ICES mar. Sci. Symp., 199: 189–199. 1995

Distribution and abundance of molluscs and decapod crustaceans in trawl samples from the Galician Shelf (NW Spain)

A. C. Fariña and F. J. Pereiro

Fariña, A. C., and Pereiro, F. J. 1995. Distribution and abundance of molluscs and decapod crustaceans in trawl samples from the Galician Shelf (NW Spain). – ICES mar. Sci. Symp., 199: 189–199.

This study presents the community composition and structure of molluscs and decapod crustaceans from trawl samples taken on the Galician Shelf in Northwest Spain. Spatial and temporal distribution, as well as the biomass and density of the main species, are presented in relation to depth and substrate type.

A. C. Fariña: Instituto Español Oceanografía, Apdo 130, 15080 La Coruña, Spain. F. J. Pereiro: Instituto Español Oceanografía, Apdo 1552, 36280 Vigo, Spain [tel: (+34) 981 20 53 62, fax: (+34) 981 229077].

Introduction

Two main groups of invertebrates (crustaceans and molluscs) are caught when trawling for fish on the Galician Shelf, which lies off northwestern Spain, reaching a depth of 500 m 30 km from the coast along its southern part and broadening to 65 km from the coast in the northern part.

Primary production is high on the Galician Shelf due to seasonal upwelling of the North Atlantic Central Water on the Atlantic coast of the Iberian Peninsula (Fraga *et al.*, 1982). Because of the high primary productivity, the area is a favourable habitat for benthic fauna. With the exception of the southern zone, the bottom is rocky only to a depth of 100 m and can be accessed by trawls between depths of 100 and 500 m. There are important pelagic and demersal fisheries on the shelf and various types of gear are used. Most fishing is done with trawls, although gillnets, longline, and other minor types of gear are also used. Catches are composed mainly of hake (5500 t landed annually), blue whiting, Norway lobster, angler fish, megrim, and more than 20 other commercially important species (Fariña *et al.*, 1989). Living with or directly related to these species are diverse groups of macrobenthic invertebrates. This article describes the distributions of their populations in this area.

Materials and methods

Since 1980 the Galician Shelf has been monitored by trawl surveys conducted with the RV "Cornide de Saavedra". Surveys are conducted twice a year to coincide with recruitment to the area (in the autumn) and the spawning season of the majority of the demersal and benthic species (in the spring). A stratified sampling design was used and selection of the trawls was random. The area is divided into three geographic sectors (Miño to Finisterre, Finisterre to Estaca, and Estaca to Ribadeo), and each sector is divided into two strata by depth (>200 m and <200 m). Hauls were 30 min in duration and were done during daylight hours. The sampler was a "baca" trawl, widely used by the Spanish fishing fleet and designed to capture demersal and benthic species which live very close to the bottom. The gear had a netting of 20 mm mesh size covering the inside of the codend. The specimens taken in each haul were identified, counted, and weighed. Sediments were collected using a cylindrical sampler attached to the footrope of the gear as described by Fernández and Fariña (1984).

Cruises conducted between the autumn of 1985 and the spring of 1987 were selected for this study since they comprised a continuous cycle of two annual surveys; in other years it was not always possible to sample during the spawning season. The hauls (109 in the spring and 108 in the autumn) are shown in Figure 1. The taxonomic nomenclature follows the literature of González Gurriarán and Méndez (1985), Fischer *et al.* (1987) and Olaso (1990).

Results

Faunal composition

A total of 54 species of invertebrates (27 species of decapods, 13 species of gastropods and 14 species of cephalopods) were captured on the cruises (Table 1).

