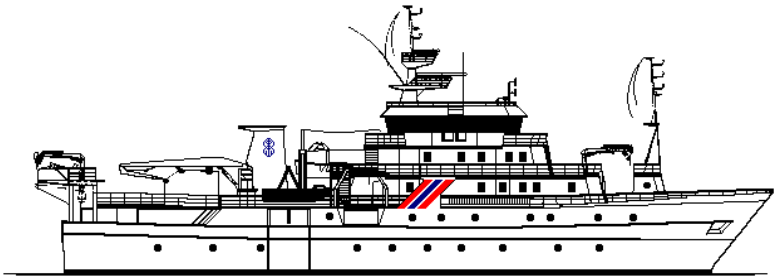
BCC Project: LMR/NANSEN/1/0609 Cruise reports "Dr. Fridtjof Nansen"



BCC SURVEY NO.1 2009

A TRANSBOUNDARY STUDY OF THE PELAGIC FISH STOCKS OF SOUTHERN ANGOLA AND NORTHERN NAMBIA

Cruise report No 01/2009

18 June – 04 July 2009

by

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1 Introduction

The transboundary pelagic survey is a dedicated research survey covering the pelagic fish resources and hydrographical conditions in the region ranging from southern Angola to northern Namibia. The main focus of the work was to assess the biomass of all commercially important pelagic fish stocks in the transboundary region, with emphasis on the horse mackerel stocks. The overall ship time of twelve days available were integrated into the yearly pelagic survey of Angola by the 'R/V Dr Fridtjof Nansen' in order to be able to continue the coverage carried out as part of the Angolan effort and to utilize the ship time optimally the survey was extended beyond the southern part of the transboundary area to include the rest of the horse mackerel distribution, but only as far as just north of Swakopmund on the inshore at 22°38.5' S.

The overall transboundary area was defined from Ponta Albina near Tombua in the north (16°00' S) southwards to the Cape Frio upwelling cell (around 19°00' S). The northern boundary represents the northernmost extreme of the Tiger Bank, from where the continental shelf starts widening and the southern boundary represents a natural biological boundary in Namibian waters due to the presence of the massive upwelling cell near Cape Frio. Ecological delimiters also included the distributions of the species, *Sardinella* sp. and *Trachurus* sp. Based on ecological delimiters the northern boundary of the transboundary area could be described as the northern limits of the distribution of Cape horse mackerel, while the southern limits of the distribution of the Sardinellas and/or Cunene horse mackerel indicated its southern extend. The definition of the transboundary area applied is expected to be wide enough to cover the likely distribution area of fish migrating from Namibia into Angolan waters and vice verse, at both warm and cold seasons.

There has been reported declines in both abundance and mean size in all main commercial pelagic species both in Angola and Namibia, particularly for horse mackerel and sardine. The zone across the Angolan-Namibian border is particularly important as this area hosts co-occurring population of carangids, i.e. Cape horse mackerel *Trachurus trachurus capensis* and Cunene horse mackerel *Trachurus trecae*, as well as clupeids, including sardine (Pilchard) *Sardinops sagax*, round herring (Redeye) *Etrumeus whiteheadi* and anchovy *Engraulis capensis*. There is special concern about the situation in the transboundary area since these stocks are known to be in low abundance, while they are at the same intensively fished in the border area.

The main purpose of this survey was to map the distribution and estimate the abundance of the most commercially important pelagic species in the Namibia-Angola transboundary area during the cold season. The study was complemented to the pelagic survey in Angola by extending the survey grid into Namibian waters. The same sampling resolution in terms of acoustic transect lines, fish sampling (pelagic and demersal trawling) and hydrographical mapping as in Angolan waters was used (Cruise report No. 2/2009). When assessed together with the results from the pelagic survey in Angola, the results of the transboundary survey would provide a complete coverage of the Cunene horse mackerel, including the proportion of the stock present in Namibian waters, if any, at the same time the pelagic survey was carried out in Angola. For sardine and the other clupeids as well as Cape horse mackerel, the survey would not cover the entire distribution area of the species, but would indicate total biomass in Angolan waters and in Namibian waters south to the 19°00' S latitude.

1.1 Objectives

The main objectives of the survey were the following:

- To estimate the abundance and to map the distribution of the main commercially important pelagic fish species, with special emphasis on the two horse mackerel Cunene horse mackerel *Trachurus trecae* and Cape horse mackerel *Trachurus capensis*, sardine "Pilchard" *Sardinops sagax* and other small pelagic species, including anchovy *Engraulis capensis* and round herring *Etrumeus whiteheadi*.

- To study the biological state of the main species, including length frequencies, length-weight relationships, reproductive stages and length-at-maturity.

- To map the meteorological and hydrographical conditions in the survey area by means of continuous recordings of weather data such as Sea-surface temperature (SST), Sea-surface salinity (SSS), wind speed and direction, using CTD-casts (Temperature, Salinity and Oxygen).

1.2 Participation

The following scientific staff participated in the survey:

From INIP, Angola:

Filomena VAZ-VELHO (Angolan Team Leader), António BARRADAS, Franscisco DE ALMEIDA, Pedro PANZO, Quilanda FIDEL, Rocha CAMALANDUA, Manuel DOMINGOS and Aristoteles AMARO.

From NatMIRC, Namibia:

Uatjavi UANIVI (Namibian Team Leader) and Richard KANGUMBA.

From IMR, Norway:

Else TORSTENSEN (Cruise Leader), Tore MØRK, Magne OLSEN and Terje SVOREN.

1.3 Survey schedule and effort

A full transceiver calibration was carried out prior to the survey in Baía dos Elephantes on 13th June. The vessel completed the pelagic survey in Angola, including the Angolan part of the transboundary area, and reached the Angolan-Namibian border at the Cunene River (17°15' S) on the 21st of June. The transboundary survey was completed just south of Cape Frio inshore at latitude 18°44'S on 25th June. The survey was then extended further south and this part of the coverage was completed just north of Swakopmund on the 2nd July inshore at 22°38.5'S and the docked in Walvis Bay on the morning of 3rd July.

Figure 1a shows the cruise track with trawling and hydrographical stations in the transboundary survey area and figure 1b shows the cruise track with trawling and hydrographical stations in the area south of the transboundary are, while the sampling effort throughout the transboundary survey, including the area south of the transboundary area is summarised in Table 1.

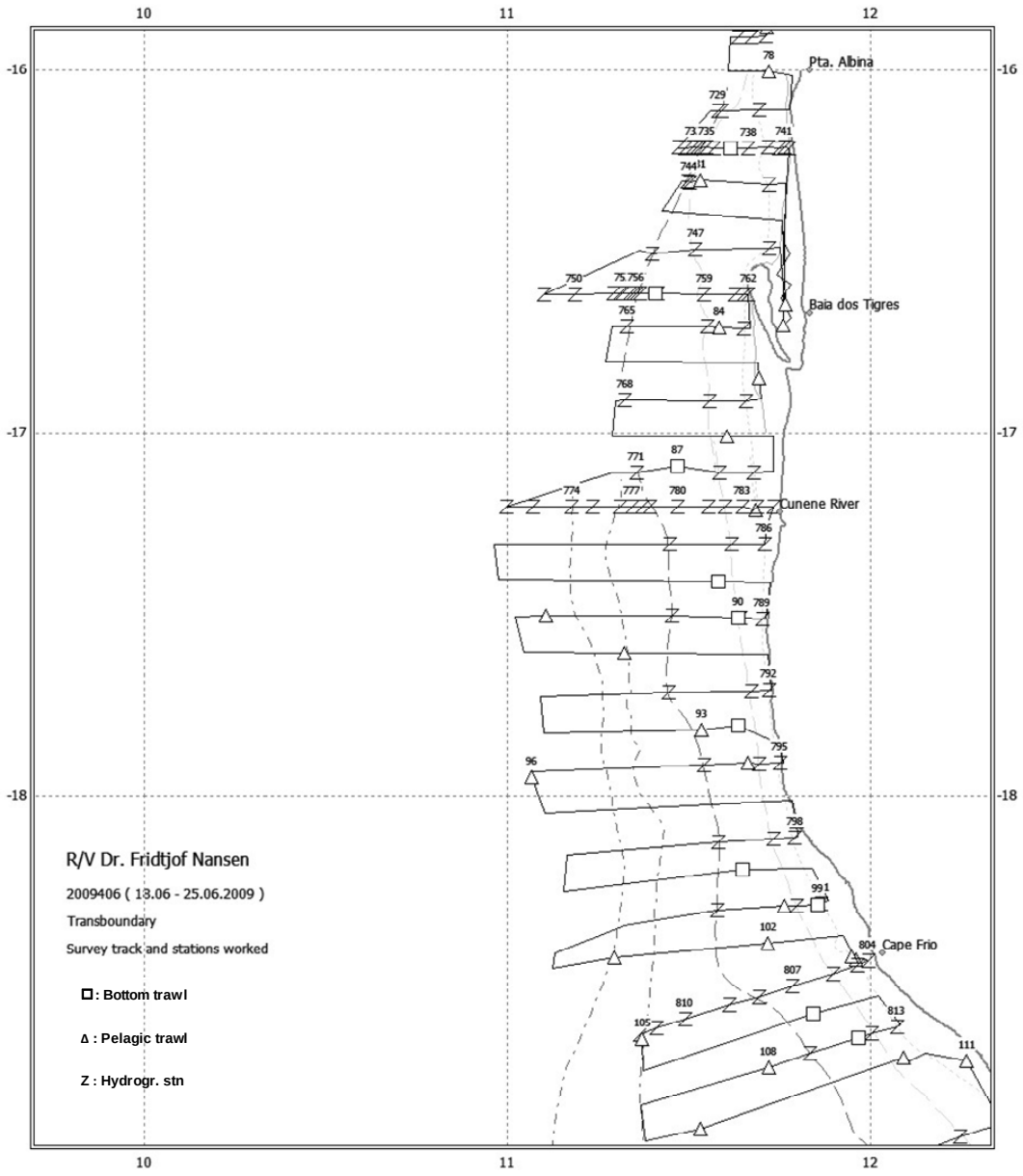

Figure 1a. Course track with trawling and hydrographic stations in the transboundary area. Depth contours at 20, 50, 100, 200 and 500 m.

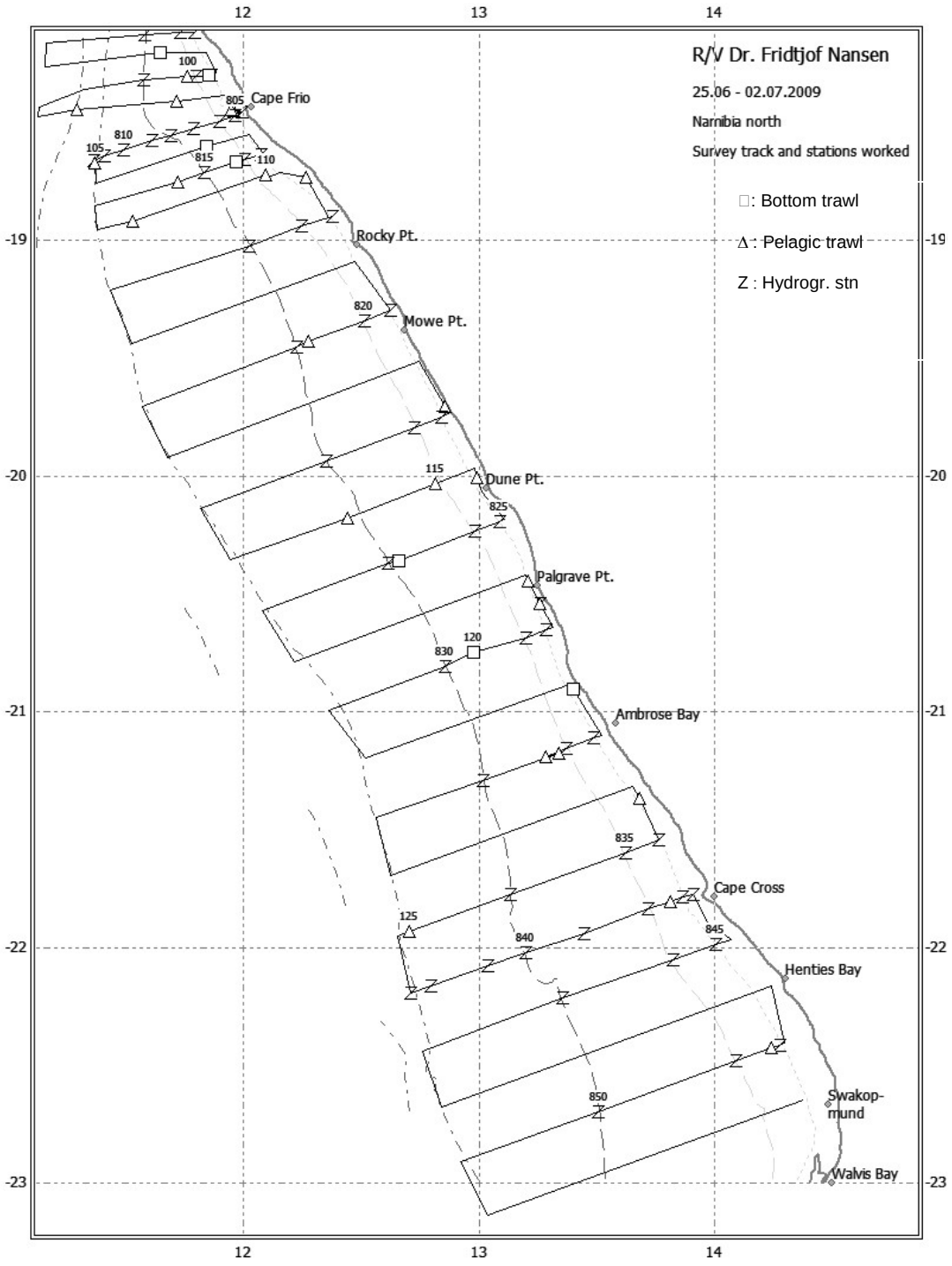

Figure 1b. Course track with trawling and hydrographic stations in the area south of the transboundary area. Depth contours at 20, 50, 100, 200 and 500 m.

Table 1. Summary of survey effort, including number of demersal (BT) and pelagic (PT) trawl hauls, CTD casts, and distance surveyed (log in n.mi).

Area	Bottom trawls	Pelagic trawls	Hydrographic stations	Log (nm)
Angola South (16°00' S - 17°15' S)	3	8	58	512
Namibia North (17°15' S - 19°00' S)	7	15	29	841
Namibia South (19°00' S - 23°00' S)	3	12	33	1131
Total	**13**	**35**	**120**	**2484**

2 Materials and methods

2.1 Survey grid

The survey design of equidistant pseudo-parallel transects (6 nautical miles apart) perpendicular to the coastline as applied in Angola was also followed in the extension into Namibian waters (Fig. 1a). Transects generally covered a depth range of 20-500 meters. However, some of the lines had to be stopped at 30-35 m due to the steeply inclining bottom near the shoreline in some areas. Transect lines in the border area from the Cunene River to Cape Frio were extended to the 2000 m isobaths in order to check for possible offshore aggregations of horse mackerel. This strategy ensured that the Namibian component of the transboundary area was covered in a way that was comparable to the data already collected in Angola. This way, distribution maps and biomass estimates could be drawn across the border area. Since, the time scheduled for the transboundary survey exceeded the duration of the survey, the survey was further extended to the south by altering the distance between the transects from 6 nm to 10 nm (Fig. 1b).

2.2 Acoustical sampling

Standard sphere calibrations were carried out, before commencement of the survey using 38.1 mm diameter tungsten carbide sphere for 18, 38, 120 and 200 kHz. The acoustic recordings were conducted using two Simrad ER 60 echosounders with keel mounted transducers at nominal operating frequencies of 18, 38, 120 and 200 kHz. All the transceivers were calibrated shortly prior to the survey, in Baía dos Elephantes on the 13th of June 2009. Acoustic data were logged and post-processed using the latest acoustic data post-processing software, the Large Scale Survey System (LSSS) Version 1.25. The

technical specifications and operational settings of the echosounder used during the survey are given in Annex II.

The acoustic data were scrutinized using the LSSS, Version 1.25. Scatterers were displayed at 38 kHz. The mean 5 n.mi area backscattering coefficients s_A (m^2/n.mi^2) were allocated to a predefined set of acoustic target groups on the basis of characteristic echogram features in conjunction with information about the species- and size compositions as derived from the trawl catches. Definitions of the acoustic target groups are given in Table 3.

Table 2. Allocation of acoustic backscattering coefficients to acoustic target groups and their definitions. Note that for horse mackerel and pilchard all encountered species are listed, while only examples are listed for the remaining groups.

Acoustic group	**Taxonomical group**	**Species**
Horse mackerel	*Trachurus* sp.	*T. trecae* *T. t. capensis*
Sardinella	*Sardinella* sp.	*S. aurita* *S. maderensis*
Pilchard	Sardinops	*Sardinops sagax*
Pelagic species 1	Clupeiformes$_{1}$	*Engraulis capensis* *Etrumeus whiteheadi*
Other demersal species	Sparidae$_{2}$	*Dentex macrophthalmus* *Pagellus bellottii*
	Other taxa	*Merluccius spp.* *Brama brama* *Chelidionichthys capensis*
Mesopelagic species	Myctophidae$_{3}$	
	Other mesopelagic fish	
Plankton		

$_{1}$: other than *Sardinops* sp.; $_{2}$: other than *Trachurus* sp.; $_{3}$: main species group.

Estimation of biomass and CV

The following target strength (TS) to length relationship was used to convert mean area backscattering coefficient s_A ($m^2/n.mi^2$) at 38 kHz to number of fish:

$$TS = 20 \log L - 72 \text{ (dB)} \quad (1)$$

or

$$C_F = \frac{10^{7.2}}{4\pi} \cdot L^{-2} \quad (2)$$

where C_F is the conversion factor from acoustic density to fish biomass and L is the mean total fish length. This target strength function was originally established for North Sea herring, but has later been attributed to clupeids in general (Foote *et al.* 1986, Foote 1987). No specific target strength relations presently are available for the species at hand, and equation (2) has therefore been applied consequently for all targeted species in this time series, following the established practice in the Namibian and Angolan national surveys. All estimates should consequently be considered as relative indices of abundance. The biomass was calculated by multiplying the number of fish by the expected length at weight, as estimated by regression of the log-length (total) against total weight.

The boundaries of encountered fish aggregations (post strata) were determined by means of contouring within the inner and outer zero-value limits of the transect lines. The strata contours were digitised using a CalBoard III digitising board / Atlas Draw v. 2.03 PC based software. Distribution plots and aerial calculations on the strata were carried out using IDL 5.6 for MS Windows. Sub-stratification was used to isolate areas of similar densities, using the following pre-defined, standard categories: 1: s_A = 0-300; 2: s_A = 300-1000; 3: s_A = 1000-3 000; 4: s_A > 3 000. Mean 5-n.mi integrator values (s_A) computed along the transect lines were re-averaged for each stratum. The overall length frequency distributions within strata were estimated by weighting the sample-distributions with the nearest valid 5 n.mi integrator value, or the average of two adjacent values. The total number of fish in each length group was estimated as:

$$\rho_i = \frac{< s_A > t_{i,j} \cdot u_i}{\sum_i \frac{u_i}{C_{Fi}}} \cdot A_s = \frac{10^{7.2} \cdot t_{i,j} \cdot u_i \cdot < s_A > \cdot A_s}{4\pi \sum_i u_i \cdot (L_i + 0.5)^2} \quad (3)$$

where:

ρ_i	=	estimated number of fish in length group i
$<s_A>$	=	mean recorded area backscattering coefficient ($m^2/n.mi^2$)
$t_{i,j}$	=	proportion of species j sampled in length group i
u_i	=	proportion of fish sampled in length group i
A_s	=	horizontal area of stratum s
C_{Fi}	=	conversion factor for length group i
L_i	=	length group i (nearest full cm below total length)
$L_i+0.5$	=	mean length in L_i.

2.3 Trawl sampling procedures

Targetted trawling was carried out on identified acoustic targets using the smallest pelagic sample trawl (10m vertical opening), the mid-sized pelagic sample trawl (12m) and the demersal sample trawl (5m). Samples were taken in baskets on deck and then weighed, and the number of fish of each species was determined from a subsample of the collected sample.

All trawl catches were sampled for species composition by weight and numbers. Records of catch rates are given in Annex II. Other species (mostly of commercial value) were collected and identified to species level and length measurements were taken (Annex III). A brief description and illustrations of the sampling trawls are provided in Annex IV.

Biological sampling

Samples of the main target species *Trachurus capensis*, *Trachurus trecae* and *Sardinops sagax*, as well as *Etrumeus whiteheadi* and *Engraulis capensis* were collected and measured for length and weight. Total length and body weight were determined to the nearest 1 cm and 1 g below, respectively. Sex and reproductive stages were determined by means of macroscopic examination, scoring each fish according to the six-point classification scale used during Angolan national surveys (Annex V). The condition factor was determined as the index of the length to weight proportion to give an idea on the body condition of the fish. Length-weight relationships of target species were determined from the regression analysis of length and weight for all stations sampled.

CF = observed weight /expected weight*100

Expected weight = $a*L^{b,}$

A Scanmar depth sensor gave real-time information of the depth. Nets were opened and closed remotely from the bridge of the vessel.

2.4 Meteorological and hydrographical sampling

Wind direction and speed, air temperature, global radiation and sea surface temperature (5 m depth) were recorded using the Norwegian Meteorological Institute's (DNMI) meteorological station on board. Values averaged over 10 min intervals were logged continuously. The weather station data were logged continuously throughout the survey. The results presented in this report are based on a standard output from the logging system, i.e. one nautical mile averages along the ship's track.

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 CTD lines with 60nm distance and on every 2nd transect at 200, 100 and 50m depth. The casts were stopped a few meters above the bottom.

Hydrographical sections were carried out at Pta. Albina, Baía dos Tigres, Cunene River (17°15' S), Cape Frio and standard sections, including Cape Cross in the area south of the transboundary area, as well as on every full degree latitude line.

3 Results

3.1 Transboundary area

Cape horse mackerel (*Trachurus capensis*): The distribution of *T. capensis* was not continuous throughout the transboundary area (Fig. 3). The first observation was made along the 16°37`S offshore of Baia dos Tigres at a bottom depth of about 122m and inshore, inside of the bay, along the same latitude at a bottom depth of 17m. It then disappeared from the trawls until the17°00`S, from where it appeared again through to the 17°30`S. The last concentration of the species in the transboundary area was observed just south of Cape Frio around the 18°44`S (Fig. 3). The species was found in a total of 19 trawl hauls both inshore as well offshore up to bottom depths of more than 1000m, but was restricted to depths of less 200m in the water column. The highest concentration of *T. capensis* was found south of the Cunene River in the area just north of the 18°00`S. The total biomass estimate of Cape

horse mackerel in the transboundary area was 202,300 tonnes of which about 71% was adult fish (> 17cm total length). Of this biomass approximately 22,000 tonnes was found on the Angolan side of the transboundary area (10.9% of total biomass).

A total of 1471 fish were analysed for length frequency distribution yielding a mean length of 16.61cm total length. The size distribution was multi-modal with modes at 7, 10, 12, 18 and 21cm total lengths, and a range of 4 to 24cm total length (Fig. 4). However, two distinct size groups are visible in the distribution, juvenile fish 9 – 14cm, and adult fish 17 – 21cm total length. The average condition factor yielded a value of 0.00784. Length-weight relationships are given in Annex III.

A total of 388 *T. capensis* were analysed for gonad maturity staging of which 215 were females and 64 were males. Hundred-and-nine of those fish could not be sexed, of which 75 were juveniles and 64 were unidentified. The majority of the fish were found in maturity stage 2, followed by stage 6 (Fig. 5). Females dominated most of the maturity stages, except stages 5 and 6, which were dominated by males. See Annex V for a description of the maturity stages. Fifty percent of the fish were predicted to mature at 12.5 cm (Fig. 6).

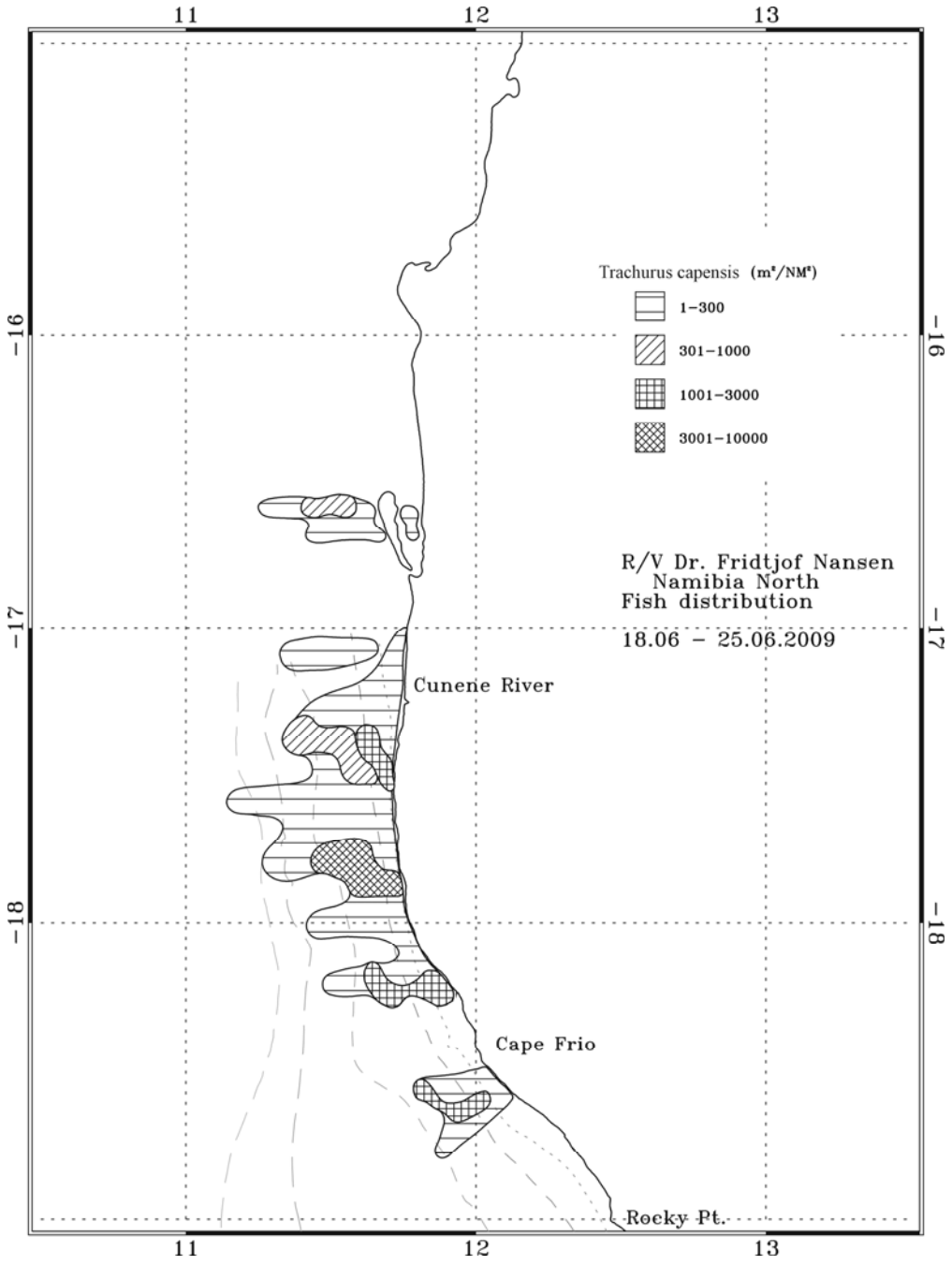

Figure 3. Distribution of the Cape horse mackerel (*T. capensis*)in the Angola-Namibian transboundary area. Depth contours at 20, 50, 100, 200 and 500 m.

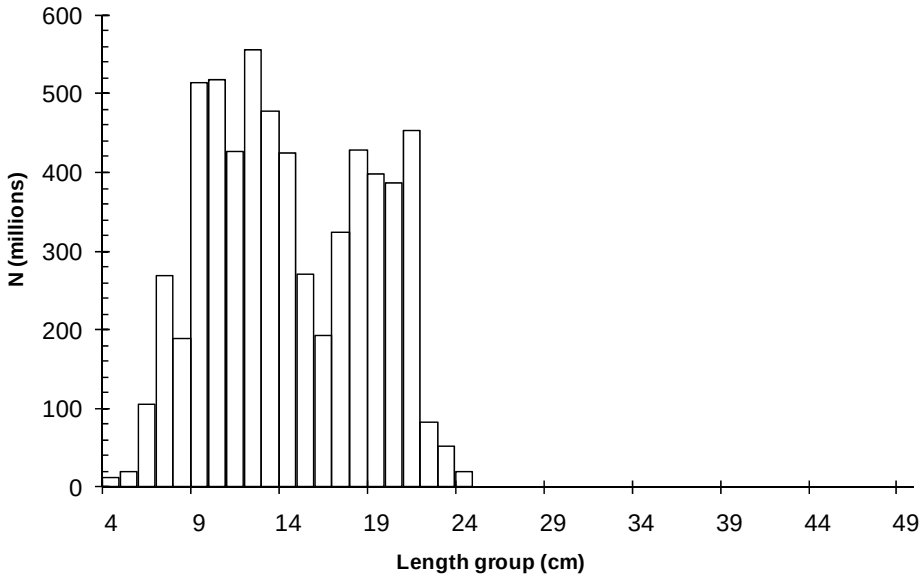

Figure 4. Length frequencies of *T. capensis* in the transboundary area

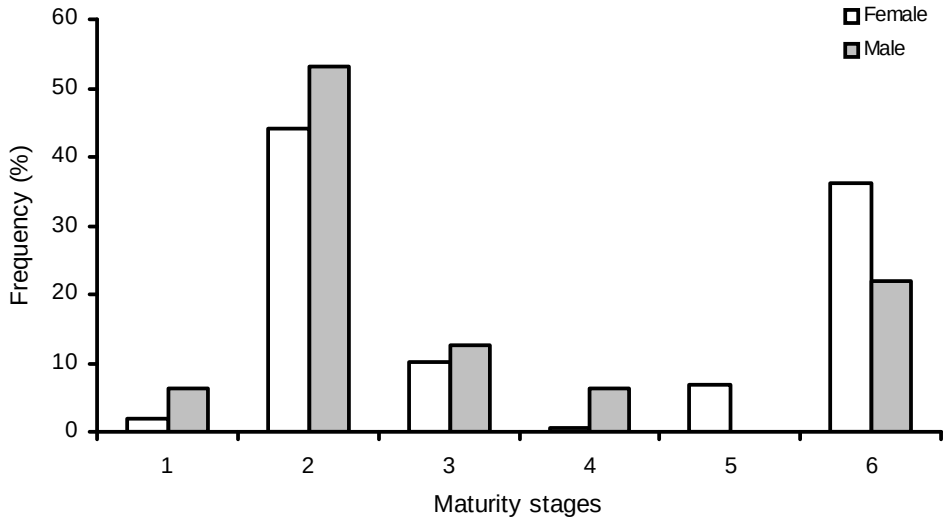

Figure 5. Frequency of *T. capensis* maturity stages by sex found in the Transboundary area

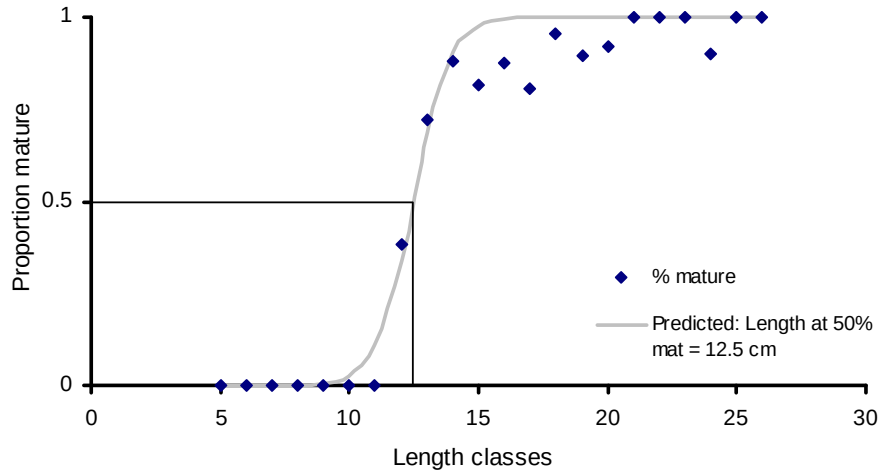

Figure 6. Proportion mature against length class (cm) of *T. capensis* caught in the Transboundary area. Maturity ogive fitted to the data is shown.

Cunene horse mackerel (*Trachurus trecae*): *T.* trecae was mostly encountered in low densities (S_A< 1000) except for the three areas of high density offshore and north of Baia dos Tigres where category 2 densities (S_A 1001 – 3000) were recorded (Fig. 7). The distribution of the species was continuous from the Angolan side of the transboundary across the border until latitude 17°30`S. *T. trecae* then reappeared again around the 18°00`S up to the 18°30`S. The total biomass of *T. trecae* was estimated at 50,700 tonnes, most of which was located in Angola, except for approximately tonnes 11,300 tonnes found on the Namibian side of the transboundary area (22.3% of total biomass). This biomass was equally shared by adult (> 18cm total length) and juvenile fish (< 18cm total length), each making up approximately 50% of the total biomass, respectively.

A total of 1522 fish were analysed for length frequency distribution yielding a mean length of 14.22cm total length with a size distribution ranging from 4 to 24cm (Fig. 8). The size distribution was bimodal with modes at 10cm and 18cm. The average condition factor yielded a value of 0.00856. Length-weight relationships are given in Annex III.

A total of 369 *T. trecae* were analysed for gonad maturity staging of which 143 were females and 134 were males. Ninety-two of those fish could not be sexed, of which 62 were juveniles and 30 were unidentified. All maturity stages were generally well represented in this species except stage 1, which was poorly represented. The majority of the fish were found in maturity stage 2, followed by stage 6 (Fig. 9). Again female was dominant sex class of most of the maturity stages, except stages 5 and 6, which were dominated by males. Fifty percent of the fish were predicted to mature at 12.5 cm (Fig. 10).

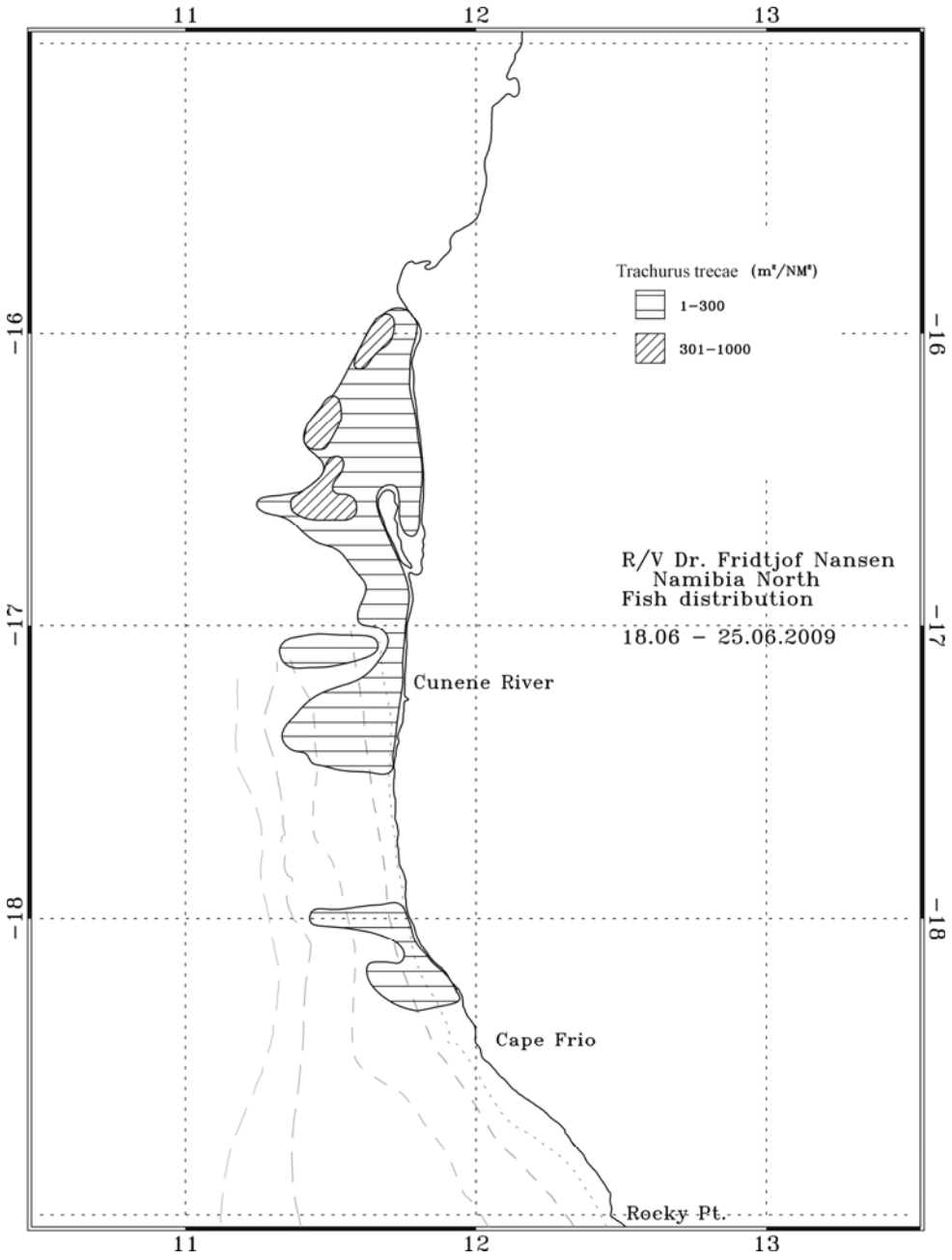

Figure 7. Distribution of the Cunene horse mackerel (*T. trecae*)in the Angola-Namibian transboundary area. Depth contours at 20, 50, 100, 200 and 500 m.

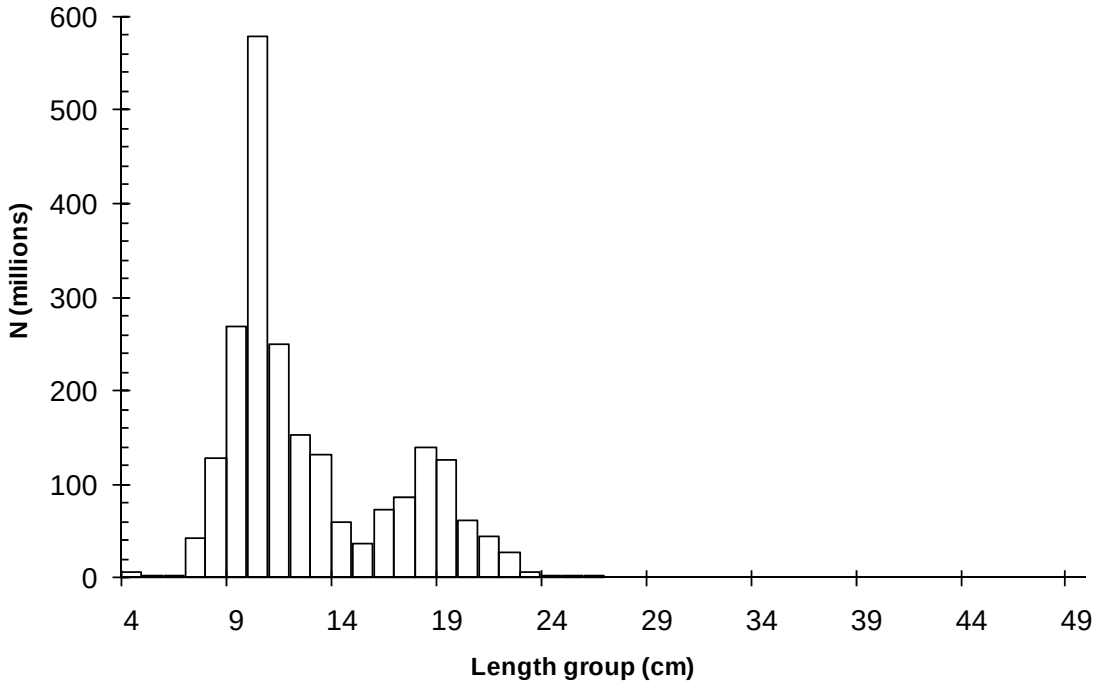

Figure 8. Length frequencies of *T. trecae* in the Transboundary area

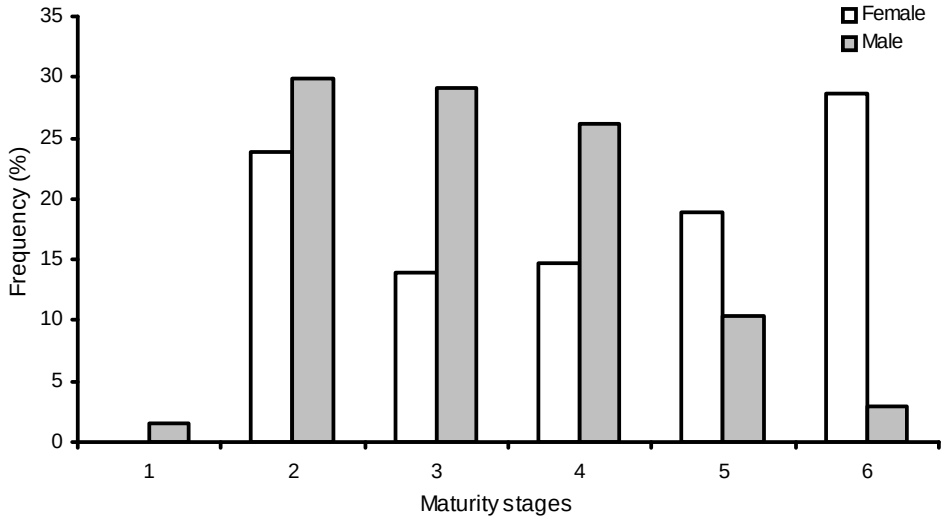

Figure 9. Frequency of *T. trecae* maturity stages by sex found in the Transboundary area.

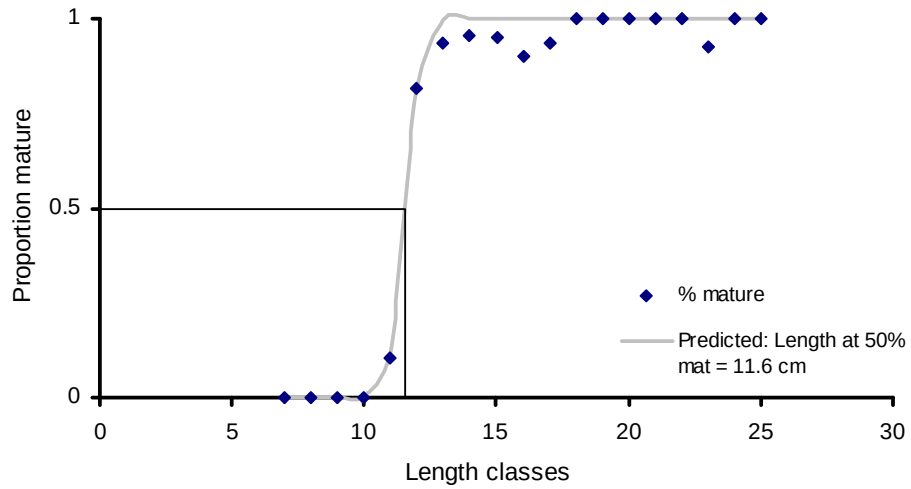

Figure 10. Proportion mature against length class (cm) of *T. trecae* caught in the Transboundary area. Maturity ogive fitted to the data is shown.

Pilchard (*Sardinops sagax*): *S. sagax* showed a very patchy distribution throughout the area, whereby the first encounter of the species in the area was made opposite Baia dos Tigres at a bottom depth of 120m (Fig. 11). The highest density (S_A >1000) of the distribution was found south of the Cunene River along the 17°25`S on the inshore, while the highest density inside Angola was found south of Baia dos Tigres slightly offshore between the 50 and 100m isobaths along the 17°00`S. The total biomass of pilchard was estimated at 35,700 tonnes.

A total of 429 fish were sampled for the length frequency distribution. The length distribution ranged from 6 to 22cm total length and was multi-modal with modes at 10, 13 and 16cm total length (Fig. 12). A small group of a relatively big fish (18 – 22cm total length) was also found in the distribution. The mean length of pilchard was 11.40cm and the average condition factor yielded a value of 0.00725.

The sample size of *S. sagax* analysed for gonad maturity staging was 90 fish of which 23 were females and 28 were males. Thirty-nine of those fish could not be sexed, of which 17 were juveniles and 22 were unidentified. Some of the fish recorded as unidentified were relatively big fish which gonads could have been large and visible enough to the naked eye. Maturity stage 1 was the dominant stage and it was dominated by males, whereas the rest of the stages where generally equally represented, with the two sex classes dominating in an equal number of maturity stages (Fig. 13). The data was not sufficient to compute a maturity ogive for this species.

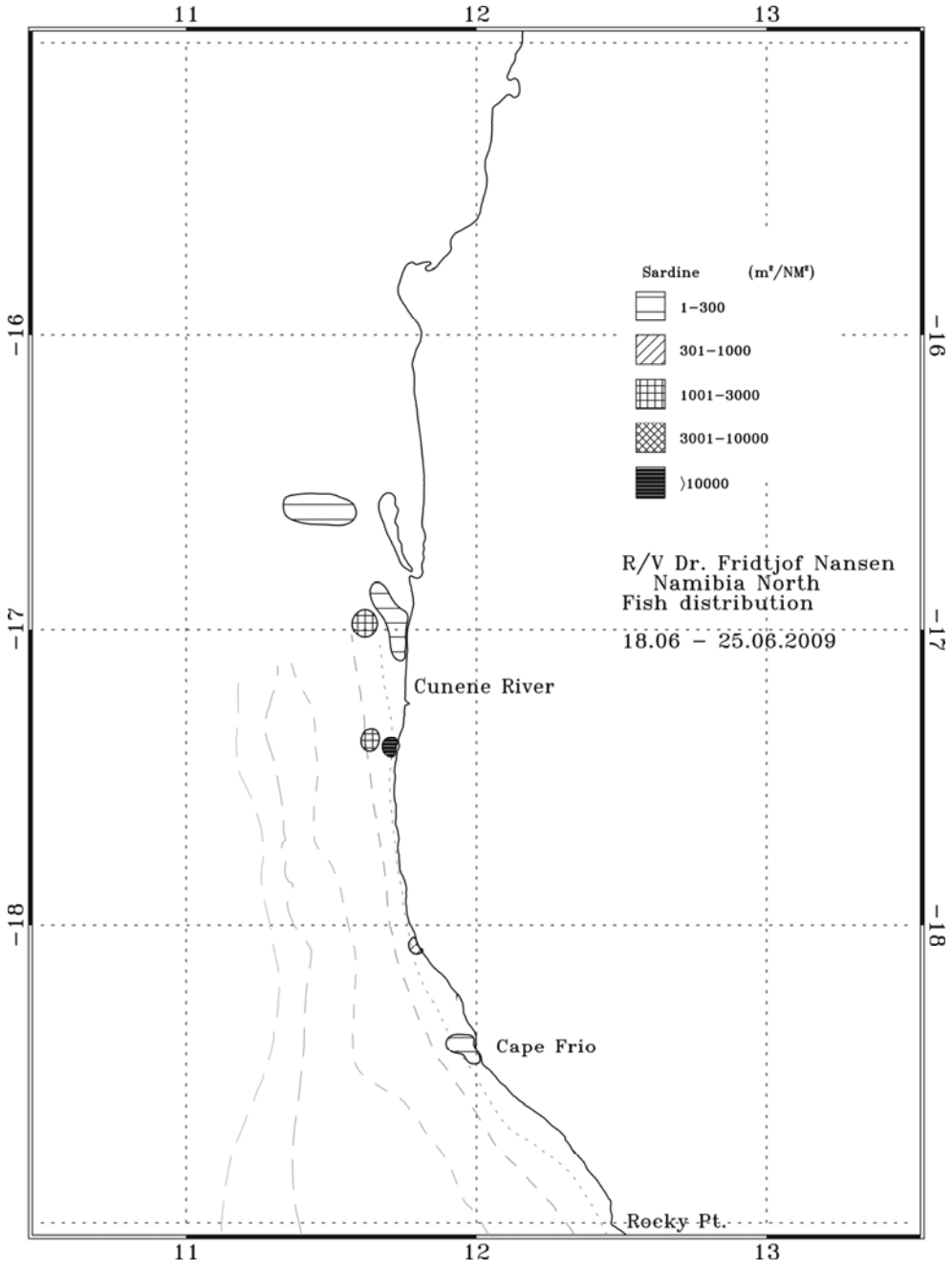

Figure 11. Distribution of pilchard in the Angola-Namibian transboundary area. Depth contours at 20, 50, 100, 200 and 500 m.

