Spatial variation in zooplankton size and taxonomic community structure along a 50 degrees N to 50 degrees S transect of the Atlantic
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Zooplankton play a vital role in the world's oceans in terms of transport of carbon out of the surface layer and providing food for fish. Zooplankton are patchily distributed on all scales, and this has important consequences for both sampling and understanding their role in the ocean. The distribution of zooplankton on different scales forms the focus of this study.

Three Atlantic Meridional Transect (AMT) cruises were carried out and data made available from three previous cruises. Zooplankton data were collected using a combination of vertical nets and using an optical plankton counter (OPC) sampling from the pumped seawater supply. Validation of methods showed that the OPC data could reliably be converted to carbon and numerical abundance estimates for open ocean conditions.

Spectral analysis suggested that surface zooplankton heterogeneity followed a power law relationship over several scales. Over the 30 to 1000 km range this was approximately –1, and for smaller and larger scales the slope was reduced. Chlorophyll was less patchy, following temperature and salinity over the same range with a slope of –1.8.

Analysis of large scale heterogeneity showed clear latitudinal trends in diversity, particularly evident in the copepod genera, with low diversity at high latitudes. The size structure appeared to be more closely related to the productivity of the area, with high zooplankton biomass associated with larger zooplankton. Regions with similar copepod communities were identified. These were found to be similar to other pelagic regions, but less closely related to watermasses or production regimes.

Multiple linear regression of surface zooplankton biomass showed a strong relationship with the physics (temperature and salinity), chlorophyll and the time of day, accounting for 55% of the variability. Use of the regression equations to predict new transects gave R^2=0.34. Improvement could be made by dividing the transect into smaller regions. Neural networks gave enhanced predictability (R^2 = 0.77 for the training set, and R^2= 0.47 for the novel set) with a simpler model, although similar variables were important.

This study has shown that copepods show latitudinal gradient in diversity, associated with seasonality, and form regions of similarity that do not conform to biogeochemical provinces or the watermasses. Neural networks may be used to predict zooplankton abundance from a few readily available parameters.