

**SURVEY OF THE PELAGIC FISH RESOURCES OFF
NORTH WEST AFRICA**

Part I

**SENEGAL - THE GAMBIA
30 October - 9 November 2005**

**Centre de Recherches Océanographiques de Dakar-Thiaroye
Dakar, Senegal**

**Institute of Marine Research
Bergen, Norway**

**Department of Fisheries
Banjul, the Gambia**

CRUISE REPORTS 'DR FRIDTJOF NANSEN'

**SURVEY OF THE PELAGIC FISH RESOURCES OFF
NORTH WEST AFRICA**

Part I

**SENEGAL - THE GAMBIA
25 October - 3 November 2005**

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CHAPTER 1 INTRODUCTION

1.1 Objective of the cruise

The general objectives of the survey were to estimate 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 in the region over a period of 50 days, in November-December 2005. For Senegal and The Gambia the agreed objectives were as follows:

- To map the distribution and estimate the biomass for the main small pelagic fish using hydro-acoustic methods. The species of interest were: sardinellas (*Sardinella aurita*) and (*Sardinella maderensis*), horse mackerel (*T. trecae*), 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.
- Collect biological data and otoliths of the main target species, especially *Sardinella aurita*, *S. maderensis* and *T. trecae*.
- To sample standard hydrographical transects for temperature, salinity and oxygen at every degree latitude, at about 12°40'N, 13°40'N, 14°50'N and 15°50'N and additionally at the 50 m and 200 m isobath every 20 NM.
- To train local participants in acoustic survey methodology including fish identification and sampling, scrutinizing of echograms, hydrographic sampling and abundance estimation.
- Conduct a parallel survey with the Senegalese R.V. "Itaf Deme". This includes inter-calibration experiments and comparisons of trawl catches.

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

1.2 Participation

Participating scientists were:

Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT), Senegal:

 Serigne Sylla (Senegalese team leader), Moise Biagui, Amadou Fallou Niang And
 Ibra Fall

Department of Fisheries (FD), The Gambia:

 Juldah Jallow (Gambian team leader), Sabena Mendy And Abdoulie Njie

Institut Mauritanien de Recherches Océanographiques et des Pêches (CNROP), Mauritania:

 Ibra Diallo

Institut National de Recherche Halieutique (INRH), Morocco:

 Lahcen Aboubdelah

Centre National des Sciences Halieutique de Boussoura (CNSHB), Guinea:

 Amadou I Bah

Institute of Marine Research (IMR), Norway:

 Jens-Otto Krakstad (Cruise Leader), Magne Olsen, Thor Egil Johannson and Ole
 Sverre Fossheim

1.3 Narrative

The survey was supposed to start on the 30/10-2005 from Dakar, but the vessel only left port at 12:30 GMT (GMT=local time) on the 31/10 due to technical problems. The survey started at the border between Guinea Bissau and Senegal (240 degree on Cape Roxo, Casamance) at 02:00 the following morning. The Senegalese research vessel “Itaf Deme” started the survey simultaneously from a position 1 nm south of “Dr. Fridtjof Nansen”. The southern border between Senegal and the Gambia (270° at 13°03’N) was reached on the 2/11 at 03:45, while the northern border of the Gambia (270° at 13°35’5’’N) was reached on the 1/11, at 23:00. A large detour was taken outside the Saloum River because an international naval exercise blocked our regular survey track. Cape Vert was reached on the 5/11 at 21:00, before the regular survey ended at St Louis at the border to Mauritania on the 7/11 at 21:00. Returning to Dakar an intercalibration exercise was conducted before the vessel returned to port in Dakar on the 8/11 at 15:00. The course track and fishing stations are shown in Figure 1, while

Table 1 shows survey effort during the survey, including number of trawl stations and CTD casts.

During all surveys in the region a common strategy has been adapted with systematic parallel course tracks spaced 10 NM (nautical miles) apart, perpendicular to the depth isobaths. 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. Pelagic trawl with floats was often used to catch fish close to the surface. A smaller pelagic trawl or the bottom trawl with floats was used for sampling pelagic fish in shallow waters (depth less than 25 m).

Four Crossshelf hydrographic transects were carried out, at Casamance, off the Gambia, at Cape Vert and at St. Louis – south.

All data collected during the survey were made available to the participants.

Table 1. Summary of survey effort by regions, including number of demersal (BT) and pelagic (PT) trawl hauls, CTD casts, and distance surveyed (log), disregarding the steaming from Cape Vert to Casamance and from St. Louis to Cape Vert (log).

Area	BT	PT	Total trawls	CTD casts	Log (NM)
Casamance to St. Louis	14	24	38	48	1550

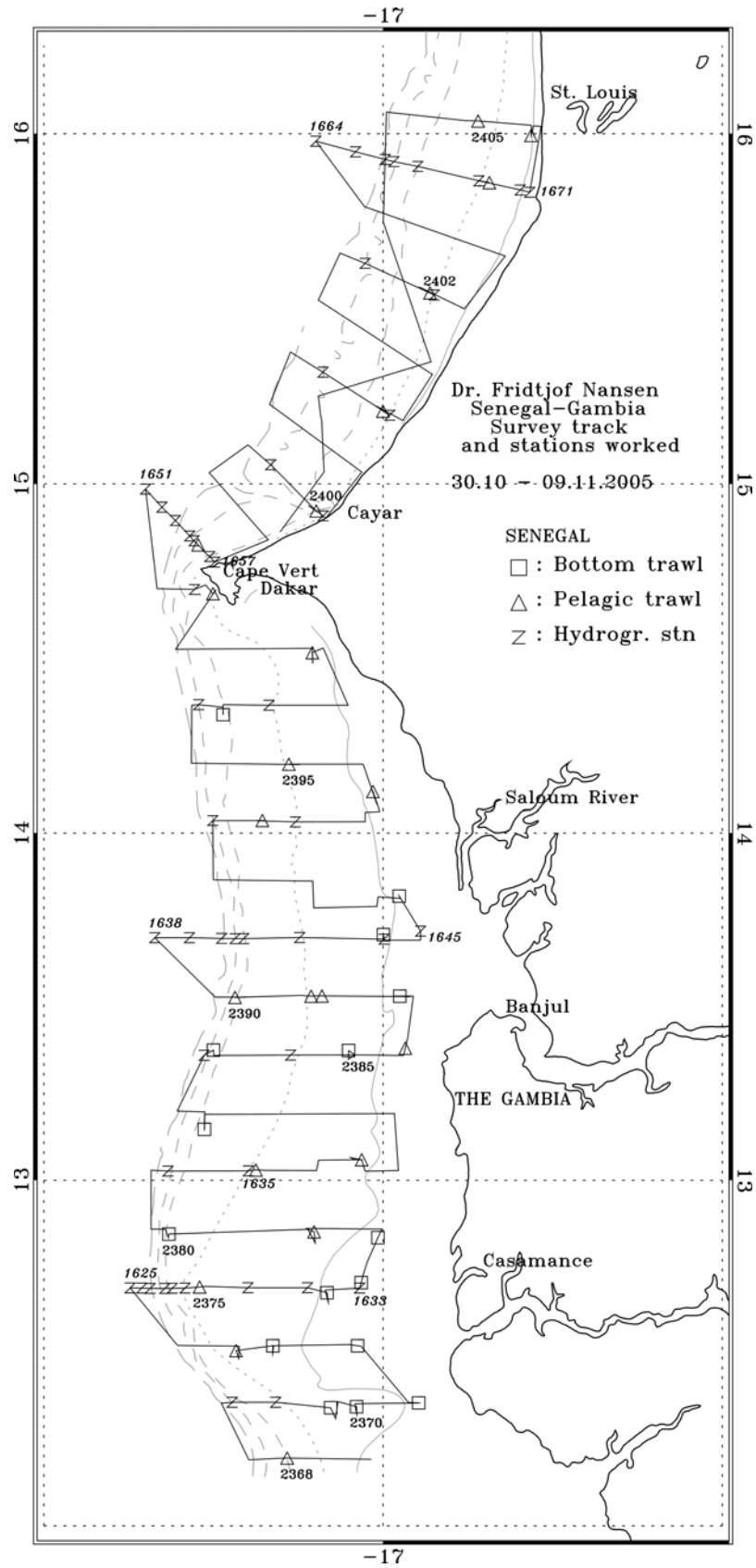


Figure 1. Course tracks with fishing and hydrographical stations; Casamance to St. Louis.

CHAPTER 2 METHODS

2.1 Environmental Data

CTD-profiling

A Seabird 911+ CTD probe was used to obtain vertical profiles of the temperature, salinity and oxygen. Real time logging was carried out using the PC based Seabird Seasave Software. CTD casts were conducted along the cruise track in transects at about every one degree latitude and at fixed stations every 50 m and 200 m depth every 20 NM. The casts were stopped a few meters above the bottom, and at a maximum of 500 m depth. Two water samples, one near the surface and one near the bottom, were collected using *Niskin* bottles at stations corresponding to the standard profiles. The samples were analysed for dissolved oxygen using the Winkler method in order to calibrate the oxygen sensor. Salinity of water samples was used to calibrate the salinity sensor using the Guildline Portasal salinometer. The salinity sensor on the CTD was stable and it was not necessary to apply any correction factor.

The oxygen sensor was calibrated during the survey. A total of 20 samples were accepted for oxygen calibration. A linear regression of the Winkler determinations on the CTD values produced the correction:

$$O_{2\text{corrected}} = a \cdot O_{2\text{recorded}} + b \quad (1)$$

were $a=1.0504$ and $b=-0.0581$

Meteorological observations

Meteorological data logged from the Aanderaa meteorological station included wind direction and speed, air temperature, incident solar intensity and sea surface temperature (SST). All data were averaged by unit distance sailed (1 NM).

Thermosalinograph

The SBE 21 Seacat thermosalinograph was running routinely during the survey. Obtaining samples of sea surface salinity and relative temperature (5 m depth) every 10 sec during the survey.

Current speed and direction measurements (ADCP)

The ship-born Acoustic Doppler Current Profiler (ADCP) from RD Instruments was running throughout the survey. The ADCP was set to external trigger, triggered by the EK 500 system. The depth cell interval set to 3 m and the number of cells was set to 120.

2.2 Biological sampling

Biological sampling of the fish was carried out using trawls. A 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 shallow waters (depth less than 25 m). Annex II gives a description of the instruments and the fishing gear used. All catches were sampled for composition by weight and numbers of each species caught. Species identification was based on the FAO Species Guides. Length frequency distributions, by total fish length in cm, of the selected target species were recorded at all the stations where they were present. Individual weight measurements were taken regularly to estimate the condition factor in the length-weight relationship:

$$\bar{w} = \frac{cond}{100} \cdot L^3$$

The specific condition factors obtained from the samples and applied for this survey were: 0.96 for sardinellas and *Trachurus trecae*.

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 (to calculate the mean length of this length group) were applied. The target groups used for Senegal and The Gambia can be found in Table 2, while the complete records of fishing stations and catches are shown in Annex I.

Table 2. Allocation of acoustic densities to taxii. Note that for the groups of sardinella, horse mackerel, and sardine all encountered species are listed, while only examples are listed for the remaining groups.

Group	Taxon	Species
Sardinella	<i>Sardinella</i> sp.	<i>S. aurita</i> <i>S. maderensis</i>
Horse mackerel	<i>Trachurus</i> sp.	<i>T. trecae</i> <i>T. trachurus</i>
Sardine	Sardinops	<i>S. pilchardus</i>
Pelagic species 1	Clupeiformes ₁	<i>Ilisha africana</i> <i>Engraulis encrasicolus</i>
Pelagic species 2	Carangidae ₂	<i>Selene dorsalis</i> <i>Chloroscombrus chrysurus</i> <i>Decapterus rhonchus</i> <i>Alectis alexandrinus</i>
Little tuny	Scombridae	<i>Euthynnus alletteratus</i> <i>Sarda sarda</i> <i>Scomber japonicus</i>
	Sphyraenidae	<i>Sphyraena guachancho</i> <i>Trichiurus lepturus</i>
	Others	<i>Zeus faber</i>
Other demersal species	Sparidae ₃	<i>Dentex angolensis</i> <i>D. macrophthalmus</i> <i>D. congoensis</i> <i>D. canariensis</i> <i>D. barnardi</i> <i>Pagellus bellottii</i> <i>Sparus caeruleostictus</i> <i>S. pagrus africanus</i>
Big-eye grunt	Other taxii	<i>Pseudupeneus prayensis</i> <i>Brachydeuterus auritus</i> <i>Arioma bondi</i> <i>Pomadasys incisus</i> <i>Galeoides decadactylus</i>
Mesopelagic species	Myctophidae ₃ Other mesopelagic fish	
Plankton	Calanoidae	<i>Calanus</i> sp.
	Euphausiidae	<i>Meganyctiphanes</i> sp.
	Other plankton	

1: other than *Sardinops* sp.; 2: other than *Trachurus* sp.; 3: main taxon in group.

2.3 Acoustic sampling

A SIMRAD EK500 Echosounder was used with the settings as shown in Annex II. The Bergen Integrator (BEI) was used for analysis and allocation of the integrated s_A -values to the individual specified target groups by 5 NM intervals. The allocation of values to target groups was based on a combination of a visual scrutiny of the behaviour pattern as deduced from echo diagrams, the BEI analysis, and the catch compositions.

In cases where the target category of fish contains more than one species (sardinellas and *Trachurus trecae*), the mean s_A -value allocated to the category is divided between the species in the same ratio as their contribution to the mean back scattering strength in the length frequency samples.

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:

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

Which can be converted (see Toresen *et al.* 1998 for details) to the area form (scattering cross sections of acoustic targets):

$$C_{Fi} = 1.26 \cdot 10^6 L^{-2}$$

where L is total length in 1 cm length group i and C_{Fi} (m^{-2}) is the reciprocal back scattering strength, or so-called fish conversion factor. In order to split and convert the allocated s_A -values (m^2/NM^2) to fish densities (numbers per length group per NM^2), the following formula was used:

$$\rho_i = s_A \cdot \frac{p_i}{\sum_{i=1}^n \frac{p_i}{C_{Fi}}}$$

where

ρ_i = density of fish in length group i

s_A = mean integrator value

p_i = proportion of fish in length group i

$\sum_{i=1}^n \frac{p_i}{C_{Fi}}$ = the relative back scattering cross section (m^2) of the length frequency sample of the

target species, and

C_{fi} = reciprocal back scattering cross section (σ_{bs}^{-1}) of a fish in length group i .

The integrator outputs were split in 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) horse mackerel, 3) carangids and associated species, and 4) demersal fish.

The above equations show that the conversion from s_A -values to number of fish is dependent on the length composition of the fish. It is therefore important to get representative length distributions from the stock in the whole distribution area.

When the size classes (of e.g. young fish and older fish) are well mixed, the various length distributions can be pooled together with equal importance. Otherwise, when the size classes are segregated, the total distribution area has to be post-stratified, according to the length distributions, and separate estimates are made for the regions containing fish with equal size.

For a region representing a distribution of a target-specie, the following basic data are needed for the estimation of abundance;

- 1) the average s_A -value for the region,
- 2) the surface (usually square nautical miles, NM^2), and
- 3) a representative length distribution of the fish in the region.

If the targeted fish is a mixture of more than one species, for example sardinellas, a representative distribution of the two, within the region, as shown in the trawl catches, are used. A length distribution representing the number of the two species for each catch will have to be calculated. Thereafter, these distributions have to be normalized to a unit number (usually 100) so they are equally weighted.

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 samples of the species in the category (e.g. sardinellas) are respectively pooled together with equal importance (normalized).

The mean back scattering strength (ρ/s_A) of each length frequency distribution of the target species is calculated and summed. This is automatically done in the Excel spread-sheet made available for acoustic abundance estimation onboard RV “Dr. Fridtjof Nansen”, provided the data are punched in this sheet.

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

The pooled length distribution is used, together with the mean s_A -value, to calculate the density (numbers per square NM) by length groups and species, 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 then converted to biomass using the estimated weight at length.

2.4 Parallel survey with R.V. “Itaf Deme”

During the survey the Senegalese research vessel “Itaf Deme” did a parallel survey with “Dr. Fridtjof Nansen”. As part of this, parallel trawl hauls were conducted with regular intervals, as well as acoustic intercalibration between the vessels. The strategy for the intercalibration followed the recommendations by MacLennan and Simmons (1992).

One research vessel placed itself 0.5 NM behind and 0.5 NM to the side of the other vessel that took the lead. The distance between the vessels were chosen so that the vessels could stay as close together as possible without disturbing each other’s acoustic recordings. Starting time and log were recorded onboard each vessel and the distance between vessels was kept constant during the experiment.

All data collected during the parallel survey and intercalibration will be analysed on land and a separate report will be produced from the exercise.

CHAPTER 3 SURVEY RESULTS

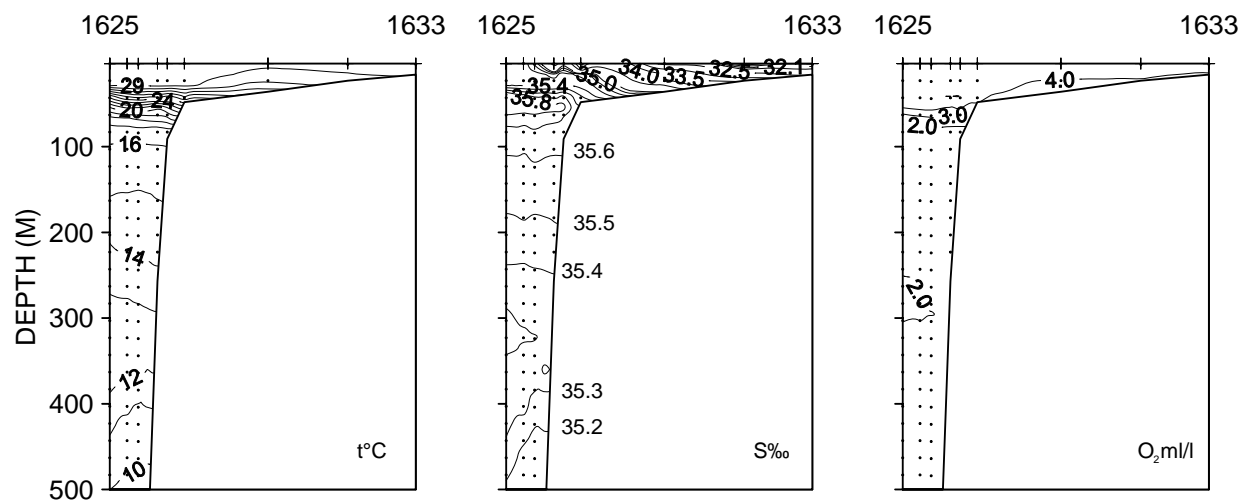
3.1 Hydrography

Hydrographical data was collected on fixed CTD stations to 500 m depth and from the Thermosalinograph and the Aanderaa weather station that continuously collect sea surface temperature, wind speed and direction, solar radiation, etc. during the survey.

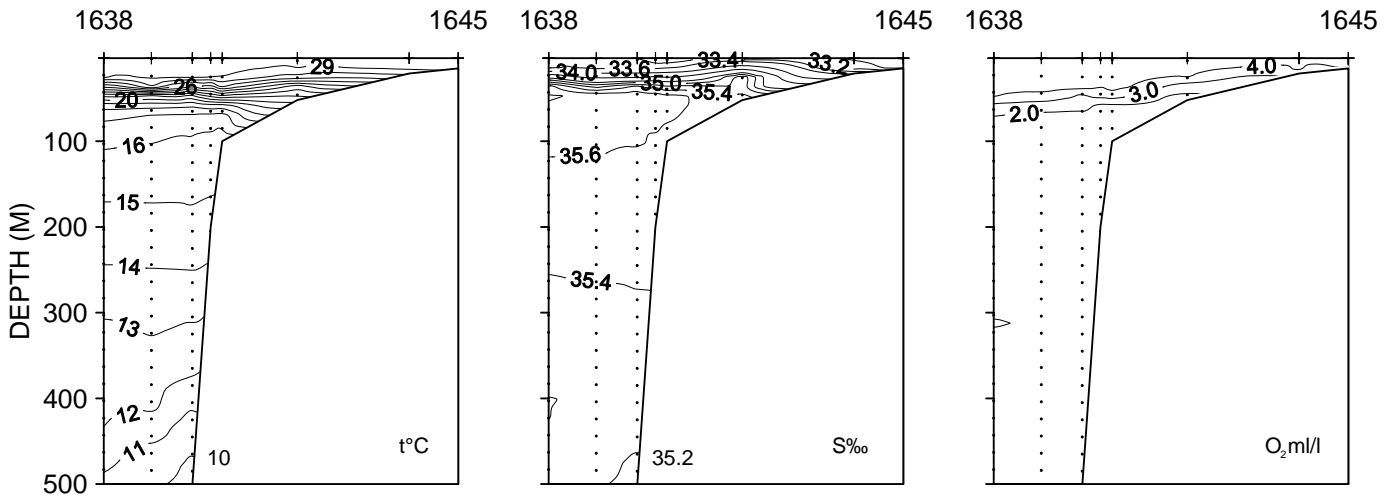
Cross shelf hydrographical profiles

Figure 2 shows the distribution of temperature, salinity and oxygen from the four hydrographical transects collected during the survey. The situation was similar to last year. The temperature layers were clearly stratified, with warm surface waters and a thermocline around 30-50 m depth. And minimum temperature of 11°C was observed around 500 m depth. Slightly more mixed conditions were experienced inshore at St. Louis. The salinity profiles showed strong influence of freshwater inshore, particularly in the Casamance area and off St. Louis. Maximum salinities were experienced at the shelf break around 100 m depth, with maximum salinities between 35.6 ‰ to 35.8 ‰. Salinity around 500 m was around 35.2 ‰. The water masses in the survey area was well oxygenated with oxygen concentrations in the surface layer >4 ml O₂/l decreasing to 2.0 ml/l oxygen between 50 – 100 m depth.

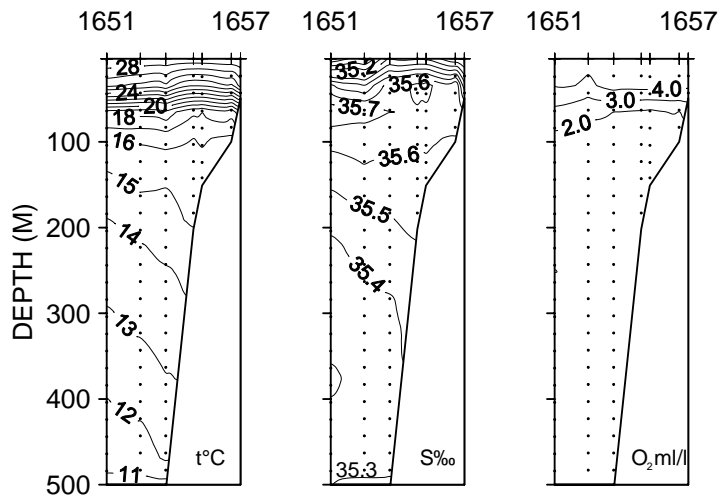
CASAMANCE



THE GAMBIA WEST



CAPE VERT



ST. LOUIS – SOUTH

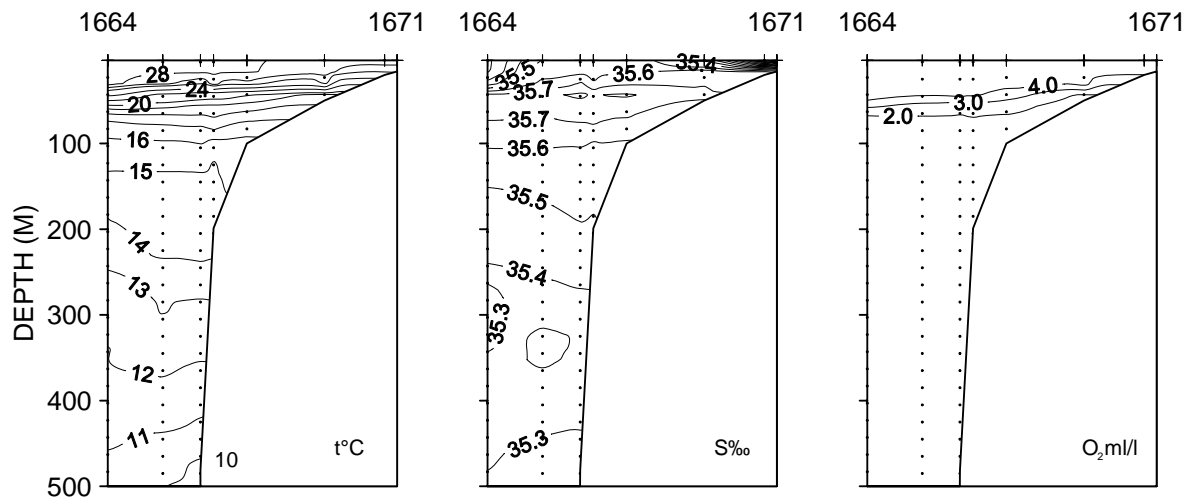


Figure 2. Hydrographical profiles with distribution of temperature, salinity and oxygen off Casamance, 13°40'N - The Gambia, c) Cape Vert, St. Louis - South

Along shelf profiles

Along shelf profiles of temperature, salinity and oxygen was created from the 200 m depth CTD stations collected at every 20 NM during the survey. Only the temperature plots are shown in Figure 3. The figures show the relatively high sea surface temperature especially in the area between St. Louis and Cape Vert (29°C), and the intrusion of cooler water masses at St. Louis.

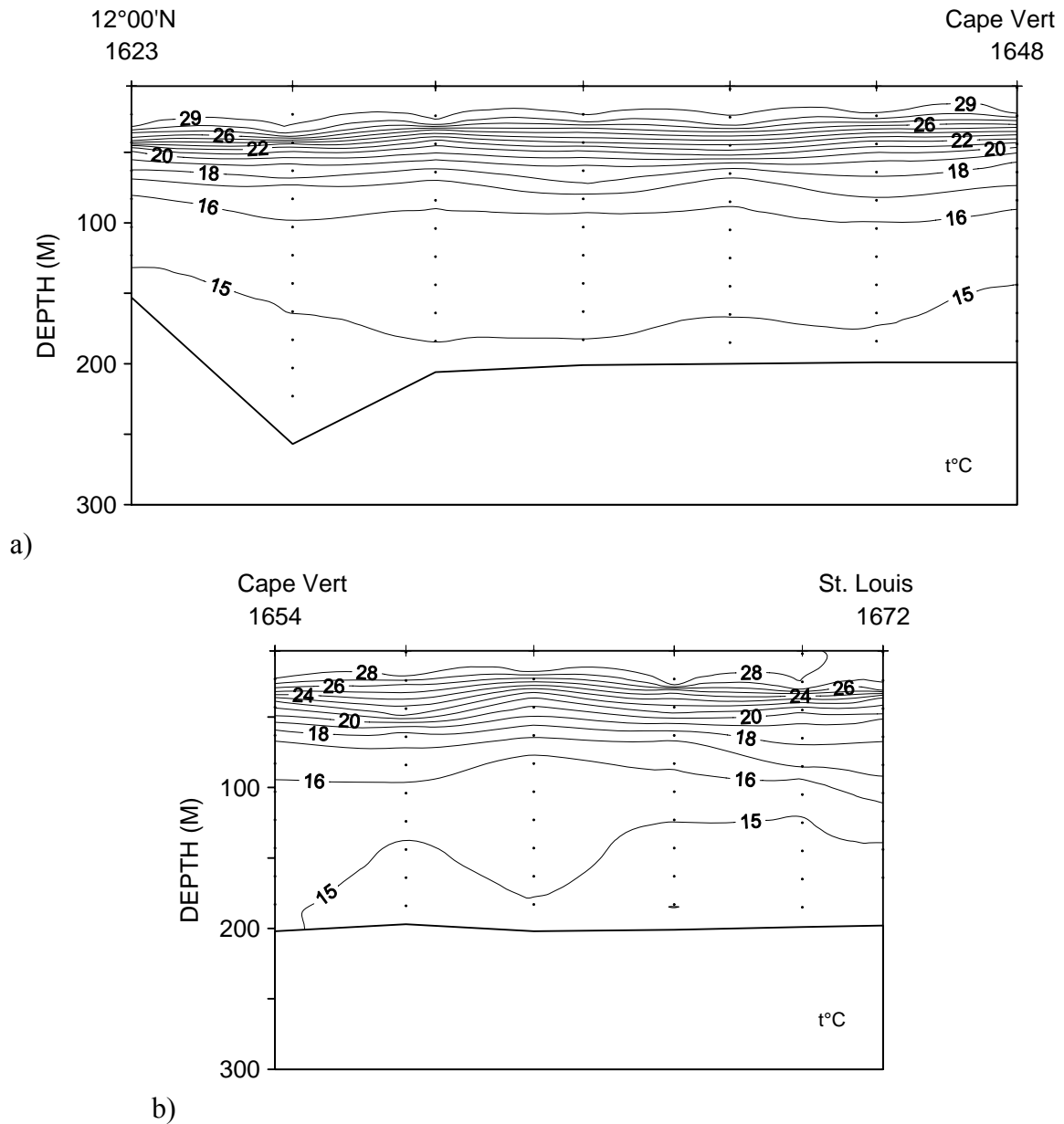


Figure 3. Alongshelf temperature at 200 m depth from a) Casamance to Cape Vert b) Cape Vert to St. Louis.

Sea surface temperature, salinity and wind direction

Figure 4 illustrates the sea surface temperature at 5 m depth, Figure 5 shows the sea surface salinity at the same depth, while Figure 6 show the wind direction and wind speed during the survey of Senegal and the Gambia.

The sea surface temperature in south of Dakar to Casamance was dominated by water masses warmer than 29°C. The warmest water masses was found along the coast (30°C) extending offshore in three large filaments with water temperatures >29.5°C. North of Cape Vert temperatures dropped slightly to 28.5°C. In the northernmost part of the survey area and inshore along the coast from St. Louis cooler water masses was experienced with temperatures down to 27.5°C outside St. Louis. Last year was warmer than normal, particular in the northern part of Senegal. This year similar temperatures to what was observed in 2004 were experienced.

The Casamance shelf was dominated by relatively low salinity, typically around 31.0‰ – 32.0‰. A large frontal zone separating the less saline shelf water from the more saline water masses offshore was observed at the shelf break, maximum salinity in this area was 34.4‰. Further north a gradual increase in salinity is observed between The Gambia and Cape Vert. The salinity at Cape Vert is around 34.4‰. In the northern part of the survey area salinity between 34.6 and 34.8 is observed. Except at St. Louis where local river discharge reduce the salinity to <34‰. Offshore from St. Louis an intrusion of more saline water masses from the north can be observed, with salinity >35‰. Compared to last year more rain has been experienced in the survey area and shelf salinity is thus less than normal.

Little wind was experienced in the area on the Casamance shelf, and the wind direction was shifty. The wind increased around Cape Vert to an average of approximately 21 - 22 knots for the rest of the survey period. The dominant wind direction in this region was from the north and generally conditions were similar to last year. The conditions were favourable for acoustic surveying throughout the survey.

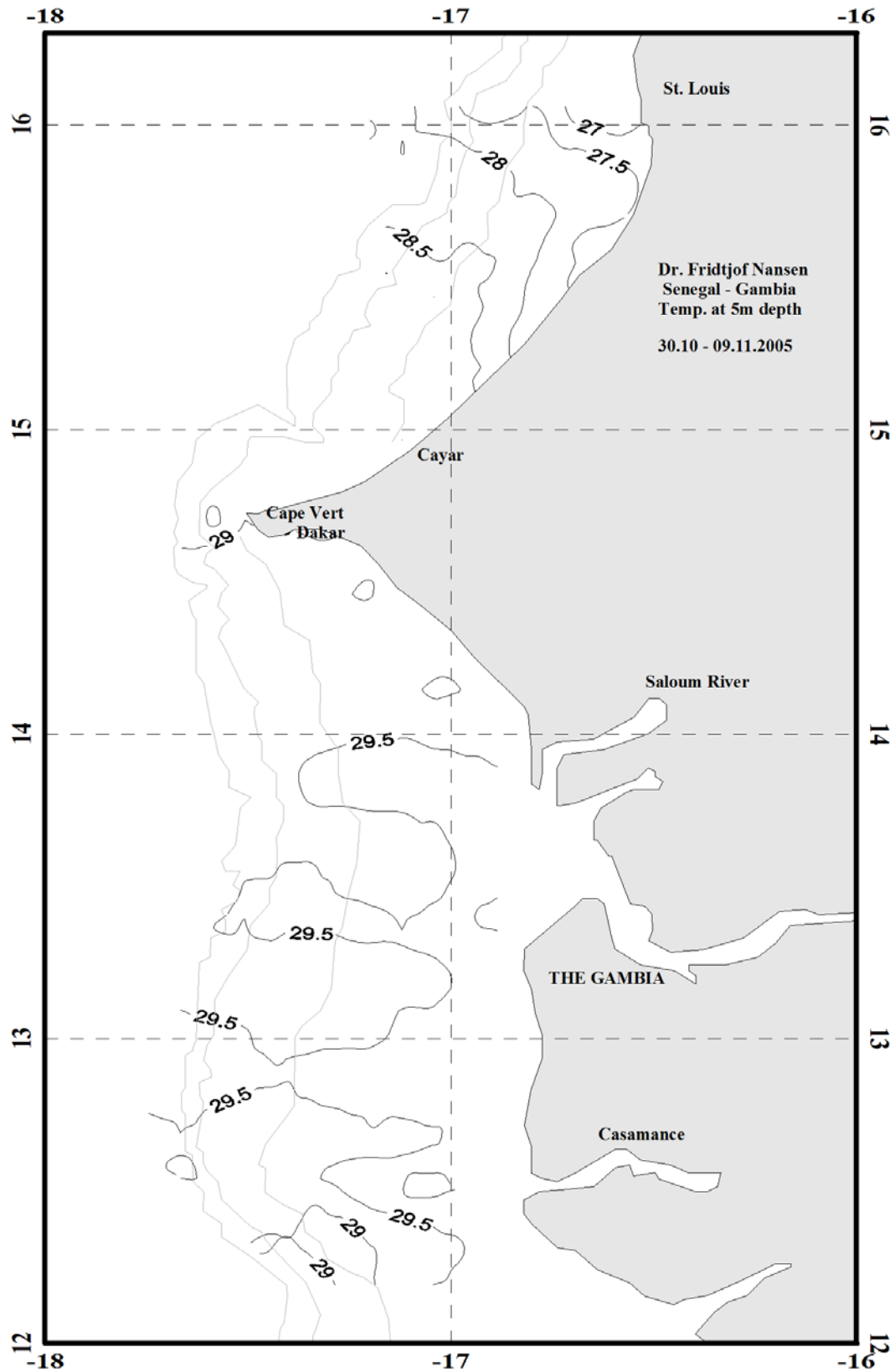


Figure 4. Sea surface temperature; Casamance to St. Louis.

