Northwest Atlantic Fisheries Organization

Serial No. N4419 **NAFO SCR Doc. 01/41**

SCIENTIFIC COUNCIL MEETING – JUNE 2001

Data on the Bathymetric Distribution of Crustaceans and Cephalopods in Flemish Cap Bank during Summer 2000

by

P. Torres and I. Loureiro

Instituto Español de Oceanografía. Centro Oceanográfico de Vigo.
Apdo. 1552, 36280 Vigo, Spain

Abstract

The results related on crustaceans and cephalopods taxa of the Spanish trawl survey carried out in summer 2000 in the Flemish Cap Bank are analysed. A total of 17 crustaceans and 8 cephalopods species were found between 126 m and 720 m of depth. Crustacean make up about 5 % and cephalopods 0.01 % of the catch. *Pandalus borealis* was the most abundant invertebrate species in the area.

Introduction

Flemish Cap Bank is an well-isolated ecosystem from the continental shelf (Konstantinov *et al*., 1983). It is located in international waters, beyond the 200 miles economic zone, where fishing is regulated by the Northwest Atlantic Fisheries Organization (NAFO).

The cephalopods and crustaceans are well known in the north-western Atlantic, as can be seen from general articles about these taxonomic group and about its geographic and bathymetric distribution (Lu & Roper, 1979; Rathjen, 1981; Roper *et al.*, 1984; Vecchione *et al.*, 1989; Squires, H.J., 1990). However, there are certain areas, like the Flemish Cap Bank, where such studies are lacking. Data on abundance, biomass and on the dominant species along the slope are particularly scarce.

The aim of this article is to improve the knowledge of this important animal group in this particular area. The present paper provides data on the abundance, biomass and bathymetric distribution of crustacean and cephalopod in Flemish Cap. This has been made possible by extensive sampling of the slope with two types of bottom trawl gear at depths ranging from 126 to 720 m. The results obtained are discussed in the light of the characteristics of the bottom trawl employed.

Material and Methods

The survey have been carried out according to NAFO methodological specifications (Doubleday, 1981) for a random stratified survey. Fishing was based on daytime trawling, between 6,30 h and 23,30 h, with hauls of 30 minutes duration. A more detailed explanation of the sampling design is available in previous works (Vazquez, 1990). A total of 143 bottom trawls were carried out in July 2000 at bottom depths ranging from 126 to 720 m (Fig. 1). They were used two types of gear: Loffoten (co-end mesh size 35 mm, 122 hauls) and Campelen (co-end mesh size 20 mm, 21 hauls) with the aim of compare their both results.

Samples were frozen on board. Specimens were identified, counted, measured and weighted at the laboratory. All trawl results were first standardized to 1 h tows. Abundance (individuals/h) and biomass (grams/h) were calculated by species and gear for five arbitrary depth strata established after sampling.

Results and Discussion

Cephalopods appear in 38 hauls and crustaceans in 128 hauls. A total of 8 cephalopods and 17 crustaceans species were caught (Table 1) corresponding to 1429 Kg and 277 505 specimens. They consisted of commercial and non-commercial species. All strata were sampled with sufficient intensity to assess their composition, at least with the Loffoten gear. The cephalopods were 0.01 % of the total catch in weight and crustaceans 5.29 % (Fig. 2). In total catches *Pandalus borealis* is the most important species.

Despite the fact that the depth range was not completely covered, analysis of the vertical distribution of the most representative species showed that at least crustaceans are zoned with depth (Table 1 and 2). In the case of cephalopods their occurrences are too low for this agreement. They seem to be confined in the more bathyal strata. No differences can be seen between the two gears used in respect to cephalopods due to the low occurrence values.

The crustaceans *Lithodes maja* and *Sabinea sarsi* are species in which abundance declined with depth. They are the most "coastal" species with the higher yield in the first stratum. The species with the higher densities at great depth included *Acantephyra pelagica* and *Pasiphaea tarda;* they are the most bathyal species (stratum 5). *Pandalus borealis* is the species with a wider distribution range. It was presented over the entire depth range sampled (all the strata), but with a maximum yield in stratum 3 (254 to 360 m).

The catch in biomass and number per hour of the dominant species has been analysed for each bathymetric stratum and for each gear (Table 2). In total catches *P. borealis* is the most important species in their both terms, biomass and number. It represents the 98 % in weight of the crustaceans and cephalopods catches. *P. borealis* is the most captured invertebrate species in Flemish Cap by the commercial fleet and it is a matter for a special paper for the NAFO meeting in November. This species and *Sabinea sarsi* show the most different yield between the two gears, so they present a higher yield with the Campelen gear. This one with a smaller cod-en mesh size.

