3rd Weekly Report M209

Mindelo - Ponta Delgada

31.03.2025 - 06.04.2025

Work in the Bay of Tarrafal continued this week. We performed the first deployments with the Tetranet, a large Bongo type net that we deployed on the lander station, where the deep scattering layer meets the slope. We performed a day and night tetranet deployment on this location and during the night captured some myctophids and squids but mostly euphausiids. Close communication with the bridge and careful manoeuvring was needed during this deployment since there were nets and fishing boats in the vicinity, which forced us to adjust the net tow slightly. Additional pelagic biological work included night video transects with PELAGIOS between eDNA station 1 (1000 m) and 3 (2500 m), to document gelatinous zooplankton and squids with the forward looking camera, and measure the biomass in the layers below the PELAGIOS with the WBAT echosounder. We concluded the PELAGIOS work in the Bay of Tarrafal on 02.04.2025. Multinets for biodiversity and foodweb sampling were done during the night and the last multinets for community composition were done on 04.04.2025. We now have a day and night multinet for all three stations where we took eDNA samples and performed ROV and PELAGIOS deployments.

On the night of 01.04.2025 we performed sampling on Nola seamount, which is about two hour transit from the Bay of Tarrafal. This sampling was part of a collaboration with OceanX and OceanQuest to study the biology of Nola Seamount. The RV OceanXplorer performed ROV and submersible dives on the seamount, and we performed repeated ADCP measurements and 5 CTD stations. At the CTD stations we collected water from 30-1000 m and filtered it over Sterivex filters to collect eDNA and seston. The stations were chosen in discussion with Cabo Verde colleagues from Imar who are on board the OceanXplorer. We plan to analyse the Nola eDNA samples for presence of vulnerable species such as sharks and cetaceans.

In addition to our pelagic work, a very important cruise objective of the Meteor cruise M209 is to map the seafloor off Cabo Verde with hydroacoustic and optical methods. Julian Stauffer from GEOMAR is in the mapping team of M209. The mapping team uses the ship-based multibeam echosounders and two kinds of in situ observation techniques: the remotely operated vehicle (ROV) KIEL6000 as well as an ocean floor observation system (XOFOS) which is towed at ca. 1.5m above the seafloor with forward and downward facing cameras. Since bathymetry shapes the distribution of benthic animal communities, we first collected multibeam data to produce a high-resolution bathymetric map of the entire bay of Tarrafal. In the past days we used this map to plan our dives with the ROV and XOFOS. These two optical methods complement each other in a very important way. XOFOS is towed downslope, creating standardisable imagery data but missing steep features and close-up images for species identification. With the ROV we move upslope and are able to map also vertical walls or even overhangs. When we plan dives with these types of gear, we try to cover a big bathymetric gradient as well as different geomorphologies and different substrate types to understand which animal communities live where and why.