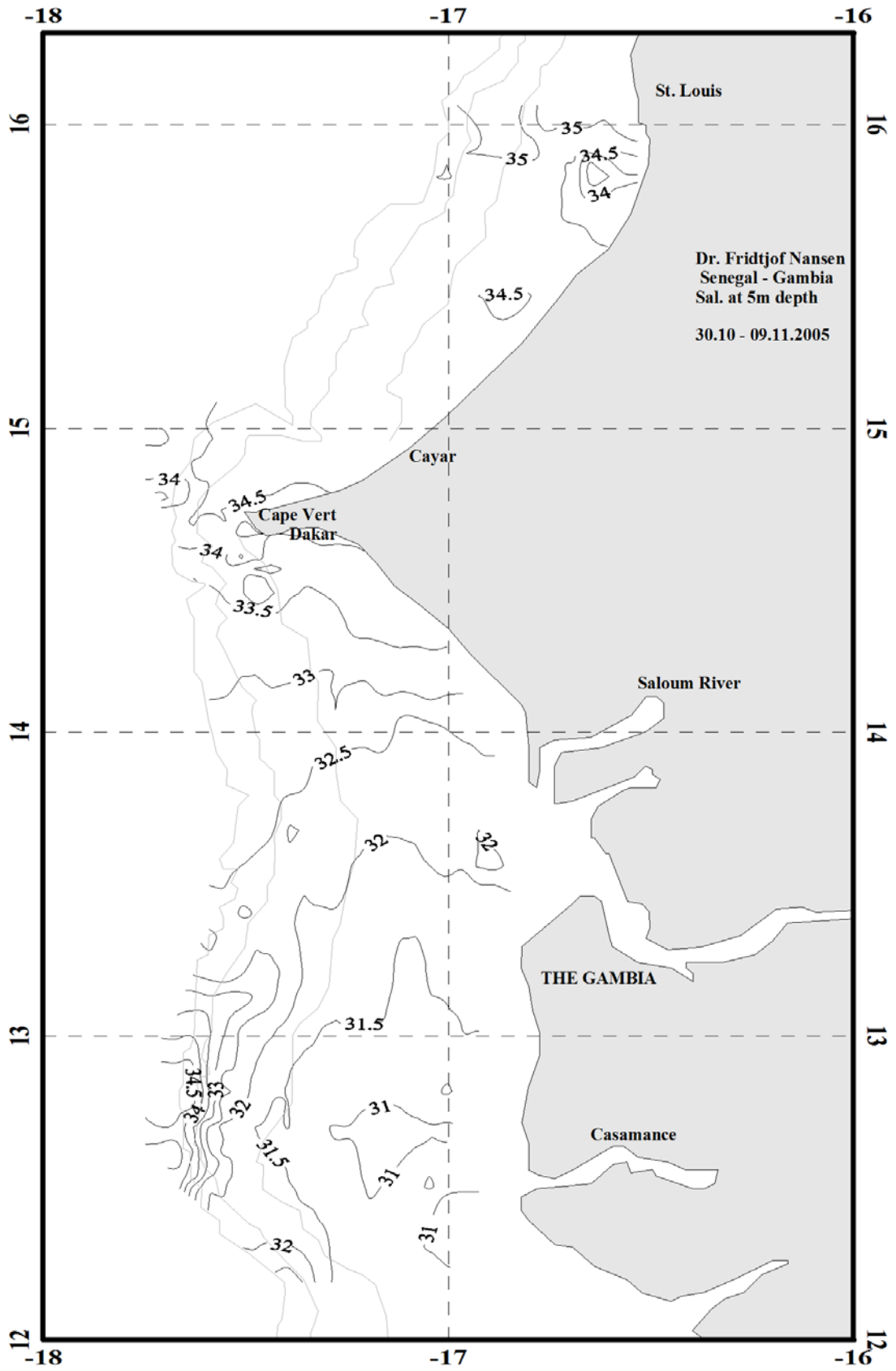


Figure 5. Sea surface salinity; Casamance to St. Louis.

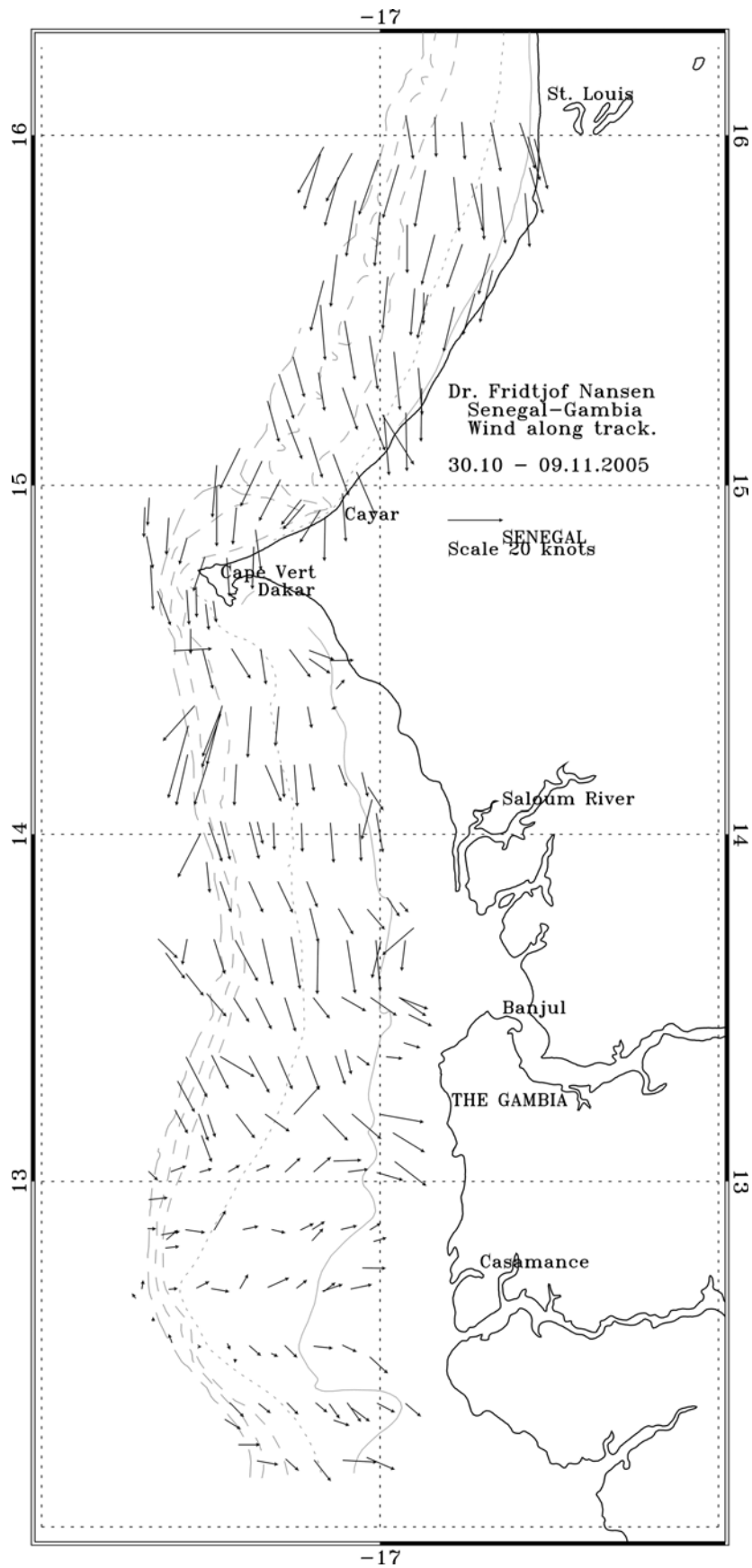


Figure 6. Wind speed and direction; Casamance to St. Louis.

3.2 The Casamance shelf

The main groups of pelagic fish encountered during the survey of Senegal and the Gambia illustrated with contoured acoustic densities are seen in Figure 7, Figure 8 and Figure 9.

The distribution of pelagic fish on the Casamance shelf reflected the low salinity shelf water. The shelf was abundant with clupeid fish also this year. *Ilisha africana* was particularly frequent in trawl catches close to the coast on the southern part of the shelf, anchovy, *Engraulis encrasicolus* were also found in one trawl catch in the same area. However, abundance estimates were only calculated for the sardinella species.

The distribution of sardinella was mainly inshore of 20 m depth in the southern part of Casamance, extending further offshore towards the 50 m isobath further north on the shelf. Dense concentrations were found around the 20 m isobath. A break in the sardinella concentrations was found in the southern part of the survey area, and there was no continuity in registration into Guinea Bissau. Figure 7. The region was dominated by *S. maderensis*, and *Sardinella aurita* only contributed approximately 9% to the biomass.

Two modal peaks of *Sardinella aurita* were found in the area, one at 24 cm, and one at 27 cm (total length) while the modal size of *S. maderensis* was 23 cm. Estimated number and biomass by length-groups can be found in Annex IV. The total biomass of sardinellas in the area was estimated to be 220 thousand tons, Table 3. Of this 19 thousand tons were *S. aurita*, while 201 thousand tons were *S. maderensis*. Last year the total biomass of sardinellas in the area was estimated to be 366 thousand tons, of this 32% were *S. aurita*.

Like the two previous years, no *Trachurus trecae* were found in the Casamance area. *Decapterus rhonchus* were found in low concentrations on the shelf break and inside of the 20 m isobath in the northern part of the Casamance area. The biomass of *Decapterus rhonchus* was 3.3 tons, and the average length in the area 28 cm.

Other pelagic fish (P2) were covering large parts of the shelf, similar to what is experienced most years. In general both carangids, other than horse mackerel and *Decapterus rhonchus*, scombrids, hairtails and barracudas were found in the area,

Table 4. The most frequently found species in the catches were *Chloroscombrus chrysurus*, *Alectis alexandrinus*, *Trichiurus Lepturus*, *Sphyraena guachancho* and *Scomberomorus tritor*. The species were well mixed with the sardinellas where their distribution overlapped, Figure 9. The estimated biomass of this group of fish was 59 thousand tons compared with 58000 tonnes last year.

Table 3. Casamance. Biomass estimates of pelagic fish, thousand tons.

<i>S. maderensis</i>	<i>S. aurita</i>	Horse mackerel	Carangids etc.
201	19	3.	59

Table 4. Catch by stations sorted by groups (in kg/hour)

Station	Fishing Depth	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other	Total
2368	0	0.4	0.1	1.9	0.6	12.6	11.3	27
2369	27	66.6	9.2	3.4	5.1	18.2	321.1	424
2370	27	383.5	302.1	5.2	37.3	8.4	1118.9	1855
2371	17	54.6	340.1	4.1	19.7	1.4	385.6	805
2372	15	21.6	52.3	1.9	12.0	2.8	448.7	539
2373	25	50.3	15.1	0	3.1	2.3	624.3	695
2374	10	2.9	225.3	10.4	0	39.7	131.0	409
2375	0	-	-	-	-	-	-	No Catch
2376	19	161.4	40.0	0.8	7.9	0.6	773.7	984
2377	16	44.9	116.5	1.4	8.2	4.8	143.8	320
2378	18	160.6	428.6	7.3	16.4	10.1	143.8	767
2379	10	-	-	-	-	-	-	No Catch
2380	79	0	7.7	0	0	0	69.1	77
2381	10	30.4	8.0	0	0	0.5	3.2	42
Mean	19.5	81.4	128.7	3.0	9.2	8.4	347.9	579
% Catch		14.1	22.2	0.5	1.6	1.5	60.1	100

3.3 The Gambian shelf

The distribution of sardinellas from the Casamance area continued into the Gambian waters with dense to very dense concentrations from 15-30 m bottom depth, especially in the northern part of the survey area, and scattered concentrations offshore between 50 and 100 m isobath. Figure 4. Both species of sardinella was found across the whole distribution area, with no clear depth separation between the species, but with *S. maderensis*, dominating in biomass by 72%. The total estimate of sardinellas in the Gambian waters during the survey was 261 thousand tons, Table 5. This comprised of 188 thousand tons of *S. maderensis* and 73 thousand tons of *S. aurita*. Last year a total of 128 thousand tons sardinella were found in this region, and 16% of this were *S. aurita*. The modal length of *S. maderensis* was 24 cm while catches of *S. aurita* in the area showed three modal peaks at 21 cm, 24 cm and 27 cm. The estimated numbers and biomass by length-groups can be found in Annex IV.

Trachurus trecae was found on the shelf break at 100 m depth extending inshore across the 50 m isobath. The distribution area continues with the distribution of *Decapterus rhonchus* at the Casamance shelf, Figure 8. The densities were low with an estimated biomass of 0.8 thousand tons of *Trachurus trecae*, and 3.6 thousand tons of *Decapterus rhonchus* Table 5. The size distribution of horse mackerel in the area consisted of one modal peaks at 23 cm. Last year 29 thousand tons were found in this area.

Carangids and associated species were found in low to medium density widely distributed over the whole Gambian shelf, Figure 9. The catches of this group were dominated by *Chloroscombrus chrysurus*. The biomass was estimated at 55.8 thousand tons.

Table 5. The Gambia. Biomass estimates of pelagic fish, thousand tons.

<i>S. maderensis</i>	<i>S. aurita</i>	Horse mackerel	Carangids etc.
188	73	4	19

Table 6. Catch by stations sorted by groups (in kg/hour)

Station	Fishing Depth	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other	Total
2382	10	290.4	439.3	0	0	0	107.1	837
2383	95	0	0	0	0	0	7.86	8
2384	110	0	29.47	0	0	0	1154.53	1184
2385	32	3.2	460.38	0	0	20.08	669.86	1154
2386	5	1061.5	846.17	0.81	4.8	3.39	83.67	2000
2387	10	175.51	70.03	0	4.3	5.75	34	290
2388	5	-	-	-	-	-	-	No Catch
2389	5	17.57	17.78	0	0	1.7	21.2	58
2390	25	41.14	8.16	0	0	0.42	71.24	121
Mean		198.7	233.9	0.1	1.1	3.9	268.7	706
% Catch		28.1	33.1	0.0	0.2	0.6	38.0	100

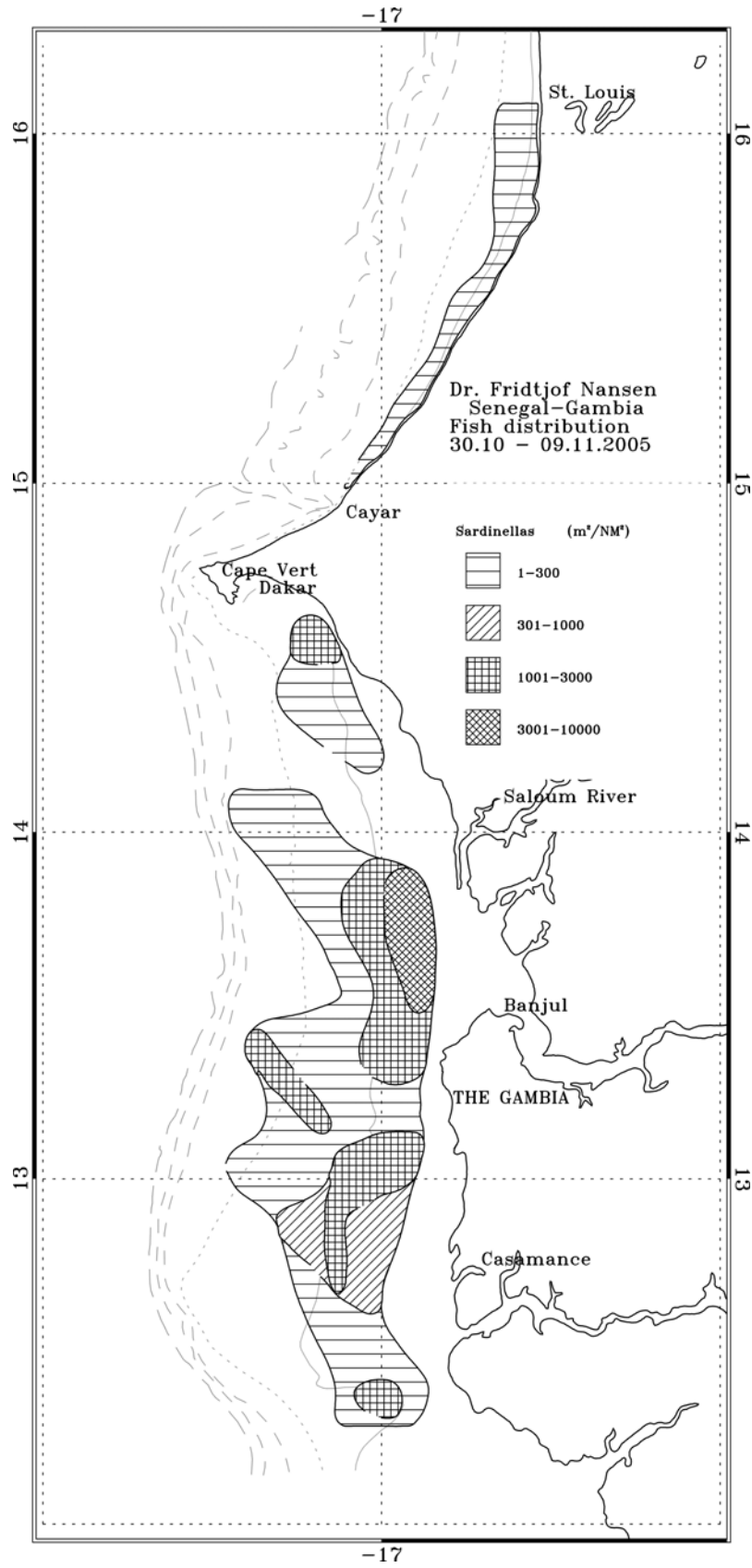


Figure 7. Distribution of sardinellas; Casamance to St. Louis.

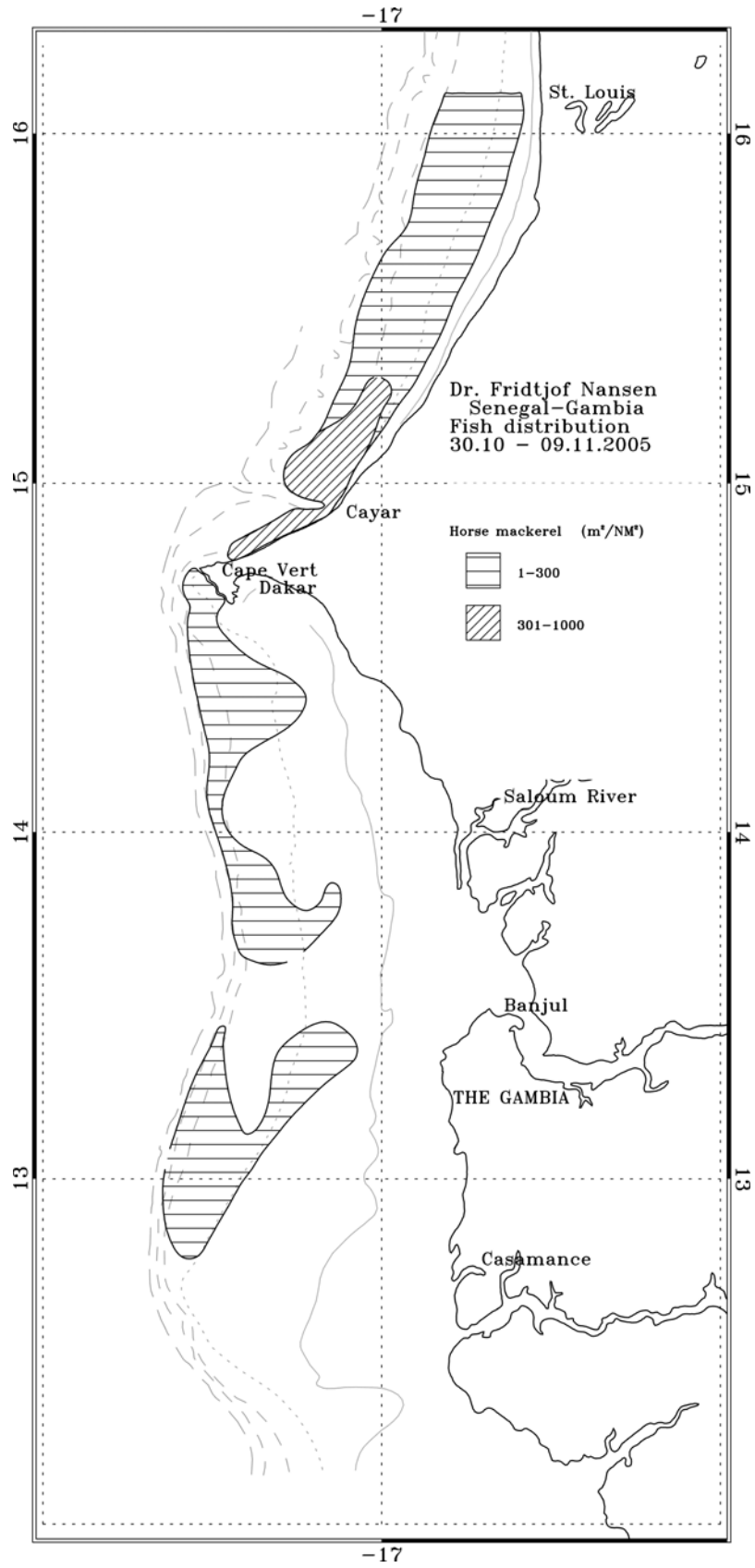


Figure 8. Distribution of *Trachurus trecae*; Casamance to St. Louis.

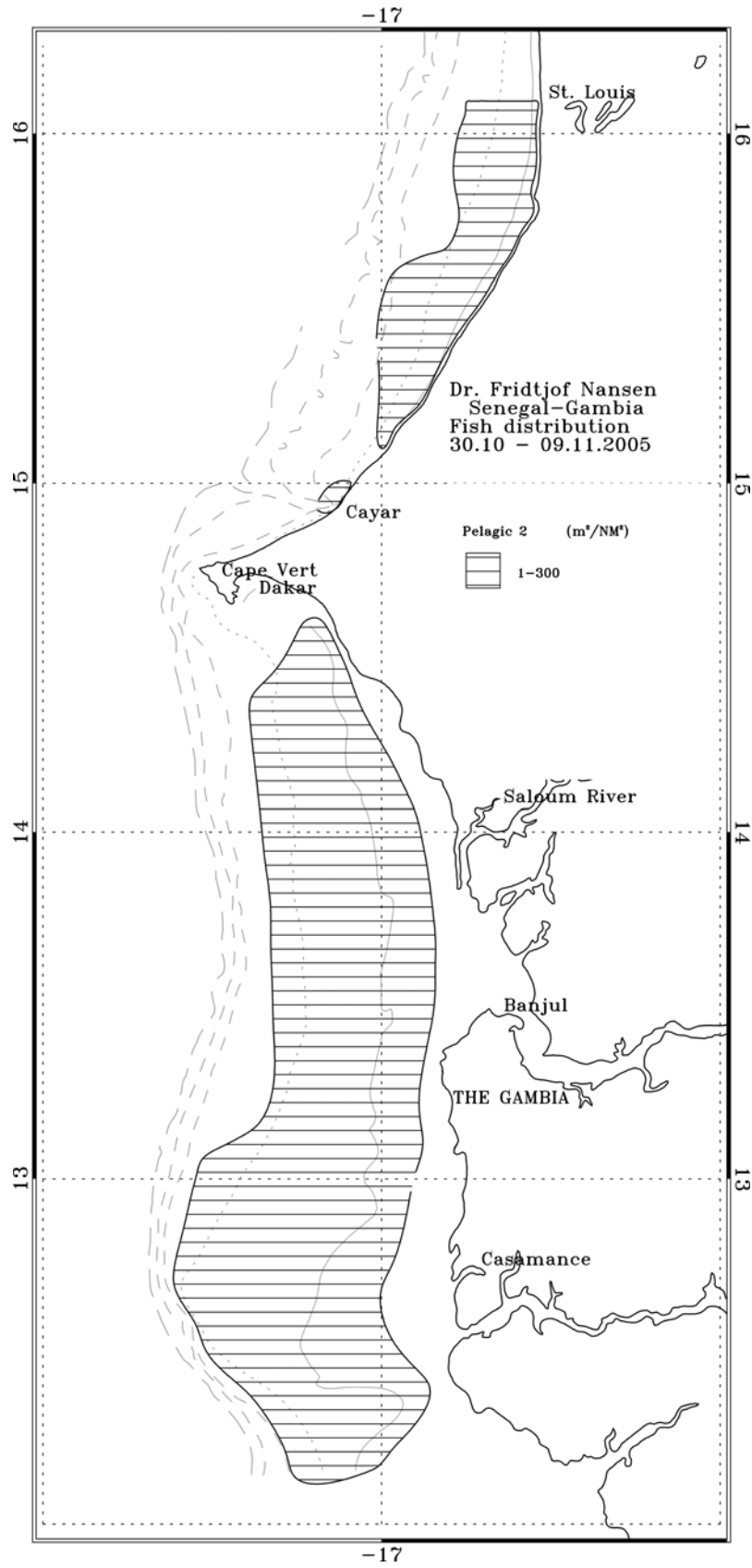


Figure 9. Distribution of carangids and associated species; Casamance to St. Louis

3.4 The Gambian border - Cape Vert

Sardinella was distributed in two areas between The Gambian border and Cape Vert. Very dense concentrations were found inshore around the 20 m isobath extending across the border from The Gambia to north of the Saloum River entrance. Scattered concentrations were found offshore to 80 m depth, and northwards from this area. Another distribution area with scattered sardinella was found north of this with dense concentrations in the northernmost part of the region at around 20 m depth, Figure 7. Table 7 shows the biomass estimates of the two sardinella species, *S. aurita* was the most dominant contributing 56% of the total biomass of 339 thousand tons. *S. maderensis* was estimated at 148 thousand tons while 191 thousand tons of *S. aurita* was found. Last year 262 thousand tons of Sardinella was found in the region, of this *S. maderensis* contributed with 59%.

Pooled length compositions of samples from *S. maderensis* showed a modal peaks at 24 cm, while the *S. aurita* had modal peaks at 21 cm, 24 cm and 27 cm. Estimated number and biomass by length-groups are found in Annex IV.

Trachurus trecae was found from the Gambian border to Cape Vert around the 100 m isobath extending inshore to <50 m bottom depth and mixing with *Decapterus rhonchus* in its distribution area. The distribution is similar to what has previously been observed at this time of the year, but the density was lower than usual, Figure 8. The total biomass was estimated at 12 thousand tons, of this *Trachurus trecae* contributed with 7 thousand tonnes and *Decapterus rhonchus* with 6 thousand tons, compared with 33 thousand tonnes of horse mackerels last year. The distribution of *Trachurus trecae* showed four modal peaks in the area, at 11, 18, 24 and 27 cm, while the *Decapterus rhonchus* showed two modal peaks, at 23 and 28 cm.

As during previous years in the other regions south of Cape Vert, carangids and associated pelagic species were distributed over most of the shelf from less than 20 m depth and offshore to between 50 and 100 m depth. The dominating species from this group in the area were *Chloroscombrus chrysurus*, *Scomber japonicus* and *Sphyraena guachancho*, Figure 6 and Table 8. The carangids and associated pelagic fish species were very scattered in the region, and the biomass was estimated at about 26 thousand tonnes, Table 7, compared to the 79 thousand tons estimated last year.

Table 7. The Gambia border to Cape Vert. Biomass estimates of pelagic fish, thousand tons.

<i>S. maderensis</i>	<i>S. aurita</i>	<i>Trachurus trecae</i>	Carangids etc.
148	191	12	26

Table 8. Catch by stations sorted by groups (in kg/hour)

Station	Fishing							Total
	Depth	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other	
2391	21	37.2	31.08	0	0	23.75	76.2	168
2392	16	59.46	87.18	0	0	0	542.64	689
2393	40	2839.76	30.53	266.43	0	0	0	3137
2394	10	0	164.8	1.02	0	5	115.18	286
2395	28	419.76	1772.04	0	0	15.46	72.72	2280
2396	105	0	69.09	0	0	0	163.2	232
2397	10	1.8	0	0	0	0	0	2
2398	22	9.67	30.71	0	0	1.84	78.44	121
Mean	31.5	421.0	273.2	33.4	0.0	5.8	131.0	864
% Catch		48.7	31.6	3.9	0.0	0.7	15.2	100

3.5 Cape Vert - St. Louis

Sardinellas were very scattered in the region between Cape Vert and St. Louis. Small concentration of *S. maderensis* only were found in a narrow band along the 20 m isobath, Figure 7. No *S. aurita* was found in the region. The modal length of *S. maderensis* in the area was 26 cm and the biomass estimate was 8 thousand tons, Table 9. Last year 25 thousand tons of *S. aurita* was found in this region together with 39 thousand tons of *S. maderensis*.

Scattered concentrations of *Trachurus trecae* were found in one continues region from south of the Cayar canyon to St. Louis, with slightly higher concentrations in the southern part of the area around Cayar. The distribution extended from approximately 100 m depth to between 50 and 20 m bottom depth. *Decapterus rhonchus* was found mixed with the *Trachurus trecae* in the same region but with a more shallow distribution. *Trachurus trecae* in the region had four modal peaks, at 11 cm 22 cm, 26 cm and 31 cm. No length frequencies from *Decapterus rhonchus* were obtained from the area so the biomass for this species were based on the average length from the number and weight in the trawl catches. The biomass of *Trachurus trecae* was thus estimated to be 73 thousand tonnes, while *D. rhonchus* was found to be 24 thousand tons. Last year the biomass of horse mackerels in this area were estimated

to be 15 thousand tonnes. The increase may possibly be attributed to local changes in distribution pattern and shift of fish northwards.

A low density region of Carangids and associated pelagic fish species were found from North of the Cayar Canyon at 20 m depth, extending offshore across the 50 m isobath further north. The dominant species in the catches were *Chloroscombrus chrysurus* and *Trichiurus lepturus* and the biomass was estimated to be 11 thousand tons compared with 20 thousand tons in 2004.

Table 9. Cape Vert to St. Louis. Biomass estimates of pelagic fish, thousand tons.

<i>S. maderensis</i>	<i>S. aurita</i>	Horse mackerels	Carangids etc.
8	-	97	11

Table 10. Catch by stations sorted by groups (in kg/hour)

Station	Fishing Depth	Clupeids	Carangids	Scombrids	Hairtails	Barracuda	Other	Total
2399	0	0	10.02	0	0	0	8.1	18
2400	75	-	-	-	-	-	-	No Catch
2401	30	0.2	464.92	1.4	0	1.92	168.64	637
2402	33	0	443.02	0	6.9	4	424.02	878
2403	33	0.36	283.26	0	0.42	0	3.26	287
2404	10	63.22	309.6	8.74	54.04	2.01	263.18	701
2405	30	1.97	67	0	17.42	0.14	115	202
Mean	30.1	11.0	263.0	1.7	13.1	1.3	173.4	464
% Catch		2.4	56.7	0.4	2.8	0.3	37.4	100

3.6 Parallel trawl survey

The parallel trawl survey was conducted successfully. During the whole survey of Senegal the Itaf Deme followed the course track of “Dr. Fridtjof Nansen”. As part of the parallel trawl survey several rounds of intercalibration and comparative trawl hauls between the vessels were conducted successfully. The data from the parallel survey will be analysed later and presented in a separate report. Due to a problem with the hydraulic system onboard Dr. Fridtjof Nansen it was not possible to conduct parallel trawling on the shelf outside Dakar as was planned at the beginning of the survey.

CHAPTER 4 OVERVIEW AND SUMMARY OF RESULTS

The survey was conducted successfully from 30th October to 9th November, covering a course track of approximately 1550 NM, including the steaming to and from the survey area to Dakar. A total of 38 fishing stations and 48 CTD casts were established.

The hydrographical data showed a stable surface layer at approximately 30-50 m depth for the whole shelf south of Cape Vert. Warm low salinity surface waters characterized the surface water in the Casamance area and the Gambia. The low salinity can be attributed to discharge from the rivers in the area. The shelf from Cape Vert and north to St. Louis was warmer than usually during the October - November survey and intrusion of cold water from the north was only visible at St. Louis. The shelf was well oxygenated in the whole survey area. The situation was similar to what was observed last year, but the low shelf salinity was even more pronounced due to heavy rain in the region.

The main concentration area for sardinella was the Casamance shelf and The Gambian coast, 83% of all the sardinella in the survey area was found in this region. Two other concentration areas were found north of this, between Saloum River and Dakar, and in a narrow band along the coast between Cayar and St. Louis. The main concentrations in all three areas were found along the 20 m isobath. The total biomass was estimated to be 828 thousand tons, and 33% of this was *S. aurita*, Figure 7. As usual *S. aurita* was more predominant in deeper and more saline waters than *S. maderensis*. The division of biomass between length groups and species are dependent on representative trawl samples of the two species. Since sardinella show strong trawl avoidance some care should be taken when interpreting the results.

Horse mackerels including the false scad *Decapterus rhonchus* were found in two areas along the shelf break at 100 m depth between the southern border of The Gambia and Cape Vert. The distribution extended inshore beyond the 50 m isobath in some parts of the southern shelf. The main distribution area of the horse mackerel was the northern shelf of Senegal between the Cayar Canyon and St. Louis, Figure 8. *Trachurus trecae* dominated along the shelf edge in the whole distribution area, while *Decapterus rhonchus* became more abundant inshore, and particularly on the southern shelf. The total estimate of *Trachurus trecae* was 81 thousand tonnes, or 69% of the total, while the biomass of the *Decapterus rhonchus* was estimated to be 36 thousand tons. 90% of the *Trachurus trecae* was found north of Cape Vert. A larger proportion of *Decapterus rhonchus* was found on the southern shelf, but 67% of the estimate biomass was still found north of Cape Vert.

The ‘P2’s’, other carangids and associated species, were distributed over most of the shelf in low densities, Figure 9. The main species in the catches of this group consisted of *Chloroscombrus chrysurus*, *Sphyraena guachancho*, *Trichiurus Lepturus* and *Selene dorsalis*. The total biomass of this group was estimated at approximately 115 thousand tons. The species in this group was mixed with dense concentrations of plankton, other pelagic fish species and in particular the *Brachydeuterus auritus*. Thus, division on acoustic energy on different targets in these groups must be done with care.

An overview of the acoustic estimates of biomass of the main groups of pelagic fish is shown in Table 11, and the geographical distribution and abundance of main species can be found in Figure 10. The total biomass of sardinellas was thus 828 thousand tonnes, horse mackerels 116 thousand tons and of carangids and associated species 115 thousand tons.

Table 11. Summary of biomass estimates of pelagic fish, Senegal and the Gambia. Values in tonnes.

	<i>S. maderensis</i>	<i>S. aurita</i>	Horse mackerel	Carangids etc.
St. Louis-Cape Vert	8	-	97	11
Cape Vert - the Gambia	148	191	12	26
The Gambia	188	73	4	19
Casamance	201	19	3.	59
Total	545	283	116	115

Table 12 lists biomass estimates of sardinellas and carangids (including *Trachurus trecae*) and associated species from the “Dr. Fridtjof Nansen” surveys of the shelf region.

Large-scale latitudinal movements of pelagic fish between West Sahara and Guinea Bissau are well known, and in the summer the sardinellas should be concentrated in Senegal for spawning. The biomass estimate of sardinella from this year is almost exactly the same as last year, and fits well within the time series of increasing sardinella abundance since 1996. The species distribution and species composition of the two species were also similar to last year. The estimate of *Trachurus trecae* from this year, 81 thousand tons, is only slightly higher than the 76 thousand tons estimated last year. *Decapterus rhonchus* was included in the P2 estimate estimated last year, but due to requests from the region it has now been separated again. The biomass estimate of this species was 36 thousand tons. The total estimate of carangids and associated species was estimated at 115 thousand tons. This is much lower than the 212 thousand tons found during the October – November survey last year, and is possibly an underestimate of the biomass of this group due to the frequent mix of fish from this group with large concentrations of *Brachydeuterus auritus* and plankton in the survey area.

