of a regional

Marine Protected Area in the Southern Ocean under the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) umbrella is highly recommended, to protect what may be a globally unique marine ecosystem.

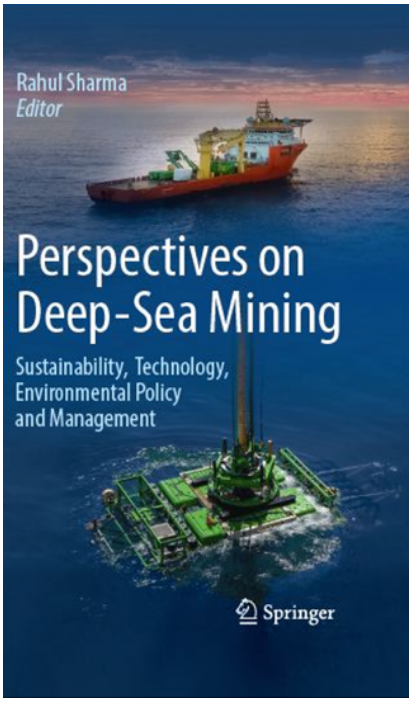
Link to paper: https://doi.org/10.1016/j.cub.2021.12.022



Perspectives on Deep-Sea Mining
Sustainability, Technology, Environmental Policy and Management
Rahul Sharma (Editor)

CSIR-National Institute of Oceanography, Dona Paula, India

This book is a sequel to 'Deep-sea mining: resource potential, technical and environmental considerations' (2017) and 'Environmental issues of deep-sea mining: impacts, consequences and policy perspectives' (2019), and aims to provide a comprehensive volume on the evolution of different aspects and perspectives of deep-sea mining from specialists around the world. The work is timely, as deep-sea minerals continue to enthuse researchers involved in activities such as ascertaining their potential as alternative sources for critical metals for green energy and other industrial applications, as well as technology development for their sustainable exploration and exploitation while addressing environmental concerns. With a steady increase in the number of contractors having exclusive rights over large tracts on the seafloor in the 'Area', i.e. regions beyond national jurisdictions, the International Seabed Authority is mandated with the responsibility of regulating such activities, and is in the process of developing a code for exploitation of deep-sea minerals. These, coupled with growing interest among private entrepreneurs, investment companies and policy makers, underlines the need for updated information to be made available in one place on the subject of deep-sea mining. The book evaluates the potential and sustainability of mining for deep-sea minerals compared to other land-based deposits, the technologies needed for mining, and processing of ores, approach towards environmental monitoring and management, as well as the regulatory frameworks and legal challenges to manage deep-sea mining activities. The book is expected to serve as an important reference for all stake holders including researchers, contractors, mining companies, regulators and NGOs involved in deep-sea mining.



The book contains 23 chapters by 60 experts from around the globe, divided in the

following sections:

1. ‘Evaluation of deep-sea mineral resources and their potential’
2. ‘Technology development for deep-sea mining and mineral processing’
3. ‘Ecosystem studies, environmental monitoring and management’
4. ‘Techno - economic models, risk assessment and payment regimes’
5. ‘Legal and socio-cultural frameworks’

The book (as well as individual chapters) can be accessed through the following link: https://link.springer.com/book/10.1007/978-3-030-87982-2.

A selection of papers on deep-sea fish:

Peripheral blood parameters of two species of the deep-sea fish family

G.I. Pronina, A.M. Orlov, D.V. Artemekov (2021)

Biology Bulletin 48 (4): 514-51

Link to paper: https://link.springer.com/article/10.1134/S1062359021030134

Development of axial locomotor musculation of beaked redfish *Sebastes mentella* (Sebastidae)

V.P. Panov, S.S. Safonova, A.M. Orlov, A.Yu. Rolskii, D.V. Artemenkov (2021)

Russian Journal of Physiology 107 (2): 203-220

Link to paper: https://rusjphysiol.org/index.php/rusjphysiol/article/view/1046

Into the deep: new data on the lipid and fatty acid profile of redfish *Sebastes mentella* inhabiting different depths in the Irminger Sea

V.P. Voronin, N.N. Nemova, T.R. Ruokolainen, D.V. Artemenkov, A.Y. Rolskii, A.M. Orlov, S.A. Murzina (2021)

Biomolecules 11: 704

Link to paper: https://www.mdpi.com/2218-273X/11/5/704

Features of blood cells and the muscle histology of mature females and males of the beaked redfish, *Sebastes mentella*

V.P. Panov, S.S. Safonova, G.I. Pronina, A,M. Orlov, A.Yu. Rolskii, D.V. Artemenkov (2021)

Zoologicheskii Zhurnal 100 (9): 1019-1027

Link to paper: https://doi.org/10.31857/S0044513421070084

The endangered Greenland shark, *Somniosus microcephalus*

A.M. Orlov, S.M. Rusyaev, S.Yu. Orlova (2021)

Reference Module in Earth Systems and Environmental Sciences.

