Zooplankton Distribution in the Namibian Upwelling Region: A comparison of net catches with ADCP measurements

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Introduction

The distribution of zooplankton biomass and species abundance in relation to physical and biological factors is important in understanding the structure and functioning of marine plankton communities. Along with conventional net catches, fisheries acoustics has a potential significant application in zooplankton studies, but has limited history of application. The relationship between acoustic backscatter intensity derived from the Acoustic Doppler Current Profilers (ADCP) and net zooplankton is investigated to describe the temporal distribution, taxonomic composition and migration of mesozoplankton in the Namibian Upwelling Region (**Fig. 1**) during an upwelling season.

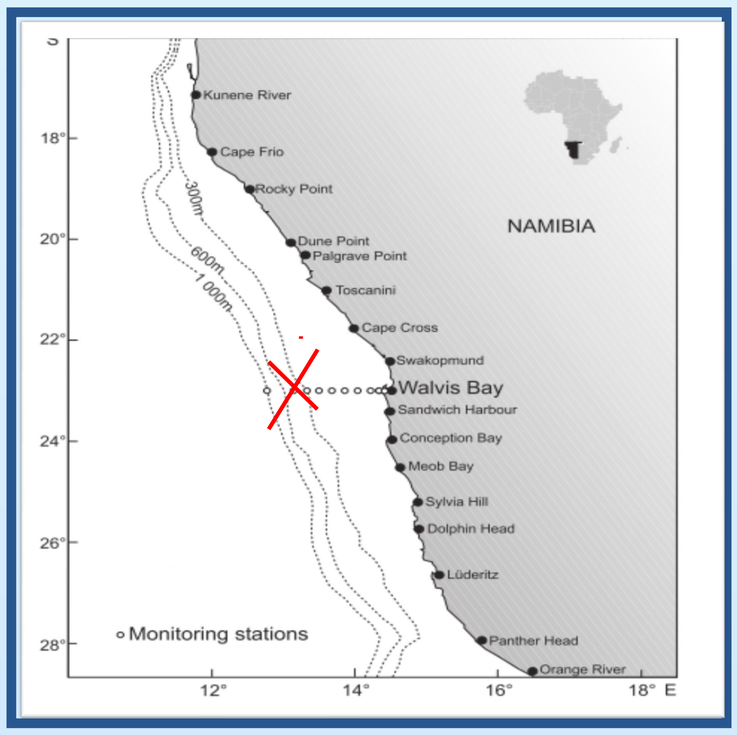

Fig. 1 Map of Namibian coast showing the sampling station at shelf break (x) along the Walvis Bay monitoring transect at 23 ° S (modified after Hansen *et al* . 2005)

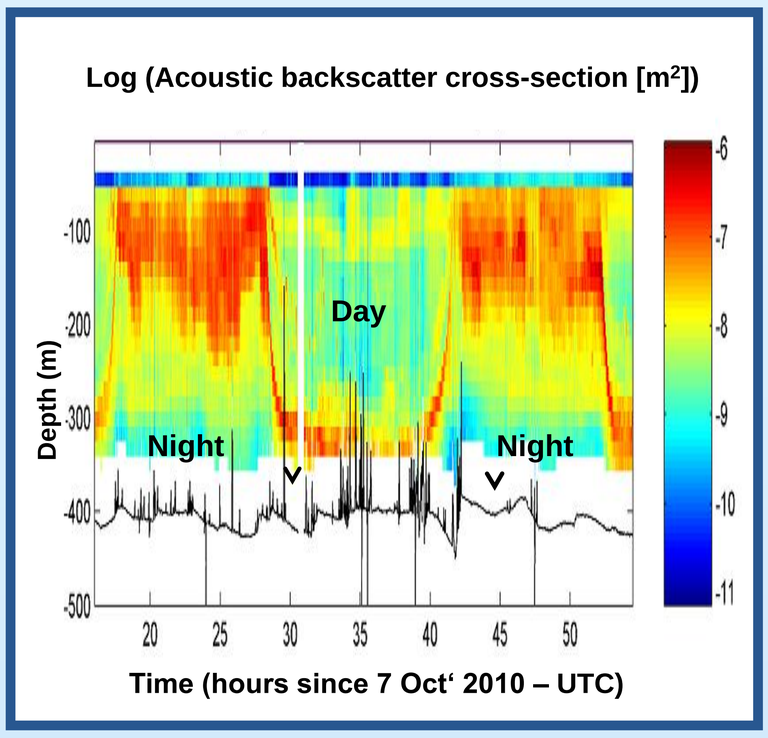

Fig. 2 Acoustic backscatter cross-section from ADCP during the sampling period

Methods

Zooplankton samples were collected off Walvis Bay (**Fig. 1**) in September 2010 with a 1 m^2 double Multiple Opening and Closing Net and Environmental Sensing System (MOCNESS) and a 150 kHz broadband vessel-mounted ADCP during daytime and night-time.

