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ACOUSTIC ABUNDANCE ESTIMATES OF BLUE WHITING OFF THE SPANISH ATLANTIC COAST IN MARCH-APRIL 1991

by

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ABSTRACT

This document describes the abundance and distribution of blue whiting from an acoustic survey on the Spanish Atlantic continental shelf (Divisions VIIIc and IXa2). The estimated total biomass was 171 thousand tonnes, corresponding to 4800 million fish.

Only young fish were recorded in the whole area surveyed , with similar length and age distribution to those found in the fishery (Ages 0-5). Older fish were not detected in this area, at least in the spawning season.

A comparison of the distribution and densities of blue whiting observed in this survey with those recorded in 1984 show that the distribution pattern in this area is quite stable.

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INTRODUCTION

Systematic acoustic surveys have been carried out onboard R.V."Cornide de Saavedra" since 1983, to estimate the abundance of the fraction of the Atlantic Iberian Sardine Stock present in the Spanish area. In these surveys information on blue whiting distribution was collected (Pastor et al,1985, Anon. 1989, Anon. 1990).

Although some attempts were made to assess the blue whiting population in 1984 and 1990 (Pastor et al, 1985, Anon., 1990), these surveys did not reach the outer limit of the distribution area.

In 1991 the area covered in the survey was extended to 1000 m. isobath (and farther if blue whiting was present), to observe the distribution of the main pelagic species in the area, and to estimate the abundance of sardine and blue whiting.

Due to the extremely bad weather conditions in this area at spawning time, and to the vast area where the southern stock is expected to be distributed (from Porcupine Bank to Gibraltar), it is not easy to survey without coordinated international surveys. For this reason, only Divisions VIIIc and IXa2 were covered.

MATERIAL AND METHODS

The methods adopted by the Planning Group for Acoustic Surveys in ICES Sub-Areas VIII and IX (Anon. 1986) were followed in the calculations.

The new Simrad EK-500 split beam 38 kHz echo sounder and integrator system was installed and used during the survey. The acoustic system was calibrated using a copper standard target (Foote et al.,1982). The calibration procedure was notably easier with this echo sounder compared with previous years. The calibration results are shown in Table 1.

Values for the fish length dependent density coefficient adopted in previous blue whiting assessments (Anon.1982, Monstad 1986) were used in the calculations.

The surveyed area, limited by 1000 m isobath, was covered following a zig-zag course with 1790 integrated nautical miles. Survey speed was 10 knots, and acoustic signals were integrated over one nautical mile intervals.

Pelagic trawl hauls with nets of 12 m and 24 m vertical opening for species identification and sampling for length, weight, maturity stage and age were made on the basis of echogram information. Figure 1 shows the cruise tracks and pelagic trawl stations.

The "degree of coverage" (Aglen, 1989) for the whole area had a value of 12.

Estimates were obtained with the computer program PESMA (J.Miquel and P.Carrera, in press), which consist of a database and a BASIC program for acoustic assessment, using the Nakken and Dommasnes formulae (Nakken et al. 1975).

RESULTS

Target strength calculations were made during the survey, with the following results:

FISHING STATION	MEAN LENGTH	$\overline{TS}$ (dB)	TS (dB)	BOTTOM DEPTH (m.)
13	17.53	-45.53	20 log L - 70.40	310
16	18.22	-43.72	20 log L - 68.93	136
25	17.99	-45.85	20 log L - 70.95	196

The calculated TS values for a 30 cm. fish give similar results to those used in the assessment of the northern stock. For that reason, values adopted in previous blue whiting assessments (Anon.1982, Monstad 1986) were used in the calculations.

In March - April 1991 the biomass in the surveyed area was estimated to be 171 thousand tonnes, corresponding to 4862 million fish.

The echo intensity distribution of blue whiting (in square meters of echo intensity by square nautical mile) in the area is shown in Figure 2. Blue whiting was widely distributed along the shelf edge, in deep waters.

