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Seasonal distribution of Crustacea Decapoda larvae in S. Torpes bay, South-western Portugal

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Palabras clave: Decapoda, larvas, distribución estacional, plancton, Portugal.
Key words: Decapoda, larvae, seasonal distribution, plankton, Portugal.

RESUMEN: DISTRIBUCIÓN ESTACIONAL DE LARVAS DE CRUSTÁCEOS DECÁPODOS EN LA COSTA SUROESTE DE PORTUGAL.—Se analiza la abundancia de larvas de crustáceos decápodos capturadas en 10 campañas de exploración planctónica realizadas en la bahía de S. Torpes, en el sudoeste de Portugal.
Los valores de máxima abundancia se registraron durante el invierno, con grandes abundancias de algunas especies de polibinidos. Durante el verano se observa un aumento de la diversidad. Se ha observado una disminución de la abundancia y de la diversidad a principios de verano a causa de las bajas temperaturas producidas por las condiciones de afloramiento.
Se presenta la distribución estacional y espacial de las especies más abundantes, para la cual se ha realizado un análisis de las correspondencias de los tres grupos principales observados, agrupados por afinidades de sus ciclos de presencias.

SUMMARY: The abundance of decapod larvae was analized from 10 planktonic surveys made in S. Torpes bay, south-western Portugal.
Maximum abundances were found in winter where high densities of a few polybinid species were observed, and in summer where samples showed high diversity. During early summer both abundance and diversity decreased due to low temperatures caused by local upwelling conditions.
The seasonal and spatial distribution of the most representative species is presented. Correlation between these species showed three main groups, coupled by affinities of their patterns of occurrence.

INTRODUCTION

Data on decapod larvae from the Portuguese coast (taxonomic or ecological aspects) are rare, since general zooplanktonic studies do not include sufficiently detailed identifications.

In neritic areas of the Northeastern Atlantic region the main works on the seasonal distribution of this group were porsuied by THORSON (1946), in the Danish Sound, Lebour (1947) off Plymouth, REES (1952, 1955) in the North Sea, KURIAN (1956) in the Adriatic Sea, BOURDILLON-CASANOVA (1960) in the Gulf of Marseille, and more recently VIVES (1966, 1979) on the coasts of Spain, SERIDJI (1971) in the bay of Alger and FUSTÉ (1982) off Barcelona.

The present work deals with the seasonal patterns of occurrence of decapod larvae on the south-western Portuguese coast, and the influence of biotic and abiotic factors on these patterns.

MATERIAL AND METHODS

Between October 1981 and September 1982, 10 plankton surveys were made in S. Torpes bay, near Sines, south-western Portugal. Figure 1 shows the position of the stations sampled. A standard larval tuna net (FAO, 1967) equiped with a flowmeter was used in oblique hauls in the upper half of the water column at each station, during 10 minutes with a speed of 1.5-2 knots. The samples were made during the light period, and were fixed and preserved in buffered 5 % formaldehyde. Temperature was recorded simultaneously at 1 and 15 meters depth. Larvae were identified and counted with the aid of a binocular microscope.

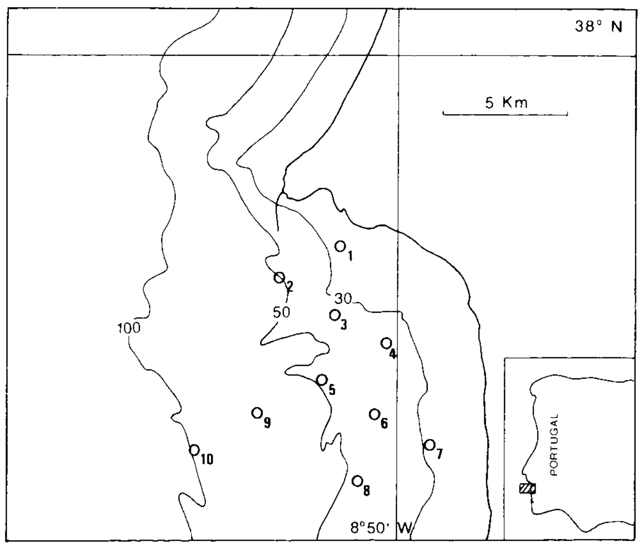

FIG. 1. — Position of stations sampled

Larval densities in ind./100m^3 were transformed to Ln *(N + 1)* (IBAÑEZ, 1971). Correlation betwen species was made using Bravais-Pearson's correlation coefficient following the UPGMA method (SNEATH and SOKAL, 1973).