There have been few studies dealing with species abundance in deep-see megafaunal communities, particularly relating to crustaceans and cephalopods. The reasons for this have been chiefly methodological, i.e. the different types of bottom trawl used and an element of bias towards results on species population density (Gordon and Duncan, 1985; Merret *at al.*, 1991).

In the Flemish Cap survey the characteristics of the gears used may have biased the results. Thus, the abundance of crustaceans and cephalopods in this zone is underestimated by the big co-end mesh size used. However, comparison of the results, especially abundance data, in the different studies poses considerable difficulty in view of the varied methodology employed in sampling and in the presentation of results. Cod-end mesh size is probably the most important aspect affecting results, and in invertebrates studies a smallest mesh size would be most suitable (Cartes and Sardá, 1992).

Acknowledgements

This study was supported by the European Commission (DG XIV, Study 98-048), IEO, CSIC, IPIMAR and the Basque Government.

References

Doubleday, W. G. 1981. Manual of Groundfish Surveys in the Northwest Atlantic. *NAFO Sci. Coun. Studies*, 2, 55 p.

Cartes, J.E. and Sardá, F., 1992. Abundance and diversity of decapod crustaceans in the deep-Catalan Sea (Western Mediterranean). *J. of Nat. Hist.*, 26, 1305-1323.

Gordon, J.D.M. and Duncan, J.A.R., 1985. The ecology of the deep-sea benthic and benthopelagic fish on the slopes of the Rockall Trough, northeastern Atlantic. *Prog. in Oceanog.*, 15, 37-69.

Konstantinov, K. G., T. N. Turuk and N. V. Plekhanova , 1983. Food links of some fishes and invertebrates on the Flemish Cap bank. *NAFO SCR Doc*. 83/IX/78 Serial No. N744, 23 p.

Lu, C.C. and Roper, C:F.E., 1979. Cephalopods from deepwater Dumpsite 106 (western Atlantic): vertical distribution and seasonal abundance. *Smithson. Contr. Zool.* 288, 1-36.

Merret, N.R., Gordon, J.D.M., Stehmann, M. and Haedrich R.L., 1991. Deep demersal fish assemblage structure in the Porcupine Seabight (eastern North Atlantic): slope sampling by three different trawls compared. *J. Mar. Biol. Ass. U.K.*, 71 (2), 329-358.

Rathjen, W.F., 1981. Exploratory squid catches along the continental slope of the eastern United States. *J. Shellfish. Res.* 1, 153-159.

Roper, C.F.E., Sweeney, M.J., Nauen, C.E., 1984.Cephalopods of the World: An annotated and illustrated catalogue of species of interest to fisheries. *Fisheries Synopsis*, Vol. 3, No. 125. FAO, Rome, 227 pp.

Squires, H.J., 1990. Decapod Crustacea of the Atlantic Coast of Canada. *Can. Bull. Fish. Aquat. Sci*. 221:532.

Vecchione, M., Roper, C.F.E., Sweeney, M.J., 1989. Marine flora and fauna of the Eastern United States. Mollusca: Cephalopoda. *NOAA Technical Report.* NMFS No. 73, 23 pp.

Vecchione, M. and Galbraith, J., 2001. Cephalopods species collected by deepwater exploratory fishing off New England. *Fish. Res.* 51, 385-391.

Vazquez , A. 1990. Results from bottom trawl survey of Flemish Cap in July 1989. *NAFO SCR Doc.*, Serial No. N1790. 25 p.

Table 1. Specimens collected during the survey. D. min.: minimum depth; D. max.: maximum depth; Freq.:frecuency of appearance for each species and gear.

		Bathymetric range		Freq. (%)	
	Nº	**D. min. (m)**	**D. max. (m)**	**Loffoten**	**Campelen**
CRUSTACEANS					
Acantephyra pelágica	174	349	703	5	0
Chionocetes opilio	15	255	555	9	5
Lebbeus polaris	2	234	416	2	0
Lithodes maja	13	157	511	7	5
Pagurus arcuatus	12	169	511	6	10
Pagurus rubescens	4	310	425	2	0
Parapasiphaea sulcatifrons	1	?	?	0	0
Pasiphaea multidentata	1	589	589	1	0
Pasiphaea tarda	140	349	703	4	0
Pontophilus norvegicus	3	207	651	2	5
Sabinea hystrix	1	651	651	1	0
Sabinea sarsi	121	156	458	9	29
Sergestes articus	1	?	?	2	0
Sergia robusta	2	565	565	1	0
Spirontocaris lilljeborgi	1	305	305	0	5
Pandalus borealis	276976	156	703	81	95
Unidentified	2	700	700	1	0
CEFALOPODS					
Bathypolypus articus	4	458	632	2	5
Histioteuthis bonnelli	5	255	632	3	0
Histioteuthis reversa	5	399	632	4	0
Ilex illecebrosus	11	344	618	4	10
Illex sp	1	171	171	0	5
Subfamilia Rossiinae	8	232	484	3	19
Taonius	1	580	580	1	0
Unidentified	1	703	703	1	0