Biomass estimates by ICES rectangle are shown in Figure 3. The highest abundance was recorded in the western part of Division VIIIc (corresponding to LLANES, A MARIÑA and SISARGAS zones in Figure 1), where the continental shelf is wider.

Highest densities were observed between 200 m and 500 m, but blue whiting was also present in shallower areas. Results of abundance and biomass estimation by geographic zones and depth strata, and for the whole area are shown in Table 2.

Length and age compositions by geographic zone and for the whole area are presented in Figures 4-6 and Tables 3,4. The more abundant age-groups were age 1 (41%) and age 2 (36%). Ages 1-4 represent 97% in number and 94% in weight in the surveyed area. Detailed data of the assessment are shown in Table 5.

DISCUSSION

Since 1980, acoustic surveys to assess the Blue Whiting Southern Stock and to investigate its total distribution area were recommended by the Blue Whiting Assessment Working Group (Anon.1991) and the ACFM (Advisory Committee on Fishery Management). It was also pointed out that the bottom trawl blue whiting fishery in this area is based on the first 5 age-groups, and it is not known whether the older fish are distributed in deeper waters, outside the fishery area, or if they migrate to the Porcupine Bank area or to other zones.

The results of this survey show that observed length and age composition are similar to those in the fishery, and older fish are not present in this area, at least at spawning time. Nevertheless, the older age-groups may be underestimated because they can escape when fishing is carried out with gears of small vertical opening (12 m and 24 m).

These results can be compared with those obtained in 1984 (Pastor et al, 1985) when the total biomass was estimated to be 133 thousand tonnes; the difference may be because the area covered was larger in 1991. The observed distribution remained quite constant through all these years, and the highest concentrations observed in 1991 (Figure 2) show the same pattern as in 1984.

Although it is not clear if the external limit of the blue whiting distribution was reached, due to noise problems in the integrator when it works at more than 1000 m depth made it difficult to interpret the echograms, pelagic trawl hauls never captured blue whiting so deep during the cruise. Thus it seems unlikely that relevant concentrations of this species were distributed beyond the external limit of the area surveyed.

REFERENCES

Aglen, A. 1989. Empirical results on precision-effort relationships for acoustic surveys. ICES, C.M.1989/B:30 Ref. D Sess. O

Anon. 1982. Report of the International Acoustic Survey on Blue Whiting in the Norwegian Sea, July/August 1982 ICES, C.M. 1982/h:5 (Mimeo)

Anon. 1986. Report of the Planning Group for Acoustic Surveys in ICES Sub-Areas VIII and IX. ICES, Doc. C.M.1986/H:27 (mimeo.).

Anon. 1989. Report of the Planning Group for Acoustic Surveys in ICES Sub-Areas VIII and IX. ICES, Doc. C.M.1989/H: (mimeo.).

Anon. 1990. Report of the Planning Group for Acoustic Surveys in ICES Sub-Areas VIII and IX. ICES, Doc. C.M.1990/H:35 (mimeo.).

Anon. 1991. Report of the Blue Whiting Assessment Working Group. ICES, Doc. C.M.1991/Assess 2 (mimeo.).

Foote, K.G. Knudsen, H.P. Vestnes, G. 1982. Standard calibration of echosounder and integrator with optimal copper spheres. Symposium on Fisheries Acoustics, Bergen, 1982. Contribution nº 40.

Monstad, T. 1986. Report of the Norwegian Surveys on Blue Whiting during Spring 1986.ICES, C.M. 1986/h:53 (mimeo)

Nakken, O. and Dommasnes, A. 1975. The application for an echointegration system in investigations on the stock strength of the Barents Sea capelin (Mallotus villosus, Muller) 1971-74. ICES, Doc. C.M. 1985/H:52. Ref. B (mimeo).

