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Acoustic abundance estimation of Sardine (Sardina pilchardus Walb) off Cantabric and Galician waters August 1985

by

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SUMMARY

Results of the anual acoustic survey of sardine present off Cantabric and Galician coast in August 1985 are reported. Estimations of the total biomass, abundance by age groups and the strength of 1985 year class were obtained. The total biomass estimation was 149.000 tons.

RESUME

On presente ici les resultats de la campagne acoustique sur la sardine au large des côtes Cantabrique et Galicienne dans Aôut 1985. On a obtenu estimations de la biomasse total, l'abondance para classe d'áge et la force de la classe annuelle de 1985. La biomasse total estimé a été 149.000 tonnes.

INTRODUCTION

The Sardine Stock of ICES Divisions VIIIc and IXa is evaluated by a Working Group since 1979 (Anon 1986). This Working Group has recommended the use of acoustics to estimate age class abundance and stock distribution to improve the evaluation. Annual acoustic surveys were carried out from 1982 with these purposes (Dias et al.1983; Pastor et al 1985 a,b,1986). The cruises dates were determined by the timing of recruitment to the fishery, at the beginning of the second semester (Anon, 1982).

In this paper the results of 1985 survey are given and refered to the part of stock present in N-NW Spanish coasts.

METHODS

The survey "Saracus-85" (10-31 August) was carried out following the standard methodology of previous surveys refered to instruments setting, surveys grid, sectors and strata (Pastor et al, 1985 a,b,1986).

A total of 2328 n.m. were surveyed, 27 pelagic trawl stations occupied and 8661 square n.m. have been evaluated. The coverage index was 25 (Aglen,1983). Figure 1 shows the surveyed area cruise track, geographic sectors, the 200 and 500 m. isobaths and the fishing stations.

A 38 KHz SIMRAD EK 400 echosounder and a digital echointegrator QD were used during the survey. The acoustic instruments were calibrated using a copper standard sphere of 60 mm. Table 1 shows the results of calibration and the settings of the controls during cruise.

Fishing stations were selected in accordance with acoustic traces on the echograms. A pelagic trawling gear with a vertical opening of 8-10 m. equiped with a SIMRAD FR 500 net sonder with wire was used. Fishing speed ranged between 3 and 4 knots.

Biological samples to obtain weight/length relationship and age/length key from otoliths were made.

Abundance of sardine for each sector and strata was estimated. The biomass values were separated into length-classes according to the size distribution in the net samples. The length distributions were converted to age distributions using the age/length key.

RESULTS

The calibration constant was calculated from the weight/length relationship

$$W = 0.0074\ L^{3.0179}$$

and from North Sea herring target strength recommended by the acoustic survey planning group (Anon,1983).

$$TS = 20 \log L - 71.2$$

The integration value of standard sphere at 20.6 m.depth was 346 mm. for a value of

$$SL + VR = 131.57\ d\ B$$

The conversion factor calculated was

$$C = 0.0476\ \ L$$

Table 2 shows the results of the fishing stations. Table 3 shows the integrator values (M), the mean length values of sardine (L), the areas, the fishing stations to be representatives and the biomass estimated by geographical sector and depth strata.

Table 4 shows the length distributions of Sardine by fishing station.

Table 5 shows the sardine biomass estimation and the abundance in number by age-class for the whole surveyed area and for every geographic subarea.

Figure 2 shows the relative abundance distribution of sardine.

The total biomass estimated was 149000 tons. This abundance level is sustancially lower than those obtained in 1983 and 1984, with 643000 and 273000 tons. respectively.

Of the total biomass estimated during the cruise, 59% was found in north Galicia, 35% in western Cantabric, 6% in eastern Cantabric and less than 1% in south Galicia.

Figure 3 shows the demographic estructure of the population in the different subareas in relation to the whole surveyed area.

DISCUSSION

The spacial distribution of sardine in this survey was similar to the situation found in the cruises carried out in previous years in August, with the highest biomass in North Galicia. However, a decrease of 45% compared with 1984 was estimated in the whole surveyed area. This decline was especially apparent in South Galicia, where the biomass decreased about 97% from 32800 to 1010 tons. In the Cantabrian Sea the biomass level decreased 29%, from 85500 to 60600 tons and 43% in North Galicia, from 154600 to 87500 tons.

