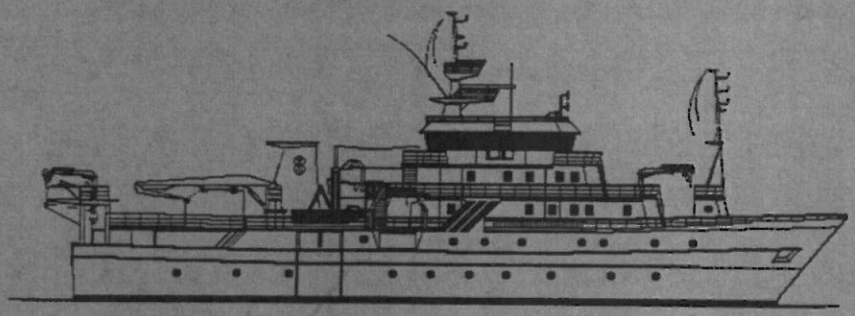

SURVEY OF THE PELAGIC FISH RESOURCES OFF NORTH WEST AFRICA

Part II MAURITANIA

9 - 18 November 1998

Centre National Recherches Oceanographie et Peche
Nouadhibou, Mauritania

Institute of Marine Research
Bergen, Norway

CRUISE REPORT "DR FRIDTJOF NANSEN"

SURVEY OF THE PELAGIC FISH RESOURCES NORTH WEST AFRICA

Part II
MAURITANIA
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by

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Bergen, 1998

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CHAPTER 1 INTRODUCTION

1.1 Objectives of the cruise

The defined general objectives were to estimate and map the distribution and biomass 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 November-December 1998.

For Mauritania the agreed objectives were:

- To map the distribution and estimate the biomass of the main small pelagic fish using hydroacoustic methods. The species of interest are: sardine *Sardina pilchardus*, sardinella *Sardinella aurita*, *S. maderensis*, horse mackerels *Trachurus trecae* and *T. trachurus*, false scad *Decapterus rhonchus*, and anchovy *Engraulis encrasicolus*.

- 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.

- To sample standard hydrographical transects for temperature, salinity and oxygen at about 16°40' N, 18°00' N, 19°00' N, 20°00' N and off Cape Blanc.

The time allocated for this part of the survey was 6 days.

1.2 Participation

Members of the scientific teams were:

Centre National de Recherches Océanographiques et des Peches, Mauritania:
Ebaye O. Mohamed MAHMOUD, Wagué ABDOULAYE, Sall Mamadou DIALLO, Ely O. Sidi O. BEIBOU and Ad CORTEN

Centre de Recherches Océanographiques de Dakar-Thiaroy, Senegal:
Mor SYLLA

Institute Scientifique des Peches Maritimes, Morocco:
Mostafa CHBANI

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

1.3 Narrative

After getting onboard the Mauritanian scientific team in Dakar on 9 November, the survey of the Mauritanian shelf started on 10 November. Figure 1 shows the survey tracks and the fishing and hydrographical stations. Systematic parallel transects were run with 10 NM distance in between.

The hydrographic profile at 16°40' N was sampled on 10 November, at 18°00' N on 13 at 19°00' N on 14 at 20°00' N on 15 and off Cape Blanc on 19 November.

The survey was terminated in Nouakchott on 17 November.

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 stations where they were present. Total fish length was measured. Individual weight was calculated as $w=al^b$, where b was estimated at 2,96 for the sardinellas and horse mackerel. 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.

Hydrographical profiles were collected with a CTD sonde and temperature, salinity and pressure (depth) were calculated by the Seabird Software system. From these data series, records were selected from standard depths and presented in figures.

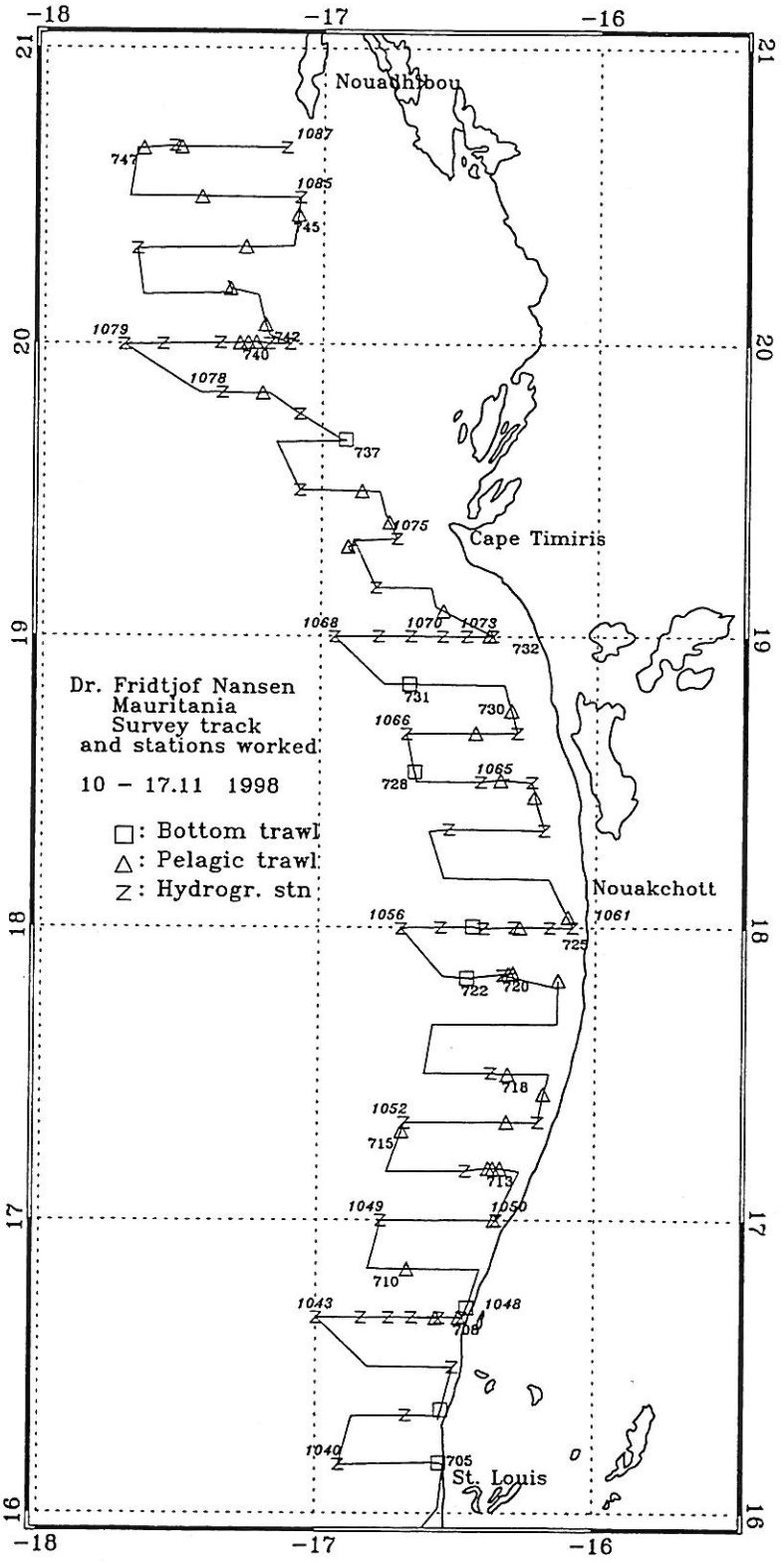


Figure 1 Course track and fishing and hydrographic stations.

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 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. Three groups were used for Mauritania: 1) sardinellas 2) horse mackerels and 3) carangids and associated species (false scad, chub mackerel, hairtails and barracudas).

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 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.

- The samples are generally pooled together with equal importance. If the size distribution of the actual specie is not uniform in an area, the length distributions may be 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.

- 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 was applied.

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

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

CHAPTER 2 SURVEY RESULTS

2.1 Hydrography

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

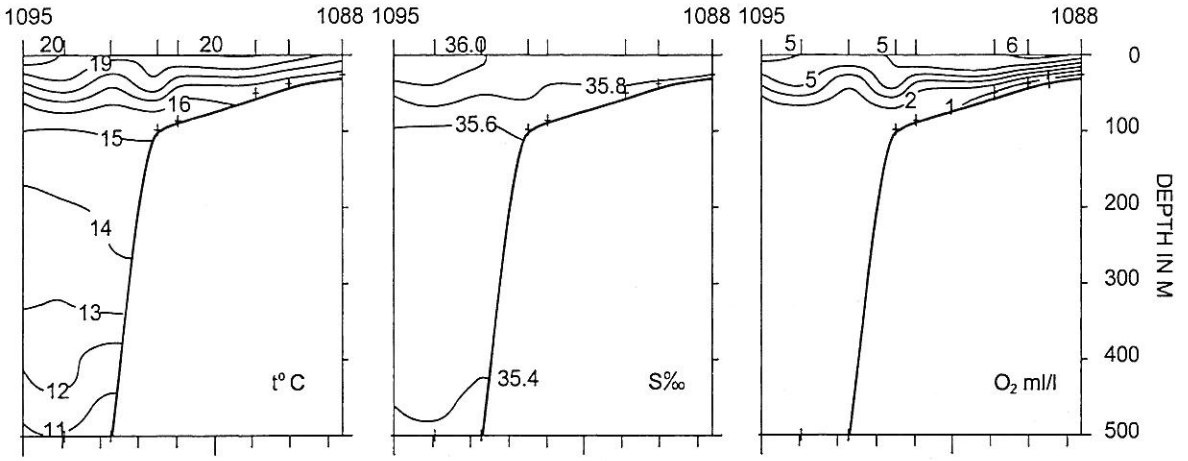
The distribution of surface temperature showed that over the shelf from St. Louis to Cape Timiris there was a decrease offshore from 26°C to 24°C. Near the coast, the temperature was stable all along the coast at around 20-22°C . Off shore, however, there was in general 2-4°C higher temperatures than inshore. The surface temperature was in general higher this year than in 1997.

All hydrographic profiles showed a sharp thermocline.

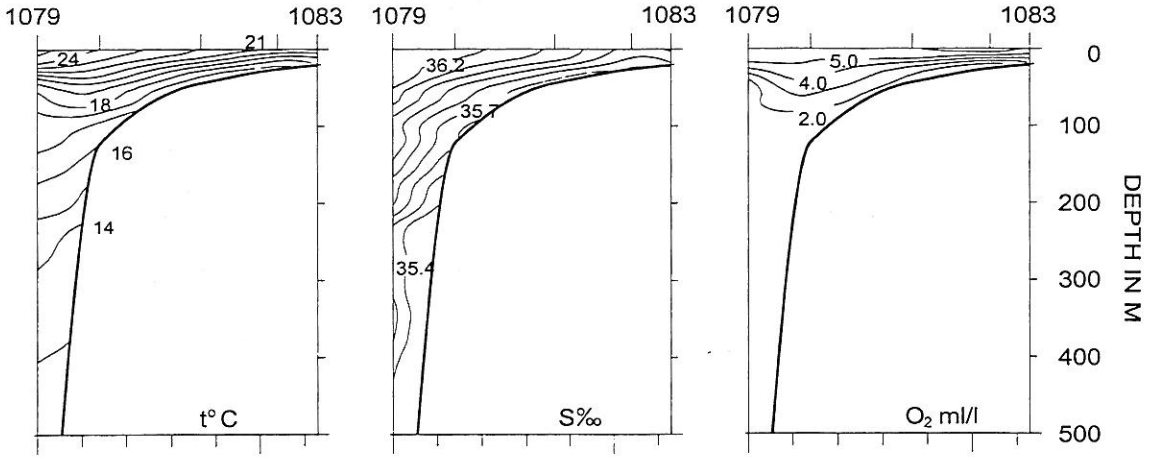
2.2 Pelagic fish on the shelf from St. Louis to Cape Timiris

Figures 4, 5 and 6 show the distribution of the main groups of pelagic fish by contoured acoustic densities for the whole shelf of Mauritania.

Sardinellas were found over the inner shelf in a nearly continuous belt along the entire coast from St. Louis to some 20 NM south of Cape Timiris, see Figure 4. Particularly dense school areas were located between about 17°00' N and 18°10' N. In addition, more offshore aggregations were found between 17°50' N - about 18°00' N and between 18°30' N - about 18°45'.