Pastor, X. , Alvarez, F. and Astudillo, A. 1985. Acoustic estimation of Sardine (Sardina pilchardus Walb.) off Cantabrian and Galician waters. August 1984. ICES Doc. C.M. 1985/H:73 (mimeo)

Calibration report EK 500

Vessel: **Cornide de Saavedra**

Bottom depth: **19 m**

Date and time: **14/03/91, 17 hs 25 min** Place: **Ria de Vigo**

Frecuency: **38 Hz**

Transducer: ES 38 B

2-way Beam Angle (in Transceiver Menu): **-20.6 dB**

Transducer Gain (in Transducer Menu): **26.5 dB**

Target strength of sphere: **-33.6 dB**

transmit power	ping interval	pulse length	band width	TS measur.	New tr. gain	S_A meas.	New 2-way beam ang.
normal	**1 sec**	**medium**	**wide**	**-33.6**	**26.5**	**10599**	**20.8**

Table 1. Calibration repport

Numbers: Millions Biomass: Thousand Tonnes

DEPTH STRATA:

A: 20 - 50 m
B: 50 - 100 m
C: 100 - 200 m
D: 200 - 500 m
E: 500 - 1000 m

	DEPTH STRATA									
	B		C		D		E		TOTAL	
ZONES	NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS	NUMBER	BIOMASS
RIAS BAIXAS	5	0.2	44	1.9	278	13.1	125	5.8	452	21.0
SISARGAS	0	0.0	76	3.0	456	18.3	345	14.3	877	35.6
A MARIÑA	4	0.1	329	10.5	604	19.9	163	5.3	1101	35.7
LUARCA	3	0.1	248	7.9	285	8.8	31	1.0	567	17.7
LLANES	11	0.4	471	15.7	592	19.9	93	3.1	1167	39.1
CANTABRIA	11	0.4	134	4.4	44	1.4	10	0.3	199	6.5
EUSKADI	69	2.2	243	7.7	149	4.7	37	1.2	498	15.7
TOTAL	**103**	**3.3**	**1545**	**51.0**	**2408**	**86.0**	**804**	**31.0**	**4862**	**171.3**

Table 2. Abundance in number (millions) and biomass (thounsand tonnes) by depth strata and zone.

AGE GROUP	ZONES R.BAIXAS	SISARGAS	A MARIÑA	LUARCA	LLANES	CANTABRIA	EUSKADI	TOTAL
I	89	261	419	307	567	106	263	2012
II	136	308	465	213	412	64	164	1762
III	106	175	156	40	141	22	53	693
IV	41	81	52	5	35	6	14	234
V	33	30	9	1	9	1	3	86
VI+	47	22	-	0	3	0	1	74
TOTAL	452	877	1101	567	1167	199	498	4861

Table 3. Abundance in number (millions) by age group and geographic zone.

AGE GROUP	ZONES R.BAIXAS	SISARGAS	A MARIÑA	LUARCA	LLANES	CANTABRIA	EUSKADI	TOTAL
I	2.7	8.8	12.0	8.7	16.1	3.0	6.9	58.1
II	5.1	10.7	14.5	7.0	14.0	2.1	5.4	58.7
III	5.0	8.3	6.5	1.8	6.4	1.0	2.4	31.5
IV	2.3	4.4	2.4	0.3	1.9	0.3	0.7	12.3
V	2.2	1.8	0.4	0.1	0.5	0.1	0.2	5.3
VI+	3.6	1.6	0	0.0	0.2	0.0	0.0	5.5
TOTAL	21.0	35.6	35.7	17.8	39.1	6.5	15.7	171.3

