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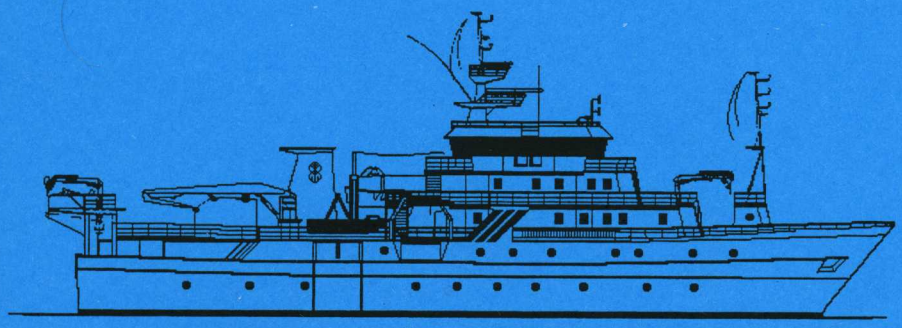
CRUISE REPORTS 'DR FRIDTJOF NANSEN'



SURVEY OF THE PELAGIC FISH RESOURCES OFF NORTH WEST AFRICA

Part I SENEGAL - THE GAMBIA

30 October - 9 November 1998

Centre de Recherches Océanographiques de Dakar-Thiaroye
Dakar, Senegal

Institute of Marine Research
Bergen, Norway

Department of Fisheries
Banjul, The Gambia

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SURVEY OF THE PELAGIC FISH RESOURCES OFF NORTH WEST AFRICA

Part I

SENEGAL - THE GAMBIA

30 October - 9 November 1998

by

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Institute of Marine Research
Bergen, 1998

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CHAPTER 1 INTRODUCTION

1.1 Objectives of the cruise

The general objectives were to estimate the biomass and map the distribution of small pelagic fish stocks off NW Africa (Morocco, Mauritania, Senegal and The Gambia) by hydro-acoustic methods and describe the hydrographic conditions there over a period of 50 days, in October-November and December 1998. For Senegal and The Gambia the agreed objectives were:

- ξ To map the distribution and estimate the biomass for the main small pelagic fish using hydroacoustic methods. The species of interst were: round sardinella *Sardinella aurita*, flat sardinella *Sardinella maderensis*, Cunene horse mackerel *Trachurus trecae*, false scad *Decapterus rhonchus*, and anchovy *Engraulis encrasicolus*.

- ξ To identify and describe the size distribution of the target fish populations by midwater and bottom trawl sampling and process the catches by recording weight and number by species.

- ξ To sample standard hydrographical transects for temperature, salinity and oxygen at about 13°35' N and 14°50' N.

The time allocated for this part of the survey, off Senegal and The Gambia, was 9 days.

1.2 Participation

Members of the scientific teams were:

Centre de Recherches Océanographiques de Dakar-Thiaroy, Senegal:
Abdoulaye SARRE, Ibrahima SOW and Mor SYLLA

Department of Fisheries, The Gambia:
Matarr BAH, Ousmann Mass JOBE and Juldeh JALLOW

Centre National de Recherches Océanographiques et des Pêches, Mauritania:
Ebaye O. Mohamed MAHMOUD

Institute of Marine Research , Norway:
Reidar TORESEN, Helge ULLEBUST, John DALEN, Reidar JOHANNESEN and Tore MØRK.

1.3 Narrative

The course tracks with the fishing and hydrographical stations are shown in Figure 1.

The survey started off Casamance on October 30 with systematic parallel course tracks spaced about 10 NM apart. To cover the whole distribution area of pelagic fish, the shelf was covered from the 15 m isobath and offshore to the 500 m isobath. Trawling was done irregularly, either to identify echo registrations or to check 'blindly' if fish were mixed with the plankton in the upper layers of the water column. In the latter case, pelagic trawl with floats was often used. A smaller pelagic trawl or the bottom trawl with floats was used for sampling the pelagic fish in very shallow waters (depth less than 25 m). The shelf was covered up to St. Louis before a call was made on Dakar on November 9, to let the participants from the Gambia and Senegal disembark and the scientists from Mauritania come onboard.

The hydrographic profile off The Gambia was occupied on November 2 and that off Cape Vert on November 3.

1.4 Methods

All catches were sampled for composition by weight and numbers of each species. The length frequency distributions of the target species were taken in all the stations where they were present. Total fish length and individual weights were measured. The weight measurements were used to establish the power factor, k, in the length-weight relationship $w=al^k$. The factor, k, was estimated to 2.96 for both flat and round sardinella. The complete records of fishing stations are shown in Annex I.

Surface temperature and meteorological data from a weather station were logged automatically and recorded with position and bottom depth every nautical mile sailed.

Hydrographic profiles were collected with a CTD sonde and temperature, salinity, and pressure (depth) were logged by the Seabird Software. From these data series, records were selected from standard depths and presented in figures. A total of 41 CTD stations were carried out.

The acoustic biomass estimates were based on the integration technique. The Bergen Integrator (BEI) was used for analysis and allocation of s_A - values. This system does not underestimate dense schools close to the bottom as some times may have happened with the EK500 used in the 1992 surveys.

The following target strength (TS) function was applied to convert s_A-values (mean integrator value for a given species or group of species in a specified area) to number of fish:

$$TS = 20 \log L - 72 \text{ dB}$$

or in the form $$C_F = 1.26 \cdot 10^6 \cdot L^{-2}$$

where L is total length and C_F is the fish conversion factor. The following formula was used to calculate the density of fish in numbers/NM^2 in each length group:

$$\rho_i = S_A \cdot \frac{p_i}{\sum_{i=1}^{n} \frac{p_i}{C_{F_i}}}$$

where

ρ_i = density of fish in length group i
s_A = mean integrator value
p_i = proportion of fish in length group i
C_{Fi} = fish conversion factor for length group i

The integrator outputs were split on fish groups using a combination of behaviour pattern as deduced from echo diagrams, the BEI analysis and catch composition as described below. The following groups were used for Senegal: 1) sardinellas, 2) carangids and associated species (chub mackerel *Scomber japonicus*, largehead hairtail *Trichiurus lepturus* and barracudas *Sphyraena* spp.).

The above equations show that the conversion from s_A-value to number of fish is dependent on the length composition of the fish. In general there are many problems associated with getting representative length distributions when the various size classes are geographically segregated. When no segregation occurs the various length distributions are pooled together with equal importance. Otherwise, when the size distribution varies with the sampling site, a weighting factor is applied that takes into account the density at the location. In most cases, the mean acoustic density at the location of the sample is the most representative index of this fish density.

A systematic approach to a) divide the s_A-value between species in a category of fish (e.g. *Sardinella aurita* and *S. maderensis*) and b) produce pooled length distributions of a target species for use in the above equation and c) calculate the biomass estimates for a region, is obtained through the following procedure:

- The mean back scattering strength (s_A/Y) of each length frequency distribution of the target species is calculated and summed.

- The mean s_A-value allocated to the category of fish is divided between the species in the same ratio as their relative contribution to the mean back scattering strength in the sample.

- For each species, the length distributions in an area are pooled by using the ratio between the allocated s_A-value (the five mile value at the trawl station of the sample) and the mean back scattering strength as the weighting factor. If the size distribution is geographically uniform (not significantly different), the samples can be pooled together with equal importance.

- The pooled length distribution is used together with the mean s_A-value to calculate the density (numbers per square NM) by length groups, for each area, using the above formula. The total number by length group in the area is obtained by multiplying each number by the area.

- The numbers are converted to biomass using the estimated weight at length.

For the estimation of the biomass of carangids and associated species an overall average length of 23 cm and a condition factor of 0.88 were applied.

Annex II gives a description of the instruments and the fishing gear used.

All data on fishing stations and fish length sampling were made available to the participants on diskettes.

