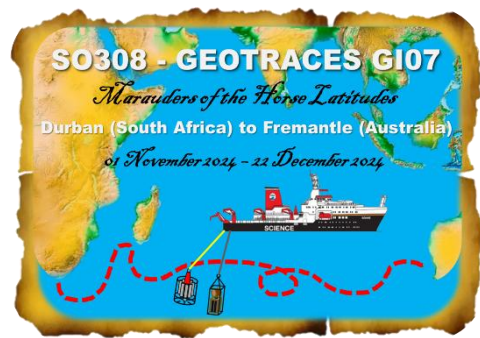


RV SONNE

Cruise SO308 South Indian Ocean GEOTRACES GI07

31st October – 22nd December 2024

Durban (South Africa) – Fremantle (Australia)



6. Weekly Report

Reporting Period: 2nd December - 8th December - 2024

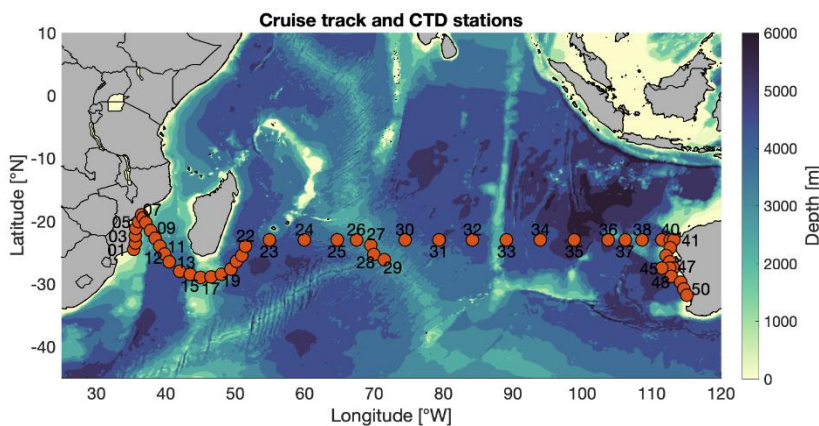


Fig. 1. The planned cruise track with 51 stations (red dots).

The GEOTRACES research cruise SO308 is 5 weeks underway, and we have just finished sampling at station 38, and will sail into the EEZ of Australia tonight (Fig. 1).

Over the last seven days we have sampled 6 stations along 23°S. We had greater distances between the stations, which allowed us to rest, and organize our

samples. The weather has been variable, with winds ranging from Force 3 to 7 and waves up to 5 meter. We have been able to conduct all the planned station work, but at some stations we had to leave the sediment sampler (MUC) out of the schedule because of the enhanced wave height.

Figure 2 shows the meridional sections of conservative temperature, absolute salinity and dissolved oxygen for the cruise SO308 up to about 100°E. The data are obtained by our outstanding team of physical oceanographers on board the Sonne: Paula Damke and Hannah Melzer (GEOMAR). The data indicate the enhanced surface water temperatures of the South Indian Ocean along our transect, and also the signatures of oxygen depleted waters just below 1000 m. In particular the low oxygen tongue in the Mozambique Strait, in waters originating from the North Indian Ocean, is evident. In addition, the signature of the Antarctic Intermediate Water at 1000-1500 m is evident in the lower salinity signatures.

In the coming 12 days we will be sampling the slope and shelf waters of Australia and its Leeuwin current. There is a paucity of biogeochemical data in this system, and it is not clear how the exchange of nutrients and trace elements with the off shore waters of the South Indian Ocean functions. Also the importance of nitrogen fixation, and the diversity of the different diazotrophs are not clear in the system. We will have daily stations on our way to Fremantle, and will attempt to unravel the mysteries.

Today, we celebrated the second advent Sunday with wonderful meals prepared by our fantastic cooks. In addition, we held our Christmas market last Friday night with Christmas music, face painting and Glühwein.

