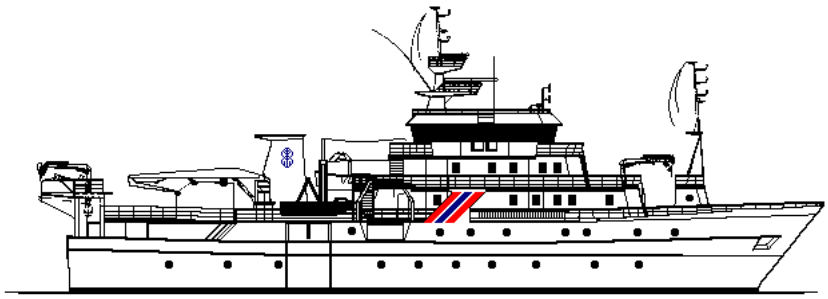
BCC Project: LMR/NANSEN/1/11 Cruise reports "Dr. Fridtjof Nansen"



BCC SURVEY NO.1 2011

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

Cruise report No 01/2011

29 July –28 August 2011

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 between southern Angola and 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 available, of twelve days, was integrated into the yearly pelagic survey of Angola conducted by the 'R/V Dr Fridtjof Nansen'. In order to be able to continue the coverage carried out by Angola and to utilize the ship time optimally, the survey was extended southwards in central Namibia to Toscanini at 20°50' S.

The overall transboundary area is defined from Ponta Albina (near Tombua) at 15°50' S and southwards to the Cape Frio upwelling cell (at around 19°00' S). The northern boundary is located at the northernmost part of the Tiger Bank, from where the continental shelf starts widening while 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 these ecological delimiters, the northern boundary of the transboundary area could be described as the northern limits of the distribution of the Cape horse mackerel, while the southern limits of the distribution of the Sardinellas and/or Cunene horse mackerel indicates its southern extend. This applied definition of the transboundary area is expected to be wide enough to cover the likely distribution area of fish migrating between Namibian and Angolan waters, at both warm and cold seasons.

The zone across the Angolan-Namibian border is particularly important as it 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* spp. There is special concern about the situation in the transboundary area since these stocks are known to be in low abundance, while they are intensively fished in the border area.

Usually, very little pelagic fish is found in northern Namibian waters, nevertheless and in order to check of the occurrence and abundance of fish in this area, the transect lines were

extended southwards to Toscanini at 20°50’ S, following a similar survey design of pseudo-parallel transect but with 10 n.mi spacing between each line.

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 complemented the pelagic survey carried out in Angola by extending the survey grid into Namibian waters. The survey and fish sampling strategy (pelagic and demersal trawling on acoustic targets) as well as the hydrographical mapping in the transboundary area follow the established standard for the yearly pelagic surveys in Angolan waters (Dr. Fridtjof Nansen Survey Report of the Angolan Pelagic Resources No. 2/2007), thus the transboundary survey provide a complete coverage of the Cunene horse mackerel, including the proportion of the stock present in Namibian waters at the time of the pelagic survey in Angola. For sardine and the other clupeids as well as Cape horse mackerel, however, the survey would not cover the entire distribution area of the species.

The estimates presented are relative indices of the proportion of the stock units distributed within the transboundary area at the time of the survey, and not absolute abundance estimates, therefore the population estimates should not be interpreted in absolute terms. For species like sardine, Cape horse mackerel and other pelagic (clupeids) the estimates do not cover the entire distribution area of the stocks (*e.g.* sardine is known to migrate between Angolan and Namibian waters, and differences from one year to another may well be caused by migration rather than population changes). As for all acoustic estimates, the indices presented here are prone to survey errors such as statistical sampling errors, vessel avoidance and the availability to acoustic sampling (Anon. 2003, 2004).

1.1 Objectives

The main objectives of the survey were the following:

- To map the distribution and estimate the abundance of the most commercially important pelagic species in the Namibia-Angola transboundary area (15°50-19°00'), following the survey design utilized in Angolan waters (6 n.mi spacing between transect lines), 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 map the distributions and estimate the abundance of the same species in northern Namibia, up to Toscanini (20°50' S), following the established survey design with 10 n.mi spacing between the transect lines.

- 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:

Antonio BARRADAS (Angolan Team Leader), Henriette LUTUBA, Pedro PANZO, Domingos PEDRO, Fátima DELICADO, Geraldina SALVADOR and Eusébio dos SANTOS.

From Namibia:

Hilkka NDJAULA, BCC, University of Cape Town (Namibian Team Leader), Ipeinge Etuwete MUNDJULU (NatMIRC) and Justine SHITHINDI (NatMIRC).

From IMR, Norway:

Diana ZAERA (Cruise Leader), Tore MØRK, Inês BERNARDES and Kåre TVEIT.

1.3 Survey schedule and effort

A full transceiver calibration of all frequencies (18, 38, 120 and 200 kHz) was carried out prior to the survey. The calibration was done in Baía dos Elephantes, Angola, on 7th of August. 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 16th of August. The coverage of the transboundary area south to Rocky Point at 19°00'S was completed on 22nd August. The survey was extended southwards, but due to strong winds the survey was ended off Toscanini, at 20°50' S, the 27th August, where the course track was then completed. The vessel docked in Walvis Bay next day.

Figure 1 shows the cruise track with pelagic, demersal trawl stations and CTD stations in the transboundary survey area (15°50'-19°00' S) and figure 2 shows cruise track with pelagic and demersal trawl stations and CTD stations in central Namibia (19-20°50'S). The survey effort, in terms of distance sailed, stations trawled and CTD stations are summarised in Table 1 below.

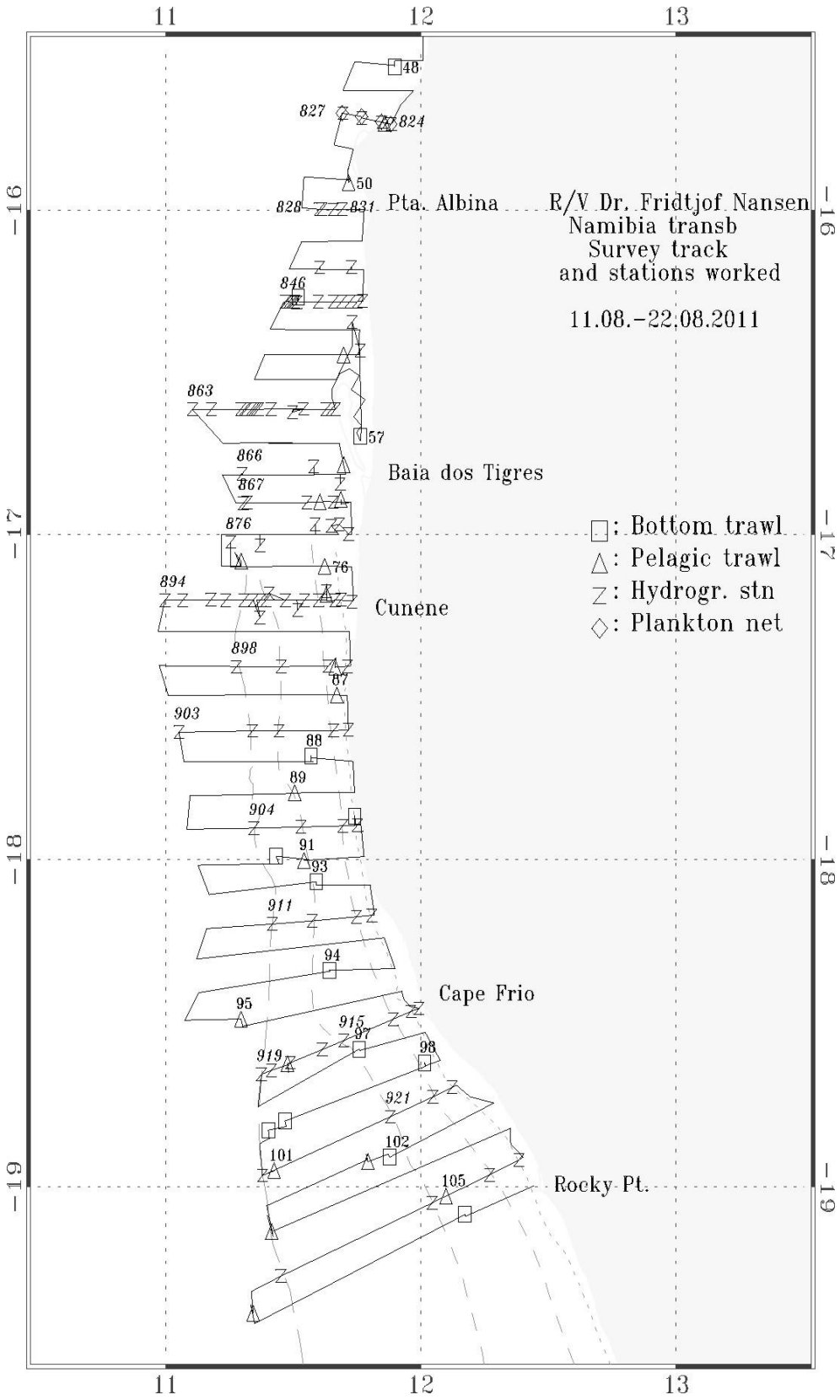

Figure 1 Course track with pelagic, demersal trawl stations and CTD casts in the transboundary area (15°50'-19°00' S).

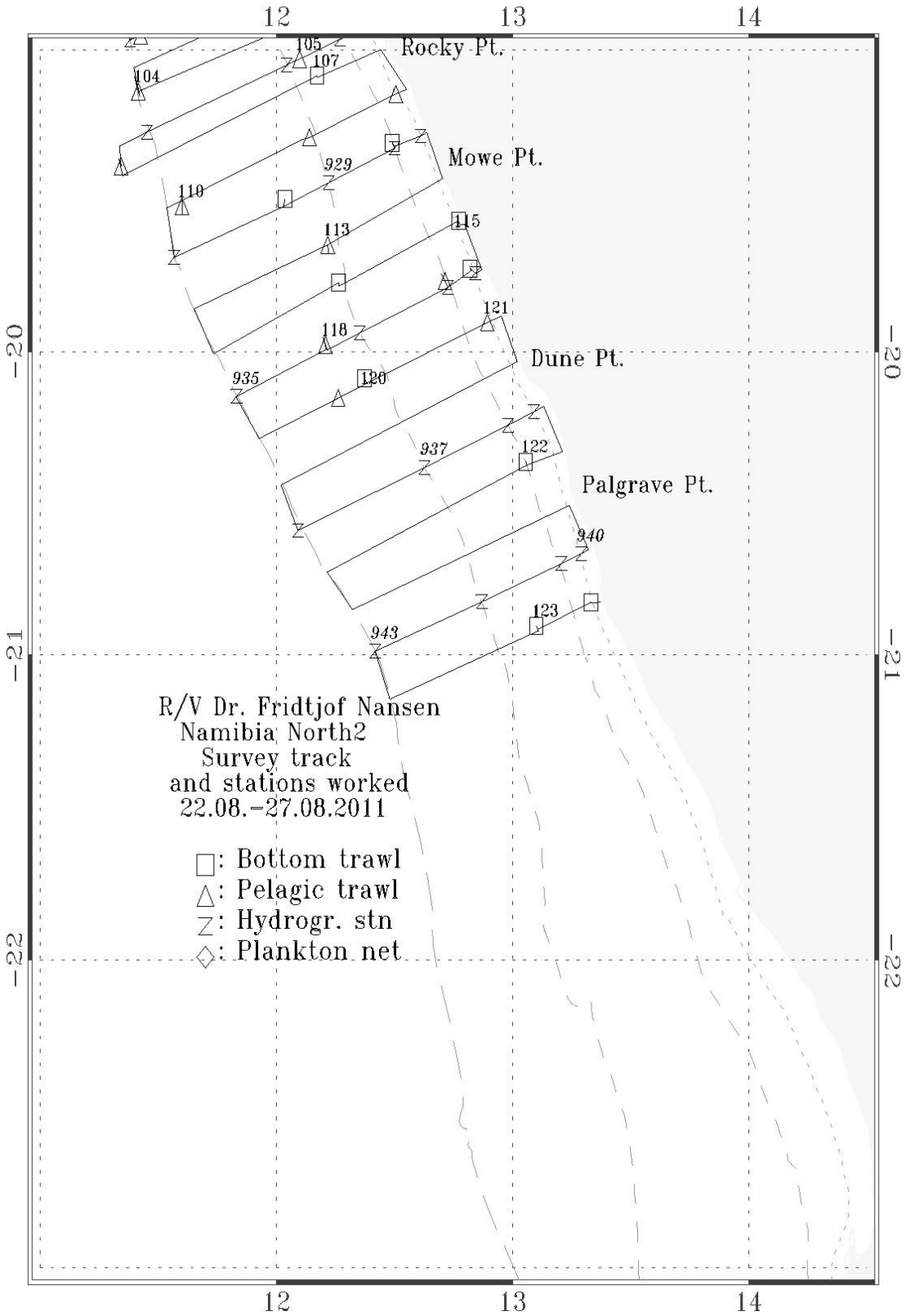

Figure 2. Course track with pelagic, demersal trawl stations and CTD casts in Northern Namibia (19°00' - 20°50'S).

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

Area	BT trawls	PT trawls	Total trawls	CTD casts	Log distance (n.mi)
Transboundary Angola (15°50'S - 17°15' S)	7	8	15	53	718.4
Transboundary Namibia (17°15'S -19°00' S)	11	11	22	33	1133.7
Northern Namibia (19°00'S -20°50' S)	9	8	17	16	940.2
Total	27	27	54	102	2792.3

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. 1), following the established practice for the transboundary surveys. Transects generally covered a depth range of 20-500 meters. As in previous surveys, some of the lines had to be stopped at 30-35 m depth due to the steeply inclining bottom near the shoreline. 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, making possible to draw across the border area distribution maps and biomass estimates.

2.2 Acoustical sampling

A standard sphere calibration was carried out at Baía dos Elephantes (Angola) on 7th of August 2011, before commencement of the survey. Standard calibration procedures for all frequencies (18, 38, 120 and 200 kHz) were followed using the appropriate calibration spheres. There were no significant deviations from the previous calibrations and subsequently no changes in the calibration parameters were made prior to the survey. 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. 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 III.

The acoustic data were scrutinized at 38 kHz using the mentioned LSSS program. 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 together with information about the species - and size compositions - as derived from the trawl catches. Definitions of the acoustic target groups are given in Table 2 below.

Table 2. Allocation of acoustic backscattering coefficients to acoustic target groups and their definitions. Note that for sardinellas, 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. 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*
	Others	*Merluccius spp.* *Brama brama* *Chelidionichthys capensis*
Mesopelagic species	Myctophidae$_{3}$ Lantern fish$_{3}$	
	Other mesopelagic fish	
Plankton		

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

Estimation of fish abundance

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 are presently 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 were determined by means of contouring within the inner and outer zero-value limits of the transect lines (post strata) using the Nansis Maptool software. 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 = 300-1 000; (3): s_A = 1 000-3 000; (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:

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

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

Targeted trawling was carried out on identified acoustic targets using the smallest pelagic sample trawl (10 m vertical opening), the mid-sized pelagic sample trawl (12 m) and the demersal sample trawl (5 m). 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 I. Other species (mostly of commercial value) were collected and identified to species level and length measurements were taken. A brief description of the sampling trawls is provided in Annex III.

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 IV). Length-weight relationships of target species were determined from the regression analysis (power fit, a, b) of the total weight to the total length recorded for all sampled specimens.

$$\mathbf{W} = a\,\mathbf{L}^{b}$$

Scanmar sensors provided real-time information of the depth of the head rope, the vertical opening of the mouth of the trawl and the clearance between the ground gear and the bottom. The trawl eye and catch sensor gave information of fish entering into the trawl and the catch retained in the codend, respectively.

2.4 Meteorological and hydrographical sampling

Wind direction and speed, air temperature, global radiation and sea surface temperature (at 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 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, oxygen and chlorophyll. Real time logging was carried out using the PC based Seabird Seasave software. CTD casts were conducted along the cruise track at the oceanographic lines (Pta. Albina, Baía dos Tigres, Cunene River, Cape Frio) and additionally on every 2nd transect at 200, 100 and 50 m depths. The casts were stopped a few meters above the bottom.

3 Results

3.1 Transboundary area

Horse mackerel

The distribution map for both species of horse mackerel is shown in Figure 3. The first encounter with *T. capensis* this year was further north of the transboundary area, at around 16°12'S (last year the location was at 16°40'S). From the catch records it could be noted that *T. capensis* was continuously distributed throughout the transboundary area, showing mainly low densities ($1 < s_A < 300$ $m^2/n.mi^2$), but with some medium-low ($301 < s_A < 1\ 000$ $m^2/n.mi^2$), medium-high ($1\ 001 < s_A < 3\ 000$ $m^2/n.mi^2$) and high ($3\ 000 < s_A < 10\ 000$ $m^2/n.mi^2$) density patches. Most of the *T. capensis* was found within the 200m isobaths, though it was also caught far offshore. As for *T. trecae*, it was also found continuously distributed, from the Angolan side of the transboundary and up to 17°11'S, but its distribution went as far as 17°51'S, with rare encounters further south of the transboundary area and down up to 19°43'S. Its densities were, however lower than those for *T. capensis*. *T. trecae* was mostly encountered in medium-low densities areas ($s_A < 1000$ m^2 nmi^{-2}) except for the two areas of medium-high density ($s_A = 1778$ and 1262 m^2 nmi^{-2}). Inside Tiger Bay, both species were caught, being *T. capensis* the most abundant (90 % of the catch).

The highest density concentrations for both species were found at around 18°10' and between Cape Frio and Rocky Point, the first was found offshore while the second one was bigger and inshore-offshore located.

The total biomass for both species was estimated at 598 000 tonnes, which is about the same level as last year's estimate (561 500 tonnes). 93% (558 500 tonnes) of the total belonged to *T. capensis*, which is slighter higher than last year's estimate (516 600 tonnes). On the other hand, *T. trecae* represented only 7% of the total biomass (39 500 tonnes) which represents around a 14% decrease as compared to last year's estimate (45 500 tonnes).

Around 80% of the caught *T. capensis* were less than 15 cm TL, while about 92% of the biomass of *T. trecae* was adult fish (>17 cm total length). This is a different situation as the one found last year when most of the *T. capensis* found (84%) were fish bigger than 17 cm TL and most of the *T. trecae* (70%) were less than 17 cm TL.

As last year, only around 14% of the total calculated biomass for both horse mackerel was found on the Angolan side of the transboundary.

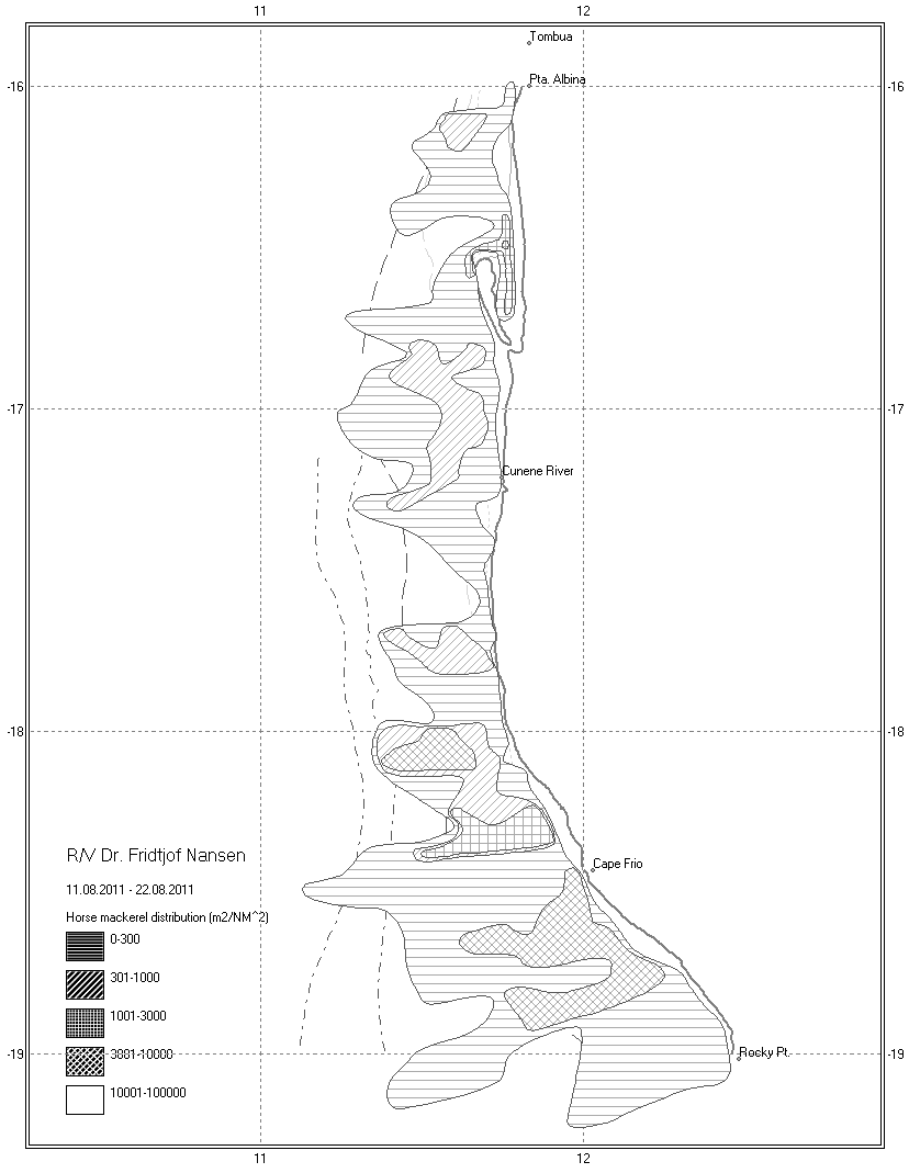

Figure 3 Distribution of both species of horse mackerel (*T. capensis* and *T. trachurus*) in the Angola-Namibia transboundary area (15°50'-19°00' S). Isobaths are indicated at 100, 200, 500, 1 000 and 2 000 m depths.

The size composition for *T. capensis* shows a bimodal distribution with modal peaks at 10 cm and 15 cm TL (Figure 4) (*N* = 10 333 mill. individuals). A total of 3743 fish were sampled for length frequency analysis which yielded a mean total length of 15.3 cm. For *T. trecae*, the size composition distribution also shows a bimodal distribution with peaks at 10 and 16 cm TL (Figure 5) (*N* = 2 342 mill. individuals). A total of 2 947 fish were sampled for length frequency analysis to get a mean total length of 18.8 cm.

Further, a sub sample of 1067 fish of *T. capensis*, was taken for length-weight and biological analyses. The length weight relationship for *T. capensis* showed a very good fit (R^2=0.99), where *a* and *b* were 0.0097 and 2.9227 respectively (Fig. 6). Maturity analysis showed that, 821 fish were found immature while 246 fish were found maturing. Majority of the fish were found to be in stage 2 with female dominating that stage (Fig. 7).

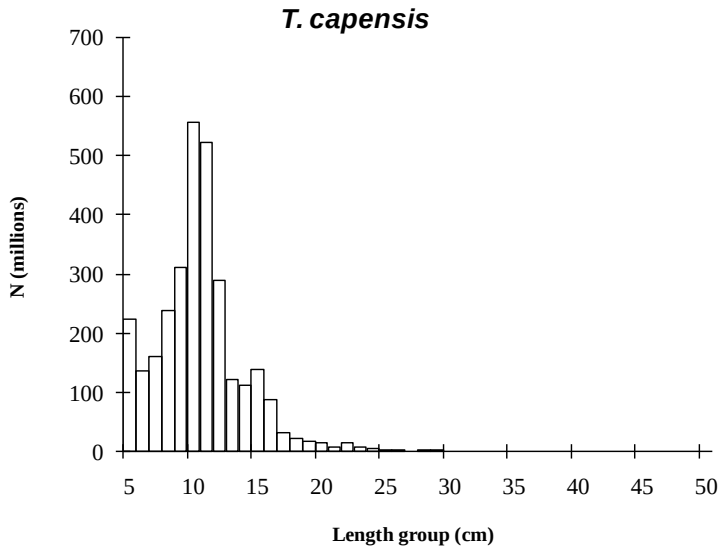

Figure 4 Length frequency distribution of *T. capensis* in the transboundary area (15°50'-19°00' S) (*N* = 10 333).

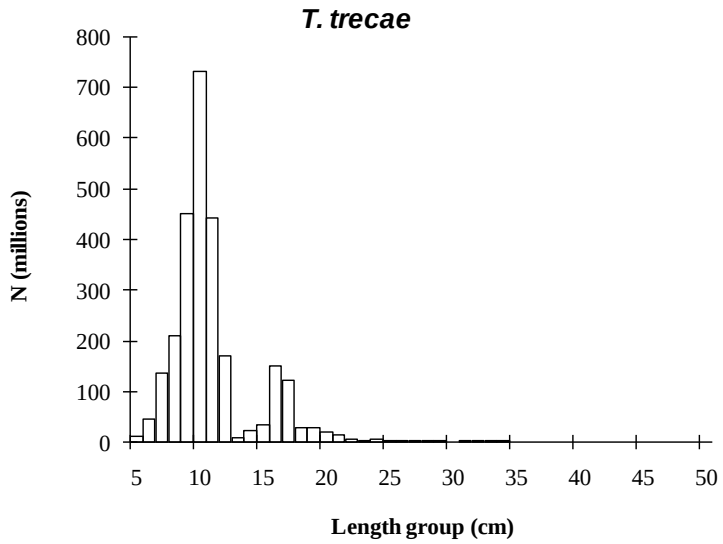

Figure 5 Length frequency distribution of *T. trecae* in the transboundary area (15°50'-19°00' S) (*N* = 2 342).

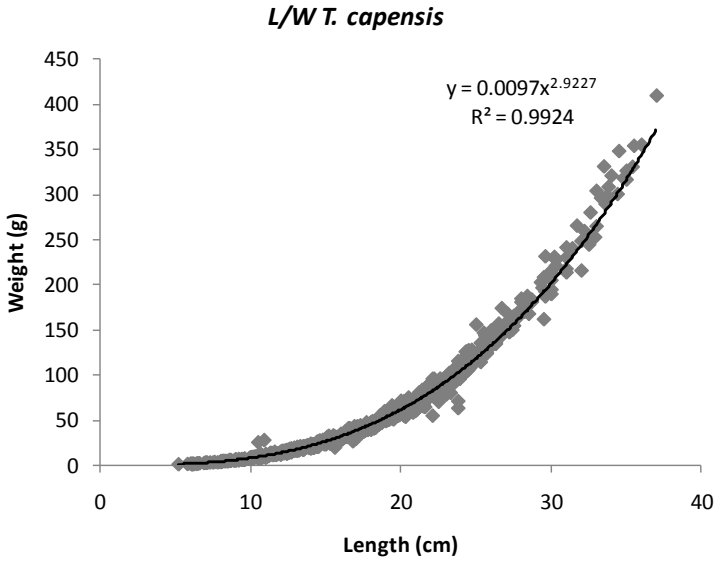

Figure 6 Length-weight relationship for *T. capensis* in the transboundary area (15°50'-19°00' S) (*n*= 1 067).

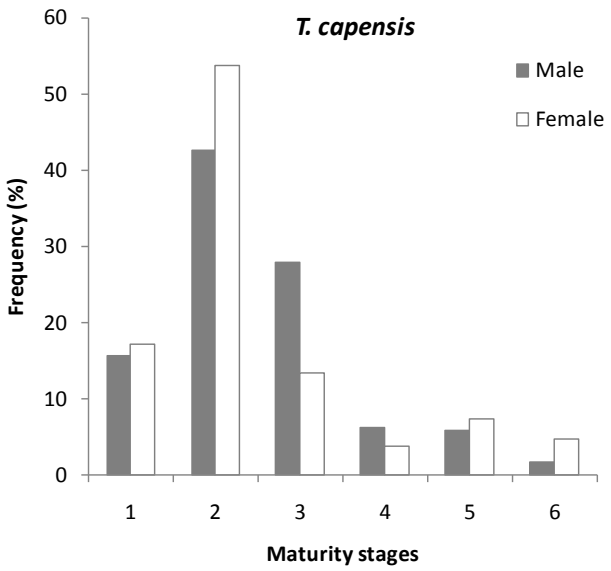

Figure 7 Frequency of *T. capensis* maturity stages by sex found in the Transboundary area.

For *T. trecae*, a subsample of 720 fish was taken for both length-weight and biological analyses. The length weight relationship (Figure 8) gave allometric parameters of 0.0125 and 2.8634 for *a* and *b* respectively (R^2 = 0.99). As for the biological analysis, 423 fish were found to be immature while 297 were mature. Majority of the fish were found in stage 2 with female domination at this stage (Figure 9).

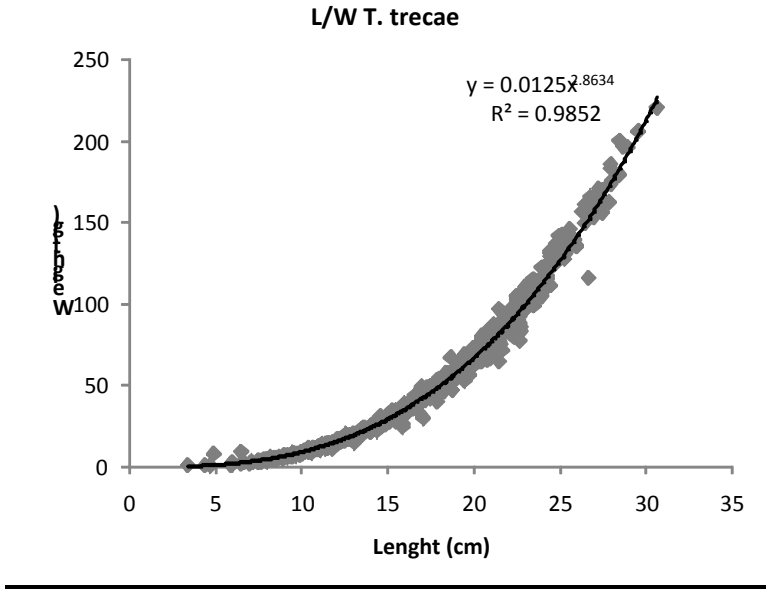

Figure 8 Length-weight relationship for *T. trecae* in the transboundary area (15°50'-19°00' S) (*n* = 720).

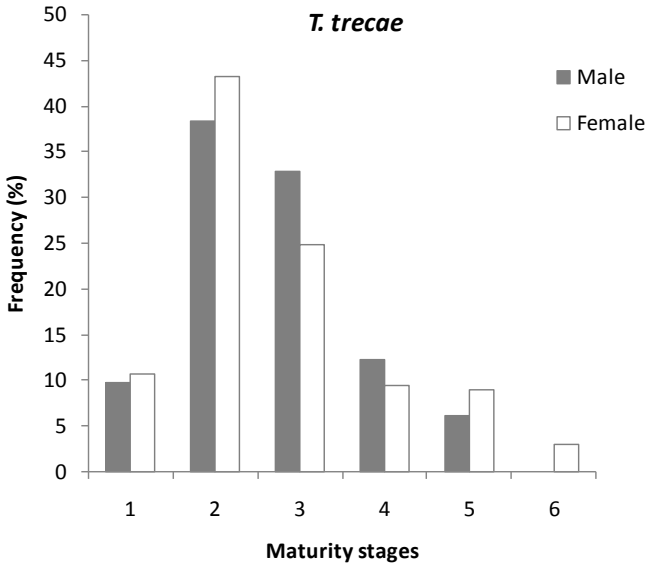

Figure 9 Frequency of *T. trecae* maturity stages by sex found in the Transboundary area.

Sardine (*Sardinops sagax, "Pilchard"*)

The distribution of *Sardinops sagax* and is shown in Figure 10 below. *S. sagax* was found in a single inshore-offshore, continuous aggregation distribution in Angolan waters south of Tiger Bay. The densities of *S. sagax* strata varied from medium-low ($300 < s_A < 1\,000$ m^2 nmi^{-2}) to very high ($s_A > 10\,000$ m^2 nmi^{-2}). The total biomass of *S. sagax* was estimated at 51 500 which represent a dramatic decline as compared to last year's estimate of 399 000 tonnes. However, these figures donot necessarily represent the state of the sardnie stock, and caution should be taken when interpreting this dramatic change as a decline in stock size. Firstly, the estimates are relative indices, not absolute estimates of abundance and so the population estimate should not be interpreted in absolute terms. Second, this was not a dedicated sardine survey where, both acoustic and net sampling was limited, thus warranting some uncertainty associated to this estimate. Further more, the estimates of the sardine do not cover the entire distribution of the sardine stock, which is known to migrate between Angolan and Namibian waters changing from one year to another, contributing to discrepancies in the figures, which partially could be attributed to migration rather than to population changes. Finally, the estimates of the relative indices of the proportion of the stock distributed within the transboundary area are, as for all acoustic estimates, prone to survey errors such as statistical sampling errors (caused by distribution in relatively small, high-density patches, which is typical for sardine), vessel avoidance and the availability to acoustic sampling (upper blind zone errors) as well as the time of the year the survey was carried out (Anon. 2003, 2004).

The total length of *S. sagax* ranged from 13-20 cm with a mode that peaks at 18cm total length (Figure 11). The mean estimated total fish length from a total of 12 771 fish sampled was 16.6 cm. A sub sample of 241 *S. sagax* was sampled for length-weight and biological analyses. The length-weight relationship for *S. sagax* showed a very good fit (R^2=0.99), where *a* and *b* were estimated at 0.003 and 3.3384 respectively (Figure 12).

Sardinella aurita was not caught in the transboundary area this year.

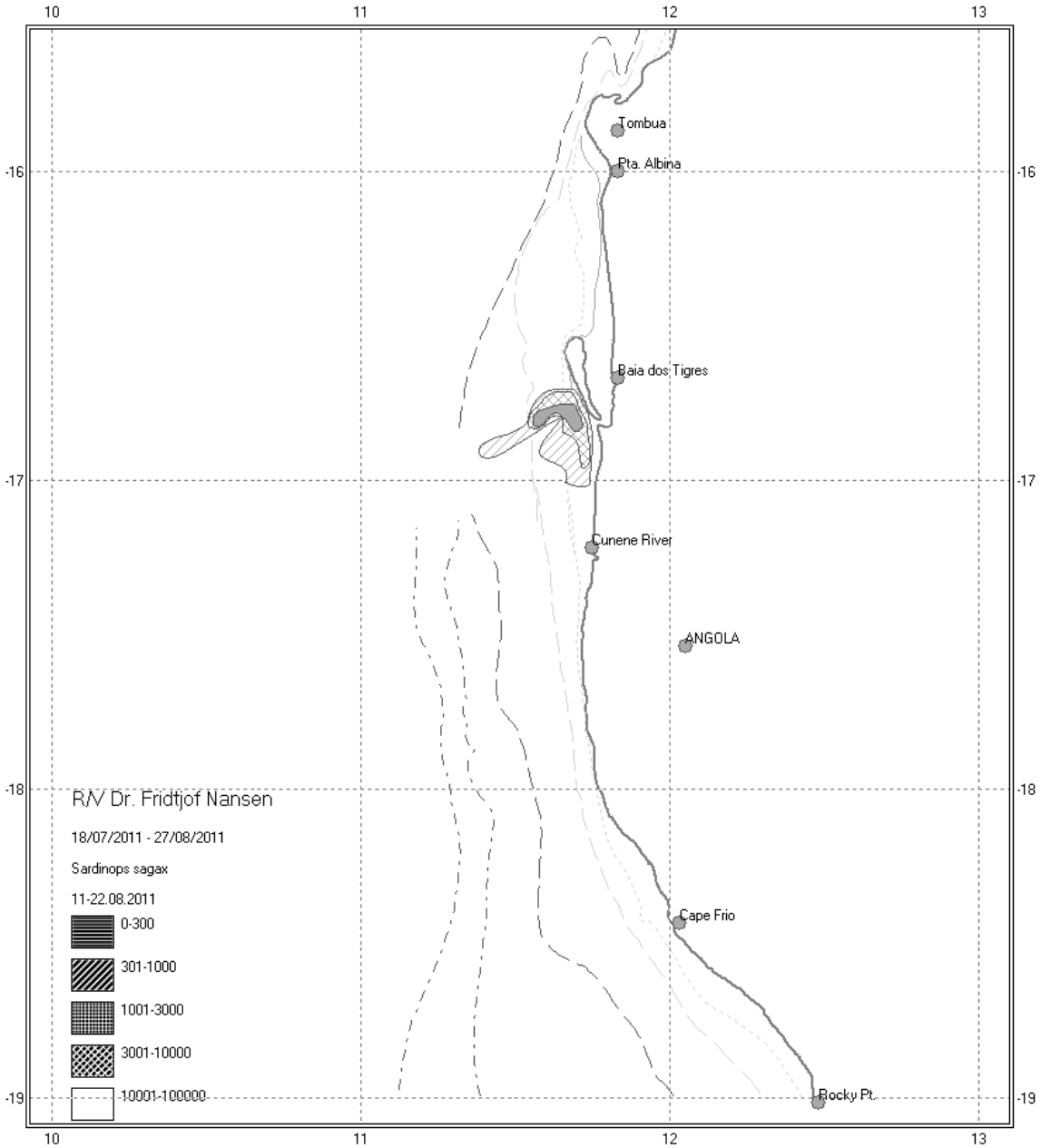

Figure 10 Distribution of *Sardinops sagax* in the Angola-Namibian transboundary area (15°50'-19°00' S). Isobaths are indicated at 50, 100, 200 and 500 m depths.

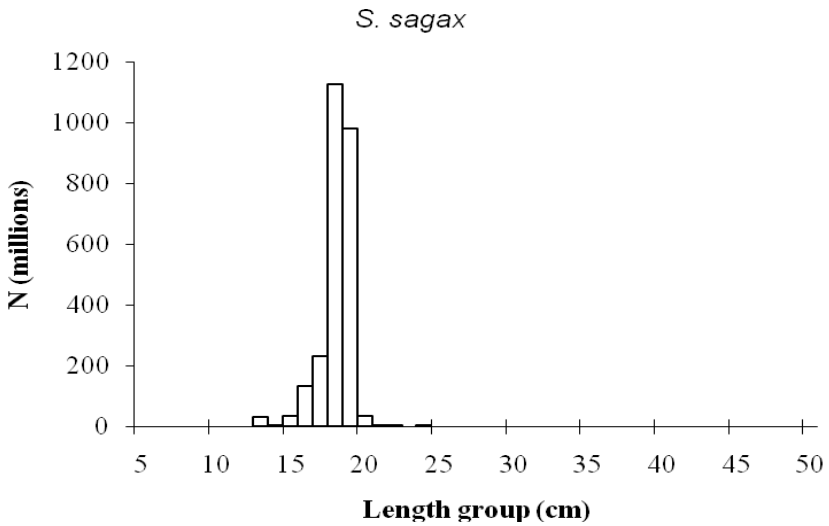

Figure 11 Length frequency of *S. sagax* in the transboundary area (15°50'-19°00' S) (*N* = 12 771).

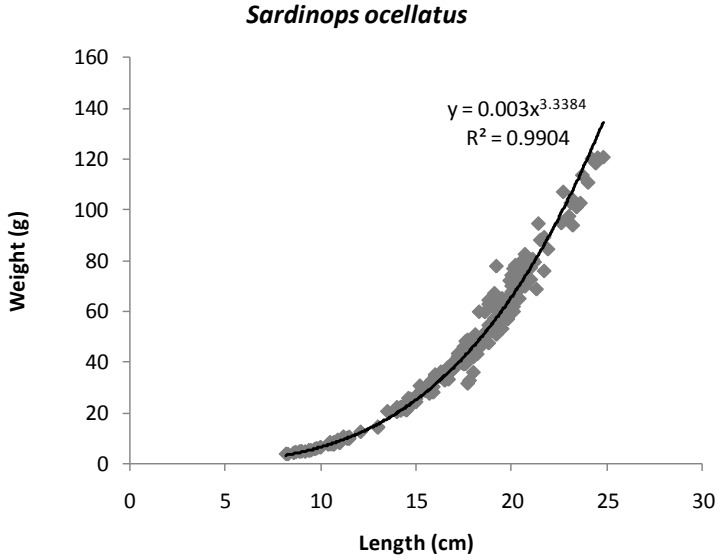

Figure 12 Length-weight relationship for *S. sagax* in the transboundary area (15°50'-19°00' S) (*n* = 241).

<u>Pelagic 1</u> (*Etrumeus whiteheadii* and *Engraulis capensis*)

E. whiteheadii and *E. capensis* were as usual, mostly found in mixed shoals and were thus recorded jointly as Pelagic Species 1 (other clupeids, Table 2). The distribution of *E. whiteheadii* and *E. capensis* is given in Figure 13 below. These species were found patchy distributed throughout the transboundary area, ranging from Pt. Albina (16°00'S) in Angola southwards north of Rock Point in Namibia. Most of the distribution areas exhibited medium-low densities ($301 < s_A < 1\,000$ m^2 nmi^{-2}) although medium-high densities patches were found along the distribution area ($1\,000 < s_A < 3\,000$ m^2 nmi^{-2}).

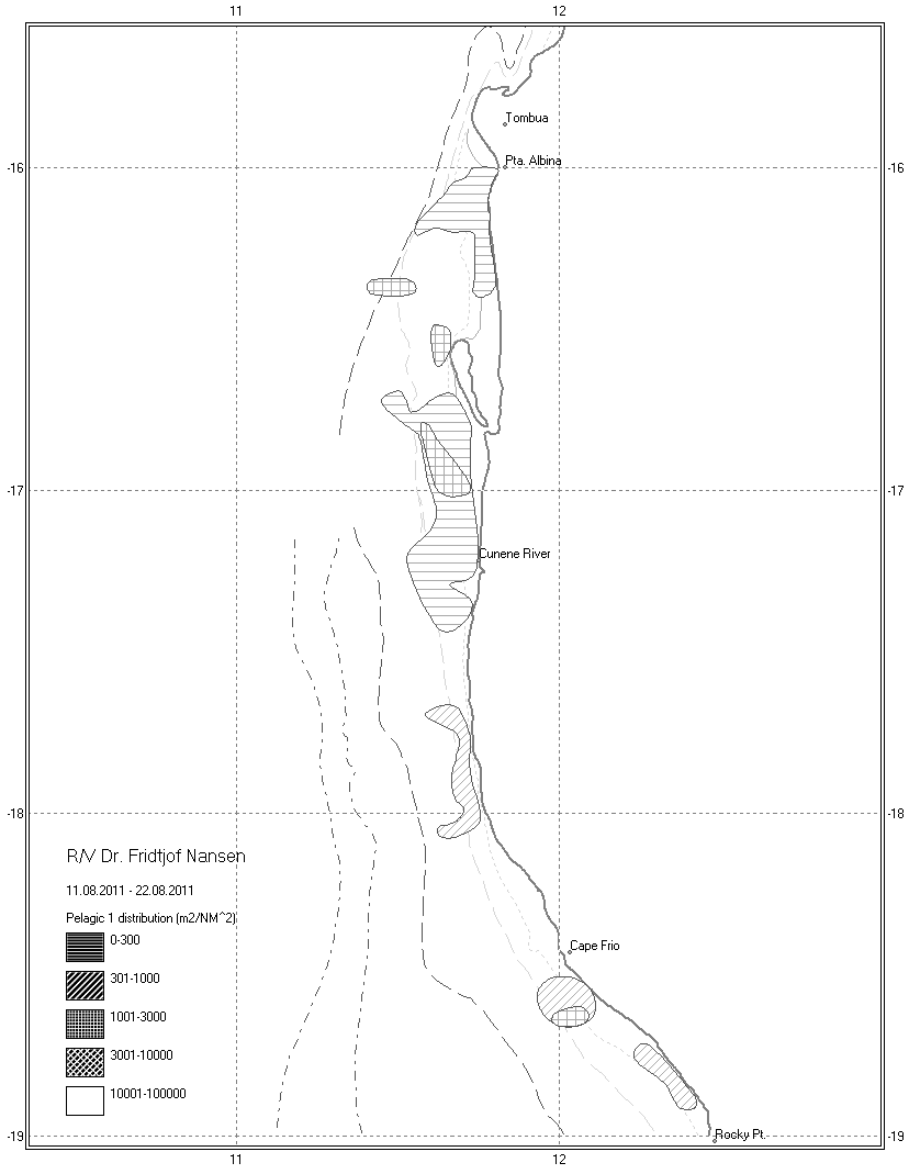

Figure 13 Distribution of Pelagic Species 1 in the Angola-Namibia transboundary area (15°50'-19°00' S). Isobaths are indicated at 50, 100, 200, 500, 1 000 and 2 000 m depths.

