



ZOOPLANKTON COMPOSITION, DISTRIBUTION AND ABUNDANCE IN THE BAY OF BISCAY AND ADJACENT ATLANTIC WATERS FROM A CETACEAN SIGHTING SURVEY

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Key words: Composition. Distribution. Abundance. Zooplankton. Cetaceans. Northeast Atlantic.

ABSTRACT

In 1989 a Spanish shipboard sighting survey was carried out as part of a combined international cetacean's survey in the North Atlantic (NASS-89). The cruise had taken place during July- August covering the Bay of Biscay and adjacent Atlantic waters between 42°- 52° N and 25° W. Zooplankton samples obtained during that cruise have recently been processed and analysed. Due to the relative scarce information available about the zooplankton of the area surveyed it was considered useful to present now this information. Data about the composition, distribution and abundance of the zooplankton fraction between 200 µm and 2 mm were obtained. The dominant groups in the oceanic area were Acantharia, Radiolaria and Amphipoda. In some stations these groups represented more than 50% on the plankton community. In the Bay of Biscay, apart from the groups found in the oceanic area, they also appeared Doliolida and the copepod *Calanoides carinatus* (Krøyer, 1848). Abundances had range between 2 and 27 785 ind. m⁻³ due to the wide extension and different

thermohaline characteristics of the area sampled. The groups with more than 500 ind. m⁻³ were the Radiolarian, Acantharia, Chaetognatha and the copepod *Calanoides carinatus*. The last two groups were more abundant in the coastal zone.

INTRODUCTION

There are abundant zooplankton data obtained with the Continuous Plankton Recorder (CPR) from the Bay of Biscay and the adjacent Atlantic waters. However zooplankton information from classic sampling stations in the oceanic part of this area is rare. The development of a cetacean sighting survey covering oceanic waters in front of the Iberian Peninsula offered the opportunity to obtain samples from these distant and less known areas.

The wide extension of the sampled area accounts for large differences in salinity and temperature, which in turn let to important variability in the composition and abundance of zooplankton.

Zooplankton is the main food of baleen whales. The observation of the stomach contents of fin whales caught in an area from the continental shelf until 125 miles to the west of Galician coasts (Aguilar and Lens, 1981), during the last years of commercial whaling, confirm the important amounts of euphausiids consumed by this species during summer (Lens *et al.*, 1983).

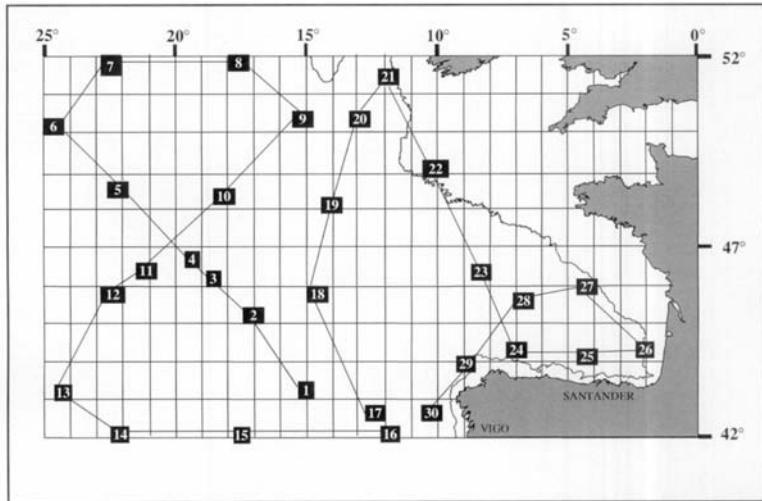


Fig. 1.
Sampling stations

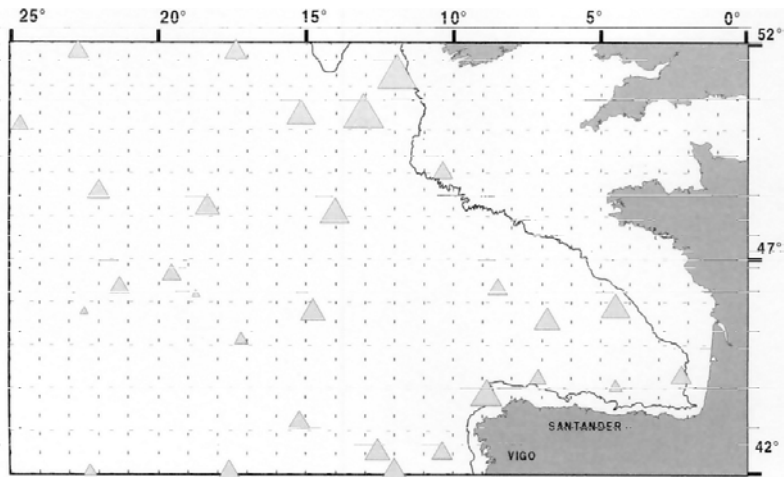


Fig.2 .
Zooplankton abundance (ind. m³).