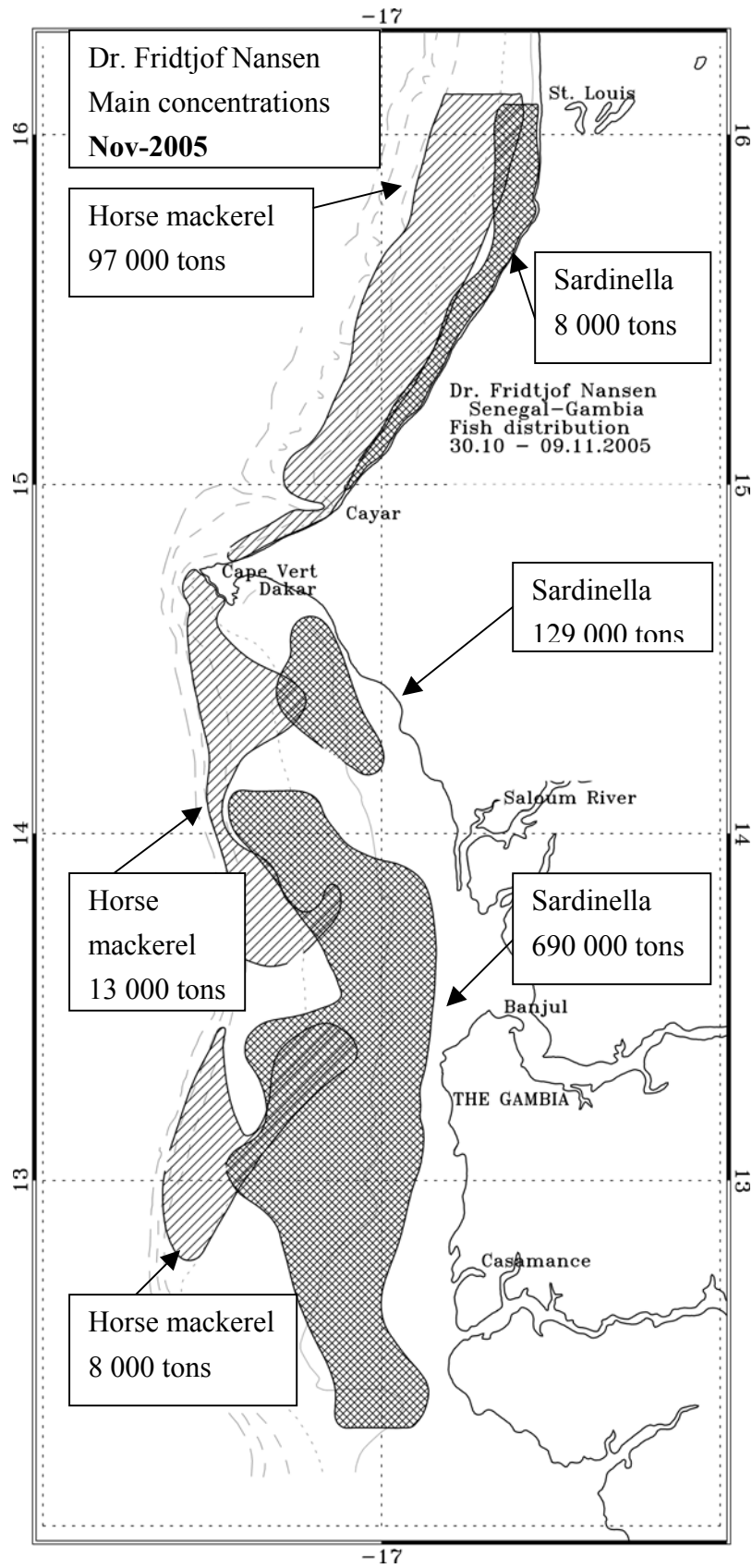


Figure 10. Major pelagic fish concentrations with estimated biomass (tonnes), Senegal and The Gambia.

Table 12. Biomass estimates from previous 'Dr Fridtjof Nansen' surveys of Senegal - The Gambia shelf in thousand tons.

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	230	530
NovDec-97	300	250
NovDec-98	390	340
NovDec-99	1 390	470
NovDec-00	300	540
JunJul-01	410	230
NovDec-01	430	480
JunJul-02	600	430
NovDec-02	910	260
JunJul-03	670	610
NovDec-03	597	319
NovDec-04	819	289
NovDec-05	828	231

* *Trachurus trecae* and other carangids

** Not available

References

Toresen, R., Gjørseter, H., and Barros, P. 1998. The acoustic method as used in the abundance estimation of capelin (*Mallotus villosus* Müller) and herring (*Clupea harengus* Linné) in the Barents Sea. Fisheries Research 34 (1998) 27-37.

MacLennan, D. N. and Simmons E. J. (1992). Fisheries Acoustics. Chapman and Hall.325p.

RÉSUMÉ

La campagne a été conduite avec succès durant la période du 30 octobre au 9 novembre selon un parcours d'une longueur approximative de 1550 milles nautiques incluant les temps de route à partir de/et vers Dakar. Au total, 48 stations de pêche de contrôle ont été réalisées.

Les données hydrographiques révèlent une stabilité de la température des eaux de surface autour des 30-50 m de profondeur, pour toute la zone au sud de Dakar. Les eaux de surface en Casamance et en Gambie se caractérisent par une température relativement élevée et une faible salinité. La côte du Cap-Vert au Nord de St-Louis a été plus chaude que d'habitude à la même époque et l'influence des eaux froides du nord n'apparaît qu'à partir de St-Louis. Les eaux étaient dans l'ensemble bien oxygénées sur toute l'étendue couverte. La situation en présence est similaire à celle observée l'année dernière, mais la faiblesse de la salinité est plus prononcée due aux fortes pluies enregistrées cette année,

Les sardinelles ont été rencontrées principalement dans sur la côte en Casamance et en Gambie, ou 83% du total des sardinelles durant cette campagne a été trouvée. Deux autres zones de concentration ont été rencontrées au nord de la Gambie, entre le fleuve Saloum et Dakar, et sur une étroite bande le long de la côte entre Cayar et St Louis. L'essentiel des concentrations sur les trois principales zones ont été trouvées le long de l'isobathe des 20 mètres. La biomasse totale a été estimée à 828 milles tonnes, dont 33% de *S. aurita*. Comme très souvent observé, la *S. aurita* a été en général rencontrée dans les eaux plus profondes et plus salées que la *S. maderensis*. La répartition de la biomasse en classes de tailles et espèces dépendent des échantillons représentatifs des deux espèces lors des opérations de pêche. Du moment que la sardinelle présente un fort taux d'évitement à l'approche du chalut, ces résultats doivent être interprétés avec précautions.

Les chinchards, aussi bien le noir que le jaune *Decapterus rhonchus*, ont été rencontrés essentiellement dans deux zones longeant la limite du plateau continentale sur l'isobathe des 100 mètres, l'une au sud de la Gambie et l'autre sur la Petite Côte. Leur distribution s'étend vers la côte jusqu'à l'isobathe des 50 mètres sur quelques parties de la côte. La principale zone de concentration a été la côte Nord entre le canyon de Cayar et St. Louis, Figure 8. Le *Trachurus trecae* a été plus abondant au large dans toute la région, tandis que le *Decapterus rhonchus* est plutôt abondant sur la côte, en particulier sur la côte sud.. La biomasse totale des *Trachurus trecae* est évaluée à 81 milles tonnes, soit 69% de la biomasse totale, tandis que la biomasse des *Decapterus rhonchus* est évaluée à 36 milles tonnes.. 90% des *Trachurus trecae* ont été trouvés au nord de Dakar. Une proportion plus importante de *Decapterus rhonchus* a été trouvée sur la côte sud , mais 67% de la biomasse estimée reste concentrée au nord de Dakar.

Les autres carangidés et espèces associées sont régulièrement distribués sur toute la côte avec des densités relativement faibles, figure 9. Les espèces principalement capturées ont été *Chloroscombrus chrysurus*, *Sphyraena guachancho*, *Trichiurus Lepturus* and *Selene dorsalis*. La biomasse totale est estimée à 115 milles tonnes. Les espèces dans ce groupe ont été mélangées avec du plancton très dense, et avec d'autres espèces pélagiques en particulier le *Brachydeuterus auritus*. Par conséquent, l'allocation des valeurs d'intégration aux différents groupes doit être entreprise avec beaucoup d'attention.

Le tableau 11 ci-dessous résume la biomasse pour chaque groupe de pélagiques ; la répartition géographique et l'abondance de ces espèces sont présentées en figure 10. Ainsi, la biomasse totale des sardinelles s'élève à 818 milles tonnes, celles de chinchards à 116 milles tonnes et les carangidés et espèces associées sont estimées à 115 milles tonnes

Le tableau 12 récapitule les biomasses totales estimées depuis 1981 par le N/O Dr Fridtjof Nansen; il s'agit de l'ensemble des sardinelles, chinchards, carangidés et associées sur les cotes sénégalaises

Il est maintenant bien connu de l'existence dans la sous région de flux migratoires à grande échelle de poissons pélagiques entre le Sahara de l'Ouest et la Guinée Bissau, et le repli des sardinelles vers le Sénégal en période chaude pour assurer la reproduction. La biomasse estimée pour les sardinelles cette campagne est presque identique à celle trouvée l'année dernière à la même période, et s'inscrit bien dans la série ascendante des biomasses trouvées pour les sardinelles depuis 1996. La distribution et la composition des espèces pour les deux sardinelles sont également similaires à celles de l'année dernière. Le *Decapterus rhonchus* a été inclus dans les P2 dans les estimations de l'année dernière, mais sur demande des scientifiques de la sous région, il a été séparé à nouveau . La biomasse estimée pour cette espèce a été de 36 milles tonnes, Les carangidés et autres espèces associées ont été estimés à 115 milles tonnes. Ceci est nettement inférieur aux 212 milles tonnes trouvées en octobre-novembre de l'année dernière, et pourrait être due à une sous-estimation de ce groupe compte tenu du mélange fréquent de ces espèces avec les fortes concentrations de *Brachydeuterus auritus* et de plancton dans la zone.

Annex I Records of fishing stations

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2368
 DATE: 1/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1212
 start stop duration Long W 1717
 TIME :03:47:04 04:17:10 30 (min) Purpose code: 1
 LOG :4448.23 4450.11 1.86 Area code : 4
 FDEPTH: 0 0 GearCond.code:
 BDEPTH: 95 123 Validity code:
 Towing dir: 269° Wire out: 150 m Speed: 40 kn*10

Sorted: Kg Total catch: 13.53 CATCH/HOUR: 27.06

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sphyraena guachancho	12.64	44	46.71	3903
Saurida brasiliensis	4.80	784	17.74	
Bregmaceros sp.	3.56	1236	13.16	
Euthynnus alletteratus	1.94	4	7.17	
Rhizoprionodon acutus	1.82	2	6.73	
Echeneis naucrates	0.74	4	2.73	
Trichiurus lepturus	0.64	78	2.37	
Engraulis encrasicolus	0.38	94	1.40	3904
Priacanthus arenatus	0.18	34	0.67	
Alloteuthis africana	0.14	42	0.52	
NOMEIDAE	0.08	18	0.30	
Decapterus punctatus	0.08	2	0.30	
Selene dorsalis, juveniles	0.06	16	0.22	
Total	27.06		100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2369
 DATE: 1/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1221
 start stop duration Long W 1709
 TIME :08:41:35 09:12:07 31 (min) Purpose code: 1
 LOG :4485.68 4487.46 1.77 Area code : 4
 FDEPTH: 25 29 GearCond.code:
 BDEPTH: 25 29 Validity code:
 Towing dir: 157° Wire out: 155 m Speed: 32 kn*10

Sorted: 35 Kg Total catch: 219.93 CATCH/HOUR: 425.67

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
J E L L Y F I S H	104.61	209	24.58	
Brachydeuterus auritus	97.90	1376	23.00	
Ilisha africana	66.29	15006	15.57	
Rhizoprionodon acutus	26.32	6	6.18	
Pomadasys jubelini	25.01	39	5.88	3906
Arius parkii	24.00	35	5.64	
Galeoides decadactylus	19.41	157	4.56	3907
Sphyraena guachancho	18.15	45	4.26	3905
Eucinostomus melanopterus	7.66	70	1.80	
Alectis alexandrinus	5.26	8	1.24	
Arius laticutatus	5.13	4	1.21	
Trichiurus lepturus	5.05	792	1.19	
Callinectes pallidus	4.61	15	1.08	
Scomberomorus tritor	3.41	6	0.80	
Pomadasys peroteti	2.90	6	0.68	
Selene dorsalis	1.66	174	0.39	
Chloroscombrus chrysurus	1.39	17	0.33	
Drepane africana	1.05	17	0.25	
Caranx senegallus	0.91	2	0.21	
Albula vulpes	0.87	2	0.20	
Penaeus notialis	0.54	25	0.13	
Lagocephalus lagocephalus	0.45	2	0.11	
Dasyatis margarita	0.43	2	0.10	
Sardinella maderensis	0.35	8	0.08	
Pteroscion peli	0.25	10	0.06	
Total	423.61		99.53	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2370
 DATE: 1/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1221
 start stop duration Long W 1705
 TIME :10:54:41 11:16:48 22 (min) Purpose code: 1
 LOG :4499.91 4501.25 1.33 Area code : 4
 FDEPTH: 26 28 GearCond.code:
 BDEPTH: 26 28 Validity code:
 Towing dir: 175° Wire out: 155 m Speed: 35 kn*10

Sorted: 35 Kg Total catch: 680.28 CATCH/HOUR: 1855.31

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	426.98	8084	23.01	
Ilisha africana	383.45	38345	20.67	
Chloroscombrus chrysurus	269.45	3537	14.52	
Arius parkii	216.08	777	11.65	
Pteroscion peli	202.61	13835	10.92	
J E L L Y F I S H	109.34	259	5.89	
Pomadasys jubelini	67.31	90	3.63	3908
Trichiurus lepturus	37.31	3316	2.01	
Pseudotolithus senegalensis	33.27	155	1.79	
Selene dorsalis, juveniles	32.65	725	1.76	
Galeoides decadactylus	31.17	466	1.68	
Parapenaeopsis atlantica	16.58	6120	0.89	
Pentanemus quinquarius	15.55	52	0.84	
Sphyraena guachancho	8.40	22	0.45	
Scomberomorus tritor	5.15	8	0.28	
Total	1855.30		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2371
 DATE: 1/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1221
 start stop duration Long W 1654
 TIME :13:01:31 13:31:15 30 (min) Purpose code: 1
 LOG :4516.19 4517.88 1.69 Area code : 4
 FDEPTH: 16 18 GearCond.code:
 BDEPTH: 16 18 Validity code:
 Towing dir: 270° Wire out: 120 m Speed: 30 kn*10

Sorted: 31 Kg Total catch: 402.71 CATCH/HOUR: 805.42

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	336.00	6552	41.72	
Arius parkii	54.72	2544	6.79	
Ilisha africana	52.16	2952	6.48	
Galeoides decadactylus	51.84	696	6.44	
Pseudotolithus senegalensis	36.24	912	4.50	
Sea urchins (strong spines)	35.28	3816	4.38	
Pteroscion peli	35.28	936	4.38	
J E L L Y F I S H	34.24	1200	4.25	
Synagrops microlepis	25.68	264	3.19	
Brachydeuterus auritus	24.72	432	3.07	
Rhinoptera marginata	20.36	18	2.53	
Trichiurus lepturus	19.68	912	2.44	
Dasyatis margarita	19.56	42	2.43	
Stromateus fiatola	11.28	48	1.40	
Pentanemus quinquarius	9.60	168	1.19	
Pseudotolithus typus	7.44	72	0.92	
Gymnura altavela	6.68	6	0.83	
Scomberomorus tritor	4.08	4	0.51	
Penaeus notialis	3.84	1440	0.48	
Caranx crysos	3.60	24	0.45	
Mustelus mustelus	3.32	6	0.41	
Pisodonophis semicinctus	2.84	16	0.35	
C R A B S	2.64	120	0.33	
Sardinella maderensis	2.48	30	0.31	3909
Sphyraena guachancho	1.38	6	0.17	
Selene dorsalis	0.48	24	0.06	
Total	805.42		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2372
 DATE: 1/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1231
 start stop duration Long W 1705
 TIME :15:57:52 16:27:39 30 (min) Purpose code: 1
 LOG :4530.93 4532.32 1.45 Area code : 4
 FDEPTH: 14 15 GearCond.code:
 BDEPTH: 14 15 Validity code:
 Towing dir: 270ø Wire out: 120 m Speed: 30 kn*10

Sorted: 24 Kg Total catch: 270.38 CATCH/HOUR: 540.76

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Arius parkii	150.72	320	27.87	
Pomadasy jubelini	102.32	134	18.92	3911
Brachydeuterus auritus	60.80	912	11.24	
Chloroscombrus chrysurus	50.88	848	9.41	
Galeoides decadactylus	32.00	256	5.92	
Pseudolithus senegalensis	28.40	86	5.25	3912
Pteroscion peli	23.84	416	4.41	
Pomadasy peroteti	16.16	32	2.99	3910
Ilisha africana	14.08	1200	2.60	
Trichiurus lepturus	12.00	368	2.22	
J E L L Y F I S H	9.28	80	1.72	
Penaeus notialis	7.52	1920	1.39	
Sardinella maderensis	7.52	64	1.39	
Dasyatis margarita	5.84	20	1.08	
Pisodonophis semicinctus	5.20	16	0.96	
Pentanemus quinquarius	3.20	64	0.59	
Sphyrna guachancho	2.82	8	0.52	
C R A B S	2.56	128	0.47	
Scomberomorus tritor	1.90	6	0.35	
Selene dorsalis	1.44	96	0.27	
Rhinoptera marginata	0.68	2	0.13	
Penaeus monodon	0.20	2	0.04	
Total	539.36		99.74	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2373
 DATE: 1/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1231
 start stop duration Long W 1720
 TIME :18:51:44 19:21:11 29 (min) Purpose code: 1
 LOG :4546.01 4547.40 1.38 Area code : 4
 FDEPTH: 25 25 GearCond.code:
 BDEPTH: 25 25 Validity code:
 Towing dir: 180ø Wire out: 140 m Speed: 30 kn*10

Sorted: 34 Kg Total catch: 335.93 CATCH/HOUR: 695.03

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Galeoides decadactylus	176.11	2714	25.34	
J E L L Y F I S H	127.12	513	18.29	
Brachydeuterus auritus	99.97	18803	14.38	
Eucinostomus melanopterus	65.21	877	9.38	
Ilisha africana	49.16	745	7.07	3913
Arius parkii	22.68	199	3.26	
Pomadasy jubelini	18.95	33	2.73	3914
Pteroscion peli	17.71	166	2.55	
Lethrinus atlanticus	14.59	2	2.10	
Pagrus caeruleostictus	14.28	46	2.05	
Alectis alexandrinus	10.92	21	1.57	
Chilomycterus reticulatus	9.89	2	1.42	
Drepane africana	8.32	37	1.20	
Pseudolithus senegalensis	8.21	21	1.18	3915
Dasyatis marmorata	6.00	8	0.86	
Acanthurus monroviae	4.74	6	0.68	
Cynoponticus ferox	4.30	19	0.62	
Fistularia tabacaria	4.06	8	0.58	
Chloroscombrus chrysurus	3.81	33	0.55	
Albula vulpes	3.10	6	0.45	
Trichiurus lepturus	3.08	12	0.44	
Sepia officinalis hierredda	2.73	6	0.39	
Sphyrna guachancho	2.30	8	0.33	
Pseudupeneus prayensis	2.15	21	0.31	
Rhizoprionodon acutus	1.84	2	0.26	
Zanobatus shoeneleini	1.49	2	0.21	
Lutjanus goreensis	1.47	2	0.21	
Lutjanus fulgens	1.43	8	0.21	
Chaetodon hoefleri	1.22	8	0.18	
Sardinella aurita	1.16	215	0.17	
Torpedo nobiliana	1.12	2	0.16	
Penaeus kerathurus	0.99	348	0.14	
Elops lacerta	0.93	2	0.13	
Plectorhinchus mediterraneus	0.91	4	0.13	
Uranoscopus polli	0.77	4	0.11	
Syacium micrurum	0.66	4	0.09	
Epinephelus goreensis	0.56	2	0.08	
Selene dorsalis juveniles	0.33	166	0.05	
Psettodes belcheri	0.33	2	0.05	
Parapenaeopsis atlantica	0.17	116	0.02	
Paronchelius stauchi	0.17	50	0.02	
Fistularia petimba	0.10	2	0.01	
Total	695.04		99.96	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2374
 DATE: 1/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1230
 start stop duration Long W 1726
 TIME :20:42:30 21:11:05 29 (min) Purpose code: 1
 LOG :4556.64 4558.14 1.44 Area code : 4
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 39 43 Validity code:
 Towing dir: 180ø Wire out: 140 m Speed: 32 kn*10

Sorted: Kg Total catch: 197.84 CATCH/HOUR: 409.32

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Alectis alexandrinus	184.14	395	44.99	3917
Sphyrna guachancho	39.68	261	9.69	
Brachydeuterus auritus	36.79	343	8.99	
Galeoides decadactylus	31.94	48	7.80	
Selene dorsalis	29.01	168	7.09	
Rhizoprionodon acutus	25.22	14	6.16	
Pomadasy jubelini	21.23	48	5.19	3916
Scomberomorus tritor	9.19	12	2.25	
Arius parkii	7.37	12	1.80	
Sphyrna couardi	6.97	4	1.70	
Trachinotus goreensis	4.59	10	1.12	
Selar crumenophthalmus	3.91	14	0.96	
Sardinella maderensis	2.94	14	0.72	
Caranx crysos	2.23	4	0.54	
Uraspis secunda	1.37	2	0.33	
Euthymnus alletteratus	1.24	2	0.30	
Stromateus fiatola	0.93	2	0.23	
Echeneis naucrates	0.58	4	0.14	
Total	409.33		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2375
 DATE: 2/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1241
 start stop duration Long W 1732
 TIME :03:44:57 04:05:22 20 (min) Purpose code: 1
 LOG :4598.09 4599.17 1.04 Area code : 4
 FDEPTH: 0 0 GearCond.code: 9
 BDEPTH: 45 43 Validity code: 9
 Towing dir: 90ø Wire out: 150 m Speed: 40 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

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

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2376
 DATE: 2/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1241
 start stop duration Long W 1710
 TIME :08:05:25 08:37:20 32 (min) Purpose code: 1
 LOG :4623.39 4625.12 1.71 Area code : 4
 FDEPTH: 19 19 GearCond.code:
 BDEPTH: 19 19 Validity code:
 Towing dir: 170ø Wire out: 150 m Speed: 32 kn*10

Sorted: 33 Kg Total catch: 525.00 CATCH/HOUR: 984.38

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Arius parkii	259.35	3964	26.35	
Brachydeuterus auritus	251.48	5723	25.55	
Ilisha africana	155.14	29295	15.76	
Pomadasy jubelini	102.38	281	10.40	3918
Galeoides decadactylus	55.13	315	5.60	
Pteroscion peli	36.75	473	3.73	
Chloroscombrus chrysurus	35.70	499	3.63	
Pseudotolithus senegalensis	23.81	315	2.42	
Elops lacerta	13.13	53	1.33	
Dasyatis margarita	11.81	26	1.20	
Trichiurus lepturus	7.88	604	0.80	
Sepiella ornata	6.30	53	0.64	
Sardinella maderensis	6.30	53	0.64	
J E L L Y F I S H	4.20	26	0.43	
Stromateus fiatola	3.94	8	0.40	
Alectis alexandrinus	3.26	2	0.33	
Parapenaeopsis atlantica	2.89	1155	0.29	
Rhizoprionodon acutus	1.52	2	0.15	
Selene dorsalis, juveniles	1.05	26	0.11	
Scomberomorus tritor	0.81	2	0.08	
Sphyaena guachancho	0.58	2	0.06	
Sepia officinalis hierredda	0.56	2	0.06	
Cynoglossus monodi	0.26	26	0.03	
Penaeus monodon	0.17	2	0.02	
Total	984.40		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2377
 DATE: 2/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1242
 start stop duration Long W 1704
 TIME :10:10:53 10:40:17 29 (min) Purpose code: 1
 LOG :4635.12 4636.64 1.50 Area code : 4
 FDEPTH: 16 16 GearCond.code:
 BDEPTH: 16 16 Validity code:
 Towing dir: 12ø Wire out: 130 m Speed: 32 kn*10

Sorted: 32 Kg Total catch: 154.51 CATCH/HOUR: 319.68

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	121.99	1457	38.16	3920
Chloroscombrus chrysurus	113.54	1630	35.52	
Ilisha africana	26.90	3724	8.41	3921
Sardinella maderensis	18.04	149	5.64	3919
Pomadasy jubelini	9.31	23	2.91	3922
Trichiurus lepturus	8.23	97	2.57	
Arius parkii	5.65	33	1.77	
Sphyaena guachancho	4.84	14	1.51	
Galeoides decadactylus	2.81	8	0.88	
Ephippion guttifer	2.75	2	0.86	
Selene dorsalis	1.74	116	0.54	
Scomberomorus tritor	1.41	4	0.44	
Decapterus rhonchus	1.18	4	0.37	
Rhizoprionodon acutus	1.03	2	0.32	
Penaeus notialis	0.17	17	0.05	
Sepiella ornata	0.08	8	0.03	
Total	319.67		99.98	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2378
 DATE: 2/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1250
 start stop duration Long W 1701
 TIME :11:44:26 12:14:55 30 (min) Purpose code: 1
 LOG :4643.49 4645.15 1.64 Area code : 4
 FDEPTH: 18 18 GearCond.code:
 BDEPTH: 18 18 Validity code:
 Towing dir: 24ø Wire out: 150 m Speed: 40 kn*10

Sorted: 34 Kg Total catch: 383.38 CATCH/HOUR: 766.76

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	422.28	8514	55.07	3925
Sardinella maderensis	103.50	954	13.50	3924
Brachydeuterus auritus	67.14	864	8.76	
Pomadasy peroteti	56.24	120	7.33	3927
Sardinella aurita	55.80	378	7.28	3923
Trichiurus lepturus	16.38	72	2.14	
Pomadasy jubelini	13.02	26	1.70	3926
Sphyaena guachancho	10.12	22	1.32	
Scomberomorus tritor	7.30	10	0.95	
Rhizoprionodon acutus	5.52	2	0.72	
Decapterus rhonchus	3.38	12	0.44	
Alectis alexandrinus	2.94	4	0.38	
Pomadasy rogeri	1.88	2	0.25	
Ilisha africana	1.26	36	0.16	
Total	766.76		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2379
 DATE: 2/11/05 GEAR TYPE: PT No: 7 POSITION:Lat N 1251
 start stop duration Long W 1712
 TIME :14:15:29 14:45:15 30 (min) Purpose code: 1
 LOG :4661.62 4663.57 1.95 Area code : 4
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 27 25 Validity code:
 Towing dir: 180ø Wire out: 150 m Speed: 40 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

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

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2380
 DATE: 2/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1251
 start stop duration Long W 1738
 TIME :19:13:33 19:25:12 12 (min) Purpose code: 1
 LOG :4702.18 4702.83 0.64 Area code : 4
 FDEPTH: 80 78 GearCond.code:
 BDEPTH: 80 78 Validity code:
 Towing dir: 182ø Wire out: 250 m Speed: 32 kn*10

Sorted: Kg Total catch: 15.34 CATCH/HOUR: 76.70

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scorpaena angolensis	15.35	305	20.01	
Chelidonichthys gabonensis	11.85	270	15.45	
Decapterus rhonchus	7.65	45	9.97	3929
Liocarcinus corrugatus	6.85	1040	8.93	
Dicologlossa cuneata	6.25	80	8.15	
Pagellus bellottii	5.65	220	7.37	3928
Priacanthus arenatus	3.05	40	3.98	
Raja miraletus	3.00	10	3.91	
Sphoeroides marmoratus	2.50	55	3.26	
Sphoeroides pachgaster	2.30	20	3.00	
Citharus linguatula	2.05	75	2.67	
Ariomma bondi	1.65	45	2.15	
Saurida brasiliensis	1.65	290	2.15	
Arnoglossus imperialis	1.15	185	1.50	
Pistularia petimba	1.05	5	1.37	
Uranoscopus polli	1.05	15	1.37	
Sepia sp.	0.95	40	1.24	
Pentheroscion mbizi	0.75	5	0.98	
Trachinus armatus	0.65	15	0.85	
Microchirus variegatus	0.45	30	0.59	
Setarches guentheri	0.30	20	0.39	
Squilla mantis	0.30	5	0.39	
OPHIDIIDAE	0.25	20	0.33	
Total	76.70		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2381
 DATE: 2/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1302
 start stop duration Long W 1723
 TIME :23:23:22 23:53:14 30 (min) Purpose code: 1
 LOG :4737.41 4739.11 1.67 Area code : 4
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 47 43 Validity code:
 Towing dir: 90ø Wire out: 140 m Speed: 32 kn*10

Sorted: Kg Total catch: 21.06 CATCH/HOUR: 42.12

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	30.44	280	72.27	3931
Decapterus rhonchus	4.52	18	10.73	3930
Brachydeuterus auritus	3.16	30	7.50	
Selar crumenophthalmus	1.32	4	3.13	
Caranx crysos	1.12	4	2.66	
Chloroscombrus chrysurus	0.62	4	1.47	
Sphyræna guanchancho	0.48	2	1.14	
Alectis alexandrinus	0.36	2	0.85	
Decapterus punctatus	0.10	4	0.24	
Total	42.12		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2382
 DATE: 3/11/05 GEAR TYPE: PT No: 7 POSITION:Lat N 1304
 start stop duration Long W 1704
 TIME :02:14:44 02:34:29 20 (min) Purpose code: 1
 LOG :4758.57 4759.89 1.29 Area code : 5
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 23 25 Validity code:
 Towing dir: 270ø Wire out: 140 m Speed: 35 kn*10

Sorted: 23 Kg Total catch: 278.92 CATCH/HOUR: 836.76

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	438.48	3096	52.40	3933
Sardinella maderensis	274.32	3240	32.78	
Brachydeuterus auritus	94.32	1368	11.27	
Sardinella aurita	16.08	141	1.92	3932
Eucinostomus melanopterus	7.92	108	0.95	
Pomadasy jubelini	4.86	18	0.58	
Alectis alexandrinus	0.57	3	0.07	
Selene dorsalis	0.15	3	0.02	
Decapterus rhonchus juv	0.06	9	0.01	
Total	836.76		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2383
 DATE: 3/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1309
 start stop duration Long W 1732
 TIME :08:55:59 09:20:48 25 (min) Purpose code: 1
 LOG :4818.86 4820.23 1.36 Area code : 5
 FDEPTH: 93 97 GearCond.code: 4
 BDEPTH: 93 97 Validity code:
 Towing dir: 360ø Wire out: 300 m Speed: 32 kn*10

Sorted: Kg Total catch: 3.28 CATCH/HOUR: 7.87

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Fistularia petimba	3.89	14	49.43	
Pagellus bellottii	2.11	34	26.81	3934
Zeus faber	0.53	5	6.73	
Dentex angolensis	0.43	10	5.46	
Brachydeuterus auritus	0.24	2	3.05	
Illex coindetii	0.17	2	2.16	
Dentex congoensis	0.12	5	1.52	
Dicologlossa hexophthalma	0.12	2	1.52	
Arnoglossus imperialis	0.12	10	1.52	
Sepia officinalis hierredda	0.07	5	0.89	
Saurida brasiliensis	0.02	2	0.25	
Priacanthus arenatus	0.02	2	0.25	
Lepidotrigla carolae	0.02	2	0.25	
Total	7.86		99.84	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2384
 DATE: 3/11/05 GEAR TYPE: 00 No: POSITION:Lat N 1323
 start stop duration Long W 1730
 TIME :13:01:30 13:19:37 18 (min) Purpose code: 1
 LOG :4845.03 4845.97 0.93 Area code : 5
 FDEPTH: 110 109 GearCond.code:
 BDEPTH: 110 109 Validity code:
 Towing dir: 180ø Wire out: 350 m Speed: 30 kn*10

Sorted: 87 Kg Total catch: 355.08 CATCH/HOUR: 1183.60

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex angolensis	499.73	2853	42.22	3935
Boops boops	464.27	4427	39.23	3937
Dentex macrophthalmus	97.87	547	8.27	
Trachurus trecae	29.47	200	2.49	3936
Scorpaena scrofa	25.87	40	2.19	
Erythrocles monodi	23.07	93	1.95	
Plectorhynchus mediterraneus	18.33	3	1.55	
Zeus faber	8.93	27	0.75	
Aulopus cadenati	6.00	27	0.51	
Leptocharias smithii	4.73	3	0.40	
Capros aper	4.40	133	0.37	
Branchiostegus semifasciatus	0.53	3	0.04	
Anthias anthias	0.40	53	0.03	
Syacium micrurum	0.40	27	0.03	
Total	1184.00		100.03	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2385
 DATE: 3/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1322
 start stop duration Long W 1706
 TIME :16:57:50 17:27:53 30 (min) Purpose code: 1
 LOG :4873.59 4875.11 1.53 Area code : 5
 FDEPTH: 32 32 GearCond.code:
 BDEPTH: 32 32 Validity code:
 Towing dir: 180ø Wire out: 150 m Speed: 30 kn*10
 Sorted: 86 Kg Total catch: 576.76 CATCH/HOUR: 1153.52

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	440.00	6090	38.14	3938
Chloroscombrus chrysurus	410.66	6000	35.60	3943
Pomadasys incisus	81.60	600	7.07	3942
Pagrus caeruleostictus	42.80	174	3.71	3939
Decapterus rhonchus	28.66	346	2.48	3941
Pomadasys jubelini	24.00	40	2.08	
Pseudupeneus prayensis	21.74	120	1.88	3940
Selene dorsalis	21.06	254	1.83	
Sphyraena guachancho	15.86	54	1.37	
Priacanthus arenatus	13.46	40	1.17	
Galeoides decadactylus	11.46	80	0.99	
Ballistes punctatus	10.80	14	0.94	
Pagellus bellottii	4.94	26	0.43	
Plectorhinchus mediterraneus	4.66	26	0.40	
Eucinostomus melanopterus	4.40	40	0.38	
Sphyraena afra	4.22	2	0.37	
Sardinella aurita	3.20	26	0.28	
Paraconger notialis	2.40	14	0.21	
Epinephelus goreensis	2.40	14	0.21	
Sea cucumbers	2.26	14	0.20	
Syacium micrurum	1.74	14	0.15	
Serranus scriba	1.20	14	0.10	
Total	1153.52		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2386
 DATE: 3/11/05 GEAR TYPE: PT No: 7 POSITION:Lat N 1323
 start stop duration Long W 1656
 TIME :18:59:30 19:30:14 31 (min) Purpose code: 1
 LOG :4886.82 4888.70 1.87 Area code : 5
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 17 17 Validity code:
 Towing dir: 10ø Wire out: 150 m Speed: 33 kn*10
 Sorted: 71 Kg Total catch: 1033.33 CATCH/HOUR: 1999.99

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	943.35	8026	47.17	3947
Chloroscombrus chrysurus	840.25	13246	42.01	3945
Sardinella aurita	94.01	701	4.70	3946
Brachydeuterus auritus	44.61	869	2.23	
Ilisha africana	23.85	1740	1.19	
Galeoides decadactylus	19.92	588	1.00	
Pomadasys jubelini	8.28	35	0.41	3944
Selene dorsalis	5.32	83	0.27	
Trichiurus lepturus	4.80	19	0.24	
Sepia officinalis hierredda	4.20	56	0.21	
Sphyraena guachancho	3.39	10	0.17	
Penaeus notialis	3.29	225	0.16	
Rhizoprionodon acutus	2.73	4	0.14	
Scomberomorus tritor	0.81	2	0.04	
Caranx hippos	0.56	27	0.03	
Arius parkii	0.54	2	0.03	
Ethmalosa fimbriata	0.29	2	0.01	
Drepane africana	0.08	2		
Alectis alexandrinus	0.04	2		
Callinectes pallidus	0.02	2		
Total	2000.34		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2387
 DATE: 3/11/05 GEAR TYPE: PT No: 7 POSITION:Lat N 1332
 start stop duration Long W 1657
 TIME :21:04:42 21:29:00 24 (min) Purpose code: 1
 LOG :4899.87 4901.27 1.38 Area code : 5
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 21 21 Validity code:
 Towing dir: 90ø Wire out: 150 m Speed: 32 kn*10
 Sorted: 33 Kg Total catch: 115.82 CATCH/HOUR: 289.55