The biomass for the group was estimated at around 89 000 tonnes, based on an average fish length of 16 cm TL and a condition factor of 0.01. As last year the biomass could not be calculated, there will be no comparisons.

The length frequency distribution for *E. whiteheadii* ranged between 9 and 23 cm TL, based on a sample of 1 247 specimens. Average TL was 14.8 cm (Figure 14).

For *E. capensis*, the length frequency distribution ranged between 7 and 15 cm TL, based on a sample of 705 specimens; the average TL for the species was 12.4 cm (Figure 15).

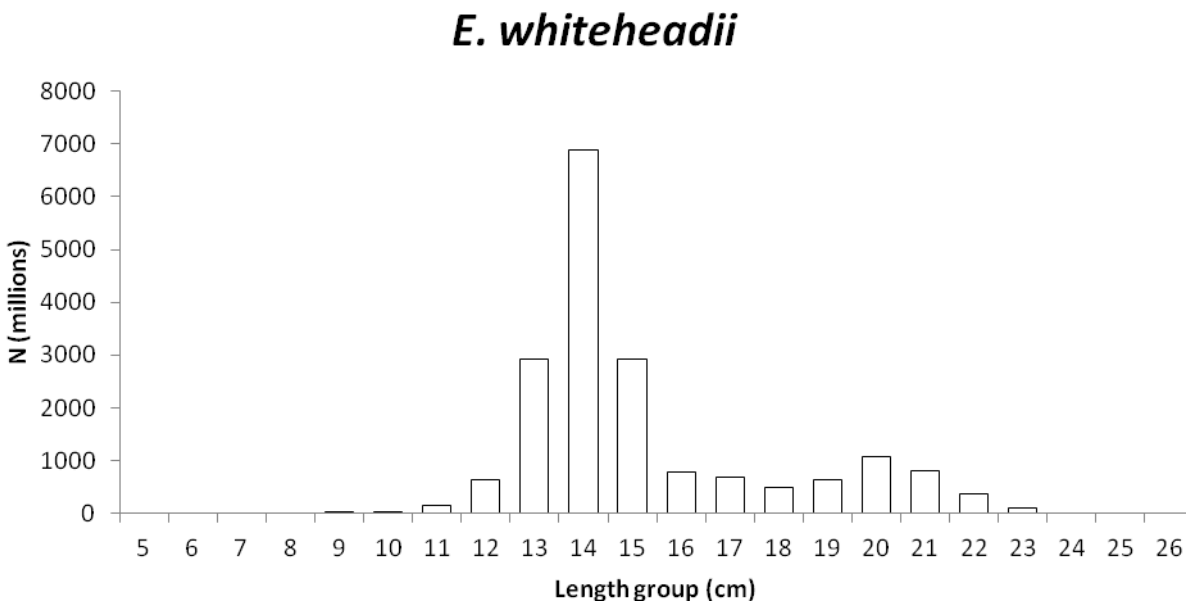

Figure 14 Length frequency of *E. whiteheadii* in the transboundary area (15°50'-19°00' S) (*n* = 1 247).

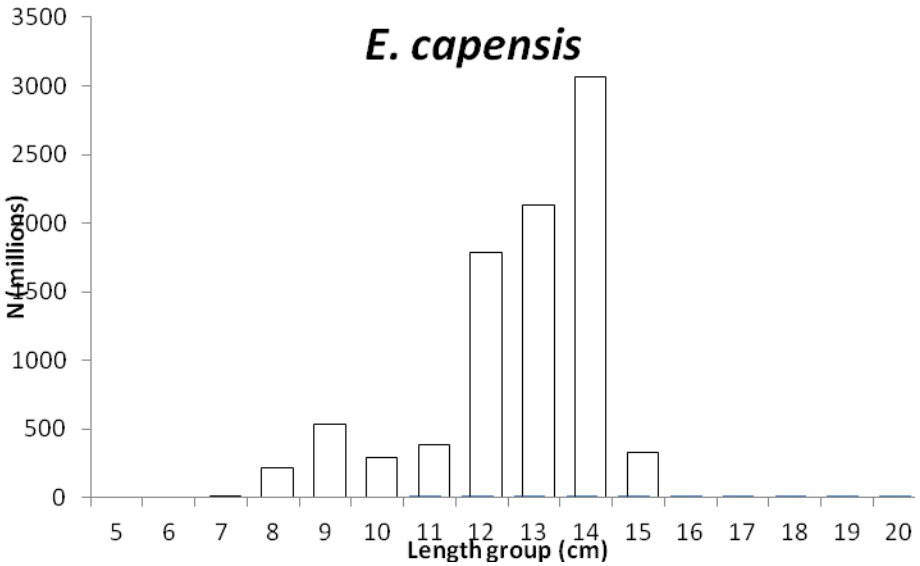

Figure 15 Length frequency of *E. capensis* in the transboundary area (15°50'-19°00' S) (*n* = 705).

3.2 Northern Namibia (19°00'-20°50' S)

Horse mackerel

T. trecae was caught in few stations south of the transboundary area. The distribution for both species is shown in Figure 16 below.

T. capensis was continuously distributed from south Rocky Point to Toscanini (20°50'S) where the survey ended. The species showed an inshore-offshore distribution, mainly with low density (s_A< 300 m^2 nmi^{-2}), but with an inner area with medium-low density (301 < s_A < 1 000 m^2 nmi^{-2}) stretching from south Rocky Point to Toscanini and two smaller areas of high density (3 001 < s_A < 10 000 m^2 nmi^{-2}) south of Rocky Point (at around19°20' S and at about 150-200 m depth) and south Dune Pt. (between 50 and 100 m deep). Densities were generally higher further offshore. The total biomass of *T. t. capensis* in northern Namibia (19°00'-20°50'S) was estimated at 188 500 tonnes, which is somewhat higher than the estimates for both 2010 and 2009 (113 400 and 140 100 tonnes respectively). The biomass for both species was estimated at 195 000 tonnes.

The size distribution of *T. capensis* ranged between 5 and 24 cm TL and shows four modal peaks at 6, 9, 12 and 20 cm total length (Figure 17). The mean estimated total fish length was 11.6 cm.

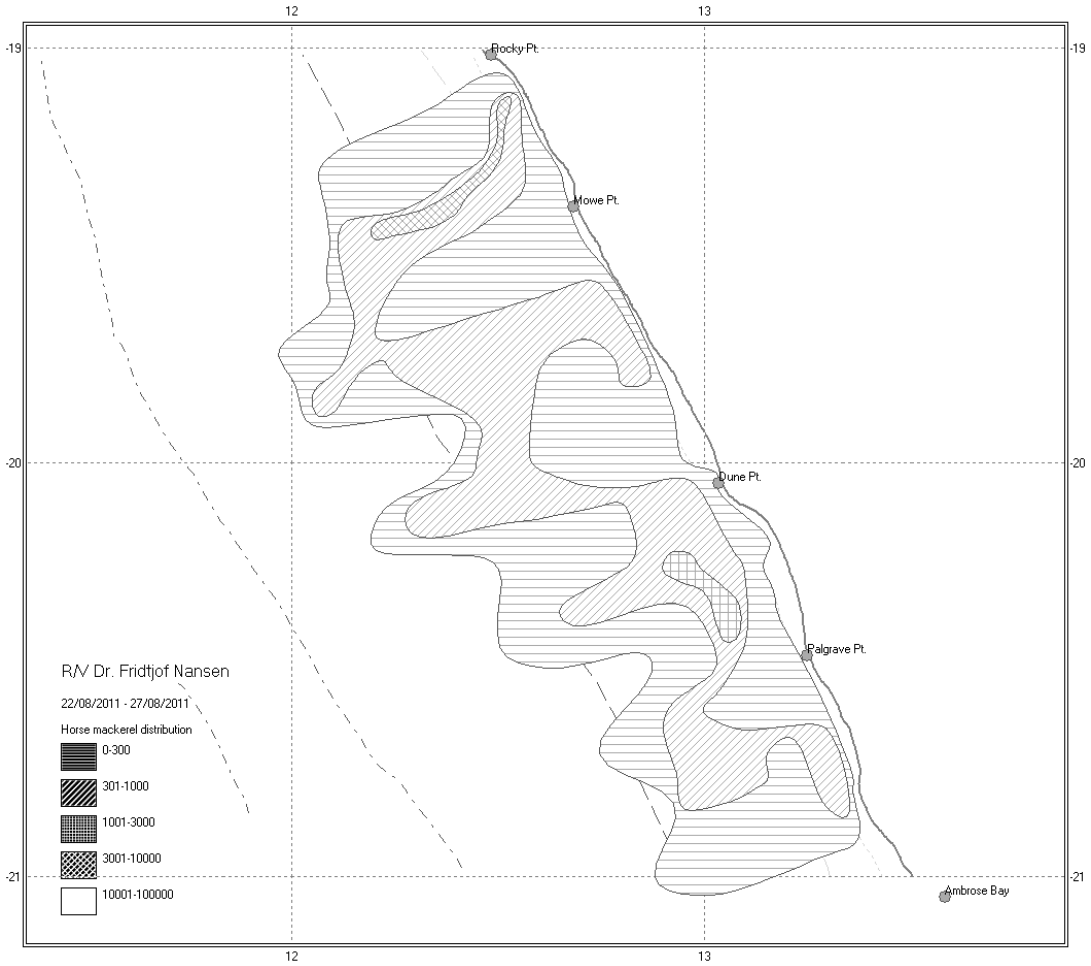

Figure 16 Distribution of horse mackerel in Northern Namibia (19°00' - 20°50'S). Isobaths are indicated at 50, 100, 200 and 500 m depths.

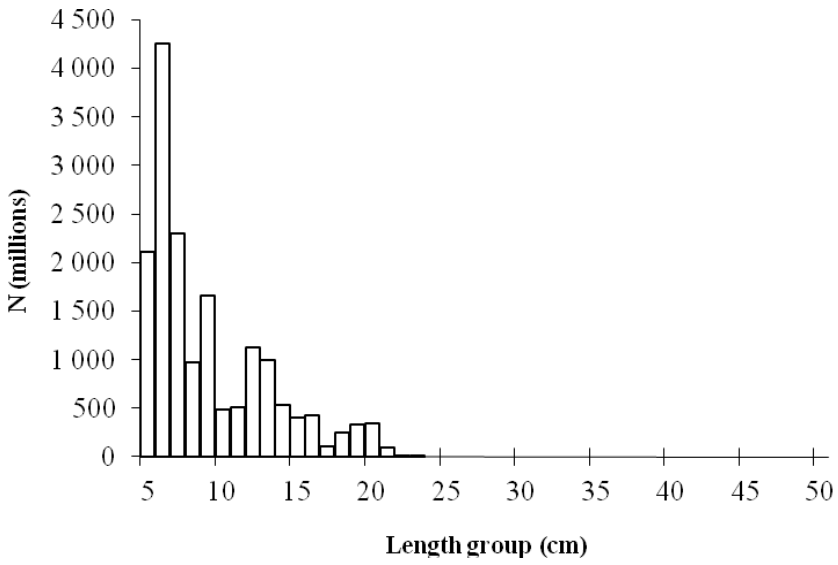

Figure 17 Length frequency of *T. capensis* in Northern Namibia (19°00'- 20°50'S) (*N* = 16 918).

Sardine (*Sardinops sagax, "Pilchard"*)

S. sagax was caught in very low numbers and only in two stations around Dune Pt., therefore no biomass was calculated and no distribution map is presented.

Pelagic 1 (*Etrumeus whiteheadii* and *Engraulis capensis*)

Species belonging to Pelagic 1 group (*Etrumeus whiteheadii* and *Engraulis capensis*) were found continuosly distributed along the whole Northern Namibia surveyed area. The area shows low density (s_A < 300 m^2 nmi^{-2}) with patches of medium-low densities (301 < s_A < 1 000 m^2 nmi^{-2}) between Rocky Point and Mowe Pt., patches of medium-high densities (1 000 < s_A < 3 000 m^2 nmi^{-2}) between Mowe Pt. and Dune Pt., and patches of high density (3 000 < s_A < 10 000 m^2 nmi^{-2}) south off Mowe Pt. and south off Dune Pt. (Figure 18).

The total biomass for the group was estimated at 132 000 tonnes for average fish TL of 12 cm and coefficient factor of 0.01.

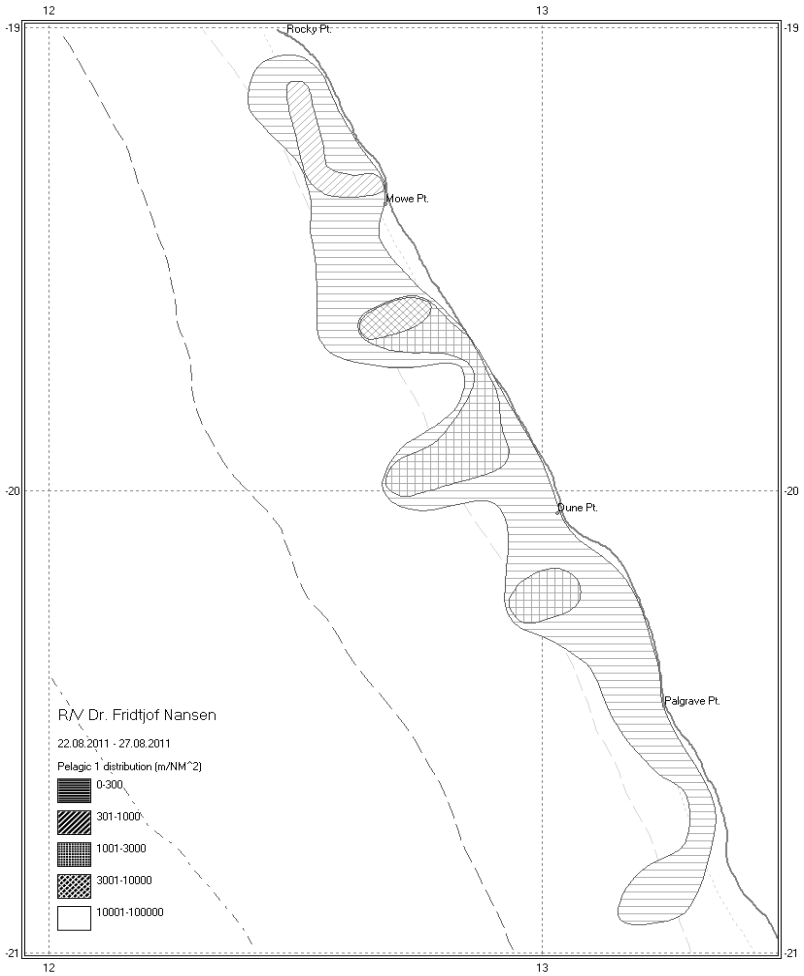

Figure 18 Distribution of Pelagic 1 group in Northern Namibia (19°00'- 20°50'S). Isobaths are indicated at 50, 100, 200 and 500 m depths.

3.3 Oceanographic Conditions

Wind

The wind stress in the transboundary area during the survey period was high, except fot the the region north of Pta. Albina (Figure 19). For most of the area winds reached between 40 and 45 knots. Except from the area north of Pta. Albina where there is no main wind direction, the rest of the region was dominated by south winds blowing parallel to the coast.

In northern Namibia (19°00'-20°50'S) the wind still blew from the south, parallel to the coast but with less strength (35 to 40 knots). The areas around Rocky Point and north of Dune Pt. Were calm with variable wind directions. (Figure 20)

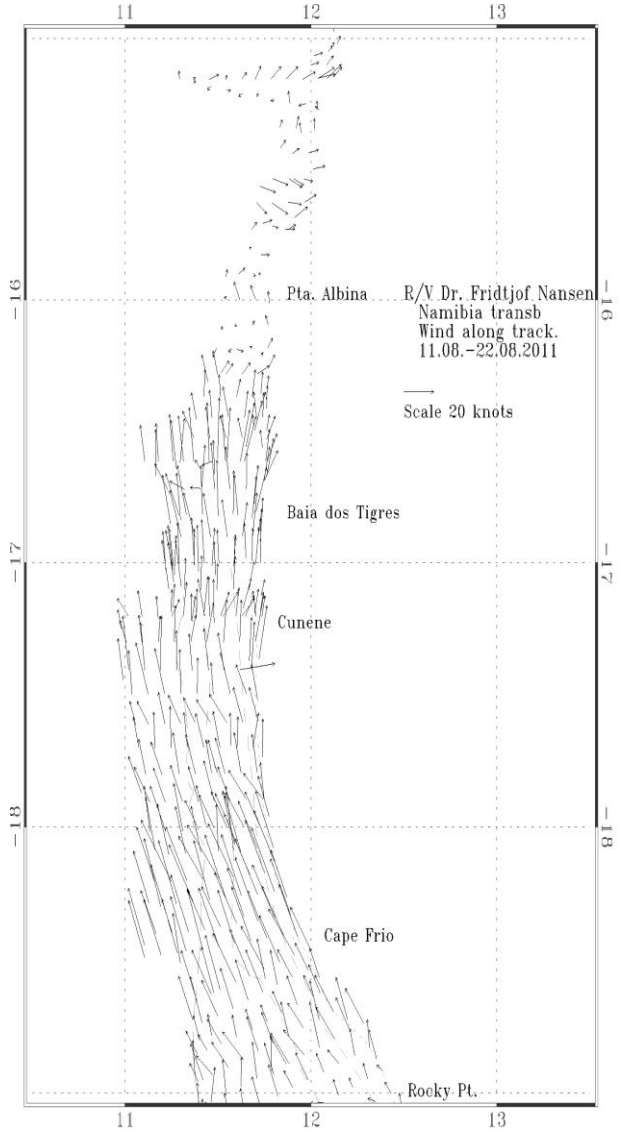

Figure 19 Wind stress recorded in the transboundary area (15°00'-19°00' S) during the survey.

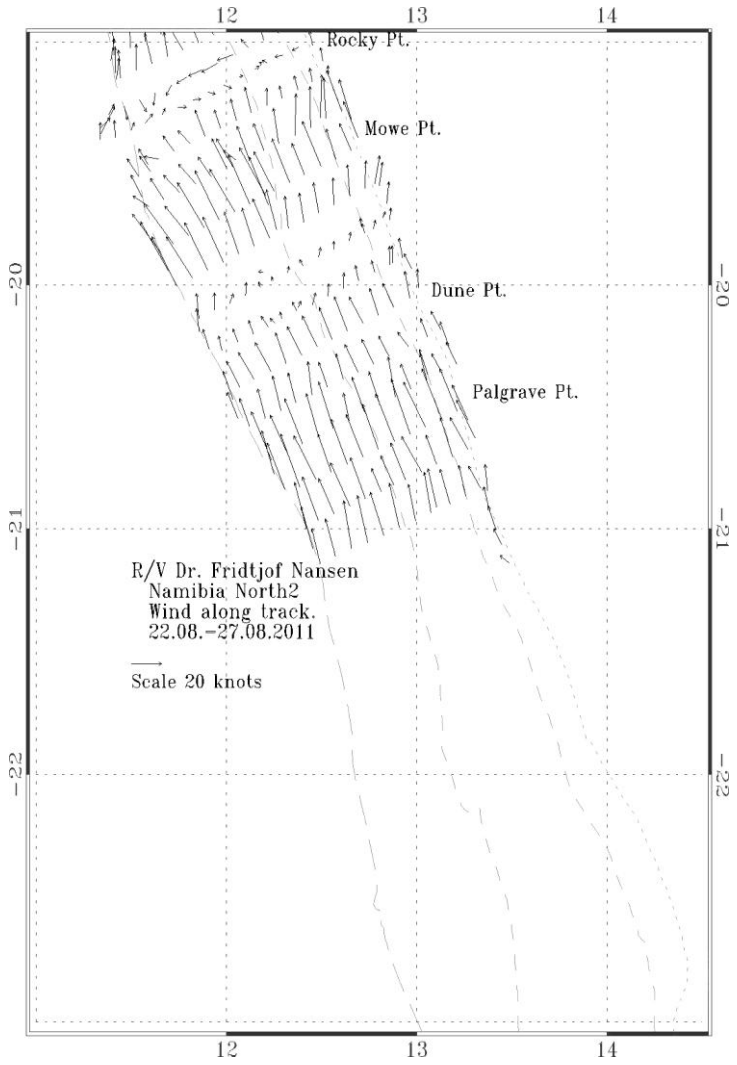

Figure 20 Wind stress recorded in Northern Namibia (19°00-20°50' S) during the survey.

Surface distributions

Figure 21(a-d) below shows the sea surface temperature (°C) (Figure 21a), the sea surface salinity (in practical salimity units, PSU) (Figure 21b), the dissolved oxygen (DO, ml/l) (Figure 21c) and fluorescence (in µg/l) (Figure 21d), recorded at 5 m depth. The position of Angola-Benguela frontal zone (ABF) can be readily identified in the region south of Baia dos Tigres (between 16°10' - 16°50' S). Surface waters north of the ABF were warmer (>18 ºC), with salinity values around 35.6 and well oxygenated (5 ml/l). From Baia dos Tigres and southwards, the isolines of cold water run parallel to the coast indicating the presence of upwelling, penomen which could be associated with the strong winds observed. The coldest

water was observed inshore around Cape Frio (14°C). The maximum fluorescence values were found around Cunene River (0.4 µg/l)

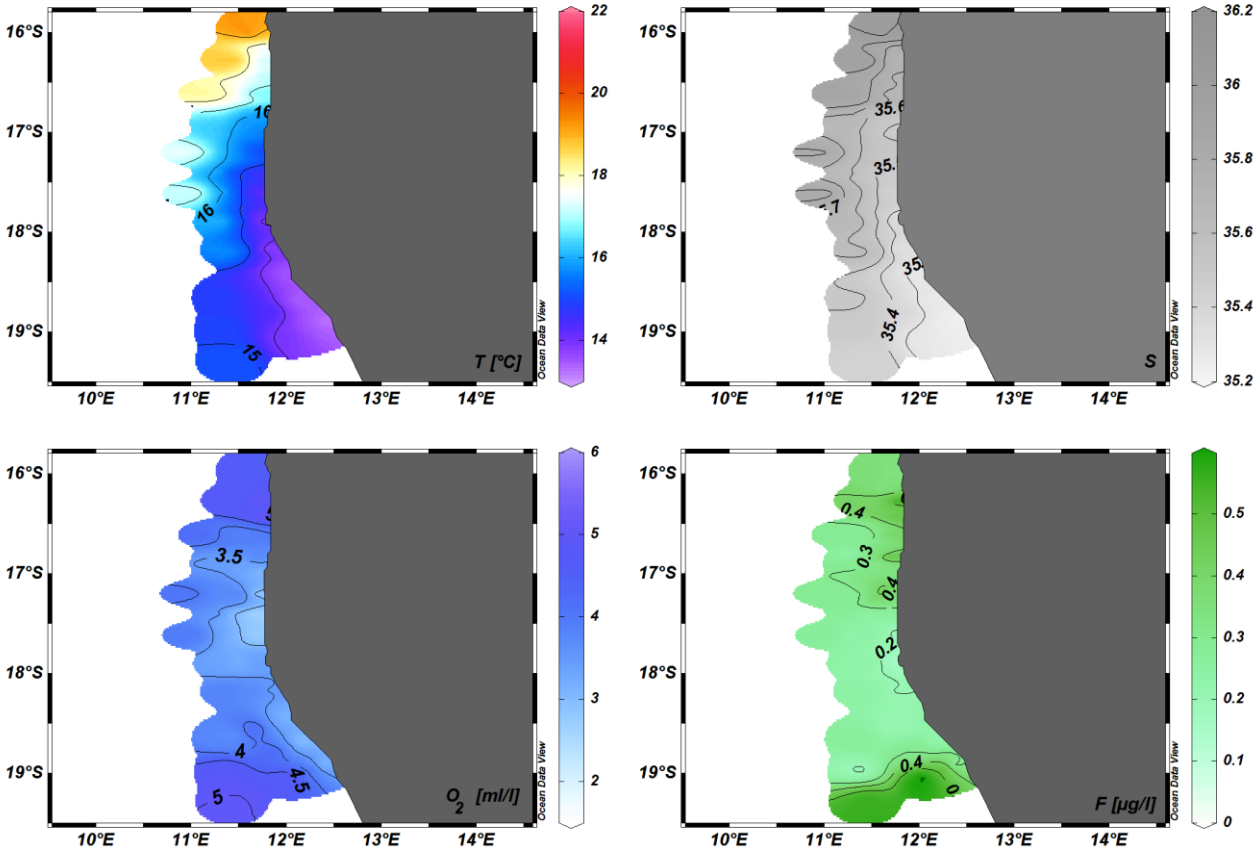

Figure 21 Sea surface temperature (°C), salinity, oxygen content and fluorescence, at 5 m depth, in the transboundary area (15°50'-19°00' S).

In the norther Namibia region, isolaines continue to run parallel to the coast with inshore waters which are colder (14°C), less saline (35.2) and with less dissolved oxygen (2 ml/l) than both offshore waters and waters longer north (Figure 22). Here again, upwelling can be associated to wind activity.

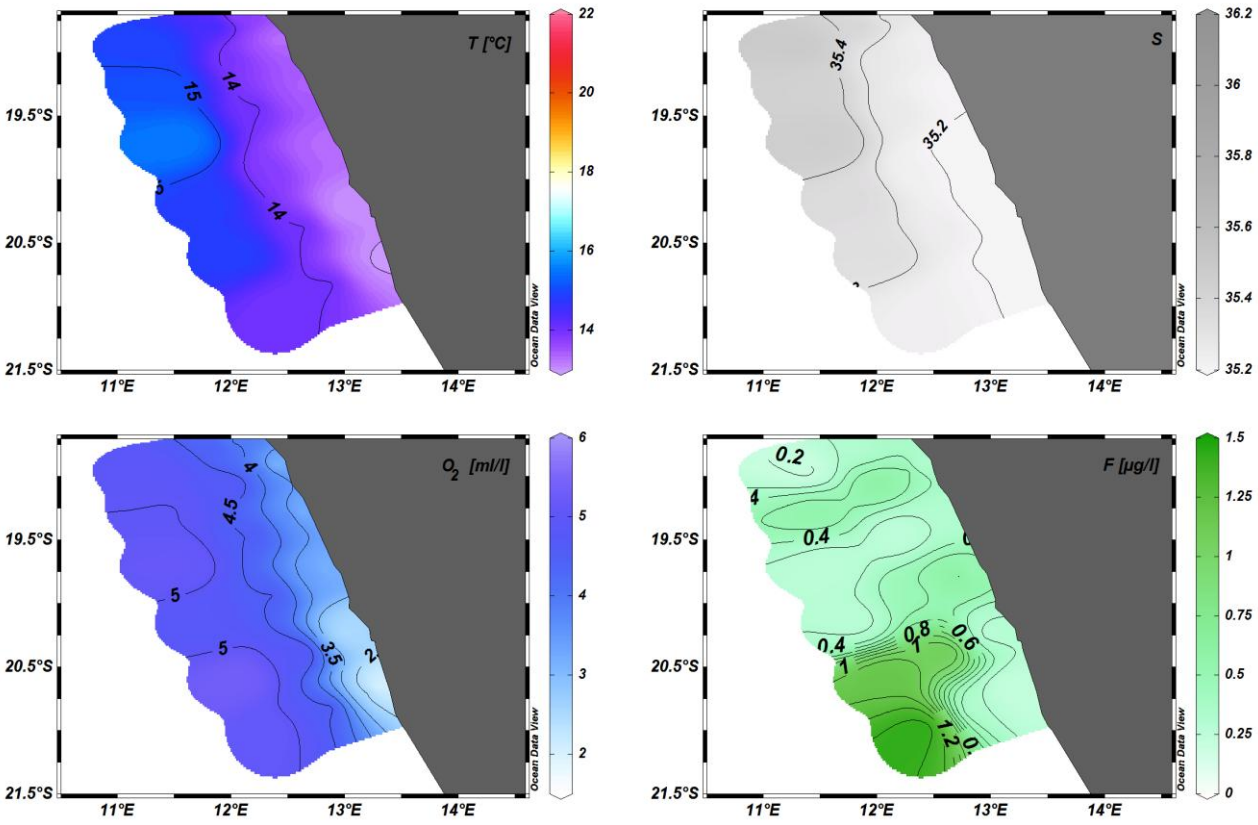

Figure 22 Sea surface temperature (°C), salinity, oxygen content and fluorescence, at 5 m depth, in Northern Namibia (19°00'-20°50' S).

Vertical hydrographical sections

Namibe

On the monitoring section off Namibe (Figure 23) a relatively high degree of stratification of the water masses was found, albeit some tilt towards the surface indicating a weak upwelling in the upper layers. Inshore waters showed higher temperatures and lower oxygen content than offshore waters.

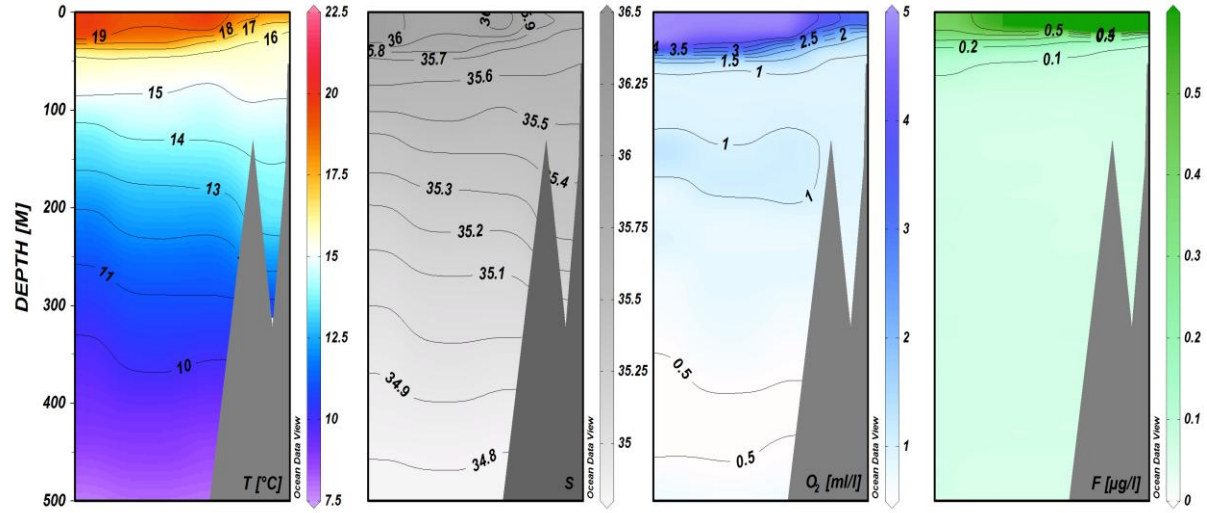

Figure 23 Vertical sections of temperature, salinity, dissolved oxygen and fluorescence off Namibe.

Pta. Albina

The water masses of Pta. Albina (Figure 24) showed a similar pattern as the previous section: fairly stratified, with relatively warm (15-17 °C) and saline (35.5-35.7) waters on the shelf plateau (about 100 m deep), but tilting slightly towards the coast indicating a probable weak upwelling. Inshore water was colder and less saline than offshore ones. Surface waters were fairly oxygenated (4 ml/l) above 25 m depth, while hypoxic conditions (<1 ml/l) prevailed near the bottom.

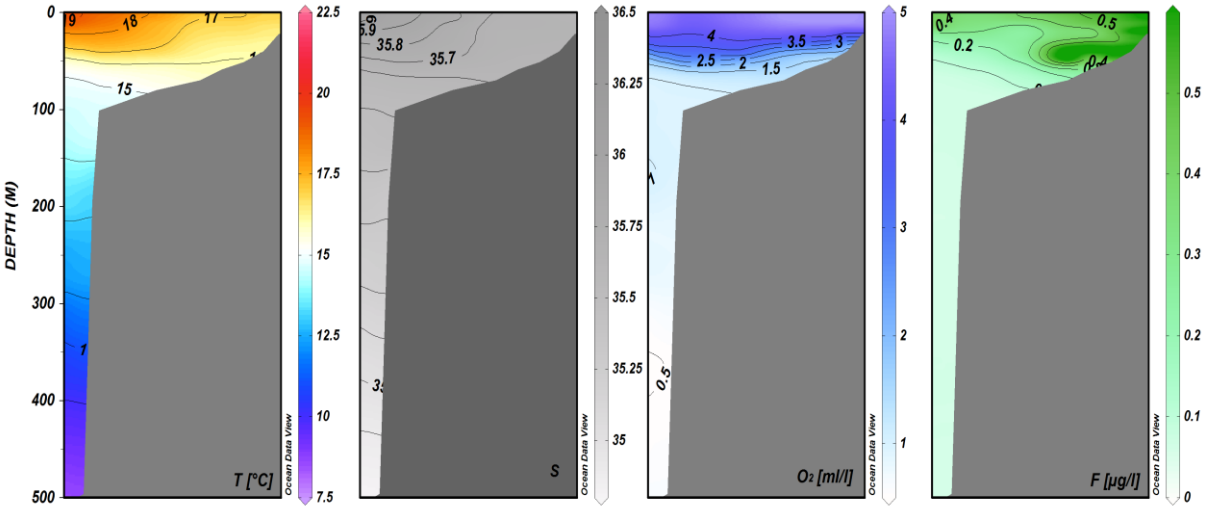

Figure 24 Vertical sections of temperature, salinity, dissolved oxygen and fluorescence off Pta. Albina

Baia dos Tigres

The water column off this section shows the same pattern as previous sections (Figure 25), but the tilting of the isolines is more pronounced as winds were stronger in this area. Inshore water masses were characterized by moderate upwelling shallower than 100 m.

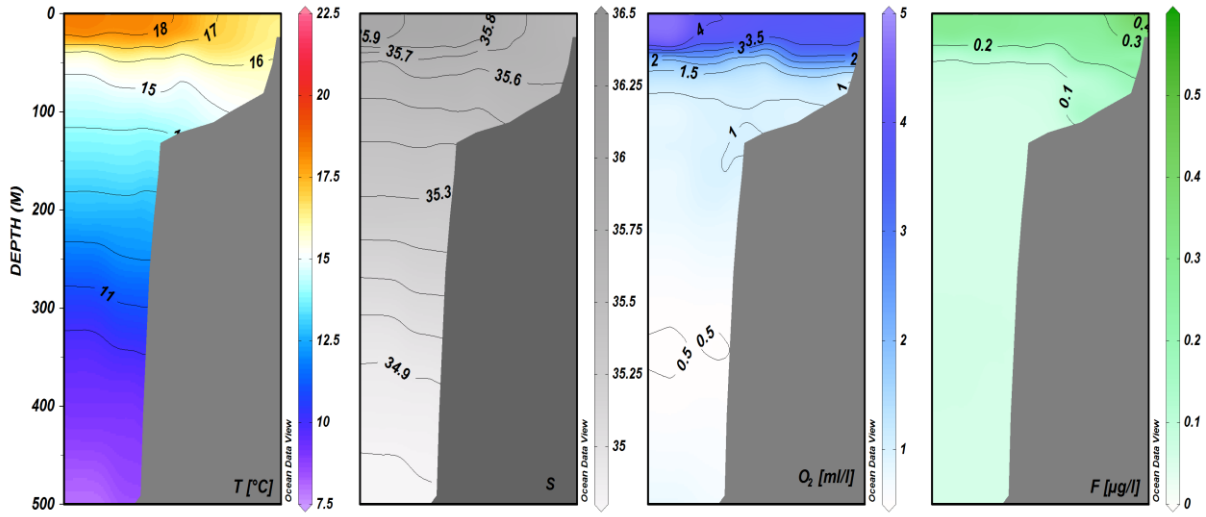

Figure 25 Vertical sections of temperature, salinity, dissolved oxygen and fluorescence off Baía dos Tigres.

Cunene River

Off Cunene River water masses showed accentuated thermocline and isohaline above the 100m indicating a subsurface upwelling (Figure 26). Surface temperatures ranged from 15-17°C, while salinities ranged from 35.5 - 35.7. The oxygen level was high in surface waters, ranging from 3 to 4 ml/l. Waters deeper than 100 m were generally hypoxic (< 1ml/l).

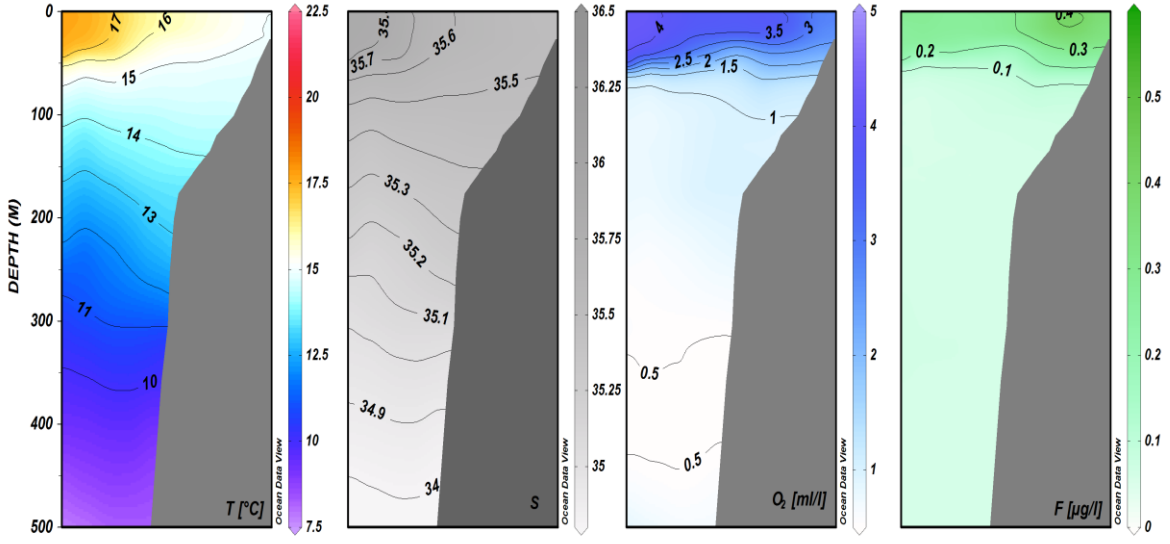

Figure 26 Vertical sections of temperature, salinity, dissolved oxygen and fluorescence off Cunene River.

Cape Frio

Off Cape Frio section it could be observed well developed uplift isolines (Figure 27) indicating the presence of a stronger upwelling. Accentuated thermocline, isohaline and oxycline above the 100m depth seem to indicate a coastal upwelling inshore, with cooler water closer to the shoreline than offshore. Oxygen values were high in the first 100 m (> 3ml/l).

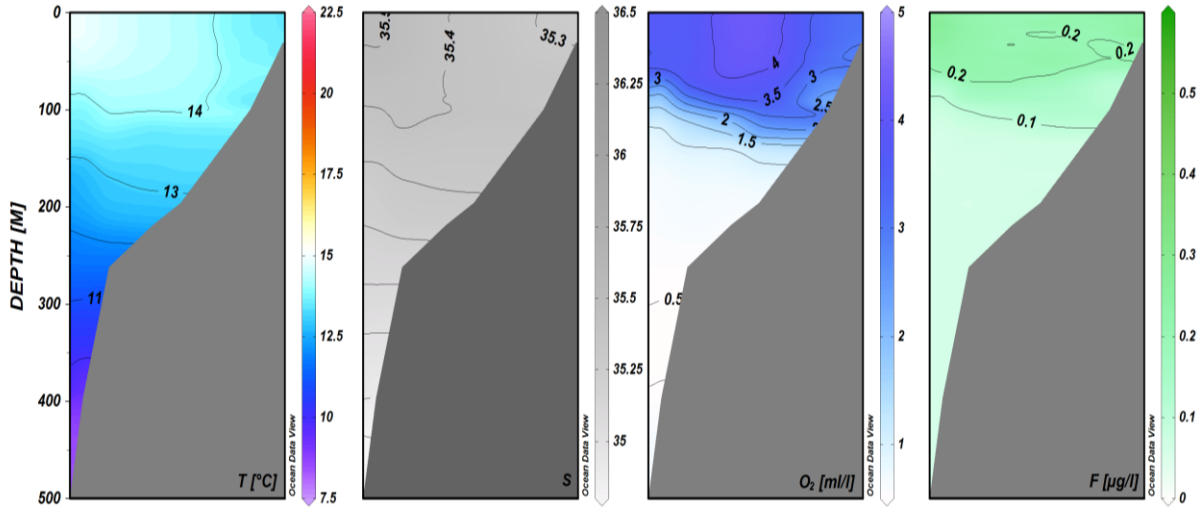

Figure 27 Vertical sections of temperature, salinity, dissolved oxygen and fluorescence off Cape Frio.

4 Conclusions and Recommendations

Once more, the results from this years' survey show the transboundary nature of the fish resources under study. The results portray a more positive picture in terms of biomass for *T. capensis,* while as for *S. Sagax* the biomass is much less than last year but higher than in 2009. But caution should be taken as changes from year to year may well reflect migration in and out of the transboundary area rather than increases in the biomass levels. It should also be noted that the estimates are relative indices, not absolute estimates of abundance, and that all estimates, in particular for the densely and patchily aggregated sardine, are prone to acoustical survey errors (Anon. 2003, 2004).

As for previous years, the results also show that the *T. capensis* population is comparatively in much better condition than the *T. trecae* in terms of estimated biomass within the transboundary area. It should, however, be emphasized that the time series of the transboundary region cannot be interpreted as time series of the stock units, as many of the populations have distribution areas that go far beyond the transboundary area and are characterized by migrations in and out of the transboundary area due to environmental factors and, in particular, the positioning of the Angola-Benguela Front (ABF). Fluctuations in the abundance estimates within the transboundary area do thus not necessarily reflect fluctuations in the stock units.

The domination of small specimens of *T. capensis* and *T. trecae* found in the transboundary area are indicative of severely reduced adult populations, and thus of the spawning stock biomasses (SSB). The size distribution of *S. sagax* was somewhat distorted (as in previous years) in terms of relatively high abundance levels for some length groups, possibly due to relatively few samples obtained combined with sampling errors introduced by fishing gear avoidance.