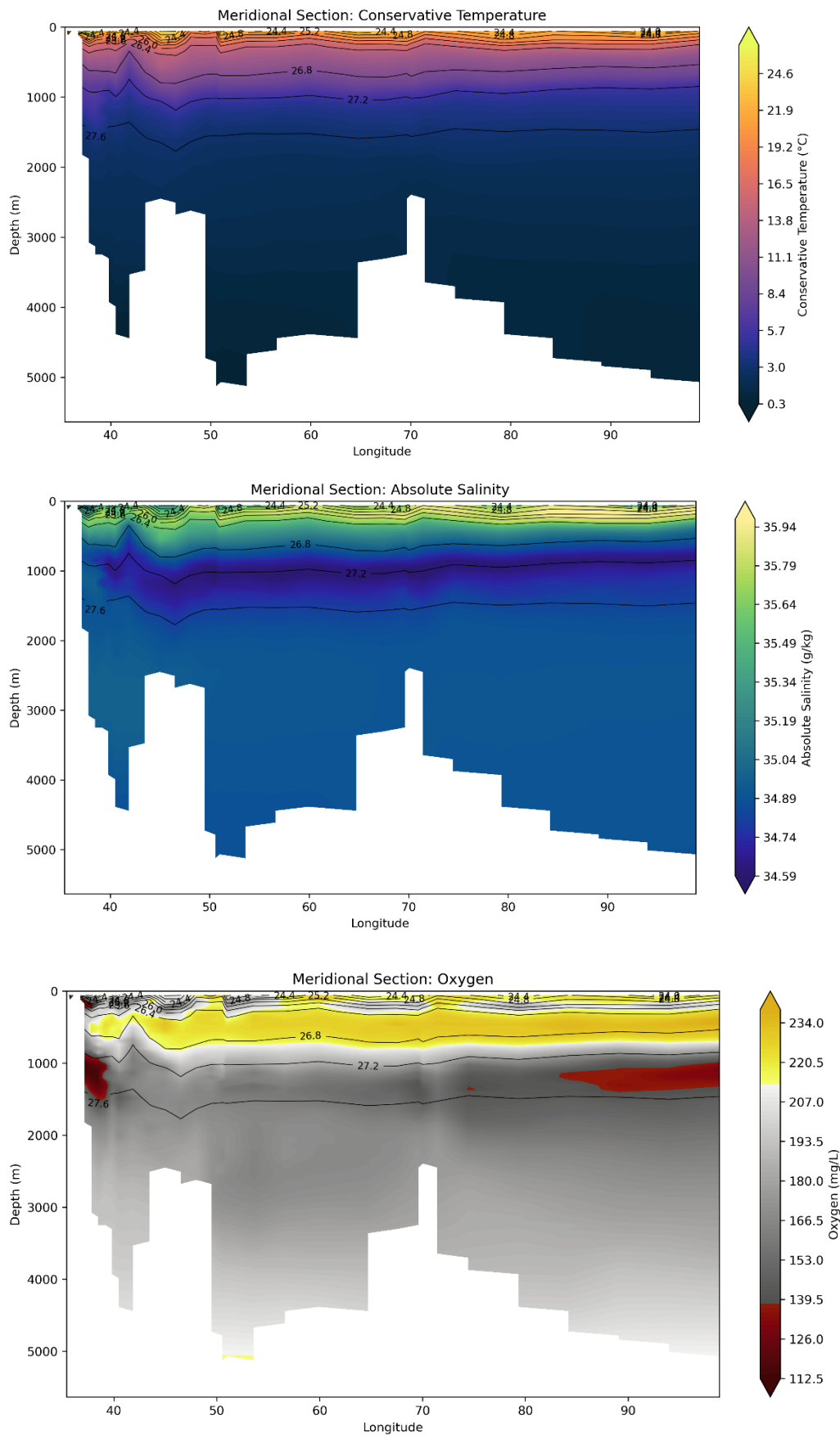


Fig. 2. Meridional section of temperature, salinity and oxygen along the cruise transect. Salinity and oxygen data are preliminary and not yet calibrated. Plots by Hannah Melzer.