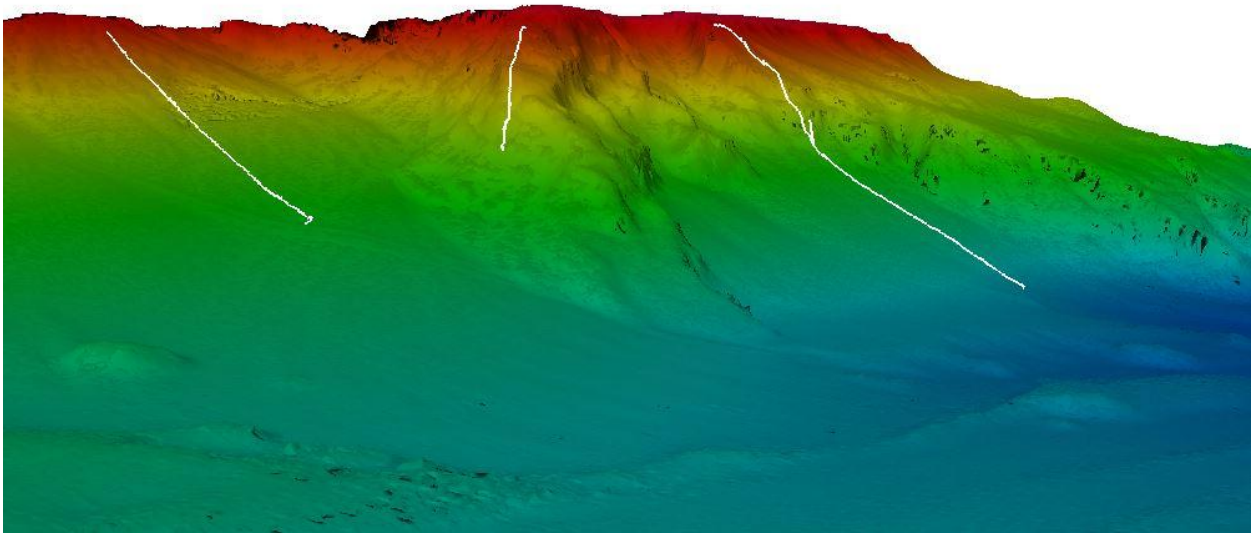

Figure 1: XOFOS tracks on the island slopes in the Bay of Tarrafal.

The mapping efforts show that the bay of Tarrafal and Monte Trigo was shaped by two landslides that created a big turbidity channel as well as a vast debris field extending in a south-westerly direction from the northern point of the bay. This created a highly variable bathymetry with various geomorphological features including huge rock walls dropping off several tens of meters. There is a strong contrast between the more fine-grained sediment dominated turbidity channel and the steep rocky edges of the bay.

One of the highlights of the second week was the second benthic ROV dive which we conducted on a step-wise ascending slope with steep walls, filmed the week before by XOFOS. Being now able to also record the benthic communities on the vertical walls showed us directly how the two methods compliment each other. We started this dive at around 1000 m of depth and ended up in the rariphotic zone, shallower than 200 m. The slope that we recorded were packed with life and we were impressed by the density and diversity of the coral communities living on this steep slope.

At the end of the second week of M209, we deployed the ROV four times in benthic mode and XOFOS six times in the bay of Tarrafal. First results show that deeper and fine-grained sediment were inhabited by bamboo corals (*Acanella* sp.) and deep hard substrates were inhabited by Iridogorgids. Moving up the bathymetric gradient, various black coral species became more frequent and the coral communities changed and became more diverse and rich. We also recorded interesting associated mobile fauna with the ROV and XOFOS. We found a dense field of pencil urchins at around 800 m of depth and a wide range of benthic fishes including several shark and ray species like for example the Cape Verde skate *Raja herwigi*. We also recorded at least two different benthic octopus species including *Pteroctopus tetracirrhus*.