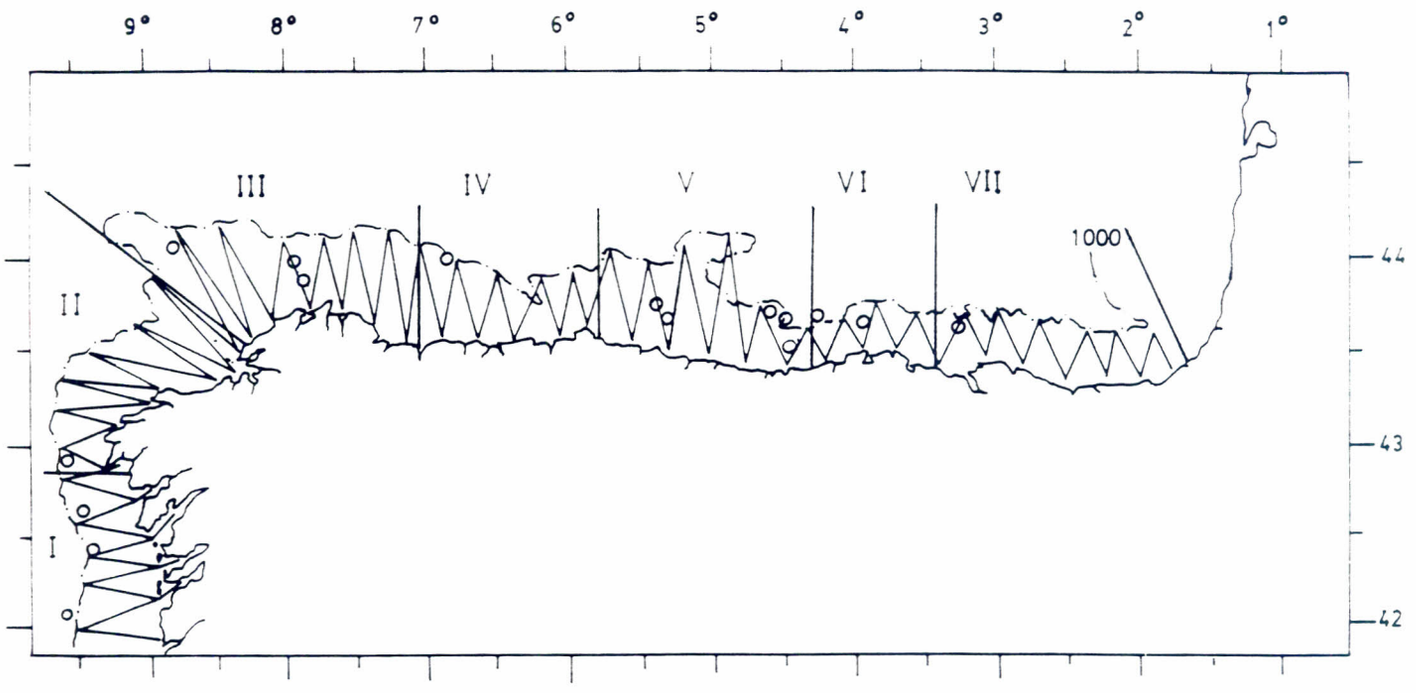
Table 4. Biomass (thousand tonnes) by age group and geographic zone.

Mean weight ($\bar{w}$): g Numbers: Millions

Mean length ($\bar{l}$): cm Biomass: Thousand Tonnes

	AGE GROUPS						TOTAL	
LENGTH	I	II	III	IV	V	VI+	NUMBER	BIOMASS
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0
15	34	0	0	0	0	0	34	0.7
16	418	42	0	0	0	0	460	11.1
17	887	333	0	0	0	0	1220	33.8
18	285	665	0	0	0	0	950	29.3
19	336	336	0	0	0	0	672	23.6
20	51	309	154	0	0	0	514	20.7
21	0	49	395	0	0	0	444	20
22	0	29	114	171	29	0	343	17
23	0	0	16	36	6	0	60	3.5
24	0	0	7	22	30	15	74	4.7
25	0	0	4	4	8	25	41	2.9
26	0	0	0	0	8	12	20	1.5
27	0	0	0	0	6	4	10	0.8
28	0	0	0	0	0	5	5	0.4
29	0	0	0	0	0	7	7	0.6
30	0	0	0	0	0	2	2	0.2
31	0	0	0	0	0	2	2	0.2
32	0	0	0	0	0	2	2	0.2
33	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0
TOTAL	2011	1763	692	233	87	74	4860	171.3
%	41.38	36.28	14.24	4.79	1.79	1.52		
$\bar{l}$	17.8	19	21.5	22.9	24.2	26.6	19.3	
Biom.	58.1	58.7	31.5	12.3	5.3	5.5	171.3	
$\bar{w}$	28.89	33.3	45.52	52.79	60.92	74.32	35.25	

