RV Meteor

Expedition M202 „ISAAC“

21.July – 07.August | Terceira – Mindelo

2. Weekly Report (22.7. - 28.7.2024)

During the first week, four ADCP (Acoustic Doppler Current Profiler) transects were conducted with regular CTD stations to classify the physical oceanography of the working area, and to relate currents to prey distribution. The use of the vessel mounted 38kHz and 75kHz ADCP's allows some rough incorporation of the dominant oceanic currents inside the canyon-like structure. We covered with the ADCP the deep-sea canyon off Terceira from southwest to northeast and did a cross-section of the canyon from northeast to southwest to measure ocean currents and water movement.

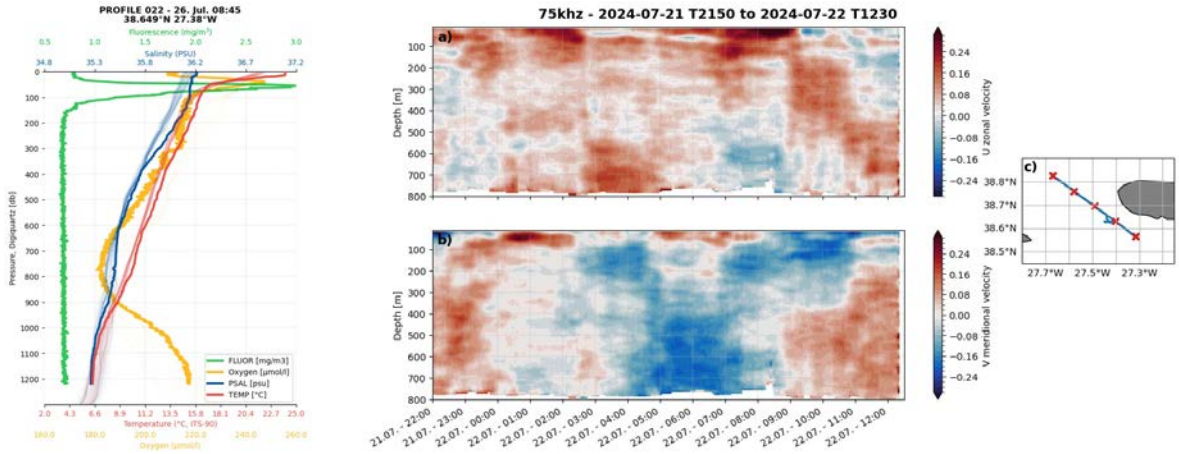

Figure 2: Left: Exemplary (uncalibrated) CTD cast southwest off Terceira in water depths of about 1200m. Actual Profiles of Temperature (Red), Salinity (Blue), Oxygen (yellow) and Fluorescence (green) are drawn by the thick solid lines. The thin lines in background denote the climatological values for this region in July. Note the offset bias in Fluorescence of about 0.7 mg/m^3. Right: Preliminary derived oceanic currents from 75kHz vessel mounted ADCP. a) Zonal velocities (red eastward, blue westward), b) meridional velocities (red northward, blue southward) and c) the according cruise track drawn in blue and performed CTD stations in red.

In addition to the transects, we also performed three Yoyo-CTDs along the canyon axis, where we deployed the CTD several times at the same station. In order to estimate the average tidal cycle and direction and strength of the internal wave energy flux inside of the Canyon (Fig. 2, right). The hydrography from the CTD casts showed the oxygen minimum zone to be located at depths above 800 m (Figure 2, left). Temperatures in the upper water columns are well above climatological values. The mixed layer is rather shallow, mostly less than 20m, the upper 100m are strongly stratified by a steep thermocline. Deep Chlorophyll Maxima (DCM) occur at depths between 60 and 100m and are connected to a sharp local oxygen maximum slightly above the DCM and with concentrations even higher than in the saturated surface waters. Since the 'Plancton Imager with Scanning Option' (PISCO) is attached to the CTD (Fig. 3, left), we collect in situ images of zooplankton larger than 200 µm during every CTD deployment (Fig. 3, right).

These images describe zooplankton species community, biomass and vertical distribution and will be analyzed automatically with AI algorithms. We also collected seawater with Niskin bottles attached to the CTD-rosette at five of the six deep-sea stations for eDNA analysis of cephalopods, fishes and marine mammals with Niskin bottles attached to the CTD-rosette. Additional water was taken to measure chlorophyll and other pigments, phyto- and zooplankton community and composition and experiments to investigate the zooplankton community in surface waters.