The main findings from the survey can be summarized as:

1) The estimate of Cape horse mackerel was higher (558 500 tonnes) than in previous years (2005: 393 000 tonnes; 2008: 205 000 tonnes; 2009: 202 300 tonnes; 2010: 516 500 tonnes).

2) Approximately 14 % (by weight) of the Cape horse mackerel in the transboundary area was found in Angolan waters, which is similar to those found for recent years (2008:

10 %; 2009: 11 %; 2010: 13%), but contrasting the comparatively high proportion of the same species found in Angolan waters during the first transboundary survey in 2005 (64 %).

3) The variation in abundance of Cape horse mackerel in the transboundary area and the relative distribution of the biomass in Angolan and Namibian waters between years show that the aggregation dynamics is highly dynamic within the transboundary area at this time of the year, and that both the total biomass and the relative distribution in the countries may fluctuate considerably over time, largely reflecting the impacts of a changing positioning of the Angola-Benguela Front (ABF).

4) The estimate of Cunene horse mackerel (39 500 tonnes) was similar to those found in previous years (2005: 44 000 tonnes, 2008: 20 000 tonnes, 2009: 50 700 tonnes; 2010: 45 000 tonnes).

5) The distribution pattern of Cunene horse mackerel was strikingly similar to that of recent years, with the majority of the biomass (around 75 %) found in Angolan waters, suggesting similar environmental regimes.

6) Given yearly fluctuations due to oceanographic conditions (*e.g.* the position of the ABF), it seems that the main bulk of the Cunene horse mackerel biomass within the transboundary area is presently found in Angolan waters, while the bulk of the Cape horse mackerel biomass is found in Namibian waters.

7) The biomass of sardine (*Sardinops sagax*, “Pilchard”) was considerable lower than last year’s (51 500 tonnes as compared with 399 000 tonnes in 2010) but higher than previous years (2005: 0; 2008: 0; 2009: 35 700 tonnes). It should however, be noted that these estimates are relative indices, not absolute estimates of abundance and so the population estimate should not be interpreted in absolute terms. Similarly, this was not a dedicated sardine survey, where both acoustic and net sampling was limited, thus warranting some uncertainty associated to this estimate, as discussed above.

8) As during last year’s survey, the entire sardine biomass was found in a single, fairly homogenous aggregation located in Angolan waters, contrasting with the situation in 2009, when many small and scattered, high-density aggregations of sardine were distributed across the border area. As for Cape horse mackerel, both the aggregation pattern and the relative distribution between Angolan and Namibian zones within the transboundary area appear to fluctuate with the environmental conditions between

years. However, the more inshore-bound and short-lived life-history of the sardine compared to the horse mackerels, combined with the fact that the sardine is still in a recovery phase from heavy fishing over the past decades, may add further to the dynamic picture for sardine compared to horse mackerel, rendering a yet more volatile and less predictable scenario in terms of abundance and distribution pattern for sardine compared to horse mackerel within the transboundary area.

9) The other clupeid species other than sardinellas (Pelagic 1 group, round herring and anchovy) were found distributed very much like in 2010. However it is worth mentioning that this year its distribution extended further north, up to Pta. Albina and there were absent from inside Tiger Bay.

10) Both horse mackerel species were found to be small in size (Cape horse mackerel <25 cm total length, Cunene horse mackerel <24 cm total length. Last year the values were: <33 cm and <24 cm respectively). This is a note of some concern, and is consistent with the finding that the mean length at 50 % maturity for Cunene horse mackerel has dropped quite dramatically from the reference year 1996 (23.0 cm total length) to 14.7 cm TL (in 2011), indicating a severely reduced stock unit due to high fishing pressure (Survey report for the pelagic resources in Angola, 2010).

11) The observed strong peaks of maturity stage 2 in both horse mackerel species, but especially for *T. capensis*, can be interpreted as a sign of a strong spawning season. It could be useful to look closer into these maturation studies in order to be able to identify spawning seasons and grounds for the species.

Recommendations

The main recommendations are:

1) The time series should be continued, at the same time of the year, in order to monitor changes within the transboundary area over time and to establish whether the observed patterns are persistent over time.

2) Additional surveys should be conducted also in the warm season, as the distribution patterns of all the targeted species are likely 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, leading expectations of more Cunene horse mackerel in Namibian waters and less Cape horse mackerel in Angolan waters during summer.

3) Angola and Namibia should, through the BCC, put in place mechanisms for continuing the monitoring of the transboundary area and expand on the established collaboration in the management of the transboundary pelagic fish resources there; all populations studied are to some extent transboundary, and most are in low abundance.

4) Collaborative monitoring should focus on joint training, harmonization of survey techniques and validation of scales, irrespective of the future of the transboundary surveys.

5) The quality and use of transboundary surveys will improve if participants are trained in biological sampling, mostly on maturity and stomach fullness staging. Such information is subjective and requires consistency. That, combined with retention of participants could help in data precision.

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CRUISE REPORT NO 2/2010. 2010. SURVEYS OF THE FISH RESOURCES OF ANGOLA, Survey of the pelagic resources, 23 May – 4 July 2010. Draft report. *Unpublished*

Annex I Records of fishing stations

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 50
DATE :11/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 15°54.85
start stop duration Lon E 11°43.00
TIME :00:45:00 00:58:13 13.2 (min) Purpose : 1
LOG : 9562.26 9563.12 0.9 Region : 4050
FDEPTH: 15 20 Gear cond.: 0
BDEPTH: 28 46 Validity : 0
Towing dir: 0° Wire out : 90 m Speed : 3.9 kn
Sorted : 471 Total catch: 470.83 Catch/hour: 2138.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2024.56	42304	94.67	141
Scomber japonicus	88.02	881	4.12	142
Sardinops ocellatus	12.04	200	0.56	143
Loligo vulgaris	5.00	23	0.23	
PORIFERA (Sponges)	4.72	55	0.22	
Pagellus bellottii	2.54	64	0.12	
Etrumeus whiteheadi	0.91	23	0.04	144
Boops boops	0.64	9	0.03	
Engraulis encrasicolus	0.09	55	0.00	
Total	2138.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 51
DATE :11/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.41
start stop duration Lon E 11°36.22
TIME :08:45:14 09:15:22 30.1 (min) Purpose : 3
LOG : 9628.96 9630.40 1.4 Region : 4050
FDEPTH: 73 71 Gear cond.: 0
BDEPTH: 73 71 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 2.9 kn
Sorted : 203 Total catch: 202.50 Catch/hour: 403.12

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Thyrsites atun	85.50	315	21.21	
Squalus megalops	70.77	141	17.56	
Dentex macrophthalmus	66.69	1827	16.54	145
Etrumeus whiteheadi	61.61	1117	15.28	146
Chelidonichthys capensis	42.40	84	10.52	
Pagellus bellottii	14.83	271	3.68	149
Sepia orbignyana	11.67	16	2.89	
Sphyrna lewini	10.85	2	2.69	
Loligo vulgaris	9.34	78	2.32	
Lagocephalus laevigatus	4.84	16	1.20	
Mustelus mustelus	4.38	8	1.09	
Dentex gibbosus	4.38	68	1.09	
Merluccius capensis	3.56	12	0.88	
Alloteuthis africana	2.59	912	0.64	
Trachurus trecae	2.33	56	0.58	147
Spondyliosoma cantharus	2.21	10	0.55	
Dentex barnardi	1.95	22	0.48	148
Raja miraletus	1.51	2	0.38	
Zeus faber	0.94	4	0.23	
Scomber japonicus	0.60	2	0.15	
Citharus linguatula	0.12	2	0.03	
Illex coindetii	0.06	2	0.01	
Total	403.12		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 52
DATE :11/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.39
start stop duration Lon E 11°43.75
TIME :10:43:27 11:13:31 30.1 (min) Purpose : 3
LOG : 9640.67 9642.18 1.5 Region : 4050
FDEPTH: 47 48 Gear cond.: 0
BDEPTH: 47 48 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.0 kn
Sorted : 239 Total catch: 238.75 Catch/hour: 476.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	284.85	6587	59.77	150
Trachurus capensis	46.83	1864	9.83	151
Myliobatis aquila	42.91	8	9.01	
Trigla lyra	27.54	82	5.78	
Loligo vulgaris	21.08	561	4.42	
J E L L Y F I S H	13.39	28	2.81	
Dasyatis marmorata	11.08	4	2.32	
Dentex macrophthalmus	5.83	409	1.22	153
Pagellus bellottii	4.41	206	0.93	
Atractoscion aequidens	3.39	18	0.71	
Raja miraletus	3.31	6	0.70	
Arius heudelotii	2.61	4	0.55	
Umbrina canariensis	2.30	56	0.48	
Thyrsites atun	2.12	4	0.44	
Merluccius capensis	1.74	10	0.36	
Etrumeus whiteheadi	1.14	28	0.24	152
Pontinus accraensis	0.60	4	0.13	
Scomber japonicus	0.42	4	0.09	
Boops boops	0.36	10	0.08	
Dentex gibbosus	0.32	4	0.07	
Spondyliosoma cantharus	0.32	10	0.07	
Total	476.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 53
DATE :11/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°16.05
start stop duration Lon E 11°31.20
TIME :15:15:06 15:45:27 30.4 (min) Purpose : 1
LOG : 9669.48 9671.09 1.6 Region : 4050
FDEPTH: 101 95 Gear cond.: 0
BDEPTH: 101 95 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.2 kn
Sorted : 102 Total catch: 354.48 Catch/hour: 700.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	503.26	5733	71.84	154
Squalus megalops	58.50	97	8.35	
Scomber japonicus	29.25	302	4.18	155
Dentex macrophthalmus	24.25	326	3.46	157
Zeus faber	24.01	34	3.43	
Isurus oxyrinchus	17.09	2	2.44	
Mustelus mustelus	14.72	6	2.10	
Etrumeus whiteheadi	11.80	180	1.68	156
Spondyliosoma cantharus	8.32	16	1.19	
Pagellus bellottii	3.54	16	0.50	
Chelidonichthys capensis	2.61	12	0.37	
Lagocephalus laevigatus	0.97	6	0.14	
Dentex barnardi	0.93	6	0.13	
Sepia orbignyana	0.71	6	0.10	
Syacium micrurum	0.59	12	0.08	
Total	700.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 54
DATE :11/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°26.76
start stop duration Lon E 11°41.81
TIME :23:22:42 23:34:55 12.2 (min) Purpose : 1
LOG : 9714.41 9715.21 0.8 Region : 4050
FDEPTH: 25 30 Gear cond.: 0
BDEPTH: 62 57 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 4.0 kn
Sorted : 63 Total catch: 62.99 Catch/hour: 309.53

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	135.14	5641	43.66	159
Trachurus trecae	118.92	5725	38.42	158
Scomber japonicus	19.12	246	6.18	162
Etrumeus whiteheadi	16.31	595	5.27	160
Sardinops ocellatus	14.50	290	4.68	161
Loligo vulgaris	2.70	20	0.87	
Engraulis encrasicolus	2.21	98	0.71	163
Merluccius capensis	0.64	5	0.21	
Total	309.53		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 55
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°21.40
start stop duration Lon E 11°43.89
TIME :05:37:18 06:07:45 30.5 (min) Purpose : 3
LOG : 9770.07 9771.64 1.6 Region : 4050
FDEPTH: 46 46 Gear cond.: 0
BDEPTH: 46 46 Validity : 0
Towing dir: 0° Wire out : 115 m Speed : 3.1 kn
Sorted : 64 Total catch: 185.43 Catch/hour: 365.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	166.64	13627	45.62	164
Trachurus capensis	67.66	4544	18.52	165
Pagellus bellottii	54.96	3144	15.05	170
Dentex macrophthalmus	22.40	1897	6.13	166
Loligo vulgaris	16.55	585	4.53	
Scomber japonicus	15.31	248	4.19	167
Chelidonichthys capensis	5.67	18	1.55	
J E L L Y F I S H	4.67	6	1.28	
Merluccius capensis	3.19	18	0.87	169
Alloteuthis africana	2.84	1105	0.78	
Etrumeus whiteheadi	2.01	53	0.55	168
Sepia orbignyana	1.18	12	0.32	
Schedophilus pemarco	0.77	6	0.21	
Dentex barnardi	0.71	18	0.19	
Umbrina canariensis	0.24	6	0.06	
Trachinocephalus myops	0.18	6	0.05	
Cepola pauciradiatus	0.18	6	0.05	
Spondyliosoma cantharus	0.12	6	0.03	
Total	365.26		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 56
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°24.11
start stop duration Lon E 11°45.60
TIME :06:37:45 07:09:41 31.9 (min) Purpose : 3
LOG : 9774.46 9776.10 1.7 Region : 4050
FDEPTH: 21 20 Gear cond.: 0
BDEPTH: 21 20 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.1 kn
Sorted : 30 Total catch: 212.10 Catch/hour: 398.43

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	209.08	8442	52.48	171
Trachurus capensis	127.55	6180	32.01	172
Loligo vulgaris	39.97	3721	10.03	
J E L L Y F I S H	9.34	39	2.34	
Calappa rubroguttata	3.94	26	0.99	
Scomber japonicus	2.63	39	0.66	173
Etrumeus whiteheadi	1.84	53	0.46	174
Alloteuthis africana	1.18	552	0.30	
Spondyliosoma cantharus	0.92	26	0.23	
Pegusa lascaris	0.92	39	0.23	
Trachinocephalus myops	0.39	13	0.10	
Engraulis encrasicolus	0.39	26	0.10	
Scomberesox saurus	0.26	13	0.07	
Total	398.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 57
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°41.96
start stop duration Lon E 11°45.80
TIME :10:35:49 10:40:08 4.3 (min) Purpose : 1
LOG : 9802.03 9802.27 0.2 Region : 4050
FDEPTH: 18 18 Gear cond.: 0
BDEPTH: 18 18 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.3 kn
Sorted : 28 Total catch: 340.92 Catch/hour: 4735.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	4250.00	385333	89.76	175
Trachurus capensis	480.00	57333	10.14	176
Scomberesox saurus	3.33	167	0.07	
Scomber japonicus	1.67	167	0.04	
Total	4735.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 58
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°35.72
start stop duration Lon E 11°37.40
TIME :15:14:42 15:44:20 29.6 (min) Purpose : 3
LOG : 9833.79 9835.16 1.4 Region : 4050
FDEPTH: 85 86 Gear cond.: 0
BDEPTH: 85 86 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 2.8 kn
Sorted : 59 Total catch: 590.30 Catch/hour: 1195.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	609.52	19055	50.99	178
Etrumeus whiteheadi	241.98	8566	20.24	179
Dentex macrophthalmus	125.55	5650	10.50	181
Trachurus trecae	88.09	3199	7.37	177
Loligo vulgaris	41.71	385	3.49	
Merluccius capensis	36.85	283	3.08	180
Chelidonichthys capensis	20.25	61	1.69	
J E L L Y F I S H	16.81	20	1.41	
Trichiurus lepturus	5.06	142	0.42	
Sepia officinalis	3.04	20	0.25	
B I V A L V E S	2.83	162	0.24	
Scomber japonicus	1.62	20	0.14	
Calappa pelii	1.01	101	0.08	
Dicologoglossa cuneata	0.61	20	0.05	
Brotula barbata	0.20	20	0.02	
GOBIIDAE	0.20	40	0.02	
Total	1195.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 59
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°36.27
start stop duration Lon E 11°29.88
TIME :17:08:21 17:22:33 14.2 (min) Purpose : 3
LOG : 9845.08 9845.79 0.7 Region : 4050
FDEPTH: 110 110 Gear cond.: 7
BDEPTH: 0 110 Validity : 4
Towing dir: 0° Wire out : 275 m Speed : 3.0 kn
Sorted : 252 Total catch: 572.17 Catch/hour: 2417.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1797.76	28863	74.36	182
Dentex macrophthalmus	388.35	8489	16.06	184
Merluccius capensis	46.94	161	1.94	185
Chelidonichthys capensis	36.21	68	1.50	
Pterothrissus belloci	35.75	351	1.48	
Trigla lyra	28.44	249	1.18	
Trachurus capensis	19.48	237	0.81	183
Mustelus mustelus	13.94	4	0.58	
Trichiurus lepturus	13.48	173	0.56	
Pagellus bellottii	11.58	85	0.48	186
Zeus faber	8.87	25	0.37	
Chelidonichthys gabonensis	4.86	275	0.20	
Squalus megalops	2.70	8	0.11	
Spondyliosoma cantharus	1.90	8	0.08	
Illex coindetii	1.52	8	0.06	
Scorpaena stephanica	1.52	59	0.06	
Arnoglossus imperialis	0.93	76	0.04	
Umbrina canariensis	0.76	8	0.03	
Sepia orbignyana	0.76	8	0.03	
Citharus linguatula	0.55	59	0.02	
Syacium micrurum	0.46	59	0.02	
Etrumeus whiteheadi	0.30	8	0.01	
Saurida brasiliensis	0.30	38	0.01	
Pegusa lascaris	0.17	8	0.01	
GOBIIDAE	0.08	30	0.00	
Total	2417.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 60
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°37.45
start stop duration Lon E 11°17.67
TIME :00:21:05 00:48:00 26.9 (min) Purpose : 3
LOG : 9872.82 9874.06 1.2 Region : 4050
FDEPTH: 612 617 Gear cond.: 0
BDEPTH: 612 617 Validity : 0
Towing dir: 0° Wire out : 1250 m Speed : 2.8 kn
Sorted : 62 Total catch: 313.83 Catch/hour: 699.47

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	195.27	435	27.92	187
Trachyrincus scabrus	143.42	802	20.50	
Aristeus varidens, female	132.68	12062	18.97	
Shrimps, small, non comm.	43.02	25676	6.15	
Alepocephalus rostratus	40.01	154	5.72	
Nezumia aequalis	29.64	793	4.24	
Helicolenus dactylopterus	21.55	198	3.08	
Hoplostethus cadenati	19.64	537	2.81	
Centrophorus squamosus	16.49	25	2.36	
Stomias affinis	8.02	183	1.15	
Chaceon maritae	7.36	13	1.05	
Lamprogrammus exutus	6.62	109	0.95	
Etmopterus pusillus	4.52	16	0.65	
Anemones, white	4.03	7	0.58	
Aristeus varidens, male	3.90	649	0.56	
Bathyuroconger vicinus	3.61	103	0.52	
Deania calcea	2.79	4	0.40	
Raja alba	2.72	7	0.39	
Anemones, pink	2.63	7	0.38	
Diaphus effulgens	2.63	96	0.38	
DICERATIIDAE	1.92	22	0.27	
Yarrella blackfordi	1.76	80	0.25	
Tetragonurus cuvieri	1.03	7	0.15	
Centroscymnus crepidater *	0.80	7	0.11	
Gadella imberbis	0.65	22	0.09	
OCTOPOTEUTHIDAE	0.65	7	0.09	
Benthodesmus tenuis	0.58	13	0.08	
Diastobranchus capensis	0.42	7	0.06	
Chlamydoselachus anguineus	0.42	2	0.06	
Galeus polli	0.36	2	0.05	
Triplophos hemingi	0.20	36	0.03	
Chlorophthalmus atlanticus	0.13	7	0.02	
Total	699.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 61
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°38.74
start stop duration Lon E 11°24.00
TIME :08:02:06 08:32:51 30.8 (min) Purpose : 3
LOG : 9914.65 9916.13 1.5 Region : 4050
FDEPTH: 125 123 Gear cond.: 0
BDEPTH: 125 123 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 2.9 kn
Sorted : 287 Total catch: 286.81 Catch/hour: 559.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	301.56	4205	53.90	215
Dentex macrophthalmus	169.60	3037	30.32	216
Merluccius capensis	34.04	90	6.08	239
Squalus megalops	12.78	33	2.28	
Zeus faber	8.97	29	1.60	
Trigla lyra	5.77	31	1.03	
Mustelus mustelus	5.75	4	1.03	
Etrumeus whiteheadi	4.80	66	0.86	189
Loligo vulgaris	3.65	20	0.65	
Raja miraletus	3.37	4	0.60	
Trachurus capensis	1.95	16	0.35	238
Scorpaena normani	1.52	18	0.27	
Chelidonichthys gabonensis	1.50	20	0.27	
Scomber japonicus	1.17	12	0.21	188
Chelidonichthys capensis	1.03	2	0.18	
Pagellus bellottii	0.55	4	0.10	
Zenopsis conchifer	0.47	2	0.08	
Trichiurus lepturus	0.43	4	0.08	
Scorpaena stephanica	0.41	2	0.07	
Illex coindetii	0.12	4	0.02	
Total	559.45		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 62
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°37.56
start stop duration Lon E 11°29.78
TIME :09:31:54 10:02:41 30.8 (min) Purpose : 3
LOG : 9922.55 9924.02 1.5 Region : 4050
FDEPTH: 111 111 Gear cond.: 0
BDEPTH: 111 111 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 2.9 kn
Sorted : 52 Total catch: 631.89 Catch/hour: 1231.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	832.63	15097	67.60	192
Merluccius capensis	101.11	343	8.21	195
Trachurus trecae	98.65	1456	8.01	194
Chelidonichthys capensis	44.29	57	3.60	
Trigla lyra	29.06	240	2.36	
Mustelus mustelus	22.03	12	1.79	
Zeus faber	21.64	62	1.76	
Sepia orbignyana	16.08	0	1.31	
Trachurus capensis	14.81	154	1.20	191
Raja miraletus	10.16	25	0.82	
Loligo vulgaris	9.57	97	0.78	
Pagellus bellottii	9.57	41	0.78	193
Atractoscion aequidens	5.89	8	0.48	
Etrumeus whiteheadi	5.32	212	0.43	190
Squalus megalops	4.97	14	0.40	
Umbrina canariensis	2.12	33	0.17	
Chelidonichthys gabonensis	1.23	16	0.10	
Scomber japonicus	1.05	16	0.09	
Lagocephalus laevigatus	0.82	8	0.07	
Trichiurus lepturus	0.74	8	0.06	
Total	1231.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 63
DATE :13/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°47.18
start stop duration Lon E 11°41.85
TIME :13:15:15 13:20:59 5.7 (min) Purpose : 1
LOG : 9952.42 9952.78 0.4 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 21 21 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.7 kn
Sorted : 85 Total catch: 4084.43 Catch/hour: 42843.67

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinops ocellatus	32272.45	505899	75.33	196
Etrumeus whiteheadi	10571.22	511448	24.67	197
Total	42843.67		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 64
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°50.18
start stop duration Lon E 11°41.04
TIME :14:27:38 14:30:59 3.4 (min) Purpose : 3
LOG : 9959.64 9959.83 0.2 Region : 4050
FDEPTH: 26 26 Gear cond.: 0
BDEPTH: 26 26 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.6 kn
Sorted : 67 Total catch: 699.92 Catch/hour: 12535.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	5425.43	681904	43.28	199
Sardinops ocellatus	3990.63	61487	31.83	200
Etrumeus whiteheadi	1937.01	96842	15.45	201
Trachurus trecae	1062.45	145558	8.48	198
Scomber japonicus	75.22	2060	0.60	202
J E L L Y F I S H	33.85	179	0.27	
Pagellus bellottii	11.28	752	0.09	
Total	12535.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 65
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°48.00
start stop duration Lon E 11°34.86
TIME :15:52:55 16:13:40 20.8 (min) Purpose : 3
LOG : 9969.07 9969.93 0.9 Region : 4050
FDEPTH: 95 95 Gear cond.: 0
BDEPTH: 95 95 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 2.5 kn
Sorted : 59 Total catch: 556.58 Catch/hour: 1609.39

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	730.70	13764	45.40	203
Dentex macrophthalmus	456.00	9149	28.33	205
Holothuria spp.	67.03	7307	4.16	
Merluccius capensis	66.51	440	4.13	204
Chelidonichthys capensis	63.44	359	3.94	
G A S T R O P O D S	62.08	40629	3.86	
B I V A L V E S	52.45	74085	3.26	
Pegusa lascaris	22.27	879	1.38	
Synagrops microlepis	20.33	1897	1.26	
Pythonichthys microphthalmus	15.09	413	0.94	
Galeichthys sp.	12.35	29	0.77	
Atractoscion aequidens	10.44	55	0.65	
Loligo vulgaris	8.24	110	0.51	
Engraulis encrasicolus	4.94	249	0.31	206
Brotula barbata	4.40	84	0.27	
Calappa pelii	3.30	55	0.20	
GOBIIDAE	3.01	688	0.19	
Umbrina canariensis	1.91	55	0.12	
Zeus faber	1.65	55	0.10	
Citharus linguatula	1.36	110	0.08	
Squilla mantis	1.36	55	0.08	
Arnoglossus imperialis	0.55	55	0.03	
Total	1609.39		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 66
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°49.90
start stop duration Lon E 11°17.95
TIME :19:08:46 19:38:51 30.1 (min) Purpose : 3
LOG : 9990.61 9992.24 1.6 Region : 4050
FDEPTH: 338 354 Gear cond.: 0
BDEPTH: 338 354 Validity : 0
Towing dir: 0° Wire out : 815 m Speed : 3.3 kn
Sorted : 172 Total catch: 602.34 Catch/hour: 1201.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	523.07	915	43.55	207
Helicolenus dactylopterus	478.40	7914	39.83	
Laemonema laureysi	63.85	1103	5.32	
Chlorophthalmus atlanticus	31.55	941	2.63	
PORIFERA (Sponges)	24.35	237	2.03	
Nezumia aequalis	15.13	329	1.26	
S H R I M P S	14.38	12040	1.20	
Pterothrissus belloci	11.09	64	0.92	
Trigla lyra	8.30	8	0.69	
Dentex macrophthalmus	8.16	36	0.68	208
Trachurus capensis	6.28	36	0.52	209
Dicologoglossa hexophthalma	2.79	78	0.23	
Holothuria spp.	2.01	413	0.17	
Galeus polli	1.93	10	0.16	
B I V A L V E S	1.81	70	0.15	
CALAPPIDAE	1.60	28	0.13	
Illex coindetii	1.32	8	0.11	
Bathynectes sp.	0.84	22	0.07	
MYCTOPHIDAE	0.84	455	0.07	
Scyliorhinus cervigoni	0.76	2	0.06	
G A S T R O P O D S	0.70	343	0.06	
Anemones, pink	0.62	22	0.05	
MURAENIDAE	0.56	8	0.05	
Malacocephalus occidentalis	0.42	8	0.03	
Pythonichthys microphthalmus	0.20	8	0.02	
Epigonus telescopus	0.14	8	0.01	
Total	1201.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 67
DATE :14/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 16°54.06
start stop duration Lon E 11°36.27
TIME :01:24:40 01:54:39 30.0 (min) Purpose : 1
LOG : 24.52 26.13 1.6 Region : 4050
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 84 69 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.2 kn
Sorted : 0 Total catch: 0.18 Catch/hour: 0.36

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardinops ocellatus	0.36	8 0.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 68
DATE :14/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°53.60
start stop duration Lon E 11°41.18
TIME :03:23:54 03:40:25 16.5 (min) Purpose : 1
LOG : 35.93 36.77 0.8 Region : 4050
FDEPTH: 18 18 Gear cond.: 0
BDEPTH: 25 26 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.1 kn
Sorted : 22 Total catch: 22.40 Catch/hour: 81.41

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Etrumeus whiteheadi	60.51	3271 74.33	210
Sepia officinalis	9.19	4 11.29	
J E L L Y F I S H	2.58	40 3.17	
Chelidonichthys capensis	1.85	4 2.28	
Sardinops ocellatus	1.85	47 2.28	213
Trachurus trecae	1.64	124 2.01	212
Arius parkii	1.38	4 1.70	
Engraulis encrasicolus	0.84	76 1.03	211
Scomber japonicus	0.51	15 0.63	214
Sepia orbignyana	0.36	7 0.45	
Loligo vulgaris	0.25	18 0.31	
Bembrops greyi	0.18	4 0.22	
Pagellus bellottii	0.15	11 0.18	
Trichiurus lepturus	0.11	4 0.13	
Total	81.41	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 69
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.20
start stop duration Lon E 11°43.00
TIME :05:31:16 05:40:42 9.4 (min) Purpose : 3
LOG : 47.89 48.38 0.5 Region : 4050
FDEPTH: 23 22 Gear cond.: 0
BDEPTH: 23 22 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
Sorted : 60 Total catch: 2573.19 Catch/hour: 16372.36

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Sardinops ocellatus	15984.31	215555 97.63	217
Trachurus trecae	288.61	11873 1.76	218
Raja alba	88.76	6 0.54	
Pagellus bellottii	5.34	267 0.03	
Pomadasys incisus	5.34	267 0.03	
Total	16372.36	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 70
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.48
start stop duration Lon E 11°40.81
TIME :06:28:21 06:48:51 20.5 (min) Purpose : 3
LOG : 53.16 54.10 0.9 Region : 4050
FDEPTH: 36 35 Gear cond.: 0
BDEPTH: 36 35 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 2.8 kn
Sorted : 65 Total catch: 1023.00 Catch/hour: 2995.61

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Engraulis encrasicolus	1559.30	81962 52.05	222
Trachurus trecae	700.59	34788 23.39	219
Etrumeus whiteheadi	419.47	20600 14.00	223
Sardinops ocellatus	272.33	5095 9.09	221
Illex coindetii	18.01	835 0.60	
Myliobatis aquila	11.42	3 0.38	
Trachurus capensis	6.15	615 0.21	220
Chelidonichthyes capensis	6.15	88 0.21	
Trichiurus lepturus	1.32	44 0.04	
Schedophilus pemarco	0.88	44 0.03	
Total	2995.61	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 71
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°58.93
start stop duration Lon E 11°39.03
TIME :08:04:17 08:24:29 20.2 (min) Purpose : 3
LOG : 61.11 62.15 1.1 Region : 4050
FDEPTH: 60 60 Gear cond.: 0
BDEPTH: 60 60 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.1 kn
Sorted : 143 Total catch: 3031.50 Catch/hour: 9004.46

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Etrumeus whiteheadi	3659.17	169393 40.64	226
Trachurus trecae	2712.83	64096 30.13	224
Trachurus capensis	1583.52	139550 17.59	225
Pegusa lascaris	239.08	8011 2.66	
Starfish	162.12	23153 1.80	
Chelidonichthys capensis	140.67	630 1.56	
Engraulis encrasicolus	118.60	5299 1.32	228
Atractoscion aequidens	99.03	630 1.10	232
Loligo vulgaris	65.58	3154 0.73	
Trichiurus lepturus	46.04	1450 0.51	
Merluccius capensis	32.79	252 0.36	231
Sardinops ocellatus	29.02	820 0.32	227
Umbrina canariensis	27.74	630 0.31	230
Galeichthys sp.	25.22	62 0.28	
Scomber japonicus	24.59	630 0.27	229
Bathynectes sp.	10.07	1262 0.11	
Sepia orbignyana	7.57	62 0.08	
G A S T R O P O D S	5.67	2522 0.06	
Pythonichthys microphthalmus	5.67	125 0.06	
Pterothrissus belloci	5.67	62 0.06	
Squilla cadenati	2.52	62 0.03	
Goneplax angulata	1.25	62 0.01	
Total	9004.46	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 72
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.00
start stop duration Lon E 11°35.17
TIME :09:31:53 10:02:13 30.3 (min) Purpose : 3
LOG : 69.19 70.71 1.5 Region : 4050
FDEPTH: 90 91 Gear cond.: 0
BDEPTH: 90 91 Validity : 0
Towing dir: 0° Wire out : 230 m Speed : 3.0 kn
Sorted : 115 Total catch: 2586.99 Catch/hour: 5116.00

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Trachurus capensis	2765.40	81338 54.05	234
Trachurus trecae	1270.34	57399 24.83	
Dentex macrophthalmus	302.57	4226 5.91	236
Etrumeus whiteheadi	279.43	7608 5.46	235
Merluccius capensis	180.20	1068 3.52	237
Loligo vulgaris	109.46	1157 2.14	
Chelidonichthys capensis	104.56	577 2.04	
Sepia officinalis	21.36	44 0.42	
Zeus faber	16.91	89 0.33	
Sepia orbignyana	16.45	89 0.32	
Starfish	15.13	2759 0.30	
Scomber japonicus	12.00	132 0.23	
Umbrina canariensis	10.22	44 0.20	
B I V A L V E S	3.10	933 0.06	
Brotula barbata	2.67	44 0.05	
Trichiurus lepturus	2.21	44 0.04	
Squilla mantis	2.21	44 0.04	
Maja squinado	1.32	132 0.03	
MAJIDAE	0.44	221 0.01	
Total	5116.00	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 73
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°0.09
start stop duration Lon E 11°22.11
TIME :13:34:48 14:04:49 30.0 (min) Purpose : 3
LOG : 100.51 101.99 1.5 Region : 4050
FDEPTH: 144 144 Gear cond.: 0
BDEPTH: 144 144 Validity : 0
Towing dir: 0° Wire out : 340 m Speed : 2.9 kn
Sorted : 302 Total catch: 302.32 Catch/hour: 604.04

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Dentex macrophthalmus	370.03	3317 61.26	242
Myliobatis aquila	60.44	14 10.01	
Zeus faber	32.77	114 5.42	
Trichiurus lepturus	30.07	569 4.98	
Trachurus trecae	24.98	336 4.13	240
Pterothrissus belloci	22.18	316 3.67	
Merluccius capensis	19.18	48 3.18	243
Squalus megalops	7.39	14 1.22	
Chelidonichthys capensis	6.33	6 1.05	
Helicolenus dactylopterus	5.69	54 0.94	
Mustelus mustelus	4.20	2 0.69	
Loligo vulgaris	3.82	36 0.63	
Trachurus capensis	3.22	42 0.53	241
Raja miraletus	2.94	4 0.49	
Umbrina canariensis	1.92	8 0.32	
Chelidonichthys gabonensis	1.54	14 0.25	
Etrumeus whiteheadi	1.32	18 0.22	244
Atractoscion aequidens	1.00	2 0.17	
Dentex angolensis	0.96	2 0.16	
Trigla lyra	0.94	12 0.16	
Galeichthys sp.	0.68	2 0.11	
Illex coindetii	0.68	4 0.11	
Sepia orbignyana	0.48	2 0.08	
Zenopsis conchifer	0.46	2 0.08	
Brotula barbata	0.38	2 0.06	
Dicologoglossa cuneata	0.24	4 0.04	
Starfish	0.18	32 0.03	
G A S T R O P O D S	0.04	4 0.01	
Total	604.04	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 74
DATE :14/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 17°4.98
start stop duration Lon E 11°17.77
TIME :18:53:58 19:35:32 41.6 (min) Purpose : 1
LOG : 136.60 138.70 2.1 Region : 4050
FDEPTH: 125 155 Gear cond.: 0
BDEPTH: 477 611 Validity : 0
Towing dir: 0° Wire out : 375 m Speed : 3.0 kn
Sorted : 30 Total catch: 30.49 Catch/hour: 44.02

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Trachurus capensis	35.44	407 80.52	245
Hoplostethus cadenati	4.01	3684 9.12	
Vitreledonella richardi	1.23	1 2.79	
S H R I M P S	1.17	1340 2.66	
MELANOSTOMIATIDAE	0.95	25 2.16	
Trachurus trecae	0.66	7 1.51	246
Saurida brasiliensis	0.33	185 0.75	
MYCTOPHIDAE	0.17	84 0.39	
Avocettina sp.	0.04	3 0.10	
Total	44.02	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 75
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°0.42
start stop duration Lon E 11°15.27
TIME :21:01:19 21:22:38 21.3 (min) Purpose : 3
LOG : 145.86 146.86 1.0 Region : 4050
FDEPTH: 742 733 Gear cond.: 0
BDEPTH: 742 733 Validity : 0
Towing dir: 0° Wire out : 1470 m Speed : 2.8 kn
Sorted : 295 Total catch: 295.38 Catch/hour: 831.28

SPECIES	CATCH/HOUR weight	% OF TOT. C numbers	SAMP
Malacocephalus occidentalis	182.22	5952 21.92	
Trachyrincus scabrus	118.20	4503 14.22	
Merluccius capensis	101.03	110 12.15	249
Talismania sp.	86.54	1365 10.41	
Ebinania costaecanarie	57.69	42 6.94	
Geryon maritae	56.99	87 6.86	
Yarrella blackfordi	45.03	1351 5.42	
Raja confundens	39.40	56 4.74	
Deania calcea	26.45	23 3.18	
MELANOSTOMIATIDAE	25.61	661 3.08	
Hoplostethus cadenati	23.22	844 2.79	
Paramola cuvieri	15.90	65 1.91	
Anemones, pink	10.41	28 1.25	
Lophiodes kempi	5.63	14 0.68	
Trachurus capensis	4.81	51 0.58	247
Centrophorus squamosus	4.78	6 0.58	
Bathyuroconger vicinus	4.64	56 0.56	
Centroscymnus crepidater	4.08	28 0.49	
Apristurus sp.	3.66	6 0.44	
Selachophidium guentheri	3.38	70 0.41	
Trachurus trecae	3.29	34 0.40	248
Plesiopenaeus edwardsianus	3.24	521 0.39	
OCTOPOTEUTHIDAE	1.69	14 0.20	
Zenion sp.	1.27	3 0.15	
Aristeus varidens, female	0.84	70 0.10	
SYNAPHOBRANCHIDAE	0.56	14 0.07	
Benthodesmus tenuis	0.42	14 0.05	
Halosaurus ovenii	0.14	14 0.02	
Aristeus varidens, male	0.14	14 0.02	
Total	831.28	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 76
DATE :15/08/2011 GEAR_TYPE: PT NO: 4 POSITION:Lat S 17°5.93
start stop duration Lon E 11°37.37
TIME :01:17:40 01:47:45 30.1 (min) Purpose : 1
LOG : 173.52 175.14 1.6 Region : 4050
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 81 68 Validity : 0
Towing dir: 0° Wire out : 116 m Speed : 3.2 kn
Sorted : 65 Total catch: 226.10 Catch/hour: 450.85

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	408.61	20867	90.63	251
Trachurus capensis	30.01	2136	6.66	250
Sardinops ocellatus	10.39	64	2.30	252
Loligo vulgaris	1.42	14	0.31	
Trichiurus lepturus	0.42	6	0.09	
Total	450.85		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 77
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°11.81
start stop duration Lon E 11°43.75
TIME :05:40:57 06:10:52 29.9 (min) Purpose : 3
LOG : 190.16 191.73 1.6 Region : 4050
FDEPTH: 27 26 Gear cond.: 0
BDEPTH: 27 26 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
Sorted : 146 Total catch: 679.63 Catch/hour: 1362.89

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1039.37	26043	76.26	253
Chelidonichthys capensis	64.07	96	4.70	
Callorhinchus capensis	51.54	40	3.78	
Galeichthys sp.	49.63	201	3.64	
Pegusa lascaris	26.19	710	1.92	
J E L L Y F I S H	24.53	34	1.80	
Stromateus fiatola	18.27	84	1.34	
Raja miraletus	17.69	24	1.30	
Mustelus mustelus	14.34	20	1.05	
Trichiurus lepturus	13.01	517	0.95	
Sphyrna zygaena	12.83	6	0.94	
Merluccius capensis	7.00	92	0.51	254
Pomatomus saltatrix	5.68	16	0.42	
White sea cucumber	4.17	201	0.31	
Atractoscion aequidens	3.59	34	0.26	
Sepia orbignyana	3.17	24	0.23	
Schedophilus pemarco	2.09	24	0.15	
Maja squinado	1.66	158	0.12	
Penaeus notialis	1.24	42	0.09	
Etrumeus whiteheadi	1.00	34	0.07	
Cynoglossus canariensis	0.58	66	0.04	
Pterothrissus belloci	0.50	34	0.04	
Pteroscion peli	0.34	34	0.03	
Umbrina canariensis	0.24	16	0.02	
Squilla mantis	0.16	8	0.01	
Total	1362.89		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 78
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°11.16
start stop duration Lon E 11°41.82
TIME :07:08:15 07:32:29 24.2 (min) Purpose : 3
LOG : 197.46 198.79 1.3 Region : 4050
FDEPTH: 42 41 Gear cond.: 0
BDEPTH: 42 41 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 148 Total catch: 1206.71 Catch/hour: 2988.14

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2029.55	50952	67.92	255
Chelidonichthys capensis	168.39	381	5.64	
Engraulis encrasicolus	127.78	7211	4.28	256
Galeichthys sp.	126.98	634	4.25	
Callorhinchus capensis	112.92	99	3.78	
Pomadasys jubelini	73.30	317	2.45	259
Raja miraletus	66.56	99	2.23	
Myliobatis sp.	64.78	20	2.17	
Argyrosomus hololepidotus	48.91	10	1.64	258
Pegusa lascaris	42.39	1030	1.42	
Dasyatis marmorata	41.60	40	1.39	
Rhinobatos albomaculatus	24.37	20	0.82	
Trichiurus lepturus	23.57	713	0.79	
Atractoscion aequidens	9.11	79	0.30	
Pomatomus saltatrix	7.73	59	0.26	
Merluccius capensis	7.53	59	0.25	
Sardinops ocellatus	3.37	99	0.11	257
ANTENNARIIDAE	2.77	40	0.09	
Umbrina canariensis	2.58	79	0.09	
C R A B S	1.98	79	0.07	
Loligo vulgaris	0.99	59	0.03	
Dentex barnardi	0.59	20	0.02	
Tetradonthidae	0.40	20	0.01	
Total	2988.14		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 79
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°11.19
start stop duration Lon E 11°37.89
TIME :09:39:33 09:53:53 14.3 (min) Purpose : 3
LOG : 209.68 210.37 0.7 Region : 4050
FDEPTH: 84 85 Gear cond.: 9
BDEPTH: 84 85 Validity : 4
Towing dir: 0° Wire out : 200 m Speed : 2.9 kn
Sorted : 30 Total catch: 272.70 Catch/hour: 1141.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	707.95	14272	62.05	260
B I V A L V E S	104.31	149121	9.14	
Merluccius capensis	50.84	414	4.46	263
Pegusa lascaris	32.38	1167	2.84	
Pythonichthys microphthalmus	28.24	565	2.48	
Atractoscion aequidens	25.61	188	2.24	265
Squilla cadenati	22.97	828	2.01	
Trachurus capensis	21.09	1393	1.85	261
Chelidonichthys capensis	19.58	188	1.72	
G A S T R O P O D S	18.45	45866	1.62	
Galeichthys sp.	17.32	38	1.52	
Raja miraletus	17.32	38	1.52	
Umbrina canariensis	13.93	377	1.22	264
Brotula barbata	13.56	264	1.19	
GOBIIDAE	13.56	1506	1.19	
Pterothrissus belloci	10.92	188	0.96	
Dentex macrophthalmus	9.41	264	0.83	262
Calappa pelii	9.04	151	0.79	
Trichiurus lepturus	3.01	113	0.26	
Citharus linguatula	1.51	151	0.13	
Total	1141.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 80
DATE :15/08/2011 GEAR_TYPE: PT NO: 1 POSITION:Lat S 17°11.17
start stop duration Lon E 11°37.79
TIME :10:25:38 11:01:43 36.1 (min) Purpose : 1
LOG : 211.98 213.97 2.0 Region : 4050
FDEPTH: 60 60 Gear cond.: 0
BDEPTH: 85 81 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 38 Total catch: 37.98 Catch/hour: 63.14