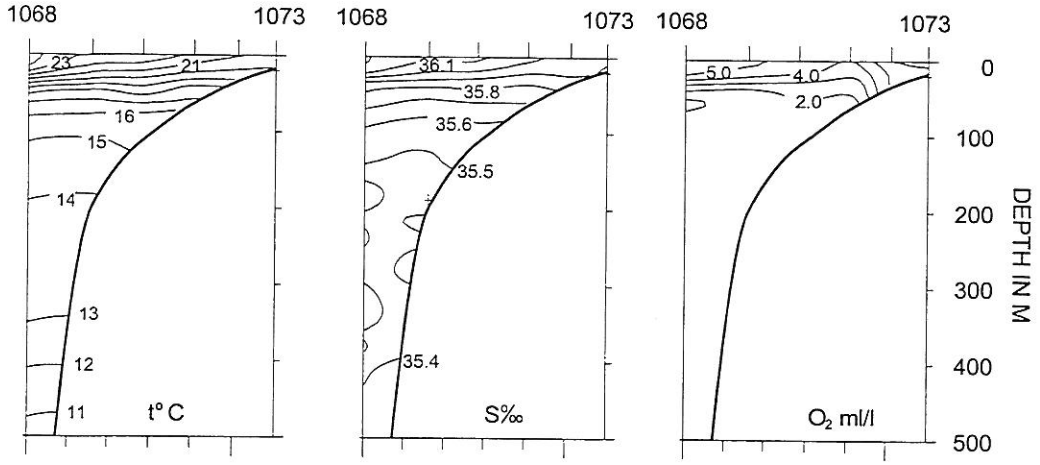


CAPE BLANC 19 - 20.11 1998

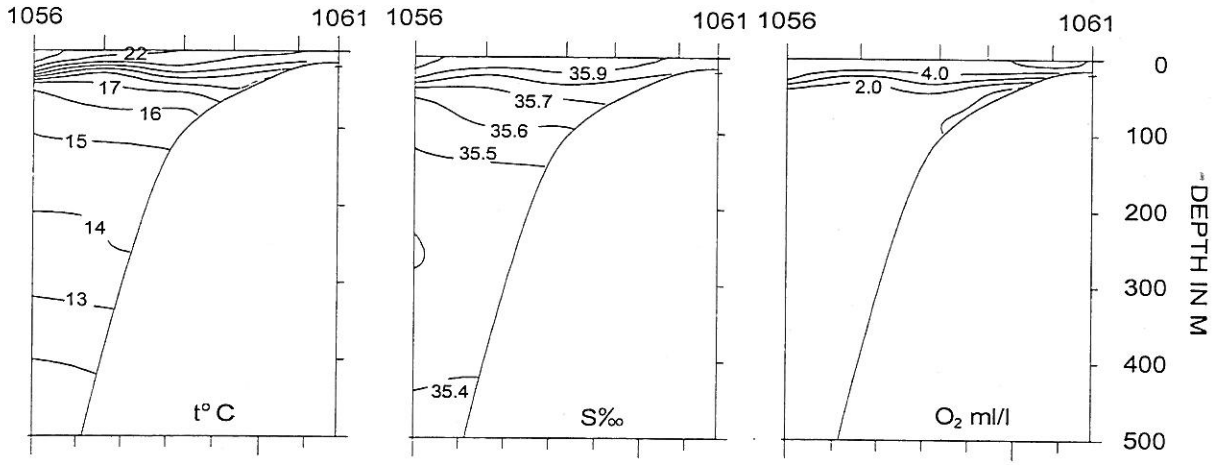


20°00 N 17.11 1997

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

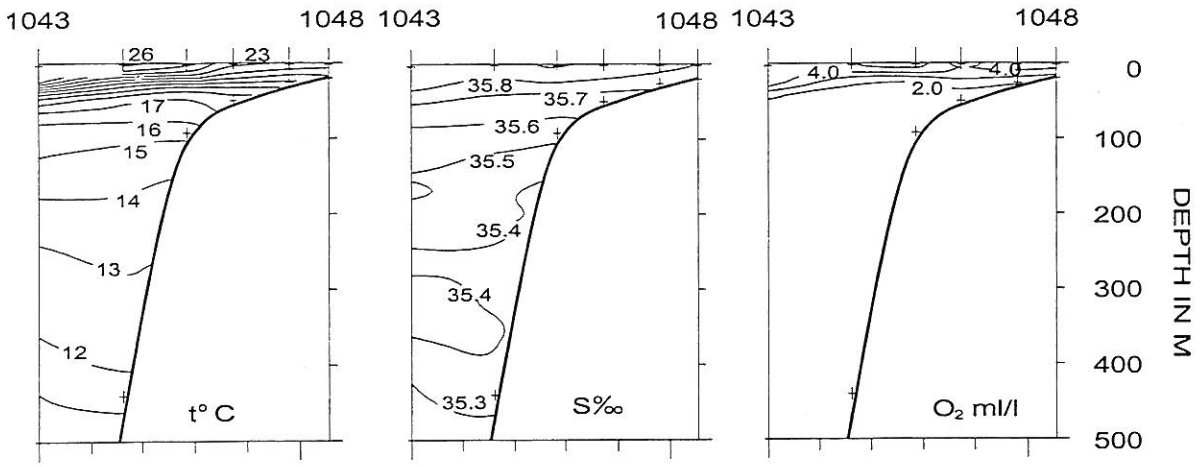


19°00 N 16.11 1997



18°00' N 14.11 1998

Figure 2. continued.



16°40' N 13.11 1997

Figure 2. continued.

The samples showed consistent large sizes of both sardinella species south of Cape Timiris with a modal length of 34 cm for round sardinella and 33 cm flat sardinella, see Annex III. The stock length compositions by numbers and weight are shown in Annex IV.

Table 1 gives the biomass estimates of sardinellas for this shelf based on their size composition in the area of sampling. The total estimate was 1.021 million tonnes of which 62% was flat- and 38% round sardinella.

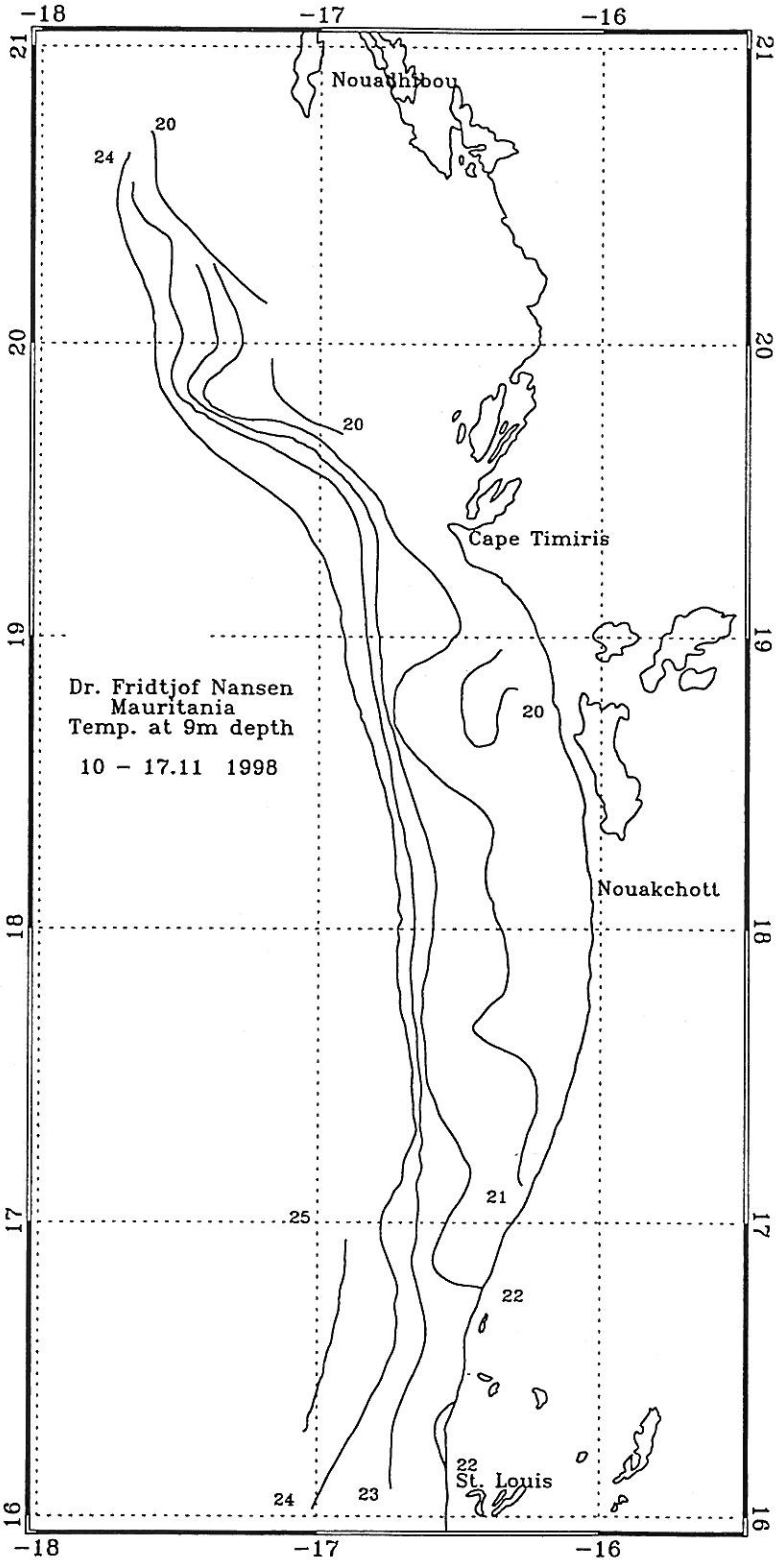


Figure 3 Sea surface temperature.

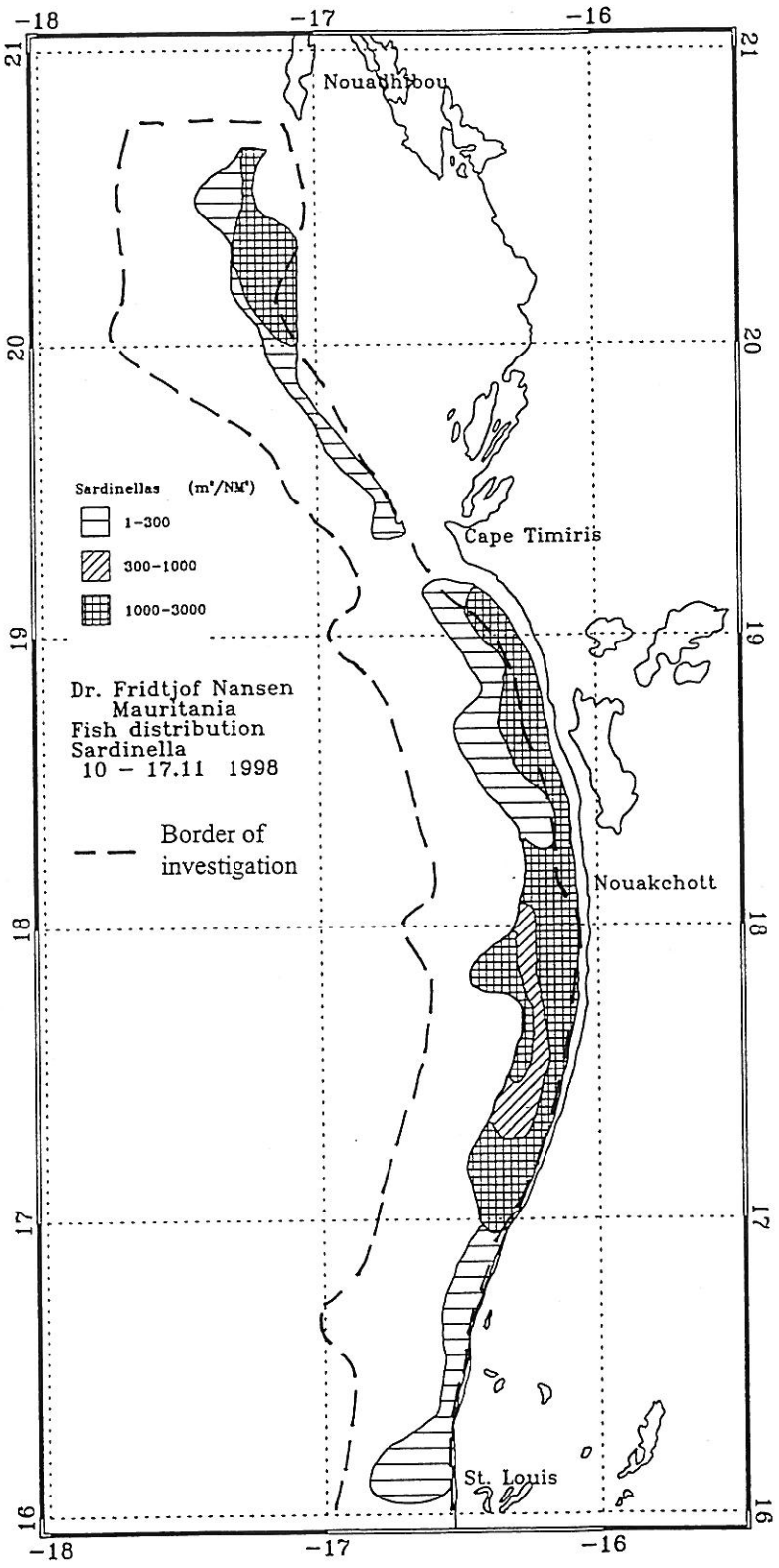


Figure 4 Distribution of sardinellas.

