SPATIO-TEMPORAL DISTRIBUTION OF THE EUROPEAN HAKE *MERLUCCIUS MERLUCCIUS* OFF CATALAN COAST (NORTHWESTERN MEDITERRANEAN)

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Abstract

The spatio-temporal distribution pattern of *Merluccius merluccius* off the Catalan coast during 1991 has been investigated, considering separately three size groups, trawl-recruits, juveniles, and adults. The species showed a wide bathymetric distribution throughout the shelf and the slope, mainly between 48 m - 300 m. Changes in the spatial distribution and abundance of the three groups were observed throughout the year. Spring showed the highest abundance, due to the massive incorporation of trawl-recruits to the demersal population at different depths, although they appeared in all seasons. Trawl-recruits were not concentrated in closed nursery areas. Movements of the species were associated with a certain segregation by size.

Key-words: coastal waters, recruitment, fishes, Balear Sea

Introduction

The European hake *Merluccius merluccius* (Linnaeus, 1758) is a demersal species which is abundant throughout its main distribution area. It is one of the most valuable fishing resources in both the northeastern Atlantic and Mediterranean waters and represents one of the main target species of the trawling fleet. Furthermore, two other gears, the long-line and gillnet catch hake, mainly large specimens, which are the most scarcely represented in trawling. The catches are carried out simultaneously with trawling in some fishing grounds in the northwestern Mediterranean (1). Information related to different aspects of the biology of this species, such as growth, feeding habits and reproduction, and fishery is relatively abundant (2-7). Considerable research has been devoted to distribution, abundance and size composition of *Merluccius merluccius*. However, detailed information on seasonal changes in the abundance and length distribution by depth is rather limited, and an explanation is required which relates the variability observed in abundance with size, depth and time of the year.

In this study the changes of the spatio-temporal distribution pattern of the hake has been investigated, and sources of these variations have been identified. Therefore, three different size groups of the population have been considered separately, given that it has been observed that these groups show differences in their distribution: 1) trawl-recruits, the firts immatur individuals 0-1 years old that exploit the trawl, 2) juveniles, the remainder immatures till to reach first size maturity, and 3) adults, all matur individuals. Smallest size fully recruited to the trawling gear corresponded to individuals of around 10-13 cm total length.

Material and methods

The Catalan coast extends for about 550 km (Fig. 1). The material was collected from 259 experimental hauls on board of commercial trawlers along the Catalan coast from March to November 1991 (Table 1). The sampling area covered a wide range of depths, from 12 m to 643 m. Hake was caught in 219 hauls from 25 m to 643 m. The bottom otter trawl is the main gear used in commercial fisheries in the Mediterranean. The mesh size of the cod-end was 38 mm streched. A covering bag was used (9 mm mesh size streched) for the cod-end in each sampling months in order to catch the smaller specimens. For each haul, the location, duration, the minimum and maximum depth (m), and the hake catch, in number of specimens and weight (kg), were recorded. Given that duration of hauls and proportion of hauls within each stratum for each season were variable, data were standardized to number of specimens per trawling hour (no. h^{-1}). The total number of specimens caught during the sampling was 87041. A representative sample of the specimens caught in each haul was measured (total length, TL, in cm). Size frequency distribution by depth stratum and season were obtained and expressed in number per hour (no.h-1). In addition, to show more precisely the changes in the spatio- temporal abundance of each size group separately, these data were organized according to three size categories within the population structure. These groups were referred to as trawl-recruits (<14 cm TL), juveniles (14 -34 cm TL), and adults (>34 cm TL) (considering 34 cm is the average of the length at first maturity of both sexes (7)).

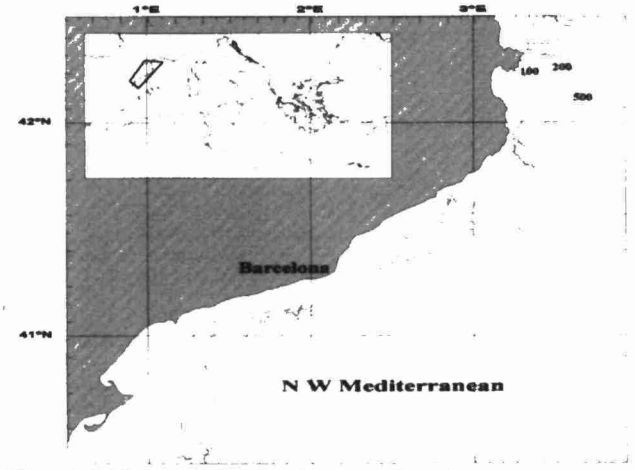

Figure 1. Catalan coast where sampling was performed.

Table 1. Summary of the sampling data. Monthly distribution of hauls. In parenthesis number of hauls with cover cod-end.

Season	total hauls	hauls with hake	total number of specimens	abundance (numer/hour)
Winter	48 (8)	45	11055	345
Spring	72 (18)	55	48715	1246
Summer	77 (20)	60	19999	297
Autunm	62 (12)	59	7275	168

Results

The results show the very wide bathymetric distribution (25-643m) of *Merluccius merluccius*, which appeared in the sampling. Hake was found widely distributed between 48 and 300 m throughout the year.

Specimens of a size <14 cm TL occurred in all four seasons. Spring showed a higher abundance, mainly in May and June, due to the massive caught of trawl-recruits, their abundance being lowest in autumn. The smallest fish (2 cm TL) (Table 2 and Fig. 2) was caught in May. The <14 cm TL individuals were found distributed throughout the shelf and the slope. The wide range of depths where trawl-recruits were found indicates that they were not concentrated in a defined nursery area. The adults (>34 cm TL) were much less abundant (Table 2 and Fig. 2). The largest fish (73 cm TL) appeared in August.

Table 2. Distribution of trawl-recruits, juveniles and adults, in percentage, per stratum and season.

	trawl-recruits (<14.0cmTL)				
	<75	75-150	150-300	>300	totaln/h
Winter	8.8	29.2	61.4	0.7	220
Spring	88.0	6.3	5.4	0.3	887
Summer	19.145.7	27.3	7.9	124	
Autunm	15.239.8	42.9	2.1	39	
	juveniles (14-34cmTL)				
	<75	75-150	150-300	>300	totaln/h
Winter	38.326.6	32.3	2.8	121	
Spring	42.4	15.0	41.5	1.1	347
Summer	19.7	28.4	44.5	7.3	167
Autunm	17.4	48.8	29.4	4.4	122
	adults (>34cmTL)				
	<75	75-150	150-300	>300	totaln/h
Winter	2.2	54.2	14.3	29.2	4
Spring	1.3	77.1	8.3	13.2	13
Summer	7.5	22.3	0.0	70.2	6
Autunm	9.9	38.8	21.7	29.6	6