


1-1-2021

## Deep-pelagic Research in the Gulf of Mexico: Ten Years and Counting...

Tracey Sutton

Find out more information about [Nova Southeastern University](#) and the [Halmos College of Natural Sciences and Oceanography](#).

Follow this and additional works at: [https://nsuworks.nova.edu/occ\\_facarticles](https://nsuworks.nova.edu/occ_facarticles)

 Part of the [Marine Biology Commons](#), and the [Oceanography and Atmospheric Sciences and Meteorology Commons](#)

---

# Deep-Sea Life

Issue 16, January 2021

Despite the calamity caused by the global pandemic, we are pleased to report that our deep ocean continues to be investigated at an impressive rate. Deep-Sea Life 16 is another bumper issue, brimming with newly published research, project news, cruise news, scientist profiles and so on. Even though DOSI produce a weekly Deep-Sea Round Up newsletter and DOSI and DSBS are active on social media, there's still plenty of breaking news for Deep-Sea Life!

Firstly a quick update on the status of INDEEP. As most of you are aware, INDEEP was a legacy programme of the Census of Marine Life (2000-2010) and was established to address knowledge gaps in deep-sea ecology. Among other things, the INDEEP project played central role in the creation of the Deep-Ocean Stewardship Initiative and funded initial DOSI activities. In 2018, the DOSI Decade of Ocean Science working group was established with a view to identifying key priorities for deep-ocean science to support sustainable development and to ensure deep-ocean ecological studies were included in the UN Decade plans via truly global collaborative science. This has resulted in an exciting new initiative called "Challenger 150". You are all invited to learn more about this during a webinar on 9th Feb (see p. 22 ). INDEEP has passed on the baton and has now officially closed its doors. **Eva and I want to sincerely thank all those that led INDEEP with us and engaged in any of the many INDEEP actions. It was a productive programme that has left a strong legacy.**

We chose this photo of the issue as we felt it beautifully captures the dedication of an early career scientist to his craft. Georgios Kazanidis was recently presented with a Nature of Scotland Conservation Science Award for his work on cold-water corals (see p. 30). Congratulations! In this issue we also celebrate the lives and contributions of three of our colleagues from a previous generation who have laid the groundwork for current and future deep-ocean researchers - Lev I. Moskalev, Sergei Evseenko and Robert Hessler. They are no longer with us but leave great legacies.



*Georgios Kazanidis. Credit: University of Edinburgh*

Drs. Abigail Pattenden (University of Limerick, Ireland), Eva Ramirez-Llodra (REV Ocean, Norway) & Paris Stefanoudis (University of Oxford / Nekton Foundation, UK) and I all enjoyed reading your fascinating submissions. Thank you for sharing your news with our community.

Dr. Maria Baker

(University of Southampton – [mb11@noc.soton.ac.uk](mailto:mb11@noc.soton.ac.uk))

A DOSI and DSBS collaborative publication.



## Issue Contents

Cruise News	2	Wanted	35
Project Focus	7	Hot off the Press	37
Meetings and Workshops	18	Obituaries	49
Scientist Profiles	25	Deep-Sea Biology Society Business	56
Opportunities	31		

# Cruise News

## Sedimentation effects survey series (ROBES III) completed

Malcolm Clark, Scott Nodder, Daniel Leduc, Joanne O’Callaghan and the 2020 shipboard team.

*National Institute of Water and Atmospheric Research, New Zealand*

### Background

Sedimentation effects from human activities such as seabed mining or bottom trawl fisheries are poorly known, yet are of concern for environmental sustainability of such activities in the deep sea. In 2016, NIWA started research into the effects of sedimentation from such seabed disturbance (“ROBES”-Resilience Of deep-sea Benthic communities to the Effects of Sedimentation) using a combination of field survey experimentation with *in situ* observations, and laboratory-based experiments (see Deep-Sea Life issue 12, December 2018).

New Zealand came out of a successful Covid-lockdown in late May 2020, and research vessel operations resumed almost immediately. In June, we completed the last of a series of three surveys in a seabed disturbance experiment. Disturbance operations occurred in 2018 and 2019 at two different scales. The priority in 2020 was to repeat sampling sites filled in 2018 and 2019 to monitor changes over time, and to evaluate recovery and resilience of the seabed communities.

### The survey

The survey occurred on the central Chatham Rise, about 250 n.miles east of New Zealand, at depths of 400-500m.

The survey was divided into two discrete parts. The first focussed on repeat sampling of “core” sites from 2018-2019, which included areas that were disturbed, surrounding sites to monitor effects of any sediment plume, and a reference site away from any likely disturbance (Figure 1, left). The second focussed on a small area around a feature termed the “Butterknife” (Figure 1, right).

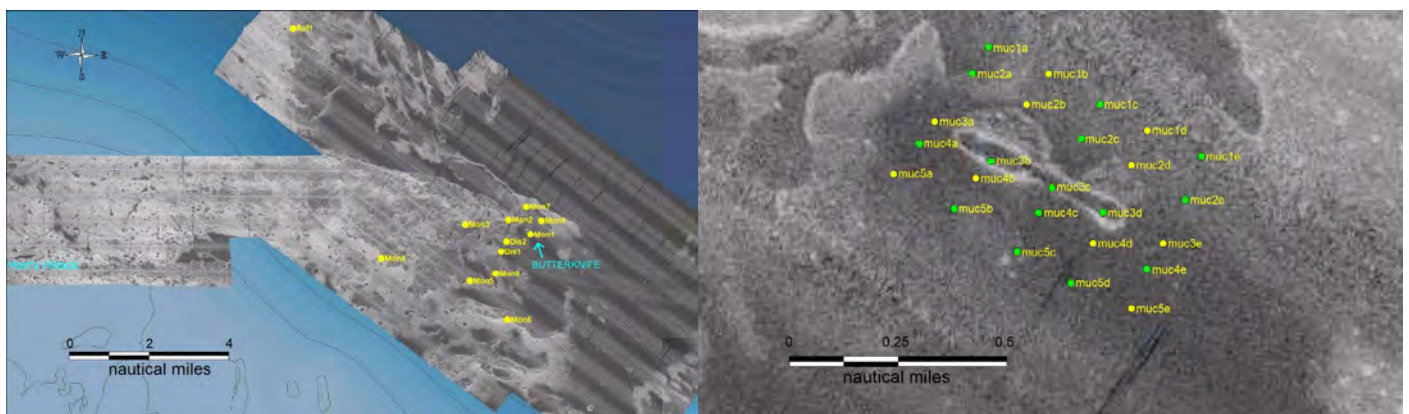


Figure 1: The survey area, with multibeam backscatter mosaic and regional bathymetry, showing Monitoring (MON) and Reference (REF) sites from 2018 (yellow circles), the Butterknife area (more detail in right figure), and Hart’s Hillock for coral collection.

Sampling occurred at 12 core sites, with towed camera (NIWA’s Deep-Towed-Imaging-System (DTIS)) at all sites, and multicore deployments at seven sites. In addition, DTIS and multicore stations were completed on three iceberg scours in the southwest of the area (to examine long-term disturbance as a contrast to our short-term period), live corals (Figure 2) were collected by beam trawl for sediment-tolerance experimental work back in the laboratory, and Conductivity-

Temperature-Depth (CTD) stations were filled over a wider area to provide a broader regional oceanographic context for sediment dispersal. A single current meter -sediment trap mooring was recovered which had been deployed in the 2019 ROBESII voyage. The mooring showed rapid colonisation and growth of hydroids (Figure 2).



Figure 2: A clump of stony coral *Goniocorella dumosa* on the seabed imaged by DTIS (left), multicoring operations on deck (middle) and the recovered sediment trap from the mooring (right).

The “Butterknife” received extensive sampling, especially with the multicorer, to monitor infaunal responses to both direct disturbance by our previous Benthic Disturber and plough-harrow operations, and indirect from localised dispersal of a sediment cloud. A subset of the Butterknife multicore sites (15 of the 25) was selected for more detailed experimental measurements (oxygen, community respiration, elutriation, sediment erosion) in the onboard laboratories.

The programme currently has a large number of samples and data sets undergoing processing and analysis. Results will hopefully start appearing in the back half of 2021 and early 2022.

---

## Upgrade to the PAP Sustained Observatory

Andrew Gates\* and Sue Hartman

*National Oceanography Centre, Southampton, UK*

Email: [\\*arg3@noc.ac.uk](mailto:*arg3@noc.ac.uk)

In November, RRS *Discovery* sailed from the National Oceanography Centre (NOC) in Southampton to recover and service the moorings at two of the UK’s Climate Linked Atlantic Sector Science (CLASS) fixed-point observatory sites, Porcupine Abyssal Plain Sustained Observatory (PAP-SO) and Whittard Canyon. We were supposed to go much earlier in the year but like so many things in 2020, the cruise was delayed by coronavirus.

Weather conditions in the North East Atlantic in November are notoriously challenging, as highlighted when part of the observatory, the PAP surface buoy, came adrift in a large storm shortly before the cruise. It was [expertly rescued](#) by the GEOMAR team on board the RV *Maria S. Merian* before RRS *Discovery* left Southampton, much to the gratitude of all involved with PAP-SO.

At Whittard Canyon, we serviced and replaced a mooring to monitor sediment transport as part of a longer-term study. At PAP-SO, we continued the long-running study on particle flux. This is integral to the time-series studies at the PAP-

SO, linking data from surface waters to observations of the deep-sea benthos.

We also upgraded the observatory with a new surface buoy. This is part of a collaboration between the NOC and the UK Met Office. The buoy, moored in 4850 m water depth, provides meteorological and oceanographic data from sensors on the mast and keel. The upgrade should provide a more reliable platform for long-term data collection and support additional innovative sensors and communications to enhance capability at PAP-SO.



Figure 1: The new PAP-SO surface buoy in unusually calm November seas

## Highlights from E/V *Nautilus* Expeditions in U.S. West Coast Sanctuaries

Lizzie Duncan

*NOAA Office of National Marine Sanctuaries*

From September 20 through October 26, 2020, the National Oceanic and Atmospheric Administration's (NOAA) [Office of National Marine Sanctuaries](#) and the [Ocean Exploration Trust](#) partnered to bring 26 sea days to E/V *Nautilus* expeditions in U.S. West Coast sanctuaries. A total of 26 remotely operated vehicle [dives](#) (300 hours of bottom time) were conducted, and 393 biological and geological samples were collected within and around Olympic Coast, Greater Farallones, Monterey Bay, and Channel Islands National Marine Sanctuaries. The on-board team also mapped 10,806 km<sup>2</sup> of seafloor between the Olympic Coast and Monterey Bay sanctuaries.



Figure 1 (left): The manipulator arm of remotely operated vehicle Hercules collecting a bamboo coral in the Greater Farallones National Marine Sanctuary. Figure 2 (right) Sponges, corals, and anemones covering a rocky outcrop within the Channel Islands National Marine Sanctuary. This expedition uncovered a massive live sponge garden, as well as a dead glass sponge reef that is unprecedented in California waters, each extending across hundreds of meters of seafloor. Photo credits: Ocean Exploration Trust and NOAA.

Highlights from the exploration expeditions include colorful colonies of corals and sponges, methane seeps and hydrates, thousands of brooding octopuses, a whale fall (carcass on the seafloor), and the discovery of diverse sponge gardens adjacent to an even more astonishing and expansive landscape of dead glass sponge mounds. A variety of research and exploration objectives chosen by sanctuary staff, [NOAA Fisheries](#), and external partners were successfully completed due to the dedication and flexibility of personnel involved in mission planning and execution. Considering the many accomplishments of the [2020 Nautilus field season](#), perhaps most notable is that the expeditions were conducted by a reduced *Nautilus* crew and guided remotely, via telepresence technologies, by 28 shoreside scientists from their homes and offices.

The data and information gathered from the expeditions are [publicly available](#) and will expand resource managers' understanding of the diversity and distribution of deep-sea habitats within sanctuaries and across the U.S. West Coast. The new discoveries of rare and unique communities provide a strong foundation for further exploration and characterization of these areas in the future.

## Research Trip From Iceland to the Azores

Saskia Brix

**SENCKENBERG**  
world of biodiversity

Email: [sbrix@senckenberg.de](mailto:sbrix@senckenberg.de)



Concurrent with the start of the UN Ocean Decade, the IceDivA expedition is launched to record marine biodiversity in the Atlantic deep sea.

Wilhelmshaven, 23 December 2020. On 8 January 2021, a team of 21 scientists aboard the research vessel *SONNE* set out on an expedition (IceDivA as SO280 (GPF 20-3\_087)) in the Atlantic to study the diversity of marine organisms in the deep sea. They intend to collect samples from the Iceland Basin to the Azores at depths between 4,000 and 5,000 meters and map the ocean floor by means of hydroacoustics. To date, the deep-sea ecosystem has been studied less extensively

than the far side of the moon. The team hopes that the IceDivA expedition will contribute to a better understanding of the deep-sea biome, ultimately leading to more efficient conservation measures.

The primary focus of the expedition on the research vessel *SONNE* (SO280 (GPF 20-3\_087)) is to study the distribution of deep-sea species. In this context, IceDivA can build on the findings of several preceding projects – e.g., the end point of the previous expedition IceAGE3 (SO276 in the summer of 2020) defines the starting point of the current journey. The integration of data from previous expeditions forms a central component of the IceDivA expedition. The comparable and consistent use of equipment and standardized sampling techniques make it possible to evaluate paradigms regarding biodiversity, species inventory, and species composition in relation to depth and width.

The IceDivA expedition connects two deep-sea projects in this regard: IceAGE (Icelandic marine Animals: Genetics and Ecology) and DIVA (Latitudinal Gradients in BioDiversity in the deep Atlantic) as well as the EU project iAtlantic. IceAGE is an established international project that was initiated in 2011 and builds on the preceding project BIOICE (Benthic Invertebrates of Icelandic Waters). By connecting to the southernmost IceAGE3 station, IceDivA adds a latitudinal gradient, which in turn forms a link to the BIODIAZ project (Controls in benthic and pelagic BIODiversity of the AZores). The study area is located in one of the regions of interest of the EU project iAtlantic (e.g., the Porcupine deep-sea plain and the Azores plateau), which studies the health of ecosystems at the high seas and the deep-sea regions in the Atlantic Ocean. A contiguous and comprehensive mapping of the ocean floor by means of hydroacoustics is an indispensable prerequisite for identifying habitats – one of the iAtlantic project's primary tasks, and an equally

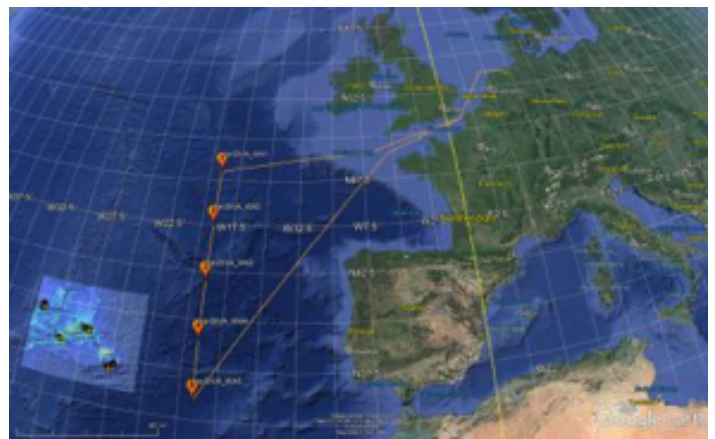


Figure 1. The planned route of the research vessel *SONNE* on the IceDivA expedition. Copyright: Alexander Kienecke

important objective in the IceDivA project.

In addition to the biological studies, the “DArgo2025\_RBRpilot” project is also on board. As part of this project, a total of 10 ARGO floats by different manufacturers will be equipped with sensors for measuring the salinity, temperature and pressure (CTD) to compare their respective performance. Breaking with the traditional approach, on this expedition the floats will be released as a swarm in a single position, if possible, to obtain an initial direct comparison of the measuring parameters. Concurrently, the water column in the release area will be examined at a fine scale with onboard CTD sensors. These measurements serve as a reference for assessing the ARGO float data. During the course of the expedition on the research vessel *SONNE*, after their successful release, the floats will repeatedly dive to depths of 2,000 meters and return to the surface 48 hours later to transmit the collected data via satellite to a data center.

Led by the team from Senckenberg am Meer, the IceDivA expedition involves 21 scientists from such institutions as the Federal Maritime and Hydrographic Agency (BSH), the British Antarctic Survey (BAS), GEOMAR, and the Universities of Hamburg and Oldenburg. In order for the expedition to go ahead in the current Covid-19 influenced world, all participants had to adhere to a 14-day domestic self-quarantine over Christmas and New Year, and go to a multi-day “test camp” in which two Corona tests were carried out before the expedition. The expedition started in Emden on January 8, 2021 and will return to Emden on February 7 after 5 weeks at sea.

Follow the trip: <https://www.iceage-project.org/icediva-current-project/>

*To study and understand nature with its unlimited diversity of life forms, and to preserve and manage it in a sustainable fashion as the basis of life for future generations – that has been the goal of the **Senckenberg Gesellschaft für Naturforschung (Senckenberg Nature Society)** for the past 200 years. This integrative “geobiodiversity research” and the dissemination of research and science are among Senckenberg’s primary tasks. Three natural history museums in Frankfurt, Görlitz, and Dresden display the diversity of life and the earth’s development over millions of years. The Senckenberg Gesellschaft für Naturforschung is a member of the Leibniz Association. The Senckenberg Natural History Museum in Frankfurt is supported by the City of Frankfurt am Main as well as numerous other partners. Additional information can be found at [www.senckenberg.de](http://www.senckenberg.de).*

# Project Focus

## Marine species distribution along the NW-Pacific and the Arctic Ocean

Chhaya Chaudhary<sup>1,2</sup>, Joan M. Alfaro-Lucas<sup>1,2</sup>, Angelika Brandt<sup>1,2</sup>, Hanieh Saeedi<sup>1,2,3</sup>

<sup>1</sup>Department of Marine Zoology, Senckenberg Research Institute, Germany; <sup>2</sup>Goethe University Frankfurt, Biosciences, Institute of Ecology, Evolution and Diversity, Germany; <sup>3</sup>OBIS Data Manager, Deep-Sea Node, Germany

The biodiversity patterns, including species' composition and distribution range changes, of marine fauna along the NW Pacific and the Arctic Ocean (AO) are still controversial and under-studied. Also, these regions, especially the AO, are reported to warm faster than the other oceans. Whether the species here are expanding their range towards the higher or the lower latitudes as a response to climate change, is also ambiguous. In the Beneficial project (Saeedi and Brandt, 2020; Saeedi *et al.*, 2019a; Saeedi *et al.*, 2019b; Saeedi *et al.*, 2020), we have shed light on the biodiversity patterns and biogeography of a wide range of marine species from the NW Pacific to the adjacent AO, and from shallow water to deep sea. In the extension of the Beneficial project (2020-2021), we will further explore the patterns of biodiversity and biogeography in the AO using data available from OBIS and GBIF, and compare them with the patterns found in the NW Pacific (Figure 1). The main goals of the extension of the Beneficial project are to understand the current patterns of biodiversity and their drivers in the entire AO, and to model future species distribution of key taxa to understand the potential future direction, and expansion or contraction of species spatial ranges.

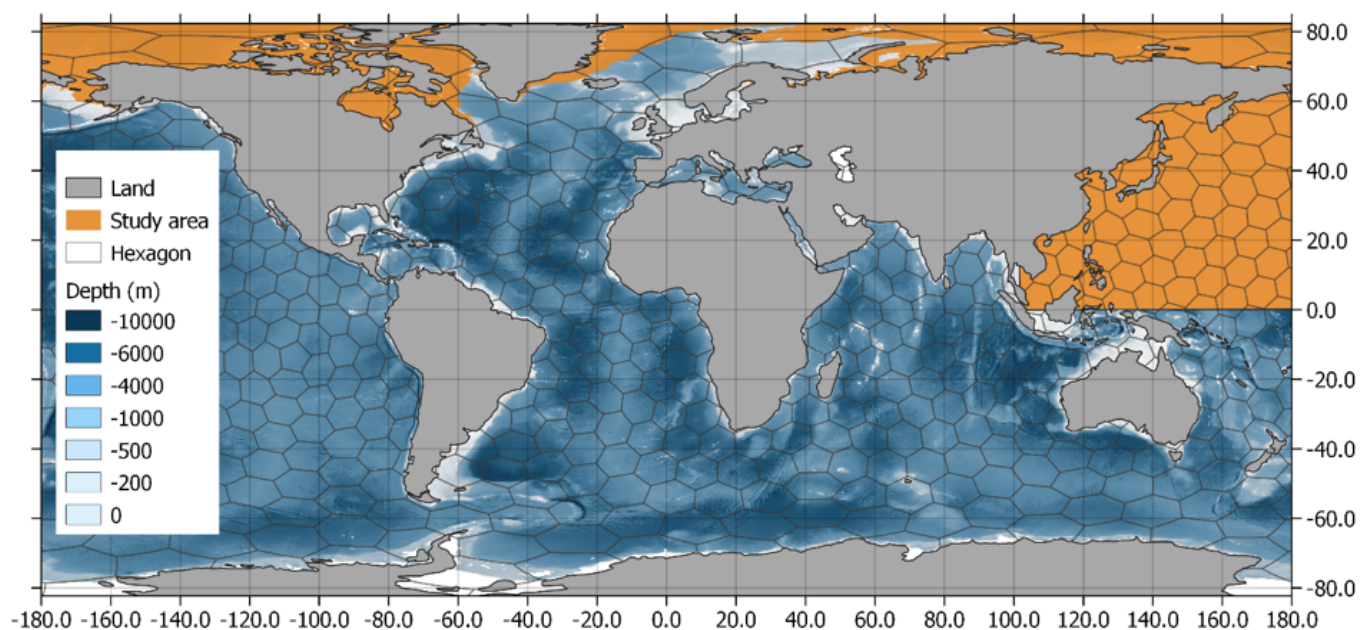


Figure 1. The map shows the world ocean divided in 50,000 km<sup>2</sup> hexagonal cells. The hexagonal cells highlighted in orange shows the study area we will cover in the extension phase of the Beneficial project (2020-2021). QGIS 3.8.3 was used to create this map.

Specifically, using over 600,000 distribution records of over 19,000 species of the NW Pacific and the AO, we aim to analyze latitudinal and depth gradients in species richness and their compositional change ( $\beta$ -diversity). We will divide the broad study area to 10,000 km<sup>2</sup> equal-area hexagonal cells and 5-degree latitudinal bands and will be using Generalized Additive Models (GAMs) and Generalized Linear Models (GLMs) to explore the relationship between the environmental drivers and species richness estimations along the AO in comparison with the NW Pacific. The  $\beta$ -diversity will be decomposed into turnover and nestedness components to shed light on the species compositional change patterns and identify  $\beta$ -diversity breakpoints within and between both oceans.