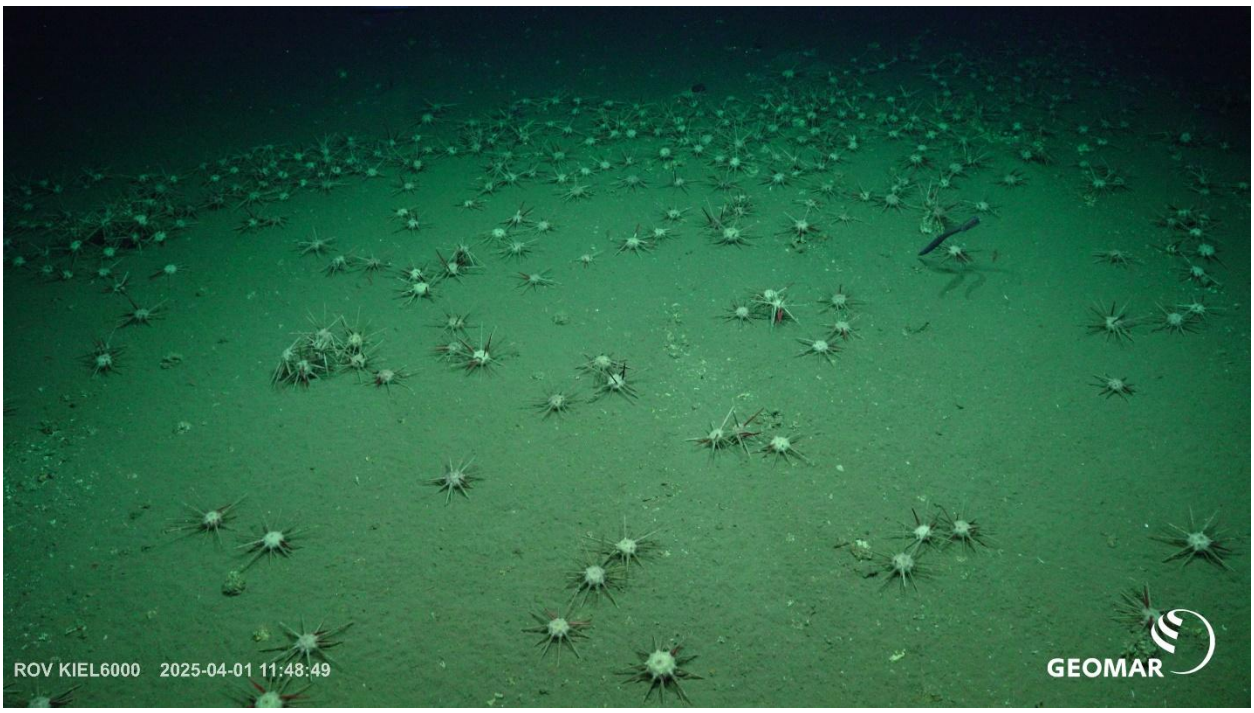

Figure 2: Pencil urchins on the seafloor of the Bay of Tarrafal.

The pristine but vulnerable habitats we encountered underline the importance of our seafloor mapping efforts. Learning more about the distribution and composition of these habitats will support future management and conservation efforts.

In addition to the above described seafloor zonation imagery efforts, we also perform ROV manoeuvres for 3D reconstruction of benthic structures, collect specific coral species for foodweb analysis, document fish biodiversity as well as associations between crustaceans, corals and sponges, document and collect crustaceans for taxonomic descriptions. For these topics we have specialists on board who focus on the observations and sampling and take turns in the ROV container during the dives.

Crustacean biodiversity encountered during dives with ROV KIEL6000 is studied by Keider Neves from Biosfera1. He collects *in situ* observations of the benthic biodiversity and collect important and/or rare samples for biodiversity studies. So far, he has been able to identify and confirm several associations of crustaceans with other organisms such as gorgonians and black corals, some of them previously unknown. Besides that, the team has collected samples representing potentially new species of decapod crustacean living in association with gorgonians. This clearly shows that the mesophotic and deepwater ecosystems of the Cabo Verde Islands are still largely unexplored and more new species to science are expected to be found during the cruise.

