Pelagic Fish Committee

ICES CM 1997/H:1

REPORT OF THE

PLANNING GROUP FOR A SARDINE ACOUSTIC SURVEY IN ICES SUB-AREAS VIII AND IX

Lisbon, Portugal
27–28 January 1997

International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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1 INTRODUCTION

The abundance estimates of sardine from the acoustic surveys carried out by both Spain and Portugal are used to tune the VPA in the assessment of this species. The best tuning results have been obtained when the surveys were carried out simultaneously. However, due to the important changes in the stock distribution area which have occurred in the last few years, the survey design needs to be revised in order to obtain more precise estimates.

Following the terms of reference set by the ICES Annual Science Conference (84th Statutory Meeting) (C. Res. 1996/2:42), the Planning Group for a Sardine Acoustic Survey in ICES Sub-Areas VIII and IX (PGSAS) met at the Instituto de Investigação das Pescas e do Mar (IPIMAR), Lisbon, from 27–28 January 1997 to:

a) co-ordinate the timing and methodologies for acoustic surveys for sardine;

b) review the survey design (including hydrographic sampling) in the light of previous surveys, and propose survey improvements.

In addition, at the same time as these surveys, Spain and Portugal will perform two ichthyoplankton surveys in order to apply the Daily Egg Production Method (DEPM) to the Spawning Stock Biomass of sardine.

2 PARTICIPANTS

Pablo Carrera	Spain (Chairman)
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*Partial attendance.

3 REVIEW OF THE DESIGN OF ACOUSTIC SURVEYS FOR SARDINE PLANNED FOR 1997. CO-ORDINATION OF SURVEY RESULTS PRESENTATION

Both countries agreed to co-ordinate and carry out a joint acoustic survey for sardine in 1997. Spain will survey the Cantabrian and Galician coasts with the new R/V "Thalassa" from 3-29 March and Portugal will survey the Portuguese coast and the Gulf of Cadiz (Spain) from 3-27 March with R/V "Noruega". It was agreed that both surveys will follow the same methodology (Dias *et al.*,1983; Anon, 1986).

Acoustic data of the last acoustic surveys undertaken by both countries were analysed in order to get an adequate coverage of the sardine distribution area and to improve the acoustic sampling. Minimum suitable distances between acoustic transects were estimated for both Spanish and Portuguese surveys. A distance of 6 nautical miles between transects was found as more adequate for the Spanish survey (Porteiro *et al*, 1996), while for the Portuguese it was estimated to be 8 nautical miles distance between transects (see appendix I).

Thus, it is planned that R/V "Thalassa" will follow an acoustic track with parallel transects equally spaced of 6 nautical miles and extending from the coast up to 200m depth. Besides, the extension of the transects beyond the outer limits of the sardine distribution area (around 200m isobath) is due to the fact that this survey is also planned to estimate the abundance of blue whiting which occurs in deeper waters. In order to get some information about sardine the southern part of the French continental shelf will be also covered. An inter-calibration of R/V "Thalassa" and R/V "Cornide de Saavedra" along the Galician coast will precede the beginning of this survey. The Portuguese survey will follow parallel transects equally spaced of 8 nautical miles and extending up to the 200m depth. Figure 1 shows the acoustic track around the whole area.

An acoustic and electronic calibration of the acoustic equipment will be undertaken at the beginning of these surveys.

Despite the adverse conditions frequently found, the Planning Group stressed that some effort should be especially focused on the implementation of the sampling trawl stations as they are fundamental for the acoustic method. Sampling trawl stations will be undertaken in both surveys in order to identify the acoustic targets, to collect biological information on the species and to determine the age and length structure of sardine. Besides it was agreed that some extra sampling will be performed in order to provide the adult parameters which are necessary for the application of the DEPM method (see point 4). In both surveys it was planned to use two pelagic gears and one semipelagic trawl.

In what concerns the estimated sardine abundance by age groups, Spain will apply an age/length key for the whole Spanish surveyed area and Portugal will use a different key for each zone of the Portuguese surveyed area.

The relation between hydrography and sardine distribution has been pointed out during this meeting (Dias *et al.*, 1996; Anon., 1997). Thus the Planning Group agreed that Oceanographic parameters should be collected during these surveys. The allocation of these stations was discussed. It was decided that CTD casts will be performed along transects over the 50, 100, 200 and 500m bathymetrics and at an outermost station approximately 10 nautical miles beyond this depth. Distance between transects will be 24 nautical miles.

It was agreed to co-ordinate the presentation of the survey results and to get the report ready for the next meeting of the ICES Working Group on the Assessment of Mackerel, Horse-Mackerel, Sardine and Anchovy in September.