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	48.38	2086	76.62	266
Sardinops ocellatus	5.84	186	9.24	268
J E L L Y F I S H	5.44	2	8.61	
Engraulis encrasicolus	3.06	150	4.84	267
Lagocephalus laevigatus	0.27	8	0.42	
Scomber japonicus	0.13	3	0.21	
BRAMIDAE	0.03	2	0.05	
Total	63.14		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 81
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°13.15
start stop duration Lon E 11°30.93
TIME :14:11:59 14:36:12 24.2 (min) Purpose : 3
LOG : 230.00 231.22 1.2 Region : 4050
FDEPTH: 134 131 Gear cond.: 0
BDEPTH: 134 131 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 3.0 kn
Sorted : 93 Total catch: 4999.49 Catch/hour: 12385.19

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	11237.61	327696	90.73	269
Dentex macrophthalmus	749.16	12220	6.05	270
Merluccius capensis	213.84	1063	1.73	271
Trichiurus lepturus	58.44	1063	0.47	
Squalus megalops	50.46	265	0.41	
Scomber japonicus	35.85	399	0.29	
Trigla lyra	13.28	131	0.11	
Loligo vulgaris	11.94	131	0.10	
Pterothrissus belloci	7.98	131	0.06	
Dicologoglossa cuneata	3.99	530	0.03	
G A S T R O P O D S	2.65	131	0.02	
Total	12385.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 82
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°12.73
start stop duration Lon E 11°28.76
TIME :15:26:44 15:47:05 20.4 (min) Purpose : 3
LOG : 235.08 236.06 1.0 Region : 4050
FDEPTH: 148 152 Gear cond.: 0
BDEPTH: 148 152 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 2.9 kn
Sorted : 203 Total catch: 842.16 Catch/hour: 2481.81

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	1027.90	12306	41.42	273
Trachurus capensis	787.66	15908	31.74	272
Squalus megalops	192.85	660	7.77	
Merluccius capensis	175.40	896	7.07	274
Zeus faber	104.20	283	4.20	
Chelidonichthys capensis	75.44	141	3.04	
Loligo vulgaris	27.82	94	1.12	
Synagrops microlepis	22.16	5092	0.89	
Pterothrissus belloci	21.69	330	0.87	
Trichiurus lepturus	12.26	141	0.49	
Helicolenus dactylopterus	10.37	566	0.42	
Zenopsis conchifer	9.43	47	0.38	
Squilla mantis	5.19	141	0.21	
Chlorophthalmus atlanticus	2.83	424	0.11	
Alloteuthis africana	2.83	47	0.11	
Dicologoglossa cuneata	1.89	141	0.08	
GOBIIDAE	1.89	141	0.08	
Total	2481.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 83
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°11.89
start stop duration Lon E 11°25.40
TIME :16:39:18 16:59:27 20.1 (min) Purpose : 3
LOG : 241.08 242.08 1.0 Region : 4050
FDEPTH: 171 174 Gear cond.: 0
BDEPTH: 171 174 Validity : 0
Towing dir: 0° Wire out : 420 m Speed : 3.0 kn
Sorted : 47 Total catch: 718.63 Catch/hour: 2140.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	1050.30	20908	49.06	276
Merluccius capensis	483.37	2073	22.58	275
Dentex macrophthalmus	210.06	2163	9.81	277
Zenopsis conchifer	70.13	328	3.28	
Squalus megalops	58.39	164	2.73	
Trigla lyra	39.32	295	1.84	
Zeus faber	38.28	191	1.79	
Synagrops microlepis	31.79	7275	1.48	
Mustelus mustelus	28.75	12	1.34	
Helicolenus dactylopterus	20.97	885	0.98	
Pterothrissus belloci	19.33	197	0.90	
Squilla mantis	19.01	754	0.89	
Pegusa lascaris	13.11	1213	0.61	
Saurida brasiliensis	11.80	3408	0.55	
Scomber japonicus	11.47	131	0.54	278
Trichiurus lepturus	8.85	98	0.41	
Macropipus australis	5.24	262	0.24	
Malacocephalus occidentalis	4.26	197	0.20	
Bembrops heterurus	4.26	131	0.20	
Atractoscion aequidens	3.69	3	0.17	
Illex coindetii	3.60	98	0.17	
Chlorophthalmus atlanticus	1.97	131	0.09	
Diastobranchus capensis	1.64	33	0.08	
SCYLLARIDAE	1.31	197	0.06	
Total	2140.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 84
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°13.36
start stop duration Lon E 11°21.46
TIME :21:11:53 21:42:14 30.3 (min) Purpose : 3
LOG : 261.33 262.82 1.5 Region : 4050
FDEPTH: 322 321 Gear cond.: 0
BDEPTH: 322 321 Validity : 0
Towing dir: 0° Wire out : 780 m Speed : 2.9 kn
Sorted : 413 Total catch: 413.42 Catch/hour: 817.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	395.81	664	48.41	280
Chlorophthalmus atlanticus	209.03	6589	25.57	
Helicolenus dactylopterus	51.91	3101	6.35	
Laemonema laureysi	34.61	1357	4.23	
S H R I M P S	27.69	9773	3.39	
Bathynectes piperitus	16.75	761	2.05	
Galeus polli	15.52	182	1.90	
Lophius vomerinus	12.76	6	1.56	
Pterothrissus belloci	12.74	69	1.56	
Malacocephalus occidentalis	8.03	305	0.98	
Nezumia aequalis	5.68	305	0.69	
Trachurus capensis	5.06	67	0.62	279
RHINOCHIMAERIDAE	4.55	2	0.56	
Macropipus australis	3.60	152	0.44	
Dentex macrophthalmus	2.69	8	0.33	281
Pegusa lascaris	2.49	69	0.30	
Parapenaeus longirostris,femal	2.35	360	0.29	
GOBIIDAE	1.66	360	0.20	
B I V A L V E S	1.25	69	0.15	
MYCTOPHIDAE	0.69	208	0.08	
Scyliorhinus cervigoni	0.63	2	0.08	
Solenocera africana	0.55	97	0.07	
Munidopsis sp.	0.55	194	0.07	
Synagrops microlepis	0.42	28	0.05	
Parapenaeus longirostris, male	0.42	69	0.05	
Saurida brasiliensis	0.14	28	0.02	
Garbage	0.00	4	0.00	
Total	817.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 85
DATE :16/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°10.85
start stop duration Lon E 11°15.01
TIME :02:06:52 02:36:58 30.1 (min) Purpose : 3
LOG : 280.16 281.52 1.4 Region : 4050
FDEPTH: 732 729 Gear cond.: 0
BDEPTH: 732 729 Validity : 0
Towing dir: 0° Wire out : 1670 m Speed : 2.7 kn
Sorted : 129 Total catch: 1375.24 Catch/hour: 2741.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Raja confundens	743.02	148	27.10	
Nezumia aequalis	441.63	14484	16.11	
Trachyrincus scabrus	393.69	1549	14.36	
Merluccius capensis	373.59	419	13.63	282
Chaceon maritae, male	130.80	293	4.77	
Raja sp.	129.77	22	4.73	
Paramola cuvieri	69.69	42	2.54	
Talismania sp.	65.92	1214	2.40	
Bathyuroconger vicinus	46.47	544	1.69	
Deania calcea	44.05	16	1.61	
Chaceon maritae, female	41.02	231	1.50	
Anemones, pink	40.39	126	1.47	
UNIDENTIFIED FISH	26.99	22	0.98	
Hoplostethus cadenati	25.32	1256	0.92	
Aristeus varidens, female	22.39	1443	0.82	
Ebinania costaecanarie	19.67	42	0.72	
Yarrella blackfordi	15.49	795	0.56	
Todarodes sp.	14.65	22	0.53	
RHINOCHIMAERIDAE	11.42	2	0.42	
Selachophidium guentheri	11.30	231	0.41	
Stomias boa boa	10.25	524	0.37	
Scymnodon squamulosus	8.69	30	0.32	
Lamprogrammus exutus	7.73	64	0.28	
Anemones, white	7.73	22	0.28	
UNIDENTIFIED FISH	6.28	1027	0.23	
Aristurus sp.	5.82	16	0.21	
Aristeus varidens, male	5.22	460	0.19	
Heterocarpus grimaldi	5.22	273	0.19	
Neocyttus sp.	3.55	42	0.13	
Notacanthus sexspinis	3.55	42	0.13	
SYNAPHOBRANCHIDAE	3.35	126	0.12	
HOMOLIDAE	3.35	22	0.12	
Bathynectes piperitus	1.26	22	0.05	
Caresproctus sp.	0.84	22	0.03	
B I V A L V E S	0.62	22	0.02	
Triplophos hemingi	0.62	64	0.02	
Total	2741.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 86
DATE :16/08/2011 GEAR_TYPE: PT NO: 1 POSITION:Lat S 17°24.59
start stop duration Lon E 11°39.82
TIME :15:44:49 16:13:00 28.2 (min) Purpose : 1
LOG : 363.87 365.62 1.8 Region : 5010
FDEPTH: 60 70 Gear cond.: 0
BDEPTH: 85 82 Validity : 0
Towing dir: 0° Wire out : 190 m Speed : 3.7 kn
Sorted : 66 Total catch: 263.24 Catch/hour: 560.28

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	317.99	17666	56.75	284
Engraulis encrasicolus	240.09	17470	42.85	283
Sardinops ocellatus	1.79	51	0.32	285
Trachurus trecae	0.34	9	0.06	
Trachurus capensis	0.09	9	0.02	
Total	560.28		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 87
DATE :17/08/2011 GEAR_TYPE: PT NO: 4 POSITION:Lat S 17°29.68
start stop duration Lon E 11°40.24
TIME :02:24:05 02:54:06 30.0 (min) Purpose : 1
LOG : 452.28 453.80 1.5 Region : 5010
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 84 61 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.0 kn
Sorted : 12 Total catch: 11.82 Catch/hour: 23.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	23.48	672	99.41	
Trichiurus lepturus	0.14	6	0.59	
Total	23.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 88
DATE :17/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°40.93
start stop duration Lon E 11°34.17
TIME :14:04:55 14:12:06 7.2 (min) Purpose : 1
LOG : 538.37 538.71 0.3 Region : 5010
FDEPTH: 145 145 Gear cond.: 0
BDEPTH: 145 145 Validity : 0
Towing dir: 0° Wire out : 340 m Speed : 2.8 kn
Sorted : 782 Total catch: 781.74 Catch/hour: 6532.65

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	4873.54	208253	74.60	287
Dentex macrophthalmus	624.23	7220	9.56	286
Merluccius capensis	455.01	2331	6.97	288
Chelidonichthys capensis	176.74	226	2.71	
Pterothrissus belloci	167.72	3384	2.57	
Trigla lyra	94.01	827	1.44	
Synagrops microlepis	28.58	4964	0.44	
Zeus faber	27.83	75	0.43	
Raja miraletus	24.07	75	0.37	
Spondyliosoma cantharus	19.55	75	0.30	
Chlorophthalmus atlanticus	18.05	4889	0.28	
Illex coindetii	6.77	75	0.10	
Squilla mantis	6.02	150	0.09	
Dicologoglossa cuneata	4.51	226	0.07	
Helicolenus dactylopterus	3.76	150	0.06	
GOBIIDAE	1.50	451	0.02	
Parapenaeus longirostris	0.75	677	0.01	
Total	6532.65		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 89
DATE :17/08/2011 GEAR_TYPE: PT NO: 1 POSITION:Lat S 17°47.72
start stop duration Lon E 11°30.34
TIME :18:37:16 19:09:49 32.6 (min) Purpose : 1
LOG : 573.70 575.66 2.0 Region : 5010
FDEPTH: 60 40 Gear cond.: 0
BDEPTH: 194 211 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.6 kn
Sorted : 8 Total catch: 8.34 Catch/hour: 15.37

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	8.09	240	52.64	289
Mustelus mustelus	6.18	2	40.17	
Synagrops microlepis	0.39	66	2.52	
S H R I M P S	0.35	295	2.28	
J E L L Y F I S H	0.13	17	0.84	
Saurida brasiliensis	0.09	59	0.60	
MYCTOPHIDAE	0.07	28	0.48	
Scomberesox saurus	0.04	2	0.24	
Leptocephalus	0.02	9	0.12	
Merluccius capensis	0.02	6	0.12	
Total	15.37		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 90
DATE :18/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°51.99
start stop duration Lon E 11°44.45
TIME :03:25:22 03:30:20 5.0 (min) Purpose : 1
LOG : 644.25 644.48 0.2 Region : 5010
FDEPTH: 64 63 Gear cond.: 0
BDEPTH: 64 63 Validity : 0
Towing dir: 0° Wire out : 148 m Speed : 2.8 kn
Sorted : 29 Total catch: 94.34 Catch/hour: 1143.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis encrasicolus	521.82	281418	45.63	
J E L L Y F I S H	308.73	2618	27.00	
Trachurus trecae	102.55	10873	8.97	290
Trachurus capensis	56.73	6364	4.96	291
Chelidonichthys capensis	41.82	158	3.66	
Merluccius capensis	21.09	291	1.84	293
Mustelus mustelus	16.73	24	1.46	
Squatina oculata	15.15	24	1.32	
Trichiurus lepturus	10.18	436	0.89	
Raja miraletus	9.45	36	0.83	
Calappa pelii	8.73	145	0.76	
Dicologoglossa cuneata	7.27	436	0.64	
Sardinops ocellatus	5.45	1018	0.48	292
Starfish	3.27	655	0.29	
Loligo vulgaris	2.55	36	0.22	
Pterothrissus belloci	2.55	36	0.22	
Sardinella aurita	2.18	36	0.19	
Pythonichthys microphthalmus	1.82	36	0.16	
Macropipus australis	1.45	73	0.13	
CORYSITIDAE	1.09	182	0.10	
Goneplax angulata	1.09	182	0.10	
Umbrina canariensis	0.73	36	0.06	
B I V A L V E S	0.36	618	0.03	
Chlorophthalmus atlanticus	0.36	36	0.03	
GRAPSIDAE	0.36	73	0.03	
Total	1143.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 91
DATE :18/08/2011 GEAR_TYPE: PT NO: 1 POSITION:Lat S 18°0.16
start stop duration Lon E 11°32.54
TIME :06:23:56 06:44:36 20.7 (min) Purpose : 1
LOG : 668.55 669.67 1.1 Region : 5010
FDEPTH: 147 186 Gear cond.: 0
BDEPTH: 218 200 Validity : 0
Towing dir: 0° Wire out : 440 m Speed : 3.3 kn
Sorted : 121 Total catch: 121.40 Catch/hour: 352.39

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	352.39	7626	100.00	294
Total	352.39		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 92
DATE :18/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°59.36
start stop duration Lon E 11°25.97
TIME :08:18:25 08:49:17 30.9 (min) Purpose : 1
LOG : 680.90 682.43 1.5 Region : 5010
FDEPTH: 287 288 Gear cond.: 0
BDEPTH: 287 288 Validity : 0
Towing dir: 0° Wire out : 650 m Speed : 3.0 kn
Sorted : 85 Total catch: 3135.15 Catch/hour: 6095.56

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	3609.99	6422	59.22	296
Helicolenus dactylopterus	1969.11	63943	32.30	
Chlorophthalmus atlanticus	270.31	7482	4.43	
Trachurus capensis	72.97	284	1.20	295
Pterothrissus belloci	55.76	282	0.91	
Dentex macrophthalmus	38.11	142	0.63	
PORIFERA (Sponges)	25.33	282	0.42	
Nezumia aequalis	14.82	354	0.24	
Lophius sp.	13.22	2	0.22	
Bathynectes piperitus	7.76	142	0.13	
Galeus polli	6.61	80	0.11	
Atractoscion aequidens	5.93	2	0.10	
Malacocephalus occidentalis	4.94	142	0.08	
MYCTOPHIDAE	0.70	70	0.01	
Total	6095.56		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 93
DATE :18/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 18°4.10
start stop duration Lon E 11°35.43
TIME :15:01:30 15:12:01 10.5 (min) Purpose : 1
LOG : 737.38 737.91 0.5 Region : 5010
FDEPTH: 176 178 Gear cond.: 0
BDEPTH: 176 178 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 3.1 kn
Sorted :2996 Total catch: 2996.00 Catch/hour: 17087.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	16591.25	335475	97.10	297
Chlorophthalmus atlanticus	255.51	867	1.50	
Helicolenus dactylopterus	106.08	143	0.62	
Dentex macrophthalmus	45.63	29	0.27	
Merluccius capensis	41.06	17	0.24	
Synagrops microlepis	39.92	297	0.23	
Squilla mantis	4.56	6	0.03	
Parapenaeus longirostris	1.14	29	0.01	
GOBIIDAE	1.14	6	0.01	
Goneplax angulata	1.14	11	0.01	
Total	17087.45		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 94
DATE :19/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 18°20.35
start stop duration Lon E 11°38.49
TIME :07:25:31 07:30:32 5.0 (min) Purpose : 1
LOG : 867.09 867.31 0.2 Region : 5010
FDEPTH: 154 153 Gear cond.: 0
BDEPTH: 154 153 Validity : 0
Towing dir: 0° Wire out : 390 m Speed : 2.7 kn
Sorted : 58 Total catch: 1558.98 Catch/hour: 18633.23

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	17910.36	406614	96.12	298
Merluccius capensis	384.02	1936	2.06	299
J E L L Y F I S H	158.13	7100	0.85	
Dentex macrophthalmus	54.86	645	0.29	
Synagrops microlepis	48.41	4841	0.26	
Chlorophthalmus atlanticus	41.95	4841	0.23	
Sardinops ocellatus	22.59	323	0.12	
Goneplax angulata	6.45	323	0.03	
Starfish	6.45	5163	0.03	
Total	18633.23		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 95
DATE :19/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 18°29.29
start stop duration Lon E 11°17.73
TIME :14:55:32 15:26:01 30.5 (min) Purpose : 1
LOG : 917.78 919.22 1.4 Region : 5010
FDEPTH: 200 240 Gear cond.: 0
BDEPTH: 930 873 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 2.8 kn
Sorted : 7 Total catch: 6.68 Catch/hour: 13.15

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	12.40	179	94.31	300
MYCTOPHIDAE	0.37	83	2.84	
J E L L Y F I S H	0.37	12	2.84	
Total	13.15		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 96
DATE :20/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 18°37.44
start stop duration Lon E 11°28.62
TIME :03:18:26 03:48:29 30.1 (min) Purpose : 1
LOG : 1000.93 1002.57 1.6 Region : 5010
FDEPTH: 220 195 Gear cond.: 0
BDEPTH: 273 266 Validity : 0
Towing dir: 0° Wire out : 500 m Speed : 3.3 kn
Sorted : 22 Total catch: 21.94 Catch/hour: 43.81

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	33.54	609	76.57	301
J E L L Y F I S H	3.89	148	8.89	
Lophiodes kempi	1.94	2	4.42	
Euphausiacea	1.60	12938	3.65	
MYCTOPHIDAE	0.80	469	1.82	
Zenopsis conchifer	0.68	2	1.55	
Synagrops microlepis	0.52	30	1.19	
Leptocephalus	0.42	180	0.96	
Trigla lyra	0.36	2	0.82	
Merluccius capensis	0.04	2	0.09	
Solenocera africana	0.02	6	0.05	
Total	43.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 97
DATE :20/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 18°34.79
start stop duration Lon E 11°45.52
TIME :09:43:58 09:50:12 6.2 (min) Purpose : 1
LOG : 1046.70 1046.99 0.3 Region : 5010
FDEPTH: 185 184 Gear cond.: 0
BDEPTH: 185 184 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 2.8 kn
Sorted : 134 Total catch: 402.39 Catch/hour: 3875.35

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	3299.52	43801	85.14	302
Merluccius capensis	236.92	1156	6.11	303
Synagrops microlepis	138.11	13175	3.56	
Raja miraletus	68.76	116	1.77	
Dentex macrophthalmus	55.76	838	1.44	304
J E L L Y F I S H	30.91	1589	0.80	
Pterothrissus belloci	17.91	751	0.46	
GOBIIDAE	15.02	1560	0.39	
Chlorophthalmus atlanticus	6.36	1994	0.16	
Sardinops ocellatus	1.73	29	0.04	
Illex coindetii	1.73	29	0.04	
Chatrabus melanurus	0.87	29	0.02	
Goneplax angulata	0.87	173	0.02	
Parapenaeus longirostris	0.58	202	0.01	
Trigla lyra	0.29	29	0.01	
Total	3875.35		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 98
DATE :20/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 18°37.26
start stop duration Lon E 12°0.86
TIME :13:09:00 13:18:04 9.1 (min) Purpose : 1
LOG : 1074.68 1075.07 0.4 Region : 5010
FDEPTH: 88 88 Gear cond.: 0
BDEPTH: 88 88 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 2.6 kn
Sorted :1646 Total catch: 1645.78 Catch/hour: 10887.19

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	3531.86	1665976	32.44	305
Engraulis encrasicolus	3456.45	640009	31.75	306
Argyrosomus hololepidotus	2664.61	2262	24.47	
Callorhinchus capensis	505.27	251	4.64	
Sardinops ocellatus	213.67	21367	1.96	307
Aequorea forskalea	196.07	8547	1.80	
Etrumeus whiteheadi	196.07	9552	1.80	308
Spondyliosoma cantharus	52.79	251	0.48	
J E L L Y F I S H	42.73	754	0.39	
Dicologoglossa cuneata	20.11	503	0.18	
GOBIIDAE	7.54	3771	0.07	
Total	10887.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 99
DATE :20/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 18°47.97
start stop duration Lon E 11°28.04
TIME :17:30:24 17:51:07 20.7 (min) Purpose : 1
LOG : 1112.40 1113.45 1.0 Region : 5010
FDEPTH: 305 302 Gear cond.: 0
BDEPTH: 305 302 Validity : 0
Towing dir: 0° Wire out : 720 m Speed : 3.0 kn
Sorted : 91 Total catch: 689.67 Catch/hour: 1997.10

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1280.85	1804	64.14	310
Helicolenus dactylopterus	409.34	10037	20.50	
Chlorophthalmus atlanticus	145.25	4205	7.27	
Trachurus capensis	112.24	880	5.62	309
J E L L Y F I S H	22.01	67	1.10	
Lophius sp.	16.07	23	0.80	
Nezumia aequalis	2.86	43	0.14	
Parapenaeus longirostris	2.20	793	0.11	
Bathynectes piperitus	1.98	43	0.10	
Galeus polli	1.88	23	0.09	
MYCTOPHIDAE	1.10	110	0.06	
Solenocera africana	0.88	23	0.04	
Munidopsis sp.	0.44	23	0.02	
Total	1997.10		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 100
DATE :20/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 18°49.65
start stop duration Lon E 11°24.15
TIME :19:19:33 19:49:54 30.4 (min) Purpose : 1
LOG : 1122.63 1124.16 1.5 Region : 5010
FDEPTH: 427 425 Gear cond.: 0
BDEPTH: 427 425 Validity : 0
Towing dir: 0° Wire out : 950 m Speed : 3.0 kn
Sorted : 60 Total catch: 480.74 Catch/hour: 950.39

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	325.80	411	34.28	312
Helicolenus dactylopterus	221.42	2578	23.30	
Galeus polli	177.13	2246	18.64	
Malacocephalus occidentalis	53.14	1819	5.59	
Laemonema sp.	34.95	395	3.68	
Aristeus varidens	30.84	7718	3.24	
Chaceon maritae	29.73	111	3.13	
Coelorinchus coelorhincus	27.99	759	2.95	
Dicrolene sp.	20.88	506	2.20	
Plesionika martia	11.07	4175	1.16	
Trachurus capensis	7.31	57	0.77	311
J E L L Y F I S H	3.95	285	0.42	
Anemones, pink	1.74	16	0.18	
Lampadena sp.	1.42	111	0.15	
Hoplostethus cadenati	1.11	285	0.12	
Yarrella sp.	0.95	237	0.10	
G A S T R O P O D S	0.32	16	0.03	
Benthodesmus tenuis	0.32	16	0.03	
Coelorinchus sp.	0.32	16	0.03	
Total	950.39		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 101
DATE :20/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 18°57.05
start stop duration Lon E 11°25.51
TIME :22:19:26 22:40:05 20.6 (min) Purpose : 1
LOG : 1139.15 1140.30 1.1 Region : 5010
FDEPTH: 210 220 Gear cond.: 8
BDEPTH: 417 452 Validity : 0
Towing dir: 0° Wire out : 660 m Speed : 3.3 kn
Sorted : 9 Total catch: 9.49 Catch/hour: 27.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Plesionika martia	6.69	4017	24.26	
Aequorea forskalea	6.28	299	22.77	
Euphausiacea	5.47	9413	19.80	
Zenopsis conchifer	3.28	15	11.88	
Triplophos hemingi	2.46	820	8.91	
Trachurus capensis	1.09	15	3.96	
Illex coindetii	0.82	299	2.97	
MYCTOPHIDAE	0.82	355	2.97	
Lampadena sp.	0.41	41	1.49	
Hoplostethus cadenati	0.27	163	0.99	
Total	27.60		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 102
DATE :21/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 18°54.57
start stop duration Lon E 11°52.65
TIME :08:49:54 09:01:03 11.2 (min) Purpose : 1
LOG : 1224.57 1225.21 0.6 Region : 5010
FDEPTH: 236 236 Gear cond.: 0
BDEPTH: 236 236 Validity : 0
Towing dir: 0° Wire out : 640 m Speed : 3.4 kn
Sorted : 168 Total catch: 2011.20 Catch/hour: 10822.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	8927.35	84398	82.49	313
Merluccius capensis	878.21	2712	8.11	314
Pterothrissus belloci	697.40	8201	6.44	
Dentex macrophthalmus	205.35	1291	1.90	315
J E L L Y F I S H	31.00	1098	0.29	
Synagrops microlepis	25.18	1679	0.23	
Malacocephalus laevis	16.14	452	0.15	
Galeus polli	13.56	258	0.13	
Trigla lyra	11.62	65	0.11	
GOBIIDAE	10.33	2260	0.10	
Chlorophthalmus atlanticus	6.46	646	0.06	
Total	10822.60		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 103
DATE :21/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 18°55.40
start stop duration Lon E 11°47.54
TIME :10:23:24 10:46:12 22.8 (min) Purpose : 1
LOG : 1232.94 1234.23 1.3 Region : 5010
FDEPTH: 220 240 Gear cond.: 0
BDEPTH: 270 268 Validity : 0
Towing dir: 0° Wire out : 570 m Speed : 3.4 kn
Sorted : 68 Total catch: 68.44 Catch/hour: 180.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	126.00	94500	69.96	
Aequorea forskalea	41.12	1926	22.83	
Euphausiacea	4.64	14589	2.58	
Brama brama	3.95	11	2.19	
Merluccius capensis	2.63	11	1.46	
Illex coindetii	0.66	63	0.37	
Zenopsis conchifer	0.58	3	0.32	
Lestidium atlanticum	0.53	37	0.29	
Total	180.11		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 104
DATE :21/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°8.19
start stop duration Lon E 11°24.93
TIME :14:56:56 16:00:09 63.2 (min) Purpose : 1
LOG : 1270.09 1273.16 3.1 Region : 5010
FDEPTH: 320 370 Gear cond.: 0
BDEPTH: 501 510 Validity : 0
Towing dir: 0° Wire out : 830 m Speed : 2.9 kn
Sorted : 136 Total catch: 136.44 Catch/hour: 129.49

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	81.48	659	62.92	316
Triplophos hemingi	16.63	3713	12.84	
MYCTOPHIDAE	9.75	4670	7.53	
Aequorea forskalea	7.05	1881	5.45	
Lampadena sp.	6.22	639	4.80	
Brama brama	3.05	4	2.35	
S H R I M P S	2.69	4082	2.07	
Benthodesmus tenuis	1.01	33	0.78	
Trachipterus sp.	0.91	1	0.70	
Illex coindetii	0.38	1	0.29	
Merluccius capensis	0.34	1	0.26	
Total	129.49		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 105
DATE :22/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 19°1.72
start stop duration Lon E 12°5.90
TIME :02:10:49 02:40:49 30.0 (min) Purpose : 1
LOG : 1360.08 1361.53 1.5 Region : 5010
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 162 178 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 2.9 kn
Sorted : 11 Total catch: 10.67 Catch/hour: 21.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	16.05	580	75.26	
Illex coindetii	3.80	536	17.81	
Chrysaora hysoscella	1.48	14	6.94	
Total	21.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 106
DATE :22/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°23.10
start stop duration Lon E 11°20.58
TIME :08:49:38 09:20:15 30.6 (min) Purpose : 1
LOG : 1413.56 1415.17 1.6 Region : 5010
FDEPTH: 220 280 Gear cond.: 0
BDEPTH: 672 679 Validity : 0
Towing dir: 0° Wire out : 650 m Speed : 3.2 kn
Sorted : 2 Total catch: 27.15 Catch/hour: 53.24

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	19.45	8906	36.54	
Lampanyctus sp.	17.33	6292	32.56	
Benthosema sp.	8.22	26143	15.43	0
Benthosema sp.	4.86	8449	9.13	
Lampadena sp.	2.43	396	4.57	
Triplophos hemingi	0.31	61	0.59	
Lestidium atlanticum	0.31	31	0.59	
Maurolicus sp.	0.31	304	0.59	
Total	53.24		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 107
DATE :22/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 19°5.06
start stop duration Lon E 12°10.35
TIME :15:56:46 16:03:26 6.7 (min) Purpose : 1
LOG : 1475.82 1476.16 0.3 Region : 5010
FDEPTH: 140 140 Gear cond.: 0
BDEPTH: 140 140 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 3.1 kn
Sorted :2589 Total catch: 2589.26 Catch/hour: 23361.74

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	20527.22	733317	87.87	317
Aequorea forskalea	2336.48	81916	10.00	
Merluccius capensis	149.23	1687	0.64	318
Chelidonichthys capensis	149.23	280	0.64	
Chrysaora sp.	81.65	1119	0.35	
Dentex macrophthalmus	67.58	848	0.29	
Sardinops ocellatus	30.95	559	0.13	
GOBIIDAE	14.08	1128	0.06	
Synagrops microlepis	2.80	280	0.01	
Bathynectes piperitus	2.53	280	0.01	
Total	23361.74		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 108
DATE :22/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 19°8.68
start stop duration Lon E 12°30.35
TIME :19:41:30 20:02:56 21.4 (min) Purpose : 1
LOG : 1505.98 1507.09 1.1 Region : 5010
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 56 69 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.1 kn
Sorted : 74 Total catch: 405.38 Catch/hour: 1134.46

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	710.26	17331	62.61	
Chrysaora sp.	197.01	831	17.37	
Engraulis encrasicolus	165.45	26090	14.58	
Etrumeus whiteheadi	35.40	1464	3.12	320
Sardinops ocellatus	16.18	1570	1.43	319
Chrysaora hysoscella	7.84	48	0.69	
Trachurus capensis	2.15	632	0.19	321
Hippocampus sp.	0.17	17	0.01	
Total	1134.46		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 109
DATE :22/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°17.36
start stop duration Lon E 12°8.40
TIME :22:42:29 23:13:25 30.9 (min) Purpose : 1
LOG : 1528.53 1530.12 1.6 Region : 5010
FDEPTH: 85 125 Gear cond.: 0
BDEPTH: 215 229 Validity : 0
Towing dir: 0° Wire out : 310 m Speed : 3.1 kn
Sorted : 4 Total catch: 4.08 Catch/hour: 7.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	4.13	43	52.21	
Aequorea forskalea	3.06	81	38.73	
Chrysaora hysoscella	0.29	8	3.68	
Synagrops microlepis	0.21	19	2.70	
Trachurus capensis	0.19	4	2.45	
Illex coindetii	0.02	2	0.25	
Total	7.91		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 110
DATE :23/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°31.08
start stop duration Lon E 11°36.03
TIME :03:06:23 03:36:37 30.2 (min) Purpose : 1
LOG : 1563.07 1564.72 1.7 Region : 5010
FDEPTH: 148 157 Gear cond.: 0
BDEPTH: 426 428 Validity : 0
Towing dir: 0° Wire out : 420 m Speed : 3.3 kn
Sorted : 24 Total catch: 24.15 Catch/hour: 47.92

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Plesionika martia	33.04	20685	68.94	
MYCTOPHIDAE	10.42	4643	21.74	
Triplophos hemingi	1.19	565	2.48	
Euphausiacea	1.19	565	2.48	
Stomias boa boa	0.89	89	1.86	
Lampadena sp.	0.89	238	1.86	
Lestidium atlanticum	0.30	298	0.62	
Total	47.92		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 111
DATE :23/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 19°29.69
start stop duration Lon E 12°2.17
TIME :09:42:21 10:13:36 31.3 (min) Purpose : 1
LOG : 1615.79 1617.33 1.5 Region : 5010
FDEPTH: 285 289 Gear cond.: 0
BDEPTH: 285 289 Validity : 0
Towing dir: 0° Wire out : 650 m Speed : 2.9 kn
Sorted : 242 Total catch: 242.04 Catch/hour: 464.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	252.98	630	54.45	322
Pterothrissus belloci	56.81	353	12.23	
Illex coindetii	41.84	154	9.01	
Mixed debries	27.49	0	5.92	
MYCTOPHIDAE	17.97	14526	3.87	
Synagrops microlepis	15.05	760	3.24	
B I V A L V E S	14.97	4292	3.22	
Lophius vomerinus	11.82	15	2.55	
Malacocephalus laevis	10.13	353	2.18	
Chlorophthalmus atlanticus	4.91	583	1.06	
Galeus polli	4.53	269	0.98	
Dentex macrophthalmus	4.53	15	0.98	
Lestidium atlanticum	0.69	38	0.15	
Euphausiacea	0.54	2495	0.12	
Bathynectes piperitus	0.31	23	0.07	
Total	464.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 112
DATE :23/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 19°18.37
start stop duration Lon E 12°29.42
TIME :14:42:18 15:01:46 19.5 (min) Purpose : 1
LOG : 1650.72 1651.67 0.9 Region : 5010
FDEPTH: 102 101 Gear cond.: 0
BDEPTH: 102 101 Validity : 0
Towing dir: 0° Wire out : 260 m Speed : 2.9 kn
Sorted : 73 Total catch: 844.82 Catch/hour: 2606.12

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	1052.39	32992	40.38	
B I V A L V E S	933.25	105242	35.81	
Chrysaora hysoscella	250.12	2826	9.60	
Trachurus capensis	218.28	5297	8.38	323
Merluccius capensis	122.02	1252	4.68	324
Chelidonichthys capensis	17.52	395	0.67	
GOBIIDAE	5.74	287	0.22	
Illex coindetii	2.50	71	0.10	
Dicologoglossa cuneata	2.50	71	0.10	
Pterothrissus belloci	1.79	37	0.07	
Total	2606.12		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 113
DATE :23/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°38.74
start stop duration Lon E 12°13.08
TIME :21:21:45 21:54:28 32.7 (min) Purpose : 1
LOG : 1702.43 1704.27 1.8 Region : 5010
FDEPTH: 195 130 Gear cond.: 0
BDEPTH: 226 226 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 3.4 kn
Sorted : 0 Total catch: 52.91 Catch/hour: 97.05

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	81.72	1401	84.20	325
Lophius vomerinus	6.93	6	7.14	
Chrysaora sp.	5.67	4	5.84	
Aequorea forskalea	1.74	62	1.80	
Merluccius capensis	0.68	13	0.70	326
Synagrops microlepis	0.31	40	0.32	
Total	97.05		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 114
DATE :24/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 19°46.30
start stop duration Lon E 12°15.81
TIME :09:58:15 10:14:48 16.6 (min) Purpose : 1
LOG : 1789.10 1789.81 0.7 Region : 5010
FDEPTH: 215 215 Gear cond.: 0
BDEPTH: 215 215 Validity : 0
Towing dir: 0° Wire out : 520 m Speed : 2.6 kn
Sorted : 88 Total catch: 812.11 Catch/hour: 2944.21

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	1641.97	20734	55.77	327
Merluccius capensis	611.93	4079	20.78	328
Aequorea forskalea	386.03	10521	13.11	
Dentex macrophthalmus	150.02	1146	5.10	329
Illex coindetii	51.26	102	1.74	
Lophius vomerinus	36.58	102	1.24	
Pterothrissus belloci	24.62	337	0.84	
B I V A L V E S	15.52	1316	0.53	
GOBIIDAE	14.18	1921	0.48	
Synagrops microlepis	10.44	841	0.35	
Chrysaora hysoscella	1.02	33	0.03	
Bathynectes piperitus	0.65	0	0.02	
Total	2944.21		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 115
DATE :24/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 19°34.02
start stop duration Lon E 12°46.22
TIME :14:37:36 14:57:39 20.1 (min) Purpose : 1
LOG : 1826.04 1826.98 0.9 Region : 5010
FDEPTH: 42 42 Gear cond.: 0
BDEPTH: 42 42 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 2.8 kn
Sorted :1190 Total catch: 1189.60 Catch/hour: 3559.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	3109.83	30165	87.36	
Chelidonichthys capensis	147.47	575	4.14	
Trachurus capensis	108.69	3926	3.05	330
Merluccius capensis	90.01	2969	2.53	331
Engraulis encrasicolus	53.63	814	1.51	332
Trachurus trecae	26.33	670	0.74	333
Dicologoglossa cuneata	21.55	814	0.61	
GOBIIDAE	1.92	96	0.05	
Sardinops ocellatus	0.48	48	0.01	
Total	3559.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 116
DATE :24/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 19°43.46
start stop duration Lon E 12°49.25
TIME :17:28:26 17:40:24 12.0 (min) Purpose : 1
LOG : 1843.96 1844.48 0.5 Region : 5010
FDEPTH: 57 57 Gear cond.: 0
BDEPTH: 57 57 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 2.6 kn
Sorted : 67 Total catch: 736.56 Catch/hour: 3692.03

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	2927.82	28341	79.30	
Trachurus capensis	465.91	18416	12.62	334
Sea cucumber	167.07	10972	4.53	
Trachurus trecae	36.94	937	1.00	335
Chrysaora hysoscella	36.39	165	0.99	
Merluccius capensis	31.98	1158	0.87	336
ANTHOZOA (Sea anemones)	15.44	5293	0.42	
Engraulis encrasicolus	9.37	827	0.25	337
Dicologoglossa cuneata	1.10	55	0.03	
Total	3692.03		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 117
DATE :24/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°46.01
start stop duration Lon E 12°42.81
TIME :19:09:49 19:36:17 26.5 (min) Purpose : 1
LOG : 1853.35 1854.96 1.6 Region : 5010
FDEPTH: 50 48 Gear cond.: 0
BDEPTH: 100 101 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.7 kn
Sorted : 240 Total catch: 239.87 Catch/hour: 543.72

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	543.51	9498	99.96	
Trachurus capensis	0.20	9	0.04	
Total	543.72		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 118
DATE :25/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°58.65
start stop duration Lon E 12°12.48
TIME :00:06:24 00:36:34 30.2 (min) Purpose : 1
LOG : 1891.96 1893.57 1.6 Region : 5010
FDEPTH: 50 69 Gear cond.: 0
BDEPTH: 258 258 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.2 kn
Sorted : 38 Total catch: 113.04 Catch/hour: 224.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aequorea forskalea	113.69	5461	50.56	
Chrysaora sp.	92.21	95	41.00	
MYCTOPHIDAE	17.67	5920	7.86	
Chrysaora hysoscella	1.01	18	0.45	
Illex coindetii	0.24	18	0.11	
Euphausiacea	0.06	191	0.03	
Total	224.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 119
DATE :25/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 20°9.22
start stop duration Lon E 12°15.71
TIME :07:35:05 07:57:41 22.6 (min) Purpose : 1
LOG : 1953.61 1954.79 1.2 Region : 5010
FDEPTH: 220 230 Gear cond.: 0
BDEPTH: 268 273 Validity : 0
Towing dir: 0° Wire out : 570 m Speed : 3.1 kn
Sorted : 96 Total catch: 96.15 Catch/hour: 255.27

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	194.34	146549	76.13	
Brama brama	37.83	40	14.82	
J E L L Y F I S H	22.46	112	8.80	
S H R I M P S	0.64	1410	0.25	
Total	255.27		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 120
DATE :25/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 20°5.27
start stop duration Lon E 12°22.40
TIME :09:50:01 10:14:09 24.1 (min) Purpose : 1
LOG : 1968.67 1969.84 1.2 Region : 5010
FDEPTH: 225 226 Gear cond.: 0
BDEPTH: 225 226 Validity : 0
Towing dir: 0° Wire out : 550 m Speed : 2.9 kn
Sorted : 150 Total catch: 3639.25 Catch/hour: 9052.86

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	6944.03	84764	76.71	338
Dentex macrophthalmus	1234.45	8706	13.64	340
Merluccius capensis	811.57	4789	8.96	339
Pterothrissus belloci	46.64	808	0.52	
Synagrops microlepis	11.19	1182	0.12	
B I V A L V E S	3.11	560	0.03	
GOBIIDAE	0.62	62	0.01	
Chlorophthalmus atlanticus	0.62	187	0.01	
Illex coindetii	0.62	62	0.01	
Total	9052.86		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 121
DATE :25/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 19°54.21
start stop duration Lon E 12°53.60
TIME :14:07:13 14:30:48 23.6 (min) Purpose : 1
LOG : 2002.87 2004.25 1.4 Region : 5010
FDEPTH: 40 50 Gear cond.: 0
BDEPTH: 64 76 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.5 kn
Sorted : 292 Total catch: 291.65 Catch/hour: 741.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	333.19	1190	44.92	
Trachurus capensis	221.28	13999	29.83	341
Engraulis encrasicolus	92.58	6613	12.48	343
Merluccius capensis	51.38	2086	6.93	342
Etrumeus whiteheadi	13.84	1251	1.87	344
Chelidonichthys capensis	13.02	71	1.76	
Argyrosomus hololepidotus	9.03	3	1.22	
Callorhinchus capensis	6.61	3	0.89	
Sardinops ocellatus	0.86	18	0.12	345
Total	741.80		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 122
DATE :26/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 20°21.82
start stop duration Lon E 13°3.37
TIME :10:24:08 10:39:04 14.9 (min) Purpose : 1
LOG : 2178.65 2179.39 0.7 Region : 5010
FDEPTH: 101 100 Gear cond.: 0
BDEPTH: 101 100 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.0 kn
Sorted : 62 Total catch: 3061.69 Catch/hour: 12304.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	11331.28	273782	92.09	346
J E L L Y F I S H	453.64	1788	3.69	
Merluccius capensis	318.37	15123	2.59	347
Aequorea forskalea	75.59	1591	0.61	
Sardinops ocellatus	57.67	993	0.47	348
GOBIIDAE	31.83	3183	0.26	
Chelidonichthys capensis	29.82	796	0.24	
Illex coindetii	3.98	197	0.03	
Chlorophthalmus atlanticus	2.01	197	0.02	
Total	12304.18		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 123
DATE :27/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 20°54.30
start stop duration Lon E 13°6.05
TIME :14:15:18 14:31:29 16.2 (min) Purpose : 1
LOG : 2413.55 2414.32 0.8 Region : 5010
FDEPTH: 124 125 Gear cond.: 0
BDEPTH: 124 125 Validity : 0
Towing dir: 0° Wire out : 300 m Speed : 2.9 kn
Sorted : 0 Total catch: 2208.24 Catch/hour: 8183.72

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	7464.61	116205	91.21	349
J E L L Y F I S H	508.31	800	6.21	
Merluccius capensis	101.40	1067	1.24	350
Aequorea forskalea	61.37	2268	0.75	
Illex coindetii	24.01	534	0.29	
GOBIIDAE	17.34	2268	0.21	
Macropipus australis	6.67	534	0.08	
Total	8183.72		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 124
DATE :27/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 20°49.61
start stop duration Lon E 13°19.95
TIME :16:36:11 16:39:31 3.3 (min) Purpose : 1
LOG : 2430.22 2430.30 0.1 Region : 5010
FDEPTH: 55 55 Gear cond.: 0
BDEPTH: 55 55 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 1.5 kn
Sorted : 0 Total catch: 122.02 Catch/hour: 2191.98

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	1857.49	11892	84.74	
Trachurus capensis	240.72	18719	10.98	351
GOBIIDAE	60.72	17533	2.77	
Merluccius capensis	27.31	898	1.25	352
Chelidonichthys capensis	2.87	144	0.13	
Sea cucumber	1.08	144	0.05	
Illex coindetii	0.72	36	0.03	
Dicologoglossa cuneata	0.72	72	0.03	
Engraulis encrasicolus	0.36	36	0.02	
Total	2191.98		100.0	

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 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.