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	107.40	923	37.09	3950
Sardinella aurita	55.50	375	19.17	3949
Chloroscombrus chrysurus	42.00	758	14.51	3952
Brachydeuterus auritus	29.18	998	10.08	3948
Decapterus rhonchus	15.95	75	5.51	3951
Ilisha africana	11.93	450	4.12	
Sphyraena guachancho	5.75	33	1.99	
Trachinotus goreensis	5.38	15	1.86	
Trichiurus lepturus	4.30	15	1.49	
Selene dorsalis	3.60	60	1.24	
Alectis alexandrinus	3.10	23	1.07	
Galeoides decadactylus	1.73	45	0.60	
Pomadasys jubelini	1.08	5	0.37	
Ethmalosa fimbriata	0.68	3	0.23	
Arius laticutatus	0.65	3	0.22	
Callinectes pallidus	0.60	5	0.21	
Penaeus notialis	0.48	23	0.17	
Hemiramphus brasiliensis	0.15	3	0.05	
Echeneis naucrates	0.13	3	0.04	
Total	289.59		100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2388
 DATE: 3/11/05 GEAR TYPE: PT No: 7 POSITION:Lat N 1332
 start stop duration Long W 1711
 TIME :23:24:01 23:32:03 8 (min) Purpose code: 1
 LOG :4916.95 4917.35 0.37 Area code : 5
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 43 43 Validity code: 9
 Towing dir: 270ø Wire out: 150 m Speed: 32 kn*10
 Sorted: Kg Total catch: CATCH/HOUR:

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

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2389
 DATE: 4/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1332
 start stop duration Long W 1713
 TIME :23:58:04 00:28:36 31 (min) Purpose code: 1
 LOG :4918.90 4920.66 1.73 Area code : 5
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 49 54 Validity code:
 Towing dir: 270ø Wire out: 140 m Speed: 35 kn*10
 Sorted: Kg Total catch: 30.09 CATCH/HOUR: 58.24

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	21.10	257	36.23	3955
Sardinella maderensis	15.60	126	26.79	3953
Selar crumenophthalmus	14.79	54	25.39	3956
Sardinella aurita	1.97	17	3.38	3954
Sphyraena guachancho	1.70	6	2.92	
Selene dorsalis	1.32	14	2.27	
Chloroscombrus chrysurus	1.32	17	2.27	
Trachinotus ovatus	0.35	2	0.60	
Echeneis naucrates	0.10	2	0.17	
Total	58.25		100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2390
 DATE: 4/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1332
 start stop duration Long W 1726
 TIME :02:10:45 02:40:28 30 (min) Purpose code: 1
 LOG :4933.36 4935.24 1.88 Area code : 5
 FDEPTH: 25 25 GearCond.code:
 BDEPTH: 103 92 Validity code:
 Towing dir: 90ø Wire out: 140 m Speed: 35 kn*10

Sorted: Kg Total catch: 60.48 CATCH/HOUR: 120.96

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	39.80	374	32.90	3958
Brachydeuterus auritus	35.08	360	29.00	3957
MYCTOPHIDAE	30.40	14874	25.13	
Priacanthus arenatus	3.88	582	3.21	
Selene dorsalis	2.40	14	1.98	
Selar crumenophthalmus	1.74	8	1.44	
Ariomma bondi	1.72	118	1.42	
Decapterus rhonchus	1.64	8	1.36	
Caranx crysos	1.38	2	1.14	
Sardinella maderensis	1.34	10	1.11	
Trachurus trecae, juvenile	0.72	80	0.60	
Sphyræna guachancho	0.42	2	0.35	
Trachinotus ovatus	0.28	2	0.23	
Promethichthys prometheus	0.16	8	0.13	
Total	120.96		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2391
 DATE: 4/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1342
 start stop duration Long W 1700
 TIME :11:26:02 11:44:33 19 (min) Purpose code: 1
 LOG :5002.06 5003.04 0.96 Area code : 4
 FDEPTH: 21 21 GearCond.code:
 BDEPTH: 21 21 Validity code:
 Towing dir: 90ø Wire out: 110 m Speed: 33 kn*10

Sorted: 21 Kg Total catch: 53.27 CATCH/HOUR: 168.22

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	35.43	291	21.06	3960
Chloroscombrus chrysurus	28.93	461	17.20	3961
Pagrus caeruleostictus	23.87	95	14.19	3962
Sphyræna afra	23.75	3	14.12	
Brachydeuterus auritus	20.27	221	12.05	3959
Galeoides decadactylus	7.20	51	4.28	
Raja miraletus	4.61	6	2.74	
Epinephelus aeneus	4.58	6	2.72	
Sepia officinalis hierredda	4.20	6	2.50	
Pomadasys incisus	4.11	25	2.44	
Pomadasys jubelini	2.72	6	1.62	
Selene dorsalis	2.15	19	1.28	
Acanthurus monroviae	2.02	6	1.20	
Sardinella aurita	1.77	6	1.05	
Pagellus bellottii	1.39	6	0.83	
Solea senegalensis	0.76	6	0.45	
Chaetodipterus goreensis	0.47	6	0.28	
Total	168.23		100.01	

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R. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2392
 DATE: 4/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1349
 start stop duration Long W 1657
 TIME :14:06:33 14:16:20 10 (min) Purpose code: 1
 LOG :5020.22 5020.68 0.44 Area code : 4
 FDEPTH: 16 16 GearCond.code:
 BDEPTH: 16 16 Validity code:
 Towing dir: 150ø Wire out: 110 m Speed: 30 kn*10

Sorted: 24 Kg Total catch: 114.88 CATCH/HOUR: 689.28

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Diplodus bellottii	446.40	5520	64.76	
Chloroscombrus chrysurus	79.92	2760	11.59	3965
Sardinella maderensis	56.04	462	8.13	3963
Pagrus caeruleostictus	37.74	240	5.48	3964
Pomadasys incisus	20.16	192	2.92	
Brachydeuterus auritus	15.12	168	2.19	
Euclinostomus melanopterus	9.36	168	1.36	
Elops lacerta	7.56	18	1.10	
Decapterus rhonchus	3.60	96	0.52	
Sardinella aurita	3.42	24	0.50	
Galeoides decadactylus	3.12	72	0.45	
Alectis alexandrinus	3.12	12	0.45	
Ephippion guttifer	1.68	24	0.24	
Epinephelus aeneus	1.50	6	0.22	
Selene dorsalis	0.54	12	0.08	
Total	689.28		99.99	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2393
 DATE: 4/11/05 GEAR TYPE: PT No: 2 POSITION:Lat N 1402
 start stop duration Long W 1721
 TIME :21:20:44 21:37:28 17 (min) Purpose code: 1
 LOG :5087.61 5088.62 1.00 Area code : 4
 FDEPTH: 40 40 GearCond.code:
 BDEPTH: 68 75 Validity code:
 Towing dir: 270ø Wire out: 150 m Speed: 35 kn*10

Sorted: 66 Kg Total catch: 888.74 CATCH/HOUR: 3136.73

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	2839.76	19585	90.53	3966
Scomber japonicus	258.74	1002	8.25	3967
Decapterus rhonchus	15.74	95	0.50	
Trachurus trecae	14.79	145	0.47	
Sarda sarda	7.69	7	0.25	
Total	3136.72		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2394
 DATE: 5/11/05 GEAR TYPE: PT No: 7 POSITION:Lat N 1407
 start stop duration Long W 1702
 TIME :01:42:23 02:12:16 30 (min) Purpose code: 1
 LOG :5119.12 5121.19 2.08 Area code : 4
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 17 16 Validity code:
 Towing dir: 160ø Wire out: 140 m Speed: 35 kn*10

Sorted: 26 Kg Total catch: 143.00 CATCH/HOUR: 286.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	150.40	1580	52.59	3970
Brachydeuterus auritus	69.00	700	24.13	3968
Euclinostomus melanopterus	23.00	370	8.04	
Pomadasys peroteti	11.20	30	3.92	3969
Decapterus rhonchus	9.50	100	3.32	
Pomadasys incisus	6.10	40	2.13	
Sphyræna guachancho	5.00	12	1.75	
Selene dorsalis	4.90	60	1.71	
Galeoides decadactylus	1.88	4	0.66	
Chaetodipterus goreensis	1.54	4	0.54	
Raja miraletus	1.52	4	0.53	
Scomberomorus tritor	1.02	2	0.36	
Penaeus notialis	0.50	30	0.17	
Dactylopterus volitans	0.44	2	0.15	
Total	286.00		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2395
 DATE: 5/11/05 GEAR TYPE: PT No: 2 POSITION:Lat N 1412
 start stop duration Long W 1717
 TIME :04:53:35 05:23:21 30 (min) Purpose code: 1
 LOG :5143.99 5145.85 1.84 Area code : 4
 FDEPTH: 30 25 GearCond.code:
 BDEPTH: 46 42 Validity code:
 Towing dir: 90ø Wire out: 120 m Speed: 40 kn*10

Sorted: 90 Kg Total catch: 1043.96 CATCH/HOUR: 2087.92

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	1450.46	16888	69.47	3974
Sardinella aurita	210.18	1670	10.07	3971
Sardinella maderensis	174.22	1206	8.34	3972
Decapterus rhonchus	158.22	1182	7.58	3973
Brachydeuterus auritus	38.74	440	1.86	
Sphyræna guachancho	14.14	46	0.68	
Pomadasys incisus	12.52	92	0.60	
Trachurus trecae	7.18	46	0.34	
Priacanthus arenatus	5.80	22	0.28	
Plectorhinchus mediterraneus	4.86	22	0.23	
Selene dorsalis	3.48	22	0.17	
Decapterus punctatus	3.48	116	0.17	
Chelidonichthys gabonensis	2.32	22	0.11	
Dactylopterus volitans	2.32	46	0.11	
Total	2087.92		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2396
 DATE: 5/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 1420
 start stop duration Long W 1728
 TIME :11:07:39 11:33:14 26 (min) Purpose code: 1
 LOG :5190.31 5190.31 Area code : 4
 FDEPTH: 105 105 GearCond.code:
 BDEPTH: 105 105 Validity code:
 Towing dir: 360ø Wire out: 360 m Speed: 32 kn*10

Sorted: 33 Kg Total catch: 100.66 CATCH/HOUR: 232.29

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex angolensis	125.86	1398	54.18	3975
Trachurus trecae	69.09	312	29.74	3976
Boops boops	13.71	312	5.90	
Sepia officinalis hierredda	4.57	2	1.97	
Scorpaena stephanica	4.36	14	1.88	
Arnoglossus imperialis	3.95	498	1.70	
Dentex macropthalmus	3.81	76	1.64	
Priacanthus arenatus	3.32	478	1.43	
Merluccius senegalensis	1.94	2	0.84	
Chaetodon hoefleri	0.76	7	0.33	
Citharus linguatula	0.48	14	0.21	
SYNGNATHIDAE	0.35	7	0.15	
Serranus africanus	0.09	7	0.04	
Total	232.29		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2397
 DATE: 5/11/05 GEAR TYPE: PT No: 4 POSITION:Lat N 1431
 start stop duration Long W 1713
 TIME :15:40:05 16:04:02 24 (min) Purpose code: 1
 LOG :5228.59 5230.40 1.81 Area code : 4
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 30 31 Validity code:
 Towing dir: 180ø Wire out: 120 m Speed: 45 kn*10

Sorted: Kg Total catch: 0.72 CATCH/HOUR: 1.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella maderensis	1.80	8	100.00	
Total	1.80		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2398
 DATE: 5/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1441
 start stop duration Long W 1730
 TIME :20:32:05 20:58:59 27 (min) Purpose code: 1
 LOG :5274.32 5276.28 1.94 Area code : 4
 FDEPTH: 22 22 GearCond.code:
 BDEPTH: 38 37 Validity code:
 Towing dir: 340ø Wire out: 130 m Speed:420 kn*10

Sorted: 1 Kg Total catch: 54.26 CATCH/HOUR: 120.58

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Pomadasys jubelini	52.22	113	43.31	3977
Decapterus rhonchus	11.87	33	9.84	3978
Trachurus trecae	11.64	109	9.65	3979
Pomadasys rogeri	10.09	7	8.37	
Sardinella maderensis - Juv.	9.67	2856	8.02	
Dactylopterus volitans	5.69	16	4.72	
Selar crumenophthalmus	4.58	18	3.80	
Decapterus punctatus juv.	2.13	78	1.77	3980
Rhizoprionodon acutus	2.07	2	1.72	
Sphyræna guachancho	1.84	7	1.53	
Brachydeuterus auritus Juv.	1.67	611	1.38	
Lithognathus mormyrus	1.47	4	1.22	
Alloteuthis africana	1.44	544	1.19	
Pomadasys incisus	1.07	7	0.89	
Brachydeuterus auritus	0.73	4	0.61	
Sepia officinalis hierredda	0.64	2	0.53	
Chelidonichthys gabonensis	0.44	2	0.36	
Penaeus notialis	0.42	38	0.35	
Caranx hippos	0.38	2	0.32	
Loligo vulgaris	0.29	2	0.24	
Eucinostomus melanopterus	0.18	2	0.15	
Selene dorsalis, juveniles	0.11	11	0.09	
Rypticus saponaceus	0.02	2	0.02	
Total	120.66		100.08	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2399
 DATE: 6/11/05 GEAR TYPE: PT No: 4 POSITION:Lat N 1450
 start stop duration Long W 1733
 TIME :04:04:33 04:34:20 30 (min) Purpose code: 1
 LOG :5320.52 5322.54 2.01 Area code : 4
 FDEPTH: 0 0 GearCond.code:
 BDEPTH: 132 114 Validity code:
 Towing dir: 135ø Wire out: 150 m Speed: 40 kn*10

Sorted: Kg Total catch: 9.06 CATCH/HOUR: 18.12

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae, juvenile	6.84	436	37.75	3981
Priacanthus arenatus	3.62	430	19.98	
Caranx crysos	3.14	72	17.33	3982
Lagocephalus laevigatus	3.14	10	17.33	
Dactylopterus volitans	1.24	6	6.84	
Illex coindetii	0.10	2	0.55	
Elagatis bipinnulata	0.04	2	0.22	
Total	18.12		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2400
 DATE: 6/11/05 GEAR TYPE: PT No: 2 POSITION:Lat N 1455
 start stop duration Long W 1712
 TIME :11:06:30 11:38:24 32 (min) Purpose code: 1
 LOG :5380.39 5382.46 1.60 Area code : 4
 FDEPTH: 70 80 GearCond.code:
 BDEPTH: 98 219 Validity code:
 Towing dir: 275ø Wire out: 320 m Speed: 40 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

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

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2401
 DATE: 6/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1512
 start stop duration Long W 1700
 TIME :18:58:47 19:13:46 15 (min) Purpose code: 1
 LOG :5448.61 5449.69 1.07 Area code : 4
 FDEPTH: 25 35 GearCond.code:
 BDEPTH: 67 78 Validity code:
 Towing dir: 320ø Wire out: 200 m Speed: 42 kn*10

Sorted: 64 Kg Total catch: 159.25 CATCH/HOUR: 637.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	365.40	2408	57.36	3983
Brachydeuterus auritus	163.60	1528	25.68	3984
Selene dorsalis	60.92	1160	9.56	3986
Chloroscombrus chrysurus	27.08	288	4.25	3985
Decapterus rhonchus	11.32	48	1.78	
Boops boops	3.92	28	0.62	
Sphyræna guachancho	1.92	28	0.30	
Scomber japonicus	1.40	8	0.22	
Loligo vulgaris	0.60	4	0.09	
Lagocephalus laevigatus	0.52	8	0.08	
Sardinella maderensis	0.20	8	0.03	
Caranx crysos	0.20	8	0.03	
Total	637.08		100.00	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2402
 DATE: 7/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1533
 start stop duration Long W 1652
 TIME :02:30:27 03:00:15 30 (min) Purpose code: 1
 LOG :5517.43 5519.30 1.85 Area code : 4
 FDEPTH: 30 35 GearCond.code:
 BDEPTH: 56 71 Validity code:
 Towing dir: 294ø Wire out: 150 m Speed: 35 kn*10

Sorted: 28 Kg Total catch: 438.92 CATCH/HOUR: 877.84

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	411.10	3600	46.83	3984
Trachurus trecae	385.20	2610	43.88	3986
Alectis alexandrinus	29.92	26	3.41	3985
Chloroscombrus chrysurus	21.30	240	2.43	
Stromateus fiatola	11.96	14	1.36	
Trichiurus lepturus	6.90	60	0.79	
Selene dorsalis	6.60	90	0.75	
Sphyræna sphyraena	4.00	8	0.46	
Loligo vulgaris	0.96	2	0.11	
Total	877.94		100.02	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2403
 DATE: 7/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1552
 start stop duration Long W 1641
 TIME :14:31:47 15:01:44 30 (min) Purpose code: 1
 LOG :5615.41 5617.40 1.97 Area code : 4
 FDEPTH: 30 35 GearCond.code:
 BDEPTH: 41 50 Validity code:
 Towing dir: 284ø Wire out: 160 m Speed: 35 kn*10

Sorted: Kg Total catch: 143.65 CATCH/HOUR: 287.30

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	140.40	860	48.87	3987
Selene dorsalis	70.44	590	24.52	3988
Trachurus trecae	68.68	318	23.91	3989
Decapterus rhonchus	3.74	2	1.30	
Brachydeuterus auritus	1.70	14	0.59	
Lagocephalus laevigatus	0.92	4	0.32	
Loligo vulgaris	0.64	2	0.22	
Trichiurus lepturus	0.42	2	0.15	
Sardinella aurita	0.36	2	0.13	
Total	287.30		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2404
 DATE: 7/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1600
 start stop duration Long W 1634
 TIME :18:27:14 18:55:09 28 (min) Purpose code: 1
 LOG :5644.52 5646.27 1.44 Area code : 4
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 21 21 Validity code:
 Towing dir: 6ø Wire out: 130 m Speed: 38 kn*10

Sorted: 28 Kg Total catch: 327.04 CATCH/HOUR: 700.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chloroscombrus chrysurus	227.79	1843	32.50	3991
J E L L Y F I S H	186.21	879	26.57	
Trichiurus lepturus	54.04	41	7.71	
Ilisha africana	50.79	3943	7.25	
Selene dorsalis	49.07	279	7.00	3994
Caranx senegallus	32.74	88	4.67	3990
Galeoides decadactylus	25.93	193	3.70	
Pentanemus quinquarius	21.00	386	3.00	
Sardinella maderensis	12.43	64	1.77	3992
Brachydeuterus auritus	9.43	129	1.35	
Scomber japonicus	8.74	4	1.25	
Pseudotolithus senegalensis	5.79	107	0.83	
Pseudotolithus typus	4.50	21	0.64	
Drepane africana	3.43	43	0.49	
Pteroscion peli	3.21	43	0.46	
Pomadasys jubelini	2.01	2	0.29	
Sphyræna guachancho	2.01	2	0.29	
Lagocephalus laevigatus	1.05	4	0.15	
Penaeus notialis	0.36	4	0.05	
Pomadasys peroteti	0.26	19	0.04	3993
Total	700.79		100.01	

DR. FRIDTJOF NANSEN PROJECT:W3 PROJECT STATION:2405
 DATE: 7/11/05 GEAR TYPE: PT No: 1 POSITION:Lat N 1602
 start stop duration Long W 1643
 TIME :20:10:55 20:41:27 31 (min) Purpose code: 1
 LOG :5655.76 5658.01 2.22 Area code : 4
 FDEPTH: 25 35 GearCond.code:
 BDEPTH: 67 81 Validity code:
 Towing dir: 273ø Wire out: 160 m Speed: 42 kn*10

Sorted: 104 Kg Total catch: 104.23 CATCH/HOUR: 201.74

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	86.75	724	43.00	3995
Trachurus trecae	39.45	315	19.55	3996
Chloroscombrus chrysurus	27.68	135	13.72	3997
J E L L Y F I S H	18.95	48	9.39	
Trichiurus lepturus	17.42	228	8.63	
Sardinella aurita	3.95	25	1.96	
Decapterus rhonchus	2.85	8	1.41	
Sardinella maderensis	1.97	10	0.98	
Penaeus notialis	0.77	62	0.38	
Fistularia petimba	0.64	2	0.32	
Dactylopterus volitans	0.27	2	0.13	
Loligo vulgaris	0.25	2	0.12	
Pentanemus quinquarius	0.21	4	0.10	
Sphyræna guachancho	0.14	2	0.07	
Saurida brasiliensis	0.14	31	0.07	
Todarodes sagittatus	0.12	2	0.06	
Arius parkii	0.12	2	0.06	
Pseudupeneus prayensis	0.06	2	0.03	
Priacanthus arenatus	0.02	4	0.01	
Total	201.76		99.99	

Annex II Description of instruments and fishing gear

The Simrad EK-500, 38 kHz scientific echosounder was used for abundance estimation during the survey, in addition data from the 18 kHz, 120 kHz and 200 kHz transducers were recorded for possible future multifrequency target identification. The Bergen Echo Integrator system (BEI) recorded the hydroacoustic data and was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape and brought back to IMR for storing.

The details of the settings of the echosounders were as follows:

Transceiver 1 menu

Transducer depth	5.5 m
Absorption coeff.	10 dB/km
Pulse length	medium (1ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-21.0 dB
SV transducer gain	26.91dB
TS transducer gain	27.05
Angle sensitivity	21.9
3 dB beamwidth along.	7.0
3 dB beamwidth athw.	6.9
Alongship offset	0.01
Athwardship offset	0.02

Transceiver 2 menu

Transducer depth	5.5 m
Absorption coeff.	38 dB/km
Pulse length	long (1ms)
Bandwidth	narrow
Max power	1000 Watt
2-way beam angle	-20.6 dB
SV transducer gain	25.95dB
TS transducer gain	26.00dB
Angle sensitivity	21.0
3 dB beamwidth along.	7.2
3 dB beamwidth athw.	7.0
Alongship offset	0.10
Athwardship offset	-0.06

Transceiver 3 menu

Transducer depth	5.5 m
Absorption coeff.	3 dB/km
Pulse length	short (0.7ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-17.2 dB
SV transducer gain	23.87dB
TS transducer gain	23.82B
Angle sensitivity	13.9
3 dB beamwidth along.	10.9
3 dB beamwidth athw.	10.7
Alongship offset	0.04
Athwardship offset	0.09

Transceiver 4 menu (default settings used)

Transducer depth	5.5 m
Absorption coeff.	53 dB/km
Pulse length	Long
Bandwidth	Narrow
Max power	1000 Watt
2-way beam angle	-20.5 dB
SV transducer gain	23.84 dB
TS transducer gain	24.8 dB
Angle sensitivity	0.0
3 dB beamwidth along.	0.0°
3 dB beamwidth athw.	0.0°
Alongship offset	- 0.00°
Athwardship offset	0.00°

Display menu

Echogram	1
Bottom range	15 m
Bottom range start	10 m
TVG	20 log R
Sv colour min -	67 dB
TS Colour minimum	-50 dB

Printer- menu

Range	0-50, 0-100, 0-150, 0-250 or 0-500 m
TVG	20 log R
Sv colour min	-63 dB

Bottom detection menu

Minimum level	-50 dB
---------------	--------

Calibration

A calibration of the acoustic equipment was conducted during the acoustic survey of the small pelagic resources off Angola in August 2005.

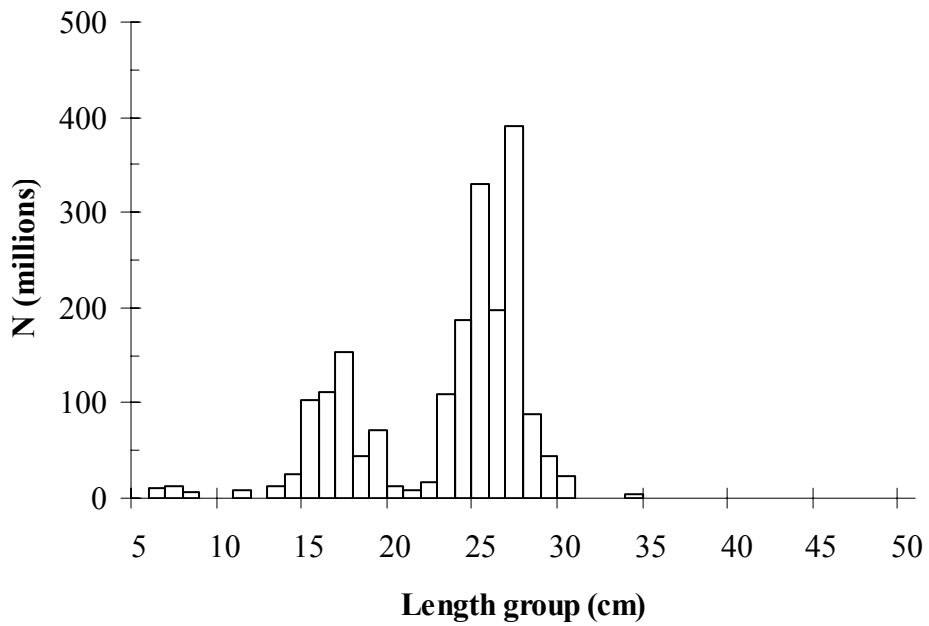
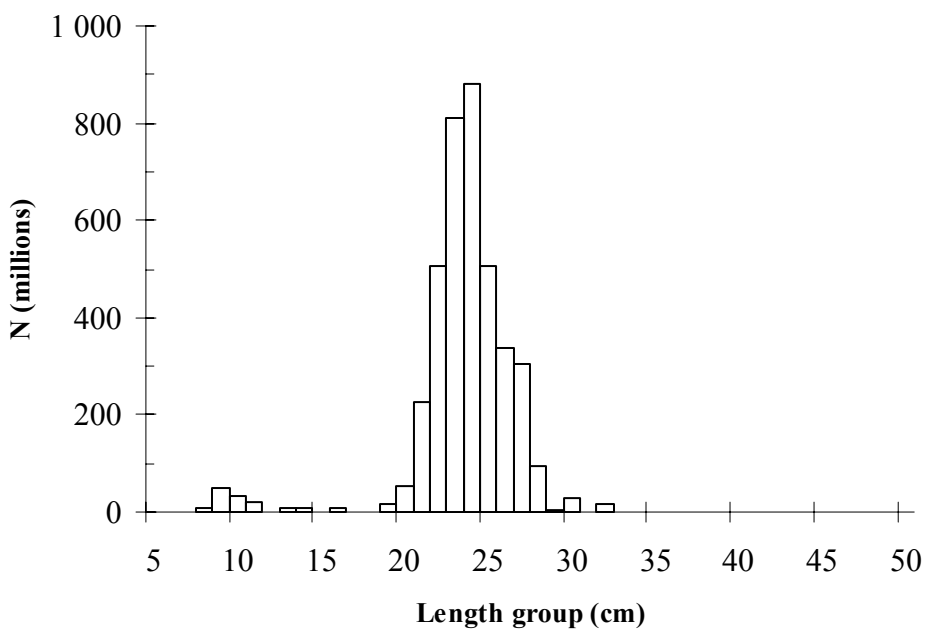
Fishing gear

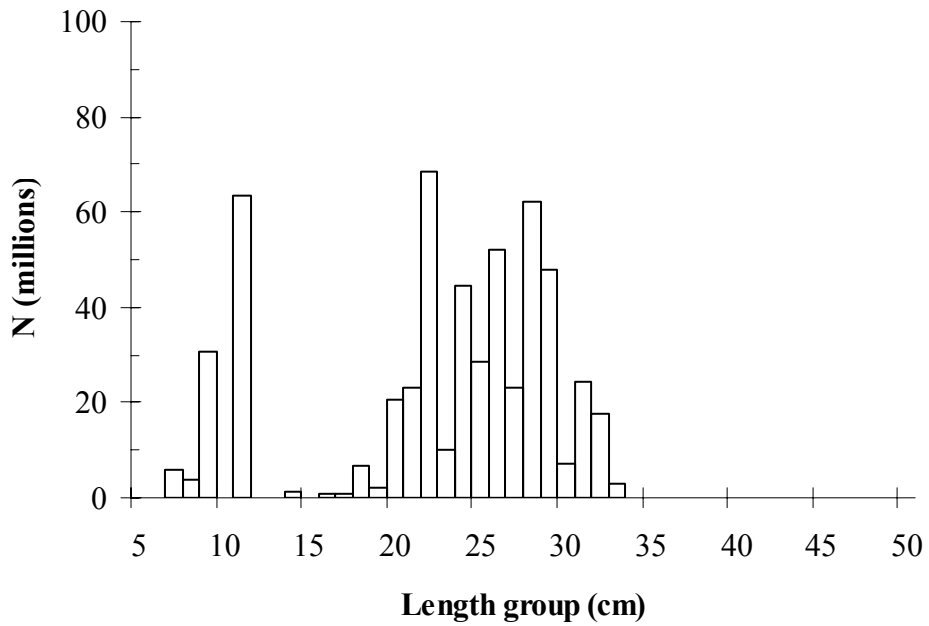
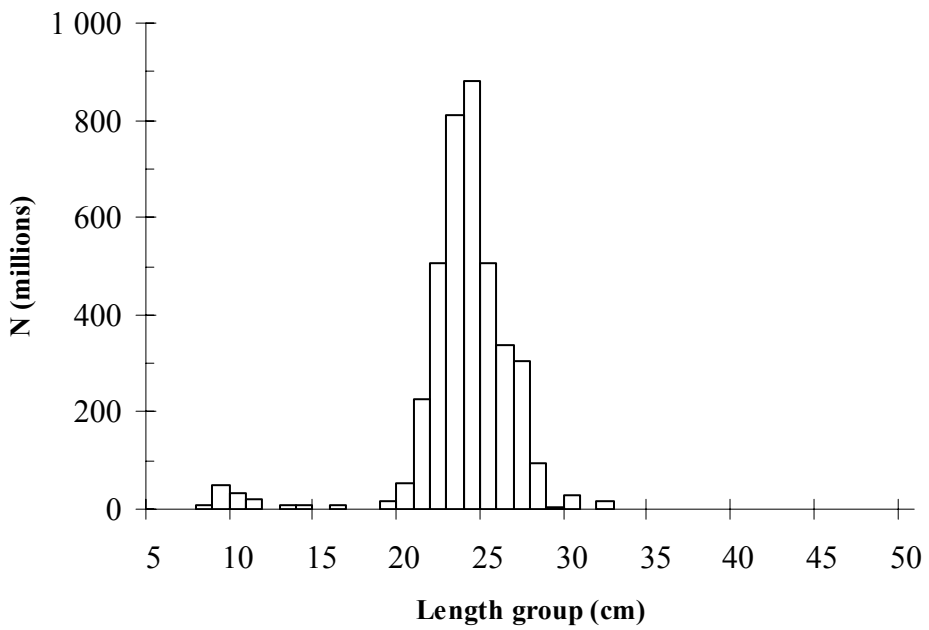
The vessel has three different sized four-panel 'Åkrahamn' pelagic trawls and one 'Gisund super bottom trawl'. The two smallest pelagic trawls and the demersal trawl were used during the survey. The smallest pelagic trawl has 10-12 m vertical opening under normal operation, whereas the intermediate sized trawl has 15-18 m opening.

The bottom trawl has a 31 m headline and a 47 m footrope fitted with a 12" rubber bobbins gear. The codend has 20 mm meshes, and has an inner net with 10 mm mesh size. The vertical opening is about 5.5 m. The distance between the wing tips is about 18 m during towing. The sweeps are 40 m long. The trawl doors are 'Thyborøen' combi, 8 m² and weigh 2000 kg. The door spreading is about 45 m when using restraining rope. Trawling was conducted for species identification only and no restraining rope was therefore used during the survey.

The SCANMAR system was used during all trawl hauls. This equipment consists of sensors, a hydrophone, a receiver, a display unit and a battery charger. Communication between sensors and ship is based on acoustic transmission. The doors are fitted with sensors to provide information on their distance and a height sensor is fitted on the bottom trawl to measure the trawl opening and provide information on clearance and bottom contact.

The pelagic trawls are equipped with a trawl eye that provides information about the trawl opening and the distance of the footrope to the bottom. A pressure sensor is used to show the depth on the headline.