RESULTS AND DICUSSION

The minimum values of temperature were reached in March (14.6 °C at 15 meters depth) and maximum values in September (20.5 °C at surface) (fig. 2).

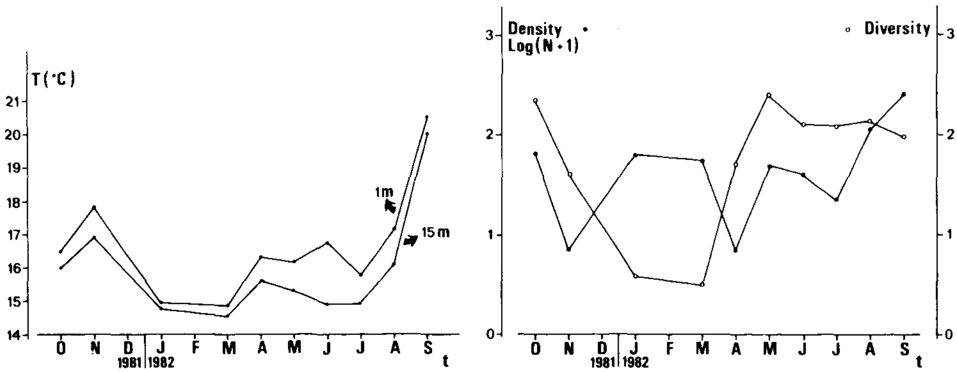

FIG. 2-3. — FIG. 2 (left): Annual fluctuation of temperature. — FIG. 3 (right): Seasonal distribution fo total Decapod larvae and diversity.

During the period May-July a decrease of temperature was observed, connected with the upwelling conditions that occur in the area. This intermitent upwelling is due to the constancy of northern winds in this period of the year and occurs essencially on the southern side ot the capes (FIÚZA, 1982, 1983).

The seasonal fluctuation of Decapod larvae sohws two peak periods of abundance (fig. 3). In winter, a few polybinid species have high densities, and in summer, particularly during August-September, a large number of species are present in the plankton. The evolution of Shannon-Weaver's index clearly illustrate this point (fig. 3). Brachyuran crab larvae showed a large dominance during winter months, considering not only the Decapod larvae but all macroplankton.

Table I shows the periods of occurrence of all Decapod larvae collected during the study. Some of the species collected in the plankton of S. Torpes bay had not been previously recorded on the Portuguese coast: *Caridion steveni* Lebour, 1930, *Pontonia flavomaculata* Heller, 1864, *Eualus gaimardii* H. Milne Edwards, 1837, and two indeterminated larvae belonging to the families Pirimelidae and Parthenopidae. These two larvae, although not identified to specific level, most certainly belong to unrecorded especies on the Portuguese coast (PAULA, 1987). In July 44 taxa were collected; this high number reflects additional sampling efford, for night samples were made in this month.

The quantitative seasonal distribution of the most abundant Decapod larvae is presented in figures 4 and 5.

Within the Caridea, the most abundant taxa were *Processa* spp., *Alpheus glaber, A. macrochelles, Athanas nitescens, Hippolyte* sp., and *Philocheras trispinosus.* Of these, *Processa* spp. was by far the most abundant.

The larval stages of the callianassid *Upogebia* sp. were very abundant in September, reaching the highest observed concentration of all Decapod larvae. In the rest of the year they were rather rare.