4 Co-ordination of Acoustic and DEPM Surveys

These acoustic surveys will be carried out simultaneously with two surveys for Daily Egg Production Method, DEPM (Parker, 1980). The DEPM surveys will be undertaken in the same area by the Spanish R/V "Cornide de Saavedra" and Portuguese R/V "Capricórnio" (Figures 2a, b).

Adult parameters (spawning fraction and batch fecundity) for the Egg Production Method (EPM) will be collected during the acoustic surveys.

The need for sampling females with hydrated oocytes in order to determine the batch fecundity was stressed by the Planning Group during the co-ordination with the DEPM surveys. It was agreed that, for this purpose, samples should be collected during daytime, from 6 to 22 hrs GMT.

The histological processing and analysis of gonads on microscope slides will be done on land in the laboratories of both institutes (IEO and IPIMAR).

5 Conclusions and Recommendations

- A co-ordinated joint acoustic survey for sardine will be carried out in 1997 along the Atlantic Iberian coast;
- Both surveys will follow the same methodology;
- The Spanish acoustic survey will follow an acoustic track with parallel transects equally spaced of 6 nautical miles and some of those extending up to the 1000 metres isobath in order to assess the Spanish fraction of blue whiting;
- The Portuguese acoustic survey will follow parallel transects equally spaced of 8 nautical miles and extending up to the 200m depth;
- Oceanographic parameters will be collected by CTD along transects;
- Adult parameters for Daily Egg Production Method (DEPM) will be collected during the acoustic surveys;
- The presentation of results will be co-ordinated and the report will be ready in September for the next meeting of the ICES Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy.

6 References

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Porteiro, C., Carrera, P. and Miquel, J. 1996. Analysis of Spanish acoustic surveys for sardine, 1991-1993: abundance estimates and inter-annual variability. ICES Journal of Marine Science, **53**:429-433.

