

NORTHWESTERN MEDITERRANEAN ANCHOVY SPAWNING GROUNDS OFF THE CATALAN SEA, GULF OF LIONS AND LIGURIAN SEA DURING 1992 AND 1993

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Under the framework of UE financed FAR project on the NW Mediterranean anchovy stock (*Engraulis encrasicolus*) off the Catalan Sea, Gulf of Lions and Ligurian Sea, two fish egg and larval surveys were carried during the peak spawning period (June-July) with the main objective delimitating the spatial distribution of the spawning areas in 1992 in order estimate Daily Egg Production spawning biomass in 1993. The present paper describes the results obtained from the surveys "MAD-0792" and "MPH-MED 93" carried out on board the R/V Garcia del Cid.

MAD-0792. A total of 195 Bongo-40 plankton oblique hauls (200 μ mesh) were carried out in stations 10 nautical miles apart within near to perpendicular to the coastline transects, distanced 10 or 12 miles apart, depending on the anchovy spawning intensities expected in different surveyed sectors. In order to assure the maximum limit of anchovy egg vertical distribution (PALOMERA, 1991), tows were carried out to the desired depth of 100 m depth, whenever possible. Vertical CTD profiles (Seabird Model) were also done at each station providing information on temperature, salinity and relative fluorescence distribution complemented with Doppler profiling of currents (GARCÍA, 1994). The main anchovy spawning grounds are located along a mid cross-section of the Gulf of Lions, whose edges coincide with the shelf break, which practically form a continuation with the more litoral spawning areas off Cape of Creus and the northern Catalanian coasts. At the southernmost sector, the traditional anchovy spawning ground (PALOMERA, 1992) opposite the Ebro river delta outflow is clearly defined, with southwestern extensions. The Liguro-Provençal basin has anchovy spawning grounds located mainly along the Tuscan shelf, limited seaward by the shelf margin; but in comparison to the previously described spawning grounds, the scale of abundances decrease six fold, approximately. Anchovy larvae offer a more spread out distribution due to their longer presence in the planktonic phase. Highest abundances occur in the mid section of the Gulf of Lions, and subsequently following a similar distributional pattern to the egg distribution. The inner litoral sector of the Gulf of Lions register practically insignificant or null presence of larvae. In general, higher larval abundances are recorded in more offshore stations (normally in the second or third station of the transect), rather than the strictly litoral ones. In comparison, anchovy larval abundances decrease greatly in the Ligurian basin, where these have not practically exceeded values over 10 larvae/m². These abundances are mostly located in the last transects, near the island of Elba, across Corsica and the Italian coasts, coinciding with the widening of the continental margins. The most productive spawning ground is located in the region comprehended between the northern Catalanian coasts and the Gulf of Lions, where the main bulk of the target species is located, in agreement with the echo-acoustic evaluations carried out in recent years (ABAD *et al.*, 1991). Several common features can be pointed out in relation with anchovy spawning grounds distribution: 1) they are associated to river runoffs (e.g., Rhône, Ebro); 2) are influenced by the strong Liguro-Provençal-Catalán current, producing associated cyclonic or anticyclonic eddies that can either disperse or retain larvae in nursery grounds favourable to growth or inversely; 3) hydrological phenomena associated to bottom topography (e.g., submarine canyons).

MPH-MED-0793. During July 1-30, 1993 another anchovy egg survey was carried out aboard the R/V Garcia del Cid with the main objective of estimating spawning biomass through the Daily Egg Production Method. This evaluation technique implies an intensive plankton vertical tow sampling. The basic scheme of egg sampling stations was based on a 5 by 5 nautical mile track (stations and transects), with transects near perpendicular to the coastline, modified in some of the covered regions to 2.5 miles between stations and 10 miles between transects. A total of 602 CalVET net (150 μ mesh) vertical tows of 100 m depth were done, representing a coverage of 59,981 km² of sea surface. Catalan Sea accounted for 292 plankton hauls, whereas the Gulf of Lions and Ligurian Sea accounted for 138 and 172, respectively. Temperature-salinity with depth from CTD (Seabird 25) profiles were obtained in 278 of the stations sampled (GARCÍA, 1994; Annex V). No spawning activity was observed in the southernmost area of the sampled area from Cape San Antonio to Castellón (Gulf of Valencia). Thereon northward, spawning was detected continuously until the Gulf of Lions. The spawning ground associated to the Ebro river delta showed high egg concentrations in the immediate zone of influence of its outflow spreading high concentrations seaward, but mainly concentrated along the shelf break where the continental shelf is widest. The influence of the Ebro river discharge on salinity is observed up to 25 miles offshore. Along the coast of the northern sector of the Catalan Sea, the continental shelf is much narrower, thereby limiting spawning to the litoral zone, until the region of the Gulf of Lions. In this area, practically no spawning occurs in its inner coastal section, and once more higher egg densities occur along the margin of the shelf. Two main spawning areas are observed in this region, a western one that forms continuity with the northernmost Catalan sector, and an eastern spawning ground influenced by the Rhône river runoff. In comparison to the southern region, surface temperatures are significantly lower (-19°-20°C) in the Gulf of Lions sector with a gradual increasing trend southward (~20°-22°C).

Although rather spatially restricted, the freshwater river discharge from the Rhône river was observed in the eastern coast of the Gulf of Lions (minimum salinity values 32.750/00). Relative fluorescence intensities increase considerably in the stations close to the river mouth, attaining maximum levels registered during the survey. Coastal upwelling in the interior part of the Gulf was clearly observed which is also reflected on the maximum levels of relative fluorescence intensities. Finally, the anchovy egg distribution off the Ligurian and N Tyrrhenian Sea was concentrated along the continental shelf of the Tuscan region. High egg densities were observed opposite the two river outflows (Arno and Magra) and the northern part of the island of Elba. In this latter zone, rather low sub-superficial temperatures and high salinities were observed indicating an upwelling process which does not reach surface layers. South of this island, isolated and dispersed anchovy egg concentrations were observed.

In conclusion, anchovy spawning grounds distribution is related to the complex hydrology which represents the linking factor of the studied regions, in such a way that the resource has an inter-relationship which should be considered for its assessment.

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