A weak recruitment in 1985 was estimated if it is compared with the 1983 and a similar situation was found in 1984. This is reflected in the very scarce abundance of 1 group fish during this cruise and which could be due also to a stock differential distribution by age group (Porteiro et al,1986) Nevertheless, the VPA results (Anon,1986) shown a similar trend with low recruitment levels, both in 1984 and 1985.

The good recruitment of 1983 is shown by the abundance of 2-group fish in 1985. This group has constituted about 50% of the stock total catch in 1985 (Anon,1986)

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Constant (TVG) (2TL40, 2TL20)	99.1	64.6	dB
Loss transmission at depth r	52.57	26.28	"
Attenuation TVG at depth r	46.50	38.31	"
Gain selected	-20	-20	"
Gain measured	-20	-20	"
Power output	High	High	
Signal duration	1	1	m sec
Bandwidth	3.3	3.3	KHz
Echo level	0.26	0.64	Vp-p
20 log U/2V2	-20.73	-12.90	dB
SL + VR	131.61	131.57	

Frequency 38 KHz
Water temperature 16ºC
Sound velocity (c)1500m/s

Sphere integration
Upper limit 18m.
Lower limit 22m.
Threshold 10mV
M (mm) 346

Echosounder	EK 400-38
Transducer	15x30 ceramic
Transmitter power	High
TVG/Gain	20 log R/O dB
Pulse length	1.0 ms
Bandwidth	3.3 KHz
Integrator	Digital QX+QD
Gain	OdB x 100
Threshold	10mV

Table 1.- Calibration results and settings of controls during survey.

DATE	TIME	STATION	GEAR	DEPTH (m)		POSITION (START)		CATCH TOTAL	DOMINANT SPECIES	WEIGHT (Kg)	
				BOTTOM	GEAR	LAT.N.	LONG.W			P/HOUR	%
11/08	19h	1	PT	50	32	43º20'06	2º00'90	277.35	Trachurus trachurus	133.15	63.26
									Scomber scombrus	1.71	0.81
									Engraulis encrasicolus	0.83	0.39
									Micromesistius poutassou	0.61	0.29
12/08	18h 47'	2	PT	46	20	43º29'45	3º24'72	100.2	Trachurus trachurus	21.8	44.61
									Engraulis encrasicolus	16.59	33.93
									Sardina pilchardus	3.22	6.59
									Scomber Scombrus	0.34	0.70
									Other species	6.93	14.17
12/08	21h 16'	3	PT	100	68	43º31'16	3º16'93	39.0	Scomber scombrus	30.46	84.77
									Engraulis encrasicolus	4.62	12.84
									Micromesistius poutassou	0.17	0.46
									Other species	0.69	1.93
13/08	20h 18'	5	PT	52	4	45º26'0	4º41'0	325.55	Sardina pilchardus	592.5	97.07
									Trachurus trachurus	10.31	1.69
									Other species	7.58	1.24
13/08	21h 99'	6	PT	67	10	43º29'7	4º47'4	84.76	Trachurus trachurus	60.97	74.33
									Sardina pilchardus	8.71	10.62
									Engraulis encrasicolus	1.07	1.27
									Other species	11.30	13.78
14/08	19h 38'	7	PT	54	20	43º35'0	6º20'0	70.66	Sardina pilchardus	22.08	39.06
									Other species	34.45	60.94
14/08	22h 51'	8	PT	57	26	43º37'4	6º24'5	105.78	Sardina pilchardus	98.00	69.48
									Trachurus trachurus	9.33	6.62
									Scomber scombrus	0.19	0.13
									Other species	33.52	23.77
15/08	00h 19'	9	PT	104	36	43º40'0	6º32'2	5.33	Scomber scombrus	3.64	37.52
									Sardina pilchardus	2.38	24.58
									Engraulis encrasicolus	1.18	12.20
									Trachurus trachurus	0.60	6.19
									Other species	1.89	19.51
15/08	21h 48'	10	PT	38	6	43º43'5	7º35'6	54.83	Sardina pilchardus	40.54	96.12
									Trachurus trachurus	1.23	2.97
									Other species	0.41	0.91
15/08	23h 30'	11	PT	88	10	43º46'2	7º37'0	176.5	Sardina pilchardus	506.67	86.10
									Trachurus trachurus	78.33	13.31
									Scomber scombrus	1.00	0.17
									Other species	2.43	0.41
17/08	20h 35'	12	PT	29	8	43º24'8	8º17'6	49.42	Trachurus trachurus	19.86	49.68
									Sardina pilchardus	19.05	47.6
									Engraulis encrasicolus	0.65	1.6
									Scomber scombrus	0.11	0.26
									Other species	0.32	0.79
17/08	22h 24'	13	PT	55	20	43º26'5	8º22'7	42.79	Sardina pilchardus	11.69	96.99
									Trachurus trachurus	0.17	1.40
									Engraulis encrasicolus	0.08	0.7
									Other species	0.11	0.91