Furthermore, we aim to explore the distribution of 22 species of corals and 144 species ecologically associated with them. The associated species are selected based on their biological association identified with corals in literature, and their spatial overlap with the coral species. The main focus of these analyses is to explore the current and future distribution of these species in RCP45 and RCP85 IPCC scenarios, using species distribution modelling based on environmental variables including temperature, current velocity and salinity from Bio-ORACLE. We will then compare the maximum latitudinal extent of the species range in the current and future scenarios. The difference would reveal the direction of range shift in these species; also if the species are showing poleward expansion or retraction.

Overall this project will help to understand the nuances of diversity patterns of the shallow and deep-sea fauna of the NW Pacific and the AO constituting a valuable baseline to decision makers and initiatives to better manage and preserve the future biodiversity of the NW Pacific and the AO under the current rapid climate change.

### References

Saeedi, Hanieh and Angelika Brandt 2020. Biogeographic Atlas of the Deep NW Pacific Fauna. Advanced Books 1. doi: <http://doi.org/10.3897/ab.e51315>

Saeedi, Hanieh, Mark J. Costello, Dan Warren and Angelika Brandt 2019a. Latitudinal and bathymetrical species richness patterns in the NW Pacific and adjacent Arctic Ocean. Scientific Reports 9: 9303. doi: <http://doi.org/10.1038/s41598-019-45813-9>

Saeedi, Hanieh, Marianna Simões and Angelika Brandt 2020. Biodiversity and distribution patterns of deep-sea fauna along the temperate NW Pacific. Progress in Oceanography 183: 102296. doi: <https://doi.org/10.1016/j.pocean.2020.102296>

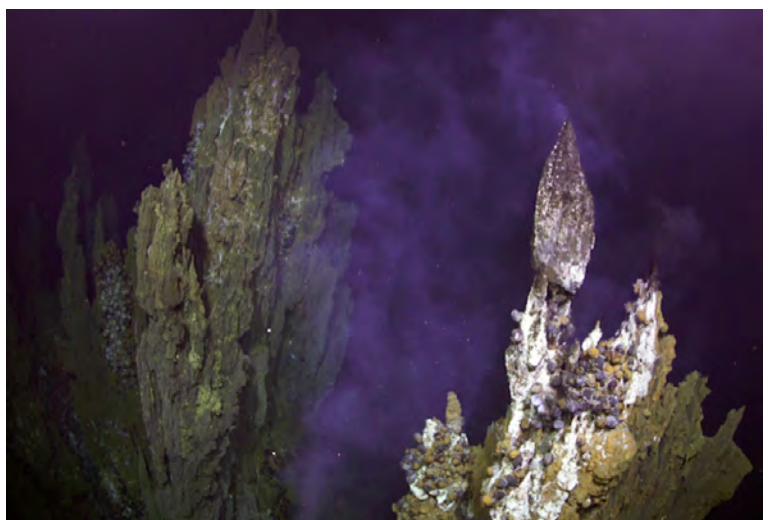
Saeedi, Hanieh, Marianna Simões and Angelika Brandt 2019b. Endemicity and community composition of marine species along the NW Pacific and the adjacent Arctic Ocean. Progress in Oceanography 178: 102199. doi: <https://doi.org/10.1016/j.pocean.2019.102199>

---

## Deep Sea, Humans and Management

A Pacific Islands Virtual Mini-Course by DOSI – Now Available to All!

Ahead of a planned workshop in Fiji, postponed due to travel restrictions posed by COVID-19, DOSI hosted a virtual mini-course “The Deep Sea, Humans, and Management”, designed for Pacific Islanders, in October 2020. With over 60 in attendance at the peak, the course took place over 3 mornings with presentations from 9 DOSI experts and a final moderated discussion linking science and policy. The course was intended to reach ocean stakeholders from all backgrounds and knowledge levels, and attendees came from a range of sectors including marine science, NGOs, government and ecotourism, and from Fiji, the Cook Islands, Kiribati, Tonga, the



Solomon Islands and the Marshall Islands. Deep-sea experts presented content which spanned science and policy, including deep-sea fishing, deep-seabed mining, and conservation practices. The course feedback has been excellent

and we extend our sincerest thanks to all of those who contributed, particularly given the challenging time differences. The course is now available to all [HERE](#) and standalone videos via the links below:

[Introduction to the Deep Sea](#) – **Verena Tunnicliffe**, University of Victoria, Canada

[Deep-Ocean Dynamics](#) – **Sabine Gollner**, Royal Netherlands Institute for Sea Research (NIOZ)

[Functions and Services of the Deep Sea](#) – **Andrew Thurber**, Oregon State University, USA

[Seabed Mining](#) – **Diva Amon**, Natural History Museum, London, UK

[The Mesopelagic Realm: connections to fisheries and mining](#) – **Jeffrey Drazen**, University of Hawaii, Manoa

[Climate Change in the Deep Sea & Relevance to Management](#) – **Lisa Levin**, Scripps Institution of Oceanography, University of California, USA

[Marine Spatial Planning and Conservation in relation to Deep-Sea Mining](#) – **Anna Metaxas**, Dalhousie University, Canada

[Environmental Impact Assessment in the Deep Ocean](#) – **Malcolm Clark**, National Institute of Water and Atmospheric Research (NIWA), New Zealand

Thank you also to **Harriet Harden-Davies**, University of Wollongong, Australia, and **Katy Soapi**, University of the South Pacific, Fiji, who presented “The Science-Policy Interface – Regional and International Policy” and **Elisabeth Holland**, University of the South Pacific, Fiji, who moderated the “Linking science and policy” discussion. Unfortunately recorded versions of these are not available at present.



Andrew Thurber (left), Sabine Gollner (middle) and Verena Tunnicliffe (right) presenting during the virtual mini-course “The Deep Sea, Humans, and Management”, organised by DOSI.

## Seamount recovery time-series off New Zealand continues

Malcolm Clark, David Bowden, Ashley Rowden and the shipboard team of voyage TAN2009

*National Institute of Water and Atmospheric Research, New Zealand*

Benthic faunal communities on deep-sea seamount features are commonly characterised by extensive growth of cold-water corals. These are vulnerable to impacts from bottom trawl gear but the overall resilience of such benthic communities, and the time frames required for recolonisation and regrowth, are uncertain (Goode *et al.* 2020). Such information is important for evaluating appropriate options for management of fishing impacts

On the Chatham Rise east of New Zealand, there are groups of small seamounts in close geographic proximity, of a broadly similar size, depth range, and elevation, and with varying levels of historical fishing effort for orange roughy. These seamounts provide a natural “compare and contrast” setting to evaluate the effects of bottom fishing. Importantly, a number of these features were closed to bottom trawling in 2001, including both fished and unfished features in the

Graveyard Seamounts complex (Figure 1). The area was surveyed using towed cameras in 2001, 2006, 2009, 2015 (see Deep Sea Life issue 5 (2015)) and again this year in August 2020. Although the 20-year period is not a long time for such studies, this series now has five time-data points, and affords a rare opportunity to potentially track small and gradual changes in community structure, and thereby understand the underlying spatial and temporal dynamics of community recovery.

The towed camera survey this year adopted the same design as earlier surveys, with eight transects radiating out from the summit to the base on each of the six seamount features. More transects were carried out on “Morgue Seamount”, as this was a heavily fished feature that was protected in 2001 and hence an important site to monitor closely for recovery. Areas of stony coral reef matrix (mainly *Solenosmilia variabilis*) that remain on Morgue are a combination of areas that were too rough to be trawled, particularly the steep spurs to the NNE and SSW (Figure 2), and small remnant patches on the flanks that were missed by trawling operations (Figure 3). These remnant corals can potentially act as local-scale recolonization sources.

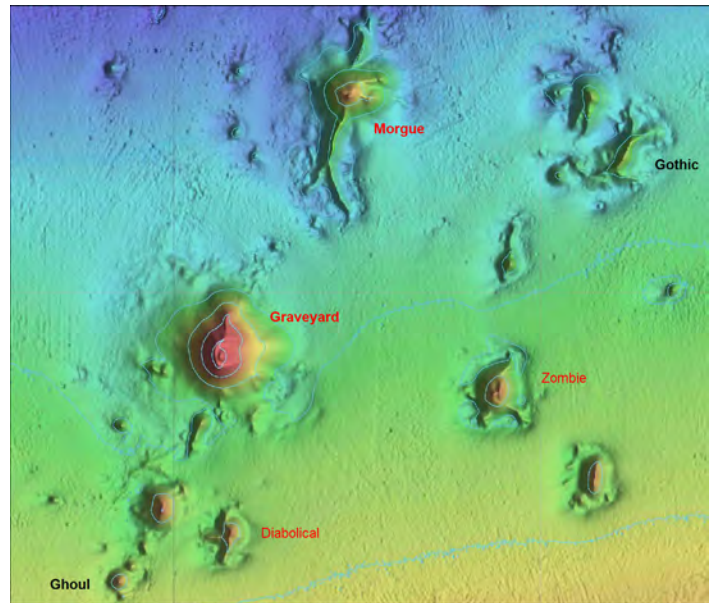


Figure 1: The Graveyard Seamounts east of New Zealand. Red names=previously/currently fished, black names=unfished.

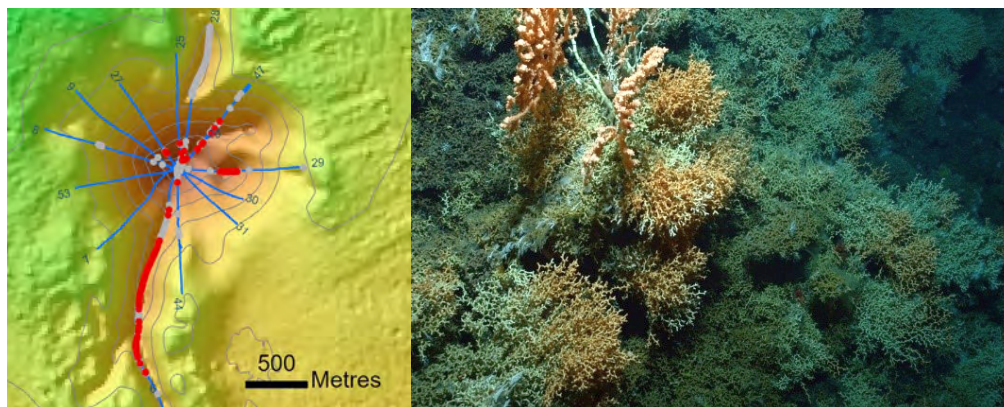


Figure 2 (left): Plot of Morgue Seamount, showing towed camera transect lines (blue), the occurrence of intact non-living stony coral (grey), and records of live stony coral heads (red). Figure 3 (right): Live stony coral *Solenosmilia variabilis* along with bamboo coral, stylasterid hydrocorals and glass sponges

Data from the first four surveys have been analysed in detail and although there were clear differences in overall community composition related to fishing intensity, there were few signs of any potential recovery of stony corals (Clark *et al.* 2019). These analyses will now be extended by incorporation of data from the latest survey, but initial observations suggest the only obvious recruiting fauna after 20 years were stylasterid hydrocorals, which were conspicuous both on natural substrata (Figure 4) and on railway wheels that had been deployed as ballast weights for instrument moorings in 2010 (Figure 5). Data from the latest survey will also allow us to focus more on finer-scale patterns in remnant patches, recolonization and settlement and use patch occupancy models to predict the long-term recovery trajectories of disturbed benthic communities on seamounts. The project, funded by Fisheries New Zealand and NIWA, is due for completion in early 2022.

#### References:

- Clark, M.R.; Bowden, D.A.; Rowden, A.A.; Stewart, R. (2019). Little evidence of benthic community resilience to bottom trawling on seamounts after 15 years. *Frontiers in Marine Science* 6: 63. 16p. <https://doi:10.3389/fmars.2019.00063>
- Goode, S.L., Rowden, A.A., Bowden, D.A., Clark, M.R. (2020). Resilience of seamount communities to trawling disturbance. *Marine Environmental Research* 161. <https://doi:10.1016/j.marnvres.2020.105086>



Figure 4 (left): Coral rubble with live stylasterid hydrocorals and orange roughy on Morgue Seamount 20 years after trawling ceased. Figure 5 (right): A mooring wheel deployed in 2010 and photographed in 2020 on Morgue.

## Update on Global Seamounts Project Workshops

An overview of the Global Seamounts Project (GSP), with contributions from several participating scientists, is now on the new Global Oceans website at [www.global-oceans.org](http://www.global-oceans.org). The GSP continues to develop, and we are now organizing virtual planning workshops beginning in the second quarter of 2021. After an initial announcement of this project in 2018, several in the deep-sea community posted interest in participating in specific Working Groups on the Open Science Framework website. We will be reaching back out to those who responded to update your interest, and all in the deep-sea community are invited to let us know of your interest in participating. We would like to gauge interest in each Working Group and begin to organize Chairs, Co-Chairs, and participants under each.

GSP Biophysical Modeling Workshops will be held first, to define GSP ecosystem modeling approaches and frameworks and the optimal scope and resolution of GSP field data to populate the models. An overview of the ecosystem modeling approach is discussed on our website by Ursula Scharler, PhD, GSP Modeling Chair, in the GSP Project Highlights section. Subsequent GSP Field Campaign workshops with input from the Working Groups will assess the modeling data plan and align it with feasible field methods for sampling and analysis. Proposed GSP workshop schedules, workflows, and agendas will be posted on our website soon.

Our GSP Workshop Coordinator, Kajal Lechman, MSc from the University of KwaZulu-Natal in Durban, South Africa, is assisting with workshop organization and you may hear from her directly over the next few weeks. (See Kajal's profile on our website at <https://bit.ly/39zOhC1>).

The workshops will be hosted virtually via Zoom by Global Oceans, a 501(c)(3) nonprofit organization, which is leading the development of this project together with many international collaborating scientists and partners. We look forward to making significant progress on the GSP this year, despite current constraints from the pandemic, and we look forward to your input! Finally, take a look at [this video](#) of Malcolm Clark talking about the GSP project – a great summary.

### GLOBAL OCEANS

#### GSP WORKING GROUPS

- WG 1 Site Selection (Collaborative)
- WG 2 Microbial Ecology
- WG 3 Phytoplankton
- WG 4 Zooplankton/Pelagic Invertebrates
- WG 5 Fish
- WG 6 Benthic Invertebrates
- WG 7 Pelagic Mega-Fauna/Mammals
- WG 8 Biogeochemistry
- WG 9 Physical Oceanography
- WG 14 Geomorphic Proxies for Biodiversity
- WG 15 Taxonomy & Systematics
- WG 10 Technologies, Tools, Calibration
- WG 11 Data Processing/Management
- WG 12 Ecosystem Modelling
- WG 13 Integrated Seamount Ecosystem Model - ISEM (Collaborative)

## GOMRI Synthesis and Legacy



GoMRI was established in 2010 with the stated goal to **improve society's ability to understand, respond to, and mitigate the impacts of petroleum pollution and related stressors of the marine and coastal ecosystems**. Numerous products resulting from GoMRI's synthesis and legacy efforts are available online. There is something for everyone here!

The 5 Key Questions this programme addressed:

- **What was the state of the science ("baseline") before Deepwater Horizon?**
- **What have we learned?** (Critical assessment)
- **What major gaps in knowledge still exist?**
- **How can we best apply what we have learned?** (What will be the impact – how do we make a difference?)
- **Where do we go from here?**

<https://gulfresearchinitiative.org/gomri-synthesis/products/>

## Deep-pelagic research in the Gulf of Mexico: ten years and counting...

Tracey Sutton

*Director, DEEPEND Research Consortium, Guy Harvey Oceanographic Center, Nova Southeastern University, USA*



Despite increasing recognition of the importance of the deep-pelagic fauna to global ocean ecosystem functioning and

services, a severe disconnect exists between stewardship and human impact. Perhaps nowhere is that dichotomy more demonstrable than the Gulf of Mexico (Gulf hereafter), a high-diversity ecosystem subjected to arguably the worst marine pollution event in human history. Three consecutive, interlinked research programs have and will address this topic, beginning in 2010 and continuing for years to come. Here we report a synthesis effort of the first two programs, as well as introducing the recently funded third program, with an open invitation to participate. The synthesis effort to which we refer is a recently completed Research Topic in *Frontiers in Marine Science* entitled “Deep Pelagic Ecosystem Dynamics in a Highly Impacted Water Column: The Gulf of Mexico after Deepwater Horizon,” which can be accessed openly [here](#). The primary focus of this 14-paper Research Topic issue was research conducted by DEEPEND ([www.deependconsortium.org](http://www.deependconsortium.org)), a 5-year (2015-2020), 102-member, 19-organization research consortium supported by The Gulf of Mexico Research Initiative (GoMRI; <https://gulfresearchinitiative.org>). DEEPEND was an expanded successor of the NOAA-supported Offshore Nekton Sampling and Analysis Program (ONSAP; 2010-2015), whose explicit mission was to provide faunal composition and abundance information for NOAA’s DWH natural resource damage assessment.

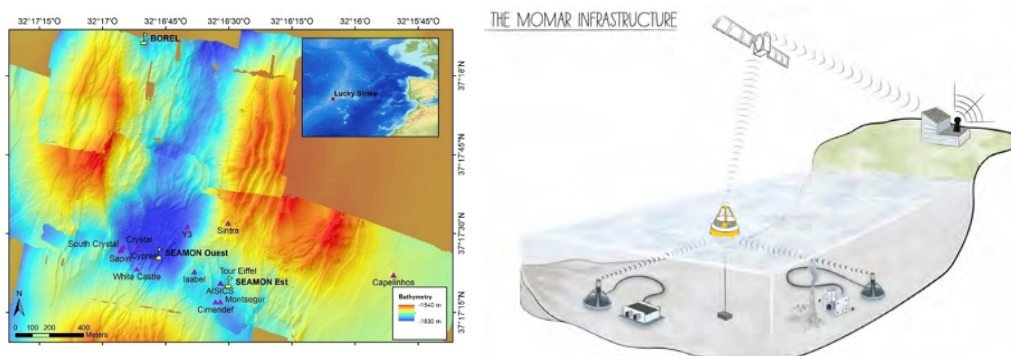
At the culmination of the 10-year tenure of GoMRI in 2020, DEEPEND was funded to continue time-series analysis and to translate information gained into resource management products via the NOAA RESTORE Science Program ([www.restoreactscienceprogram.noaa.gov](http://www.restoreactscienceprogram.noaa.gov)). We are expanding our research and data utilization to encompass the role of the deep-pelagic fauna as essential prey for higher trophic levels (e.g., cetaceans, seabirds), including endangered species. We will also be examining the interactions and connectivity at the ‘oceanic rim,’ including pelagic habitat use by coastal, deep-demersal, and deep-benthic fauna, and trophic subsidies to deep-benthic habitats by pelagic sources. We envision developing many new connections between stakeholders, resource users, and resource management, and [invite all interested parties to contact us](#) to see how we might develop synergies and partnerships (via the DEEPEND website). We look forward to hearing from you!

## EMSO-Azores deep-sea observatory: 10 years of monitoring the Lucky Strike vent field (Mid-Atlantic Ridge)

Sarradin Pierre-Marie<sup>1</sup>, Matabos Marjolaine<sup>1</sup>, Sarrazin Jozée<sup>1</sup>, Cannat Mathilde<sup>2</sup> and the EMSO-Azores team.

<sup>1</sup>Deep Sea Laboratory, Ifremer, Brest, France; <sup>2</sup>Paris Globe Institute of Physics/CNRS, Paris, France

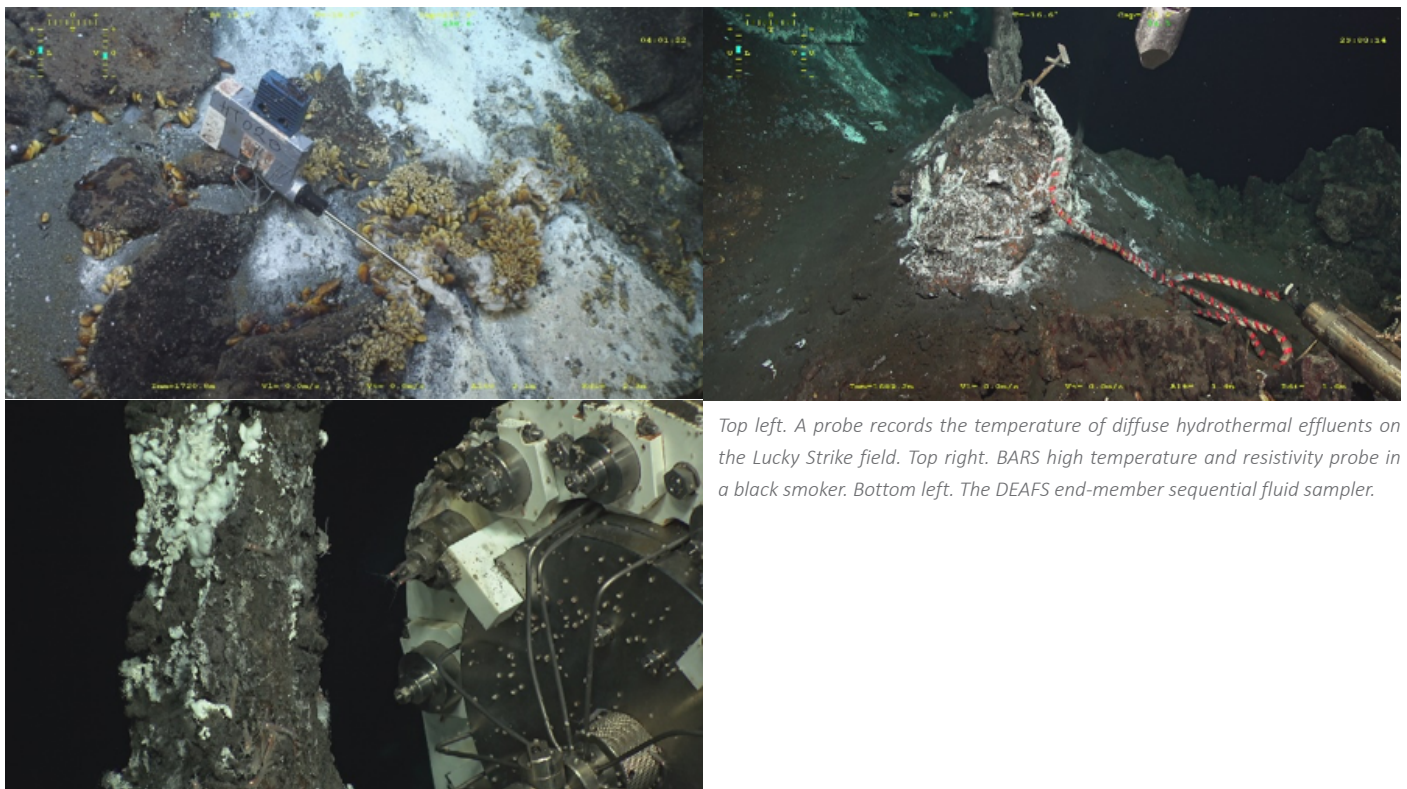
The deep-sea observatory [EMSO Azores](#) is set atop an active volcano which hosts the large active Lucky Strike hydrothermal vent field (LS – 1700 m depth). The uncabled [infrastructure](#), comprised of two seabed monitoring nodes (SeaMoN East and West) acoustically linked to a surface relay buoy, supports several sensors on the seafloor and at the surface. Scientific and technical data are daily transmitted to the Data Centre in Brest and are available [online](#). The nodes are completed by an array of autonomous instruments.



