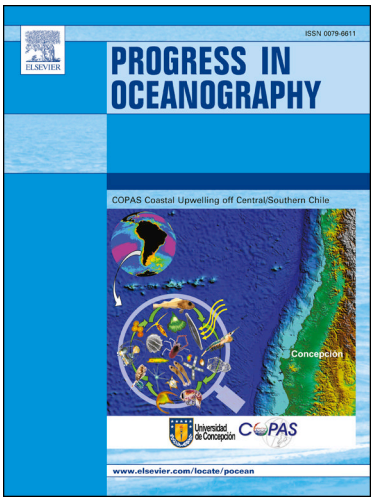

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A trophic index for sardine (*Sardina pilchardus*) and its relationship to population abundance in the southern Bay of Biscay and adjacent waters of the NE Atlantic

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Abstract

The trophic position of sardine (*Sardina pilchardus*) in spring was determined from the analysis of the natural abundance of stable nitrogen isotopes in the southern Bay of Biscay between 1998 and 2014. Mesozooplankton (200-500µm) was employed as the reference baseline, as its isotopic signature tracked the seasonal development of phytoplankton blooms. Two methods for estimating trophic position were compared. Scaling the isotopic enrichment per trophic level to the isotopic signature of the reference baseline produced lower trophic position estimates than those using the traditional assumption of a constant enrichment per trophic level. Indeed, the studied sardine population is placed as a mid trophic level consuming prey near the base of the food web. Zonal averages of trophic position increased with decreasing size of the sardine stock and increasing values of the upwelling index, suggesting the interaction of trophic relationships and population dynamics. The effects of changes in the timing of phytoplankton blooms and the release of competition for prey at low population densities were discussed as potential factors causing an increase in mean trophic position of sardine in recent years. The application of the scaled trophic position estimates to the monitoring of sardine populations will facilitate the comparison of different studies and provide new insights on the factors regulating these populations.

1. Introduction

The large natural fluctuations in abundance experienced by the populations of planktivorous fish are attributed mainly to changes in the food web driven by alterations in the climate (Chavez et al., 2003). Because of their opportunistic feeding and their high reproductive