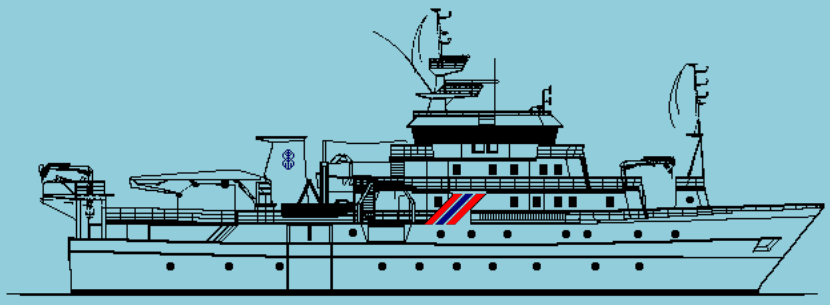
The bottom trawl has a headline of 31 m, footrope 47 m and 20 mm meshsize in the codend with an inner net of 10 mm meshsize. The trawl height was about 4.5 m and distance between wings during towing about 21 m. The sweeps are 40 m long. The trawl is equipped with a 12" rubber

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 IV Gonad 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.



SURVEY OF THE FISH RESOURCES OF ANGOLA

Cruise Report No 4/2011

Survey of the demersal resources

Part II
Southern region: Tômbua - Cunene

11 – 16 August 2011

Institute of Marine Research
IMR, Bergen
Norway

Instituto Nacional de Investigação das Pescas
INIP, Luanda
Angola

THE EAF-NANSEN PROJECT

FAO started the implementation of the project “Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries (EAF-Nansen GCP/INT/003/NOR)” in December 2006 with funding from the Norwegian Agency for Development Cooperation (Norad). The EAF-Nansen project is a follow-up to earlier projects/programmes in a partnership involving FAO, Norad and the Institute of Marine Research (IMR), Bergen, Norway on assessment and management of marine fishery resources in developing countries. The project works in partnership with governments and also GEF-supported Large Marine Ecosystem (LME) projects and other projects that have the potential to contribute to some components of the EAF-Nansen project.

The programme has previously conducted the following demersal surveys in the area:

January 1985	-	June 1986	(6 surveys)
January 1989	-	December 1989	(3 surveys)
May 1991	-	September 1992	(3 surveys)
January 1994	-	March 2011	(19 surveys)

CRUISE REPORTS "DR. FRIDTJOF NANSEN"

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11 - 16 August 2011

by

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Luanda, ANGOLA

Bergen, 2011

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CHAPTER 1 INTRODUCTION

Objectives

Briefly, the objectives of the agreed previously by the responsible of the Demersal Programme of the *Instituto Nacional de Investigação Pesqueira* (INIP) of Angola, and the responsible from the Institute of Marine Research (IMR), Norway, consisted:

- To map and describe the distribution, composition and abundance of the main demersal species on the Angolan shelf and slope (down to 800 m), from Tômbua (15°40'S) to Cunene River (17°14'S) using bottom trawl and the swept-area method.
- To collect biological data such as length, weight, sex and maturity stage of commercial species (*Dentex macrophthalmus, D. angolensis, Pagellus bellottii, Pseudotolithus senegalensis, Umbrina canariensis, Merluccius polli, Brachydeuterus auritus, A. varidens, P. longirostris, Chaceon maritae* and *Panulirus regius*), as defined by INIP.
- Monitor the general hydrographical conditions using thermosalinograph and CTD-sonde on trawl stations area; carry out the monitoring lines using INIP's new standard hydrographical profiles for collection of temperature, salinity and oxygen, water nutrients, phytoplankton and zooplankton. These tasks were integrated with the ones planned for the pelagic cruise in the Angolan coast.

Participation

The scientific staff consisted of:

From INIP, Angola:

António BARRADAS (Co-cruise leader, Angola), Henriette Lutuba NSILULU, Fátima DELICADO, Eusébio dos SANTOS, Pedro PANZO, Domingos PEDRO, Bomba BAZIKA and Geraldina SALVADOR.

From BCC:

Hilkka NDJAULA (Co-cruise leader, Namibia).

From NatMIRC-Namibia:

Ipeinge Etuwete MUNDJULU, Justine SHITHINDI.

From IMR, Norway:

Diana ZAERA (Cruise leader), Inês Dias BERNARDES, Tore MØRK, Kåre TVEIT

Narrative

Due to time constraints, the southern region was not covered during the main demersal survey that took place 23 March – 8 April 2011 (Mehl *et al*. 2011). Three days were added to the pelagic survey that took place from 20 July - 27 August, and the standard bottom trawl stations were taken from 11 to 16th of August.

The complete narrative from the cruise where the demersal monitoring was included can be consulted in the report of the pelagic resources of Angola (Zaera *et al.* 2011), while the objectives of the Angolan demersal surveys are described in detail in the main demersal survey report 2011 (Mehl *et al*. 2011).

The coverage of the South region of Angola started following the calibration of the Simrad ER 60 Scientific echo sounder, done in Baía dos Elephantes on August 7th. The coverage of the Southern region was completed on the 16th of August with the Cunene River monitoring line.

The area surveyed for demersal resources included the South of Angola, from Tômbua (15°48'S) until Cunene River (17°15'S). No bottom trawl sampling was conducted between Benguela and Tômbua as the shelf and slope are very steep and the bottom conditions are therefore not suitable for trawling.

The demersal stations were integrated in the pelagic survey which took place between 19th of July until the 27th of August. A systematic survey track, consisting of pseudo-parallel acoustic transect lines perpendicular to the coast line with equally spaced transect lines (6 nautical miles, NM, apart) was followed during the survey. The bottom trawl stations[1] to be taken were thus integrated into the pelagic survey transects.

One monitoring line was carried out in the Southern region of Angola, in accordance with INIP standards for monitoring lines. CTD sampling was done near all bottom trawl stations, while additional CTD profiles were obtained along the acoustic transects.

[1] A standard geographical allocation of the trawl stations to be taken during the Angolan demersal trawl surveys was implemented in 2003.

CHAPTER 2 METHODS

Survey effort

Table 1 presents the surveyed area by depth strata, total number of successful swept-area hauls, number of hauls failed and allocation of trawl stations. Figure 1 shows the cruise tracks in the southern region, and the locations of bottom trawl stations.

Table 1. Survey design and effort for the 2011 demersal survey in the southern region. Size of the survey area by depth stratum, total number of successful swept-area hauls, number of hauls failed, proportion of stations relative to stratum size and allocation of trawl stations.

	Depth strata (m)										
	20-50	50-100	100-200	200-300	300-400	400-500	500-600	600-700	700-800	Total	Failures
Area (NM^2)	507	591	594	100	77	48	39			**1956**	
# hauls (BT)	8	5	6	0	2	0	0	1	2	**24**	2
%area	25.9	30.2	30.4	5.1	3.9	2.5	2	0	0	11.83	
%hauls	33.3	20.8	25.0	0.0	8.3	0.0	0.0	8.3	4.2		

A stratified semi-random survey design was used with depth and area as stratifying variables. Trawling was carried out along transects perpendicular to the coast, which were approximately 12 NM apart (Figure 1). Trawling shallower than 400 m was mainly done during daytime and deeper than 400 m during dark hours. The planned design was sometimes slightly modified due to unsuitable bottom conditions.

Based on a decision made in 2003, the trawl positions of the 2000 demersal survey should be the standard for future surveys in the southern region as the survey had a reasonable good coverage. Therefore, the station positions and effort have been similar during the 2000 and 2003-2011 surveys in the southern region.

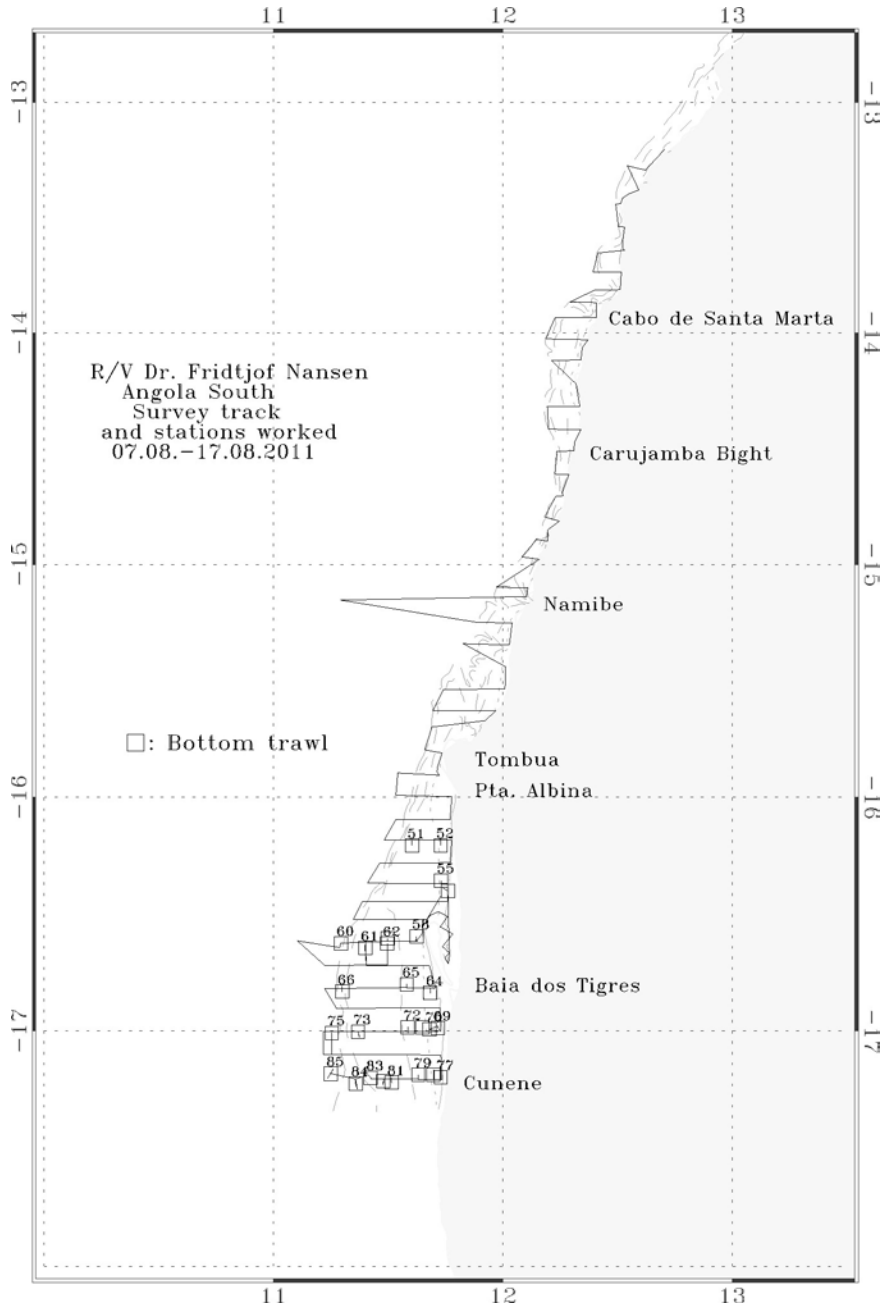

Figure 1. Angola south: Cunene - Tômbua. Course track with trawl stations. Depth contours at 20, 50, 100 and 200 m.

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 at standard INIP transects and monitoring lines. 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 every third cruise track between the standard transects and monitoring lines at bottom depths 50, 100, 200 and 500 m.

The transects off Congo River, Pta. das Palmerinhas, Lobito, Namibe and Cunene River were carried out in accordance with the monitoring lines 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 litre (µg l^{-1}) 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, at relative fluorescence units [RFU], 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 3m 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).

Fish sampling

A brief description of the fishing gear is provided in Annex IV. 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, in the southern region, were taken for the commercial demersal species such as *Dentex macrophthalmus, D. angolensis, Pagellus bellottii, Pseudotolithus senegalensis, Umbrina canariensis, Merluccius polli, Merluccius capensis, Brachydeuterus auritus, A. varidens, P. longirostris,* and *Panulirus regius*.

For some commercially important species, pooled length frequency distributions, in which individual samples are raised to total catch, are shown by area in Annex II. The catch data, from each station, is logged into Nansis software after the sampling is complete. All the data introduced is quality controlled during the survey.

Areas, depth strata and calculations

Table 1 shows the areas, in NM^2, for the southern region, by depth strata. These strata are used to calculate the swept-area biomass estimates. All valid stations are treated as representative for the relevant depth intervals where the species or group of species were caught.

All equations used for the calculations are given in Annex VI. The effective fishing width of the trawl gear used by R/V "Dr Fridtjof Nansen" is considered to be 18.5 m. The effective fishing area is the product of the fishing width multiplied by the towing distance measured by the GPS. It is assumed that all fish within the trawling path are caught, which gives a catchability coefficient (q), *i.e.* the fraction of the fish encountered by the trawl that was actually caught, equal to 1. The catchability coefficient is seldom known, but because the coefficient is assumed to be constant between surveys, the swept-area estimates will reflect any change in population abundances between surveys.

The survey design and effort, previous to 2002, were inconsistent, and made difficult any comparison between surveys. Therefore, it was discussed and agreed upon by the responsible of the Demersal Programme of the INIP, and the responsible for the Angolan Demersal Programme at the Institute of Marine Research, Norway that all biomass estimates since 1985 should be calculated in a standardized procedure. Data from the "Nansis" database were exported to flat ASCII text files. The software R 2.2.1[⊗] was used to calculate stratified density estimates sorted by survey and stratified by depth and latitude. Biomass estimates by species or species groups were obtained from a stratified mean density estimator using the equations in Annex IV.

[⊗] R Development Core Team (2005). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org.

CHAPTER 3 OCEANOGRAPHIC CONDITIONS

Surface distribution

Wind, sea surface temperature (SST, 5m depth), sea surface salinity (SSS, 5m depth), sea surface oxygen (SSO, 5m depth) and sea surface fluorescence (SSF, 5m depth) were continuously recorded, during the survey.

Figure 2 shows the distribution pattern of temperature, salinity, oxygen and fluorescence in the surface waters (standardized for 5 m depth).

Three areas of warm surface water (>19°C) and rich in oxygen content (>4 ml/l) were recorded in the southern Region. Each of the areas was associated with weak wind occurrence. This was registered in Baia dos Elefantes, Namibe and Ponta Albina zones. The lowest values of surface temperature (15°C) and salinity (35.4) were observed at Cunene area. The minimum value of salinity is related with the outflows of Cunene River.

The temperature, salinity and oxygen surface distributions indicate that the Angola – Benguela Front was located between Baía dos Tigres and Cunene River. An average of fluorescence value of 0.3 µg/l was observed in the whole region but off Namibe was found a singular higher fluorescence concentration (0.5µg/l).

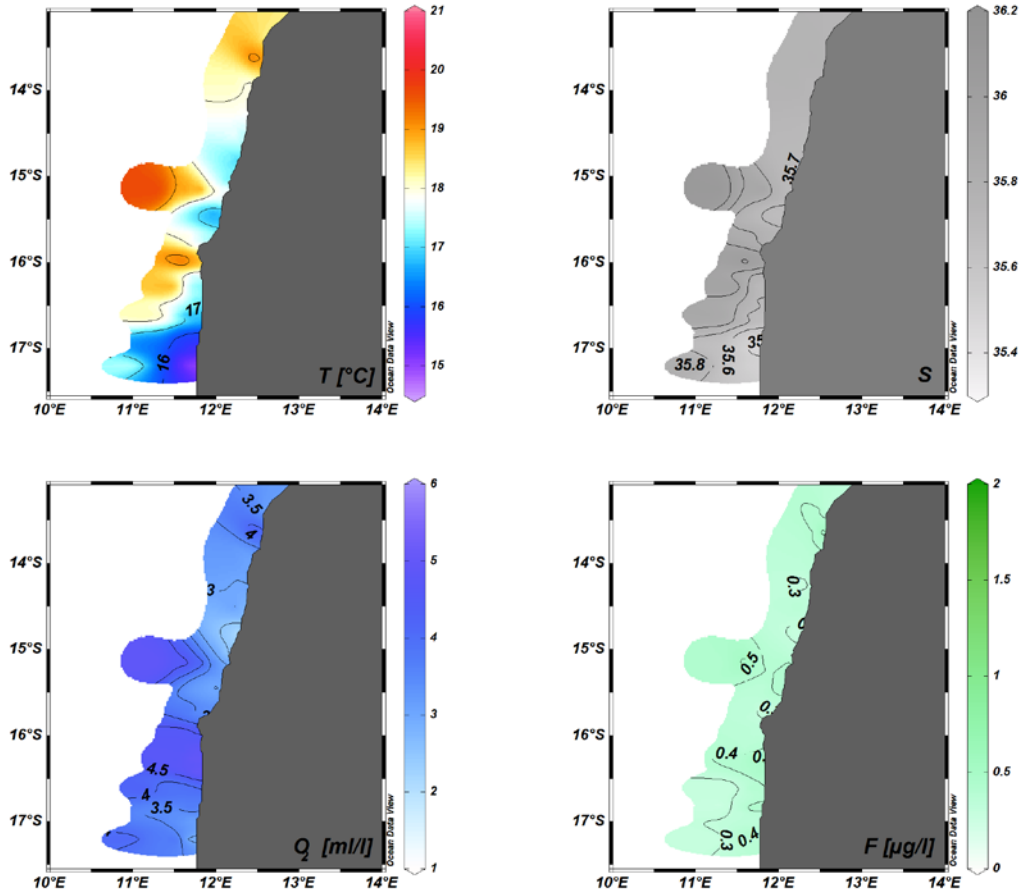

Figure 2. Surface distribution of water temperatures, salinity, oxygen and fluorescence at 5m depth in southern region.

In the area between south off Carujamba Bight and south off Pta Albina the wind pattern was varied both in speed and direction (Figure 3). From Baia dos Elefantes ($13^0$13'00'' S, $12^0$43'60'') to Carujamba moderate winds were observed blowing northwards. The strongest winds (around 30 knots) were registered in the area between South of Ponta Albina and Cunene River. These strong winds were blowing Northwards mainly, being the wind direction fairly constant along the entire South region.

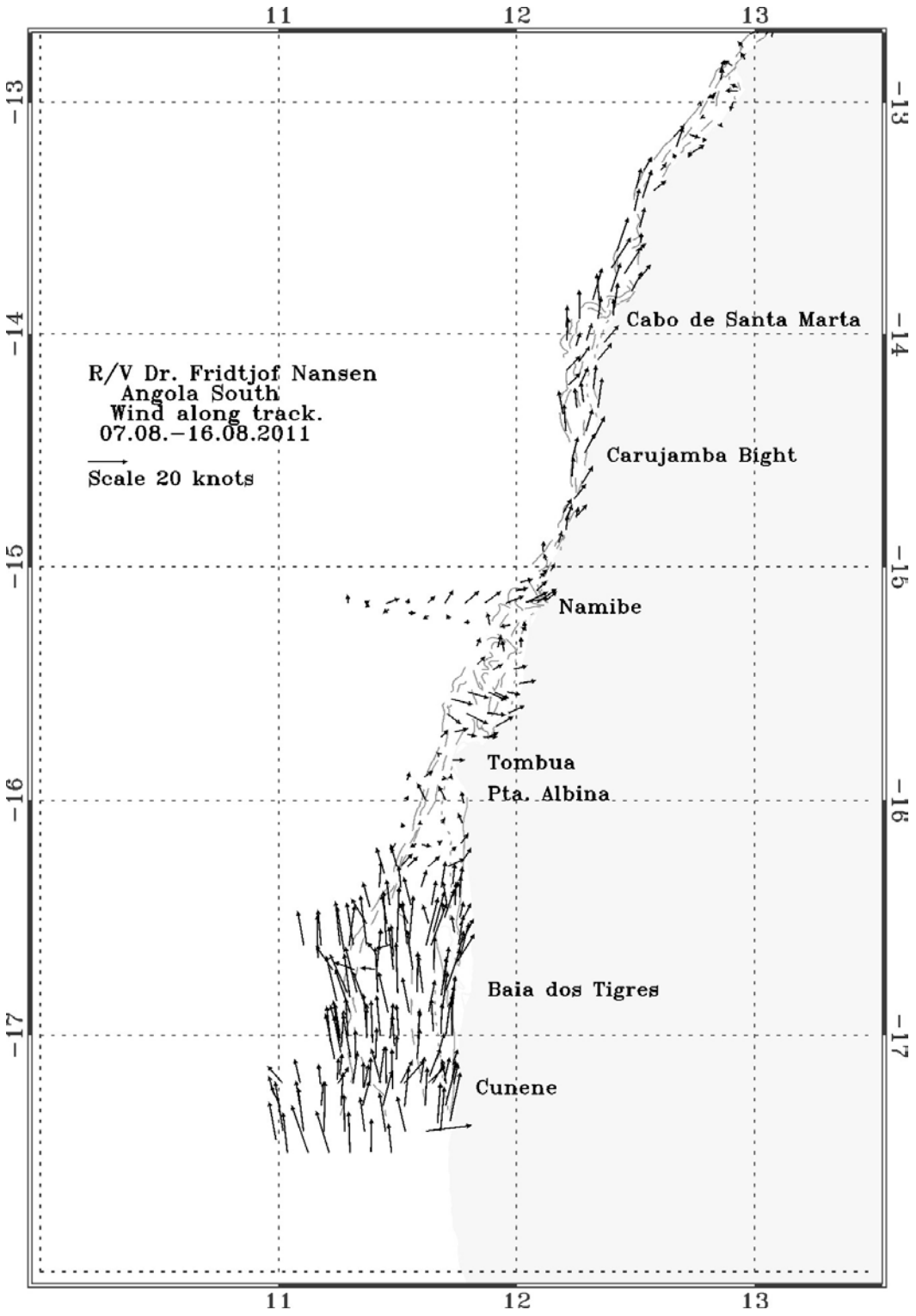

Figure 3. Distribution of wind velocities along the survey track for the southern region.

Standard sections

In the section off Santa Marta (Figure 4) there was a downwelling of the isolines of four parameters (temperature, salinity, oxygen and fluorescence). The mixed layer is less thick offshore (0-25 m) than in the coastal zone (0-≥50m) with a reversed thermocline/halocline. It was also observed rapid depletion of oxygen content above 100m, against with the situation occurred in the previous sections. Most of the surface layer (0-30m) of the continental shelf was dominated by temperature ≥17°C and salinity of 35.7. Similarly, oxygen and fluorescence contents varied very little in the same layer (3-2.5ml/l and 0.3-0.2µg/l respectively).

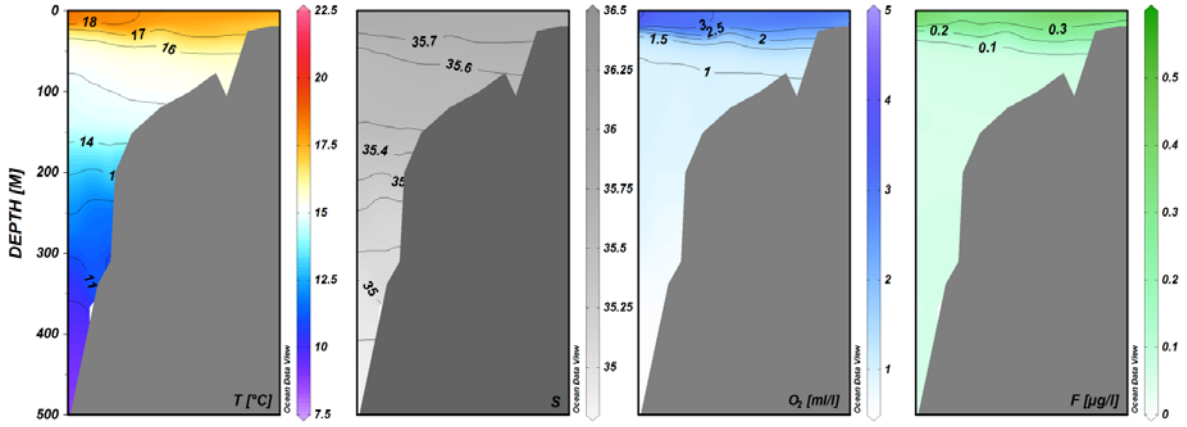

Figure 4. Vertical sections of temperature, salinity, oxygen and fluorescence off Santa Marta.

The behaviour of oceanographic parameters in Namibe and Tômbua sections, figures 5 and 6 respectively, is similar in terms of subsurface water. The slope of isolines of temperature and salinity shows weak signs of upwelling ongoing in both Namibe and Tômbua sections. However, warmer water (19ºC) deeper than up 30 m depth offshore was present in Namibe zone against colder water (17ºC) observed in offshore of Tômbua. Surface salinity varied from 36 offshore to 35.8 inshore at Namibe and from 35.8 to 35.7 at Tômbua section. The Namibe inshore zone was richer in florescence (0.5 µg/l) showing the intensive biological activities in this area.

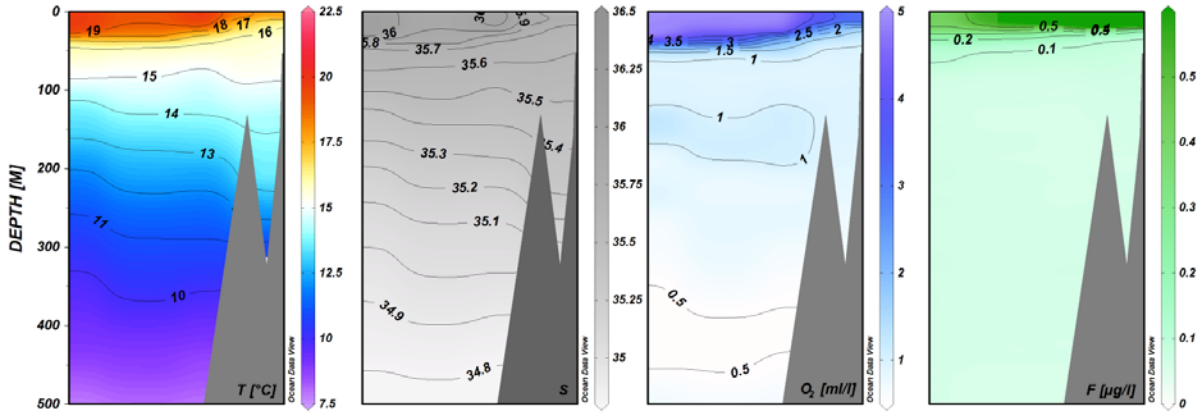

Figure 5. Vertical sections of temperature, salinity, oxygen and fluorescence off Namibe.

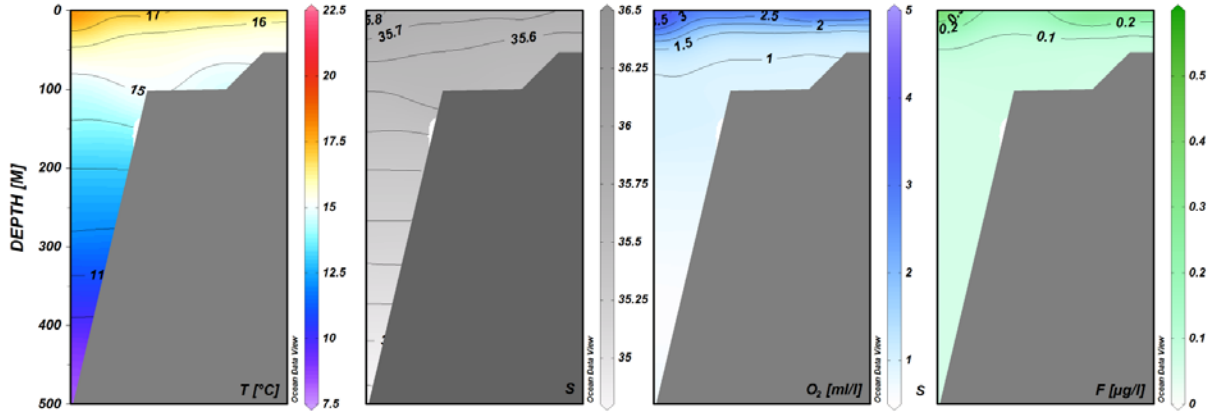

Figure 6. Vertical sections of temperature, salinity, oxygen and fluorescence off Tômbwa.

Section off Cunene River (Figure 8) is located closer the southern border of Angola coast. The structure of waters mass was similar as Baía dos Tigres section (Figure 7), in both column and surface, but with slight difference in terms of values. Low values of surface temperature (15°C) and surface salinity (35.5) were recorded near the shore in the Cunene section, showing the influence of Cunene River probably associated with the intensive upwelling revealed by uplift of isolines (with slope around 80°). Oxygen content of 4-2.5ml/l prevailed at the surface layer while lowest oxygen values appeared below the 350-450m. The fluorescence ranged from 0.4 to ≤ 0.1µg/l in water column.

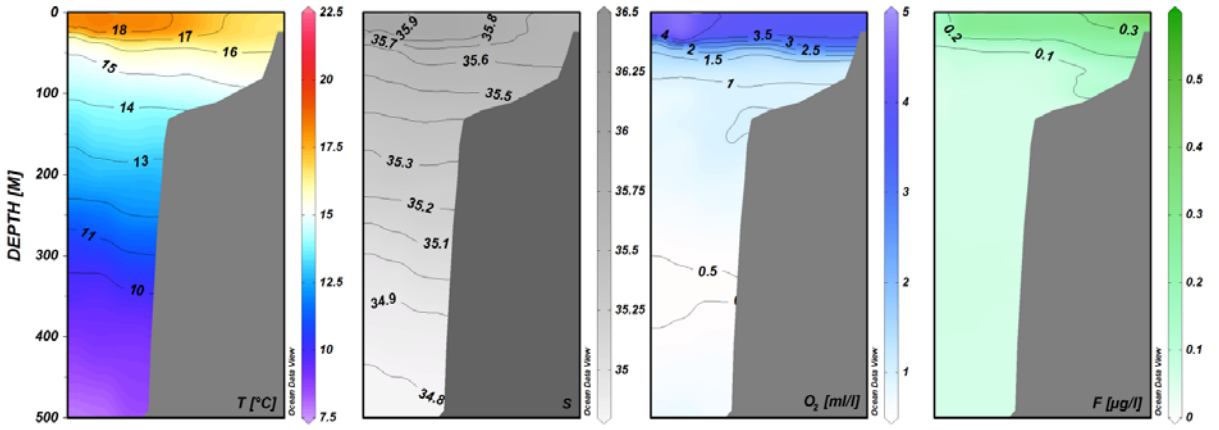

Figure 7. Vertical sections of temperature salinity, oxygen and fluorescence off Baía dos Tigres.

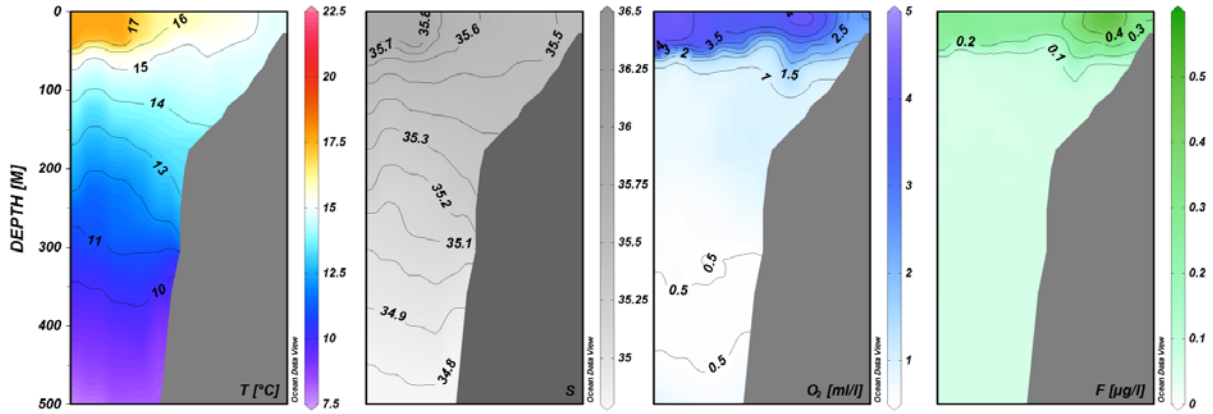

Figure 8. Vertical sections of temperature salinity, oxygen and fluorescence off Cunene River.

Santa Marta shows the vertical distribution of temperature, salinity, oxygen and fluorescence. In this section the uplift of isolines of temperature and salinity revealed how much the upwelling phenomenon was intensive. Increased surface temperature (18ºC) was observed in Baía dos Tigres zone against 17ºC found in previous offshore Tômbwa and salinity ranged from 35.9 offshore to 35.7 inshore Baía dos Tigres. The water column was very stratified as observed in most of previous sections. The minimum oxygen value was located at the same layer (350 – 450m) and the high value of fluorescence (0.3µg/l) was found inshore zone.

CHAPTER 4 CATCH RATES, DISTRIBUTION, COMPOSITION AND BIOMASS ESTIMATES OF DEMERSAL RESOURCES ON THE SHELF

The inner shelf is defined to be the area between 20 and 70 m bottom depth, and the outer shelf from 71 to 200 m depth. Several of the species which inhabit the shelf, particularly the seabreams (*Sparidae*) and hakes (*Merlucciidae*), are also found in deeper waters, usually in smaller densities. The results from fish distribution on the slope below 200 m are presented in Chapter 3.

Map with trawl station locations can be consulted in Figure 1, and the station information and catch by species are presented in Annex I. Pooled length distributions, weighted by the catch of the main species by region, are shown in Annex II. Further, the mean densities (tonnes·NM^{-2}) and the frequency of occurrence of the most important species are shown in Annex III.

During the survey days 26 trawl stations were sampled on the southern shelf. The southern region has not been regularly sampled throughout the years, except for the 2000 and 2003-2011 surveys. Other surveys' results in the time series should therefore be interpreted with caution, as the strategy and design of these surveys were not standardized. Some trawl stations were interrupted as high catches of horse mackerel affected the trawl performance, and may have prevented an adequate sampling of the catch.

The average total catches per hour on the inner shelf were 5 166 kg/hour and 2 772 kg/hour on the outer shelf (Table 2). The pelagic group dominated with 91% (4697 kg/hour) of the mean catch rate on the inner shelf and 71% (1976 kg/hour) on the outer shelf. The mean catches of the demersal group were 1.4 % (71 kg/hour) on the inner shelf and 20.6 % (571 kg/hour) on outer shelf. Shrimps were only caught in low numbers at one station on the inner shelf. The mean catch rates were 20 kg/hour for cephalopods and 21 kg/hour for sharks on the inner shelf, which represented 0.4 % of the catch for each of the groups. On the outer shelf the figures were 1.1 % (30 kg/hour) the cephalopods and 1.7 % (47 kg/hour) for sharks. The "other" group of species contributed to 7% (357 kg/hour) of the average mean catch rate on the inner shelf and 5% (147 kg/hour) on the outer shelf.

Table 2 Catch rates (kg/hour) by main groups caught in valid swept area bottom trawl hauls in the southern region. A: Inner shelf (20-70 m), B: Outer shelf (71-200 m).

A. Inner shelf (20-70 m).

Station	Depth	Cephalopods	Demersal	Pelagic	Sharks	Shrimps	Other	Total
52	48	21.1	21.3	333.2			101.0	476.5
55	46	20.6	81.6	251.6			11.5	365.3
56	21	41.2	0.9	341.1			15.3	398.4
64	26		11.3	12490.7			33.9	12535.9
69	23		10.7	16272.9			88.8	16372.4
70	36	18.0		1399.9			1577.7	2995.6
71	60	73.2	184.8	8055.2			691.3	9004.5
77	27	3.2	60.8	1071.7	78.7	1.2	147.3	1362.9
78	42	1.0	269.0	2056.5	112.9		548.7	2988.1
Mean	36	19.8	71.2	4697.0	21.3	0.1	357.3	5166.6
SD	14	24.3	94.9	6070.3	43.1	0.4	519.7	5982.4
% Catch		0.4	1.4	90.9	0.4	0.0	6.9	

B. Outer shelf (71-200 m).

Station	Depth	Cephalopods	Demersal	Pelagic	Sharks	Shrimps	Other	Total
51	72	23.6	93.6	64.5	86.0		135.3	403.1
58	86	44.8	162.6	946.3			41.7	1195.3
61	124	3.8	204.2	309.9	18.5		23.1	559.4
62	111	25.7	951.3	120.6	27.0		107.2	1231.8
65	95	8.2	551.6	730.7			318.9	1609.4
72	91	147.3	495.7	4329.4			143.7	5116
73	144	5.0	394.1	59.6	11.6		133.7	604
81	133	11.9	963	11331.9	50.5		27.9	12385.2
82	150	30.6	1203.3	799.9	192.8		255.1	2481.8
83	173	3.6	697.1	1070.6	87.1		282.4	2140.9
Mean	118	30.4	571.7	1976.3	47.4		146.9	2772.7
SD		43.3	377.2	3518.7	61		106.5	3648.5
%Catch		1.1	20.6	71.3	1.7		5.3	

When considering the main demersal groups, seabreams (except *Boops boops*) were an abundant group and caught in all of the stations from the outer shelf. The average catch rate of seabreams on the inner shelf was 12 kg/hour and 434 kg/hour on the outer shelf (Table 3). *Dentex macrophthalmus* was the most dominant seabream. The average catch rate of croakers (mainly *Umbrina canariensis*) was 22 kg/hour on the inner and 4 kg/hour on the outer shelf. Grunts were caught in a couple of stations on the inner shelf, while no snappers or groupers were caught on the shelf in the south.

Table 3 Catch rates (kg/hour) by main demersal groups caught in valid swept area bottom trawl hauls in the southern region. A: Inner shelf (20-70 m), B: Outer shelf (71-200 m).

A. Inner shelf (20-70 m).

Station	Depth	Croakers	Groupers	Grunts	Seabream	Snappers	Other	Total
52	48	5.7			10.9		460.0	476.5
55	46	0.2			78.2		286.8	365.3
56	21				0.9		397.5	398.4
64	26				11.3		12524.6	12535.9
69	23			5.3	5.3		16361.7	16372.4
70	36						2995.6	2995.6
71	60	126.8					8877.7	9004.5
77	27	4.2					1358.7	1362.9
78	42	60.6		73.3	0.6		2853.7	2988.1
Mean	36	21.9		8.7	11.9		5124.0	5166.6
SD		44.0		24.3	25.3		5984.3	5982.4
%Catch		0.4		0.2	0.2		99.2	

B. Outer shelf (71-200 m)

Station	Depth	Croakers	Groupers	Grunts	Seabream	Snappers	Other	Total
51	72				90.1		313.1	403.1
58	86				125.5		1069.8	1195.3
61	124				170.1		389.3	559.4
62	111	8.0			842.2		381.5	1231.8
65	95	12.3			456.0		1141.0	1609.4
72	91	10.2			302.6		4803.2	5116.0
73	144	2.9			371.0		230.1	604.0
81	133				749.2		11636.0	12385.2
82	150				1027.9		1453.9	2481.8
83	173	3.7			210.1		1927.1	2140.9
51	72				90.1		313.1	403.1
Mean	118	3.7			434.5		2334.5	2772.7
SD		4.8			328.9		3538.5	3648.5
%Catch		0.1			15.7		84.2	

As previously mentioned, the “pelagic” group dominated the catches on the inner shelf, and carangids, mainly horse mackerel and clupeoids were the most abundant groups with average catch rates of 1 750

and 3 123 kg/hour, respectively. The average catch rate of the carangids and clupeoids on the outer shelf was 1 899 kg/hour and 60 kg/hour, respectively.

Table 4 Catch rates (kg/hour) by main pelagic groups caught in valid swept area bottom trawl hauls in the southern region. A: Inner shelf (20-70 m), B: Outer shelf (71-200 m).

A. Inner shelf (20-70 m).

Station	Depth	Barracuda	Carangids	Clupeoids	Hairtails	Scombrids	Other	Total
52	48		331.7	1.1		0.4	143.3	476.5
55	46		234.3	2.0		15.3	113.6	365.3
56	21		336.6	2.2		2.6	56.9	398.4
64	26		6487.9	5927.6		75.2	45.1	12535.9
69	23		288.6	15984.3			99.4	16372.4
70	36		706.7	2251.1	1.3		36.5	2995.6
71	60		4296.4	3806.8	46.0	24.6	830.7	9004.5
77	27		1039.4	1.0	13.0		309.5	1362.9
78	42		2029.6	131.1	23.6		803.9	2988.1
Mean	36		1750.1	3123.0	9.3	13.1	271.0	5166.6
SD			2209.2	5272.9	16.1	24.9	320.4	5982.4
%Catch			33.9	60.4	0.2	0.3	5.2	

B. Outer shelf (71-200 m).

Station	Depth	Barracuda	Carangids	Clupeoids	Hairtails	Scombrids	Other	Total
51	72		2.3	61.6	0.0	0.6	338.6	403.1
58	86		697.6	242.0	5.1	1.6	249.1	1195.3
61	124		303.5	4.8	0.4	1.2	249.5	559.4
62	111		113.5	5.3	0.7	1.1	1111.2	1231.8
65	95		730.7	4.9	0.0		873.7	1609.4
72	91		4035.7	279.4	2.2	12.0	786.6	5116.0
73	144		28.2	1.3	30.1		544.5	604.0
81	133		11237.6		58.4	35.8	1053.3	12385.2
82	150		787.7		12.3		1681.9	2481.8
83	173		1050.3		8.8	11.5	1070.3	2140.9
Mean	118		1898.7	59.9	11.8	6.4	795.9	2772.7
SD			3486.0	107.8	18.8	11.4	459.7	3648.5
%Catch			68.5	2.2	0.4	0.2	28.7	

Biomass estimates

Table 5 shows the time series from 1986 to 2011 of swept-area biomass estimates for commercial species on the shelf of the southern region. The biomass estimates were calculated by stratifying depth (20-49 m, 50-99 m and 100-199 m). The sampling intensity in the southern region has been variable throughout the years and only surveys that have covered each of the strata with at least two stations are included in Table 5. The high coefficient of variations (CV) shown in Table 5 indicates that the trends in the time series should be interpreted with care.

The seabreams biomass estimate was about 16 000 tonnes in which *D. macrophthalmus* contributed 98%. This estimated was more than 40% higher than last year, but is still below the average of the time series.

The biomasses of the croakers have varied considerably during the last surveys. Therefore, no clear trend in the time series can be seen. The 2011 estimate of 770 tonnes is more than 100% higher than the 2010 estimate and at the same level as the 2009 estimate, but among the lowest in the time series. The estimate of *U. canariensis*, which is one of the most abundant among croakers, also shows large annual variation and there is no evident trend in the time series.