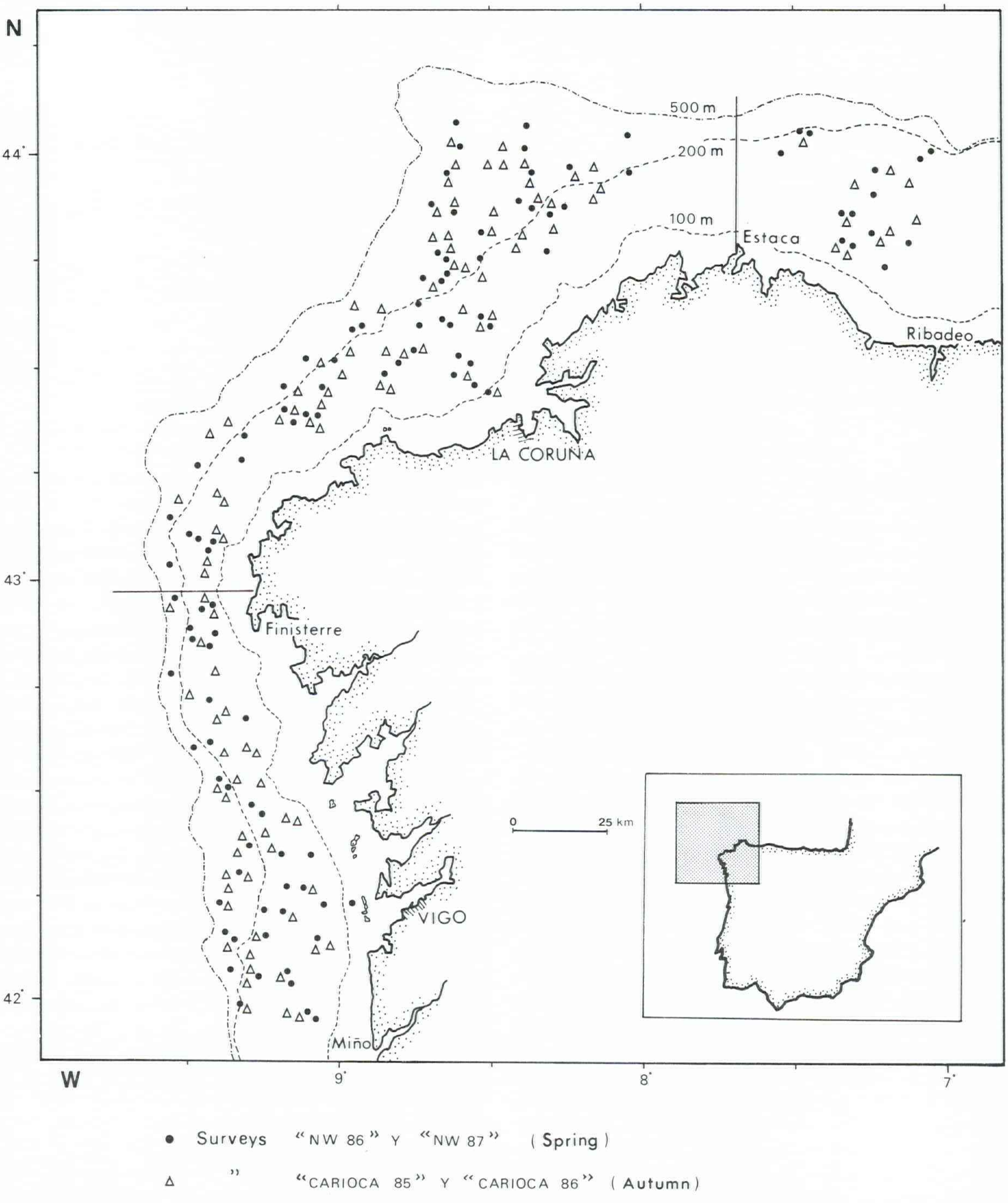


Figure 1. The location of hauls in the geographic sectors of the Galician Shelf during surveys conducted in the spring and autumn between 1985 and 1987.

Table 1. Index of species of crustaceans and molluscs caught on the Galician Shelf during the surveys.

MOLLUSCA
- **Gastropoda**
  - **Prosobranchia**
    - **Archaeogastropoda**
      - *Calliostoma granulatum* (Born, 1778)
    - **Mesogastropoda**
      - *Aporrhais pespelicani* (Linnaeus, 1758)
      - *Aporrhais serresianus* (Michaud, 1828)
      - *Lunatia fusca* (Blainville, 1825)
      - *Cassidaria tyrrhena* (Chemnitz, 1789)
      - *Semicassis saburon* (Bruguière, 1789)
      - *Argobuccinum olearium* (Linnaeus, 1758)
      - *Charonia rubicunda* (Perry, 1811)
    - **Neogastropoda**
      - *Coralliophila alaucoides* (Blainville, 1829)
      - *Colus gracilis* (Da Costa, 1778)
      - *Neptunea contraria* (Linnaeus, 1758)
      - *Buccinum humphreysianum* Bennet, 1825
  - **Opisthobranchia**
    - *Scaphander lignarius* (Linnaeus, 1758)
- **Cephalopoda**
  - **Decapoda**
    - *Sepia orbignyana* Ferusac, 1826
    - *Sepia elegans* Blainville, 1827
    - *Rossia macrosoma* (Delle Chiaje, 1829)
    - *Sepiola rondeleti* Steenstrup, 1856
    - *Sepietta oweniana* (Orbigny, 1839)
    - *Loligo forbesi* Steenstrup, 1856
    - *Loligo vulgaris* Lamarck, 1798
    - *Alloteuthis subulata* (Lamarck, 1798)
    - *Alloteuthis media* (Linnaeus, 1758)
    - *Illex coindetti* (Verany, 1839)
    - *Todaropsis eblanae* (Ball, 1841)
    - *Todarodes sagittatus* (Lamarck, 1798)
  - **Octopoda**
    - *Octopus vulgaris* Cuvier, 1797
    - *Eledone cirrosa* (Lamarck, 1798)

CRUSTACEA
- **Decapoda**
  - **Dendrobranchiata**
    - *Solenocera membranacea* (Risso, 1816)
  - **Pleocymata**
    - **Caridea**
      - *Alpheus glaber* (Olivi, 1792)
      - *Pontophilus spinosus* (Leach, 1815)
      - *Chlorotocus crassicornis* (Costa, 1871)
      - *Dichelopandalus bonnieri* (Caullery, 1896)
      - *Plesionika heterocarpus* (Costa, 1871)
      - *Pasiphaea sivado* (Risso, 1816)
      - *Processa canaliculata* Leach, 1815
    - **Astacidea**
      - *Nephrops norvegicus* (Linnaeus, 1758)
      - *Homarus gammarus* (Linnaeus, 1758)
    - **Palinura**
      - *Polycheles typhlops* (Heller, 1862)
    - **Anomura**
      - *Anapagurus leavis* (Bell, 1846)
      - *Pagurus bernhardus* (Linnaeus, 1758)
      - *Pagurus prideauxi* Leach, 1815
      - *Pagurus variabilis* (A. M. Edwards-Bouvier, 1892)
      - *Munida intermedia* (A. M. Edwards-Bouvier, 1892)
      - *Munida sarsi* Brinkman, 1936
    - **Brachyura**
      - *Paromola cuvieri* (Risso, 1816)
      - *Macropodia tenuirostris* (Leach, 1814)
      - *Atelecyclus rotundatus* (Olivi, 1792)
      - *Goneplax rhomboides* (Linnaeus, 1758)
      - *Liocarcinus depurator* (Linnaeus, 1758)
      - *Macropipus tuberculatus* (Roux, 1830)
      - *Polybius henslowii* Leach, 1820
      - *Bathynectes maravigna* (Prestrandea, 1839)
      - *Cancer bellianus* Johnson, 1861
      - *Cancer pagurus* Linnaeus, 1758

Yields

Figure 2 shows the biomass proportions of the yields of the decapods, gastropods, and cephalopods in each of the geographic sectors during the two spring and autumn seasons.

In the spring in the Miño–Finisterre sector, most of the biomass was cephalopods, but the proportion of cephalopods decreased from the south towards the north of the shelf. However, in all samples *Illex coindetti*, *Todaropsis eblanae*, and *Eledone cirrosa* comprised more than 80% of the total molluscan biomass.

Together with the cephalopods, decapods were important in all three sectors in the autumn. The gastropods represented only a small fraction of the biomass, although *Neptunea contraria* was prominent in the Miño–Finisterre sector at depths of less than 200 m, where its biomass occupied third place after *Illex* and *Eledone*.