Left. The active hydrothermal vents on the Lucky Strike vent fields © M. Cannat. Right. The EMSO-Azores infrastructure © Capsule graphik.

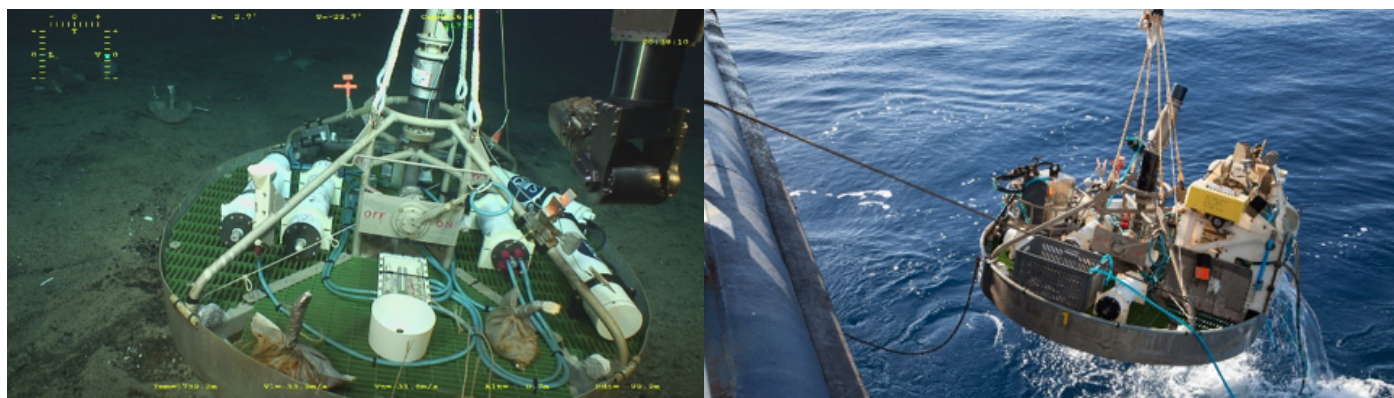
Every year, the [MoMARSAT maintenance cruise](#) is carried out to ensure the calibration and replacement of sensors, retrieval of complete data sets, infrastructure updates and maintenance, and energy replacement. The cruise program includes associated exploration and monitoring activities including video surveys, rock, fluids and faunal sampling and in situ experiments. Some of the most striking results obtained by our team are summarized on the EMSO website: <https://www.emso-fr.org/News/EMSO-Azores-10-years-already>.

In a nutshell, over the last 10 years, we have obtained decisive results to understand how the hydrothermal circulation was established, how hydrothermal fluids were formed, and what relationships were established at depth between the magmatic heat source, the permeability created by the faults and numerous fractures at the axis of the ridge, and the hydrothermal system. We also contributed to an important discovery: hydrothermal emissions from ridges play a key role in the ocean's iron content. Modeling currents and their interactions with topography suggested the formation of eddies that could strongly increase the spatial dispersion of particles and larvae. The study of faunal temporal dynamics highlighted the stability of vent communities on a decadal scale and allowed a better characterization of the distribution of species at the individual level, notably through the citizen science project, [Deep Sea Spy](#). Video imagery also allowed the multi-year 3D reconstruction of the active Eiffel Tower edifice. Most impressive, the existence of biological rhythms at the behavioral level and by molecular sequencing was revealed for the first time on a deep-sea hydrothermal species! On a smaller scale, microorganisms were shown to colonize the surfaces of basaltic glasses of the oceanic crust and to participate in their alteration.



Top left. A probe records the temperature of diffuse hydrothermal effluents on the Lucky Strike field. Top right. BARS high temperature and resistivity probe in a black smoker. Bottom left. The DEAFS end-member sequential fluid sampler.

In addition to this fundamental knowledge on the functioning of the hydrothermal ecosystem, this observatory has enabled us to develop and operate a complex infrastructure for 10 years. The electronic core of the system has been transferred to an industrial company to be commercialized, and the infrastructure developed prefigures environmental monitoring stations that could be used in the future for exploitation projects or to monitor vulnerable marine ecosystems. These technologies, and the knowledge acquired, will make it possible to respond more effectively to questions regarding the evaluation of the impacts of human activities on deep-sea ecosystems (pollution, mineral resource exploitation, etc.).



Left. The Seamon West node on the seafloor © Ifremer/Momarsat2015. Right. Recovery of the Seamon East node © M. Cannat/Momarsat2015.

### Associated publications

Barreyre T, Olive JA, Crone TJ, Sohn RA (2018) Depth-dependent permeability and heat output at basalt-hosted hydrothermal systems across mid-ocean ridge spreading rates. *Geochemistry, Geophys Geosystems* 19:1259–1281.

Barreyre T, Sohn RA (2016) Poroelastic response of mid-ocean ridge hydrothermal systems to ocean tidal loading: Implications for shallow permeability structure. *Geophys Res Lett* 43:1660–1668.

Chavagnac V, Leleu T, Fontaine F, Cannat M, Ceuleneer G, Castillo A (2018a) Spatial Variations in Vent Chemistry at the Lucky Strike Hydrothermal Field, Mid-Atlantic Ridge (37°N): Updates for Subseafloor Flow Geometry From the Newly Discovered Capelinhos Vent. *Geochemistry, Geophys Geosystems* 19:4444–4458.

Chavagnac V, Saleban Ali H, Jeandel C, Leleu T, Destrigneville C, Castillo A, Cotte L, Waeles M, Cathalot C, Laes-Huon A, Pelleter E, Nonnotte P, Sarradin PM, Cannat M (2018b) Sulfate minerals control dissolved rare earth element flux and Nd isotope signature of buoyant hydrothermal plume (EMSO-Azores, 37°N Mid-Atlantic Ridge). *Chem Geol* 499:111–125.

Escartin J, Barreyre T, Cannat M, Garcia R, Gracias N, Deschamps A, Salocchi A, Sarradin PM, Ballu V (2015) Hydrothermal activity along the slow-spreading Lucky Strike ridge segment (Mid-Atlantic Ridge): Distribution, heatflux, and geological controls. *Earth Planet Sci Lett* 431:173–185.

Girard F, Sarrazin J, Arnaubec A, Cannat M, Sarradin P-M, Wheeler B, Matabos M (2020) Currents and topography drive assemblage distribution on an active hydrothermal edifice. *Prog Oceanogr* 187.

Husson B, Sarradin P-M, Zeppilli D, Sarrazin J (2017) Picturing thermal niches and biomass of hydrothermal vent species. *Deep Res Part II Top Stud Oceanogr* 137:6–25.

Husson B, Sarrazin J, van Oevelen D, Sarradin PM, Soetaert K, Menesguen A (2018) Modelling the interactions of the hydrothermal mussel *Bathymodiolus azoricus* with vent fluid. *Ecol Modell* 377:35–50.

Mat AM, Sarrazin J, Markov G V., Apremont V, Dubreuil C, Eché C, Fabioux C, Klopp C, Sarradin PM, Tanguy A, Huvet A, Matabos M (2020) Biological rhythms in the deep-sea hydrothermal mussel *Bathymodiolus azoricus*. *Nat Commun* 11:1–12.

Vic C, Gula J, Rouillet G, Pradillon F (2018) Dispersion of deep-sea hydrothermal vent effluents and larvae by submesoscale and tidal currents. *Deep Res Part I Oceanogr Res Pap* 133:1–18.



## Danish Center for Hadal Research – HADAL



PI: Ronnie N Glud; Co-PIs: Bo Thamdrup, Peter Stief, Mathias Middelboe, Frank Wenzhöfer, Hiroshi Kitazato

Maurício Shimabukuro, John Paul Balmonte & Ronnie N Glud

A new Center for Research Excellence (HADAL) funded by the Danish National Research Foundation was established in September 2020 at University of Southern Denmark (SDU). HADAL builds on the foundation of an ERC Advanced Grant (HADES-ERC 2016-2021) and aims to unravel the diversity, adaptations, and biogeochemical contributions of life in hadal trenches—the deepest, most remote, and least explored habitats on Earth. Whereas one might expect these extreme environments to be relatively barren, recent advances have shown diverse biological communities that thrive in part on sinking or laterally-advected organic matter funneled to the deepest portions of trenches. High

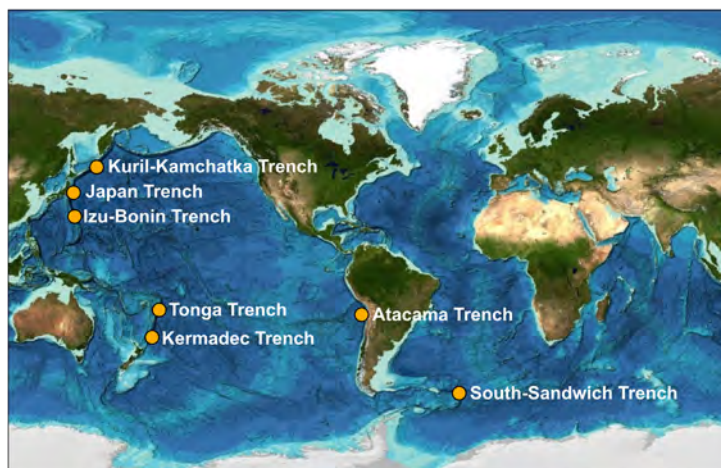


Figure 1. Map of hadal trenches that will have particular focus for HADAL center scientists in the coming years

benthic carbon turnover rates measured *in situ* from the Atacama and Izu-Bonin Trenches, for example, exceed those observed in adjacent abyssal sediments and rival measurements in bathyal and shelf sediments. These unexpected findings underscore trenches' largely unexplored role as deep-sea 'hotspots' of material deposition and biological activity.



Figure 2 (left). A benthic lander system developed for autonomous sediment sampling and *in situ* incubation experiments that will be used during HADAL. Figure 3 (right). Group photo of people involved in the SO261 expedition to the Atacama Trench in 2018. The photo was taken during the first post-cruise meeting in Denmark.

The vision of HADAL to define the diversity of life and the dynamics of elemental cycling in the deepest oceanic regions relies on: (1) developing autonomous and moored equipments that can monitor parameters, material transport and process rates, and realizing experiments at *in situ* hadal depths, as well as (2) laboratory experiments exploring the

effects of hydrostatic pressure on microbial interactions and processes using sophisticated high-pressure technology. While HADAL is based at SDU, its hub at Tokyo University for Marine Science and Technology (TUMSAT) facilitates explorations of trenches in the North Pacific. HADAL has developed collaborations with national and international scientists across a dozen universities and welcomes new opportunities for partnerships. Additional positions for PhD students and Postdocs will be advertised during the first semester of 2021.

For more news: <https://www.sdu.dk/hadal>

For contact: [rnglud@biology.sdu.dk](mailto:rnglud@biology.sdu.dk)

# Meetings & Workshops

## OBSERVING LIFE IN A CHANGING OCEAN: EXPLORING A CENSUS OF MARINE LIFE TODAY

The Consortium for Ocean Leadership (COL) is pleased to invite you to attend a virtual symposium entitled Observing Life in a Changing Ocean: Exploring a 'Census of Marine Life' Today, on **Wednesday, January 27, 2021 (3:00-6:00 PM Eastern Time)**.

[Click here for more information and to register for this event.](#)

The program will bring together thought leaders from multiple sectors to discuss the needs, benefits, and opportunities of a national program for marine biodiversity research and observations that is collaborative, innovative, and improves our ability to predict and manage change. Such an initiative is critical for addressing the ocean priorities of a new administration and Congress. The Census of Marine Life (2000-2010) offers lessons for how to accomplish such a program at the scale needed, and new technologies make sustained and systematic observations more feasible today than ever before.

We hope you will join us for this event and help set a road map for marine biodiversity research and observation in the coming decade.



### Protecting biodiversity at deep-sea hydrothermal vents

Presentations by Cindy Lee Van Dover, Pat Halpin, Elisabetta Menini (Duke University)

Eva Ramirez-Llodra (Norwegian Institute for Water Research & REV Ocean)

and Jon Yearsley (University College Dublin)

**THURSDAY 28 JANUARY 2021 – 4pm GMT / 11am EST**

[Join webinar](#)

#### Synopsis

Hydrothermal vent ecosystems in the deep sea are renowned for their strange invertebrates exquisitely adapted for life under extreme conditions of temperature and fluid chemistry. These ecosystems are distributed along mid-ocean ridges throughout the world's ocean. Hydrothermal vent ecosystems are also sources of metals that are of interest to an emergent deep-sea mining industry, introducing a tension between conservation and exploitation.

This webinar introduces deep-sea mining interests and the rationale for protection of active vent ecosystems. We will review the global status of protection of hydrothermal vent fields (primarily in national waters) as well as spatial concepts for protection of active vent ecosystems on the seabed in international waters of the North Atlantic. Vent species occupy benthic habitats as juveniles and adults, but spend a critical part of their life history in the water column as larvae. We present new information on mid-water circulation patterns above the northern Mid-Atlantic Ridge and the potential for multiple hydrographic barriers to larval dispersal along the ridge. Before opening the floor for questions and discussion, we introduce inactive and extinct sulfide ecosystems that may be targets of deep-sea miners, emphasizing some important ecological questions that we think need to be answered in advance of industrial mining.

## What Does the Future Hold for Cold-Water Corals in an Era of Global Environmental Change?

CONFERENCE SESSION

### What Does the Future Hold for Cold-Water Corals in an Era of Global Environmental Change?



[www.icrs2021.de](http://www.icrs2021.de)



Scleractinian corals and gorgonians are among the main ecosystem engineers in the deep-sea, generating complex three-dimensional habitats characterized by high abundance and diversity of associated species, comparable to tropical and temperate shallow coral reefs. Cold-water coral reefs and coral gardens are distributed globally and have been exposed to substantial anthropogenic pressures like fishing, oil and gas exploration and global change. In recent years, knowledge of these ecosystems has greatly increased. This session will present the most recent advances in our knowledge of cold-water coral ecology and conservation including: (1) the discovery, mapping and characterization of cold-water coral reefs and coral gardens ecosystems, (2) the ecological and eco-physiological processes in these ecosystems, (3) the threats and their effects on these fragile ecosystems, and (4) the last advances in their restoration, management and conservation. We expect this session to be especially interesting for the scientific community

focused on the research about cold-water coral reefs and coral gardens in the deep-sea, but also for all the scientific community generally working on coral ecology, management and conservation. We expect this session to allow significantly increasing the scientific collaboration between these two scientific communities, which are traditionally limited despite the many similarities in research lines and methods.



INCISE, the *International Network for submarine Canyon Investigation and Scientific Exchange* is an initiative that aims to bring together scientists working on all aspects of submarine canyon research, and to stimulate discussions across disciplines.

Following the postponement of INCISE 2020 due to Covid restrictions and continued disruption, INCISE 2021 will be an online meeting, and will be hosted by the University of Gibraltar. It will run over the course of the week of the 14 June 2021, and will be divided into 2 x 2 hour sessions per day to avoid zoom fatigue. We will try to find time slots that will work for as many people around the world as possible. While we are disappointed that we cannot hold this meeting in person, in line with the INCISE ethos we will try to create as many opportunities as possible for cross-disciplinary discussions.



**NEW DATES**

## **New dates – 3 to 11 September 2021 in Marseille**

The International Union for Conservation of Nature (IUCN) and the French government have agreed to hold the IUCN World Conservation Congress 2020 from 3 to 11 September 2021 in Marseille. The event, originally scheduled for June 2020, was postponed due to the COVID-19 pandemic.

The world is increasingly recognising the inextricable link between biodiversity conservation and human and economic wellbeing, a connection made all the more visible by the COVID-19 pandemic. The IUCN Congress will be a key milestone for nature conservation and the development of a new global framework for biodiversity. The French government and IUCN remain steadfast in their commitment to these goals.

The different Congress components will take place on the following dates:

- The [Forum](#) will take place from 4 to 7 September
- The [Exhibition](#) will be held from 4 to 9 September
- The [IUCN Members' Assembly](#) will meet from 8 to 10 September

- The [Nature Generation Areas](#), or “Espaces Générations Nature”, will be running from 4 to 11 September”

[MORE INFO](#)



January 2021 marks the beginning of perhaps the most critical decade of our lives. The global COVID-19 crisis highlighted more than ever our vulnerability and dependence on the environment for our health and prosperity. Many are relying on a growing Green Economy to drive us back to recovery.

But what about the sustainable, knowledge-based and equitable Blue Economy?

‘**Brave New Ocean**’ is a high-level virtual event organized by the Intergovernmental Oceanographic Commission of UNESCO. It will convene global leaders, scientists, philanthropists, leaders of United Nations agencies, and sports personalities to discuss the immense challenges and opportunities the ocean provides for realizing the potential of the Sustainable Development Goals and the role that the Ocean Decade can play in meeting these challenges!

‘**Brave New Ocean**’ will be broadcast through the following channels:

<https://www.youtube.com/unesco>

<https://www.facebook.com/oceandecade/live>

<https://www.facebook.com/locUnesco/live/>

[CLICK TO ADD TO YOUR CALENDAR](#)

# Introducing Challenger 150

**The Deep-Ocean Stewardship Initiative**  
*invites you to a*  
**WEBINAR**

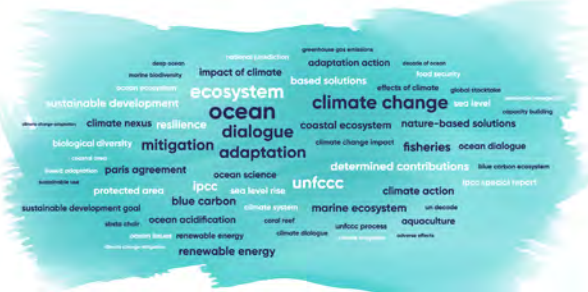
**Tuesday 9 February at 2 – 3pm GMT**

Proposed by DOSI as an official Ocean Decade Programme, **Challenger 150** is a new 10 year deep-sea science programme which follows in the wake of the Census of Marine Life. With partners REV Ocean and the Schmidt Ocean Institute, Challenger 150 aims to deliver *'the deep ocean we want'* as part of the UN Decade of Ocean Science for Sustainable Development. We invite the deep-sea and Ocean Decade community to a webinar to find out more about the Challenger 150 programme.

[REGISTER NOW](#)

UNFCCC Ocean and Climate Dialogue Side Event:  
**Ocean-Climate-Policy Nexus**

View on Youtube at <https://youtu.be/s6EcZ16V0io>



- **Introduction** - Lisa Levin
- *Current perceptions of the ocean-climate nexus: an analysis of submissions to the UNFCCC Ocean and Climate Change Dialogue - Bobbi-Jo Dobush & Bleuenn Guilloux*
- *The role of civil society to ensure a science-to-policy approach for the ocean-climate nexus - Loreley Picourt*, Ocean and Climate Platform
- *The science and governance of biodiversity influence on climate in areas beyond national jurisdiction* - **Lisa Levin**, UC San Diego, DOSI
- *Pacific Perspectives Panel* – **Elisabeth Holland** (Moderator), USP
- **Satyendra Prasad**, Permanent Mission Representative of Fiji to the UN
- **Clement Yow Mulalap**, Federated States of Micronesia
- Questions and discussion with the audience

Also see:

*Current Perceptions of the Ocean-Climate Nexus: An Analysis of Submissions to the UNFCCC Ocean and Climate Change Dialogue* [Nov 2020]

[https://www.dosi-project.org/wp-content/uploads/DOSI-Ocean-Dialogue-Submission-Synthesis-ES\\_FINAL2\\_web.pdf](https://www.dosi-project.org/wp-content/uploads/DOSI-Ocean-Dialogue-Submission-Synthesis-ES_FINAL2_web.pdf)

and

OP ED – A sea change in climate action.

<https://theecologist.org/2020/dec/11/sea-change-climate-action>



## 16<sup>th</sup> Deep-Sea Biology Symposium

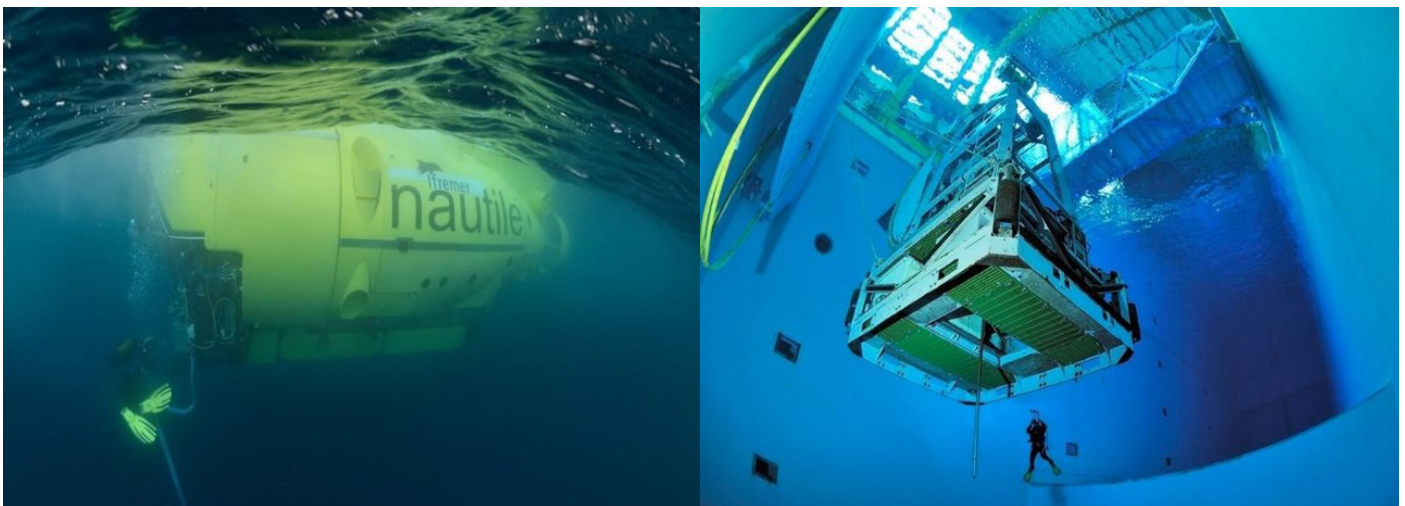
[Ifremer](#) (Brest) will host the 16th Deep-Sea Biology Symposium in Brest, France between 12 and 17 of September 2021. Brest's history has always been linked to the sea and the oceans. Nowadays, Brest has a leading position in European deep-sea science, technology and industry. Ifremer has a long experience in deep-sea research and technology with a dedicated deep-sea department ([Department of Physical Resources and Deep-Sea Ecosystems-REM](#)), mainly investigating the deep-sea seafloor and the sub-seafloor, biodiversity and the dynamics of deep-sea ecosystems, and the interaction between the biosphere and the geosphere on scales ranging from bacteria to the glacial cycles.