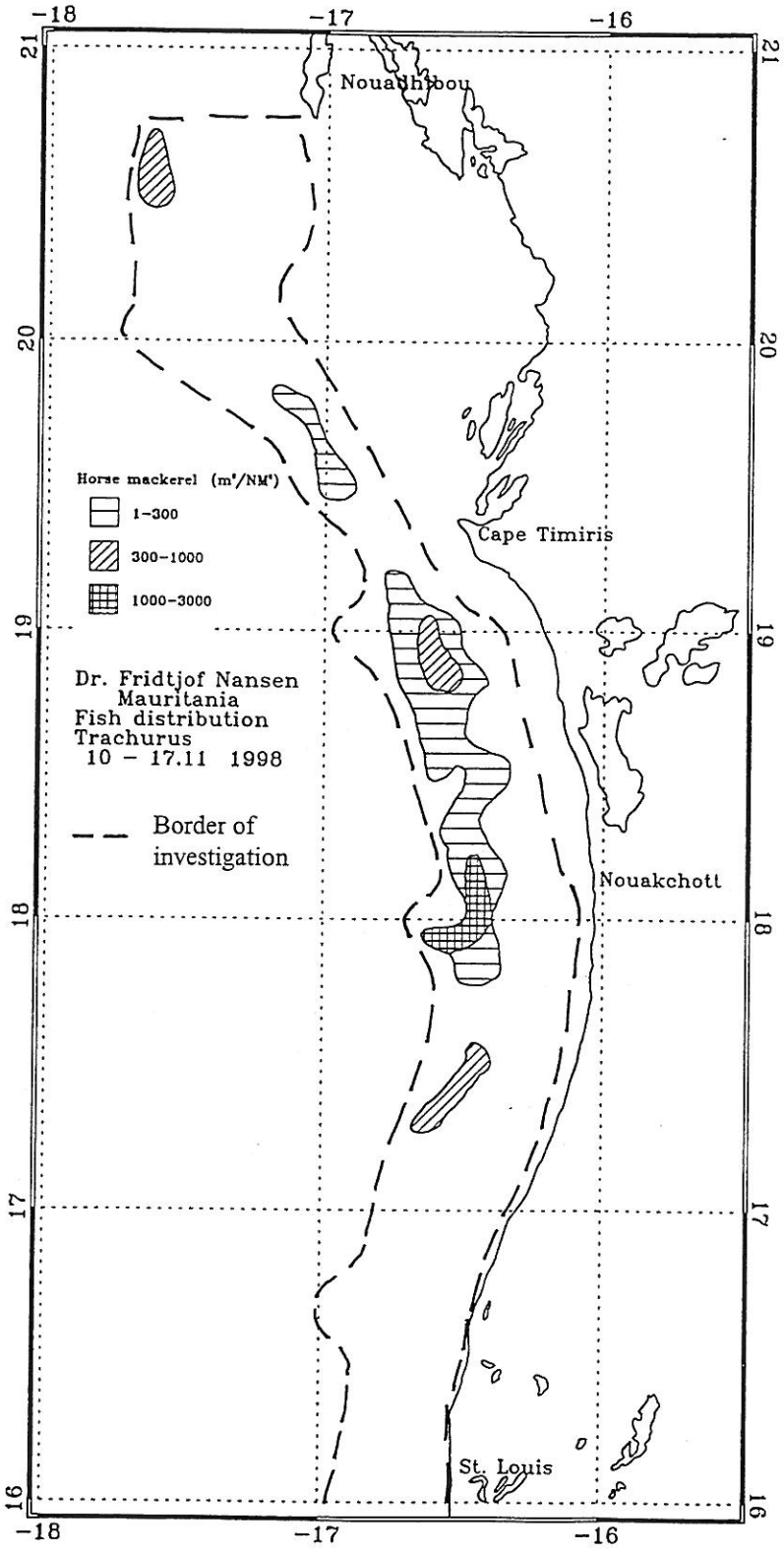


Figure 5 Distribution of horse mackerels.

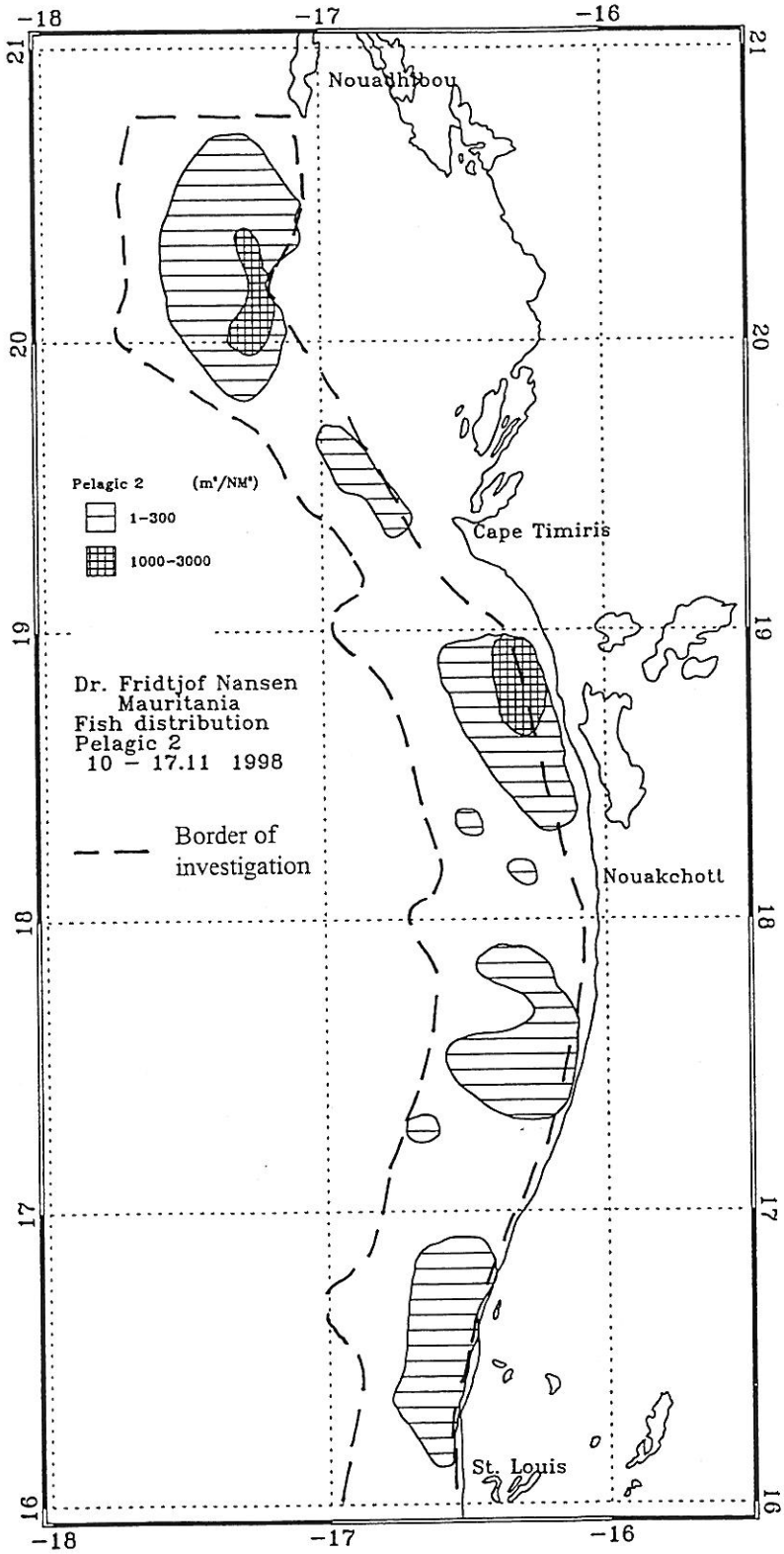


Figure 6 Distribution of carangids and associated species.

The distribution of horse mackerel is shown in Figure 5. Horse mackerel occurred in two concentrations; a larger one between 17°50'N and 19°20'N and a smaller between 17°20'N - 17°40'N. The aggregations were found at the edge of the shelf, close to the bottom at depths around 150-200 m. The biomass was estimated at 235 000 tonnes. Only Cunene horse mackerel, *Trachurus trecae* was recorded. The modal length observed in the total length distribution of horse mackerel was 40 cm.

Figure 6 shows the distribution of the mixed group which took the form of three main distributions, at 16°10'N - 16°55'N, at 17°25'N - 17°55'N and at about 18°20'N - 19°00'N. The total biomass was estimated at 164 000 tonnes. The samples from the distributional areas consisted of Atlantic bumper, *Chloroscombrus chrysurus*, false scad, *Decapterus rhonchus*, West African Spanish mackerel, *Scomberomorus tritor*, Atlantic bonito, *Sarda sarda*, pompano, *Trachinotus* spp. with small amounts of chub mackerel, *Scomber japonicus* and barracudas, *Sphyraena* spp.

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

Flat sardinella	Round sardinella	Horse mackerels	Carangids etc.
685	336	235	164

2.3 Pelagic fish on the shelf from Cape Timiris to Cape Blanc

From Cape Timiris and northwards a school area of juvenile sardinellas were recorded (Figure 4). At about 20°15'N-20°50'N this distribution was rather dense. Only round sardinella were present, with a modal length of 8 cm.

The main distribution area of juvenile sardinellas in this area is thought to lie in shallow inshore waters which could not be covered by the survey. The patches which were surveyed therefore only represent incidental unknown parts of the total abundance of the juvenile stocks. However, the biomass of the sardinella covered by the vessel was estimated to some 104 000 tonnes.

Horse mackerel were registrated in two smaller areas at the outer parts of the shelf (Figure 5). The aggregations which were rather sparse consisted could not be sampled by trawling.

However, it is assumed that it was *Trachurus trecae* of the same size distribution as on the outer shelf further south. These biomass was estimated at 24 000 tonnes.

Two areas with varying densities of anchovy were recorded (Figure 7), one from Cape Timiris and some 30 NM nortwards and the other from about 20°00'N - 20°30'N. The anchovy was often mixed with juvenile sardinellas and carangids. Also for anchovy, the main distributional in this area is thought to lie in shallow inshore waters which could not be covered by the survey. The estimate of 190 000 tonnes is therefore thought to be an underestimate and should not be used for assessment purpose.

The carangids and associated species were found in two main concentrations in this area, one from Cape Timiris and some 20 NM nortwards and the other from about 19°50'N - 20°45'N. An area of higher density was delineated from about 20°00'N - 20°20'N, see Figure 6.

The catches of this group consisted mainly of false scad and largehead hairtail, *Trichiurus lepturus*. The biomass was estimated at 120 000 tonnes.

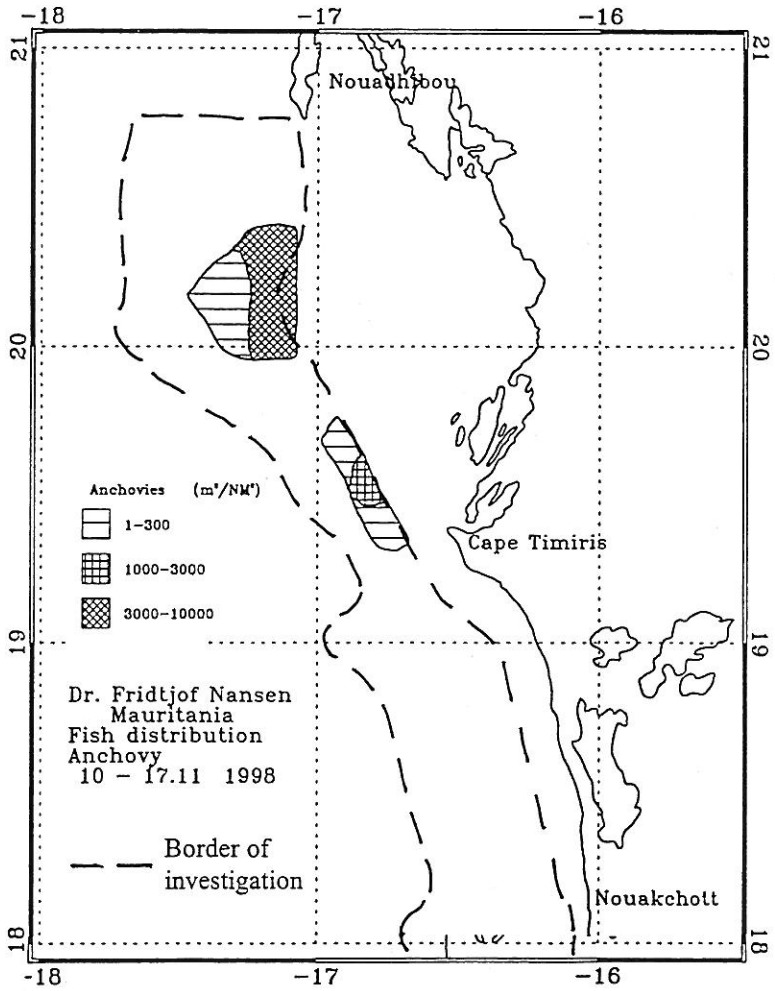


Figure 7. Distribution of anchovy. Cape Timiris - Cape Blanc.

CHAPTER 3 OVERVIEW AND SUMMARY OF RESULTS

The survey was conducted successfully in the period 9 to 18 November with a course track of 1 160 NM, 44 fishing stations and 48 CTD stations (Figure 1).

The hydrographical data showed lowered surface temperatures inshore between St. Louis and Cape Timiris with upward slanting isoterms shorewards from about 50 m depth.

Mainly adult sardinella were found in high density between St. Louis and Cape Timiris, while juveniles were found in the area between Cape Timiris and Cape Blanc (Figure 4). Horse mackerels were found in medium density in one main area extending from some 30 NM south of Nouakchott and northwards to Cape Timiris (Figure 5). Carangids (not including horse mackerel) and associated species occurred in low densities all along the shelf, with patches of high density areas (Figure 6).

The total biomass of sardinella was estimated at 1 125 000 tonnes with 62% flat and 38% round sardinella, that of horse mackerel at 259 000 tonnes and that of the carangids and associated species at 284 000 tonnes, see Table 2.

Table 2 Summary of biomass estimates of pelagic fish, Mauritania. 1 000 tonnes.

	Flat sardinella	Round sardinella	Horse mackerel	Carangids etc.
St. Louis-Cape Timiris	685	336	235	164
Cape Timiris-Cape Blanc	0	104	24	120
Total	685	440	259	284

Table 3 lists biomass estimates of sardinella and carangids and associated species from previous 'Dr Fridtjof Nansen' surveys of this shelf region. Compared with the surveys from ,the same season: NovDec/86, NovDec/95, NovDec/96 and NovDec/97, the estimate of 1 125 000 tonnes of sardinella from the current survey is lower than the estimates in 95 and 96, but in line with that of 1997. The carangid estimate of 284 000 tonnes is considerably lower than that from NovDec/97, and somewhat lower than the estimate of NovDec/96, but higher than that at the same time of the year in 1995.

Table 3 Biomass estimates from previous 'Dr Fridtjof Nansen' surveys of the Mauritanian shelf. 1 000 tonnes.