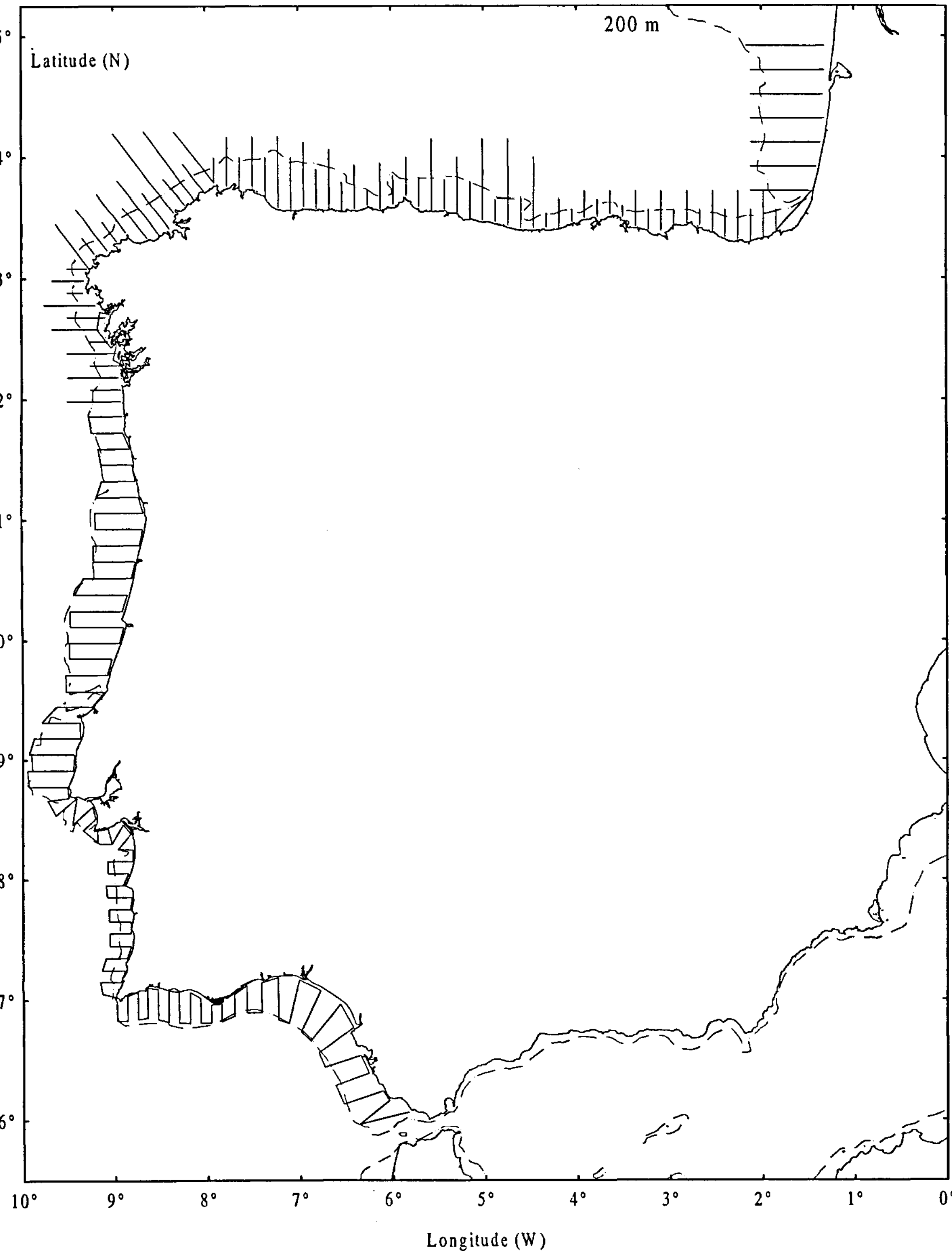

Figure 1: Acoustic track for the spring 1997 acoustic surveys.

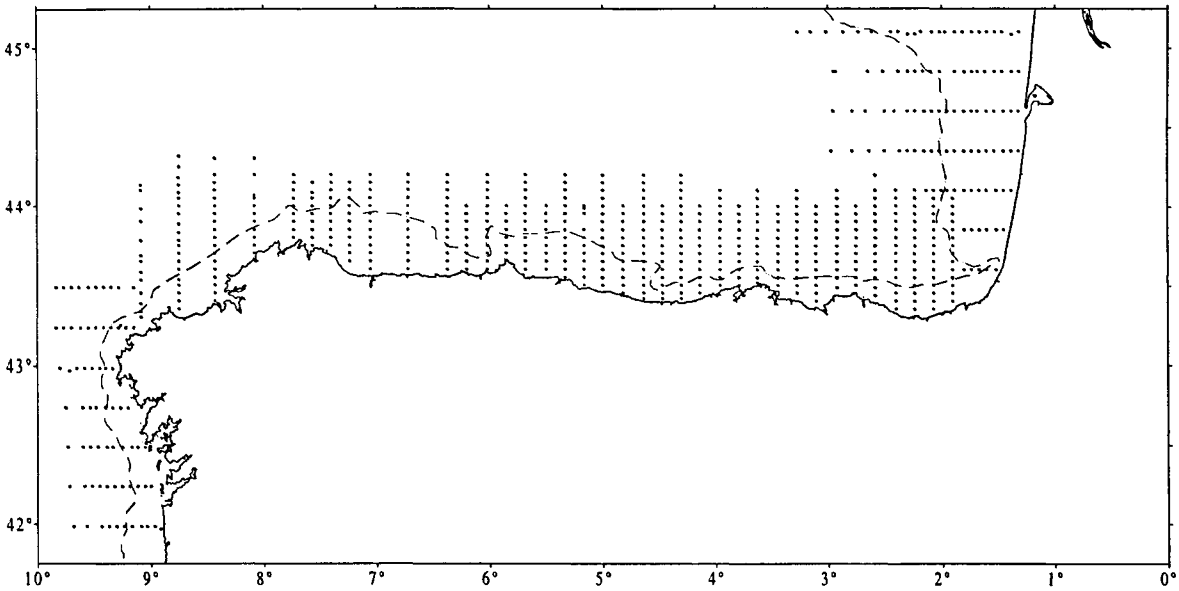

Figure 2a: Survey design to be followed during the Spanish Ichthyoplankton survey