Results and Discussion

Mesozooplankton net catches and ADCP measurements both revealed a bimodal vertical distribution with major biomass concentrations in the surface layer (0-80 m) and at depths below 200 m, as well as diel vertical migrations (**Figs. 2-3**). These migrations were mainly performed by dominant calanoid copepods (>70% of abundance) of the size range 0.5-2.0 mm (**Fig. 4**). The scarcity of zooplankton within the thermocline and oxygen minimum zone (OMZ) suggests that these layers act as effective barriers to non-migrating zooplankton. Zooplankton tend to avoid the thermocline and the OMZ. Some zooplankton such as Ostracoda did not perform diel vertical migrations.The acoustic backscatter cross-section (ABSC) from the ADCP as a measure for biomass generally did not show significant correlations to mesozooplankton biomass from net catches, although some mesozooplankton size classes were responsible for more than 40% of the backscatter during daytime (**Fig. 5**).

Conclusions and Outlook

The bimodal distribution of zooplankton on a temporal scale is mainly explained by diel vertical migration, although other factors need to be considered. Migration patterns matched well as determined parallel by ADCP measurements and net catches, although their biomass correlations were generally weak. Future studies should investigate how mesoscale structures shape zooplankton communities on a short term.

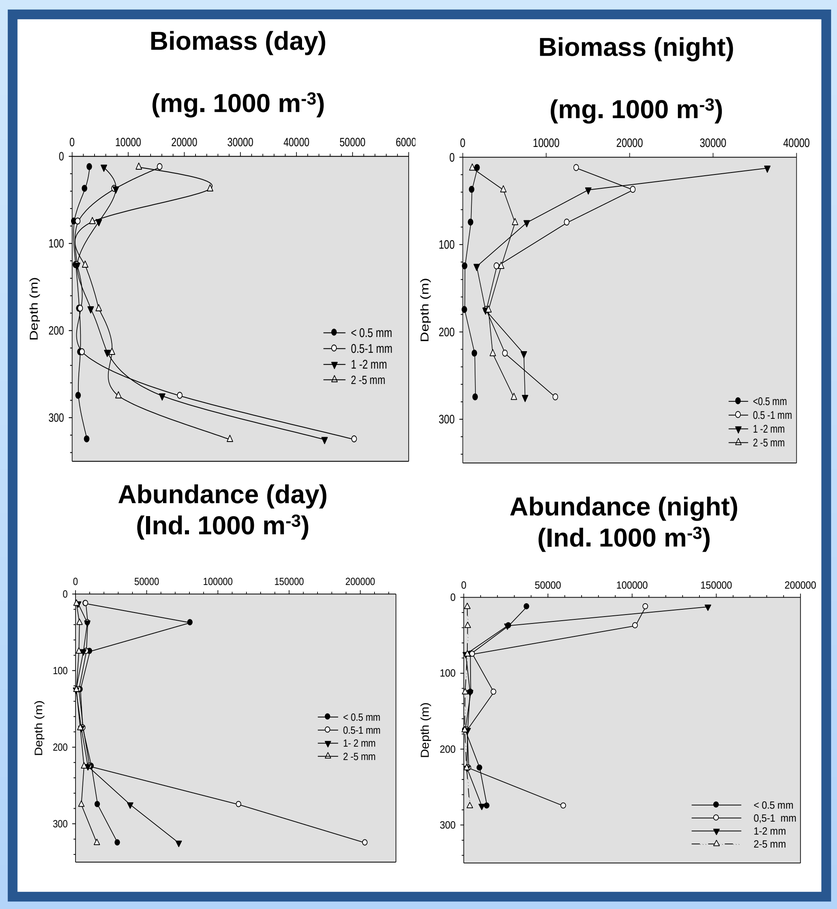

Fig. 3 Vertical size class distribution of biomass and abundance of mesozooplankton, net catches