Survey:	Sardinellas	Carangids etc.
AprMay-81	20	370
Sept -81	75	*
FebMar-82	50	470
NovDec-86	300	540
FebMar-92	1970	190
NovDec-95	1780	190
NovDec-96	1405	400
NovDec-97	1200	660

* Not available

Annex I Records of fishing stations

PROJECT STATION: 705
DATE:10/11/98 GEAR TYPE: BT No: 3
POSITION:Lat N 1610 Long W 1633

	start	stop	duration		
TIME	:08:01:51	08:31:41	30 (min)	Purpose code:	1
LOG	: 158.36	159.91	1.53	Area code :	1
FDEPTH:	19	27		GearCond.code:	
BDEPTH:	19	27		Validity code:	

Towingdir: 270ø Wire out: 120 m Speed: 30 kn*10

Sorted: 63 Kg Total catch: 3200.00 CATCH/HOUR: 6400.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	2460.00	157000	38.44	
Ilisha africana	1700.00	22800	26.56	
Galeoides decadactylus	635.00	21100	9.92	
Selene dorsalis	315.00	26286	4.92	1436
Pteroscion peli	250.00	3000	3.91	
Pomadasys peroteti	250.00	1300	3.91	
Trachurus trecae	115.00	8000	1.80	1435
Sardinella maderensis	115.00	6300	1.80	1437
Decapterus rhonchus	95.00	400	1.48	
Lagocephalus laevigatus	90.00	700	1.41	
Alectis alexandrinus	70.00	1000	1.09	
Pomatomus saltatrix	50.00	100	0.78	
Sphyraena sphyraena	40.00	800	0.63	
Caranx senegallus	35.00	100	0.55	
Pseudotolithus typus	25.00	300	0.39	
Trichiurus lepturus	20.00	200	0.31	
Trichiurus lepturus	20.00	200	0.31	
Pagellus bellottii	15.00	100	0.23	
Scomberomorus tritor	15.00	100	0.23	
Chloroscombrus chrysurus	10.00	800	0.16	
Loligo vulgaris	5.00	100	0.08	
Sardinella aurita	5.00	600	0.08	
Total	6335.00		98.99	

PROJECT STATION: 706
DATE:10/11/98 GEAR TYPE:BT No: 3 POSITION:Lat N 1621 Long W 1633

	start	stop	duration		
TIME	:14:15:10	14:53:58	39 (min)	Purpose code:	1
LOG	: 211.52	213.65	2.13	Area code :	1
FDEPTH:	20	19		GearCond.code:	
BDEPTH:	20	19		Validity code:	

Towingdir: 194ø Wire out: 110 m Speed: 30 kn*10

Sorted: 58 Kg Total catch: 364.46 CATCH/HOUR: 560.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	353.54	2825	63.05	1439
Brachydeuterus auritus	72.00	526	12.84	
Decapterus rhonchus	48.92	203	8.72	1438
Sardinella maderensis	15.69	83	2.80	1441
Pagellus bellottii	11.08	46	1.98	
Pomadasys rogeri	9.23	9	1.65	
Rhizoprionodon acutus	8.62	11	1.54	
Sardinella aurita	8.31	18	1.48	1440
Alectis alexandrinus	7.38	18	1.32	
GYMNURIDAE	5.85	5	1.04	
Campogramma glaycos	5.54	9	0.99	
Arius heudeloti	4.62	18	0.82	
Drepane africana	3.08	2	0.55	
Raja miraletus	2.46	3	0.44	
Sphyrna mokarran	2.46	2	0.44	
Balistes capriscus	1.85	2	0.33	
Eucinostomus melanopterus	0.09	9	0.02	
Total	560.72		100.01	

PROJECT STATION: 707
DATE:10/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 1640 Long W 1634

	start	stop	duration		
TIME	:23:19:19	23:49:25	30 (min)	Purpose code:	1
LOG	: 286.45	288.21	1.73	Area code :	1
FDEPTH:	0	0		GearCond.code:	
BDEPTH:	37	47		Validity code:	

Towingdir: 270ø Wire out: 150 m Speed: 35 kn*10

Sorted: 52 Kg Total catch: 158.25 CATCH/HOUR: 316.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	152.70	828	48.25	1442
Auxis thazard	47.40	300	14.98	1447
Alectis alexandrinus	30.00	24	9.48	
Rhizoprionodon acutus	22.80	12	7.20	
Decapterus rhonchus	12.60	42	3.98	1444
Brachydeuterus auritus	11.10	84	3.51	
Pomadasys peroteti	9.00	24	2.84	
Trachinotus ovatus	9.00	42	2.84	
Trachurus trecae	7.50	312	2.37	1443
Stromateus fiatola	6.00	6	1.90	
Sardinella aurita	2.10	18	0.66	1445
Campogramma glaycos	1.80	6	0.57	
Loligo vulgaris	1.50	12	0.47	
Sardinella maderensis	1.20	6	0.38	1446
Sphyraena guachancho	0.60	12	0.19	
Total	315.30		99.62	

PROJECT STATION: 708
DATE:11/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 1640 Long W 1629

	start	stop	duration		
TIME	:01:08:45	01:39:36	31 (min)	Purpose code:	1
LOG	: 297.34	299.02	1.65	Area code :	1
FDEPTH:	10	10		GearCond.code:	
BDEPTH:	18	21		Validity code:	

Towingdir: 270ø Wire out: 150 m Speed: 40 kn*10

Sorted: 27 Kg Total catch: 382.50 CATCH/HOUR: 740.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus rhonchus	338.71	4417	45.75	1448
Sardinella maderensis	230.32	7126	31.11	1449
Trachurus trecae	120.58	4390	16.29	
Trichiurus lepturus	12.19	108	1.65	
Sphyraena guachancho	10.84	135	1.46	
Alectis alexandrinus	8.13	27	1.10	
Lagocephalus laevigatus	5.42	27	0.73	
Brachydeuterus auritus	5.42	27	0.73	
Pteroscion peli	2.71	27	0.37	
Galeoides decadactylus	1.35	27	0.18	
Chloroscombrus chrysurus	1.35	135	0.18	
Selene dorsalis	1.35	27	0.18	
Total	738.37		99.73	

PROJECT STATION: 709
DATE:11/11/98 GEAR TYPE:BT No: 3 POSITION:Lat N 1642 Long W 1627

	start	stop	duration		
TIME	:02:35:15	03:05:37	30 (min)	Purpose code:	1
LOG	: 304.42	306.25	1.82	Area code :	1
FDEPTH:	20	20		GearCond.code:	
BDEPTH:	20	20		Validity code:	

Towingdir: 20ø Wire out: 110 m Speed: 35 kn*10

Sorted: 24 Kg Total catch: 337.54 CATCH/HOUR: 675.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Pomadasys peroteti	197.40	1148	29.24	
Galeoides decadactylus	141.40	4144	20.95	
Pteroscion peli	133.00	2492	19.70	
Pseudotolithus typus	88.20	392	13.07	
Stromateus fiatola	28.00	28	4.15	
Leptocharias smithii	23.80	56	3.53	
Sardinella maderensis	16.80	168	2.49	
Arius heudeloti	16.80	84	2.49	
Brachydeuterus auritus	8.40	1848	1.24	
Decapterus rhonchus	7.00	28	1.04	
Chloroscombrus chrysurus	5.60	952	0.83	
Sphyraena guachancho	2.80	56	0.41	
Ilisha africana	2.80	28	0.41	
Pomadasys incisus	1.40	28	0.21	
Selene dorsalis	1.40	56	0.21	
Diplodus sargus *	0.28	28	0.04	
Total	675.08		100.01	

PROJECT STATION: 710
DATE:11/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 1650 Long W 1640

	start	stop	duration		
TIME	:05:42:59	06:12:48	30 (min)	Purpose code:	1
LOG	: 328.34	329.97	1.60	Area code :	1
FDEPTH:	0	0		GearCond.code:	
BDEPTH:	300	374		Validity code:	

Towingdir: 270ø Wire out: 150 m Speed: 35 kn*10

Sorted: 67 Kg Total catch: 337.50 CATCH/HOUR: 675.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachinotus ovatus	285.00	630	42.22	
Trichiurus lepturus	218.00	3430	32.30	
MYCTOPHIDAE	129.00	99080	19.11	
Remora remora	29.00	50	4.30	
Trachurus trecae	8.00	820	1.19	1450
Ruvettus pretiosus	4.80	2	0.71	
Sepia officinalis hierredda	0.50	30	0.07	
Engraulis encrasicolus	0.50	10	0.07	
Illex coindetii	0.10	10	0.01	
Todarodes sagittatus	0.10	10	0.01	
Total	675.00		99.99	

PROJECT STATION: 711
DATE:11/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 1660 Long W 1622

	start	stop	duration		
TIME	:11:18:03	11:47:40	30 (min)	Purpose code:	1
LOG	: 372.04	373.69	1.64	Area code :	1
FDEPTH:	10	10		GearCond.code:	
BDEPTH:	20	20		Validity code:	

Towingdir: 270ø Wire out: 120 m Speed: 35 kn*10

Sorted: 53 Kg Total catch: 796.50 CATCH/HOUR: 1593.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	1290.00	3600	80.98	1480
Sardinella maderensis	277.50	1110	17.42	1481
Chloroscombrus chrysurus	25.50	210	1.60	
Total	1593.00		100.00	

PROJECT STATION: 712

DATE:11/11/98 GEAR TYPE: PT No: 1POSITION:Lat N 1711
start stop duration Long W 1620
TIME :14:24:23 14:39:30 15 (min) Purpose code: 1
LOG : 396.46 397.49 1.01 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 35 41 Validity code:
Towingdir: 270ø Wire out: 100 m Speed: 40 kn*10

Sorted: 36 Kg Total catch: 117.95 CATCH/HOUR: 471.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella aurita	331.80	1120	70.33	1482
Sardinella maderensis	140.00	560	29.67	1483
Total	471.80		100.00	

PROJECT STATION: 713

DATE:11/11/98 GEAR TYPE: PT No: 1POSITION:Lat N 1711
start stop duration Long W 1622
TIME :14:45:48 14:55:11 9 (min) Purpose code: 1
LOG : 397.95 398.55 0.59 Area code : 1
FDEPTH: 20 20 GearCond.code:
BDEPTH: 44 47 Validity code:
Towingdir: 270ø Wire out: 215 m Speed: 40 kn*10

Sorted: 30 Kg Total catch: 240.40 CATCH/HOUR: 1602.67

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella maderensis	1384.00	6240	86.36	1485
Sardinella aurita	200.00	640	12.48	1484
Lagocephalus laevigatus	16.00	107	1.00	
Chloroscombrus chrysurus	2.67	53	0.17	
Total	1602.67		100.01	

PROJECT STATION: 714

DATE:11/11/98 GEAR TYPE: PT No: 1POSITION:Lat N 1711
start stop duration Long W 1623
TIME :15:02:25 15:17:30 15 (min) Purpose code: 1
LOG : 398.92 399.84 0.91 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 50 55 Validity code:
Towingdir: 270ø Wire out: 110 m Speed: 40 kn*10

Sorted: 30 Kg Total catch: 121.92 CATCH/HOUR: 487.68

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella maderensis	312.80	640	64.14	1487
Sardinella aurita	174.40	640	35.76	1486
Chloroscombrus chrysurus	0.32	48	0.07	
Trachinotus ovatus	0.16	16	0.03	
Total	487.68		100.00	

PROJECT STATION: 715

DATE:11/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 1718
start stop duration Long W 1642
TIME :19:11:17 19:44:32 33 (min) Purpose code: 1
LOG : 431.11 433.10 1.97 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 245 241 Validity code:
Towingdir: 209ø Wire out: 150 m Speed: 37 kn*10

Sorted: 64 Kg Total catch: 322.00 CATCH/HOUR: 585.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Brama brama	240.91	236	41.15	
Trichiurus lepturus	170.91	300	29.19	
MYCTOPHIDAE	127.27	80182	21.74	
Euthynnus alletteratus	45.45	27	7.76	
Total	584.54		99.84	

PROJECT STATION: 716

DATE:11/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 1720
start stop duration Long W 1619
TIME :23:05:43 23:27:42 22 (min) Purpose code: 1
LOG : 460.70 461.91 1.19 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 49 55 Validity code:
Towingdir: 270ø Wire out: 150 m Speed: 35 kn*10

Sorted: 66 Kg Total catch: 2373.40 CATCH/HOUR: 6472.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Decapterus rhonchus	2806.36	15845	43.36	1489
Chloroscombrus chrysurus	1140.68	8973	17.62	
Sardinella maderensis	1116.82	3818	17.25	1490
Selene dorsalis	439.09	3436	6.78	
Trichiurus lepturus	329.32	2100	5.09	
Sardinella aurita	210.00	668	3.24	1488
Brachydeuterus auritus	157.50	1050	2.43	
Trachurus trecae	138.41	2195	2.14	
Sphyrna mokarran	95.45	8	1.47	
Pagellus bellottii	38.18	191	0.59	
Total	6471.81		99.97	

PROJECT STATION: 717

DATE:12/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 1726
start stop duration Long W 1611
TIME :01:25:22 01:56:28 31 (min) Purpose code: 1
LOG : 476.39 478.66 2.25 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 21 21 Validity code:
Towingdir: 12ø Wire out: 150 m Speed: 40 kn*10

Sorted: 57 Kg Total catch: 723.77 CATCH/HOUR: 1400.85

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Brachydeuterus auritus	768.00	6265	54.82	
Sardinella maderensis	335.07	1403	23.92	1492
Decapterus rhonchus	140.32	2516	10.02	
Sardinella aurita	84.68	265	6.04	1491
Trichiurus lepturus	42.33	242	3.02	
Ilisha africana	10.88	97	0.78	
Pagellus bellottii	10.88	265	0.78	
Boops boops	1.20	242	0.09	
Sphyraena guachancho	0.23	23	0.02	
Total	1393.59		99.49	

PROJECT STATION: 718

DATE:12/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 1730
start stop duration Long W 1619
TIME :03:35:56 03:49:13 13 (min) Purpose code: 1
LOG : 489.20 490.05 0.83 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 61 65 Validity code:
Towingdir: 270ø Wire out: 150 m Speed: 40 kn*10

Sorted: 63 Kg Total catch: 6367.00 CATCH/HOUR: 29386.16

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella maderensis	18369.23	60000	62.51	1494
Sardinella aurita	10938.46	27692	37.22	1493
Lagocephalus laevigatus	23.08	462	0.08	
Trachurus trecae	23.08	3231	0.08	
Auxis thazard	4.62	462	0.02	
Selene dorsalis	4.62	462	0.02	
Total	29363.09		99.93	

