

CYCLIC FLUCTUATIONS OF BLUE WHITING (*MICROMESISTIUS POUTASSOU*) OVER 1950- 2011 IN THE NW MEDITERRANEAN

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Abstract

Landings of blue whiting fluctuated with a periodicity of 6 to 8 years in the NW Mediterranean over the period 1950-2011, independently of fishing effort. We show that these fluctuations are correlated with the winter Western Mediterranean oscillation index (WeMOi), but not with other major climatic modes, such as the North Atlantic Oscillation (NAO). In addition, recruitment is shown to be correlated with winter SST. We conclude that years with cold winters enhance recruitment in blue whiting, which appears as a strong year class in the catches in the following year.

Keywords: Fisheries, Fishes, Recruitment, North-Western Mediterranean

Introduction

Blue whiting is one of the species with highest landings off the northern Catalan coast (between 750 and 2500 annual tones in the last decade). It is fished exclusively by bottom trawl. Cyclic fluctuations in blue whiting landings have been observed since the mid XX century. These fluctuations cannot be explained by changes in trawl fishing effort, which in the last 70 years has undergone marked changes. Thus, other alternatives, in addition to fishing effort, are explored to unveil the underlying conditions which would explain the landings variability i.e. the species link to environmental conditions and intrinsic response to changes in abundance.

Material and Methods

Data and data source: Blue whiting landings 1950-2011 (from literature 1950-1961 and official statistics 1962-2011); length frequency during high (1988-1989) and low (2009-2011) landings periods ([1], [2]); recruitment and SSB data (1994-2011; [2]). Installed engine power 1971-2011, an approximate measure of trawl fishing effort, was examined to compare with the evolution of landings (data source: official statistics). Since landings consist mainly of ≥ 1 year old individuals, which coincide with the age at-first-maturity, landings were taken as a proxy for SSB. The environmental variables considered were: SST (data source: L'Estartit meteorological station); winter (December to March) Western Mediterranean oscillation index (WeMOi; www.ub.es/gc/menu.htm); and winter NAO index (www.cru.uea.ac.uk/~timo/projpages/nao_update.htm). The linear trend was removed from SST and landings data series. Data were analyzed through lagged cross-correlation, with 0, 1 and 2 years lags, and wavelet periodogram ([3]).

Results

Blue whiting landings showed a number of cycles over 1950-2011 with different periodicities, of around 8 years at the beginning (1950-1980) and shorter at present, of around 6 years (Fig.1). The years of high volume of landings coincided with high fisheries production in the winter months, while in the periods of low landings, these were distributed all along the year. Furthermore, the number of age classes was higher in the years of high landings (up to 3-4 age classes); and, with low fisheries production, landings were concentrated on age classes 1 and 2. Significant correlations ($p < 0.05$) were found for recruits (class 0) and winter (December- January) SST (negative), and between landings and winter WeMOi (positive) with time lags of 0 and 1 year.

Discussion

Positive WeMOi phases, which correspond to low sea surface temperature, strong northerly winds and low precipitation ([4],[5]) are linked to high landings, with time lags of 0 and 1 year. In addition, low temperatures during the winter months (December to January), at the beginning of the reproduction period, result in good recruitment. The environmental conditions during positive WeMOi phases enhance intense winter convection events north of the study area (Gulf of Lions; [6]). Fluctuations in the intensity of this phenomenon have been related to interannual variations in primary production ([7]). These environmental conditions are likely to enhance survival of the early life stages during the winter months resulting in one strong cohort, which will be exploited the following years.

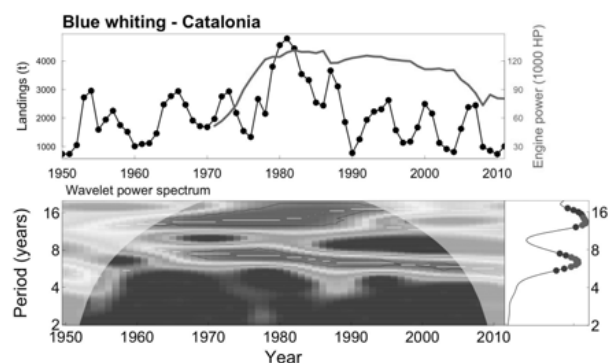


Fig. 1. Blue whiting landings and trawl fishing effort (upper panel); wavelet spectrum of the landings (bottom panel).

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