DISPLACEMENTS OF SHOALS OF ARISTEUS ANTENNATUS DEDUCED FROM THE FISHING ACTIVITY OF WEST LIGURIAN TRAWLERS

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RESUME'- Un chalutage des crevettes rouges, *Aristeus antennatus* (Risso), conduit de maniére intensive et prolongée sur une aire limité (au large de Ventimille) fait supposer un déplacement continu de crevettes rouges vers cette aire de récolte.

The red-shrimp fishery of the Ligurian sea (for some historical notes see Orsi Relini e Relini 1985) has shown a serious reduction in the central and eastern sectors since 1980; however, in a very limited area of the Western Ligurian Riviera, off the coast of Ventimiglia, in the last few years, the trawlers have obtained increasing catches of *Aristeus antennatus*. Now that a work-group on the biology of the deep Penaeids has been set up(1), we are of the opinion that the description of some features of the west ligurian trawling activity - which are in some respects unique - may provide some information on the biology of *A. antennatus*.

Off the coast at Ventimiglia, the shelf is very narrow and slanting and the slope is cut by two submarine valleys which are situated close to each other and positioned at right angles to the coast (a map can be found in Relini Orsi and Relini 1979). Owing to the presence of rocks, the bottoms of the eastern valley cannot be trawled and fishing activity must be concentrated on bottoms ranging from 500 to 700 m in the western valley, on a single course North to South, which can be covered in 45-60 minutes. In summer 1985, due to the good catches and the high market price of the shrimps, all the trawler fleet of San Remo (14 units) fished continuously in this area from June to September, six days a week, from dawn to dusk, excluding only the days of very bad weather. The large number of trawlers working in the same zone often forced then to wait in turns to be able to reach the exact position where it was suitable to begin the haul. Once the trawling began, the main attention of the skippers was in the regulation of the speed:indeed they assert the existence of local currents, mainly in the same direction as the trawling(i.e.N-S)which influence the result of the haul.

We analyzed the catch on board during some days in July and August, recording (of each shrimp caught) the carapace length in mm, the sex, and the maturative stage. For the ovaries four categories were established, based mainly on the accumulation of carotenoproteins i.e. on the colour of the ovarian tissue in toto (Relini Orsi e Relini 1979): white = virgin or spent recovering ovary; pink = at the beginning of maturation; light violet = in advanced maturation; dark violet = ready to spawn. The males having spermatophores in the deferent terminal ampoules were considered mature.Fig. 1 illustrates the complete catch obtained on 27/7/85 by the trawler "Carmelo" totalling about 45 kg of shrimps. As we have already recorded for other Ligurian fishing grounds (Relini Orsi and Relini 1979) the fishing is aimed mainly at spawners. Other days of fishing produced comparable results. It is remarkable that the fished stock remained productive under the described fishing pressure. The best catches reached 90 kg per day per trawler and only after the middle of September decreased to 15 kg per day.The catch composition in terms of maturity stages remained approximately the same, while the largest size classes showed a reduction in the advanced fishing season.

Bearing in mind the characteristics of the fishery and the catches it must be assumed that

1) A continuous arrival of shrimps occurs which replaces those captured on the fishing ground.

2) The movement of the shoals, which are composed mainly of mature spawners, could be passive, owing to the particular hydrodynamic characteristics in the canyons or, more probably active, as pelagic shrimps are generally considered good swimmers. They could correspond to trophic or reproductive requirements: e.g. are abundantly represented in the catches *Pasiphaea sivado* and the other pelagic shrimps that form part of the diet of *A. antennatus* (Brian 1931). Particularly the reproductive hypothesis is interesting: in submarine canyons ascending currents have been recorded (Picazzo and Tucci 1982) and these could be useful in the spreading of eggs and larvae. The small Western Ligurian fishing ground could be a fixed course in a reproductive migration. It is evident that more hydrological information concerning this zone is needed.

(1) The idea for this w.-g. arose within a coop.progr. CSIC-CNR (Sardà-Orsi Relini).

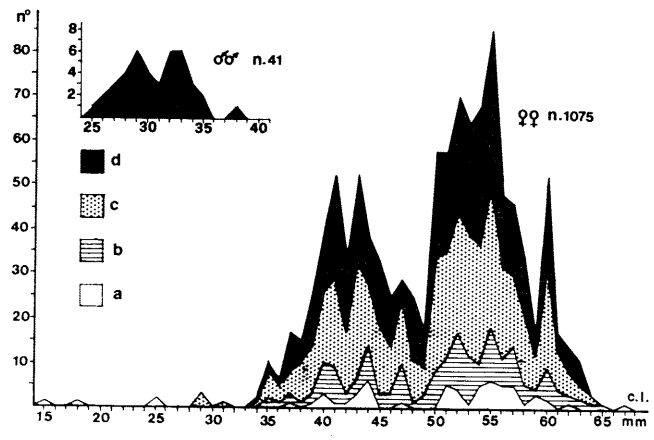

Fig. 1 - Length/frequency distribution and maturative stages of *A. antennatus* trawled in the canyon of Ventimiglia (a= virgin or spent-recovering; b = at the beginning of maturation; c = in advanced maturation; d = ready to spawn).