Annex III Pooled length distributions by species*Sardinella aurita* October – November 2005*Sardinella maderensis* October – November 2005

Trachurus trecae October – November 2005*Decapterus rhonchus* October – November 2005

Annex IV Estimated number and biomass by length-group and sectors

Round sardinella (*Sardinella aurita*): October-November 2005

Numbers in millions						Biomass in 1000 tonnes					
Length cm	St. Louis- C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL	Length cm	St. Louis- C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL
5						5					
6						6					
7						7					
8						8					
9						9					
10						10					
11						11					
12						12					
13						13					
14						14					
15						15					
16						16					
17						17					
18						18					
19						19					
20						20					
21		103.5	159.6	6.5	269.7	21		9.9	15.2	0.6	25.7
22		88.9	107.5	1.0	197.4	22		9.7	11.8	0.1	21.6
23		183.0	118.9	17.8	319.7	23		22.8	14.8	2.2	39.8
24		416.0	134.1	67.4	617.5	24		58.7	18.9	9.5	87.2
25		62.2	15.6		77.9	25		9.9	2.5		12.4
26		73.0	10.3	0.3	83.7	26		13.0	1.8	0.1	14.9
27		128.2	21.2	25.7	175.1	27		25.6	4.2	5.1	35.0
28		67.2	13.2		80.4	28		14.9	2.9		17.9
29		84.5	1.2	5.1	90.9	29		20.8	0.3	1.3	22.4
30		19.3			19.3	30		5.3			5.3
31						31					
32						32					
33						33					
34						34					
35						35					
36						36					
37						37					
38						38					
39						39					
40						40					
41						41					
42						42					
43						43					
44						44					
45						45					
46						46					
47						47					
48						48					
49						49					
50						50					
Total		1 225.8	581.7	123.9	1 931.4	Total		191	73	19	282

Flat sardinella (*Sardinella maderensis*): October-November 2005

Numbers in millions						Biomass in 1000 tonnes					
Length cm	St. C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL	Length cm	St. C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL
5						5					
6						6					
7						7					
8						8					
9						9					
10						10					
11						11					
12						12					
13						13					
14				59.5	59.5	14				1.7	1.7
15		4.8	9.6		14.4	15		0.2	0.3		0.5
16				6.3	6.3	16				0.3	0.3
17			8.5		8.5	17			0.4		0.4
18				91.8	91.8	18				5.6	5.6
19		4.8	9.6	6.3	20.8	19		0.3	0.7	0.5	1.5
20						20					
21		46.7	73.3	537.2	657.2	21		4.5	7.0	51.2	62.7
22		144.7	53.0	268.9	466.7	22		15.8	5.8	29.4	51.0
23	4.4	186.8	405.2	365.3	961.7	23	0.5	23.3	50.5	45.5	119.8
24	0.9	413.3	467.8	256.2	1 138.1	24	0.1	58.3	66.0	36.2	160.7
25		91.5	189.0	126.9	407.4	25		14.6	30.1	20.2	64.9
26	12.3	60.6	111.6	39.1	223.6	26	2.2	10.8	19.9	7.0	40.0
27	7.9	88.4	35.9	16.7	148.8	27	1.6	17.6	7.2	3.3	29.7
28	9.6	5.3			15.0	28	2.1	1.2			3.3
29	7.0	5.3			12.3	29	1.7	1.3			3.0
30						30					
31						31					
32						32					
33						33					
34						34					
35						35					
36						36					
37						37					
38						38					
39						39					
40						40					
41						41					
42						42					
43						43					
44						44					
45						45					
46						46					
47						47					
48						48					
49						49					
50						50					
Total	42.1	1 052.3	1 363.6	1 774.3	4 232.4	Total	8	148	188	201	545

Cunene horse mackerel (*Trachurus trecae*): October-November 2005

Numbers in millions						Biomass in tonnes					
Length cm	St. Louis- C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL	Length cm	St. Louis- C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL
5						5					
6						6					
7	5.7				5.7	7	0.0				0.0
8	3.8				3.8	8	0.0				0.0
9	30.7				30.7	9	0.3				0.3
10						10					
11	57.5	6.1			63.6	11	0.8	0.1			0.9
12						12					
13						13					
14		1.3			1.3	14		0.0			0.0
15						15					
16		0.7			0.7	16		0.0			0.0
17		0.7			0.7	17		0.0			0.0
18		6.7			6.7	18		0.4			0.4
19		2.0			2.0	19		0.1			0.1
20	18.8	1.8			20.6	20	1.6	0.1			1.7
21	16.1	7.2			23.2	21	1.5	0.7			2.2
22	60.1	8.0	0.4		68.5	22	6.6	0.9	0.0		7.5
23	7.5	2.4			10.0	23	0.9	0.3			1.2
24	22.8	18.0	3.9		44.7	24	3.2	2.5	0.5		6.3
25	28.7				28.7	25	4.6				4.6
26	51.7	0.6			52.3	26	9.2	0.1			9.3
27	16.4	6.0	0.7		23.1	27	3.3	1.2	0.1		4.6
28	62.0				62.0	28	13.8				13.8
29	45.5	2.1	0.4		47.9	29	11.2	0.5	0.1		11.8
30	7.3				7.3	30	2.0				2.0
31	24.6				24.6	31	7.4				7.4
32	17.8				17.8	32	5.9				5.9
33	3.1				3.1	33	1.1				1.1
34						34					
35						35					
36						36					
37						37					
38						38					
39						39					
40						40					
41						41					
42						42					
43						43					
44						44					
45						45					
46						46					
47						47					
48						48					
49						49					
50						50					
Total	480.1	63.5	5.3		548.9	Total	73	7	1		81

False scad (*Decapterus rhonchus*): October-November 2005

Numbers in millions						Biomass in tonnes					
Length cm	St. Louis- C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL	Length cm	St. Louis- C. Vert	C. Vert- Gambia	The Gambia	Casa- mance	TOTAL
5						5					
6						6					
7						7					
8						8					
9						9					
10						10					
11						11					
12						12					
13						13					
14						14					
15			0.4		0.4	15			0.0		0.0
16			1.6	1.0	2.6	16			0.1	0.0	0.1
17			1.8		1.8	17			0.1		0.1
18		0.8	0.2		1.0	18		0.0	0.0		0.1
19		0.8	1.8	2.0	4.5	19		0.1	0.1	0.1	0.3
20		0.8			0.8	20		0.1			0.1
21			0.6	1.0	1.6	21			0.1	0.1	0.2
22		3.1	0.2		3.3	22		0.3	0.0		0.4
23		4.6	1.0	1.0	6.6	23		0.6	0.1	0.1	0.8
24		5.4			5.4	24		0.8			0.8
25		0.8	1.9	2.0	4.6	25		0.1	0.3	0.3	0.7
26		1.5	1.3	2.0	4.9	26		0.3	0.2	0.4	0.9
27	24.4	1.5	1.7	2.0	29.6	27	4.9	0.3	0.3	0.4	5.9
28	49.9	3.4	3.9	4.0	61.2	28	11.1	0.8	0.9	0.9	13.6
29	26.5	0.4	1.8	1.0	29.7	29	6.5	0.1	0.5	0.2	7.3
30	1.0		1.1		2.1	30	0.3		0.3		0.6
31	0.6	0.8	0.4		1.7	31	0.2	0.2	0.1		0.5
32	1.2		1.2	2.0	4.4	32	0.4		0.4	0.7	1.4
33	0.6	0.4			1.0	33	0.2	0.1			0.3
34		1.8	0.2		2.0	34		0.7	0.1		0.8
35		1.1			1.1	35		0.5			0.5
36		0.7			0.7	36		0.3			0.3
37		0.4			0.4	37		0.2			0.2
38		0.4			0.4	38		0.2			0.2
39						39					
40						40					
41						41					
42						42					
43						43					
44						44					
45						45					
46						46					
47						47					
48						48					
49						49					
50						50					
Total	104.3	28.3	21.1	17.9	171.5	Total	23.6	5.6	3.6	3.3	36.0

Annex V Regional Estimates, October – December 2004

October-November 2005: Sardine (*Sardina pilchardus*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5		18.3					18.3
6		101.9					101.9
7		350.3					350.3
8		1,631.1					1,631.1
9		1,379.4					1,379.4
10		653.5					653.5
11		1,049.9	2.9				1,052.8
12		1,356.8	6.5				1,363.3
13		1,628.6	5.2				1,633.8
14		1,265.6	13.4				1,279.0
15		663.4	0.9				664.2
16		68.6	0.4				69.1
17		28.6					28.6
18		683.0					683.0
19		3,187.0					3,187.0
20		7,300.5					7,300.5
21		9,536.1	19.6	20.5			9,576.2
22		11,811.4	175.1	102.5			12,089.1
23		12,081.0	965.4	492.2			13,538.6
24		9,257.3	2,013.3	1,353.6			12,624.2
25		3,450.9	2,388.6	1,415.1			7,254.6
26		912.6	1,148.0	1,421.1			3,481.7
27		287.8	374.1	1,652.8			2,314.6
28			77.3				77.3
29							
30							
Total	N.A.	68,703.6	7,190.5	6,457.8			82,351.9

October-November 2005: Sardine (*Sardina pilchardus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5		25					25
6		229					229
7		1,212					1,212
8		8,214					8,214
9		9,698					9,698
10		6,203					6,203
11		13,093	43				13,136
12		21,730	121				21,851
13		32,857	122				32,979
14		31,639	392				32,031
15		20,256	31				20,287
16		2,528	19				2,547
17		1,257					1,257
18		35,460					35,460
19		193,774					193,774
20		515,737					515,737
21		777,142	1,867	1,957			780,966
22		1,103,226	19,152	11,213			1,133,591
23		1,285,642	120,277	61,323			1,467,242
24		1,116,344	284,234	191,096			1,591,674
25		469,212	380,217	225,258			1,074,687
26		139,254	205,086	253,889			598,230
27		49,073	74,682	329,975			453,730
28			17,176				17,176
29							
30							
Total	N.A.	5,833,805	1,103,419	1,074,711			8,011,935

October-November 2005: Round sardinella (*Sardinella aurita*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7		291.2	386.8	90.6			768.6
8		441.8	174.6				616.4
9		150.6	440.7	16.2			607.5
10		10.0	234.2				244.2
11		10.0	95.8	3.2			109.1
12			41.5				41.5
13		29.0	25.4				54.4
14		90.7	353.0				443.7
15		200.8	29.9				230.7
16		167.3	314.8				482.1
17		317.7	13.1				330.8
18		167.3	30.5				197.8
19		74.0	10.2				84.2
20		23.9	6.8				30.7
21		21.3	5.1	0.7		269.7	296.8
22		3.9	5.1	1.5		197.4	207.9
23		39.5		0.7		319.7	359.9
24		119.4	6.8	0.1		617.5	743.8
25		214.5	15.2	0.3		77.9	307.9
26		348.9	35.6	0.1		83.7	468.2
27		264.9	30.5	1.2		175.1	471.7
28		97.1	22.0	3.1		80.4	202.6
29		51.0	15.2	8.3		90.9	165.3
30		47.4	3.4	6.3		19.3	76.4
31		6.6	3.4	1.6			11.6
32		86.9		0.4			87.3
33		54.7					54.7
34		71.8					71.8
35		115.7					115.7
36		36.7					36.7
37		67.8					67.8
38		9.2					9.2
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	3,631.9	2,299.5	134.4		1,931.4	7,997.2

October-November 2005: Round sardinella (*Sardinella aurita*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7		1,155	1,566	367			3,088
8		2,551	1,029				3,580
9		1,214	3,627	133			4,974
10		109	2,603				2,712
11		144	1,399	47			1,590
12			778				778
13		671	600				1,271
14		2,599	10,332				12,931
15		7,028	1,070				8,099
16		7,064	13,578				20,641
17		16,006	673				16,679
18		9,956	1,856				11,812
19		5,146	723				5,869
20		1,901	560				2,461
21		1,974	485	71		25,727	28,257
22		321	555	162		21,586	22,625
23		4,717		92		39,826	44,636
24		16,450	956	18		87,177	104,601
25		33,402	2,425	41		12,394	48,263
26		60,972	6,352	23		14,945	82,291
27		51,795	6,084	237		34,964	93,081
28		21,133	4,891	695		17,860	44,579
29		12,301	3,755	2,033		22,391	40,481
30		12,634	922	1,723		5,265	20,544
31		1,936	1,016	477			3,429
32		28,052		128			28,180
33		19,340					19,340
34		27,727					27,727
35		48,668					48,668
36		16,773					16,773
37		33,616					33,616
38		4,921					4,921
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	452,272	67,837	6,247		282,137	808,494

October-November 2005: Flat sardinella (*Sardinella maderensis*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5				5.9			5.9
6				82.8			82.8
7				78.6			78.6
8				44.3			44.3
9			0.5	5.1			5.6
10				0.5			0.5
11							
12			23.5				23.5
13							
14			19.6	59.5		59.5	138.6
15			23.5			14.4	37.9
16			15.6	55.3		6.3	77.3
17			19.6			8.5	28.1
18			9.6	16.4		91.8	117.8
19			3.9			20.8	24.7
20			27.4				27.4
21			84.1	7.2		657.2	748.5
22			96.7	10.8		466.7	574.2
23		14.0	134.0	112.7	4.4	957.3	1,222.4
24		147.2	70.2	17.7	0.9	1,137.2	1,373.2
25		129.8	63.3	53.3		407.4	653.8
26		198.2	218.2	427.0	12.3	211.3	1,067.0
27		236.7	175.1	172.7	7.9	141.0	733.4
28		9.1	224.5	274.6	9.6	5.3	523.1
29		60.4	51.7	71.4	7.0	5.3	195.8
30		17.0	4.4	74.9			96.3
31		1.5	34.0	52.5			87.9
32			11.3	45.7			57.0
33		3.0	32.7	23.5			59.2
34				24.9			24.9
35				10.8			10.8
36							
37				10.8			10.8
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	816.8	1,343.2	1,739.0	42.1	4,190.3	8,131.4

October-November 2005: Flat sardinella (*Sardinella maderensis*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5				9			9
6				218			218
7				319			319
8				261			261
9			4	42			46
10				6			6
11							
12			440				440
13							
14			572	1,743		1,742	4,057
15			839			517	1,356
16			675	2,384		274	3,333
17			1,006			440	1,446
18			582	994		5,582	7,158
19			278			1,480	1,759
20			2,265				2,265
21			8,020	690		62,703	71,413
22			10,570	1,184		51,031	62,786
23		1,759	16,700	14,042	546	119,270	152,317
24		20,999	9,905	2,501	124	160,552	194,081
25		20,867	10,078	8,482		64,850	104,278
26		35,765	38,975	76,292	2,193	37,757	190,983
27		47,721	34,963	34,485	1,576	28,141	146,886
28		2,018	49,880	61,021	2,144	1,183	116,245
29		15,038	12,738	17,597	1,729	1,312	48,414
30		4,670	1,206	20,410			26,286
31		452	10,195	15,745			26,393
32			3,733	15,067			18,800
33		1,092	11,817	8,480			21,389
34				9,826			9,826
35				4,624			4,624
36							
37				5,449			5,449
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	150,383	225,442	301,873	8,311	536,833	1,222,842

October-November 2005: Anchovy (*Engraulis encrasicolus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5		478.0					478.0
6		2,090.0		11.6			2,101.7
7		791.3		407.2			1,198.5
8		1,120.5		116.4			1,236.9
9		154.5		1,012.3			1,166.8
10				465.4			465.4
11				2,815.8			2,815.8
12				2,024.6			2,024.6
13				128.0			128.0
14							
15							
16							
17							
18							
19							
20							
Total	N.A.	4,634.3		6,981.4			11,615.7

October-November 2005: Anchovy (*Engraulis encrasicolus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5		429					429
6		3,099		31			3,130
7		1,803		1,649			3,452
8		3,716		686			4,402
9		715		8,332			9,047
10				5,172			5,172
11				41,112			41,112
12				37,961			37,961
13				3,023			3,023
14							
15							
16							
17							
18							
19							
20							
Total	N.A.	9,763		97,967			107,730

October-November 2005: Atlantic horse mackerel (*Trachurus trachurus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9		29.5					29.5
10		249.2					249.2
11		481.7					481.7
12		587.4					587.4
13		431.3					431.3
14		225.9					225.9
15		219.9					219.9
16		224.6					224.6
17		96.3					96.3
18		112.3					112.3
19		239.6					239.6
20		280.0					280.0
21		237.0					237.0
22		198.8					198.8
23		32.1					32.1
24		20.8					20.8
25		1.0					1.0
26		1.5					1.5
27		2.0					2.0
28		0.5					0.5
29		2.5					2.5
30		1.5					1.5
31		2.5					2.5
32		4.1					4.1
33		2.0					2.0
34		3.6					3.6
35		0.5					0.5
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	3,688.2					3,688.2

October-November 2005: Atlantic horse mackerel (*Trachurus trachurus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9		212					212
10		2,423					2,423
11		6,154					6,154
12		9,637					9,637
13		8,913					8,913
14		5,786					5,786
15		6,880					6,880
16		8,474					8,474
17		4,333					4,333
18		5,972					5,972
19		14,926					14,926
20		20,261					20,261
21		19,782					19,782
22		19,025					19,025
23		3,495					3,495
24		2,568					2,568
25		141					141
26		238					238
27		355					355
28		99					99
29		547					547
30		363					363
31		666					666
32		1,171					1,171
33		641					641
34		1,225					1,225
35		191					191
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	144,481					144,481

October-November 2005: Cunene horse mackerel (*Trachurus trecae*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7					5.7		5.7
8				3.8	3.8		7.7
9		22.3	22.4	8.6	30.7		84.0
10		162.5	19.3	145.1			327.0
11		2,655.0	366.6	185.3	57.5	6.1	3,270.4
12		3,525.3	191.8	153.0			3,870.1
13		1,142.2	45.3	78.1			1,265.6
14		582.3	52.1	243.5		1.3	879.2
15		46.5	7.6	25.9			80.0
16		39.3	5.5	16.7		0.7	62.2
17				7.4		0.7	8.1
18		88.4	0.1	5.3		6.7	100.6
19		84.4				2.0	86.4
20		628.9			18.8	1.8	649.5
21		743.9	0.0	3.8	16.1	7.2	770.9
22		675.7	4.3		60.1	8.3	748.5
23		1,279.3	4.6		7.5	2.4	1,293.9
24		678.6	0.0		22.8	21.9	723.3
25		633.9	0.0		28.7		662.6
26		549.5	0.0	0.4	51.7	0.6	602.2
27		149.3	14.7		16.4	6.7	187.1
28		321.0	17.8	0.0	62.0		400.8
29		409.6	14.9	1.1	45.5	2.5	473.6
30		178.6	21.3	0.0	7.3		207.3
31		123.5	8.7	1.1	24.6		157.9
32		44.6	6.4	3.9	17.8		72.7
33			5.9	6.5	3.1		15.5
34		7.4	0.5	0.0			8.0
35				7.6			7.6
36			0.3	4.9			5.2
37			5.3	10.8			16.2
38			0.3	3.9			4.2
39			1.0	2.2			3.2
40			4.7	11.5			16.2
41			15.6	4.9			20.6
42			15.3				15.3
43			17.7				17.7
44			5.0				5.0
45			4.3	1.1			5.4
46			4.3	3.8			8.2
47							
48							
49				3.8			3.8
50							
Total	N.A.	14,772.3	883.8	944.0	480.1	68.8	17,149.0

October-November 2005: Cunene horse mackerel (*Trachurus trecae*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7					23		23
8				23	23		45
9		161	184	71	252		668
10		1,580	215	1,613			3,408
11		33,919	5,353	2,705	839	89	42,904
12		57,837	3,597	2,868			64,302
13		23,607	1,070	1,844			26,521
14		14,912	1,524	7,127		37	23,600
15		1,454	272	925			2,651
16		1,483	239	718		29	2,469
17				380		35	415
18		4,704	9	322		410	5,445
19		5,256				144	5,401
20		45,514			1,554	146	47,213
21		62,100	0	365	1,533	683	64,681
22		64,651	475		6,575	912	72,614
23		139,467	578		936	304	141,285
24		83,823	1		3,223	3,086	90,133
25		88,286	1		4,575		92,862
26		85,904	2	67	9,231	105	95,309
27		26,088	2,926		3,267	1,337	33,618
28		62,418	3,948	0	13,786		80,152
29		88,339	3,673	267	11,205	608	104,093
30		42,564	5,806	4	1,997		50,370
31		32,436	2,620	330	7,371		42,757
32		12,875	2,116	1,272	5,859		22,122
33			2,132	2,354	1,126		5,612
34		2,567	202	7			2,776
35				3,262			3,262
36			120	2,302			2,422
37			2,693	5,485			8,179
38			180	2,112			2,292
39			582	1,284			1,866
40			2,975	7,351			10,325
41			10,727	3,381			14,108
42			11,279				11,279
43			13,967				13,967
44			4,223				4,223
45			3,922	979			4,901
46			4,186	3,707			7,893
47							
48							
49				4,472			4,472
50							
Total	N.A.	981,943	91,794	57,598	73,376	7,924	1,212,636

October-November 2005: False scad (*Caranx rhonchus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9				2.8			2.8
10							
11				2.8			2.8
12							
13							
14				30.9			30.9
15				7.5		0.4	7.9
16				15.4		2.6	18.0
17				12.3		1.8	14.1
18				14.0		1.0	15.0
19				3.8		4.5	8.4
20				1.6		0.8	2.3
21				54.0		1.6	55.6
22				20.3		3.3	23.5
23				77.1		6.6	83.7
24				26.4		5.4	31.8
25				9.3		4.6	13.9
26				57.3		4.9	62.2
27				18.0	24.4	5.2	47.6
28				29.2	49.9	11.3	90.4
29				5.4	26.5	3.2	35.1
30				3.1	1.0	1.1	5.2
31				1.7	0.6	1.1	3.5
32					1.2	3.2	4.4
33					0.6	0.4	1.0
34						2.0	2.0
35						1.1	1.1
36						0.7	0.7
37						0.4	0.4
38						0.4	0.4
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.			393.0	104.3	67.2	564.5

October-November 2005: False scad (*Caranx rhonchus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9				23			23
10							
11				41			41
12							
13							
14				904			904
15				268		14	282
16				666		112	778
17				634		94	728
18				853		59	912
19				272		323	595
20				129		63	192
21				5,151		151	5,302
22				2,218		357	2,575
23				9,609		819	10,428
24				3,734		756	4,489
25				1,480		736	2,216
26				10,238		869	11,107
27				3,589	4,877	1,041	9,508
28				6,484	11,086	2,520	20,090
29				1,327	6,528	786	8,641
30				850	281	287	1,417
31				516	182	343	1,040
32					399	1,041	1,440
33					218	128	347
34						770	770
35						458	458
36						332	332
37						180	180
38						195	195
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.			48,985	23,571	12,434	84,990

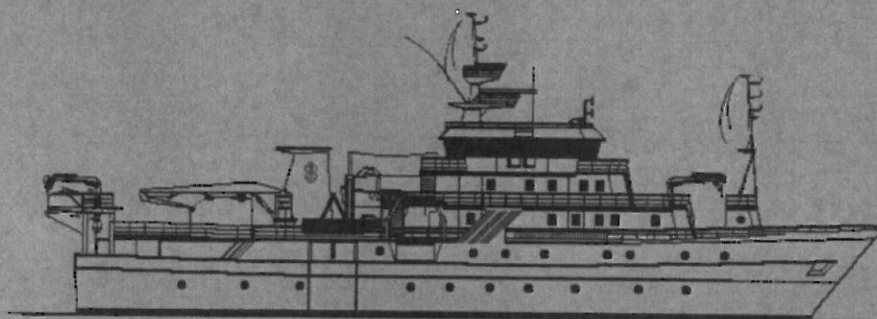
October-November 2005: Chub mackerel (*Scomber japonicus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10		11.7					11.7
11		341.2					341.2
12		1,082.1					1,082.1
13		1,208.1					1,208.1
14		405.7					405.7
15		224.3					224.3
16		208.0					208.0
17		412.4					412.4
18		398.8					398.8
19		278.3					278.3
20		474.3					474.3
21		239.2					239.2
22		135.5					135.5
23		76.8					76.8
24		68.3					68.3
25		63.4					63.4
26		20.1					20.1
27		4.0					4.0
28		2.3					2.3
29		4.1					4.1
30							
31							
32							
33							
34							
35		14.3					14.3
36							
37		14.3					14.3
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	5,687.2					5,687.2

October-November 2005: Chub mackerel (*Scomber japonicus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10		114					114
11		4,359					4,359
12		17,753					17,753
13		24,969					24,969
14		10,390					10,390
15		7,015					7,015
16		7,849					7,849
17		18,568					18,568
18		21,211					21,211
19		17,331					17,331
20		34,321					34,321
21		19,966					19,966
22		12,967					12,967
23		8,377					8,377
24		8,440					8,440
25		8,832					8,832
26		3,139					3,139
27		697					697
28		447					447
29		890					890
30							
31							
32							
33							
34							
35		5,361					5,361
36							
37		6,320					6,320
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	239,314					239,314

NORAD-FAO PROJECT GCP/INT/730/NOR CRUISE REPORTS "DR. FRIDTJOF NANSEN"



**SURVEY OF THE PELAGIC FISH RESOURCES OFF
NORTH WEST AFRICA**

Part II

MAURITANIA

10 November - 19 November 2005

**Institut Mauritanien de Recherches Océanographiques et des Pêches
Nouadhibou, Mauritanie**

**Institute of Marine Research
Bergen, Norway**

CRUISE REPORTS “DR FRIDTJOF NANSEN”

**SURVEY OF THE PELAGIC FISH RESOURCES OFF
NORTH WEST AFRICA**

Part II

**MAURITANIA
10 November - 19 November 2005**

by

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CHAPTER 1 INTRODUCTION

1.1 Objective of the cruise

The general objectives of the survey were to estimate biomass and map the distribution of the small pelagic fish stocks off NW Africa (Morocco, Mauritania, Senegal and the Gambia) by hydro-acoustic methods and describe the hydrographical conditions there over a period of 50 days, in November-December 2003. For Mauritania the agreed objectives were as follows:

- To map the distribution and estimate the biomass for the main small pelagic fish using hydro-acoustic methods. The species of interest were: sardinellas (*Sardinella aurita*) and (*Sardinella maderensis*), sardine (*Sardina pilchardus*) horse mackerels (*Trachurus trachurus*) and (*T. trecae*), false scads (*Decapterus rhonchus*), and anchovy (*Engraulis encrasicolus*) and chub mackerel (*Scomber japonicus*).
- 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.
- Collect biological data and otoliths of the main target species, especially *sardina pilchardus*, *Sardinella aurita*, *Sardinella maderensis* and *T. trecae*.
- To sample standard hydrographical transects for temperature, salinity and oxygen at every degree latitude, at about 17°00'N, 18°00'N, 19°00'N, 20°00'N and off Cape Blanc.
- To train local participants in acoustic survey methodology including fish identification and sampling, scrutinizing of echograms, acoustic abundance estimation and hydrographical sampling.
- To conduct a parallel survey with the Mauritanian research vessel Al Awam. This will include intercalibration and parallel trawling.

The time allocated for this part of the survey, off Mauritania, was 9 days.

1.2 Participation

Participating scientists were:

Institut Mauritanien de Recherches Océanographiques et des Pêches (IMROP), Mauritania:

Ahmed Diagne (Team Leader Mauritania), Ibra Diallo, Ould Mohamed Moussa Mohamed and Aboud Ciré Ball

Centre de Recherches Océanographiques de Dakar-Thiaroye (CRODT), Senegal:

Abdoulaye Sarre, Ibrahima Sow and Mor Sylla

Department of Fisheries (FD), The Gambia:

Juldeh Jallow

Institut National de Recherche Halieutique (INRH), Morocco:

Lahcen Aboubdelah

Institute of Marine Research (IMR), Norway:

Jens-Otto Krakstad (Cruise leader), Magne Olsen, Thor Egil Johannson and Ole Sverre Fossheim

1.3 Narrative

The vessel departed from Dakar 12:00 GMT on the 10th November and steamed north to start the survey at the border between Senegal and Mauritania at St. Louis (16°00'N). The survey started off St. Louis at 22:00 GMT the same evening after we meet the Mauritanian R.V. "Al Awam" at 16°06'N 17°00'W. Both vessels followed the standardized survey outline used in Mauritania with systematic parallel course tracks spaced about 10 NM (nautical miles) apart, perpendicular to the depth isobaths. 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. Pelagic trawl with floats was often used to catch fish close to the surface. A smaller pelagic trawl or the bottom trawl with floats was used for sampling pelagic fish in very shallow waters (depth less than 25 m).

The Dr. Fridtjof Nansen covered the shelf and slope of Mauritania from St. Louis at the Senegalese border to Cape Blanc, the northern border of Mauritania. The Mauritanian vessel followed Dr. Fridtjof Nansen until the 15th November around Cape Timiris. Unfortunately it

caught the trawl in the propeller in this position and was delayed to such an extent that the parallel survey had to be terminated.

Dr. Fridtjof Nansen reached Cape Blanc and the end of the regular survey 18th November 14:00 GMT. The vessel then steamed to Nouakchott where the survey was completed on the 19th November at 10:00 GMT.

Course track and fishing stations are shown in Figure 1, while Table 1 show survey effort during the survey, including number of trawl stations and CTD casts. All data collected during the survey were made available to the participants.

Five transects with hydrographical profiles were carried out, at 17°05' N, 18°05'N - at Nouakchott, 19°05' - south of Cape Timiris, 20°05'N outside Banc D'arguin, and at 20°50' N - Cape Blanc.

Table 1. Summary of survey effort by regions, including number of demersal (BT) and pelagic (PT) trawl hauls, CTD casts, and distance surveyed (log), disregarding the steaming from Cape Vert to St. Louis and from Cape Blanc to Nouakchott (log).

Area	BT	PT	Total trawls	CTD casts	Log (nm)
St. Louis to Cape Blanc	13	32	45	56	1680

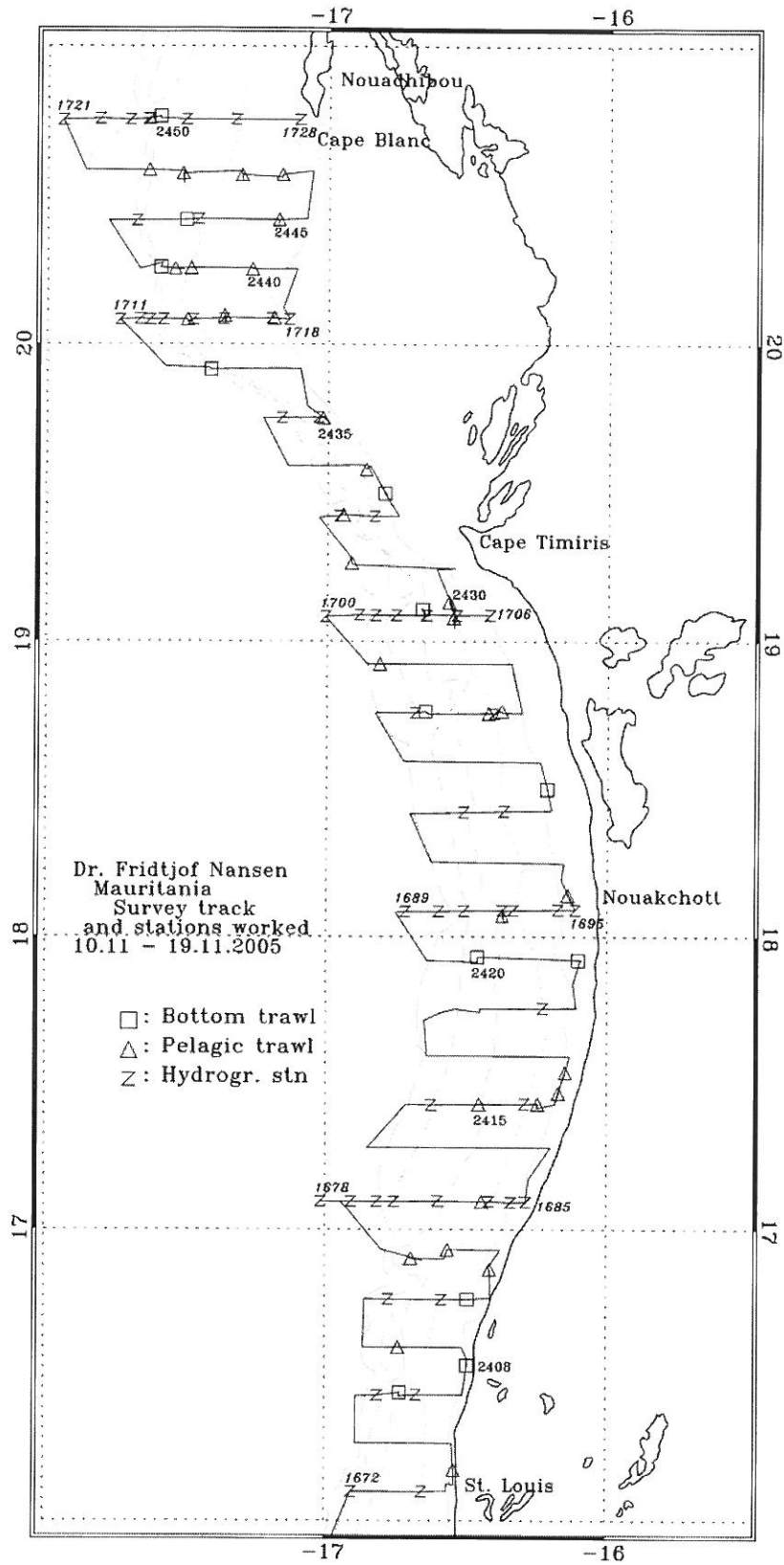


Figure 1. Course tracks with fishing and hydrographic stations; St. Louis to Cape Blanc

CHAPTER 2 METHODS

2.1 Environmental Data

CTD-profiling

A Seabird 911+ CTD probe was used to obtain vertical profiles of the temperature, salinity and oxygen. Real time logging was carried out using the PC based Seabird Seasave Software. CTD casts were conducted along the cruise track in transects at about every one degree latitude and at fixed stations every 50 m and 200 m depth every 20 NM. The casts were stopped a few meters above the bottom, and at a maximum of 500 m depth. Two water samples, one near the surface and one near the bottom, were collected using *Niskin* bottles at stations corresponding to the standard profiles. The samples were analysed for dissolved oxygen using the Winkler method in order to calibrate the oxygen sensor. Salinity of water samples was used to calibrate the salinity sensor using the Guildline Portasal salinometer. The salinity sensor on the CTD was stable and it was not necessary to apply any correction factor.

The oxygen sensor was calibrated during the survey off Senegal. A total of 20 samples were accepted for oxygen calibration. A linear regression of the Winkler determinations on the CTD values produced the correction:

$$O_{2\text{corrected}} = a \cdot O_{2\text{recorded}} + b \quad (1)$$

were $a=1.0504$ and $b=-0.0581$

Meteorological observations

Meteorological data logged from the Aanderaa meteorological station included wind direction and speed, air temperature, incident solar intensity and sea surface temperature (SST). All data were averaged by unit distance sailed (1 NM).

Thermosalinograph

The SBE 21 Seacat thermosalinograph was running routinely during the survey. Obtaining samples of sea surface salinity and relative temperature (5 m depth) every 10 sec during the survey. Correlations between the salinity data collected with the CTD and the Thermosalinograph showed that the thermosalinograph started reading incorrect values sometime during the survey of Mauritania, and data are therefore not presented here.

Current speed and direction measurements (ADCP)

The ship-born Acoustic Doppler Current Profiler (ADCP) from RD Instruments was running throughout the survey. The ADCP was set to external trigger, triggered by the EK 500 system. The depth cell interval set to 3 m and the number of cells was set to 120.

2.2 Biological sampling

Biological sampling of the fish was carried out using trawls. A 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). Annex II gives a description of the instruments and the fishing gear used. All catches were sampled for composition by weight and numbers of each species caught. Species identification was based on the FAO Species Guides. Length frequency distributions, by total fish length in cm, of the selected target species were taken in all the stations where they were present. Individual weight measurements were taken regularly to estimate the condition factor in the length-weight relationship:

$$\bar{w} = \frac{cond}{100} \cdot L^3$$

The specific condition factors obtained from the samples and applied for this survey were: 0.96 for sardinellas and horse mackerels.

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 (to calculate the mean length of this length group) were applied. The target groups used for Mauritania can be found in Table 2, while the complete records of fishing stations and catches are shown in Annex I.

Table 2. Allocation of acoustic densities to taxii. Note that for the groups of sardinella, horse mackerel, and pilchard all encountered species are listed, while only examples are listed for the remaining groups.

Group	Taxon	Species
Sardinella	<i>Sardinella</i> sp.	<i>S. aurita</i> <i>S. maderensis</i>
Horse mackerel	<i>Trachurus</i> sp.	<i>T. trecae</i> <i>T. trachurus</i>
Sardine	Sardinops	<i>S. pilchardus</i>
Pelagic species 1	Clupeiformes ₁	<i>Ilisha africana</i> <i>Engraulis encrasicolus</i>
Pelagic species 2	Carangidae ₂	<i>Selene dorsalis</i> <i>Chloroscombrus chrysurus</i> <i>Decapterus rhonchus</i> <i>Alectis alexandrinus</i>
Little tuny	Scombridae	<i>Euthynnus alletteratus</i> <i>Sarda sarda</i> <i>Scomber japonicus</i>
	Sphyraenidae	<i>Sphyraena guachancho</i>
	Others	<i>Trichiurus lepturus</i> <i>Zeus faber</i>
Other demersal species	Sparidae ₃	<i>Dentex angolensis</i> <i>D. macrophthalmus</i> <i>D. congoensis</i> <i>D. canariensis</i> <i>D. barnardi</i> <i>Pagellus bellottii</i> <i>Sparus caeruleostictus</i> <i>S. pagrus africanus</i>
Big-eye grunt	Other taxii	<i>Pseudupeneus prayensis</i> <i>Brachydeuterus auritus</i> <i>Arioma bondi</i> <i>Pomadasys incisus</i> <i>Galeoides decadactylus</i>
Mesopelagic species	Myctophidae ₃ Other mesopelagic fish	
Plankton	Calanoidae	<i>Calanus</i> sp.
	Euphausiidae	<i>Meganyctiphanes</i> sp.
	Other plankton	

₁: other than *Sardinops* sp.; ₂: other than *Trachurus* sp.; ₃: main taxon in group.

