

Course title: Deep-sea biodiversity and conservation

Modality: CFA- Advance Training Course

Orientation:

- ✓ Ocean Observation and Global Change
- ✓ Sustainable use of Marine Resources
- ✓ Integral Management of the Sea
- ✓ Technological Progress, Engineering and Business Management

Dates: 15 – 19 April 2024

Timetable: 09:00 to 12:30 and 13:30 to 18:00

Duration:

Location: University of Aveiro, room TBD, with videoconference connection to the remaining Do*Mar *campi*

Language: English

Academic coordinators:

Name	Institution	e-mail
Ana Hilário	University of Aveiro	ahilario@ua.pt
Joana Xavier	CIIMAR, University of Porto	jxavier@ciimar.up.pt

Lecturers (TBC):

Name	Institution
Ana Colaço	University of Azores, Portugal
Anna Metaxas	Dalhousie University, Canada
Eva Ramirez-Llodra	REV Ocean, Norway
Harriet Harden-Davies	Edinburgh Univeristy, UK
Jon Copley	University of Southampton, UK
Lisa Levin	Scripps Institution of Oceanography, USA
Marta Chantal Ribeiro	University of Porto, Portugal

General description:

The deep-sea, i.e. the water column and seafloor below 200 m depth, is the vastest and most underexplored biome on Earth. This biome hosts a rich, and often specialized, diversity of species, habitats and ecosystems. It provides a variety of fundamental supporting, provisioning and regulating and services for the health of the oceans. This course focuses on establishing a baseline of knowledge on deep-sea ecosystems and their functioning, as well as on how disturbance and changes, both natural and anthropogenic, affect these ecosystems. The syllabus integrates science, technology, policy and law, providing key concepts to develop ecosystem-based management of resource use and strategies to maintain the integrity of marine ecosystems within and beyond national jurisdiction.

Contents:

1. Deep-sea ecosystems: biodiversity and functioning
2. Methods in deep-sea ecology and exploration
3. Human Impacts on deep-sea ecosystems
4. Sustainable use of deep-sea resources
5. Law and policy in deep-sea conservation

Teaching methodologies:

The five themes of syllabus will be explored over five days of face-to-face work (8 hours/day). A series of lectures will cover different topics from each of the syllabus' items, which will then be analysed in detail through the reading and critical discussion, in class, of scientific articles distributed to the students in advance.

For syllabus items C1 and C5, an exercise to explore data in digital biodiversity portals (C1) and a role-playing exercise in which each group of 2 or 3 students (depending on the number of students in the class) will represent a stakeholder involved in the management of deep-sea resources (C5) will also be developed. The results of the first of these exercises will be summarized for each of the portals and discussed in respect to the contribution of the data to deep sea conservation policies. The second exercise will be moderated by a guest expert in environmental law.

Finally, groups of 2 to 4 students (depending on the number of students in the class) will be asked to conduct an interview with an expert in the field of deep-sea research, including its socio-economic component. To prepare this interview, students will be able to use a list of experts provided by the lecturers or suggest experts themselves.

Evaluation system:

The evaluation will be based on the following exercises:

- Exercise 1 (in class, individual): Short presentation (3 minutes) of a “hot topic” in deep-sea biology and its relevance based on a list of papers provided before the course;
- Exercise 2 (in class, in group): Hands-on exploration of deep-sea biodiversity on public data portals (OBIS, GBIF, ICES VME) and presentation of findings;
- Exercise 3 (in class + delivery 2 weeks after the course, in group): Based on the selected hot topics (Exercise 1) each group will prepare and publish on a website dedicated to the course one interview with an expert in the field;
- Exercise 4 (in class): Debate on the sustainable and equitable use of deep-sea resources.

Brief CV of the lecturers:

Ana Hilário (PhD) - Deep-sea biologist at the Centre for Environment and Marine Studies of the University of Aveiro. Ana holds a BSc in Aquatic Sciences from University of Porto (Portugal) and a PhD in Ocean and Earth Science from Southampton University (UK). In the last 15 years Ana has led several

national and international projects and participated in more than 25 oceanographic cruises dedicated to the study of deep-sea ecosystems. Currently she co-leads Challenger 150 (www.challenger150.world), a 10-year programme of deep-sea biological science endorsed by UN Decade of Ocean Science for Sustainable Development.

Joana Xavier (PhD) - Principal Investigator and leader of the Deep-Sea Biodiversity and Conservation Team at CIIMAR, University of Porto (Portugal), and an invited Associate Professor II in Deep-Sea Biology at the Department of Biological Sciences, and KG Jebsen Centre for Deep-Sea Research of the University of Bergen (Norway). Her research focusses on the understanding of basin to global scale diversity, distribution and connectivity patterns of deep-sea vulnerable marine species and ecosystems, and how ecological and evolutionary processes, as well as anthropogenic pressures underpin such patterns.

Relevant references:

Baker M, Ramirez-Llodra E, Tyler PA (Eds) (2020) Natural Capital and Exploitation of the Deep Ocean. Oxford University Press, 221 pp.

Clark MR, Consalvey M, Rowden AA (2016) Biological sampling in the deep-sea. John Wiley & Sons, 840pp.

Howell et al (2020) A Blueprint for an Inclusive, Global Deep-Sea Ocean Decade Field Program. *Frontiers in Marine Science*, 7 (5), 1-25.

Ramirez-Llodra E (2020) Deep-Sea Ecosystems: Biodiversity and Anthropogenic Impacts. In: The Law of the Seabed. Brill, p 36–60.

Rex MA and Etter RJ (2010) Deep-Sea Biodiversity: Pattern and Scale. Harvard University Press, 354 pp.

Sharma R (Ed.) (2019) Environmental Issues of Deep-Sea Mining: Impacts, Consequences and Policy Perspectives. Springer, 577 pp.

Tyler P A (Ed.) (2003). Ecosystems of the world, Vol. 28. Ecosystems of the deep oceans. Elsevier, 559 pp.