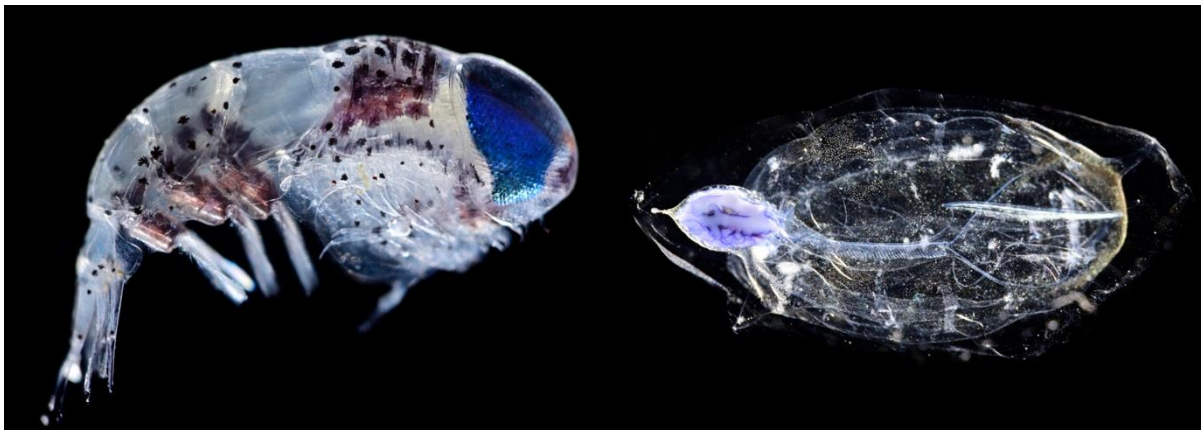
RV SONNE

Cruise SO285 „TRAFFIC 2“
Emden - Emden,
20th August - 2nd November 2021

7. Weekly report

27th September - 3rd October 2021

As part of the so-called biological carbon pump, plankton binds large quantities of CO_2 in the ocean. According to our current understanding, their CO_2 uptake capacity is closely linked to the circulation of the ocean and has a significant influence on natural climate variations such as the transitions from ice ages to warm periods. The response of the biological carbon pump to today's climate change cannot yet be reliably estimated. What is clear, however, is that marine ecosystems are changing right now. Long-term observations by our South African colleagues show, for example, that the species composition of zooplankton off South Africa has changed and that it is increasingly dominated by smaller species. In addition, there is the question of whether jellyfish and jellyfish-like zooplankton such as salps are entering ecological niches previously occupied by fish and crustaceans such as copepods and amphipods.



Amphipod *Salp* *Pictures: Solvin Zankl*

To assess potential impacts of such changes on fisheries and the biological carbon pump, we need to better understand marine ecosystems in their function and also be able to detect changes. Here off Namibia and South Africa, we are interested in both aspects, which means we are studying abundances and species composition as well as the evolution of ecosystems in environments dominated by nutrient-rich upwelled waters under the influence of global change. In addition to warming and the strengthening of driving trade winds, oxygen minimum zones (OMZs) also play a role here. These zones occasionally become so intense that, for example, rock lobsters prefer to escape from these regions and die on beaches of South Africa and Namibia rather than being exposed to 'respiratory stress' caused by low oxygen concentrations in these waters.
To study the Benguela upwelling system, as mentioned in the last report, we completed four transects from the coast of South Africa into the Benguela Current, which moves northward along the South African continental slope.