The decapod *Polybius henslowii* was the species with the highest biomass in the spring in the Miño–Finisterre sector, followed by *Liocarcinus depurator*. Between Estaca and Ribadeo, *Liocarcinus* and *Pagurus prideauxi* dominated the biomass both in the spring and in the autumn. In the autumn, the biomass of *Polybius* was dominant between Miño and Estaca, although it was mostly restricted to depths less than 200 m.

Numerical yields

In each of the defined geographic sectors and depth zones, different species were the most abundant. *Illex coindetti* and *Alloteuthis* sp. were the most abundant in the spring samples taken between Miño and Finisterre at depths of less than 200 m, while at depths greater than 200 m concentrations of *Plesionika heterocarpus* were as important as *Illex*.

In the spring between Finisterre and Estaca, *Illex coindetti*, *Polybius henslowii*, and *Liocarcinus depurator* were dominant at less than 200 m, while at greater depths *Munida intermedia* together with *Munida sarsi*,

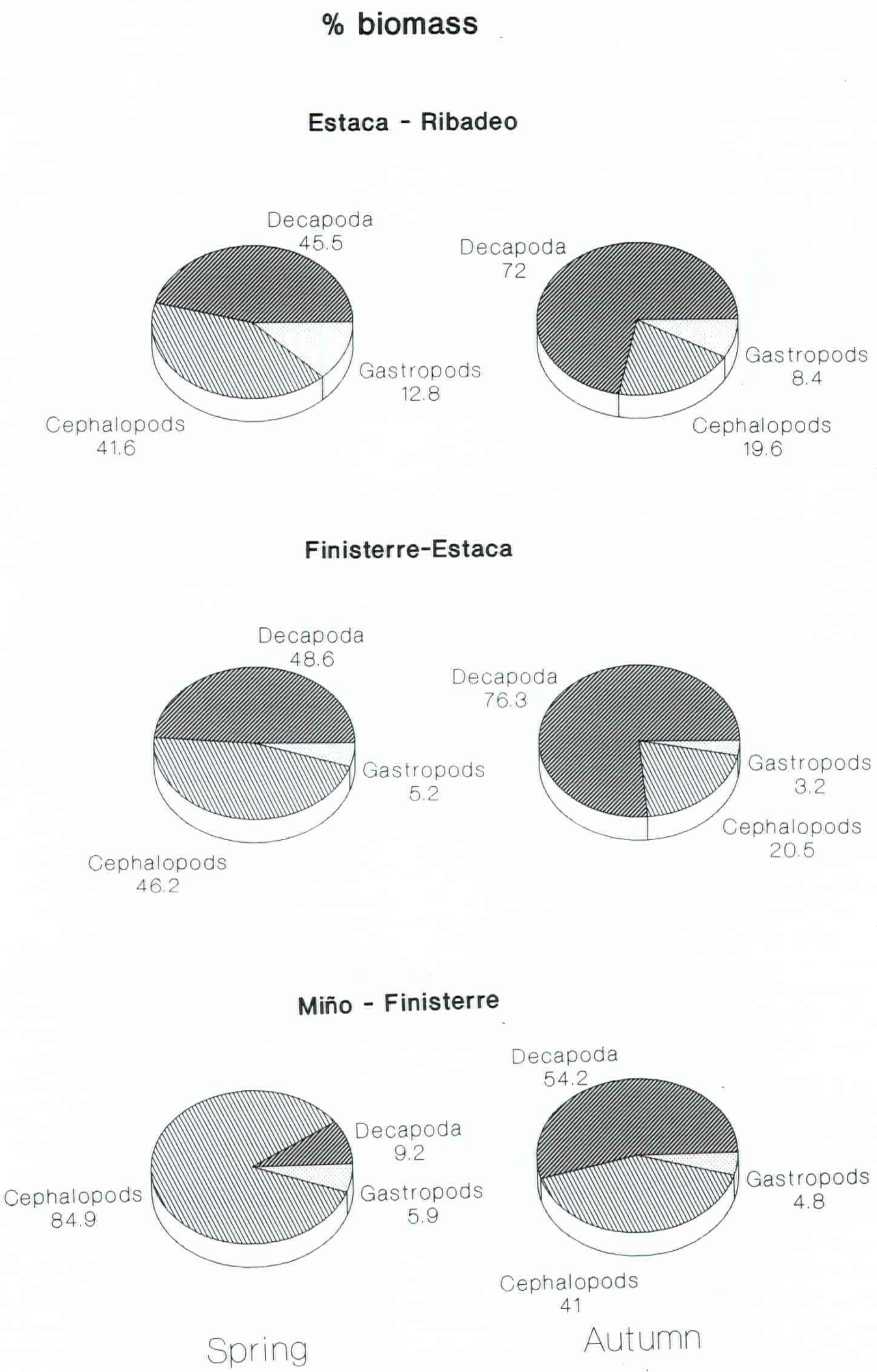


Figure 2. The percent biomass of the various components of the macrobenthos in the three geographical sectors from surveys conducted during the spring and autumn.