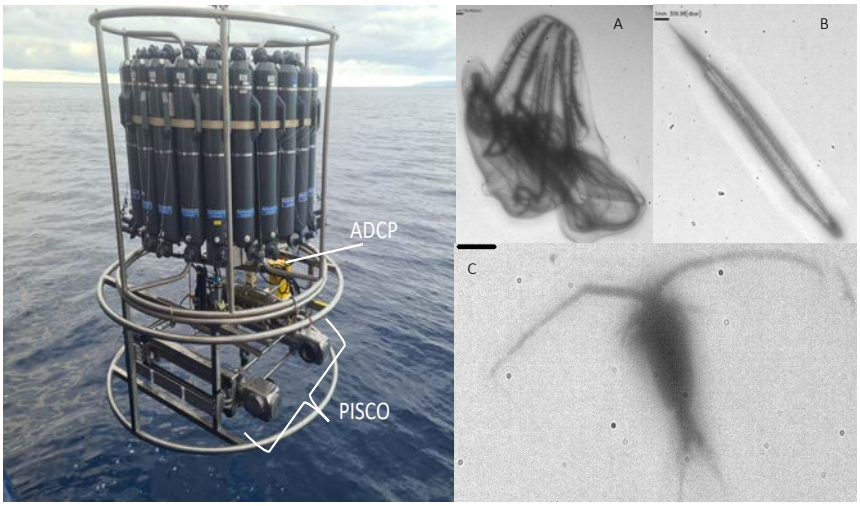

Figure 3: Left: CTD rosette with attached Niskin bottles, ADCP and PISCO. Right: Images from PISCO: A: Jelly, B: Chaetognath, C: Copepod. Foto: Jan Taucher

On the morning of 22 July, two drifting NCS, “Darcy 1” and “Darcy 2”, were deployed. They consist of a buoy that keeps the system afloat, a line with various lengths and the camera with a bait bag and eJelly (Fig. 4, left). In the evening, the Nautilus Camera System placed on the seafloor released earlier than expected and was retrieved the next morning. First inspections show deep-sea sharks and various scavenging fauna being attracted to the bait. During the first week, we conducted six NCS drifter deployments at 750m, 1000m and 1200m, and three NCS lander deployments in depths between 1562 and 1715 m. A first screening of the footage showed lanternsharks attacking the baitbag attached to the eJelly pole (Fig. 4, right).

Figure 4: Left: Drifting Nautilus Camera System before deployment. Right: Lantern shark filmed during Lander deployment on 24 July 2024 at 1715m. The estimated body length is about 50 cm.

Using the towed camera PELAGIOS (Fig. 5, left), which is equipped with a forward-looking camera, we have been performing video transects at multiple depths from the chlorophyll maximum at 60-80 m to 1400 m in the bathypelagic zone where beaked whales forage. PELAGIOS is towed behind the ship over the A-frame with the LWL-winch. The fiber optic cable allows a video preview on board. With the live preview, we can already annotate the organisms that we see on the camera with the Ocean Floor Observation Protocol. During PELAGIOS transects we have encountered a variety of gelatinous zooplankton taxa. The most abundant gelatinous taxa in the Terceira region seem to be ctenophores and hydromedusae (Fig. 5, right). This is an important taxonomic group that are predators on mesozooplankton and also are prey for oceanic animals. Due to their delicate structure, they are also notoriously hard to sample with nets, requiring in situ observations such as towed and CTD-mounted cameras to document them. Although cephalopods are a primary target taxonomic group that we would like to document, they are very hard to find. They are able to avoid nets and oceanographic instruments as they can sense the bow pressure and the bioluminescence that is induced by the towed instruments. Fortunately, we were so far able to observe a flying squid of the family Ommastrephidae, a histioteuthid squid, a *Mastigoteuthis* and a *Planctoteuthis* as well as mastigoteuthids.