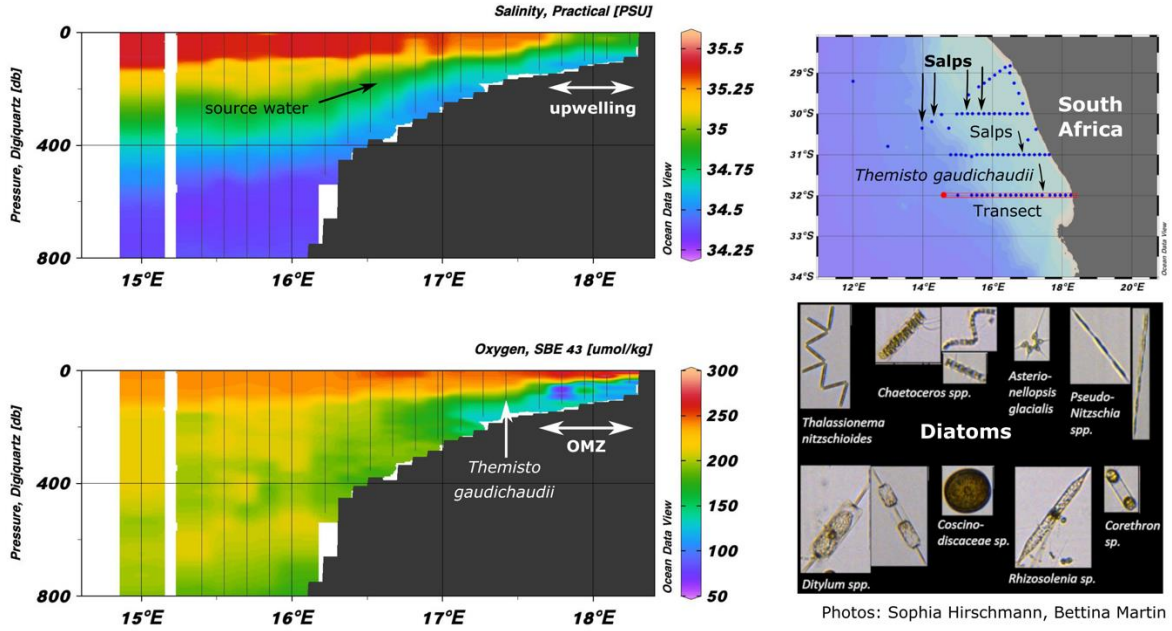


Figure 1. Distribution of salinity and dissolved oxygen (top and bottom-left) in the southernmost transect (see upper right map, marked in red), with blue dots indicating our sampling sites). The double arrow "upwelling" marks the region, where deep water reaches the surface. The photos depict a variety of Diatoms typically found within the upwelling zone, which were recorded with the FlowCam on board our vessel. Arrows on the map (top right) mark stations, where we observed mass occurrences of salps and the amphipode Themisto gaudichaudii.

On the coast, upwelling causes low-saline waters (= source waters) to reach the surface from depths of 100 to 400 m, where it displaces the high-saline and older surface waters (see Figure 1). In this nutrient-rich upwelling zone, we found large amounts of diatoms (see photos in Figure 1) and an OMZ extending from the bottom far into the water column. This indicates tremendous oxygen consumption due to the degradation of dead and sinking diatoms in the water column. However, the low oxygen concentrations near the bottom are usually associated with resuspension of sediments, when sedimentary organic material is carried back into bottom waters, where it is decomposed (oxidized). In the region, where the top of the oxygen minimum layer drops from 50 m to below 100 m depth, we observed the mass appearance of a psyllid (amphipod, *Themisto gaudichaudii*) that filled nearly all of our nets. The combination of a still slightly elevated food supply (algae) and sufficient oxygen for respiration seemed to be perfect conditions for the psyllid to grow.
We observed the mass appearance of a single plankton group at five other stations, marked with arrows on the map in Figure 1. At these locations, however, they were not crustaceans but the previously mentioned salps. In contrast to the psyllids, the salps occurred predominantly on the outer shelf, where the food supply must have been comparatively low. In order to better assess the causes and consequences of these observations, we will further evaluate our data in the weeks following the cruise. In the meantime, we have reached the northern Benguela upwelling area, where the station work continues with undiminished intensity. More about this will be reported in the course of the next week.

RV SONNE, at sea, 23°S / 15°W, 3rd October 2021
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