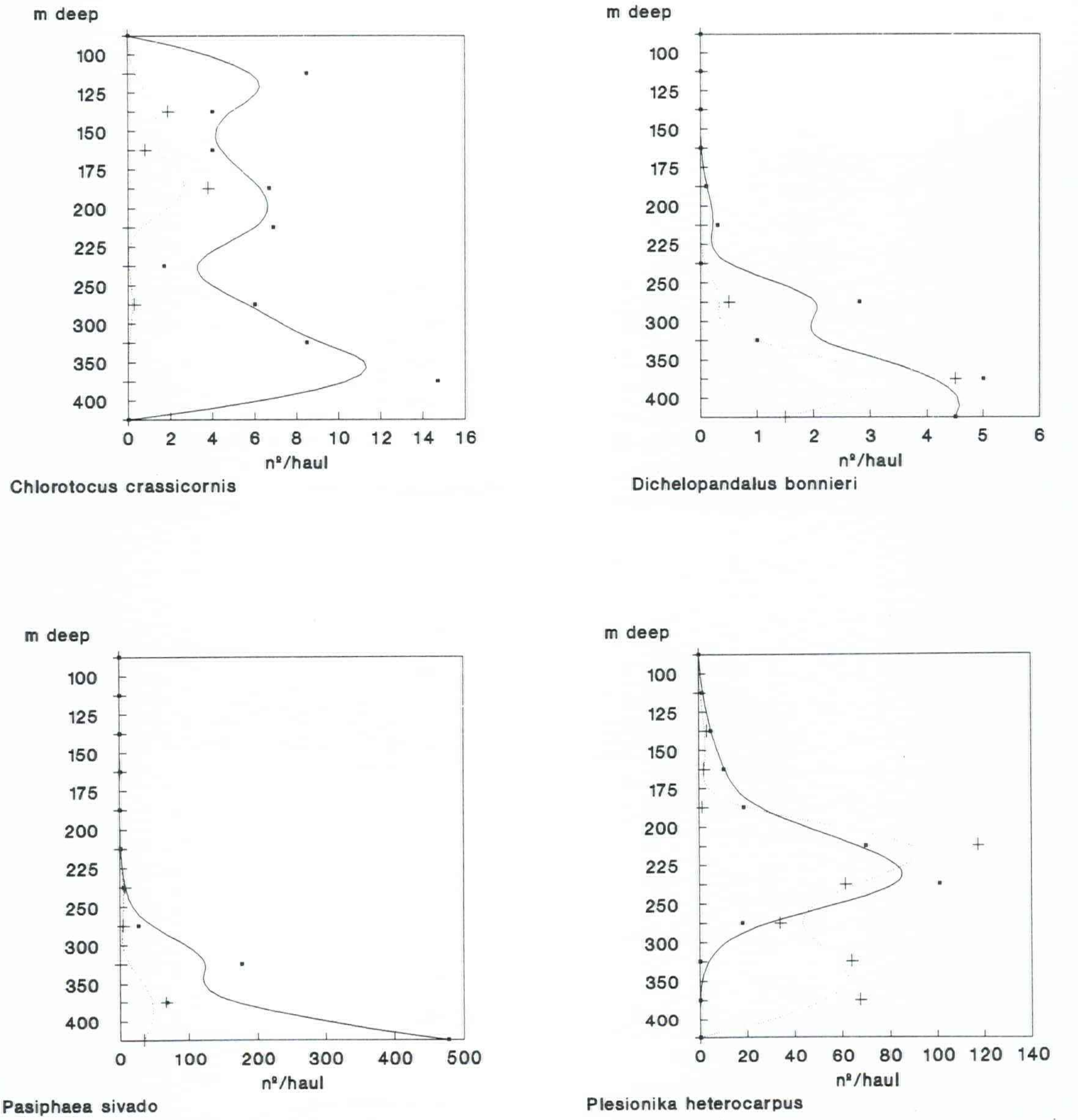


Figure 3. Bathymetric distribution of *Chlorotocus crassicornis*, *Dichelopandalus bonnieri*, *Pasiphaea sivado*, and *Plesionika heterocarpus* (■ = Spring, + = Autumn).

Liocarcinus depurator, *Solenocera membranacea*, and *Pasiphaea sivado* established the dominance of the decapods.

Distribution

Geographic distribution

Most of the species mentioned have a broad distribution on the shelf, including *A. rotundatus*, *G. rhomboides*, *A. pespelicani*, *A. serresianus*, *C. gracilis*, and *T. sagittatus* which, although captured only occasionally, occurred in all geographic sectors.

However, some decapods were found only in small numbers and only in the northern Finisterre–Estaca zone at depths greater than 300 m, including *Cancer bellianus*, *Paromola cuvieri*, and *Polycheles typhlops*. Others, such as *C. crassicornis*, *P. canaliculata*, *P. heterocarpus*, *S. membranacea*, and *N. norvegicus*, were found mainly between Miño and Estaca and only rarely between Estaca and Ribadeo, which is the steepest sector with coarse sandy sediments.

Bathymetric distribution

Although the depth range in which trawling takes place is not very wide (93–432 m) and many species were

