

# Vertical zooplankton dynamics at the shelf of the northern Benguela

V. Mohrholz, T. Heene (IOW, Baltic Sea Research Institute, Germany)  
A.J. Da Silva (BENEFIT office)

BENEFIT ENV project: Poleward undercurrent

## Introduction

The distribution of zooplankton at the Namibian shelf is characterised by a high spatial and temporal variability. Common ship born measurement strategies can not provide measuring intervals which allow the investigation of the wide spectrum of temporal variations in zooplankton concentration. Using net samples for determining zooplankton biomass patterns on classical basis is a laborious work. Also, the spatial resolution and vertical extension is rather limited since net sampling integrates over certain depth levels and requires a large effort for data analysis. In contrast, the application of the ADCP backscattering signal allows detecting plankton concentration patterns with high spatial and temporal resolution.

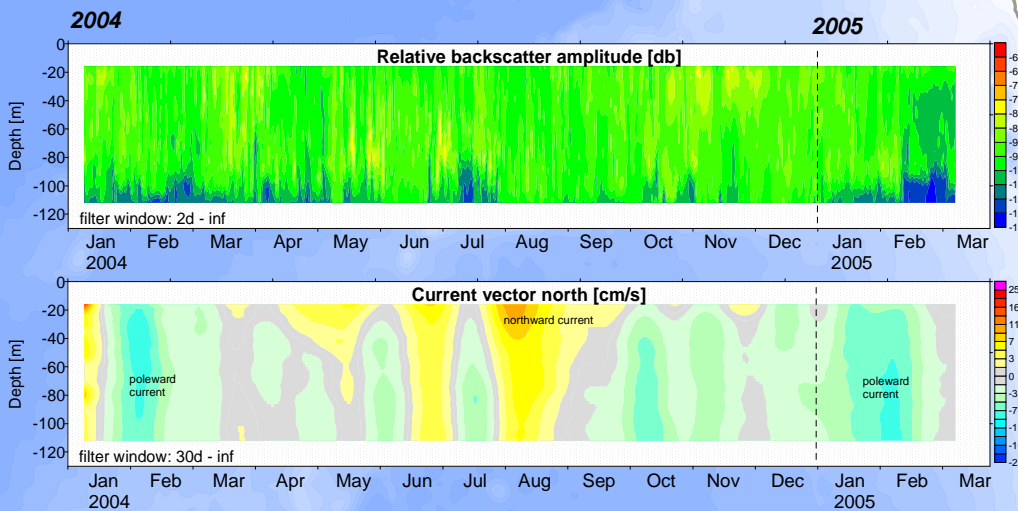


Figure 2 Relative backscatter amplitude (RBA, upper panel) and along shore current (lower panel) at the mooring off Walvis Bay. The data were low pass filtered with a cut off frequency of  $2d^{-1}$  resp.  $30d^{-1}$ . The blue patterns in the RBA indicates low zooplankton concentrations near the bottom. The occurrence of these patterns is well correlated with a poleward current component at the Namibian shelf.

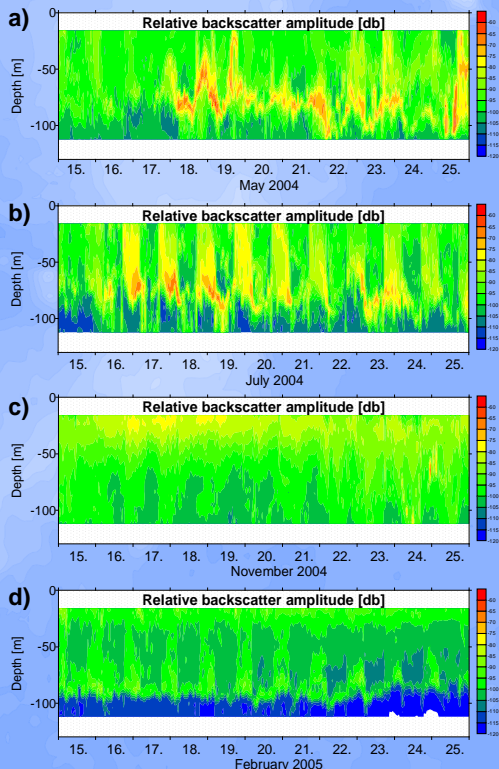


Figure 3 The vertical distribution of scattering particles (zooplankton) showed a high temporal and spatial variability. Although the signal of diurnal migration is present in the entire time serie, periods with very different dynamics were found. Panel a depict a situation where zooplankton is concentrated in the midwater layer during the entire diurnal cycle, whereas in situation b a pronounced signal of the diurnal migration covers the entire water column. In contrast, period c is characterised by a zooplankton accumulation near the surface, with a weak diurnal migration signal only. Panel d shows a situation with a thick oxygen depleted (zooplankton free) bottom layer and an extremely low zooplankton concentration in the rest of the water column.