The biomass estimate of hake was about 4 800 tonnes, almost the double of the 2010 estimate but considerable lower than the 2009 estimate of 31 000 tonnes, the highest in the time series. *Merluccius capensis* (Cape hake) was the only hake species caught, while Benguela hake (*M. polli*) contributed about 65% of the biomass in 2008.

The biomass estimate of the cephalopods in 2011 was about 1 700 tonnes, which is similar to the 2010 estimate but only about half of the 2008 estimate.

The biomass estimate of sharks (includes Chimaeriformes) was about 2 000 tonnes, which is much higher than the estimates from the three previous surveys and similar to the 2007 estimate. These figures should be carefully interpreted, as they do reflect neither the real species composition nor their biomass due to inadequate sampling gear.

The biomass estimate of hairtails (*Trichiurus lepturus*) was about 650 tonnes, the highest since 2000. As a benthopelagic species, its biomass estimates over time is unlikely to represent a reliable reflection of changes in the stock.

The biomass estimate of horse mackerel was 105 000 tonnes, which is a considerable reduction from the estimates in 2010 and 2009 of 286 000 and 322 000 tonnes, respectively. The 2009 estimate was the highest estimate in the time series, almost 50% higher than the 2008 estimate and three times higher than the 2007 estimate. The contribution of *Trachurus trecae* (Cunene horse mackerel) within the horse mackerel biomass was 99% in 2009, but only 27% in 2010 and 30% in 2011.

The 2007-2009 biomass estimates of clupeids were smaller than the very high estimate of about 300 000 tonnes in 2006, and the 2010 and 2011 estimates were also much higher than what was found in 2007-2009. The 2011 biomass estimate of clupeids was considerably lower than the estimated biomass in 2010 and much lower than the estimates of 309 000 tonnes in 2006 which is the highest of the time series.

The biomass estimates of the pelagic species groups are unreliable, as the bottom trawl only catches fish close to the seabed and therefore is not a suitable sampling tool for these groups. The large fluctuations in the time series do not reflect the true change of abundance of these stocks.

Table 5 Biomass estimates (tonnes) of important species on the shelf (20-200 m) in the southern region. CV values are indicated in brackets.

Survey	Hake		T.treace		Horsemackerel		Cephalopod		Sharks		Clupeids		Carangids		Scombrids	
1986.1	1099	(0.55)	14235	(0.59)	23059	(0.46)	1188	(1.00)	618	(0.65)	51	(1.83)	23059	(0.46)	43	(1.00)
1986.2	3709	(0.81)	69542	(0.49)	78132	(0.53)	1555	(0.47)	2593	(0.92)	0		78165	(0.53)	173	(0.89)
1989.1	349	(0.88)	2883	(1.09)	15681	(0.90)	776	(0.61)	188	(0.88)	0		15681	(0.90)	60	(0.79)
1989.2	1121	(1.30)	979	(0.94)	13706	(0.75)	6114	(0.83)	12200	(1.37)	0		13706	(0.75)	35	(1.11)
1989.3	6739		11636		39225		2087		551		0		39225		155	
1991.1	2920	(1.28)	21429	(0.59)	50458	(0.51)	732	(0.42)	4005	(1.48)	6	(1.69)	50459	(0.51)	106	(1.46)
1991.2	4385	(0.68)	25595	(0.60)	62961	(0.58)	2192	(1.71)	957	(0.53)	444	(1.61)	62961	(0.58)	0	
1992	6756	(0.46)	8106	(0.91)	95433	(0.41)	744	(0.63)	2220	(0.65)	70	(1.54)	95436	(0.41)	0	
1993	4023	(0.40)	52839	(0.91)	64235	(0.75)	2501	(0.81)	2278	(0.71)	8	(1.55)	64235	(0.75)	347	(1.03)
2000	3559	(0.80)	185345	(1.05)	218410	(0.86)	1934	(0.29)	2051	(0.48)	43	(1.76)	218473	(0.86)	28	(0.87)
2002	3779	(0.81)	116985	(1.30)	237050	(0.63)	1937	(0.96)	69	(0.94)	1217	(1.69)	237058	(0.63)	711	(1.76)
2003	7014	(0.64)	76533	(0.80)	113879	(0.74)	1630	(0.86)	1163	(1.16)	3601	(1.55)	114293	(0.75)	546	(1.83)
2004	11860	(0.64)	72982	(0.56)	237659	(0.80)	2547	(0.71)	348	(0.72)	12998	(1.82)	237659	(0.80)	5	(1.83)
2005	5067	(0.65)	114	(1.83)	129070	(0.52)	2309	(0.61)	1067	(0.38)	2410	(0.74)	129088	(0.52)	1	(1.83)
2006	3713	(0.39)	126892	(0.47)	184129	(0.48)	1545	(0.68)	3630	(1.40)	308909	(1.03)	184129	(0.48)	2221	(1.66)
2007	3006	(0.52)	100468	(0.54)	107896	(0.51)	1459	(0.48)	2016	(0.49)	1747	(0.78)	107918	(0.51)	95	(1.35)
2008	1722	(1.04)	169349	(0.57)	215813	(0.48)	3235	(0.57)	278	(1.12)	43	(1.26)	215813	(0.48)	1124	(0.85)
2009	31018	(0.32)	322270	(0.82)	322460	(0.82)	1017	(0.50)	271	(0.61)	2148	(1.82)	322460	(0.82)	50	(1.69)
2010	2495	(0.83)	76870	(0.69)	286228	(0.49)	1732	(0.73)	190	(1.01)	100656	(1.25)	286240	(0.49)	605	(1.10)
2011	4827	(0.53)	32076	(0.53)	104890	(0.66)	1683	(0.50)	2054	(0.60)	65380	(0.97)	104890	(0.66)	485	(0.71)

	Hairtails		Croakers		Seabreams		Ommastrephidae		Sepiidae		D.macrophthalamus		D.angolensis		U.canariensis	
1986.1	334	(0.85)	1560	(0.94)	9736	(0.33)	31	(0.64)	138	(0.88)	8304	(0.34)	81	(1.15)	135	(1.26)
1986.2	1694	(1.30)	3960	(0.96)	19201	(0.49)	0		726	(0.74)	17054	(0.54)	5	(1.69)	86	(1.48)
1989.1	965	(1.36)	1492	(0.63)	17853	(0.47)	61	(0.54)	159	(1.08)	17020	(0.47)	139	(1.59)	361	(1.04)
1989.2	510	(0.99)	3601	(0.93)	32669	(0.43)	7	(1.69)	0		31615	(0.44)	16	(1.69)	442	(0.75)
1989.3	1746		1443		15594		192		17		15509		27		86	
1991.1	1335	(0.71)	1341	(0.54)	22333	(0.33)	25	(1.09)	20	(1.55)	20180	(0.37)	6	(1.69)	118	(0.93)
1991.2	255	(0.61)	567	(0.51)	22536	(0.43)	25	(0.91)	31	(0.98)	21994	(0.44)	7	(1.69)	102	(1.10)
1992	13	(1.42)	576	(0.91)	32666	(0.54)	428	(1.16)	148	(0.71)	31822	(0.55)	118	(1.69)	30	(0.99)
1993	361	(1.38)	2744	(0.60)	58399	(0.52)	145	(0.40)	126	(1.57)	57722	(0.51)	238	(1.58)	496	(0.87)
2000	1008	(1.45)	3623	(0.61)	61693	(0.95)	9	(1.69)	400	(0.50)	58636	(1.01)	63	(1.29)	305	(0.72)
2002	0		1046	(1.18)	24802	(1.00)	21	(1.69)	1043	(1.64)	23819	(0.98)	0		12	(1.69)
2003	48	(1.16)	1115	(0.39)	15856	(0.39)	397	(0.69)	53	(1.40)	13313	(0.38)	0		172	(0.84)
2004	1	(1.69)	518	(1.18)	26946	(0.69)	549	(0.86)	920	(1.54)	24702	(0.74)	1	(1.69)	8	(1.83)
2005	274	(1.53)	6164	(0.71)	12654	(0.50)	1655	(0.86)	63	(1.43)	12121	(0.50)	221	(1.69)	330	(1.20)
2006	26	(1.74)	923	(0.55)	11470	(0.31)	98	(0.91)	199	(0.90)	11058	(0.32)	0		229	(1.07)
2007	93	(1.25)	4168	(1.21)	15520	(0.36)	555	(1.04)	15	(1.69)	14579	(0.37)	70	(1.69)	563	(0.96)
2008	85	(0.74)	404	(0.94)	9147	(0.38)	6	(1.69)	504	(1.16)	7276	(0.45)	113	(1.69)	44	(0.94)
2009	27	(0.72)	695	(0.68)	9804	(0.52)	371	(0.87)	0	(1.69)	9618	(0.53)	1	(1.69)	118	(1.23)
2010	148	(1.37)	321	(0.93)	9218	(0.38)	46	(1.09)	0	NA	8118	(0.39)	0	NA	99	(1.52)
2011	649	(0.66)	768	(1.05)	15964	(0.38)	57	(1.39)	97	(1.42)	15671	(0.39)	3	(1.69)	179	(0.95)

Distribution

Figure 9 shows the distribution of seabreams in the southern survey area. Medium concentrations (1001-3000 kg/hour) of seabreams was found in large parts of the survey area from 50 to 200 m, with surrounding distributions of lower densities in deeper and shallower waters, in the area between Cunene River and Baía dos Tigres.

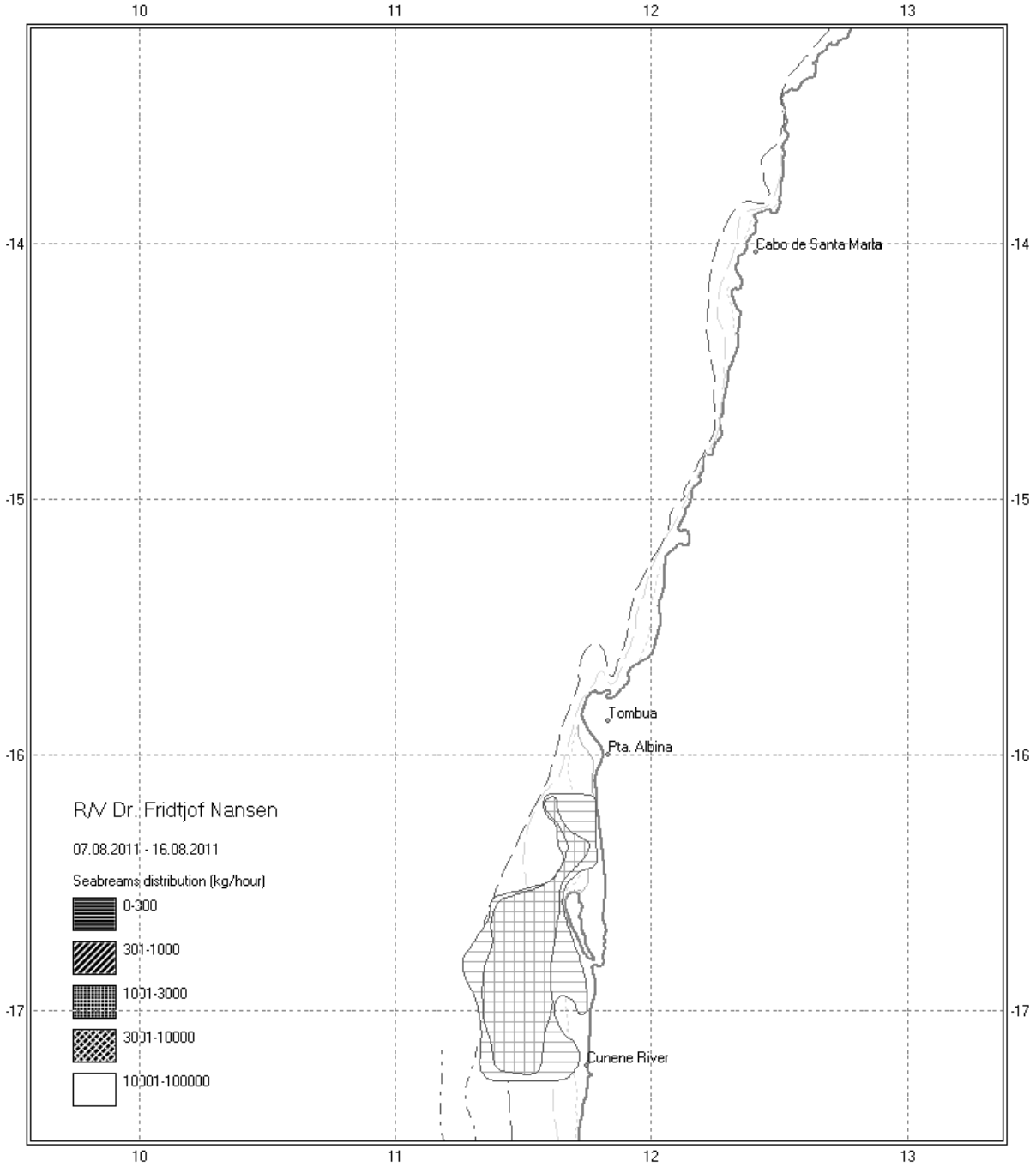

Figure 9 Distribution of seabreams (family Sparidae) in the southern region, Cunene-Tômbua. Depth contours at 20, 50, 100 and 200 m.

CHAPTER 5 CATCH RATES, DISTRIBUTION, COMPOSITION AND BIOMASS ESTIMATES OF DEEP-WATER SHRIMP AND HAKE ON THE SLOPE

The slope is defined in the report to be between 201 and 800 m bottom depth. The trawl positions are mapped in Figure 1, station information and catch by species are presented in Annex I. Pooled length distributions, weighted by catch, of the main species by region are shown in Annex II. Further, the mean densities (tonnes·NM^{-2}) and the frequency of occurrence of the most important species are shown in Annex III.

The slope is very steep and rocky in the south and makes trawling difficult. Five trawl stations were carried on the southern slope in depths between 200 and 800 meters (Annex I). The average catch per hour was 1 258 kg/hour, and the "demersal" group contributed 26% while "pelagic" group contributed only 0.3% (Table 6). Hake (*M. capensis*) was caught on all stations on the slope with an average catch rate of 317 kg/hour, contributing 25% to the total catch. Cephalopods, shrimps and sharks contributed from 0.3 to 4% of catches. Striped red shrimps (*Aristeus varidens*) were found at the three deepest stations and the mean catch rate was 33 kg/hour, representing about 2.6 %. Seabreams were caught in low numbers only at the two shallowest stations in the slope area. The "other" group (non-commercial species) dominated the catches and contributed to 67% to the total.

Table 6 Catch rates (kg/hour) by main groups caught in valid swept area bottom trawl hauls in the southern region slope (201-800 m).

Station	Depth	Cephalopods	Demersal	Pelagic	Sharks	Shrimps	Other	Total
60	615	0.6	201.9	0.6	25.4	179.6	291.4	699.5
66	346	1.3	531.2	6.3	2.7	14.4	645.2	1201.1
75	738	1.7	104.4	8.5	39.0	4.2	673.5	831.3
84	322	0.0	398.5	5.1	20.7	31.0	362.3	817.6
85	731	14.7	392.6	0.0	70.0	32.8	2231.2	2741.3
Mean	550	3.7	325.7	4.1	31.5	52.4	840.7	1258.1
SD		6.2	170.5	3.7	25.1	72.1	795.4	850.2
%Catch		0.3	25.9	0.3	2.5	4.2	66.8	

Table 7 Catch rates (kg/hour) by main deep-water groups caught in valid swept area bottom trawl hauls in the southern region slope (201-800 m).

Station	Depth	A.varidens	M. capensis	N.africana	P.longirostris	Seabream	Other	Total
60	615	136.6	195.3	0.0	0.0	0.0	367.6	699.5
66	346	0.0	523.1	0.0	0.0	8.2	669.9	1201.1
75	738	1.0	101.0	0.0	0.0	0.0	729.3	831.3
84	322	0.0	395.8	0.0	2.8	2.7	416.3	817.6
85	731	27.6	373.6	0.0	0.0	0.0	2340.1	2741.3
Mean	550	33.0	317.8	0.0	0.6	2.2	904.6	1258.1
SD		59.1	168.3	0.0	1.2	3.5	817.5	850.2
%Catch		2.6	25.3	0.0	0.0	0.2	71.9	

Biomass estimates

Table 8 shows the time series from 1986 to 2011 of the swept-area biomass estimates for different species and species groups on the southern slope. The numbers of trawl stations on the southern slope is very low due to the difficult trawling conditions caused by untrawlable sea bed. Therefore, no stratifying depth was done for the data. Further, only stations in the depth range 200-600 m are included in the biomass estimates, and in 2011 as in previous years, just two stations were carried out between 200 and 600 meters. Thus, these biomass estimates should be regarded merely as indicators and not as actual estimates.

The biomass estimates of hake have fluctuated over the whole time series. The 2011 estimate of 3 900 tonnes was the highest since 2007, almost 25 % higher than the 2010 estimate. The lack of any clear trend in the time series is probably caused by the low sampling effort on the southern slope between 200 and 600 meters. The contribution of the two hake species (*M. capensis* and *M. polli*) has varied through the years, and it is reasonable to believe that, in some surveys, a misidentification of the hakes could have happened. In the present survey only *M. capensis* was caught.

No *A. varidens* was found between 200 and 600 m in 2011, but this species was present at the stations deeper than 600 m. The low abundance of *P. longirostris* was found, estimated to 12 tonnes. However, as earlier mentioned these estimates are highly unreliable since only two hauls were the basis for the estimates. The estimated biomasses of horse mackerel and cephalopods on the slope were considerably lower than in 2010.

Table 8 Biomass estimates (tonnes) of important species group on the slope (200-600 m) in the southern region. CV values are indicated in brackets.

Survey	Hake		Horse mackerel		Shrimps		Cephalopod		Sharks		Seabreams		P.longirostris		A.varidens	
1986.1	2754	(0.84)	26	(1.00)	182	(0.16)	15	(1.00)	66	(0.40)	1261	(0.95)	0		106	(1.00)
1991.1	3285	(0.52)	62	(0.02)	47	(0.43)	43	(0.14)	463	(0.33)	325	(0.83)	21	(0.77)	0	
1991.2	19798	(0.62)	549	(0.48)	0		0		506	(0.68)	2669	(0.08)	0		0	
1992	10793	(0.82)	58	(1.00)	235	(0.88)	0		49	(0.19)	2035	(1.00)	15	(1.00)	161	(1.00)
1997.2	3411		13		13		0		917		413		13		0	
2000	3358	(0.86)	0		44	(0.84)	0		73	(0.47)	0		44	(0.84)	0	
2002	1245		0		20		14		104		0		0		0	
2003	454	(1.00)	0		156	(0.91)	0		226	(0.34)	0		79	(1.00)	0	
2004	5749	(0.53)	50	(0.62)	97	(0.40)	34	(0.93)	40	(0.97)	579	(0.57)	57	(0.75)	30	(1.00)
2005	882	(0.48)	24	(0.84)	134	(0.71)	15	(1.00)	56	(0.62)	0		3	(0.55)	57	(0.87)
2006	4507	(0.96)	169	(0.66)	72	(1.00)	0		5	(1.00)	0		0		0	
2007	1528		0		27		0		4323		0		0		0	
2008	964	(0.38)	563	(1.00)	280	(0.61)	9	(1.00)	188	(0.42)	232	(1.00)	45	(1.00)	225	(1.00)
2009	2751	(0.69)	0	NA	705	(0.03)	51	(0.38)	192	(0.93)	0		0		607	(0.13)
2010	2336	(0.36)	921	(1.00)	729	(1.00)	36	(0.55)	4	(1.00)	0		0		196	(1.00)
2011	3902	(0.09)	48	(0.06)	198	(0.41)	5	(1.00)	104	(0.79)	45		12		0	NA

Distribution

Figure 10 shows the distribution of *Merluccius capensis* in the southern region. The distribution covers large parts of the outer shelf and the slope from Cunene River to north of Baía dos Tigres. The highest densities (1001-3000 kg/hour) were found off and north of Cunene River.

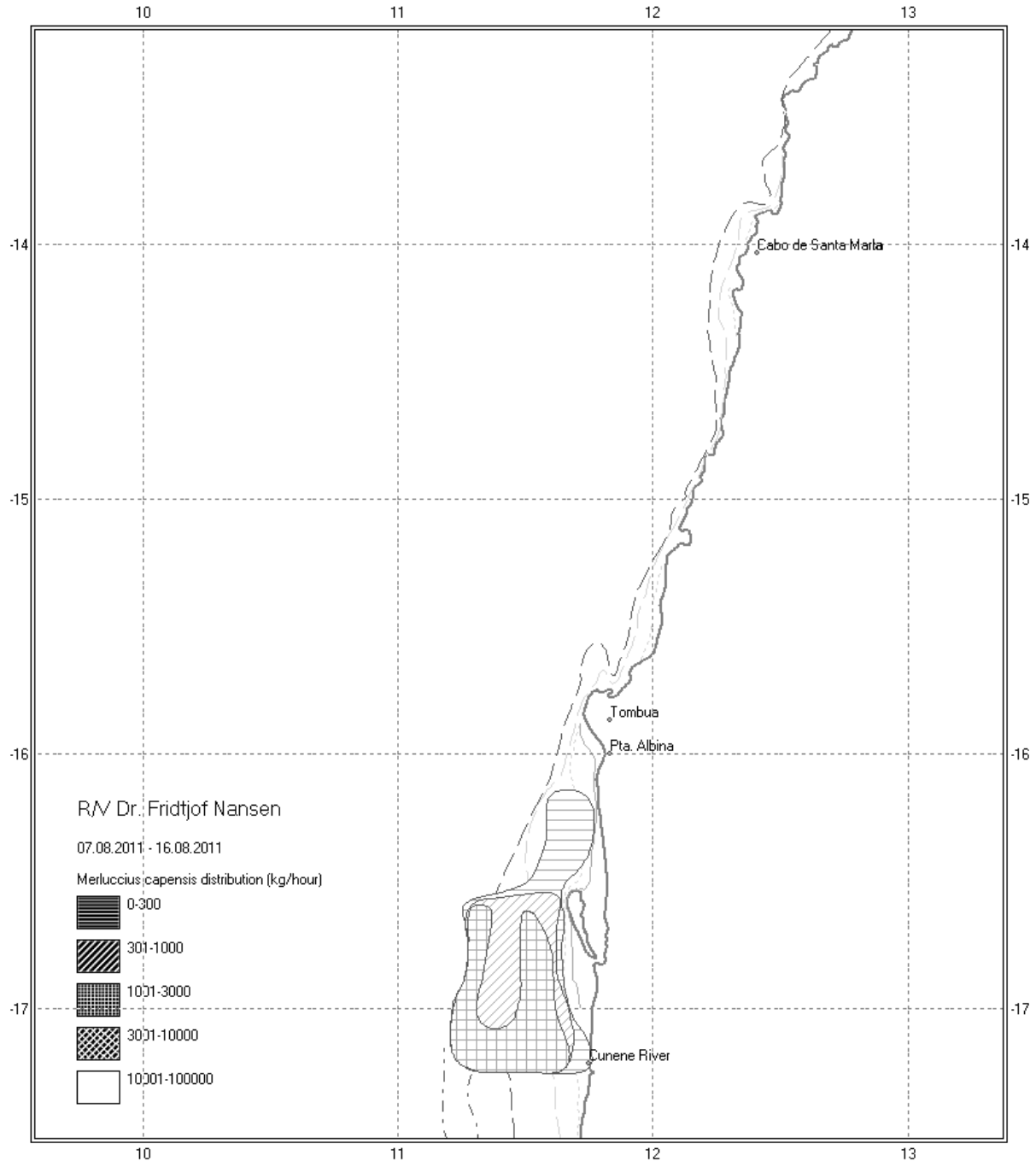

Figure 10 Distribution of hake (*Merluccius capensis.*) in the southern region, Cunene - Tômbua. Depth contours at 20, 50, 100 and 200 m.

CHAPTER 6 SUMMARY

From 23 March to 8 April and 11 - 16August the 2011 demersal resource survey off Angola was carried out using R/V “Dr. Fridtjof Nansen”. Except from the area between Tômbua and Benguela, which is unsuitable for trawling due to poor bottom conditions, the shelf and upper slope (20-800 m) from Cunene River to Congo River was covered.

In total, 26 trawl stations were carried out in the southern region, of which 24 were valid and used in the biomass estimation.

The southern region is not included in the overall biomass estimates, as the surveys in this region have not been properly standardized throughout the years. However, the effort, *i.e*. the number of stations by stratum on the southern shelf, is relatively similar from 2000 to 2011 (Annex IV) and the estimates in this period are comparable. The estimates on the southern slope are very unreliable as the number of tows is very low due to difficult trawling conditions.

REFERENCES

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ANNEXES

ANNEX I. Fishing Stations

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 51
DATE :11.08.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.41
start stop duration Lon E 11°36.22
TIME :08:45:14 09:15:22 30.1 (min) Purpose : 3
LOG : 9628.96 9630.40 1.4 Region : 4050
FDEPTH: 73 71 Gear cond.: 0
BDEPTH: 73 71 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 2.9 kn
Sorted : 203 Total catch: 202.50 Catch/hour: 403.12

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Squalus megalops	70.77	141	17.56	
Sphyrna lewini	10.85	2	2.69	
Mustelus mustelus	4.38	8	1.09	
Thyrsites atun	85.50	315	21.21	
Dentex macrophthalmus	66.69	1827	16.54	145
Etrumeus whiteheadi	61.61	1117	15.28	146
Trachurus trecae	2.33	56	0.58	147
Chelidonichthys capensis	42.40	84	10.52	
Raja miraletus	1.51	2	0.38	
Scomber japonicus	0.60	2	0.15	
Illex coindetii	0.06	2	0.01	
Zeus faber	0.94	4	0.23	
Merluccius capensis	3.56	12	0.88	
Lagocephalus laevigatus	4.84	16	1.20	
Spondyliosoma cantharus	2.21	10	0.55	
Dentex barnardi	1.95	22	0.48	148
Dentex gibbosus	4.38	68	1.09	
Pagellus bellottii	14.83	271	3.68	149
Loligo vulgaris	9.34	78	2.32	
Alloteuthis africana	2.59	912	0.64	
Citharus linguatula	0.12	2	0.03	
Sepia orbignyana	11.67	16	2.89	
Total	403.12		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 52
DATE :11.08.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.39
start stop duration Lon E 11°43.75
TIME :10:43:27 11:13:31 30.1 (min) Purpose : 3
LOG : 9640.67 9642.18 1.5 Region : 4050
FDEPTH: 47 48 Gear cond.: 0
BDEPTH: 47 48 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.0 kn
Sorted : 239 Total catch: 238.75 Catch/hour: 476.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	284.85	6587	59.77	150
Trachurus capensis	46.83	1864	9.83	151
Trigla lyra	27.54	82	5.78	
Loligo vulgaris	21.08	561	4.42	
Atractoscion aequidens	3.39	18	0.71	
Merluccius capensis	1.74	10	0.36	
Umbrina canariensis	2.30	56	0.48	
Pagellus bellottii	4.41	206	0.93	
Etrumeus whiteheadi	1.14	28	0.24	152
Thyrsites atun	2.12	4	0.44	
Boops boops	0.36	10	0.08	
Raja miraletus	3.31	6	0.70	
Spondyliosoma cantharus	0.32	10	0.07	
Dentex gibbosus	0.32	4	0.07	
Arius heudelotii	2.61	4	0.55	
Scomber japonicus	0.42	4	0.09	
Pontinus accraensis	0.60	4	0.13	
J E L L Y F I S H	13.39	28	2.81	
Dasyatis marmorata	11.08	4	2.32	
Myliobatis aquila	42.91	8	9.01	
Dentex macrophthalmus	5.83	409	1.22	153
Total	476.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 55
DATE :12.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°21.40
start stop duration Lon E 11°43.89
TIME :05:37:18 06:07:45 30.5 (min) Purpose : 3
LOG : 9770.07 9771.64 1.6 Region : 4050
FDEPTH: 46 46 Gear cond.: 0
BDEPTH: 46 46 Validity : 0
Towing dir: 0° Wire out : 115 m Speed : 3.1 kn
Sorted : 64 Total catch: 185.43 Catch/hour: 365.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	166.64	13627	45.62	164
Trachurus capensis	67.66	4544	18.52	165
Dentex macrophthalmus	22.40	1897	6.13	166
Scomber japonicus	15.31	248	4.19	167
Etrumeus whiteheadi	2.01	53	0.55	168
Chelidonichthys capensis	5.67	18	1.55	
Umbrina canariensis	0.24	6	0.06	
Merluccius capensis	3.19	18	0.87	169
Alloteuthis africana	2.84	1105	0.78	
Sepia orbignyana	1.18	12	0.32	
Loligo vulgaris	16.55	585	4.53	
Spondyliosoma cantharus	0.12	6	0.03	
Pagellus bellottii	54.96	3144	15.05	170
Dentex barnardi	0.71	18	0.19	
Schedophilus pemarco	0.77	6	0.21	
Cepola pauciradiatus	0.18	6	0.05	
J E L L Y F I S H	4.67	6	1.28	
Trachinocephalus myops	0.18	6	0.05	
Total	365.26		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 56
DATE :12.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°24.11
start stop duration Lon E 11°45.60
TIME :06:37:45 07:09:41 31.9 (min) Purpose : 3
LOG : 9774.46 9776.10 1.7 Region : 4050
FDEPTH: 21 20 Gear cond.: 0
BDEPTH: 21 20 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.1 kn
Sorted : 30 Total catch: 212.10 Catch/hour: 398.43

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	209.08	8442	52.48	171
Trachurus capensis	127.55	6180	32.01	172
Scomber japonicus	2.63	39	0.66	173
Scomberesox saurus	0.26	13	0.07	
Loligo vulgaris	39.97	3721	10.03	
Calappa rubroguttata	3.94	26	0.99	
Etrumeus whiteheadi	1.84	53	0.46	174
Pegusa lascaris	0.92	39	0.23	
Spondyliosoma cantharus	0.92	26	0.23	
Alloteuthis africana	1.18	552	0.30	
J E L L Y F I S H	9.34	39	2.34	
Engraulis encrasicolus	0.39	26	0.10	
Trachinocephalus myops	0.39	13	0.10	
Total	398.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 58
DATE :12.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°35.72
start stop duration Lon E 11°37.40
TIME :15:14:42 15:44:20 29.6 (min) Purpose : 3
LOG : 9833.79 9835.16 1.4 Region : 4050
FDEPTH: 85 86 Gear cond.: 0
BDEPTH: 85 86 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 2.8 kn
Sorted : 59 Total catch: 590.30 Catch/hour: 1195.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	88.09	3199	7.37	177
Trachurus capensis	609.52	19055	50.99	178
Etrumeus whiteheadi	241.98	8566	20.24	179
Dentex macrophthalmus	125.55	5650	10.50	181
Chelidonichthys capensis	20.25	61	1.69	
Trichiurus lepturus	5.06	142	0.42	
GOBIIDAE	0.20	40	0.02	
Merluccius capensis	36.85	283	3.08	180
Loligo vulgaris	41.71	385	3.49	
Scomber japonicus	1.62	20	0.14	
Dicologoglossa cuneata	0.61	20	0.05	
Brotula barbata	0.20	20	0.02	
Calappa pelii	1.01	101	0.08	
J E L L Y F I S H	16.81	20	1.41	
B I V A L V E S	2.83	162	0.24	
Sepia officinalis	3.04	20	0.25	
Total	1195.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 59
DATE :12.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°36.27
start stop duration Lon E 11°29.88
TIME :17:08:21 17:22:33 14.2 (min) Purpose : 3
LOG : 9845.08 9845.79 0.7 Region : 4050
FDEPTH: 110 110 Gear cond.: 7
BDEPTH: 0 110 Validity : 4
Towing dir: 0° Wire out : 275 m Speed : 3.0 kn
Sorted : 252 Total catch: 572.17 Catch/hour: 2417.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Mustelus mustelus	13.94	4	0.58	
Squalus megalops	2.70	8	0.11	
Zeus faber	8.87	25	0.37	
Trachurus trecae	1797.76	28863	74.36	182
Trachurus capensis	19.48	237	0.81	183
Dentex macrophthalmus	388.35	8489	16.06	184
Trichiurus lepturus	13.48	173	0.56	
Merluccius capensis	46.94	161	1.94	185
Pterothrissus belloci	35.75	351	1.48	
Trigla lyra	28.44	249	1.18	
Chelidonichthys capensis	36.21	68	1.50	
Chelidonichthys gabonensis	4.86	275	0.20	
Scorpaena stephanica	1.52	59	0.06	
Pagellus bellottii	11.58	85	0.48	186
Arnoglossus imperialis	0.93	76	0.04	
Citharus linguatula	0.55	59	0.02	
Pegusa lascaris	0.17	8	0.01	
Syacium micrurum	0.46	59	0.02	
Illex coindetii	1.52	8	0.06	
Spondyliosoma cantharus	1.90	8	0.08	
Sepia orbignyana	0.76	8	0.03	
Umbrina canariensis	0.76	8	0.03	
Etrumeus whiteheadi	0.30	8	0.01	
GOBIIDAE	0.08	30	0.00	
Saurida brasiliensis	0.30	38	0.01	
Total	2417.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 60
DATE :13.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°37.45
start stop duration Lon E 11°17.67
TIME :00:21:05 00:48:00 26.9 (min) Purpose : 3
LOG : 9872.82 9874.06 1.2 Region : 4050
FDEPTH: 612 617 Gear cond.: 0
BDEPTH: 612 617 Validity : 0
Towing dir: 0° Wire out : 1250 m Speed : 2.8 kn
Sorted : 62 Total catch: 313.83 Catch/hour: 699.47

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	195.27	435	27.92	187
Trachyrincus scabrus	143.42	802	20.50	
Shrimps, small, non comm.	43.02	25676	6.15	
Lamprogrammus exutus	6.62	109	0.95	
Nezumia aequalis	29.64	793	4.24	
Stomias affinis	8.02	183	1.15	
Hoplostethus cadenati	19.64	537	2.81	
Bathyuroconger vicinus	3.61	103	0.52	
Yarrella blackfordi	1.76	80	0.25	
Diaphus effulgens	2.63	96	0.38	
Helicolenus dactylopterus	21.55	198	3.08	
Triplophos hemingi	0.20	36	0.03	
Chaceon maritae	7.36	13	1.05	
Gadella imberbis	0.65	22	0.09	
Raja alba	2.72	7	0.39	
Chlorophthalmus atlanticus	0.13	7	0.02	
OCTOPOTEUTHIDAE	0.65	7	0.09	
Alepocephalus rostratus	40.01	154	5.72	
Tetragonurus cuvieri	1.03	7	0.15	
Benthodesmus tenuis	0.58	13	0.08	
Diastobranchus capensis	0.42	7	0.06	
Anemones, pink	2.63	7	0.38	
Anemones, white	4.03	7	0.58	
DICERATIIDAE	1.92	22	0.27	
Aristeus varidens, female	132.68	12062	18.97	
Aristeus varidens, male	3.90	649	0.56	
Centrophorus squamosus	16.49	25	2.36	
Galeus polli	0.36	2	0.05	
Etmopterus pusillus	4.52	16	0.65	
Chlamydoselachus anguineus	0.42	2	0.06	
Deania calcea	2.79	4	0.40	
Centroscymnus crepidater *	0.80	7	0.11	
Total	699.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 61
DATE :13.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°38.74
start stop duration Lon E 11°24.00
TIME :08:02:06 08:32:51 30.8 (min) Purpose : 3
LOG : 9914.65 9916.13 1.5 Region : 4050
FDEPTH: 125 123 Gear cond.: 0
BDEPTH: 125 123 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 2.9 kn
Sorted : 287 Total catch: 286.81 Catch/hour: 559.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Squalus megalops	12.78	33	2.28	
Mustelus mustelus	5.75	4	1.03	
Trachurus trecae	301.56	4205	53.90	215
Dentex macrophthalmus	169.60	3037	30.32	216
Trachurus capensis	1.95	16	0.35	238
Merluccius capensis	34.04	90	6.08	239
Zeus faber	8.97	29	1.60	
Pagellus bellottii	0.55	4	0.10	
Scomber japonicus	1.17	12	0.21	188
Trichiurus lepturus	0.43	4	0.08	
Raja miraletus	3.37	4	0.60	
Chelidonichthys capensis	1.03	2	0.18	
Chelidonichthys gabonensis	1.50	20	0.27	
Etrumeus whiteheadi	4.80	66	0.86	189
Illex coindetii	0.12	4	0.02	
Loligo vulgaris	3.65	20	0.65	
Scorpaena normani	1.52	18	0.27	
Scorpaena stephanica	0.41	2	0.07	
Trigla lyra	5.77	31	1.03	
Zenopsis conchifer	0.47	2	0.08	
Total	559.45		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 62
DATE :13.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°37.56
start stop duration Lon E 11°29.78
TIME :09:31:54 10:02:41 30.8 (min) Purpose : 3
LOG : 9922.55 9924.02 1.5 Region : 4050
FDEPTH: 111 111 Gear cond.: 0
BDEPTH: 111 111 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 2.9 kn
Sorted : 52 Total catch: 631.89 Catch/hour: 1231.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sepia orbignyana	16.08	0	1.31	
Dentex macrophthalmus	832.63	15097	67.60	192
Trachurus trecae	98.65	1456	8.01	194
Trachurus capensis	14.81	154	1.20	191
Zeus faber	21.64	62	1.76	
Mustelus mustelus	22.03	12	1.79	
Squalus megalops	4.97	14	0.40	
Merluccius capensis	101.11	343	8.21	195
Pagellus bellottii	9.57	41	0.78	193
Loligo vulgaris	9.57	97	0.78	
Scomber japonicus	1.05	16	0.09	
Chelidonichthys capensis	44.29	57	3.60	
Umbrina canariensis	2.12	33	0.17	
Etrumeus whiteheadi	5.32	212	0.43	190
Chelidonichthys gabonensis	1.23	16	0.10	
Raja miraletus	10.16	25	0.82	
Trigla lyra	29.06	240	2.36	
Trichiurus lepturus	0.74	8	0.06	
Lagocephalus laevigatus	0.82	8	0.07	
Atractoscion aequidens	5.89	8	0.48	
Total	1231.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 64
DATE :13.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°50.18
start stop duration Lon E 11°41.04
TIME :14:27:38 14:30:59 3.4 (min) Purpose : 3
LOG : 9959.64 9959.83 0.2 Region : 4050
FDEPTH: 26 26 Gear cond.: 0
BDEPTH: 26 26 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.6 kn
Sorted : 67 Total catch: 699.92 Catch/hour: 12535.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1062.45	145558	8.48	198
Trachurus capensis	5425.43	681904	43.28	199
Sardinops ocellatus	3990.63	61487	31.83	200
Etrumeus whiteheadi	1937.01	96842	15.45	201
Scomber japonicus	75.22	2060	0.60	202
Pagellus bellottii	11.28	752	0.09	
J E L L Y F I S H	33.85	179	0.27	
Total	12535.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 65
DATE :13.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°48.00
start stop duration Lon E 11°34.86
TIME :15:52:55 16:13:40 20.8 (min) Purpose : 3
LOG : 9969.07 9969.93 0.9 Region : 4050
FDEPTH: 95 95 Gear cond.: 0
BDEPTH: 95 95 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 2.5 kn
Sorted : 59 Total catch: 556.58 Catch/hour: 1609.39

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	730.70	13764	45.40	203
Dentex macrophthalmus	456.00	9149	28.33	205
Zeus faber	1.65	55	0.10	
Brotula barbata	4.40	84	0.27	
Citharus linguatula	1.36	110	0.08	
Synagrops microlepis	20.33	1897	1.26	
GOBIIDAE	3.01	688	0.19	
Umbrina canariensis	1.91	55	0.12	
Loligo vulgaris	8.24	110	0.51	
Atractoscion aequidens	10.44	55	0.65	
Galeichthys sp.	12.35	29	0.77	
Chelidonichthys capensis	63.44	359	3.94	
Engraulis encrasicolus	4.94	249	0.31	206
Squilla mantis	1.36	55	0.08	
Arnoglossus imperialis	0.55	55	0.03	
Pegusa lascaris	22.27	879	1.38	
Merluccius capensis	66.51	440	4.13	204
Calappa pelii	3.30	55	0.20	
Pythonichthys microphthalmus	15.09	413	0.94	
G A S T R O P O D S	62.08	40629	3.86	
B I V A L V E S	52.45	74085	3.26	
Holothuria spp.	67.03	7307	4.16	
Total	1609.39		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 66
DATE :13.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°49.90
start stop duration Lon E 11°17.95
TIME :19:08:46 19:38:51 30.1 (min) Purpose : 3
LOG : 9990.61 9992.24 1.6 Region : 4050
FDEPTH: 338 354 Gear cond.: 0
BDEPTH: 338 354 Validity : 0
Towing dir: 0° Wire out : 815 m Speed : 3.3 kn
Sorted : 172 Total catch: 602.34 Catch/hour: 1201.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	523.07	915	43.55	207
Chlorophthalmus atlanticus	31.55	941	2.63	
Helicolenus dactylopterus	478.40	7914	39.83	
Scyliorhinus cervigoni	0.76	2	0.06	
Galeus polli	1.93	10	0.16	
Dentex macrophthalmus	8.16	36	0.68	208
Nezumia aequalis	15.13	329	1.26	
Laemonema laureysi	63.85	1103	5.32	
PORIFERA (Sponges)	24.35	237	2.03	
Pterothrissus belloci	11.09	64	0.92	
Trachurus capensis	6.28	36	0.52	209
Trigla lyra	8.30	8	0.69	
Dicologoglossa hexophthalma	2.79	78	0.23	
Malacocephalus occidentalis	0.42	8	0.03	
Illex coindetii	1.32	8	0.11	
Epigonus telescopus	0.14	8	0.01	
Bathynectes sp.	0.84	22	0.07	
CALAPPIDAE	1.60	28	0.13	
MYCTOPHIDAE	0.84	455	0.07	
Pythonichthys microphthalmus	0.20	8	0.02	0
MURAENIDAE	0.56	8	0.05	
B I V A L V E S	1.81	70	0.15	
G A S T R O P O D S	0.70	343	0.06	
Anemones, pink	0.62	22	0.05	
S H R I M P S	14.38	12040	1.20	
Holothuria spp.	2.01	413	0.17	
Total	1201.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 69
DATE :14.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.20
start stop duration Lon E 11°43.00
TIME :05:31:16 05:40:42 9.4 (min) Purpose : 3
LOG : 47.89 48.38 0.5 Region : 4050
FDEPTH: 23 22 Gear cond.: 0
BDEPTH: 23 22 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
Sorted : 60 Total catch: 2573.19 Catch/hour: 16372.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinops ocellatus	15984.31	215555	97.63	217
Raja alba	88.76	6	0.54	
Trachurus trecae	288.61	11873	1.76	218
Pagellus bellottii	5.34	267	0.03	
Pomadasys incisus	5.34	267	0.03	
Total	16372.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 70
DATE :14.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.48
start stop duration Lon E 11°40.81
TIME :06:28:21 06:48:51 20.5 (min) Purpose : 3
LOG : 53.16 54.10 0.9 Region : 4050
FDEPTH: 36 35 Gear cond.: 0
BDEPTH: 36 35 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 2.8 kn
Sorted : 65 Total catch: 1023.00 Catch/hour: 2995.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Myliobatis aquila	11.42	3	0.38	
Trachurus trecae	700.59	34788	23.39	219
Trachurus capensis	6.15	615	0.21	220
Sardinops ocellatus	272.33	5095	9.09	221
Engraulis encrasicolus	1559.30	81962	52.05	222
Etrumeus whiteheadi	419.47	20600	14.00	223
Trichiurus lepturus	1.32	44	0.04	
Chelidonichthyes capensis	6.15	88	0.21	
Illex coindetii	18.01	835	0.60	
Schedophilus pemarco	0.88	44	0.03	
Total	2995.61		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 71
DATE :14.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°58.93
start stop duration Lon E 11°39.03
TIME :08:04:17 08:24:29 20.2 (min) Purpose : 3
LOG : 61.11 62.15 1.1 Region : 4050
FDEPTH: 60 60 Gear cond.: 0
BDEPTH: 60 60 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.1 kn
Sorted : 143 Total catch: 3031.50 Catch/hour: 9004.46