Link to paper: https://doi.org/10.1016/B978-0-12-821139-7.00106-9

Papers from SPECIAL ISSUE OF THE JOURNAL OF MARINE SCIENCE AND ENGINEERING

"DEEPWATER FISHES" (Guest Editor Dr. Alexei M. Orlov)

https://www.mdpi.com/journal/jmse/special_issues/DeepwaterFishes

Comparative analysis of lipids and fatty acids in beaked redfish *Sebastes mentella* Travin, 1951 collected in wild and in commercial products

S.A. Murzina, V.P. Voronin, T.R. Roukolainen, D.V. Artemenkov, A.M. Orlov (2022)

Link to paper: https://www.mdpi.com/2077-1312/10/1/59

A new species of *Diaphus* associated with seamounts of the Emperor Chain, North-Western Pacific Ocean (Teleostei: Myctophiformes: Myctophidae)

A.M. Prokofiev, O.R. Emelyanova, A.M. Orlov, S.Y. Orlova (2022)

Link to paper: https://www.mdpi.com/2077-1312/10/1/65

A very large spawning aggregation of a deep-sea eel: magnitude and status

A. Williams, D. Osterhage, F. Althaus, T. Ryan, M. Green, J. Pogonoski (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/7/723

Walleye pollock *Gadus chalcogrammus*, a species with continuous range from the Norwegian Sea to Korea, Japan, and California: new records from the Siberian Arctic

A.M. Orlov, M.O. Rybakov, E.V. Vedishcheva, A.A. Volkov, S.Yu. Orlova (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/10/1141

Bidenichthys okamotoi, a new species of the Bythitidae (Ophidiiformes, Teleostei) from the Koko Seamount, Central North Pacific

P.R. Møller, W.W. Schwarzhans, H. Lauridsen, J.G. Nielsen (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/12/1399

Deep-sea fish fauna on the seamounts of southern Japan with taxonomic notes on the observed species

K. Koeda, S. Takashima, T. Yamakita, S. Tsuchida, Y. Fujiwara (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/11/1294

The biology of mesopelagic fishes and their catches (1950–2018) by commercial and experimental fisheries

D. Pauly, C. Piroddi, L. Hood, N. Bailly, E. Chu, V. Lam, E.A. Pakhomov, L.K. Pshenichnov, V.I. Radchenko, M.L.D. Palomares (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/10/1057

Exploring deep-sea biodiversity in the Porcupine Bank (NE Atlantic) through fish integrative taxonomy

Rafael Bañón, A. de Carlos, C. Farias, N. Vilas-Arrondo, F. Baldó (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/10/1075

Age, growth and otolith microstructure of the spotted lanternfish *Myctophum punctatum* Rafinesque 1810

F. Longo, D. Malara, M.G. Stipa, P. Consoli, T. Romeo, M. Sanfilippo, F. Abbate, F. Andaloro, P. Battaglia (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/8/801

Deep-Water Cartilaginous Fishes in the Central Mediterranean Sea: Comparison between Geographic Areas with Two Low Impact Tools for Sampling

A. Carluccio, F. Capezzuto, P. Maiorano, L. Sion, G. D'Onghia (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/7/686

The effects of capture and time out of water on sablefish (*Anoplopoma fimbria*) reflexes, mortality, and health

C. Rodgveller, C.V. Löhr, J.A. Dimond (2021)

Link to paper: https://www.mdpi.com/2077-1312/9/6/675

Taxonomy and distribution of the deep-sea batfish genus *Halieutopsis* (Teleostei: Ogcocephalidae), with descriptions of five new species

H.-C. Ho (2022)

Link to paper: https://www.mdpi.com/2077-1312/10/1/34

Deep-Sea Biology Society News

President's Letter

January 2022

Dear Deep-Sea Biology colleagues,

Firstly, a big Happy New Year from your Deep-Sea Biology Society trustees and I. As 2022 dawns I fear things are not back to "normal" for most of us but I have high hopes that a trickle of travel, family, and science plans can filter into our lives once again in the next 12 months.

Since we last spoke at the AGM the "big" handover to your new trustees has occurred. Thank you to trustees old and new for their patience as we have all got to grips with the inner mechanics of our society. Needless to say we have set off at a roaring pace:

- We have changed the rules of awards to make them more inclusive – keep your eye out for updates and remember you can apply throughout the year for many of the awards.
- Our push to ensure our society is a diverse and inclusive place is going well – look out for an invite to the sub-committee for further discussion in the coming months. Related to this topic there is a magnificent new paper out, 'Safe working environments are key to improving inclusion in open-ocean, deep-ocean, and high-seas science' (Amon et al., 2022) - this is an important topic given much of deep-sea biology demands time at sea. It's one of the most significant papers I've read in years and well worth your time: https://www.sciencedirect.com/science/article/pii/S0308597X21005583.
- And after the success of DSBS16 (what an amazing conference!), the organisers were kind enough to share crucial tips and lessons from our society's first ever hybrid conference; golden drops of knowledge that will in no doubt become very useful for DSBS17. We are in the midst of signing the MOU for DSBS17 in Hong Kong with Prof Qian and the team at the Hong Kong University of Science and Technology (HKUST). Looking at the beautiful views and sunshine-drenched vistas of HK is not an easy task from the dull greyness of an Essex January but at least we have something to look forward to and work towards.

The January-induced activity of looking ahead has kicked up some occasions even closer in time too. The next SIBECOL-AIL meeting in Aveiro, Portugal, in July 2022 (https://sibecol-ail-meeting2022.web.ua.pt) has a special session dedicated to deep-sea ecology. Also, plans for the Deep-Sea Coral conference, being organised by the wonderful Dr Seb Hennige and team at the University of Edinburgh, are taking form – more news on this very soon but it's looking like May 2023 (fixed dates to follow).

Two thIngs that have certainly minimised my January blues are my discovery of The Deep-sea podcast by Alan "The Prof" Jamison and Dr Thom Linley, accompanied by an assortment of deep-sea legends. How did I miss this? And if you haven't seen the inspiring Dr Diva Amon diving in subs on National Geographic's 'Welcome to Earth', where have you

been? Will Smith was her in-awe side-kick. And the footage of the bioluminescence was astonishing and made me fall in love with the deep sea all over again. Well worth a watch.

On that joy-filled note I wish you a happy and healthy 2022. Don't be strangers, drop me a line (pun totally played for) if you have ideas for our society and community.

All the best,

Michelle

President of the Deep-Sea Biology Society

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