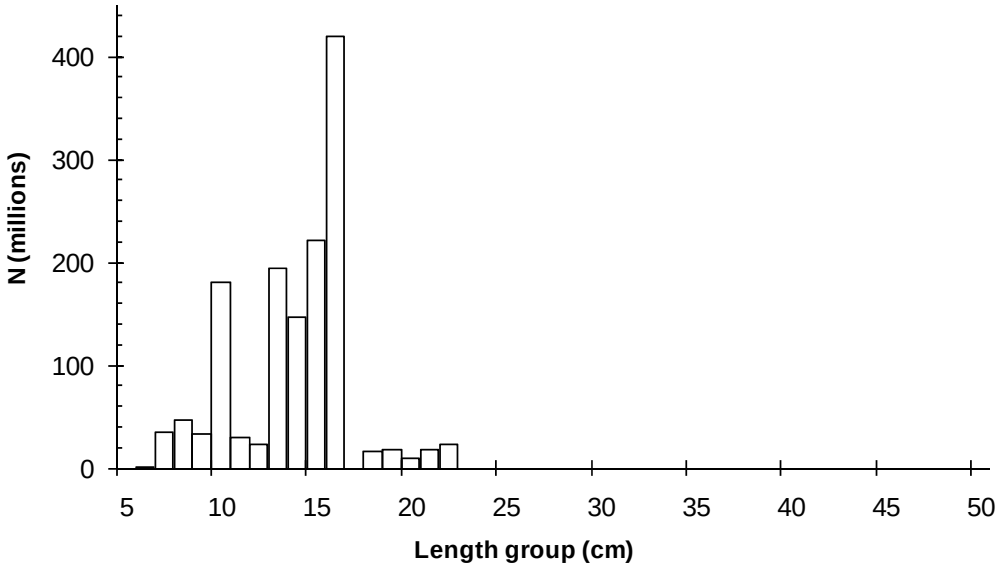

Figure 12. Length frequencies of *S. sagax* in the Transboundary area

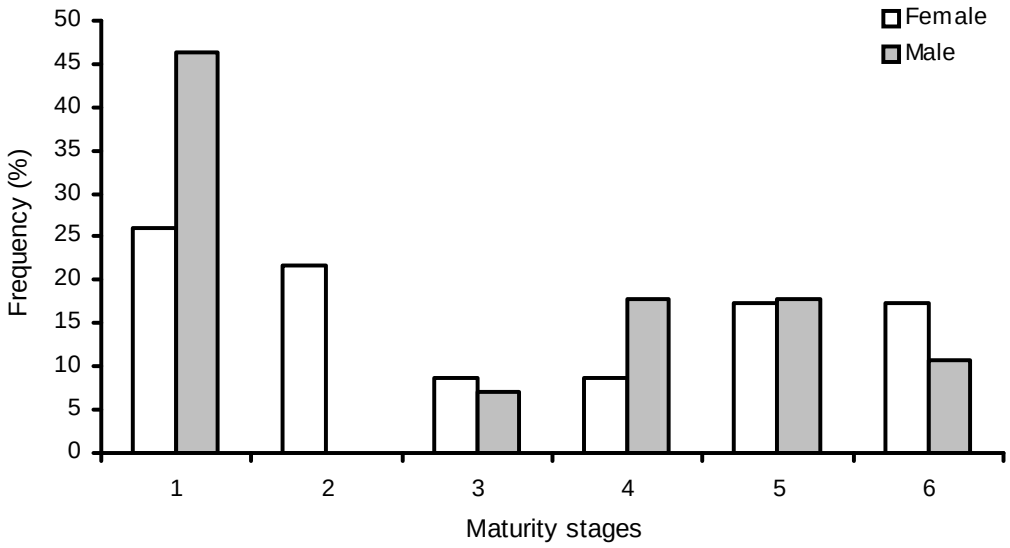

Figure 13. Frequency of *S. sagax* maturity stages by sex found in the Transboundary area.

Sardinella (*Sardinella aurita*): The only sardinella found in the transboundary area was found inside Angola just south of Pt. Albina (*see* Cruise report No. 2/2009).

Clupoiformes (*Etrumeus whiteheadi* and *Engraulis capensis*): The distribution of *E. whiteheadi* was mapped together with that of *E. capensis* under the Pelagic species 1 acoustic group (Table 1). The first acoustic encounter of these species was made south of Pt. Albina along the 16°13`S at a bottom depth of 76m (Fig. 14). The two species were mostly found in mixed shoals. Two areas of category 3 densities ($S_A$ 3001 – 1000) were found, one opposite Baia dos Tigres and the other one south of the Cunene River along the 17°25`S. The combined total biomass of the two species was estimated at 71,747 tonnes.

The sample size of 353 fish was used to determine size distribution of *E. whiteheadi*. This yielded a bimodal distribution with the range of 14 and 24cm total length, and modal lengths of 15 and 20cm, respectively (Fig. 15). The mean length of *E. whiteheadi* was 15.83cm total length and the condition factor of total weight over a cube of total length yielded a value of 0.00674. The size distribution of *E. capensis* ranged from 7 to 11cm total length with a single modal length at 10cm total length (Fig. 16) and the mean length was 9.21cm total length. The condition factor yielded a value of 0.00600.

A total of 34 *E. whiteheadi* were analysed for gonad maturity staging of which 3 were females, 3 were males and 28 were unidentified. Those fish that could be identified were found at maturity stages 4 and 5 (Fig. 17). The sample size of *E. capensis* was 22 fish, all of which were classified as juveniles. Thus, for these clupeoids the data was not sufficient to compute maturity ogives.

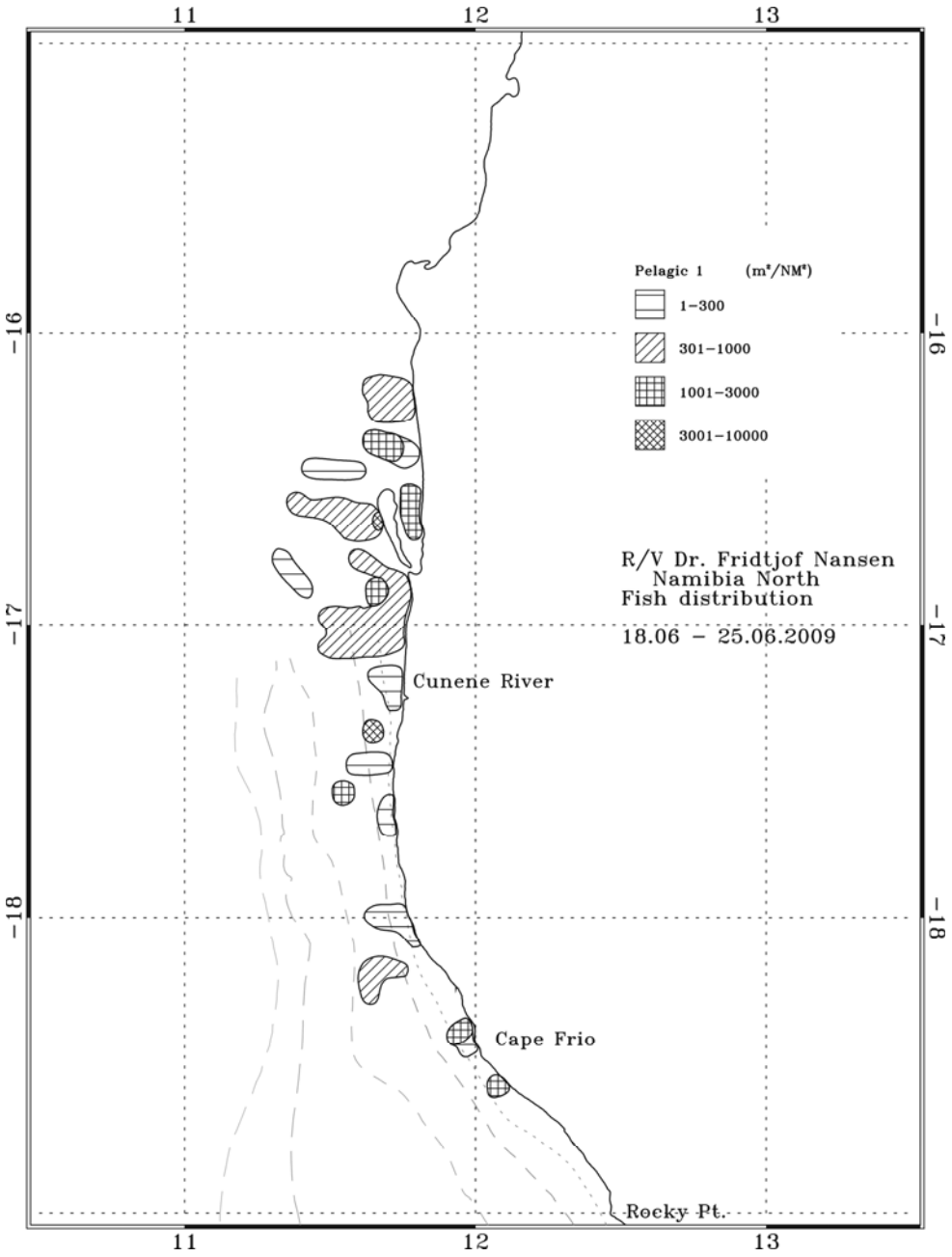

Figure 14. Distribution of clupeids (round herring and anchovy) in the Angola-Namibian transboundary area. Depth contours at 20, 50, 100, 200 and 500 m.

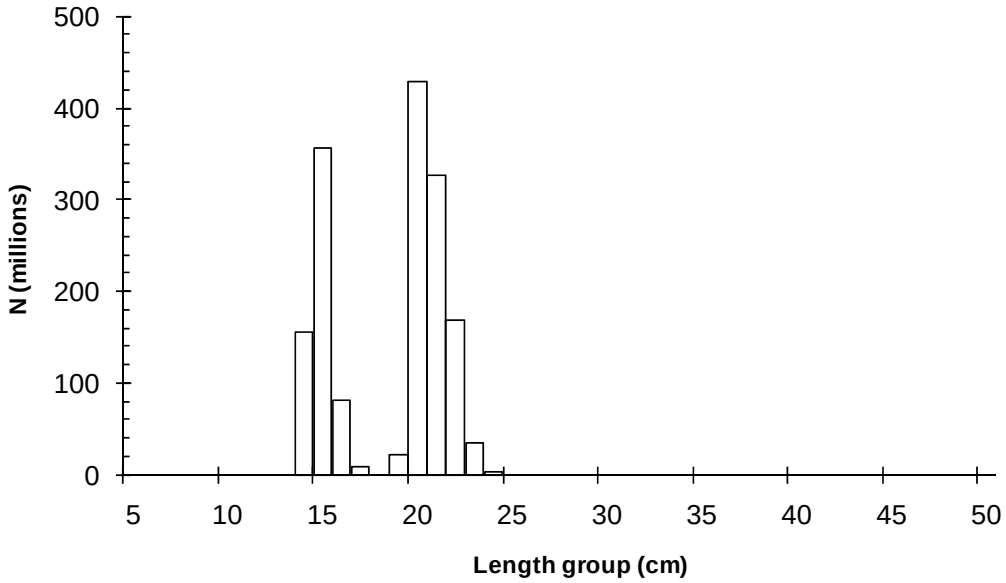

Figure 15. Length frequencies of *E. whiteheadi* in the Transboundary area

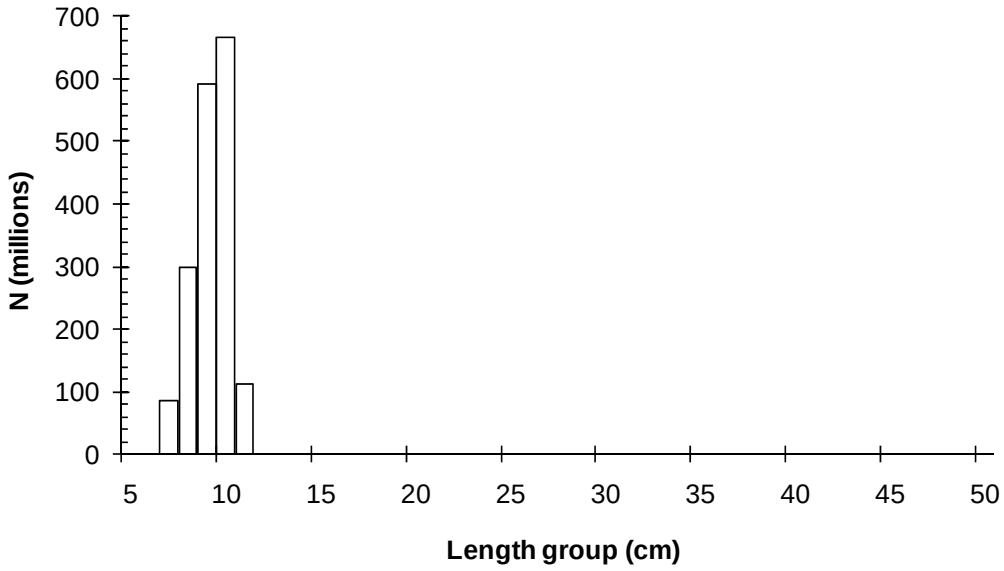

Figure 16. Length frequencies of *E. capensis* in the Transboundary area

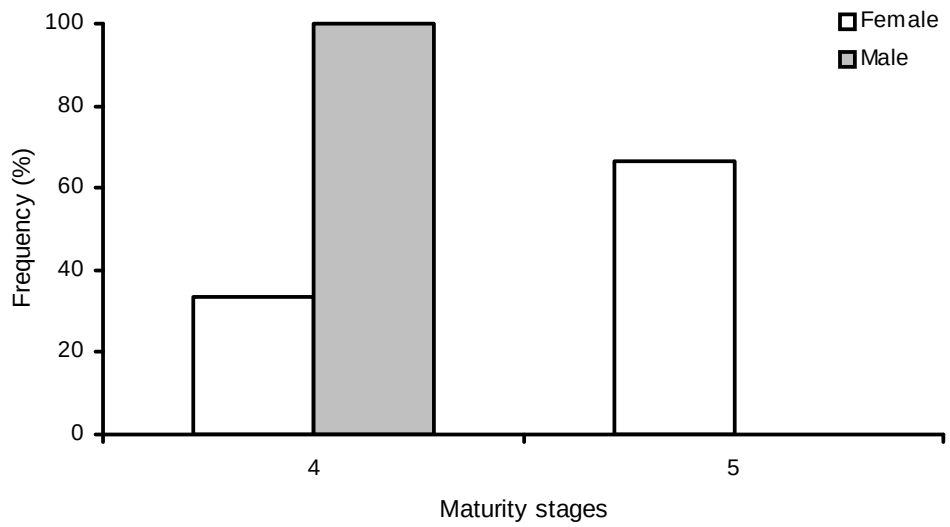

Figure 17. Frequency of *E. whiteheadi* maturity stages by sex found in the Transboundary area.

3.2 Area south of Transboundary area

Horse mackerels (*Trachurus capensis* and *Trachurus trecae*): The distributions of the two horse mackerel species were mapped together for the area south of the transboundary area (Fig. 18). The distribution was continuous throughout the area with some concentrations of category-2 density (S_A 3001 - 1000) offshore in the area close to 19°48`S and 20°45`S. However, the highest density (Category 3) was found in four separate spots between 20°30`S and 20°30`S (Fig. 12). *T. capensis* was the dominant species of the horse mackerels in this area since the only observation of *T. trecae* was made opposite Dune Point around 20°00`S. Horse mackerels were observed from a total of 13 trawl hauls both inshore as well offshore up to bottom depths of just more than 200m,. The total biomass estimate of horse mackerel in this area was 145,400 tonnes of which only 5,300 tonnes was contributed by *T. trecae.*

The samples size of *T. capensis* analysed for length frequency distribution consisted of 998 fish, and yielded a mean length of 13.51cm. The size distribution of *T. capensis* was multi-modal with modes at 9, 13, 15, 17 and 20cm, and a range of 6 to 26 (Fig. 19). A total of 239 fish were analysed for length frequency distribution of *T. trecae* and yielded a mean length of 12.82cm with a size distribution ranging from 9 to 18cm (Fig. 20). The size distribution was bimodal with modes at 13cm and 15cm. The average condition factor for *T. capensis* yielded a value of 0.00777 and for *T. trecae* it was 0.00779.

The sample size of 479 *T. capensis* were analysed for gonad maturity staging in the area south of the Transboundary area of which 227 were females and 95 were males. Hundred-and-fifty-seven of those fish could not be sexed, of which 93 were juveniles and 64 were unidentified. All maturity stages were represented for those fish that could be identified, with stages 2 and 6 being the dominant stages (Fig. 21). Male was the dominant sex class for stages 1 to 4, while females dominated stages 5 and 6. The maturity ogive for *T. capensis* yielded a length at 50% maturity (L_{50}) of 13.3 cm (Fig. 22). *T. trecae* sampled for maturity staging in the area south of the Transboundary area had a sample size of 39 fish of which 18 were females, 11 were males and 10 were juveniles. The majority of the fish were found in stage 6, and this was the only stage were both of sex classes, male and female, were found together (Fig. 23). For the other maturity stages females were exclusively found at stages 2 and 5, and males exclusively at stages 3 and 4. There was no fish at stage 1 since all juvenile fish could not be sexed. The maturity ogive for *T. trecae* yielded a length at 50% maturity (L_{50}) of 12.3 cm (Fig. 24).

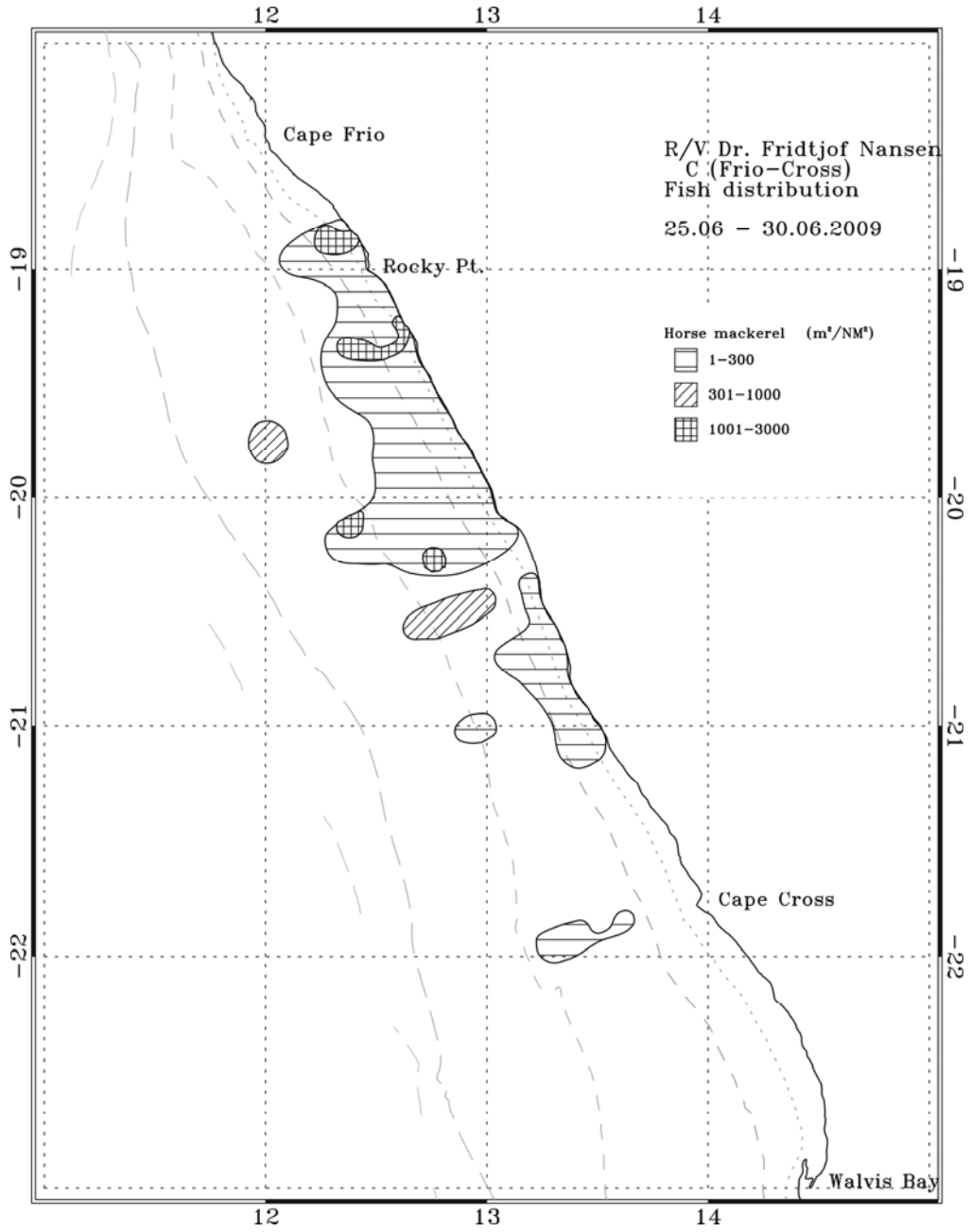

Figure 18. Distribution of the horse mackerels in the area south of the Angola-Namibian transboundary area. Depth contours at 20, 50, 100, 200 and 500 m.

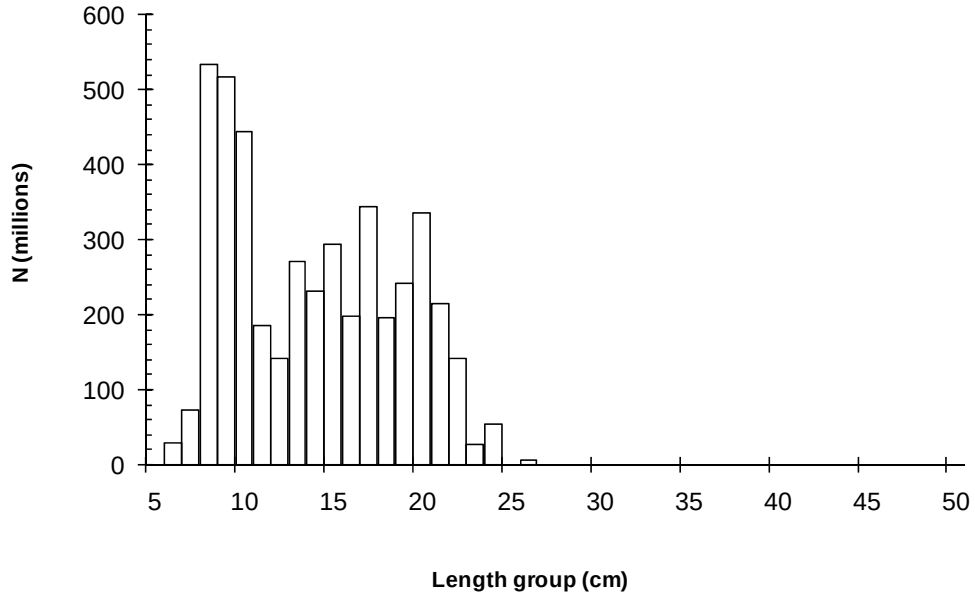

Figure 19. Length frequencies of *T. capensis* in the area south of Transboundary area

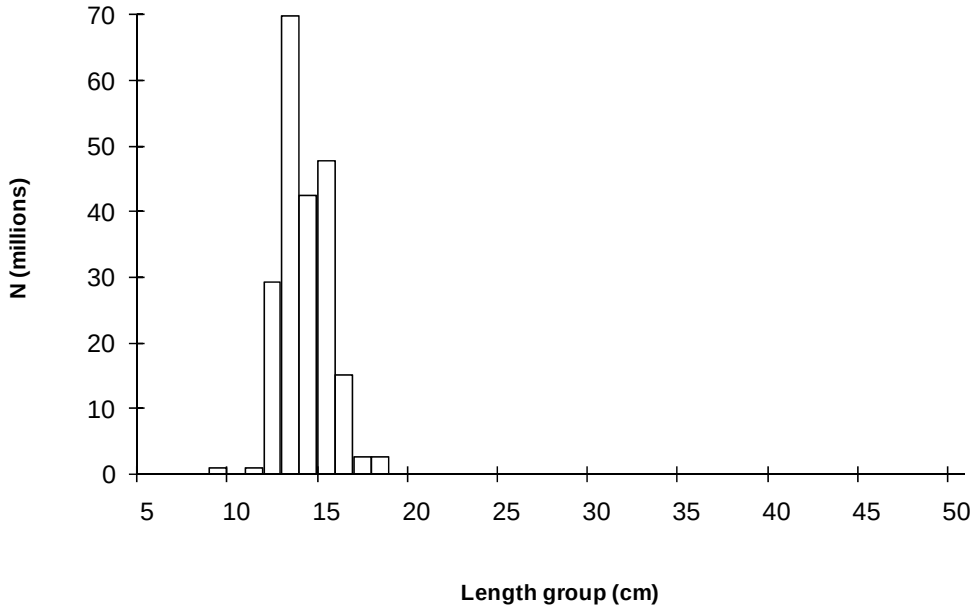

Figure 20. Length frequencies of *T. trecae* in the area south of the Transboundary area

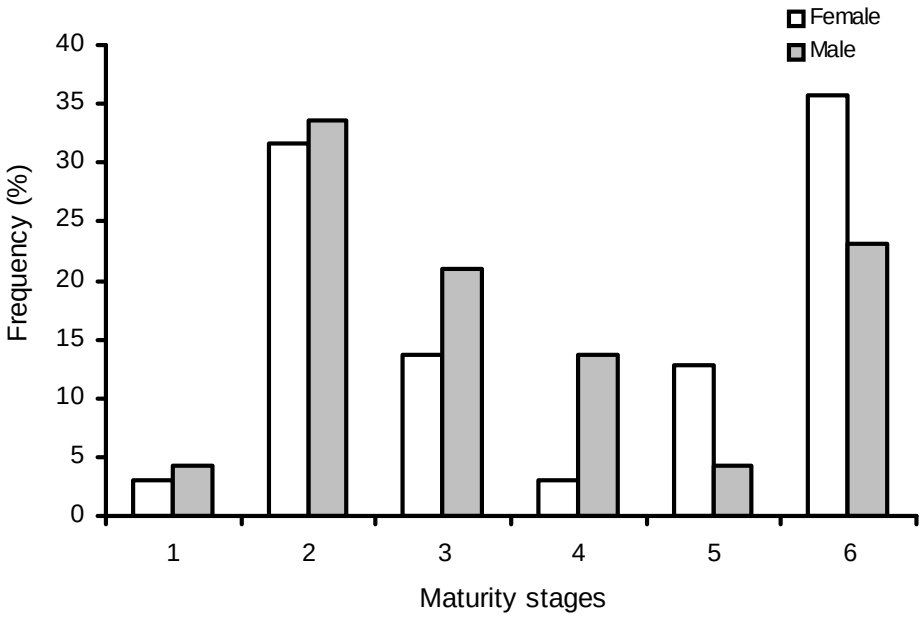

Figure 21. Frequency of *T. capensis* maturity stages by sex found in the area south of the Transboundary area

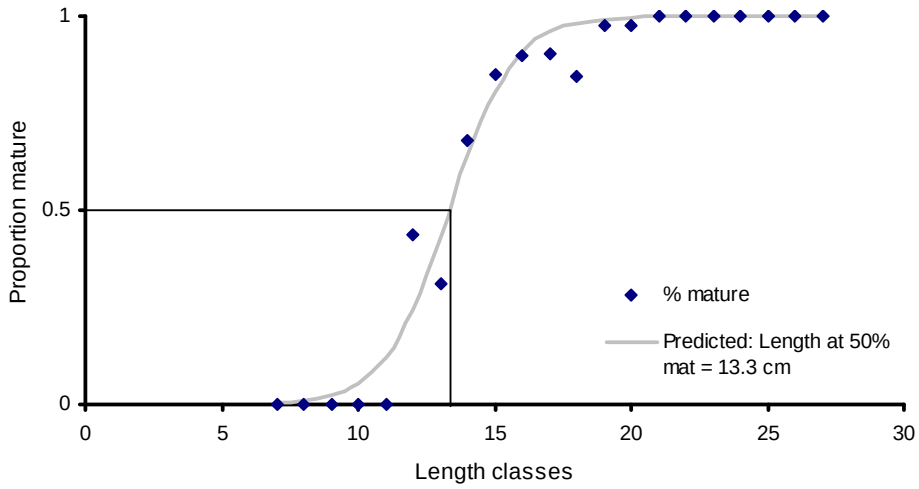

Figure 22. Proportion mature against length class (cm) of *T. capensis* caught in the area south of the Transboundary area. Maturity ogive fitted to the data is shown.

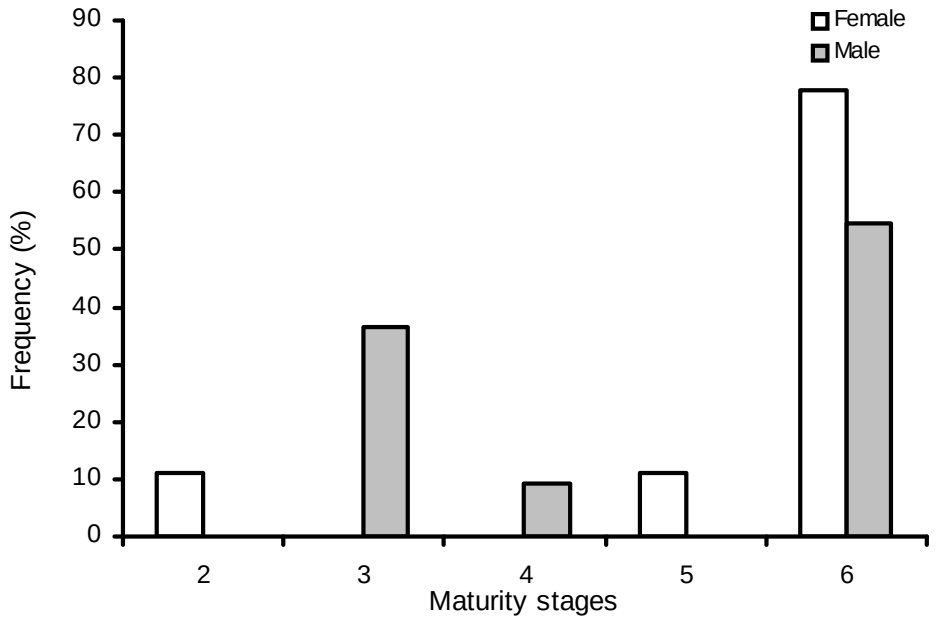

Figure 23. Frequency of *T. trecae maturity* stages by sex found in the area south of the Transboundary area

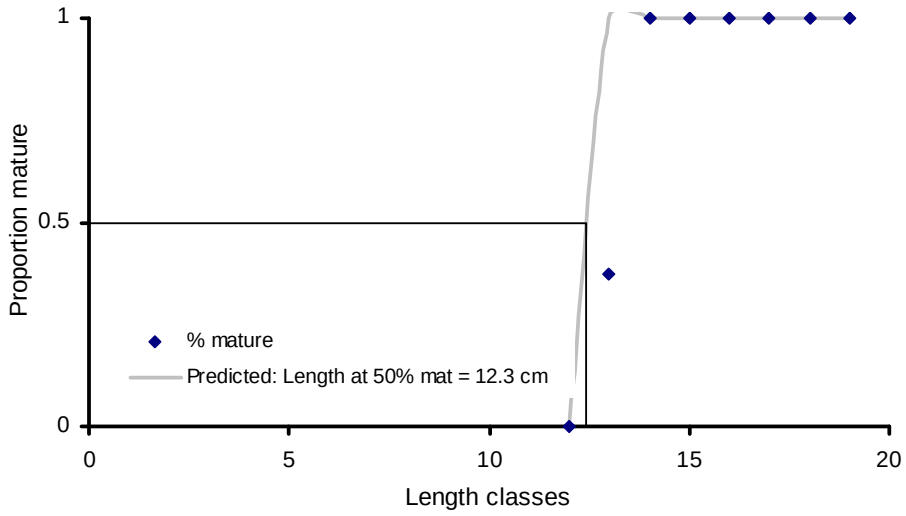

Figure 24. Proportion mature against length class (cm) of *T. trecae* caught in the area south of the Transboundary area. Maturity ogive fitted to the data is shown.

3.3 Oceanographic Conditions

Wind: The winds observed in the transboundary area during the survey period had, according to the scale, an average of 42.5 knots (22 m/s) (Fig. 25). The following wind patterns have been observed:

16-17°S. The winds were predominantly northerly reaching velocities of around 40 knots while of the less intensity, south-easterly winds, have been registered north of Baia dos Tigres.

17-18°S. Strong south-westerly winds prevailed, reaching velocities of between 40-45 knots.

18-19°S. South-westerly winds were also experienced in this area and were stronger off Cape Frio reaching velocity of > 45 knots.

Winds were, in general, more strong (>45 knots / >5m/s) off Cape Frio, but maintained the same speeds from north Cape Frio and Cunene River up to Baia dos Tigres then became south-easterly further north.

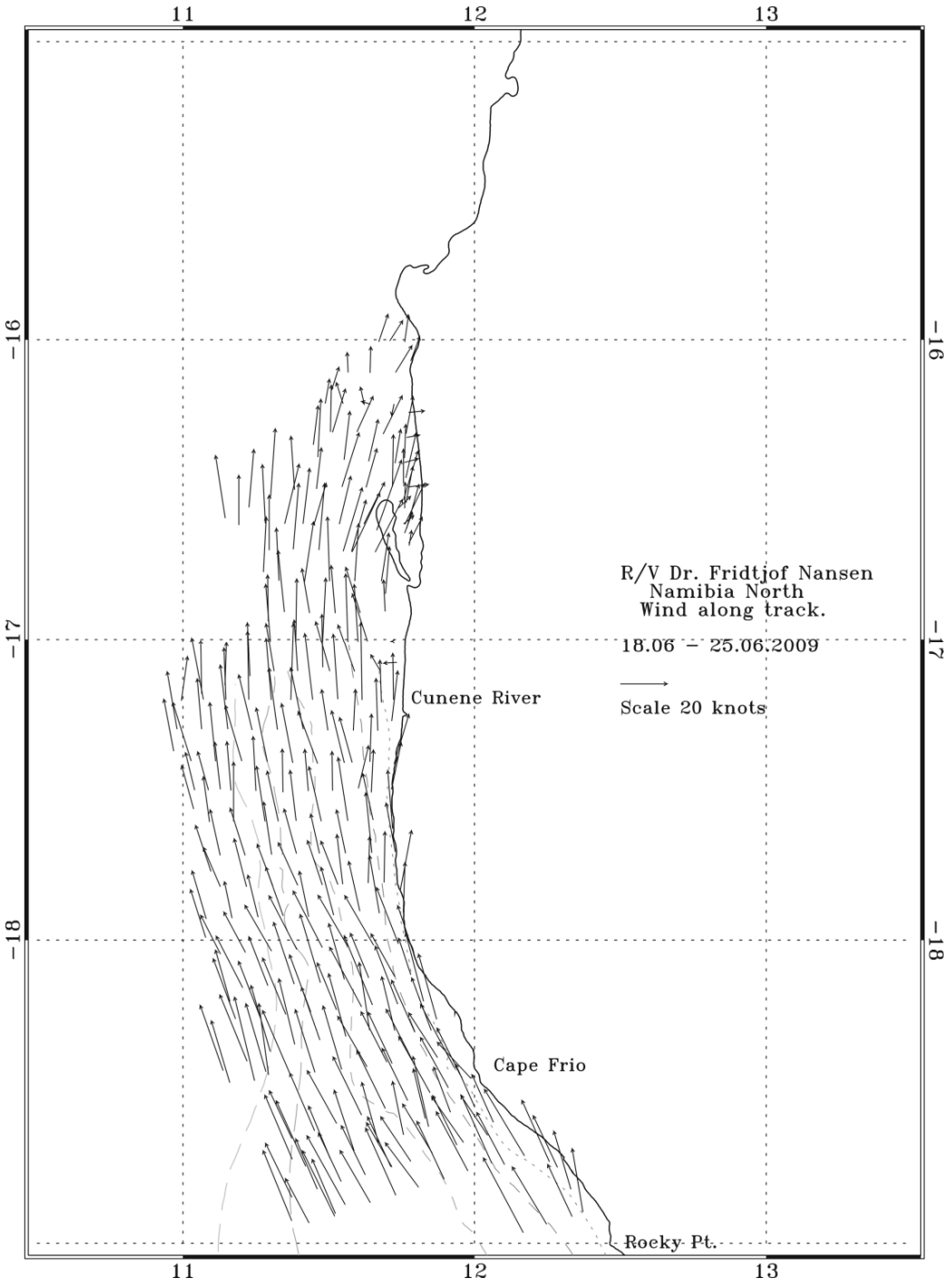

Figure 25. Wind in the transboundary area

Surface distribution*:* Fig. 26 shows the sea surface temperature (SST, ºC) (a), sea surface salinity (SSS, psu) (b) and fluorescence (µ) recorded at the 5m depth in the transboundary

area using CTD. In the area of Cape Frio the sea surface temperature ranged from 14 to 15 °C, the isotherm of 15°C is oriented alongshore and pocked off Baia dos Tigres. Lower value of salinity of 35.4 psu was found due to the outflows of the Cunene River moving southwards and off Baia dos Tigres was observed the maximum value of salinity (35.6 psu).

Two pockets of high values (1.8 - 2µ) of fluorescence were observed off Cape Frio. The minimum values of 0.2 µg/l were found alongshore.

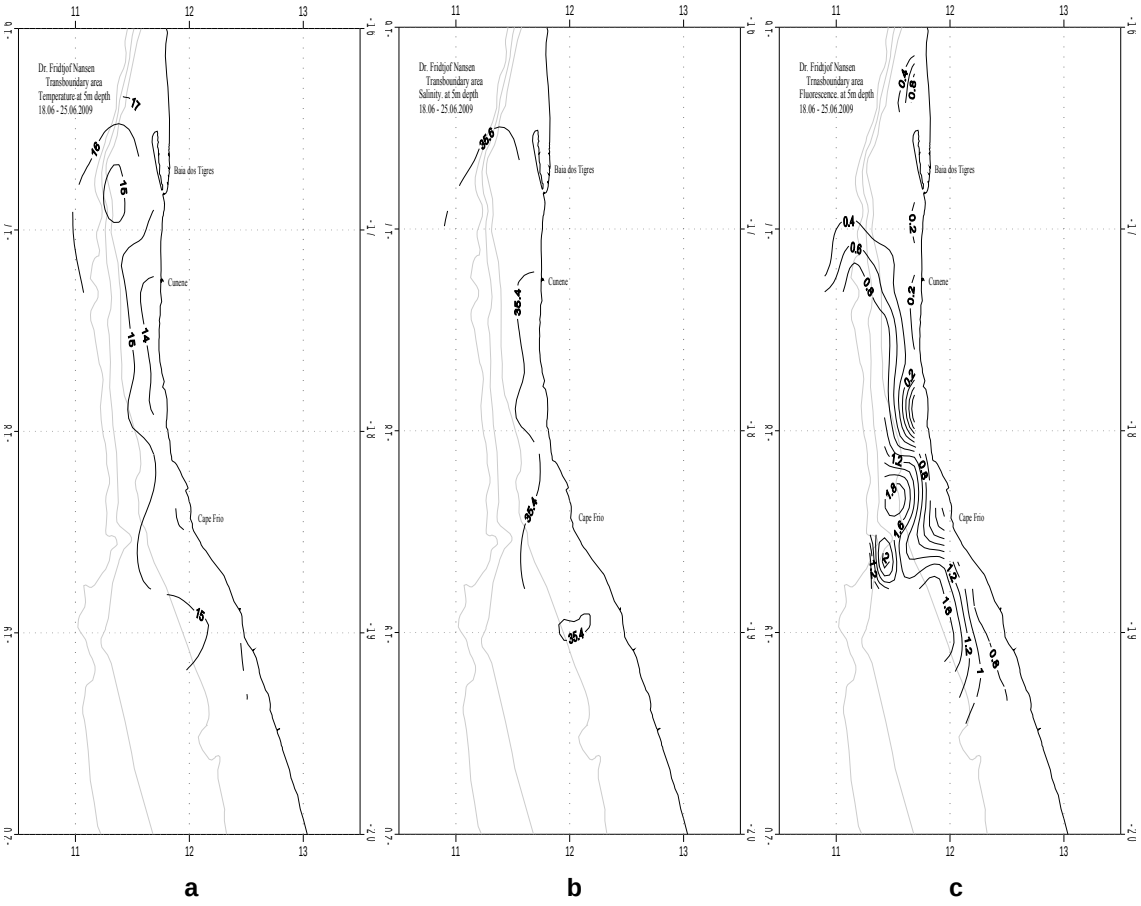

Figure 26. Sea surface temperature (SST ºC) (a), sea surface salinity (SSS) (b) and fluorescence (µg/l) recorded in the transboundary area using CTD.

Pta. Albina (Fig. 27a): This section exhibited a high level of stratification through the water mass at depth, with a relatively high surface temperature (SST) of 17 °C and surface salinity (SSS) of 35.7 psu., which was also higher than that recorded in the area at the same time last year (35.5 psu.). Oxygen content of 2ml/l prevailed at the surface layer while low oxygen values appeared below the 100-150m water depths.

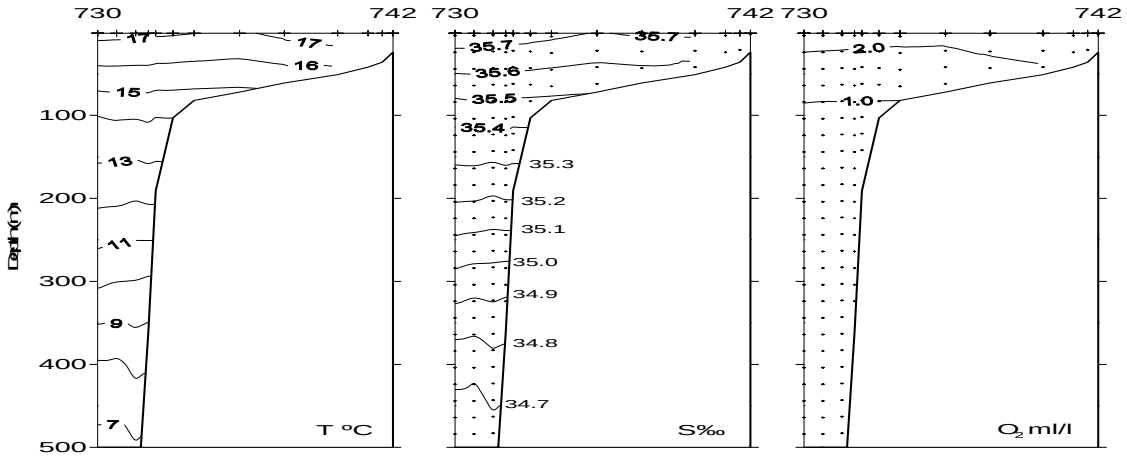

Figure 27a. Vertical sections of temperature, salinity and oxygen off Pta. Albina

Section off Baia dos Tigres (Fig. 27b): The isotherm of 15°C was oriented alongshore and pocked off into Baia dos Tigres. As was found at Pta. Albina Oxygen content of 2ml/l prevailed at the surface layer while low oxygen values appeared below the 100-150m. Off Baia dos Tigres was observed the maximum value of salinity (35.6 psu), compared to previous years.

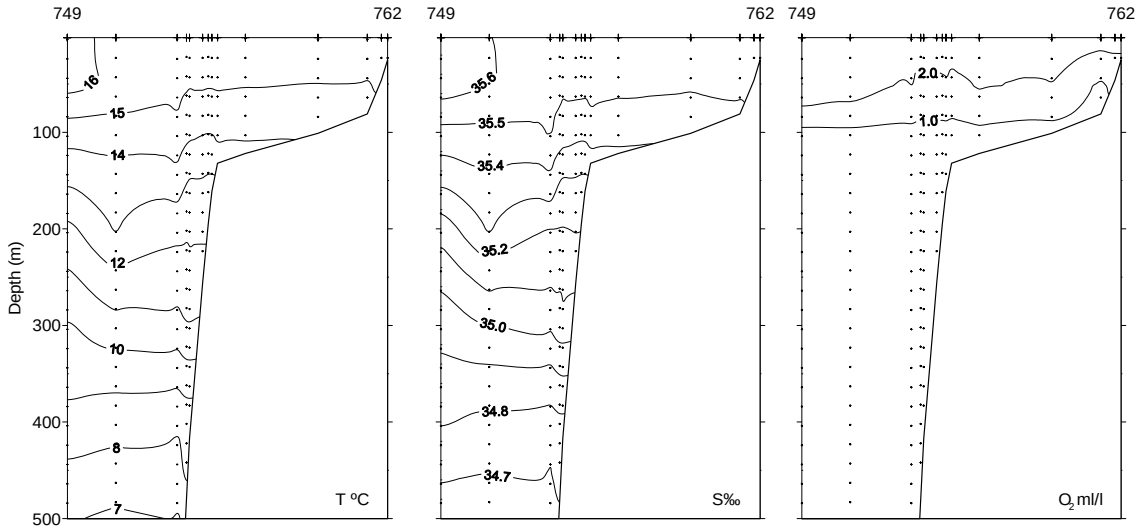

Figure 27b. Vertical sections of temperature, salinity and oxygen off Baía dos Tigres.

Section off Cunene River (Fig. 27c): Lower value of salinity of 35.3 psu was found in this section on the shelf edge as well turbulence in the isolines due to the outflow of the Cunene River. Oxygen content of 2ml/l prevailed at the surface layer while low oxygen values appeared below the 100-150m water depths. There were indications of very weak coastal upwelling close inshore with cooler water close to the shoreline than offshore.

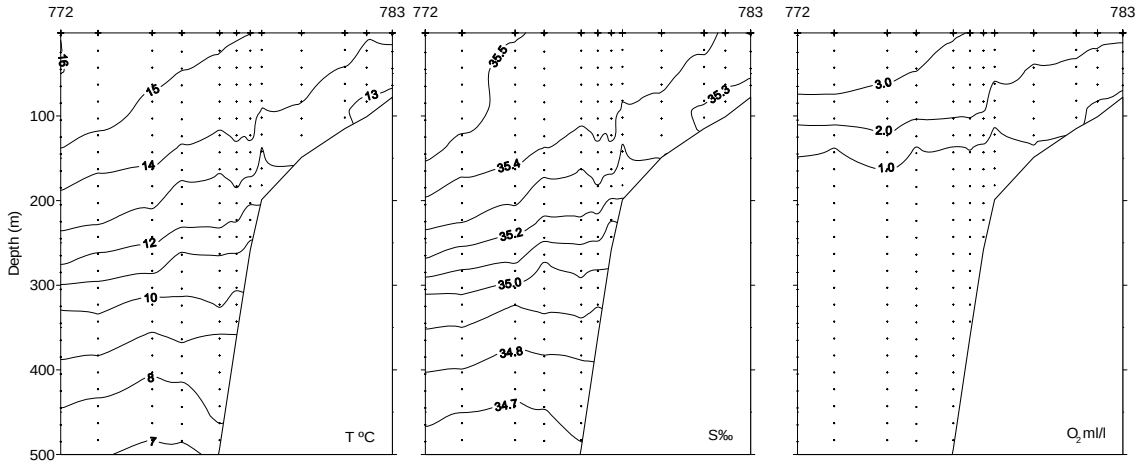

Figure 27c. Vertical sections of temperature, salinity and oxygen off Cunene River.

Section off Cape Frio (Fig. 27d): In the area of Cape Frio the sea surface temperature ranged from 14 to 15°C. There were indications of very weak coastal upwelling close inshore, as evidenced by elevated isolines (T, S, 0_2) at depths above 100m, with cooler water closer to the shoreline than offshore.