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2712.83	64096	30.13	224
Trachurus capensis	1583.52	139550	17.59	225
Etrumeus whiteheadi	3659.17	169393	40.64	226
Engraulis encrasicolus	118.60	5299	1.32	228
Sardinops ocellatus	29.02	820	0.32	227
Scomber japonicus	24.59	630	0.27	229
Atractoscion aequidens	99.03	630	1.10	232
Chelidonichthys capensis	140.67	630	1.56	
Umbrina canariensis	27.74	630	0.31	230
Loligo vulgaris	65.58	3154	0.73	
Galeichthys sp.	25.22	62	0.28	
Pythonichthys microphthalmus	5.67	125	0.06	
Merluccius capensis	32.79	252	0.36	231
Trichiurus lepturus	46.04	1450	0.51	
Pterothrissus belloci	5.67	62	0.06	
Pegusa lascaris	239.08	8011	2.66	
Bathynectes sp.	10.07	1262	0.11	
Starfish	162.12	23153	1.80	
Sepia orbignyana	7.57	62	0.08	
Squilla cadenati	2.52	62	0.03	
Goneplax angulata	1.25	62	0.01	
G A S T R O P O D S	5.67	2522	0.06	
Total	9004.46		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 72
DATE :14.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.00
start stop duration Lon E 11°35.17
TIME :09:31:53 10:02:13 30.3 (min) Purpose : 3
LOG : 69.19 70.71 1.5 Region : 4050
FDEPTH: 90 91 Gear cond.: 0
BDEPTH: 90 91 Validity : 0
Towing dir: 0° Wire out : 230 m Speed : 3.0 kn
Sorted : 115 Total catch: 2586.99 Catch/hour: 5116.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1270.34	57399	24.83	
Trachurus capensis	2765.40	81338	54.05	234
Etrumeus whiteheadi	279.43	7608	5.46	235
Dentex macrophthalmus	302.57	4226	5.91	236
Merluccius capensis	180.20	1068	3.52	237
Chelidonichthys capensis	104.56	577	2.04	
Scomber japonicus	12.00	132	0.23	
Zeus faber	16.91	89	0.33	
Umbrina canariensis	10.22	44	0.20	
Brotula barbata	2.67	44	0.05	
Loligo vulgaris	109.46	1157	2.14	
Squilla mantis	2.21	44	0.04	
Sepia orbignyana	16.45	89	0.32	
Sepia officinalis	21.36	44	0.42	
Trichiurus lepturus	2.21	44	0.04	
Starfish	15.13	2759	0.30	
B I V A L V E S	3.10	933	0.06	
Maja squinado	1.32	132	0.03	
MAJIDAE	0.44	221	0.01	
Total	5116.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 73
DATE :14.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°0.09
start stop duration Lon E 11°22.11
TIME :13:34:48 14:04:49 30.0 (min) Purpose : 3
LOG : 100.51 101.99 1.5 Region : 4050
FDEPTH: 144 144 Gear cond.: 0
BDEPTH: 144 144 Validity : 0
Towing dir: 0° Wire out : 340 m Speed : 2.9 kn
Sorted : 302 Total catch: 302.32 Catch/hour: 604.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	24.98	336	4.13	240
Trachurus capensis	3.22	42	0.53	241
Dentex macrophthalmus	370.03	3317	61.26	242
Trichiurus lepturus	30.07	569	4.98	
Pterothrissus belloci	22.18	316	3.67	
Umbrina canariensis	1.92	8	0.32	
Merluccius capensis	19.18	48	3.18	243
Chelidonichthys capensis	6.33	6	1.05	
Dentex angolensis	0.96	2	0.16	
Zeus faber	32.77	114	5.42	
Zenopsis conchifer	0.46	2	0.08	
Helicolenus dactylopterus	5.69	54	0.94	
Raja miraletus	2.94	4	0.49	
Atractoscion aequidens	1.00	2	0.17	
Brotula barbata	0.38	2	0.06	
Trigla lyra	0.94	12	0.16	
Chelidonichthys gabonensis	1.54	14	0.25	
Mustelus mustelus	4.20	2	0.69	
Squalus megalops	7.39	14	1.22	
Etrumeus whiteheadi	1.32	18	0.22	244
Loligo vulgaris	3.82	36	0.63	
Illex coindetii	0.68	4	0.11	
Dicologoglossa cuneata	0.24	4	0.04	
Galeichthys sp.	0.68	2	0.11	
Sepia orbignyana	0.48	2	0.08	
Starfish	0.18	32	0.03	
Myliobatis aquila	60.44	14	10.01	
G A S T R O P O D S	0.04	4	0.01	
Total	604.04		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 75
DATE :14.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°0.42
start stop duration Lon E 11°15.27
TIME :21:01:19 21:22:38 21.3 (min) Purpose : 3
LOG : 145.86 146.86 1.0 Region : 4050
FDEPTH: 742 733 Gear cond.: 0
BDEPTH: 742 733 Validity : 0
Towing dir: 0° Wire out : 1470 m Speed : 2.8 kn
Sorted : 295 Total catch: 295.38 Catch/hour: 831.28

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	4.81	51	0.58	247
Trachurus trecae	3.29	34	0.40	248
Merluccius capensis	101.03	110	12.15	249
Geryon maritae	56.99	87	6.86	
Trachyrincus scabrus	118.20	4503	14.22	
Deania calcea	26.45	23	3.18	
Apristurus sp.	3.66	6	0.44	
Ebinania costaecanarie	57.69	42	6.94	
Malacocephalus occidentalis	182.22	5952	21.92	
Hoplostethus cadenati	23.22	844	2.79	
Yarrella blackfordi	45.03	1351	5.42	
Talismania sp.	86.54	1365	10.41	
Bathyuroconger vicinus	4.64	56	0.56	
Selachophidium guentheri	3.38	70	0.41	
Raja confundens	39.40	56	4.74	
Zenion sp.	1.27	3	0.15	
Centroscymnus crepidater	4.08	28	0.49	
Centrophorus squamosus	4.78	6	0.58	
Plesiopenaeus edwardsianus	3.24	521	0.39	
Paramola cuvieri	15.90	65	1.91	
Anemones, pink	10.41	28	1.25	
Lophiodes kempi	5.63	14	0.68	
OCTOPOTEUTHIDAE	1.69	14	0.20	
Aristeus varidens, female	0.84	70	0.10	
Aristeus varidens, male	0.14	14	0.02	
Benthodesmus tenuis	0.42	14	0.05	
SYNAPHOBRANCHIDAE	0.56	14	0.07	
Halosaurus ovenii	0.14	14	0.02	
MELANOSTOMIATIDAE	25.61	661	3.08	
Total	831.28		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 77
DATE :15.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°11.81
start stop duration Lon E 11°43.75
TIME :05:40:57 06:10:52 29.9 (min) Purpose : 3
LOG : 190.16 191.73 1.6 Region : 4050
FDEPTH: 27 26 Gear cond.: 0
BDEPTH: 27 26 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
Sorted : 146 Total catch: 679.63 Catch/hour: 1362.89

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chelidonichthys capensis	64.07	96	4.70	
Callorhinchus capensis	51.54	40	3.78	
Sphyrna zygaena	12.83	6	0.94	
Mustelus mustelus	14.34	20	1.05	
Trachurus trecae	1039.37	26043	76.26	253
Galeichthys sp.	49.63	201	3.64	
Raja miraletus	17.69	24	1.30	
Merluccius capensis	7.00	92	0.51	254
Pomatomus saltatrix	5.68	16	0.42	
Cynoglossus canariensis	0.58	66	0.04	
Pegusa lascaris	26.19	710	1.92	
Pterothrissus belloci	0.50	34	0.04	
Umbrina canariensis	0.24	16	0.02	
Pteroscion peli	0.34	34	0.03	
Etrumeus whiteheadi	1.00	34	0.07	
Trichiurus lepturus	13.01	517	0.95	
Stromateus fiatola	18.27	84	1.34	
Sepia orbignyana	3.17	24	0.23	
Schedophilus pemarco	2.09	24	0.15	
Squilla mantis	0.16	8	0.01	
White sea cucumber	4.17	201	0.31	
Atractoscion aequidens	3.59	34	0.26	
J E L L Y F I S H	24.53	34	1.80	
Maja squinado	1.66	158	0.12	
Penaeus notialis	1.24	42	0.09	
Total	1362.89		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 78
DATE :15.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°11.16
start stop duration Lon E 11°41.82
TIME :07:08:15 07:32:29 24.2 (min) Purpose : 3
LOG : 197.46 198.79 1.3 Region : 4050
FDEPTH: 42 41 Gear cond.: 0
BDEPTH: 42 41 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 148 Total catch: 1206.71 Catch/hour: 2988.14

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2029.55	50952	67.92	255
Chelidonichthys capensis	168.39	381	5.64	
Callorhinchus capensis	112.92	99	3.78	
Argyrosomus hololepidotus	48.91	10	1.64	258
Engraulis encrasicolus	127.78	7211	4.28	256
Sardinops ocellatus	3.37	99	0.11	257
Pomadasys jubelini	73.30	317	2.45	259
Atractoscion aequidens	9.11	79	0.30	
Pomatomus saltatrix	7.73	59	0.26	
Umbrina canariensis	2.58	79	0.09	
Merluccius capensis	7.53	59	0.25	
Dentex barnardi	0.59	20	0.02	
Pegusa lascaris	42.39	1030	1.42	
Raja miraletus	66.56	99	2.23	
Dasyatis marmorata	41.60	40	1.39	

Myliobatis sp.	64.78	20	2.17
Galeichthys sp.	126.98	634	4.25
ANTENNARIIDAE	2.77	40	0.09
Trichiurus lepturus	23.57	713	0.79
Rhinobatos albomaculatus	24.37	20	0.82
C R A B S	1.98	79	0.07
Loligo vulgaris	0.99	59	0.03
Tetradonthidae	0.40	20	0.01
Total	2988.14		100.00

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 79
DATE :15.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°11.19
start stop duration Lon E 11°37.89
TIME :09:39:33 09:53:53 14.3 (min) Purpose : 3
LOG : 209.68 210.37 0.7 Region : 4050
FDEPTH: 84 85 Gear cond.: 9
BDEPTH: 84 85 Validity : 4
Towing dir: 0° Wire out : 200 m Speed : 2.9 kn
Sorted : 30 Total catch: 272.70 Catch/hour: 1141.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Pythonichthys microphthalmus	28.24	565	2.48	
Trachurus trecae	707.95	14272	62.05	260
Trachurus capensis	21.09	1393	1.85	261
Brotula barbata	13.56	264	1.19	
Merluccius capensis	50.84	414	4.46	263
Atractoscion aequidens	25.61	188	2.24	265
Umbrina canariensis	13.93	377	1.22	264
Pterothrissus belloci	10.92	188	0.96	
Calappa pelii	9.04	151	0.79	
Dentex macrophthalmus	9.41	264	0.83	262
Squilla cadenati	22.97	828	2.01	
Galeichthys sp.	17.32	38	1.52	
Chelidonichthys capensis	19.58	188	1.72	
Raja miraletus	17.32	38	1.52	
GOBIIDAE	13.56	1506	1.19	
Pegusa lascaris	32.38	1167	2.84	
Trichiurus lepturus	3.01	113	0.26	
Citharus linguatula	1.51	151	0.13	
B I V A L V E S	104.31	149121	9.14	
G A S T R O P O D S	18.45	45866	1.62	
Total	1141.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 81
DATE :15.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°13.15
start stop duration Lon E 11°30.93
TIME :14:11:59 14:36:12 24.2 (min) Purpose : 3
LOG : 230.00 231.22 1.2 Region : 4050
FDEPTH: 134 131 Gear cond.: 0
BDEPTH: 134 131 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 3.0 kn
Sorted : 93 Total catch: 4999.49 Catch/hour: 12385.19

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	11237.61	327696	90.73	269
Dentex macrophthalmus	749.16	12220	6.05	270
Scomber japonicus	35.85	399	0.29	
Pterothrissus belloci	7.98	131	0.06	
Merluccius capensis	213.84	1063	1.73	271
Trichiurus lepturus	58.44	1063	0.47	
Squalus megalops	50.46	265	0.41	
Trigla lyra	13.28	131	0.11	
Loligo vulgaris	11.94	131	0.10	
Dicologoglossa cuneata	3.99	530	0.03	
G A S T R O P O D S	2.65	131	0.02	
Total	12385.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 82
DATE :15.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°12.73
start stop duration Lon E 11°28.76
TIME :15:26:44 15:47:05 20.4 (min) Purpose : 3
LOG : 235.08 236.06 1.0 Region : 4050
FDEPTH: 148 152 Gear cond.: 0
BDEPTH: 148 152 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 2.9 kn
Sorted : 203 Total catch: 842.16 Catch/hour: 2481.81

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	787.66	15908	31.74	272
Dentex macrophthalmus	1027.90	12306	41.42	273
Zeus faber	104.20	283	4.20	
Zenopsis conchifer	9.43	47	0.38	
Synagrops microlepis	22.16	5092	0.89	
Pterothrissus belloci	21.69	330	0.87	
Squalus megalops	192.85	660	7.77	
Trichiurus lepturus	12.26	141	0.49	
Squilla mantis	5.19	141	0.21	
Helicolenus dactylopterus	10.37	566	0.42	
Chlorophthalmus atlanticus	2.83	424	0.11	
Merluccius capensis	175.40	896	7.07	274
GOBIIDAE	1.89	141	0.08	
Dicologoglossa cuneata	1.89	141	0.08	
Loligo vulgaris	27.82	94	1.12	
Alloteuthis africana	2.83	47	0.11	
Chelidonichthys capensis	75.44	141	3.04	
Total	2481.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 83
DATE :15.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°11.89
start stop duration Lon E 11°25.40
TIME :16:39:18 16:59:27 20.1 (min) Purpose : 3
LOG : 241.08 242.08 1.0 Region : 4050
FDEPTH: 171 174 Gear cond.: 0
BDEPTH: 171 174 Validity : 0
Towing dir: 0° Wire out : 420 m Speed : 3.0 kn
Sorted : 47 Total catch: 718.63 Catch/hour: 2140.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	483.37	2073	22.58	275
Zeus faber	38.28	191	1.79	
Trachurus capensis	1050.30	20908	49.06	276
Dentex macrophthalmus	210.06	2163	9.81	277
Trichiurus lepturus	8.85	98	0.41	
Helicolenus dactylopterus	20.97	885	0.98	
Saurida brasiliensis	11.80	3408	0.55	
Synagrops microlepis	31.79	7275	1.48	
Trigla lyra	39.32	295	1.84	
Pterothrissus belloci	19.33	197	0.90	
Squilla mantis	19.01	754	0.89	
Scomber japonicus	11.47	131	0.54	278
Atractoscion aequidens	3.69	3	0.17	
Squalus megalops	58.39	164	2.73	
Mustelus mustelus	28.75	12	1.34	
SCYLLARIDAE	1.31	197	0.06	
Zenopsis conchifer	70.13	328	3.28	
Macropipus australis	5.24	262	0.24	
Pegusa lascaris	13.11	1213	0.61	
Chlorophthalmus atlanticus	1.97	131	0.09	
Bembrops heterurus	4.26	131	0.20	
Malacocephalus occidentalis	4.26	197	0.20	
Illex coindetii	3.60	98	0.17	
Diastobranchus capensis	1.64	33	0.08	
Total	2140.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 84
DATE :15.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°13.36
start stop duration Lon E 11°21.46
TIME :21:11:53 21:42:14 30.3 (min) Purpose : 3
LOG : 261.33 262.82 1.5 Region : 4050
FDEPTH: 322 321 Gear cond.: 0
BDEPTH: 322 321 Validity : 0
Towing dir: 0° Wire out : 780 m Speed : 2.9 kn
Sorted : 413 Total catch: 413.42 Catch/hour: 817.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	5.06	67	0.62	279
Merluccius capensis	395.81	664	48.41	280
Galeus polli	15.52	182	1.90	
Helicolenus dactylopterus	51.91	3101	6.35	
Chlorophthalmus atlanticus	209.03	6589	25.57	
Garbage	0.00	4	0.00	
MYCTOPHIDAE	0.69	208	0.08	
Lophius vomerinus	12.76	6	1.56	
GOBIIDAE	1.66	360	0.20	
Nezumia aequalis	5.68	305	0.69	
Dentex macrophthalmus	2.69	8	0.33	281
Bathynectes piperitus	16.75	761	2.05	
Macropipus australis	3.60	152	0.44	
S H R I M P S	27.69	9773	3.39	
Pterothrissus belloci	12.74	69	1.56	
Malacocephalus occidentalis	8.03	305	0.98	
Munidopsis sp.	0.55	194	0.07	
Laemonema laureysi	34.61	1357	4.23	
Solenocera africana	0.55	97	0.07	
Parapenaeus longirostris, male	0.42	69	0.05	
Parapenaeus longirostris,femal	2.35	360	0.29	
Synagrops microlepis	0.42	28	0.05	
Pegusa lascaris	2.49	69	0.30	
Saurida brasiliensis	0.14	28	0.02	
B I V A L V E S	1.25	69	0.15	
RHINOCHIMAERIDAE	4.55	2	0.56	
Scyliorhinus cervigoni	0.63	2	0.08	
Total	817.57		100.00	

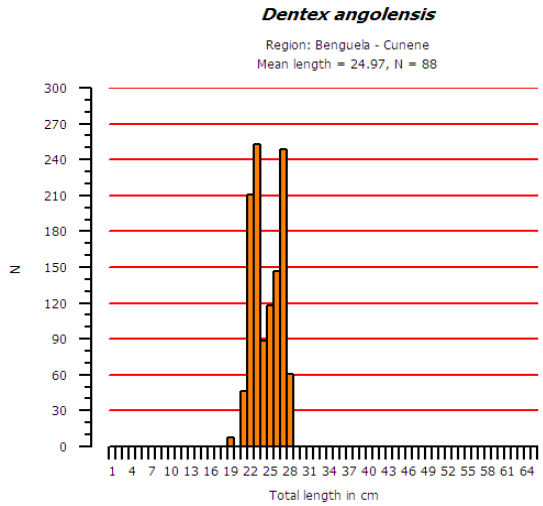
R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 85
DATE :16.08.2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°10.85
start stop duration Lon E 11°15.01
TIME :02:06:52 02:36:58 30.1 (min) Purpose : 3
LOG : 280.16 281.52 1.4 Region : 4050
FDEPTH: 732 729 Gear cond.: 0
BDEPTH: 732 729 Validity : 0
Towing dir: 0° Wire out : 1670 m Speed : 2.7 kn
Sorted : 129 Total catch: 1375.24 Catch/hour: 2741.34

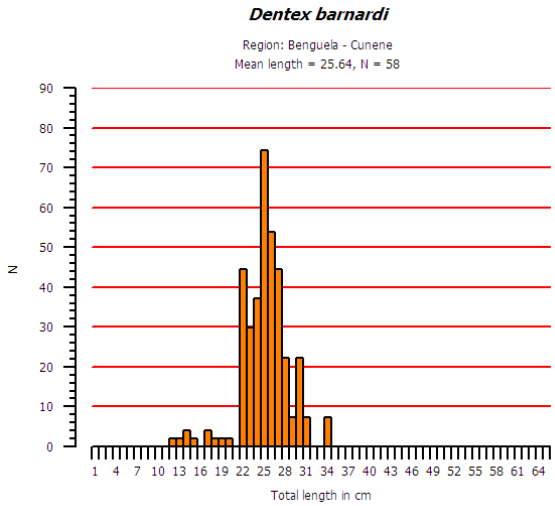
SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	373.59	419	13.63	282
Trachyrincus scabrus	393.69	1549	14.36	
Nezumia aequalis	441.63	14484	16.11	
Bathyuroconger vicinus	46.47	544	1.69	
Hoplostethus cadenati	25.32	1256	0.92	
Yarrella blackfordi	15.49	795	0.56	
Stomias boa boa	10.25	524	0.37	
Selachophidium guentheri	11.30	231	0.41	
Heterocarpus grimaldi	5.22	273	0.19	
Chaceon maritae, female	41.02	231	1.50	
Chaceon maritae, male	130.80	293	4.77	
Anemones, pink	40.39	126	1.47	
Bathynectes piperitus	1.26	22	0.05	
Notacanthus sexspinis	3.55	42	0.13	
Talismania sp.	65.92	1214	2.40	
Ebinania costaecanarie	19.67	42	0.72	
UNIDENTIFIED FISH	26.99	22	0.98	
SYNAPHOBRANCHIDAE	3.35	126	0.12	
Lamprogrammus exutus	7.73	64	0.28	
Paramola cuvieri	69.69	42	2.54	
HOMOLIDAE	3.35	22	0.12	
Caresproctus sp.	0.84	22	0.03	
Neocyttus sp.	3.55	42	0.13	
B I V A L V E S	0.62	22	0.02	
Anemones, white	7.73	22	0.28	
Triplophos hemingi	0.62	64	0.02	
UNIDENTIFIED FISH	6.28	1027	0.23	0
Aristeus varidens, female	22.39	1443	0.82	
Aristeus varidens, male	5.22	460	0.19	
Todarodes sp.	14.65	22	0.53	
RHINOCHIMAERIDAE	11.42	2	0.42	
Deania calcea	44.05	16	1.61	
Scymnodon squamulosus	8.69	30	0.32	
Apristurus sp.	5.82	16	0.21	
Raja sp.	129.77	22	4.73	
Raja confundens	743.02	148	27.10	
Total	2741.34		100.00	

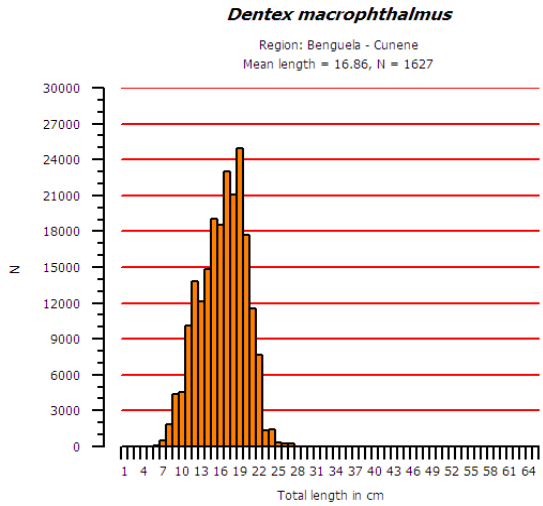
ANNEX II. Length distribution of main species

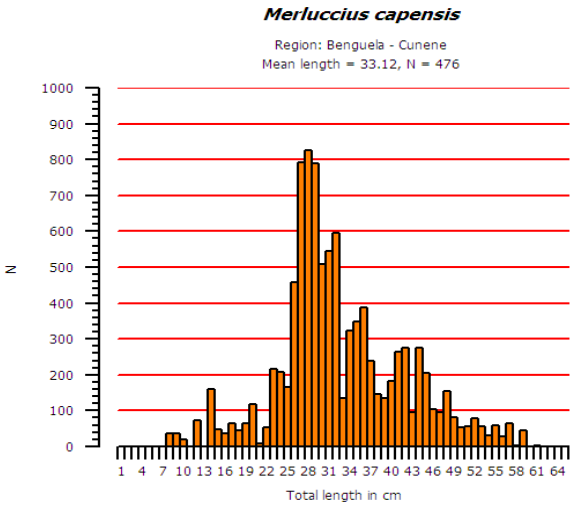
South Angola

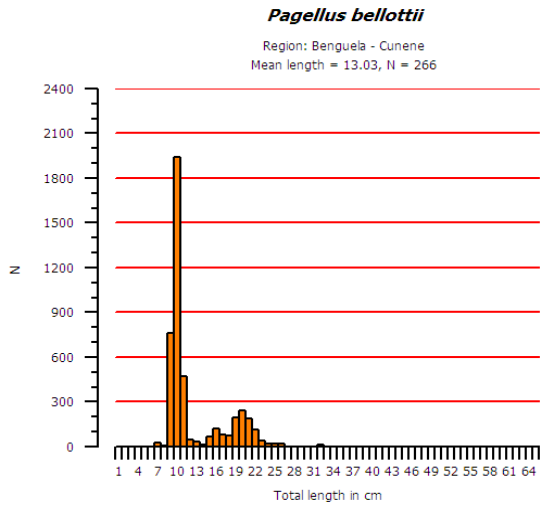
Pooled length frequency distribution of the main species weighted by the catch

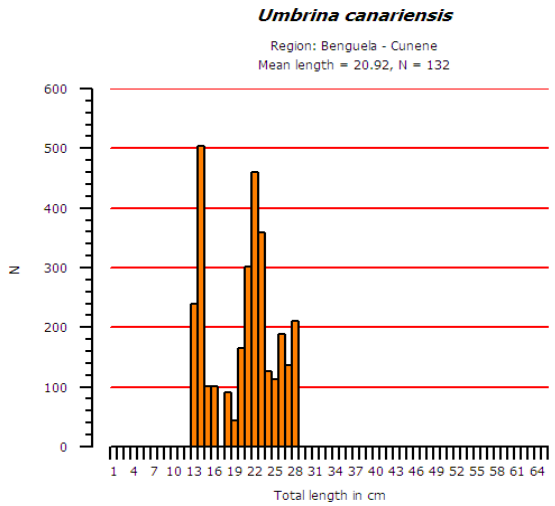












ANNEX III. Swept area estimates

Benguela – Cunene
A. Shelf 20 – 200 m

SPECIES NAME	SAMPLE DISTRIB. BY CATCH CLASSES Lower limits, Kg/nm						% incidence	Mean dens.	Mean densities by bottom depth strata t/nm²			
	>0	10	30	100	300	1000		t/nm²	0-30 m	30-50 m	50-100 m	100-200 m
Trachurus capensis	4	2	1	2	3	2	73.68	40.007	38.894	0.991	32.981	72.614
Sardinops ocellatus	2		1			2	26.32	33.422	156.025	2.499	0.186	
Trachurus trecae	2		6	4	4		84.21	18.802	19.669	25.479	32.382	2.457
Etrumeus whiteheadi	7	1	2	1	1	1	68.42	10.919	13.542	3.836	27.512	0.066
Dentex macrophthalmus	2	1	3	5	1		63.16	7.979		0.229	7.058	19.233
Engraulis encrasicolus	2		2		1		26.32	3.397	0.003	15.132	0.8	
Merluccius capensis	6	4	4	1			78.95	2.461	0.056	0.097	2.237	5.827
Chelidonichthys capensis	4	5	3				63.16	1.291	0.509	1.324	2.551	0.739
Squalus megalops	3	3	1				36.84	0.723			0.494	1.877
Loligo vulgaris	10	3	1				73.68	0.654	0.322	0.316	1.583	0.326
Pegusa lascaris	4	1	1				31.58	0.587	0.215	0.322	1.712	0.074
Zeus faber	5	2	1				42.11	0.41			0.132	1.187
Galeichthys sp.	3	1	1				26.32	0.356	0.394	0.964	0.261	0.004
Trichiurus lepturus	9	3					63.16	0.349	0.103	0.191	0.347	0.621
Starfish	2		1				15.79	0.3			1.14	0.001
Scomber japonicus	10	2					63.16	0.295	0.546	0.127	0.254	0.275
Callorhinchus capensis		1	1				10.53	0.267	0.409	0.857		
Atractoscion aequidens	7		1				42.11	0.235	0.029	0.097	0.719	0.061
Trigla lyra	4	2					31.58	0.207		0.228		0.503
Myliobatis aquila	1	2					15.79	0.205		0.46		0.343
Raja miraletus	6	1					36.84	0.175	0.14	0.533	0.011	0.095
Pagellus bellottii	6	1					36.84	0.173	0.122	0.481	0.103	0.059
J E L L Y F I S H	6						31.58	0.17	0.506	0.149	0.122	
Thyrsites atun	1	1					10.53	0.161		0.018	0.597	
Raja alba		1					5.26	0.15	0.712			
G A S T R O P O D S	3	1					21.05	0.146			0.536	0.015
Zenopsis conchifer	3	1					21.05	0.144				0.457
Holothuria spp.		1					5.26	0.142			0.539	
Mustelus mustelus	6						31.58	0.142	0.114		0.031	0.348
Synagrops microlepis	2	1					15.79	0.141			0.163	0.309
Pterothrissus belloci	6						31.58	0.138	0.004		0.036	0.406
B I V A L V E S	2	1					15.79	0.122			0.463	
Pomadasys jubelini		1					5.26	0.117		0.556		
Myliobatis sp.		1					5.26	0.104		0.492		
Sepia orbignyana	7						36.84	0.101	0.025	0.01	0.239	0.096
Dasyatis marmorata	1	1					10.53	0.086		0.408		
Umbrina canariensis	9						47.37	0.085	0.002	0.04	0.261	0.023
Argyrosomus hololepidotus		1					5.26	0.078		0.371		
Helicolenus dactylopterus	3						15.79	0.067				0.211
Squilla mantis	5						26.32	0.05	0.001		0.026	0.138
Sepia officinalis	2						10.53	0.043			0.164	
Illex coindetii	5						26.32	0.042		0.164		0.025
Pythonichthys microphthalmus	2						10.53	0.042			0.158	
Rhinobatos albomaculatus	1						5.26	0.039		0.185		
Stromateus fiatola	1						5.26	0.031	0.145			
Pomatomus saltatrix	2						10.53	0.022	0.045	0.059		
Sphyrna zygaena	1						5.26	0.021	0.102			
Saurida brasiliensis	1						5.26	0.021				0.067
Sphyrna lewini	1						5.26	0.02			0.076	
Bathynectes sp.	1						5.26	0.017			0.065	
Alloteuthis africana	4						21.05	0.017	0.01	0.023	0.018	0.016
Brotula barbata	4						21.05	0.015			0.055	0.002
Dicologoglossa cuneata	4						21.05	0.012			0.004	0.034

Chelidonichthyes capensis	1	5.26	0.012		0.056		
Lagocephalus laevigatus	2	10.53	0.01			0.034	0.005
GOBIIDAE	3	15.79	0.01			0.026	0.011
Penaeus notialis	1	5.26	0.002	0.01			
Other fish			0.144	0.158	0.099	0.146	0.163
Sum all species			125.876	232.811	56.793	116.219	108.689
Sum SNAPPERS, JOBFISHES							
Sum GROUPERS, SEABASSES							
Sum GRUNTS, SWEETLIPS			0.126	0.043	0.556		
Sum CROAKERS, DRUMS, WEAKF., KOBS			0.399	0.033	0.509	0.98	0.084
Sum PANDORAS, PORGIES, SEABREAMS,			8.174	0.129	0.727	7.221	19.298
Sum SHARKS, CHIMAERAS			1.173	0.625	0.857	0.6	2.225
Sum BATOID FISHES, RAYS			0.758	0.852	2.077	0.011	0.438
Sum CEPHALOPODS			0.857	0.357	0.512	2.005	0.464
Numbers of stations included in analysis, total and by depth strata			19	4	4	5	6

Benguela – Cunene
B. Slope 200 – 1000 m

SPECIES NAME	SAMPLE DISTRIB. BY CATCH CLASSES Lower limits, Kg/nm						% incidence	Mean dens.	Mean densities by bottom depth strata t/nm²			
	>0	10	30	100	300	1000		t/nm²	200-300 m	300-400 m	400-500 m	>500 m
Merluccius capensis			2	3			100	10.792		14.763		8.145
Raja confundens		1		1			40	5.762				9.603
Trachyrincus scabrus			2	1			60	4.782				7.971
Nezumia aequalis	2	1		1			80	3.604		0.329		5.788
Helicolenus dactylopterus	1	1		1			60	3.452		8.24		0.26
Chlorophthalmus atlanticus	2		1				60	1.614		4.032		0.002
Malacocephalus occidentalis	2		1				60	1.352		0.143		2.158
Aristeus varidens, female	2		1				60	1.131				1.886
Talismania sp.		1	1				40	1.101				1.836
Chaceon maritae, male			1				20	0.965				1.608
Raja sp.			1				20	0.957				1.596
Laemonema laureysi		2					40	0.628		1.569		
Paramola cuvieri	1	1					40	0.627				1.045
Ebinania costaecanarie	1	1					40	0.555				0.925
Deania calcea	2	1					60	0.533				0.889
Hoplostethus cadenati	3						60	0.494				0.823
Yarrella blackfordi	2	1					60	0.447				0.745
Geryon maritae		1					20	0.405				0.675
Bathyuroconger vicinus	2	1					60	0.402				0.67
Anemones, pink	3	1					80	0.395		0.01		0.652
Shrimps, small, non comm.		1					20	0.311				0.519
Chaceon maritae, female		1					20	0.303				0.504
Alepocephalus rostratus		1					20	0.29				0.483
S H R I M P S	2						40	0.276		0.691		
UNIDENTIFIED FISH	1						20	0.245				0.409
MELANOSTOMIATIDAE	1						20	0.182				0.303
Pterothrissus belloci	2						40	0.155		0.387		
Centrophorus squamosus	2						40	0.153				0.256
PORIFERA (Sponges)	1						20	0.15		0.375		
Bathynectes piperitus	2						40	0.123		0.284		0.015
Galeus polli	3						60	0.12		0.293		0.004
RHINOCHIMAERIDAE	2						40	0.115		0.077		0.14
Todarodes sp.	1						20	0.108				0.18
Selachophidium guentheri	2						40	0.107				0.179
Trachurus capensis	3						60	0.107		0.183		0.057
Lamprogrammus exutus	2						40	0.105				0.175
Lophius vomerinus	1						20	0.087		0.216		
Anemones, white	2						40	0.086				0.144
Stomias boa boa	1						20	0.076				0.126
Apristurus sp.	2						40	0.069				0.115
Dentex macrophthalmus	2						40	0.068		0.171		
Aristeus varidens, male	3						60	0.068				0.113
Scymnodon squamulosus	1						20	0.064				0.107
Stomias affinis	1						20	0.058				0.097
Chaceon maritae	1						20	0.053				0.089
Trigla lyra	1						20	0.051		0.128		
Lophiodes kempi	1						20	0.04				0.067
Heterocarpus grimaldi	1						20	0.039				0.064
Etmopterus pusillus	1						20	0.033				0.055
Centroscymnus crepidater	1						20	0.029				0.048
SYNAPHOBRANCHIDAE	2						40	0.029				0.048
Neocyttus sp.	1						20	0.026				0.044
Notacanthus sexspinis	1						20	0.026				0.044
HOMOLIDAE	1						20	0.025				0.041

Macropipus australis	1	20	0.024		0.061		
B I V A L V E S	3	60	0.024		0.049		0.008
Trachurus trecae	1	20	0.023				0.039
Plesiopenaeus edwardsianus	1	20	0.023				0.038
Raja alba	1	20	0.02				0.033
Diaphus effulgens	1	20	0.019				0.032
Dicologoglossa hexophthalma	1	20	0.017		0.043		
Pegusa lascaris	1	20	0.017		0.042		
OCTOPOTEUTHIDAE	2	40	0.017				0.028
Parapenaeus longirostris,femal	1	20	0.016		0.04		
DICERATIIDAE	1	20	0.014				0.023
Holothuria spp.	1	20	0.012		0.031		
GOBIIDAE	1	20	0.011		0.028		
Solenocera africana	1	20	0.004		0.009		
Parapenaeus longirostris, male	1	20	0.003		0.007		
Other fish			0.113	0	0.148	0	0.089
Sum all species			44.133	0	32.35	0	51.989
Sum SNAPPERS, JOBFISHES							
Sum GROUPERS, SEABASSES							
Sum GRUNTS, SWEETLIPS							
Sum CROAKERS, DRUMS, WEAKF., KOBS							
Sum PANDORAS, PORGIES, SEABREAMS,			0.068		0.171		
Sum SHARKS, CHIMAERAS			1.134		0.393		1.628
Sum BATOID FISHES, RAYS			6.739				11.231
Sum CEPHALOPODS			0.133		0.02		0.208
Numbers of stations included in analysis, total and by depth strata			5	0	2	0	3

ANNEX IV. Station allocation by survey and depth strata

Table 1 – Numbers of valid bottom trawl stations by depth strata. Angolan demersal surveys 1985-2011.

	1985.1	1985.2	1985.3	1985.4	1986.1	1986.2	1989.1	1989.2	1989.3	1991.1	1991.2	1992	1993	1994	1995.1	1995.2	1996	1997.1	1997.2	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
OUTSIDE	11	13	13	11	28	24	31	23	10	30	56	55	1	17	16	0	5	1	62	0	0	1	0	0	1	0	3	0	1	0	0	0	0
20-50south	0	2	0	0	6	3	5	2	3	6	2	4	3	0	0	0	0	0	0	0	0	8	0	2	4	8	7	8	5	6	9	8	8
50-100south	0	1	0	0	8	6	8	8	1	14	12	20	11	0	0	0	0	0	4	0	0	9	0	5	7	7	5	5	8	8	6	6	5
100-200south	0	0	0	0	8	3	9	8	6	10	12	7	9	0	0	0	0	0	6	0	0	7	0	3	7	5	7	7	7	7	7	7	6
200-300south	0	0	0	0	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0
300-400south	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	0	0	0	1	0	0	1	0	1	2	2	1	1	1	2	2	2	2
400-500south	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
500-600south	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
600-700south	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	3	1	2	2	1	1	1	1
700-800south	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	2	2	2	2
20-50central	0	0	0	3	8	11	17	24	5	17	13	15	0	9	14	0	10	6	1	9	14	23	12	16	16	17	16	16	15	17	16	16	11
50-100central	0	0	0	4	15	14	21	29	4	26	13	16	0	12	13	0	12	9	10	17	19	27	18	18	19	18	20	18	20	18	18	18	15
100-200central	0	0	0	2	2	4	13	11	3	15	10	12	0	14	15	12	12	8	13	12	14	22	16	15	13	14	14	16	15	14	14	13	9
200-300central	0	0	0	4	3	1	4	3	3	10	6	8	0	8	9	21	9	7	11	8	8	12	4	2	3	2	6	3	2	2	1	2	2
300-400central	0	0	0	2	4	1	0	7	1	7	3	9	0	9	11	15	10	7	1	6	6	10	4	6	4	6	6	6	6	6	6	6	3
400-500central	0	0	0	4	5	0	3	4	3	6	3	7	0	8	9	18	9	7	0	4	6	8	6	2	3	3	4	3	2	3	3	3	2
500-600central	0	0	0	1	2	0	1	2	4	1	0	9	0	5	7	14	8	7	0	7	5	9	3	5	3	3	5	4	5	4	4	4	4
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20-50north	5	4	7	6	14	13	3	14	3	7	8	12	0	9	9	0	9	8	0	0	14	11	11	16	13	15	14	14	17	17	17	19	13
50-100north	9	8	7	7	25	28	19	33	14	20	19	17	0	9	12	0	12	10	4	0	24	24	14	23	20	24	20	18	21	19	20	20	18
100-200north	5	5	3	6	5	20	6	6	4	11	12	10	0	11	11	0	12	11	8	0	29	24	18	23	20	21	21	17	23	23	20	19	17
200-300north	1	0	1	5	5	6	8	6	4	4	14	9	0	8	7	0	10	9	3	0	12	11	7	7	7	8	7	6	7	7	7	5	7
300-400north	0	0	5	6	15	4	2	4	4	6	6	5	0	9	8	0	9	8	2	0	12	10	11	6	6	6	6	5	5	4	5	6	4
400-500north	0	0	1	2	3	6	5	4	4	6	2	6	0	6	4	0	8	7	0	0	7	8	5	6	6	6	6	5	6	6	6	6	6
500-600north	0	0	3	3	3	3	3	6	0	1	0	5	0	5	5	0	10	8	0	0	6	7	8	6	6	6	7	4	6	6	7	5	6
600-700north	0	0	0	0	0	1	0	0	1	0	0	3	0	2	3	0	0	0	0	0	1	7	5	6	6	7	8	4	8	6	6	5	4
700-800north	0	0	0	0	0	0	1	0	0	0	0	4	0	3	2	0	5	5	0	0	0	8	3	9	9	8	9	7	6	7	7	8	6
TOTAL	31	33	40	66	161	148	159	194	77	200	193	245	24	147	162	91	157	118	126	71	178	264	152	186	185	200	208	179	198	193	191	188	155

ANNEX V. Instruments and fishing gear used

The Simrad ER-60/18, 38, 120 and 200 kHz 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 last calibrations took place 07.03.2010, Baia dos Elefantes. The details of the settings of the 38 kHz echo sounder where as follows:

Transceiver-2 menu (38 kHz)

Transducer depth	5.50 m
Absorption coefficient	8.7 dB/km
Pulse length	medium (1,024ms)
Bandwidth	2.43 kHz
Max power	2000 Watt
2-way beam angle	-20,6dB
Gain	25.38 dB
SA correction	-0.48 dB
Angle sensitivity	21.9
3 dB beam width	7.12º along ship
	7.24º athwart ship
Along ship offset	0.17º
Athwart ship offset	0.05º

Bottom detection menu

Minimum level	-45 dB

Fishing gear

The vessel has two different sized "Åkrahamn" pelagic trawls and one "Gisund super bottom trawl". Trawls were used for identification of acoustic targets only.

The bottom trawl has a headline of 31 m, footrope 47 m and 20 mm mesh size in the cod end with an inner net of 10 mm mesh size. 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 equipped with a 12" rubber bobbins gear. New doors are 'Thyborøn' combi type, 7.41 m^2, 1720 kg. These have been in use onboard since 19.02.08.

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. A catch sensor on the cod-end indicated the size of the catch.

ANNEX VI. Equations

1. Biomass estimates

The stratified estimator of mean density in the entire area is calculated as (Cochran, 1977)

$$\bar{y}_{st} = \sum_{i=1}^{L} W_i \bar{y}_i , \tag{1}$$

where

L is the number of strata,

$W_i = \frac{area_i}{total\ area}$ is the proportion of the i^{th} stratum of the total survey area,

$\bar{y}_i = \frac{\sum_{k=1}^{n_i} y_{i,k}}{n_i}$ is the average density in the i^{th} stratum

$y_{i,k}$ is the density [tonnes/NM^2] by the k^{th} tow in stratum i

n_i is the number of tows in the i^{th} stratum.