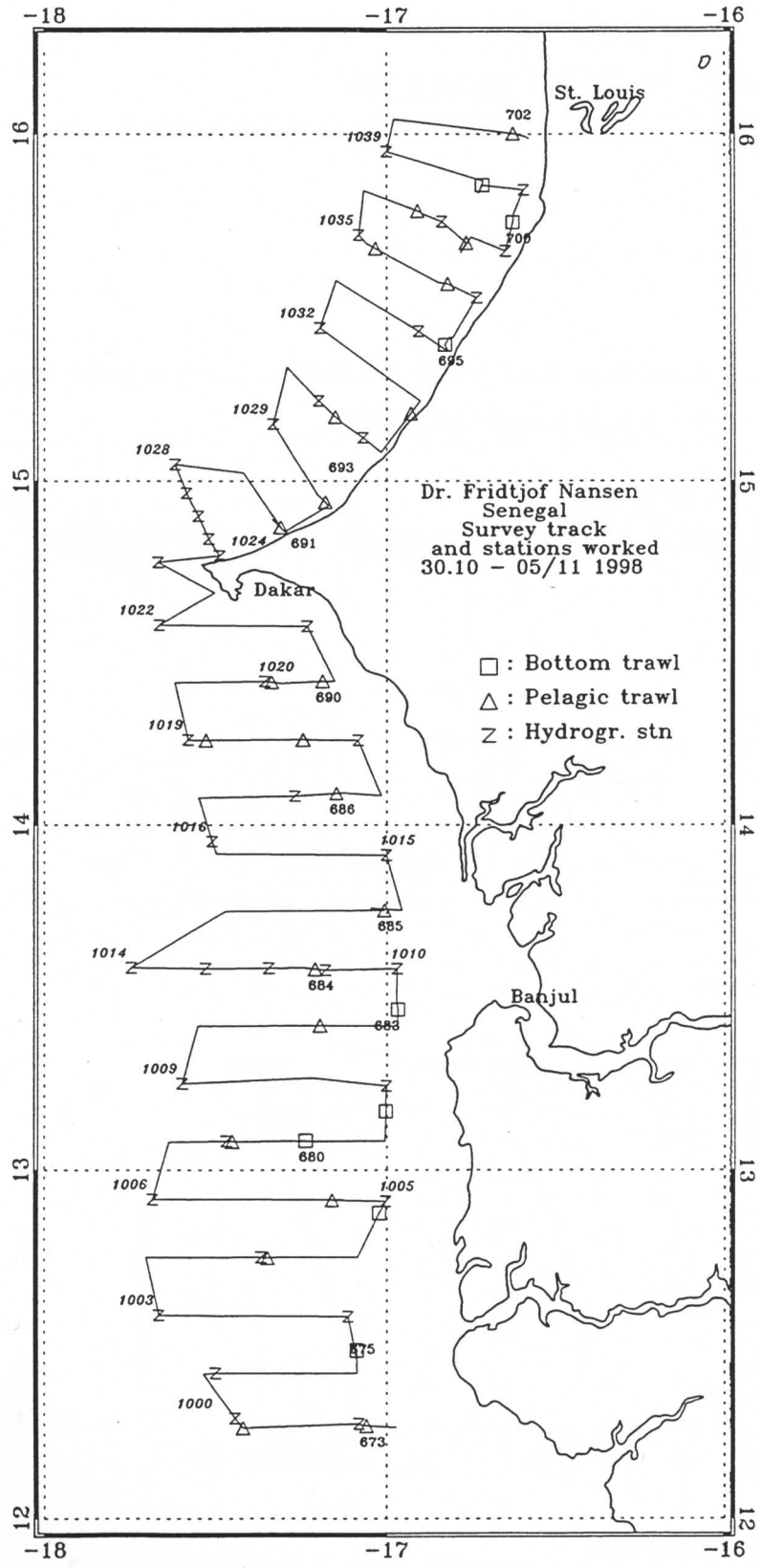
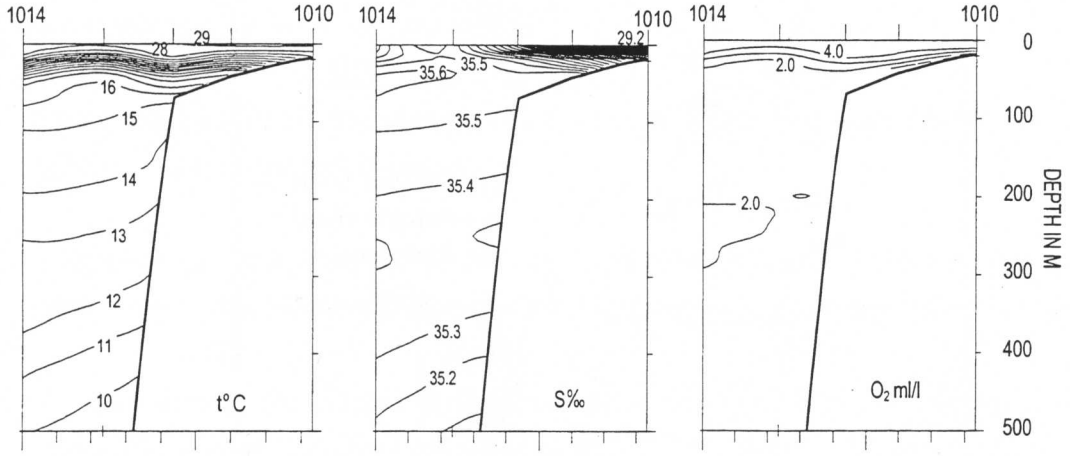


Figure 1 Course tracks with fishing and hydrographic stations; Casamance to St. Louis.

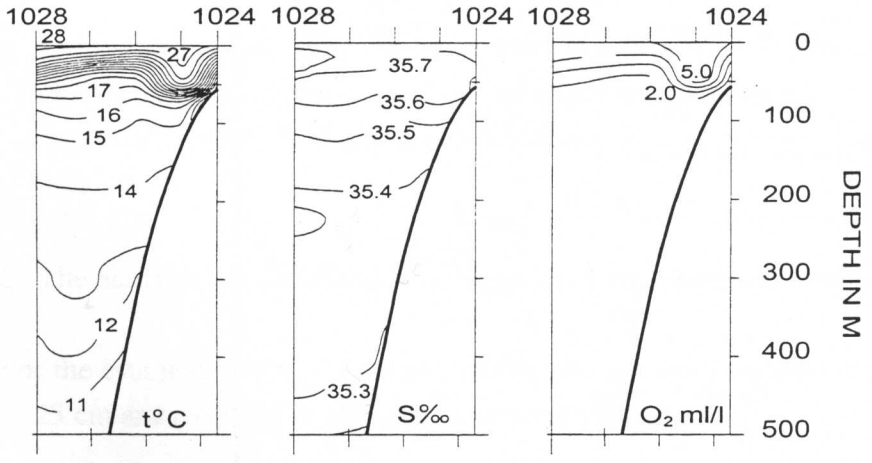
CHAPTER 2 SURVEY RESULTS

2.1 Hydrography

Figure 2 shows the distribution of temperature, salinity and oxygen in the two profiles and Figure 3 the sea surface temperature at 5 m of depth.



CAPE VERT 3.11 1998



THE GAMBIA - WEST 2.11 1998

Figure 2 Hydrographic profiles with distribution of temperature, salinity and oxygen.

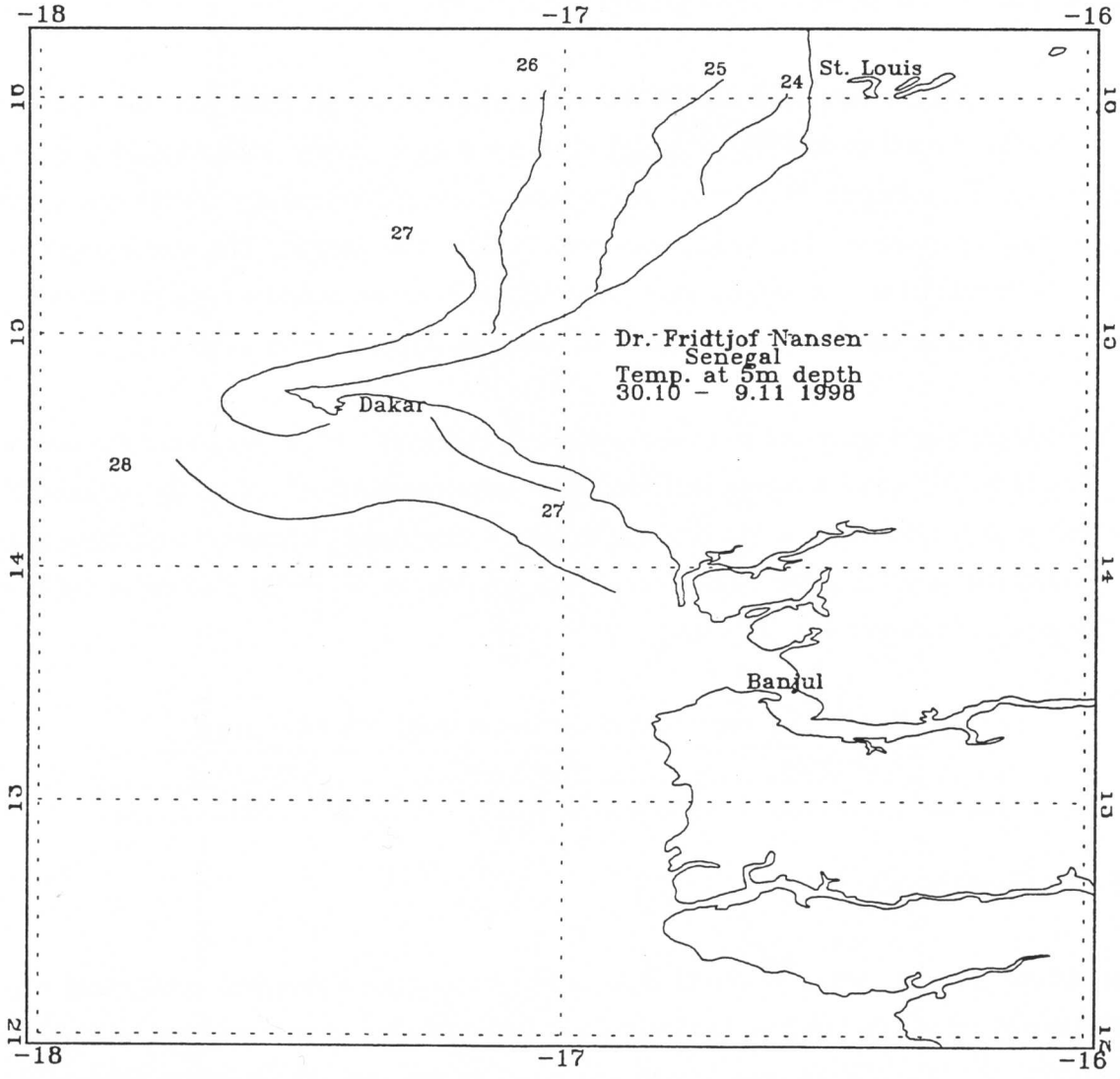


Figure 3 Sea surface temperature; Casamance to St. Louis.