In 1988, Ifremer hosted the [5th Deep-Sea Biology Symposium in Brest](#). After 32 years, there is still an urgent need for rapid technological developments to access, investigate, understand and protect this unique and remote environment. Furthermore, in the last few years anthropogenic pressures in the deep sea have risen exponentially and we are all aware that the deep sea is a treasure of biodiversity, resources and the last frontier on Earth for biomimicry. For all these reasons, the 16th Deep-Sea Sea Biology Symposium will propose to you two associated events a student Workshop on "Artificial Intelligence and new technologies to describe deep-sea biodiversity" and a round Table with scientists, stakeholders and companies about deep-sea biomimicry.

Daniela Zeppilli (Ifremer) and the local organizing committee

For further information <https://wwz.ifremer.fr/16dsbs/>

Don't forget to follow us on [Twitter @16dsbs](#).



### Call for Special Sessions

Submit proposals for special sessions at the 16<sup>th</sup> Deep-Sea Biology Symposium in Brest, France between 12 and 17 of September 2021.

The 16<sup>th</sup> DSBS scientific sessions will cover:

- Conservation topics and stewardship (natural/anthropogenic impacts, conservation, governance);
- Biodiversity and ecosystem functioning (biodiversity patterns, species distribution, function, food webs);
- Life-history traits and population connectivity (reproductive ecology, larval development and dispersal, and population connectivity);
- Adaptations of deep-sea organisms (from molecules to organisms: how life adapt to extreme conditions);
- Access to the deep sea (technological and methodological advances to access and investigate deep-sea life, including observatories and cutting edge technologies –e.g. A.I. and omics);
- Deep-sea biomimicry (discovery of new technologies inspired by deep-sea biological solutions and processes)

Special sessions should cover one or more of these topics.



## Procedure for submitting proposals

Special session proposals must be submitted online filling out this form (<https://forms.ifremer.fr/lep/call-for-proposal-dsbs-2021/>) and should include:

- Special session title
- Related 16<sup>th</sup> DSBS Topic (1-6)
- Your contact details (full name, institution, email)
- Special session content: Background, aim and description (up to 250 words)
- Will you identify speakers for your session and/or invite contributions?
- Additional remarks, requirements

## Responsibilities of a special session chair

- As a proposer of an accepted special session, you will become the special session chair.
- Your primary responsibility is to solicit and to collect high-valued contributions by directly contacting the colleagues working in the proposed research field.
- You will also oversee the review process by collaborating with the conference chairs and the scientific committee in determining which abstracts are to be accepted.
- You will structure presentation time in your session.
- Only registered participants can be designated as a session chair to avoid no show onsite.
- Given the uncertain evolution of the COVID-19 pandemic, chairs and speakers should be prepared to adjust their session formats to an online meeting or webinar.

## Important Dates

Proposals Due: January 30th 2021

Notification Regarding the Proposals: February 15th 2021

Each proposal will be evaluated by the scientific and organizing committees.

# Scientist Profiles

## JP Balmonte

Postdoctoral Researcher

*HADAL & Nordcee, Department of Biology, University of Southern Denmark*

Contact: [jpbalmonte@biology.sdu.dk](mailto:jpbalmonte@biology.sdu.dk)



Living in Manila (Philippines) and Los Angeles (California) as a kid, I have always been surrounded by oceans, but with neither a clue about the vast diversity of organisms they harbor, nor their potential to be investigated as a career. While at UC San Diego, a talk by Dr. Doug Bartlett opened my eyes to the innumerable microorganisms that thrive in the deep sea. At first, I simply wanted to know their identities (using sequencing technologies), and how they change in time and space. Gradually, I became curious about their adaptations and functions – surely, I guessed, they would not exist and thrive without a compelling reason.

Admittedly, my curiosity for microorganisms is not confined to the deep sea, but it is the comparison of microbial life in multiple environments to those in the deep sea that makes this habitat so strange and enticing to study. Wrapping my head around microbial life strategies in surface waters comes a bit more naturally; but putting myself in deep-sea microbial “shoes” is much more of a challenge. Even more peculiar are microorganisms that hitch a ride to the seafloor on sinking particles, as if they were taking an elevator down to the abyss. Who are they? What do they have (genomic features or otherwise) that enable them to withstand massive changes in pressure? Might they actually survive once in the deep, interact with other microorganisms, and shape the existing microbial communities present in the seafloor?

It seems that my curiosity (and luck and opportunities) has brought me back to the deep sea, a full circle; but, this time, to the deepest regions: hadal trenches. A circuitous path – which includes research trips to the central Arctic, Greenland, Pacific and Atlantic Oceans, rivers and lakes in Europe and North America, and the Guaymas Basin hydrothermal vent – enables comparison and provides context for investigating microbial life in deep-sea trenches. After all, understanding microbial ecological and evolutionary processes requires a distinction of features that are system-specific, from those that apply across systems.

I just started a postdoctoral position at the HADAL Center in SDU in January 2021, and I am thrilled at the opportunity to expand the limits of our knowledge alongside a vibrant team that Dr. Ronnie Glud has put together (see scientist profiles by Clemens Schaubberger, Mauricio Shimabukuro, and Sachia Traving).

### Biography:

- 2021 – Postdoctoral Researcher, HADAL & Nordcee, University of Southern Denmark
- 2018 – 2020 – Postdoctoral Fellow, Dept. of Ecology & Evolution, Uppsala University
- 2014 – 2018 – PhD in Marine Sciences, Department of Marine Sciences, The University of North Carolina at Chapel Hill

- 2011 – 2014 – MS in Marine Sciences, Department of Marine Sciences, The University of North Carolina at Chapel Hill
- 2007 – 2011 – BS in Molecular Biology, University of California, San Diego
- 2007 – 2011 – BS in Ecology, Evolution, and Behavior, University of California, San Diego

---

## Belén Franco-Cisterna

PhD student

*HADAL & Nordcee - Department of Biology, University of Southern Denmark*

Contact: [belen@biology.sdu.dk](mailto:belen@biology.sdu.dk)



I am a marine biologist studying the interaction between microorganisms and zooplankton carcasses. Since I started my studies, I have been passionate about the role of zooplankton in the oceans. We know these small animals are relevant when they are alive. However, as carcasses, they also play an important role in the biogeochemistry and ecology of the sea.

How does it relate to deep marine life? Zooplankton carcasses can be a food source for the benthic food webs.

My PhD project focuses on carbon and nitrogen cycling associated with sinking copepod and krill carcasses. We attempt to unravel which processes are leading the cycling of elements from the carcasses, how physical factors affect these processes, and how fast the degradation of organic matter occurs. The results we have obtained are giving us insights into the potential of sinking zooplankton carcasses to fuel the deep ocean with labile organic material.

Within the HADAL center, my work is framed on the area of exploration of sources and pathways for material supply to hadal trenches. After finishing my PhD, I will continue as a post-doctoral researcher in the HADAL center to go deeper into this study.

Besides research, during my career, I have also participated in scientific outreach activities, so I am happy to collaborate either in research or knowledge dissemination works.

Biography:

- 2018-2021 Ph.D. in Biology, University of Southern Denmark, Denmark.
- 2017 Outreach team, Millennium Institute of Oceanography, Chile
- 2014-2016 M.Sc. in Oceanography, Universidad de Concepción, Chile.
- 2009-2013 B.S. in Marine Biology, Universidad de Concepción, Chile.

## Henry Knauber

M.Sc. Ecology and Evolution

*Goethe University Frankfurt & Senckenberg Research Institute and Natural History Museum, Germany*

Email: [henry.knauber@senckenberg.de](mailto:henry.knauber@senckenberg.de)

LinkedIn: <https://www.linkedin.com/in/henry-knauber/>



My overall interest in zoology, marine environments and biodiversity led me to study Biological science (BSc) as well as Ecology and Evolution (MSc). During my master thesis, which I carried out at the [Crustacea section of the Senckenberg Research Institute Frankfurt](#), under the supervision of Dr. Torben Riehl and Prof. Dr. Angelika Brandt, I came in touch with deep-sea biodiversity and taxonomy. Thus far, my scientific research has focused on the diversity and distribution of benthic haploniscid crustaceans from the Kuril-Kamchatka Trench region of the Northwest Pacific. Haploniscidae are a highly abundant and speciose family of deep-sea macrobenthic isopods with a circumglobal distribution. I recently finished my master thesis which investigated a haploniscid species complex by means of integrative taxonomy. The combination of molecular, morphological and biogeographical data revealed a larger species diversity within the species complex than initially assumed. Furthermore, the impact of bathymetric structures such as the Kuril-Kamchatka Trench and the Kuril-Island Ridge on these haploniscid species was evaluated. Due to low dispersal abilities of the Haploniscidae, both structures restrict their distribution and serve as barriers, promoting diversification and thus speciation.

During my research, I have become more and more interested in the deep sea. As the largest, yet poorly explored habitat on our planet, I want to investigate and explore its biodiversity and the questions that ultimately arise about its origin. Therefore, I am currently looking for PhD positions that allow me to continue researching deep-sea biodiversity and its evolutionary patterns.

## Maurício Shimabukuro

Postdoctoral Researcher

*HADAL & Nordcee – Department of Biology, University of Southern Denmark*

Contact: [shimabukuro@biology.sdu.dk](mailto:shimabukuro@biology.sdu.dk); [mshima84@gmail.com](mailto:mshima84@gmail.com)



I have been passionate by the ocean and marine life since my young age, when I loved holiday time, going to the beach and exploring rocky shores. At that time, exploration of deep-sea life was only an impossible dream in my mind, but this changed when I started my PhD to study the diversity and distribution of fauna associated with deep-sea organic falls. Now I hold a PhD in biological oceanography with background in benthic ecology, taxonomy and phylogeny of deep-sea annelids. In general, I am interested in ecological and evolutionary processes shaping the current biodiversity and biogeographic patterns of deep-sea animals.

My current research aims to investigate meiofauna standing stock in hadal trenches in relation to food availability and the biogeography and connectivity of trench

meiofauna organisms. I started this research two years ago at IFREMER/LEP, but I recently joined the HADAL1 centre to continue my work. In HADAL I will have opportunity to investigate more trenches, such as the Japan, South Orkney and South Sandwich trenches, comparing samples that we took in the Atacama Trench. The Atacama Trench is considered a hotspot of deep-sea meiofauna standing stock since this trench is under influence of one of the most productive marine regions. However, not only Atacama but other trenches around the world could sustain a high meiofauna standing stock due to the role of trenches as depocentre of organic matter. My position at HADAL just started and I will be dedicated to this research field for the next three years. So, if you have an interest in meiofauna ecology and hadal communities, feel free to contact me!

#### Biography:

- 2020 – Postdoctoral Researcher (HADAL & Nordcee), University of Southern Denmark
- 2019-2020 – Postdoctoral Researcher (EEP/LEP), Institut Français de Recherche pour l'Exploitation de la Mer
- 2014-2018 – PhD in Biological Oceanography, University of São Paulo
- 2012-2013 – Environmental Consultancy at Foundation of Aquatic Studies and Research
- 2011 – Management of database in the Brazilian node of OBIS
- 2008-2011 – MSc in Biological Oceanography, University of São Paulo
- 2003-2006 – B.S. in Biological Science, Mackenzie University at São Paulo

---

## Clemens Schauburger

Postdoctoral Researcher

*HADAL & Nordcee – Department of Biology, University of Southern Denmark*

Contact: [schauburger@biology.sdu.dk](mailto:schauburger@biology.sdu.dk)



You might be wondering: how did someone from landlocked Austria end up in marine science? I think it all started for me when I read a review paper by Bo Barker Jørgensen about microbial communities of subsurface sediments. These microbes manage to keep their genomes intact and remain viable over millions of years despite living under such energy-limited conditions that it violates our understandings of the constraints of life. I was working on nitrifying communities in wastewater treatment plants and drinking water filtration systems back then, and thought that *Nitrospira* cultivates were slow growers—I was simply lacking perspective.

So, for my PhD I changed gears to geomicrobiology and moved to an island. At the University of Southern Denmark, I studied microbial and viral communities in the Kermadec and Atacama trenches with an emphasis on the variability of these communities along the trench axes. I was interested in the assembly processes of these communities and the functional groups driving nutrient cycles. While this work and the efforts of other research groups has provided a good foundational understanding of the biogeochemistry and microbial ecology of these systems, numerous open questions remain.

For instance, why does microbial community composition change continuously over sediment depth, despite

biogeochemical conditions exhibiting stepwise changes in selective forces? What role does microbial evolutionary diversification play for microbes in these sediments given the limited number of microbial generations and severe dispersal limitation of this system? What are the impacts of hydrostatic pressure on microbial metabolisms?

Our team at the University of Southern Denmark and others working on these topics will hopefully be able to answer some of these questions in the upcoming years.

Biography:

- 2020 – Postdoc
- 2017 – 2020: PhD. thesis on: “Microbial and viral communities of hadal trenches”
- 2015 – 2017: M.Sc. studies in Molecular Microbiology, Immunology and Microbial Ecology; Master thesis topic: “The environmental detection of comammox Nitrospira”
- 2011 – 2015: Bachelor of Science in Biology at University of Vienna

## Sachia Traving

Postdoctoral Researcher

*HADAL & Nordcee, Department of Biology, University of Southern Denmark*

Contact: [sjtraving@biology.sdu.dk](mailto:sjtraving@biology.sdu.dk), [sjtraving@gmail.com](mailto:sjtraving@gmail.com)



I am a postdoc in the HADAL center at University of Southern Denmark. My research interests are focused on the ecology and biology of hadal viruses (infecting prokaryotes). I have a background in marine microbial ecology and I'm very excited about my postdoc at the HADAL center where I will be able to combine experimental work on cultured isolates with metagenomic sequence data from various trenches. In general, we are able to generate massive amounts of sequence data from all kinds of biologically derived samples. However, large amounts of the genomic data we acquire is still of unknown or putative function. Cultured representatives are valuable as reference material for sequence-based data as they provide a model system for investigating gene-function, translation and activity. Furthermore, model organisms allow us to constrain biological activity which we can correlate to *in situ* rate measurements.

Considering the unique environmental conditions of hadal ecosystems and the vast and novel diversity they harbor, we need good model systems which will enable us to investigate virus-host interactions and microbial activity which we can couple to the broader microbial and viral communities characterized through metagenomic data. I'm excited to migrate my research to the deepest parts on our planet.

Biography:

- 2020-current – Postdoctoral Researcher, HADAL and Nordcee, University of Southern Denmark, Denmark.
- 2018-2020 – awarded the DFF-International Postdoctoral Fellowship, carried out at University of British Columbia, Canada
- 2016-2017 – Postdoctoral Researcher in EU BONUS project BluePrint, University of Copenhagen, Denmark

- 2012-2016 – Ph.D. in Marine microbial ecology, University of Copenhagen and Technical University of Denmark, Denmark
- 2009-2011 – M.Sc. Marine microbiology, University of Copenhagen, Denmark
- 2005-2009 – B.Sc. Biology, University of Copenhagen, Denmark

---

## Deep-Sea Biologist Wins Nature of Scotland Conservation Science Award for Early Career Researchers

Congratulations to Georgios Kazanidis, a deep-sea biologist currently based at the University of Edinburgh and serving as the Scientific Project Manager for the H2020 ATLAS and iAtlantic projects.

On 25 November 2020 Georgios was “Highly Commended” in the “RSPB - Nature of Scotland Conservation Science Award for Early Career Researchers”. This came as a recognition of his work over the last nine years studying Vulnerable Marine Ecosystems (e.g. cold-water coral reefs and sponge grounds) in Scotland and the wider North Atlantic.

The Conservation Science Award recognises the achievements of Early Career Researchers whose exemplary, peer-reviewed research has had an important impact in support of nature conservation in Scotland or has exceptional promise of doing so in the future. The award was sponsored by the Scottish Alliance for Geoscience, Environment and Society (SAGES).

Link to Press Release made by the University of Edinburgh: <https://www.ed.ac.uk/geosciences/about/news?item=1403>



Figure 1. Cold-water coral reefs in the Rockall Bank. Credits: Changing Oceans Expedition 2012 - University of Edinburgh

# Opportunities



## E-SCoRe Award 2021

The E-SCoRe Award 2021, which is awarded to young researchers for outstanding collections-based research by the Consortium of European Taxonomic Facilities (CETAF) will be open for new candidates to apply until 14 February 2021. CETAF Community will celebrate for the second year the new generation of scientists who have shown interest in the collections that help to document, describe and understand life on Earth. By awarding the E-SCoRe award, CETAF wishes to highlight the significance of collections-based research in the fight against biodiversity loss and climate change as well as to support early career researchers in this field.

More information on eligibility and criteria on our [website](#).

## Travel Grants for Deep-Sea Experts



Image: Danovaro et al. 2020

We are delighted to announce that the Deep-Ocean Stewardship Initiative and the High-Seas Alliance are offering limited grants for deep-sea experts to attend key meetings, conferences, workshops and events.

Funding is open to all scientists and social scientists that are members of the DOSI network (sign up here). Applications by members of all underrepresented groups are encouraged.

Please review the application and grant guidelines before submission of application. To apply, please fill out and submit



the application form, including the budget template provided.

Applications must be submitted 60 days in advance of the meeting, conference, workshop or event. The Grant Review Committee will respond 40 days in advance of the meeting via email.

Please contact Travis Aten at [travisgaten@gmail.com](mailto:travisgaten@gmail.com) if you have any questions.

[APPLY NOW](#)

---

## Engineer in numerical ecology at Ifremer, Brest, France



The deep sea laboratory at Ifremer, Brest (France), is seeking an engineer in numerical ecology or biostatistics for a 9 month contract as part of the European H2020 iAtlantic project. The successful candidate will contribute to the iAtlantic Work Package 3 which objective is to assess ecosystem changes in the Atlantic and determine factors responsible for these changes. More particularly he/she will:

- Design, in collaboration with members of WP3, a workflow of numerical approaches for the analysis of time series in ecology acquired within the framework of the project H2020. These series consist of heterogeneous historical data on the abundance and density of species and communities, associated in some cases with oceanographic data.
- Coordinate a report on methods for performing regional assessments of ecosystem change and tipping points using time series data, including protocols for harmonisation of common data and metadata standards.
- Analyse time-series of ecological data in collaboration with the project partners.
- Help organize and facilitate a workshop on the analysis of heterogeneously acquired time series (sampling, optical and acoustic imagery).

The application deadline is 15 February 2021. For more information or to apply please send a CV, motivation letter and references to Marjolaine Matabos: [Marjolaine.Matabos@ifremer.fr](mailto:Marjolaine.Matabos@ifremer.fr)



## Tenure-Track Faculty Position in Evolutionary Biology Department of Biological Sciences

The Department of Biological Sciences at Lehigh University invites applications for a tenure-track position at the level of Assistant Professor. We are particularly interested in applicants studying natural populations, although all applicants investigating fundamental questions in evolutionary biology (broadly defined) whose research complements or enhances existing departmental strengths are welcomed. Hires are expected to develop an internationally recognized extramurally funded research program and contribute to the department's excellence in teaching.

Eligible applicants will hold a Ph.D. at the time of employment and have at least one year of postdoctoral research experience. To apply, please submit: (1) a cover letter, (2) curriculum vitae, (3) research statement, (4) teaching statement, (5) a statement of contributions to promote diversity and inclusion, and (6) have at least three letters of recommendation submitted to <https://academicjobsonline.org/ajo/jobs/17733>

For additional information contact BIOS Faculty-Search Committee Chair at [inbios@lehigh.edu](mailto:inbios@lehigh.edu) or by mail at 111 Research Drive, Bethlehem, PA 18015. <http://www.lehigh.edu/~inbios/>

The initial deadline for applications is February 1, 2021.



## Speaker Opportunity

The United Nations celebrates World Oceans Day every year on 8 June. This year's United Nations World Oceans Day virtual event will take place on Tuesday, 8 June 2021, in celebration of the theme "The Ocean: Life & Livelihoods". Learn more about UN World Oceans Day at [www.UNworldoceansday.org](http://www.UNworldoceansday.org).

The ocean covers over 70% of the planet. It is our life source, supporting humanity and every other organism on earth. The ocean produces at least 50% of the planet's oxygen (Nature), it is home to most of earth's biodiversity, and is the main source of protein for more than a billion people around the world. The ocean is also key to the global economy with an estimated 40 million people being directly employed by ocean-based industries by 2030 (OECD). Humanity has defined itself through its relations with the ocean culturally, socially and economically. The ocean has become central to maintaining life and livelihoods in every respect. Nevertheless, we have yet to understand our impacts on this life source or to discover our true interconnectedness. What we do know is that the ocean is now in need of our support. With over 30% of the world's marine fishery resources overexploited or depleted (FAO), and 70-90% of coral reefs threatened by 1.5°C (IPCC), we are taking more from the ocean than can be replenished. To protect and preserve the ocean and all it sustains, we must create a new balance, rooted in true understanding of the ocean and how humanity relates to it. We must build a connection to the ocean that is inclusive, innovative, and informed by lessons from the past.

UNWOD 2021 will feature keynotes, panel discussions, presentations and performances that spotlight biodiversity, latest oceanic discoveries, the interconnectivity between the ocean and human wellbeing, and more. It will celebrate and support the life and livelihood that the ocean sustains, and help us all understand our role in protecting and preserving the ocean's abundance for generations to come. If you have a solution or perspective that falls within one of the five segments of the day outlined below, please submit an application to participate [here](#). **Deadline for submission: 15 February 2021**

**OCEANIC DISCOVERIES** This segment will highlight the awe and beauty of the ocean and the incredible biodiversity of marine life, zooming in on its contribution to scientific discoveries, medical advances, ecosystem restoration, art and more.

