

Spatial and temporal distribution of the early life stages of three commercial fish species in the northeastern shelf of the Gulf of Cádiz

F. Baldó^{a,*}, E. García-Isarch^a, M.P. Jiménez^b, Z. Romero^b,
A. Sánchez-Lamadrid^a, I.A. Catalán^a

^aCentro de Investigación y Formación Pesquera y Acuicola El Toruño, Junta de Andalucía, C/ Nac. IV, Km 654,
11500 El Puerto de Santa María, Cádiz, Spain

^bInstituto Español de Oceanografía, Apt. 2609, 11006 Cádiz, Spain

Received 1 February 2005; accepted 2 April 2006
Available online 9 August 2006

Abstract

Monthly cruises were carried out during an annual cycle in a coastal fringe located at the northeastern shelf of the Gulf of Cádiz, characterised by its important and diverse fishery activity, in order to study the ichthyoplankton abundance, composition and seasonality. From March 2002 to March 2003, the abundance of fish eggs and larvae was estimated monthly at 26 sampling stations in the area. The mean abundance through the analysed period was 955 eggs/100 m³ and 326 larvae/100 m³ of the total species of fish caught. Higher mean densities occurred during the warmest months. Three commercially important species in the area (anchovy *Engraulis encrasicolus*, sardine *Sardina pilchardus* and wedge sole *Dicologlossa cuneata*) represented 57% and 50% of mean fish eggs and larval concentrations, respectively. Anchovy eggs and larvae were the most abundant in the area, each representing 33% of the total mean fish egg and larval concentrations. Temporal variations in the abundance of eggs and larvae showed different reproduction patterns for the analysed species: while anchovy reproduction mainly occurred during the spring–summer period, sardine reproduced during autumn–winter whereas wedge sole was mainly winter–spring spawner in the area. Furthermore, the spatial distribution was different for the early stages of these three species. Cluster analysis of the sampling stations (based on Bray–Curtis similarities derived from the annual mean concentrations of eggs and larvae of the three species) revealed four well-defined areas: a coastal western sector, a coastal eastern sector, an offshore sector and a single sampling station, close to the Guadalquivir River mouth, which showed a high degree of accordance with the oceanographic characterisation of the area.

© 2006 Elsevier Ltd. All rights reserved.

Keywords: Ichthyoplankton; Fish eggs/larvae; *Engraulis encrasicolus*; *Sardina pilchardus*; *Dicologlossa cuneata*; Gulf of Cádiz

1. Introduction

The Gulf of Cádiz (ICES region IXa) is an area with an important fishery activity involving different fishing types and target species, related to the seasonal variation in species abundances.

*Corresponding author. Tel.: +34913473735;
fax: +34914135597.

E-mail address: francisco.baldo@md.ieo.es (F. Baldó).

The fisheries in the Spanish waters off the Gulf of Cádiz are characterised by the great diversity in exploited species (Sobrino et al., 1994), related to the bathymetric particularities of its continental shelf and slope, the existence of a warm-temperate climate, and the enrichment produced by the outflows of important rivers as the Guadalquivir, the Guadiana and the Tinto-Odiel. As generalised by some authors for most fishery production worldwide (Caddy and Bakun, 1994), enrichment processes associated to river outflows are probably responsible for the high fishery production in the area.

The small pelagics anchovy *Engraulis encrasicolus* (Linnaeus, 1758) and sardine *Sardina pilchardus* (Walbaum, 1792), and the flatfish wedge sole *Dicologlossa cuneata* (Moreau, 1881) are three species of high commercial interest in the Gulf of Cádiz. Anchovies and sardines are traditionally exploited by an important fleet of purse seiners, being the anchovy the main target species, while the sardine is the second species captured (Millán, 1992). On the other hand, the wedge sole constitutes one of the main target species exploited by the bottom-trawl (Sobrino et al., 1994; Jiménez et al., 1998, 2001) and gillnet fishery (Jiménez et al., 1998, 2001) in this zone.

There are several biological studies focused on the biology of these three species in the area, mainly related to reproductive or growth aspects. Anchovy growth and reproduction were studied by Rodríguez-Roda (1977) and Millán (1999). Rodríguez-Roda (1970) also described reproductive aspects of the sardine. The reproductive biology and growth of the wedge sole have been intensively studied by Jiménez et al. (1998, 2001) and Vila et al. (2002), respectively. In spite of the known aspects of the adult phases of these species in the area, the knowledge on their early life stages is scarce. The few available studies are limited either temporally or spatially. In the case of anchovy, the description of the important spawning and nursery grounds in coastal areas of the Gulf lacked seasonal component (Rubín et al., 1997, 1999). On the other hand, more recent studies (García-Isarch et al., 2003a, b) were focused on the spatial and temporal variation of the ichthyoplankton in a very limited area off the Guadalquivir River mouth. Drake et al. (2002) and Baldó and Drake (2002) described the Guadalquivir estuary as an important nursery area for many marine fish species.

In general, abiotic factors like temperature, light or salinity can modulate eggs and larval abundance

in two different ways: either affecting the spawning stock, i.e. modifying spawning time (Ré et al., 1988; Sánchez-Velasco et al., 2002), or influencing larval survival through its effect on growth (Frank and Leggett, 1981) or development (Johnston et al., 2001). Hydrography and hydrodynamics play a key role in the determination of final survival. In species whose developmental success is linked to relatively confined areas, or with high mesoscale variability, survival strongly depends on processes and structures ranging metres to kilometres, and days to weeks. Within these, pycnoclines, fronts, river plumes or eddies provoke retention mechanisms and enhanced food availability which may promote survival (Sabatés, 1990; Sabatés and Masó, 1992). On the other hand, if spawning areas are far from nursery areas, changes in the dominant currents may result in larval expatriation with obvious consequences for larval mortality (Hare et al., 2002; Catalán et al., 2006).

This study was carried out in a shallow region of the Gulf of Cádiz that could play an important role as spawning and nursery area for anchovy, sardine and wedge sole (Rubín et al., 1997, 1999; García-Isarch et al., 2003a, b). Further, the shallowest portion of this area is generally out of reach of the Spanish routine ichthyoplankton studies. In the present study it was monthly analysed the ichthyoplankton abundance during a whole annual cycle, in order to ascertain the relative seasonal importance of each species. Particular attention was given to the spatial associations emerging on an annual basis, based on the mean abundance of eggs and larvae of the three species. The possible links between the resulting biologically based zonation and oceanographic features are discussed.

2. Material and methods

Monthly research cruises were carried out from March 2002 to March 2003 on board the vessel *Regina Maris* from the Consejería de Agricultura y Pesca of the Junta de Andalucía. This monitoring consisted of a grid of 26 fixed stations distributed over a coastal fringe (from 6 to 90 m depth) between the mouths of the Guadalquivir and the Guadiana Rivers (Fig. 1). The stations were positioned in a design of 10 radials quasi-perpendicular to the coastline, alternating short radials (with 2 stations) with longer ones (with three stations or four in the case of the radial at the Guadalquivir River mouth), with the exception of the area between the mouths

Download English Version:

<https://daneshyari.com/en/article/4538301>

Download Persian Version:

<https://daneshyari.com/article/4538301>

[Daneshyari.com](https://daneshyari.com)