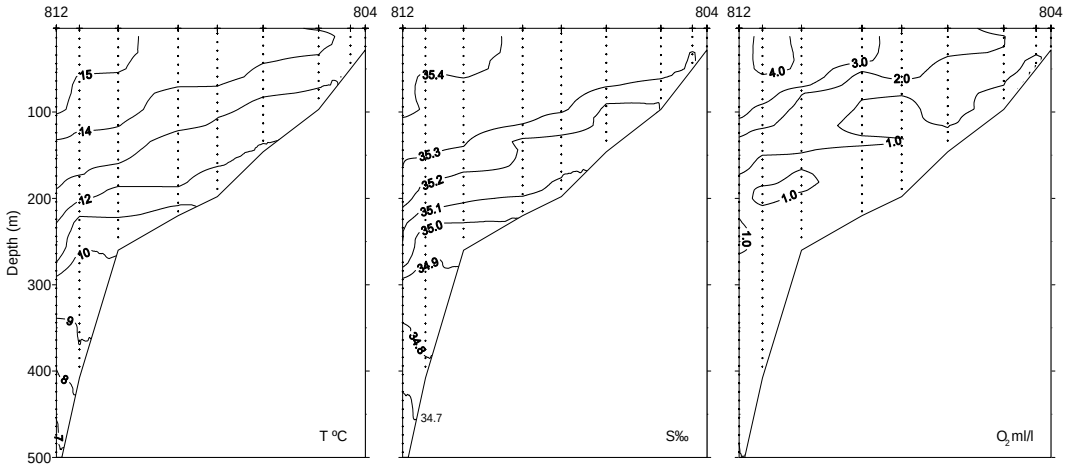

Figure 27d. Vertical sections of temperature, salinity and oxygen off Cape Frio.

4 Discussion

The results clearly show the transboundary nature of the fish resources studied. The results also strongly support the recent reports of alarmingly low abundance levels of the horse mackerels (*T. capensis* and *T. trecae*) and sardine (*S. sagax*). However, *T. capensis* could be better off than *T. trecae* given the size of its biomass and the proportion of its adult population. Sardinellas, did not exhibit a transboundary nature since although it was found within the defined transboundary area its distribution was limited to the Angolan side of the area only. It was difficult to make meaningful deduction out of the distribution of the clupeids, *E. capensis* and *E. whiteheadi* due to small sample sizes for species as few measurements of the species were missing or not taken whenever they were encountered in the samples, but from the acoustic data it could be deduced that most of the biomass could have been on the Angolan side of the transboundary area. Most of the biomass for this group of species could have been contributed by *E. whiteheadi* as it contributed more to the catches in terms of weight as well number of fish than E*. capensis*.

The narrow ranges in the size distribution of the horse mackerels *T. capensis* and *T. trecae* as well as the few members of the adult component or spawning stock found in the populations are indicative of severely reduced stocks. The size distribution of pilchard (*S. sagax*) was distorted as it showed relatively high biomass values for some length classes and then very values for the neighbouring length classes, probably as a result of small sample sizes. Small sample sizes could be a result of the behaviour of the species, since this is a fast swimming fish and may therefore have avoided the trawl gear. The separate cohort of big pilchard (*S. sagax*) in the size distribution was observed from a trawl haul offshore of Baia dos Tigres, and this may be an indication that although pilchards tend to concentrate in shallow waters on the inshore, they may also migrate offshore as they mature. However, further research may be needed to investigate this behaviour, but this could prove difficult given the low abundance of the species and the fact that as a result of high mortality the fish may not reach sizes that will allow for such observations to be made. Similarly, the behaviour of the clupeids could have resulted in their low sample sizes, and the narrow size distribution consisting only of small fish, particularly found in the size distribution of E*. capensis*. The abundances of the species investigated are also reflected in the low lengths at 50% maturity (L_{50}), as the fish mature earlier when abundances are low.

5 Conclusion

The main conclusions from the survey can be summarized as:

1) The biomass of Cape horse mackerel found in the Angolan waters (10.9%) was very little to be of any significance, and its distribution also covered less than half of the Angolan part of the transboundary area.
2) Cunene horse mackerel was found as far south as Cape Frio (19º00' S) and beyond, and the biomass was very low (22.3%) but significant given the overall low biomass of the species in the area. The species appear to have extended its distribution further south for this time of the year.
3) Sardine biomass was very low and the species was found in scattered but high-density aggregations in limited locations throughout the transboundary area. There appeared to be offshore migration of mature fish on the Angolan part of the transboundary area.
4) The other clupeid species (round herring and anchovy) were only found in scattered, but high-density aggregations, but as a result of small sample sizes no meaningful conclusion can be made.
5) All target species found were small in size. Both horse mackerel species were less than 25cm, and the little that was found of various clupeids were generally of small size groups.
6) The size at which 50% of the fish matured was very low for all species, a situation commensurate with the low biomasses and the small sizes of the fish, and this is also an indication of declining stock.

6 Recommendations

The main recommendations are:

1) The survey should be repeated at the same time of the year in order to establish whether the observed pattern is persistent over time and to monitor development trends in the transboundary area over time, if any.
2) Investigation should also be conducted in the warm season. The distribution pattern of all species under investigation here will likely be quite different in the alternate season. Horse mackerel distributions over the transboundary area generally follow the position of the Angolan-Benguelan front (ABF), i.e. both species have more southern

distribution in the warm season. This will, in turn lead to expectations of more Cunene horse mackerel in Namibian waters and less Cape horse mackerel in Angolan waters during summer.

3) The two countries should consider putting in place mechanisms for continuing to monitor the transboundary area and collaboration in the management of the fish resources there; all stocks under study here are to some extent transboundary and most stocks are in low abundance.
4) Collaborative monitoring should consider harmonisation of the different monitoring and survey techniques used in each of the two countries.
5) Offshore migration of mature pilchards needs to be further investigated as this could have management implications for the stock.

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8 Acknowledgements

Good cooperation rendered by the officers and crew on the R/V ‘Dr Fridtjof Nansen’ at sea has been highly acknowledged.

Annex I Records of fishing stations

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 78
DATE :17.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°0.20
start stop duration Lon E 11°43.18
TIME :23:24:22 23:38:46 14.4 (min) Purpose : 1
LOG : 9763.52 9764.38 0.9 Region : 4050
FDEPTH: 0 10 Gear cond.: 0
BDEPTH: 38 42 Validity : 0
Towing dir: 0° Wire out : 145 m Speed : 3.6 kn
Sorted : 96 Total catch: 894.23 Catch/hour: 3728.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	3617.89	51415	97.03	174
Sardinella aurita	46.28	388	1.24	175
Scomber japonicus	26.35	259	0.71	
Loligo vulgaris	19.01	271	0.51	
Pagellus bellottii	17.47	309	0.47	
Saurida brasiliensis	1.54	38	0.04	
Total	3728.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 79
DATE :18.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.83
start stop duration Lon E 11°36.80
TIME :07:05:11 07:25:35 20.4 (min) Purpose : 1
LOG : 9809.62 9810.69 1.1 Region : 4050
FDEPTH: 73 76 Gear cond.: 0
BDEPTH: 73 76 Validity : 0
Towing dir: 0° Wire out : 190 m Speed : 3.1 kn
Sorted : 137 Total catch: 1365.50 Catch/hour: 4016.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	3330.88	78059	82.94	176
Dentex macrophthalmus	307.35	8265	7.65	177
Merluccius polli	215.00	1412	5.35	
Mustelus mustelus	73.53	29	1.83	
Argyrosomus hololepidotus	42.06	29	1.05	
Octopus vulgaris	21.47	29	0.53	
Loligo vulgaris	14.71	971	0.37	
Sepia orbignyana	10.29	29	0.26	
Citharus linguatula	0.88	29	0.02	
Total	4016.18		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 80
DATE :18.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°42.14
start stop duration Lon E 11°45.70
TIME :12:43:15 13:13:21 30.1 (min) Purpose : 1
LOG : 9856.20 9857.99 1.8 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 19 15 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 3.6 kn
Sorted : 9 Total catch: 8.64 Catch/hour: 17.23

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	11.70	287	67.94	
Pomatomus saltatrix	3.13	42	18.17	
Sardinella aurita	1.32	26	7.64	179
Trachurus trecae	0.96	80	5.56	178
Starfish	0.04	24	0.23	
Maja squinado	0.02	2	0.12	
Trachurus capensis	0.02	2	0.12	
Lagocephalus laevigatus	0.02	2	0.12	
Engraulis capensis	0.02	2	0.12	
Total	17.23		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 81
DATE :18.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°18.26
start stop duration Lon E 11°31.90
TIME :18:13:13 18:24:05 10.9 (min) Purpose : 1
LOG : 9902.27 9903.00 0.7 Region : 4050
FDEPTH: 0 40 Gear cond.: 0
BDEPTH: 84 85 Validity : 0
Towing dir: 0° Wire out : 125 m Speed : 4.0 kn
Sorted : 138 Total catch: 482.76 Catch/hour: 2667.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2486.74	151989	93.23	180
Todarodes sagittatus	74.45	309	2.79	
Sepia orbignyana	55.69	39	2.09	
Dentex macrophthalmus	41.60	1028	1.56	
Merluccius capensis	5.61	22	0.21	
Scomber japonicus	1.74	22	0.07	
Etrumeus whiteheadi	1.35	22	0.05	
Total	2667.18		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 82
DATE :18.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°38.63
start stop duration Lon E 11°46.05
TIME :23:32:33 23:36:14 3.7 (min) Purpose : 1
LOG : 9947.08 9947.33 0.3 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 19 19 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 4.2 kn
Sorted : 9 Total catch: 9.01 Catch/hour: 146.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis capensis	63.90	67984	43.62	
SEMELIDAE	25.04	9154	17.09	
Trachurus trecae	20.98	2455	14.32	181
J E L L Y F I S H	20.33	163	13.87	
Loligo vulgaris	6.50	49	4.44	
POTAMIDIDAE	4.72	553	3.22	
NATICIDAE	2.28	341	1.55	
B I V A L V E S	1.46	65	1.00	
Trichiurus lepturus	0.98	16	0.67	
Dicologoglossa cuneata	0.33	33	0.22	
Total	146.50		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 83
DATE :19.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°36.81
start stop duration Lon E 11°24.52
TIME :10:47:28 10:55:22 7.9 (min) Purpose : 1
LOG : 19.24 19.67 0.4 Region : 4050
FDEPTH: 120 123 Gear cond.: 0
BDEPTH: 120 123 Validity : 0
Towing dir: 0° Wire out : 330 m Speed : 3.3 kn
Sorted : 154 Total catch: 5014.21 Catch/hour: 38082.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	18374.13	314195	48.25	183
Trachurus trecae	17401.22	245362	45.69	182
Etrumeus whiteheadi	1501.06	24182	3.94	184
Sardinops ocellatus	378.08	0	0.99	185
Dentex macrophthalmus	141.80	0	0.37	
Scomber japonicus	136.12	0	0.36	
Merluccius capensis	97.29	0	0.26	
Todaropsis eblanae	44.51	0	0.12	
PATELLIDAE	8.35	0	0.02	
Total	38082.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 84
DATE :19.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°42.42
start stop duration Lon E 11°35.06
TIME :15:49:25 16:31:43 42.3 (min) Purpose : 1
LOG : 53.71 56.43 2.7 Region : 4050
FDEPTH: 40 40 Gear cond.: 0
BDEPTH: 94 0 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 3.9 kn
Sorted : 3 Total catch: 2.55 Catch/hour: 3.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sphyrna zygaena	2.84	1	78.43	
Etrumeus whiteheadi	0.78	16	21.57	
Total	3.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 85
DATE :19.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°50.89
start stop duration Lon E 11°41.61
TIME :22:47:28 23:06:56 19.5 (min) Purpose : 1
LOG : 109.85 110.83 1.0 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 22 22 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.0 kn
Sorted : 67 Total catch: 201.81 Catch/hour: 621.59

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	476.80	15579	76.71	186
J E L L Y F I S H	127.05	5544	20.44	
Trichiurus lepturus	8.59	333	1.38	
Arius parkii	4.62	28	0.74	
Etrumeus whiteheadi	3.97	213	0.64	
Sardinops ocellatus	0.28	9	0.04	
Sardinella aurita	0.18	9	0.03	
Pagellus bellottii	0.09	9	0.01	
Total	621.59		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 86
DATE :20.06.2009 GEAR TYPE: PT NO: 5 POSITION:Lat S 17°0.40
start stop duration Lon E 11°36.29
TIME :05:12:23 05:29:47 17.4 (min) Purpose : 1
LOG : 163.83 164.90 1.1 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 83 91 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.7 kn
Sorted : 0 Total catch: 138.21 Catch/hour: 476.31

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	436.30	738	91.60	189
Chrysaora hysoscella	17.47	420	3.67	
Scomber japonicus	14.37	289	3.02	187
Sardinops ocellatus	4.72	155	0.99	188
Aequorea sp.	3.17	196	0.67	
Todaropsis eblanae	0.28	3	0.06	
Total	476.31		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 87
DATE :20.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 17°5.35
start stop duration Lon E 11°28.20
TIME :09:29:12 09:36:51 7.7 (min) Purpose : 1
LOG : 198.13 198.51 0.4 Region : 4050
FDEPTH: 127 128 Gear cond.: 0
BDEPTH: 127 128 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 3.0 kn
Sorted : 123 Total catch: 1172.09 Catch/hour: 9192.86

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	5927.29	128824	64.48	191
Chrysaora hysoscella	1359.53	17882	14.79	
Trachurus trecae	767.45	12588	8.35	190
Dentex macrophthalmus	539.84	7522	5.87	192
Merluccius capensis	467.22	3576	5.08	
Aequorea sp.	100.63	4024	1.09	
Zeus faber	14.90	149	0.16	
Synagrops microlepis	9.65	1043	0.10	
Pterothrissus belloci	5.96	71	0.06	
Total	9192.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 88
DATE :20.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 17°12.60
start stop duration Lon E 11°41.00
TIME :22:39:15 22:53:00 13.8 (min) Purpose : 1
LOG : 273.92 274.68 0.8 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 59 68 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 37 Total catch: 449.40 Catch/hour: 1953.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	1335.65	105235	68.36	195
Trachurus capensis	464.35	61670	23.77	194
JELLYFISH	100.17	1722	5.13	
Sardinops ocellatus	32.87	1513	1.68	196
Trachurus trecae	12.52	1878	0.64	193
Zeus faber	5.74	52	0.29	
Scomber japonicus	2.61	104	0.13	
Total	1953.91		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 89
DATE :21.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 17°24.63
start stop duration Lon E 11°34.86
TIME :09:55:17 10:02:29 7.2 (min) Purpose : 1
LOG : 374.03 374.41 0.4 Region : 5010
FDEPTH: 123 125 Gear cond.: 0
BDEPTH: 123 125 Validity : 0
Towing dir: 0° Wire out : 310 m Speed : 3.2 kn
Sorted : 107 Total catch: 990.36 Catch/hour: 8253.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	6649.50	125233	80.57	197
Chrysaora hysoscella	906.75	6592	10.99	
Merluccius capensis	303.83	2250	3.68	
Synagrops microlepis	242.58	49758	2.94	
Dentex macrophthalmus	67.42	542	0.82	
Aequorea sp.	49.58	2092	0.60	
Sepia officinalis hierredda	17.08	75	0.21	
Trigla capensis *	16.25	75	0.20	
Total	8253.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 90
DATE :21.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 17°30.48
start stop duration Lon E 11°38.15
TIME :12:49:14 12:55:32 6.3 (min) Purpose : 1
LOG : 396.09 396.42 0.3 Region : 5010
FDEPTH: 106 106 Gear cond.: 0
BDEPTH: 106 106 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 3.2 kn
Sorted : 100 Total catch: 2091.58 Catch/hour: 19919.81

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	10840.00	46400	54.42	
Trachurus capensis	5620.00	278400	28.21	199
Trachurus trecae	1110.00	46000	5.57	198
C R U S T A C E A N S	822.00	708000	4.13	
Merluccius capensis	482.00	4200	2.42	
VENERIDAE	284.00	6200	1.43	
SEMELIDAE	268.57	3000	1.35	
Synagrops microlepis	140.00	30000	0.70	
Dicologoglossa cuneata	84.00	4600	0.42	
POTAMIDIDAE	63.24	3400	0.32	
Bathynectes piperitus	60.00	5000	0.30	
Sardinops ocellatus	44.00	1400	0.22	
Ophisurus serpens	42.00	600	0.21	
Etrumeus whiteheadi	34.00	1600	0.17	
GOBIIDAE	14.00	1800	0.07	
Scomber japonicus	12.00	200	0.06	
Total	19919.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 91
DATE :21.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 17°30.16
start stop duration Lon E 11°6.47
TIME :17:09:18 17:30:10 29.9 (min) Purpose : 1
LOG : 430.34 432.13 1.8 Region : 5010
FDEPTH: 180 150 Gear cond.: 0
BDEPTH: 1336 1201 Validity : 0
Towing dir: 0° Wire out : 500 m Speed : 3.6 kn
Sorted : 0 Total catch: 2.32 Catch/hour: 4.65

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Tetragonurus atlanticus	1.15	6	24.62	
Shrimps, small, non comm.	0.77	1218	16.63	
MYCTOPHIDAE	0.68	209	14.69	
Trachurus capensis	0.60	4	12.96	
Aequorea sp.	0.54	44	11.66	
REGALECIDAE	0.28	4	6.05	
Krill	0.22	76	4.75	
Chrysaora hysoscella	0.20	4	4.32	
Todaropsis sp.	0.14	8	3.02	
Paralepis sp.	0.06	14	1.30	
Total	4.65		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 92
DATE :21.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 17°36.41
start stop duration Lon E 11°19.41
TIME :21:13:21 21:47:37 34.3 (min) Purpose : 1
LOG : 466.39 468.30 1.9 Region : 5010
FDEPTH: 100 90 Gear cond.: 0
BDEPTH: 554 386 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.3 kn
Sorted : 0 Total catch: 36.96 Catch/hour: 64.73

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	35.38	412	54.65	200
MYCTOPHIDAE	15.18	6263	23.46	
REGALECIDAE	9.11	7	14.07	
Krill	4.13	7921	6.39	
Todaropsis sp.	0.79	11	1.22	
Octopus sp.	0.14	2	0.22	
Total	64.73		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 93
DATE :22.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 17°48.94
start stop duration Lon E 11°32.16
TIME :08:08:54 08:42:53 34.0 (min) Purpose : 1
LOG : 564.78 566.49 1.7 Region : 5010
FDEPTH: 100 150 Gear cond.: 0
BDEPTH: 186 200 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 3.0 kn
Sorted : 0 Total catch: 75.75 Catch/hour: 133.76

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	96.32	1374	72.01	
Trachurus capensis	33.55	447	25.08	201
Aequorea sp.	3.88	155	2.90	
Total	133.76		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 94
DATE :22.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 17°48.28
start stop duration Lon E 11°38.11
TIME :10:04:41 10:10:30 5.8 (min) Purpose : 1
LOG : 576.70 576.99 0.3 Region : 5010
FDEPTH: 119 121 Gear cond.: 0
BDEPTH: 119 121 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 3.0 kn
Sorted : 127 Total catch: 2029.44 Catch/hour: 20958.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	13549.05	344509	64.65	202
Chrysaora hysoscella	4676.08	60971	22.31	
Merluccius capensis	1445.78	8262	6.90	
Aequorea forskalea	740.24	28090	3.53	
Synagrops microlepis	251.15	60971	1.20	
Chelidonichthys capensis	186.71	661	0.89	
Dentex macrophthalmus	61.14	1818	0.29	
Sufflogobius bibarbatus	11.57	1983	0.06	
Todarodes angolensis	9.91	330	0.05	
Dicologoglossa cuneata	8.26	330	0.04	
Zeus faber	8.26	165	0.04	
Bathynectes piperitus	4.96	661	0.02	
Squilla mantis	4.96	165	0.02	
Total	20958.07		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 95
DATE :22.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 17°54.47
start stop duration Lon E 11°39.72
TIME :12:55:50 13:24:46 28.9 (min) Purpose : 1
LOG : 596.76 598.52 1.8 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 120 127 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.7 kn
Sorted : 40 Total catch: 530.65 Catch/hour: 1100.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	617.53	14505	56.11	
Chrysaora hysoscella	477.22	2588	43.36	
Trachurus capensis	5.81	900	0.53	203
Total	1100.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 96
DATE :22.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 17°56.84
start stop duration Lon E 11°4.06
TIME :17:02:01 17:33:35 31.6 (min) Purpose : 1
LOG : 632.25 633.96 1.7 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 1972 2123 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
N O C A T C H	0.00	0	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 97
DATE :22.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 18°4.19
start stop duration Lon E 11°47.79
TIME :22:52:04 23:14:14 22.2 (min) Purpose : 1
LOG : 681.33 682.49 1.2 Region : 5010
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 35 42 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.2 kn
Sorted : 8 Total catch: 8.10 Catch/hour: 21.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis capensis	9.14	2543	41.73	
Sardinops ocellatus	6.36	701	29.01	204
Etrumeus whiteheadi	5.87	414	26.79	
Loligo vulgaris	0.41	11	1.85	
Trachurus trecae	0.08	8	0.37	
Trachurus capensis	0.05	5	0.25	
Total	21.91		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 98
DATE :23.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 18°12.18
start stop duration Lon E 11°38.84
TIME :07:32:28 07:37:57 5.5 (min) Purpose : 1
LOG : 759.30 759.59 0.3 Region : 5010
FDEPTH: 137 136 Gear cond.: 0
BDEPTH: 137 136 Validity : 0
Towing dir: 0° Wire out : 360 m Speed : 3.1 kn
Sorted : 68 Total catch: 373.28 Catch/hour: 4079.56

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	2903.28	49410	71.17	205
Chrysaora hysoscella	769.40	4033	18.86	
Aequorea sp.	355.19	9137	8.71	
Merluccius capensis	44.48	186	1.09	
Callinectes sp.	3.61	120	0.09	
BOTHIDAE	2.40	66	0.06	
Synagrops microlepis	1.20	120	0.03	
Total	4079.56		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 99
DATE :23.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 18°17.90
start stop duration Lon E 11°51.20
TIME :10:12:03 10:22:33 10.5 (min) Purpose : 1
LOG : 780.14 780.69 0.6 Region : 5010
FDEPTH: 61 55 Gear cond.: 0
BDEPTH: 61 55 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.1 kn
Sorted : 106 Total catch: 999.75 Catch/hour: 5707.42

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	3535.26	158872	61.94	206
JELLYFISH	2020.93	26078	35.41	
Trachurus trecae	36.08	1564	0.63	207
Merluccius capensis	35.57	537	0.62	
Maja squinado	23.69	913	0.42	
Chelidonichthys capensis	17.75	103	0.31	
'Undidentified crab'	17.24	1616	0.30	
Etrumeus whiteheadi	12.90	754	0.23	
Scomber japonicus	4.28	51	0.08	
Dicologoglossa cuneata	3.77	51	0.07	
Total	5707.48		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 100
DATE :23.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 18°18.24
start stop duration Lon E 11°45.75
TIME :11:30:33 12:01:10 30.6 (min) Purpose : 1
LOG : 787.93 789.89 2.0 Region : 5010
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 117 132 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.8 kn
Sorted : 0 Total catch: 32.32 Catch/hour: 63.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	36.54	756	57.70	
Chrysaora hysoscella	26.79	272	42.30	
Total	63.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 101
DATE :23.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 18°26.77
start stop duration Lon E 11°17.73
TIME :17:34:22 18:04:12 29.8 (min) Purpose : 1
LOG : 839.99 841.96 2.0 Region : 5010
FDEPTH: 40 40 Gear cond.: 0
BDEPTH: 978 1144 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 4.0 kn
Sorted : 0 Total catch: 37.57 Catch/hour: 75.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	25.85	145	34.20	
Aequorea sp.	20.07	694	26.56	
Dasyatis violacea	15.39	2	20.36	
MYCTOPHIDAE	11.51	3271	15.22	
Trachurus capensis	1.93	18	2.56	208
Todaropsis eblanae	0.66	36	0.88	
Paralepis sp.	0.16	18	0.21	
Total	75.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 102
DATE :23.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 18°24.38
start stop duration Lon E 11°43.07
TIME :21:29:41 22:02:07 32.4 (min) Purpose : 1
LOG : 871.62 873.35 1.7 Region : 5010
FDEPTH: 100 95 Gear cond.: 0
BDEPTH: 146 153 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 3.2 kn
Sorted : 56 Total catch: 224.80 Catch/hour: 415.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	223.50	607	53.74	
Aequorea sp.	192.41	3560	46.26	
Total	415.91		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 103
DATE :24.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 18°27.04
start stop duration Lon E 11°57.60
TIME :00:44:21 00:49:16 4.9 (min) Purpose : 1
LOG : 894.43 894.88 0.5 Region : 5010
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 39 51 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 5.5 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
N O C A T C H	0.00	0	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 104
DATE :24.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 18°26.57
start stop duration Lon E 11°56.94
TIME :01:11:31 01:36:34 25.1 (min) Purpose : 1
LOG : 896.27 897.64 1.4 Region : 5010
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 51 36 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 71 Total catch: 496.18 Catch/hour: 1188.46

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora sp.	652.93	7444	54.94	
Sardinops ocellatus	303.47	47466	25.54	209
Engraulis capensis	155.93	27681	13.12	210
Aequorea sp.	76.12	1744	6.40	
Total	1188.46		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 105
DATE :24.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 18°40.28
start stop duration Lon E 11°22.20
TIME :08:57:45 09:35:50 38.1 (min) Purpose : 1
LOG : 941.81 943.90 2.1 Region : 5010
FDEPTH: 50 95 Gear cond.: 0
BDEPTH: 509 475 Validity : 0
Towing dir: 0° Wire out : 300 m Speed : 3.3 kn
Sorted : 56 Total catch: 398.59 Catch/hour: 628.03

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	335.85	629	53.48	
MYCTOPHIDAE	271.32	200360	43.20	
Thyrsites atun	13.31	14	2.12	
Aequorea sp.	6.51	199	1.04	
Brama brama	0.85	2	0.14	
Trachurus capensis	0.19	2	0.03	
Total	628.03		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 106
DATE :24.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 18°36.02
start stop duration Lon E 11°50.51
TIME :13:47:37 13:54:28 6.9 (min) Purpose : 1
LOG : 978.78 979.15 0.4 Region : 5010
FDEPTH: 146 146 Gear cond.: 0
BDEPTH: 146 146 Validity : 0
Towing dir: 0° Wire out : 400 m Speed : 3.3 kn
Sorted : 66 Total catch: 360.36 Catch/hour: 3156.44

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus capensis	1156.20	9153	36.63	211
Aequorea forskalea	1055.04	24280	33.42	
Chrysaora hysoscella	688.91	4818	21.83	
Merluccius capensis	250.51	1253	7.94	
Synagrops microlepis	4.82	1060	0.15	
GOBIIDAE	0.96	53	0.03	
Total	3156.44		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 107
DATE :24.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 18°40.01
start stop duration Lon E 11°58.00
TIME :17:24:59 17:32:25 7.4 (min) Purpose : 1
LOG : 1006.51 1006.89 0.4 Region : 5010
FDEPTH: 117 116 Gear cond.: 0
BDEPTH: 117 116 Validity : 0
Towing dir: 0° Wire out : 310 m Speed : 3.1 kn
Sorted : 91 Total catch: 6998.87 Catch/hour: 56518.47

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus capensis	48192.19	771561	85.27	212
Chrysaora hysoscella	7435.15	6557	13.16	
Merluccius capensis	634.08	1090	1.12	
Aequorea forskalea	240.57	8746	0.43	
Synagrops microlepis	10.90	1090	0.02	
Engraulis capensis	5.49	1090	0.01	
Total	56518.38		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 108
DATE :24.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 18°44.92
start stop duration Lon E 11°43.18
TIME :20:06:02 20:36:52 30.8 (min) Purpose : 1
LOG : 1025.16 1026.89 1.7 Region : 5010
FDEPTH: 70 67 Gear cond.: 0
BDEPTH: 256 245 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 3.4 kn
Sorted : 0 Total catch: 601.55 Catch/hour: 1170.71

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
J E L L Y F I S H	700.62	47264	59.85	
MYCTOPHIDAE	467.08	37273	39.90	
Brama brama	3.02	2	0.26	
Total	1170.71		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 109
DATE :25.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 18°54.98
start stop duration Lon E 11°31.91
TIME :01:38:29 02:09:17 30.8 (min) Purpose : 1
LOG : 1069.03 1070.77 1.7 Region : 5010
FDEPTH: 150 198 Gear cond.: 0
BDEPTH: 272 277 Validity : 0
Towing dir: 0° Wire out : 540 m Speed : 3.4 kn
Sorted : 8 Total catch: 428.27 Catch/hour: 833.75

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
J E L L Y F I S H	833.75	999	100.00	
Total	833.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 110
DATE :25.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 18°43.29
start stop duration Lon E 12°5.58
TIME :07:01:21 07:20:54 19.6 (min) Purpose : 1
LOG : 1108.70 1109.76 1.1 Region : 5010
FDEPTH: 45 56 Gear cond.: 0
BDEPTH: 89 93 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 35 Total catch: 731.43 Catch/hour: 2244.80

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	876.52	5414	39.05	
Trachurus capensis	757.29	85590	33.74	
Aequorea sp.	563.94	13470	25.12	
Engraulis capensis	47.05	1565	2.10	
Total	2244.80		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 111
DATE :25.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 18°43.87
start stop duration Lon E 12°15.84
TIME :08:55:16 09:04:45 9.5 (min) Purpose : 1
LOG : 1121.32 1121.88 0.6 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 32 31 Validity : 0
Towing dir: 0° Wire out : 155 m Speed : 3.5 kn
Sorted : 23 Total catch: 317.76 Catch/hour: 2009.02

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Engraulis capensis	1223.96	163878	60.92	213
Sardinops ocellatus	445.54	71867	22.18	214
Chrysaora hysoscella	339.52	6828	16.90	
Total	2009.02		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 112
DATE :26.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 19°25.60
start stop duration Lon E 12°16.71
TIME :06:17:35 06:44:21 26.8 (min) Purpose : 1
LOG : 1305.96 1307.35 1.4 Region : 5010
FDEPTH: 110 120 Gear cond.: 0
BDEPTH: 150 138 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.1 kn
Sorted : 64 Total catch: 1209.00 Catch/hour: 2711.78

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	1774.21	4986	65.43	
Trachurus capensis	717.76	16683	26.47	215
Aequorea sp.	219.36	6987	8.09	
Total	2711.33		99.98	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 113
DATE :26.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 19°42.21
start stop duration Lon E 12°51.36
TIME :21:30:27 22:00:58 30.5 (min) Purpose : 1
LOG : 1446.40 1447.98 1.6 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 32 32 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.1 kn
Sorted : 16 Total catch: 54.34 Catch/hour: 106.90

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	89.61	325	83.82	
Trachurus capensis	11.17	212	10.45	216
Thyrsites atun	2.10	4	1.97	
Galeichthys feliceps	1.50	4	1.40	
Engraulis capensis	1.46	354	1.36	217
Merluccius capensis	1.06	35	0.99	
Total	106.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 114
DATE :27.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 20°10.60
start stop duration Lon E 12°26.64
TIME :10:56:11 11:47:01 50.8 (min) Purpose : 1
LOG : 1562.07 1564.56 2.5 Region : 5010
FDEPTH: 200 218 Gear cond.: 0
BDEPTH: 226 246 Validity : 0
Towing dir: 0° Wire out : 560 m Speed : 2.9 kn
Sorted : 75 Total catch: 4070.06 Catch/hour: 4803.38

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus capensis	2926.53	52514	60.93	218
J E L L Y F I S H	1800.94	8554	37.49	
Lophius vaillanti	50.17	65	1.04	
Hyperoglyphe moselii	25.73	65	0.54	
Total	4803.38		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 115
DATE :27.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 20°1.81
start stop duration Lon E 12°49.03
TIME :15:23:12 15:57:56 34.7 (min) Purpose : 1
LOG : 1592.82 1594.95 2.1 Region : 5010
FDEPTH: 30 30 Gear cond.: 0
BDEPTH: 107 116 Validity : 0
Towing dir: 0° Wire out : 90 m Speed : 3.7 kn
Sorted : 37 Total catch: 334.26 Catch/hour: 577.47

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Aequorea forskalea	509.99	11413	88.31	
Chrysaora hysoscella	60.33	249	10.45	
Trachurus capensis	7.15	1104	1.24	219
Total	577.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 116
DATE :27.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 20°0.48
start stop duration Lon E 12°59.60
TIME :17:54:11 18:07:51 13.7 (min) Purpose : 1
LOG : 1611.12 1611.82 0.7 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 37 38 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.1 kn
Sorted : 0 Total catch: 37.71 Catch/hour: 165.52

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	83.83	1005	50.65	
Trachurus trecae	27.83	1049	16.81	222
Trachurus capensis	21.46	386	12.97	220
Merluccius capensis	14.48	250	8.75	
J E L L Y F I S H	11.37	4	6.87	
Engraulis capensis	6.36	909	3.85	221
GOBIIDAE	0.18	4	0.11	
Total	165.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 117
DATE :27.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 20°21.46
start stop duration Lon E 12°39.44
TIME :22:54:12 23:07:56 13.7 (min) Purpose : 1
LOG : 1653.54 1654.34 0.8 Region : 5010
FDEPTH: 156 150 Gear cond.: 0
BDEPTH: 156 150 Validity : 0
Towing dir: 0° Wire out : 430 m Speed : 3.5 kn
Sorted : 98 Total catch: 550.73 Catch/hour: 2404.93

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	1401.75	25873	58.29	223
Chrysaora hysoscella	524.02	1515	21.79	
Merluccius capensis	362.45	3694	15.07	
Aequorea forskalea	39.87	734	1.66	
Lophius vaillanti	32.05	218	1.33	
Todarodes angolensis	14.67	26	0.61	
Chelidonichthys capensis	13.45	26	0.56	
Austroglossus microlepis	10.04	26	0.42	
GOBIIDAE	5.15	1345	0.21	
Pterothrissus belloci	1.48	26	0.06	
Total	2404.93		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 118
DATE :28.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 20°26.78
start stop duration Lon E 13°12.51
TIME :10:35:36 11:06:11 30.6 (min) Purpose : 1
LOG : 1768.14 1769.85 1.7 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 44 63 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 74 Total catch: 448.68 Catch/hour: 880.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis capensis	460.89	53494	52.35	224
J E L L Y F I S H	372.60	2990	42.32	
Etrumeus whiteheadi	28.14	1766	3.20	225
Sardinops ocellatus	10.83	177	1.23	226
Trachurus capensis	5.18	259	0.59	227
Chelidonichthys capensis	2.71	47	0.31	
Total	880.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 119
DATE :28.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 20°32.46
start stop duration Lon E 13°15.59
TIME :12:25:39 12:36:53 11.2 (min) Purpose : 1
LOG : 1777.84 1778.57 0.7 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 37 36 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.9 kn
Sorted : 37 Total catch: 834.21 Catch/hour: 4453.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	3726.25	525667	83.68	229
Chrysaora hysoscella	265.20	1719	5.96	
Engraulis capensis	195.21	35530	4.38	230
Chelidonichthys capensis	95.77	123	2.15	
Sardinops ocellatus	90.85	7612	2.04	231
Trachurus capensis	79.80	10436	1.79	228
Total	4453.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 120
DATE :28.06.2009 GEAR TYPE: PT NO: 21 POSITION:Lat S 20°44.66
start stop duration Lon E 12°58.65
TIME :16:24:04 16:33:56 9.9 (min) Purpose : 1
LOG : 1807.63 1808.11 0.5 Region : 5010
FDEPTH: 143 144 Gear cond.: 0
BDEPTH: 143 144 Validity : 0
Towing dir: 0° Wire out : 370 m Speed : 2.9 kn
Sorted : 7 Total catch: 434.40 Catch/hour: 2640.73

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	926.44	1641	35.08	
Trachurus capensis	840.73	26006	31.84	232
Aequorea sp.	625.53	14736	23.69	
Merluccius capensis	192.22	2699	7.28	
GOBIIDAE	55.81	10140	2.11	
Total	2640.73		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 121
DATE :29.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 20°54.31
start stop duration Lon E 13°23.93
TIME :03:17:46 03:35:25 17.7 (min) Purpose : 1
LOG : 1915.43 1916.33 0.9 Region : 5010
FDEPTH: 31 30 Gear cond.: 0
BDEPTH: 31 30 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
Sorted : 28 Total catch: 139.45 Catch/hour: 474.05

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	255.81	8227	53.96	233
Chrysaora hysoscella	103.34	1615	21.80	
Chelidonichthys capensis	41.81	204	8.82	
Aequorea sp.	32.63	663	6.88	
Callorhinchus capensis	25.16	17	5.31	
Galeichthys feliceps	11.22	34	2.37	
Merluccius capensis	2.55	85	0.54	
Dicologoglossa cuneata	1.53	51	0.32	
Total	474.05		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 122
DATE :29.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 21°11.27
start stop duration Lon E 13°16.95
TIME :07:02:09 07:18:14 16.1 (min) Purpose : 1
LOG : 1944.64 1945.54 0.9 Region : 5010
FDEPTH: 50 60 Gear cond.: 0
BDEPTH: 126 120 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 37 Total catch: 408.76 Catch/hour: 1525.22

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea sp.	703.92	12231	46.15	
Chrysaora hysoscella	591.04	3981	38.75	
Etrumeus whiteheadi	212.61	24586	13.94	235
Sardinops ocellatus	10.67	1108	0.70	236
Trachurus capensis	6.57	944	0.43	234
Engraulis capensis	0.41	123	0.03	
Total	1525.22		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 123
DATE :29.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 21°10.46
start stop duration Lon E 13°20.42
TIME :09:00:20 09:31:14 30.9 (min) Purpose : 1
LOG : 1949.29 1951.04 1.8 Region : 5010
FDEPTH: 40 40 Gear cond.: 0
BDEPTH: 107 115 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.4 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
N O C A T C H	0.00	0	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 124
DATE :29.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 21°21.91
start stop duration Lon E 13°41.00
TIME :22:24:20 22:54:43 30.4 (min) Purpose : 1
LOG : 2076.64 2078.30 1.7 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 27 32 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 34 Total catch: 137.32 Catch/hour: 271.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	218.43	1722	80.54	
Chelidonichthys capensis	41.16	893	15.18	
Callorhinchus capensis	10.90	8	4.02	
Etrumeus whiteheadi	0.47	39	0.17	
Trachurus capensis	0.16	8	0.06	
GOBIIDAE	0.08	8	0.03	
Total	271.20		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 125
DATE :30.06.2009 GEAR TYPE: PT NO: 2 POSITION:Lat S 21°55.84
start stop duration Lon E 12°42.28
TIME :07:03:55 07:51:17 47.4 (min) Purpose : 1
LOG : 2156.22 2158.77 2.5 Region : 5010
FDEPTH: 180 210 Gear cond.: 0
BDEPTH: 416 354 Validity : 0
Towing dir: 0° Wire out : 500 m Speed : 3.2 kn
Sorted : 0 Total catch: 159.60 Catch/hour: 202.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	89.21	34	44.14	
Brama brama	87.51	99	43.30	
MYCTOPHIDAE	25.39	16157	12.56	
Total	202.11		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 126
DATE :30.06.2009 GEAR TYPE: PT NO: 5 POSITION:Lat S 21°48.16
start stop duration Lon E 13°48.87
TIME :17:49:45 18:05:04 15.3 (min) Purpose : 1
LOG : 2247.24 2248.07 0.8 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 75 70 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 66 Total catch: 230.38 Catch/hour: 902.25

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	489.36	1277	54.24	
Aequorea sp.	406.45	7198	45.05	
Trachurus capensis	3.43	384	0.38	237
J E L L Y F I S H	3.02	16	0.33	
Total	902.25		100.00	

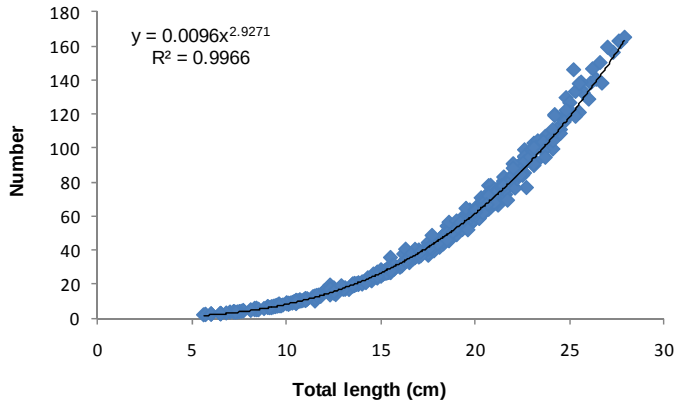
R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 127
DATE :01.07.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 22°25.62
start stop duration Lon E 14°14.58
TIME :16:37:02 16:45:15 8.2 (min) Purpose : 1
LOG : 2465.64 2466.16 0.5 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 62 59 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.8 kn
Sorted : 35 Total catch: 140.24 Catch/hour: 1024.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea sp.	955.91	4706	93.27	
GOBIIDAE	58.47	52619	5.70	
Chrysaora hysoscella	10.52	205	1.03	
Total	1024.90		100.00	

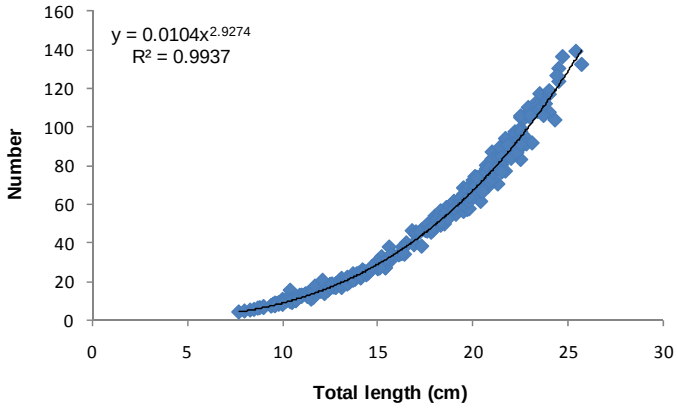
Annex II Catch rates

Station	Bottom depth	*T.capensis*	*T.trecae*	*S. sagax*	*E. whiteheadi*	*E. capensis*	Others	Total
78	40.00	0.00	3617.89	0.00	0.00	0.00	110.65	3728.54
79	74.00	0.00	3330.88	0.00	0.00	0.00	685.29	4016.17
80	17.00	0.02	0.96	0.00	0.00	0.02	16.25	17.25
81	84.00	0.00	2486.74	0.00	1.35	0.00	179.09	2667.18
82	19.00	0.00	20.98	0.00	0.00	63.90	125.54	210.42
83	122.00	18374.13	17401.22	378.08	1501.06	0.00	428.07	38082.56
84	47.00	0.00	0.00	0.00	0.78	0.00	2.84	3.62
85	22.00	0.00	476.80	0.28	3.97	0.00	140.53	621.58
86	87.00	0.00	0.00	4.72	436.30	0.00	35.29	476.31
87	128.00	5927.29	767.45	0.00	0.00	0.00	2497.73	9192.47
88	64.00	464.35	12.52	32.87	1335.65	0.00	108.52	1953.91
89	124.00	6649.50	0.00	0.00	0.00	0.00	1603.49	8252.99
90	106.00	5620.00	1110.00	44.00	34.00	0.00	13111.81	19919.81
91	1268.00	0.60	0.00	0.00	0.00	0.00	4.04	4.64
92	470.00	35.38	0.00	0.00	0.00	0.00	29.35	64.73
93	193.00	33.55	0.00	0.00	0.00	0.00	100.20	133.75
94	120.00	13549.05	0.00	0.00	0.00	0.00	7409.02	20958.07
95	124.00	5.81	0.00	0.00	0.00	0.00	1094.75	1100.56
96	2048.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
97	38.00	0.05	0.08	6.36	5.87	9.14	9.55	31.05
98	136.00	2903.28	0.00	0.00	0.00	0.00	1176.28	4079.56
99	58.00	3535.26	36.08	0.00	12.90	0.00	2123.23	5707.47
100	124.00	0.00	0.00	0.00	0.00	0.00	63.33	63.33
101	1061.00	1.93	0.00	0.00	0.00	0.00	73.64	75.57
102	150.00	0.00	0.00	0.00	0.00	0.00	415.91	415.91
103	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
104	44.00	0.00	0.00	303.47	0.00	155.93	884.98	1344.38
105	492.00	0.19	0.00	0.00	0.00	0.00	627.84	628.03
106	146.00	1156.20	0.00	0.00	0.00	0.00	2000.24	3156.44
107	116.00	48192.19	0.00	0.00	0.00	5.49	8326.19	56523.87
108	250.00	0.00	0.00	0.00	0.00	0.00	1170.72	1170.72
109	274.00	0.00	0.00	0.00	0.00	0.00	833.75	833.75
110	91.00	757.29	0.00	0.00	0.00	47.05	1487.51	2291.85
111	32.00	0.00	0.00	445.54	0.00	1223.96	1563.48	3232.98
Mean	241.59	3153.12	860.64	35.74	98.00	44.28	1424.68	5616.46
St DEV	413.28	8811.14	3019.72	107.54	338.79	207.37	2743.28	11736.77
% Catch		56.14	15.32	0.64	1.74	0.79	25.37	

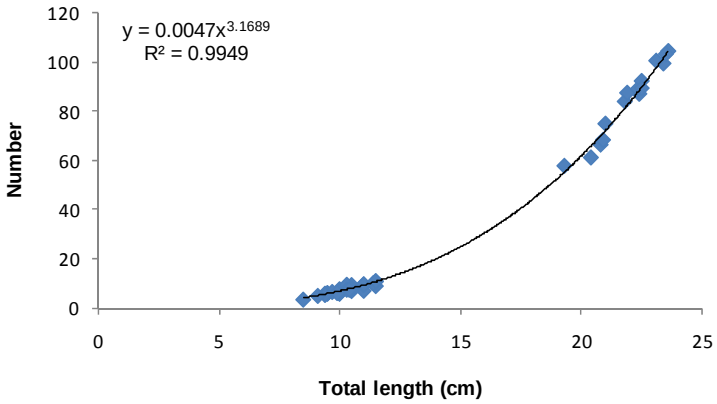
Annex III Length weight relationships and gonad maturity



(a) *T. capensis*



(b) *T. trecae*



(c) S. sagax

Annex IV Instruments and fishing gear

The Simrad EK-60, 38 kHz echo scientific sounder was used during the survey for fish abundance estimation, in addition data from the 18 kHz, 120 kHz and the 200 kHz transducers were logged for possible future multi frequency target estimation. The Large Scale Survey System (LSSS) Version 1.25 logging the echogram raw data from the sounder, was used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape, and a backup of the database of scrutinized data. The details of the settings of the 38 kHz were as follows:

Transceiver-2 menu (38 kHz)

Transducer depth	5.50 m
Absorbtion coeff.	8,7 dB/km
Pulse length	medium (1,024ms)
Bandwidth	2,43 kHz
Max power	2000 Watt
2-way beam angle	-20,6dB
gain	25,04 dB
SA correction	-0,46 dB
Angle sensitivity	21.9
3 dB beamwidth	7,76º along ship
	7,86º athwardship
Alongship offset	-0.12º
Athwardship offset	0.06º

Bottom detection menu Minimum level -40 dB

Fishing gear

The vessel has two different sized "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.

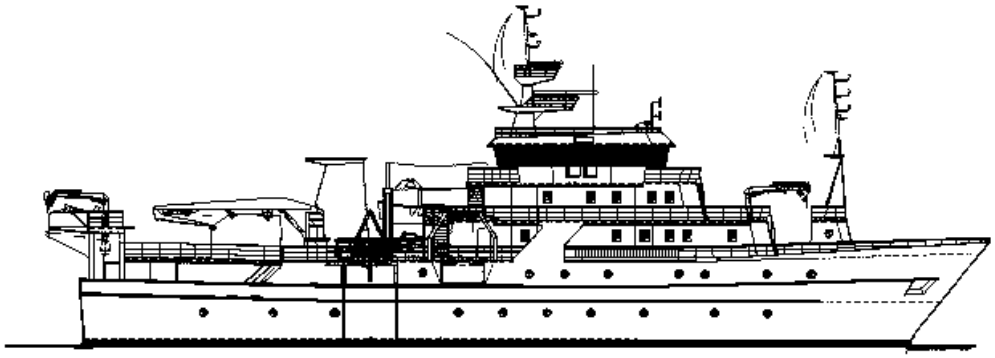
The bottom trawl has a headline of 31 m, footrope 47 m and 20 mm meshsize in the codend with an innernet of 10 mm meshsize. The trawl height was about 4.5 m and distance between wings during towing about 21 m. The sweeps are 40 m long. The trawl is equiped with a 12" rubber bobbins gear. New doors are 'Thyborøn' combi type, 7.41 m^2, 1720 kg. These have been in used onboard since 19.02.08. During the present survey the door distance was kept nearly constant at about 50 m at all depths by the use of a 9.5 m strap

between the wires at 120 m distance from the doors (normally applied at depths greater than 80 m).

