

RELATIONSHIP BETWEEN ANCHOVY (*ENGRAULIS ENCRASICOLUS*) RECRUITS AND ANCHOVY SPAWNERS ESTIMATED FROM ACOUSTIC SURVEYS IN NORTHWESTERN MEDITERRANEAN SEA

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Abstract

In this study we present the abundance and biomass of European anchovy (*Engraulis encrasicolus*) estimated by acoustic methods in the Northwestern Mediterranean Sea (GSA06). during two different seasons, winter, the anchovy recruitment season and summer, when the majority of the anchovy stock belongs to the spawner fraction of one year-old. Four standardized acoustic surveys carried out covering the study area during two consecutive years (every six months), two of them during the peak of anchovy recruitment and the other two during the peak of anchovy spawn, allow to observe changes in the anchovy stock abundance and biomass in this area. Acoustic data from summer and winter echo-surveys were analyzed in an effort to better understand the life cycle of anchovy in relation to the survival during its first year of life.

Keywords: Acoustics, Continental shelf, Pelagic, Fisheries, North-Western Mediterranean

Introduction

Small pelagics, such as anchovy, support large fisheries in the Mediterranean Sea [1]. Similar to other small pelagic species, anchovy is short-lived with high rates of natural mortality and high fecundity in which recruitment plays a major role in setting year-to-year changes in the level of the stock. When the stock is overexploited, the age classes usually decrease in number and it is important to understand the extent to which the year-to-year fluctuation of the population depends on recruitment or the 0 age class [2]. In the Spanish Mediterranean, anchovy spawning takes place from April to October with a peak in June-July [3] and the recruitment occurs from September to February with a peak in December [4]. For sustainable management of fish stocks, it is necessary to understand the dynamics of populations and their fluctuations over time. In the case of anchovy, this fact is crucial because most of the spawners come from the previous recruitment.

Material and methods

The study was carried out in the Spanish Mediterranean continental shelf (from 30 to 200 meters depth), corresponding to the GSA06 (Northern Spain) division adopted by the GFCM. Four acoustic surveys were performed in two different seasons, winter and summer (December 2008, June 2009, December 2009 and June 2010) then two anchovy live cycles was monitored (recruit-spawners-recruit-spawners). Acoustic data were recorded using an EK60 echosounder (Simrad) operating at five frequencies (18, 38, 70, 120 and 200 kHz). Acoustic sampling took place along parallel transects, perpendicular to the bathymetry and with a 4 or 8 nautical mile (nmi) distance from each other. Simultaneous to the acoustic sampling, fish samples were collected using a pelagic trawl (16 m vertical opening) to identify species composition and their relative abundance [5]. Anchovy individuals captured were sized to the 0.5 cm total length lower and weight-length relationship was fitted to an exponential model using the root mean square method. Sex and maturity were also recorded and otoliths were extracted for age study. Acoustic data were analysed using Echoview software (Myriax Ltd.). Anchovy abundance and biomass were estimated with the VBA software PESMA and the software ArcView 3.2 and ArcGIS 9.3.

Results and discussion

Anchovy abundance (Fig. 1) in number of individuals estimated in the study area in December 2008 was 5971 million corresponding the majority of them to anchovy recruits (age 0), with a length interval between 6 and 15.5 cm, and mode in 10-11 cm. Anchovy abundance dropped to 2489 million six months later (June 2009), nearly half of the abundance detected in December, with a length interval between 7 y 17 cm, and mode in 14 cm, being all of them spawners, one-year old. The same pattern was detected the following year, being the anchovy abundance estimated in December 2009, 4380 million (recruits), dropping to 1738 million individuals in July 2010, one-year old anchovy spawners. With regard to the anchovy biomass (in tons) estimated during these four acoustic surveys (Fig.1), it can be observed that differences between seasons are lower due to the growth of anchovy individuals by length and weight which compensates for the loss of

individuals (abundance). In December 2009, 28547 tons of anchovy recruits were estimated, and six months later, in June 2009, the biomass estimated was 28090 tons, since although the number of anchovy individuals was almost half. The same pattern was observed the following year, 25791 tons of anchovy recruits estimated in December 2009 and 22306 tons of anchovy spawners estimated by acoustic methods in July 2010. For sustainable management of fish stocks, it is necessary to understand the dynamics of populations and their fluctuations over time. In the case of anchovy, our data could be a good indicator of the anchovy natural mortality in this area.

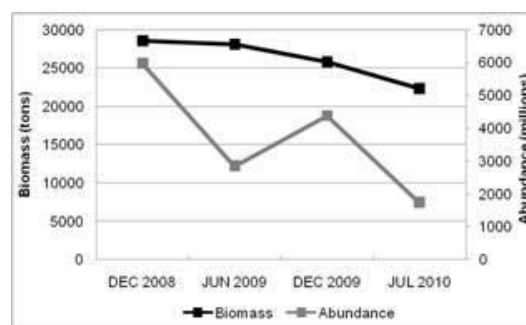


Fig. 1. Anchovy biomass (tons) and abundance (n° individuals) estimated by acoustic methods (four surveys) in Northern Spain (GSA06).

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