Observations of particles and zooplankton in the ocean

Tobias Strickmann, PhD student at GEOMAR, is conducting a range of activities on the Sonne. He collects environmental DNA samples for collaborators at GEOMAR, and together with Anita Butterley (University of Tasmania) also collects proteomics samples for collaborators at Woods Hole.

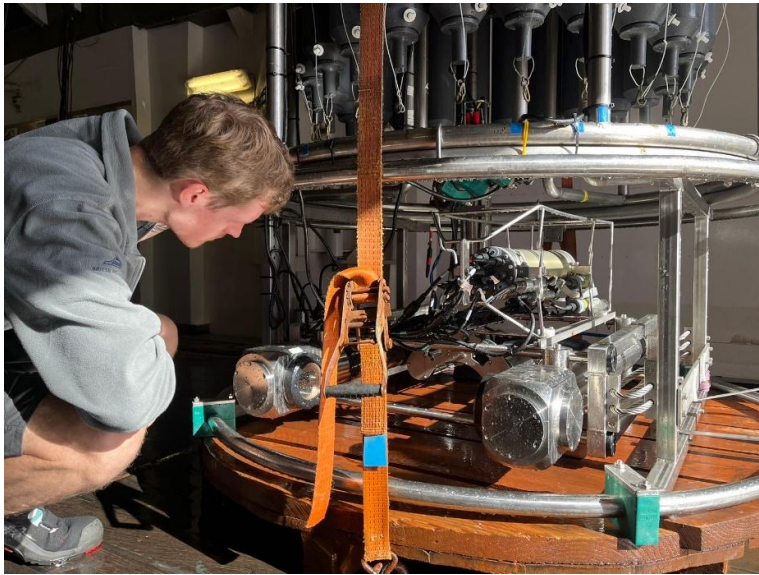


Fig. 3. Tobias inspects the Plankton Imaging and Scanning Optics (PISCO) camera system attached to the conductivity temperature depth (CTD) rosette. Photo by Can Gürses.

The PhD research of Tobias deals with particles and small organisms in the water column. Tobias makes use of cameras attached to the conductivity temperature depth (CTD) rosette frame (Fig. 3). Tobias photographs the particles that pass the cameras' fields of view as the CTD frame moves through the water column (Fig. 4). With the use of computer algorithms, he counts the particles and determines the particle diameter and calculates biovolume, which in turn is used to estimate carbon content of the particles. With this approach, Tobias can estimate how the overall particulate carbon reservoir changes with depth, which, similar to Wan Zhang's thorium activities (see weekly report 4), provides

insights into the strength of the biological carbon pump (BCP). Combining particle count and size data from cameras with environmental parameters (like temperature and pH) from CTD instruments, he can investigate the effects of environmental conditions on the efficiency of the BCP.

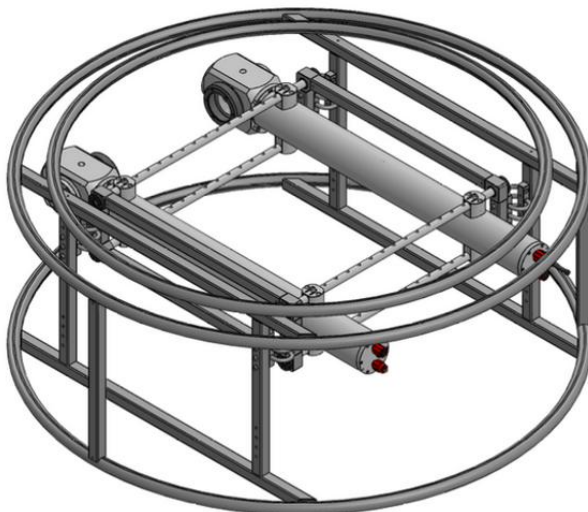


Fig. 4. Schematic of the Plankton Imaging and Scanning Optics (PISCO) camera system courtesy of Tobias Strickmann and Anton Theileis.