TABLE I

Seasonal occurrence of Decapod larvae

Months	O	N	J	M	A	M	J	J	A	S
Solenocera membranacea	—	—	—	—	—	+	—	—	—	—
Sergestes robustus	—	—	+	—	—	+	—	+	—	—
Sergestes sp.	—	—	—	—	—	+	—	—	—	—
Pandalina brevirostris	+	+	+	—	+	+	+	+	—	—
Pandalus sp.	—	—	—	—	—	—	+	—	—	—
Plesionika sp.	+	+	+	—	—	+	—	—	—	+
Hippolyte sp.	+	—	—	—	—	—	+	+	+	+
Thoralus cranchii	+	+	+	—	—	+	+	+	—	+
Eualus pusiolus	+	+	+	—	—	+	+	+	—	+
Eualus gaimardii	+	—	—	—	+	+	—	+	+	+
Eualus occultus	—	—	—	—	—	+	—	—	—	—
Caridion steveni	—	—	—	—	—	+	—	—	—	—
Lysmata seticaudata	—	—	—	—	—	—	—	—	—	+
Athanas nitescens	+	+	—	—	—	+	+	+	+	+
Alpheus glaber	+	+	+	+	—	+	+	+	+	+
Alpheus macrocheles	+	+	+	+	+	+	+	+	+	+
Processa spp.	+	+	+	+	+	+	+	+	+	+
Palaemon sp.	+	—	+	+	+	+	+	+	+	+
Pontonia flavomaculata	—	+	—	—	—	—	—	—	—	+
Periclimenes sp.	—	—	—	—	—	—	—	—	+	+
Philocheras trispinosus	+	+	+	+	+	+	+	—	+	—
Philocheras bispinosus	+	+	+	+	—	+	+	—	—	+
Philocheras sculptus	—	—	+	—	—	+	+	—	+	+
Philocheras fasciatus	—	—	+	—	+	+	—	—	+	+
Pontocaris cataphracta	—	+	—	—	—	—	—	—	—	+
Crangon crangon	—	—	—	+	—	—	—	—	—	—
Stenopus spinosus	+	—	—	—	—	—	—	—	—	+
Scyllarus arctus	+	+	+	—	—	+	+	—	+	+
Axius stirhyncus	—	—	+	—	—	—	—	—	—	—
Callianassa sp. 1	+	—	—	—	+	—	+	—	—	+
Callianassa sp. 2	+	—	—	—	—	+	+	—	+	+
Upogebia sp.	+	+	—	+	+	—	—	—	—	+
Diogenes pugilator	+	—	+	+	—	+	+	+	+	+
Dardanus sp.	—	—	—	—	—	—	—	—	—	+
Pagurus cuanensis	+	—	—	—	+	—	—	—	—	—
Pagurus bernhardus	—	—	—	—	+	+	—	+	+	+
Pagurus sp.	—	—	—	—	—	+	+	—	—	+
Catapaguroides timidus	+	—	—	+	+	+	+	+	—	+
Anapagurus laevis	+	—	+	—	—	+	—	+	+	+
Anapagurus hyndmani	+	—	—	+	+	+	+	—	+	+
Anapagurus sp.	+	—	—	+	—	+	+	—	+	—
Spiropagurus elegans	—	—	—	—	—	+	—	—	—	—
Paguridae undertermined	—	—	—	—	—	—	—	—	+	—
Galatheia nexa	+	—	+	+	—	—	—	—	—	—
Galatheia dispersa	+	—	+	+	+	+	+	+	+	+
Galatheia intermedia	+	—	—	—	—	+	+	+	+	+
Galatheia squamifera	+	—	+	+	—	+	+	—	—	+
Galatheia strigosa	+	—	+	—	—	+	—	—	—	—
Galatheidae undetermined	+	—	—	—	—	+	—	—	+	—
Porcellana platychelles	+	—	—	—	—	—	—	—	—	—
Pisidia longicornis	+	—	+	+	+	+	+	+	+	+
Dromia personata	—	—	—	—	—	—	—	—	—	+
Homola barbata	—	—	—	—	—	+	—	—	—	—