Table 5. Assessment of Blue Whiting in Spanish waters in Spring 1991.



° Pelagic trawl stations

ZONES:

I	RIAS BAIXAS
II	SISARGAS
III	A MARIÑA
IV	LUARCA
V	LLANES
VI	CANTABRIA
VII	EUSKADI

Fig. 1: Cruise track and pelagic trawl stations.

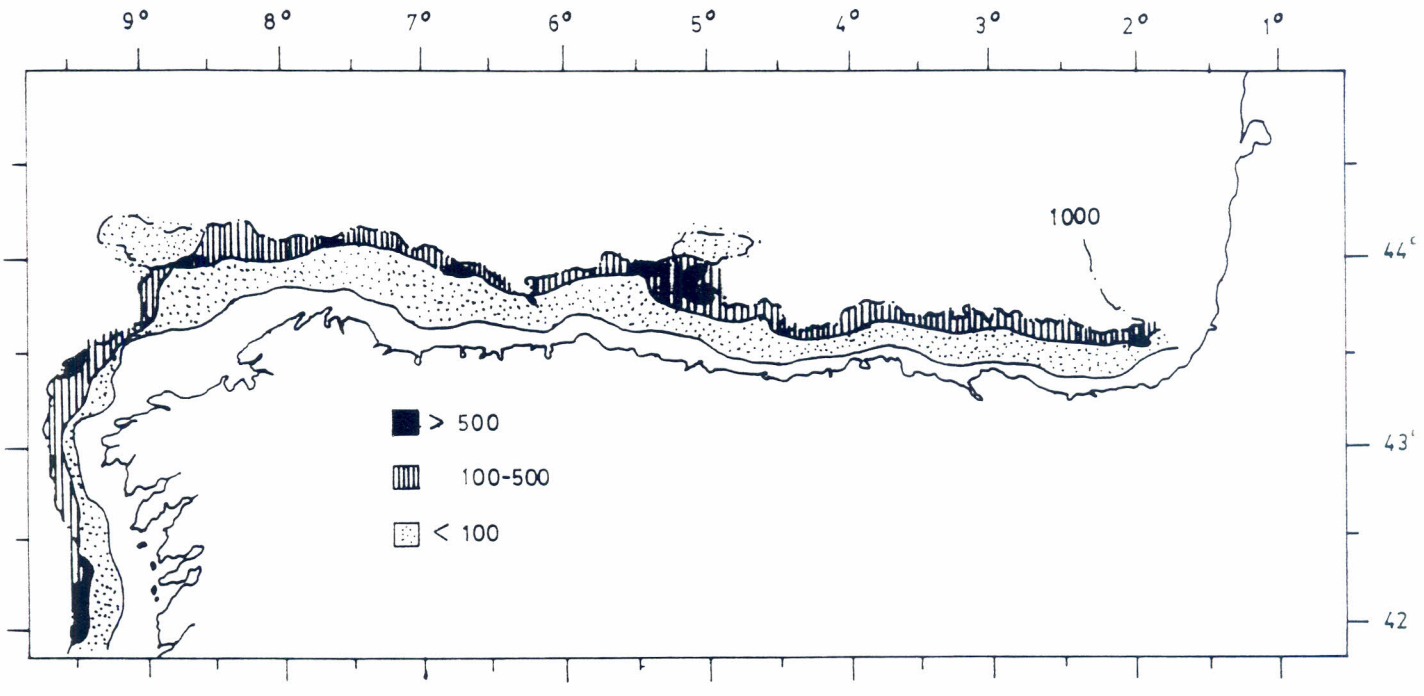


Fig. 2: Density distribution of blue whiting. Echo intensity in m^2/n. $mile^2$.