The SCANMAR system was used on 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 the trawl was 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. A catch sensor on the cod-end indicated the size of the catch.

Annex V Maturity stages

Stage	Maturity stage	Description
I	Immature	Small gonads, do not occupy more than 1/3 of abdominal cavity length. Ovary pinkish; testis whitish. Ova not visible to naked eye
II	Maturing virgin and recovering spent	The gonads begin to develop, increasing substantially in size; about ½ length of the abdominal cavity. Gonads more opaque, small points visible to the naked eye (oocytes at the beginning of vitelogenese).The gonads in rest/recovery more flaccid with some more conspicuous blood than the gonads in development.
III	Mature. Before pre-spawning	At the beginning, oocyte more conspicuous giving the gonad a granular aspect. Ovary yellow-orange, testis creamy. Visible sperm in testis if open. Gonads quite swollen in the beginning of the reproduction period. Gonads that have spawned once lose consistency, but opaque oocytes present, and sperm in testis if cut. At the end of the stage is possible to find some translucent oocytes. Gonads occupy about 2/3 of abdominal cavity.
IV	Mature Pre-spawning	The gonads occupy about 2/3 of abdominal cavity. Ovaries orange in colour with visible blood vessels. Most oocytes translucent, testis creamy, flat and brilliant texture. The gonads stop flowing oocytes and sperm flows at low pressure.
V	Mature. In spawning	The gonads occupy about 2/3 or less of abdominal cavity. Ovaries orange in colour with the conspicuous blood vessels, blood stained mainly in one end. Most oocytes translucent; testis creamy, flat and brilliant texture. The gonads stop flowing oocytes and sperm flows at low pressure. Pinky stains at the end of gonad.
VI	Post-spawning	The gonads decrease in size and occupy about ½ or less, of abdominal cavity. Gonads flaccid and bloody. Ovary can contain remaining oocytes that were not emitted. Testis may have sperm remaining in the seminal duct. Pinkish areas in the whole extension of the gonad.



SURVEYS OF THE FISH RESOURCES OF ANGOLA

Cruise Report No 2/2009

Survey of the pelagic resources
23 May – 4 July 2009

Institute of Marine Research
IMR
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INIP
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Survey of the pelagic resources
23 May – 4 July 2009

by

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Bergen, 2009

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CHAPTER 1 NTRODUCTION

1.1 Objectives

This survey is one of a series aimed at monitoring the pelagic fish resources of Angola, as agreed with the Instituto Nacional de Investigação Pesqueira (INIP), Luanda, and to improve the understanding and knowledge in terms of the biology, ecology and population dynamics of the main pelagic species in relation to the environment and the whole ecosystem. Acoustic surveying using the echo integration is the principal tool for estimating stock abundance of pelagic species, and the survey estimates, therefore form the basis for recommendation on the Total Allowable Catch (TAC).

The specific objectives of the survey were the following:

- To estimate the abundance and to map the distribution of the main commercially important pelagic and semi-pelagic fish species in Angolan waters, including the two sardinella species *Sardinella aurita* and *S. maderensis*, the Cunene horse mackerel *Trachurus trecae*, the Cape horse mackerel *Trachurus capensis* and other pelagic species.

- To collect stomachs and otoliths from both horse mackerel species and to collect depth stratified samples of zoo and phytoplankton in order to continue the studies on feeding biology, relating stomach contents to estimated zooplankton compositions and densities.

- To collect horse mackerel samples for further genetic studies

- To map the general meteorological, hydrographical and biological conditions in the survey area by means of continuous recordings of weather data, CTD-casts (Temperature, Salinity and Oxygen), ADCP measurements (Acoustic Doppler Current Profiler) and plankton sampling along acoustical and hydrographical transect lines.

- On-the-job training of cruise participants on the main survey routines, including using the new Nansis database, Nansis MapTool and scrutinizing acoustical data with the post-processing system, Large Scale Survey System (LSSS).

1.2 Participation

The scientific staff consisted of:

From INIP, Luanda:

António BARRADAS (Team leader, 23/5 – 04/7), Paulo CELSO (23/5 – 30/5), Geraldina JOSÉ (23/5 – 30/5), Paula FARÍA (23/5 – 30/5) Andom LUSSEVAKUENO (23/5 – 30/5), Francisco de ALMEIDA (23/5 – 04/7), Filomena VAZ-VELHO (Team leader, 30/5 – 04/7), Aristóteles AMARO (30/5 – 04/7), Pedro PANZO (30/5 – 04/7), Manuel DOMINGOS (30/5 – 04/7), Rocha CAMALANDUA (30/5 – 04/7).

From CIP-Namibe:
Quilanda FIDEL (23/5 – 04/7)
From NatMIRC-Namibia:
Uatjavi UANIVI (10/6-04/7) and Richard KANGUMBA (10/6-04/7)

From IMR, Bergen:
Jens-Otto KRAKSTAD (Cruise leader, 23/5 - 10/6), Diana ZAERA (23/5 – 10/6), Else TORSTENSEN (Cruise leader, 10/6 – 04/7), Magne OLSEN (10/6 – 04/7), Jan Frode WILHELMSEN (23/5 – 10/6), Ole Sverre FOSSHEIM (23/5 – 10/6), Tore MØRK (10/6 – 04/7), Terje SVOREN (10/6 – 04/7)

1.3 Narrative

The vessel departed Pointe Noire on the 23rd May at 21:00 UTC. After completing the embarkation of the scientific personnel, the vessel steamed to the border between Congo and Angola where the survey started south of Congo River on the 24th May in the morning. The survey area was divided into three regions:

(a) Congo River - North of Pta. das Palmerinhas (6°-9°S): ANGOLA NORTH;
(b) The region between 9°S and 13°S: ANGOLA CENTRAL;
(c) The region between 13°S and Cunene River (17°15'S): ANGOLA SOUTH.

On 30th of May the vessel steamed to Luanda for a crew change. It departed again on Tuesday 2nd June at 14:00 UTC and returned to Ambriz to complete the coverage of the northern region. This was completed on the 4th of June, and the vessel carried on covering the central region. On 10th June at 6:00 the vessel steamed to Lobito for a change of the Norwegian scientific team and to pick up two Namibian scientists. The survey restarted on the 11th June, and the central region was completed on 13th of June. The coverage of the Southern region and the shelf of Angola at Cunene River was completed on 20th of June.

Calibration of the Simrad ER 60 Scientific echosounder (18, 38, 120, 200 kHz transducers) was done in Baía dos Elefantes on 14th June.

A systematic survey track implemented in 2002 with equally spaced transect lines (6 nautical miles apart) perpendicular to the coast was followed during the survey. The Cabinda region was not included in this survey due to stricter enforcement of regulations implied by the oil companies in the area.

1.4 Survey effort

Figure 1(a-c) shows the cruise tracks with fishing, plankton and hydrographical stations for the northern, central and southern regions of Angola. The sampling trawls, including the small (10 m vertical opening) and the mid-sized (15 m vertical opening) pelagic trawls and the demersal trawl (5 m), were used during the survey. Table 1 summarizes the survey effort by regions.

Table 1. Summary of survey effort by regions, including number of demersal (BT) and pelagic (PT) trawl hauls, CTD casts, Multinet stations (2-5 zooplankton samples per station) and distance surveyed (log).

Area	BT	PT	Total Trawls	CTD casts	Multinet stations	Log (NM)
Pta. Palmerinhas - Congo River	8	24	32	59	17	1562.3
Benguela - Pta. Palmerinhas	9	28	37	99	8	1533.2
Cunene River - Benguela	15	4	19	132	6	1141,4
Total	32	56	88	290	31	4235,9

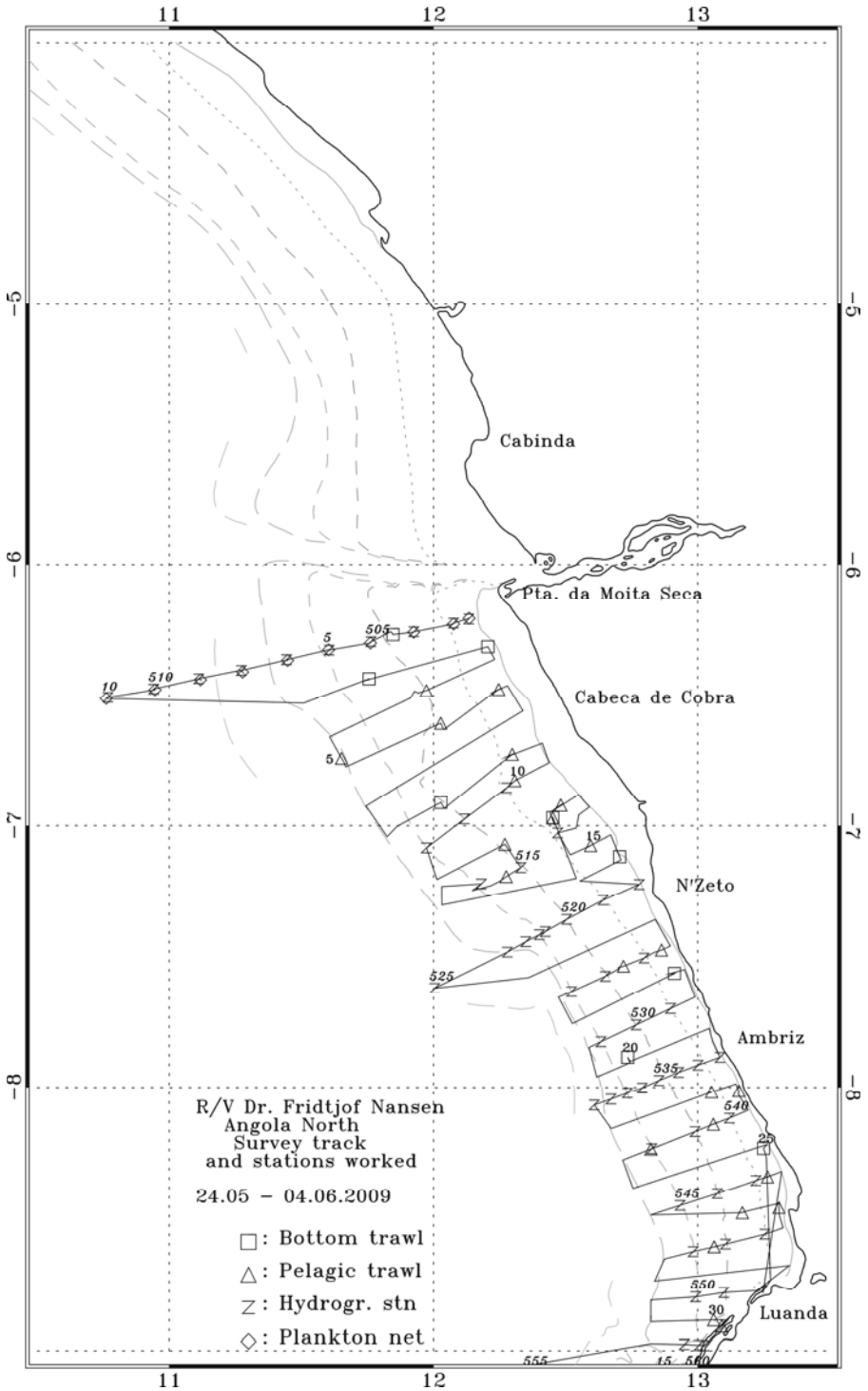


Figure 1a. Course track with fishing, plankton and hydrographical stations, Pta. das Palmerinhas- Congo River. Depth contours at 20, 50, 100, 200, and 500m.

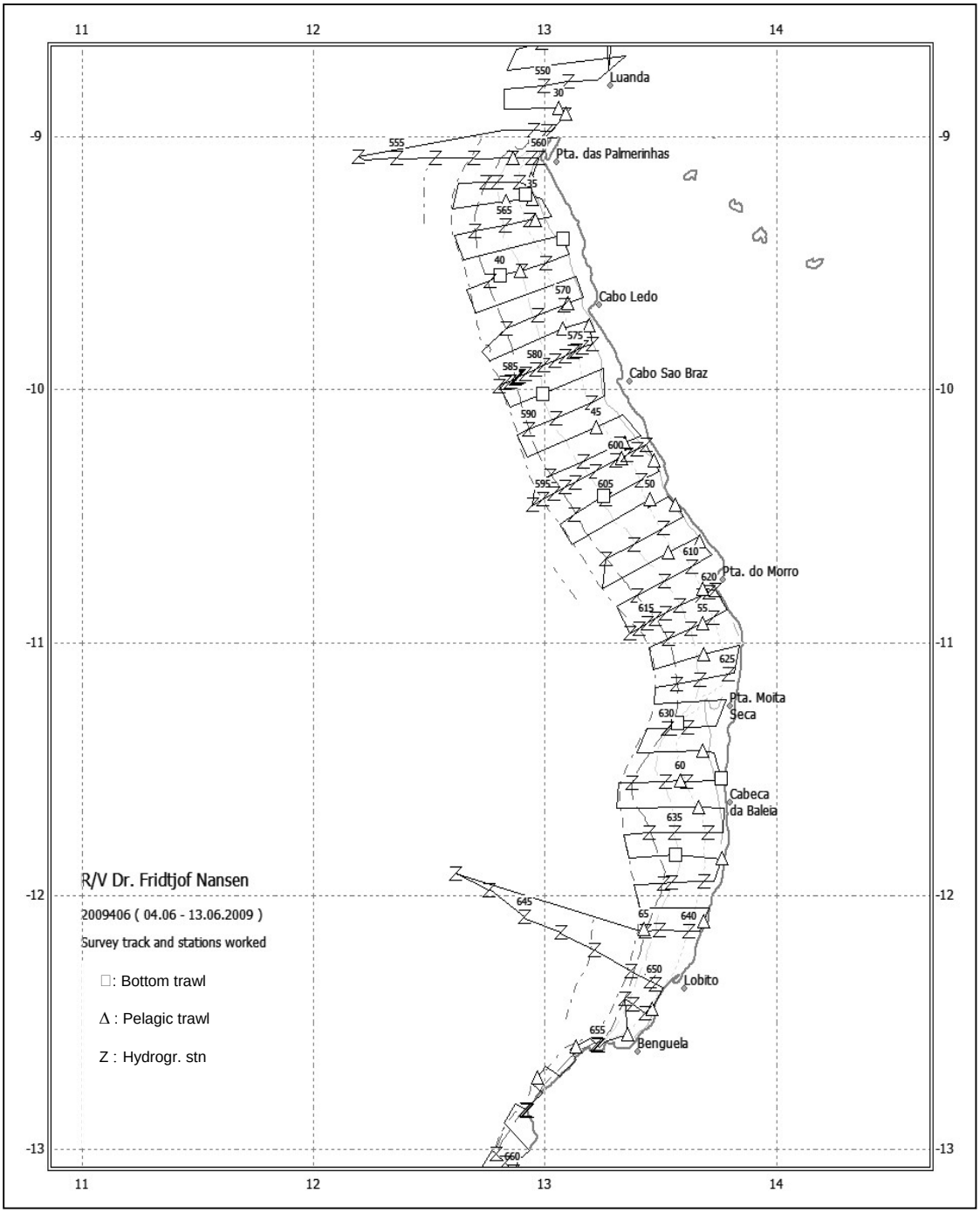


Figure 1b. Course track with fishing, plankton and hydrographical stations, Benguela -Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200, and 500m.

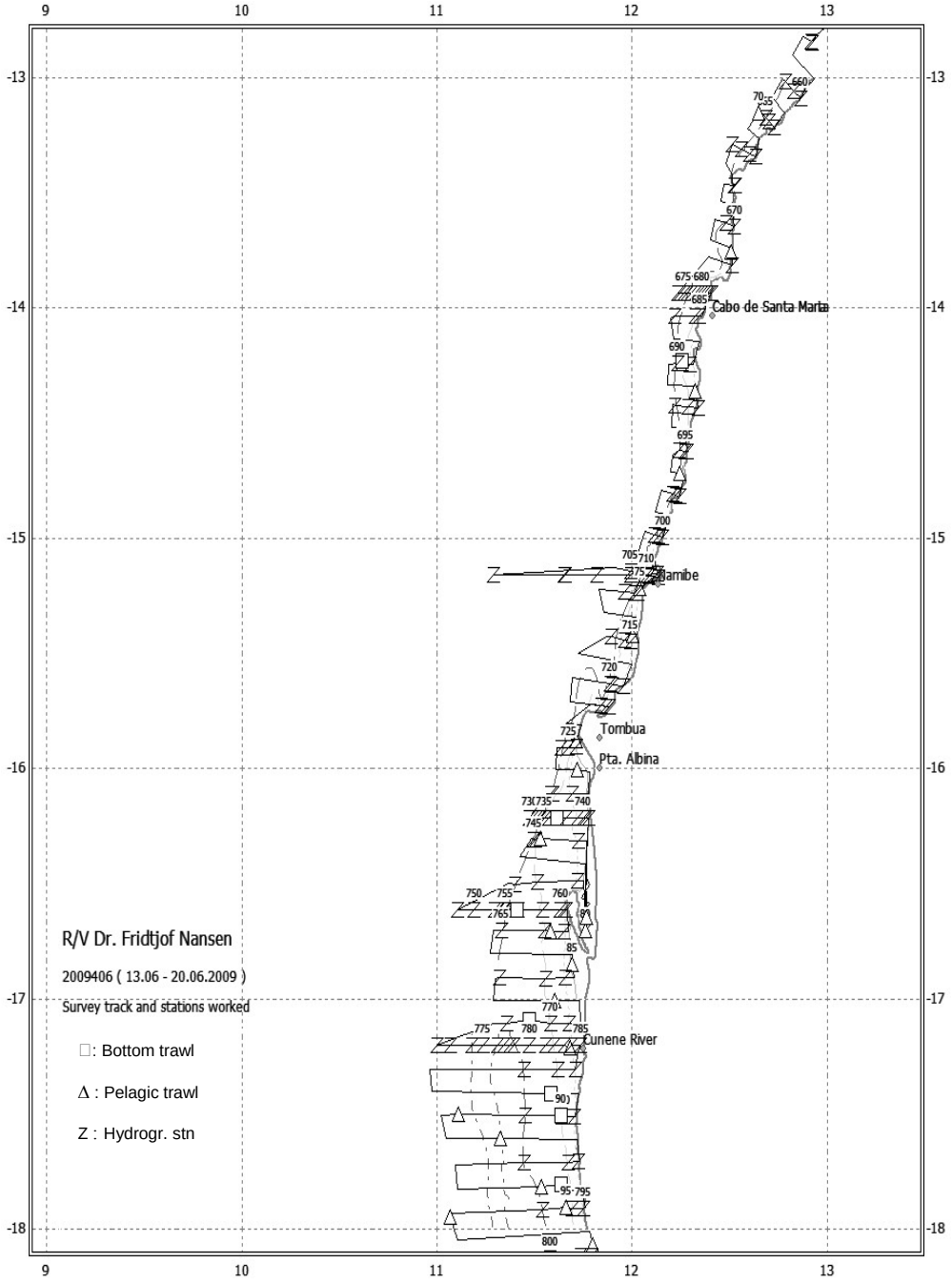


Figure 1c. Course track with fishing, plankton and hydrographical stations, Cunene-Benguela. Depth contours at 10, 20, 50, 100, 200 and 500 m.

CHAPTER 2 METHODS

2.1 Hydrographical sampling

CTD

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 60 NM distance, and *ad hoc* as deemed necessary. The casts were stopped a few meters above the bottom, and at a maximum of 1500 m depth. The oxygen sensor has shown to be stable, and no calibration was conducted during the survey. Additional CTD stations were added on most transects at bottom depths 50, 100 and 200 m.

The transects off Congo river, Pta. das Palmerinhas, Lobito, Namibe and Cunene river were carried out in accordance with the standard monitoring transects run by INIP.

Attached to the CTD was also a Chelsea fluorometer of the type Mk III Aquatrack. It measures chlorophyll A in microgram per liter with an uncertainty of 3%. Factory slope and offset was 0.921 and -0.02.

Thermosalinograph

The SBE 21 Seacat thermosalinograph was running routinely during the survey, obtaining samples of sea surface salinity and relative temperature and fluorescence (5 m depth) every 10 sec. An attached in-line Turner Design SCUFA Fluorometer was continuously measuring Chlorophyll levels [RFU] at 5 m below the sea surface while underway during the entire cruise. The instrument was configured with a bright blue photodiode, a 420 nm Excitation filter and a 680 nm Emission filter. It was calibrated against the secondary orange standard dye. The maximum output was equivalent to 5Volt = 100%. It had a linear temperature compensation of 2.14%/°C

Current speed and direction measurements (ADCP)

A vessel-mounted Acoustic Doppler Current Profiler (VMADCP) from RD Instruments was run continuously during the survey in broadband mode shallower than about 400 m and in narrow band mode in deeper waters. The frequency of the VMADCP is 150 kHz, and data were averaged and stored in 3 m or 4 m vertical bins. All data were stored on files for post survey processing.

Meteorological observations

Meteorological data logged from the Norwegian Meteorological Institute's (DNMI) meteorological station on board, included air temperature, humidity, air pressure, wind direction and speed, and sea surface temperature (SST). All data were averaged by unit distance sailed (1 NM).

2.2 Fish sampling

A brief description of the fishing gear is provided in Annex II. All trawl catches were sampled for species composition by weights and numbers. Records of catch rates are given in Annex I. Total length (TL) frequencies were taken for the commercial pelagic species such as sardinella, horse mackerel, sardine, round herring, anchovy, *Brachydeuterus auritus* and demersal species mainly dentex.

Biological samples were obtained for sardinella, horse mackerel and tuna. Total length (TL) and body weight were determined to the nearest 1 cm and 1 g bellow. Sex and reproductive stages were determined by means of macroscopic examination, scoring each fish according to the six-point classification scale first proposed by INIP (Table 2).

Table 2. Adapted scale by INIP for the classification of maturity stage for both horse mackerel and sardinella in Angola (partial spawners)

Stage	Maturity stage	Description
I	Immature	Small gonads, do not occupy more than 1/3 of abdominal cavity length. Ovary pinkish; testis whitish. Ovary not visible to naked eye
II	Maturing virgin and recovering spent	The gonads begin to develop, increasing substantially in size; about ½ length of the abdominal cavity. Gonads more opaque, small points visible to the naked eye (oocytes at the beginning of vitelogenese).The gonads in rest/recovery more flaccid with some more conspicuous blood than the gonads in development.
III	Mature. Before pre-spawning	At the beginning, oocyte more conspicuous giving the gonad a granular aspect. Ovary yellow-orange, testis creamy. Visible sperm in testis if open. Gonads quite swollen in the beginning of the reproduction period. Gonads that have spawned once lose consistency, but opaque oocytes present, and sperm in testis if cut. At the end of the stage is possible to find some translucent oocytes. Gonads occupy about 2/3 of abdominal cavity.
IV	Mature Pre-spawning	The gonads occupy about 2/3 of abdominal cavity. Ovaries orange in colour with visible blood vessels. Most oocytes translucent, testis creamy, flat and brilliant texture. The gonads stop flowing oocytes and sperm flows at low pressure.
V	Mature. In spawning	The gonads occupy about 2/3 or less of abdominal cavity. Ovaries orange in colour with the conspicuous blood vessels, blood stained mainly in one end. Most oocytes translucent; testis creamy, flat and brilliant texture. The gonads stop flowing oocytes and sperm flows at low pressure. Pinky stains at the end of gonad.
VI	Post-spawning	The gonads decrease in size and occupy about ½ or less, of abdominal cavity. Gonads flaccid and bloody. Ovary can contain remaining oocytes that were not emitted. Testis may have sperm remaining in the seminal duct. Pinkish areas in the whole extension of the gonad.

Stomach samples of horse mackerel were collected for further analysis at INIP, Luanda. Feeding biology will be investigated in more details at a later stage by relating the stomach contents to recorded availability of zooplankton.

2.3 Plankton sampling

Phytoplankton

Samples of phytoplankton were collected using the CTD bottles during daytime at 5, 15, 25, 50 and 75 meter depths.

Zooplankton

The zooplankton sampling was conducted by means of HYDROBIOS Multinet (180 μm), at four depths intervals, 0-25, 25-50,50-75,75-100 and 100-200 m., at transects off Congo river, Pta. das Palmerinhas, Lobito, Namibe and Cunene river. Data from the flow meter was recorded electronically from the Mulinet receiver unit. A SCANMAR depth sensor gave real-time information of the depth. The nets were opened and closed remotely from the bridge of the vessel. The samples were preserved in formalin 4%.

2.4 Acoustic sampling

Acoustic equipment

Acoustic data were recorded using a Simrad ER60 scientific echosounder equipped with keel-mounted transducers at nominal operating frequencies of 18, 38, 120 and 200 kHz. Few locations along the Angolan coast are favourable for transceiver calibration (essentially Baía dos Tigres and Baía dos Elephantes), and the survey was therefore started without *a priori* calibration. All transceivers were calibrated in Baía dos Elephantes the 13rd of June.

Acoustic data were logged and post-processed using the latest acoustic data post-processing software, the Large Scale Survey System (LSSS) Version 1.25. The technical specifications and operational settings of the echosounder used during the survey are given in Annex II.

Allocation of acoustic energy to species group

The acoustic data were scrutinized using the LSSS version 1. 25. Scatterers were displayed at 38 kHz. The mean 5 NM area backscattering coefficient s_A (m^2/NM^2) was allocated to a predefined set of species groups on the basis established echogram features. Acoustic groups and respective species are listed in Table 3. Ground truthing and estimation of mean length and weight were accomplished by means of targeted pelagic and demersal trawling.

Table 3. Allocation of acoustic densities to species groups. Note that for the groups sardinella, horse mackerel, big-eye grunt and pilchard all encountered species are listed, while only examples are listed for the remaining groups.

Group	Taxon	Species
Sardinella	*Sardinella* sp.	*S. aurita*
		S. maderensis
Horse mackerel	*Trachurus* sp.	*T. trecae*
		T. trachurus capensis
Pilchard	Sardinops	*S. ocellatus*
Big-eye grunt		*Brachydeuterus auritus*
Pelagic species 1	Clupeiformes$_1$	*Ilisha africana*
		Etrumeus whiteheadi
		Engraulis encrasicolus
Pelagic species 2	Carangidae$_2$	*Selene dorsalis*
		Chloroscombrus chrysurus
		Decapterus rhonchus
		Seriola carpenteri
	Scombridae	*Auxis thazard*
		Sarda sarda
		Scomber japonicus
	Sphyraenidae	*Sphyraena guachancho*
	Others	*Trichiurus lepturus*
		Lepidopus caudatus
Other demersal species	Sparidae$_3$	*Dentex angolensis*
		D. macrophthalmus
		D. congoensis
		D. canariensis
		D. barnardi
		Pagellus bellottii
		Sparus caeruleostictus
		S. pagrus africanus
	Other taxii	*Saurida brasiliensis*
		Arioma bondi
		Pomadasys incisus
		Galeoides decadactylus
Mesopelagic species	Myctophidae$_3$	*Diaphus dumerili*
	Other mesopelagic fish	*Trachinocephalus myops*
Plankton	Calanoidae	*Calanus* sp**.**
	Euphausiidae	*Meganyctiphanes sp.*
	Other plankton	

$_1$: other than *Sardinops* sp.; $_2$: other than *Trachurus* sp.; $_3$: main taxon in group.

Estimation of biomass

The target strength (TS) function used to convert mean area backscattering coefficient s_A (m^2/NM^2) at 38 kHz to number of fish corresponds to:

$$TS = 20 \log L - 72 \text{ (dB)} \quad (1)$$

or

$$C_F = \frac{10^{7.2}}{4\pi} \cdot L^{-2} \quad (2)$$

where C_F is the conversion factor from acoustic density to fish biomass and L is the mean total fish length. This target strength function was originally established for North Sea herring, but has later been attributed to clupeids in general (Foote *et al*., 1986; Foote, 1987).

No specific target strength relations presently are available for the species at hand, and equation (2) has therefore been applied consequently for all targeted species in this time series. The biomass was calculated by multiplying the number of fish by the expected length at weight, estimated by regressing the log-length (total) against total weight. Separate length-weight relationships were worked for each region (north, central, south), pooling all data within each region.

The boundaries of encountered fish aggregations (post strata) were determined by means of contouring within the inner and outer zero-value limits of the transect lines. The strata contours were digitised using Golden Software Didger software Version 3.0.7 and Nansis Maptool Version 1.05. Sub-stratification was used to isolate areas of similar densities, using the following pre-defined, standard categories: 1: s_A = 0-300; 2: s_A = 301-1 000; 3: s_A = 1 001-3 000; 4: s_A > 3 001 (m^2/NM^2).

Mean 5-NM integrator values (s_A) computed along the transect lines were re-averaged for each stratum. The short spacing between the lines (6 NM) makes it impossible to exclude all between-transect values without removing some on-line contributions, particularly for sardinella on the inner shelf. The potential positive bias of including between-line values is likely smaller than the negative bias that would have been introduced by excluding high on-line contributions. This bias is also counteracted by the shallow distribution pattern (partly above the integration limit) and vessel avoidance behaviour of sardinella (Misund and Aglen, 1992). All estimates should consequently be considered as relative indices of abundance.

The overall length frequency distributions within strata were estimated by weighting the sample-distributions with the nearest valid 5 NM integrator value, or the average of two adjacent values. Target species of the same genus, i.e. *S. aurita* / *S. maderensis* and *T. trecae* / *T. trachurus capensis*, are not acoustically distinguishable, and the s_A values were therefore split according to the relative distributions of the two species in each length group. The total number of fish in each length group was estimated as:

$$\rho_i = \frac{< s_A > t_{i,j} \cdot u_i}{\sum_i \frac{u_i}{C_{Fi}}} \cdot A_s = \frac{10^{7.2} \cdot t_{i,j} \cdot u_i \cdot < s_A > \cdot A_s}{4\pi \sum_i u_i \cdot (L_i + 0.5)^2} \qquad (3)$$

where:

ρ_i	=	estimated number of fish in length group i
$<s_A>$	=	mean recorded area backscattering coefficient (m^2/NM^2)
$t_{i,j}$	=	proportion of species j in length group i
u_i	=	proportion of sampled fish in length group i
A_s	=	horizontal area of stratum s
C_{Fi}	=	conversion factor for length group i
L_i	=	length group i (nearest full cm below total length)
$L_i+0.5$	=	mean length in L_i.

CHAPTER 3 OCEANOGRAPHIC CONDITIONS

3.1 Surface distribution

Northern region

The wind observed in this region during the survey was mainly moderate, with an average velocity of around 10 knots (5m/s) (Figure 2a). The wind patterns varied, generally north of Luanda the wind was south-easterly while the dominant direction off Ambriz was northerly with average of 8 knots (4m/s) while between N' Zeto and Cabeça de Cobra the wind was quiet with multiple directions. The wind increased to about 20 knots (10m/s) with south-westerly wind between Cabeça de Cobra and Pta da Moita Seca. Experiencing almost the same intensity, prevailed southerly wind (blowing northward) off Congo River mouth and surrounding areas. To sum up, wind was strong (>10 knots / >5m/s) north of Luanda and considerably weakened up to Cabeça de Cobra (>10 knots / >5m/s) then increased (>10 knots / 5m/s) northward off the Congo River mouth and beyond.

Off Congo River mouth the sea surface temperature ranged from 27 to 28 °C (Figure 3a), with a pocket of 26ºC trapped off Cabeça de Cobra, The cooler water was found alongshore ranging from 23ºC off Luanda to 24.5ºC between Ambriz and N´zeto that appears to be warmer in the area than observed last year.

Lower values of salinity were ranging from 23.0 to 30.0 psu (Figure 4a) due to the outflows of the Congo River moving forward with strong gradients and an isohaline front southward. Pockets of isohaline of 35.0 psu were found inshore N´zeto and between Ambriz and Luanda. Higher values of salinity (35.5 psu) were found seawards.

The presence of lower value of fluorescence (0.04µ) was observed in the entire region (Figure 5a). Two pockets of isolines of 0.04 µ were found inshore Cabeça de Cobra, off Nzeto and near Luanda. The highest value (0.14 µ) was found just south Luanda

Central Region

In this region the wind was very variable both in strength and direction (Figure 2b). The strongest winds (around 20 knots) were registered off Lobito and Pta das Palmeirinhas while the winds between Quicombo up to south Pta das Palmeirinhas and north Luanda were moderate in average. The predominant wind direction with the strong wind (> 10m/s) was southwest

Surface water temperature varied from 23ºC near the coast to 26ºC offshore (Figure 3b). The lower values of salinity (35.8 psu) were found in vicinity of Pta das Palmerinhas and Pta do Morro. Offshore salinity was 36.2 psu. The isoline of 36 psu was oriented alongshore but turned offshore from Pta das Palmeirinhas (Figure 4b).

Two pockets of high values (1.2 – 1.4µ) of fluorescence were found in vicinity of Pta das Palmeirinhas and between Benguela and Lobito. The high concentrations are due to the discharge of rivers nearby. In general, low values of fluorescence (0.04µ) were found in the entire region (Figure 5b).

Southern Region

The wind in this region was stronger and predominantly south easterly, SE, and south westerly, SW (Figure 2c). Between Baia dos Tigres and Cunene River's the SE winds were very strong, the speeds registered in this area reached approximately 40 knots.
From Namibe the predominantly wind was SW and moderate in speed reaching 8-12 knots and between Carujamba and Cabo de Santa Marta the winds were weak and more variable.
.

The horizontal temperature distribution (Figure 3c) shows lower values than in both central and northern regions. The lowest values, 15 to 17°C, were observed between Baía dos Tígres and Cunene. The salinity conditions along the coast varied between 35-36 psu with maximum value found off Namibe (Figure 4c). Lowest salinity was observed off Baia dos Tigres, which may be influenced by the outflows of Cunene River. The salinity distribution indicates a northward drifting of the water.
An average of fluorescence value of 0.06μ was observed in the whole region but off Cabo de Santa Marta (Figure 5c) and in the surroundings was found a singular higher fluorescence concentration ranging between 1.2 – 1.6 μ.

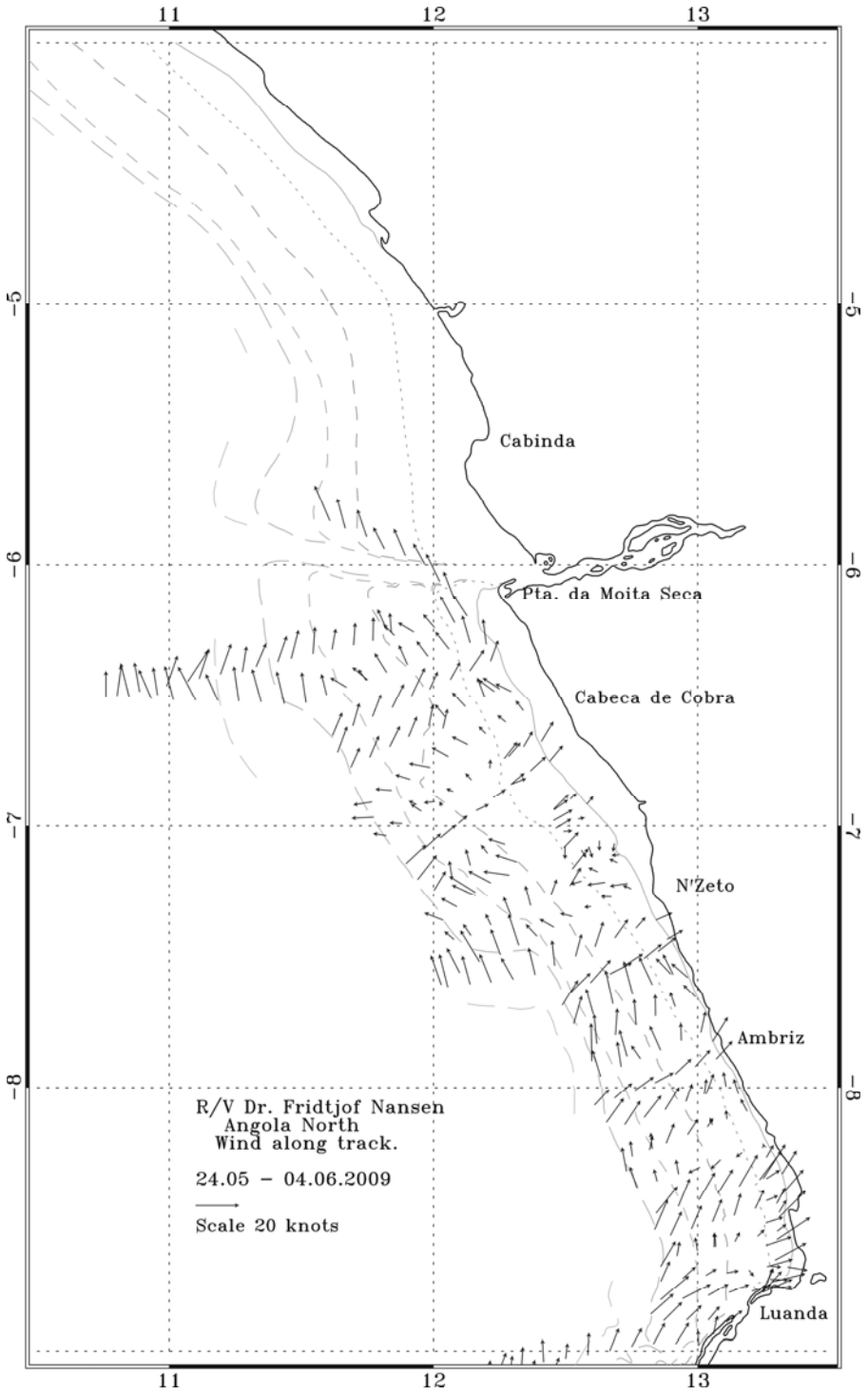


Figure 2a. Distribution of wind velocities along the survey track for the northern region. Depth contours at 20, 50, 100, 200, and 500m.

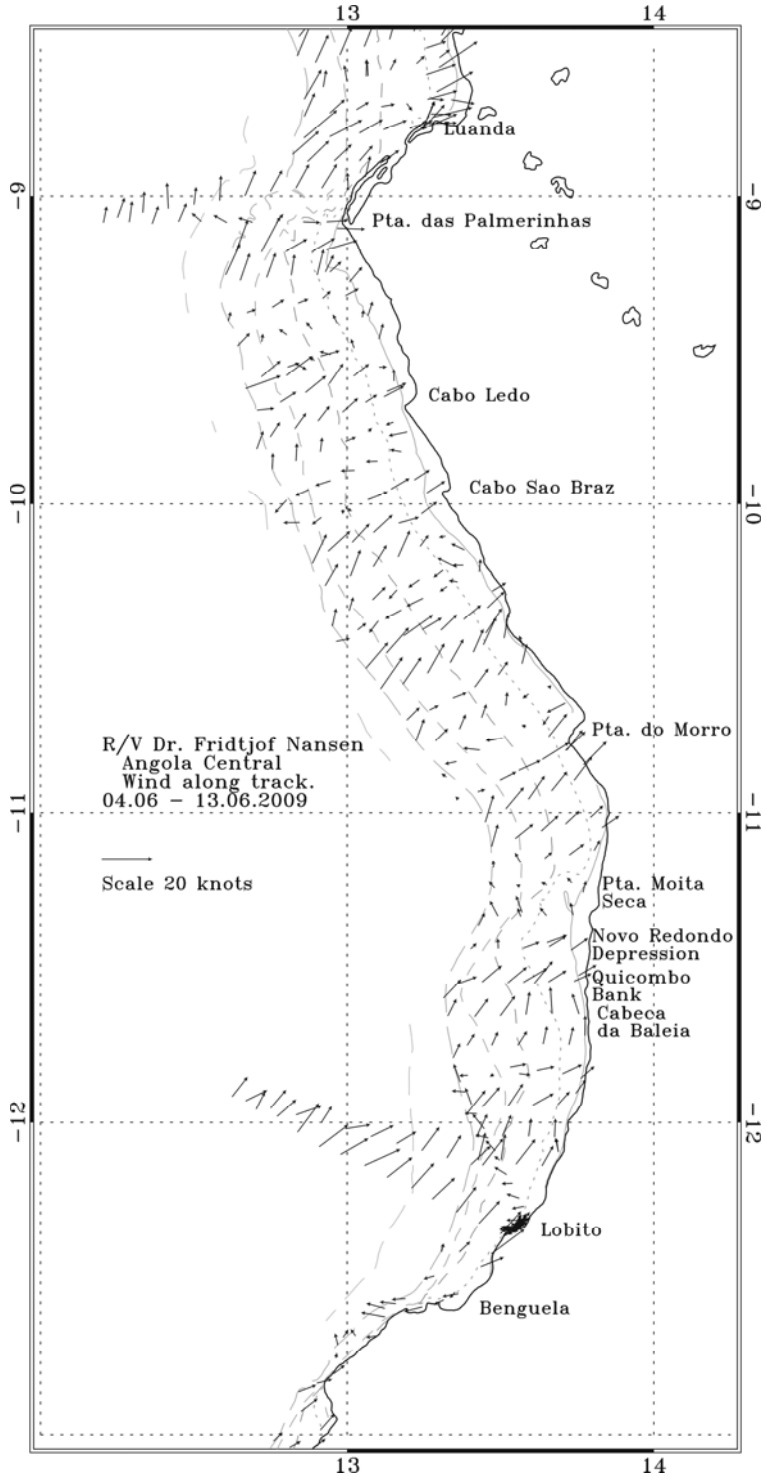


Figure 2b. Distribution of wind velocities along the survey track for the central region. Depth contours at 20, 50, 100, 200, and 500m.

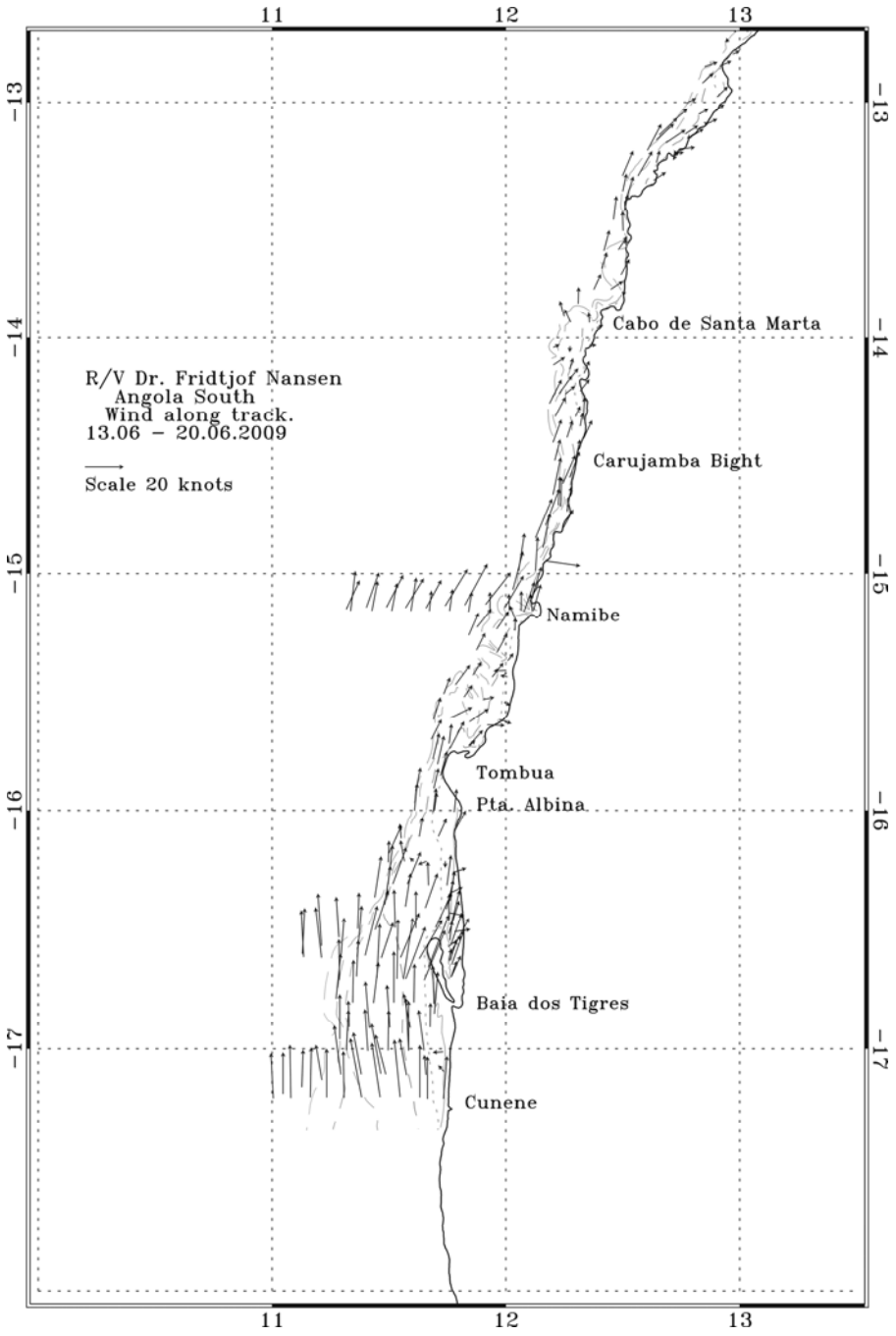


Figure 2c. Distribution of wind velocities along the survey track for the southern region. Depth contours at 10, 20, 50, 100, 200 and 500 m.

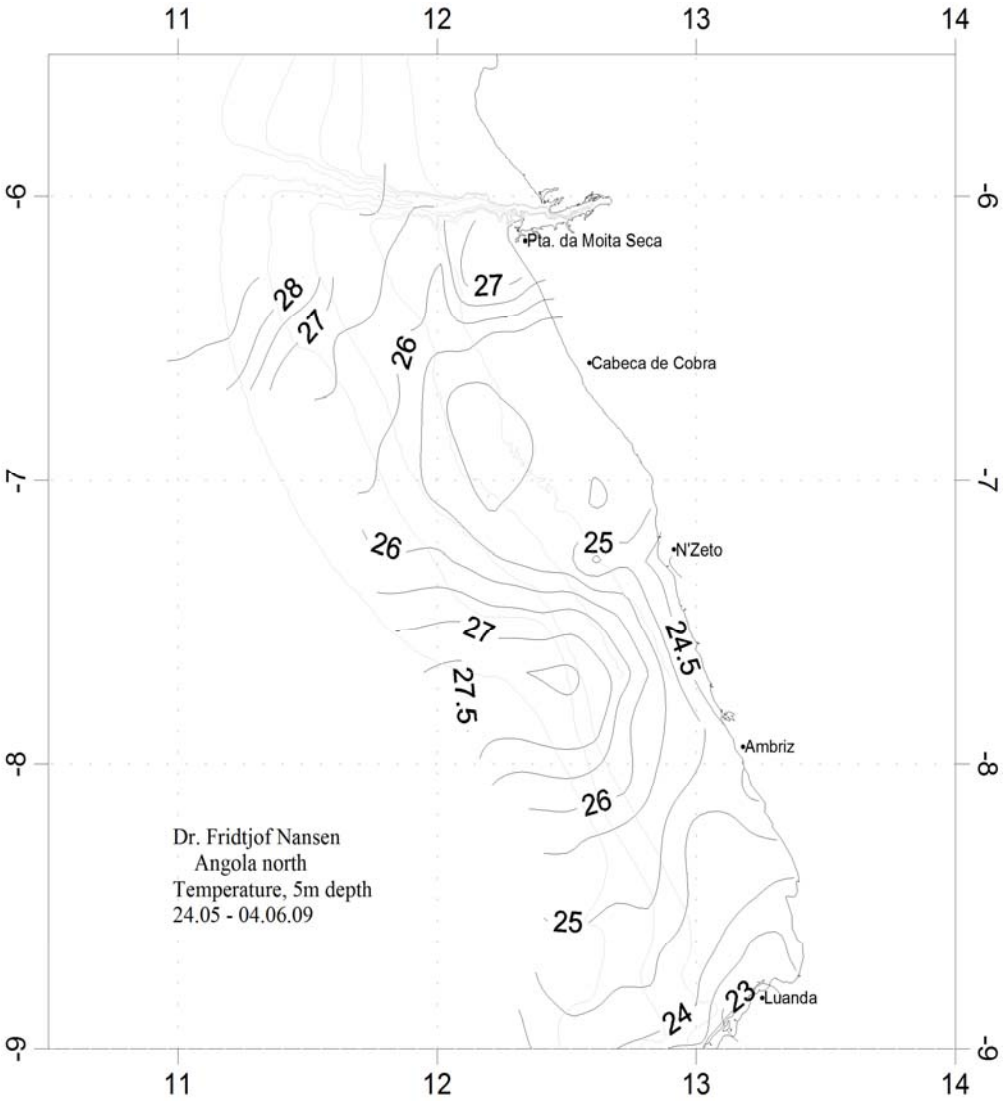


Figure 3a. Distribution of water temperatures at 5m depth in the northern region. Depth contours at 20, 50, 100, 200, and 500m.