2.3 Acoustic sampling

Acoustic recordings were collected with SIMRAD EK500 Echo sounders, with settings as shown in Annex II. Four frequencies 18 kHz, 38 kHz, 120 kHz and 200 kHz were logged. All abundance estimation was based on data from the 38 kHz transducer. The Bergen Integrator (BEI) was used for analysis and allocation of the integrated s_A -values to the individual specified target groups by 5 NM intervals. The allocation of values to target groups was based on a combination of a visual scrutiny of the behaviour pattern as deduced from echo diagrams, the BEI analysis, and the catch compositions.

In cases where the target category of fish contains more than one species (sardinellas and horse mackerels), the mean s_A -value allocated to the category is divided between the species in the same ratio as their contribution to the mean back scattering strength in the length frequency samples.

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:

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

Which can be converted (see Toresen *et al.* 1998 for details) to the area form (scattering cross sections of acoustic targets):

$$C_{Fi} = 1.26 \cdot 10^6 L^{-2}$$

where L is total length in 1 cm length group i and C_{Fi} (m^{-2}) is the reciprocal back scattering strength, or so-called fish conversion factor. In order to split and convert the allocated s_A -values (m^2/NM^2) to fish densities (numbers per length group per NM^2), the following formula was used:

$$\rho_i = s_A \cdot \frac{p_i}{\sum_{i=1}^n \frac{p_i}{C_{Fi}}}$$

were

ρ_i = density of fish in length group i

s_A = mean integrator value

p_i = proportion of fish in length group i

$\sum_{i=1}^n \frac{p_i}{C_{Fi}}$ = the relative back scattering cross section (m^2) of the length frequency sample of the

target species, and

C_{fi} = reciprocal back scattering cross section (σ_{bs}^{-1}) of a fish in length group i .

The integrator outputs were split in 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) horse mackerels, 3) carangids and associated species, and 4) demersal fish.

The above equations show that the conversion from s_A -values to number of fish is dependent on the length composition of the fish. It is therefore important to get representative length distributions from the stock in the whole distribution area.

When the size classes (of e.g. young fish and older fish) are well mixed, the various length distributions can be pooled together with equal importance. Otherwise, when the size classes are segregated, the total distribution area has to be post-stratified, according to the length distributions, and separate estimates are made for the regions containing fish with equal size.

For a region representing a distribution of a target-specie, the following basic data are needed for the estimation of abundance;

- 1) the average s_A -value for the region,
- 2) the surface (usually square nautical miles, NM^2), and
- 3) a representative length distribution of the fish in the region.

If the targeted fish is a mixture of more than one species, for example sardinellas, a representative distribution of the two, within the region, as shown in the trawl catches, are used. A length distribution representing the number of the two species for each catch will have to be calculated. Thereafter, these distributions have to be normalized to a unit number (usually 100) so they are equally weighted.

A systematic approach to a) divide the s_A -value between species in a category of fish (e.g. *Sardinella aurita* and *S. maderensis*), 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 samples of the species in the category (e.g. sardinellas) are respectively pooled together with equal importance (normalized).

The mean back scattering strength (ρ/s_A) of each length frequency distribution of the target species is calculated and summed. This is automatically done in the Excel spread-sheet made

available for acoustic abundance estimation onboard RV “Dr. Fridtjof Nansen”, provided the data are punched in this sheet.

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

The pooled length distribution is used, together with the mean s_A -value, to calculate the density (numbers per square NM) by length groups and species, 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 then converted to biomass using the estimated weight at length.

2.4 Parallel survey with R.V. “Al Awam”

During the survey the Mauritanian research vessel “Al Awam” did a parallel survey with “Dr. Fridtjof Nansen”. As part of this, parallel trawl hauls were conducted with regular intervals, as well as acoustic intercalibration between the vessels. The strategy for the intercalibration followed the recommendations by MacLennan and Simmons (1992).

One of the research vessels placed itself 0.5 NM behind and 0.5 NM to the side of the vessel that took the lead. The distance between the vessels were chosen so that the vessels could stay as close together as possible without disturbing each other’s acoustic recordings. Starting time and log were recorded onboard each vessel and the distance between vessels was kept constant during the experiment.

All data collected during the parallel survey and intercalibration will be analysed on land and a separate report will be produced on the exercise.

CHAPTER 3 SURVEY RESULTS

3.1 Hydrography

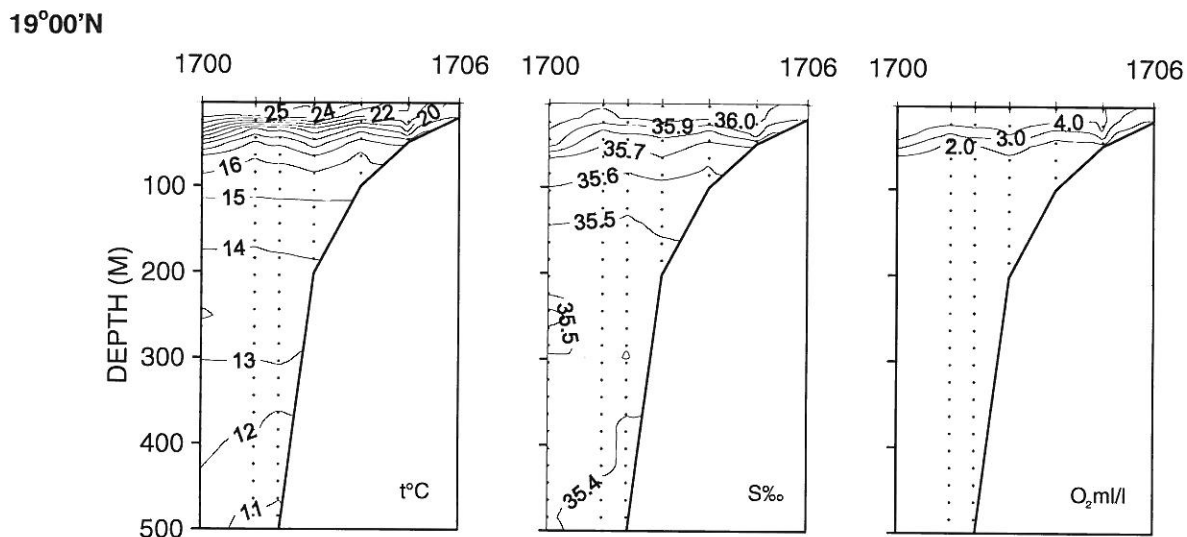
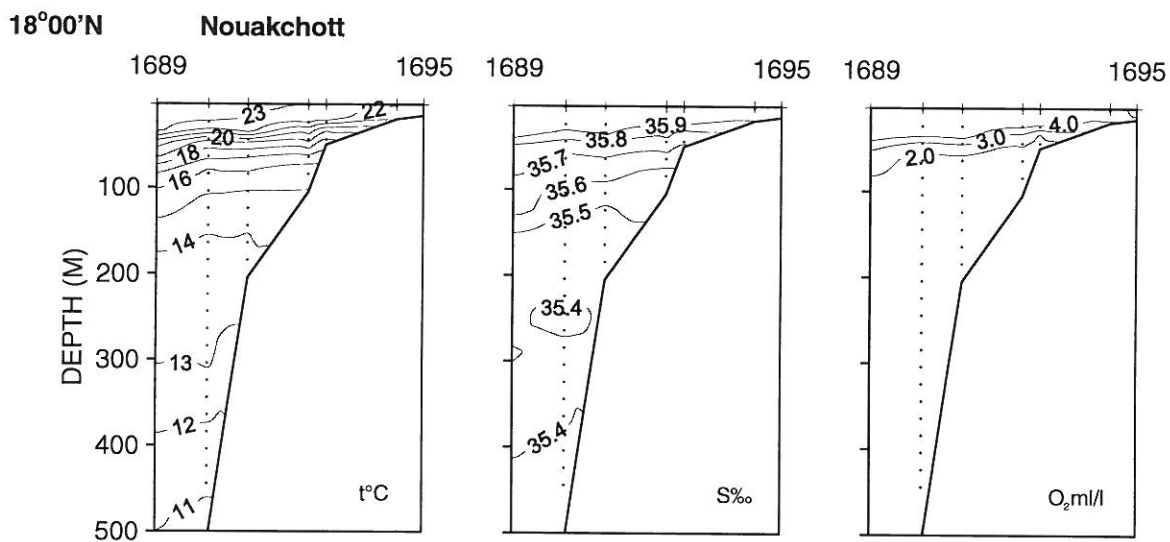
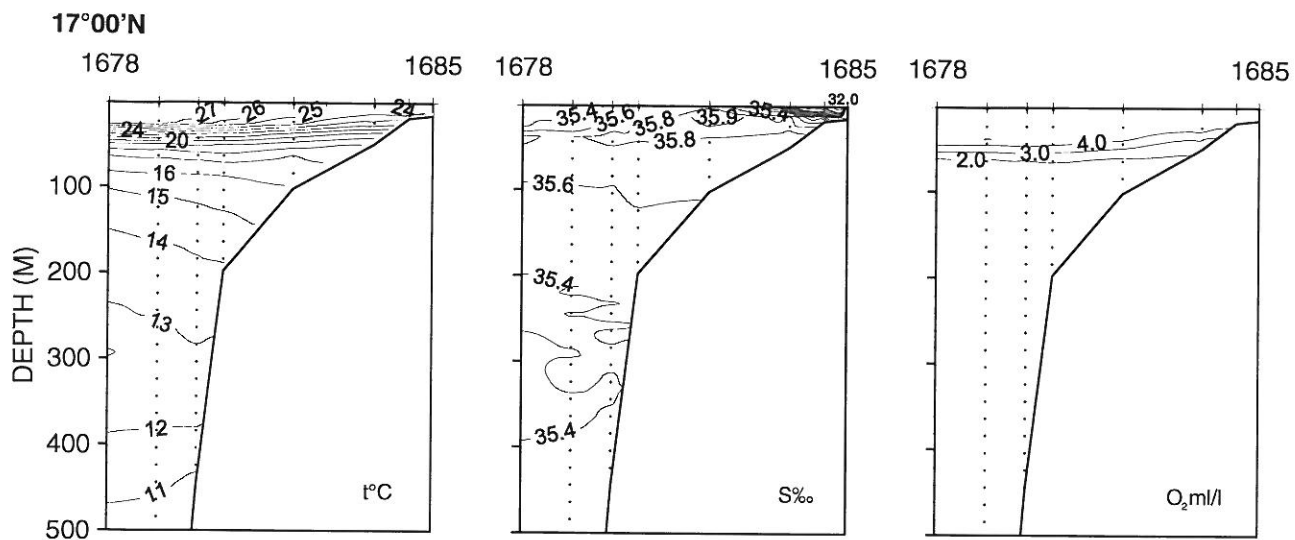
Hydrographical data was collected on fixed CTD stations to 500 m depth and from the Aanderaa weather station that continuously collect sea surface temperature, wind speed and direction, solar radiation etc. during the survey.

Cross shelf hydrographical profiles

Figure 2 shows the distribution of temperature, salinity and oxygen from the five hydrographical transects collected during the survey. The surface waters showed an increase in water temperature from the coast and offshore, and a decrease from profile to profile northwards. The profiles at 17°N, 18°N and 19°N show a clear stratification around 50 m depth and minimum temperatures around <12°C was measured at 500 m depth. The 19°N line and to a larger extent the line at 20°N show clear indications of an upwelling situation with colder water masses from below the thermocline extending up on the inner shelf, while the line at Cape Blanc show well mixed water conditions without any clear thermocline. Cooler water masses (17°C) are observed on the inner shelf and warmer temperatures offshore (21°C). Minimums temperatures around 11°C is observed offshore at 500 m depth.

The salinity profiles generally show a gradual decreases in salinity with depth, with minimum levels around 250 m depths. The surface waters at the 17°N line is influenced by fresh water along the coast extending offshore towards the 100 m depth station. The rest of the survey area has sea surface salinity around 35.9‰. Particularly the cross shelf transect around 20°N shows clear signs of upwelling with deepening of the salinocline offshore and water been pushed up the shelf. Well-mixed water masses are observed at Cape Blank with salinity ranging from 36.1‰ offshore in the surface waters and 35.8‰ inshore. A salinity level of 35.4‰ is observed offshore at 500 m depth as in the rest of the survey area.

All the CTD transects show well oxygenated waters, with approximately >4 ml/l O₂ in the surface water, declining to 2 ml/l O₂ at approximately 70 m depth.



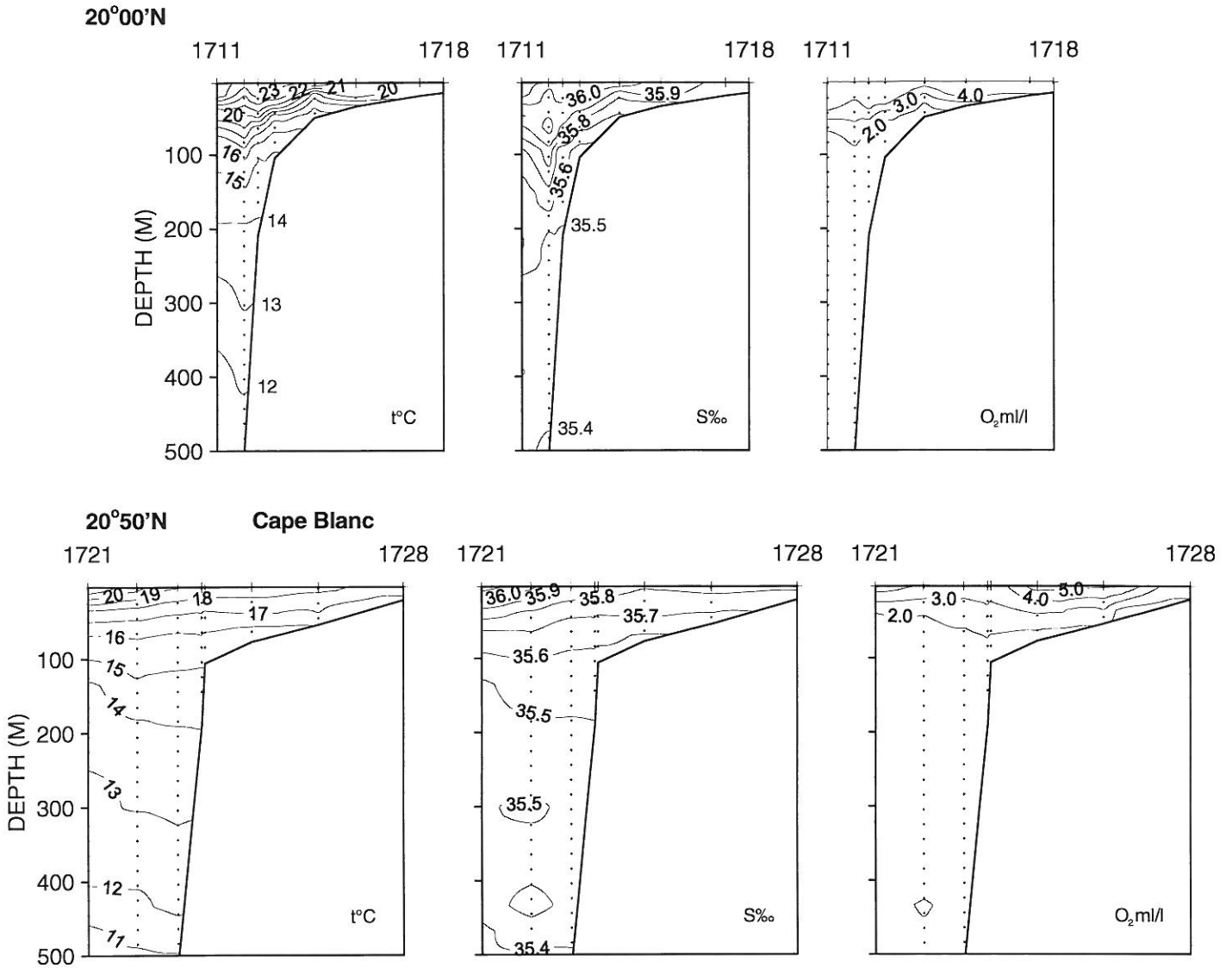


Figure 2. Hydrographical profiles with distribution of temperature, salinity and oxygen

Sea surface temperature and wind direction

Figure 3 shows the sea surface temperature at 5 m of depth. The southern part of Mauritania was characterized by relatively warm water masses, with surface water temperatures $>28^{\circ}\text{C}$ offshore, and $<26^{\circ}\text{C}$ inshore. At Nouakchott temperatures were slightly cooler than last year, approximately 1°C in the surface layer, both in shallow and deeper waters. Further north between Nouakchott and Cape Timiris even cooler water masses with a water temperatures $<22^{\circ}\text{C}$ was observed along the coast, dropping to $<21^{\circ}\text{C}$ at Cape Timiris. Off the shelf break, water temperatures are typically 25°C in this region. A strong thermal front can be observed off Cape Timiris where offshore waters dropping from $>25^{\circ}\text{C}$ to $<21^{\circ}\text{C}$. The wider shelf between Cape Timiris and Cape Blanc showed gradually colder water masses with water masses with temperatures $<20^{\circ}\text{C}$ experienced over most of the inner shelf. Another frontal

region can be seen south west of Cape Blanc with temperatures dropping from $>23^{\circ}\text{C}$ to $<19^{\circ}\text{C}$. Temperatures were similar to last year but with stronger frontal zones evident in the region this year.

The sea surface salinity recorded at 5 m depth with the thermosalinograph turned out to give incorrect readings and the data will therefore not be presented here.

Figure 4 show the wind direction and wind speed during the survey of Mauritania. The wind came from north and northwest in the whole survey area. Off Sr. Louis and around Cape Timiris more variable winds were experienced, with the wind direction often coming from northeast turning to east. The conditions were favourable for acoustic surveying throughout the survey.

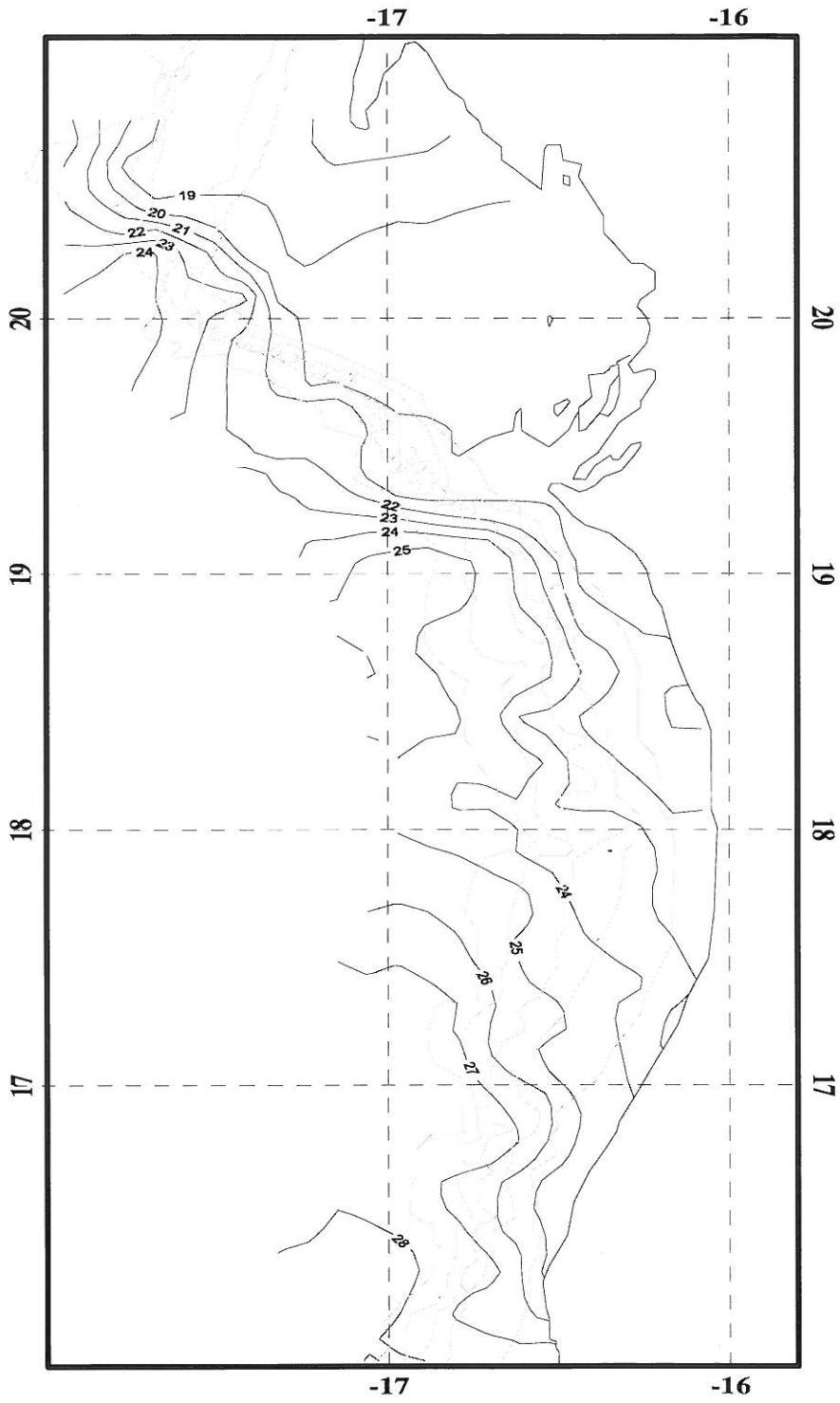


Figure 3. Sea surface temperature; St. Louis to Cape Blanc

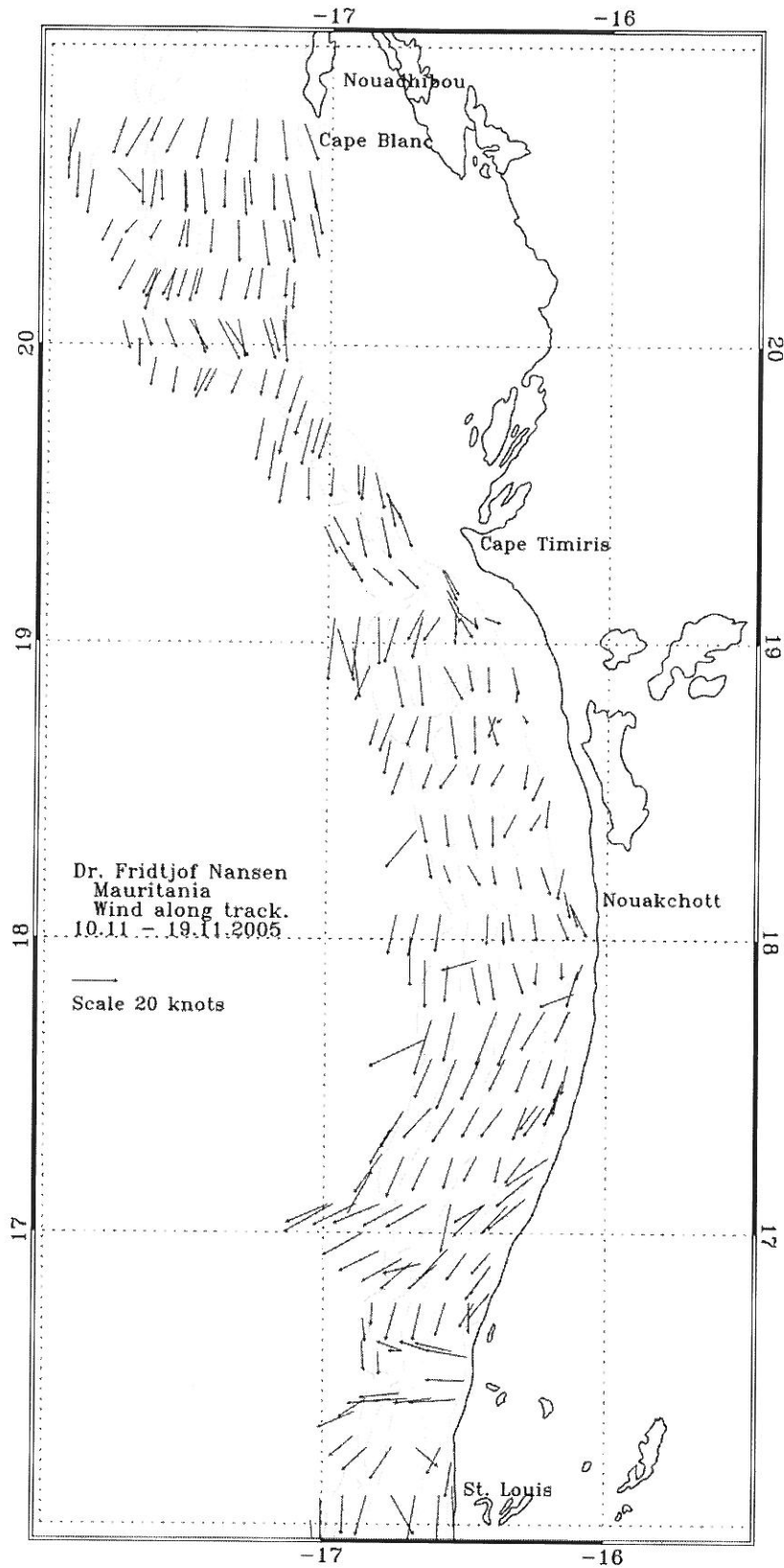


Figure 4. Wind speed and direction; St. Louis to Cape Blanc

3.2 St. Louis to Cape Timiris

The main groups of pelagic fish for the shelf of Mauritania illustrated with contoured acoustic densities are seen in Figure 5, Figure 6, Figure 7 and Figure 8. Estimated number and biomass by length-groups of the main pelagic species can be found in Annex IV.

Sardinella was found in two large distribution areas on the shelf between St. Louis and Cape Timiris. The distribution was similar to last year but with lower densities, each of the two main distribution areas showed mainly low to medium densities. The sardinella was distributed between the 15 m depth and offshore to approximately 50 m depth, with highest concentrations found around 20 m, Figure 5. Both species of sardinella were found, but *S. maderensis* dominated completely with a biomass of 302 thousand tons compared with 6 thousand tons of *S. aurita*,

Table 3. Last year the biomass of *S. aurita* in this region was estimated to be 189 thousand tons, while the biomass of *S. maderensis* was estimated at 1 244 thousand tons. Three modal peaks at 6 cm, 14 cm and 26 cm length was observed for *Sardinella maderensis*. Only few length frequencies were available for *S. aurita* but based on calculating the mean length in the catch from the total weight and number two modal size groups of *S. aurita* at 22 cm and 29 cm was observed together with juveniles of 7 cm.

Trachurus trecae were found in two low-density areas between St. Louis and Cape Timiris, mainly between 20 m and 200 m depth. The southernmost area extended into Senegal territorial waters. The highest concentrations were generally found both at the shelf break and close inshore around the “shallow break” at 30 m depth, Figure 6. Between these density highs lower concentrations were found throughout the shelf. *Decapterus rhonchus* was mixed with the *T. trecae*, within its distribution area, but typically with main concentrations somewhat more shallow. The schools were mixed with plankton and other pelagic species inshore, and particularly in the south of the distribution area. Like last year a few catches of *T. trachurus* were made offshore south of Cape Timiris. The abundance was low, and not calculated separately but included in the estimate of *T. trecae*. The main modal peak seen in the length distribution of *T. trecae* was at 11 cm, representing roughly one-year-old fish. Much larger *T. trecae* was found on the shelf break with a modal peak around 37 cm. The length distribution collected from *D. rhonchus* was of variable quality, but the distribution showed a modal peak at 16 cm and 23 cm. The biomass of *T. trecae* in the area was estimated to be 58 thousand tons, while 49 thousand tons of *D. rhonchus* was found. Last year roughly 30 thousand tons of *T. trecae* was found in this area, no separate estimate was made for *D. rhonchus*.

The sardine (*Sardina pilchardus*) was found in high concentrations close to the coast between Nouakchott and Cape Timiris, mainly distributed between 15 and 50 m depth. The distribution was associated with an upwelling area with cooler than the surrounding water masses. Only mature fish with a modal peak at 27 cm were found in this area. The total biomass was estimated to be 1 090 thousand tons. Last year, sardine of the same size range was present in the same area, but in low concentrations. The abundance was calculated to 20 thousand tonnes.

Anchovy (*Engraulis encrasicolus*) were only found in very low concentrations south of Cape Timiris and no separate estimate was calculated.

Other pelagic fish (P2) were found in low concentrations over large parts of the shelf from around 15 m to >50 m bottom depth, Figure 8. The P2's were not found further offshore than the 100 m isobath. In general both carangids other than horse mackerel, scombrids, hairtails

and barracudas were found in the area, Table 4. The trawl catches were dominated by *Trichiurus lepturus* (P2), *Chloroscombrus chrysurus* (P2), *Lagocephalus laevigatus*, *Brachydeuterus auritus*, *Sepia officinalis* and *Stromateus fiatola* in addition to the other pelagic target species, sardine, sardinellas, anchovy and horse mackerels. The P2 species were well mixed with the sardinellas and horse mackerel in the areas where their distribution overlapped. The estimated biomass of this group of fish was 62 thousand tonnes compared with 106 thousand tonnes last year.

Table 3. St.Louis – Cape Timiris. Biomass estimates of pelagic fish, thousand tonnes.

<i>S. maderensis</i>	<i>S. aurita</i>	<i>Sardina pilchardus</i>	Horse mackerels	Carangids etc.
304	4	1 088	107	62

Table 4. Catch by stations sorted by groups (in kg/hour) St. Louis – Cape Blanc

Station	Fishing Depth	Clupeids	Carangids	Scomberids	Hairtails	Barracudas	Other	Total
2406	10	268	87	0	68	0	710	1132
2407	86	4	4162	0	0	0	545	4711
2408	20	104	59	47	0	7	1416	1633
2409	20	-	-	-	-	-	-	No Catch
2410	26	38	658	0	14	2	2282	2994
2411	10	636	252	0	18	2	116	1025
2412	30	0	42	0	0	0	166	208
2413	30	0	5994	0	0	0	46	6040
2414	30	-	-	-	-	-	-	No Catch
2415	30	0	148	0	27	0	19	194
2416	10	8	361	0	2	6	77	454
2417	10	1	148	0	0	0	29	177
2418	10	1282	2978	0	13	53	85	4411
2419	16	225	696	0	0	0	386	1307
2420	133	1	574	77	43	0	75	771
2421	30	0	297	0	13	0	7	316
2422	10	523	570	0	17	22	2480	3612
2423	18	7	224	0	0	2	515	748
2424	167	0	46	0	0	0	612	658
2425	10	0	150	0	18	0	19	188
2426	10	17490	0	65	0	0	0	17554
2427	0	0	0	0	1	0	2	2
2428	112	0	4198	1	110	0	454	4762
2429	25	0	42	0	0	0	0	42
2430	30	0	48	1	0	0	1	50
2431	5	0	38	0	8	0	638	684
Mean	34.2	857.8	907.2	7.9	14.6	3.9	444.9	2236
% Catch		38.4	40.6	0.4	0.7	0.2	19.9	100