The distribution of surface temperature and the profile The Gambia-west show that there was a stable surface layer with a temperature of 28-29°C over the whole shelf south of Dakar. North of Cape Vert there was a trend of decreasing temperature towards the shore, with a decline from 27°C over the entire shelf just north of Cape Vert to 24°C close to the shore off St. Louis.

2.2 The Casamance shelf

Figures 4 and 5 show the distributions of the main groups of pelagic fish by contoured acoustic densities for the whole shelf of Senegal and The Gambia.

Off the Casamance coast, about 20-30 NM west of the river mouth, there were two school areas of sardinella of medium and high density in shallow waters, mostly inside the 25 m depth line (Figure 4). The samples from these aggregation were predominantly (90%) flat sardinella (*Sardinella maderensis*). The modal size was 24 cm (total length). The size composition is shown in Annex III and the stock length compositions by numbers and weight in Annex IV. The total biomass of sardinellas in the area was estimated at 109 000 tonnes (Table 1).

Other pelagic fish were found in various densities, and over a wider area than the sardinellas, see Figure 5. The trawl samples indicated that these consisted of carangids, scombrids and hairtails with the carangids as the dominating group. See Annex I (records of fishing stations) for species composition in the hauls taken in this area (stn. no. 673-678). The estimated biomass of this group of fish was 101 000 tonnes.

Table 1. Casamance. Biomass estimates of pelagic fish, 1 000 tonnes.

Flat sardinella	Round sardinella	Carangids etc.
98	11	101

2.3 The Gambian shelf

The school area of sardinella found inshore off Casamance continued northwards off The Gambia (Figure 4). The highest concentrations were recorded in two medium to high density areas some 20 NM off the coast, north and south in the area. The samples showed a 70% dominance of round sardinella (*Sardinella aurita*). The pooled length composition of the round sardinella had a mode of 23 cm, see Annex III, while the mode of the length distribution for flat sardinella was 27 cm. The stock length compositions by numbers and weight are shown in Annex IV.

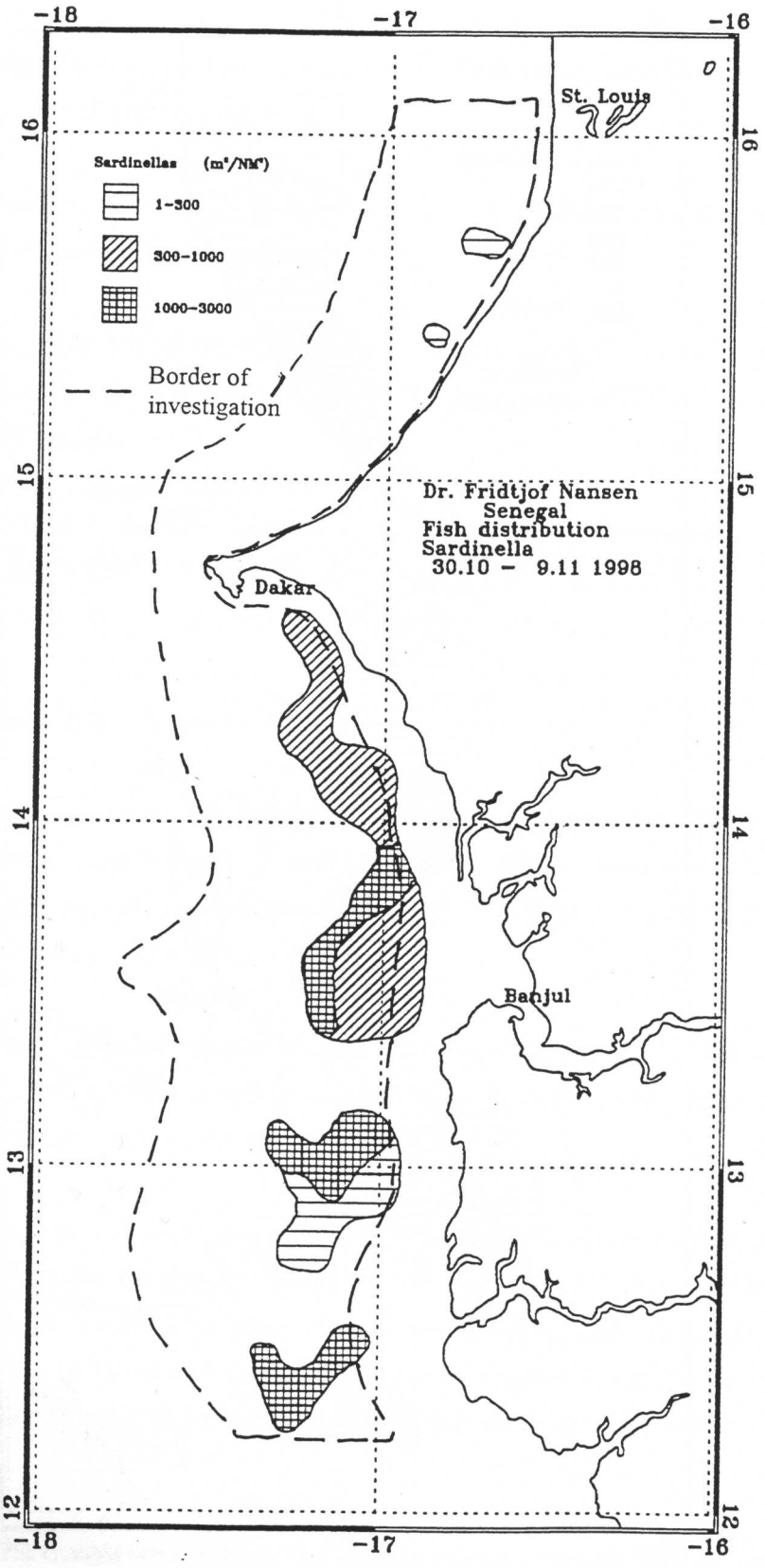


Figure 4 Distribution of sardinellas; Casamance to St. Louis.

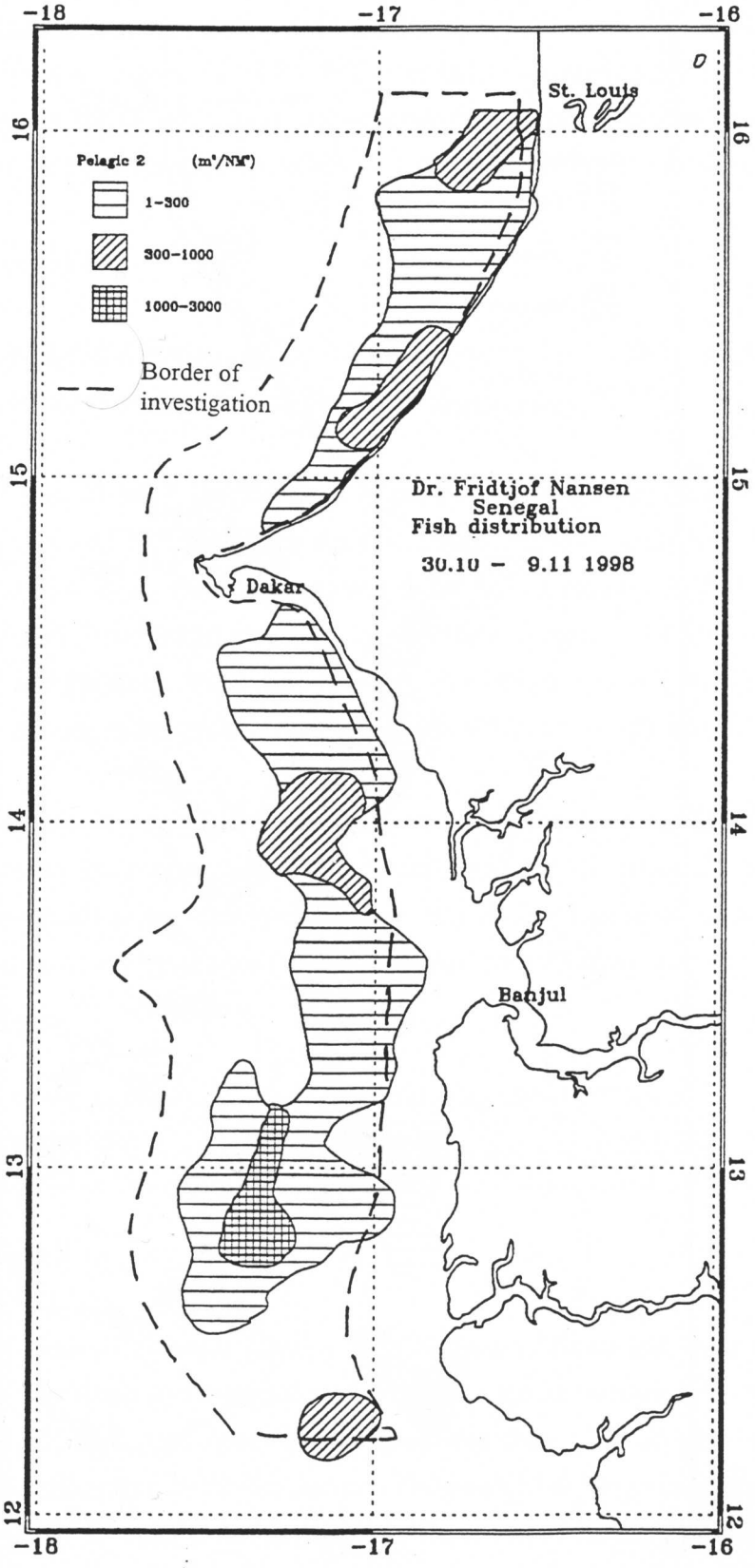


Figure 5 Distribution of carangids and associated species; Casamance to St. Louis.