Table 2.- Results of the pelagic fishing stations.

DATE	TIME	STATION	GEAR	DEPTH (m)		POSITION(START)		CATCH TOTAL	DOMINANT SPECIES	WEIGHT (Kg)	
				BOTTOM	GEAR	LAT.N.	LONG.W.			P/HOUR	%
18/08	23h 56'	14	PT	63	10	43º23'	8º28'9	12.46	Sardina pilchardus	11.0	88.28
									Other species	1.46	11.72
20/08	21h 39'	15	PT	118	80	42º19'8	9º4' 7	4.6	Other species	7.2	100.
21/08	21h 50'	16	PT	43	20	42º 1'0	8º54'6	77.7	Trachurus trachurus	1.33	2.25
									Other species	57.68	97.75
22/08	12h 18'	17	PT	245	8	42º19'59	9º17'82	8.1	Micromesistius poutassou	6.72	92.59
									Other species	0.54	3.00
23/08	19h 25'	18	PT	28	4	42º15'5	8º42'6	25.22	Trachurus trachurus	4.03	35.69
									Sardina pilchardus	3.08	7.36
									Scomber scombrus	2.31	20.42
23/08	22h 36'	19	PT	43	20	42º22'0	8º50'9	1.89	Sardina pilchardus	0.54	34.48
									Trachurus trachurus	0.30	19.10
									Other species	0.73	46.42
24/08	8h 30'	20	PT	261	8	42º21'0	9º21'5	16.00	Micromesistius poutassou	6.09	87.50
									Other species	0.87	12.50
24/08	12h 20'	21	PT	588	500	42º32'4	9º30'2	3.00	Other species	1.15	1.00
24/08	15h 15'	22	PT	162	4	42º39'31	9º27'01	5.85	Micromesistius poutassou	2.08	94.02
									Other species	0.13	5.98
24/08	19h 53'	23	PT	27	8	42º46'17	8º58'05	36.7	Sardina pilchardus	17.53	88.75
									Scomber scombrus	0.38	1.90
									Trachurus trachurus	0.15	0.76
									Engraulis encrasicolus	0.06	0.28
									Other species	1.64	8.31
24/08	23h 50'	24	PT	48	22	42º54'3	9º13'5	3.55	Sardina pilchardus	1.68	73.24
									Micromesistius poutassou	0.12	5.35
									Other species	0.49	21.41
25/08	9h 50'	25	PT	98	4	42º52'6	9º34'0	399.6	Micromesistius poutassou	232.43	99.84
									Other species	0.38	0.16
25/08	22h 22'	26	PT	45	8	42º59'4	9º18'2	14.2	Sardina pilchardus	28.00	98.59
									Other species	0.40	1.41
26/08	20h 30'	27	PT	54	8	43º36'8	8º15'4	3.21	Sardina pilchardus	8.09	97.48
									Scomber scombrus	0.21	2.52

Table 2.- Results of the pelagic fishing stations.