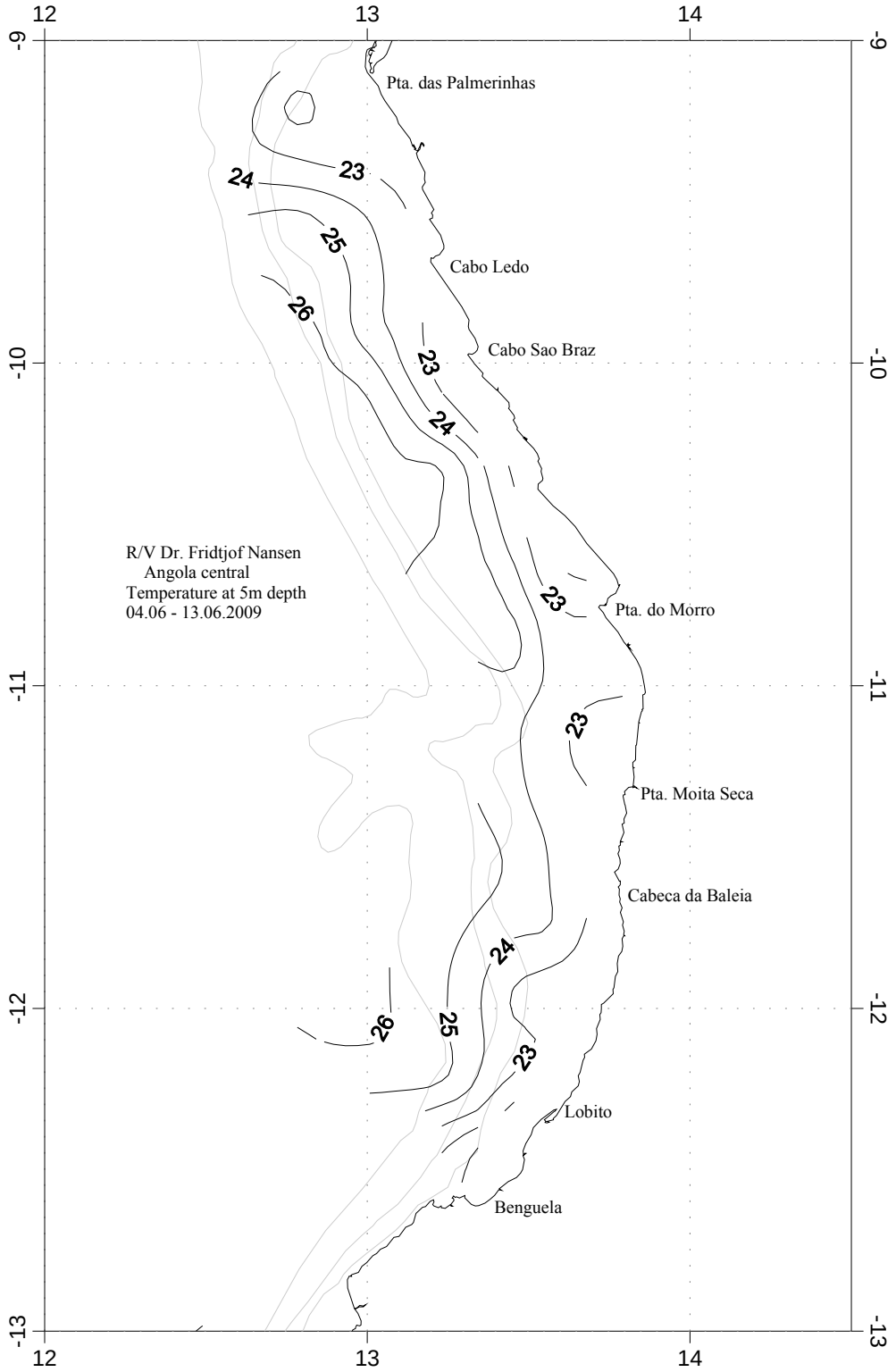


Figure 3b. Distribution of water temperatures at 5m depth in the central region. Depth contours at 20, 50, 100, 200, and 500m.

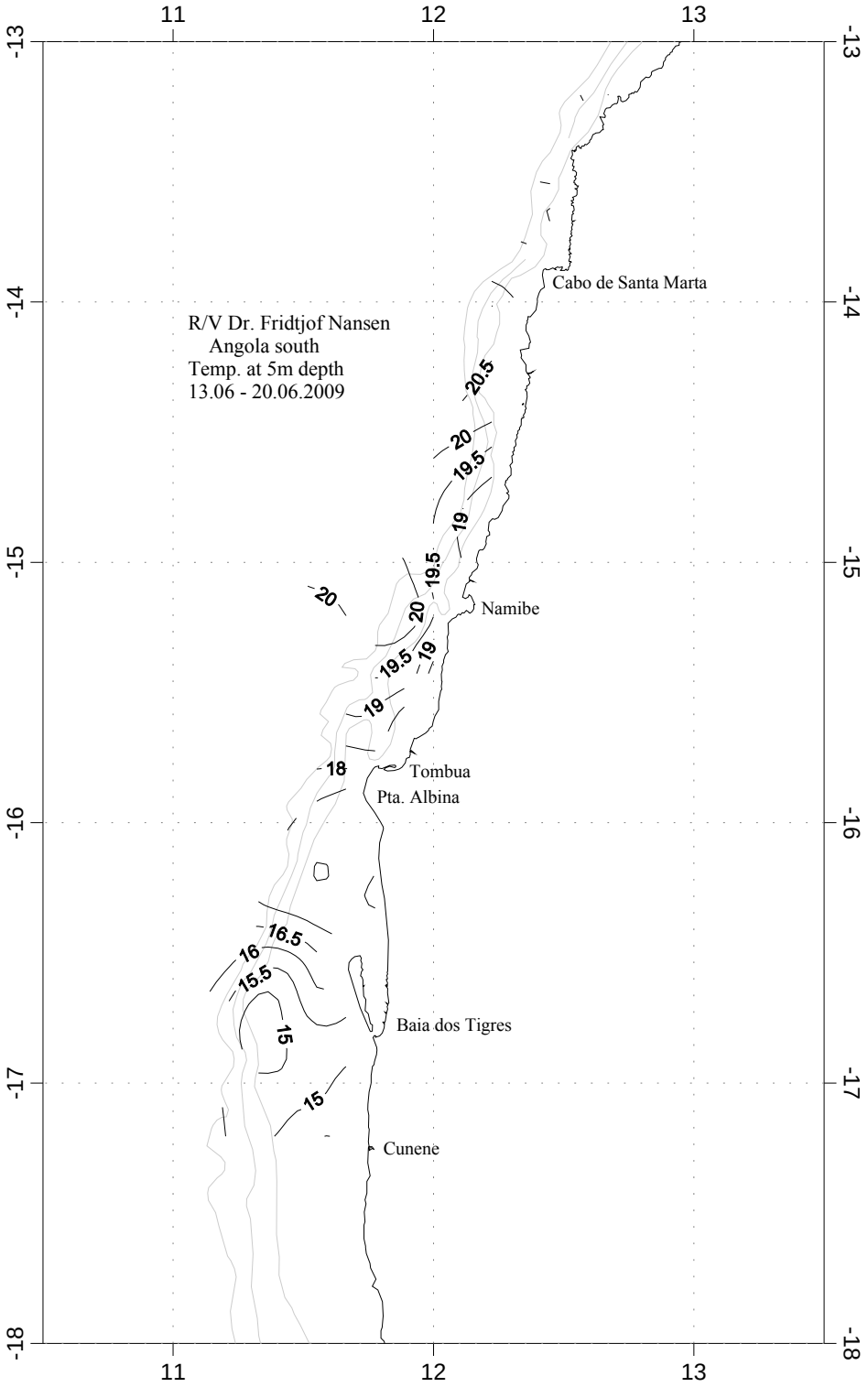


Figure 3c. Distribution of water temperatures at 5m depth in the southern region. Depth contours at 20, 50, 100, 200, and 500m.

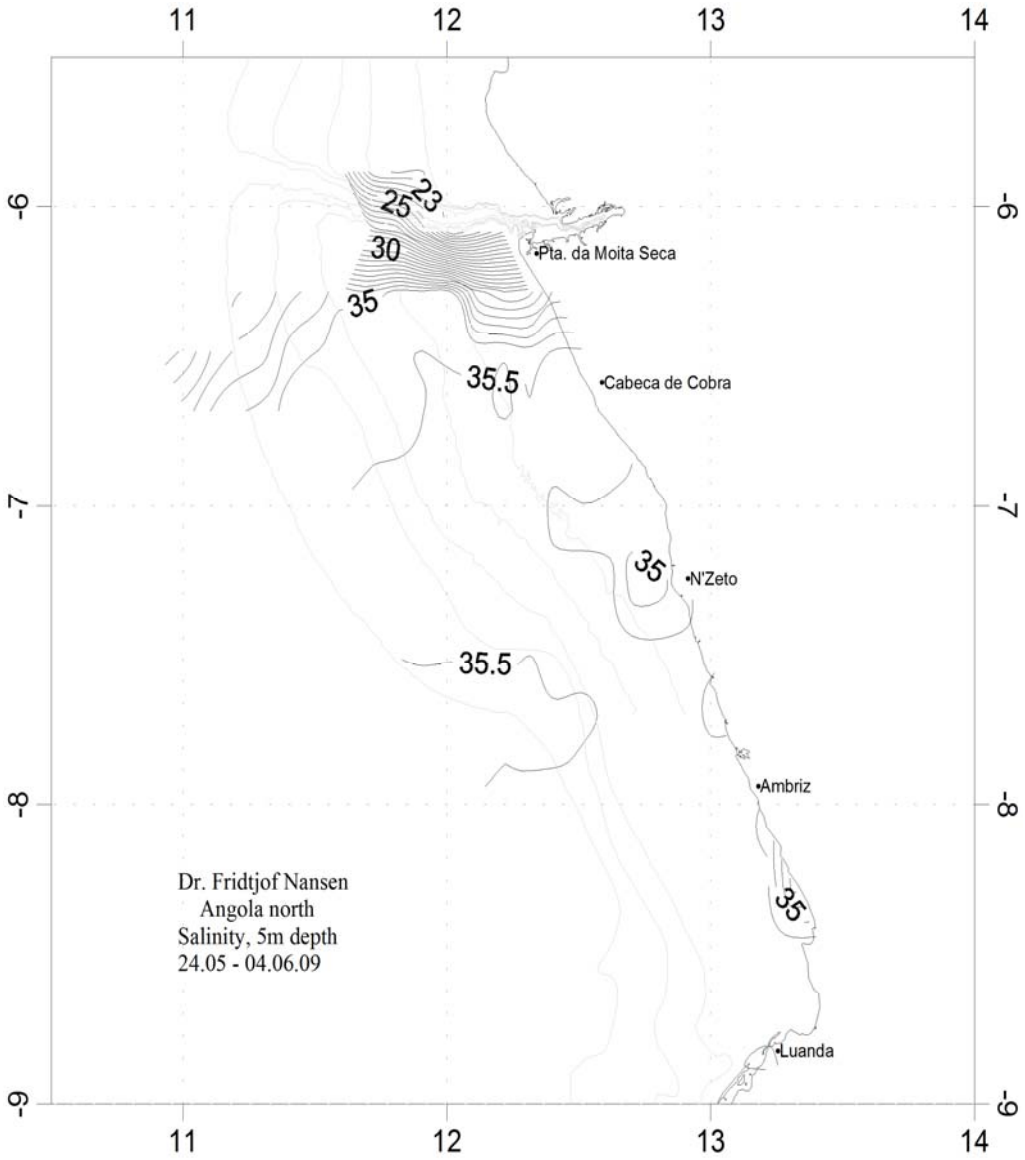


Figure 4a. Distribution of salinity at 5m depth in the northern region. Depth contours at 20, 50, 100, 200, and 500m.

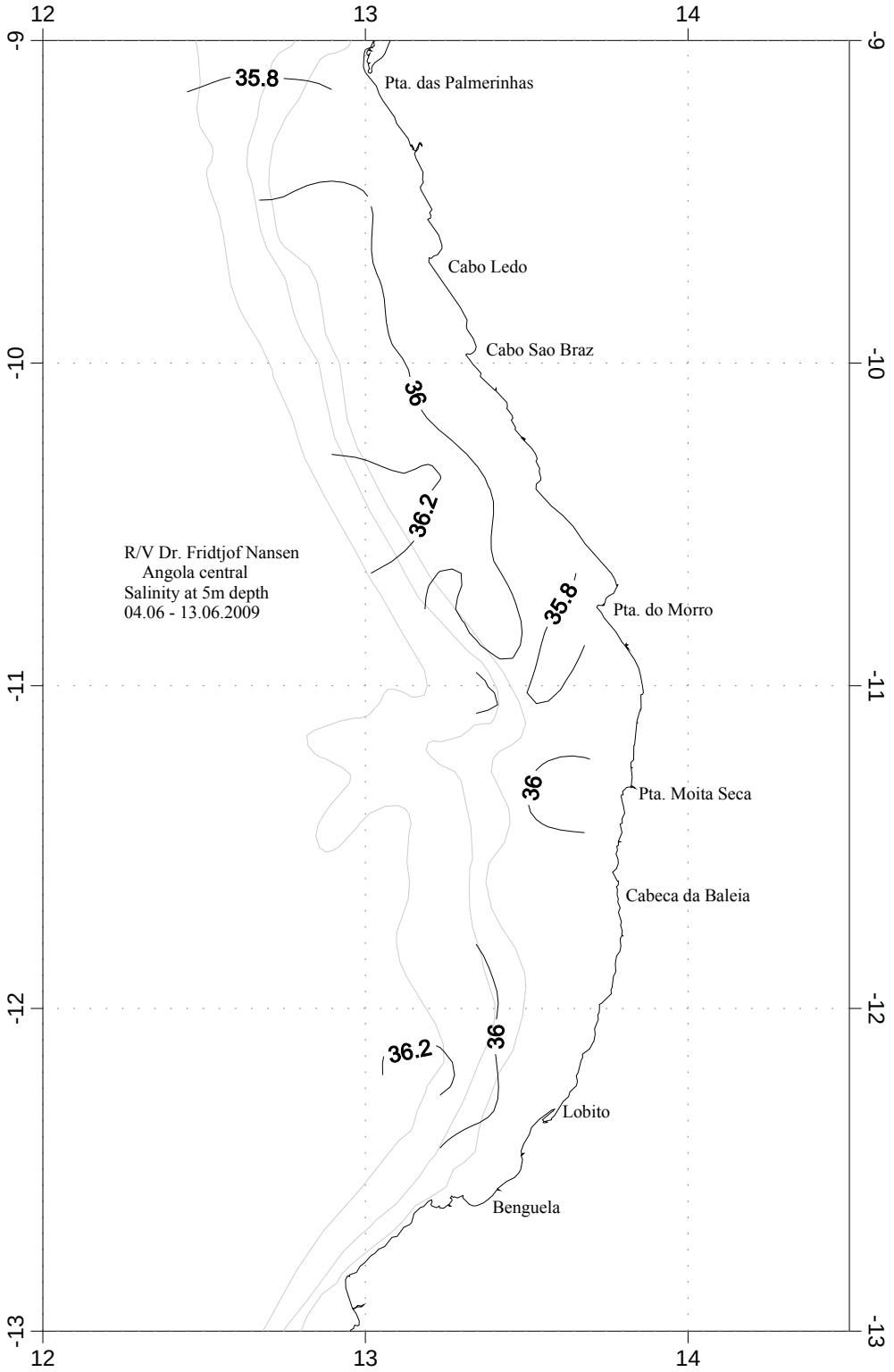


Figure 4b. Distribution of salinity at 5m depth in the central region. Depth contours at 20, 50, 100, 200, and 500m.

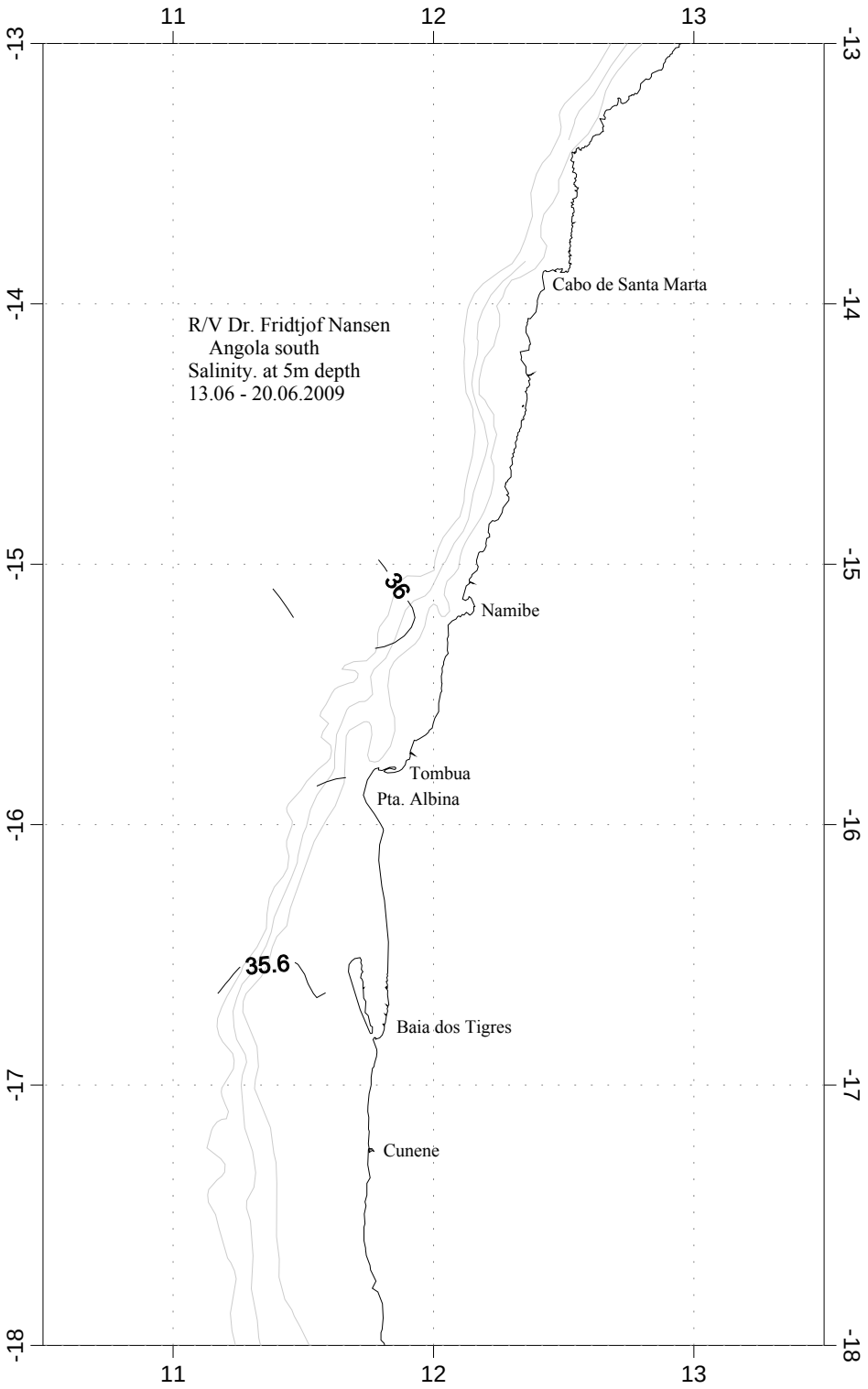


Figure 4c. Distribution of salinity at 5m depth in the southern region. Depth contours at 20, 50, 100, 200, and 500m.

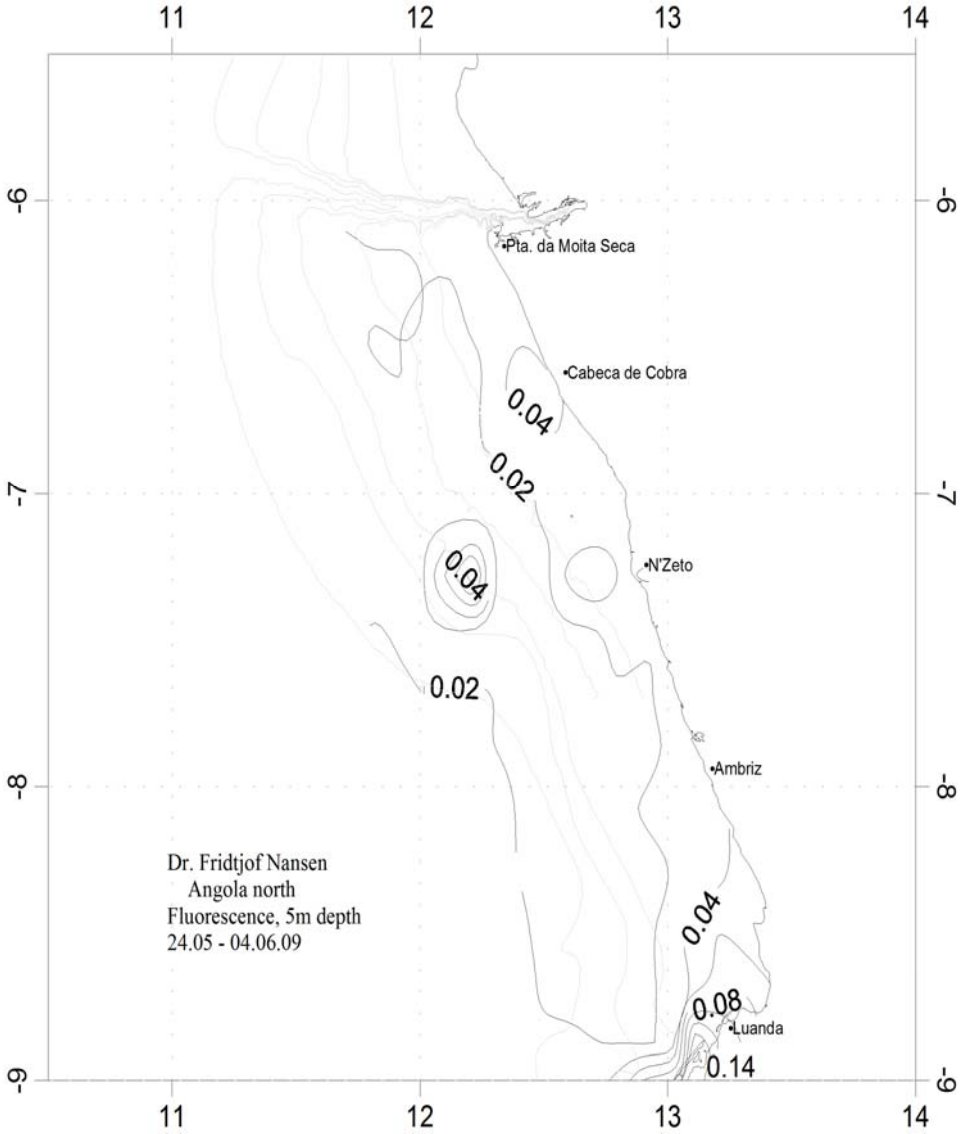


Figure 5a. Distribution of fluorescence at 5m depth in the northern region. Depth contours at 20, 50, 100, 200, and 500m.

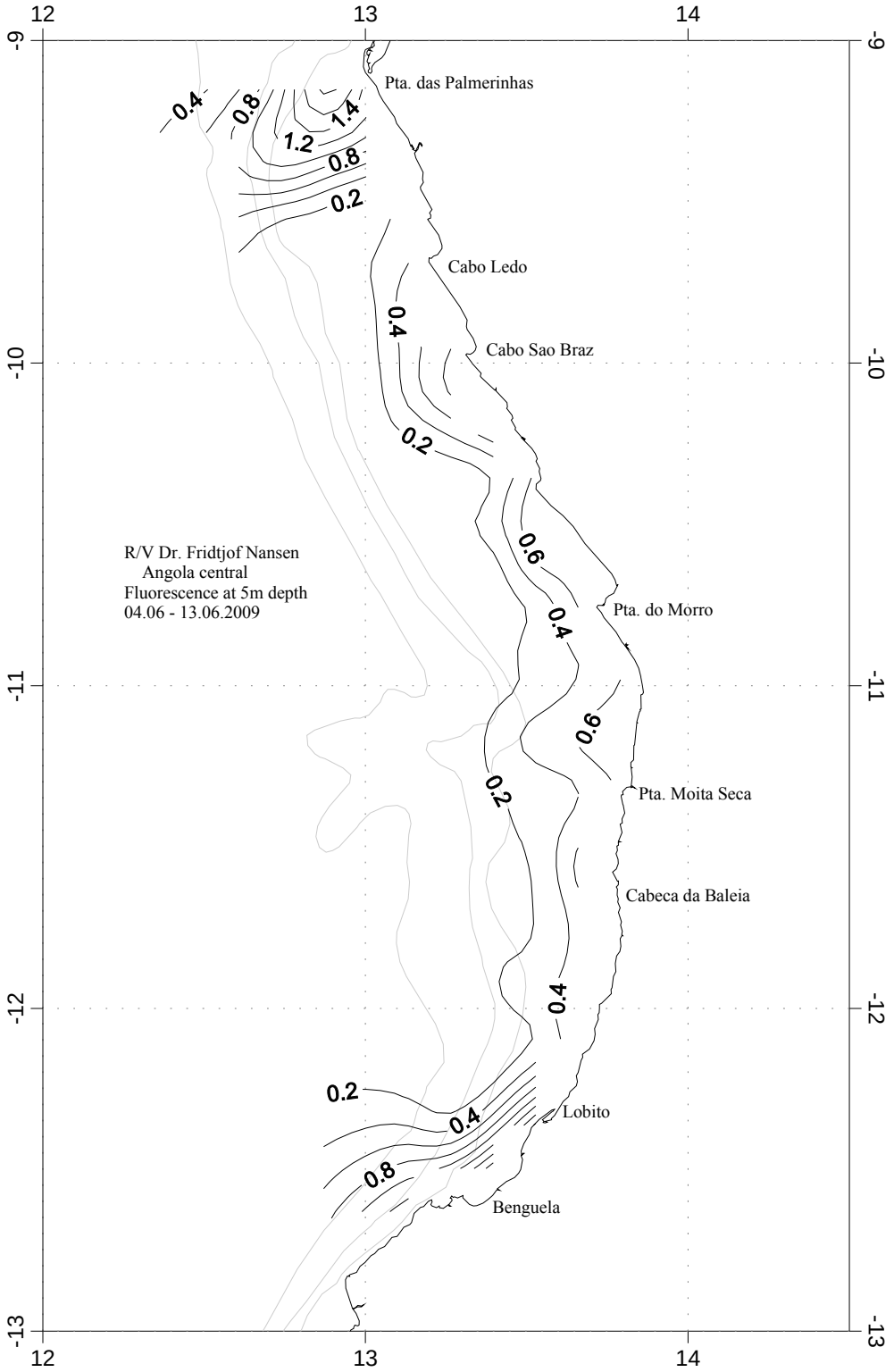


Figure 5b. Distribution of fluorescence at 5m depth in the central region. Depth contours at 20, 50, 100, 200, and 500m.

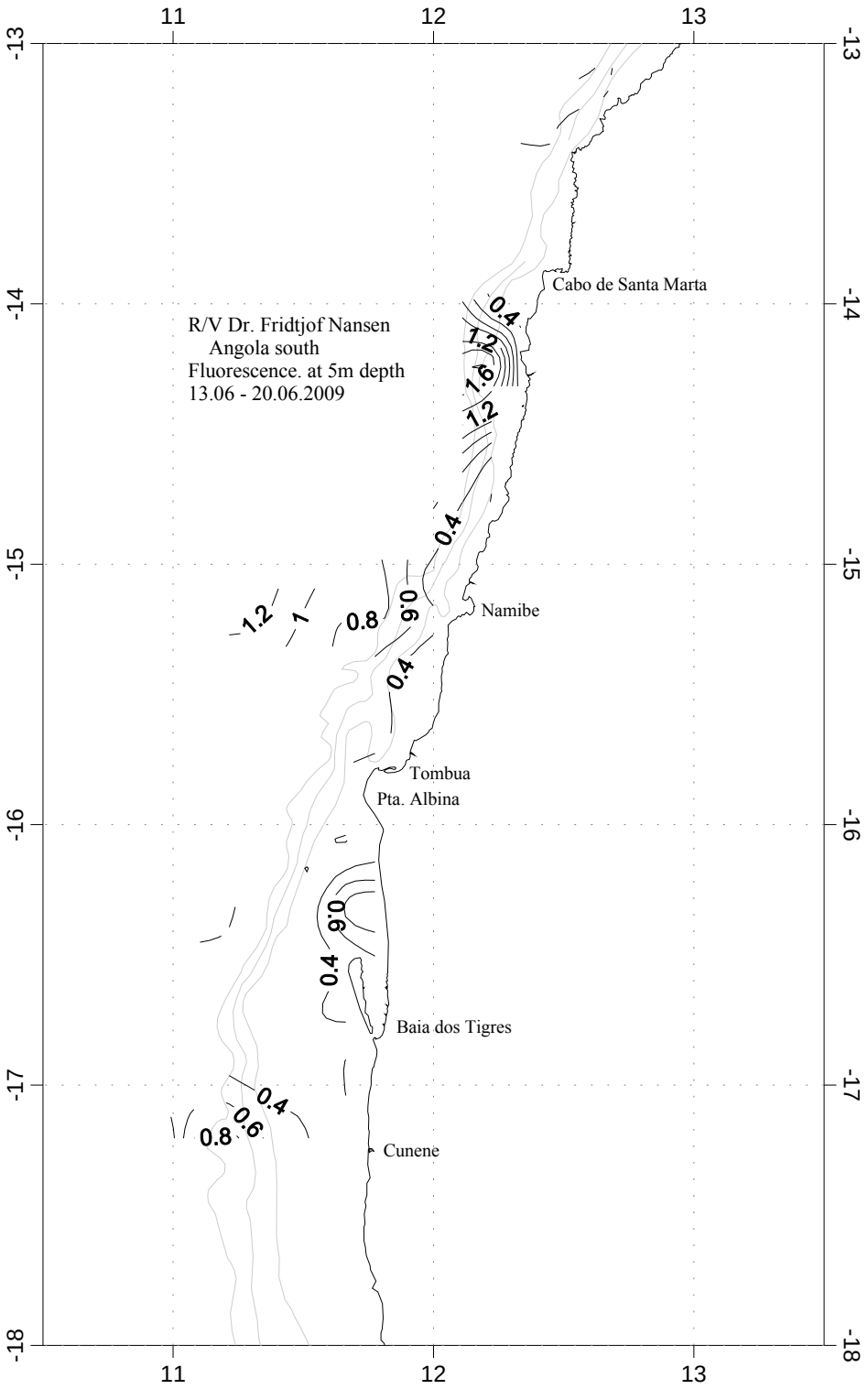


Figure 5c. Distribution of fluorescence at 5m depth in the southern region. Depth contours at 20, 50, 100, 200, and 500m.

3.2 Standard sections

Section off **Moita Seca** (Figure 6a). This section is located off the Congo River's mouth. At end of the May, the river discharge starts reducing due to the transition period i.e. from the rain to the dry season one. At station 508 we can observe less saline water (35.3 psu) while close to the river's mouth salinity content was higher (35.9 psu) probably due to the instability around the river's mouth induced by the discharge. Also is found the oxygen content was high at the surface (3ml/l) from the station 505 onwards. In this section, as in the next, the maximum temperature was found near the surface and decreased with depth.

Sections of **N'zeto** (Figure 6b) and **Ambriz**, (Figure 6c) At station 523 we can observe subsurface water above 100m depth welled up to the surface toward the coast indicating a week upwelling and a higher salinity content (36.0 psu) was found at subsurface layer between stations 518 and 525. From stations 532 and 539 the oxygen content was high at the surface (3ml/) and appears to be less to the one recorded last year almost at the same period time.

Section off **Pta. of Palmerinhas** (Figure 6d). The oxygen distribution was very similar to the previous sections (N´zeto and Ambriz) revealing a minimum (1-0.5ml/l) at about 150-500m. It seems that the oxygen concentrations in these oxygen-minimum layers of this area have decreased comparing to the previous years. At stations 560-554 the salinity distribution shows high values (35.9-36.0 psu) at the surface the same with the previous sections. This can be attributed to the prevailed south-westerly wind around Luanda that pushed high salinity concentrations from the ocean basin toward to coast. The sea surface temperature was slightly lower (22-20ºC) than in previous section.

Section off **Cabo Ledo** (Figure 6e) is located south off Kwanza river's mouth. As in the previous section there is appearance of the high salinity (35.9-36.0psu) and temperature (24-23ºC). At surface layer the oxygen ranged between 3-2.0ml/l. The data indicates an ongoing upwelling process.

Section off **Cabo São Braz** (Figure 6f). The distribution of oceanographic parameters is very similar to the previous section also for the last year. Salinity increased offshore from 36.0 to 36.1 psu. There is sign of a weak upwelling in the section off Cabo São Braz.

Section off **Pta. do Morro** (Figure 6g) reveals the pattern similar to that observed off Cabo São Braz with a 100m homogeneous layer of constant temperatures ranging from 18 to 22ºC. At surface the salinity was in the range of 35.8 to 35.9 psu. Low oxygen content (0.5m/l) was observed in shallow waters.

Section off **Lobito** (Figure 6h) exhibits a relative homogeneity upper 100m with temperatures ranged from 18ºC to 25ºC. Near shore a temperature of 23ºC was observed with offshore surface water temperature reaching 25ºC. Near shore salinities of about 35.7 psu was observed and 36 psu offshore, vertically the salinity waters decreased sharply reaching value of 34.9 psu at about 400m depth- The presence of low salinity can be attributed to outflows of the Catumbela River and level of oxygen of 3 ml/l, was registered at the surface. There were no signs of upwelling.

Section off **Santa Marta** (Figure 6i). At surface there is appearance of the high salinity (35.9 psu) and the water temperature reached 19ºC. Level of oxygen of 3 ml/l was registered at the surface, vertically decreased to a minimum of 0.5ml/l at about 200 m depth.

Section off **Namibe** (Figure 6j). The surface temperature (18-20ºC) shows lower values than in the previous sections and gets cooler towards the coast. The layer of lower oxygen (0.5ml/l) was found offshore at around 300-450m. The maximum surface salinity near the coast (35.9 psu) was found in this section.

Sections off **Pta. Albina** (Figure 6l), **Baía dos Tigres** (Figure 6m) and **Cunene River** (Figure 6n) are located in the southern region from where we have observed low surface temperatures with values down to 14°C in the Cunene section near the shore. The influence of Cunene River is shown in the surface salinity values (35.5 - 35.4 psu). Oxygen content of 2ml/l prevailed at the surface layer while low oxygen values appeared below the 100-150m off Pta Albina, Baía dos Tigres and Cunene.

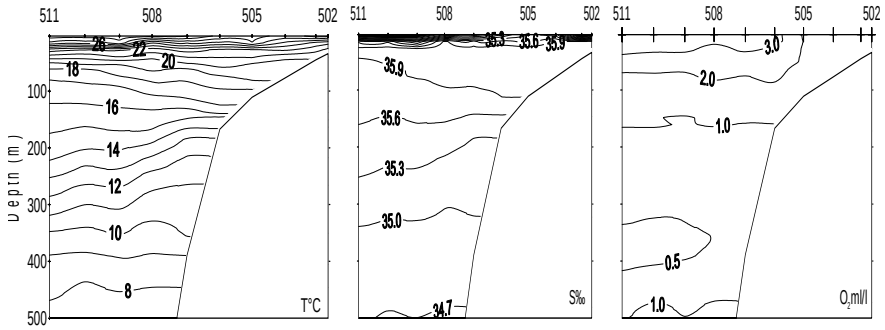


Figure 6a. Vertical sections of temperature, salinity and oxygen off Pta. da Moita Seca, Congo River.

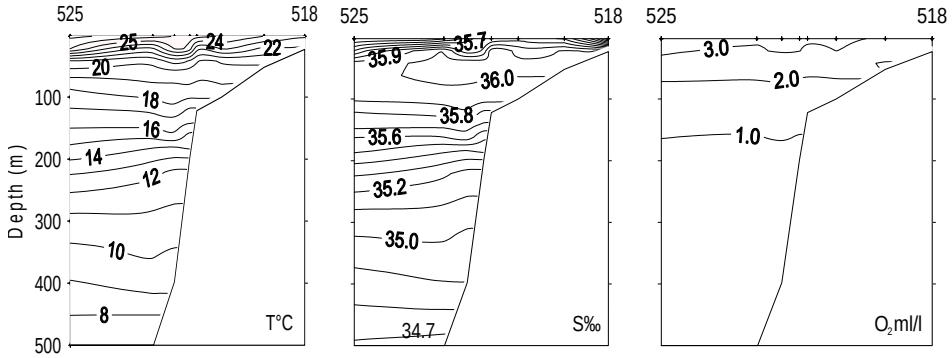


Figure 6b. Vertical sections of temperature, salinity and oxygen off N'zeto.

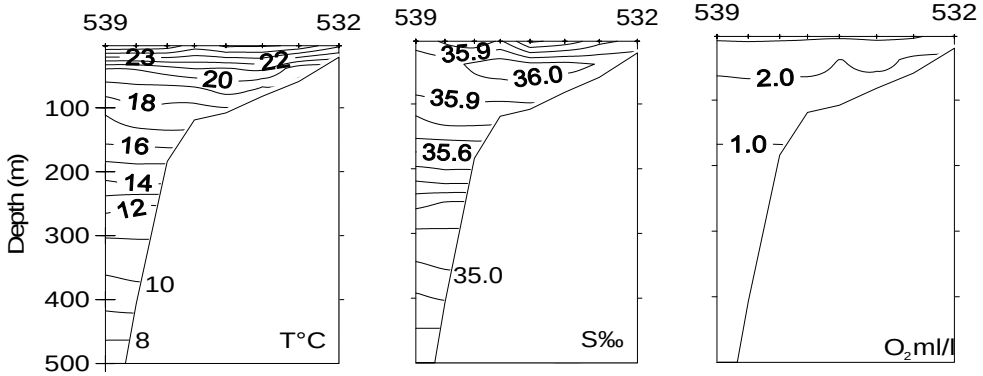


Figure 6c. Vertical sections of temperature, salinity and oxygen off Ambriz.

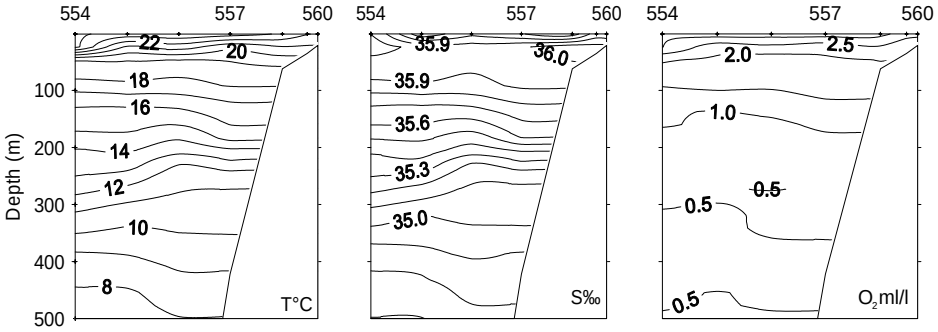


Figure 6d. Vertical sections of temperature, salinity and oxygen off Pta. Palmerinhas.

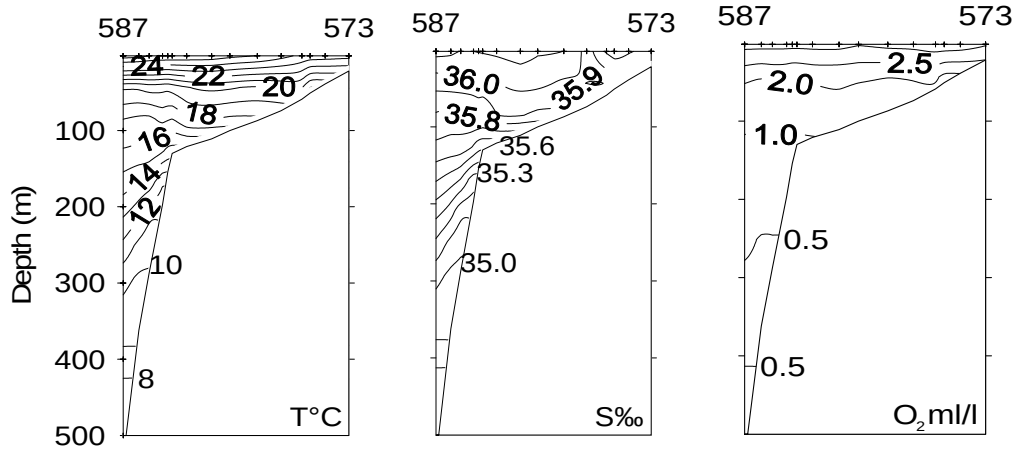


Figure 6e. Vertical sections of temperature, salinity and oxygen off Cabo Ledo.

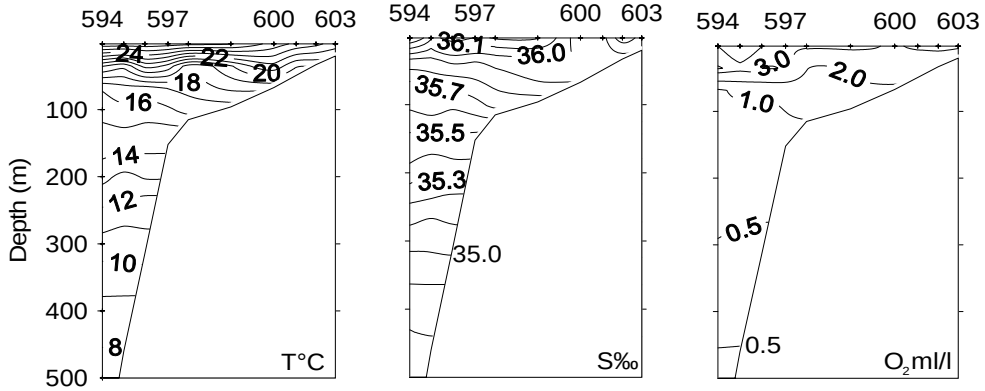


Figure 6f. Vertical sections of temperature, salinity and oxygen off south Cabo São Braz.

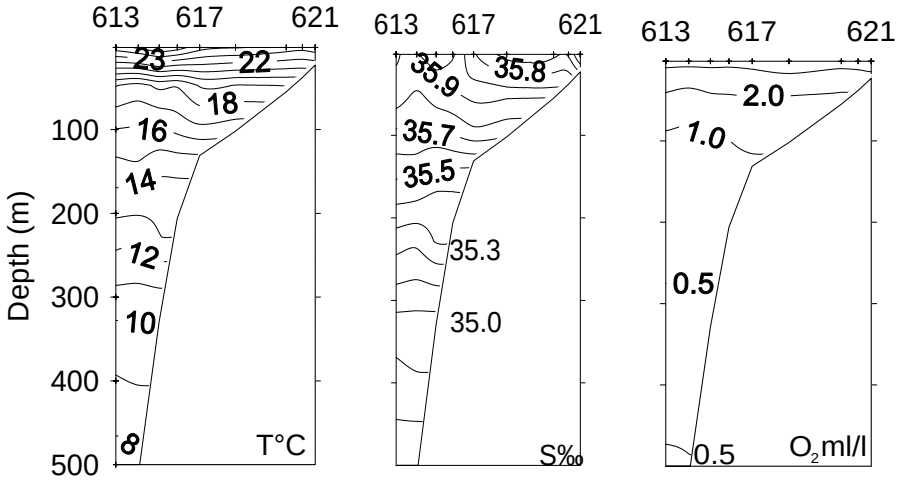


Figure 6g. Vertical sections of temperature salinity and oxygen off Pta. do Morro.

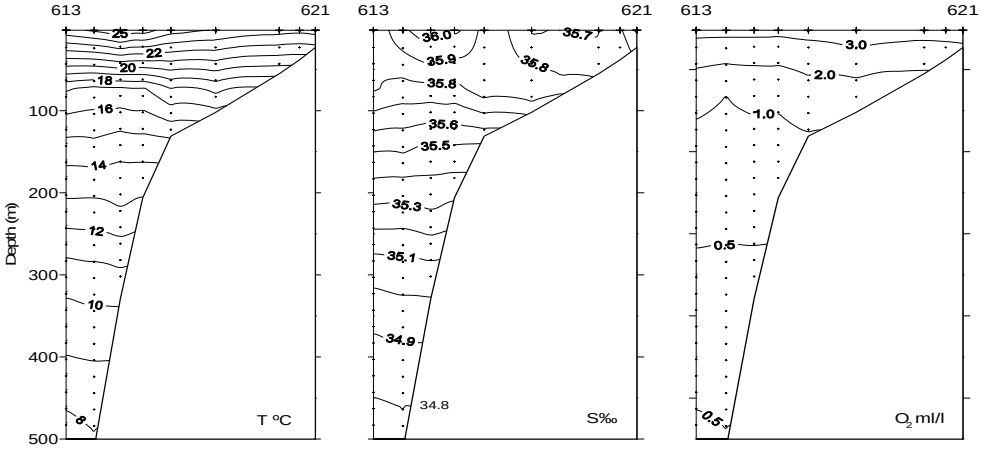


Figure 6h. Vertical sections of temperature salinity and oxygen off Lobito.

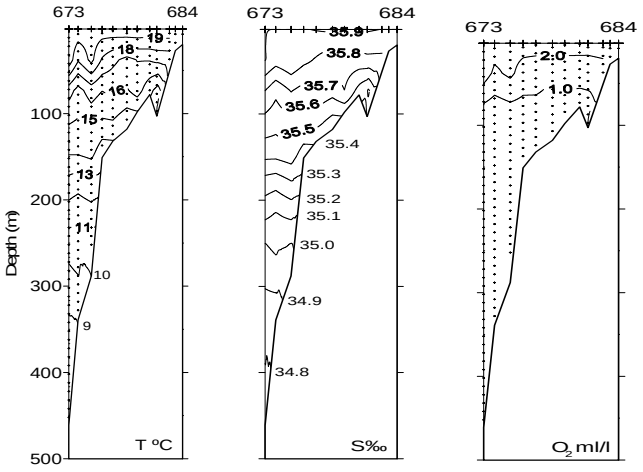


Figure 6i. Vertical sections of temperature salinity and oxygen off Santa Marta.

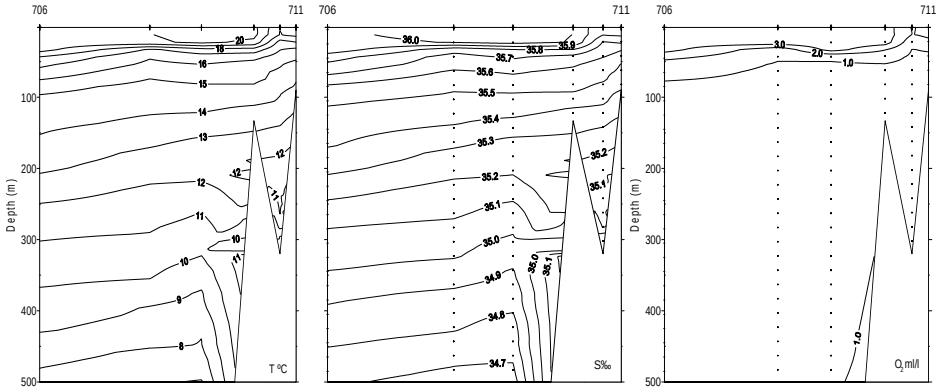


Figure 6J . Vertical sections of temperature salinity and oxygen off Namibe.