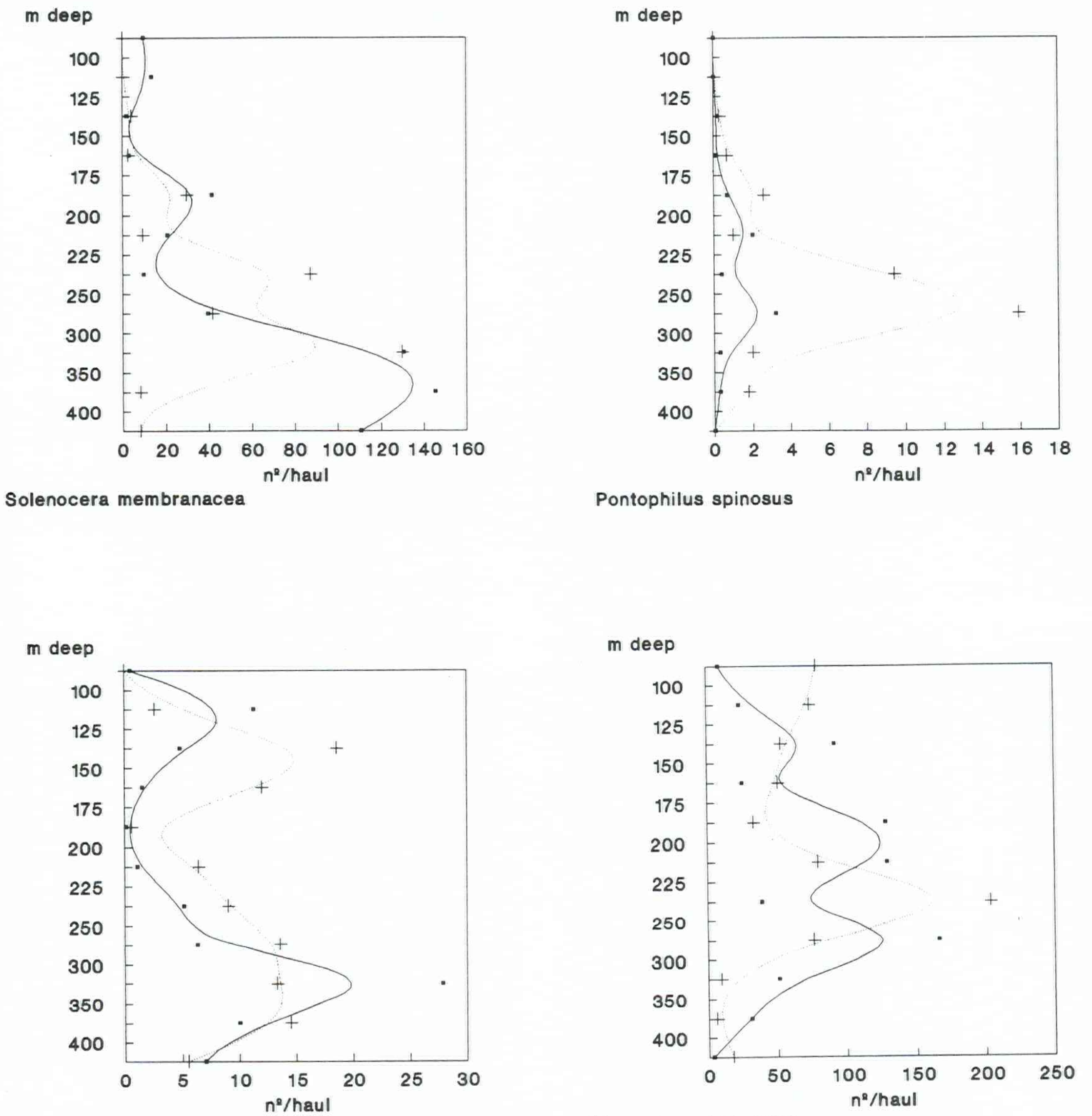


Figure 4. Bathymetric distribution of *Solenocera membranacea*, *Pontophilus spinosus*, *Nephrops norvegicus*, and *Liocarcinus depurator* (■ = Spring, + = Autumn).

present throughout this range but had higher concentrations at certain depths, certain trends could be established which in some cases changed seasonally.

Figures 3–5 show the distribution of the most representative decapods. *Chlorotocus crassicornis* was more abundant in the spring and was found throughout the range of depths. *Dichelopandalus bonnieri* and *Pasiphaea sivado* were restricted almost exclusively to depths greater than 200 m and their concentration increased with depth.

The distribution of *Plesionika heterocarpus* and *Solenocera membranacea* varied little between seasons. The number of *S. membranacea* tended to increase with depth, while *P. heterocarpus* formed larger aggregations between 200 and 250 m. In contrast, *Pontophilus spinosus* was more abundant in the autumn between depths of 200 and 300 m. The distribution of *Nephrops norvegicus* seemed to be influenced less by depth than by other factors.

Liocarcinus depurator was less abundant between Miño and Finisterre than in the other two sectors. It was found at all depths, but there was a tendency towards