	(DEPTH - m)	(n.m.^{2})		(cm)	STAT. nº	(Tons)
	1	20.55	-	-	-	-
20	2	54.35	-	-	-	-
	3	279.79	-	-	-	-
	1	20.90	7	12.52	18,19,23	105.2
21	2	76.30	1	18.71	24,22	81.7
	3	208.71	-	-	-	-
	1	28,91	15	12.52	18,19,23	312.0
22	2	95,47	5	18.71	24,22	511.1
	3	191.28		-	-	-
	1	28.91	173	19.04	24,26	5 448.5
23	2	49.47	59	20.19	13,14,24,26	3 372.0
	3	155.05	1	"	"	179.1
	1	29.96	175	19.04	24,26	5 711.7
24	2	74.21	9	20.19	13,14,24,26	771.6
	3	192.33	-	-	-	-
	1	59.93	85	14.47	12	4 219.3
25	2	105.57	77	20.19	13,14,24,26	9 409.2
	3	317.07	6	"	"	2 197.9
	1	17.42	424	19.95	10,11	8 431.4
26	2	79.79	93	20.17	27	8 585.6
	3	275.95	2	"	"	637.0
	1	58.53	230	19.95	10,11	15 367.2
27	2	57.49	247	20.17	27,	16 388.6
	3	363.41	-	-	-	-
	1	33.10	145	19.95	10,11	5 478.8
28	2	55.05	3	20.17	27	190.6
	3	429.61	2	"	"	991.6
	1	24.04	47	20.60	5,6,7,8	1 334.4
29	2	64.80	26	"	"	1 989.8
	3	363.06	1	"	"	428.8
	1	18.81	81	20.60	5,6,7,8	1 799.5
30	2	94.77	102	"	"	11 416.7
	3	134.49	1	"	"	158.8
	1	35.88	111	20.60	5,6,7,8	4 703.7
31	2	29.09	5	"	"	171.8
	3	160.27	-	-	-	-
	1	22.99	14	20.60	5,6,7,8	380.1
32	2	79.44	-	-	-	-
	3	267.59	1	20.60	5,6,7,8	316.0
	1	24.04	161	20.60	5,6,7,8	4 571.2
33	2	66.05	83	"	"	6 523.7
	3	206.96	-	-	-	-
	1	26.69	338	20.60	5,6,7,8	10.654.5
34	2	43.55	144	"	"	7 406.6
	3	157.49	-	-	-	-
	1	29.61	-	-	-	-
35	2	50.52	-	-	-	-
	3	98.96	-	-	-	-
	1	68.69	88	20.70	1,2,3	7 191.3
36	2	65.50	15	"	"	1 164.0
	3	58.18	-	-	-	-
	1	31.35	1	20.70	1,2,3	37.1
37	2	116.72	2	"	"	276.6
	3	72.12	-	-	-	-
	1	26.82	-	-	-	-
38	2	65.50	-	-	-	-
	3	81.18	-	-	-	-
	1	14.28	4	20.70	1,2,3	67.7
39	2	131.01	-	-	-	-
	3	135.54	-	-	-	-
	1	36.58	-	-	-	-
40	2	102.09	-	-	-	-
	3	160,97	-	-	-	-
TOTAL						148.928.4

Table 3. Integrator values (M), mean length values of sardine (L) geographical sectors and fishing stations to be representatives. Stratum 1=0-50m, 2= 50-100m and 3=100-200m.

1 (cm)	2	5	6	7	8	9	10	11	12	13	14	18	19	23	24	26	27
5																	
6																	
7												8	1	2			
8												101	7	92			
9												156	3	90			
10												210		40			
11									14			59		4			
12									311								
13									226			4					
14									23			1		1			
15												1					
16												1					
17									2			13		1	7		
18				4			53	95	5	5	1	25		43	13	31	1
19	9	712	5	20	31	2	191	912	12	5	11	7		82	12	149	13
20	37	1581	33	64	281	2	270	570	14	15	26	1		45	4	31	13
21	33	1659	55	142	325	8	172	418	25	105	47			30	4	6	9
22	13	514	29	110	337	4	33	209	56	165	29			13	1		5
23	1	119	3	28	18		14	19	38	180	13			9			1
24	3		1		12			21	9	45	4			2			
25		40							2	5							
26				4													

Table 4.- Length distribution of sardines in each sample.