Table 2. Catch rates for each bathymetric stratum and gear. First line Loffoten and second line Campelen gear. "*"Less than 3 individuals examined; "---" No data; "?" No hauls.

	Nº/h	Kg / h	Nº/h	Kg / h	Nº/h	Kg / h	Nº/h	Kg / h	Nº/h	Kg / h
SPECIES	**Stratum 1 (126-181 m)**		**Stratum 2 (182-253 m)**		**Stratum 3 (254-360 m)**		**Stratum 4 (362-541 m)**		**Stratum 5 (542-721 m)**	
CRUSTACEANS										
Acantephyra pelágica	---	---	---	---	2	0.01	---	---	16	0.10
	---	---	---	---	---	---	---	---	---	---
Chionocetes opilio	---	---	---	---	0.2	0.034	0.4	0.130	*	*
	---	---	---	---	*	*	---	---	?	?
Lebbeus polaris	---	---	*	*	---	---	*	*	---	---
	---	---	---	---	---	---	---	---	?	?
Lithodes maja	0.6	0.490	*	*	*	*	*	*	---	---
	*	*	---	---	---	---	---	---	?	?
Pagurus arcuatus	---	---	---	---	0.3	---	0.2	---	---	---
	1.5	---	---	---	---	---	---	---	?	?
Pagurus rubescens	---	---	---	---	*	*	0.2	---	---	---
	---	---	---	---	---	---	---	---	?	?
Pasiphaea multidentata	---	---	---	---	---	---	---	---	*	*
	---	---	---	---	---	---	---	---	?	?
Pasiphaea tarda	---	---	---	---	1.8	0.010	---	---	12.6	0.170
	---	---	---	---	---	---	---	---	?	?
Pontophilus norvegicus	---	---	---	---	*	*	---	---	*	*
	---	---	*	*	---	---	---	---	?	?
Sabinea hystrix	---	---	---	---	---	---	---	---	*	*
	---	---	---	---	---	---	---	---	?	?
Sabinea sarsi	*	*	*	*	0.9	0.002	---	---	---	---
	10.5	0.050	8.7	0.008	1.2	0.003	1.5	0.004	?	?
Sergestes articus	---	---	---	---	---	---	*	*	*	*
	---	---	---	---	---	---	---	---	?	?
Sergia robusta	---	---	---	---	---	---	---	---	*	*
	---	---	---	---	---	---	---	---	?	?
Spirontocaris lilljeborgi	---	---	---	---	---	---	---	---	---	---
	---	---	---	---	*	*	---	---	?	?
Pandalus borealis	*	*	1281	13	3962	38	1830	26	420	8
	1767	7	41395	132	11819	175	11725	157	?	?
CEFALOPODS										
Bathypolypus articus	---	---	---	---	---	---	---	---	0.4	0.034
	---	---	---	---	---	---	*	*	?	?
Histioteuthis bonnelli	---	---	---	---	*	*	*	*	0.4	0.123
	---	---	---	---	---	---	---	---	?	?
Histioteuthis reversa	---	---	---	---	---	---	0.2	0.012	*	*
	---	---	---	---	---	---			?	?
Ilex illecebrosus	---	---	---	---	---	---	0.2	0.002	0.6	0.009
	---	---	---	---	*	*	*	*	?	?
Subfamilia Rossiinae	---	---	*	*	---	---	0.2	0.004	---	---
	---	---	---	---	0.6	0.007	*	*	?	?