Table 2 shows that the biomass estimates of the sardinellas amounted to 141 000 tonnes, of which 99 000 tonnes were round sardinella.

Carangids and associated species were found in the same area and also here somewhat to the offshore side of the sardinella school area (Figure 5).

Catches of this group consisted mainly of carangids. See Annex I (records of fishing stations) for species composition in the hauls taken in this area (st.nr 680-683). The biomass was estimated at 43 000 tonnes.

Table 2. The Gambia. Biomass estimates of pelagic fish, 1 000 tonnes.

Flat sardinella	Round sardinella	Carangids etc.
42	99	43

2.4 The Gambian border - Cape Vert

The school area of sardinella off the Gambia continued northwards to Cape Vert (Figure 4). The greatest densities was found between 25 and 40 m depth. Table 3 shows the biomass estimates for the two sardinella species that summed up to 136 000 tonnes. Flat sardinella dominated the estimated biomass in the area by 52%.

Pooled length compositions of samples showed that the adult part of the flat sardinella had a modal length of 25 cm and the round sardinella had it of 24 cm, see Annex III. Stock size compositions by numbers and weight are shown in Annex IV.

Also here, the carangids and associated pelagic fish were distributed over most of the area with the highest concentrations outside the Saloum River, see Figure 5. Atlantic bumper, *Chloroscombrus chrysurus* was caught in most of the trawl samples, and false scad appeared with some high catch rates. It is notable that hardly any horse mackerel was caught south of Dakar. The biomass of the carangids and associated pelagic fish was estimated at about 88 000 tonnes (Table 3).

Table 3. The Gambia border to Cape Vert. Biomass estimates of pelagic fish, 1 000 tonnes.

Flat sardinella	Round sardinella	Carangids etc.
71	65	88

2.5 Cape Vert - St. Louis

On this part of the shelf sardinellas were found in very low inshore concentrations, between Cayar and some 25 NM northwards (Figure 4). The samples showed a dominance of young flat sardinella. The modal length of the flat sardinella was 10 cm, see Annex III. The biomass of the sardinellas was estimated at 2 000 tonnes (Table 4).

Carangids and associated pelagic fish were mainly found on the offshore side of the sardinella distribution all the way from Cape Vert to St. Louis (Figure 5). The catches consisted also here of Atlantic bumper, false scad, lookdown *Selene dorsalis* and hairtails. The biomass estimate was 112 000 tonnes.

Table 4. Cape Verte to St. Louis. Biomass estimates of pelagic fish, 1 000 tonnes.

Flat sardinella	Round sardinella	Carangids etc.
1	1	112

CHAPTER 3 OVERVIEW AND SUMMARY OF RESULTS

The survey was conducted successfully in the period October 30 to November 9 with a course track of about 1 748 NM and 31 fishing stations.

The hydrographical data showed a stable surface layer for the whole shelf in the south, but with declining surface temperatures towards the coast from about Dakar northwards.

Pelagic fish

Sardinellas were found in three main concentrations along the inshore shelf from Casamance in the south to Cap Vert (Figure 4). High densities were found in the area off The Gambia and west of the Saloum river. Off Gambia round sardinella dominated, while further north and south, the flat sardinella was the dominating species. Very low concentrations of the two sardinella species were found inshore between Cayar and St. Louis.

The distribution of carangids and associated species formed a band along the coast mostly on the offshore side of the sardinella areas, but still on the inner shelf, mainly inside the isobath of 50 m (Figure 5). South of Cape Vert the catches of this group consisted of Atlantic bumper, false scad, barracudas and hairtails. Horse mackerel was hardly present. The catches north of Cape Vert were also dominated by bumper with the additional presence of little tunny and hairtail.

An overview of the estimates of biomass of the main groups of pelagic fish based on the echo integration data is shown in Table 5. The total biomass of sardinellas was thus 382 000 tonnes and of carangids and associated species about 344 000 tonnes.

Table 5. Summary of biomass estimates of pelagic fish, Senegal and The Gambia. 1 000 tonnes.

	Flat sardinella	Round sardinella	Carangids etc.
St. Louis-Cape Vert	1	1	112
Cape Vert-Gambia	71	65	88
Gambia	42	99	43
Casamance	98	11	101
Total	212	176	344

Table 6 lists biomass estimates of sardinellas and carangids and associated species from previous 'Dr. Fridtjof Nansen' surveys of this shelf region. Large-scale latitudinal movements of pelagic fish between West Sahara and Guinea Bissau are well known and November is still within the season of northern distribution. Compared with the NocDec/96 and NovDec/97 surveys the estimate of 388 000 tonnes of sardinellas from the current survey is high and at the level of the Sept/81 estimate. The carangid estimate of 344 000 tonnes is somewhat higher than that of 1997 and but significantly lower than the estimate of 526 000 tonnes in 1996.

Table 6. Biomass estimates from previous 'Dr Fridtjof Nansen' surveys of the Senegal-The Gambia shelf. 1 000 tonnes.

Survey:	Sardinellas	Carangids etc.
AprMay-81	210	570
Sept -81	360	*
FebMar-82	40	90
NovDec-86	330	170
FebMar-92	1 530	690
NovDec-95	760	220
NovDec-96	231	526
NovDec-97	295	254

* Not available

Annex I Records of fishing stations

PROJECT STATION: 673
DATE:31/10/98 GEAR TYPE: PT No: 6 POSITION:Lat N 1216
start stop duration Long W 1704
TIME :04:26:26 04:49:26 23 (min) Purpose code: 1
LOG :8300.60 8301.65 1.05 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 27 29 Validity code: 2
Towing dir: 270ø Wire out: 150 m Speed: 35 kn*10

Sorted: 29 Kg Total catch: 176.64 CATCH/HOUR: 460.80

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sphyrna sp.	133.04	282	28.87	
Ilisha africana	95.48	23935	20.72	1383
Brachydeuterus auritus Juv.	62.61	751	13.59	1384
Rhizoprionodon acutus	57.91	31	12.57	
Chloroscombrus chrysurus	38.03	297	8.25	1385
Galeoides decadactylus	21.29	78	4.62	
Spondyliosoma cantharus	13.30	16	2.89	
Trichiurus lepturus	7.98	219	1.73	
Scomberomorus tritor	6.57	16	1.43	
Arius heudeloti	4.70	16	1.02	
Caranx senegallus	3.76	157	0.82	
Sardinella maderensis (Juv.)	3.76	157	0.82	1386
Penaeus notialis	2.19	125	0.48	
Sardinella maderensis	2.19	16	0.48	
Elops lacerta	1.10	16	0.24	
Sardinella aurita	0.23	3	0.05	
Selene dorsalis	0.16	16	0.03	
Trachinotus ovatus	0.16	31	0.03	
Sardinella aurita (Juvenile)	0.16	31	0.03	
Total	454.62		98.67	

PROJECT STATION: 674
DATE:31/10/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1216
start stop duration Long W 1725
TIME :07:25:18 07:55:22 30 (min) Purpose code: 1
LOG :8322.42 8324.12 1.69 Area code : 1
FDEPTH: 0 0 GearCond.code:
BDEPTH: 649 831 Validity code:
Towing dir: 324ø Wire out: 150 m Speed: 35 kn*10

Sorted: Kg Total catch: 3.85 CATCH/HOUR: 7.70

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Remora remora	7.50	22	97.40	
Seriola carpenteri	0.20	4	2.60	
Total	7.70		100.00	

PROJECT STATION: 675
DATE:31/10/98 GEAR TYPE: BT No: POSITION:Lat N 1229
start stop duration Long W 1705
TIME :13:04:35 13:34:32 30 (min) Purpose code: 1
LOG :8366.52 8368.27 1.70 Area code : 1
FDEPTH: 16 17 GearCond.code:
BDEPTH: 16 17 Validity code: 2
Towing dir: 200ø Wire out: 100 m Speed: 30 kn*10

Sorted: Kg Total catch: 11.90 CATCH/HOUR: 23.80

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	19.38	5864	81.43	
Chloroscombrus chrysurus	2.36	28	9.92	
Eucinostomus melanopterus	1.82	8	7.65	
Sardinella maderensis	0.32	2	1.34	
Total	23.88		100.34	