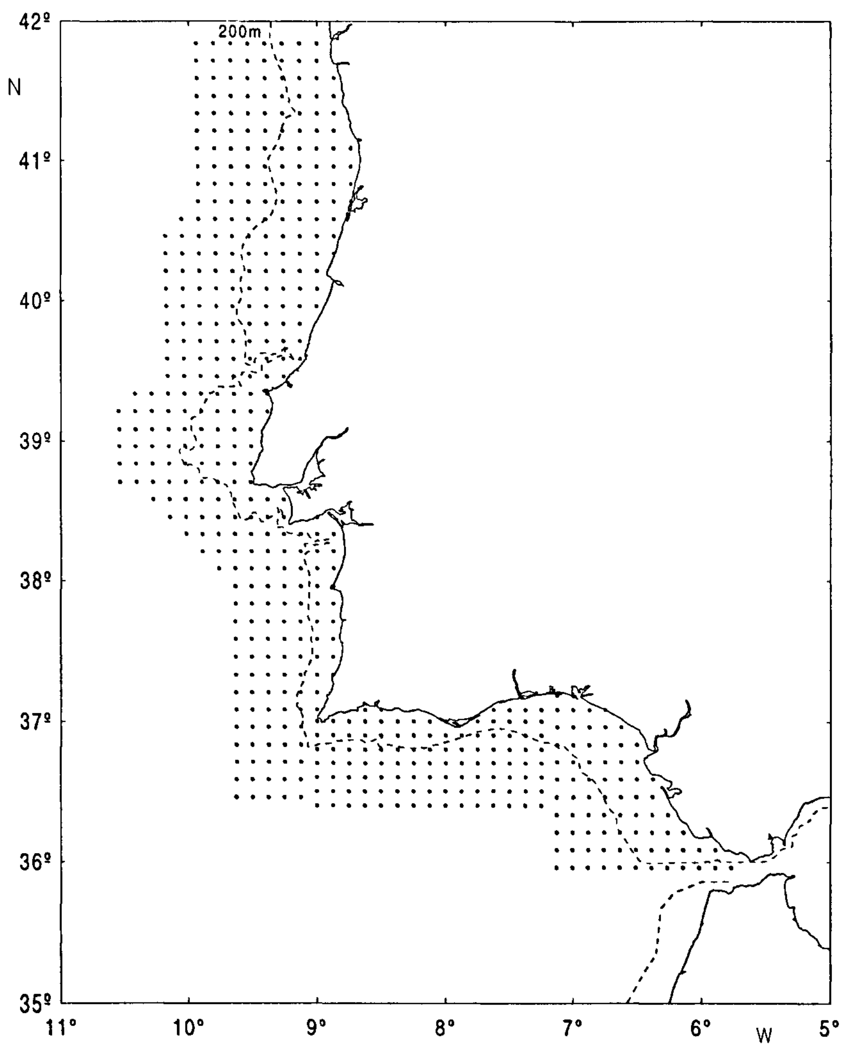

Figure 2b: Survey design to be followed during the Portuguese Ichthyoplankton survey

APPENDIX 1

Analysis of the Previous Portuguese Acoustic Sardine Data

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As it was already referred, the Planning Group discussed the acoustic survey track design in order to get a suitable coverage of the surveyed area and to improve the acoustic sampling of sardine.

The Portuguese acoustic sardine data of the surveys undertaken in the last year (in spring and summer 1996) were analysed using geostatistics methods (Petitgas, 1993; Petitgas and Prampart, 1993). In order to know the mean size of the sardine aggregations., the sardine distributions were analysed and the experimental variograms performed on both raw and logarithmic data has been fitted , when possible, to theoretical models. It was also assumed that the range of these variograms are good estimators of the mean size of the sardine patches. Thus, a good distance between transect could that which coincides to this mean size.

Survey design consisted in a zigzag grid with 10 nmi between peaks. As in the Spanish area, total backscattering values (S_A values, m^2 nmi^{-2}) were collected and stored every nautical mile with its geographical position. These values has been allocated into different species, according to fishing stations performed at the same time. S_A values by nmi allocated to sardine are shown in figure 1a,b. In contrast to the distribution found in the Spanish area, sardine was distributed all around the Portuguese coast. There were no gaps among transects and sardine showed a widespread distribution, as far as 200 m depth.

Trends against longitude and latitude were almost negligible. Only in the spring survey, high values are mainly located at the south part of the distribution area, which gave a scarce correlation between latitude and sardine S_A values. Trends against depth has no checked. Thus, in absence of clear trends, data can be treated as a whole. Nevertheless sardine size composition showed a distribution pattern along the coast. According to that, data could be split into three main areas: Central-North, from the Spanish-Portuguese border to 39° N, Central South, which is the western coast until 37° N and South.

This analysis has been firstly performed using the whole set data, with the 200 m isobath as the outer border of the distribution area. Then, the area was split into the three main zones in order to check differences in aggregation pattern according to the different size composition along the coast. In this particular case, distribution area has been matched to the positive area of sardine presence.

Table 1 shows the main features of data as well as the fitted variograms models for each analysed area. Due to the survey design, to perform experimental variograms, a lag of 1.5 nmi with a tolerance of 35° in two main directions, (north-south and west-east) were used. Both experimental variograms and their theoretical models can be also seen in Figures 2a,b.

As most of the acoustic data, sardine S_A values presented a skewed distribution. Few values gave important contribution on both mean and its variance. As it was pointed out in this case, log transformations improve the knowledge of the spatial structure and gave more stable variograms than raw data (Fernandes, 1996). Thus, this analysis was firstly performed on log transformation data.