AGE	EAST CANTABRIC	WEST CANTABRIC	NORTH GALICIA	SOUTH GALICIA	TOTAL
0			103 060	9 171	112 231
1		23	7 725	580	8 328
2	37 196	225 460	622 910	9 494	895 060
3	24 401	143 850	173 600	1 331	343 182
4	22 466	129 440	151 950	1 085	304 941
5	24 072	143 670	140 620	831	309 193
6	11 284	65 794	64 026	365	141 469
7	4 362	23 265	29 160	131	56 918
8	2 472	7 442	13 374	53	23 341
9	1 341	7 372	10 711	43	19 467
10	328	3 540	2 431	9	6 308
TOTAL	127 922	749 856	1319 567	23 093	2 220 438
BIOMASS (tons)	8 737	51 856	87 485	1 010	149 090

Table 5.- Abundance in number by age-class (x 10^{-3}) for the whole surveyed area and for every geographic subarea, and biomass in tons.

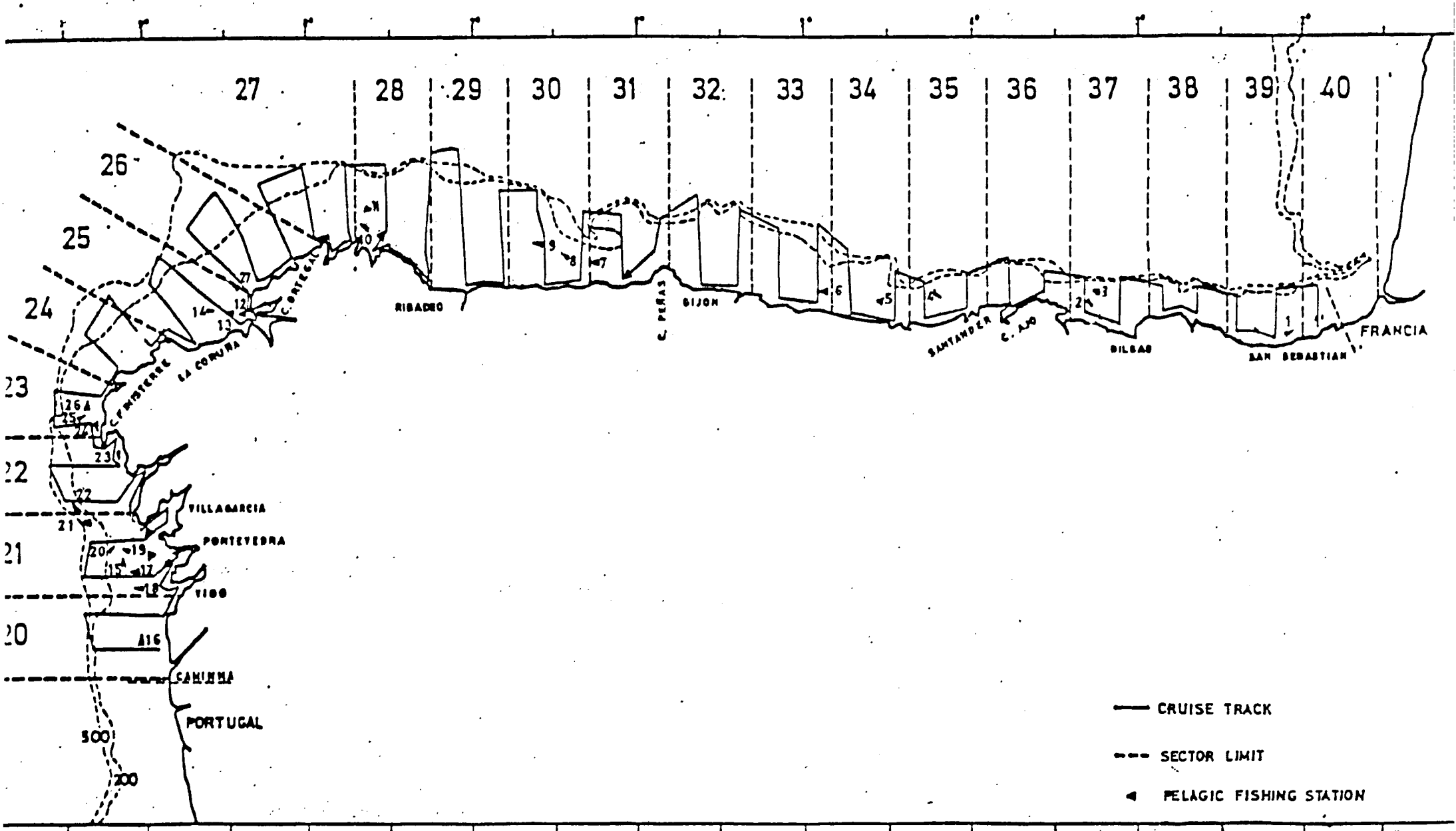

Figure 1.-Area surveyed showing cruise track, geographical sectors, 200 and 500 m. contour and pelagic fishing stations.