PROJECT STATION: 676
DATE:31/10/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1245
start stop duration Long W 1721
TIME :21:12:45 21:41:42 29 (min) Purpose code: 1
LOG :8441.88 8443.53 1.64 Area code : 1
FDEPTH: 0 0 GearCond.code:
BDEPTH: 35 32 Validity code:
Towing dir: 90ø Wire out: 150 m Speed: 35 kn*10

Sorted: 12 Kg Total catch: 111.60 CATCH/HOUR: 230.90

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Selene dorsalis	86.90	463	37.64	1389
Istiophorus albicans	51.72	2	22.40	
Scomberomorus tritor	21.93	17	9.50	
Sardinella maderensis	14.28	72	6.18	1387
Euthynnus alletteratus	14.07	25	6.09	
Caranx senegallus	13.24	12	5.73	
CORYPHAENIDAE	12.41	2	5.37	
Galeoides decadactylus	7.45	10	3.23	
Decapterus rhonchus	3.10	10	1.34	1390
Pomadasys peroteti	2.69	2	1.17	
Sardinella aurita	2.28	10	0.99	1388
Pomadasys jubelini	0.83	2	0.36	
Total	230.90		100.00	

PROJECT STATION: 677
DATE: 1/11/98 GEAR TYPE: BT No: POSITION:Lat N 1253
start stop duration Long W 1701
TIME :00:08:26 00:38:04 30 (min) Purpose code: 1
LOG :8466.00 8467.76 1.74 Area code : 1
FDEPTH: 19 19 GearCond.code:
BDEPTH: 19 19 Validity code: 2
Towing dir: 30ø Wire out: 120 m Speed: 30 kn*10

Sorted: Kg Total catch: 72.50 CATCH/HOUR: 145.00

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	39.60	548	27.31	
Sardinella maderensis	32.00	288	22.07	1391
Pomadasys peroteti	17.80	28	12.28	
Arius heudeloti	15.00	72	10.34	
Trachinotus ovatus	9.76	4	6.73	
Galeoides decadactylus	5.30	38	3.66	
Trichiurus lepturus	5.00	10	3.45	
Chloroscombrus chrysurus	4.60	44	3.17	
Eucinostomus melanopterus	4.40	46	3.03	
Decapterus rhonchus	4.30	90	2.97	1392
Selene dorsalis	3.80	36	2.62	
Echeneis naucrates	2.30	18	1.59	
Penaeus notialis	0.70	66	0.48	
Sphyraena guachancho	0.20	2	0.14	
Synaptura cadenati	0.10	2	0.07	
Ilisha africana	0.10	6	0.07	
Penaeus kerathurus	0.02	2	0.01	
Sepia sp.	0.02	2	0.01	
Total	145.00		100.00	

PROJECT STATION: 678
DATE: 1/11/98 GEAR TYPE: PT No: 7 POSITION:Lat N 1255
start stop duration Long W 1710
TIME :02:25:31 02:55:33 30 (min) Purpose code: 1
LOG :8480.44 8482.32 1.85 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 27 24 Validity code: 2
Towing dir: 90ø Wire out: 150 m Speed: 40 kn*10

Sorted: 26 Kg Total catch: 130.75 CATCH/HOUR: 261.50

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella maderensis	174.00	1180	66.54	1393
Sardinella aurita	22.00	120	8.41	1394
Euthynnus alletteratus	16.00	20	6.12	
Chloroscombrus chrysurus	14.00	110	5.35	
Scomberomorus tritor	11.00	20	4.21	
Trichiurus lepturus	11.00	30	4.21	
Brachydeuterus auritus	8.50	8120	3.25	
Sphyraena guachancho	5.00	10	1.91	
Decapterus rhonchus	0.00	100		
Total	261.50		100.00	

PROJECT STATION: 679
DATE: 1/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1305
start stop duration Long W 1727
TIME :08:45:32 09:15:09 30 (min) Purpose code: 1
LOG :8537.66 8539.46 1.77 Area code : 1
FDEPTH: 0 0 GearCond.code: 4
BDEPTH: 63 59 Validity code:
Towing dir: 90ø Wire out: 150 m Speed: 35 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
N O C A T C H	0.00			
Total				

PROJECT STATION: 680
DATE: 1/11/98 GEAR TYPE: BT No: POSITION:Lat N 1305
start stop duration Long W 1714
TIME :10:34:45 11:04:08 29 (min) Purpose code: 1
LOG :8551.31 8552.78 1.44 Area code : 1
FDEPTH: 39 41 GearCond.code:
BDEPTH: 39 41 Validity code:
Towing dir: 270ø Wire out: 200 m Speed: 30 kn*10

Sorted: 87 Kg Total catch: 963.00 CATCH/HOUR: 1992.41

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Decapterus rhonchus	1690.97	6854	84.87	1396
Sardinella aurita	210.74	1366	10.58	1395
Pomadasys incisus	27.54	228	1.38	
Acanthurus monroviae	26.86	68	1.35	
Pseudupeneus prayensis	12.97	114	0.65	
Dactylopterus volitans	6.14	68	0.31	
Sardinella maderensis	4.55	23	0.23	
Priacanthus arenatus	3.87	23	0.19	
Chaetodon marcellae	2.73	23	0.14	
Dentex canariensis	2.50	23	0.13	
Dentex macrophthalmus	2.28	23	0.11	
Total	1991.15		99.94	

PROJECT STATION: 681
DATE: 1/11/98 GEAR TYPE: BT No: POSITION:Lat N 1310
start stop duration Long W 1700
TIME :13:13:52 13:43:37 30 (min) Purpose code: 1
LOG :8574.03 8575.74 1.70 Area code : 1
FDEPTH: 18 18 GearCond.code:

BDEPTH: 18 18 Validity code: 2
Towing dir: 360º Wire out: 120 m Speed: 30 kn*10

Sorted: 93 Kg Total catch: 93.75 CATCH/HOUR: 187.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Arius heudeloti	124.20	616	66.24	
Pseudupeneus prayensis	23.60	182	12.59	
Alectis alexandrinus	7.80	12	4.16	
Chloroscombrus chrysurus	4.80	48	2.56	
Decapterus rhonchus	3.70	20	1.97	
Caranx senegallus	3.60	16	1.92	
Epinephelus aeneus	3.30	2	1.76	
Pagrus caeruleostictus	3.10	48	1.65	
Balistes punctatus	2.40	2	1.28	
Trachinotus maxillosus	2.40	12	1.28	
Dentex canariensis	2.40	20	1.28	
Pomadasys incisus	1.80	4	0.96	
Eucinostomus melanopterus	1.50	10	0.80	
Pomadasys incisus	1.00	6	0.53	
Bodianus speciosus	0.80	4	0.43	
Acanthurus monroviae	0.60	4	0.32	
Sardinella maderensis	0.30	2	0.16	
Sardinella aurita	0.20	2	0.11	
ACAAC02	0.00			
Total	187.50		100.00	

PROJECT STATION: 682
DATE: 1/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1325
start stop duration Long W 1712
TIME :20:50:34 21:20:37 30 (min) Purpose code: 1
LOG :8645.24 8646.90 1.61 Area code : 1
FDEPTH: 5 5 GearCond.code:
BDEPTH: 46 42 Validity code:
Towing dir: 90º Wire out: 150 m Speed: 35 kn*10

Sorted: 36 Kg Total catch: 109.80 CATCH/HOUR: 219.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	140.40	1098	63.93	1397
Trachurus trecae	57.00	942	25.96	1400
Alectis alexandrinus	8.10	6	3.69	
Auxis thazard	3.72	18	1.69	
Trachinotus ovatus	3.06	12	1.39	
Sardinella maderensis	2.88	48	1.31	1399
Sphyraena guachancho	2.34	6	1.07	
Decapterus punctatus	1.32	84	0.60	1398
Scomber japonicus	0.78	6	0.36	
Total	219.60		100.00	

PROJECT STATION: 683
DATE: 1/11/98 GEAR TYPE: BT No: POSITION:Lat N 1328
start stop duration Long W 1658
TIME :23:02:45 23:32:44 30 (min) Purpose code: 1
LOG :8661.79 8663.45 1.63 Area code : 1
FDEPTH: 20 20 GearCond.code:
BDEPTH: 20 20 Validity code:
Towing dir: 360º Wire out: 120 m Speed: 30 kn*10

Sorted: 65 Kg Total catch: 493.00 CATCH/HOUR: 986.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	441.76	8834	44.80	
Sardinella maderensis	426.76	3450	43.28	1401
Galeoides decadactylus	39.00	330	3.96	
Eucinostomus melanopterus	33.76	436	3.42	
Decapterus rhonchus	15.76	690	1.60	
Arius heudeloti	11.20	74	1.14	
Chloroscombrus chrysurus	8.20	136	0.83	
Ilisha africana	3.76	150	0.38	
Penaeus notialis, female	3.30	210	0.33	
Pagellus bellottii	2.26	46	0.23	
Total	985.76		99.97	

PROJECT STATION: 684
DATE: 2/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1335
start stop duration Long W 1713
TIME :02:07:46 02:41:11 33 (min) Purpose code: 1
LOG :8683.44 8685.43 1.97 Area code : 1
FDEPTH: 10 5 GearCond.code:
BDEPTH: 48 56 Validity code: 2
Towing dir: 270º Wire out: 150 m Speed: 40 kn*10