The spatial structure seemed to be isotropic, with no differences between North-South direction and West-East direction. Nugget effect was an important feature of these variograms. Ranges varied between 10 to 6 nmi, being higher in the northern area. This could be related to the size of the continental shelf as well as the different size composition around the coast. In fact, in the southern part younger (age groups I and II) are mainly distributed.

From this preliminary analysis, ranges of the spatial structures are higher than those found in the Spanish area. This and the continuity of the sardine distribution around the coast are the main differences between the Spanish and the Portuguese sardine distribution.

In order to avoid problems with the independence of transects when zigzag design are used, systematic parallel survey design with a random start seems to be more appropriate. In the Portuguese coast, distance between transects could be 8 nmi.

References

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Area	Survey	Total No inside	No zeroes inside	Area (sq nmi)	Mean (Sa)	Variance	No of values and their contribution to mean and variance (%) >2000 No	>2000 % m	>2000 % v	>1000 No	>1000 % m	>1000 % v	>500 No	>500 % m	>500 % v	>200 No	>200 % m	>200 % v	Model (performed over raw data and log transf. in whole area and only on log by subareas)
Whole area	Spring	990	516	8452.1	352.52	685122.9	44	44.2	79.6	107	66.6	87.5	198	84.1	89.2	366	96.8	89.5	100000+Sph(565000;10); 0.42+Sph(8; 10)
	Summer	959	557	8452.1	391.35	1073460	62	59.4	86.7	108	74.6	90.2	189	87.9	90.8	320	97.8	91	474000+Sph(600000;9); 1+Sph(8.7; 9)
Central-N	Spring	276	52	2104.69	297.46	477339	5	25.9	83.4	16	42.8	91.5	36	57.5	93.3	138	89.4	95.7	1.5 + Exponential(3.5; 8)
	Summer	256	39	2137.87	732.81	1712482	31	57.6	85.1	57	74.3	76.8	100	88	87.1	160	97	90	3.5 + Spherical(2.4; 6)
Central S	Spring	65	8	433.92	975.38	1442197	11	55.2	78.2	25	79	78.7	39	93.7	80.5	52	99.2	87.6	Nugget effect
	Summer	39	5	328.71	1533.33	5634910	10	82.9	79.3	13	89.1	79.6	18	93.7	81.9	31	99.5	91.6	2 + Spherical(6; 7)
South	Spring	243	11	2060.34	877.78	1233549	28	45.1	77.7	69	69.5	80.9	131	89.8	82.2	198	98.4	90.3	0.5 + Spherical(2.3; 6)
	Summer	188	17	1738.01	787.77	1313268	24	52.4	81	44	69.3	83.4	56	86	84.1	145	98.2	90.7	1.2 + Exponential(3.2; 6)

Table 1: Number total of data inside each area, number of nil values, surface (nmi^2), mean S_A value and its variance, number of values higher than 2000 S_A, 1000 S_A, 500 S_A and 200 S_A and their contribution in percentage to mean and its variance and fitted variogram for each area and survey.