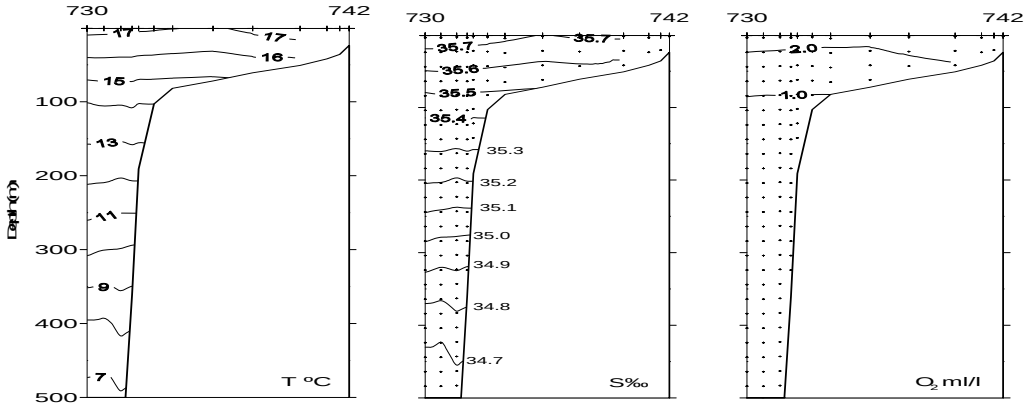


Figure 6l Vertical sections of temperature salinity and oxygen south off Pta. Albina.

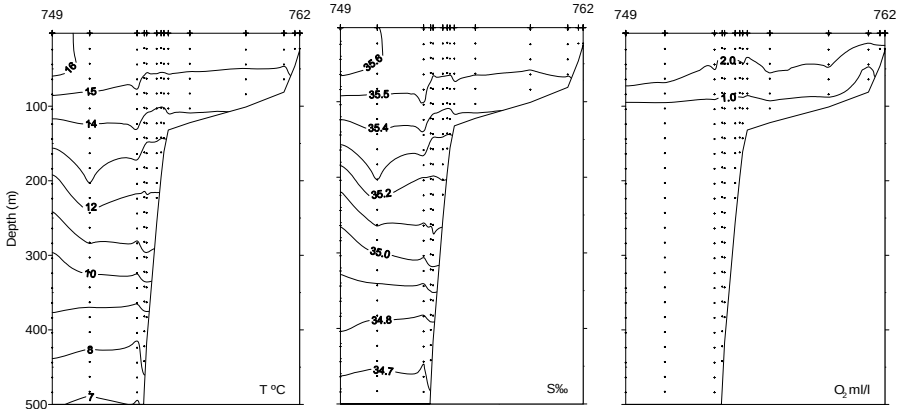


Figure 6m. Vertical sections of temperature salinity and oxygen off Baía dos Tigres

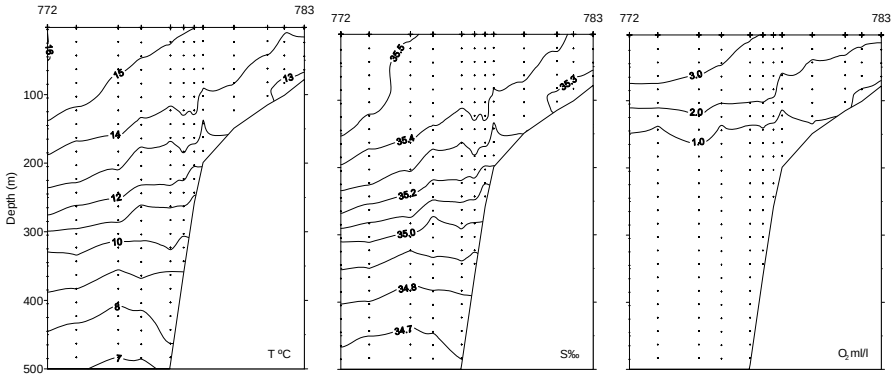


Figure 6n. Vertical sections of temperature salinity and oxygen off Cunene River.

CHAPTER 4 DISTRIBUTION, SIZE COMPOSITION AND BIOMASS ESTIMATES

4.1 Congo River-Pta. Palmerinhas

Sardinella

Sardinella was continuously distributed from north of Cabeça da Cobra to Luanda (Figure 7) showing low densities offshore ($0<s_A<300$ m^2/NM^2). The highest densities ($3\ 001<s_A<10\ 000$ m^2/NM^2) were found at north of Nzeto and inshore south of Ambriz.

Figure 8 shows the length distribution of the sardinella in the northern region. The size distribution of *S. maderensis* showed three modal peaks around 6, 16 and 24 cm (Figure 8 a). *S. aurita* showed a bimodal distribution peaking at 15 and 29 cm (Figure 8 b). The last cohort dominates the distribution.

The estimated biomass for this region was 206 000 tons, which is around 10% higher than the biomass estimated in 2008 (186 000 tons). S. *maderensis* dominated the total biomass, contributing around 84% (174 000 tonnes) and S. *aurita* 16 % (32 000 tonnes).

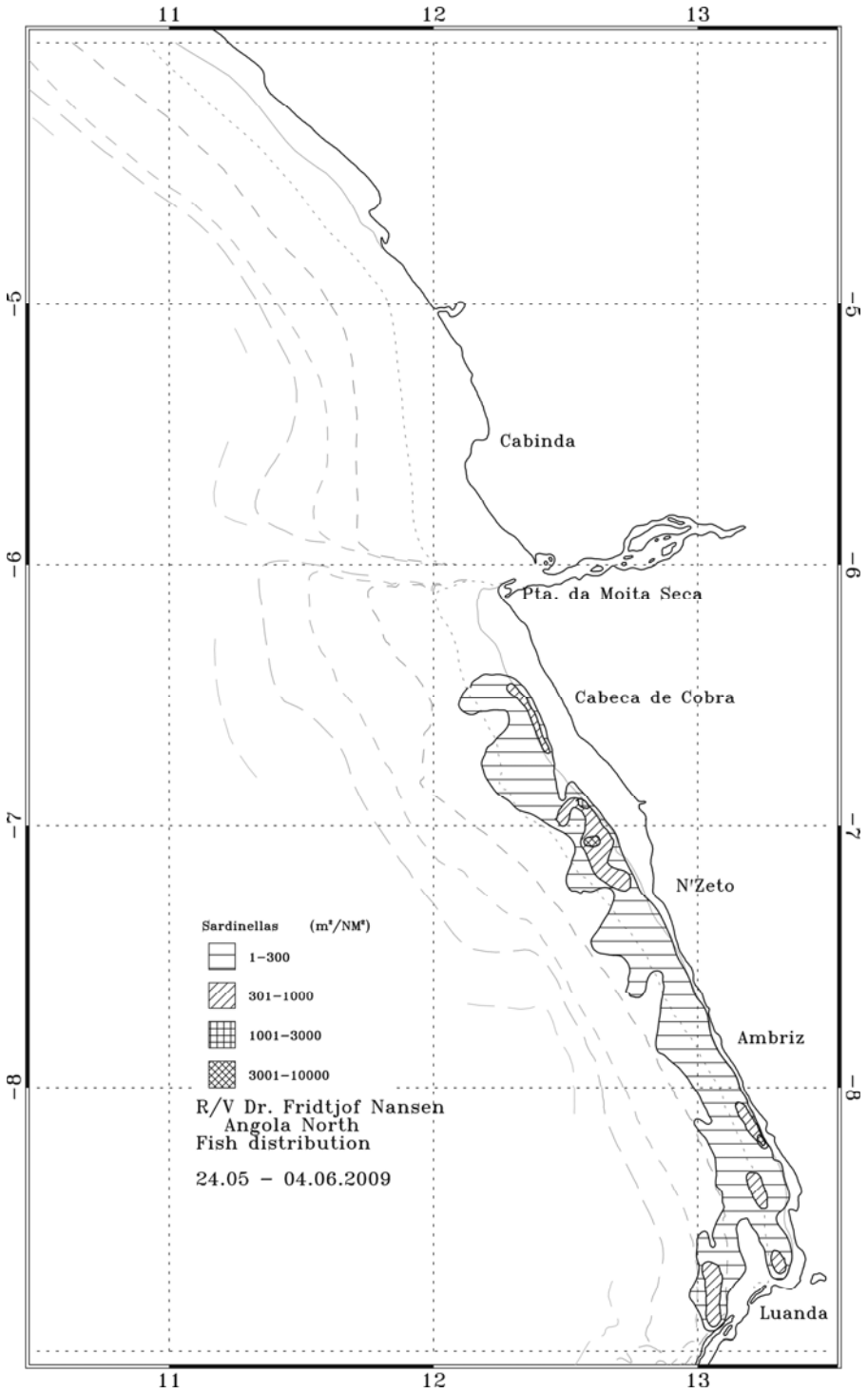
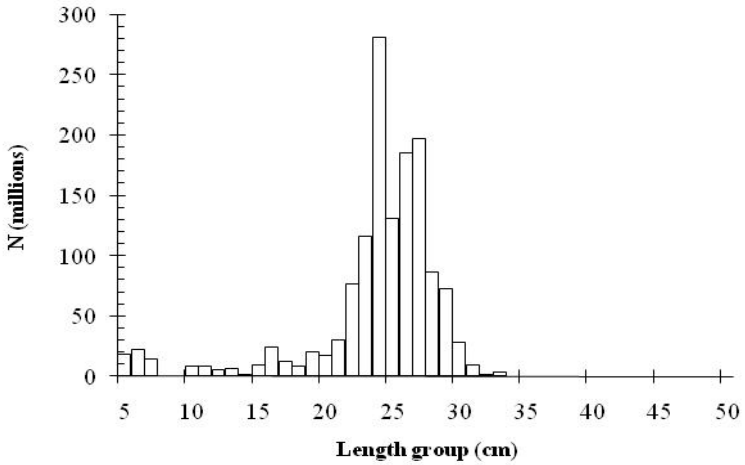


Figure 7. Distribution of *Sardinella* spp. Pta. das Palmerinhas-Congo River. Depth contours at 20, 50, 100, 200, and 500m.

a) *Sardinella maderensis*



b) *Sardinella aurita*

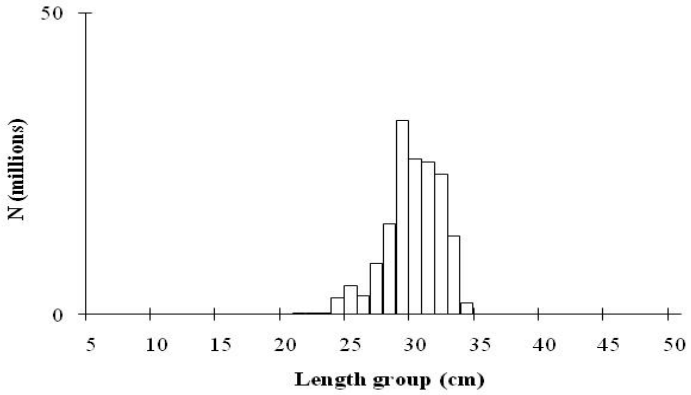


Figure 8. Total length distribution of *Sardinella maderensis* (a) and *S. aurita* (b), Pta. das Palmerinhas-Congo River.

Horse mackerel

Cunene horse mackerel, *T. trecae,* was found in five low-density areas, offshore of Pta. da Moita Seca, south of Cabeca da Cobra, Nzeto, Ambriz and inshore of Pta das Palmerinhas ($1< s_A<300$ m^2/NM^2) Figure 9.

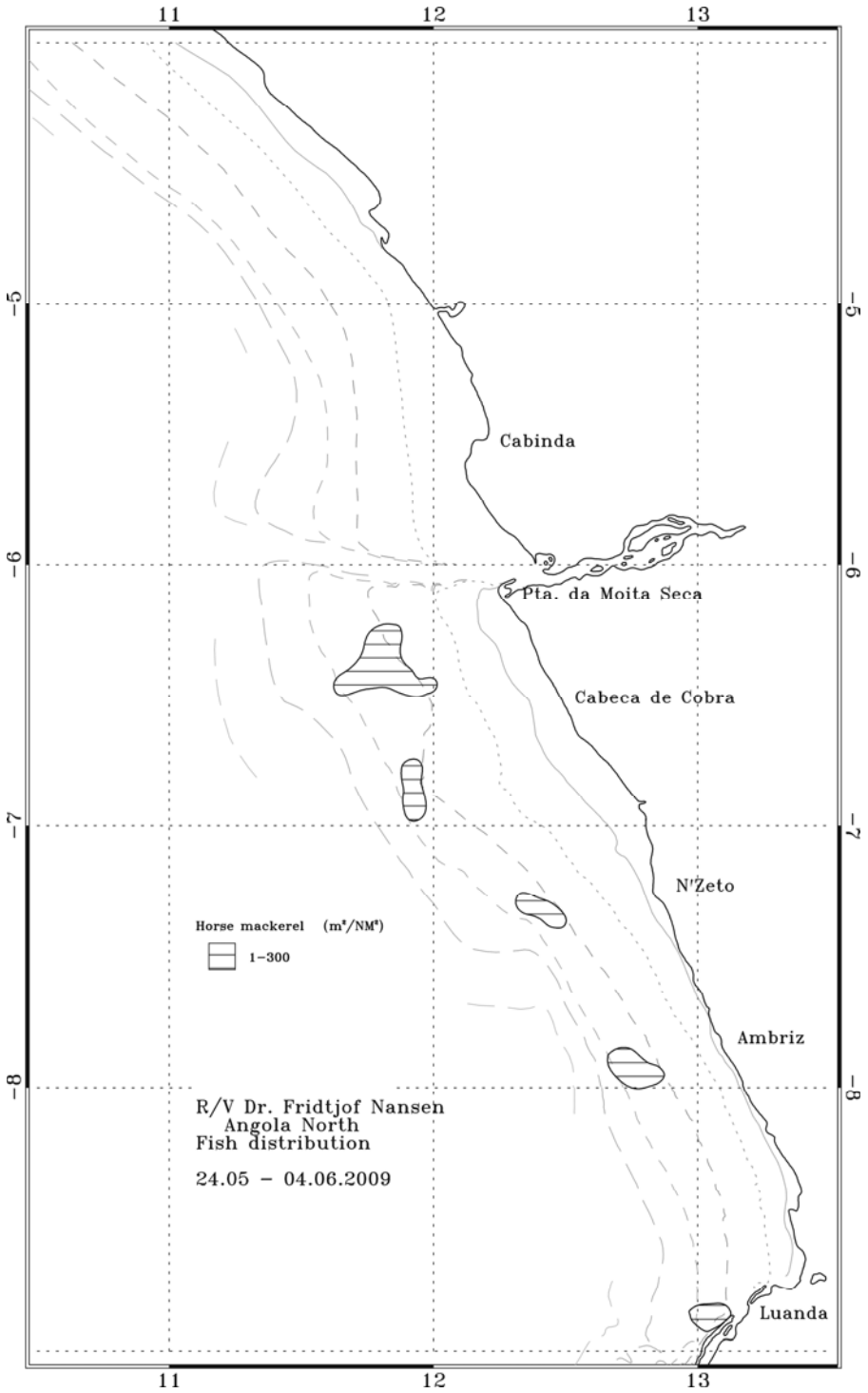


Figure 9. Distribution of Cunene horse mackerel (*Trachurus trecae*), Pta. das Palmerinhas-Congo River. Depth contours at 20,50,100, and 500m.

The size distribution of Cunene horse mackerel showed three clear cohorts, peaking at 15, 24 and 34 cm (Figure 10).The length distribution was dominated by fish smaller than 16 cm. Fish bigger than 30 cm were found at depths stratum less than 100 m (Figure 11).

The acoustic densities were also low to yield a valid biomass estimate for Cunene horse mackerel the same was observed in 2008. This fact, combined with reduction on size structure of Cunene horse mackerel population size in this region should be taken as a clear indication that the stock is at critical level.

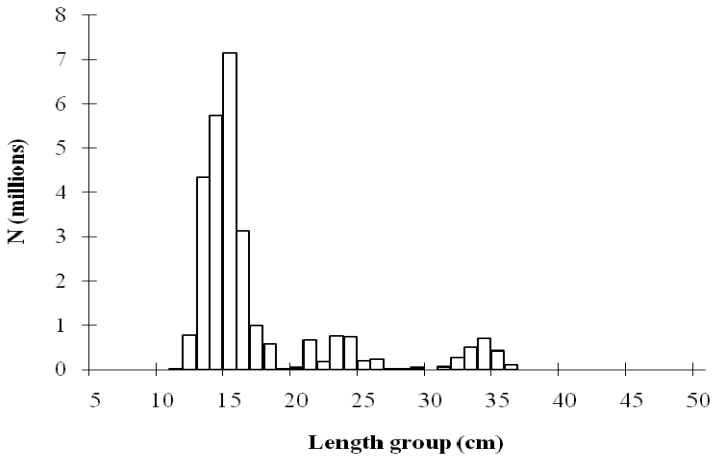


Figure 10. Total length frequency distribution of Cunene horse mackerel, Pta. das Palmerinhas- Congo River

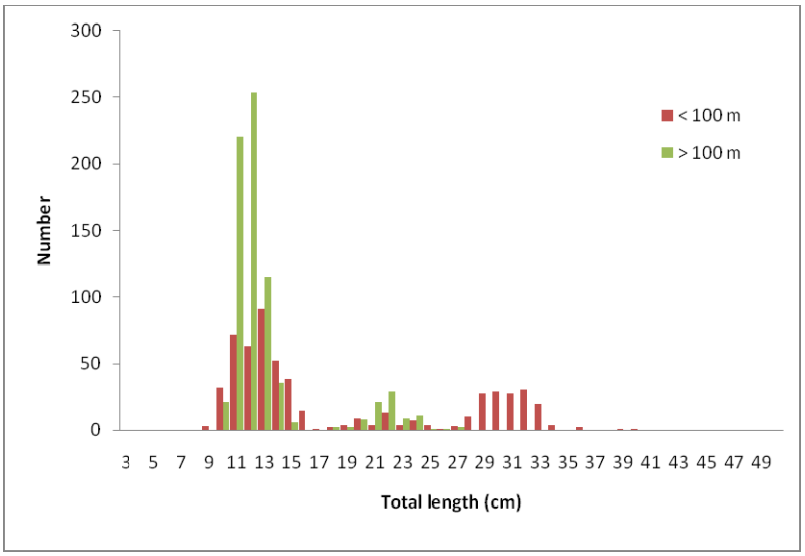


Figure 11. Length distribution of Cunene horse mackerel (*Trachurus trecae*) by depths stratum, Pta. das Palmerinhas-Congo River (depths >100 and <100 m)

Pelagic species Group 1

This group was not abundant enough to estimate the biomass in the region.

Pelagic species Group 2

This group was continuously distributed from south of Congo River to Pta. das Palmerinhas in low densities ($1<s_A<300$ m^2/NM^2) (Figure 12). The dominant species belongs to the Carangids group (Table 4) with *Caranx Chrysururus* being the dominating specie. The biomass was estimated at 24 000 tons, lower than the previous year's biomass (48 000 tons).

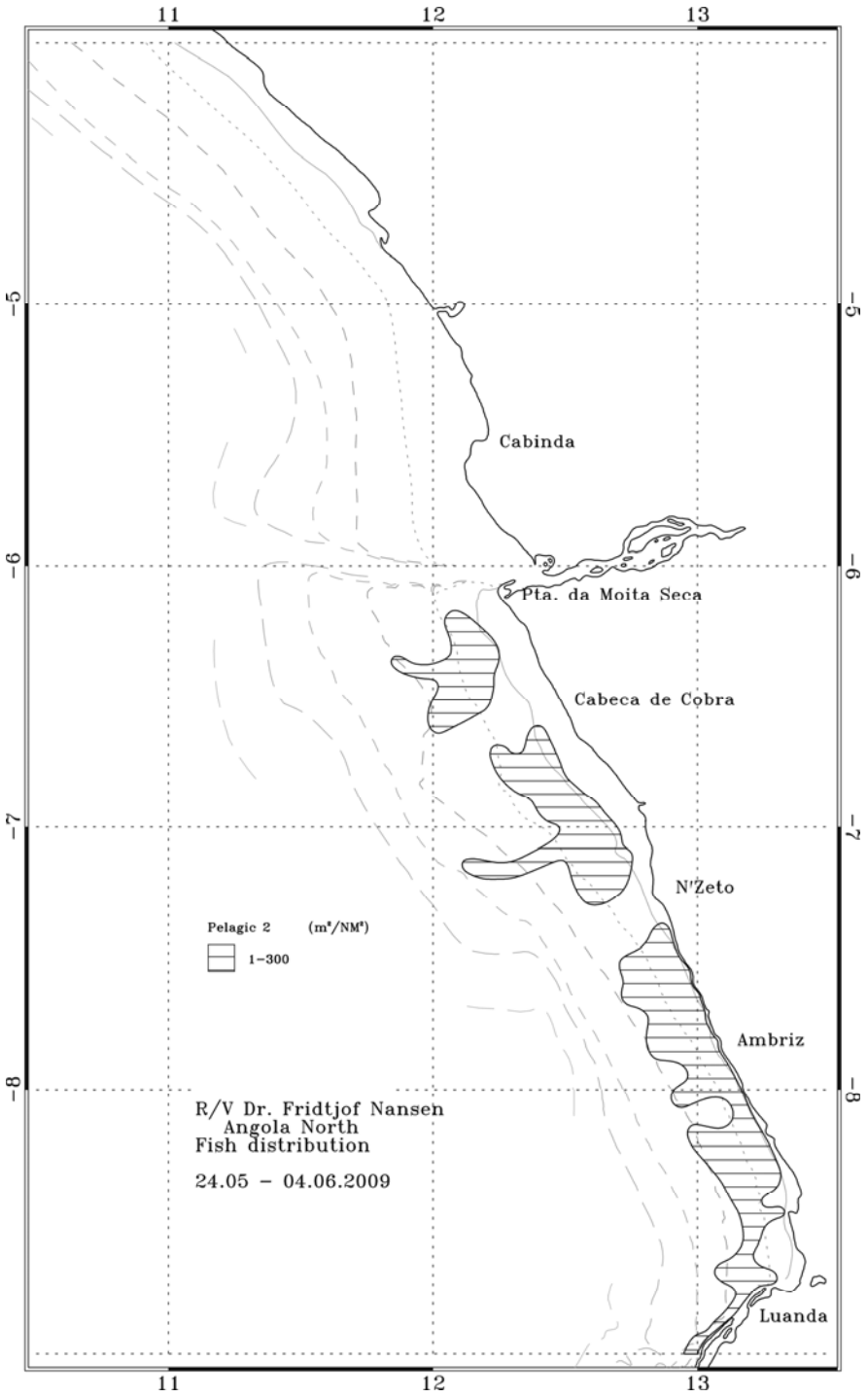


Figure 12. Distribution of Pelagic 2, Pta. das Palmerinhas-Congo River. Depth contours at 20, 50, 100, 200 and 500m.

Table 4. Catch rates (kg/h) of the main groups of pelagic fish, Pta das Palmerinhas-Congo River.

Station	Gear depth	Barracuda	Carangids	Clupeoids	Hairtails	Scombrids	Other	Total
1	93.5		6.8				107.6	114.4
2	124.5		363.4		3.3		169.5	536.2
3	25.0	29.4	201	28.5	3.4		182	444.4
4	10.0		10.9		7.7		1	19.6
5	35.0	1.6			1.6		49.6	52.7
6	10.0		3.6		43.3		5.2	52.1
7	10.0	8.8	1	507.9		4.8	87.6	610.2
8	102.5		7		1.3		49.6	57.9
9	10.0			2.8		3		5.8
10	22.5		5	222.7			1.6	229.2
11	0.0		0.8					0.8
12	0.0		0.7				1.2	1.9
13	28.5						0.1	0.1
14	10.0		3326.2	512.3		5.6		3844
15	5.0	21.4	2776.4	1005.4			4.7	3807.9
16	16.0		13.1	472.2		1.8	150.5	637.5
17	0.0	65.6	100.8	143.2	19.2	11.3	194.1	534.1
18	5.0				121.7	10.5	4.2	136.5
19	16.0	28.9	29.5	175.8	8		65.8	308.1
20	117.5		48.8		57		181.2	287.1
21	5.0	45.7	15.8	207	114.7	234.7	1672.8	2290.7
22	5.0	14.9	7	22.9	63		118.2	226
23	45.5		48.9		61.3	6.3	15.5	131.9
24	29.0				117.1		35.2	152.4
25	28.5	13.8	42.3	38.9	18.4		1380.8	1494.2
26	10.0	119	127.7	399.1	25.4		416.4	1087.6
27	2.5	4.4	45.8	29.3	35.5	3.6	485.1	603.7
28	10.0	13.3	15.3	74.1	16.5	1.3	132.2	252.6
29	17.5							
30	0.0		34.7	451.3	58.4	2.3		546.8
31	5.0	11.7	91.1	381.2	102	2.4	23.9	612.3
32	2.5			290.6		11.2		301.7
Mean	25.8	12.2	236.2	150.8	28.4	9.3	178.6	615.4
Std dev	34.9	25.1	758.5	238.8	39.4	42	380.4	986.8
%Catch		2.0	38.4	24.5	4.6	1.5	29.0	

4.2 Pta. das Palmerinhas - Benguela

Sardinella

The sardinella distribution in this region was at low ($1<s_A<300$ m^2/NM^2) and medium densities ($301<s_A<1000$ m^2/NM^2) (Figure 13). High-density patches ($s_A>1000$ m^2/NM^2) were found offshore south of Pta do Morro and inshore south of Cabeça da Baleia, and Benguela. Sardinella was usually observed in the upper water layers, schooling near the surface during daytime and caught during night when forming loose aggregations.

The length distribution of *S. maderensis* showed two clear cohorts, peaking at 11 and 30cm. Individuals <15cm were found in shallow waters (Figure 14 a). The distribution of *S. aurita* was different from the previous surveys that the length distribution was dominated by the adult population. This year the length distribution of this species showed two clear modal peaks at 15 and 29cm, being the juvenile cohort the dominant one (Figure 14b).

The biomass for sardinella was estimated at total of 232 000 tonnes. This is lower than the 264 000 tons found last year. The biomass consisted of 141 000 tons S. *maderensis* which was at some level of last year and 99 000 tons of S. *aurita* lower than last year biomass estimate.

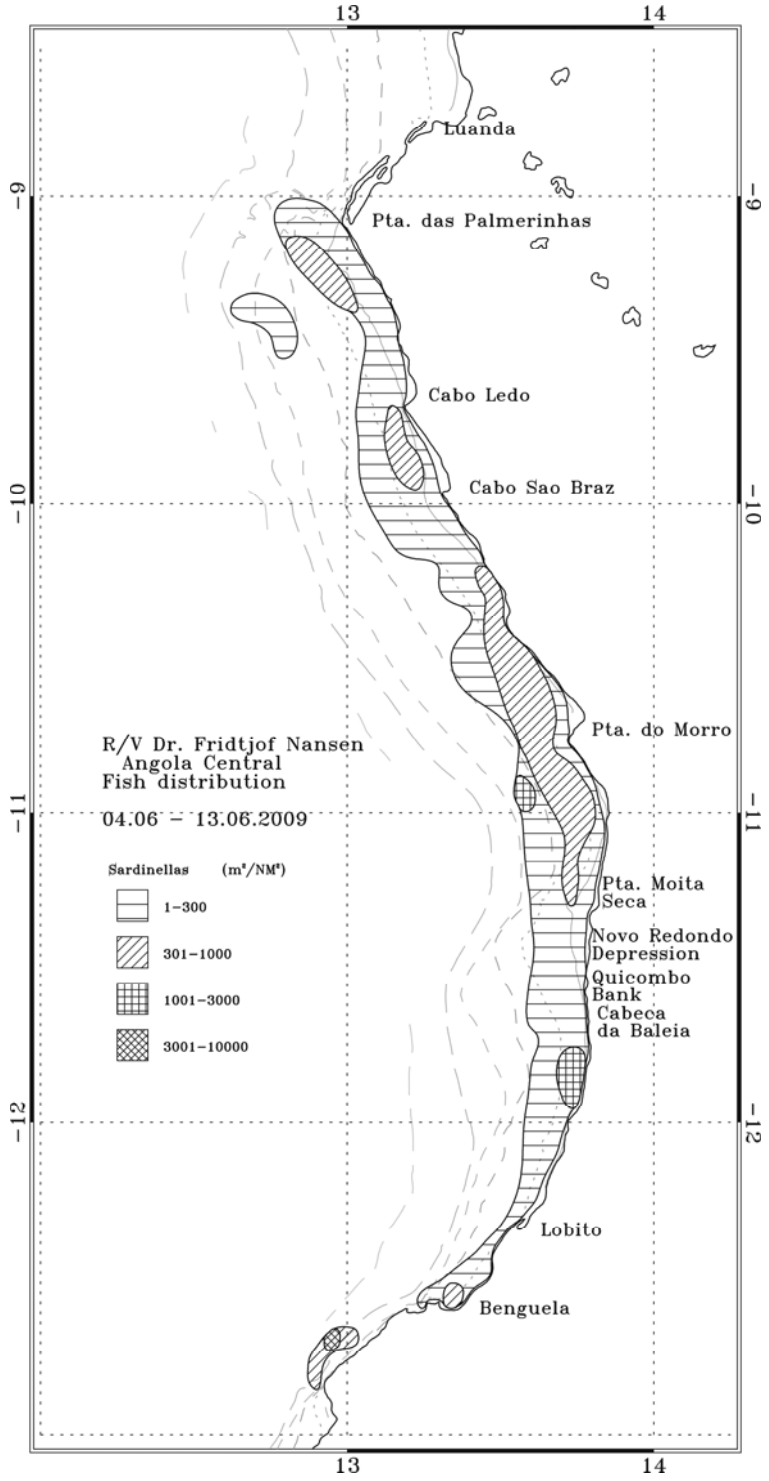
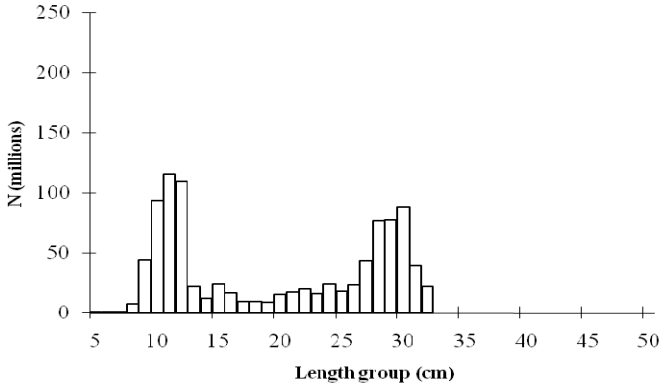


Figure 13. Distribution of *Sardinella* spp. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100 and 200 m.

a) *Sardinella maderensis*



b) *Sardinella aurita*

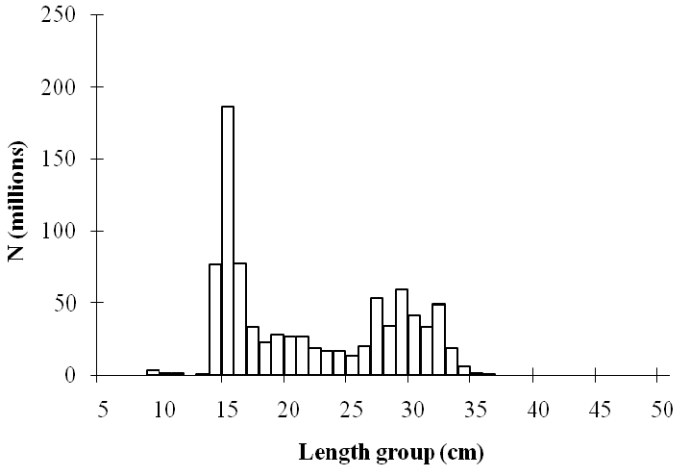


Figure 14. Total length distribution of *Sardinella maderensis* (a) and S. *aurita* (b). Pta. das Palmerinhas- Benguela.

Horse mackerel

Only the Cunene horse mackerel was found in this region. Like last year, it was found in low-densities patches (s_A< 300) located inshore (Figure 15). A more offshore distribution was observed between Pta das Palmerinhas and Cabo Ledo.

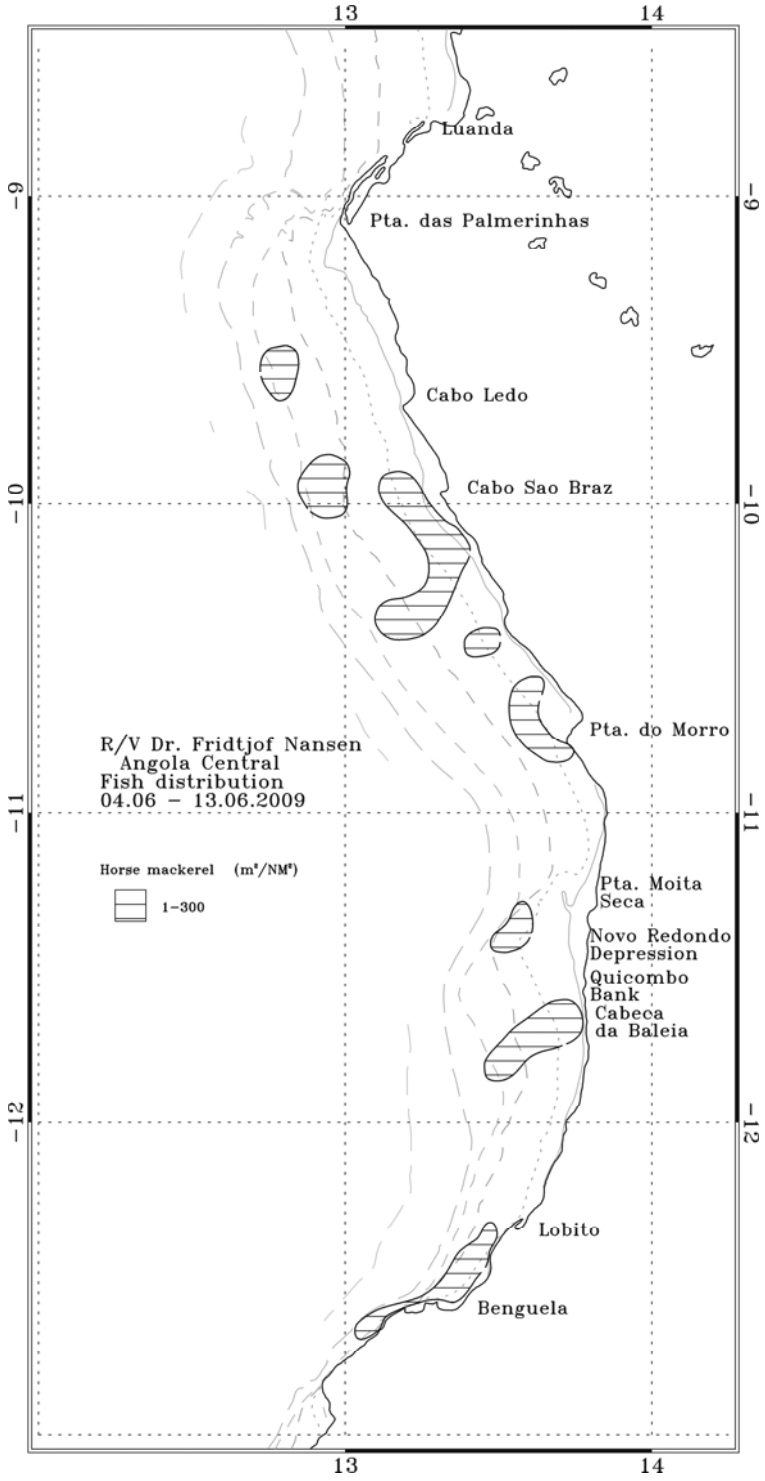


Figure 15. Distribution of horse mackerel (*Trachurus trecae*). Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500 m.

Figure 16 shows the total length frequency distribution. The population has a bimodal distribution pattern, with the main peak around 14 cm and a smaller peak around 16-18 cm. The bulk of the biomass (~90 %) consisted of individuals < 25 cm. However, this year the proportion

of bigger fish (> 25 cm) has almost disappeared compared with 2008 (Figure 16). Length distribution by depths shows that the large proportion of juvenile cohort and the few adult fish were found at depths less than 100 m (Figure 17).

The biomass of Cunene horse mackerel was estimated at 7 000 tons, 80 % lower than last year (40 000 tons). This is the lowest estimate in the time series since 1985. The decrease of the biomass associated with decrease in size distribution gives a strong indication that resource is at a low level.

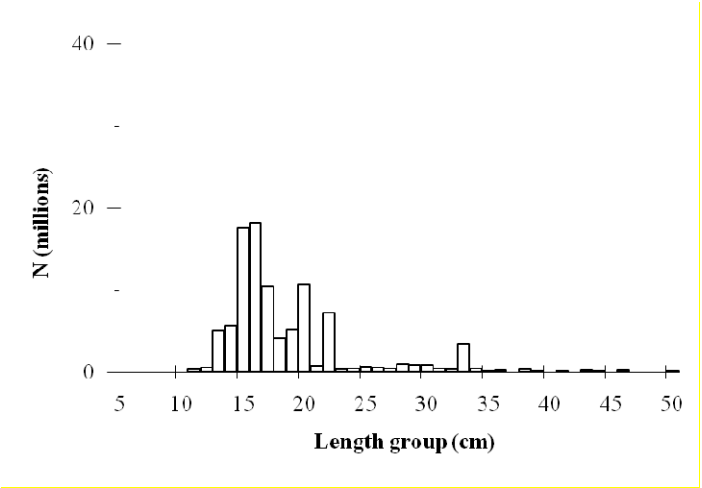


Figure 16. Total length distribution of horse mackerel (*Trachurus trecae*), Pta. das Palmerinhas- Benguela.

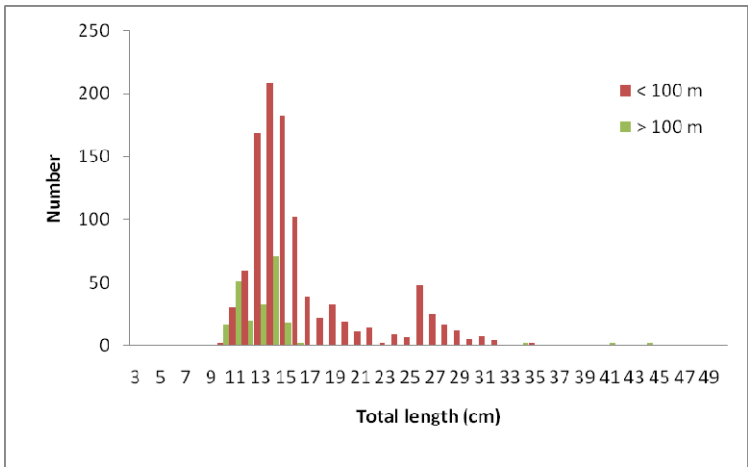


Figure 17. Length distribution of Cunene horse mackerel (*Trachurus trecae*) by depths stratum, Pta. das Palmerinhas- Benguela (depths <100m and >100 m)

Other pelagic species

Pelagic species Group 1

The most common species was *Ilisha Africana.*

Pelagic species Group 2

This group is distributed at low densities ($1<s_A<300$ m^2/NM^2) in three continuous areas, between Pta das Palmerinhas to south of Cabo São Braz, north of Pta do Morro to Lobito and south of Benguela (Figure 18). The most common species this group was the Hairtail found between 50-60 meters depths and the carangidae inshore (Table 5), dominated by *Chloroscombrus chrysurus*.and *Decapterus rhonchus.*

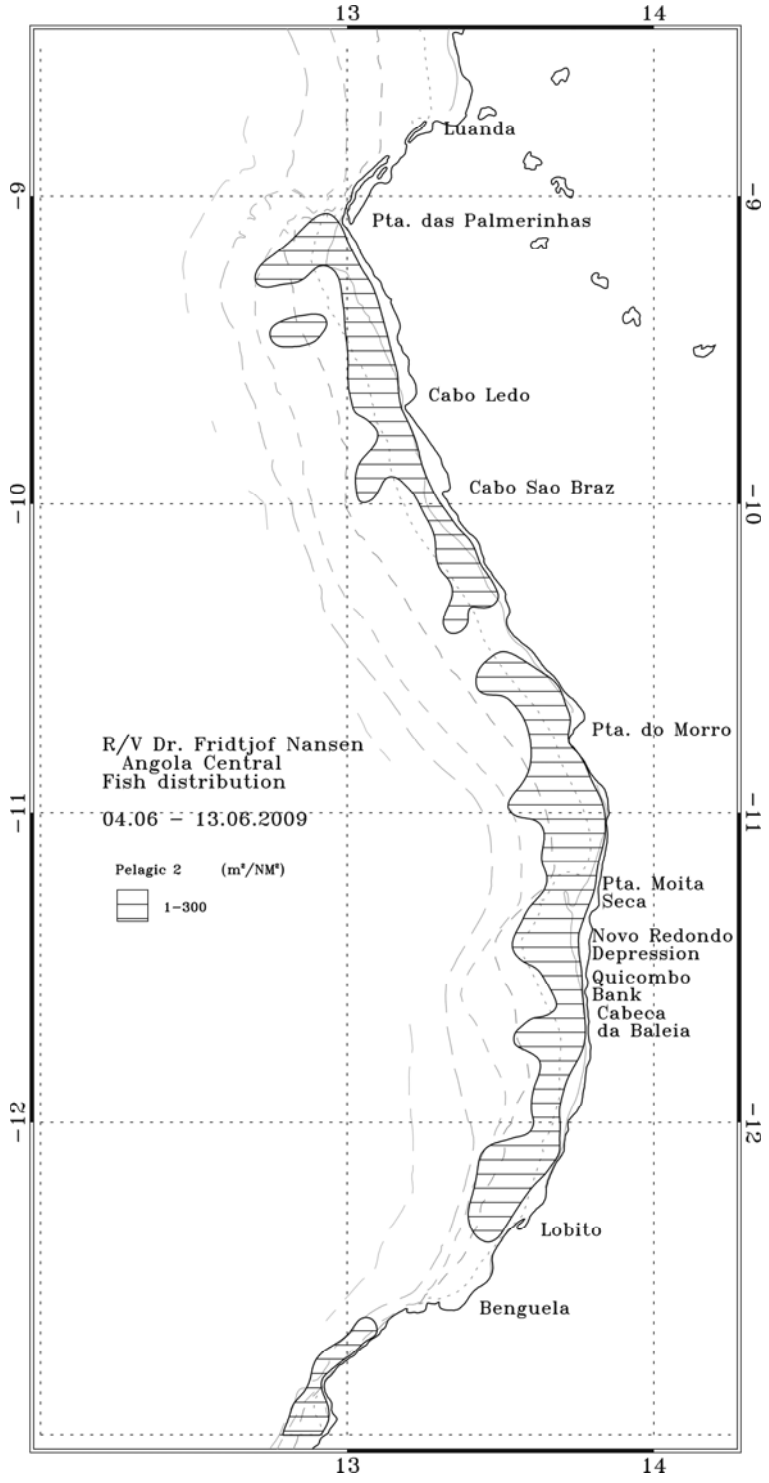


Figure 18. Distribution of other pelagic species, group 2. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500 m.

The biomass estimate, based on an average length of 25 cm and a condition factor equal to 0.01, was 25 000 tons, much higher than the estimated 2 000 tons in 2008.

Table 5. Catch rates (kg/h) of the main groups of pelagic fish, Pta. das Palmerinhas- Benguela.

Station	Gear depth	Barracuda	Carangids	Clupeoids	Hairtails	Scombrids	Others	Total
33	22		0.1				0.5	0.6
34	83		17.5	6.5	80.7	4.5	3.0	112.1
35	26	0.1	38.0	24.4	22.6		18.6	103.6
36	30			4.2	6.4		115.7	126.3
37	42		35.9	13.4			10.9	60.2
38	19	4.3	66.1	23.1	1.0		536.7	631.1
39	95							
40	140							
41	38	6.4	11.5	22.9	6.9		330.5	378.2
42	67				7.4	4.0		11.4
43	24	4.7	47.7	15.4	13.7		21.3	102.8
44	100							
45	68	7.4	49.3			23.7		80.4
46	47	14.0	17.7	29.6	0.5	9.5	284.9	356.2
47	58							
48	20	0.8				1.4		2.2
49	100							
50	44	3.7	0.4	47.4	2.7		33.3	87.4
51	19	1.5	4.5	38.8	28.8		41.4	114.9
52	60	1.2			11.2			12.5
53	25						4.0	4.0
54	54				256.0		33.5	289.5
55	76				103.9	0.8	16.4	121.1
56	78				70.9		23.7	94.6
57	54					1.4		1.4
58	34							
59	21	0.3	0.4	56.8	24.3		19.6	101.5
60	58					0.6		0.6
61	46	7.6	26.8		350.9		14.4	399.7
62	120							
63	20	4.2	0.7	0.2	0.1		1.4	6.6
64	25						13.0	13.0
65	278							
66	22	5.4			5.5		141.5	152.4
67	56	0.2		42.8	2.4		2.1	47.5
68	434				37.6			37.6
69	502							
Mean	81.2	1.7	8.6	8.8	27.9	1.2	45.0	93.2
Std dev	105.5	3.1	17.1	15.8	71.9	4.2	111.0	142.6
%Catch		1.8	9.2	9.4	30.0	1.3	48.3	

4.3 Benguela - Cunene

Sardinella

S. aurita was the dominated sardinella species found in this region *(*Figure 19). *S. maderensis* was found at only one station south of Cabo de Santa Marta inshore. *S. aurita* was found in very small patchy areas. A dense patch ($3001<s_A<10\ 000$ m^2/NM^2) areas were found at around Namibe inshore and south of Tombwa at 100 m depths.

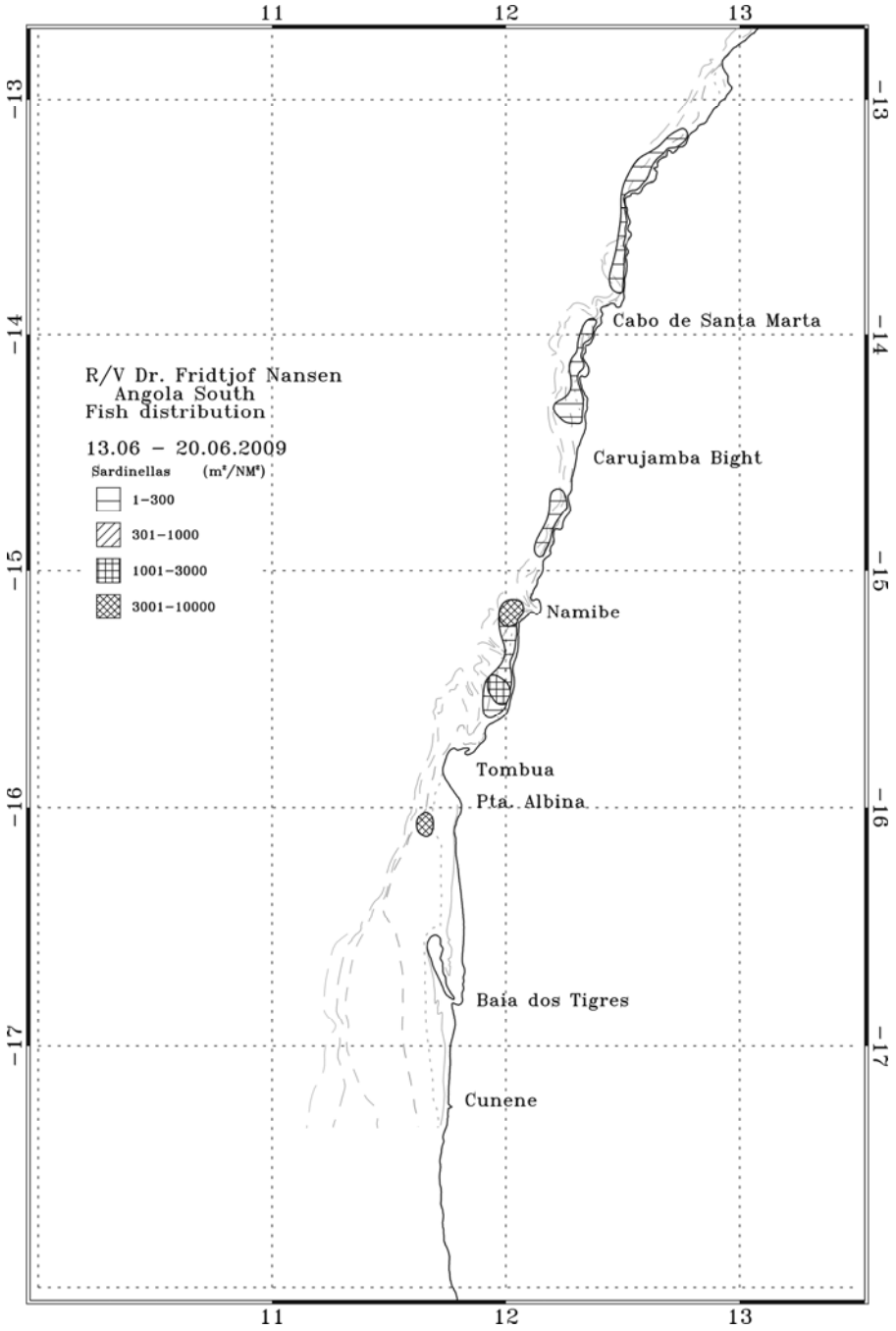


Figure 19. Distribution of Sardinella. Benguela –Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 m.

