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Estimating zooplankton biomass through conventional and acoustic methods in the Northern Humboldt Current System

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The Northern Humboldt Current System (NHCS) hosts almost ten times more fish per surface unit than other upwelling systems, with Peruvian anchovy (*Engraulis ringens*) as emblematic specie. In the NHCS, zooplankton is the main food for anchovy and other main pelagic fish. In this bottom-up structured system knowledge on the spatiotemporal dynamics of meso- and macrozooplankton biomass is crucial. Here we estimated mesozooplankton biomass from net sampling using a regression between its biovolume and wet weight in an area comprised between 8 and 14°S. This regression was calibrated from four surveys for which we have precise information on zooplankton wet weight and corresponding biovolume. To estimate macrozooplankton biomass we used a bi-frequency acoustic method on 13 acoustic surveys from 2002-2012. Spatial pattern of meso- and macrozooplankton distribution were then studied using a geostatistics model with external drift. Total zooplankton biomass ranged between 31 $g.m^{-2}$ (2011) and 121 $g.m^{-2}$ (2012). Macrozooplankton biomass was higher than the one of mesozooplankton except in 2009. We observed a clear seasonal pattern with significantly more biomass in spring than in other seasons. Meso- and macrozooplankton biomass were significantly higher offshore than over the shelf. Anchovy biomass was significantly and positively correlated with total zooplankton biomass. Yet, both anchovy and zooplankton biomasses were not correlated with the temperature anomaly even if zooplankton biomass increased close to the shelf during high positive temperature anomalies. These results highlight the importance to rely on direct prey biomass estimate since classical environmental parameters (e.g. temperature) poorly explain anchovy dynamics.

Key-Words: biomass, Mesozooplankton, Macrozooplankton, Volume, Wet Weight, Acoustics, Peru.

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