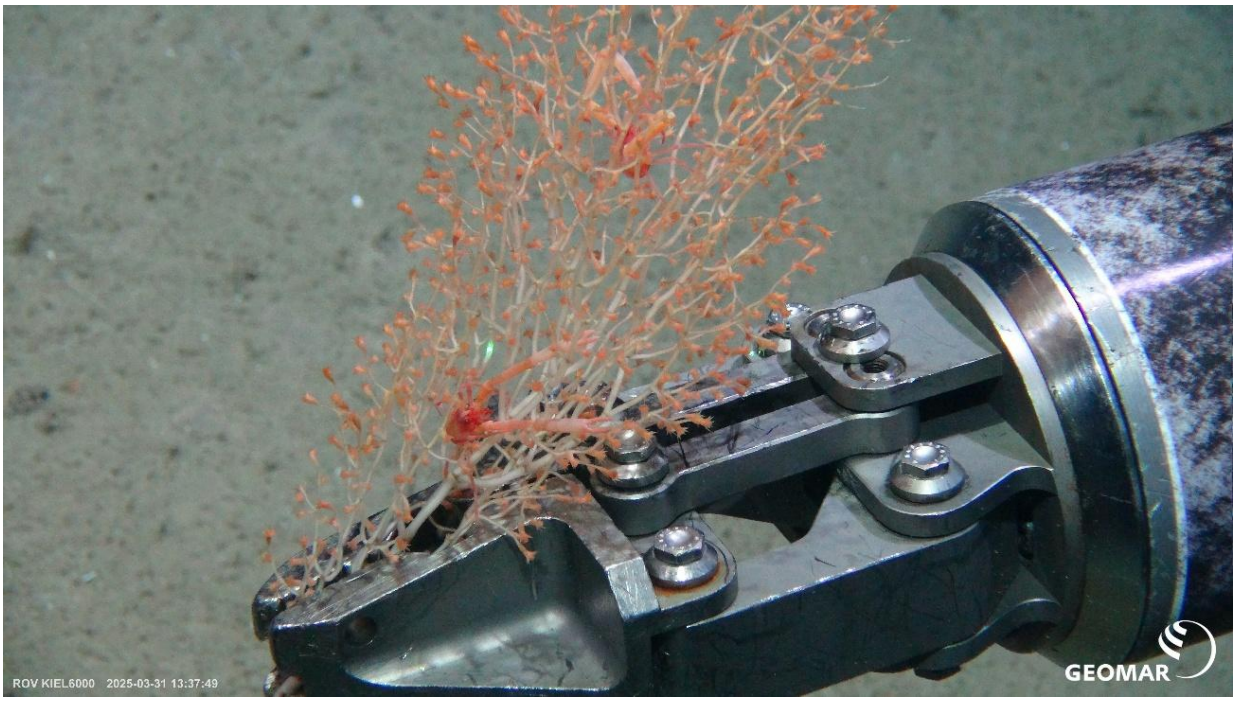

Fig. 3. Sampling of two specimens of Uroptychus concolor associated with the deep-water bamboo coral Acanella.

During the ROV dives in the Bay of Tarrafal we have been also surveying fish biodiversity on the deep and rariphotic reefs, with expert presence of Rui Freitas from UTA, Mindelo. The transects have identified 3 species of scorpionfish, making them the dominant species in richness. Additional highlights include new records for two spine goosefish and an orange coffinfish in the Eastern Atlantic region, which were encountered in the Bay of Tarrafal. During the the transects in the pelagic zone, we came across a deep-sea eel with a large mouth (*Saccopharynx*), a Bigeye squaretail. The discovery of the large-eyed rabbitfish *Hydrolagus mirabilis*, which is chimaera, in the Cabo Verde archipelago is also a significant encounter.

Figure 4: One of the dominant fish species we encounter in the deep-sea surveys : Helicolenus dactylopterus.

Corals are also being observed and sampled to better understand their foodweb ecology. Teresa Amaro from the University of Aveiro is a specialist in deep-sea foodwebs. She contributes to the cruise objective to unravel deep-sea benthic foodwebs. To investigate the role of environmental variability in the feeding strategies of black corals and gorgonians, she hypothesizes that these corals, in areas with lower phytoplankton availability, adapt their feeding strategies by relying more heavily on particulate organic matter or other alternative food sources. To understand this, water samples and coral specimens were collected using the ROV Kiel 6000 at four different stations, ranging from 200 to 1500 meters depth in Santo Antão. During each dive, coral specimens were collected and returned to the ship in three BioBoxes, and a total of 13 different species of corals have been collected so far for future analysis. She is continuing this kind of sampling off the islands of Fogo and Santiago.

On 04.04.2025 we recovered the small lander with physical oceanographic sensors that we deployed in the beginning of our stay in the Bay of Tarrafal. This system collects data on oxygen, currents and other oceanographic parameters for almost two weeks. We are excited to find out what the daily cycle of currents in the Bay of Tarrafal look like. The day multinet at station 1 that followed the recovery was the 100th station activity. After the second multinet we started the transit to Fogo with a speed of 8.5 knots to collect multibeam data on the way. During the transit we had a “Bergfest” to celebrate the middle of the expedition.

On 05.05.2025 we arrived in Fogo and we are impressed by the dramatic landscape of this volcanic island. The first mission in this region is to map the coastal zone as shallow as possible, to create bathymetric maps for the ROV and XOFOS deployments. The island slope is very steep, and the horizontal distance between 1000 m and 2500 m is only 3 nm, compared to 9.5 nm in Tarrafal.

We are enjoying a good atmosphere on board with scientists and crew and are grateful for the excellent support on RV METEOR. We look forward to extend our research program from the Bay of Tarrafal to Fogo and Santiago.

On behalf of the M209-team

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