Figure 20 shows the length frequency distribution of S. *aurita* that ranged from 24 to 34 cm total length (TL) with two modal peaks at around 23 and 26cm, the latter dominated the distribution.

The biomass of *S.aurita* was estimated at 92 000 tons, which is the highest estimate since February 1985.

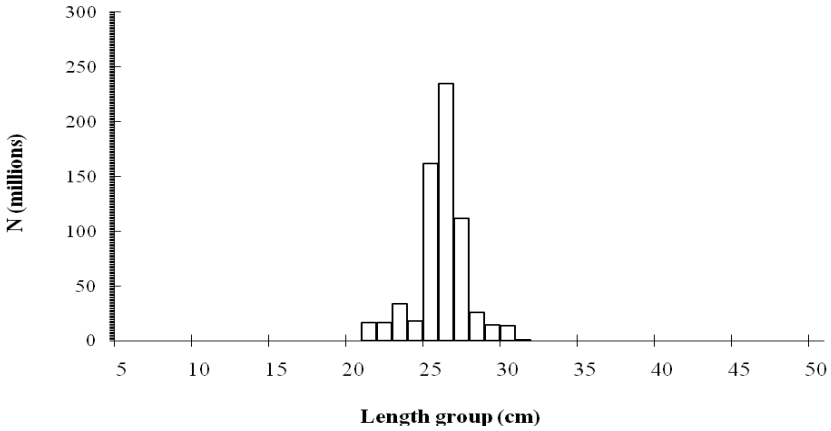


Figure 20. Total length distribution of *Sardinella aurita* Benguela-Cunene

Horse mackerel

Both species of horse mackerel, the Cape horse mackerel *Trachurus capensis* and the Cunene horse mackerel *T. trecae* were found off southern Angola (figure 21). Cunene horse mackerel was distributed throughout the Angola continental self and the Cape horse mackerel was associated while the cold waters of the Benguela current. In this region horse mackerel presented a continuous distribution from north of Namibe to the Cunene at low densities ($1< s_A<300$ m^2/NM^2). Three small areas with high densities ($1001< s_A<3000$ m^2/NM^2) were found offshore between south of Namibe and Towbwa and south of Pta Albina. Cape horse mackerel was caught in three stations at 16 º 36'S, 17º 05'S and 17º 12'S at around 100 m depth.

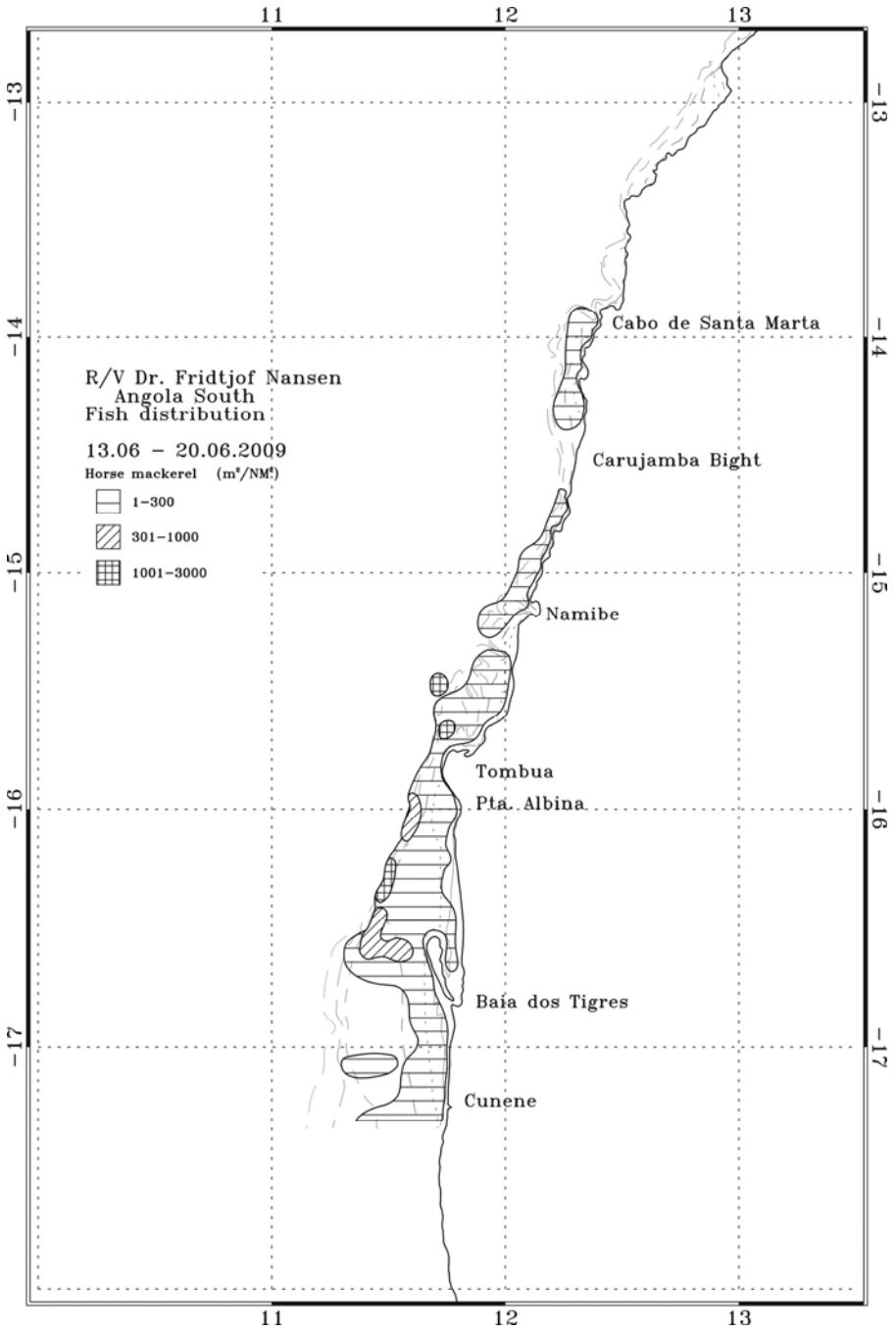
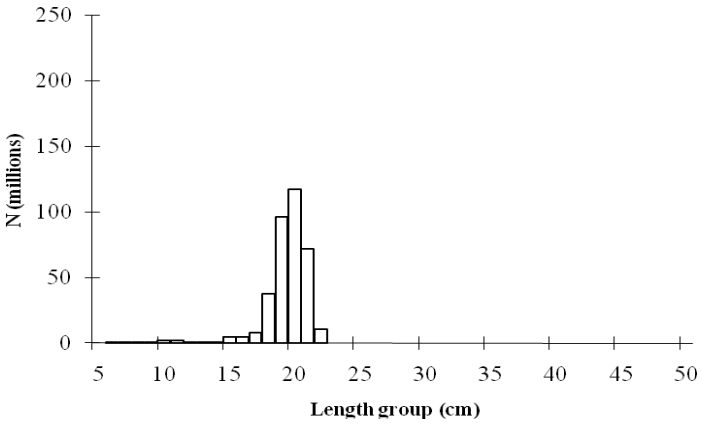


Figure 21. Distribution of horse mackerel. Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 m.

Figure 22 a and b show the length frequency distribution of the Cape and Cunene horse mackerels, respectively. Like previous surveys in this region the length frequency distributions of both species was dominated by juvenile fish, smaller than 20 cm. Cape horse mackerel showed unimodal distribution peaking at around 20 cm (Figure 22 a). Cunene horse mackerel has two main modes, at about 10 and 16 cm (Figure 22 b) and large proportion was found at depths <100m (Figure 23). Larger fish (TL >25 cm) represented only a small percentage of the total (Figure 23).

a) *Trachurus trachurus capensis*



b) *Trachurus trecae*

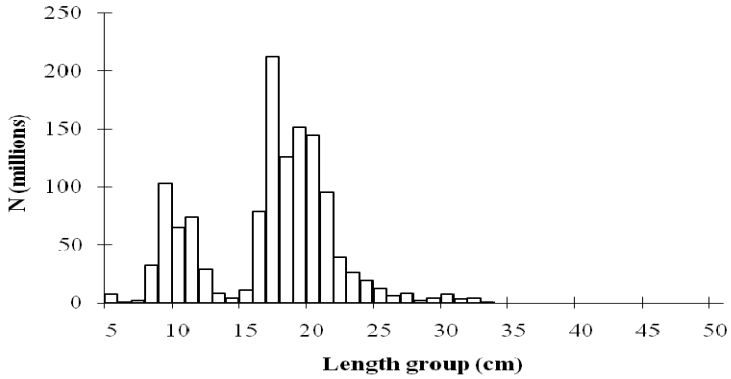


Figure 22 Total length distributions of (a) *Trachurus trachurus capensis* and (b) *T. trecae* (b), Benguela-Cunene.

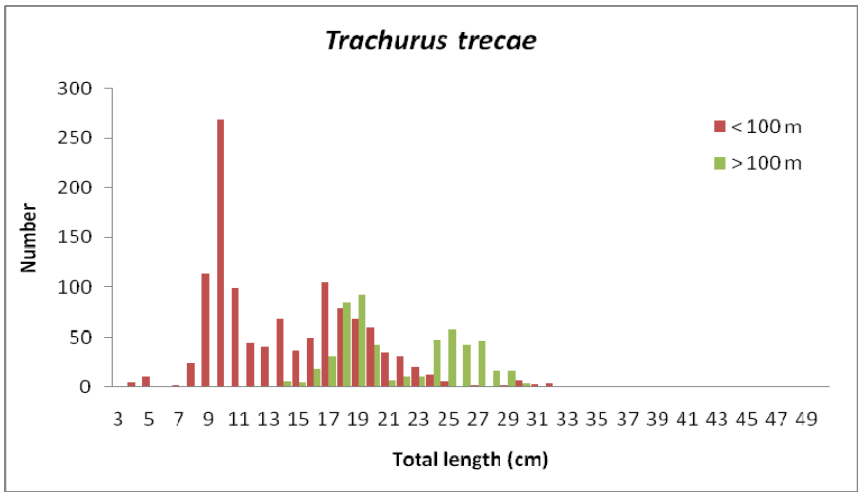


Figure 23. Length distribution of Cunene horse mackerel (*Trachurus trecae*) by depths stratum, Benguela - Cunene (depths <100m and >100 m)

The biomass estimate for horse mackerel in the region was 98 000 tons which is 30% higher than compare to the last year (33 000). The biomass of Cunene horse mackerel was estimated to 76 000 tones and for Cape horse mackerel 22 000 tons. These estimates are much higher than the ones in 2008, with 29 000 tones estimated for Cunene horse mackerel and 3000 tones Cape horse mackerel, respectively. It is important to consider that the difference in the biomass of Cape horse mackerel cannot be evaluated without taking consideration the seasonal fluctuations on the position of the Angola-Benguela front.

Other species

The pelagic 1 was dominating group in this region and the most common species were round herring (*Etrumeus whiteheadi*) and anchovy (*Engraulis encrasicolus*). The biomass estimates for this group of species are presented in the 2009 trans-boundary report.

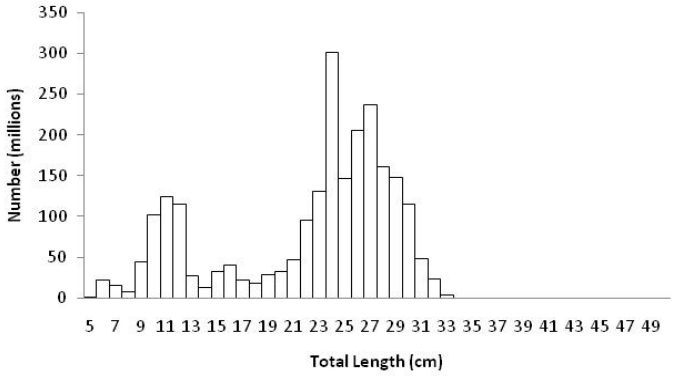
CHAPTER 5 SUMMARY OF SURVEY RESULTS

5.1 Sardinella

The total biomass estimate for sardinellas was 529 000 tons, which is within the range as estimated in 2008 (506 000 tonnes) (Table 7). However, the general overall distribution pattern is different from last year, where *S. aurita* was found further south up to Pta Albina. Such changes in the behavioural pattern are common and may be related to environmental conditions. In the present survey the central and southern region was in general warmer compared to the condition observed in 2008 and therefore could explain the southward movement of *S. aurita.* As usually observed in Angolan water the biomass was dominated by *S. maderensis*, being 58% of the total, which was approximately the same level that observed in 2008 represented by 54 % of *S. maderensis* and 4 6% of *S. aurita*

The overall length frequency distribution of the two Sardinella species were dominated by the adult population (Figure 24). The distribution of *S. maderensis* shows two well-defined cohorts with modal peaks around 11 and 25-27cm. The distribution is also indicating that recruits enter into the fishery (Figure 24 a) this was not seen last year No such indication of recruitment was found for *S. aurita,* the distribution showed two modal peaks at 15 and 27cm (Fig. 24 b).

a) *S. maderensis.*



b) *S. aurita.*

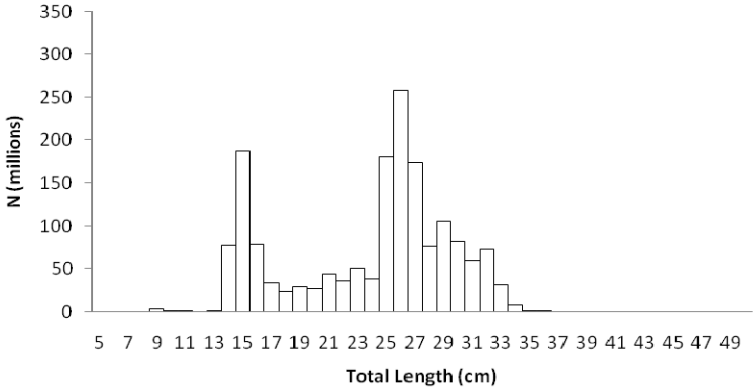


Figure 24. Overall length distribution (a) and relative cumulative biomass (b) of *S. maderensis* and *S.aurita*.

Table 7 Biomass estimates of sardinellas by regions and surveys (1 000 tons).

Survey	Cunene-Benguela	Palmerinhas-Benguela	Cabinda-Palmerinhas	Benguela-Cabinda	Cunene-Cabinda
1/85	25	20	80	300	325
2/85	110	190	180	370	480
3/85	0	70	190	260	260
4/85	0	200	110	310	310
1/86	10	140	110	250	260
2/86	10	130	130	260	270
1/89	40	200	60	260	300
2/89	20	40	130	170	190
3/89	40	100	60	160	200
1/91	?	180	120	300	300
2/91	?	68	154	222	222
1/92	?	119	161	280	280
1/94	*	410	100	510	
2/94	*	245	290	535	
1/95	*	140	24	164	
2/95	?	277	297	574	574
1/96	49	175	70	245	294
2/96	0	130	233	363	363
1/97	0	195	300†	495	495
1/98	75	389	79†	468	543
3/98	0	233	159†	392	392
2/99	0	228	135†	363	363
2/2000	0	179	174†	353	353
2/2001	0	257	177†	434	434
9/2002	0	165	178	343	343
8/2003	2	277	153†	430	432
8/2004	0	175	187†	262	362
8/2005	0	148	95	242	242
8/2006	20	244	366	610	630
6/2007	55	483	187	670	725
6/2008	56	264	186	450	506
6/2009	92	232	206	437	529

* not surveyed
† surveyed from Congo River- Pta das Palmerinhas

5.2 Cunene horse mackerel

The total biomass of Cunene horse mackerel was estimated at 83 000 tonnes, which is around 14% higher than the biomass estimated in 2008 (Table 8). As in 2008 no biomass was estimated for the northern region due to very low acoustic densities For central region the biomass was estimated at very low level (7 000 tons) being the lowest estimate for the times series. The bulk of the biomass in the present year is mainly due to an increase in the Cunene horse mackerel biomass in the south region (76 000 tonnes) relative to the 2008 biomass (16 000 tonnes).

Like in the previous surveys, 90% of total biomass of Cunene horse mackerel is dominated by juvenile (TL < 21 cm) (Figure 25). The component of large fish (TL> 21) has almost disappeared from the distribution. Currently, the stock is reduced to two cohorts of small fish that mainly constitute the illegal fraction of the fishable population. These two cohorts of small fish are more

vulnerable to the environment changes could result on the recruitment failure. The reduction of larger fish, indicate that this component of the spawning stock is at a very low level,. (with low probability of long-term recovering and far away from the levels seen in the second half of the 1990ths .

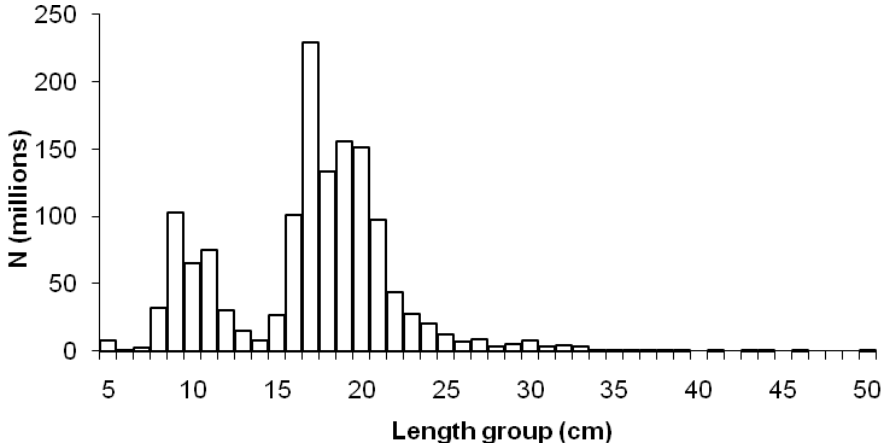


Figure 25. Overall length distribution in numbers of *T. trecae*.

The results of the survey shows that in the northern and central region the stock is at a very low level.) In the southern region large proportion of small fish could play an important role for a long term recovering of stock. Given the actually state of Cunene horse mackerel in terms of management is recommendable not to allow any horse mackerel fishing activity in the entire distribution area.

Table 8 Biomass estimates of Cunene horse mackerel by regions and surveys (1 000 tons)

Survey	Cunene-Benguela	Palmerinhas-Benguela	Cabinda-Palmerinhas	Benguela-Cabinda	Cunene-Cabinda
1/85	30	195	40	235	265
3/85	50	90	40	130	180
4/85/86	100	125	20	145	245
1/89	35	55	40	95	130
3/89	170	40	35	75	245
1/91	100	80	20	100	200
2/91	100	70	30	100	200
1/92	98	86	80	166	264
1/94	*	238	1	239	478
2/94	*	130	120	250	500
1/95	*	?	84	84	168
2/95	70	160	110	270	340
1/96	286	214	6	220	506
2/96	140	157	63	220	360
1/97	234	55	138†	193	427
1/98	163	58	18†	76	239
3/98	118	112	37†	149	267
2/99	124	129	68†	197	321
2/00	92	178	63†	241	333
2/01	64	22	3†	25	89
9/02	118	13	31†	44	162
8/03	120	34	12†	46	166
8/04	32	107	90†	197	229
8/05	102	57	21†	78	180
8/06	45	77	31†	108	153
8/07	73	57	27	84	154
6/08	29	40	-	40	69
6/09	76	7	-	7	83

* not surveyed
† surveyed from Congo River- Pta das Palmerinhas
- low acoustic densities

5.3 Conclusions

In the present survey the environmental conditions were characterized by warm waters, especially in the central and southern region as compared with 2008. The range of temperatures found in the northern and central and regions was 23° to 28°C and 23° to 26° respectively , while in the south temperatures varies between 15° to 20°C.

The total biomass estimate for sardinellas is 529 000 tons, which is within the range estimated in 2008. *S. aurita* was found further south up to Pta Albina. The proportion of biomass of the two species of Sardinella was 42% for *S. maderensis* and 58% for *S. aurita* and the latter dominates the southern region.

The total biomass of horse mackerel was estimated at 105 000 tons. The Cunene horse mackerel stock was estimated at total of 83 000 tons and Cape horse mackerel 22 000 tons. The Cunene horse mackerel stock in the northern and central region is near to depletion and the biomass in the two regions is less than 10 000 tons.

The overall length distribution of Cunene horse mackerel was still dominated by fish <20cm, indicating that the spawning component of the stock is strongly reduced. *depleted disappeared from distribution.*

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ANNEX 3

Conditions for trawling during the scientific expedition of RV Dr Fridtjof Nansen in the EEZ of Mauritius in September /October 2008

a) The vessel shall submit a research programme indicating dates of entries and exits, the precise geographical coordinates about the areas where trawling activities will be conducted along with coordinates of stations;
b) During the trawling operations, the vessel shall take all measures to ensure safety of fishermen and other users in the area;
c) No harmful substances and /or explosives shall be used;
d) No drilling shall be undertaken;
e) Trawling shall be carried out in such a way that no 'collateral' damage occurs to the marine environment;
f) A preliminary report and the final results and conclusions shall be submitted to this Ministry after completion of the expedition;
g) Provide access to an officer from Mauritius, at its request, to all data and samples derived from the scientific research and to furnish it with data which may be copied and samples which may be divided without detriment to their scientific value;
h) The approval of the Government shall be sought before publishing the results of the research conducted in our EEZ;
i) Appropriate acknowledgements shall be given to Mauritius in all publications resulting from the study and a copy of all publications shall be submitted to the Government of Mauritius;
j) Any Intellectual Property Rights (IPR) arising from the research shall be vested in the Government of Mauritius;
k) Allow the participation of a Mauritian scientist in the marine research project on board the research vessel.

ANNEX I. Records of fishing stations

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 1
DATE :24.05.2009 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°16.11
start stop duration Lon E 11°50.79
TIME :13:35:49 13:51:59 16.2 (min) Purpose : 1
LOG : 6210.43 6211.22 0.8 Region : 4054
FDEPTH: 94 93 Gear cond.: 0
BDEPTH: 94 93 Validity : 0
Towing dir: 0° Wire out : 240 m Speed : 2.9 kn
Sorted : 31 Total catch: 30.82 Catch/hour: 114.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex angolensis	61.48	338	53.76	2
Dentex congoensis	16.51	200	14.44	4
Dentex barnardi	13.36	63	11.68	3
Trachurus trecae	6.79	252	5.94	1
Pagellus bellottii	5.01	22	4.38	
Zeus faber	4.68	15	4.09	
Fistularia petimba	3.27	4	2.86	
Chaetodon hoefleri	1.45	4	1.27	
Citharus linguatula	1.26	4	1.10	
Lagocephalus laevigatus	0.33	4	0.29	
Trigla lyra	0.22	15	0.19	
Total	114.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 2
DATE :25.05.2009 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°26.32
start stop duration Lon E 11°45.38
TIME :10:56:25 11:26:44 30.3 (min) Purpose : 1
LOG : 6353.09 6354.68 1.6 Region : 4054
FDEPTH: 122 127 Gear cond.: 0
BDEPTH: 122 127 Validity : 0
Towing dir: 0° Wire out : 300 m Speed : 3.1 kn
Sorted : 271 Total catch: 270.96 Catch/hour: 536.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	259.63	3877	48.42	5
Selene dorsalis	103.79	372	19.36	8
Dentex congoensis	67.88	894	12.66	7
Dentex angolensis	39.18	226	7.31	6
Boops boops	26.02	655	4.85	
Spicara alta	20.18	394	3.76	
Ariomma bondi	6.27	121	1.17	
Trichiurus lepturus	3.30	6	0.62	
Zeus faber	3.01	6	0.56	
Pterothrissus belloci	2.63	18	0.49	
Dentex barnardi	1.37	2	0.25	
Uranoscopus polli	1.13	2	0.21	
Illex coindetii	0.93	18	0.17	
Trigla lyra	0.87	2	0.16	
Total	536.20		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 3
DATE :25.05.2009 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°18.90
start stop duration Lon E 12°12.36
TIME :14:57:50 15:16:03 18.2 (min) Purpose : 1
LOG : 6386.79 6387.72 0.9 Region : 4054
FDEPTH: 25 25 Gear cond.: 0
BDEPTH: 25 25 Validity : 0
Towing dir: 0° Wire out : 75 m Speed : 3.1 kn
Sorted : 78 Total catch: 134.87 Catch/hour: 444.37

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	143.89	17463	32.38	10
Selene dorsalis	129.39	2194	29.12	9
Chloroscombrus chrysurus	57.13	1545	12.86	11
Sphyraena guachancho	29.39	287	6.61	
Ilisha africana	20.10	722	4.52	
Galeoides decadactylus	15.29	201	3.44	
Alectis alexandrinus	14.50	40	3.26	
Pseudotolithus typus	10.02	7	2.25	
Sardinella maderensis	8.40	353	1.89	12
Stromateus fiatola	6.56	7	1.48	
Pagellus bellottii	6.23	23	1.40	
Trichiurus lepturus	3.43	214	0.77	
Sepiella ornata	0.06	10	0.01	
Total	444.37		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 4
DATE :25.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°29.02
start stop duration Lon E 11°58.37
TIME :17:27:07 17:57:20 30.2 (min) Purpose : 1
LOG : 6407.08 6408.95 1.9 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 99 107 Validity : 0
Towing dir: 0° Wire out : 84 m Speed : 3.7 kn
Sorted : 10 Total catch: 9.86 Catch/hour: 19.58

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	10.03	590	51.22	13
Trichiurus lepturus	7.71	24	39.35	
Saurida brasiliensis	0.95	240	4.87	
Selene dorsalis	0.83	4	4.26	
Illex coindetii	0.06	6	0.30	
Total	19.58		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 5
DATE :25.05.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 6°44.56
start stop duration Lon E 11°39.14
TIME :21:02:35 21:22:42 20.1 (min) Purpose : 1
LOG : 6437.81 6439.09 1.3 Region : 4054
FDEPTH: 30 40 Gear cond.: 0
BDEPTH: 540 531 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.8 kn
Sorted : 3 Total catch: 17.69 Catch/hour: 52.74

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	48.28	96182	91.55	
Sphyraena guachancho	1.55	253	2.94	
Trichiurus lepturus	1.55	78	2.94	
S H R I M P S	0.78	1745	1.47	
MELANOSTOMIATIDAE	0.39	21	0.74	
Loligo vulgaris	0.19	98	0.37	
Total	52.74		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 6
DATE :26.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°36.55
start stop duration Lon E 12°1.65
TIME :00:24:32 00:54:38 30.1 (min) Purpose : 1
LOG : 6464.74 6466.36 1.6 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 86 83 Validity : 0
Towing dir: 0° Wire out : 90 m Speed : 3.2 kn
Sorted : 26 Total catch: 26.16 Catch/hour: 52.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	43.33	74	83.14	
Trachurus trecae	3.57	223	6.84	14
Saurida brasiliensis	2.03	564	3.90	
MYCTOPHIDAE	1.39	1161	2.68	
Sepia orbignyana	1.37	4	2.64	
Alloteuthis africana	0.40	279	0.76	
Illex coindetii	0.02	28	0.04	
Nemichthys scolopaceus	0.00	4	0.00	
Total	52.11		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 7
DATE :26.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°28.76
start stop duration Lon E 12°14.79
TIME :03:19:16 03:49:20 30.1 (min) Purpose : 1
LOG : 6486.39 6488.24 1.9 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 35 40 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.7 kn
Sorted : 102 Total catch: 305.79 Catch/hour: 610.16

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	497.14	3280	81.48	15
Brachydeuterus auritus	80.81	1868	13.24	17
Sphyraena guachancho	8.80	359	1.44	
Sepia orbignyana	6.82	12	1.12	
Sardinella aurita	6.29	30	1.03	16
Euthynnus alletteratus	4.79	12	0.78	18
Ilisha africana	4.49	84	0.74	
Chloroscombrus chrysurus	0.54	24	0.09	
Decapterus rhonchus	0.24	6	0.04	
Selene dorsalis	0.24	6	0.04	
Total	610.16		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 8
DATE :26.05.2009 GEAR TYPE: BT NO: 6 POSITION:Lat S 6°54.70
start stop duration Lon E 12°1.70
TIME :12:41:51 13:12:22 30.5 (min) Purpose : 1
LOG : 6573.15 6574.70 1.6 Region : 4054
FDEPTH: 101 104 Gear cond.: 0
BDEPTH: 101 104 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.1 kn
Sorted : 29 Total catch: 29.42 Catch/hour: 57.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trigla lyra	13.38	96	23.11	
Dentex angolensis	8.62	59	14.89	20
Mustelus mustelus	7.18	4	12.41	
Trachurus trecae	6.98	399	12.07	19
Sepia orbignyana	6.00	4	10.37	
Zeus faber	4.03	12	6.97	
Octopus vulgaris	2.75	2	4.76	
Squatina oculata	2.46	2	4.25	
Fistularia petimba	2.18	4	3.77	
Chaetodon hoefleri	1.38	8	2.38	
Trichiurus lepturus	1.30	2	2.24	
Dentex gibbosus	0.79	2	1.36	
Dentex congoensis	0.53	14	0.92	
Loligo vulgaris	0.26	14	0.44	
Citharus linguatula	0.04	2	0.07	
Total	57.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 9
DATE :26.05.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 6°43.65
start stop duration Lon E 12°17.88
TIME :15:56:39 16:26:41 30.0 (min) Purpose : 1
LOG : 6598.92 6600.72 1.8 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 40 44 Validity : 0
Towing dir: 0° Wire out : 90 m Speed : 3.6 kn
Sorted : 3 Total catch: 2.88 Catch/hour: 5.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Euthynnus alletteratus	3.00	8	52.08	22
Sardinella maderensis	2.76	14	47.92	21
Total	5.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 10
DATE :26.05.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 6°49.67
start stop duration Lon E 12°18.46
TIME :19:25:37 19:33:57 8.3 (min) Purpose : 1
LOG : 6627.25 6627.80 0.6 Region : 4054
FDEPTH: 25 20 Gear cond.: 0
BDEPTH: 42 40 Validity : 0
Towing dir: 0° Wire out : 60 m Speed : 4.0 kn
Sorted : 32 Total catch: 31.86 Catch/hour: 229.21

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	213.67	986	93.22	23
Sardinella maderensis	8.99	43	3.92	26
Decapterus rhonchus	4.96	122	2.17	24
Boops boops	1.58	230	0.69	
Total	229.21		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 11
DATE :27.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°4.27
start stop duration Lon E 12°16.22
TIME :02:38:58 03:09:34 30.6 (min) Purpose : 1
LOG : 6691.10 6692.65 1.6 Region : 4054
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 92 93 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.0 kn
Sorted : 0 Total catch: 0.39 Catch/hour: 0.76

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	0.76	31	0.00	25

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 12
DATE :27.05.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 7°11.63
start stop duration Lon E 12°16.51
TIME :04:39:46 05:09:48 30.0 (min) Purpose : 1
LOG : 6701.80 6703.60 1.8 Region : 4054
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 123 136 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.6 kn
Sorted : 1 Total catch: 0.97 Catch/hour: 1.94

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Echeneis naucrates	1.20	2	61.86	
Selene dorsalis	0.70	16	36.08	
Sepia orbignyana	0.04	6	2.06	
Total	1.94		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 13
DATE :27.05.2009 GEAR TYPE: PT NO: 6 POSITION:Lat S 6°58.19
start stop duration Lon E 12°27.07
TIME :15:51:35 16:10:48 19.1 (min) Purpose : 1
LOG : 6780.56 6781.67 1.1 Region : 4054
FDEPTH: 25 32 Gear cond.: 0
BDEPTH: 43 43 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 4.0 kn
Sorted : 0 Total catch: 0.04 Catch/hour: 0.13

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Echeneis naucrates	0.13	3	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 14
DATE :27.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°55.31
start stop duration Lon E 12°28.91
TIME :17:12:41 17:42:44 30.1 (min) Purpose : 1
LOG : 6789.09 6790.81 1.7 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 35 40 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.4 kn
Sorted : 117 Total catch: 1925.22 Catch/hour: 3844.03

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	3266.52	23720	84.98	28
Sardinella maderensis	512.31	2833	13.33	27
Selar crumenophthalmus	43.49	166	1.13	
Decapterus rhonchus	16.15	34	0.42	
Sarda sarda	3.81	4	0.10	30
Euthynnus alletteratus	1.76	4	0.05	29
Total	3844.03		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 15
DATE :27.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°4.55
start stop duration Lon E 12°35.68
TIME :22:06:04 22:25:07 19.1 (min) Purpose : 1
LOG : 6825.55 6826.70 1.1 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 37 40 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.6 kn
Sorted : 121 Total catch: 1209.00 Catch/hour: 3807.87

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chloroscombrus chrysurus	2727.56	30772	71.63	33
Sardinella maderensis	992.13	7874	26.05	31
Decapterus rhonchus	24.88	346	0.65	34
Sphyraena guachancho	21.42	63	0.56	
Selar crumenophthalmus	14.49	94	0.38	
Sardinella aurita	13.23	94	0.35	32
Selene dorsalis	9.45	94	0.25	
Brachydeuterus auritus	4.72	31	0.12	
Total	3807.87		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 16
DATE :28.05.2009 GEAR TYPE: BT NO: 6 POSITION:Lat S 7°7.08
start stop duration Lon E 12°42.26
TIME :00:05:19 00:34:21 29.0 (min) Purpose : 1
LOG : 6840.57 6842.06 1.5 Region : 4054
FDEPTH: 16 16 Gear cond.: 0
BDEPTH: 21 20 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.1 kn
Sorted : 103 Total catch: 308.56 Catch/hour: 637.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	437.19	3223	68.58	36
Brachydeuterus auritus	130.33	1318	20.44	37
Sardinella aurita	30.87	138	4.84	35
Stromateus fiatola	13.33	27	2.09	
Chloroscombrus chrysurus	9.34	95	1.46	38
Ilisha africana	4.13	83	0.65	
Caranx crysos	3.06	4	0.48	
Rhizoprionodon acutus	2.58	2	0.41	
Galeoides decadactylus	2.21	41	0.35	
Eucinostomus melanopterus	1.86	29	0.29	
Sarda sarda	1.76	2	0.28	
Trachurus trecae	0.70	4	0.11	
Penaeus kerathurus	0.12	12	0.02	
Penaeus notialis	0.04	4	0.01	
Total	637.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 17
DATE :28.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°28.56
start stop duration Lon E 12°51.77
TIME :18:06:59 18:37:02 30.1 (min) Purpose : 1
LOG : 6985.24 6987.09 1.9 Region : 4054
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 34 40 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.7 kn
Sorted : 83 Total catch: 267.48 Catch/hour: 534.07

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	164.13	3762	30.73	
Ilisha africana	100.63	4564	18.84	
Sphyraena guachancho	65.59	198	12.28	
Selene dorsalis	34.44	395	6.45	43
Trachurus trecae	33.84	146	6.34	39
Sardinella maderensis	33.24	294	6.22	40
Chloroscombrus chrysurus	24.56	180	4.60	41
Trichiurus lepturus	19.17	54	3.59	
Stromateus fiatola	17.97	36	3.36	
Scomberomorus tritor	11.26	12	2.11	
Sardinella aurita	9.34	48	1.75	42
Seriola carpenteri	7.91	18	1.48	
Elops lacerta	5.69	12	1.07	
Drepane africana	3.17	6	0.59	
Rhizoprionodon acutus	2.46	2	0.46	
Galeoides decadactylus	0.54	6	0.10	
Echeneis naucrates	0.12	6	0.02	
Total	534.07		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 18
DATE :28.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°32.27
start stop duration Lon E 12°43.15
TIME :20:08:41 20:28:21 19.7 (min) Purpose : 1
LOG : 6996.04 6997.23 1.2 Region : 4054
FDEPTH: 0 10 Gear cond.: 0
BDEPTH: 81 86 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 3.6 kn
Sorted : 45 Total catch: 44.74 Catch/hour: 136.47

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	121.71	302	89.18	
Euthynnus alletteratus	10.52	15	7.71	44
Sepia orbignyana	2.47	9	1.81	
Alloteuthis africana	0.76	390	0.56	
Brachydeuterus auritus	0.61	6	0.45	
Saurida brasiliensis	0.31	101	0.22	
Bregmaceros sp.	0.09	58	0.07	
Total	136.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 19
DATE :29.05.2009 GEAR TYPE: BT NO: 6 POSITION:Lat S 7°33.94
start stop duration Lon E 12°54.73
TIME :02:08:03 02:38:25 30.4 (min) Purpose : 1
LOG : 7048.13 7049.54 1.4 Region : 4054
FDEPTH: 16 16 Gear cond.: 0
BDEPTH: 34 39 Validity : 0
Towing dir: 0° Wire out : 80 m Speed : 2.8 kn
Sorted : 156 Total catch: 155.94 Catch/hour: 308.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	99.47	921	32.29	46
Ilisha africana	54.13	1662	17.57	
Brachydeuterus auritus	49.00	751	15.90	48
Sphyraena guachancho	28.94	67	9.39	
Sardinella aurita	22.23	107	7.21	47
Chloroscombrus chrysurus	13.43	121	4.36	49
Myliobatis aquila	9.88	2	3.21	
Selene dorsalis	9.76	121	3.17	
Trichiurus lepturus	8.02	28	2.60	
Trachurus trecae	6.32	45	2.05	45
Stromateus fiatola	5.41	18	1.76	
Sepia orbignyana	1.48	2	0.48	
Total	308.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 20
DATE :29.05.2009 GEAR TYPE: BT NO: 6 POSITION:Lat S 7°53.15
start stop duration Lon E 12°44.10
TIME :09:09:27 09:33:07 23.7 (min) Purpose : 1
LOG : 7106.37 7107.49 1.1 Region : 4054
FDEPTH: 118 117 Gear cond.: 9
BDEPTH: 118 117 Validity : 0
Towing dir: 0° Wire out : 300 m Speed : 2.8 kn
Sorted : 0 Total catch: 113.25 Catch/hour: 287.07

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex angolensis	104.31	471	36.34	50
Trichiurus lepturus	57.03	104	19.87	
Trachurus trecae	48.80	2195	17.00	51
Sepia orbignyana	17.24	48	6.00	
Umbrina canariensis	12.40	38	4.32	
Scorpaena stephanica	10.39	25	3.62	
Brotula barbata	8.39	10	2.92	
Dentex congoensis	5.15	61	1.79	52
Antennarius sp.	4.69	3	1.63	
Octopus vulgaris	4.28	5	1.49	
Dentex barnardi	3.88	10	1.35	
Raja miraletus	2.13	3	0.74	
Chaetodon hoefleri	2.08	15	0.72	
Chelidonichthys gabonensis	1.80	13	0.63	
Zeus faber	1.75	10	0.61	
Citharus linguatula	0.71	18	0.25	
Boops boops	0.61	18	0.21	
Uranoscopus polli	0.51	3	0.18	
Lophius vaillanti	0.28	3	0.10	
Ariomma bondi	0.23	3	0.08	
SOLEIDAE	0.15	3	0.05	
Loligo vulgaris	0.15	20	0.05	
Pagellus bellottii	0.08	3	0.03	
Saurida brasiliensis	0.03	8	0.01	
Paramola cuvieri	0.03	3	0.01	
Total	287.07		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 21
DATE :29.05.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°1.09
start stop duration Lon E 13°3.15
TIME :20:57:16 21:17:21 20.1 (min) Purpose : 1
LOG : 7199.13 7200.33 1.2 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 62 69 Validity : 0
Towing dir: 0° Wire out : 75 m Speed : 3.6 kn
Sorted : 118 Total catch: 767.00 Catch/hour: 2290.69

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	1631.56	15393	71.23	56
Euthynnus alletteratus	220.41	36	9.62	
Sardinella maderensis	137.98	806	6.02	55
Trichiurus lepturus	114.68	233	5.01	
Sphyraena guachancho	45.69	54	1.99	
Sardinella aurita	43.01	197	1.88	54
Ilisha africana	25.98	340	1.13	
Sepia orbignyana	22.40	18	0.98	
Rhizoprionodon acutus	16.13	3	0.70	
Trachurus trecae	15.83	54	0.69	53
Sarda sarda	14.34	18	0.63	
Stromateus fiatola	2.69	18	0.12	
Total	2290.69		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 22
DATE :29.05.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 8°0.78
start stop duration Lon E 13°9.36
TIME :22:48:08 23:03:03 14.9 (min) Purpose : 1
LOG : 7210.35 7211.22 0.9 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 25 27 Validity : 0
Towing dir: 0° Wire out : 75 m Speed : 3.5 kn
Sorted : 56 Total catch: 56.16 Catch/hour: 226.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	111.07	885	49.15	59
Trichiurus lepturus	62.98	233	27.87	
Sphyraena guachancho	14.89	20	6.59	
Ilisha africana	14.49	258	6.41	
Sardinella maderensis	5.79	97	2.56	58
Chloroscombrus chrysurus	3.50	24	1.55	
Galeoides decadactylus	3.14	4	1.39	
Sardinella aurita	2.66	8	1.18	
Pomadasys jubelini	2.54	4	1.12	
Alectis alexandrinus	1.89	4	0.84	
Selene dorsalis	1.57	4	0.69	
Bregmaceros sp.	1.49	93	0.66	
Total	226.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 23
DATE :30.05.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°8.44
start stop duration Lon E 13°3.55
TIME :01:04:32 01:24:11 19.6 (min) Purpose : 1
LOG : 7226.38 7227.51 1.1 Region : 4054
FDEPTH: 39 52 Gear cond.: 0
BDEPTH: 73 66 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.5 kn
Sorted : 43 Total catch: 43.16 Catch/hour: 131.85

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	61.25	131	46.46	
Decapterus rhonchus	48.88	46	37.07	
Stromateus fiatola	9.65	46	7.32	
Euthynnus alletteratus	6.26	6	4.75	
Pagellus bellottii	2.75	3	2.09	
Pomadasys jubelini	1.74	3	1.32	
Brachydeuterus auritus	1.07	428	0.81	
Bregmaceros sp.	0.18	171	0.14	
GOBIIDAE	0.06	82	0.05	
Total	131.85		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 24
DATE :30.05.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°14.10
start stop duration Lon E 12°49.35
TIME :03:51:00 04:21:02 30.0 (min) Purpose : 1
LOG : 7246.34 7248.33 2.0 Region : 4054
FDEPTH: 34 24 Gear cond.: 0
BDEPTH: 213 124 Validity : 0
Towing dir: 0° Wire out : 60 m Speed : 4.0 kn
Sorted : 26 Total catch: 76.29 Catch/hour: 152.38

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	117.14	334	76.88	
MYCTOPHIDAE	24.88	22874	16.33	
Synagrops microlepis	5.97	116	3.92	
HOLUTHUROIDEA	4.39	489	2.88	
Total	152.38		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 25
DATE :30.05.2009 GEAR TYPE: BT NO: 6 POSITION:Lat S 8°13.93
start stop duration Lon E 13°14.94
TIME :09:48:04 10:08:15 20.2 (min) Purpose : 1
LOG : 7299.06 7300.21 1.1 Region : 4054
FDEPTH: 28 29 Gear cond.: 0
BDEPTH: 28 29 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 3.4 kn
Sorted : 117 Total catch: 502.55 Catch/hour: 1494.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	393.78	5269	26.35	60
Galeoides decadactylus	249.96	639	16.73	
Pteroscion peli	180.89	3262	12.11	
Cynoponticus ferox	152.14	27	10.18	
Pomadasys peroteti	111.85	333	7.49	
Torpedo marmorata	93.33	12	6.25	
Dasyatis margarita	51.02	51	3.41	
Ilisha africana	38.86	803	2.60	
Pseudotolithus typus	33.89	140	2.27	
Chloroscombrus chrysurus	24.29	178	1.63	
Pomadasys incisus	22.36	101	1.50	
Trichiurus lepturus	18.40	345	1.23	
Torpedo torpedo	16.35	27	1.09	
Sepia orbignyana	15.85	27	1.06	
Sphyraena guachancho	13.80	27	0.92	
Cymbium marmoratum	12.90	39	0.86	
Parapenaeopsis atlantica	11.89	1763	0.80	
Dicologoglossa cuneata	11.12	155	0.74	
Trachurus trecae	11.12	101	0.74	61
Stromateus fiatola	9.57	27	0.64	
Pentanemus quinquarius	9.07	89	0.61	
Selene dorsalis	6.90	27	0.46	
Penaeus notialis	4.85	27	0.32	
Total	1494.20		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 26
DATE :02.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°20.40
start stop duration Lon E 13°15.84
TIME :18:57:19 19:08:20 11.0 (min) Purpose : 1
LOG : 7371.11 7371.66 0.6 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 36 34 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.0 kn
Sorted : 89 Total catch: 199.58 Catch/hour: 1087.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	399.07	6262	36.69	62
Ilisha africana	316.95	7150	29.14	
Sphyraena guachancho	118.96	272	10.94	
Alectis alexandrinus	89.54	76	8.23	
Sardinella maderensis	77.28	567	7.11	63
Trichiurus lepturus	25.40	54	2.33	
Chloroscombrus chrysurus	20.82	371	1.91	
Seriola carpenteri	15.53	11	1.43	
Galeoides decadactylus	14.01	49	1.29	
Sardinella aurita	4.90	11	0.45	
Pomadasys jubelini	3.32	11	0.31	
Selene dorsalis	1.09	27	0.10	
Trachurus trecae	0.74	11	0.07	
Total	1087.60		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 27
DATE :03.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°28.68
start stop duration Lon E 13°10.12
TIME :01:34:54 01:49:58 15.1 (min) Purpose : 1
LOG : 7427.17 7427.93 0.8 Region : 4054
FDEPTH: 0 5 Gear cond.: 0
BDEPTH: 71 68 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.0 kn
Sorted : 75 Total catch: 151.54 Catch/hour: 603.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	425.98	3534	70.56	64
Isurus oxyrinchus	55.18	0	9.14	
Trichiurus lepturus	35.54	104	5.89	
Selene dorsalis	35.22	183	5.83	68
Sardinella maderensis	25.50	131	4.22	66
Trachurus trecae	9.56	327	1.58	67
Sphyraena sp.	4.38	12	0.73	
Sardinella aurita	3.63	16	0.60	65
Scomber japonicus	3.59	12	0.59	69
Stromateus fiatola	2.91	12	0.48	
Decapterus rhonchus	1.04	8	0.17	
Saurida brasiliensis	0.36	116	0.06	
Sepia orbignyana	0.28	40	0.05	
Illex coindetii	0.20	68	0.03	
Engraulis encrasicolus	0.20	40	0.03	
Sepiella ornata	0.12	12	0.02	
Bregmaceros sp.	0.08	60	0.01	
Total	603.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 28
DATE :03.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 8°27.52
start stop duration Lon E 13°18.42
TIME :03:50:50 04:21:22 30.5 (min) Purpose : 1
LOG : 7439.06 7440.65 1.6 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 28 28 Validity : 0
Towing dir: 0° Wire out : 125 m Speed : 3.1 kn
Sorted : 129 Total catch: 128.55 Catch/hour: 252.64

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	117.23	1665	46.40	70
Ilisha africana	71.04	1238	28.12	
Trichiurus lepturus	16.51	226	6.53	
Sphyraena guachancho	13.27	4	5.25	
Alectis alexandrinus	12.97	4	5.13	
Sepia orbignyana	7.35	8	2.91	
Stromateus fiatola	4.93	14	1.95	
Sardinella maderensis	3.01	43	1.19	71
Galeoides decadactylus	1.42	4	0.56	
Scomberomorus tritor	1.34	2	0.53	
Chloroscombrus chrysurus	1.32	14	0.52	
Penaeus notialis	1.30	65	0.51	
Trachurus trecae	0.53	10	0.21	72
Decapterus rhonchus	0.28	2	0.11	
Selene dorsalis	0.16	4	0.06	
Total	252.64		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 29
DATE :03.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°36.51
start stop duration Lon E 13°3.75
TIME :07:18:57 07:36:59 18.0 (min) Purpose : 1
LOG : 7464.06 7465.16 1.1 Region : 4054
FDEPTH: 20 15 Gear cond.: 0
BDEPTH: 112 109 Validity : 0
Towing dir: 0° Wire out : 60 m Speed : 3.8 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
N O C A T C H	0.00	0	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 30
DATE :03.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°53.13
start stop duration Lon E 13°3.62
TIME :18:26:02 18:56:23 30.4 (min) Purpose : 1
LOG : 7567.29 7568.96 1.7 Region : 4054
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 108 86 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 114 Total catch: 276.57 Catch/hour: 546.76