Months	O	N	J	M	A	M	J	J	A	S
Ethusa mascarone	—	—	—	—	—	—	+	+	+	+
Dorippe lanata	+	—	—	—	—	—	+	—	—	—
Ebalia tuberosa	—	—	—	—	—	—	—	+	+	—
Ebalia tumefacta	+	—	+	—	—	+	+	+	—	+
Xantho sp.	—	—	—	—	+	+	+	+	+	+
Eriphia verrucosa	—	—	—	+	—	—	—	—	+	—
Pilumnus hirtellus	+	+	+	+	+	+	+	+	+	+
Carcinus maenas	+	+	+	+	+	+	—	—	+	—
Portumnus latipes	—	—	—	—	+	+	—	+	+	—
Liocarcinus puber	+	—	—	+	+	+	+	+	+	+
Polybiinae undetermined	+	+	+	+	+	+	+	+	+	+
Atelecyclus sp. 1	—	—	+	+	+	+	—	+	+	—
Atelecyclus sp. 2	—	—	—	—	—	—	—	+	—	—
Corystidae undetermined	+	—	—	+	+	+	+	+	—	—
Thia scutellata	—	—	—	—	—	+	+	+	+	—
Pirimela denticulata	+	—	—	+	+	+	—	—	+	+
Pirimelidae undetermined	—	—	—	—	—	—	—	+	—	—
Goneplax rhomboides	+	+	+	—	+	—	+	—	—	+
Pachygrapsus marmoratus	—	—	—	—	—	—	+	—	+	—
Brachynotus sexdentatus	—	+	—	—	+	—	—	—	—	—
Grapsidae undetermined	—	—	—	—	—	—	—	+	—	—
Pinnotheres pinnotheres	—	—	+	+	—	—	—	—	—	—
Pinnotheres pisum	—	—	—	—	—	—	—	+	—	—
Pisa sp. 1	—	—	—	—	—	—	—	+	—	—
Pisa sp. 2	—	—	—	—	—	—	—	+	—	—
Majidae undetermined 1	—	—	—	—	—	—	—	+	—	—
Majidae undetermined 2	—	—	—	—	—	—	—	+	—	—
Eurynome aspera	—	—	+	+	—	—	+	+	—	—
Achaeus cranchii	—	—	—	—	—	—	—	+	—	—
Inachus sp.	—	—	—	—	—	—	—	+	—	—
Macropodia sp.	+	—	—	—	—	—	—	+	—	—
Parthenope sp.	—	—	—	—	—	—	—	+	+	—
Parthenopidae undetermined	—	—	—	—	—	—	—	—	—	+

Diogenes pugilator, Anapagurus hyndmani, Galatheia dispersa and *Pisidia longicornis* were the most abundant anomurans. *Pisidia longicornis* was very common from May to August.

The most abundant taxa of the Brachyura were *Thia scutellata, Pilumnus hirtellus* and undertermined Polybiinids. Among these brachyurans the Polybiinae showed highest densities, specialy in winter months. The irregularity of the seasonal distribution of this group reflects the occurrence of several abundant species.

There is a tendency of most species to decrease larval densities during June-July. This was also observed for total Decapod larval density and diversity. This tendency is probably connected with the decrease of temperature due to the above refered upwelling conditions. The low temperatures (decreasing to winter values in this period) may affect larval survival or condition adult reproduction and embryonic development. The highest peak of total Decapod larvae occurs in September, probably reflecting optimal feeding conditions. The major peak of chlorophyl *a* was observed in August (GONÇALVES e