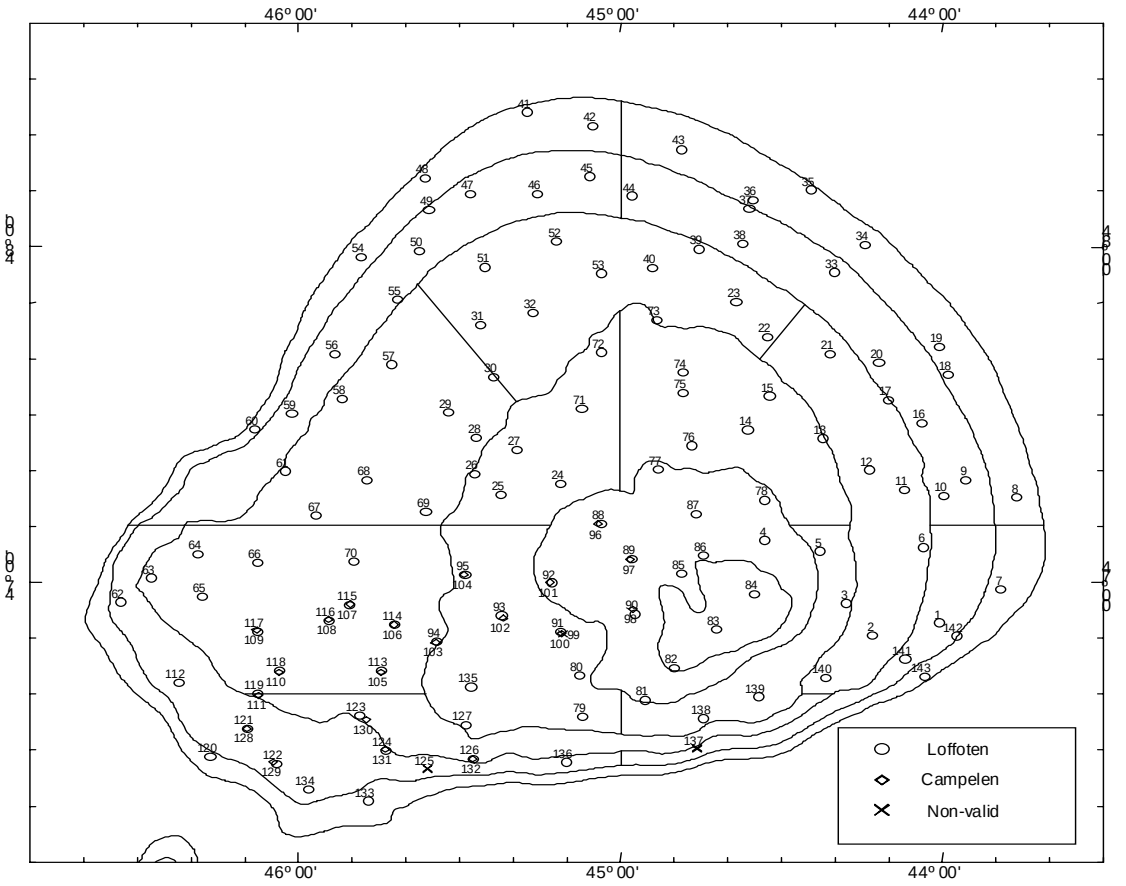

Figure 1. Location of the samples in the study area.

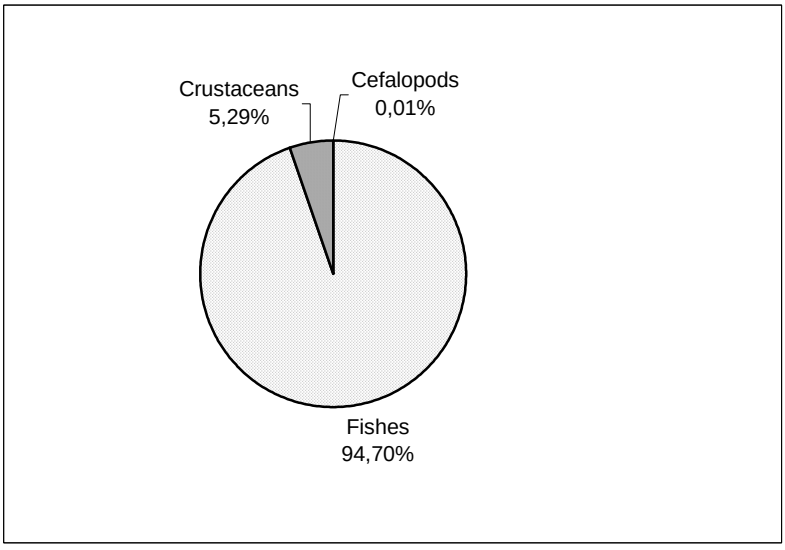

Figure 2. Mean value of the catch composition expressed in percentage.