PROJECT STATION: 719

DATE:12/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 1749
start stop duration Long W 1608
TIME :16:47:21 17:14:12 27 (min) Purpose code: 1
LOG : 553.95 555.59 1.62 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 21 22 Validity code:
Towingdir: 180ø Wire out: 150 m Speed: 35 kn*10

Sorted: 67 Kg Total catch: 1175.00 CATCH/HOUR: 2611.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella aurita	2372.22	2567	90.85	1495
Sardinella maderensis	223.56	816	8.56	1496
Loligo vulgaris	15.56	16	0.60	
Total	2611.34		100.01	

PROJECT STATION: 720

DATE:12/11/98 GEAR TYPE: PT No: 3POSITION:Lat N 1751
start stop duration Long W 1619
TIME :19:34:23 19:46:17 12 (min) Purpose code: 1
LOG : 572.44 573.06 0.64 Area code : 1
FDEPTH: 50 40 GearCond.code:
BDEPTH: 76 73 Validity code:
Towingdir: 90ø Wire out: 130 m Speed: 34 kn*10

Sorted: 8 Kg Total catch: 8.65 CATCH/HOUR: 43.25

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Trichiurus lepturus	18.50	55	42.77	
Ephippion guttifer	12.50	635	28.90	
Sepia officinalis hierredda	3.50	10	8.09	
Trachurus trecae	3.50	255	8.09	1497
Octopus vulgaris	2.50	5	5.78	
Lagocephalus laevigatus	1.25	5	2.89	
Lepidotrigla carolae	0.75	10	1.73	
Boops boops	0.75	25	1.73	
Total	43.25		99.98	

PROJECT STATION: 721

DATE:12/11/98 GEAR TYPE: PT No: 3POSITION:Lat N 1751
start stop duration Long W 1618
TIME :19:51:18 20:01:35 10 (min) Purpose code: 1
LOG : 573.34 574.00 0.65 Area code : 1
FDEPTH: 40 10 GearCond.code:
BDEPTH: 71 69 Validity code:
Towingdir: 90ø Wire out: 100 m Speed: 35 kn*10

Sorted: 32 Kg Total catch: 32.00 CATCH/HOUR: 192.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Ephippion guttifer	48.00	516	25.00	
Trichiurus lepturus	47.40	216	24.69	
Sardinella maderensis	33.60	102	17.50	1499
Sepia officinalis hierredda	23.40	12	12.19	
Trachurus trecae	23.40	912	12.19	1498
Sardinella aurita	6.90	18	3.59	
MUGILIDAE	6.60	6	3.44	
Lagocephalus laevigatus	0.90	48	0.47	
Total	190.20		99.07	

PROJECT STATION: 722

DATE:12/11/98 GEAR TYPE:BT No: 3 POSITION:Lat N 1750
start stop duration Long W 1628
TIME :21:42:03 22:11:16 29 (min) Purpose code: 1
LOG : 586.18 587.56 1.35 Area code : 1
FDEPTH: 131 109 GearCond.code:
BDEPTH: 131 109 Validity code:
Towingdir: 90ø Wire out: 420 m Speed: 30 kn*10

Sorted: 35 Kg Total catch: 101.70 CATCH/HOUR: 210.41

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Merluccius senegalensis	83.79	453	39.82	
SCORPAENIDAE	24.83	621	11.80	
Raja sp.	21.72	12	10.32	
GALATHEIDAE *	13.97	8545	6.64	
Trachurus trecae	10.86	124	5.16	1500
Synagrops microlepis	8.38	1142	3.98	
Zeus faber	7.14	62	3.39	
Synodus synodus	6.21	267	2.95	
Torpedo torpedo	4.97	6	2.36	
Brotula barbata	4.14	130	1.97	
Octopus vulgaris	3.52	12	1.67	
Illex coindetii	2.48	19	1.18	
Loligo vulgaris	2.48	19	1.18	
GOBIIDAE	2.48	546	1.18	
Pterothrissus belloci	1.86	31	0.88	
Dentex macrophthalmus	1.86	19	0.88	
Portunus validus	1.86	81	0.88	
Umbrina canariensis	1.86	6	0.88	
Solenocera africana	1.24	745	0.59	
Chlorophthalmus atlanticus	1.24	81	0.59	
Trigla lyra	1.24	6	0.59	
Ophisurus serpens	0.62	19	0.29	
Capros aper	0.62	25	0.29	
Citharus linguatula	0.62	25	0.29	
Sepia officinalis hierredda	0.41	12	0.19	
Total	210.40		99.95	

PROJECT STATION: 723
DATE:13/11/98 GEAR TYPE:BT No: 3 POSITION:Lat N 1800
start stop duration Long W 1627
TIME :03:32:06 04:01:28 29 (min) Purpose code: 1
LOG : 631.06 632.63 1.54 Area code : 1
FDEPTH: 110 107 GearCond.code:
BDEPTH: 110 107 Validity code:
Towingdir: 90ø Wire out: 440 m Speed: 30 kn*10

Sorted: 24 Kg Total catch: 139.20 CATCH/HOUR: 288.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Dentex macrophthalmus	172.34	3451	59.84	
Merluccius polli	44.07	372	15.30	
Brotula barbata	19.86	149	6.90	
BYTIIDAE	16.14	596	5.60	
Chelidonichthys gabonensis	9.93	472	3.45	
Portunus validus	9.93	1477	3.45	
Decapterus rhonchus	5.59	12	1.94	
Pontinus kuhlii	3.10	199	1.08	
Citharus linguatula	2.48	62	0.86	
Synagrops microlepis	1.86	323	0.65	
MURAENESOCIDAE	1.24	99	0.43	
GOBIIDAE	0.25	248	0.09	
Capros aper	0.12	99	0.04	
Total	286.91		99.63	

PROJECT STATION: 724
DATE:13/11/98 GEAR TYPE: PT No: 2POSITION:Lat N 1760
start stop duration Long W 1616
TIME :06:00:09 06:23:53 24 (min) Purpose code: 1
LOG : 641.75 643.19 1.42 Area code : 1
FDEPTH: 1 0 GearCond.code:
BDEPTH: 41 30 Validity code:
Towingdir: 90ø Wire out: 150 m Speed: 35 kn*10

Sorted: 38 Kg Total catch: 107.15 CATCH/HOUR: 267.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Trachurus trecae	76.50	3040	28.56	1501
Lagocephalus laevigatus	73.38	40	27.39	
Trichiurus lepturus	30.00	130	11.20	
MUGILIDAE	28.75	25	10.73	
Selene dorsalis	13.00	35	4.85	
Campogramma glaycos	10.50	5	3.92	
Decapterus rhonchus	9.50	25	3.55	
Sardinella maderensis	5.50	15	2.05	
Pomadasys peroteti	5.50	10	2.05	
Illex coindetii	4.75	30	1.77	
Sarda sarda	4.00	5	1.49	
Pagellus bellottii	4.00	15	1.49	
Sardinella aurita	2.50	5	0.93	
Sepia officinalis hierredda	2.00	8	0.75	
Scomber japonicus	2.00	10	0.75	
Total	271.88		101.48	

PROJECT STATION: 725
DATE:13/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 1802
start stop duration Long W 1606
TIME :08:33:51 09:03:44 30 (min) Purpose code: 1
LOG : 656.53 658.28 1.75 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 17 16 Validity code:
Towingdir: 155ø Wire out: 130 m Speed: 35 kn*10

Sorted: 76 Kg Total catch: 185.30 CATCH/HOUR: 370.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella maderensis	170.50	630	46.01	1503
Trichiurus lepturus	64.40	200	17.38	
Chloroscombrus chrysurus	38.50	290	10.39	1502
Pomadasys rogeri	25.80	36	6.96	
MULLIDAE	13.50	10	3.64	
Rhinoptera marginata	12.00	10	3.24	
Brachydeuterus auritus	9.50	70	2.56	
Sardinella aurita	7.50	20	2.02	
Selene dorsalis	4.00	20	1.08	
Mustelus mustelus	4.00	10	1.08	
Pomadasys incisus	4.00	10	1.08	
Illex coindetii	3.80	14	1.03	
Lagocephalus laevigatus	3.10	2	0.84	
Decapterus rhonchus	3.00	10	0.81	
Plectorhinchus mediterraneus	2.80	4	0.76	
PORTUNIDAE	2.00	70	0.54	
Octopus vulgaris	1.20	2	0.32	
Trigla lyra	1.00	10	0.27	
Total	370.60		100.01	

PROJECT STATION: 726
DATE:13/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 1827
start stop duration Long W 1613
TIME :16:42:30 17:12:17 30 (min) Purpose code: 1
LOG : 734.12 735.85 1.70 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 19 18 Validity code:
Towingdir: 161ø Wire out: 150 m Speed: 35 kn*10

Sorted: Kg Total catch: 38.45 CATCH/HOUR: 76.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella maderensis	49.20	154	63.98	1505
Chloroscombrus chrysurus	11.10	54	14.43	1504
Pomadasys incisus	6.30	28	8.19	
Diplodus puntazzo	5.20	6	6.76	
Stromateus fiatola	4.70	6	6.11	
Remora sp.	0.40	2	0.52	
Total	76.90		99.99	

PROJECT STATION: 727
DATE:13/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 1830
start stop duration Long W 1621
TIME :18:55:37 19:25:17 30 (min) Purpose code: 1
LOG : 749.57 751.38 1.76 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 43 37 Validity code:
Towingdir: 90ø Wire out: 150 m Speed: 35 kn*10

Sorted: 49 Kg Total catch: 102.00 CATCH/HOUR: 204.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Trachurus trecae	59.10	1656	28.97	1507
Trichiurus lepturus	54.00	348	26.47	
Sardinella maderensis	29.40	66	14.41	1506
Euthynnus alletteratus	20.66	10	10.13	
Pagellus bellottii	10.70	52	5.25	
Lagocephalus laevigatus	9.00	90	4.41	
Illex coindetii	6.90	260	3.38	
Decapterus rhonchus	5.40	30	2.65	
Sardinella aurita	2.70	6	1.32	
MUGILIDAE	2.30	2	1.13	
Scomber japonicus	1.40	6	0.69	
Remora remora	0.80	2	0.39	
Pomadasys incisus	0.60	2	0.29	
Pseudupeneus prayensis	0.60	2	0.29	
Trigla lyra	0.20	2	0.10	
Total	203.76		99.88	

PROJECT STATION: 728
DATE:13/11/98 GEAR TYPE:BT No: 3 POSITION:Lat N 1832
start stop duration Long W 1639
TIME :22:51:23 23:21:20 30 (min) Purpose code: 1
LOG : 777.50 778.98 1.47 Area code : 1
FDEPTH: 332 330 GearCond.code:
BDEPTH: 332 330 Validity code:
Towingdir: 170ø Wire out:1050 m Speed: 30 kn*10

Sorted: 28 Kg Total catch: 197.68 CATCH/HOUR: 395.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Pontinus kuhlii	335.30	6930	84.81	
Merluccius senegalensis	27.30	294	6.91	
Brama brama	11.20	14	2.83	
Parapenaeus longirostris	7.00	504	1.77	
GOBIIDAE	4.20	1540	1.06	
Phycis blennoides	3.50	182	0.89	
Chlorophthalmus atlanticus	2.80	126	0.71	
Pterothrissus belloci	1.40	14	0.35	
Mustelus mustelus	1.40	14	0.35	
Synagrops microlepis	0.70	112	0.18	
MURAENESOCIDAE	0.28	42	0.07	
Illex coindetii	0.28	14	0.07	
Total	395.36		100.00	

PROJECT STATION: 729

DATE:14/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1840
start stop duration Long W 1626
TIME :02:50:02 03:19:53 30 (min) Purpose code: 1
LOG : 806.09 807.88 1.75 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 68 77 Validity code:
Towingdir: 270ø Wire out: 150 m Speed: 40 kn*10

Sorted: 41 Kg Total catch: 168.84 CATCH/HOUR: 337.68

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	100.80	264	29.85	1508
Trichiurus lepturus	72.80	456	21.56	
Sarda sarda	64.00	32	18.95	
Mugil cephalus	62.80	56	18.60	
Campogramma glaycos	17.20	24	5.09	
Auxis thazard	10.00	16	2.96	
Trachurus trecae	6.80	280	2.01	
Lagocephalus laevigatus	0.40	24	0.12	
Loligo vulgaris	0.08	8	0.02	
Total	334.88		99.16	

PROJECT STATION: 730

DATE:14/11/98 GEAR TYPE: PT No: 7 POSITION:Lat N 1845
start stop duration Long W 1619
TIME :05:36:47 06:06:54 30 (min) Purpose code: 1
LOG : 824.80 826.75 1.93 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 19 19 Validity code:
Towingdir: 345ø Wire out: 150 m Speed: 35 kn*10

Sorted: 32 Kg Total catch: 526.30 CATCH/HOUR: 1052.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus rhonchus	465.00	9646	44.18	1509
Brachydeuterus auritus	234.00	1440	22.23	
Pomadasys incisus	100.50	510	9.55	
Pagellus bellottii	87.00	1410	8.27	
Sardinella maderensis	61.50	180	5.84	
Diplodus sargus *	47.30	48	4.49	
Pomadasys rogeri	23.70	18	2.25	
Sarpa salpa	10.50	30	1.00	
Pomadasys jubelini	9.40	14	0.89	
Selene dorsalis	9.20	4	0.87	
Sardinella aurita	3.00	120	0.29	
Illex coindetii	1.50	30	0.14	
Total	1052.60		100.00	

PROJECT STATION: 731

DATE:14/11/98 GEAR TYPE:BT No: 3 POSITION:Lat N 1850
start stop duration Long W 1641
TIME :08:49:17 09:19:19 30 (min) Purpose code: 1
LOG : 851.44 852.90 1.43 Area code : 1
FDEPTH: 167 137 GearCond.code:
BDEPTH: 167 137 Validity code:
Towingdir: 90ø Wire out: 510 m Speed: 30 kn*10