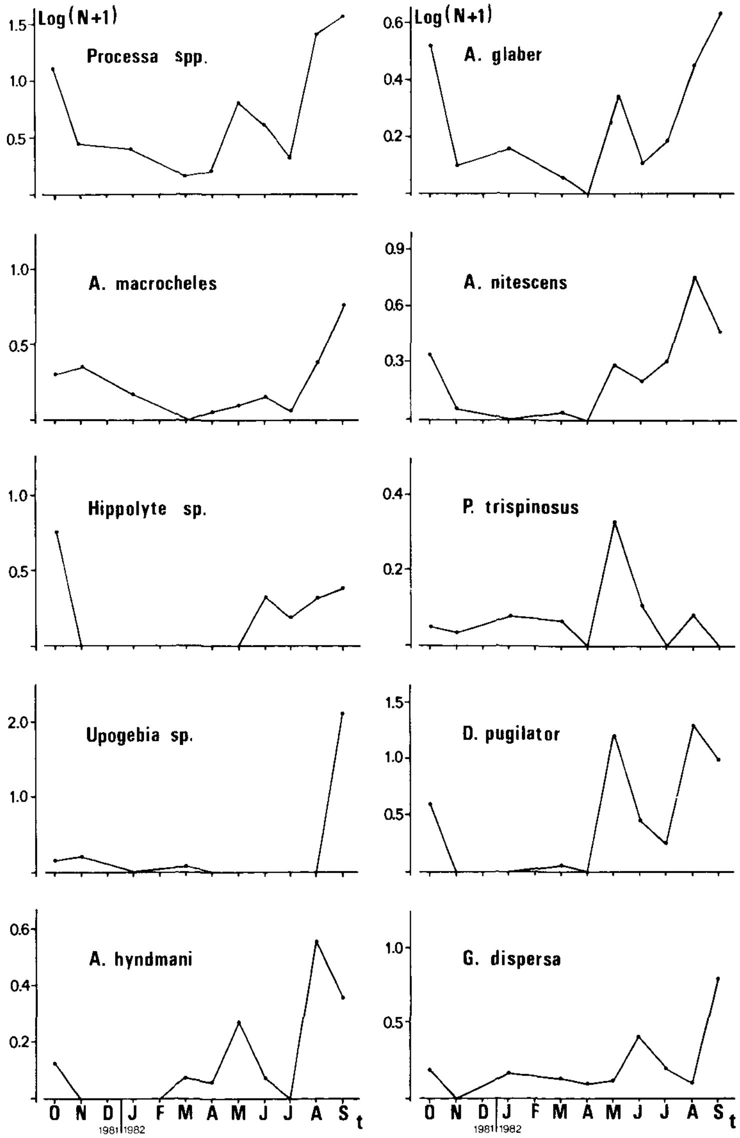

FIG. 4. — Seasonal distribution of the most abundant taxa.

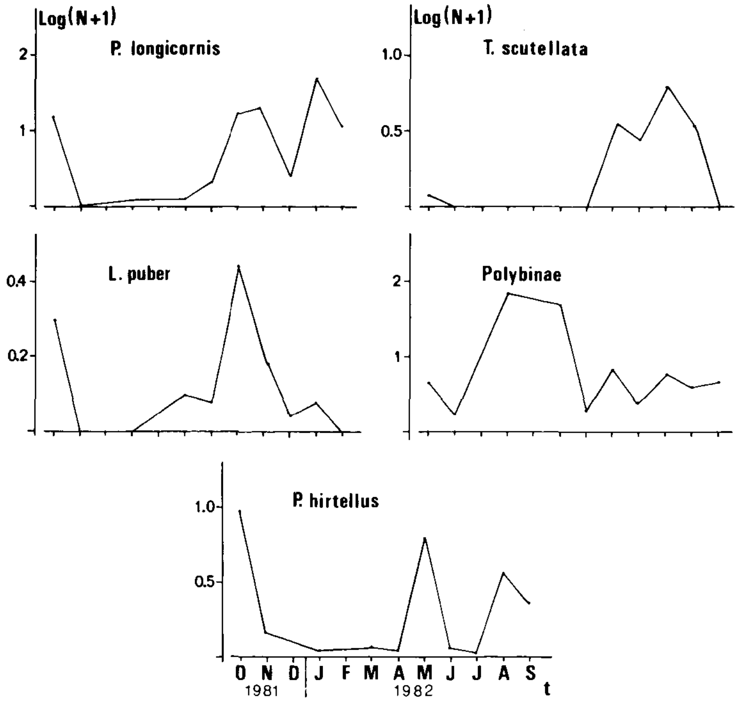

FIG. 5. — Seasonal distribution of the most abundant taxa (cont.)

COSTA, 1983) and copepods had their maximum concentrations in September-October (PAULA *et al*, 1983). A similar pattern of seasonal occurrence was reached by RÉ (1984) for fish egg and larvae in the same research area.

Figure 6 represent the spatial distribution of the most abundant species.

Shore species were mainly concentrated near the coast (*P. trispinosus, A. nitescens, P. longicornis, D. pugilator, P. hirtellus, L. puber* and *T. scutellata*).

A. macrochelles had higher concentration off the coast.

Some taxa do not show patchiness, as *Hippolyte* sp., *Upogebia sp., Processa* spp. and Polybiinae. The two later taxa represent several species each and thus different larval dispersion centers.