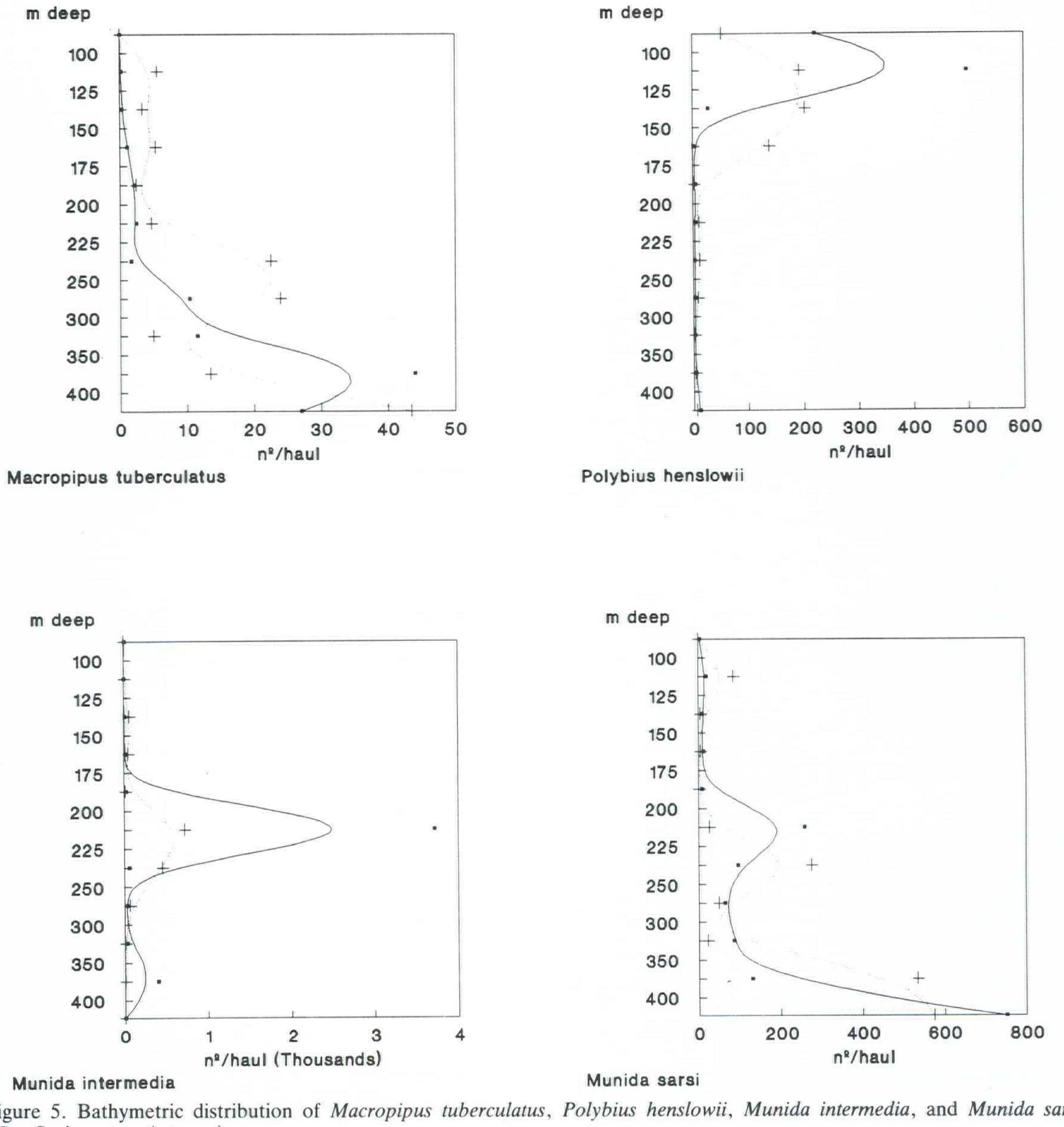


Figure 5. Bathymetric distribution of *Macropipus tuberculatus*, *Polybius henslowii*, *Munida intermedia*, and *Munida sarsi* (■ = Spring, + = Autumn).

lower concentrations at depths greater than 300 m. The opposite was shown by *Macropipus tuberculatus*, which clearly increased in abundance at depths greater than 200 m.

Polybius henslowii formed dense clusters that were more or less pelagic in the Finisterre–Estaca sector. *Munida intermedia* formed significant aggregations in the northwest part of the Finisterre–Estaca sector just below the 200 m isobath. *Munida sarsi* was less abundant than *M. intermedia* and reached its greatest abundance below 350 m. The two species were often found together, but in terms of ecological habits there seemed to be some segregation between the two species. In fact, in 75% of the hauls in which either of these species was present, one of the species dominated and represented 80% of the total number of the two species. In the remaining 25% of the hauls, the proportions of the two species were variable with each species representing 25 to 75% of the total.

The distribution of the most representative cephalopods is presented in Figures 6 and 7. *A. subulata* and *A. media* occurred mainly at depths of less than 150 m, and were more abundant south of Cape Finisterre. *Illex coindetti* was very abundant in the spring at all depths,

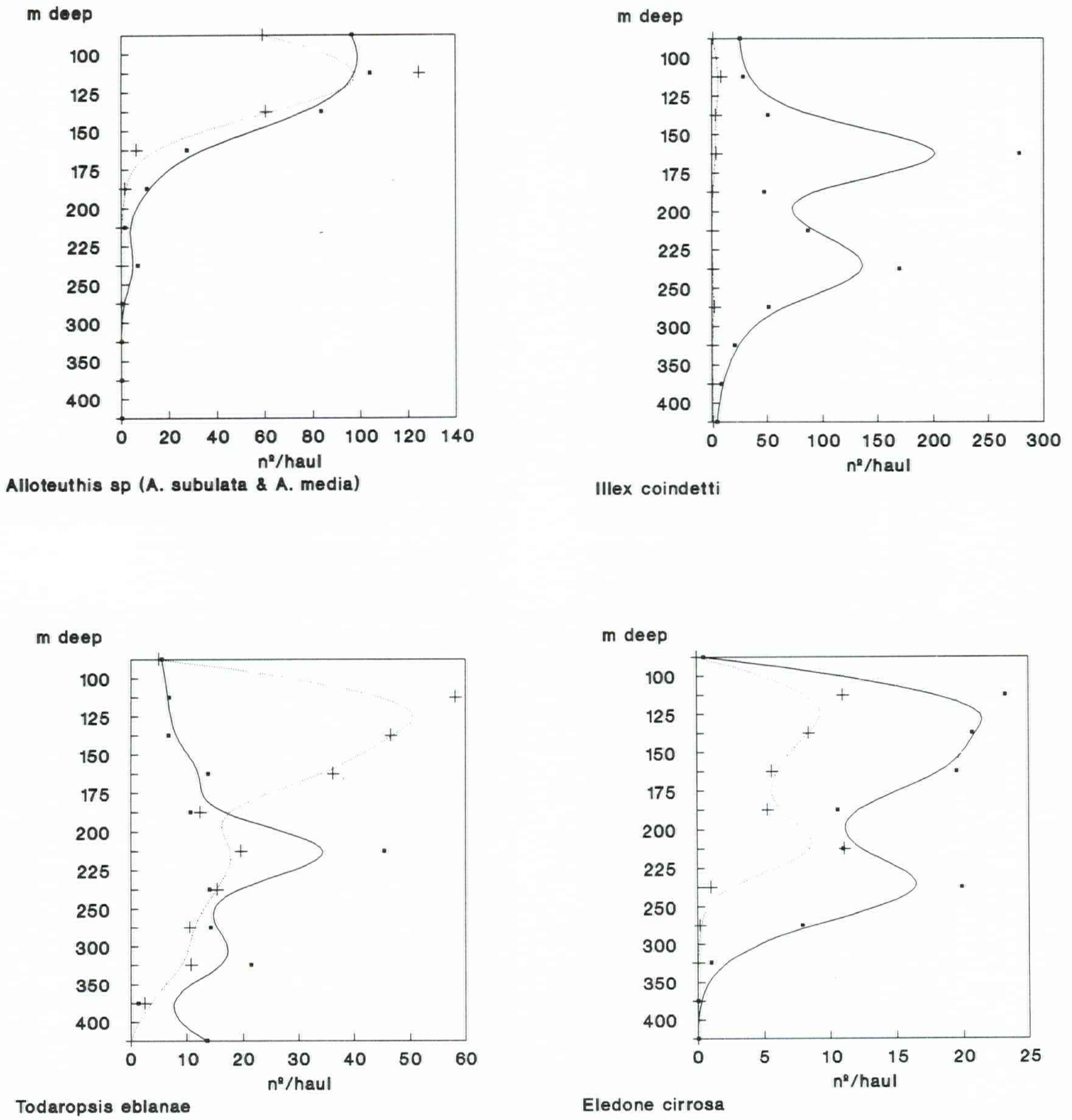


Figure 6. Bathymetric distribution of *Alloteuthis* sp., *Illex coindetti*, *Todaropsis eblanae*, and *Eledone cirrosa* (■ = Spring, + = Autumn).