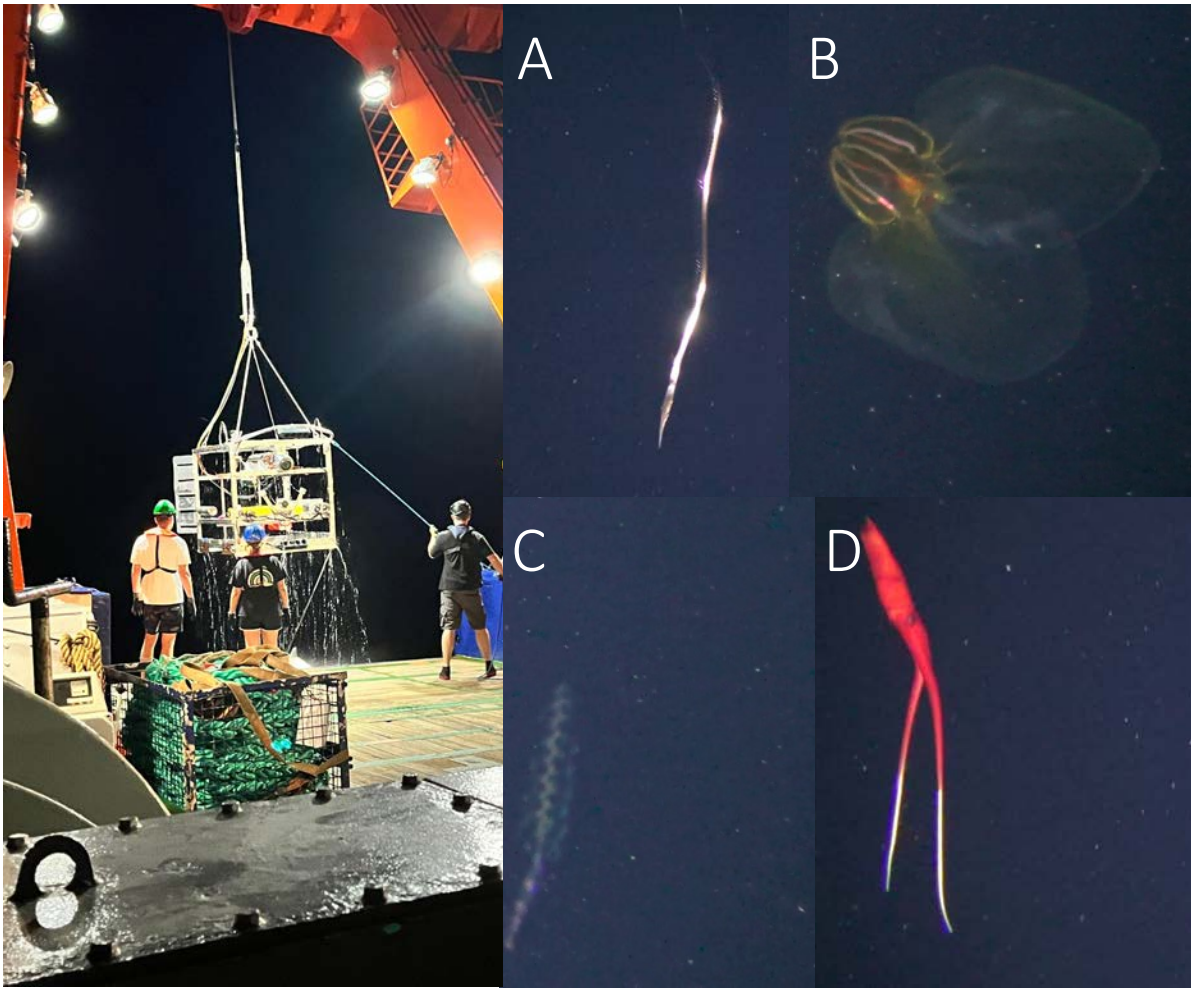

Figure 5: Left: Deployment of the towed camera system PELAGIOS during the night. Right: Footage of the first PELAGIOS dives. A: Sawtootheel, B: Ctenophore, C: *Planctoteuthis*, D: *Mastigoteuthis*

To the best of our knowledge, our observation of *Planctoteuthis* during M202 is a first time for the Atlantic, although specimens have been captured with nets. In addition to video-focused

pelagic transects, we also performed acoustic-focused transects through our core stations Ziphius 1, Sowerby 1 and Risso. For this, we towed PELAGIOS with an attached echosounder at 500, 900 and 1200 m to acoustically detect whale prey in high resolution at different depths. These transects took place on 24 and 27 July and were long and intensive, but resulted in exceptionally high-quality data. After the first 4 hours of the first transect, we had a failure of the lights and camera. After recovery, the engineers on board could identify a problem with a shortcut in the cabling of the lights. This was quickly solved and we could proceed with the transects after 30 minutes. Preliminary analysis of the acoustic data shows cephalopods off the bottom and this is where we will focus our next PELAGIOS transects. In the first week, we also deployed two different net systems: Rectangular Midwater Trawl and Multinet to sample midwater fauna and deployed a mooring on 28 July. We collected a lot of different data during the first week with the help of the great crew of RV METEOR.

Best wishes from aboard the RV Meteor on behalf of all participants.

Véronique Merten (Chief Scientist, M202)
GEOMAR Helmholtz-Centre for Ocean Research Kiel, Germany

Logo: Julia Stefanschitz