Sorted: 51 Kg Total catch: 429.59 CATCH/HOUR: 859.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius senegalensis	439.20	1264	51.12	
Trichiurus lepturus	118.40	400	13.78	
Synagrops microlepis	103.20	13712	12.01	
Trachurus trecae	89.60	176	10.43	1510
Chlorophthalmus atlanticus	27.20	3072	3.17	
Umbrina canariensis	24.90	54	2.90	
Zeus faber	20.80	176	2.42	
Pterothrissus belloci	16.00	208	1.86	
Dentex congoensis	11.40	18	1.33	
Dentex macrophthalmus	4.80	16	0.56	
Decapterus rhonchus	3.20	16	0.37	
GALATHEIDAE *	1.60	64	0.19	
Helicolenus dactylopterus	1.60	128	0.19	
Capros aper	0.80	128	0.09	
Zenopsis conchifer	0.16	16	0.02	
Citharus linguatula	0.16	16	0.02	
GOBIIDAE	0.16	80	0.02	
Total	863.18		100.48	

PROJECT STATION: 732

DATE:14/11/98 GEAR TYPE: PT No: 7 POSITION:Lat N 1900
start stop duration Long W 1623
TIME :16:27:44 16:58:10 30 (min) Purpose code: 1
LOG : 909.64 911.65 1.95 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 20 25 Validity code:
Towingdir: 270ø Wire out: 150 m Speed: 40 kn*10

Sorted: 68 Kg Total catch: 587.10 CATCH/HOUR: 1174.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	1162.80	2720	99.03	1511
Sardinella maderensis	8.50	16	0.72	
Campogramma glaycos	1.90	2	0.16	
Total	1173.20		99.91	

PROJECT STATION: 733

DATE:14/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1905
start stop duration Long W 1633
TIME :18:51:36 19:21:34 30 (min) Purpose code: 1
LOG : 927.15 928.96 1.81 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 56 64 Validity code:
Towingdir: 293ø Wire out: 150 m Speed: 35 kn*10

Sorted: 65 Kg Total catch: 686.20 CATCH/HOUR: 1372.40

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	954.00	2160	69.51	1512
Sardinella maderensis	254.00	680	18.51	1513
Euthynnus alletteratus	60.90	28	4.44	
Campogramma glaycos	60.00	80	4.37	
Trachurus trecae	28.00	2180	2.04	1514
Illex coindetii	9.30	38	0.68	
Lagocephalus laevigatus	6.00	20	0.44	
Chlorophthalmus atlanticus	0.20	240	0.01	
Total	1372.40		100.00	

PROJECT STATION: 734

DATE:15/11/98 GEAR TYPE: PT No: 1 POSITION:Lat N 1918
start stop duration Long W 1654
TIME :23:42:24 00:12:11 30 (min) Purpose code: 1
LOG : 963.90 965.47 1.55 Area code : 1
FDEPTH: 120 150 GearCond.code:
BDEPTH: 220 794 Validity code:
Towingdir: 120ø Wire out: 400 m Speed: 40 kn*10

Sorted: 1 Kg Total catch: 9.08 CATCH/HOUR: 18.16

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	14.40	4128	79.30	
Merluccius polli	1.20	8	6.61	
Solenocera africana	0.80	1216	4.41	
Synagrops microlepis	0.80	64	4.41	
Parapenaeus longirostris	0.80	192	4.41	
Illex coindetii	0.16	16	0.88	
Total	18.16		100.02	

PROJECT STATION: 735

DATE:15/11/98 GEAR TYPE: PT No: 7 POSITION:Lat N 1924
start stop duration Long W 1645
TIME :02:39:07 03:09:11 30 (min) Purpose code: 1
LOG : 983.18 985.16 1.96 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 17 20 Validity code:
Towingdir: 341ø Wire out: 120 m Speed: 40 kn*10

Sorted: 33 Kg Total catch: 133.24 CATCH/HOUR: 266.48

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus rhonchus	118.40	2688	44.43	1515
Pomadasys incisus	66.40	304	24.92	
Diplodus sargus *	30.00	64	11.26	
Stromateus fiatola	16.00	24	6.00	
Pagellus bellottii	8.80	456	3.30	
Sardinella aurita	8.00	672	3.00	
Engraulis encrasicolus	7.68	1968	2.88	
Arius heudeloti	7.20	8	2.70	
Boops boops	1.60	224	0.60	
Penaeus notialis	1.60	160	0.60	
Penaeus kerathurus	0.80	72	0.30	
Total	266.48		99.99	

PROJECT STATION: 736

DATE:15/11/98 GEAR TYPE: PT No: 4 POSITION:Lat N 1930
start stop duration Long W 1651
TIME :04:28:39 04:58:59 30 (min) Purpose code: 1
LOG : 993.73 995.56 1.83 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 50 65 Validity code:
Towingdir: 270ø Wire out: 150 m Speed: 35 kn*10

Sorted: 29 Kg Total catch: 559.65 CATCH/HOUR: 1119.30

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis encrasicolus	798.00	164910	71.29	
Trichiurus lepturus	138.40	208	12.36	1516
Campogramma glaycos	74.80	88	6.68	
Trachurus trecae	72.00	6840	6.43	
Sarda sarda	21.00	10	1.88	
Auxis thazard	8.00	2	0.71	
Arius heudeloti	5.00	2	0.45	
Stromateus fiatola	1.00	2	0.09	
Total	1118.20		99.89	

PROJECT STATION: 737

DATE:15/11/98 GEAR TYPE:BT No: 3 POSITION:Lat N 1940
start stop duration Long W 1655
TIME :09:27:52 09:42:31 15 (min) Purpose code: 1
LOG :1035.66 1036.45 0.78 Area code : 1
FDEPTH: 27 40 GearCond.code:
BDEPTH: 27 40 Validity code:
Towingdir: 270ø Wire out: 150 m Speed: 30 kn*10

Sorted: 43 Kg Total catch: 728.85 CATCH/HOUR: 2915.40

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Engraulis encrasicolus	2088.00	632340	71.62	1520
Scomberomorus tritor	310.40	72	10.65	
Sardinella aurita	96.00	20160	3.29	1517
Stromateus fiatola	66.00	60	2.26	
Pagellus bellottii	66.00	300	2.26	
Sepia officinalis hierredda	48.00	60	1.65	
Diplodus bellottii	39.00	6900	1.34	
Arius latiscutatus	36.00	60	1.23	
Sardina pilchardus	36.00	10320	1.23	1519
Illex coindetii	30.00	60	1.03	
Mustelus mustelus	26.80	20	0.92	
Trachurus trecae	17.20	1560	0.59	1518
Argyrosomus regius	13.20	4	0.45	
Selene dorsalis	12.00	180	0.41	
Brachydeuterus auritus	6.00	120	0.21	
Trichiurus lepturus	6.00	120	0.21	
Chloroscombrus chrysurus	6.00	720	0.21	
Diplodus sargus *	3.60	4	0.12	
Raja miraletus	3.20	4	0.11	
Psettodes belcheri	3.20	4	0.11	
Solea senegalensis	2.80	4	0.10	
Total	2915.40		100.00	

PROJECT STATION: 738

DATE:15/11/98 GEAR TYPE: PT No: 1POSITION:Lat N 1950
start stop duration Long W 1713
TIME :12:35:23 13:03:04 28 (min) Purpose code: 1
LOG :1062.09 1064.25 2.12 Area code : 1
FDEPTH: 25 25 GearCond.code:
BDEPTH: 75 474 Validity code:
Towingdir: 270ø Wire out: 1 m Speed: kn*10

Sorted: 33 Kg Total catch: 500.05 CATCH/HOUR: 1071.54

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sepia elegans	1060.71	100961	98.99	
Stromateus fiatola	5.14	15	0.48	
Trichiurus lepturus	2.57	4	0.24	
Schedophilus pemarco	1.50	2	0.14	
Remora sp.	1.07	4	0.10	
Sphoeroides spengleri	0.54	4	0.05	
Total	1071.53		100.00	

PROJECT STATION: 739

DATE:15/11/98 GEAR TYPE: PT No: 1POSITION:Lat N 2000
start stop duration Long W 1718
TIME :19:19:09 19:36:55 18 (min) Purpose code: 1
LOG :1117.66 1118.87 1.22 Area code : 1
FDEPTH: 12 12 GearCond.code:
BDEPTH: 35 33 Validity code:
Towingdir: 90ø Wire out: 100 m Speed: 37 kn*10

Sorted: 34 Kg Total catch: 146.20 CATCH/HOUR: 487.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Trichiurus lepturus	186.67	480	38.30	1525
Decapterus rhonchus	72.67	280	14.91	1524
Lichia amia	72.00	13	14.77	
Sepia officinalis hierredda	40.00	920	8.21	
Trachurus trecae	40.00	4373	8.21	1523
Engraulis encrasicolus	34.67	4000	7.11	1522
Sardinella aurita	18.67	3520	3.83	1521
Arius heudeloti	14.67	40	3.01	
Parapenaeus longirostris	0.33	13	0.07	
Total	479.68		98.42	

PROJECT STATION: 740

DATE:15/11/98 GEAR TYPE: PT No: 1POSITION:Lat N 2000
start stop duration Long W 1716
TIME :19:43:09 19:52:38 9 (min) Purpose code: 1
LOG :1119.24 1120.01 0.66 Area code : 1
FDEPTH: 12 12 GearCond.code:
BDEPTH: 31 30 Validity code:
Towingdir: 90ø Wire out: 100 m Speed: 40 kn*10

Sorted: 40 Kg Total catch: 101.15 CATCH/HOUR: 674.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Decapterus rhonchus	188.33	1100	27.93	1527
Trichiurus lepturus	165.00	380	24.47	1526
Scomberomorus tritor	125.00	87	18.54	
Arius heudeloti	55.00	13	8.16	
Engraulis encrasicolus	48.33	7347	7.17	1528
Trachurus trecae	35.00	3700	5.19	1530
Sardinella aurita	33.33	5400	4.94	1529
Sepia officinalis hierredda	15.13	213	2.24	
Illex coindetii	4.13	87	0.61	
Penaeus kerathurus	2.47	13	0.37	
Parapenaeus longirostris	2.47	67	0.37	
Total	674.19		99.99	

PROJECT STATION: 741

DATE:15/11/98 GEAR TYPE: PT No: 1POSITION:Lat N 2000
start stop duration Long W 1715
TIME :19:09:39 20:14:12 11 (min) Purpose code: 1
LOG :1121.03 1121.79 0.76 Area code : 1
FDEPTH: 12 12 GearCond.code:
BDEPTH: 29 28 Validity code:
Towingdir: 90ø Wire out: 100 m Speed: 40 kn*10

Sorted: 40 Kg Total catch: 160.40 CATCH/HOUR: 874.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Trichiurus lepturus	381.82	938	43.64	1531
Sepia officinalis hierredda	130.91	1658	14.96	
Pomadasys incisus	120.00	502	13.72	
Decapterus rhonchus	98.18	393	11.22	1532
Stromateus fiatola	48.00	44	5.49	
Engraulis encrasicolus	26.18	2945	2.99	1533
Trachurus trecae	17.45	1811	1.99	1535
Pomadasys jubelini	16.36	22	1.87	
Illex coindetii	16.36	764	1.87	
Sardinella aurita	8.73	1025	1.00	1534
Lagocephalus laevigatus	4.36	22	0.50	
Arius heudeloti	4.36	22	0.50	
Penaeus notialis	2.18	22	0.25	
Total	874.89		100.00	

PROJECT STATION: 742

DATE:15/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 2004
start stop duration Long W 1713
TIME :22:21:55 22:21:57 10 (min) Purpose code: 1
LOG :1136.78 1137.41 0.63 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 25 25 Validity code:
Towingdir: 160ø Wire out: 130 m Speed: 35 kn*10

Sorted: 31 Kg Total catch: 930.00 CATCH/HOUR: 5580.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Engraulis encrasicolus	2304.00	230400	41.29	1537
Sardinella aurita	2304.00	239040	41.29	1536
Trachurus trecae	432.00	27360	7.74	1538
Pomadasys incisus	228.00	900	4.09	
Scomberomorus tritor	162.00	180	2.90	
Decapterus rhonchus	144.00	360	2.58	
Total	5574.00		99.89	

PROJECT STATION: 743

DATE:16/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 2011
start stop duration Long W 1720
TIME :00:00:16 00:01:19 31 (min) Purpose code: 1
LOG :1151.48 1153.20 1.72 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 26 24 Validity code:
Towingdir: 350ø Wire out: 150 m Speed: 35 kn*10

Sorted: 30 Kg Total catch: 152.25 CATCH/HOUR: 294.68

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Engraulis encrasicolus	135.97	16742	46.14	1541
Trichiurus lepturus	90.48	232	30.70	1539
Decapterus rhonchus	40.65	600	13.79	1540
Stromateus fiatola	14.52	19	4.93	
Pomadasys incisus	7.26	39	2.46	
Sepia elegans	4.84	19	1.64	
Sardinella aurita	0.97	19	0.33	
Total	294.69		99.99	

PROJECT STATION: 744

DATE:16/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 2020
start stop duration Long W 1717
TIME :06:46:51 07:02:53 16 (min) Purpose code: 1
LOG :1206.65 1207.67 1.00 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 33 32 Validity code:
Towingdir: 89ø Wire out: 130 m Speed: 35 kn*10

Sorted: 40 Kg Total catch: 9975.00 CATCH/HOUR: 37406.25

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Engraulis encrasicolus	20437.50	1387500	54.64	1542
Sardinella aurita	10125.00	503438	27.07	1543
Campogramma glaycos	3468.75	2813	9.27	
Scomberomorus tritor	3375.00	938	9.02	
Total	37406.25		100.00	