**FACES OF THE SEA** A compilation of short "spotlight" videos will feature stories of individuals whose lives are deeply and visibly interconnected with the ocean across a variety of sectors, such as fisheries, aquaculture, shipping, tourism and marine conservation.

**A CHANGING OCEAN** This series of speaking segments will highlight human impacts on the ocean and the need to take action, with different speakers addressing how life and livelihoods are affected by issues such as climate change, marine pollution and IUU fishing. **CREATING SUSTAINABLE LIVELIHOODS** This moderated panel discussion will highlight solutions with the capacity to transform and establish human-centric, harmonious solutions to balance our relationship with the ocean, such as grassroots efforts, community-scale initiatives, capacity-building programs and governance structures.

**THE FUTURE OF A WORKING OCEAN** This moderated panel discussion will address the role of the private sector, entrepreneurs, finance, the blue economy, and technology in paving a path forward to a sustainable and just working ocean.



for Marcel Jaspars and Abbe Brown

## Song of the Oceans

### World Ocean Day 2021

Do you like to sing, even if only in the shower? We already know you love the ocean, so, if you're still reading, then this is may be for you. Please join us in a global, virtual sing-along of *Song of the Oceans* to be premiered on World Ocean Day 2021. We need singers (no talent required!) and translators to make this happen. Can you help?

#### ABOUT

Composed by [Paul Meador](#), known for his music at the wedding of Prince William and Kate, with lyrics by internationally-acclaimed poet, [Dr Grahame Davies](#), *Song of the Oceans* blends science and music to educate the world about the deep sea. Informed by deep-sea research, you can hear the beautiful song performed by a community choir of representatives from across the University of Aberdeen (listen [NOW](#)), but we want to do more. We would like to get people all around the world singing it, and premiere it on [World Ocean Day](#) on June 8<sup>th</sup> 2021. If you want to join in, please:

[CONTACT US >>](#)



## “la Caixa” INPhINIT doctoral fellowship opportunity to study deep-sea vulnerable marine ecosystems

The Interdisciplinary Centre for Marine and Environmental Research (CIIMAR) of the University of Porto (Portugal) is welcoming international applicants wishing to pursue a PhD under the theme “Unravelling the ecological drivers of deep-sea vulnerable marine ecosystems biodiversity and structure in the temperate Northeast Atlantic” open through “la Caixa” Foundation Doctoral INPhINIT Incoming Fellowship Programme.

The main goal of this project is to investigate the community composition, structure and environmental drivers of distribution of deep-sea vulnerable marine ecosystems (VMEs), as those dominated by sponges and corals, along the Portuguese continental shelf and slope.

The PhD student will integrate CIIMAR’s Deep-Sea Biodiversity and Conservation Research Team and join the DEEPbaseline project, an awardee of the Ocean Conservation Fund supported by Oceano Azul Foundation and Oceanário de Lisboa, that brings together scientists, local fishing communities and associations, fisheries managers, and the wider society to foster awareness and advance management and conservation actions towards VMEs sustainability.

To know more about the “la Caixa” call (including application criteria and procedures) visit:

[www.inphinitlacaixa.org](http://www.inphinitlacaixa.org)

Additional information about the project and research team contact Joana Xavier (jxavier@ciimar.up.pt) and see:

[http://www2.ciimar.up.pt/pdfs/resources/phd\\_position\\_offers\\_inphinit\\_6aHzn\\_.pdf](http://www2.ciimar.up.pt/pdfs/resources/phd_position_offers_inphinit_6aHzn_.pdf)

<https://www2.ciimar.up.pt/research.php?team=37>

**Application deadline: 4 February 2021**

# Wanted

## Special Issue “Deepwater Fishes” - An invitation from Guest Editor

(For info: this journal has the Directory of Open Access Journals (DOAJ) Seal which is awarded to journals that demonstrate best practice in open access publishing.)

Dear Colleagues,

This is to let you know that the open access journal, Journal of Marine Science and Engineering (IF: 2.033, ISSN 2077-1312) is pleased to announce the launching of a new Special Issue entitled “Deepwater Fishes”, for which I am serving as Guest Editor.

For further reading, please follow the link to the Special Issue Website at:

[https://www.mdpi.com/journal/jmse/special\\_issues/DeepwaterFishes](https://www.mdpi.com/journal/jmse/special_issues/DeepwaterFishes)

The submission deadline is 15 May 2021. 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 at:

[https://susy.mdpi.com/user/manuscripts/upload/7ba89527275053b265e912f15af57a07?form%5Bjournal\\_id%5D=99&form%5Bspecial\\_issue\\_id%5D=65642](https://susy.mdpi.com/user/manuscripts/upload/7ba89527275053b265e912f15af57a07?form%5Bjournal_id%5D=99&form%5Bspecial_issue_id%5D=65642)

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-water fishes are 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-water fishes and commercial exploitation of some 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. Present Special Issue will provide an overview of the current status of knowledge on the variety of topics related to deep-water fishes, including their taxonomy, zoogeography, phylogeny, molecular biology, evolution, life history, role in the ecosystem, stock assessment, fisheries and management worldwide. Also, the research needs and perspectives for further advancement in this field will be identified. This 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-water fishes 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 Technical University, 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), 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 bathydemersal 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", "Trudy VNIRO" and "Acta Ichthyologica et Piscatoria".

---

## Call for Papers:

### Topical Collection on the "Biodiversity in Abyssal Polymetallic Nodule Areas" in the Journal of Marine Biodiversity.

The extraction of polymetallic nodules from the abyssal seabed will lead to habitat changes and destruction and is likely to have adverse effects on the local fauna. However, there is a lack of biological data from these areas to make informed predictions about how species may respond to mining impacts.

The aim of this TC is to close some knowledge gaps about the abyssal biodiversity of polymetallic nodule areas prior to the start of any mining activities. Submission is now open (and will remain so until June 2021) for original articles, short communications and reviews on all topics related to the biodiversity of species and supraspecific taxa from nodule areas, including, but not limited to, integrative taxonomy, genetic connectivity, biodiversity, and biogeographical studies. Contributions on potential mining effects on the biota and their recovery potential after mining as well as methodological studies for ecological surveying in the frame of mining impact are also welcomed. Authors are encouraged to include identification keys to taxa from the region to aid in identification as part of exploratory surveys and monitoring.

For further information, please visit the MARB website:

<https://www.springer.com/journal/12526/updates/17178708>

Guest editors: Tammy Horton (NOC, Southampton, UK, [tammy.horton@noc.ac.uk](mailto:tammy.horton@noc.ac.uk)), Nuria Sanchez (Universidad Complutense de Madrid, Spain, [nurisanc@bio.ucm.es](mailto:nurisanc@bio.ucm.es)), Stefanie Kaiser (University of Lodz, Poland, [ssm.kaiser@gmail.com](mailto:ssm.kaiser@gmail.com))

# Hot off the Press

## A new species of *Munida* Leach, 1820 (Crustacea: Decapoda: Anomura: Munididae) from seamounts of the Nazca-Desventuradas Marine Park

María de los Ángeles Gallardo Salamanca, Enrique Macpherson, Jan M. Tapia Guerra, Cynthia M. Asorey, & Javier Sellanes, 2021

*PeerJ*, 9, p.e10531

*Munida diritas* sp. nov. is described for the seamounts near Desventuradas Islands, in the intersection of the Salas & Gómez and Nazca Ridges, Chile. Specimens of the new species were collected in the summit (~200 m depth) of one seamount and observed by ROV at two nearby ones. This species is characterized by the presence of distinct carinae on the thoracic sternites 6 and 7. Furthermore, it is not related with any species from the continental shelf nor the slope of America, while it is closely related to species of *Munida* from French Polynesia and the West-Pacific Ocean (i.e., *M. ommata*, *M. psylla* and *M. rufiantennulata*). In situ observations indicate that the species lives among the tentacles of ceriantarid anemones and preys on small crustaceans. The discovery of this new species adds to the knowledge of the highly endemic benthic fauna of seamounts of the newly created Nazca-Desventuradas Marine Park, emphasizing the relevance of this area for marine conservation.



Figure 1: Thanks to Cynthia Asorey (co-author) for highlighting the likeness between *Munida diritas* and this llama (and for giving us all something to smile about!).

Link to paper: <https://doi.org/10.7717/peerj.10531>

## A new genus and species of spionid polychaete (Annelida, Spionidae) from a deepwater cold seep site in the Eastern Mediterranean Sea off Turkey.

James A Blake & Patricia A. Ramey-Balci. 2020.

*Zoosymposia*, 19, 121–134

Abstract: A new spionid polychaete was discovered in deep-sea sediments in the eastern Mediterranean Sea during an expedition by the Ocean Exploration Trust. Specimens were collected by the E/V *Nautilus* in August 2012 off Turkey, at a depth of 2216 m on the Anaximander Seamount at the Amsterdam mud volcano site. Cores were taken from sediments covered with microbial mats. The new species belongs to the *Pygospioopsis-Atherospio* Group, which has unusual neuropodial hooks, modified neurosetae in some anterior setigers, and branchiae in middle body segments that are broad, flattened, and fused to the dorsal lamellae. The new species is assigned to a new genus and species, *Aciculaspioanaximanderi* n. gen., n. sp., and is unusual in having a reduced setiger 1 lacking notosetae; well-developed pre- and postsetal lamellae that encompass the neurosetae and notosetae; notopodial lamellae free from the branchiae in anterior setigers that become fused and flattened in middle and posterior segments; unidentate hooded hooks in both noto- and neuropodia; neuropodial spines in setigers 4–10; and a pygidium with three anal cirri. *Aciculaspio*

*anaximanderi* n. gen., n. sp. is the first species in the *Atherospio-Pygospiopsis* Group collected from a deep-water cold seep habitat.

Link to paper: <https://doi.org/10.11646/zoosymposia.19.1.14>

---

## **The quest for seafloor macrolitter: a critical review of background knowledge, current methods and future prospects.**

Canals, M., Pham, C.K., Bergmann, M., Gutow, L., Hanke, G., van Sebille, E., Angiolillo, M., Buhl-Mortensen, L., Cau, A., Ioakeimidis, C., Kammann, U., Lundsten, L., Papatheodorou, G., Purser, A., Sanchez-Vidal, A., Schulz, M., Vinci, M., Chiba, S., Galgani, F., Langenkämper, D., Möller, T., Nattkemper, T.W., Ruiz, M., Suikkanen, S., Woodall, L.C., Fakiris, E., Jack, M.E.M., Giorgetti, A., 2020.

*Environmental Research Letters.*

The seafloor covers some 70% of the Earth's surface and has been recognized as a major sink for marine litter. Still, litter on the seafloor is the least investigated fraction of marine litter, which is not surprising as most of it lies in the deep sea, i.e. the least explored ecosystem. Although marine litter is considered a major threat for the oceans, monitoring frameworks are still being set up. This paper reviews current knowledge and methods, identifies existing needs, and points to future developments that are required to address the estimation of seafloor macrolitter. It provides background knowledge and conveys the views and thoughts of scientific experts on seafloor marine litter offering a review of monitoring and ocean modeling techniques. Knowledge gaps that need to be tackled, data needs for modeling, and data comparability and harmonization are also discussed. In addition, it shows how research on seafloor macrolitter can inform international protection and conservation frameworks to prioritize efforts and measures against marine litter and its deleterious impacts.

Link to paper: <https://iopscience.iop.org/article/10.1088/1748-9326/abc6d4>

---

## **Rock sponges (lithistid Demospongiae) of the Northeast Atlantic seamounts, with description of ten new species**

Francisca C. Carvalho, Paco Cárdenas, Pilar Ríos, Javier Cristobo, Hans Tore Rapp and Joana R. Xavier, 2020

*PeerJ*, 8, e8703

Contact: [Francisca.Carvalho@uib.no](mailto:Francisca.Carvalho@uib.no)

Lithistid demosponges, also known as rock sponges, are a polyphyletic group of sponges which are widely distributed. In the Northeast Atlantic (NEA), 17 species are known and the current knowledge on their distribution is mainly restricted to the Macaronesian islands. In the Mediterranean Sea, 14 species are recorded and generally found in marine caves. Lithistids were sampled in nine NEA seamounts during the scientific expeditions Seamount 1 (1987) and Seamount 2 (1993) organized by the MNHN of Paris. Collected specimens were identified through the analyses of external and internal morphological characters using light and scanning electron microscopy, and compared with material from various museum collections as well as literature records. A total of 68 specimens were analysed and attributed to 17 species across two orders, seven families, and seven genera, representing new records of distribution. Ten of these species are new to science, viz. *Neoschrammeniella inaequalis* sp. nov., *N. piserai* sp. nov., *N. pomponiae* sp. nov.,

*Discodermia arbor* sp. nov., *D. kellyae* sp. nov., *Macandrewia schusteriae* sp. nov., *M. minima* sp. nov., *Exsuperantia levii* sp. nov., *Leiodermatium tuba* sp. nov. and *Siphonidium elongatus* sp. nov., and are here described and illustrated. New bathymetric records were also found for *D. ramifera*, *D. verrucosa* and *M. robusta*. The Meteor seamount group has a higher species richness (15 species) compared to the Lusitanian seamount group (six species). The majority of the species had their distribution restricted to one seamount, and ten are only known from a single locality, but this can be a result of sample bias. The number of species shared between the seamounts and the Macaronesian islands is very reduced. The same pattern repeats between the NEA and Mediterranean Sea. This study demonstrates that NEA seamounts are ecosystems with a higher diversity of lithistids than previously thought, increasing the number of lithistids known to occur in the NEA and Mediterranean Sea from 26 to 36 species.

Link to paper: <https://doi.org/10.7717/peerj.8703>

## The First In Situ Observation of the Ram's Horn Squid *Spirula spirula* Turns “Common Knowledge” Upside Down.

Lindsay, D.J.; Hunt, J.C.; McNeil, M.; Beaman, R.J.; Vecchione, M., 2020

*Diversity*, 12, 449.

The remotely-operated vehicle ROV SuBastian (R/V *Falkor*, Schmidt Ocean Institute) has been conducting a series of cruises off the Great Barrier Reef, Australia, since summer 2020. On 27 October scientists observed a rare squid in its natural environment for the first time ever, and its behaviour was “opposite” to what had been assumed.

Because Schmidt Ocean Institute has a completely Open data policy, the observation was streaming live on YouTube and Facebook (Dhugal Lindsay was commentating at the time). The discovery was quickly introduced in the New York Times and one month after the initial observation this paper was published. For those of you who have been unable to get to sea for surveys this year, there are lots of new discoveries waiting to be reported in the Schmidt Ocean Institute’s YouTube archives, so have fun! (says Dhugal!).

The ram’s horn squid *Spirula spirula* (Linnaeus, 1758) is the only extant cephalopod with an internal calcareous, chambered shell that is coiled, making it the sole living representative of the once speciose order Spirulida. As also supposed for its Cenozoic and Cretaceous ancestors, the function of the septate, many-chambered shell of *Spirula* has been considered as primarily for buoyancy. Behavioural observations of this species have been confined to those made in aquaria involving freshly net-caught specimens. Invariably, during those aquaria observations, the posterior end containing the open planispiral shell pointed towards the top of the tank, while the upward-oriented terminal fins moved with a rapid “waving or fluttering motion”, presumably attempting to keep the animal submerged. A large photophore is present between the two fins on the posterior end of the body, and this has been observed to emit a “pale, yellowish-green light” that can glow “uninterruptedly for hours”. We report here the first *in situ* observations of *S. spirula* in its natural habitat, illustrating the importance of such observations for a correct understanding of the ecology of deep-water organisms.

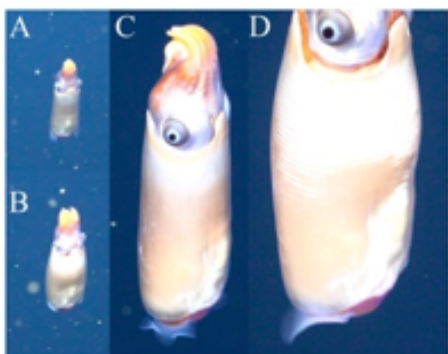


Figure 1. Frame grabs from the 4K video record of *Spirula spirula* observed *in situ*: (A) resting position with no part of the interior shell visible external to the mantle; (B) inflated mantle prior to jetting escape showing the lack of mantle inflation in the area of the internal shell; (C) resting position with curled arms; and (D) hyperinflated mantle at start of jetting escape.

Link to paper: <https://www.mdpi.com/1424-2818/12/12/449>



Schmidt Ocean Institute paid for the cost of publishing it Open Access. Thank you!

## Currents and topography drive assemblage distribution on an active hydrothermal edifice

Fanny Girard, Jozée Sarrazin, Aurélien Arnaubec, Mathilde Cannat, Pierre-Marie Sarradin, Benjamin Wheeler, Marjolaine Matabos, 2020

*Progress in Oceanography*, 187, 102397

The deep sea is characterized by a wide range of landscapes, including complex features where topography and currents interact to form highly heterogeneous habitats. In addition to a complex topography, hydrothermal vent environments are characterized by strong environmental gradients that structure the spatial distribution of biological communities. The role of vent fluid temperature and chemical composition on species distribution is now well understood, but investigations on the effects of the complex sulfide edifice topography are scarce. Here, we used a novel approach combining 3D photogrammetric reconstruction, in situ

environmental measurements and modeling to characterize assemblage distribution on the active edifice Eiffel Tower (Lucky Strike, Mid-Atlantic Ridge). Through the analysis of a high-resolution 3D model of the edifice, we show that assemblage distribution along with hydrothermal activity vary with their position on the edifice. Although physical terrain variables had a minor effect on assemblage distribution, the distance from fluid exits explained the distribution of most assemblages. However, these particular variables did not significantly explain the distribution of medium-sized *Bathymodiolus azoricus* mussels, the dominant assemblage on the edifice. Similarly, proximity to fluid exits only partially accounted for the distribution of microbial mats throughout the edifice. By modeling the current-driven dispersion of hydrothermal plumes around the edifice, we demonstrated that differences in mussel sizes may be due to differences in exposure time to currents bringing plume material. For the first time, we provide evidence that hydrothermal plumes can affect faunal assemblages meters away from fluid exits and that this relatively long-distance effect of vent plumes can fully account for microbial mat distribution throughout the edifice. Our findings extend the area of influence of hydrothermal plumes on vent communities considerably beyond previous estimations and suggest that the interactions between bottom currents, topography and smoker locations should be further investigated and considered as important structuring factors at vents. This novel approach, allowing to cover large areas of the seafloor, is particularly well suited for deep environments where topography and currents interact to form complex oceanographic patterns (e.g. canyons, seamounts). Its application to larger areas and various ecosystems can significantly enhance our understanding of benthic communities' distributions at large.

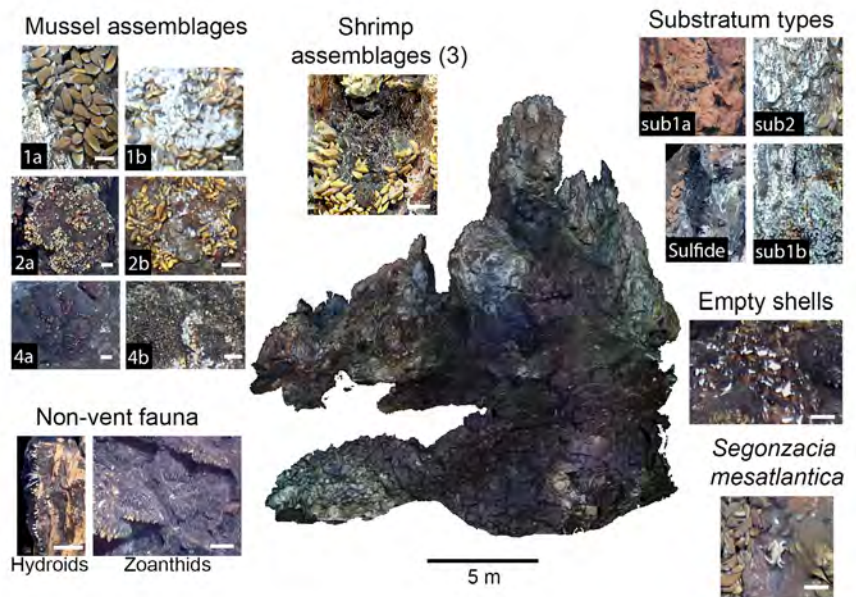


Figure: "3D photogrammetric reconstruction of the active hydrothermal edifice Eiffel Tower (Lucky Strike vent field, Mid-Atlantic Ridge). The different faunal assemblages and substrata visible on the edifice are represented. Unless indicated otherwise, all scale bars represent a distance of 5 cm."

Link to paper: <https://doi.org/10.1016/j.pocan.2020.102397>

# Wooden Stepping Stones: Diversity and Biogeography of Deep-Sea Wood Boring *Xylophagidae* (Mollusca: Bivalvia) in the North-East Atlantic Ocean, With the Description of a New Genus

Chiara Romano, Amandine Nunes-Jorge, Nadine Le Bris, Greg W. Rouse, Daniel Martin and Christian Borowski, 2020

*Frontiers in Marine Science*

Contact: [cromano@ceab.csic.es](mailto:cromano@ceab.csic.es)

Organic matter is never thrown away in the deep sea!

Sunken wood reaching the seafloor becomes a food source supporting unique deep-sea life, including wood-degrading and chemo-synthetic organisms. Wood-boring bivalves of the family *Xylophagidae* are primarily responsible for the structural degradation and recycling of deep-sea wood. They are keystone organisms for the assemblages living on these ephemeral ecosystems, but their actual diversity and biogeographic distribution are virtually unknown.

Using experimentally wood deployed from boreal to temperate latitudes in NE Atlantic and Mediterranean waters and from 130 to 2,300 m depth, we have: (1) investigated the diversity and phylogeny of the *Xylophagidae*, (2) obtained their first barcode data, (3) assessed population genetic connectivity for the most common species, and (4) drawn up conclusions on their ecological requirements.

Phylogenetic analyses, based on mitochondrial and nuclear genes (COI, 18S rRNA, 28S rRNA), revealed non-monophyly of *Xylophaga*, the type genus of *Xylophagidae*, and led us to revise its taxonomy and erect the new genus *Xylonora*.

By integrating morphology and genetics, we demonstrated the existence of seven species with contrasting characteristics. For instance, *Xylophaga dorsalis* and the member of the new genus *Xylonora atlantica* occurred frequently and showed wide Atlanto-Mediterranean distributions, broad bathymetric, thermal and salinity ranges, and a relatively high genetic connectivity. In contrast, the bathyal *Abditoconus brava* occurred at both sides of the Mediterranean entrance but showed limited genetic connectivity.