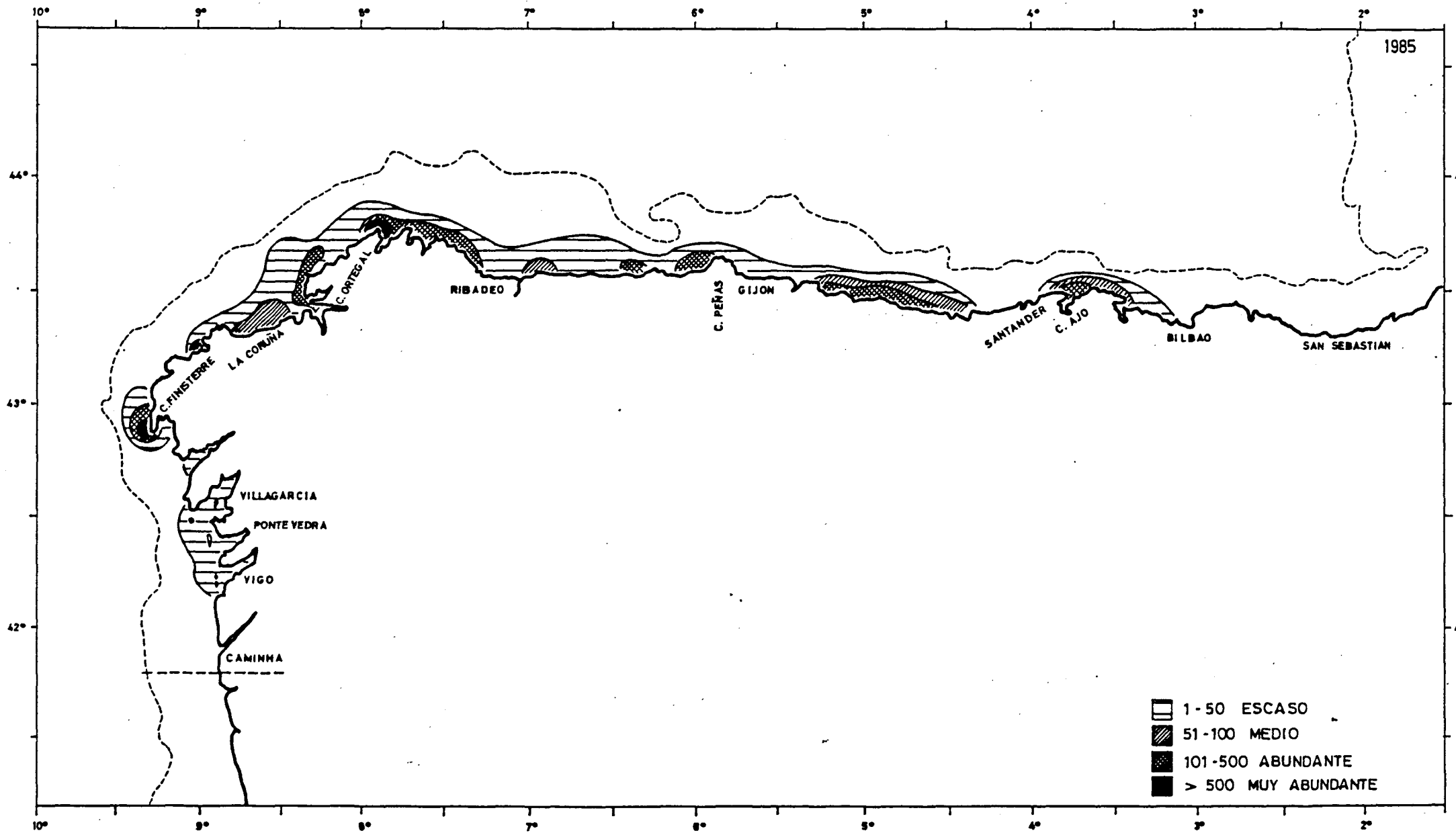

Figure 2.- Relative abundance distribution of sardine.

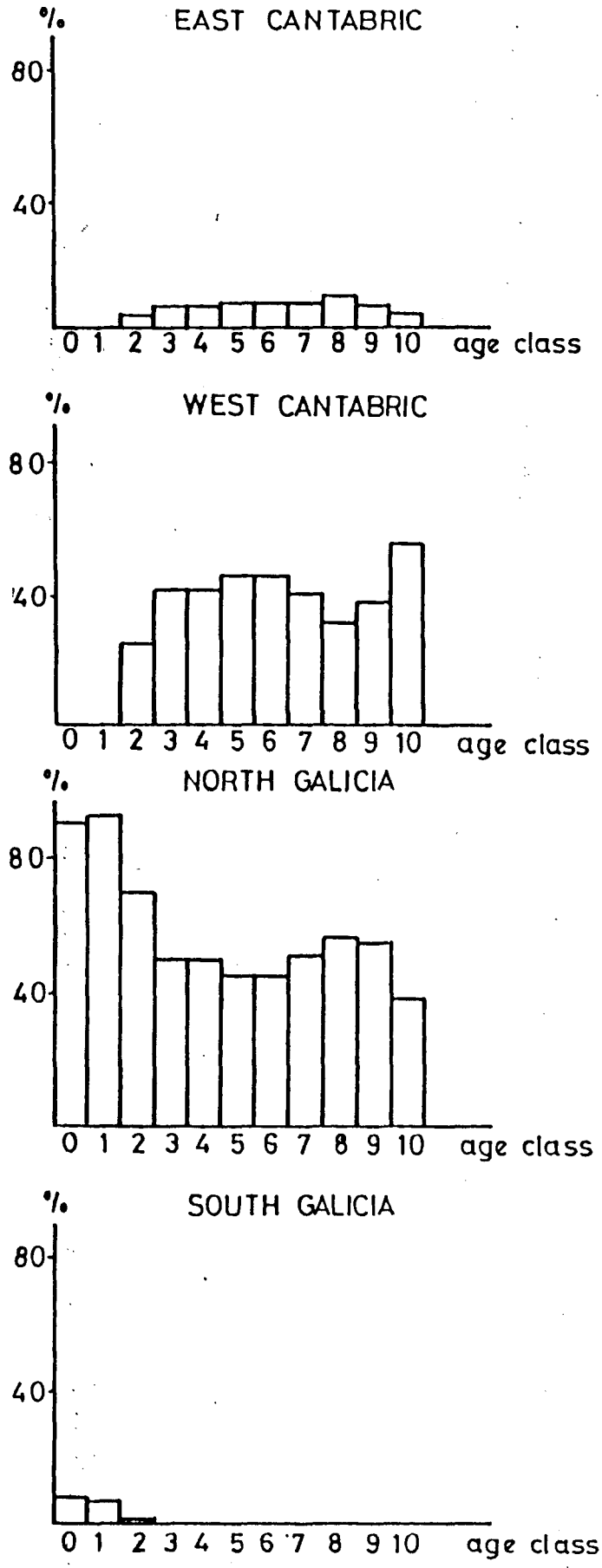

Figure 3.- Demographic estructure of the population in the different subareas, in relation to the whole surveyed area.