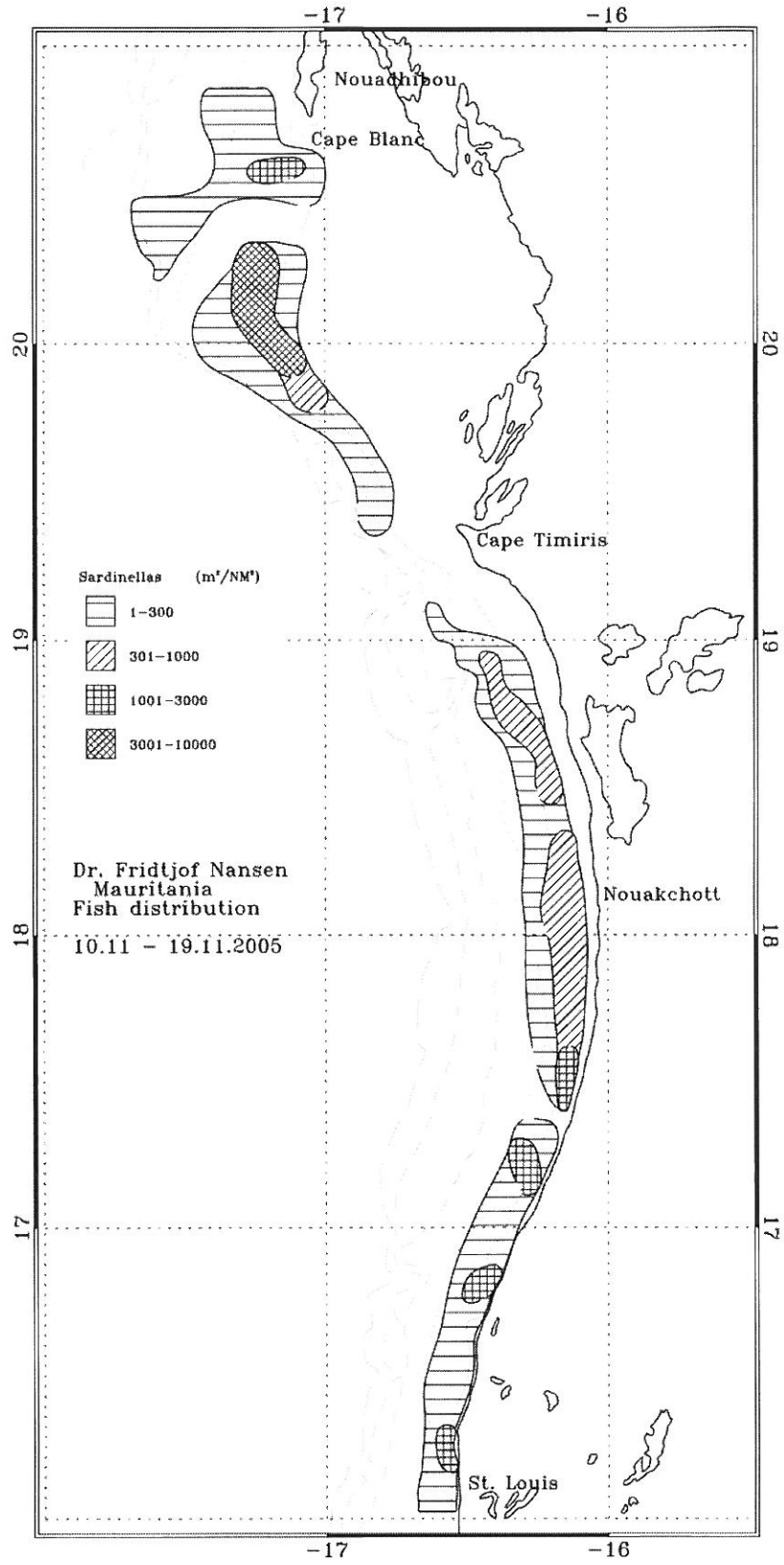


Figure 5. Distribution of sardinellas; St. Louis to Cape Blanc

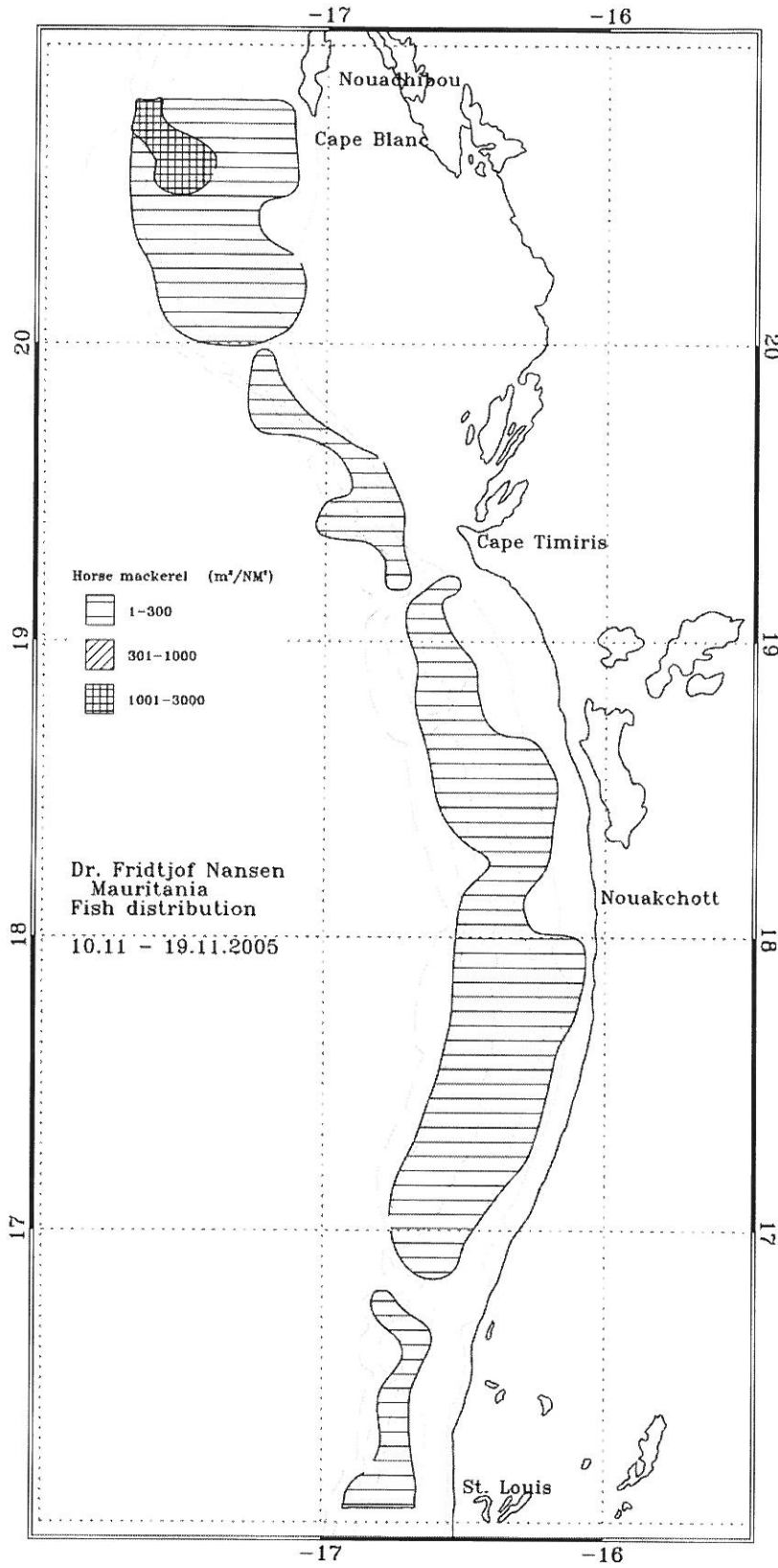


Figure 6. Horse mackerels; St. Louis to Cape Blanc

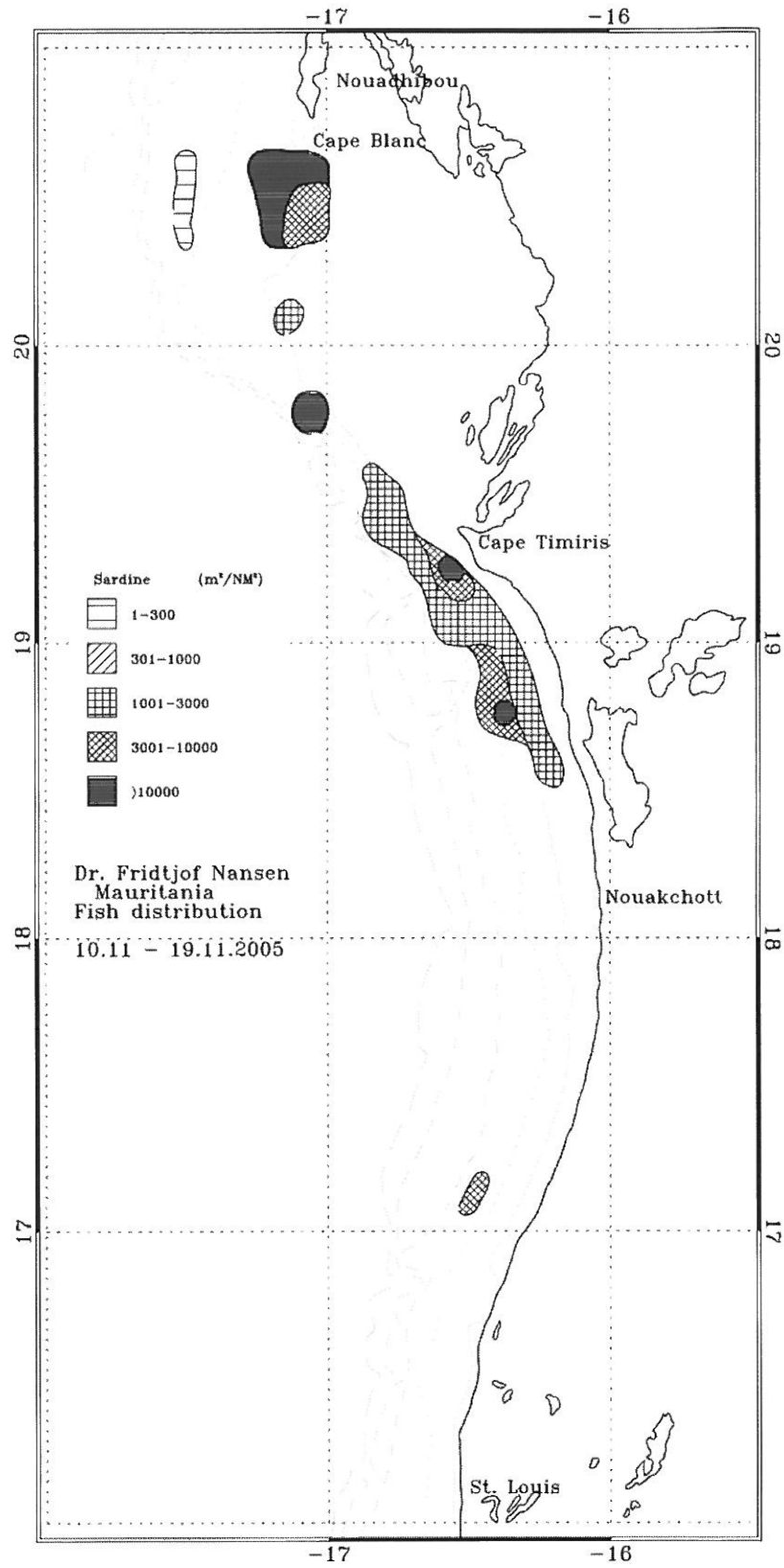


Figure 7. Sardine, St. Louis to Cape Blanc

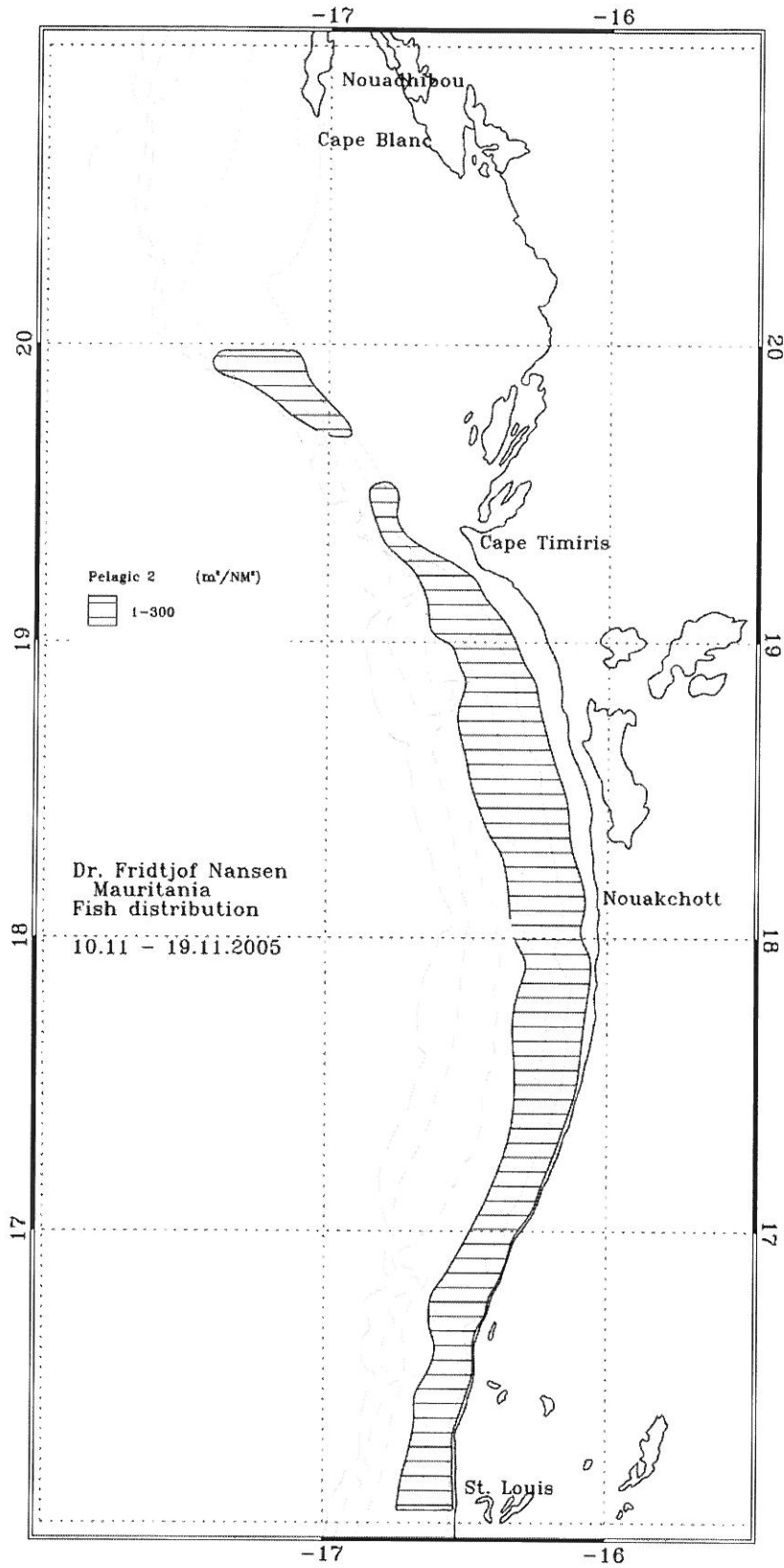


Figure 8. Carangids and associated species; St. Louis to Cape Blanc

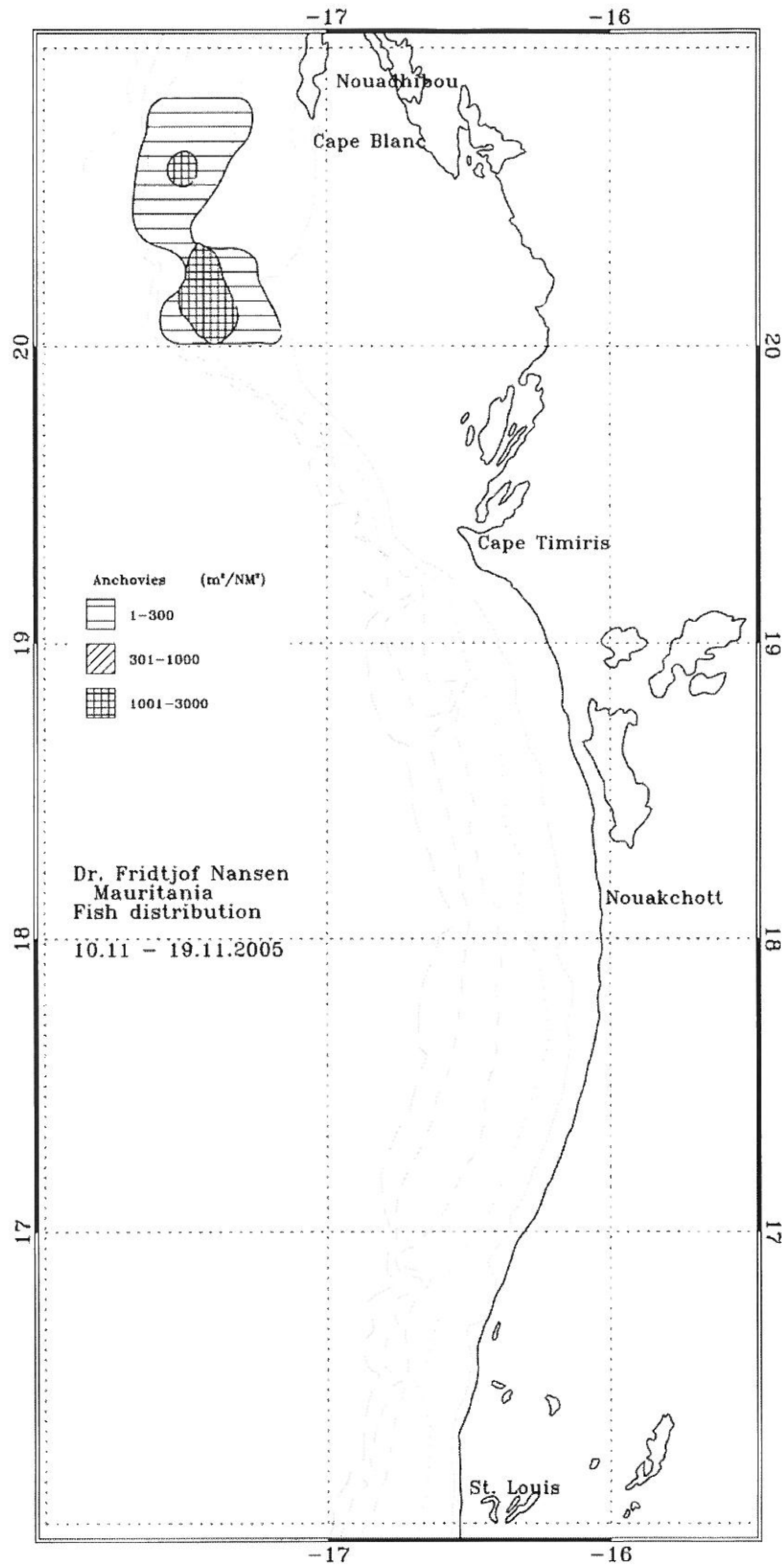


Figure 9. Distribution of Anchovy; St. Louis to Cape Blanc

3.3 Cape Timiris – Cape Blanc

The shelf region between Cape Timiris and Cape Blanc is known as a very productive area for pelagic fish. This year four different clupeid species were found mixed in high quantities in this area, in addition to several carangid species in lower densities. This made species separation particularly difficult and abundance estimates should be treated with caution.

Both species of sardinellas were found on the shelf at Cape Blanc from less than 20 m depth to and deeper than the 50 m isobath, Figure 5. *S. aurita* the most dominant of the two species and distributed in the whole region, while no *S. maderensis* were found north of 20°15'N. The highest fish concentrations were found off the central part of Banc D'arguin and the distribution continued inshore of the area surveyed, indicating that some sardinella may have been missed in the shallow part (<15 depth) of Banc D'arguin. The total estimate of sardinellas between Cape Timiris and Cape Blanc during this survey was 293 thousand tons, Table 5. This comprised of 68 thousand tons of *S. maderensis* and 225 thousand tons of *S. aurita*. As observed the previous few years mainly adults of *S. maderensis* were found in the area, with modal peaks visible at 23 cm and 26 cm. The *S. aurita* in the area were mainly juvenile fish with two modal peaks at 7-9 cm and 14-16 cm, and another peak of mature fish at 26 cm. The estimated number and biomass by length-groups are in Annex IV.

Sardine (*Sardina pilchardus*) was found in high and very high concentrations inshore in the whole region between Cape Timiris and Cape Blanc, extending northwards. Four school groups or concentrations were found within this region. Highest concentrations were found in the northern part of the region around the 20 m isobath consisting of adult fish with a modal peak around 24 cm. Smaller concentrations of juvenile fish (modal peak of 14 cm) were found offshore of the 50 m isobath in the same area, Figure 7. The biomass of sardine in this region was estimated to be 1.1 million tons, Table 5.

Anchovy (*Engraulis encrasicolus*) were found in relatively large concentrations north of 20°00'N to the border. The main part of the concentration was found just inshore of the 50 m isobath, Figure 9. The size of the fish in the area was between 6 and 13 cm with a modal peak at 7, 9 and 11 cm. Usually no estimate of anchovy has been estimated due to its low occurrence in the area but this year 98 thousand tons of anchovy was calculated.

Cunene and Atlantic horse mackerel are frequently found mixed in the region between Cape Blanc and Cape Timiris. However this year only *Trachurus trecae* was found here. Also notably was the absence of any major concentrations of *Decapterus rhonchus* although a few fish were found inshore on the central part off Banc D'arguin. The Cunene horse mackerel

was found on the whole shelf between 20 m depth to the shelf break around 100 m depth with highest concentrations on the shelf break in the northern part of the region, Figure 6. The estimated biomass of horse mackerels in the area was 92 thousand tons, Table 5, consisting only of *T. trecae*. The biomass consisted mainly of juveniles, with a modal peak of 11 cm, while a few adult fish with a modal peak around 30 cm, and even 43 cm were present along the shelf break. The estimated number and biomass by length-groups can be found in Annex IV.

Carangids and associated species were found in low density on the shelf between 20 and 100 m depth from Cape Timiris and south of 20°00'N. Very low catches were found north of this area, Figure 8. *Chloroscombrus chrysurus*, *Trichiurus lepturus* and *Campogramma glaycos* dominated the group by weight. The biomass estimate of this group was 3 thousand tons, Table 5.

Table 5. Cape Timiris – Cape Blanc. Biomass estimates of pelagic fish, thousand tons.

<i>S. maderensis</i>	<i>S. aurita</i>	<i>Sardina pilchardus</i>	<i>Engraulis encrasicolus</i>	Horse mackerels	Carangids etc.
225	68	1103	98	92	3

Table 6. Catch by stations sorted by groups (in kg/hour) Cape Timiris – Cape Blanc

Station	Fishing							Total
	Depth	Clupeids	Carangids	Scomberids	Hairtails	Barracudas	Other	
2432	5	0	97.55	0	84.54	0	23.46	206
2433	20	129.66	3.8	0	0.28	0	68.56	202
2434	20	919.43	2216.18	0	0	0	100.69	3236
2435	5	72.11	345.63	0	0	0	29.11	447
2436	115	0	4.02	0	0	0	2455.08	2459
2437	20	1670.73	95	0	2.13	0	7.54	1775
2438	10	2577.99	721.61	1582.36	0	5.73	20.7	4908
2439	10	189.64	57.3	0	0.28	0.32	8.54	256
2440	15	4895.8	814.67	0	0	0	0	5710
2441	20	6153.94	309.09	2.96	2.63	0	17.56	6486
2442	25	0	47.04	2.95	17.16	0	0	67
2443	109	1.42	8.84	0	0	0	3551.91	3562
2444	60	1004.15	4630.3	0	0	0	17.45	5652
2445	20	0	0.41	0	0	0	0	0
2446	10	1049.8	23.67	0	0	2	0	1075
2447	20	12.82	161.44	0	0	0	0.99	175
2448	23	441.6	567.38	22.12	0	0	1.34	1032
2449	45	572.8	1836.8	10.4	0	0	7.52	2428
2450	95	24.3	20691.45	0	0	0	1173.01	21889
Mean	32.7	936.9	1528.1	74.0	5.9	0.6	390.3	2936
% Catch		31.9	52.0	2.5	0.2	0.0	13.3	100

3.4 Parallel trawl survey

Only the first part of the parallel trawl survey was conducted successfully. Unfortunately Al Awam got problems outside Cape Timiris and was delayed for two days, before they continued the survey of the shelf between Cape Timiris and Cape Blanc. The last part of the survey was therefore not a parallel with Dr. Fridtjof Nansen but biomass estimates should still be comparable. Two intercalibration experiments were conducted successfully during this first leg. Thus the problems with Al Awam do not affect the parallel trawl survey to any serious extent. The data from the parallel survey and intercalibration will be analysed later and presented in a separate report.

CHAPTER 4 OVERVIEW AND SUMMARY OF RESULTS

The survey was conducted successfully from 10th to 19th November, covering a course track of approximately 1 680 NM. A total of 45 fishing stations and 56 CTD casts were established.

The hydrographical data showed similar temperatures to those observed last year but with more pronounced frontal zones off Cape Timiris and Cape Blanc. Cold water masses <20°C was present in the northernmost part of the survey area around Cape Blanc and inshore of 20 m depth on Banc D'arguin, Figure 3. The major part of the Mauritanian shelf showed stable salinity levels around 35.9‰ – 36.0‰ while some freshwater influence was visible inshore off St. Louis due to river run-off.

Sardinellas were generally found along the whole shelf of Mauritania, between 15 m depth and offshore to approximately 50 m bottom depth, Figure 5. As usually observed in Mauritania the biomass was dominated by *S. maderensis*. The proportion, 88%, was similar to what was observed last year. 52% of the biomass of both species was found south of Cape Timiris and the density was generally lower, particularly so on the southern shelf, compared to last year, Table 7.

Sardines were found inshore in shallow waters in an area off Cape Timiris, in smaller school groups between Cape Timiris and Cape Blanc and in a dense distribution area around Cape Blanc, Figure 7. The total biomass was estimated to be 2.2 million tons, among the highest ever recorded in the Mauritanian waters during this time of the year. Approximately 50% of the biomass was found off Cape Timiris while the rest was found north of this area.

Anchovy was found in relatively high density on the shelf off Banc D'arguin, Figure 9. The biomass was estimated to be 98 thousand tons. The abundance of anchovy is fluctuating considerable both regionally and within Mauritania and there are several years since last time there was large abundance of this species found in the region during the November survey.

Four different low density distribution areas in an almost continuous band formed the distribution area of Cunene horse mackerel and False scad off Mauritania. The distribution of the two species was continuous from the shelf break and almost to the 20 isobath with false scad most dominant in the inshore part of the distribution area, Figure 6. The abundance of false scad south of Cape Timiris was 49 thousand tons while none was found north of this.

The total abundance estimate of Cunene horse mackerel was 149 thousand tons, 39% of this was found south of Cape Timiris. Only very few Atlantic horse mackerel was found in Mauritania this year and no estimate was made of this species

Other carangids and associated species were distributed over most of the shelf at rather low densities along the whole coast north to 20°N, Figure 8. The main species of P2 in the catches was *Trichiurus lepturus*, and *Chloroscombrus chrysurus* while *Brachydeuterus auritus*, *Stromateus fiatola* and *Lagocephalus laevigatus* was frequently caught on the shelf south of Cape Timiris. The main groups of species in the catches can be found in Table 4 and 6. The total biomass was estimated at approximately 65 thousand tons, of this 62 thousand tons were found south of Cape Timiris.

An overview of the acoustic biomass estimates of the main groups of pelagic fish is shown in Table 7, and their corresponding geographical distribution in Figure 10. The total biomass of sardinellas was thus 601 thousand tons, sardine was estimated to be 2.2 million tons, anchovy 98 thousand tons, horse mackerels 198 thousand tons and carangids and associated species 65 thousand tons.

Table 7. Summary of biomass estimates of pelagic fish, Mauritania. thousand tons / Résumé des biomasses de pélagiques en Mauritanie, en milliers de tonnes.

	<i>Sardinella maderensis</i>	<i>Sardinella aurita</i>	<i>Sardina pilchardus</i>	<i>Engraulis encrasicolus</i>	Horse mackerels	Carangids etc.
St. Louis – Cape Timiris	302	6	1 075	0	106	62
Cape Timiris – Cape Blanc	225	68	1 103	98	92	3
Total	527	74	2 178	98	198	65

The abundance of sardinella in Mauritanian waters has increased since the estimate in November 2002 where only 320 tons of sardinella were found until the estimate last year when 1.5 million tons were found. This year 601 thousand tons of sardinella was estimated in the area, Table 8. Large fluctuations have been experienced during the last 10 years of annual surveys in Mauritanian waters. The reason for this is not clear but sardinellas and sardine mix together where the two species coexist and species separation is generally difficult and may affect the estimates. This year we observed a large decrease in the abundance of *Sardinella* while the sardine has a similar increase in abundance. Although the estimate in this report is considered the best estimate possible, the numbers should still be treated with caution. It is also probable that some sardinella was distributed on the large shelf area inside of 15 m bottom depth, and therefore not found during the survey.

This year 149 thousand tons of *Trachurus trecae* was found, this is an increase since the observed 74 thousand tons last year. In addition the abundance of *Decapterus rhonchus* was estimated to be 49 thousand tons. Last year 9 thousand tons of *Trachurus trachurus* was found in Mauritania while this year only a few scattered fish were caught. The horse mackerels are the most valuable of the small pelagic fish species in this region and the abundance in Mauritania is lower than it has been in many years, and still decreasing. However, looking at the regional estimate we can see that the main abundance of both *Trachurus trecae* and *T. trachurus* is found north of the Mauritanian border (Annex V), and there is probably little reason for concern.

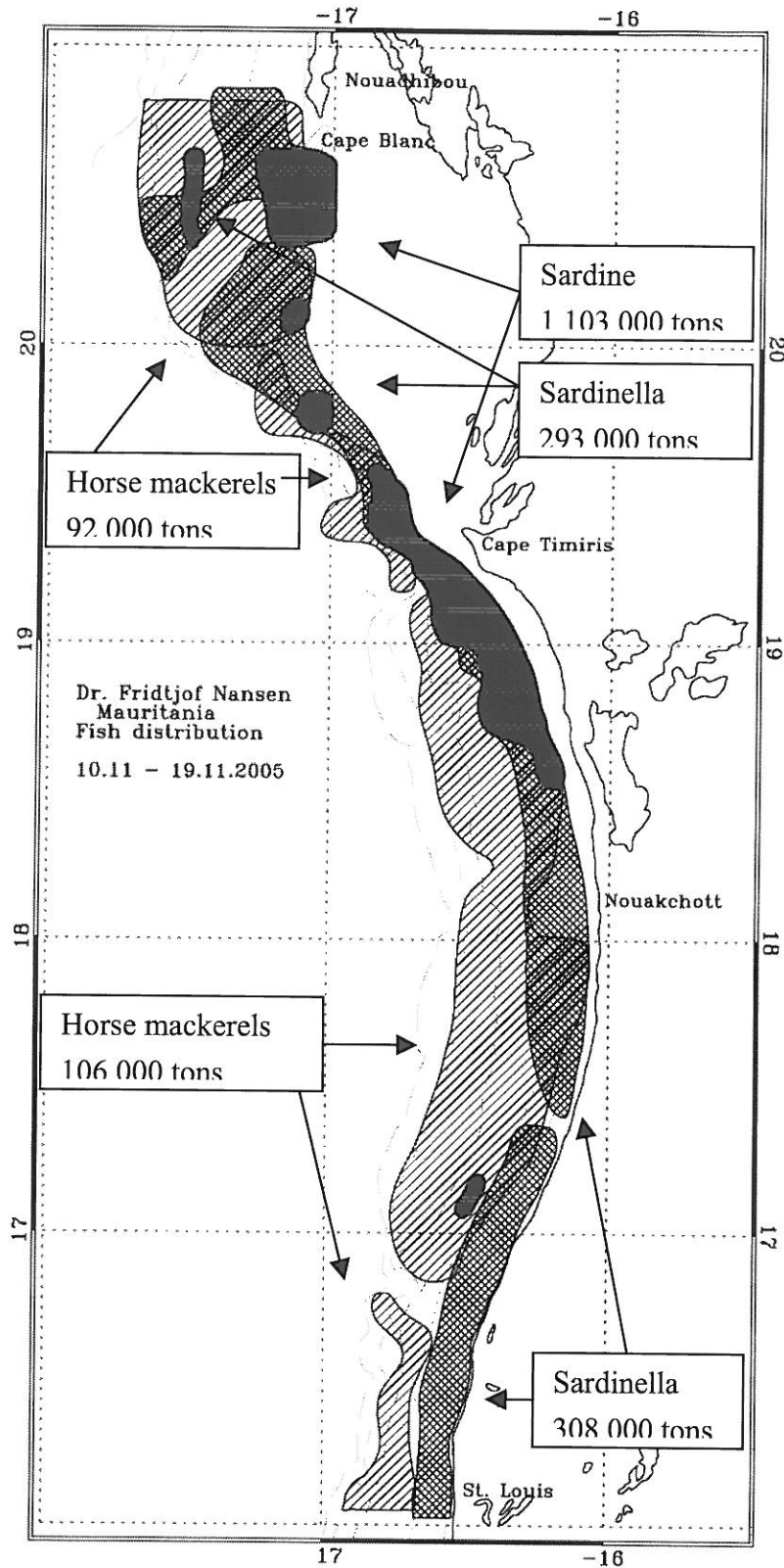


Figure 10. Major pelagic fish concentrations with estimated biomass (tonnes), Mauritania / Concentrations principales des poissons pélagiques et biomasses estimées (tonnes), Mauritanie.

Table 8. Biomass estimates from the 'Dr. Fridtjof Nansen' surveys of the Mauritanian shelf, thousand tons / Biomasses estimées par le 'Dr. Fridtjof Nansen' sur les cotes de la Mauritanie, en milliers de tonnes.

Survey:	Sardinellas	Carangids etc.
AprMay-81	20	370
Sept -81	75	*
FebMar -82	50	470
NovDec-86	300	540
FebMar-92	1 970	190
NovDec-95	1 780	190
NovDec-96	1 400	400
NovDec-97	1 200	660
NovDec-98	1 130	280
NovDec-99	740	560
NovDec-00	930	1 040
June -01	570	670
NovDec-01	230	370
June -02	930	1 130
NovDec-02	320	440
June -03	890	620
Nov -03	1 287	400
Nov -04	1 548	231
Nov -05	601	198

* Not available

RÉSUMÉ

La campagne a été conduite avec succès durant la période du 10 au 19 novembre selon un parcours d'une longueur approximative de 1680 milles nautiques. Au total, 45 stations de pêche de contrôle et 56 stations CTD ont été réalisées.

Les données hydrographiques révèlent des températures similaires à celles observées l'année dernière mais avec des fronts plus prononcés au large de Cap Timiris et Cap Blanc. Des masses d'eaux 20°C étaient présentes au nord de la zone couverte autour de Cap de Blanc et près de la côte, sur les fonds de 20m au niveau du Banc D'arguin, Figure 3. La grande majorité des eaux couvertes en Mauritanie montre une stabilité de la salinité autour de 35.9‰ – 36.0‰ tandis qu'une influence d'eaux douces était perçue au large de St. Louis due au fleuve à ce niveau.

Les sardinelles ont été rencontrées en général sur toute la côte, entre 15m de profondeur vers approximativement 50m de profondeur, Figure 5. Comme c'est le cas souvent en Mauritanie, les *S. Maderensis* ont prédominé. La proportion, de 88%, est similaire à celle observée l'année dernière. 52% de la biomasse des deux espèces étaient trouvés au sud de Cap Timiris

avec une densité généralement plus faible, surtout au sud, que celle observée l'année dernière.

Les sardines ont été rencontrées sur la côte dans les petits fonds à Cap Timiris, en bancs moins denses entre Cap Timiris et Cap Blanc et en fortes concentrations autour de Cap Blanc, Figure 7. Le total de la biomasse en Mauritanie est estimée à 2.2 millions de tonnes, parmi les records de biomasses enregistrées en Mauritanie en cette période de l'année. Autour de 50% de cette biomasse a été trouvée au large de Cap Timiris tandis que le reste était trouvé au nord de cette zone.

L'anchois a été rencontré dans des proportions relativement denses sur la côte autour du Banc D'arguin, Figure 9. L'abondance des anchois fluctue considérablement d'une région à une autre et voici plusieurs années depuis la dernière fois que des concentrations aussi denses ont été rencontrées dans la région en novembre.

Quatre zones de distribution de faible densité, étalées pratiquement sur une bande continue, constituent l'aire de répartition des chinchards noirs et des chinchards jaunes en Mauritanie. La distribution des deux espèces était continue depuis la limite du plateau continental jusqu'à l'isobathe des 20 m avec une prédominance des chinchards jaunes vers la côte, Figure 6. La biomasse des chinchards jaunes au sud du Cap Timiris était de 49 milles tonnes alors qu'aucune trace n'a été rencontrée au nord de cette zone. La biomasse totale des chinchards noirs est évaluée à 149 milles tonnes, 39% de celle-ci a été trouvée au sud de Cap Timiris. Seules quelques traces de *T. Trachurus* ont été trouvées en Mauritanie cette année et aucune estimation n'a été faite pour cette espèce.

Les autres carangidés et espèces associées sont régulièrement distribués sur toute la côte jusqu'à 20°N, avec de moindres densités, Figure 8. Les principales espèces de P2 dans les captures étaient le *Trichiurus lepturus*, et le *Chloroscombrus chrysurus*, tandis que les *Brachydeuterus auritus*, *Stromateus fiatola* et les *Lagocephalus laevigatus* ont été fréquemment capturées sur la côte au sud de Cap Timiris. Les groupes principaux d'espèces dans les captures sont figurés Table 4 et 6. La biomasse totale est estimée approximativement à 65 milles tonnes, dont 62 milles tonnes au sud de Cap Timiris.

Le tableau 7 ci-dessous résume la biomasse pour chaque groupe de pélagiques ; la répartition géographique et l'abondance de ces espèces sont présentées en figure 10. Ainsi, la biomasse totale des sardinelles s'élève à 601 milles tonnes, celle des sardines à 2.2 milles tonnes, celle des anchois à 98 milles tonnes, celles de chinchards à 198 milles tonnes et les carangidés et espèces associées sont estimées à 65 milles tonnes.

L'abondance des sardinelles en Mauritanie a augmenté notablement depuis les estimations de novembre 2002 où seulement 320 milles tonnes de sardinelles ont été trouvées jusqu'aux estimations de l'année dernière où 1.5 million tonnes ont été trouvées, Table 8. Cette année une biomasse de 601 milles tonnes de sardinelles a été estimée. D'importantes fluctuations ont été observées durant les 10 dernières années de campagne annuelle en Mauritanie. La raison réelle n'est pas très claire mais les sardinelles et les sardines se mélangent quand elles co-existent, leur séparation est généralement difficile et ceci peut affecter les estimations. Cette année on assiste à une forte diminution des sardinelles tandis que la tendance inverse est observée pour les sardines. Bien que les estimations dans le rapport soient considérées comme les meilleures possibles, les nombres doivent toutefois être manipulés avec précaution. C'est aussi probable que des sardinelles soient localisées sur la côte dans les fonds inférieurs à 15 m et qu'elles ne soient pas prises en compte dans cette étude.

Cette année 149 milles tonnes de *Trachurus trecae* ont été trouvées, ceci représente une hausse par rapport aux 74 milles tonnes observés l'année dernière. En plus, la biomasse des *Decapterus rhonchus* a été estimée à 49 milles tonnes. L'année dernière 9 milles tonnes de *Trachurus trachurus* ont été trouvées en Mauritanie tandis que cette année seules quelques traces ont été enregistrées.