By providing the first DNA barcoding of xylophagids, we expect to facilitate species discrimination and to boost its future taxonomic and ecological knowledge.

Link to the paper: <https://www.frontiersin.org/articles/10.3389/fmars.2020.579959/full>

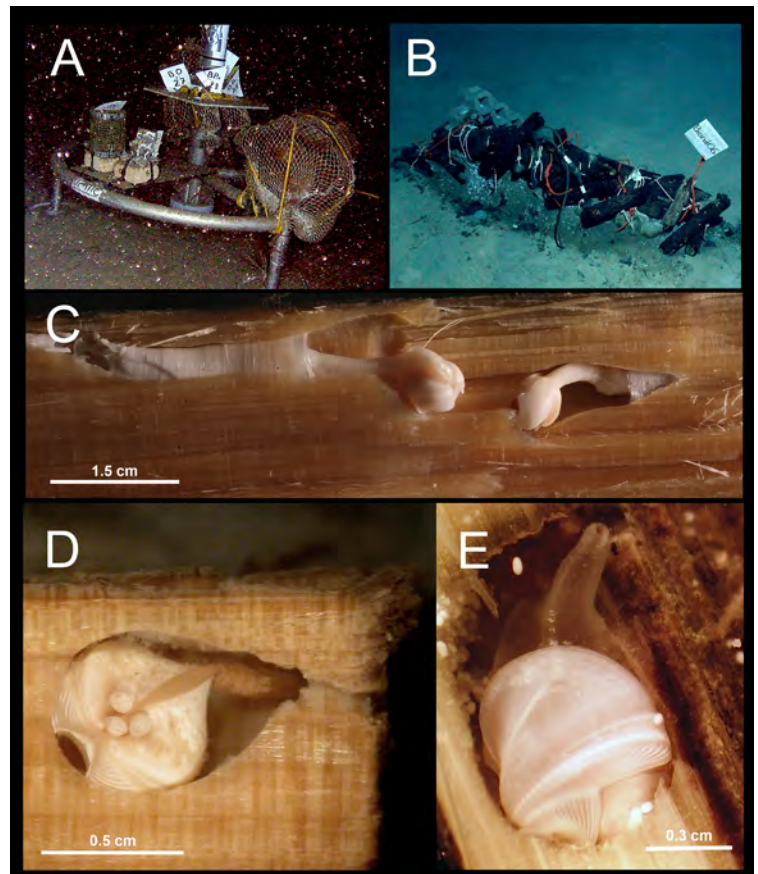


Figure 1 A) Moored lander with wood blocks in Lacaze-Duthiers Canyon, (LECOB LDC monitoring cruises); B) Large wood logs deployed in the deep Nile Fan, (cruise Medeco, DiWood); C) *Xyloredo* sp. 1 in pine wood from Avilés Canyon, 2,000 m depth; D) *Xylonora* sp. 2 in a Chemecoli fir wood cube from the Rainbow hydrothermal vent field (Chemeco Project), E) *Xylophaga dorsalis* in wood from La Fonera Canyon, 130 m deep.

## **Biodiversity, community structure and ecosystem function on kelp and wood falls in the Norwegian deep sea**

Rob P. Harbour, Craig R. Smith, Cornelia Simon-Nutbrown, Marta Cecchetto, Emily Young, Caterina Coral, Andrew K. Sweetman, 2021

*Marine Ecology Progress Series, 657, 73-91*

Fjordic systems in temperate and arctic regions often feature extensive kelp forests at their shallow coastal margins as well as extensive terrestrial forests. Detrital export from these shallow water and terrestrial ecosystems provides important sources of carbon for deep-sea communities in the form of kelp and wood falls. Benthic landers with experimental substrates (wood blocks and kelp parcels) were deployed for 10 months at a depth of 530 m in a deep Norwegian fjord to investigate and compare macro- and megabenthic community structure, biodiversity and ecosystem functioning on kelp and wood falls. Results revealed that while wood and kelp falls can support a similar number of species and abundance of fauna, they support significantly different faunal communities. Biomass and secondary production on both wood and kelp substrates was significantly greater than in the control samples. Secondary production estimates were similar or higher than those reported from soft-sediment ecosystems at shallower European marine sites. Biological trait analysis showed that macrofaunal assemblages were distinct between the kelp and wood, providing evidence for differences in ecosystem function between the substrates. This case study from a deep-sea fjord in Norway provides clear evidence that while wood and kelp organic falls can support similar abundances of fauna, the associated benthic biodiversity, community structure and ecosystem functioning can be dramatically different between these substrates. The work presented here aims to provide information that is useful in assessing the extent of anthropogenic impacts on deep fjord ecosystems with respect to informing future conservation and management strategies.

Link to paper: Mar Ecol Prog Ser 657:73-91. <https://doi.org/10.3354/meps13541>

---

## **Fear and loathing of the deep ocean: why don't people care about the deep sea?**

Alan J Jamieson, Glenn Singleman, Thomas D Linley, Susan Casey, 2020

*ICES Journal of Marine Science*

A recurring question within deep-sea science and conservation is why do not people care about the deep sea? How does the deep-sea science community convince non-scientific audiences to support, engage, and care more for the largest habitat on Earth? Here, we examine various aspects of an apparent dichotomy of perspectives between the scientific and non-scientific communities by discussing the problematic roots from within human neuropsychology, and how knowledge of the deep sea is delivered to, perceived by, and ultimately valued by non-scientific audiences. The answers are complex, covering issues such as conscious and subconscious thalassophobia, perspectivism, aesthetics, phenomenology, abstract interpretation, epistemology and media-driven enigmatization, self-deprecation by the science community, and perceived value-driven ethics. This discussion focusses on the nexus of scientific and non-scientific perceptions to catalyze meaningful societal engagement with the deep sea and to try and understand “Why do not people care about the deep sea?”

Link to paper: <https://doi.org/10.1093/icesjms/fsaa234>

## Biological rhythms in the deep-sea hydrothermal mussel

### *Bathymodiolus azoricus*

Mat A.M., Sarrazin J., Markov G.J., Apremont V., Dubreuil C., Eché C., Fabioux C., Klopp C., Sarradin P.-M., Tanguy A., Huvet A. & Matabos M., 2020

*Nature Communications*, 11(1), 1-12

While circadian rhythms, linked to day/night alternation, occur within all terrestrial living groups, coastal marine organisms also exhibit circatidal rhythms. But whether time could influence the physiology of deep-sea animals was unknown. Direct observations using deep-sea observatories previously evidenced rhythms in community dynamics (Cuvelier *et al.*, 2014; Lelièvre *et al.*, 2017). Other studies also showed tidal-related growth increments on mussel shells (Nedoncelle *et al.*, 2015; Schöne & Giere, 2005). All these clues suggested that tides could play a determining role in the functioning of hydrothermal organisms.

After detecting tidal oscillations in the valve-activity of the vent mussel *Bathymodiolus azoricus*, we designed an original sampling strategy to determine if rhythms were also present in gene expression. Samples were collected at 1700 m depth every 2 hours 4 minutes over 24 hours 48 minutes (2 tidal cycles, ~1 daily cycle), a quite challenging timing with a submersible! Moreover, because we didn't know if these animals could perceive light, sampling was performed under red light to be compatible with chronobiological research. Mussels were "fixed" immediately on the bottom in a hypersaline solution in order to prevent any modification of gene expression during surfacing. Our results, published in Mat *et al.* (2020), show that the temporal transcriptome (i.e. all the expressed genes which provide a snapshot of the physiological state of an organism at time "t") exhibits oscillations which period corresponds to tides. Experiments ran in parallel in the lab strengthened our observations and validated the need to work under red light in the deep-sea. This study was the first to reveal, *in situ*, the presence of biological rhythms in a deep-sea species, both in terms of behavior and molecular sequencing.

The story behind the paper is here <https://go.nature.com/3m0LwPH>.

Link to paper: <https://doi.org/10.1038/s41467-020-17284-4>

---

## Identification of two species of the genus *Antimora* Günther, 1878 (Pisces: Moridae) using some osteological characters

L.A. Jawad, A.M. Orlov, I.V. Grigorov (2020)

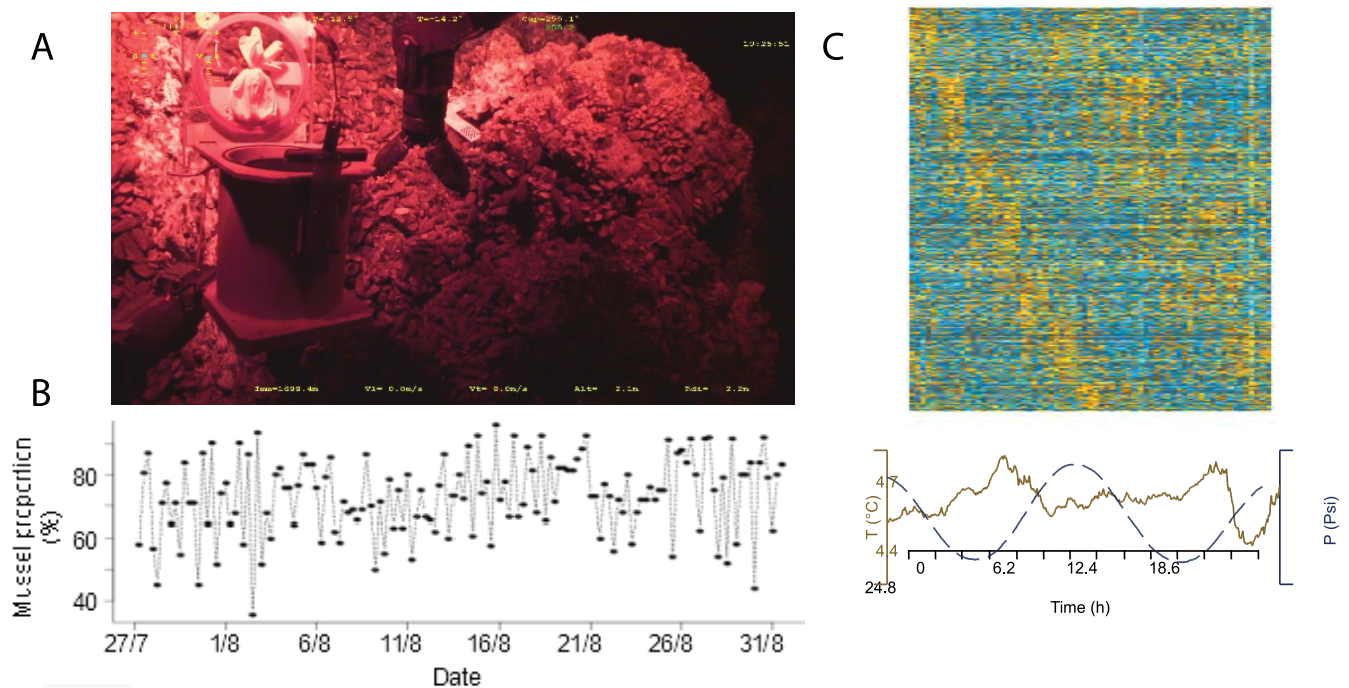
*Cahiers de Biologie Marine* 61: 323-342

This paper presents the results of a comparative study of eight osteological complexes, the structure of the vertebral column, the pattern of interdigitation of the dorsal- and anal-fin pterygiophores, with the neural and haemal spines of the vertebrae, the distribution of the dorsal- and ventral-procurrent caudal-fin rays, the distribution of the principal caudal-fin rays, the morphology of the caudal-fin skeleton and the regionalization of the vertebral column of two species of the genus *Antimora*, teleost fish family Moridae. Osteological characters that may prove valuable for taxonomic purposes are described and can be added to those already present in the diagnostic features of both species. Formulae for the structure of the vertebral column, the interdigitation of the dorsal- and anal-fin pterygiophores, the distribution of the dorsal and ventral procurrent caudal-fin rays, and the distribution of the principal caudal-fin rays are developed. The vertebral column of *A. microlepis* and *A. rostrata* can be divided in six morphologically distinct regions, which

are more complicated than the classical division in truncal and caudal parts only. These descriptive morphological parameters express a morphotype that may be linked with the morid mode of swimming.

Link to paper:

<http://application.sb-roscoff.fr/cbm/article.htm;jsessionid=79FD97BE34AA4BFDD8C3154B52A2F211?execution=e1s1>



Chronobiology study of the vent mussel *Bathymodiolus azoricus*. A. Sampling under red light and RNA fixation on the seafloor with the ROV Victor6000. (copyright: Ifremer/Momarsat 2017). B. Proportion of opened mussels over a month (1 point every 6h) showing tidal rhythm. C. Expression of a subset of genes over a tidal cycle. The graph below shows the evolution of pressure and temperature (Mat et al. 2020).

## Commercial value of trawl macrofauna of the North Pacific and adjacent seas

I.V. Volvenko, A.V. Gebruk, O.N. Katugin, A.A. Ogorodnikova, G.M. Vinogradov, O.A. Maznikova, A.M. Orlov  
(2020)

*Environmental Reviews* 28 (3): 269-283

A checklist of 1541 animal species from the Chukchi, Bering, Okhotsk, and Japan seas and the North Pacific Ocean was generated based on 459 research vessel surveys (68 903 trawl tows at depths from 5 to 2200 m) in the period 1977–2014. The study area spanned over 25 million km<sup>2</sup>. For each species, the scientific name is given, as well as English and Russian common names, along with the following details: areas where species were collected, trawl type (benthic and (or) midwater), real or potential commercial importance, and possible product yield and minimum wholesale prices. Almost 20% of species in trawl catches had no commercial value, and >50% were cheap or very cheap (US\$0.5–\$2/kg). Only 3.3% of species were expensive and very expensive (US\$10–\$30/kg), and their numbers increased from north to south. About 33% of species can be considered as unexploited reserves for fisheries. These are mainly small fishes and invertebrates, with total biomass many times exceeding that of currently exploited biological resources. Product output for most species exceeded 90% of the raw mass. Occurrence of such species was much higher in the pelagic zone than on the seafloor. The most abundant local commercial species are characterized by significant natural fluctuations in abundance. Therefore, a sustainable fishery in the region can be secured (among other factors) by expansion of the assortment of commercial bioresources. A regional supply of bioresources provides such an

opportunity. The checklist can be used for development of bioresource management, aquaculture and conservation, assessment of environmental damage caused by climate change, and (or) anthropogenic impact (including pollution, man-made hydro-technical constructions, oil–gas extractions, nuclear reactor accidents, etc.).

Link to paper: <https://cdnsiencepub.com/doi/10.1139/er-2019-0073>

---

## **Hypothesis of *Antimora* spp.(Moridae) dispersion in the world oceans based on data on modern distribution, genetic analysis, and ancient records**

A.M. Orlov, A.F. Bannikov, S.Y. Orlova (2020)

*Journal of Ichthyology* 60 (3): 399-410

Based on the analysis of the current distribution, the results of the molecular genetic study into the diversity of the mtDNA region (the first subunit of the cytochrome c oxidase I gene (COI)) in the samples of the blue hake *Antimora rostrata* and the Pacific flatnose *A. microlepis*, and the generalization of literature data on fossil records of morids (Moridae), a scheme for hypothetical spreading of these species in the oceans is presented.

Link to paper: <https://link.springer.com/article/10.1134/S0032945220030108>

---

## **Using different hard structures to estimate the age of deep-sea fishes: A case study of the Pacific flatnose, *Antimora microlepis* (Moridae, Gadiformes, Teleostei)**

N.B. Korostelev, P.H. Frey, A.M. Orlov (2020)

*Fisheries Research* 232: Art. 105731

Age was estimated for the Pacific flatnose *Antimora microlepis* using the operculum, vertebrae, otoliths, scales and pectoral finrays. Otoliths and vertebrae were the only structures that produced recognizable marks considered to be annuli. Annuli counts from these two structures were similar producing ages ranging from 5 to 35 years. These two hard structures may be useful to estimate the age of other deep-sea fishes.

Link to paper: <https://www.sciencedirect.com/science/article/pii/S0165783620302484>

---

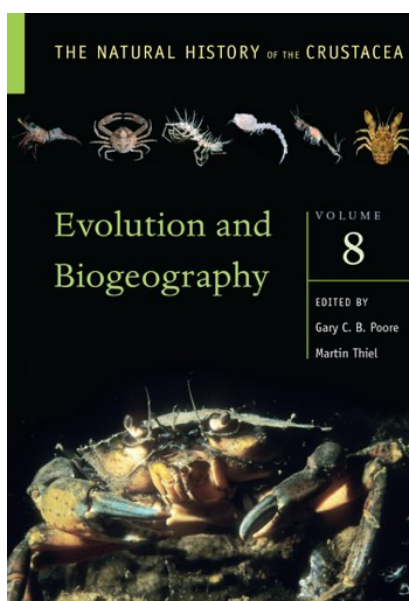
***Bathyraja (Arctoraja) sexoculata* sp. nov., a new softnose skate (Rajiformes: Arhynchobatidae) from Simushir Island, Kuril Islands (western North Pacific), with special reference to geographic variations in *Bathyraja (Arctoraja) smirnovi***

R. Misawa, A.M. Orlov, S.Y. Orlova, I.I. Gordeev, H. Ishihara, T. Hamatsu, Y. Ueda, K. Fujiwara, H. Endo, Y. Kai  
(2020)

*Zootaxa* 4861 (4): 515-543

A new species of softnose skate (Arhynchobatidae), *Bathyraja sexoculata* Misawa, Orlov, Orlova, Gordeev and Ishihara is described on the basis of five specimens collected from off the east coast of Simushir Island, Kuril Islands, located in the western North Pacific. The specimens conformed to the genus *Bathyraja* by having the anteriormost pectoral-fin skeleton almost reaching the snout tip, and a slender unsegmented rostral cartilage. Within *Bathyraja*, the new species belongs to the subgenus *Arctoraja* (currently with four valid species) due to the relatively short tail (79–86% of disc width), high count of predorsal caudal vertebrae (more than 86), and large strong nuchal and scapular thorns. It is most similar to *Bathyraja (Arctoraja) smirnovi*, distributed in the Seas of Japan and Okhotsk, in having tail thorns not extending to the nuchal area, median thorns discontinuous from the nape to the tail, and no mid-dorsal thorns. However, *B. sexoculata* can be distinguished from *B. smirnovi* by the following characters: three pairs of white blotches on the dorsal disc surface (vs. blotches absent, or a pair of white or dark blotches in *B. smirnovi*), dark blotch around cloaca, dark bands along mid ventral line of tail (vs. dark blotch and band usually absent ventral disc surface in *B. smirnovi*), 86–93 predorsal caudal vertebrae (vs. 80–87 in *B. smirnovi*), and a unique mitochondrial DNA cytochrome c oxidase subunit I sequence. Proportional measurements, including disc width, disc length, head length, preoral length, preanial length, internarial distance, eye diameter, and tail length, also differ between the two species. For the referential purpose, geographical variations of *B. smirnovi* distributed in the Seas of Japan and Okhotsk are analyzed and clarified based on morphological and genetic data. Significant morphological and genetic differences were found between local populations in the Seas of Japan and Okhotsk.

Link to paper: <https://www.biotaxa.org/Zootaxa/article/view/zootaxa.4861.4.3>

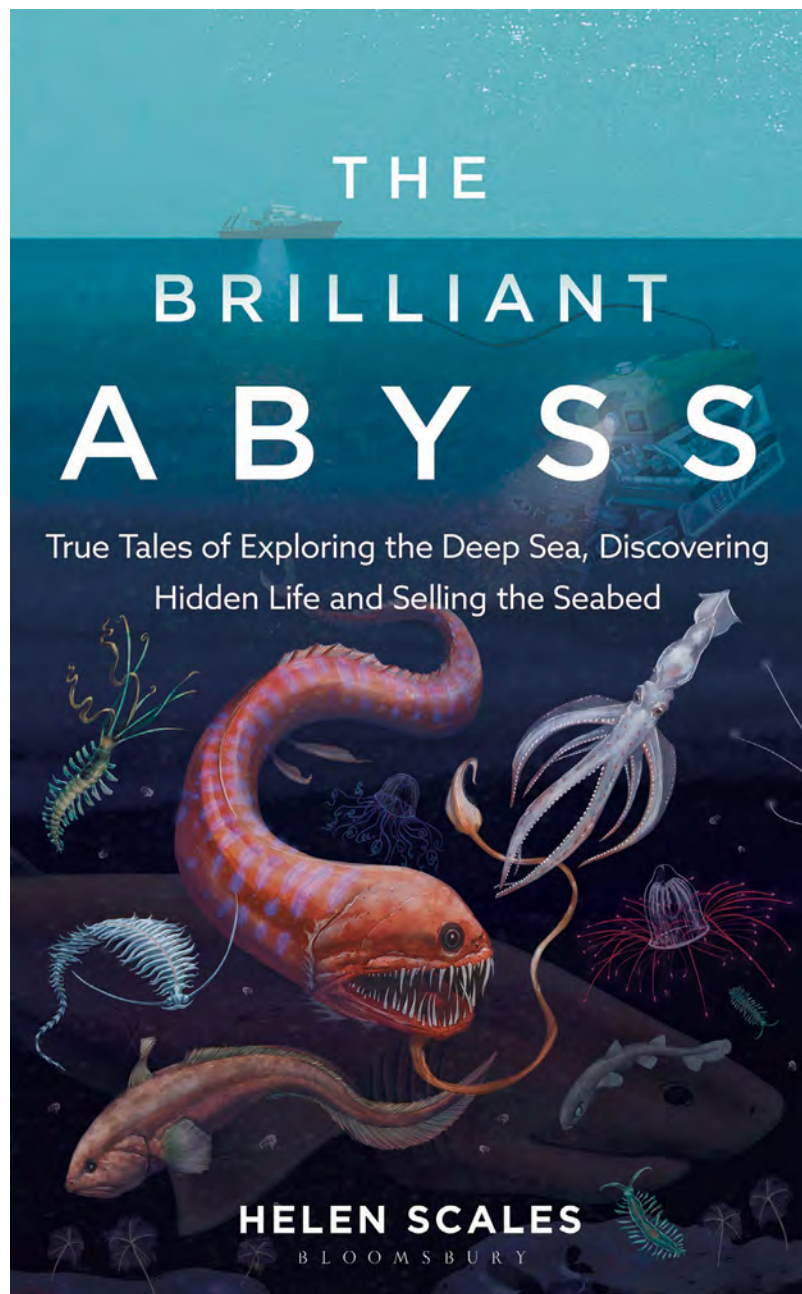


## The Natural History of the Crustacea

Edited by Martin Thiel, Professor of Marine Biology at Universidad Católica del Norte in Coquimbo, Chile and Gary Poore, Curator Emeritus of Marine Biology at Museum Victoria in Melbourne, Australia

This is the eighth volume of a ten-volume series on *The Natural History of the Crustacea*. The volume examines Evolution and Biogeography, and the first part of this volume is entirely dedicated to the explanation of the origins and successful establishment of the Crustacea in the oceans. In the second part of the book, the biogeography of the Crustacea is explored in order to infer how they conquered different biomes globally while adapting to a wide range of aquatic and terrestrial conditions. The final section examines more general patterns and processes, and the chapters offer useful insight into the future of crustaceans.