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	423.26	1807	77.41	73
Trichiurus lepturus	58.42	123	10.68	
Sardinella maderensis	28.07	119	5.13	74
Trachinotus ovatus	18.29	59	3.34	
Trachurus trecae	14.73	51	2.69	75
Sarda sarda	2.33	2	0.43	
Caranx crysos	1.66	2	0.30	
Total	546.76		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 31
DATE :03.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°54.51
start stop duration Lon E 13°5.45
TIME :19:50:48 20:20:12 29.4 (min) Purpose : 1
LOG : 7574.15 7575.90 1.8 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 49 53 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.6 kn
Sorted : 79 Total catch: 300.04 Catch/hour: 612.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	269.73	1204	44.05	77
Sardinella maderensis	111.47	512	18.20	76
Trichiurus lepturus	102.04	269	16.66	
Trachurus trecae	83.47	614	13.63	78
Brachydeuterus auritus	23.92	255	3.91	
Sphyraena guachancho	11.71	269	1.91	
Selene dorsalis	7.61	6	1.24	
Scomberomorus tritor	2.37	6	0.39	
Total	612.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 32
DATE :04.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 9°5.05
start stop duration Lon E 12°51.65
TIME :13:07:35 13:32:22 24.8 (min) Purpose : 1
LOG : 7676.70 7681.27 4.6 Region : 4054
FDEPTH: 0 5 Gear cond.: 0
BDEPTH: 63 36 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 11.1 kn
Sorted : 0 Total catch: 124.67 Catch/hour: 301.74

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	276.64	1019	91.68	79
Sardinella maderensis	13.92	61	4.61	80
Sarda sarda	7.02	5	2.33	82
Euthynnus alletteratus	4.16	5	1.38	81
Total	301.74		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 33
DATE :04.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 9°10.09
start stop duration Lon E 12°56.39
TIME :15:26:35 15:57:12 30.6 (min) Purpose : 1
LOG : 7690.44 7691.96 1.5 Region : 4040
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 21 23 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.0 kn
Sorted : 5 Total catch: 5.26 Catch/hour: 10.31

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Scomberomorus tritor	9.11	10	88.40	83
Brachydeuterus auritus	0.49	4	4.75	
Alectis alexandrinus	0.35	2	3.42	
Trachinotus ovatus	0.22	2	2.09	
Selene dorsalis	0.14	2	1.33	
Total	10.31		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 34
DATE :04.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 9°15.32
start stop duration Lon E 12°49.99
TIME :20:41:04 21:07:59 26.9 (min) Purpose : 1
LOG : 7731.96 7733.42 1.5 Region : 4040
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 89 77 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.2 kn
Sorted : 0 Total catch: 162.23 Catch/hour: 361.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachinotus ovatus	198.85	586	55.01	
Trichiurus lepturus	80.65	245	22.31	
Sardinella maderensis	19.16	74	5.30	85
Caranx hippos	18.05	29	4.99	
Decapterus rhonchus	17.49	49	4.84	
Sardinella aurita	13.15	56	3.64	84
Ilisha africana	6.51	67	1.80	
Sarda sarda	4.48	4	1.24	
Brachydeuterus auritus	2.99	20	0.83	
Trachurus trecae	0.13	4	0.04	
Total	361.45		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 35
DATE :04.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 9°14.71
start stop duration Lon E 12°56.75
TIME :22:05:23 22:27:48 22.4 (min) Purpose : 1
LOG : 7740.11 7741.30 1.2 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 23 28 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.2 kn
Sorted : 68 Total catch: 67.70 Catch/hour: 181.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	67.17	1343	37.08	86
Decapterus rhonchus	36.13	265	19.94	
Ilisha africana	24.35	476	13.44	
Trichiurus lepturus	22.61	62	12.48	
Brachydeuterus auritus	18.60	292	10.27	87
Sardinella aurita	3.26	62	1.80	88
Pomadasys peroteti	2.06	8	1.14	
Trachurus trecae	1.63	32	0.90	89
Pomatomus saltatrix	1.15	8	0.64	
Selar crumenophthalmus	1.12	5	0.62	
Selene dorsalis	0.99	19	0.55	
Alectis alexandrinus	0.88	5	0.49	
Chloroscombrus chrysurus	0.83	8	0.46	
Trachinotus ovatus	0.24	3	0.13	
Sphyraena guachancho	0.13	19	0.07	
Total	181.18		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 36
DATE :04.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 9°13.83
start stop duration Lon E 12°54.79
TIME :23:04:11 23:24:17 20.1 (min) Purpose : 1
LOG : 7743.82 7744.77 1.0 Region : 4040
FDEPTH: 29 30 Gear cond.: 0
BDEPTH: 29 30 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 2.8 kn
Sorted : 63 Total catch: 320.85 Catch/hour: 958.24

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Galeoides decadactylus	670.48	6974	69.97	
Brachydeuterus auritus	115.73	1344	12.08	
Pteroscion peli	43.75	612	4.57	
Syacium micrurum	24.79	403	2.59	
Pomadasys peroteti	24.34	105	2.54	
Dasyatis margarita	10.60	15	1.11	
Rhinobatos albomaculatus	10.45	15	1.09	
Sepia orbignyana	10.45	12	1.09	
Pseudotolithus senegalensis	9.86	30	1.03	
Ephippion guttifer	8.51	15	0.89	
Trichiurus lepturus	6.42	30	0.67	
Lithognathus mormyrus	5.67	15	0.59	
Rhizoprionodon acutus	4.78	3	0.50	
Calappa rubroguttata	4.63	60	0.48	
Ilisha africana	4.18	75	0.44	
Pomadasys incisus	1.34	15	0.14	
Penaeus notialis	1.19	15	0.12	
Squilla mantis	0.45	15	0.05	
Dicologoglossa cuneata	0.45	15	0.05	
Parapenaeopsis atlantica	0.15	30	0.02	
Total	958.24		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 37
DATE :05.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 9°19.67
start stop duration Lon E 12°57.56
TIME :00:59:04 01:19:18 20.2 (min) Purpose : 1
LOG : 7758.19 7759.28 1.1 Region : 4040
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 38 46 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.2 kn
Sorted : 66 Total catch: 230.66 Catch/hour: 683.77

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	503.72	4026	73.67	90
Sardinella aurita	107.91	738	15.78	91
Chloroscombrus chrysurus	32.37	282	4.73	92
Ilisha africana	13.40	166	1.96	
Selar crumenophthalmus	11.95	42	1.75	
Brachydeuterus auritus	10.91	104	1.60	
Selene dorsalis	3.53	30	0.52	
Total	683.77		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 38
DATE :05.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 9°24.27
start stop duration Lon E 13°4.58
TIME :07:37:11 07:59:02 21.9 (min) Purpose : 1
LOG : 7814.29 7815.43 1.1 Region : 4040
FDEPTH: 19 19 Gear cond.: 0
BDEPTH: 19 19 Validity : 0
Towing dir: 0° Wire out : 90 m Speed : 3.1 kn
Sorted : 88 Total catch: 264.72 Catch/hour: 726.92

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	536.70	5709	73.83	93
Chloroscombrus chrysurus	57.67	305	7.93	
Ephippion guttifer	30.65	16	4.22	
Ilisha africana	23.07	384	3.17	
Galeoides decadactylus	22.24	198	3.06	
Scomberomorus tritor	8.98	16	1.24	
Rhinoptera marginata	8.65	8	1.19	
Pseudupeneus prayensis	8.32	33	1.14	
Pentheroscion mbizi	6.67	49	0.92	
Balistes capriscus	5.52	8	0.76	
Decapterus rhonchus	5.52	33	0.76	
Sphyraena guachancho	4.28	107	0.59	
Selene dorsalis	2.88	33	0.40	
Pagellus bellottii	2.72	16	0.37	
Dentex barnardi	1.32	16	0.18	
Trichiurus lepturus	0.99	99	0.14	
Epinephelus goreensis	0.66	8	0.09	
Bothus sp.	0.08	8	0.01	
Total	726.92		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 39
DATE :05.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 9°31.97
start stop duration Lon E 12°53.56
TIME :10:25:25 11:09:54 44.5 (min) Purpose : 1
LOG : 7835.98 7838.58 2.6 Region : 4040
FDEPTH: 10 0 Gear cond.: 0
BDEPTH: 102 88 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.5 kn
Sorted : 0 Total catch: 0.07 Catch/hour: 0.09

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Lagocephalus laevigatus	0.00	1	0.00	
Chilomycterus spinosus mauret.	0.09	1	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 40
DATE :05.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 9°32.89
start stop duration Lon E 12°48.23
TIME :13:20:36 13:56:09 35.6 (min) Purpose : 1
LOG : 7854.00 7855.79 1.8 Region : 4040
FDEPTH: 140 141 Gear cond.: 0
BDEPTH: 140 141 Validity : 0
Towing dir: 0° Wire out : 340 m Speed : 3.0 kn
Sorted : 85 Total catch: 340.35 Catch/hour: 574.43

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Anthias anthias	376.37	5646	65.52	
Zenopsis conchifer	36.29	25	6.32	
Dentex macrophthalmus	35.86	160	6.24	
Raja sp.	31.22	8	5.44	
Dentex angolensis	20.25	68	3.53	
Erythrocles monodi	19.07	25	3.32	
Octopus vulgaris	13.50	15	2.35	
Spicara alta	12.15	68	2.12	
Trachurus trecae	10.80	32	1.88	94
Scorpaena normani	5.06	34	0.88	
Grammoplites gruveli	3.80	34	0.66	
Pterothrissus belloci	2.87	17	0.50	
Umbrina canariensis	2.53	8	0.44	
Trigla lyra	1.69	8	0.29	
Peristedion sp.	1.69	25	0.29	
Bothus podas africanus	1.27	25	0.22	
Total	574.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 41
DATE :05.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 9°39.43
start stop duration Lon E 13°5.90
TIME :19:42:31 20:14:47 32.3 (min) Purpose : 1
LOG : 7908.55 7910.45 1.9 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 43 33 Validity : 0
Towing dir: 0° Wire out : 135 m Speed : 3.5 kn
Sorted : 82 Total catch: 259.75 Catch/hour: 482.96

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	330.49	3670	68.43	95
Sardinella maderensis	63.59	441	13.17	97
Ilisha africana	22.93	351	4.75	
Pomadasys jubelini	18.41	20	3.81	
Trachurus trecae	8.83	180	1.83	96
Chloroscombrus chrysurus	8.76	73	1.81	
Trichiurus lepturus	6.86	33	1.42	
Sphyraena guachancho	6.41	67	1.33	
Sardinella aurita	6.25	28	1.29	98
Pomadasys incisus	2.96	17	0.61	
Decapterus rhonchus	2.73	22	0.57	
Boops boops	1.84	112	0.38	
Pagellus bellottii	1.28	6	0.27	
Galeoides decadactylus	0.95	6	0.20	
Alloteuthis africana	0.67	279	0.14	
Total	482.96		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 42
DATE :06.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 9°45.61
start stop duration Lon E 13°4.60
TIME :02:39:51 02:56:56 17.1 (min) Purpose : 1
LOG : 7966.57 7967.53 1.0 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 70 64 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.4 kn
Sorted : 31 Total catch: 30.51 Catch/hour: 107.24

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	68.89	253	64.24	100
Sardinella aurita	15.89	49	14.81	99
Trachurus trecae	10.76	323	10.03	101
Trichiurus lepturus	7.38	7	6.88	
Sarda sarda	4.04	4	3.77	
Alloteuthis africana	0.21	91	0.20	
Saurida brasiliensis	0.07	32	0.07	
Total	107.24		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 43
DATE :06.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 9°44.60
start stop duration Lon E 13°11.38
TIME :03:59:12 04:29:46 30.6 (min) Purpose : 1
LOG : 7974.68 7976.25 1.6 Region : 4040
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 24 25 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.1 kn
Sorted : 0 Total catch: 90.66 Catch/hour: 177.94

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	57.51	820	32.32	104
Chloroscombrus chrysurus	45.63	1215	25.65	102
Brachydeuterus auritus	21.30	669	11.97	103
Ilisha africana	14.43	279	8.11	
Trichiurus lepturus	13.74	41	7.72	
Sphyraena guachancho	4.67	18	2.63	
Caranx bicolor	3.28	24	1.84	
Trachinotus ovatus	3.18	24	1.79	0
Pomadasys jubelini	2.51	8	1.41	
Selene dorsalis	2.02	53	1.14	
Stromateus fiatola	1.84	2	1.04	
Alectis alexandrinus	1.59	10	0.89	
Sardinella aurita	1.55	49	0.87	105
Trachinotus ovatus	1.37	18	0.77	
Trachurus trecae	1.35	29	0.76	106
Engraulis sp.	0.98	377	0.55	
Galeoides decadactylus	0.49	4	0.28	
Pomadasys incisus	0.49	2	0.28	
Total	177.94		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 44
DATE :06.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 10°1.11
start stop duration Lon E 12°59.24
TIME :12:05:43 12:36:25 30.7 (min) Purpose : 1
LOG : 8026.09 8027.69 1.6 Region : 4040
FDEPTH: 105 96 Gear cond.: 8
BDEPTH: 105 96 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.1 kn
Sorted : 92 Total catch: 91.71 Catch/hour: 179.24

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex angolensis	44.46	461	24.81	
Trigla lyra	29.51	203	16.46	
Dentex barnardi	27.65	102	15.43	
Invertebrate	10.85	1436	6.05	
Dentex gibbosus	10.85	18	6.05	
Raja miraletus	10.36	20	5.78	
Octopus vulgaris	9.38	8	5.23	
Pagellus bellottii	8.52	66	4.75	
Citharus linguatula	4.26	88	2.38	
Zeus faber	4.16	14	2.32	
Fistularia petimba	3.93	8	2.19	
Dentex macrophthalmus	2.99	8	1.67	
Alloteuthis africana	2.50	850	1.40	
Chaetodon hoefleri	2.33	14	1.30	
Chelidonichthys gabonensis	2.09	14	1.17	
Uranoscopus polli	1.78	8	0.99	
Pontinus accraensis	1.64	2	0.92	
Parapandalus narval	1.47	117	0.82	
Sepia orbignyana	0.51	4	0.28	
Total	179.24		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 45
DATE :06.06.2009 GEAR TYPE: pt NO: 21 POSITION:Lat S 10°8.96
start stop duration Lon E 13°13.23
TIME :20:39:35 21:08:56 28.2 (min) Purpose : 1
LOG : 8099.75 8101.39 1.6 Region : 4040
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 68 68 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.0 kn
Sorted : 192 Total catch: 1191.20 Catch/hour: 2533.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	2121.76	9033	83.75	107
Sardinella maderensis	231.43	1410	9.13	108
Trachurus trecae	49.58	289	1.96	109
Selene dorsalis	49.32	383	1.95	
Hemicaranx bicolor	41.26	66	1.63	
Sarda sarda	23.74	26	0.94	
Trachinotus ovatus	9.10	26	0.36	
Sphyraena guachancho	7.38	40	0.29	
Total	2533.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 46
DATE :06.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 10°12.57
start stop duration Lon E 13°20.50
TIME :23:34:19 00:04:36 30.3 (min) Purpose : 1
LOG : 8122.05 8123.84 1.8 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 41 53 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.5 kn
Sorted : 90 Total catch: 362.25 Catch/hour: 717.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	284.94	2909	39.70	110
Sardinella aurita	137.91	1213	19.21	112
Sardinella maderensis	116.91	1189	16.29	111
Trachurus trecae	74.50	1960	10.38	113
Ilisha africana	29.09	420	4.05	
Selene dorsalis	17.68	135	2.46	
Sphyraena guachancho	13.95	238	1.94	
Rhizoprionodon acutus	12.38	4	1.73	
Pomadasys rogeri	9.67	24	1.35	
Sarda sarda	9.51	8	1.33	
Stromateus fiatola	4.52	8	0.63	
Caranx crysos	2.42	4	0.34	
Pomadasys incisus	1.59	8	0.22	
Illex coindetii	0.63	198	0.09	
Engraulis encrasicolus	0.55	135	0.08	
Trichiurus lepturus	0.48	8	0.07	
Saurida brasiliensis	0.48	103	0.07	
Pteroscion peli	0.40	48	0.06	
Boops boops	0.24	8	0.03	
Total	717.84		100.01	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 47
DATE :07.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°16.33
start stop duration Lon E 13°19.84
TIME :08:06:43 08:43:21 36.6 (min) Purpose : 1
LOG : 8182.08 8184.40 2.3 Region : 4040
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 59 57 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.8 kn
Sorted : 31 Total catch: 31.00 Catch/hour: 50.78

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachinotus ovatus	50.78	131	100.00	
Total	50.78		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 48
DATE :07.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 10°16.87
start stop duration Lon E 13°28.36
TIME :10:32:08 11:02:58 30.8 (min) Purpose : 1
LOG : 8195.98 8197.66 1.7 Region : 4040
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 19 21 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.3 kn
Sorted : 84 Total catch: 83.91 Catch/hour: 163.30

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	85.14	1460	52.14	115
Sardinella aurita	69.58	886	42.61	114
Trachinotus ovatus	3.39	41	2.07	
Raja miraletus	2.71	4	1.66	
Sarda sarda	1.40	2	0.86	
Sphyraena guachancho	0.78	2	0.48	
Echeneis naucrates	0.29	6	0.18	
Parapenaeopsis atlantica	0.02	2	0.01	
Total	163.30		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 49
DATE :07.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 10°25.21
start stop duration Lon E 13°15.05
TIME :13:17:36 13:45:57 28.4 (min) Purpose : 1
LOG : 8215.31 8216.87 1.6 Region : 4040
FDEPTH: 100 101 Gear cond.: 0
BDEPTH: 100 101 Validity : 0
Towing dir: 0° Wire out : 260 m Speed : 3.3 kn
Sorted : 90 Total catch: 809.67 Catch/hour: 1713.59

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1534.81	100495	89.57	116
Trigla lyra	50.29	476	2.93	
Zeus faber	28.38	76	1.66	
Raja miraletus	27.62	38	1.61	
Dentex angolensis	13.14	248	0.77	
Lagocephalus laevigatus	11.24	19	0.66	
Squatina oculata	10.37	4	0.61	
Sea urchin, weak spines	8.19	762	0.48	
Pseudupeneus prayensis	7.24	152	0.42	
Pagellus bellottii	6.29	57	0.37	
Torpedo torpedo	4.76	19	0.28	
Dentex barnardi	3.24	38	0.19	
Boops boops	3.05	57	0.18	
Chaetodon hoefleri	1.90	19	0.11	
Monochirus sp.	1.14	19	0.07	
Sepia orbignyana	0.57	76	0.03	
Octopus vulgaris	0.57	19	0.03	
Dentex congoensis	0.57	19	0.03	
Citharus linguatula	0.21	114	0.01	
Total	1713.59		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 50
DATE :07.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°25.86
start stop duration Lon E 13°27.30
TIME :18:44:30 19:08:02 23.5 (min) Purpose : 1
LOG : 8260.34 8261.72 1.4 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 45 44 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.5 kn
Sorted : 118 Total catch: 213.65 Catch/hour: 544.56

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	392.27	3413	72.03	117
Sardinella aurita	60.56	275	11.12	118
Ilisha africana	47.03	770	8.64	
Brachydeuterus auritus	33.26	311	6.11	119
Sphyraena guachancho	3.67	23	0.67	
Trichiurus lepturus	2.70	10	0.50	
Pomadasys incisus	1.84	10	0.34	
Trachurus trecae	1.71	20	0.31	120
Alloteuthis africana	0.59	229	0.11	
Engraulis encrasicolus	0.41	110	0.07	
Decapterus rhonchus	0.36	5	0.07	
Saurida brasiliensis	0.18	51	0.03	
Total	544.56		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 51
DATE :07.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°27.29
start stop duration Lon E 13°33.65
TIME :20:46:49 21:16:42 29.9 (min) Purpose : 1
LOG : 8275.08 8276.67 1.6 Region : 4040
FDEPTH: 5 8 Gear cond.: 0
BDEPTH: 19 19 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.2 kn
Sorted : 83 Total catch: 83.36 Catch/hour: 167.39

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	41.37	382	24.71	121
Ilisha africana	38.76	938	23.15	
Trichiurus lepturus	28.82	86	17.21	
Sardinella maderensis	15.16	522	9.06	122
Sepia orbignyana	9.24	10	5.52	
Stromateus fiatola	7.91	34	4.73	
Ephippion guttifer	5.06	2	3.02	
Galeoides decadactylus	4.74	20	2.83	
Eucinostomus melanopterus	2.87	6	1.72	
Raja miraletus	2.77	4	1.66	
Selene dorsalis	2.57	90	1.54	
Chloroscombrus chrysurus	1.65	18	0.98	
Sphyraena guachancho	1.45	8	0.86	
Lagocephalus laevigatus	1.45	8	0.86	
Sepia officinalis hierredda	1.06	2	0.64	
Pomadasys peroteti	0.74	4	0.44	
Pomadasys jubelini	0.66	2	0.40	
Pomadasys incisus	0.36	2	0.22	
Arius parkii	0.30	2	0.18	
Decapterus rhonchus	0.26	4	0.16	
Caranx bicolor	0.12	2	0.07	
Pteroscion peli	0.08	2	0.05	
Total	167.39		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 52
DATE :08.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°38.61
start stop duration Lon E 13°32.01
TIME :03:33:12 04:04:12 31.0 (min) Purpose : 1
LOG : 8332.36 8334.08 1.7 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 63 57 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 94 Total catch: 93.87 Catch/hour: 181.63

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	83.59	480	46.02	125
Trachurus trecae	48.08	1370	26.47	123
Sardinella aurita	33.09	172	18.22	124
Trichiurus lepturus	11.22	21	6.18	
Alloteuthis africana	1.61	2	0.88	
Saurida brasiliensis	1.41	586	0.78	
Sepia orbignyana	1.35	4	0.75	
Sphyraena guachancho	1.24	2	0.68	
Sepia sp.	0.04	2	0.02	
Total	181.63		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 53
DATE :08.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 10°35.91
start stop duration Lon E 13°40.15
TIME :05:06:50 05:37:37 30.8 (min) Purpose : 1
LOG : 8341.42 8342.97 1.6 Region : 4040
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 24 26 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.0 kn
Sorted : 4 Total catch: 3.90 Catch/hour: 7.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	4.04	60	53.08	
Sardinella maderensis	2.96	21	38.97	126
Alectis alexandrinus	0.60	4	7.95	
Total	7.60		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 54
DATE :08.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°47.17
start stop duration Lon E 13°40.72
TIME :15:29:52 16:00:13 30.3 (min) Purpose : 1
LOG : 8408.66 8410.49 1.8 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 52 55 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.6 kn
Sorted : 178 Total catch: 178.24 Catch/hour: 352.49

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	256.00	449	72.63	
Trachurus trecae	39.85	206	11.30	127
Brachydeuterus auritus	33.52	261	9.51	129
Sardinella maderensis	14.24	69	4.04	128
Euthynnus alletteratus	3.88	6	1.10	131
Trachinotus ovatus	3.05	10	0.86	
Sardinella aurita	1.88	10	0.53	130
Sepia orbignyana	0.08	4	0.02	
Total	352.49		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 55
DATE :08.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°55.36
start stop duration Lon E 13°40.93
TIME :18:29:09 18:57:34 28.4 (min) Purpose : 1
LOG : 8430.05 8431.61 1.6 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 70 83 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 99 Total catch: 99.30 Catch/hour: 209.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	103.91	203	49.55	
Sardinella maderensis	61.14	285	29.15	133
Brachydeuterus auritus	16.37	116	7.80	134
Sardinella aurita	11.19	49	5.34	135
Trachurus trecae	8.79	131	4.19	132
Sepia orbignyana	5.79	6	2.76	
Alloteuthis africana	1.14	302	0.54	
Scomber japonicus	0.80	2	0.38	
Saurida brasiliensis	0.59	237	0.28	
Total	209.71		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 56
DATE :08.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 11°2.65
start stop duration Lon E 13°41.08
TIME :22:49:24 23:16:22 27.0 (min) Purpose : 1
LOG : 8464.37 8466.01 1.6 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 85 72 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.7 kn
Sorted : 93 Total catch: 322.17 Catch/hour: 717.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	437.34	1718	61.00	137
Sardinella maderensis	183.61	741	25.61	136
Trichiurus lepturus	70.86	249	9.88	
Brachydeuterus auritus	23.72	176	3.31	138
Trachurus trecae	1.47	45	0.20	139
Total	717.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 57
DATE :09.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 11°19.06
start stop duration Lon E 13°34.40
TIME :08:06:24 08:37:17 30.9 (min) Purpose : 1
LOG : 8545.77 8547.39 1.6 Region : 4040
FDEPTH: 54 53 Gear cond.: 0
BDEPTH: 54 53 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.1 kn
Sorted : 10 Total catch: 10.35 Catch/hour: 20.10

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Pagellus bellottii	8.86	64	44.06	
Sepia officinalis hierredda	1.90	4	9.47	
Trigla lyra	1.65	14	8.21	
Caranx bicolor	1.55	8	7.73	
Sarda sarda	1.40	4	6.96	
Fistularia petimba	1.36	2	6.76	
Zeus faber	1.26	2	6.28	
Scorpaena normani	0.87	10	4.35	
Grammoplites gruveli	0.66	8	3.29	
Chilomycterus spinosus mauret.	0.47	4	2.32	
Pseudupeneus prayensis	0.12	2	0.58	
Total	20.10		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 58
DATE :09.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 11°25.55
start stop duration Lon E 13°40.87
TIME :12:05:19 12:35:09 29.8 (min) Purpose : 1
LOG : 8578.81 8580.42 1.6 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 32 37 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.2 kn
Sorted : 0 Total catch: 0.13 Catch/hour: 0.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	0.26	2	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 59
DATE :09.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 11°32.13
start stop duration Lon E 13°45.55
TIME :14:05:16 14:35:31 30.3 (min) Purpose : 1
LOG : 8591.97 8593.66 1.7 Region : 4040
FDEPTH: 20 22 Gear cond.: 0
BDEPTH: 20 22 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.4 kn
Sorted : 62 Total catch: 239.46 Catch/hour: 474.96

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Pteroscion peli	101.45	3463	21.36	
Gymnura micrura	80.43	34	16.93	
Ilisha africana	56.83	1672	11.96	
Parapenaeopsis atlantica	55.93	19809	11.78	
Dicologoglossa cuneata	39.27	1059	8.27	
Pseudotolithus senegalensis	36.30	298	7.64	
Trichiurus lepturus	24.28	393	5.11	
Brachydeuterus auritus	19.64	530	4.13	140
Pseudotolithus typus	16.07	60	3.38	
Rhinobatos albomaculatus	7.14	10	1.50	
Torpedo marmorata	6.64	44	1.40	
Stromateus fiatola	5.95	18	1.25	
Galeoides decadactylus	4.52	42	0.95	
Dasyatis marmorata	4.07	4	0.86	
Cynoglossus canariensis	4.05	6	0.85	
Raja miraletus	3.49	6	0.73	
Pomadasys incisus	2.38	12	0.50	
Trachurus trecae	1.15	44	0.24	143
Sardinella aurita	0.99	10	0.21	142
Paramola cuvieri	0.89	179	0.19	
Cymbium marmoratum	0.77	6	0.16	
Argyrosomus hololepidotus	0.60	6	0.13	
G A S T R O P O D S	0.54	18	0.11	
Sepiella ornata	0.48	36	0.10	
Selene dorsalis	0.42	36	0.09	
Sardinella maderensis	0.34	48	0.07	141
Sphyraena sp.	0.30	30	0.06	
Brotula barbata	0.06	6	0.01	
Total	474.96		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 60
DATE :09.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 11°32.72
start stop duration Lon E 13°34.97
TIME :16:27:43 16:58:07 30.4 (min) Purpose : 1
LOG : 8608.07 8609.80 1.7 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 64 52 Validity : 0
Towing dir: 0° Wire out : 0 m Speed : 3.4 kn
Sorted : 49 Total catch: 48.94 Catch/hour: 96.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	54.69	280	56.60	144
Sardinella aurita	39.19	168	40.56	145
Trachinotus ovatus	2.15	2	2.23	
Scomber japonicus	0.59	2	0.61	
Total	96.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 61
DATE :09.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 11°38.92
start stop duration Lon E 13°39.86
TIME :22:04:03 22:28:45 24.7 (min) Purpose : 1
LOG : 8655.80 8657.14 1.3 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 53 39 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 115 Total catch: 276.36 Catch/hour: 671.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	350.87	770	52.27	
Trachurus trecae	189.69	4302	28.26	146
Sardinella maderensis	44.70	403	6.66	147
Sardinella aurita	35.20	323	5.24	148
Decapterus rhonchus	26.82	5	3.99	
Brachydeuterus auritus	14.36	134	2.14	149
Sphyraena guachancho	7.60	34	1.13	
Alloteuthis africana	1.97	743	0.29	
Saurida brasiliensis	0.12	34	0.02	
Total	671.32		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 62
DATE :11.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 11°50.22
start stop duration Lon E 13°33.85
TIME :12:23:54 12:57:52 34.0 (min) Purpose : 1
LOG : 8783.32 8785.13 1.8 Region : 4040
FDEPTH: 111 128 Gear cond.: 0
BDEPTH: 111 128 Validity : 0
Towing dir: 0° Wire out : 270 m Speed : 3.2 kn
Sorted : 89 Total catch: 675.02 Catch/hour: 1192.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Anthias anthias	557.08	4778	46.72	
Dentex macrophthalmus	232.23	1314	19.48	
Trachurus trecae	164.97	5382	13.84	150
Dentex angolensis	66.98	616	5.62	
Boops boops	60.81	791	5.10	
Erythrocles monodi	22.29	134	1.87	
Trigla lyra	18.26	120	1.53	
Pagellus bellottii	14.36	148	1.20	
Pontinus accraensis	13.69	26	1.15	
Raja miraletus	9.52	14	0.80	
Pterothrissus belloci	8.87	94	0.74	
Torpedo marmorata	3.62	14	0.30	
Zeus faber	3.50	14	0.29	
Peristedion sp.	3.21	67	0.27	
Uranoscopus polli	3.21	14	0.27	
Dentex barnardi	3.09	14	0.26	
Citharus linguatula	2.81	53	0.24	
Chaetodon hoefleri	2.68	14	0.23	
Sepia orbignyana	0.67	14	0.06	
Syacium micrurum	0.41	26	0.03	
Total	1192.26		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 63
DATE :11.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 11°51.11
start stop duration Lon E 13°45.76
TIME :14:55:48 15:25:22 29.6 (min) Purpose : 1
LOG : 8802.63 8804.24 1.6 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 20 21 Validity : 0
Towing dir: 0° Wire out : 105 m Speed : 3.3 kn
Sorted : 9 Total catch: 9.34 Catch/hour: 18.95

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Lobotes surinamensis	9.03	2	47.64	
Sphyraena guachancho	4.18	20	22.06	
Pomadasys jubelini	2.11	4	11.13	
Brachydeuterus auritus	1.42	2	7.49	
Pomadasys peroteti	1.03	2	5.46	
Selene dorsalis	0.73	8	3.85	
Ilisha africana	0.16	2	0.86	
Trichiurus lepturus	0.12	4	0.64	
Pteroscion peli	0.12	2	0.64	
Trachinotus ovatus	0.04	4	0.21	
Total	18.95		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 64
DATE :11.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 12°6.07
start stop duration Lon E 13°41.19
TIME :21:22:29 21:44:40 22.2 (min) Purpose : 1
LOG : 8857.77 8859.05 1.3 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 26 24 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.5 kn
Sorted : 138 Total catch: 830.76 Catch/hour: 2247.32

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella aurita	2217.94	59989	98.69	151
Sardinella maderensis	13.80	1039	0.61	153
Brachydeuterus auritus	12.98	617	0.58	152
Trachurus trecae	2.60	81	0.12	154
Total	2247.32		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 65
DATE :12.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 12°7.74
start stop duration Lon E 13°25.54
TIME :02:03:17 02:19:13 15.9 (min) Purpose : 1
LOG : 8885.54 8886.63 1.1 Region : 4040
FDEPTH: 90 97 Gear cond.: 0
BDEPTH: 274 282 Validity : 0
Towing dir: 0° Wire out : 262 m Speed : 4.1 kn
Sorted : 31 Total catch: 31.40 Catch/hour: 118.19

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	118.19	131831	100.00	
Total	118.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 66
DATE :12.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 12°26.62
start stop duration Lon E 13°27.79
TIME :21:21:38 21:30:37 9.0 (min) Purpose : 1
LOG : 9007.34 9007.88 0.5 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 20 23 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.5 kn
Sorted : 34 Total catch: 34.02 Catch/hour: 227.05

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	141.49	5473	62.32	157
Trachurus trecae	25.56	647	11.26	155
Sepia orbignyana	22.83	47	10.05	
Sardinella maderensis	12.28	87	5.41	156
Trichiurus lepturus	5.47	380	2.41	
Sphyraena guachancho	5.41	33	2.38	
Pagellus bellottii	3.47	47	1.53	
Galeoides decadactylus	3.20	40	1.41	
Pseudupeneus prayensis	3.00	47	1.32	
S H R I M P S	1.74	1301	0.76	
Pomadasys incisus	1.33	7	0.59	
Boops boops	0.93	20	0.41	
Bregmaceros sp.	0.33	194	0.15	
Total	227.05		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 67
DATE :13.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 12°32.88
start stop duration Lon E 13°21.30
TIME :00:39:11 00:52:14 13.1 (min) Purpose : 1
LOG : 9033.28 9034.17 0.9 Region : 4040
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 49 62 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 4.1 kn
Sorted : 0 Total catch: 80.99 Catch/hour: 372.37

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella maderensis	119.08	8611	31.98	160
Trachurus trecae	93.84	1614	25.20	158
Sardinella aurita	78.39	828	21.05	159
Engraulis encrasicolus	42.76	11320	11.48	161
Sepia orbignyana	33.56	32	9.01	
Trichiurus lepturus	2.39	18	0.64	
Brachydeuterus auritus	2.11	207	0.57	
Sphyraena guachancho	0.23	18	0.06	
Total	372.37		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 68
DATE :13.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 12°35.56
start stop duration Lon E 13°8.00
TIME :03:40:58 04:12:46 31.8 (min) Purpose : 1
LOG : 9056.79 9058.92 2.1 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 449 419 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 4.0 kn
Sorted : 0 Total catch: 122.98 Catch/hour: 232.04

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella aurita	156.98	191	67.65	163
Trichiurus lepturus	37.64	123	16.22	
MYCTOPHIDAE	20.75	10817	8.94	
Sardinella maderensis	13.77	62	5.94	162
Rhizoprionodon acutus	2.89	2	1.24	
Total	232.04		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 69
DATE :13.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 12°43.08
start stop duration Lon E 12°57.94
TIME :06:58:54 07:20:54 22.0 (min) Purpose : 1
LOG : 9083.70 9085.27 1.6 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 502 503 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 4.3 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
N O C A T C H	0.00	0	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 70
DATE :14.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 13°9.16
start stop duration Lon E 12°38.92
TIME :18:12:01 18:40:26 28.4 (min) Purpose : 1
LOG : 9185.56 9187.49 1.9 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 750 605 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 4.1 kn
Sorted : 0 Total catch: 141.14 Catch/hour: 297.97

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	145.04	574	48.68	
Trichiurus lepturus	119.49	410	40.10	
Isurus oxyrinchus	32.51	2	10.91	
Trachurus trecae	0.93	4	0.31	
Total	297.97		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 71
DATE :15.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 13°45.24
start stop duration Lon E 12°30.52
TIME :03:49:37 04:19:37 30.0 (min) Purpose : 1
LOG : 9267.25 9269.08 1.8 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 93 81 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.7 kn
Sorted : 11 Total catch: 10.73 Catch/hour: 21.46

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus trecae	5.88	58	27.40	164
Trichiurus lepturus	5.56	8	25.91	
Scomber japonicus	5.10	18	23.77	166
Sardinella aurita	4.80	26	22.37	165
Saurida brasiliensis	0.12	34	0.56	
Total	21.46		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 72
DATE :15.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 14°13.66
start stop duration Lon E 12°15.22
TIME :14:52:02 15:22:33 30.5 (min) Purpose : 1
LOG : 9347.66 9349.34 1.7 Region : 4050
FDEPTH: 101 101 Gear cond.: 0
BDEPTH: 101 101 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.3 kn
Sorted : 0 Total catch: 1503.80 Catch/hour: 2956.36

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	2034.14	17398	68.81	
Trachurus trecae	406.95	3342	13.77	167
Umbrina canariensis	244.76	1081	8.28	
Boops boops	117.96	1474	3.99	
Pagellus bellottii	49.93	413	1.69	
Squatina oculata	33.42	20	1.13	
Dentex barnardi	24.57	79	0.83	
Dentex angolensis	14.74	59	0.50	
Chelidonichthys gabonensis	12.78	79	0.43	
Trigla lyra	11.01	118	0.37	
Alloteuthis africana	6.09	2320	0.21	
Total	2956.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 73
DATE :15.06.2009 GEAR TYPE: PT NO: 4 POSITION:Lat S 14°21.76
start stop duration Lon E 12°19.43
TIME :18:28:32 18:54:08 25.6 (min) Purpose : 1
LOG : 9376.03 9377.78 1.8 Region : 4050
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 68 44 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 4.1 kn
Sorted : 123 Total catch: 294.12 Catch/hour: 689.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	307.45	1228	44.60	168
Sardinella aurita	135.80	839	19.70	169
Trachurus trecae	109.69	532	15.91	170
Pomatomus saltatrix	80.70	101	11.71	
Sphyrna zygaena	38.32	14	5.56	
Engraulis encrasicolus	8.98	1641	1.30	
Trichiurus lepturus	3.70	5	0.54	
Saurida brasiliensis	2.23	729	0.32	
Sepia orbignyana	1.80	12	0.26	
Alloteuthis africana	0.68	518	0.10	
Total	689.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 74
DATE :16.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 14°43.16
start stop duration Lon E 12°14.81
TIME :01:28:19 01:57:38 29.3 (min) Purpose : 1
LOG : 9428.61 9430.32 1.7 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 126 790 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.5 kn
Sorted : 90 Total catch: 1590.68 Catch/hour: 3255.14

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	3122.62	20816	95.93	171
Scomber japonicus	132.52	432	4.07	
Total	3255.14		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 75
DATE :17.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 15°12.91
start stop duration Lon E 12°2.34
TIME :02:25:18 02:50:11 24.9 (min) Purpose : 1
LOG : 9597.42 9598.79 1.4 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 82 35 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 69 Total catch: 927.45 Catch/hour: 2235.72

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	2235.72	14090	100.00	172
Total	2235.72		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 76
DATE :17.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 15°25.19
start stop duration Lon E 12°0.21
TIME :07:02:30 07:33:46 31.3 (min) Purpose : 1
LOG : 9634.46 9636.16 1.7 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 40 41 Validity : 0
Towing dir: 0° Wire out : 145 m Speed : 3.3 kn
Sorted : 0 Total catch: 0.37 Catch/hour: 0.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Spondyliosoma cantharus	0.71	2	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 77
DATE :17.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 15°52.81
start stop duration Lon E 11°42.86
TIME :20:01:54 20:26:02 24.1 (min) Purpose : 1
LOG : 9741.78 9743.12 1.3 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 64 50 Validity : 0
Towing dir: 0° Wire out : 145 m Speed : 3.3 kn
Sorted : 122 Total catch: 669.65 Catch/hour: 1664.42

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1623.36	18974	97.53	173
Dasyatis marmorata	19.56	15	1.18	
Loligo vulgaris	11.63	410	0.70	
Merluccius capensis	4.80	15	0.29	
Chilomycterus spinosus mauret.	3.01	15	0.18	
Scomber japonicus	1.52	15	0.09	
Trichiurus lepturus	0.42	15	0.03	
Engraulis encrasicolus	0.14	27	0.01	
Total	1664.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 78
DATE :17.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°0.20
start stop duration Lon E 11°43.18
TIME :23:24:22 23:38:46 14.4 (min) Purpose : 1
LOG : 9763.52 9764.38 0.9 Region : 4050
FDEPTH: 0 10 Gear cond.: 0
BDEPTH: 38 42 Validity : 0
Towing dir: 0° Wire out : 145 m Speed : 3.6 kn
Sorted : 96 Total catch: 894.23 Catch/hour: 3728.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	3617.89	51415	97.03	174
Sardinella aurita	46.28	388	1.24	175
Scomber japonicus	26.35	259	0.71	
Loligo vulgaris	19.01	271	0.51	
Pagellus bellottii	17.47	309	0.47	
Saurida brasiliensis	1.54	38	0.04	
Total	3728.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 79
DATE :18.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.83
start stop duration Lon E 11°36.80
TIME :07:05:11 07:25:35 20.4 (min) Purpose : 1
LOG : 9809.62 9810.69 1.1 Region : 4050
FDEPTH: 73 76 Gear cond.: 0
BDEPTH: 73 76 Validity : 0
Towing dir: 0° Wire out : 190 m Speed : 3.1 kn
Sorted : 137 Total catch: 1365.50 Catch/hour: 4016.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	3330.88	78059	82.94	176
Dentex macrophthalmus	307.35	8265	7.65	177
Merluccius polli	215.00	1412	5.35	
Mustelus mustelus	73.53	29	1.83	
Argyrosomus hololepidotus	42.06	29	1.05	
Octopus vulgaris	21.47	29	0.53	
Loligo vulgaris	14.71	971	0.37	
Sepia orbignyana	10.29	29	0.26	
Citharus linguatula	0.88	29	0.02	
Total	4016.18		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 80
DATE :18.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°42.14
start stop duration Lon E 11°45.70
TIME :12:43:15 13:13:21 30.1 (min) Purpose : 1
LOG : 9856.20 9857.99 1.8 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 19 15 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 3.6 kn
Sorted : 9 Total catch: 8.64 Catch/hour: 17.23

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	11.70	287	67.94	
Pomatomus saltatrix	3.13	42	18.17	
Sardinella aurita	1.32	26	7.64	179
Trachurus trecae	0.96	80	5.56	178
Starfish	0.04	24	0.23	
Maja squinado	0.02	2	0.12	
Trachurus capensis	0.02	2	0.12	
Lagocephalus laevigatus	0.02	2	0.12	
Engraulis encrasicolus	0.02	2	0.12	
Total	17.23		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 81
DATE :18.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°18.26
start stop duration Lon E 11°31.90
TIME :18:13:13 18:24:05 10.9 (min) Purpose : 1
LOG : 9902.27 9903.00 0.7 Region : 4050
FDEPTH: 0 40 Gear cond.: 0
BDEPTH: 84 85 Validity : 0
Towing dir: 0° Wire out : 125 m Speed : 4.0 kn
Sorted : 138 Total catch: 482.76 Catch/hour: 2667.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2486.74	151989	93.23	180
Todarodes sagittatus	74.45	309	2.79	
Sepia orbignyana	55.69	39	2.09	
Dentex macrophthalmus	41.60	1028	1.56	
Merluccius capensis	5.61	22	0.21	
Scomber japonicus	1.74	22	0.07	
Etrumeus whiteheadi	1.35	22	0.05	
Total	2667.18		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 82
DATE :18.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°38.63
start stop duration Lon E 11°46.05
TIME :23:32:33 23:36:14 3.7 (min) Purpose : 1
LOG : 9947.08 9947.33 0.3 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 19 19 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 4.2 kn
Sorted : 9 Total catch: 9.01 Catch/hour: 146.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis encrasicolus	63.90	67984	43.62	
SEMELIDAE	25.04	9154	17.09	
Trachurus trecae	20.98	2455	14.32	181
J E L L Y F I S H	20.33	163	13.87	
Loligo vulgaris	6.50	49	4.44	
POTAMIDIDAE	4.72	553	3.22	
NATICIDAE	2.28	341	1.55	
B I V A L V E S	1.46	65	1.00	
Trichiurus lepturus	0.98	16	0.67	
Dicologoglossa cuneata	0.33	33	0.22	
Total	146.50		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 83
DATE :19.06.2009 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°36.81
start stop duration Lon E 11°24.52
TIME :10:47:28 10:55:22 7.9 (min) Purpose : 1
LOG : 19.24 19.67 0.4 Region : 4050
FDEPTH: 120 123 Gear cond.: 0
BDEPTH: 120 123 Validity : 0
Towing dir: 0° Wire out : 330 m Speed : 3.3 kn
Sorted : 154 Total catch: 5014.21 Catch/hour: 38082.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	18374.13	314195	48.25	183
Trachurus trecae	17401.22	245362	45.69	182
Etrumeus whiteheadi	1501.06	24182	3.94	184
Sardinops ocellatus	378.08	0	0.99	185
Dentex macrophthalmus	141.80	0	0.37	
Scomber japonicus	136.12	0	0.36	
Merluccius capensis	97.29	0	0.26	
Todaropsis eblanae	44.51	0	0.12	
PATELLIDAE	8.35	0	0.02	
Total	38082.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 84
DATE :19.06.2009 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°42.42
start stop duration Lon E 11°35.06
TIME :15:49:25 16:31:43 42.3 (min) Purpose : 1
LOG : 53.71 56.43 2.7 Region : 4050
FDEPTH: 40 40 Gear cond.: 0
BDEPTH: 94 0 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 3.9 kn
Sorted : 3 Total catch: 2.55 Catch/hour: 3.62

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sphyrna zygaena	2.84	1	78.43	
Etrumeus whiteheadi	0.78	16	21.57	
Total	3.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2009406 STATION: 85
DATE :19.06.2009 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°50.89
start stop duration Lon E 11°41.61
TIME :22:47:28 23:06:56 19.5 (min) Purpose : 1
LOG : 109.85 110.83 1.0 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 22 22 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.0 kn
Sorted : 67 Total catch: 201.81 Catch/hour: 621.59

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus trecae	476.80	15579	76.71	186
J E L L Y F I S H	127.05	5544	20.44	
Trichiurus lepturus	8.59	333	1.38	
Arius parkii	4.62	28	0.74	
Etrumeus whiteheadi	3.97	213	0.64	
Sardinops ocellatus	0.28	9	0.04	
Sardinella aurita	0.18	9	0.03	
Pagellus bellottii	0.09	9	0.01	
Total	621.59		100.00	

ANNEX II Acoustic equipment and Fishing gear used

The Simrad ER-60/18, 38, 120 and 200kHz scientific sounder was run during the survey only for observation of fish and bottom conditions.

Standard sphere calibrations were carried out using 38.1 mm diameter tungsten carbide sphere for 18, 38, 120 and 200 kHz. The calibrations took place 18.03.2008, Baia dos Elefantes. The details of the settings of the 38kHz echo sounder where as follows:

Transceiver-2 menu (38 kHz)

Transducer depth	5.50 m
Absorbtion coeff.	8,7 dB/km
Pulse length	medium (1,024ms)
Bandwidth	2,43 kHz
Max power	2000 Watt
2-way beam angle	-20,6dB
gain	25,04 dB
SA correction	-0,46 dB
Angle sensitivity	21.9
3 dB beamwidth	7,76º along ship
	7,86º athwardship
Alongship offset	-0.12º
Athwardship offset	0.06º

Bottom detection menu Minimum level -40 dB

Fishing gear

The vessel has two 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 headline of 31 m, footrope 47 m and 20 mm meshsize in the codend with an innernet of 10 mm meshsize. The trawl height was about 4.5 m and distance between wings during towing about 21 m. The sweeps are 40 m long. The trawl is equiped with a 12" rubber bobbins gear. New doors are 'Thyborøn' combi type, 7.41 m^2, 1720 kg. These have been in used onboard since 19.02.08. During the present survey the door distance was kept nearly constant at about 50 m at all depths by the use of a 9.5 m strap between the wires at 120 m distance from the doors (normally applied at depths greater than 80 m).

The SCANMAR system was used on 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 the trawl was 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. A catch sensor on the cod-end indicated the size of the catch.