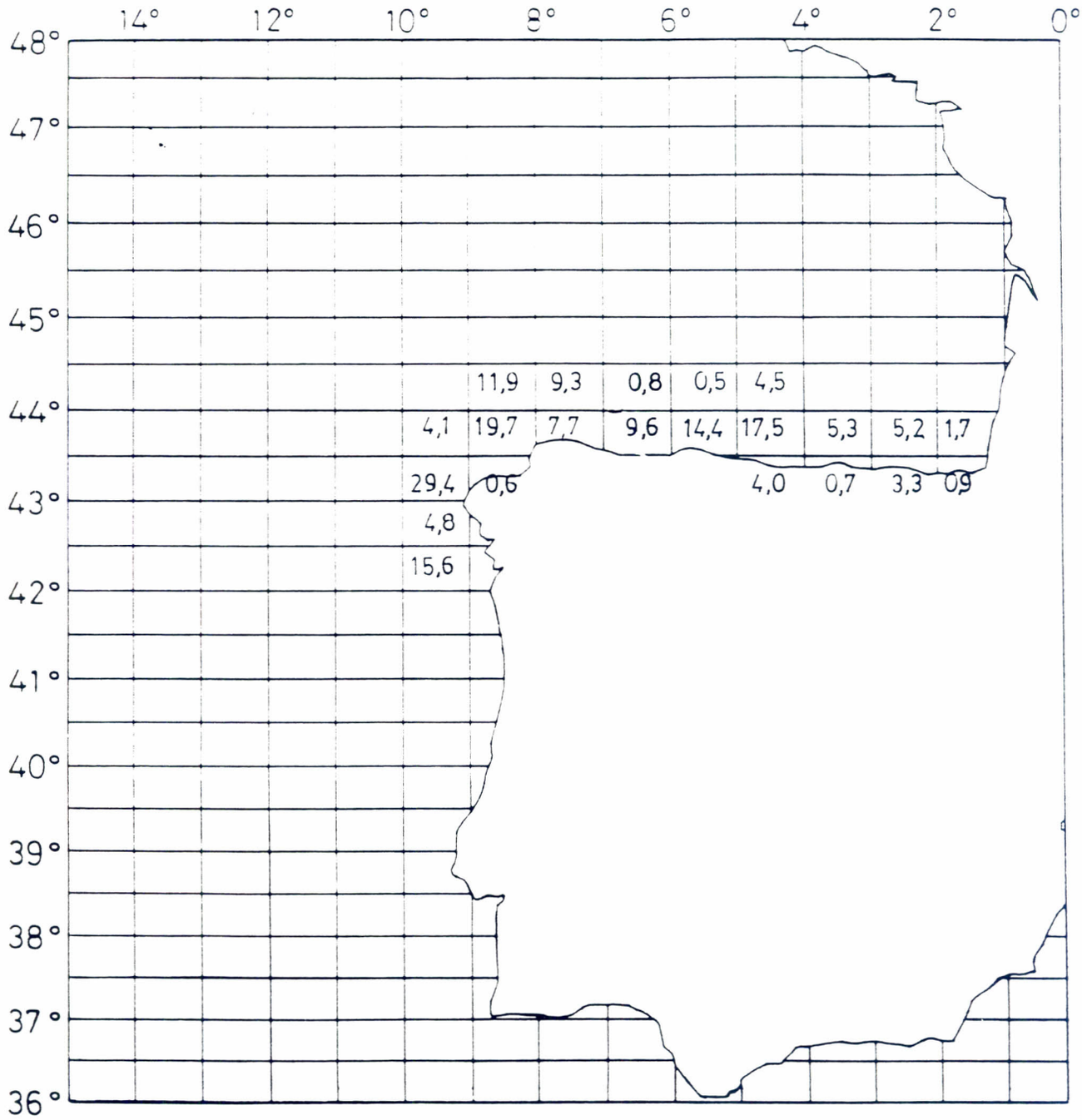


Fig. 3: Estimated biomass (thousand tonnes) of blue whiting by ICES rectangle.

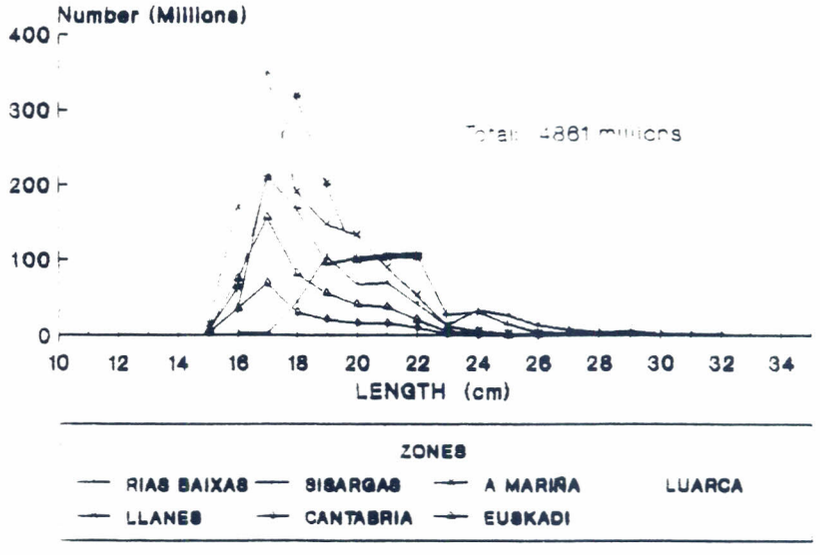


