

BALLON SOTO, ROBERTO MICHAEL. Acoustic study of macrozooplankton off Perú: biomass estimation, spatial patterns, impact of physical forcing and effect on forage fish distribution.

ABSTRACT

The Northern Humboldt Current system (NHCS) represents less than 0.1% of the world ocean surface but produces more fish, mainly Peruvian anchovy (*Engraulis ringens*), per unit area than any other region in the world. Although this system produces enough macrozooplankton to feed its high production of forage fish, the paucity of information on zooplankton hampers research in the system. The objective of this study was to investigate the multiscale dynamics of the spatiotemporal distribution of the macrozooplankton biomass off Peru in relation to the physical environment and their fish predators. For that a bi-frequency acoustic method was developed and applied to extract, from historical acoustic data, high-resolution information on the biomass and the patterns of distribution of macrozooplankton, the pelagic red squid 'munida', fish and other marine compartments. This method also allows estimating the vertical extension of this epipelagic community (ZVEEC). We demonstrated that ZVEEC coincide with the upper limit of the oxygen minimum zone (OMZ), which allowed both producing high-resolution spatial data of the upper limit of the OMZ and estimating the volume habitat of anchovy. The estimated macrozooplankton biomass was about four times higher than previously reported. This estimate is in agreement with the recent findings on forage fish trophic ecology and supports the current hypotheses explaining the NHCS high fish production. The study of the impacts of the submeso- and mesoscale physical structures on macrozooplankton provided evidence of the bottom-up physical effect on the distribution of macrozooplankton biomass. We also found further evidence of the structuring bottom-up effect that macrozooplankton exert on forage fish. The high-resolution biological and physical data obtained in this study opens new perspective to perform integrated multiscale ecological studies and to calibrate biogeochemical, trophic and End-to-End models.