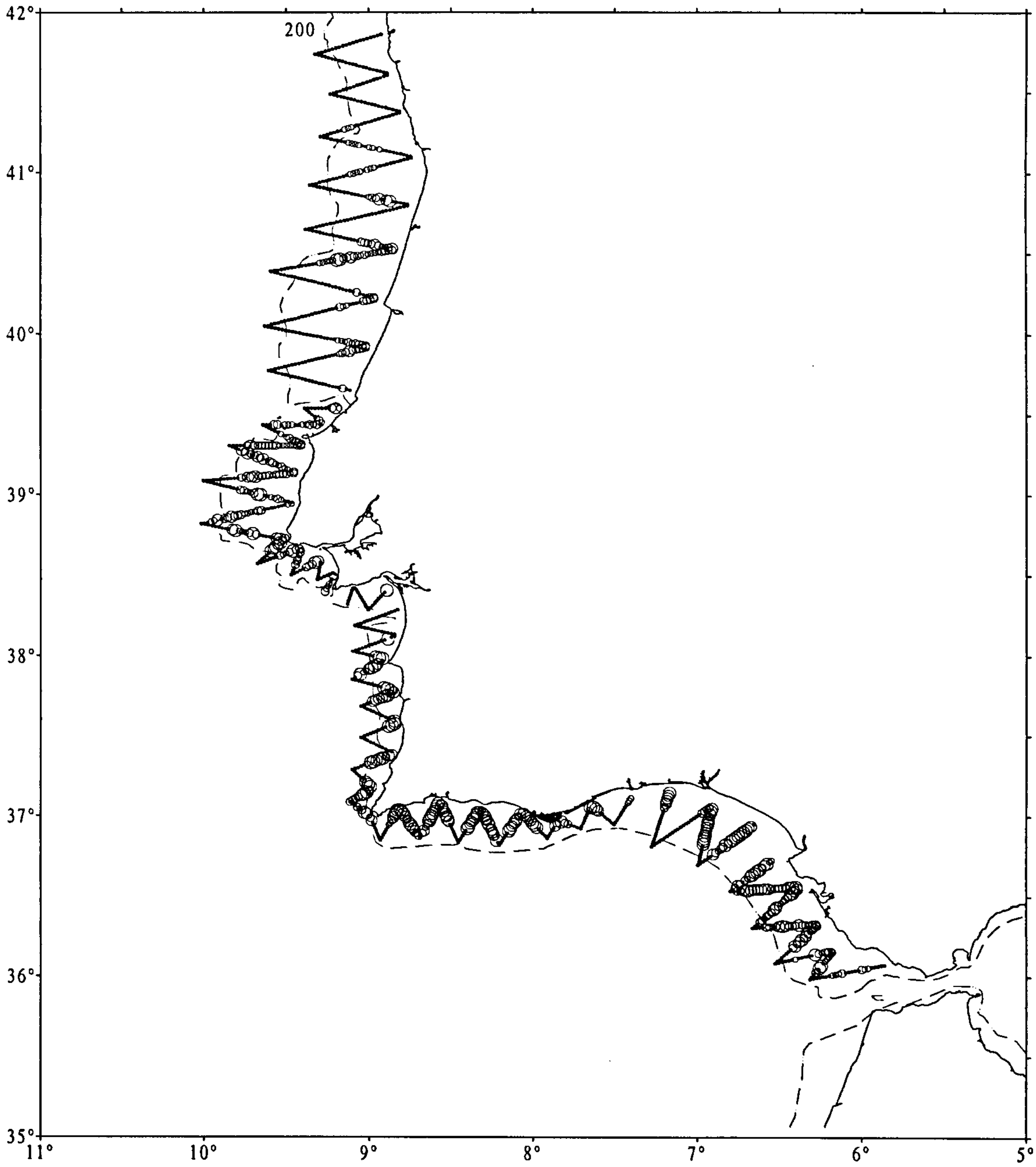

Figure 1a: Sardine backscattering values in spring 1996. Zeroes values are denoted by black dots . Positive values are represented in classed increasing circles (1-200; 200-500; 500-1000 and >1000 S_A values).