PROJECT STATION: 745

DATE:16/11/98 GEAR TYPE: PT No: 7POSITION:Lat N 2026
start stop duration Long W 1705
TIME :09:13:20 09:43:29 30 (min) Purpose code: 1
LOG :1223.36 1225.07 1.69 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 24 26 Validity code:
Towingdir: 7ø Wire out: 130 m Speed: 35 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

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

PROJECT STATION: 746

DATE:16/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 2030
start stop duration Long W 1726
TIME :12:24:25 12:55:13 31 (min) Purpose code: 1
LOG :1249.19 1250.93 1.71 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 59 50 Validity code:
Towingdir: 90ø Wire out: 150 m Speed: 37 kn*10

Sorted: Kg Total catch: 107.60 CATCH/HOUR: 208.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Trichiurus lepturus	99.68	132	47.86	1546
Sardinella aurita	87.58	81	42.05	1544
Sardinella maderensis	8.13	35	3.90	1545
Loligo vulgaris	5.42	8	2.60	
Schedophilus pemarco	3.39	10	1.63	
Sarda sarda	3.10	2	1.49	
Lagocephalus laevigatus	0.97	2	0.47	
Total	208.27		100.00	

PROJECT STATION: 747

DATE:16/11/98 GEAR TYPE: PT No: 3POSITION:Lat N 2040
start stop duration Long W 1739
TIME :16:59:23 17:11:53 13 (min) Purpose code: 1
LOG :1280.86 1281.67 0.79 Area code : 1
FDEPTH: 25 25 GearCond.code:
BDEPTH: 131 103 Validity code:
Towingdir: 90ø Wire out: 150 m Speed: 40 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

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

PROJECT STATION: 748

DATE:16/11/98 GEAR TYPE: PT No: 4POSITION:Lat N 2040
start stop duration Long W 1731
TIME :19:03:25 19:23:24 20 (min) Purpose code: 1
LOG :1291.00 1292.28 1.25 Area code : 1
FDEPTH: 10 10 GearCond.code:
BDEPTH: 73 76 Validity code:
Towingdir: 270ø Wire out: 150 m Speed: 35 kn*10

Sorted: 32 Kg Total catch: 64.00 CATCH/HOUR: 192.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT.	C SAMP
Sardinella aurita	180.00	402	93.75	1546
Trichiurus lepturus	11.70	18	6.09	
Total	191.70		99.84	

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.

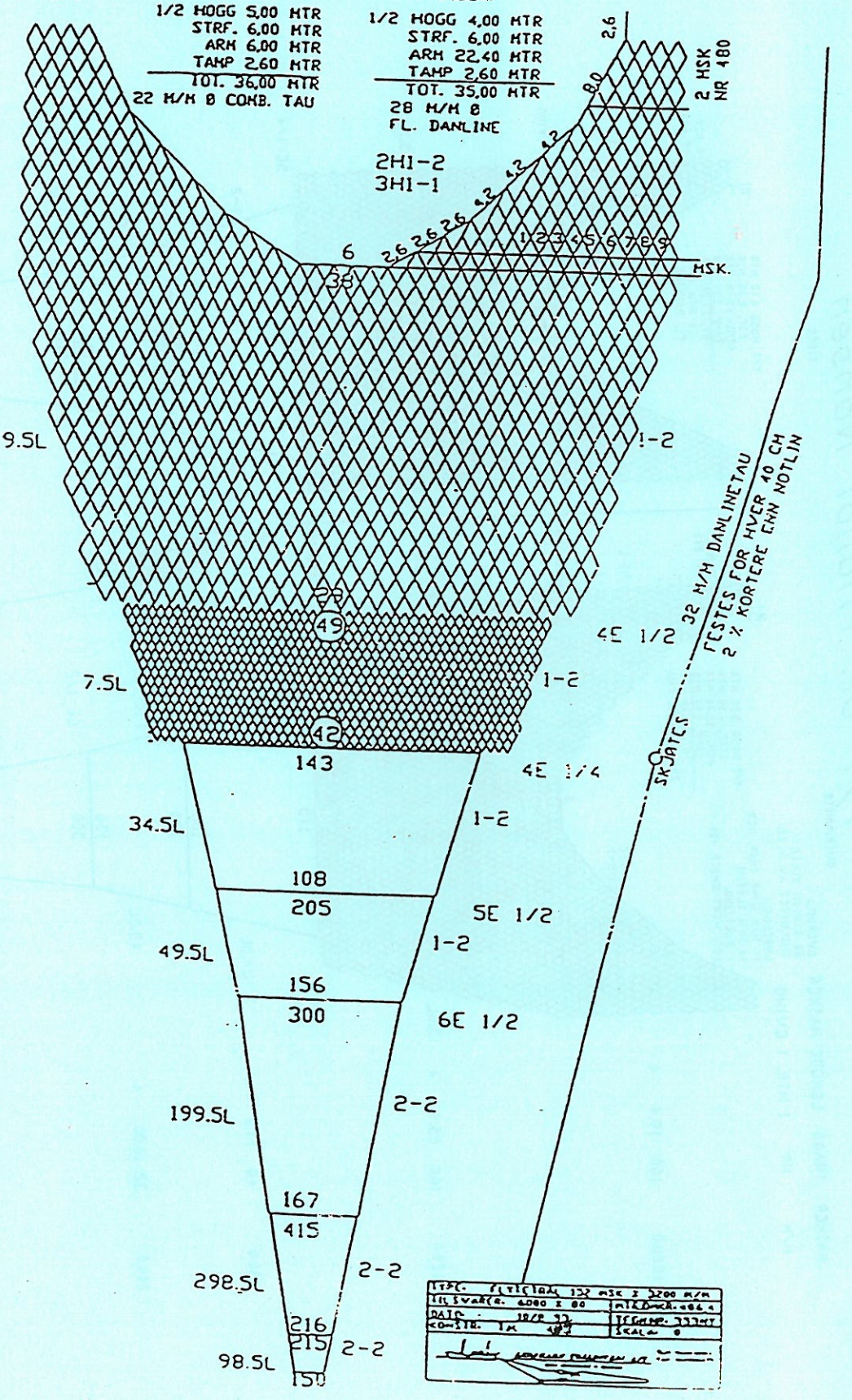
F/F Dr. Fridtjof Nansen

OVER/UNDER/SIDER

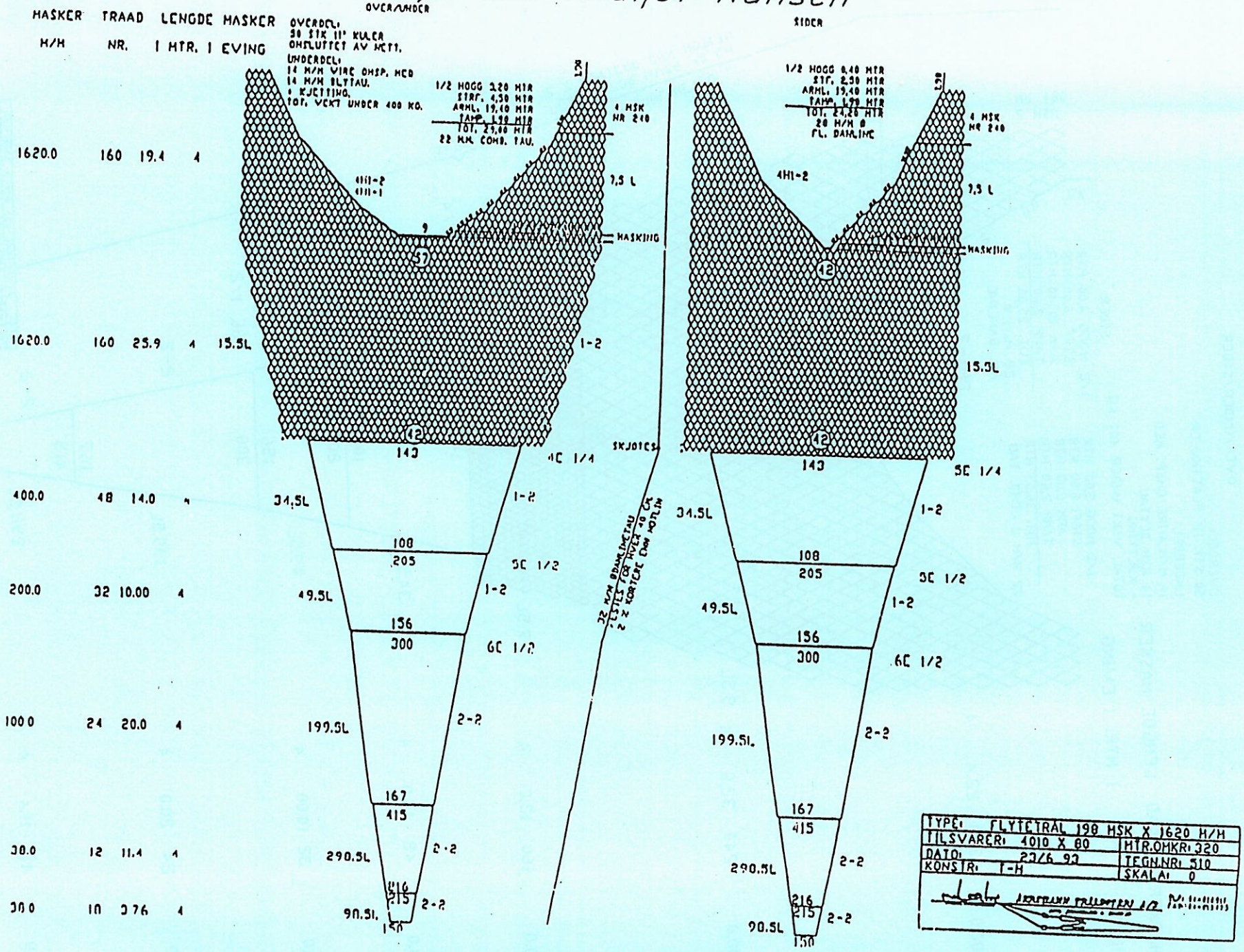
OVERDEL:
50 STK 11" PLASTKULER

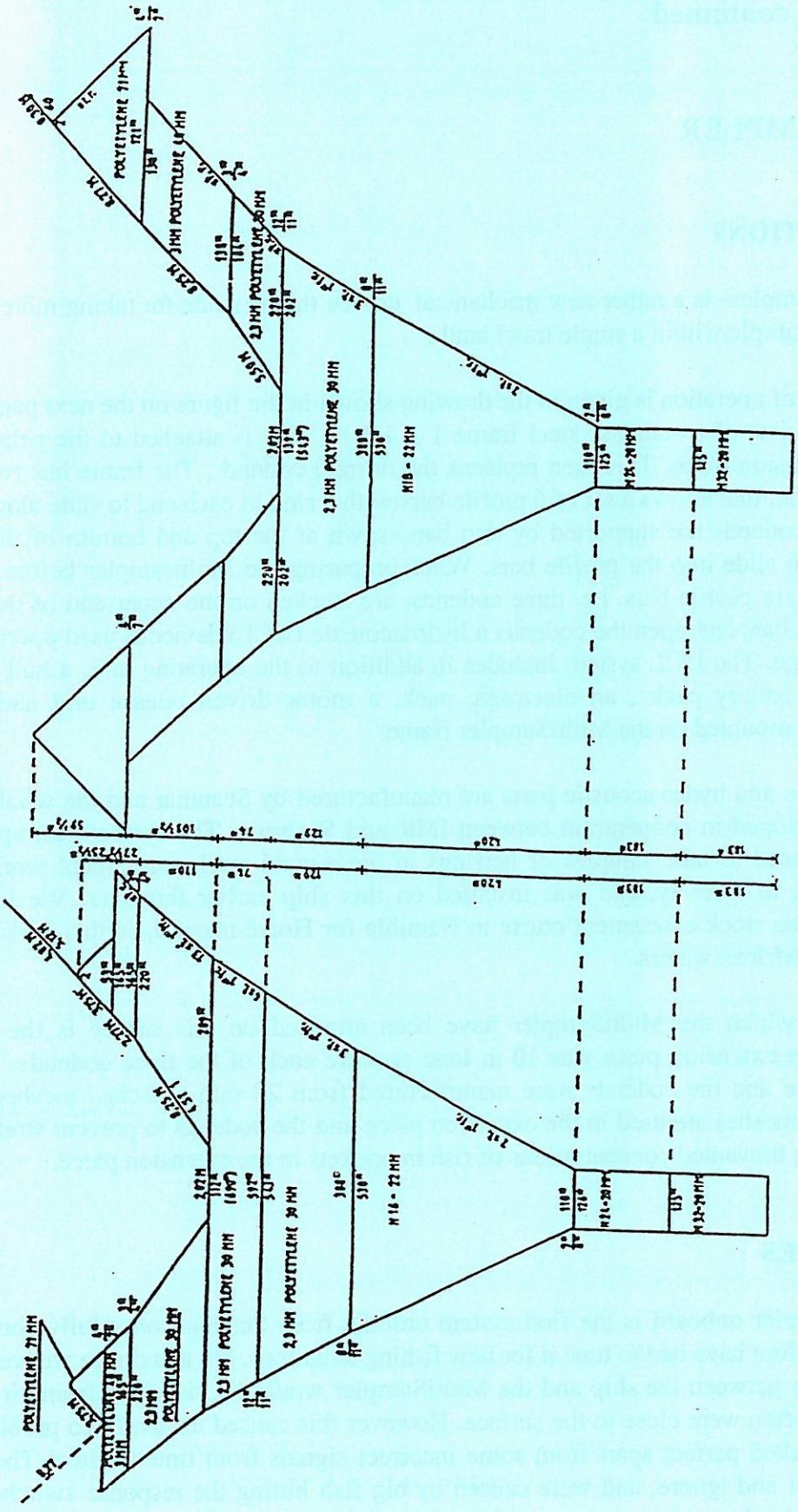
UNDERDEL
14 M/M WIRE OMSP. MED
14 M/M BLYTAU
+ KJETTING.
TOTAL VEKT UNDER 400 KG.