The existence of an upwelling in this coastal area and the great quantities of euphausiids found in the stomachs could explain the concentration of fin whales during summer months and the importance of the Galician coasts as a feeding area for this species.

One of the aims to carry out zooplankton sampling during the sighting survey was to relate the distribution of cetaceans with the abundance and composition of zooplankton.

MATERIALS AND METHODS

The cetacean sighting survey was carried out in July-August 1989. The 42° - 52° N parallels, the 25° W meridian and the 200 m depth contour of the adjacent European continental shelf limited the area covered. The survey had two legs. The first one covered the western most part of that area and the second one the

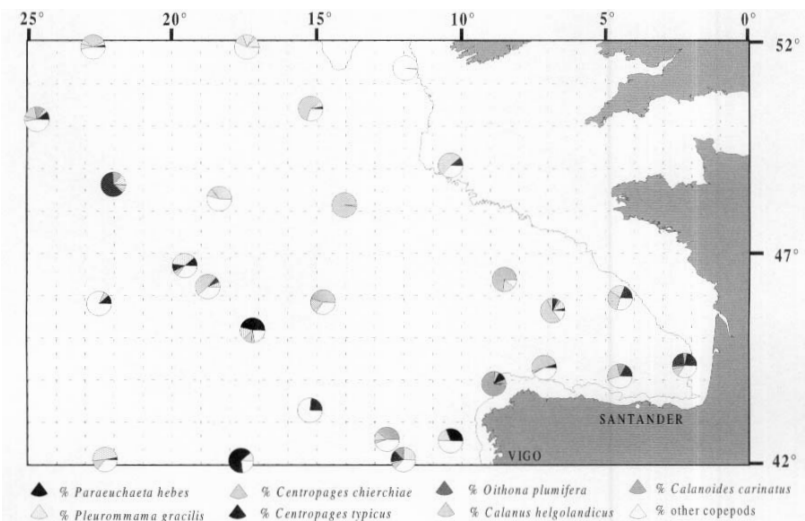


Fig. 3.
Relative abundance of zooplankton dominant groups in the stations sampled.

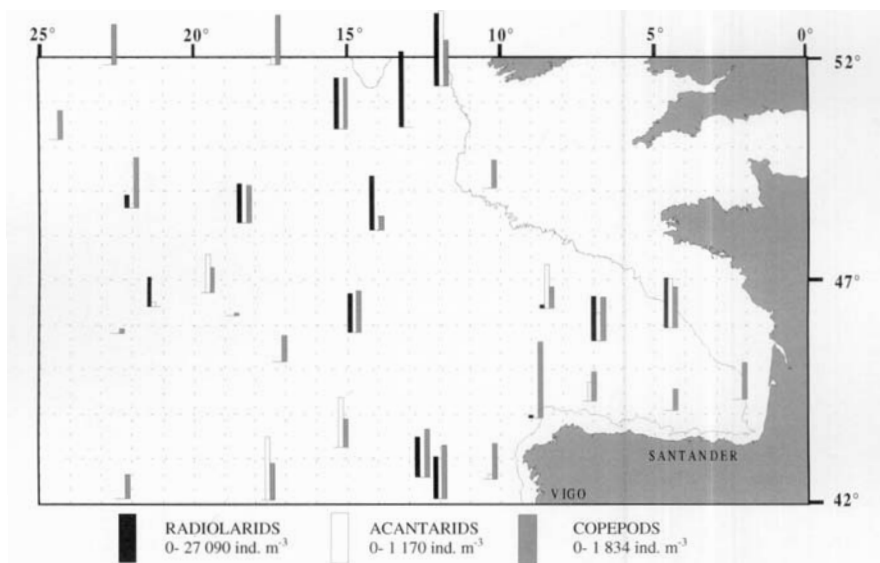


Fig. 4.
Absolute abundance of zooplankton dominant groups.

Bay of Biscay proper. 16 (stations 1 -16) and 14 (stations 17 -30) zooplankton sampling stations were carried out in the first and second legs respectively. Sampling was done daily at dusk with the exception of station 3 that was done during daylight coinciding with a high concentration of cetacean sightings (fig 1).

A BONGO net equipped with flowmeters and mesh size of 200 μm was used. Oblique tows were

made using 150 m of wire with one intermediate stop of 5 min when hauling the net. Zooplankton samples were preserved with a saline 5 % commercial formalin solution buffered with BORAX (calcium carbonate). In the lab the samples were analysed for taxa identification and specimen counting for both absolute and relative abundance using a stereoscope microscope.