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DISPLACEMENTS OF ARISTEUS ANTENNATUS DEDUCED FROM THE STRUCTURE OF THE FISHED STOCK IN THE PORTOFINO AREA (EASTERN LIGURIAN RIVIERA)

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RESUME' - Le retour de crevettes rouges de grande taille sur une aire chalutable (au large de Portofino) où elles étaient absentes depuis cinq ans, fait supposer d'importants déplacements des formes adultes.

A trawling area for red shrimps occurs at about 700 m depth on muddy bottoms extended on the slope between the Portofino Promontory and the submarine canyon on the river Bisagno. These bottoms have been exploited since the fifties and in recent yeara were studied in a prolonged CNR research (1976-1981) on the slope fishery resources. During surveys carried out as part of this research there was observed a decreasing trend in the catch of *Aristeus antennatus* up to their extinction after the summer at 1980 (Relini Orsi et al. 1982).

In the subsequent years explorative deep fishing was effected in the same area in the appropriate seasons (spring and summer) but *Aristeus antennatus* proved absent. Finally in the summer ot 1985, at the end of July, some small catches (1-10 kg per haul lasting 3 hours) of this shrimp were obtained and in August the yield increased to 20 kg per haul. It must be noted that it was only one trawler which effected this fishing activity and only once or twice every week: so these catches represent in total a very scarce quantity compared to those registered in the past (Orsi Relini and Relini 1985a).

Nevertheless, having been able to observe the demographic structure of the catch (on board in the summer of 1985), we are of the opinion that from it some information can be deduced on the behaviour of *A. antennatus*. We have recorded of each shrimp the carapace length in mm, the sex and the maturative stage. For the ovaries four categories were established, based mainly on the accumulation of carotenoproteins, i.e. on the colour of the ovarian tissue in toto (Relini Orsi and Relini 1979): white = virgin or spent-recovering ovary; pink = at the beginning of maturation; light violet = in advanced maturation; dark violet = ready to spawn. The males having spermatophores in the deferent ampoules were considered also ready to spawn.

From the point of view of reproduction the composition of the catches (fig. 1), as in other cases (see Orsi Relini et al. in this volume, page 00) shows that the shrimps are in large part spawners. The structure in terms of size-classes is particularly interesting because these shrimps appeared after an absence of five years, a period considered longer than the life span of bathyal Penéids (Burukovskii 1980; Cau, Deiana and Mura 1982; Orsi Relini and Relini 1985b).

In the Ligurian sea the females of *A. antennatus* in terms of size/frequency distribution can generally be divided into two main groups separated approximately at the carapace length of 50 mm: those smaller than this size were supposed to belong to the group age 0+ - 1 and those larger mainly to the group age 1+ to 2+; a total life span of 24-27 months was evaluated (Orsi Relini and Relini 1985b, Relini Orsi and Relini 1979). The shrimps caught at Portofino (fig. 1) belong mainly to the second group of size; if the above suppositions are correct, they did not grow to their advanced age locally because no presence of shrimps has been registered by trawlers since 1980. The hypothesis of a recruitment in very deep waters seems to be refuted since in other Aristaeidae the young shrimps live on higher levels than the old specimens (Burukovskii 1975, Cau, Deiana and Mura 1984).

The nearest fishing grounds where *A. antennatus* occurred in the previous year were situated on the Western Ligurian Riviera or on the Tyrrhenian coast at Latium: the arrival of reproductive shoals in the area of Portofino allows us to assume large horizontal displacements of the spawners.

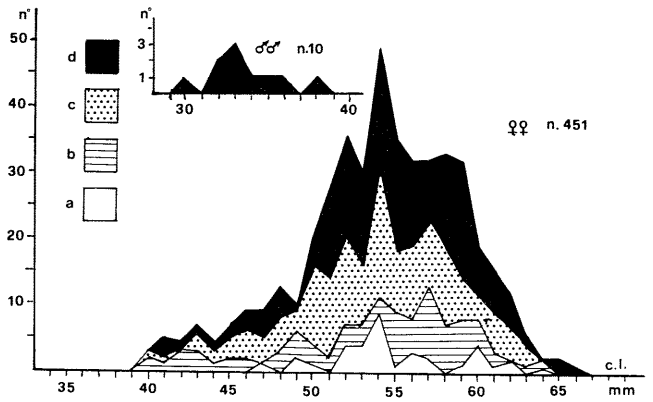

Fig. 1 - Catch composition in terms of sex ratio, sizes (carapace length) and reproductive stages in *Aristeus antennatus* (a = virgin or spent-recovering gonads); b = at the beginning of maturation; c = in advanced maturation; d = ready to spawn).

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