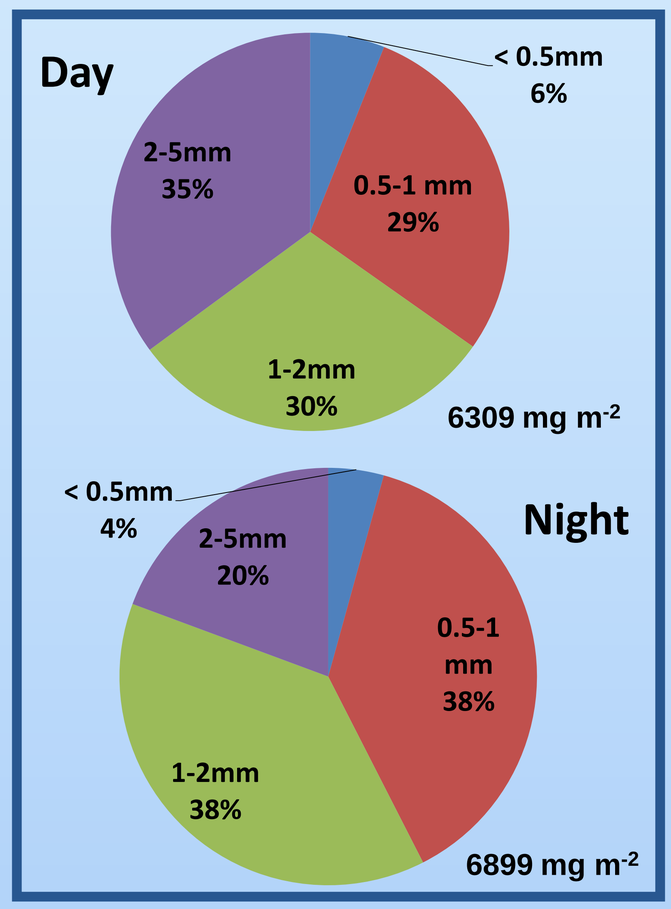

Fig. 4 Standing stock biomass of mesozooplankton size classes (0-300 m), net catches

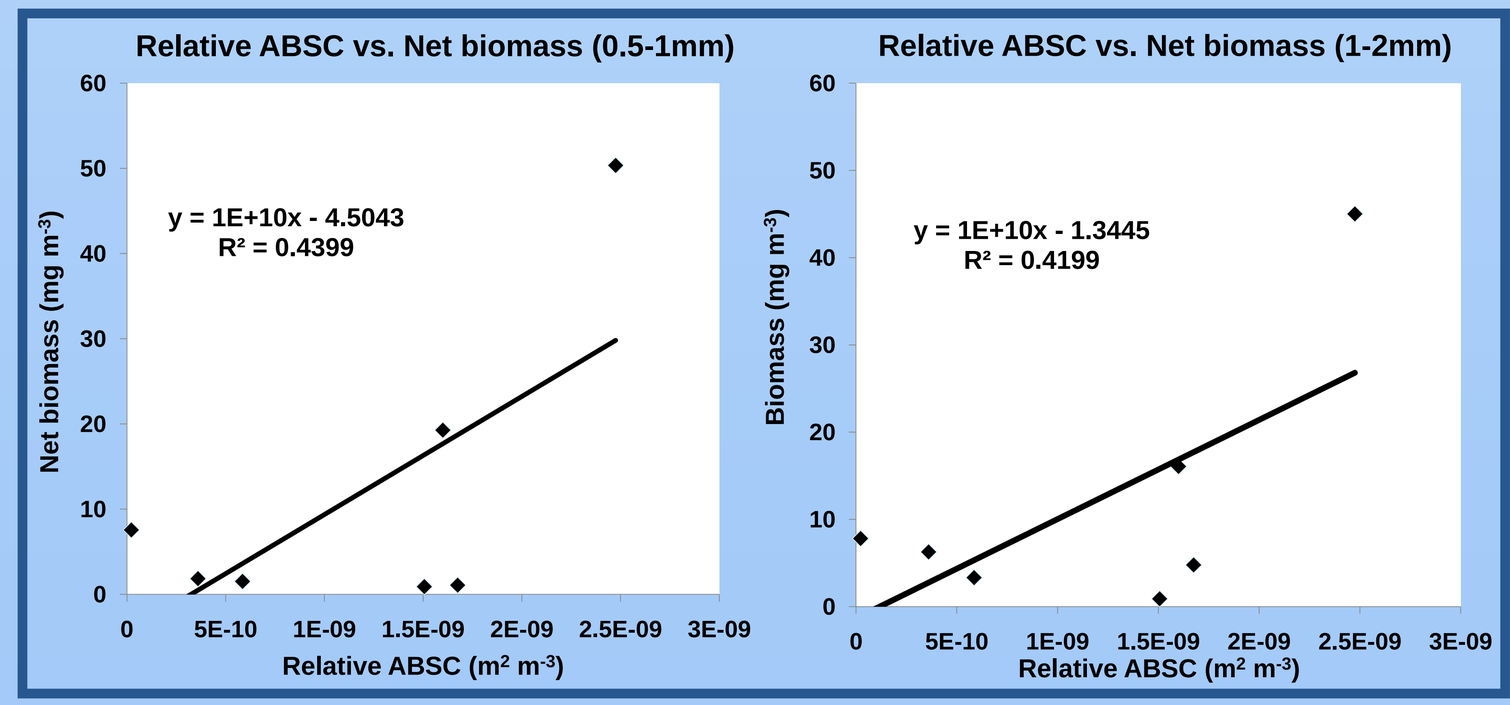

Fig. 5 Acoustic backscatter cross-section and net zooplankton biomass, including regression equations and coefficients of determination, r^2 for size classes 0.5-1 and 1-2 mm during the day

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