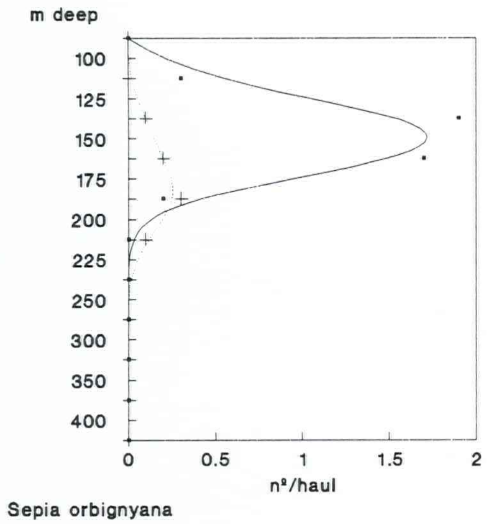
but was rarely found in the autumn at depths of less than 200 m. In contrast, the other flying squid found in these waters, *Todaropsis eblanae*, was significantly more abundant at less than 200 m in the autumn than in the spring, when it was slightly more abundant at depths greater than 200 m.

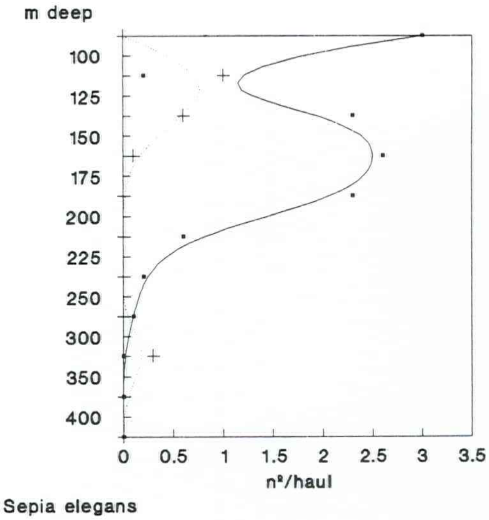
Eledone cirrosa occurred on all parts of the shelf. It was found in almost all hauls and the mean number per haul was higher in the spring than in the autumn. *Sepia orbignyana* and *S. elegans* were more abundant in the spring, *S. orbignyana* being restricted to the stratum less than 200 m.

Because of the small number of gastropod specimens caught per haul (with the exception of *Scaphander lignarius*), no clear differences in distributions could be identified. However, we can point out the weak seasonal differences in the abundance of *S. lignarius* (Fig. 7) and the distribution in the deeper stratum of *Colus gracilis* and *Buccinum humphreysianum*.

Discussion

Although the bathymetric distribution of macrobenthic species is known in general terms in the Atlantic area





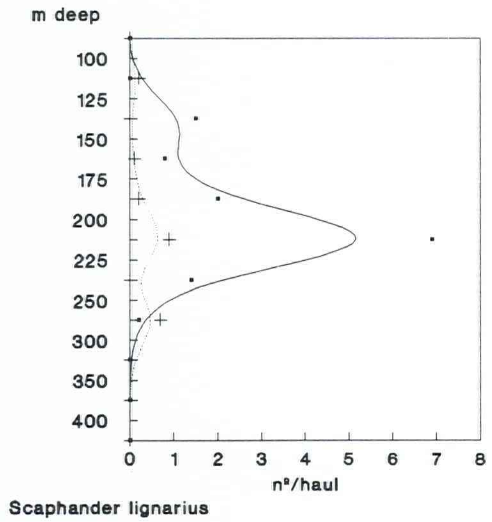


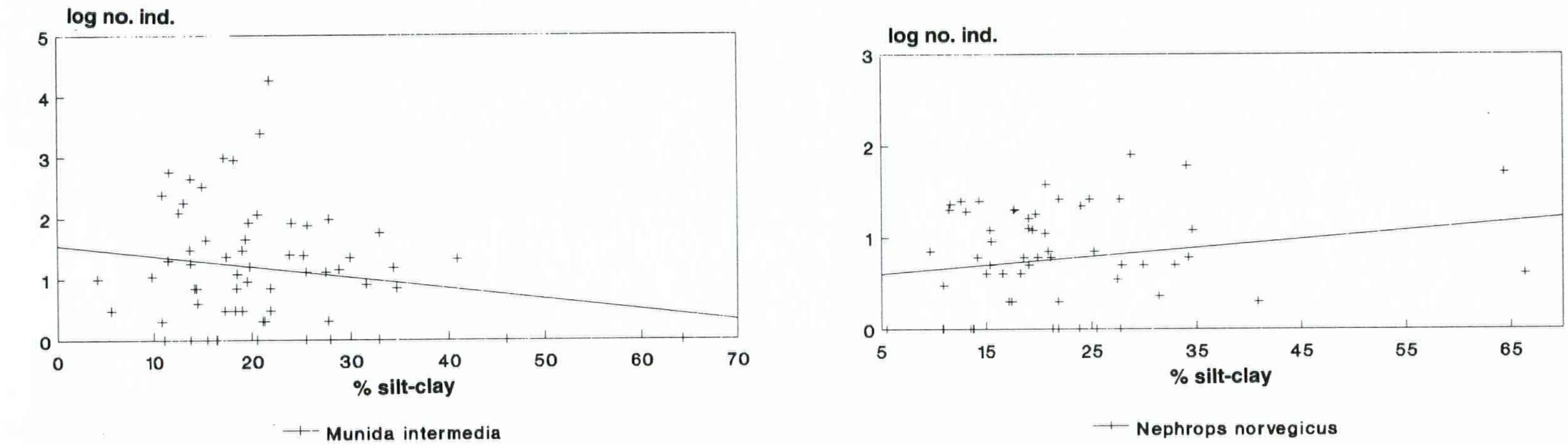
Figure 7. Bathymetric distribution of *Sepia orbignyana*, *Sepia elegans*, and *Scaphander lignarius* (■ = Spring, + = Autumn).