Fig. 4: Length distribution by geographic zone

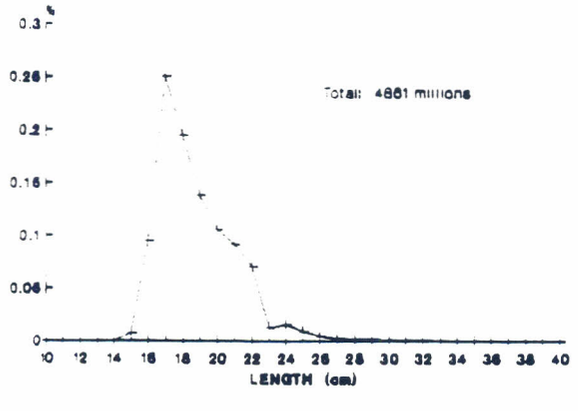


Fig. 5: Length distribution (%)

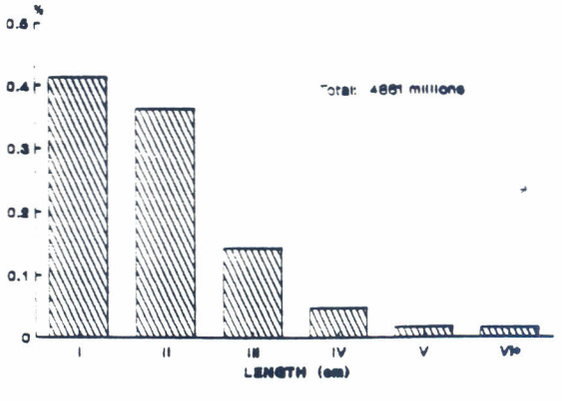


Fig. 6: Age composition (%)