Sorted: 38 Kg Total catch: 38.45 CATCH/HOUR: 69.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	30.73	331	43.96	1403
Decapterus rhonchus	24.91	795	35.63	1402
Scomberomorus tritor	6.36	24	9.10	
Sphyraena guachancho	5.45	18	7.80	
Arius heudeloti	1.18	2	1.69	
Ariomma bondi	0.91	13	1.30	
Echeneis naucrates	0.36	2	0.51	
Total	69.90		99.99	

PROJECT STATION: 685
DATE: 2/11/98 GEAR TYPE: PT No: 3 POSITION:Lat N 1345
start stop duration Long W 1700
TIME :11:12:06 11:42:00 30 (min) Purpose code: 1
LOG :8764.09 8766.52 2.39 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 23 27 Validity code:
Towing dir: 270º Wire out: 100 m Speed: 45 kn*10

Sorted: 31 Kg Total catch: 76.53 CATCH/HOUR: 153.06

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	148.26	3634	96.86	1404
Trachinotus ovatus	2.00	10	1.31	
Decapterus rhonchus	1.50	6	0.98	
Callinectes pallidus	1.30	16	0.85	
Total	153.06		100.00	

PROJECT STATION: 686
DATE: 2/11/98 GEAR TYPE: PT No: 3 POSITION:Lat N 1406
start stop duration Long W 1709
TIME :20:01:36 20:21:10 20 (min) Purpose code: 1
LOG :8847.44 8848.81 1.37 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 33 29 Validity code:
Towing dir: 90º Wire out: 100 m Speed: 40 kn*10

Sorted: 63 Kg Total catch: 1333.40 CATCH/HOUR: 4000.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	3030.00	38937	75.75	1407
Sardinella maderensis	541.80	6174	13.54	1405
Sardinella aurita	283.50	2457	7.09	1406
Arius heudeloti	50.40	63	1.26	
Pomadasys rogeri	44.10	126	1.10	
Auxis thazard	31.50	63	0.79	
Decapterus rhonchus	6.30	63	0.16	
Selene dorsalis	6.30	126	0.16	
Pomadasys incisus	6.30	126	0.16	
Total	4000.20		100.01	

PROJECT STATION: 687
DATE: 2/11/98 GEAR TYPE: PT No: 3 POSITION:Lat N 1415
start stop duration Long W 1715
TIME :23:43:12 00:00:00 17 (min) Purpose code: 1
LOG :8877.27 8877.27 Area code : 1
FDEPTH: 20 20 GearCond.code:
BDEPTH: 39 39 Validity code:
Towing dir: 90º Wire out: 150 m Speed: 40 kn*10

Sorted: 57 Kg Total catch: 575.00 CATCH/HOUR: 2029.41

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	977.65	6339	48.17	1408
Sardinella maderensis	638.82	3918	31.48	1409
Chloroscombrus chrysurus	247.06	1765	12.17	
Decapterus rhonchus	90.00	1482	4.43	
Trachurus trecae	47.65	565	2.35	
Alectis alexandrinus	28.24	35	1.39	
Total	2029.42		99.99	

PROJECT STATION: 688
DATE: 3/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1415
start stop duration Long W 1732
TIME :02:20:45 02:51:22 31 (min) Purpose code: 1
LOG :8897.59 8899.25 1.62 Area code : 1
FDEPTH: 5 5 GearCond.code:
BDEPTH: 160 423 Validity code: 2
Towing dir: 270º Wire out: 150 m Speed: 30 kn*10

Sorted: 28 Kg Total catch: 168.00 CATCH/HOUR: 325.16

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	325.16	1347	100.00	
Total	325.16		100.00	

PROJECT STATION: 689
DATE: 3/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1425
start stop duration Long W 1720
TIME :06:34:37 07:04:16 30 (min) Purpose code: 1
LOG :8927.82 8929.58 1.74 Area code : 1
FDEPTH: 0 0 GearCond.code: 1
BDEPTH: 57 51 Validity code: 1
Towing dir: 90º Wire out: 150 m Speed: 40 kn*10

Sorted: 75 Kg Total catch: 0.75 CATCH/HOUR: 1.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Auxis thazard	1.08	4	72.00	
Echeneis naucrates	0.42	6	28.00	
Total	1.50		100.00	

PROJECT STATION: 690
DATE: 3/11/98 GEAR TYPE: PT No: 3 POSITION:Lat N 1425
start stop duration Long W 1711
TIME :08:20:19 08:40:08 20 (min) Purpose code: 1
LOG :8938.35 8939.78 1.41 Area code : 1
FDEPTH: 10 13 GearCond.code:
BDEPTH: 32 34 Validity code:
Towing dir: 90º Wire out: 150 m Speed: 40 kn*10

Sorted: 68 Kg Total catch: 374.00 CATCH/HOUR: 1122.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	454.50	4695	40.51	1411
Chloroscombrus chrysurus	447.00	7185	39.84	1412
Sphyrna sp.	76.80	18	6.84	
Sardinella aurita	76.50	570	6.82	1410
Pomadasys incisus	34.50	525	3.07	
Boops boops	19.50	540	1.74	
Chilomycterus spinosus mauret.	5.70	3	0.51	
Plectorhinchus mediterraneus	3.00	105	0.27	
Pagellus bellottii	1.50	15	0.13	
Selene dorsalis	1.50	15	0.13	
Decapterus punctatus	1.50	135	0.13	
Total	1122.00		99.99	

PROJECT STATION: 691

DATE: 3/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1452

	start	stop	duration			Long W	1719
TIME	:23:27:10	23:57:12	30 (min)	Purpose code:	1		
LOG	:9058.95	9060.93	1.95	Area code	: 1		
FDEPTH:	0	0		GearCond.code:			
BDEPTH:	101	118		Validity code:			

Towing dir: 323ø Wire out: 150 m Speed: 40 kn*10

Sorted: 10 Kg Total catch: 26.67 CATCH/HOUR: 53.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Ariomma bondi	36.60	410	68.62	
Trachurus trecae	12.74	550	23.88	1413
Sepia sp.	2.00	200	3.75	
Priacanthus arenatus	0.74	2	1.39	
Echeneis naucrates	0.74	2	1.39	
Saurida brasiliensis	0.24	40	0.45	
Ephippion guttifer	0.24	10	0.45	
Ariomma sp.	0.04	10	0.07	
Total	53.34		100.00	

PROJECT STATION: 692

DATE: 4/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1456

	start	stop	duration			Long W	1711
TIME	:01:54:47	02:26:36	32 (min)	Purpose code:	1		
LOG	:9075.06	9076.90	1.85	Area code	: 1		
FDEPTH:	0	0		GearCond.code:			
BDEPTH:	101	114		Validity code:	2		

Towing dir: 327ø Wire out: 150 m Speed: 40 kn*10

Sorted: 14 Kg Total catch: 27.92 CATCH/HOUR: 52.35

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	26.63	188	50.87	
Brachydeuterus auritus	9.75	56	18.62	
Ariomma bondi	9.00	233	17.19	
Trachurus trecae	4.13	165	7.89	1414
Saurida brasiliensis	1.69	296	3.23	
Hypoclydonia bella ?	1.16	1076	2.22	
Total	52.36		100.02	

PROJECT STATION: 693

DATE: 4/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1511

	start	stop	duration			Long W	1709
TIME	:07:23:54	07:53:29	30 (min)	Purpose code:	1		
LOG	:9114.32	9116.13	1.81	Area code	: 1		
FDEPTH:	0	0		GearCond.code:			
BDEPTH:	116	103		Validity code:			

Towing dir: 138ø Wire out: 150 m Speed: 40 kn*10

Sorted: Kg Total catch: 191.90 CATCH/HOUR: 383.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Istiophorus albicans	42.00	2	10.94	
Trachurus trecae	7.60	334	1.98	1415
Remora remora	0.20	2	0.05	
Total	49.80		12.97	

PROJECT STATION: 694

DATE: 4/11/98 GEAR TYPE: PT No: 3 POSITION:Lat N 1512

	start	stop	duration			Long W	1656
TIME	:10:29:11	10:59:03	30 (min)	Purpose code:	1		
LOG	:9134.73	9136.82	2.08	Area code	: 1		
FDEPTH:	8	8		GearCond.code:			
BDEPTH:	26	27		Validity code:			

Towing dir: 219ø Wire out: 100 m Speed: 40 kn*10

Sorted: 32 Kg Total catch: 96.90 CATCH/HOUR: 193.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	149.40	1190	77.09	1416
Campogramma glaycos	15.60	216	8.05	1417
Brachydeuterus auritus	10.20	108	5.26	
Trachinotus ovatus	9.00	54	4.64	
Sphyrna sp.	5.00	24	2.58	
Pomadasys rogeri	1.40	4	0.72	
Decapterus rhonchus	1.40	12	0.72	
Selene dorsalis	1.20	12	0.62	
Scomberomorus tritor	0.60	6	0.31	
Total	193.80		99.99	

PROJECT STATION: 695

DATE: 4/11/98 GEAR TYPE: BT No: POSITION:Lat N 1524

	start	stop	duration			Long W	1650
TIME	:18:26:44	18:56:32	30 (min)	Purpose code:	1		
LOG	:9198.63	9200.12	1.47	Area code	: 1		
FDEPTH:	24	24		GearCond.code:			
BDEPTH:	24	24		Validity code:			