(Le Danois, 1948; Holthuis, 1980), the relative seasonal abundance with respect to depth has not been previously described for Galician waters.

Some species show great variations in abundance in this area (González-Gurriarán and Olaso, 1987), but the Galician Shelf is a fairly homogeneous structure, unlike adjacent areas such as the Cantabrian Shelf, where well differentiated communities have been clearly observed (Olaso, 1990).

The seasonal differences in abundance of certain cephalopods may be explained more by the position they occupy in the food web and their behaviour in the water column (reproduction, migration, etc.) than by factors such as temperature and substrate type. The interaction of the combination of these factors may explain the distribution of certain species (Lagardère, 1973). Thus the abundance of *Munida intermedia* and *M. sarsi* on the Galician Shelf was very different from those in the Cantabrian. Since both species are distributed on substrates with wide variations in the silt–clay fraction, the stratified distribution at different depths of both species may be related more to trophic competition levels.

The relationships between the silt–clay fraction and the numerical presence of *M. intermedia*, *M. sarsi*, *N. norvegicus*, *P. heterocarpus*, *P. spinosus*, and *S. membranacea* were analysed, but no significant correlations



a : 1.5518, b : 0.0175

r : -0.1789

a : 0.5565, b : 0.0095

r : 0.1948

Figure 8. Relationship between numbers of *M. intermedia* and *N. norvegicus* ($\log_{10}$) and percent of silt–clay in the sediment.

were found, as the example in Figure 8 shows. The particular methodology used on the cruises may have affected the information obtained for species such as *Nephrops norvegicus*, which has complex behaviour and locomotor activity outside of its burrows (Bagge and Münch-Petersen, 1979; Hillis, 1971; Atkinson and Naylor, 1976). The type of bottom sediment is considered to be the primary factor governing the distribution of *Nephrops norvegicus*. However, on the Galician Shelf, *Nephrops* was found on bottoms in which the silt–clay fraction is not as high as on other areas of the sea floor of the North Atlantic (Fariña and Fernández, 1984), such as in the Irish Sea (Chapman, 1980) or the Gulf of Cádiz (Fernández and Fariña, 1984).

Although most of the species described can be considered euribathymetric, within the range of depths considered, distribution patterns can be established with maximum densities occurring at certain depths. Generally, distributions do not change noticeably with season, although there are seasonal changes in abundance for some species.

References

Atkinson, R. J. A., and Naylor, E. 1976. An endogenous activity rhythm and the rhythmicity of *Nephrops norvegicus* (L.). J. Exp. Mar. Biol. Ecol., 25: 95–108.

Bagge, O., and Münch-Petersen, S. 1979. Some possible factors governing the catchability of Norway lobster in the Kattegat. Rapp. P.-v. Réun. Cons. perm. int. Explor. Mer, 175: 143–146.

Chapman, C. J. 1980. Ecology of juvenile and adult Nephrops. *In* The biology and management of lobsters, Vol. 2, pp. 143–146. Ed. by J. S. Cobb and B. F. Phillips. Academic Press, New York. 390 pp.

Fariña, A. C., and Fernández, A. 1984. Relación entre la presencia de cigala (*Nephrops norvegicus* L.) y la granulometría del sedimento en la plataforma de Galicia. *In* Actas do IV° Simposio Ibérico de Estudos do Benthos Marinho, Vol. 1, pp. 179–191. Ed. V. Monteiro Marques. Lisboa, Portugal. 333 pp.

Fariña, A. C., Morlán, R., and Landín, B. 1989. Análisis de la pesquería litoral de arrastre de la flota de la Coruña. *In* Jornadas sobre economía y sociología de las comunidades pesqueras, pp. 179–196. Min. Agr. Pesc. y Alim, Madrid. 621 pp.

Fernández, A., and Fariña, A. C. 1984. Contribución al conocimento del sustrato y especies acompañantes de la cigala (*Nephrops norvegicus* L.) en el Golfo de Cádiz. Bol. Inst. Esp. Oceanogr., 1(2): 126–133.

Fischer, W., Bauchot, M. L., and Schneider, M. 1987. Fiches FAO d'identification des espèces pour les besoins de la pêche. (Rév. 1). Méditerranée et mer Noire. Zone de pêche 37. Vol. I. Végétaux et Invertébrés. Rome, FAO, Vol. 1: 760 pp.

Fraga, F., Mouriño, C., and Manríquez, M. 1982. Las masas de agua en la costa de Galicia: junio–octubre. Inv. Pesq. Res. Exp. Cient. 10: 51–77.

González Gurriarán, E., and Méndez, M. 1985. Crustáceos Decápodos das costas de Galicia. I. Brachyura. Cuad. da Area de Cienc. Biolóx., Sem. de Est. Gal., Vol. 2. O. Castro-Sada, A. Coruña: Ed. do Castro, 242 pp.

González-Gurriarán, E., and Olaso, I. 1987. Cambios espaciales y temporales de los Crustáceos Decápodos de la plataforma continental de Galicia (NW de España). Inv. Pesq. 51 (suppl. 1): 323–341.

Holthuis, L. B. 1980. FAO series catalogue, Vol. 1. Shrimps and prawns of the world. An annotated catalogue of species of interest to fisheries. FAO Fish. Synop., No. 125, Vol. 1. 271 pp.

Hillis, J. P. 1971. Effects of light on *Nephrops* catches. ICES CM 1971/K: 3.

Lagardère, J. P. 1973. Distribution des décapodes dans le sud du Golfe de Gascogne. Rev. Trav. Inst. Pêches Marit., 37: 77–95.

Le Danois, E. 1948. Les profondeurs de la mer. Payot, Paris. 303 pp.

Olaso, I. 1990. Distribución y abundancia del megabentos invertebrado en fondos de la plataforma cantábrica. Publ. Espec. Inst. Esp. Oceanogr. N 5. Ed. Min. Agr. Pesc. y Alim. Madrid. 128 pp.