Link to book: <https://global.oup.com/academic/content/series/n/natural-history-of-crustacea-nhc/?lang=en&cc=au>



Helen Scales, PhD, is a marine biologist, writer, and public broadcaster. She is the author of *Spirals in Time: The Secret Life and Curious Afterlife of Seashells* and *Eye of the Shoal: A Fishwatcher's Guide to Life, the Ocean, and Everything*. She has written for National Geographic, the Guardian, New Scientist, BBC Wildlife Magazine, and BBC Focus, among others, and also presents the Earth Unscrewed podcast. She teaches marine biology and science writing at Cambridge University, UK and advises the marine conservation charity Sea Changers. She divides her time between Cambridge, England, and the French coast of Finistère.

Helen has turned her attention to the deep ocean with her latest book which is due for release in March 2021:

"The oceans have always shaped human lives," writes marine biologist Helen Scales in her vibrant new book *The Brilliant Abyss*, but the surface and the very edges have so far mattered the most. "However, one way or another, the future ocean is the deep ocean."

The deep sea is the last, vast wilderness on the planet. For centuries, myth-makers and storytellers have concocted imaginary monsters of the deep, and now scientists are looking there to find bizarre, unknown species, chemicals to make new medicines, and to gain a greater understanding of how this world of ours works. With an average depth of 12,000 feet and chasms that plunge much deeper, it forms a frontier for new discoveries.



*The Brilliant Abyss* tells the story of our relationship with the deep sea – how we imagine, explore and exploit it. It captures the golden age of discovery we are currently in and looks back at the history of how we got here, while also looking forward to the unfolding new environmental disasters that are taking place miles beneath the waves, far beyond the public gaze.

Throughout history, there have been two distinct groups of deep-sea explorers. Both have sought knowledge but with different and often conflicting ambitions in mind. Some people want to quench their curiosity; many more have been lured by the possibilities of commerce and profit. The tension between these two opposing sides is the theme that runs throughout the book, while readers are taken on a chronological journey through humanity's developing relationship with the deep sea. *The Brilliant Abyss* ends by looking forwards to humanity's advancing impacts on the deep, including mining and pollution and what we can do about them.

Deep-Sea Life readers can use this discount code for the Bloomsbury website - **SEA20** and will allow 20% off (rrp) via [www.bloomsbury.com/brilliantabyss](http://www.bloomsbury.com/brilliantabyss)

## Sleeping with the enemy: unravelling the symbiotic relationships between the scale worm *Neopolynoe chondrocladiae* (Annelida: Polynoidae) and its carnivorous sponge hosts

Sergi Taboada, Ana Serra Silva, Cristina Díez-Vives, Lenka Neal, Javier Cristobo, Pilar Ríos, Jon Thomassen Hestetun, Brett Clark, Maria Eleonora Rossi, Juan Junoy, Joan Navarro, Ana Riesgo, 2020

*Zoological Journal of the Linnean Society*, zlaa146

Marine annelid polychaetes are known to engage in a multitude of symbiotic relationships. However, there are still many aspects of symbiotic relationships involving polychaetes that need to be addressed in detail. Taboada et al (2020) described the exceptional symbiotic relationship between the deep-water polynoid worm *Neopolynoe chondrocladiae* and its hosts, two carnivorous sponges from the genus *Chondrocladia*. To achieve that they used a combined morphological, molecular and isotopic approach to narrow down the type of symbiotic relationship between the worm and its hosts. Analysis on a faecal pellet recovered from the worm indicated that the polynoid feeds on the crustacean prey captured by the sponge, something corroborated by stable isotope analysis. Interestingly, light and confocal microscopy analyses suggested that *N. chondrocladiae* elytra produce bioluminescence. Taboada et al. (2020) proposed that the worm might be using this bioluminescence as a lure for prey (increasing the food available for both the sponge and the polynoid) and thus fuelling a mutualistic relationship.

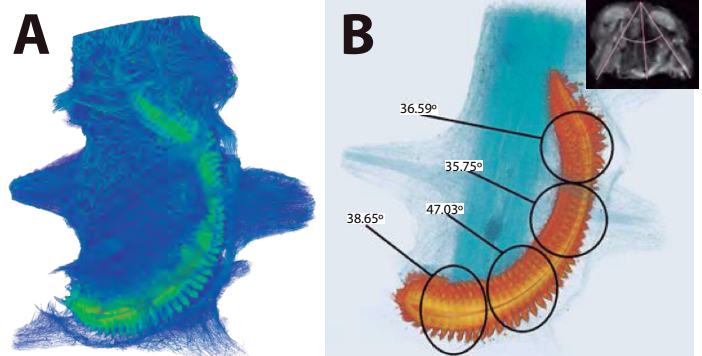


Figure 1 A: microCT scan capture of *C. virgata* (NHMUK 1890.4.10.6) and its symbiotic *Neopolynoe chondrocladiae*. Full video of the scan available at <https://youtu.be/l7woszSZHEk> Figure 1 B: average angle of the parapodia with respect to the body axis of *N. chondrocladiae* along its body.

Link to paper:

<https://academic.oup.com/zoolinnea/advance-article-abstract/doi/10.1093/zoolinnea/zlaa146/6055457>

# Obituaries

## Sergei Evseenko



*18 August 1949 – 15 October 2020*

On October 15, 2020, Sergei Evseenko, a world-renowned scientist, head of the laboratory of oceanic ichthyofauna at the P.P. Shirshov Institute of Oceanology of the Russian Academy of Sciences, died suddenly at the age of 72.

S.A. Evseenko was born on August 18, 1949 in Moscow. After graduation, he was hired at the Federal Research Institute of Fisheries and Oceanography (VNIRO). In 1967, he entered the Lomonosov Moscow State University, where he graduated in 1972 with a degree in Zoology (Specialization - Ichthyology), after which he returned to the laboratory of pelagic fish of VNIRO. Here he was engaged in research on the reproduction and development of commercial and mass fish species in the Atlantic and Pacific oceans. His works were devoted to the problems of morphology and ecology of fish in early ontogeny, as well as to elucidation of the main parameters of reproduction and patterns of distribution and abundance of fish larvae depending on environmental factors. The result of his research was the defense of his PhD dissertation (1979) on the early stages of development of flatfishes in the North-West Atlantic.

In 1983, Sergei joined the Institute of Oceanology as a senior researcher, and in 1999 became head of the laboratory of oceanic ichthyofauna. A significant part of these publications were devoted to the development of problems of morphology, anatomy, individual development and evolution of a new family of flounders discovered by him in the Southern Ocean. In 1998, he defended his doctoral dissertation on this topic.

His main research interests also included taxonomy and ecology of the early stages of fish development at high and low latitudes, including deep-water species. He developed an ecological classification of flatfishes, first described the larvae of several dozen species of oceanic fish species, and identified patterns of distribution of ichthyoplankton in the upwelling areas of the Eastern Pacific and in large-scale frontal zones of the World's oceans. He published about 200 scientific publications, among them, in collaboration with N.V. Parin and E.D. Vasilyeva, he published a major work "Catalog of Fishes of the Seas of Russia". He was a member of 10 long marine expeditions.

For a long time, Sergei held the position of Executive Secretary of the main ichthyological journal of Russia "Voprosy ikhtologii/Journal of Ichthyology", and since 2011 he has been Deputy Editor-in-Chief. Sergey was a worthy successor of the scientific directions laid down by the outstanding Russian ichthyologists, prof. Theodore Rass and corresponding member of the Russian Academy of Sciences, Nikolai Parin.

With the death of Sergei Evseenko, modern ichthyology suffered an irreparable loss. Colleagues remember him as an intelligent, friendly and cheerful person. He was rightfully respected and loved by everyone. Everyone who was lucky enough to know this wonderful man and outstanding scientist will keep a bright memory of him.

## Lev I. Moskalev



4 January 1935 – 4 December 2020

### IN MEMORIAM

The distinguished marine biologist, Lev I. Moskalev, passed on the 4 December 2020 at the age of 85. The student of academician Lev A. Zenkevitch, Lev Moskalev began his scientific career in the legendary era of the Soviet RV *Vityaz* expeditions, the time of glorious discoveries in deep-sea oceanography.

Born and educated in Moscow, Lev graduated from the Moscow State University. He spent his first years in marine science (1957-1960) in the North, at the Biological Station *Dal'niye Zelentsy* on the Barents Sea coast. His entire life after that was linked with the Laboratory of Benthos (since 1983 - the Laboratory of Ocean Benthic Fauna) of the P.P. Shirshov Institute of Oceanology in Moscow.

Lev worked in various fields of marine biology, however his main area always remained malacology. His PhD (1968) dealt with the systematics and zoogeography of the mollusc family Acmaeidae from the Pacific Ocean. In 1977 Lev conducted a world revision of the family Lepetidae (Gastropoda). Among his scientific interests was the mollusc class Monoplacophora, the fascinating example of the deep-sea "living fossils". Among seven Recent monoplacophoran genera currently accepted three were established by Lev Moskalev. Altogether Lev described 16 new species and 14 new genera in the phyla Mollusca and Echinodermata. Fourteen animal species in various taxa were named after Lev in the recognition of his merits.

In the last period of his career Lev dealt with the hydrothermal vent fauna. In the Soviet Union Lev was among pioneers in this field and one of the first scientific observers in the deep diving manned submersibles *Pisces* and *Mir*. Lev spent in dives in total 200 hours, his deepest dive was at 5460 m. With more than 30 oceanographic cruises, mainly the deep-sea, Lev spent at sea several years of his life.

Apart from marine science, Lev was a dedicated historiographer and the archive keeper. More than others he understood the importance of historical records for the continued development of science. The archive of Lev is a storage of unique historical documents, the real cultural heritage of the passing era of "heroic oceanography". In 2005 Lev authored a popular science book "Masters of the Deep" describing some personalities and episodes in the history of ocean exploration.

Lev was involved in the research not only rationally but also passionately. We'll cherish his stories about joint expeditions and meetings with legends of the deep-sea biology, many of them his friends – Lev Zenkevitch, Zinaida Filatova, George Belayev, Torben Wolff, Hjalmar Thiel, Eve and Allan Southward, Michael Türkay and others. Lev was a very hospitable host; many visitors of our lab remember with gratitude the happy time spent in his welcoming home.

We were really lucky to cross with Lev in our lives, to be friends with him and work together in marine science.

Colleagues from the Laboratory of Ocean Benthic Fauna,

P.P. Shirshov Institute of Oceanology, Moscow

## Robert R. Hessler



17 October, 2020

### A giant of deep-sea biology

Deep-sea biology lost a giant when Robert (Bob) R. Hessler passed away on 17 October, 2020 at the age of 87. Bob had a profound influence on the field and people of deep-sea biology, pioneering use of the HOV *Alvin* in the mid 1960's, fundamentally advancing our understanding of deep-sea biodiversity from sediments to hydrothermal vents, developing key oceanographic equipment used to sample and study deep-sea ecosystems, and inspiring and training a remarkable number of talented deep-sea scientists. Bob's career in deep-sea biology began serendipitously at Woods Hole Oceanographic Institution in 1960, spanned decades at Scripps Institution of Oceanography from 1969 - 2000, and extended beyond his retirement.

Bob's many, many contributions to our understanding of deep-sea biology were summarized as follows in the special 1998 volume of *Deep-Sea Research II* titled 'Deep-sea biodiversity: a tribute to Robert R. Hessler', honoring his impending retirement (Smith et al., 1998).



Main image article, top: Bob Hessler with his baby, the USNEL box corer, early 1980's. Above left: Bob Hessler greeting Japanese Emperor Hirohito at Scripps Institution of Oceanography mid 1970s. Above right: Hessler in an equator crossing ceremony, 1973.

"Although the deep-ocean fauna had been sampled since the Challenger Expedition in 1872, the biodiversity of the deep-sea floor was unappreciated until the year 1967, when Hessler and Sanders published their now classic paper "Faunal Diversity in the Deep-Sea". This publication was the first of many works authored or co-authored by Hessler elucidating the biodiversity of deep-sea ecosystems. Hessler's remarkable contributions range from design of sampling equipment, through community characterization and ecological theory, to taxonomic description and phylogenetic analysis. Below we highlight some of his most noteworthy contributions to the study of deep-sea biodiversity. Because of the great breadth of his work, it is inevitable that we will fail to mention many of his contributions.

"In 1967, Hessler and Howard Sanders provided the first quantitative analysis of large deep-sea macrofaunal samples, discovering remarkable levels of species richness (up to 365 species) in epibenthic-

sled hauls from 1400 to 4700 m depths along the Gay Head-Bermuda Transect. This is among the most widely cited papers documenting high deep-sea species diversity, and is the seminal work in the now 30 yr old debate on mechanisms maintaining species diversity in the deep ocean. Interestingly, Hessler's and Sanders' results are remarkably similar to



Above left: Bob Hessler and Craig Smith at Craig's dissertation defense, 1983. Above right: Bob Hessler with wife Cece and a new piece of oceanographic equipment named after Bob (Ray is Bob's middle name).

those from the more intensive study of Grassle and Maciolek (1992); in fact, Grassle and Maciolek suggest that the main reason for higher species richness in their own study is that major advances in deep-sea systematics (produced in part by Hessler, see below) now allow identification of many more species than could be resolved in 1967. The Hessler and Sanders (1967) paper is also noteworthy because it introduced (1) the subsequently widely used epibenthic sled and (2) the sled-sample collection from the Gay Head-Bermuda Transect. The Gay Head-Bermuda samples have figured prominently in numerous studies of deep-sea diversity (e.g. Rex, 1973, 1976, 1983; Etter and Rex, 1990; Rex et al., 1993), including papers in this volume (Rex and Etter; Pineda and Caswell; Wilson). These sled samples also provided material for Hessler's (1970) monograph, "The Desmosomatidae (Isopoda, Assellota) of the Gay Head-Bermuda Transect", which is regarded by carcinologists as a classic study of the systematics of deep-sea isopods (Torben Wolff, personal communication). Following their 1967 paper, Hessler and Sanders collaborated on a pair of influential publications in *Science* dealing with the diversity and ecology of North Atlantic deep-sea benthos (Sanders and Hessler, 1969a, b).

"In 1972, as ecologists pondered the causes of high deep-sea species diversity, Hessler and Paul Dayton (Dayton and Hessler, 1972) introduced the "cropping hypothesis", suggesting that competitive exclusion in deep-sea macrofauna is prevented by predation from mobile mega- and macrobenthos; thus, a high diversity of competing species could coexist. This theory still figures prominently in discussions of deep-sea diversity maintenance and is the topic of current experimental studies in the deep sea (D. Thistle and J. Eckman, pers. commun.).

"The 1974 paper by Hessler and Jumars, titled "Abyssal Community Analyses from Replicate Box Cores in the Central North Pacific", yielded another major advance in the appreciation of deep-sea diversity. This was the first study to document high diversity on local (1 m<sup>2</sup>) scales in the deep sea, and demonstrated that a plethora of deposit-feeding species could coexist even in the most oligotrophic of deep-ocean habitats. This paper also introduced the USNEL box corer as a quantitative sampler for deep-sea macrofauna; the box corer continues to be used throughout the world in studies of infaunal benthos.

"Hessler's work has not been restricted to the fauna living on or in soft sediments. Through baited camera and trap studies, Hessler helped demonstrate that mobile scavengers, such as large amphipods and macrourid fish, are a ubiquitous component of deep-sea communities (Hessler et al., 1972, 1978; Dayton and Hessler, 1972; Shulenberg and Hessler, 1974; Ingram and Hessler, 1983). This work substantially expanded appreciation for the range of niches and adaptations present in deep-sea ecosystems. In the late 1970s and early 1980s, Hessler became concerned about environmental threats to deep-sea biodiversity posed by manganese-nodule mining and radioactive waste disposal. He helped plan and conduct programs to evaluate nodule-mining effects on seafloor communities (e.g. National Research Council, 1984; Wilson and Hessler, 1987b), and contributed substantially to studies of the hazards of subseabed disposal of high-level nuclear wastes (e.g. Hessler and Jumars, 1979). A number of important papers addressing basic deep-sea ecology emerged from these environmental impact studies (e.g. Snider et al., 1984; Ingram and Hessler, 1983, 1987). As is widely recognized, Hessler has also been a major player in studies of the ecology and phylogeny of the hydrothermal-vent fauna. He participated in the first biological cruise to deep-sea vents on the Galapagos Spreading Center in 1979, and has authored or co-authored papers on the community structure, dispersion patterns, succession, population genetics, endosymbiosis, taxonomy and biogeography of vent biota (e.g. Hessler and Smithey, 1983; Hessler et al., 1985, 1988; Smith and Hessler, 1987; Johnson et al., 1988; Stein et al., 1988; Hessler and Lonsdale, 1991; France et al., 1992). Many of the more dramatic early photographs of vent ecosystems viewed by the general public were obtained from Hessler's specially designed stereo camera mounted on Alvin's manipulator.

"To round out his research of relevance to deep-sea biodiversity, Hessler has contributed substantially to elucidation



Above left: Lisa Levin lab commemorating Bob at sea, 2020. Above right: Bob Hessler flanked by Bob George on the left and Torben Wolff on the right. Taken at Ocean Assembly in Edinburgh, UK.

of the systematics and evolution of the deep-sea fauna. Groups that have received his particular attention include the cephalocarids (e.g. Hessler and Sanders, 1972), isopods (e.g. Hessler, 1970; Hessler and Thistle, 1975; Hessler et al., 1979), leptostracans (Hessler, 1984), malacostracans (Hessler and Wilson, 1983), komokiacean Foraminifera (Tendall and Hessler, 1977), and the deep-sea fauna in general (Wilson and Hessler, 1987a). The breadth of these studies is truly impressive.

“Hessler has, more than any other scientist, shaped the face of current deep-sea research through the training of graduate students. Hessler chaired or co-chaired the Ph.D. committees of Frank Rowkop, Peter Jumars, David Thistle, Joe Siebenaller, Leslie Snider, Craig Smith, George Wilson, Lauren Mullineaux, Michel Boudrias, Joan Bernhard, and Scott France, and helped to inspire other students such as Lisa Levin, Jesus Pineda, James Barry and Eric Vetter. Many Hessler students have made significant contributions to the study of deep-sea biodiversity and ecology...

“In summary, Robert Hessler has profoundly influenced our understanding of deep-sea biodiversity and of deep-sea biology in general.”

It is difficult to imagine what our current understanding of deep-sea biodiversity would be if Hessler had not joined the Woods Hole Oceanographic Institution after earning his Ph.D. in paleontology at the University of Chicago in 1960 and been encouraged by Howard Sanders to work in the deep ocean. At Scripps, Bob was the first biology faculty member with a nearly exclusive focus on the deep sea.

Bob authored or co-authored more than 130 papers on deep-sea biology and biodiversity, the functional morphology and evolution of marine arthropods, and the potential environmental impacts of manganese nodule mining. Bob was also very instrumental in making “deep-sea biology” a major, collaborative, international field of study. He was the first to organize an international meeting called the International Deep-Sea Biology Symposium, which now meets every three years and draws more than 400 scientists from at least 30 countries. He hosted a long list of international colleagues, postdocs and students at his lab at Scripps, stimulating a collaborative spirit across deep-sea biology.

Bob was passionate and adventurous in his desire to understand deep-sea ecosystems, inspiring students and colleagues alike. As Tony Rice said: “What a giant he was, with a mind like a surgeon’s scalpel.” Myriam Sibuet points out: “He was a mentor during my early career in abyssal biology. He encouraged me in my early days of Echinoderm taxonomy and also opened my way to ecology by working on species diversity.” And from Hjalmar Thiel “There was a common sense between Bob and myself, and in addition to our interests in science and ocean protection a life-long friendship developed”. Paul Tyler comments “Bob had a universal influence in deep-sea biology and although geographically distanced from him he offered me valuable advice and guidance in the earlier parts of my career”. Bob George recalls “I first met Dr. Hessler along with Dr. Howard Sanders and Dr. Bob Higgins in 1963 in Madras India when they came to study marine benthic diversity in the Bay of Bengal. I arranged a “Catamaran” cruise and we successfully took several anchorage dredge samples. This study led to the paper by Hessler and Sanders to prove their “Time Stability Hypothesis.” Bob was affable and had the gift of deep dedication to deep-ocean ecology. We all lost a great deep-sea ecologist who deeply cared for saving marine biodiversity.”

Bob also excelled as a teacher. His classes and lectures on deep-sea biology, hydrothermal vent ecology, and marine arthropods were extremely popular at Scripps and elsewhere. He was an extraordinary, beloved adviser of graduate students, and in 1999 was the first Scripps professor to win the Distinguished Teaching Award from the University of California at San Diego Academic Senate. In nominating remarks for the award, colleagues noted that Hessler had enticed students with world-class teaching and advised graduate students for the past 27 years. They added that his

contributions included shaping, perpetuating and invigorating the field of deep-sea biology.

In retirement, Bob continued to make regular visits to Sweden for his work on crustacean morphology and evolution. He also turned to another of his passions – art – devoting considerable time to painting and sculpture.

Bob will be dearly missed as a deep-sea biologist, colleague, mentor, teacher, friend, artist and outdoor enthusiast, but his memory will live on in the vibrant field and community of scientists that he helped to shape.