Towing dir: 30ø Wire out: 150 m Speed: 30 kn*10

Sorted: 71 Kg Total catch: 366.40 CATCH/HOUR: 732.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus Juv.	173.50	6810	23.68	1419
Selene dorsalis	112.00	9300	15.28	1420
Sardinella maderensis	112.00	9476	15.28	1418
Ilisha africana	73.00	940	9.96	
Pteroscion peli	70.00	930	9.55	
Pomadasys rogeri	62.00	2210	8.46	
Trichiurus lepturus	47.50	640	6.48	
Stromateus fiatola	21.50	30	2.93	
Umbrina canariensis	18.00	300	2.46	
Penaeus notialis	17.60	520	2.40	
Sphyraena guachancho	12.00	70	1.64	
Alectis alexandrinus	3.50	10	0.48	
Pomadasys jubelini	3.00	10	0.41	
Pagellus bellottii	2.50	10	0.34	
Galeoides decadactylus	2.50	10	0.34	
Sepia officinalis hierredda	1.00	20	0.14	
Trachurus trecae	1.00	30	0.14	
Engraulis encrasicolus	0.10	2	0.01	
Remora remora	0.10	10	0.01	
Total	732.80		99.99	

PROJECT STATION: 696

DATE: 4/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1534

	start	stop	duration			Long W	1649
TIME	:21:14:20	21:44:16	30 (min)	Purpose code:	1		
LOG	:9215.40	9217.12	1.69	Area code	: 1		
FDEPTH:	0	0		GearCond.code:			
BDEPTH:	45	56		Validity code:			

Towing dir: 300ø Wire out: 150 m Speed: 38 kn*10

Sorted: 70 Kg Total catch: 3961.55 CATCH/HOUR: 7923.10

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	3215.00	24852	40.58	1423
Chloroscombrus chrysurus	2542.20	15276	32.09	1422
Brachydeuterus auritus	1236.90	9804	15.61	1421
Selene dorsalis	530.00	4332	6.69	
Stromateus fiatola	148.20	228	1.87	
Sardinella maderensis	108.30	798	1.37	
Sphyraena guachancho	102.60	228	1.29	
Sardinella aurita	22.80	228	0.29	
Scomber japonicus	17.10	114	0.22	
Total	7923.10		100.01	

PROJECT STATION: 697

DATE: 4/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1540

	start	stop	duration			Long W	1702
TIME	:23:27:14	23:57:13	30 (min)	Purpose code:	1		
LOG	:9229.61	9231.42	1.79	Area code	: 1		
FDEPTH:	0	0		GearCond.code:			
BDEPTH:	187	295		Validity code:			

Towing dir: 311ø Wire out: 150 m Speed: 38 kn*10

Sorted: 72 Kg Total catch: 133.70 CATCH/HOUR: 267.40

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	114.00	6776	42.63	
Auxis thazard	114.00	192	42.63	1424
Trichiurus lepturus	21.80	272	8.15	
Katsuwonus pelamis	13.00	12	4.86	
Trachinotus ovatus	4.60	14	1.72	
Total	267.40		99.99	

PROJECT STATION: 698

DATE: 5/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1547

	start	stop	duration			Long W	1655
TIME	:02:56:55	03:26:39	30 (min)	Purpose code:	1		
LOG	:9251.21	9253.04	1.81	Area code	: 1		
FDEPTH:	0	0		GearCond.code:			
BDEPTH:	94	86		Validity code:	2		

Towing dir: 113ø Wire out: 150 m Speed: 40 kn*10

Sorted: 26 Kg Total catch: 68.28 CATCH/HOUR: 136.56

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	129.90	7956	95.12	1425
Lagocephalus laevigatus	4.70	48	3.44	
Saurida brasiliensis	0.86	150	0.63	
Engraulis encrasicolus	0.40	2	0.29	
Brachydeuterus auritus	0.20	2	0.15	
Sepia sp.	0.20	4	0.15	
Terapon sp.	0.20	4	0.15	
Illex coindetii	0.10	4	0.07	
Total	136.56		100.00	

PROJECT STATION: 699

DATE: 5/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1541

	start	stop	duration			Long W	1646
TIME	:05:38:42	06:11:22	33 (min)	Purpose code:			
LOG	:9268.01	9269.97	1.94	Area code	:		
FDEPTH:	0	0		GearCond.code:			
BDEPTH:	42	44		Validity code:			

Towing dir: 217ø Wire out: 150 m Speed: 38 kn*10

Sorted: 68 Kg Total catch: 939.20 CATCH/HOUR: 1707.64

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP

Chloroscombrus chrysurus	947.64	5773	55.49	1426
Trachinotus ovatus	161.27	749	9.44	
Carcharhinus sp.	127.64	45	7.47	
Brachydeuterus auritus	118.18	1205	6.92	
Selene dorsalis	84.00	749	4.92	1430
Sardinella maderensis	78.18	796	4.58	1428
Stromateus fiatola	59.09	91	3.46	
Sardinella aurita	43.64	273	2.56	1477
Trachurus trachurus	28.36	1251	1.66	1429
Trichiurus lepturus	27.27	478	1.60	
Pomadasys rogeri	15.27	38	0.89	
Sphyraena guachancho	10.73	22	0.63	
Engraulis encrasicolus	2.18	69	0.13	
Alectis alexandrinus	1.73	2	0.10	
Galeoides decadactylus	0.91	2	0.05	
Decapterus rhonchus	0.82	2	0.05	
Campogramma glaycos	0.82	2	0.05	
Total	1707.73		100.00	

PROJECT STATION: 700

DATE: 5/11/98 GEAR TYPE: BT No: POSITION:Lat N 1545
start stop duration Long W 1638
TIME :08:34:33 09:04:20 30 (min) Purpose code: 1
LOG :9285.90 9287.27 1.36 Area code : 1
FDEPTH: 22 23 GearCond.code:
BDEPTH: 22 23 Validity code:
Towing dir: 17ø Wire out: 120 m Speed: 30 kn*10

Sorted: 28 Kg Total catch: 244.00 CATCH/HOUR: 488.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	352.00	25280	72.13	1432
Selene dorsalis	33.60	1424	6.89	
Lagocephalus laevigatus	20.80	16	4.26	
Drepane africana	14.40	64	2.95	
Raja miraletus	12.80	16	2.62	
Stromateus fiatola	9.40	14	1.93	
Decapterus rhonchus	9.20	22	1.89	
Galeoides decadactylus	8.40	14	1.72	
Trichiurus lepturus	6.40	320	1.31	
Sphyraena guachancho	6.40	128	1.31	
Pomadasys rogeri	6.20	22	1.27	
Sardinella maderensis	4.80	464	0.98	1431
Chloroscombrus chrysurus	3.20	32	0.66	
Penaeus notialis, male	0.40	12	0.08	
Total	488.00		100.00	

PROJECT STATION: 701

DATE: 5/11/98 GEAR TYPE: BT No: POSITION:Lat N 1551
start stop duration Long W 1643
TIME :11:09:21 11:39:07 30 (min) Purpose code: 1
LOG :9302.40 9304.01 1.56 Area code : 1
FDEPTH: 49 50 GearCond.code:
BDEPTH: 49 50 Validity code:
Towing dir: 201ø Wire out: 200 m Speed: 30 kn*10

Sorted: 33 Kg Total catch: 156.80 CATCH/HOUR: 313.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	257.00	2790	81.95	
Decapterus rhonchus	16.00	40	5.10	
Pomadasys rogeri	11.00	8	3.51	
Alectis alexandrinus	10.00	10	3.19	
Trachurus trecae	6.00	600	1.91	1433
Brachydeuterus auritus	4.00	50	1.28	
Pseudotolithus senegalensis	2.20	2	0.70	
Octopus sp.	2.00	10	0.64	
Pagellus bellottii	2.00	10	0.64	
Sciaena umbra	1.00	10	0.32	
Brotula barbata	1.00	10	0.32	
Stromateus fiatola	0.80	8	0.26	
Zeus faber	0.60	2	0.19	
Total	313.60		100.01	

PROJECT STATION: 702

DATE: 5/11/98 GEAR TYPE: PT No: 3 POSITION:Lat N 1600
start stop duration Long W 1638
TIME :17:07:21 17:37:40 30 (min) Purpose code: 1
LOG :9351.08 9353.26 2.14 Area code : 1
FDEPTH: 10 20 GearCond.code:
BDEPTH: 39 29 Validity code: 2
Towing dir: 92ø Wire out: 130 m Speed: 40 kn*10

Sorted: Kg Total catch: 9.25 CATCH/HOUR: 18.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Selene dorsalis	9.40	186	50.81	1434
Trachinotus ovatus	6.40	26	34.59	
Campogramma glaycos	1.50	2	8.11	
Brachydeuterus auritus	1.00	2	5.41	
Chloroscombrus chrysurus	0.20	2	1.08	
Echeneis naucrates	0.02	2	0.11	
Total	18.52		100.11	