Every day Tobias posts a “catch of the day” photo on the notice board (Fig. 5). The images come from the Plankton Imaging and Scanning Optics (PISCO) camera system, developed by engineer Anton Theileis and others from the Plankton Imaging research group at GEOMAR. This bespoke camera has a special lens that allows the focus to shift while taking photos, resulting in sharp images. The amazing images are a challenge to obtain: Anton is on hand for constant tinkering, and the image data volume is extremely large. The Underwater Vision Profiler (UVP) is also operating on the CTD frame, and has a fixed focus and automatically crops the images it takes resulting in a more manageable data output.

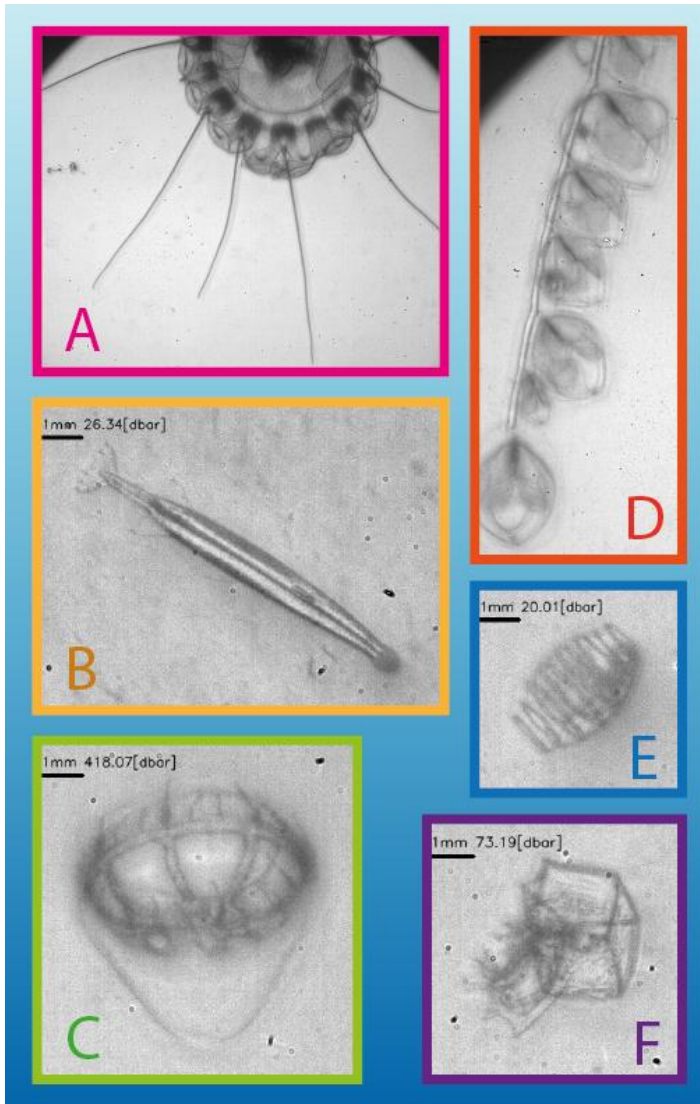


Fig. 5. A) Hydrozoic jellyfish, B) chaetognath, C) hydrozoic jellyfish, D) colonial siphonophore (likely from order physonectae), E) doliolid (order doliolida), F) siphonophore (family Abylidae). Photos courtesy of Tobias Strickmann.

Tobias uses a custom classification system developed by Dausmann to identify the plankton in the photos, although he must first manually assign taxonomy to train the system on the dataset. The South Indian Ocean is understudied compared to other ocean regions, so Tobias is excited to contribute to the limited knowledge of zooplankton community composition in this area.

RV SONNE at sea 23°0 S/109°0 E

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