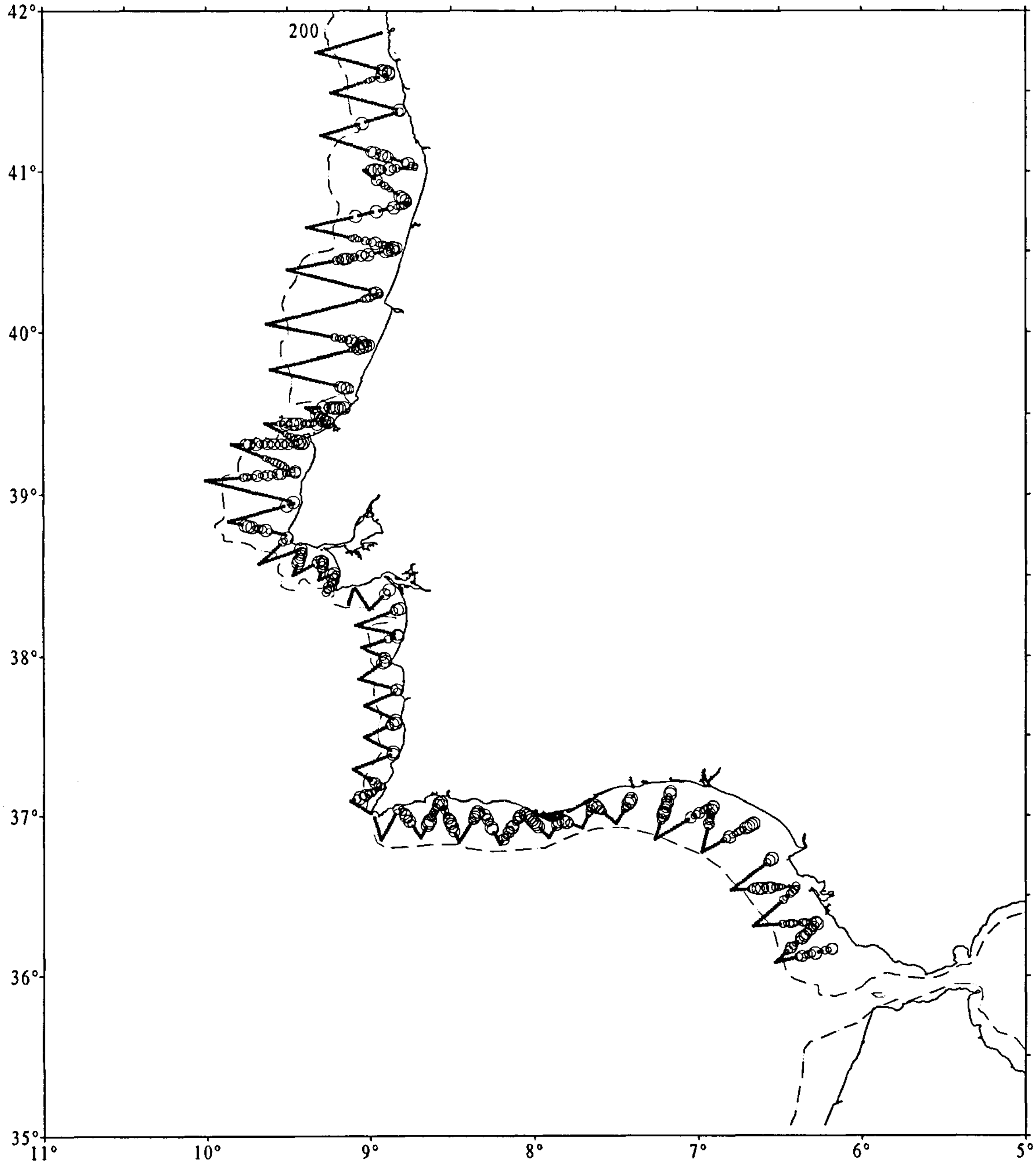

Figure 1b: Sardine backscattering values in summer 1996. Zeroes values are denoted by black dots . Positive values are represented in classed increasing circles (1-200; 200-500; 500-1000 and >1000 S_A values).