From January 2004 to March 2005 an oceanographic mooring was operated at the Namibian shelf 20nm off Walvis Bay (Fig. 1). The mooring was equipped with a 300kHz ADCP, which provided the acoustic backscattering<sup>1)</sup> of nearly the entire water column at a temporal and spatial resolution of one hour resp. 4 meter. Additionally, temperature, salinity and oxygen concentration were measured at selected depth levels.

The observed patterns reflect diurnal vertical migration of plankton as well as variations of zooplankton concentration at longer time scales up to the seasonal signal. The most pronounced pattern at the Namibian shelf is a layer of extremely low zooplankton concentration above the sea floor (blue colour in Fig. 2 & 3). The thickness of this layer varied between 5 and 20m at time scales of several days and is correlated with the intensity of the poleward undercurrent at the shelf. In the austral summer the maximum vertical extension of the oxygen depleted layer appears with a delay of 10 to 20 days after the maximum intensity of the poleward undercurrent.

Above the oxygen depleted bottom layer we did not find a distinct seasonal cycle in the zooplankton concentration. However, there is a high variability on short-term scales. Figure 3 gives an impression of different regimes. Which factors are controlling the vertical migration of the zooplankton remains unclear yet and will be investigated in the further project work.

1) The acoustic backscattering of an ADCP is used in this study as a qualitativ measure of the zooplankton concentration. For quantitativ calculations of the zooplankton biomass a calibration with net samples is necessary, which was successfully done in this area by Postel et. al (in press). A calibration of the data presented here is planned, but not finished yet.

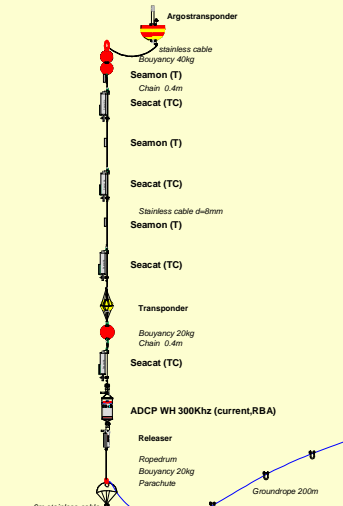


Figure 1 Design of the hydrographic mooring at the Namibian shelf. Position 23°00' S 14°03' E 20nm off Walvis Bay

A comparison of the ADCP backscattering signal with contemporary CTD oxygen concentration profiles reveals a close correlation of low oxygen concentrations with the layer of low acoustic backscattering (Fig. 4). From these correlation the lower oxygen concentration limit of the suitable habitat for the zooplankton was estimated to be 0.4 ml/l oxygen. Below these oxygen level the zooplankton concentration decreased rapidly.

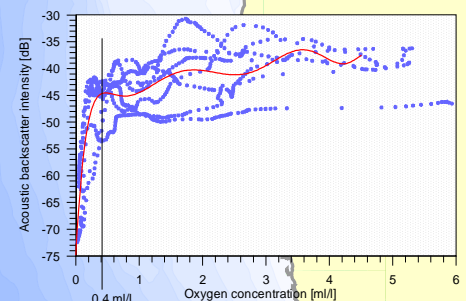


Figure 4 Correlation of the ADCP backscattering signal with measured oxygen concentration from CTD profiles.

The observations presented here are a first step towards a better understanding of the short term zooplankton dynamics at the Namibian shelf.

## Acknowledgement

The "Poleward undercurrent" project is funded by the BENEFIT programme (environmental working group). The data acquisition and the maintenance of the mooring was supported by the environmental group of NatMIRC Swakopmund. The Baltic Sea Research Institute in Warnemünde (IOW) provided the mooring equipment and technical assistance.