Annex II Instruments and fishing gear used

The Simrad EK-500, 38kHz echo scientific sounder was used during the survey for fish abundance estimation. The Bergen Echo Integrator system (BEI) logging the echogram raw data from the sounder, was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data was stored to tape, and a backup of the database of scrutinized data, stored. The details of the settings of the 38kHz where as follows:

Transceiver-1 menu	Transducer depth	5.5 - 6.5 m
	Absorbtion coeff.	10 dB/km
	Pulse length	medium (1ms)
	Bandwidth	wide
	Max power	2000 Watt
	2-way beam angle	-21.0 dB
	SV transducer gain	27.48 dB
	TS transducer gain	27.72 dB
	Angle sensitivity	21.9
	3 dB beamwidth	6.8 dg
	Alongship offset	-0.05 dg
	Athwardship offset	0.14 dg
Display menu	Echogram	1
	Bottom range	12 m
	Bottom range start	10 m
	TVG	20 log R
	Sv colour min	-67 dB
	TS Colour minimum	-60 dB
Printer- menu	Range	0 - 50 or 0 -100 m and 100 - 350m
	TVG	20 log R
	Sv colour min	-62 dB
Bottom detection menu	Minimum level	-40 dB

A calibration experiment using a standard copper sphere, performed in Baia dos Tigres 15 June 1995 gave the following results:

Sv Transducer gain 28.1 dB
Ts Transducer gain 28.0 dB

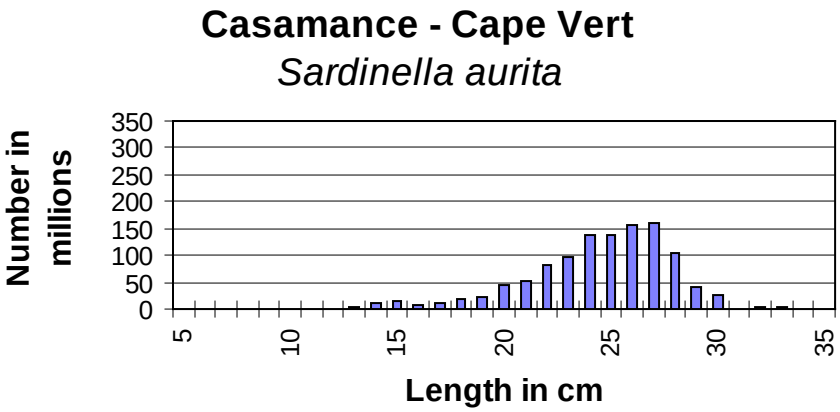
Hydrography

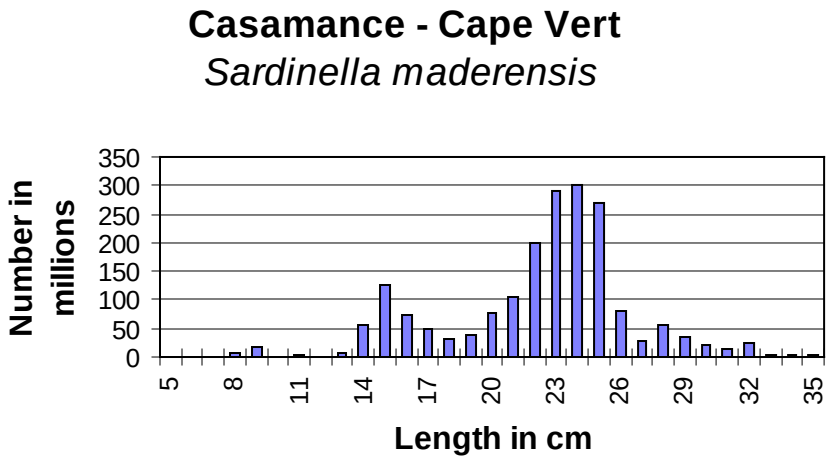
Conductivity**,** temperature, density and dissolved oxygen were sampled regularly at CTD stations with Seabird 911 + CTD sonde. The salinity is computed from the data on conductivity by the software retrieving data from the sensors.

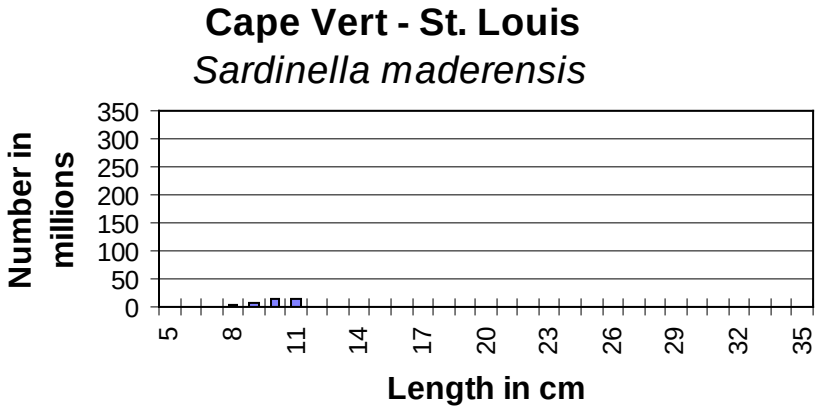
Fishing gear

The vessel has two different sized "Åkrahamn" pelagic trawls and one "Gisund super" bottom trawl. For all trawls, the Tyborøn, 7.8m² (1670kg) trawl doors were used. Complete drawings of the trawls used are included.

Annex III Pooled length distributions by species and regions







Annex IV Stock length distribution by numbers and weight

Senegal & The Gambia 1998

Sardinella aurita

	N (millions)					Biomass (tonnes)				
Length cm	St.Louis-Cap Vert	Cap Vert-Gambia	Gambia	Casa-mance	TOTAL	St. Louis-Cap Vert	Cap Vert-Gambia	Gambia	Casa-mance	TOTAL
5										
6										
7										
8										
9										
10										
11										
12										
13		3.0			3.0		66			66
14		14.9			14.9		409			409
15		9.0	7.9		16.9		299	265		564
16		3.0	4.0		7.0		120	160		279
17		3.0	7.9		10.9		143	380		522
18		9.0	11.9		20.9		505	671		1176
19		17.9	7.9		25.9		1179	523		1702
20		14.9	31.8		46.7		1140	2426		3566
21		13.7	35.8		49.5		1208	3143		4350
22		77.6	23.8		101.4		7802	2397		10199
23		89.0	19.9		108.8		10176	2272		12448
24	0.5	97.4	23.8	3.4	125.2	71	12602	3084	445	16202
25	0.8	72.5	47.7	3.4	124.4	119	10556	6944	501	18120
26	1.6	41.7	116.0	3.4	162.7	267	6799	18935	562	26563
27		24.7	151.8	3.4	179.9		4493	27642	627	32761
28	0.3	12.3	102.5	3.4	118.5	55	2481	20751	697	23984
29		8.2	37.3	1.7	47.3		1843	8373	386	10602
30		8.8	5.6	24.1	38.5		2183	1376	5960	9519
31										
32		2.3			2.3		699			699
33		2.3			2.3		765			765
34										
35				5.6	5.6				2169	2169
TOTAL	3.3	525.1	635.6	48.6	1212.6	512	65467	99343	11346	176668

Annex IV continued

Senegal & The Gambia 1998

Sardinella maderensis

	N (millions)					Biomass (tonnes)				
Length cm	St.Louis-Cap Vert	Cap Vert-Gambia	Gambia	Casa-mance	TOTAL	St. Louis-Cap Vert	Cap Vert-Gambia	Gambia	Casa-mance	TOTAL
5										
6										
7	0.2					1				
8	0.7			55.9		4			315	
9	5.4			111.8		42			876	
10	9.8					103				
11	7.8			18.6		108			257	
12	1.1					20				
13	0.2			3.4	3.6	3			76	80
14	0.4	53.3		5.2	58.9	12	1461		141	1614
15	1.7	71.9	4.0	36.1	113.7	57	2399	133	1206	3794
16	1.9	55.6		15.5	73.0	77	2235		622	2933
17	0.8	9.3	7.9	20.6	38.6	39	443	375	987	1844
18	1.1	18.0		10.3	29.4	61	1013		582	1656
19		18.6		12.6	31.2		1224		829	2053
20	0.5	12.8	7.8	32.6	53.7	42	978	592	2490	4102
21		30.3	38.9	17.6	86.8		2665	3419	1546	7630
22		40.7	70.2	61.9	172.8		4095	7061	6226	17383
23		73.4	97.0	63.7	234.1		8396	11096	7284	26775
24		87.0	77.7	73.6	238.2		11256	10054	9520	30829
25		105.9	42.7	67.4	216.0		15422	6217	9819	31458
26	0.3	23.1	19.4	42.0	84.8	45	3776	3167	6853	13840
27	1.6	14.3		6.4	22.3	298	2607		1162	4067
28	0.5	16.0		67.7	84.3	110	3240		13710	17060
29	0.5	17.3		33.5	51.3	122	3868		7522	11513
30	0.5	9.0		22.4	31.9	135	2222		5535	7892
31		1.8		22.4	24.2		489		6089	6578
32		7.2		33.5	40.7		2145		10019	12164
33		1.8			1.8		587			587
34				5.6					1993	1993
35		1.8		5.6			696		2169	2865
TOTAL	35.2	669.0	365.5	846.0	1691.4	1280	71215	42115	97826	210709