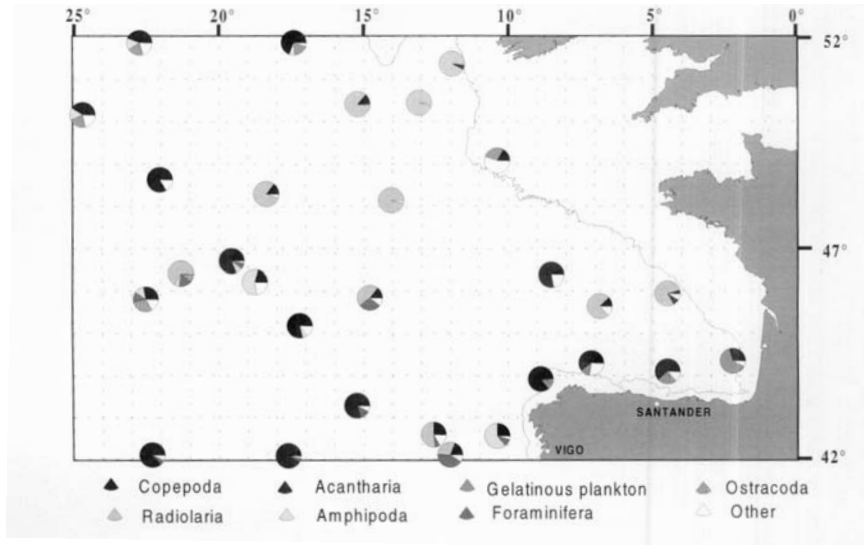


Fig. 5.
Relative abundance of copepods dominant species.

Table 1.
Zooplankton abundance (ind. m⁻³).

Estac.	ind. m ⁻³	Estac.	ind. m ⁻³
1	137	16	941
2	15	17	424
3	2	18	366
4	57	19	1396
5	175	20	27785
6	43	21	19500
7	119	22	86
8	181	23	75
9	1059	24	37
10	264	25	12
11	83	26	120
12	2	27	1028
13		28	506
14	12	29	2145
15	415	30	120

RESULTS.

In the majority of the stations zooplankton abundance was very low, especially in the first leg that correspond to oceanic stations. In some of them the abundance was as low as 2 ind. m⁻³. The highest abundances were found in stations 20 and 21 in the northern most part of the area covered in the second leg (Fig. 2 and TABLE 1) with 27 785 ind. m⁻³ and 19 500 ind. m⁻³ respectively. The dominant components were small organisms mainly radiolarids and acantarids.

Radiolarids (Figs. 3 and 4) were practically the only group present in station 19 (99,5% and 1 389 ind. m⁻³). In stations 20 and 21 they dominate the mesozooplankton community (97% y 92% respectively). The maximum abundance was found in station 20 with 27 090 ind. m⁻³. 3) Next unit, from 9.1 m to 2.9 m depth, is composed by alternated beds of sands and sandy silts, showing significant bioclastic fraction, characteristic of confined environments (probably a estuarine lagoon);

In stations 1, 4 and 15 acantarids represent between 60 and 83% (Figs. 3 and 4). The highest abundance (1 170 ind.m⁻³) was found in station 21.

Foraminifers were also an important part of the zooplankton community in some stations, such as 16 (first leg) with 42 % and 18 (second leg) with 30 %.