Les chinchards sont les petits pélagiques les plus valeureuses dans cette région et leur abondance en Mauritanie est inférieure à celle d'il y a plusieurs années, et elle continue de chuter. Cependant, en regardant l'évaluation régionale nous pouvons voir que la principale abondance de *Trachurus trecae* et *T. trachurus* est trouvée à la frontière nord de la Mauritanie, et il y a probablement peu raison de s'inquiéter à ce propos

References

Toresen, R., Gjørseter, H., and Barros, P. 1998. The acoustic method as used in the abundance estimation of capelin (*Mallotus villosus* Müller) and herring (*Clupea harengus* Linné) in the Barents Sea. Fisheries Research 34 (1998) 27-37.

MacLennan, D. N. and Simmons E. J. (1992). Fisheries Acoustics. Chapman and Hall.325p.

R/V "DR. FRIDTJOF NANSEN" PROJECT:W3 PROJECT STATION:2450
 DATE:18/11/05 GEAR TYPE: BT No:15 POSITION:Lat N 2046
 start stop duration Long W 1736
 TIME :09:31:31 09:39:21 8 (min) Purpose code: 1
 LOG :7306.73 7307.12 0.39 Area code : 3
 FDEPTH: 95 94 GearCond.code:
 BDEPTH: 95 94 Validity code:
 Towing dir: 195ø Wire out: 340 m Speed: 30 kn*10

Sorted: 36 Kg Total catch: 2918.51 CATCH/HOUR: 21888.83

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trercae, juvenile	20691.45	1029428	94.53	4088
Octopus vulgaris	630.00	608	2.88	
Cepola pauciradiatus	176.18	3038	0.80	
PORTUNIDAE	172.50	5468	0.79	
Plesionika martia	157.95	114210	0.72	
Blennius normani	30.38	1823	0.14	
Sardina pilchardus	24.30	608	0.11	
Synagrops microlepis	6.00	600	0.03	
Total	21888.76		100.00	

Annex II. Instruments and fishing gear used

The Simrad EK-500, 38kHz scientific echosounder was used for abundance estimation during the survey, in addition data from the 18 kHz, 120 kHz and 200 kHz transducers were recorded for possible future multifrequency target identification. The Bergen Echo Integrator system (BEI) recorded the hydroacoustic data and was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape and brought back to IMR for storing.

The details of the settings of the echosounders were as follows:

Transceiver 1 menu

Transducer depth	5.5 m
Absorption coeff.	10 dB/km
Pulse length	medium (1ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-21.0 dB
SV transducer gain	26.91dB
TS transducer gain	27.05
Angle sensitivity	21.9
3 dB beamwidth along.	7.0
3 dB beamwidth athw.	6.9
Alongship offset	0.01
Athwardship offset	0.02

Transceiver 2 menu

Transducer depth	5.5 m
Absorption coeff.	38 dB/km
Pulse length	long (1ms)
Bandwidth	narrow
Max power	1000 Watt
2-way beam angle	-20.6 dB
SV transducer gain	25.95B
TS transducer gain	26.00dB
Angle sensitivity	21.0
3 dB beamwidth along.	7.2
3 dB beamwidth athw.	7.0
Alongship offset	0.10
Athwardship offset	-0.06

Transceiver 3 menu

Transducer depth	5.5 m
Absorption coeff.	3 dB/km
Pulse length	short (0.7 ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-17.2 dB
SV transducer gain	23.87dB
TS transducer gain	23.82B
Angle sensitivity	13.9
3 dB beamwidth along.	10.9
3 dB beamwidth athw.	10.7
Alongship offset	0.04
Athwardship offset	009

Transceiver 4 menu

Transducer depth	5.5 m
Absorption coeff.	53 dB/km
Pulse length	Long
Bandwidth	Narrow
Max power	1000 Watt
2-way beam angle	-20.5 dB
SV transducer gain	23.84 dB
TS transducer gain	24.80 dB
Angle sensitivity	0.0
3 dB beamwidth along.	0.0°
3 dB beamwidth athw.	0.0°
Alongship offset	0.00°
Athwardship offset	0.00°

Display menu

Echogram	1
Bottom range	15 m
Bottom range start	10 m
TVG	20 log R
Sv colour min -	67 dB
TS Colour minimum	-50 dB

Printer- menu

Range	0-50, 0-100, 0-150, 0-250 or 0-500 m
TVG	20 log R
Sv colour min	-63 dB

Bottom detection menu

Minimum level	-50 dB
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Calibration

A calibration of the acoustic equipment was conducted during the survey in Angola in August 2005.

Fishing gear

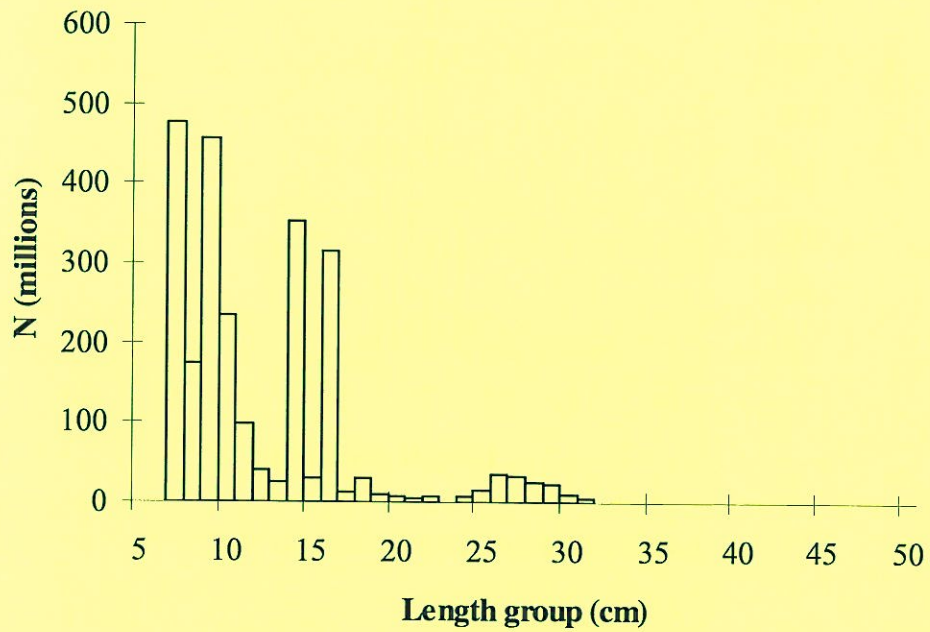
The vessel has three different sized four-panel 'Åkrahamn' pelagic trawls and one 'Gisund super bottom trawl'. The two smallest pelagic trawls and the demersal trawl were used during the survey. The smallest pelagic trawl has 10-12 m vertical opening under normal operation, whereas the intermediate sized trawl has 15-18 m opening.

The bottom trawl has a 31 m headline and a 47 m footrope fitted with a 12" rubber bobbins gear. The codend has 20 mm meshes, and has an inner net with 10 mm mesh size. The vertical opening is about 5.5 m. The distance between the wing tips is about 18 m during towing. The sweeps are 40 m long. The trawl doors are 'Thyborøen' combi, 8 m² and weigh 2000 kg. The door spreading is about 45 m when using restraining rope. Trawling was conducted for species identification only and no restraining rope was therefore used during the survey.

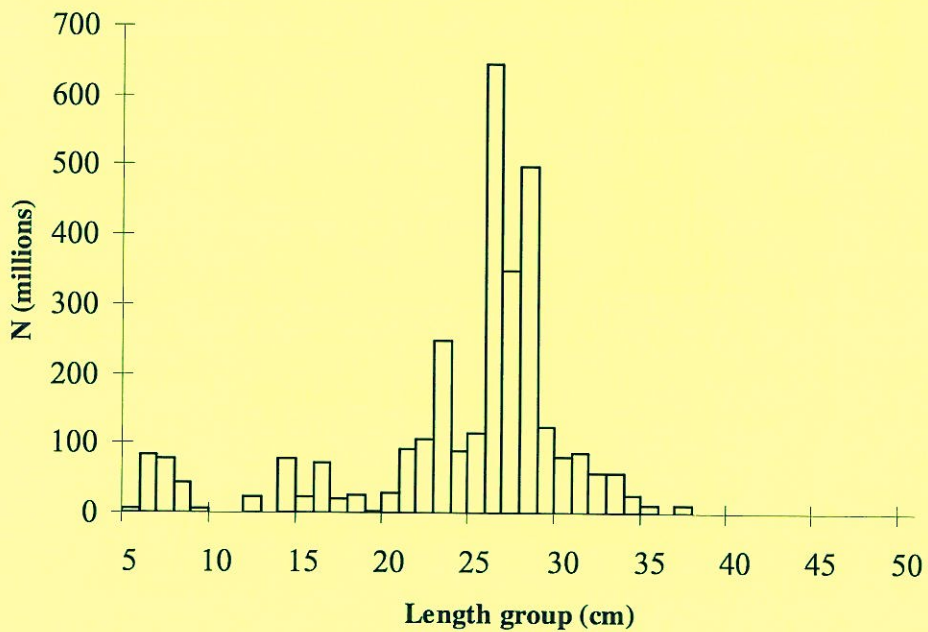
The SCANMAR system was used during all trawl hauls. This equipment consists of sensors, a hydrophone, a receiver, a display unit and a battery charger. Communication between sensors and ship is based on acoustic transmission. The doors are fitted with sensors to provide information on their distance and a height sensor is fitted on the bottom trawl to measure the trawl opening and provide information on clearance and bottom contact.

The pelagic trawls are equipped with a trawl eye that provides information about the trawl opening and the distance of the footrope to the bottom. A pressure sensor is used to show the depth on the headline.

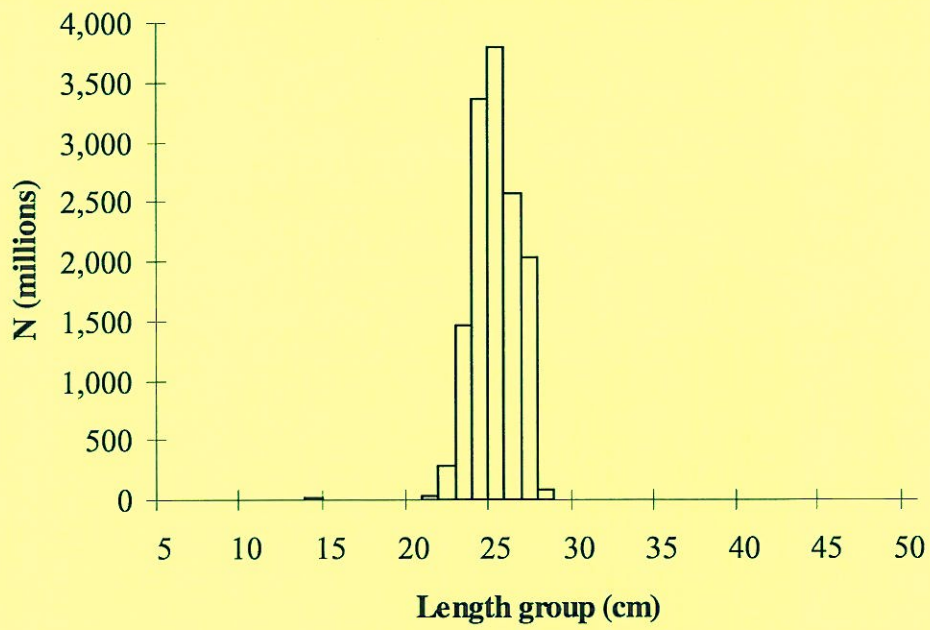
Annex III. Pooled length distribution by species and region



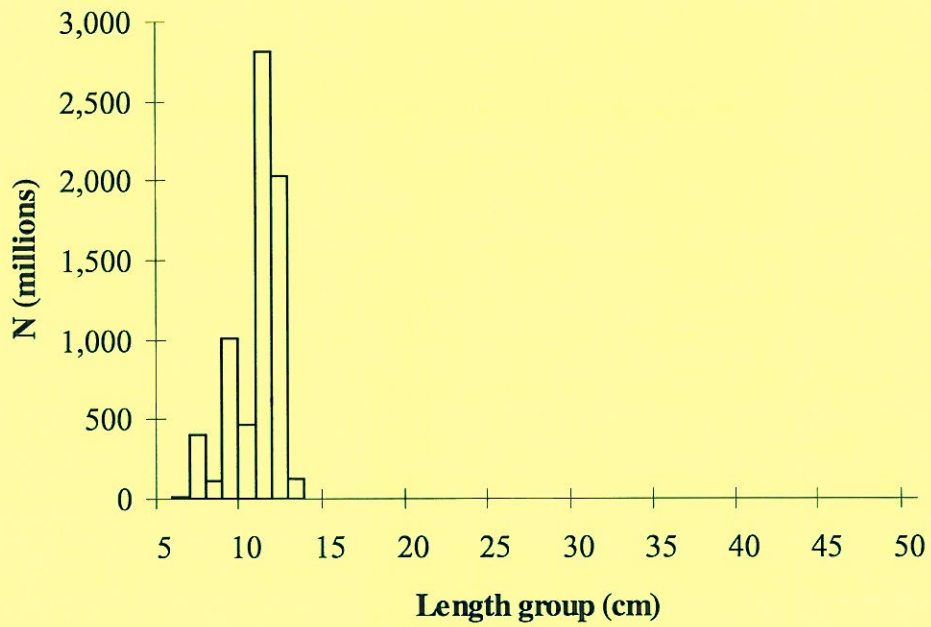
Round sardinella (*Sardinella aurita*) November 2005



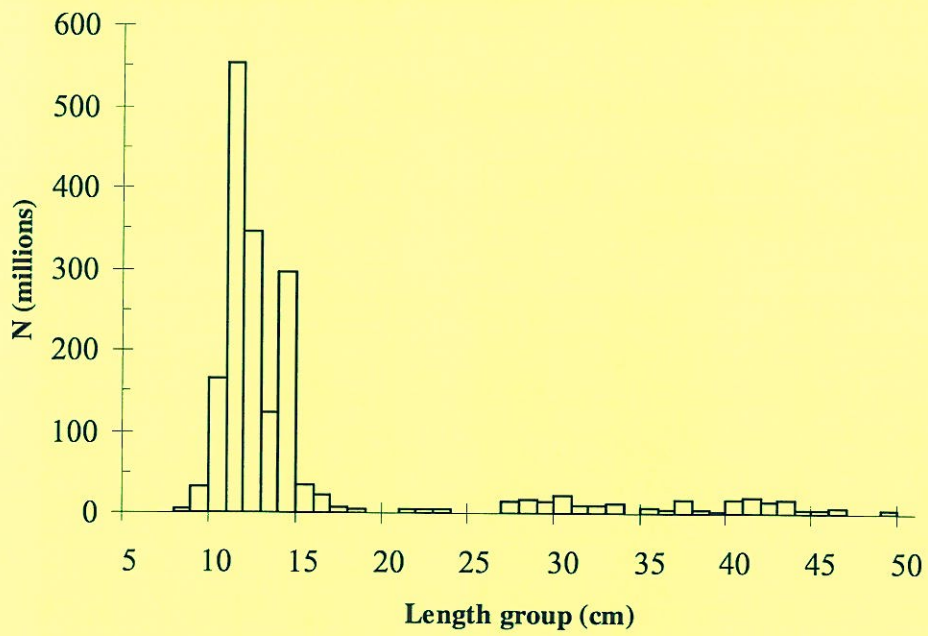
Flat sardinella (*Sardinella maderensis*) November 2005



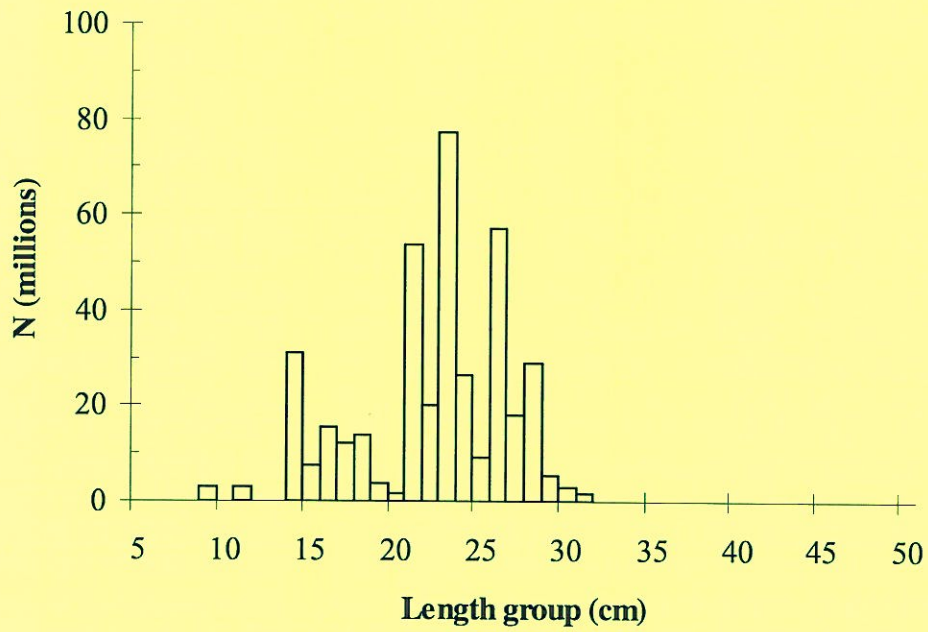
Sardine (*Sardina pilchardus*) November 2005



Anchovy (*Engraulis encrasicolus*) November 2005



Cunene horse mackerel (*Trachurus trecae*) November 2005



False Scad (*Decapterus rhonchus*) November 2005

Annex IV. Estimated number and biomass by length-group and sectors

Round sardinella (*Sardinella aurita*) November 2005

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7	90.6	386.8	477.4
8		174.6	174.6
9	16.2	440.7	456.9
10		234.2	234.2
11	3.2	95.8	99.0
12		41.5	41.5
13		25.4	25.4
14		353.0	353.0
15		29.9	29.9
16		314.8	314.8
17		13.1	13.1
18		30.5	30.5
19		10.2	10.2
20		6.8	6.8
21	0.7	5.1	5.8
22	1.5	5.1	6.6
23	0.7		0.7
24	0.1	6.8	6.9
25	0.3	15.2	15.5
26	0.1	35.6	35.7
27	1.2	30.5	31.7
28	3.1	22.0	25.1
29	8.3	15.2	23.5
30	6.3	3.4	9.7
31	1.6	3.4	5.0
32	0.4		0.4
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

Biomass in tonnes

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7	0.4	1.6	0,2
8		1.0	0,1
9	0.1	3.6	0,4
10		2.6	0,3
11	0.0	1.4	0,1
12		0.8	0,1
13		0.6	0,1
14		10.3	1,0
15		1.1	0,1
16		13.6	1,4
17		0.7	0,1
18		1.9	0,2
19		0.7	0,1
20		0.6	0,1
21	0.1	0.5	0,1
22	0.2	0.6	0,1
23	0.1		0,0
24	0.0	1.0	0,1
25	0.0	2.4	0,2
26	0.0	6.4	0,6
27	0.2	6.1	0,6
28	0.7	4.9	0,6
29	2.0	3.8	0,6
30	1.7	0.9	0,3
31	0.5	1.0	0,1
32	0.1		0,0
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

Flat sardinella (*Sardinella maderensis*) November 2005

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5	5.9		5.9
6	82.8		82.8
7	78.6		78.6
8	44.3		44.3
9	5.1	0.5	5.6
10	0.5		0.5
11			
12		23.5	23.5
13			
14	59.5	19.6	79.1
15		23.5	23.5
16	55.3	15.6	70.9
17		19.6	19.6
18	16.4	9.6	25.9
19		3.9	3.9
20		27.4	27.4
21	7.2	84.1	91.3
22	10.8	96.7	107.5
23	112.7	134.0	246.7
24	17.7	70.2	87.9
25	53.3	63.3	116.6
26	427.0	218.2	645.2
27	172.7	175.1	347.9
28	274.6	224.5	499.0
29	71.4	51.7	123.1
30	74.9	4.4	79.4
31	52.5	34.0	86.5
32	45.7	11.3	57.0
33	23.5	32.7	56.2
34	24.9		24.9
35	10.8		10.8
36			
37	10.8		10.8
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	1,739.0	1,343.2	3,082.2

Biomass in tonnes

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5	0.0		0,0
6	0.2		0,0
7	0.3		0,0
8	0.3		0,0
9	0.0	0.0	0,0
10	0.0		0,0
11			
12		0.4	0,0
13			
14	1.7	0.6	0,2
15		0.8	0,1
16	2.4	0.7	0,3
17		1.0	0,1
18	1.0	0.6	0,2
19		0.3	0,0
20		2.3	0,2
21	0.7	8.0	0,9
22	1.2	10.6	1,2
23	14.0	16.7	3,1
24	2.5	9.9	1,2
25	8.5	10.1	1,9
26	76.3	39.0	11,5
27	34.5	35.0	6,9
28	61.0	49.9	11,1
29	17.6	12.7	3,0
30	20.4	1.2	2,2
31	15.7	10.2	2,6
32	15.1	3.7	1,9
33	8.5	11.8	2,0
34	9.8		1,0
35	4.6		0,5
36			
37	5.4		0,5
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	302	225	527

Sardine (*Sardina pilchardus*) November 2005

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9			
10			
11		2.9	2.9
12		6.5	6.5
13		5.2	5.2
14		13.4	13.4
15		0.9	0.9
16		0.4	0.4
17			
18			
19			
20			
21	20.5	19.6	40.1
22	102.5	175.1	277.7
23	492.2	965.4	1,457.6
24	1,353.6	2,013.3	3,366.9
25	1,415.1	2,388.6	3,803.7
26	1,421.1	1,148.0	2,569.1
27	1,652.8	374.1	2,026.8
28		77.3	77.3
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	6,457.8	7,190.5	13,648.4

Biomass in tonnes

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9			
10			
11		0.0	0
12		0.1	0
13		0.1	0
14		0.4	0
15		0.0	0
16		0.0	0
17			
18			
19			
20			
21	2.0	1.9	4
22	11.2	19.2	30
23	61.3	120.3	182
24	191.1	284.2	475
25	225.3	380.2	605
26	253.9	205.1	459
27	330.0	74.7	405
28		17.2	17
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	1,075	1,103	2,178

Anchovy (*Engraulis encrasicolus*) November 2005

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6		11.6	11.6
7		407.2	407.2
8		116.4	116.4
9		1,012.3	1,012.3
10		465.4	465.4
11		2,815.8	2,815.8
12		2,024.6	2,024.6
13		128.0	128.0
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total		6,981.4	6,981.4

Biomass in tonnes

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6		0.0	0
7		1.6	2
8		0.7	1
9		8.3	8
10		5.2	5
11		41.1	41
12		38.0	38
13		3.0	3
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total		98	98

Cunene horse mackerel (*Trachurus trecae*) November 2005

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8	3.8		3.8
9	8.6	22.4	31.0
10	145.1	19.3	164.4
11	185.3	366.6	551.9
12	153.0	191.8	344.8
13	78.1	45.3	123.4
14	243.5	52.1	295.6
15	25.9	7.6	33.5
16	16.7	5.5	22.2
17	7.4		7.4
18	5.3	0.1	5.4
19			
20			
21	3.8	0.0	3.8
22		4.3	4.3
23		4.6	4.6
24		0.0	0.0
25		0.0	0.0
26	0.4	0.0	0.4
27		14.7	14.7
28	0.0	17.8	17.8
29	1.1	14.9	16.0
30	0.0	21.3	21.3
31	1.1	8.7	9.8
32	3.9	6.4	10.3
33	6.5	5.9	12.4
34	0.0	0.5	0.5
35	7.6		7.6
36	4.9	0.3	5.2
37	10.8	5.3	16.2
38	3.9	0.3	4.2
39	2.2	1.0	3.2
40	11.5	4.7	16.2
41	4.9	15.6	20.6
42		15.3	15.3
43		17.7	17.7
44		5.0	5.0
45	1.1	4.3	5.4
46	3.8	4.3	8.2
47			
48			
49	3.8		3.8
50			
Total	944.0	883.8	1,827.8

Biomass in tonnes

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8	0.0		0.0
9	0.1	0.2	0.0
10	1.6	0.2	0.2
11	2.7	5.4	0.8
12	2.9	3.6	0.6
13	1.8	1.1	0.3
14	7.1	1.5	0.9
15	0.9	0.3	0.1
16	0.7	0.2	0.1
17	0.4		0.0
18	0.3	0.0	0.0
19			
20			
21	0.4	0.0	0.0
22		0.5	0.0
23		0.6	0.1
24		0.0	0.0
25		0.0	0.0
26	0.1	0.0	0.0
27		2.9	0.3
28	0.0	3.9	0.4
29	0.3	3.7	0.4
30	0.0	5.8	0.6
31	0.3	2.6	0.3
32	1.3	2.1	0.3
33	2.4	2.1	0.4
34	0.0	0.2	0.0
35	3.3		0.3
36	2.3	0.1	0.2
37	5.5	2.7	0.8
38	2.1	0.2	0.2
39	1.3	0.6	0.2
40	7.4	3.0	1.0
41	3.4	10.7	1.4
42		11.3	1.1
43		14.0	1.4
44		4.2	0.4
45	1.0	3.9	0.5
46	3.7	4.2	0.8
47			
48			
49	4.5		0.4
50			
Total	58	92	149

False Scad (*Decapterus rhonchus*) November 2005

Numbers in millions

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9	2.8		2.8
10			
11	2.8		2.8
12			
13			
14	30.9		30.9
15	7.5		7.5
16	15.4		15.4
17	12.3		12.3
18	14.0		14.0
19	3.8		3.8
20	1.6		1.6
21	54.0		54.0
22	20.3		20.3
23	77.1		77.1
24	26.4		26.4
25	9.3		9.3
26	57.3		57.3
27	18.0		18.0
28	29.2		29.2
29	5.4		5.4
30	3.1		3.1
31	1.7		1.7
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	393.0		393.0

Biomass in tonnes

Length cm	St. Louis - Cape Timiris	Cape Timiris - Cape Blanc	TOTAL
5			
6			
7			
8			
9	0.0		0.0
10			
11	0.0		0.0
12			
13			
14	0.9		0.1
15	0.3		0.0
16	0.7		0.1
17	0.6		0.1
18	0.9		0.1
19	0.3		0.0
20	0.1		0.0
21	5.2		0.5
22	2.2		0.2
23	9.6		1.0
24	3.7		0.4
25	1.5		0.1
26	10.2		1.0
27	3.6		0.4
28	6.5		0.6
29	1.3		0.1
30	0.9		0.1
31	0.5		0.1
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
Total	49		49

October-November 2005: Round sardinella (*Sardinella aurita*), number in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7		291.2	386.8	90.6			768.6
8		441.8	174.6				616.4
9		150.6	440.7	16.2			607.5
10		10.0	234.2				244.2
11		10.0	95.8	3.2			109.1
12			41.5				41.5
13		29.0	25.4				54.4
14		90.7	353.0				443.7
15		200.8	29.9				230.7
16		167.3	314.8				482.1
17		317.7	13.1				330.8
18		167.3	30.5				197.8
19		74.0	10.2				84.2
20		23.9	6.8				30.7
21		21.3	5.1	0.7		269.7	296.8
22		3.9	5.1	1.5		197.4	207.9
23		39.5		0.7		319.7	359.9
24		119.4	6.8	0.1		617.5	743.8
25		214.5	15.2	0.3		77.9	307.9
26		348.9	35.6	0.1		83.7	468.2
27		264.9	30.5	1.2		175.1	471.7
28		97.1	22.0	3.1		80.4	202.6
29		51.0	15.2	8.3		90.9	165.3
30		47.4	3.4	6.3		19.3	76.4
31		6.6	3.4	1.6			11.6
32		86.9		0.4			87.3
33		54.7					54.7
34		71.8					71.8
35		115.7					115.7
36		36.7					36.7
37		67.8					67.8
38		9.2					9.2
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	3,631.9	2,299.5	134.4		1,931.4	7,997.2

October-November 2005: Round sardinella (*Sardinella aurita*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7		1,155	1,566	367			3,088
8		2,551	1,029				3,580
9		1,214	3,627	133			4,974
10		109	2,603				2,712
11		144	1,399	47			1,590
12			778				778
13		671	600				1,271
14		2,599	10,332				12,931
15		7,028	1,070				8,099
16		7,064	13,578				20,641
17		16,006	673				16,679
18		9,956	1,856				11,812
19		5,146	723				5,869
20		1,901	560				2,461
21		1,974	485	71		25,727	28,257
22		321	555	162		21,586	22,625
23		4,717		92		39,826	44,636
24		16,450	956	18		87,177	104,601
25		33,402	2,425	41		12,394	48,263
26		60,972	6,352	23		14,945	82,291
27		51,795	6,084	237		34,964	93,081
28		21,133	4,891	695		17,860	44,579
29		12,301	3,755	2,033		22,391	40,481
30		12,634	922	1,723		5,265	20,544
31		1,936	1,016	477			3,429
32		28,052		128			28,180
33		19,340					19,340
34		27,727					27,727
35		48,668					48,668
36		16,773					16,773
37		33,616					33,616
38		4,921					4,921
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	452,272	67,837	6,247		282,137	808,494

October-November 2005: Flat sardinella (*Sardinella maderensis*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5				5.9			5.9
6				82.8			82.8
7				78.6			78.6
8				44.3			44.3
9			0.5	5.1			5.6
10				0.5			0.5
11							
12			23.5				23.5
13							
14			19.6	59.5		59.5	138.6
15			23.5			14.4	37.9
16			15.6	55.3		6.3	77.3
17			19.6			8.5	28.1
18			9.6	16.4		91.8	117.8
19			3.9			20.8	24.7
20			27.4				27.4
21			84.1	7.2		657.2	748.5
22			96.7	10.8		466.7	574.2
23		14.0	134.0	112.7	4.4	957.3	1,222.4
24		147.2	70.2	17.7	0.9	1,137.2	1,373.2
25		129.8	63.3	53.3		407.4	653.8
26		198.2	218.2	427.0	12.3	211.3	1,067.0
27		236.7	175.1	172.7	7.9	141.0	733.4
28		9.1	224.5	274.6	9.6	5.3	523.1
29		60.4	51.7	71.4	7.0	5.3	195.8
30		17.0	4.4	74.9			96.3
31		1.5	34.0	52.5			87.9
32			11.3	45.7			57.0
33		3.0	32.7	23.5			59.2
34				24.9			24.9
35				10.8			10.8
36							
37				10.8			10.8
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	816.8	1,343.2	1,739.0	42.1	4,190.3	8,131.4

October-November 2005: Flat sardinella (*Sardinella maderensis*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5				9			9
6				218			218
7				319			319
8				261			261
9			4	42			46
10				6			6
11							
12			440				440
13							
14			572	1,743		1,742	4,057
15			839			517	1,356
16			675	2,384		274	3,333
17			1,006			440	1,446
18			582	994		5,582	7,158
19			278			1,480	1,759
20			2,265				2,265
21			8,020	690		62,703	71,413
22			10,570	1,184		51,031	62,786
23		1,759	16,700	14,042	546	119,270	152,317
24		20,999	9,905	2,501	124	160,552	194,081
25		20,867	10,078	8,482		64,850	104,278
26		35,765	38,975	76,292	2,193	37,757	190,983
27		47,721	34,963	34,485	1,576	28,141	146,886
28		2,018	49,880	61,021	2,144	1,183	116,245
29		15,038	12,738	17,597	1,729	1,312	48,414
30		4,670	1,206	20,410			26,286
31		452	10,195	15,745			26,393
32			3,733	15,067			18,800
33		1,092	11,817	8,480			21,389
34				9,826			9,826
35				4,624			4,624
36							
37				5,449			5,449
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	150,383	225,442	301,873	8,311	536,833	1,222,842

October-November 2005: Anchovy (*Engraulis encrasicolus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5		478.0					478.0
6		2,090.0		11.6			2,101.7
7		791.3		407.2			1,198.5
8		1,120.5		116.4			1,236.9
9		154.5		1,012.3			1,166.8
10				465.4			465.4
11				2,815.8			2,815.8
12				2,024.6			2,024.6
13				128.0			128.0
14							
15							
16							
17							
18							
19							
20							
Total	N.A.	4,634.3		6,981.4			11,615.7

October-November 2005: Anchovy (*Engraulis encrasicolus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5		429					429
6		3,099		31			3,130
7		1,803		1,649			3,452
8		3,716		686			4,402
9		715		8,332			9,047
10				5,172			5,172
11				41,112			41,112
12				37,961			37,961
13				3,023			3,023
14							
15							
16							
17							
18							
19							
20							
Total	N.A.	9,763		97,967			107,730

October-November 2005: Atlantic horse mackerel (*Trachurus trachurus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9		29.5					29.5
10		249.2					249.2
11		481.7					481.7
12		587.4					587.4
13		431.3					431.3
14		225.9					225.9
15		219.9					219.9
16		224.6					224.6
17		96.3					96.3
18		112.3					112.3
19		239.6					239.6
20		280.0					280.0
21		237.0					237.0
22		198.8					198.8
23		32.1					32.1
24		20.8					20.8
25		1.0					1.0
26		1.5					1.5
27		2.0					2.0
28		0.5					0.5
29		2.5					2.5
30		1.5					1.5
31		2.5					2.5
32		4.1					4.1
33		2.0					2.0
34		3.6					3.6
35		0.5					0.5
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	3,688.2					3,688.2

October-November 2005: Atlantic horse mackerel (*Trachurus trachurus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9		212					212
10		2,423					2,423
11		6,154					6,154
12		9,637					9,637
13		8,913					8,913
14		5,786					5,786
15		6,880					6,880
16		8,474					8,474
17		4,333					4,333
18		5,972					5,972
19		14,926					14,926
20		20,261					20,261
21		19,782					19,782
22		19,025					19,025
23		3,495					3,495
24		2,568					2,568
25		141					141
26		238					238
27		355					355
28		99					99
29		547					547
30		363					363
31		666					666
32		1,171					1,171
33		641					641
34		1,225					1,225
35		191					191
36							
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	144,481					144,481

October-November 2005: Chub mackerel (*Scomber japonicus*), biomass in tonnes

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10		114					114
11		4,359					4,359
12		17,753					17,753
13		24,969					24,969
14		10,390					10,390
15		7,015					7,015
16		7,849					7,849
17		18,568					18,568
18		21,211					21,211
19		17,331					17,331
20		34,321					34,321
21		19,966					19,966
22		12,967					12,967
23		8,377					8,377
24		8,440					8,440
25		8,832					8,832
26		3,139					3,139
27		697					697
28		447					447
29		890					890
30							
31							
32							
33							
34							
35		5,361					5,361
36							
37		6,320					6,320
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	239,314					239,314

October-November 2005: Chub mackerel (*Scomber japonicus*), numbers in millions

Length cm	C. Cantin- C. Juby	C. Juby- C. Blanc	C. Blanc- C. Timiris	C. Timiris- St. Louis	St. Louis- C. Vert	C. Vert- Casamance	TOTAL
5							
6							
7							
8							
9							
10		11.7					11.7
11		341.2					341.2
12		1,082.1					1,082.1
13		1,208.1					1,208.1
14		405.7					405.7
15		224.3					224.3
16		208.0					208.0
17		412.4					412.4
18		398.8					398.8
19		278.3					278.3
20		474.3					474.3
21		239.2					239.2
22		135.5					135.5
23		76.8					76.8
24		68.3					68.3
25		63.4					63.4
26		20.1					20.1
27		4.0					4.0
28		2.3					2.3
29		4.1					4.1
30							
31							
32							
33							
34							
35		14.3					14.3
36							
37		14.3					14.3
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48							
49							
50							
Total	N.A.	5,687.2					5,687.2