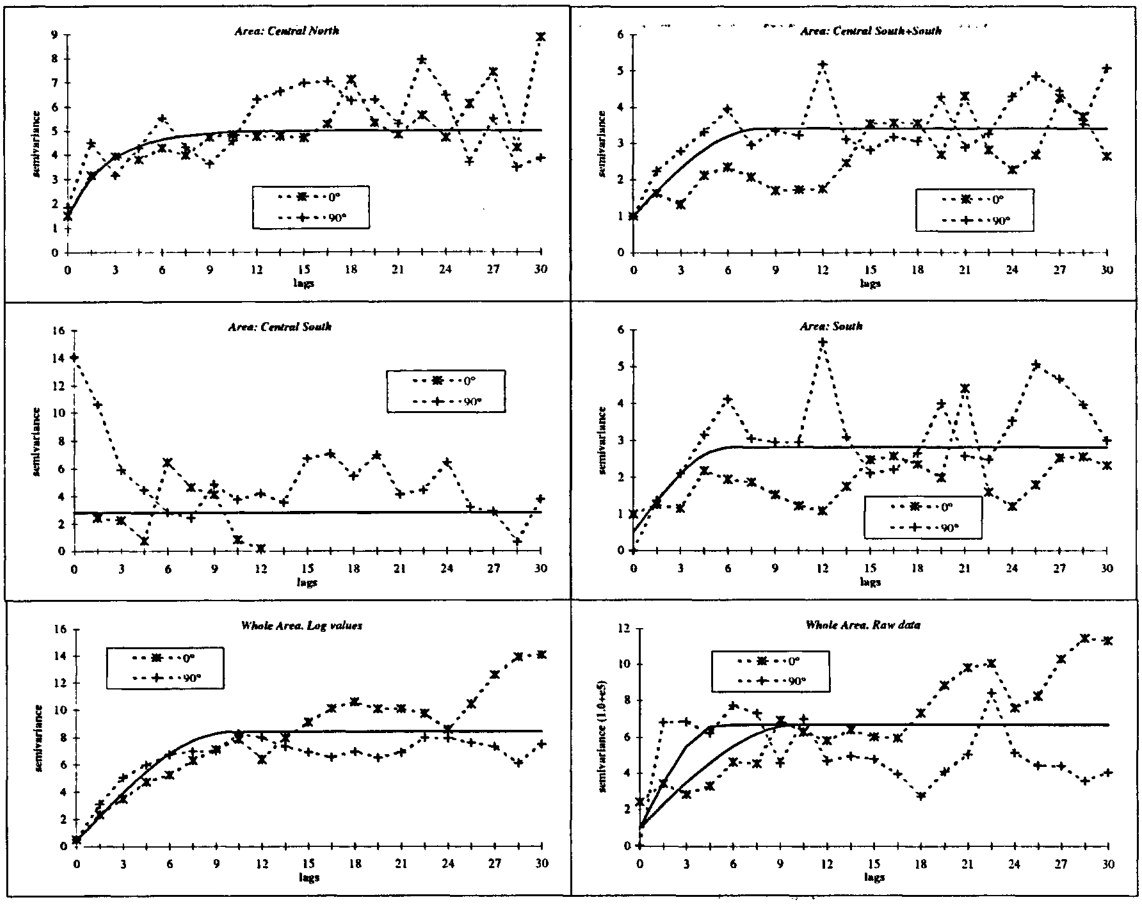

Figure 2a: Experimental variograms and fitted models (0° and 90° directions) for each area and the whole area of the spring acoustic survey.

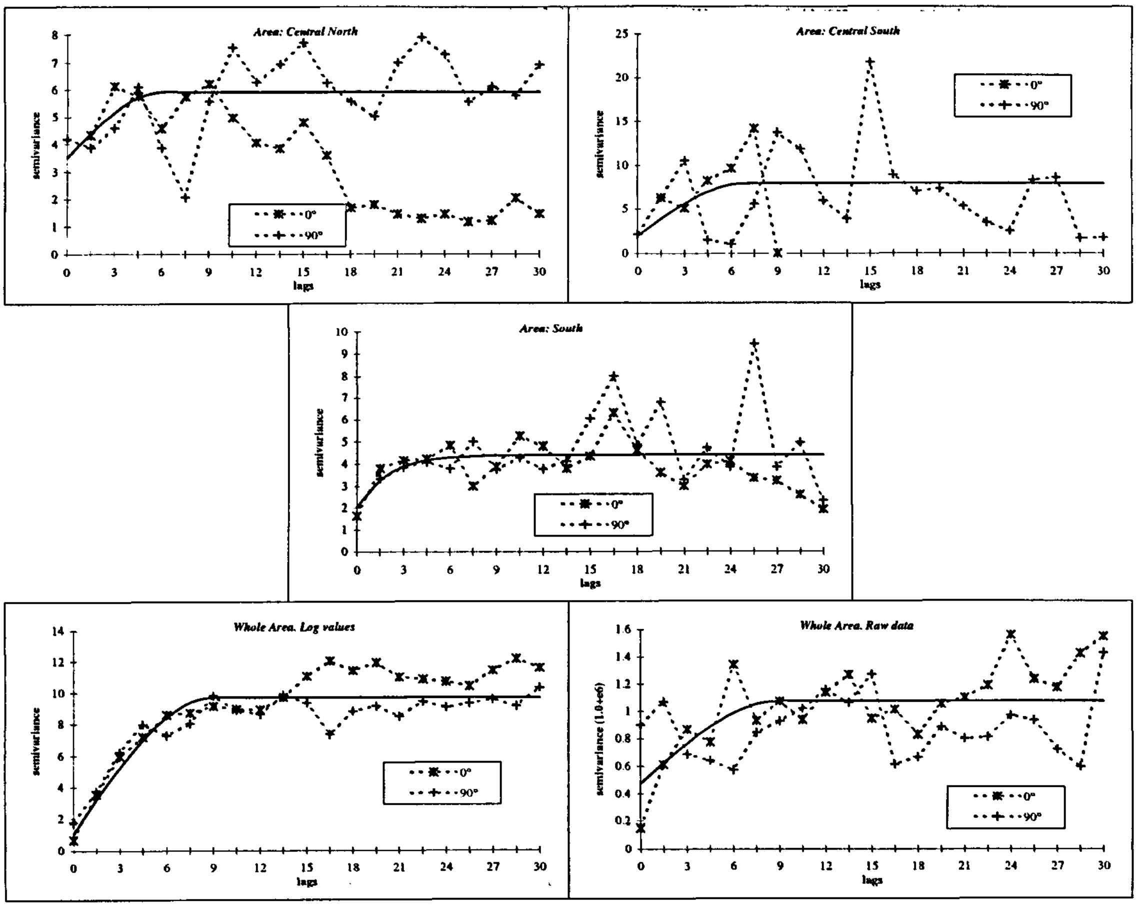

Figure 2b: Experimental variograms and fitted models (0° and 90° directions) for each area and the whole area of the summer acoustic survey.