MASKER M/M	TRAAD NR.	LENGDE MASKER I MTR.	I EVING
3200.0	240	22.4	4
3200.0	240	32.0	4
1620.0	160	13.0	4
400.0	48	14.0	4
200.0	32	10.00	4
100.0	24	20.0	4
38.0	12	11.4	4
38.0	18	3.76	4



F/F Dr. Fridtjof Nansen





Bottom trawl: High opening shrimp and fish trawl with net headline 31m (floatline), footrope 47m, gear with 12 cm diameter roller disks, 40 m sweeps, estimated headline hight 6m and distance between wings during towing 18-20m.

ANNEX II continued

MULTISAMPLER

SPECIFICATIONS

The «MultiSampler» is a rather new mechanical device that is made for taking more than one discrete fish sample within a single trawl haul .

The principle of operation is given in the drawing shown in the figure on the next page.
It mainly consists of a stainless steel frame 1 x 1.3 m that is attached to the pelagic trawl using an extension piece. This then replaces the normal codend . The frame has two shafts, one at each side, that allows a set of 6 profile bars with a ring in each end to slide along them. The 4 panel codends are supported by two bars, sewn at the top and bottom of the mouth. These are then slide into the profile bars. When preparing the Mulitsampler before shooting the trawl, the six profile bars, i.e. three codends, are stacked on the upper end of the shafts . To release the bars and open the codends a hydroacoustic (HCL) device is used operated from the ships bridge. The HCL system includes in addition to the operating unit, a hull mounted transducer, a battery pack , an electronic pack, a motor driven release unit and another transducer are mounted on the MultiSampler frame.

The electronics and hydro acoustic parts are manufactured by Scanmar and the whole system has been developed in cooperation between IMR and Scanmar. The system has, up to, now mainly been used to take samples of herrings in the annual stock assessment work in The Vestfjord area in Norway, and was installed on this ship earlier this year. We have then utilised it at one stock assessment cruise in Namibia for Horse-macrell, so this cruise will be the second in African waters.

The trawl in which the MultiSampler have been attached on this survey is the smallest «Åkratrål» The extension piece was 10 m long as were each of the three codends. Both the extension piece and the codends were manufactured from 24 mm stretched meshed, thread no.14. Square meshes are used in the extension piece and the codends to prevent stretching of the net causing unwanted concentrations of fish in pockets in the extension piece.

EXPERIENCES

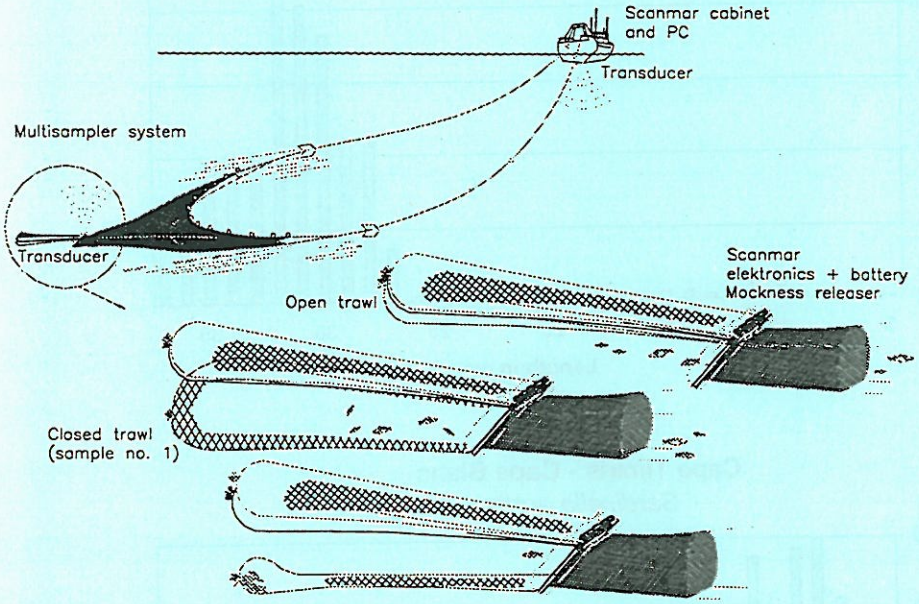
The MultiSampler onboard is the first system ordered from Scanmar on a fully commercial basis, we therefore have had to tune it for new fishing situations. On this cruise we were afraid that the signals between the ship and the MultiSampler would be disturbed from air-bubbles since the fish often were close to the surface. However this caused us nearly no problems and the system worked perfect apart from some incorrect signals from time to time. These were easy to sort out and ignore, and were caused by big fish hitting the response switches while entering the codend.

Some small handling problems occurred on deck when we had big catches, but this will probably be solved after some experience with the system. We still will consider to do some adjustments on the mechanical- and netparts to make it easier to empty the codends.

CONCLUSIONS

The MultiSampler gives the trawl the opportunity to go through fish layers without getting anything of it into the codend during the flushing period and is one of the benefits for using this type of gear.

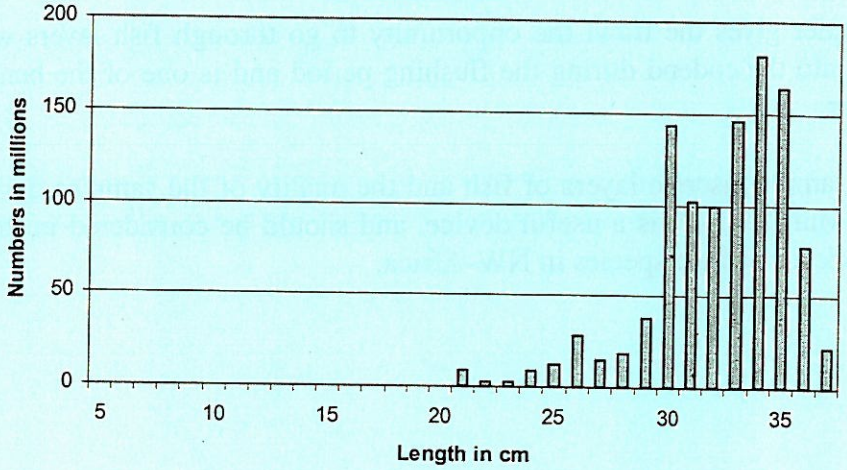
The ability to sample discrete layers of fish and the quality of the samples during this cruise show that the MultiSampler is a useful device, and should be considered in the future stock assessment work for pelagic species in NW-Africa.



Annex III Pooled length distributions by species and regions

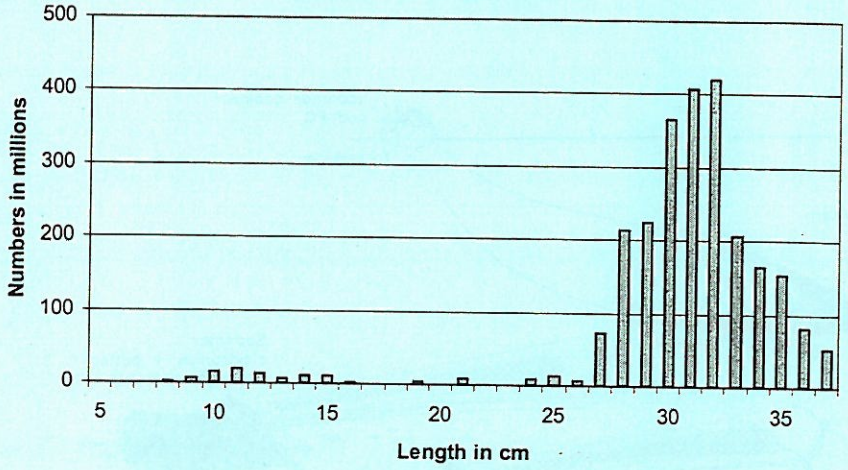
St. Louis - Cape Timiris

Sardinella aurita



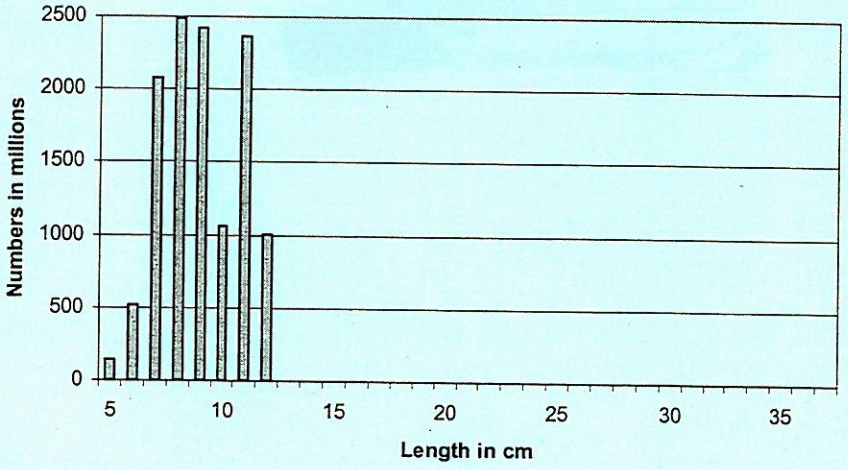
St. Louis - Cape Timiris

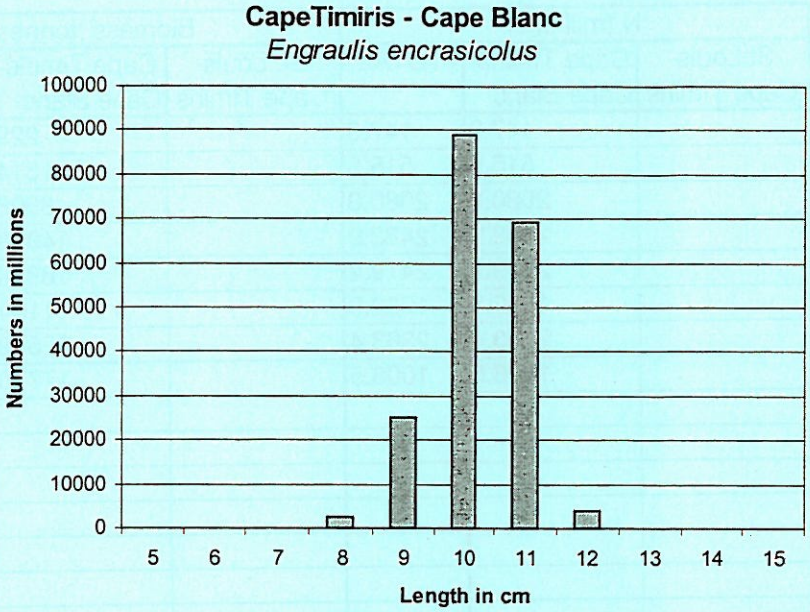
Sardinella maderensis



Cape Timiris - Cape Blanc

Sardinella aurita




CapeTimiris - Cape Blanc
Engraulis encrasicolus
Numbers in millions
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
5
6
7
8
9
10
11
12
13
14
15
Length in cm

Annex IV Stock length distribution by numbers and weight

Mauritania 1998

Sardinella aurita

	N (millions)			Biomass (tonnes)		
Length cm	St.Louis-Cape Timiris	Cape Timiris-Cape Blanc	TOTAL	St. Louis-Cape Timiris	Cape Timiris-Cape Blanc	TOTAL
5		147.3	147.3		229	229
6		515.5	515.5		1314	1314
7		2080.0	2080.0		8096	8096
8		2483.9	2483.9		14003	14003
9		2419.2	2419.2		18956	18956
10		1062.3	1062.3		11194	11194
11		2363.4	2363.4		32599	32599
12		1006.5	1006.5		17770	17770
13						
14						
15						
16						
17						
18						
19						
20						
21	8.9		8.9	784		784
22	2.7		2.7	270		270
23	2.7		2.7	307		307
24	8.9		8.9	1154		1154
25	12.5		12.5	1820		1820
26	28.1		28.1	4586		4586
27	15.3		15.3	2785		2785
28	18.2		18.2	3685		3685
29	38.0		38.0	8515		8515
30	143.6		143.6	35549		35549
31	102.2		102.2	27818		27818
32	99.5		99.5	29704		29704
33	145.9		145.9	47649		47649
34	181.3		181.3	64625		64625
35	164.1		164.1	63630		63630
36	77.5		77.5	32653		32653
37	22.1		22.1	10084		10084
TOTAL	1071.4	12078.3	13149.7	335620	104160	439780

Annex IV continued

Mauritania 1998

Sardinella maderensis

	N (millions)			Biomass (tonnes)		
Length cm	St.Louis-Cape Timiris	Cape Timiris-Cape Blanc	TOTAL	St. Louis-Cape Timiris	Cape Timiris-Cape Blanc	TOTAL
5						
6						
7	0.6		0.6	2		2
8	1.7		1.7	10		10
9	6.2		6.2	49		49
10	15.3		15.3	161		161
11	20.4		20.4	281		281
12	13.1		13.1	231		231
13	7.7		7.7	171		171
14	11.7		11.7	322		322
15	11.3		11.3	376		376
16	3.3		3.3	132		132
17	0.9		0.9	45		45
18						
19	3.6		3.6	235		235
20	0.5		0.5	36		36
21	8.9		8.9	784		784
22						
23						
24	9.4		9.4	1215		1215
25	14.3		14.3	2081		2081
26	7.2		7.2	1183		1183
27	73.1		73.1	13321		13321
28	213.8		213.8	43276		43276
29	224.0		224.0	50224		50224
30	366.7		366.7	90746		90746
31	408.4		408.4	111198		111198
32	419.8		419.8	125379		125379
33	207.8		207.8	67895		67895
34	164.3		164.3	58544		58544
35	153.2		153.2	59415		59415
36	81.0		81.0	34092		34092
37	52.4		52.4	23904		23904
TOTAL	2500.5	0.0	2500.5	685307	0	685307