Craig R. Smith and Lisa A. Levin

### References

- Dayton, P.K., Hessler, R.R., 1972. Role of biological disturbance in maintaining diversity in the deep-sea. *Deep-Sea Research*, 19, 199-208.
- Etter, R.J., Rex, M.A., 1990. Population differentiation decreases with depth in deep-sea gastropods. *Deep-Sea Research* 37, 1251-1261.
- France, S.C., Hessler, R.R., Vrijenhoek, R.C., 1992. Genetic differentiation between spatially disjunct populations of the deep-sea, hydrothermal vent-endemic amphipod *Ventiella sulfuris*. *Marine Biology* 114, 551-559.
- Grassle, J.F., Maciolek, N.J., 1992. Deep-sea species richness: regional and local diversity estimates from quantitative bottom samples. *American Naturalist* 139, 313-341.
- Hessler, R.R., 1970. The Desmosomatidae (Isopoda, Asellota) of the Gay Head-Bermuda Transect. *Bulletin of the Scripps Institution of Oceanography* 15, 1-185.
- Hessler, R.R., 1984. *Dahliella calderiensis*, new genus, new species: a leptostracan (Crustacea, Malacostraca) from the deep-sea hydrothermal vents. *Journal of Crustacean Biology* 4, 655-664.
- Hessler, R.R., Ingram, C.L., Yayanos, A.A., Burnett, B.R., 1978. Scavenging amphipods from the floor of the Philippine Trench. *Deep-Sea Research* 25, 1029-1047.
- Hessler, R.R., Isaacs, J.D., Mills, E. L., 1972. Giant amphipod from the abyssal Pacific Ocean. *Science* 175, 636-637.
- Hessler, R.R., Jumars, P.A., 1974. Abyssal community analysis from replicate box cores in the Central North Pacific. *Deep-Sea Research* 21, 185-209.
- Hessler, R.R., Jumars, P. A., 1979. The relation of benthic communities to radioactive waste disposal in the deep-sea. *Ambio Special Report* 6, 93-96.
- Hessler, R.R., Lonsdale, P.F., 1991. Biogeography of Mariana Trough hydrothermal vents. *Deep-Sea Research* 38, 185-199.
- Hessler, R.R., Sanders, H.L., 1967. Faunal diversity in the deep-sea. *Deep-Sea Research* 14, 65-78.
- Hessler, R.R., Sanders, H.L., 1972. Two new species of *Sandersiella* (Cephalocarida) including one from the deep sea. *Crustaceana* 24, 181-196.
- Hessler, R.R., Smithey, W.J. Jr., 1983. The distribution and community structure of megafauna at the Galapagos Rift hydrothermal vents. In: Rona, P., Bostrom, K., Laubier, L., Smith, K. Jr., (Eds.), *Hydrothermal Processes at Seafloor Spreading Centers*. Plenum, New York, pp. 735-770.
- Hessler, R.R., Smithey, W.M. Jr., Keller, C.H., 1985. Spatial and temporal variations of giant clams, tube worms and mussels at deep-sea hydrothermal vents. *Bulletin of the Biological Society in Washington* 6, 411-428.
- Hessler, R.R., Thistle, D., 1975. On the place of origin of deep-sea isopods. *Marine Biology* 32, 155-165.
- Hessler, R.R., Wilson, G.D.F., 1983. The origin and biogeography of malacostracan crustaceans in the deep sea. In: Sims, R W., Price, J.H., Whalley, P.E.S. (Eds.), *Evolution, Time and Space: The Emergence of the Biosphere*. Academic Press, London, pp. 227-254.

- Hessler, R.R., Wilson, G.D., Thistle, D., 1979. The deep-sea isopods: A biogeographic and phylogenetic overview. *Sarsia* 64, 67-75.
- Hessler, R.R., Smithey, W.M., Boudrias, M.A., Keller, C.H., Lutz, R.A., Childress, J.J., 1988. Temporal change in megafauna at the Rose Garden hydrothermal vent (Galapagos Rift; eastern tropical Pacific). *Deep-Sea Research* 35, 1681-1709.
- Ingram, C.L., Hessler, R.R., 1983. Distributional and behavioral patterns of scavenging amphipods from the central North Pacific. *Deep-Sea Research* 30, 683-706.
- Ingram, C.L., Hessler, R.R., 1987. Population biology of the deep-sea amphipod *Eurythenes gryllus*: inferences from in situ analyses. *Deep-Sea Research* 34, 1889-1910.
- Johnson, K.S., Childress, J.J., Hessler, R.R., Sakamoto-Arnold, C.M., Beehler, C.L., 1988. Chemical and biological interactions in the Rose Garden hydrothermal vent field, Galapagos spreading center. *Deep-Sea Research* 35, 1723-1744.
- National Research Council, 1984. Deep Seabed Stable Reference Areas. National Academy Press, Washington, DC, 74 pp.
- Rex, M.A., 1973. Deep-sea species diversity: decreased gastropod diversity at abyssal depths. *Science* 181, 1051-1053.
- Rex, M.A., 1976. Biological accommodation in the deep-sea benthos: comparative evidence in the importance of predation and productivity. *Deep-Sea Research* 23, 975-987.
- Rex, M.A., 1983. Geographic patterns of species diversity in the deep-sea benthos. In: Rowe, G T., (Ed), *The Sea* vol. 8: Deep-Sea Biology. Wiley Interscience, New York, pp. 453-472.
- Rex, M.A., Stuart, C.T., Hessler, R.R., Allen, J.A., Sanders, H.L., Wilson, G. D., 1993. Global scale latitudinal patterns of species diversity in the deep-sea benthos. *Nature* 365, 636-639.
- Sanders, H.L., Hessler, R.R., 1969a. Diversity and composition of abyssal benthos. *Science* 166, 1034.
- Sanders, H.L., Hessler, R.R., 1969b. Ecology of the deep-sea benthos. *Science* 163, 1419-1424.
- Shulenberg, E., Hessler, R.R., 1974. Scavenging abyssal benthic amphipods trapped under oligotrophic central North Pacific Gyre waters. *Marine Biology* 28, 185-187.
- Smith, C.R. and R. R. Hessler. 1987. Colonization and succession in deep-sea ecosystems. *Trends in Ecology and Evolution* 2: 359-363.
- Smith, C.R., L. A. Levin and L. S. Mullineaux. 1998. Deep-Sea Biodiversity: A tribute to Robert R. Hessler. *Deep-Sea Research II*, 45, 1-12.
- Snider, L.J., Burnett, B.R., Hessler, R.R., 1984. The composition and distribution of meiofauna and nanobiota in a central North Pacific deep-sea area. *Deep-Sea Research* 31, 1225-1249.
- Stein, J., Cary, S.C., Hessler, R., Ohta, S., Vetter, R., Childress, J., Felbeck, H., 1988. Chemoautotrophic symbiosis in a hydrothermal vent gastropod. *Biological Bulletin* 174, 373-378.
- Tendall, O.S., Hessler, R.R., 1977. An introduction to the biology and systematics of Komokiacea (Textulania, Foraminifera). *Galathea Report* 14, 1-104.
- Wilson, G., Hessler, R., 1987a. Speciation in the deep sea. *Annual Review of Ecological Systematics* 18, 185-207.
- Wilson, G., Hessler, R., 1987b. The effects of manganese nodule test mining on the benthic fauna in the North Equatorial Pacific. In: Spiess, F., Hessler, R., Weydert, M. (Eds.), *Environmental effects of Deep-Sea Dredging*. Scripps Institution of Oceanography, La Jolla, CA, pp. 24-86.



# Deep-Sea Biology Society News

## President's Letter

January 2021

Dear Deep-Sea Biology Colleagues,

I write to you in January from the cold, empty streets of a Covid-19 locked-down London. For those of us used to celebrating the new year with plans of travel, adventures in the mountains or just thinking ahead to exciting new meetings and projects with our colleagues, it has not been the easiest start. Many of us are having to undertake home-schooling of our children, childcare and maintain work commitments without any support. Many of us are also having to deal with the trauma of being denied access to loved ones, or worse, losing them. For the younger generation of scientists just starting out, almost all of them are having to find their way in a scientific landscape that lacks all the usual routes of social interactions and engagements. Christmas parties, chats over coffee, impromptu corridor conversations, and of course, in-person meetings have all gone, for the time being.

From what I remember of in-person meetings (it's starting to feel like a distant memory...) the most important bits were often between sessions, or during coffee when it would be possible to have one-to-one conversations with people, perhaps make agreements and ideas that you could then take back to the main groups. This was the same whether it was a 500-person conference or ten people around a table. In simple terms, the talks are where you find out things, and the chats where you agree things.

I don't think we are anywhere close to being able to replicate this online, but my goodness we have come a long way in 2020. When I proposed to the Society trustees in April last year that we host an online early-career meeting I had in mind 50 or so people on a one-day Zoom call. I held rather low hopes, I have to admit. In the end, for eDSBS in August last year we had 352 participants, 82 talks and 67 posters over 3 days, with multiple online socials, student networkers, panel events and your President even managed to fluff the prize-giving speeches as in every previous meeting (although he was ably rescued by his 5-year-old daughter and her sticker book). Online meetings clearly have huge potential in their own right, and there is now no excuse for not making all our in-person conferences online-accessible as well.

In 2021, we hope and plan for seeing each other in person again. The 16<sup>th</sup> Deep-Sea Biology Symposium will be held this year in Brest, France between 12-17 September. Travel restrictions permitting, it will be an in-person meeting where everyone can also join the sessions online if they need to. On behalf of the trustees and the membership, I would like to thank our hosts at IFREMER, led by Daniela Zeppilli for taking on this responsibility at such short notice. We are also grateful, and understanding of the reasons for the cancellation of the proposed meeting in Shizuoka, Japan, and look forward to a bid to host the DSBS in Japan again in the future. You can read more about the proposed meeting in Brest later in this message. You can also read below about further work the Society is doing in its key areas of Awards, Communications, Diversity, Membership, Early-Careers, Students, Mentoring, Development and Finances. Remember, the Society is here for all of you, to help you at whatever stage of the career path you are on.

With that in mind, I will close on an important announcement. In our triennial DSBS this September, all of the current serving Trustee positions will be up for re-election, including mine. I will have served five years in my role and it will be time for new leadership and momentum. I strongly encourage anyone that is curious to consider applying for a Trustee role. My motto in the workplace has always been to volunteer for the things you want to do before getting volunteered for the things you don't want to! Working for the Society is fun, rewarding and will give you access to great networking opportunities. It's also full of useful skills and experiences that you can take to your day-to-day work such as leadership, project management, financial management, chairing meetings, organising events and developing long-term strategy. There is no better training in these things than simply getting stuck in and having a go.

Wishing you all a healthy and productive start to 2021,

Adrian Glover,

President, Deep-Sea Biology Society

[president@dsbsoc.org](mailto:president@dsbsoc.org)

## eDSBS Student and Early Career Presentations Awardees

### Early Career Outstanding Talks

Danielle DeLeo (Smithsonian National Museum of Natural History, USA): “Illuminating the impact of diel vertical migration on visual gene expression in deep-sea shrimp”

Cherisse Du Preez (Fisheries and Oceans Canada): “Rapid deep ocean changes with long-lasting results”

### Early Career Outstanding Posters

Mackenzie Gerring (State University of New York College, USA): “Pressure Tolerance in Enzymes of Abyssal and Hadal Fishes”

### Honorable Mention

Shinta Fujimoto (Tohoku University, Japan): “An undescribed genus and species of the phylum Loricifera from Japanese Waters, Northwest Pacific”

### Student Outstanding Talks

Kathrin Busch (GEOMAR, Germany): “Seamount effects on seawater and sponge-associated microbial communities”

### Also Noted for Student talks

Otis Brunner (Okinawa Institute of Science and Technology, Japan): “Hydrothermal Vent Community Assemblage Networks of the North-West Pacific”

Maeva Perez (Université de Montréal, Canada): “Fine scale population structure of a keystone microbial species uncovered with CRISPR”

Jeremy Horowitz (James Cook University, Australia): “Targeted capture of conserved loci provides phylogenomic resolution for black corals (Order Antipatharia) at the generic and species level”

Virginia Biede (Florida State University, USA): “Seamount hard substrate community response to large scale disturbance”

Darrin Schultz (Monterey Bay Aquarium Research Institute, USA): “The chromosome-scale genome assembly of a ctenophore and animal genome architecture”

### Student Outstanding Posters

Charlie Keeney (University of Plymouth, UK and NUI Galway, Ireland): “Combining genetic and visual data to improve identification of Octocorallia (Alcyoniidae and Paramuricea) from the Irish deep-sea”

### Honorable Mention

Sam Afoullouss (NUI Galway, Ireland): “Bioactive Metabolites isolated from North East Atlantic Deep-Sea Corals and Sponges”

Katharine Bigham (Victoria University of Wellington, N.I.W.A., New Zealand): “Effects of turbidity flows on deep-sea benthic communities: signs of early megafauna recovery observed in time-series imagery”

## Awards and Prizes for 2021

Rachel Jeffreys

Awards Officer, [awards@dsbsoc.org](mailto:awards@dsbsoc.org)

### Dive Deeper Research Bursaries

Deadline: 30 June 2021

The Dive Deeper research bursary scheme is designed to support the professional development of deep-sea biology researchers who do not currently have permanent employment. The scheme provides up to £1000 towards activities that can enhance the career prospects of researchers, but does not provide direct salary support. The bursaries can be used for research-related activities that include, but are not limited to, collaborative travel visits, training, oceanographic cruise participation and laboratory work. The bursaries are open to any members of the Society that are without permanent employment, and include PhD candidates who have submitted their PhD, post-doctoral researchers seeking further employment, and retired researchers wishing to carry on research in deep-sea biology.

### Cruise Bursaries

Deadline: none

The Deep-Sea Biology Society cruise bursaries are designed to support student and early-career deep-sea biologists to participate in research cruises, encourage new collaborations and develop new research directions. Bursaries are awarded for travel, subsistence and associated shipping costs required to join a research cruise. These bursaries are open to graduate (Masters and PhD) students and postdoctoral scientists.

Up to £2000 will be awarded to facilitate cruise participation. Successful applicants should provide a twitter feed highlighting the cruise and with links and credit to the DSBSoc and produce a short video blog and report on their return for the Deep-Sea Biology Society website.

### Best PhD-Thesis paper

Deadline: 30 June 2021

This award is to recognise a promising young researcher in the area of deep-sea biology. The first author of the paper must be a current or recent Ph.D. student and a member of the DSBS society. The paper must originate from a Ph.D. thesis within three years of the award deadline. Articles that have been accepted but not published are also eligible. In order to apply an electronic copy of the paper must be submitted alongside a statement from the supervisor of the applicant/nominated Ph.D. candidate, which outlines the importance of the nominated paper and its contribution to the field. The prize is a £500 cash prize.

### Paper of the Year

Deadline: 30 June 2021

The Society is awarding the 'Paper of the Year' award, which will be awarded to an outstanding paper published in the year leading up to the 16th Deep-Sea Biology Symposium and AGM of the Society. The prize will be one-year free membership of the Society and a £100 cash prize.

### Landmark Paper

Deadline: 30 June 2021

The Deep-Sea Biology Society is pleased to accept nominations for the triennial award for the Landmark Paper in Deep-Sea Biology Research. This award honours current and major advancements in research that either: reveal key information, challenge our current understanding, overturn paradigms or significantly bolster the field of deep-sea biology. We are currently accepting nominations for papers published from mid- 2018 to mid- 2021. The prize is £500 cash prize, free society membership and a feature write up on the Deep-Sea Biology Society website and in the newsletter 'Deep-Sea Life'. In order to apply you need to submit a pdf of the paper and the nominator needs to supply a letter (1 page of A4) explaining why they consider this paper to be a landmark contribution to deep-sea biological science.

## 16<sup>th</sup> Deep-Sea Biology Symposium Travel Awards

Deadline: To be announced soon

The Society would like to invite applications for awards towards travel to the 16th Deep-Sea Biology Symposium, France. These awards are open to any members of the society and can be used towards any costs associated with attendance and presentation (oral or poster) at the symposium. The maximum amount that can be requested is £750. Awards will be based on both the quality of the abstract and evidence of financial need. Successful applicants will be required to write a short blog post, report or video blog for the Society website about their experience at the Symposium.

## 16<sup>th</sup> Deep-Sea Biology Symposium Best Oral and Poster Presentations for Students and Early-Career Researchers

Deadline: none

A free membership to the Society will be awarded to the best student as well as early-career oral and poster presentations at 16th Deep-Sea Biology Symposium, Brest, France, 12-17 September 2021.

**All terms and conditions for our awards can be found on our website: <https://dsbsoc.org/grants-awards/society-awards/>.**

---

## Communications

Paris Stefanoudis

Communications Officer, [communications@dsbsoc.org](mailto:communications@dsbsoc.org)

We have been continuously updating the Society's website and social media with content derived from Deep-Sea Life 15, as part of the integration of the communication aspects of the Deep-Sea Biology Society, INDEEP and DOSI, and will continue to do so over the next six months with content from the current Deep-Sea Life issue. You can see some examples on our [website](#) using the tag "Deep-Sea Life". You can also access all previous Deep-Sea Life issues on the Society's [website](#) and the [DOSI website](#).

We are witnessing a continuous growth on our Twitter account, which now stands ~5,900 followers, up ~9% from this point six months ago. We are committed to strengthen our social media presence in the coming months even more, so as to ensure that we stay connected with the growing community of deep-sea biologists around the world. You can follow us [here](#).

We are really keen on promoting the next generation of deep-sea researchers on our social media and website, particularly Black, Indigenous and People of Colour, in order to inspire younger audiences, and promote diversity, inclusivity and equity in our field. This can be a simple tweet with a few lines on the work that you do, a picture, some URLs, or a more comprehensive scientist profile that can be featured on our website. The latter is an initiative that has already been in place for students and early-career researchers (check [here](#)). Therefore, if you are a student or early-career researcher interested in this, please get in touch with the Student Officer ([students@dsbsoc.org](mailto:students@dsbsoc.org)) and Early-Career Officer ([early\\_career@dsbsoc.org](mailto:early_career@dsbsoc.org)), respectively.

Finally, if you want us to help spread the word about upcoming events, courses, new papers etc. that are of interest to the wider deep-sea biology community please direct message us on our Twitter Account or contact our Communications Officer at [communications@dsbsoc.org](mailto:communications@dsbsoc.org).

---

## Diversity

Raissa Hogan

[diversity@dsbsoc.org](mailto:diversity@dsbsoc.org)

We are actively seeking ways to promote and develop diversity initiatives in order to increase representation of under-represented groups in the field of deep-sea biology. In 2021 we hope to develop a strategy to address the above issues and share with our community. Some of our strategic objectives at the moment center on:

social and environmental justice education

creation of a diversity, equity, inclusion and antiracism space

funds aimed at generating opportunities to increase representation and leadership opportunities for Black, Indigenous, People of Colour, and other marginalised groups.

If you have any ideas, areas of concern or would like to be involved in those discussions please contact [diversity@dsbsoc.org](mailto:diversity@dsbsoc.org).

---

## Deep-Sea Biology Society Early-Career Support

Andrea Quattrini

Early Career Officer, [early\\_career@dsbsoc.org](mailto:early_career@dsbsoc.org)

We held several early-career activities in the second half of 2020. A webinar entitled “Global Research Cruise Opportunities: Enhancing opportunities for early-career scientists” kicked off the first day of the virtual eDSBS conference. This webinar included presentations by Eva Ramirez-Llorda (RevOcean), Lucy Woodall (Nekon Foundation, University of Oxford), Leonard Pace (Schmidt Ocean Institute), Kasey Cantwell (NOAA Office of Ocean Exploration and Research), and Nicole Raineault (Ocean Exploration Trust), followed by a Q&A and panel discussion with webinar speakers. In December 2020, we hosted an informal chat with other early-career members of the society about experiences with job searches and applications, which included marine policy, academia, teaching, and government research positions.

There are several activities planned for 2021. The early-career webinar series will continue, with topics that include: 1) How to be an effective chief scientist, 2) Grant writing, 3) How to give an award-winning presentation, and 4) Effective science communication. We will also hold an early-career networking event at the DSBS conference in France.

---

## Students

Ily Iglesias

Student Officer, [students@dsbsoc.org](mailto:students@dsbsoc.org)

We had two very successful student-panel events during eDSBS, where middle-career and senior researchers provided advice and lessons learned about life beyond graduate school in the world of deep-sea science.

In addition to continued communication to our student members, we have been working collaboratively to highlight the research and journey of individual students through the creation of student profiles for the [Society website](#). We have already 10 amazing profiles, and we are really keen to include more in the months to come. If you are interested please do not hesitate to contact [students@dsbsoc.org](mailto:students@dsbsoc.org) for more information.

Currently, we are developing a student event for the upcoming 16<sup>th</sup> DSBS meeting in France. Preliminary topics include scientific visuals for publications and presentations, but if you have other ideas that you would like to see included please contact [students@dsbsoc.org](mailto:students@dsbsoc.org).

---

## Mentoring

Rachel Jeffreys, Andrea Quattrini & Ily Iglesias

The mentoring network was set up as a space to provide advice and support for both graduate and early career researchers. It consists of groups of scientists at various stages in their careers, from graduate scientists to professors. The groups meet every 4-8 weeks via an online platform and discuss a variety of topics including but not limited to: paper writing, work-life balance, job applications and career progression.

The DSBS mentoring network for 2021 has been established. We first polled the society to obtain feedback on the program over the past two years. Most participants found the program extremely useful, and we thank all mentors who have participated. For 2021, we created 10 mentoring groups, which consist of approx. 70 mentees and mentors.

---

We also drafted a document that includes suggestions for how the program should be organized and led with a list of suggested topics for discussion.

If you are interested in joining the network please do contact [mentoring@dsbsoc.org](mailto:mentoring@dsbsoc.org). Similarly if you already participate in the network and have any suggestions or ideas please let us know.

---

## Development

Julia Sigwart

Development Officer, [development@dsbsoc.org](mailto:development@dsbsoc.org)

During 2020, the Society and our members have focussed on supporting early career scientists, with events such as eDSBS. We are also thinking a lot about ways to both diversify participation in deep sea biology at all career stages, and how to support under-represented groups. These are the main foci of our ongoing fundraising work, and during 2021 we will be actively seeking ways to increase support for these efforts through donations to the Society.

Donations to the Society can be received here: <https://dsbsoc.wildapricot.org/Donate>

---

## Membership

Santiago Herrera

[membership@dsbsoc.org](mailto:membership@dsbsoc.org)

Membership in 2020 increased to 487, >80% increase from mid-2020, largely attributed to eDSBS. Approx. 40% of members are students, while 11% are researchers (inc. students) from developing nations. We continue offering membership waivers to researchers from [developing countries](#), and in difficult financial situations (e.g. undergraduate students). To apply for this waiver, please write an email to [membership@dsbsoc.org](mailto:membership@dsbsoc.org) with a brief justification for your request. Please also include a link to your institutional webpage, for verification purposes.

---

## Finances

Chris Yesson

Treasurer, [treasurer@dsbsoc.org](mailto:treasurer@dsbsoc.org)

Our 2019 accounts were approved at the AGM and have been submitted and approved by the UK charity commission. The accounts and our annual report are publicly available on the charity commission [website](#).

Despite event cancellations and the general effect of the pandemic, 2020 ended up as a strong year for society finances. Membership remains our main income stream, and the boost from eDSBS saw our membership income keep pace with previous years, exceeding our budget expectations for a non-symposium year. Our expenditure was lower than budgeted, due to no uptake for travel and field related awards due to COVID restrictions. All unspent awards will be redirected to awards in 2021. We also secured funding from Gordon and Betty Moore Foundation to support eDSBS and the postponed CBE meeting (which will be carried forward). We will be preparing our 2020 annual accounts in the coming months and will circulate to the membership before the AGM.

---