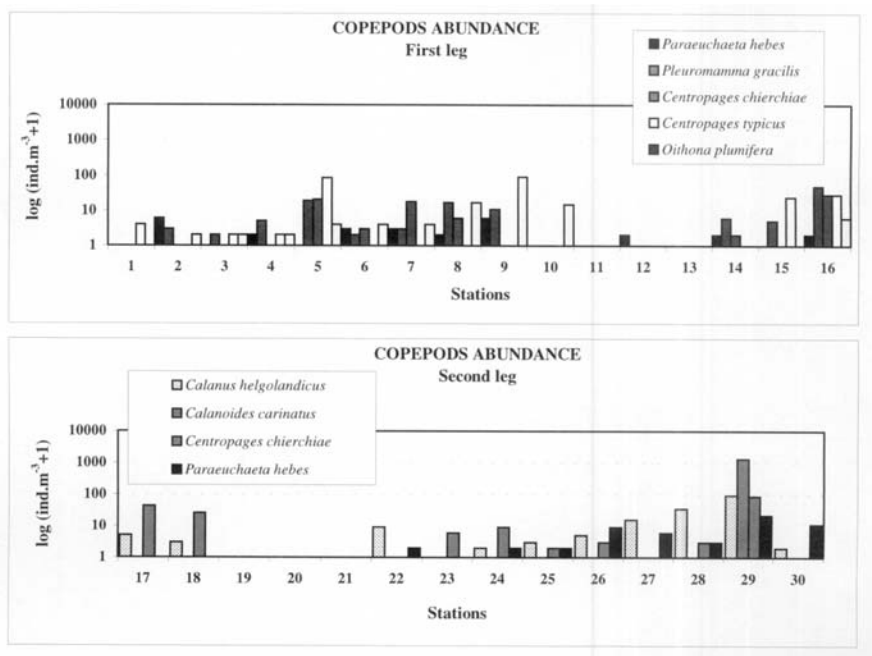


Fig. 6 and 7.
Dominant copepod species in both legs.

The pelagic species *Globigerina bulloides* (d'Orbigny, 1826) belonging to this group was found on the Galician continental shelf stations, and *Orbulina universa* (d'Orbigny, 1839) was regularly present in more oceanic waters. Their abundance was in all cases under 500 ind.m^{-3} .

The results obtained about the presence of gelatinous plankton are influenced by the decay of their structures due to extensive period of time they were preserved in formalin before observation. For this reason this group should be considered under represented. In the coastal zone gelatinous plankton was mainly constituted by jellyfish with a maximum of 27 % in station 26 and the highest number of organisms (214 ind.m^{-3}) in station 29. Doliolids reach 43 % (50 ind.m^{-3}) in station 18 and salps 30 % (37 ind.m^{-3}) in station 26. Great amounts of big jellyfish were found in station 6. In the oceanic area apart from these groups also appeared siphonofords. In station 8 they represent the 20 % of the specimens found (35 ind.m^{-3})

Copepods were dominant in the most oceanic part of the first leg reaching 87 % in station 14 and 83 % in station 5. The most common copepod species in the

oceanic area were *Paraeuchaeta hebes* (Giesbrecht, 1888) with 36% in station 2, *Pleuromamma gracilis* (Claus, 1863) with 42% in station 14 and *Centropages typicus* (Krøyer, 1849) with 47% (83 ind.m^{-3}) in station 5 (Figs.5, 6 and 7). Other oceanic species such as *Rhincalanus cornutus* (Dana, 1849) and *Centropages krøyeri* (Giesbrecht, 1892) only appeared in station 3 representing altogether 2 % of the sample. Some species were observed in both the oceanic and the coastal area. *Rhincalanus nasutus* (Giesbrecht, 1888) appear in the oceanic stations 6, 7 and 8 and also, but with a very low abundance, in the more coastal stations 17 and 21 (97 ind.m^{-3}).

The highest abundance ($1\ 834 \text{ ind. m}^{-3}$) and diversity of copepods was found in station 29 of the coastal area. The dominant species was *Calanoides carinatus* (Krøyer, 1848) with a 63 % ($1\ 351 \text{ ind. m}^{-3}$). *Centropages chierchiai* (Giesbrecht, 1889) was the 23 % of the zooplankton community in station 24 but their absolute abundance was greater in station 29 (86 ind.m^{-3}). The more thermophilic *Temora stylifera* (Dana, 1849) appeared in station 26 in the inner most part of the Bay of Biscay, where a relatively high sea surface temperature ($22,2 \text{ }^{\circ}\text{C}$) and low salinity (34,9) were

found. There it represents 7% of the community and an abundance of 8 ind. m⁻³.

Other crustacean groups found were amphipods and ostracods. Amphipods appear in station 30 with 60 % and in station 3 with 55 %. Their maximum abundance was found in station 20 (139 ind. m⁻³). Ostracods were found at very low abundances. They represent 30 % in station 12, but the maximum abundance was 8 ind.m⁻³ in station 11.

The scarcity of meroplankton in the composition of the plankton community may be due to the fact that most of the stations were oceanic or from waters deeper than 500 m.

As was described zooplankton composition was dominated by small organisms that are not normally eaten by the rorquals. In the other hand euphausiids only appear with low densities in some stations. The maximum abundance was found in stations 27, 28 and 29, with values between 5 and 11 ind. m⁻³, but no cetacean sightings were made around these stations. Equally the absolute abundance of mesozooplankton in station 3, where the highest concentration of fin whales sightings was found (Lens, 1991), was only of 2 ind. m⁻³, being amphipods and the copepods *Oithona plumifera*, *Centropages typicus* and *Pleurommama gracilis* the dominant species.

Fin whales was one of the most frequently sighted species along the whole area (Lens, 1991), but their distribution doesn't seem to reflect the the possible extension of the feeding area. It could rather show the progressive movement of rorquals from oceanic waters towards the coastal upwelling area off the Galician continental shelf.

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