The analysis of the dendrogram of correlations between species (fig. 7) showed three main groups. Species aré associated considering their similar specific larval periods in the plankton and coincidence of maximum abundances. The first group (species 3, 11 and 12, i. e., *P. trispinosus, C. maenas* and Polybiinae) represents winter occurrence species. The main central group consists of summer occurrence species; the first two species (10 and 13, i. e., *T. scutellata* and *Xantho* sp.) have their seasonal distribution very localizated from April-May to August; *Processa* spp., *A. nitescens, D. pugilator, P. longicornis*

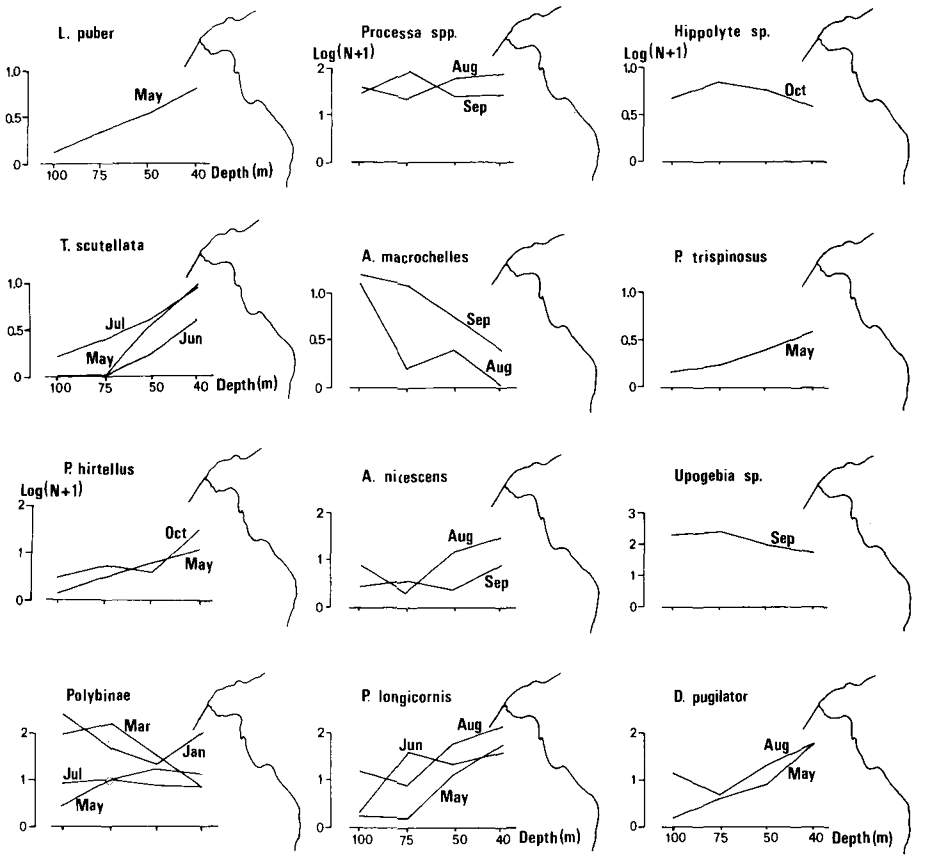

FIG. 6. — Shore-off shore distribution of the most abundant taxa in the periods of maximum abundance.

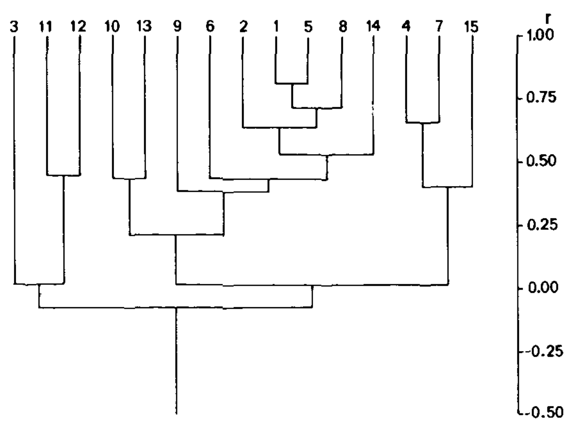

FIG. 7. — Correlation's dendrogram between species (see text for species references).

and *P. hirtellus* (2,1,5,6 and 14 in the dendrogram) have wide distributions and maxima in August-September. The third group, formed by *Upogebia* sp., *G. dispersa* and *Callianassa* sp. (4, 7 and 15 in the dendrogram) shows automnal occurrence with maximum abundance in September-October.

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