The total biomass in the area is calculated by

$$B = \bar{y}_{st} \cdot total\ area \tag{2}$$

The estimated variance of the biomass (var(biomass)) was calculated by:

$$\text{var}(biomass) = \left(\sum \frac{W_i^2 s_i^2}{n_i} \right) A^2 \tag{3}$$

where

$s_i^2 = \frac{\sum_{k=1}^{n_i} (y_{i,k} - \bar{y}_i)^2}{n_i - 1}$, and A is total area

The standard error (SE) of the stratified mean was calculated as (Cochran 1977):

$$SE = \sqrt{\text{var}(biomass)} \tag{4}$$

The precision for the estimates (CV) was calculated by (Zar 1999[2]):

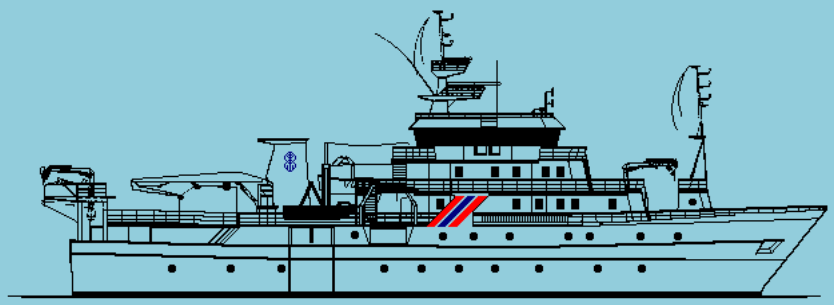
$$CV = \frac{SE}{biomass} \tag{5}$$

If the sample size is "large" enough, then the Central Limit Theorem states that each time a survey is conducted there is a 95% chance that the true mean is in the interval (see Cochran[3], 1977)

$$biomass \pm t_{(n-1)} SE \tag{6}$$

where *t* is from Students t-table with (n-1) degrees of freedom and $\alpha = 0.025$.

[2] Zar JH, 1999, Biostatistical analysis. Prentice Hall, New Jersey, 4. ed., 663 pp.
[3] Cochran, W.G.1977. Sampling Techniques, 3rd ed. John Wiley and Sons, N.Y. 228 pp.

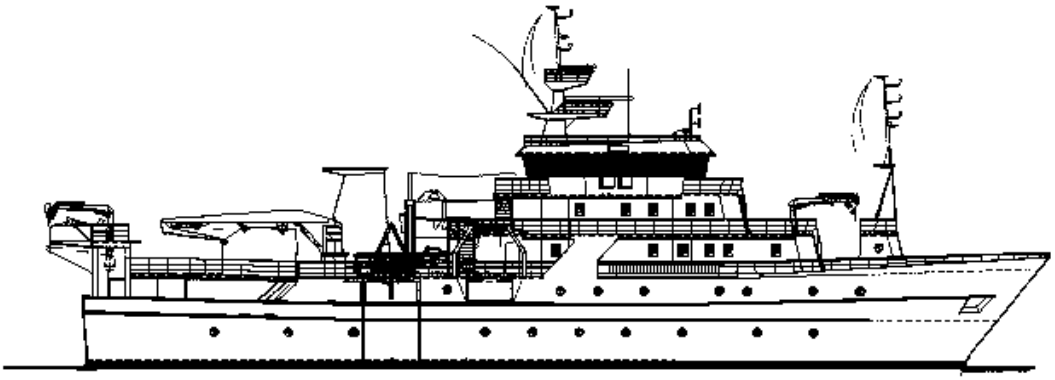


SURVEYS OF THE FISH RESOURCES OF ANGOLA

Survey of the pelagic resources
July 18th – August 28th 2011

Institute of Marine Research
IMR
Bergen

Instituto Nacional de Investigação Pesqueira
INIP
Luanda



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THE EAF-NANSEN PROJECT

FAO started the implementation of the project "Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries (EAF-Nansen GCP/INT/003/NOR)" in December 2006 with funding from the Norwegian Agency for Development Cooperation (NORAD). The EAF-Nansen project is a follow-up to earlier projects/programmes in a partnership involving FAO, NORAD and the Institute of Marine Research (IMR), Bergen, Norway on assessment and management of marine fishery resources in developing countries. The project works in partnership with governments and also GEF-supported Large Marine Ecosystem (LME) projects and other projects that have the potential to contribute to some components of the EAF-Nansen project.

The programme has previously conducted the following demersal surveys in the area:

January 1985	-	June 1986	(6 surveys)
January 1989	-	December 1989	(3 surveys)
May 1991	-	September 1992	(3 surveys)
January 1994	-	July 2011	(20 surveys)

SURVEYS OF THE FISH RESOURCES OF ANGOLA

Survey of the pelagic resources
18 July – 28 August 2011

by

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Nansen Report EAF-N2011/8a

Bergen, 2011

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CHAPTER 1 INTRODUCTION

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 the Total Allowable Catch's recommendation (TAC).

The specific objectives of the survey were the following:

- To estimate the abundance and 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* as well as other clupeid and carangid species.

- To collect biological information of target species: *T. trecae, T. capensis, S. aurita, S. maderensis, Sardinops ocellata, Decapterus rhonchus, Selene dorsalis, Chloroscombrus chrysurus* as well as *Brachideuterus auritus*.

- To collect stomachs and otoliths from both sardinellas species for analyses of diet composition and length-age relationships.

- To collect otoliths from both horse mackerel species for length at age relationships.

- To collect depth stratified samples of zoo and phytoplankton in order to continue the studies on feeding biology, relating stomach contents to estimated zooplankton composition and densities.

- 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.

- To collect seal scats from the breeding fur seal colonies (with pups) in the Tiger Bay area in order to study their diet composition as basis for subsequent evaluations of their impact on the fish communities in the region.

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

1.2 Participation

The scientific staff consisted of:

From INIP, Angola:
18.07-28.08: António BARRADAS (Co-cruise leader, Angola), Henriette Lutuba NSILULU, Fátima DELICADO, Eusébio dos SANTOS, Pedro PANZO and Aristóteles AMARO,

28.07-28.08: António BARRADAS (Co-cruise leader, Angola), Henriette Lutuba NSILULU, Fátima DELICADO, Eusébio dos SANTOS, Pedro PANZO, Domingos PEDRO, Bomba BAZIKA and Geraldina SALVADOR.

From BBC:
04.08-28.08: Hilkka NDJAULA (Co-cruise leader, Namibia)

From NatMIRC-Namibia:
04.08-28.08: Ipeinge Etuwete MUNDJULU and Justine SHITHINDI.

From IMR, Norway:
04.08-28.08: Diana ZAERA (Cruise leader), Inês Dias BERNARDES, Tore MØRK and Kåre TVEIT

1.3 Narrative

The vessel departed Pointe Noire on the 19th of July at 21:00 UTC and steamed towards Congo River, where the survey started with the first monitoring line off Moita Seca (Congo River) on the 20th of July at 08:55 UTC. The survey area has been divided into three regions:

(a) Congo River - North of Pta. das Palmerinhas (6°00'- 9°00'S): ANGOLA NORTH,
(b) The region between Pta. das Palmerinhas (9°00'S) and 13°00'S: ANGOLA CENTRAL,
(c) The region between 13°00'S and Cunene River (17°15'S): ANGOLA SOUTH.

The northern region was completed on the 27th of July (23:30 UTC) with the monitoring line off Pta. das Palmerinhas. The vessel steamed to Luanda to exchange local scientists. The survey restarted on the 29th of July (15:00 UTC). The coverage of the central region started the same day at 18:00 (UTC) and was completed on the 7th of August. The coverage of the Southern region was completed on the 16th of August.

The calibration of the Simrad ER 60 Scientific echo sounder (18, 38, 120, 200 kHz transducers) was done in Baía dos Elephantes on August 7th.

A systematic survey track, implemented in 2002, consisting of pseudo-parallel acoustic transect lines perpendicular to the coast line with equally spaced transect lines (6 nautical miles, NM, apart) 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 since 2009. The oil exploitation in the northern region has been rapidly expanding in the last years affecting both the length and track of some of the original acoustic lines.

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), 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)
Congo River - Pta. Palmerinhas	8	10	18	62	39	1556.94
Pta. Palmerinhas - Benguela	6	13	19	86	37	1377.07
Benguela - Cunene River	8	14	22	118	37	1341.85
Total	22	37	59	266	113	4275.86

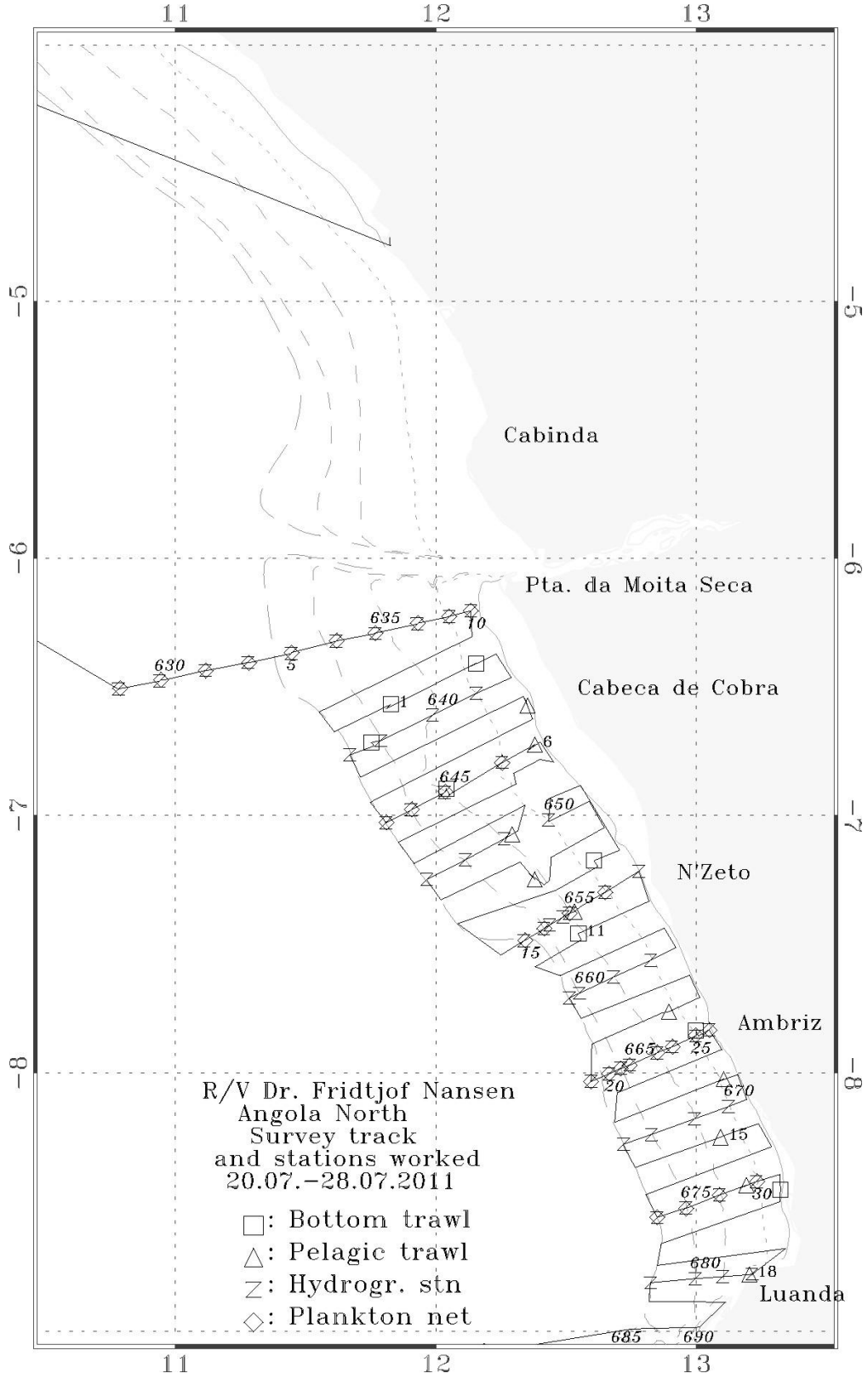


Figure 1a. Course track with fishing, plankton and hydrographical stations, Congo River - Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200, and 500m.

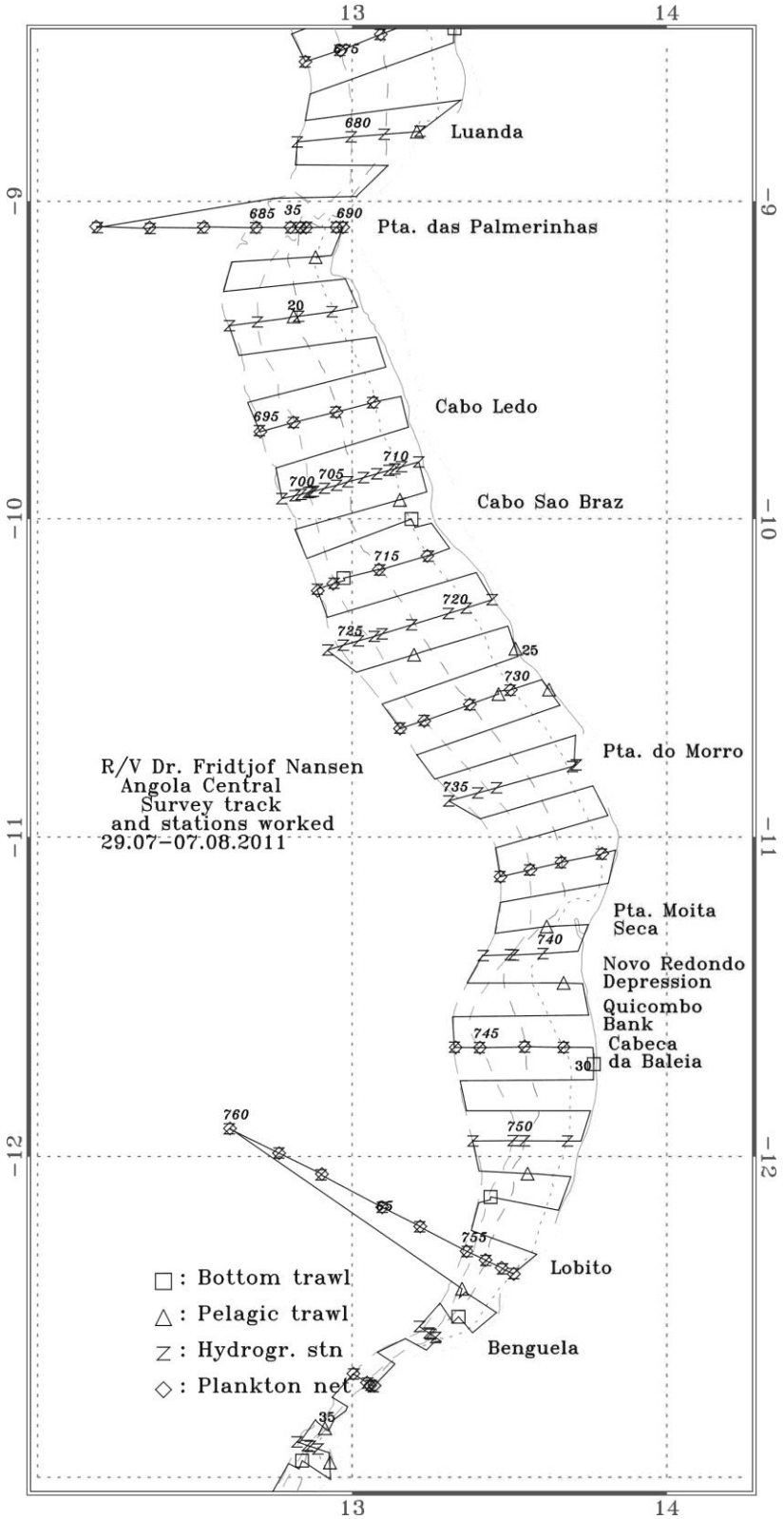


Figure 1b. Course track with fishing, plankton and hydrographical stations, Pta. das Palmerinhas - Benguela. Depth contours at 20, 50, 100, 200, and 500m.

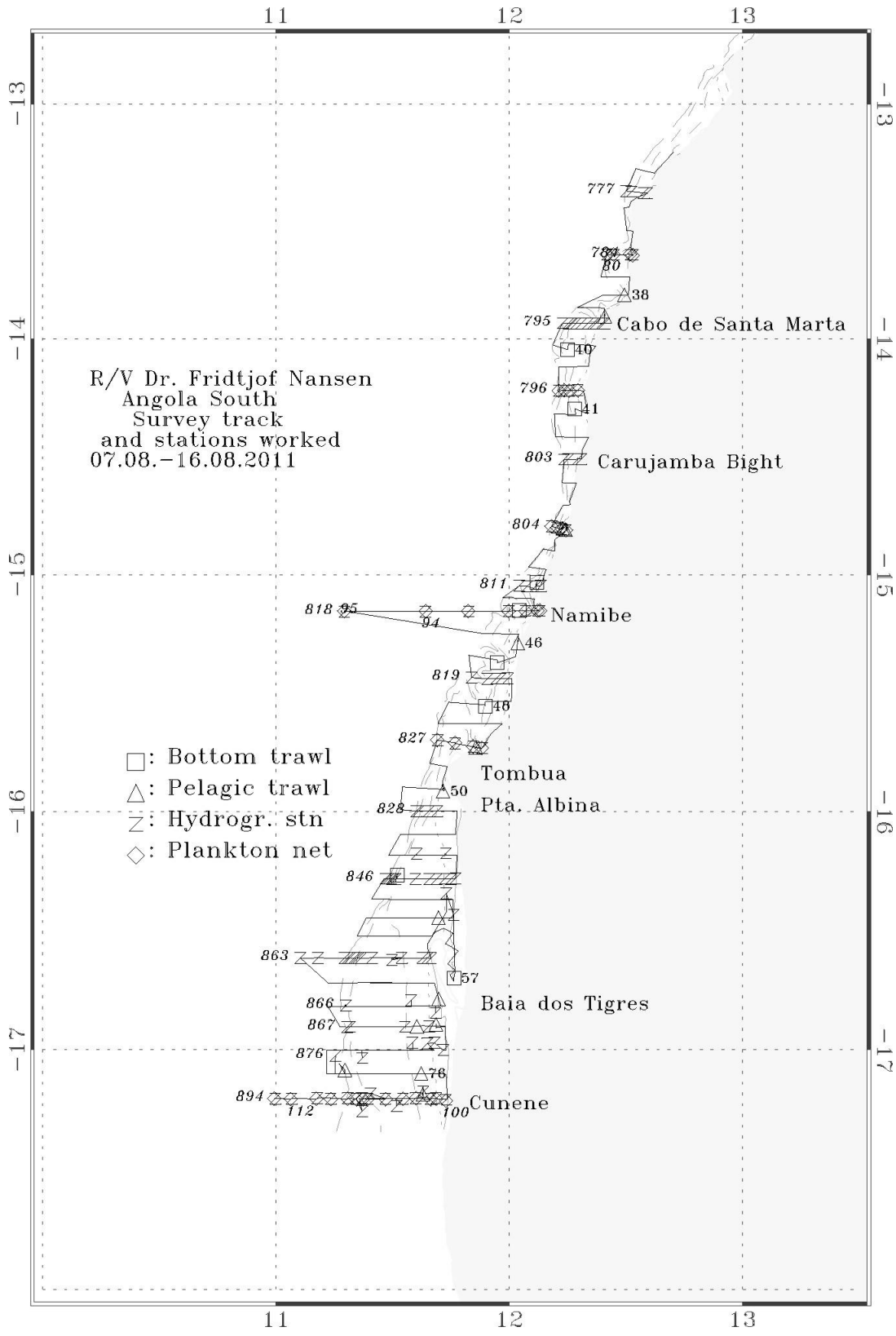


Figure 1c. Course track with fishing, plankton and hydrographical stations, Benguela - Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 m.

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 at standard INIP transects and monitoring lines. 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 every third cruise track between the standard transects and monitoring lines at bottom depths of 50, 100, 200 and 500 m.

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

Attached to the CTD was a Chelsea fluorometer of the type Mk III Aquatrack. It measures chlorophyll A (measured in microgram per litre, µg l^{-1}) 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 to obtain samples of sea surface salinity, relative temperature and fluorescence (5 m depth) every 10 sec. An attached in-line Turner Design SCUFA Fluorometer was continuously measuring Chlorophyll levels, in relative fluorescence units [RFU], 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 run continuously during the survey in broadband mode in waters shallower than about 400 m, and in narrow band mode in deeper waters. The frequency of the VMADCP is 150kHz, data were averaged and stored in 3m 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) 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 IV. 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 spp.* Annex II).

Biological samples were obtained for the different species of sardinella (*Sardinella aurita* and *S. maderensis*), the different species of horse mackerel (*T. trecae* and *T. capensis*), *Sardinops ocellatus*, *Decapterus rhonchus*, *Selene dorsalis*, *Brachideuterus auritus* and *Chloroscombrus chrysurus*. Total length (TL) and body weight were determined to the nearest 1 cm and 1 g bellow, respectively. 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. Maturity scale adapted by INIP to determine maturity stages for both horse mackerel and sardinella (partial spawners) in Angola.

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). Gonads in rest/recovery stage, more flaccid with some more conspicuous blood than gonads in development.
III	Mature. Before pre-spawning	At the beginning, oocytes more conspicuous giving the gonad a granular aspect. Ovary yellow-orange, testis creamy. Visible sperm in testis if open. Gonads quite swollen at the beginning of the reproduction period. Gonads that have spawned once lose consistency, but opaque oocytes are present, and sperm in testis if cut. At the end of the stage it 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 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. Pink 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 sardinellas were collected for further analysis at INIP, Luanda. Feeding biology will be investigated in more detail at a later stage by relating the stomach contents to recorded availability of zooplankton. In addition otoliths and genetic samples were collected from horse mackerel and both sardinellas.

2.3 Plankton sampling

Phytoplankton

Phytoplankton samples were collected along on monitoring lines and on every third acoustic line using CTD bottles at 5, 15, 25, 50 and 75 meter depths.

Zooplankton

The zooplankton sampling was conducted by means of a HYDROBIOS Multinet (180 µm) at five depths intervals, 0-25, 25-50, 50-75, 75-100 and 100-200 m along the monitoring lines (off Congo River, Pta. das Palmerinhas, Lobito, Namibe and Cunene River) and on every sixth acoustic line. Data from the flow meter were recorded electronically from the Multinet 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 echo sounder equipped with keel-mounted transducers at nominal operating frequencies of 18, 38, 120 and 200 kHz. The survey was started without *a priori* calibration. All transceivers were calibrated in Baía dos Elephantes the 07 of August.

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 echo sounder used during the survey are given in Annex IV.

Allocation of acoustic energy to species group

The acoustic data were scrutinized using the LSSS version 1. 25. Scatters were displayed at 38 kHz. The mean 5 nautical miles (NM) area backscattering coefficient s_A (m^2/NM^2) was allocated to a predefined set of groups of species based on established echogram features. Acoustic groups and its 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).

No specific target strength relations are presently available for the studied species, 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 regression of 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 Nansis Maptool Version 1.51. 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

Sea surface temperature (SST, 5m depth), sea surface salinity (SSS, 5m depth), sea surface oxygen (SSO, 5m depth), sea surface fluorescence (SSF, 5m depth) together with wind strength and direction, were continuously recorded.

Northern region

The wind observed in this region during the survey was variable, both in intensity and direction, with an average velocity of around 8 m/s (15 knots, Figure 2a). In the area around the Congo River (Pta. de Moita Seca) winds were predominantly southwards and with increasing velocity offshore. Further south, between N'Zeto and north of Luanda, wind velocity varied from calm areas (2 - 3m/s) to moderate windy areas (up to almost 6m/s). Although the direction varied along the area surveyed, it generally came from the south.

This year colder temperatures were recorded in the region (Figure 3a), with values between 21°C (off Luanda) and 23° C (off Congo River's mouth). Colder waters were found closer to the coast increasing offshore. A pocket of colder waters was found off N'Zeto (<19°C) probably due to the presence of upwelling in this area. The influence of the wind can be shown in the shape of the isolines.

Salinity values (Figure 3a) along the surveyed area decreased towards the south, with a maximum between south off Congo River and south of Luanda (35.8).The influence of the Congo River is less obvious inshore than in previous years. This could be probably attributed to the circulation pattern of Congo River's plume and to the fact that the river's discharge was reduced compared with previous years.

Oxygen values (Figure 3a) ranged between 4 and 5 ml/l in most of the area surveyed, with the higher values in the northern decreasing towards the south. Pockets of lower oxygen values were recorded around N'Zeto (≤ 3 ml/l) and off Luanda (3.5 ml/l).

Fluorescence (Figure 3a) showed no gradient throughout the region and the highest value registered was 1.39 µg/l near Ambriz.

Central Region

In this region the wind was very variable both in strength and direction (Figure 2b) with dominance of southerly winds. The strongest winds were mainly registered between Cabo Ledo and Cabo São Braz; while the weakest winds occurred in the vicinity around the Ponta do Morro and north off Lobito.

The spatial distribution of temperature in this region showed colder temperatures than last year (Figure 3b). Near shore temperatures had lower values (around 19°C) increasing offshore (maximum recorded of 21°C). Both, in the southern and northern end of this region coastal temperature values were lower (19°C) than in the middle central zone (20°C). The isothermal run more or less parallel to coast,

suggesting that an upwelling is taking place along the continental shelf except in the vicinity of south off Ponta do Morro and Lobito-Benguela areas.

The salinity values were of 35.8 for most of the coastal water (Figure 3b), with two small pocket of lower salinity (35.6) south of Cabo Ledo inshore and Palmerinhas offshore (35.6). Discharges from the Kwanza River (south of Pta. das Palmerinhas) may have influenced these values. Salinity values decreased towards the coast.

The intrusion of a tongue of warm (20ºC) and saline waters (≥35.8) closer the Benguela town (Fig.3b) can be associated to the strong wind drift observed in the southern part of this region and by the presence of weak winds in the vicinity of the Lobito coastal zone.

Oxygen values were in the range of 3.5 to ≥4.5 ml/l for most of the area (Figure 3b), being lowest (1.6 ml/l) around Ponta do Morro.

The values of fluorescence varied along the central region (Figure 3b) ranging between 0.4 and 1.2µg/l. The highest values were found south of Cabo Ledo (1.2µg/l) and in the area between south of Pta. do Morro and Lobito (1.0µg/l).

Southern Region

Southerly winds predominated in this area, although in the extreme north of the region and south of Pta. Albina, wind direction was variable. It is also in this last areas were winds were weaker, while the strongest winds (around 30 knots) were registered around Baía dos Tigre and Cunene River (Figure 2c).

Three focus of zonal surface warm-water-rich-in-oxygen (≥19°C and 4 ml/l respectively) transport were observed, each one apparently associated with weak wind occurrence: Baía dos Elefantes, Namibe and Ponta Albina. The lowest temperature (15°C) and salinity (35.4) values were observed around Cunene River, which could be a consequence of the outflows of the river. The temperature, salinity and oxygen surface distributions indicate that the Angola – Benguela Front was located between Baía dos Tigres and Cunene River.

An average of fluorescence value of 0.3µg/l was observed in the whole region, although off Namibe (Figure 3c) it was found a high fluorescence concentration (0.5µg/l).

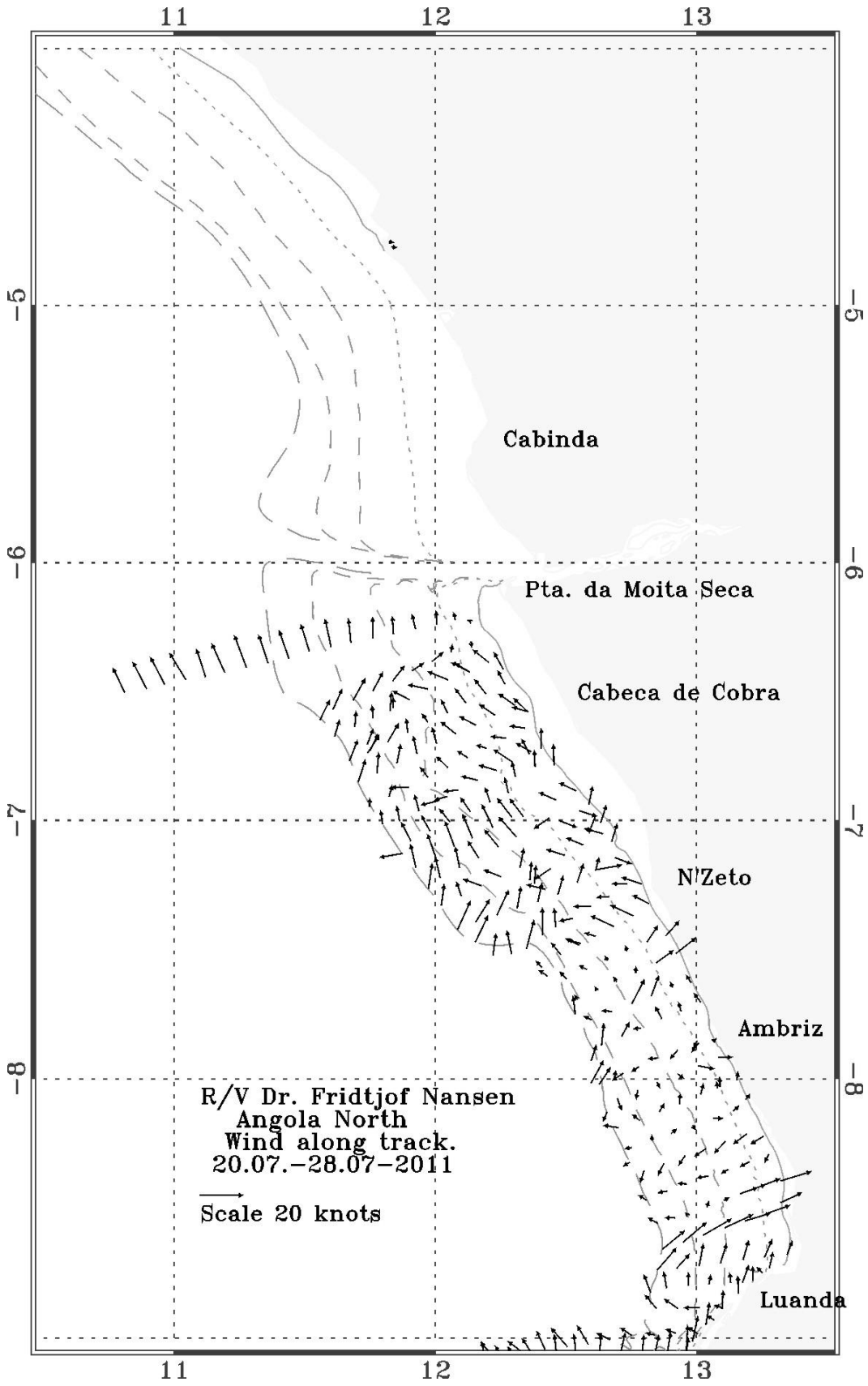


Figure 2a. Distribution of wind velocities along the survey track for the northern region. Depth contours at 20, 50, 100, 200, and 500m.

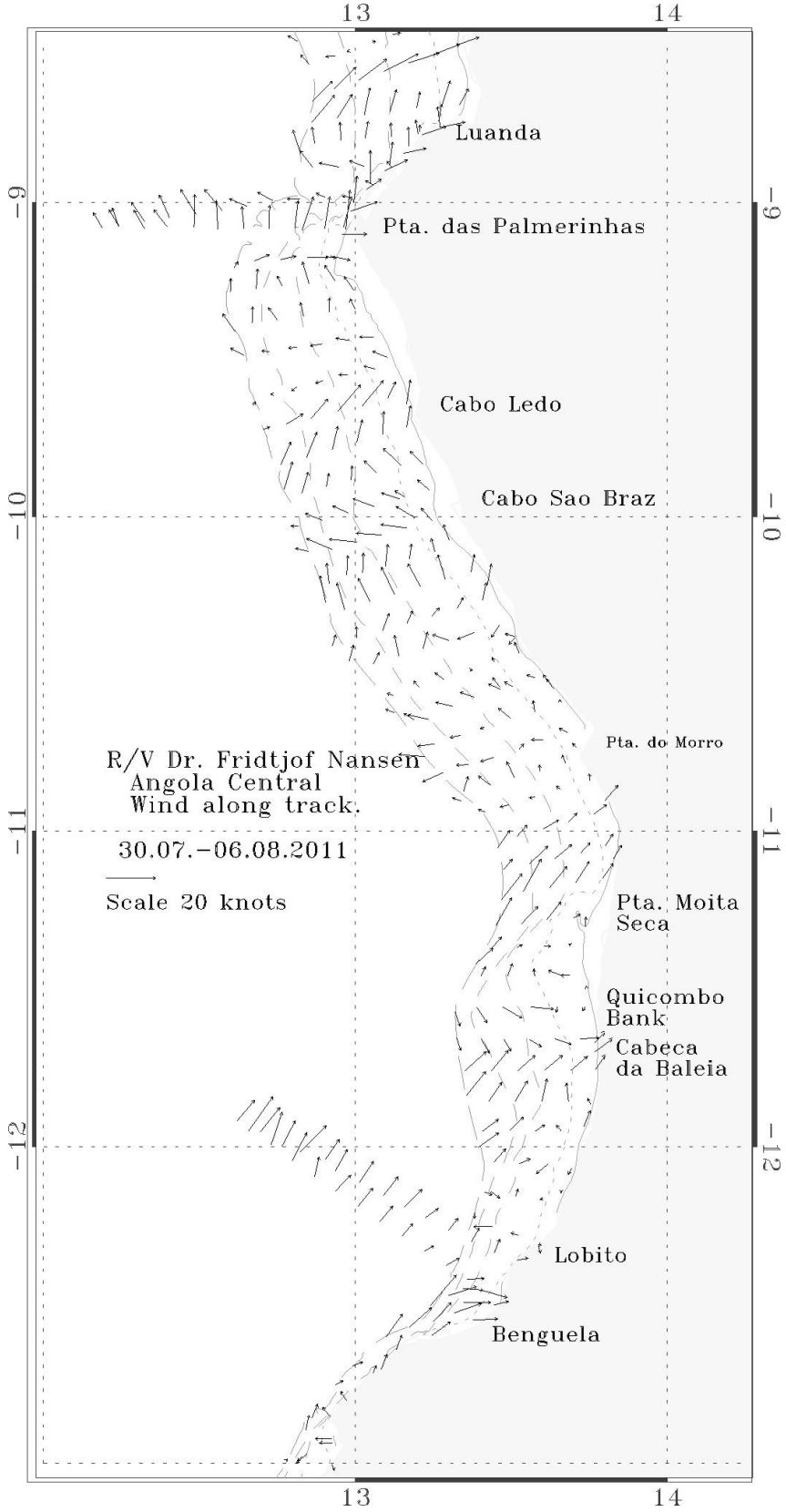


Figure 2b. Distribution of wind velocities along the survey track for the central region. Depth contours at 20, 50, 100, 200, and 500m.

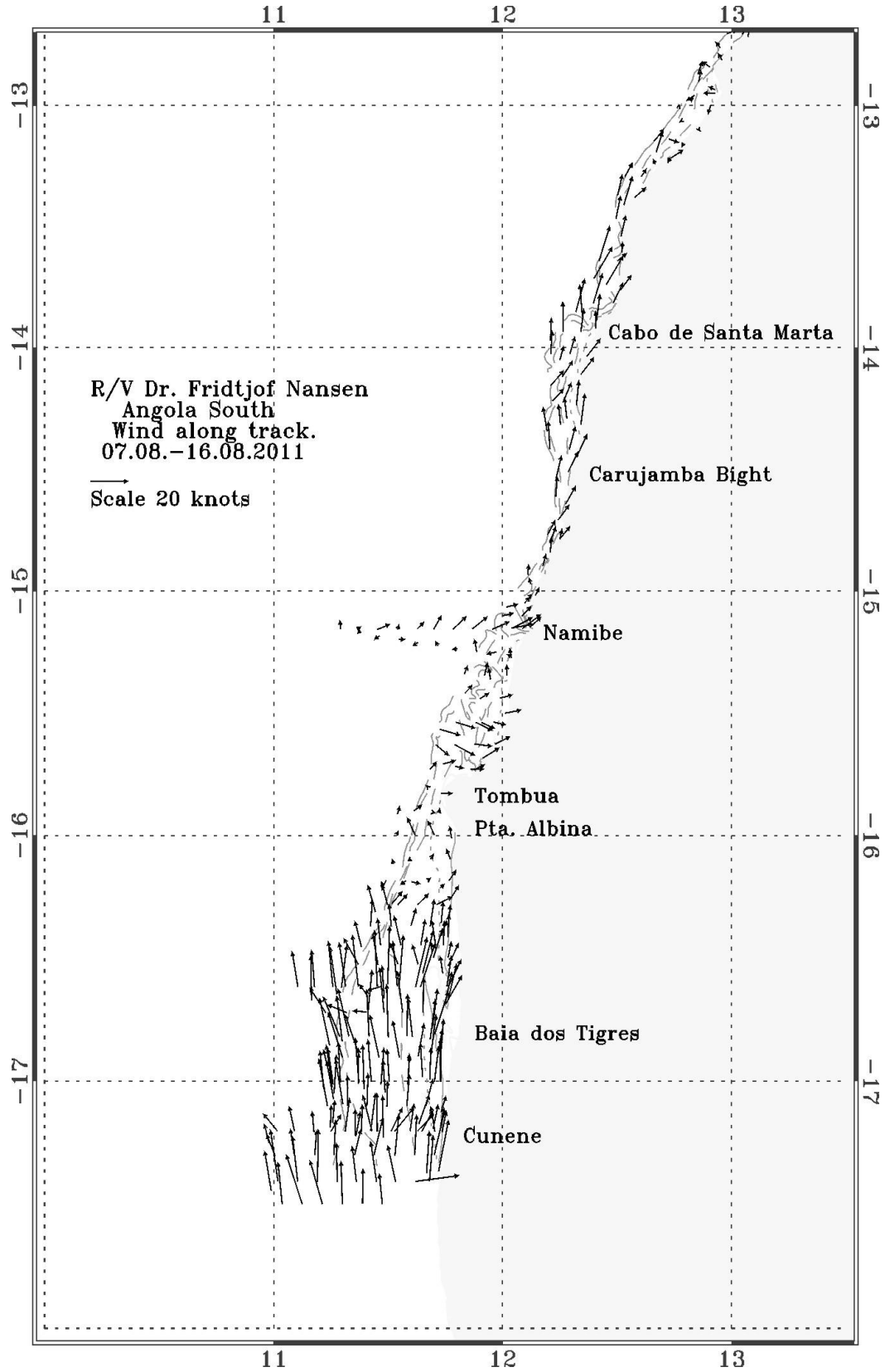


Figure 2c. Distribution of wind velocities along the survey track for the southern region. Depth contours at 10, 20, 50, 100, 200 and 500 m.

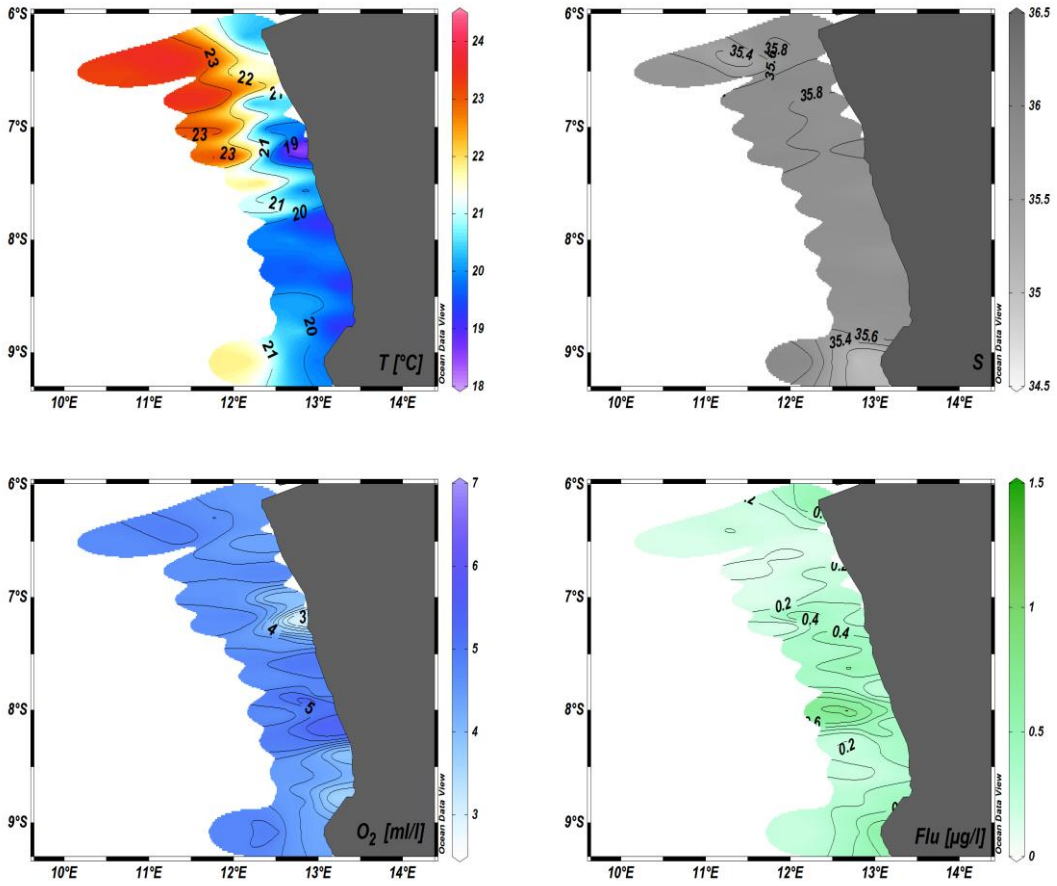


Figure 3a. Surface distribution of water temperatures, salinity, oxygen and fluorescence at 5m depth in the northern region.

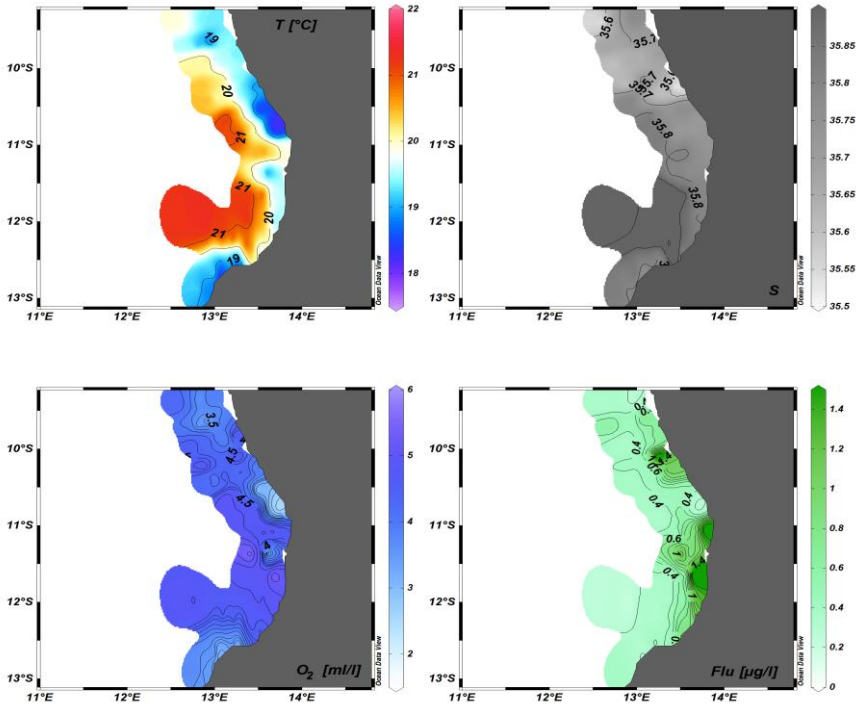


Figure 3b. Surface distribution of water temperatures, salinity, oxygen and fluorescence at 5m depth in the central region.

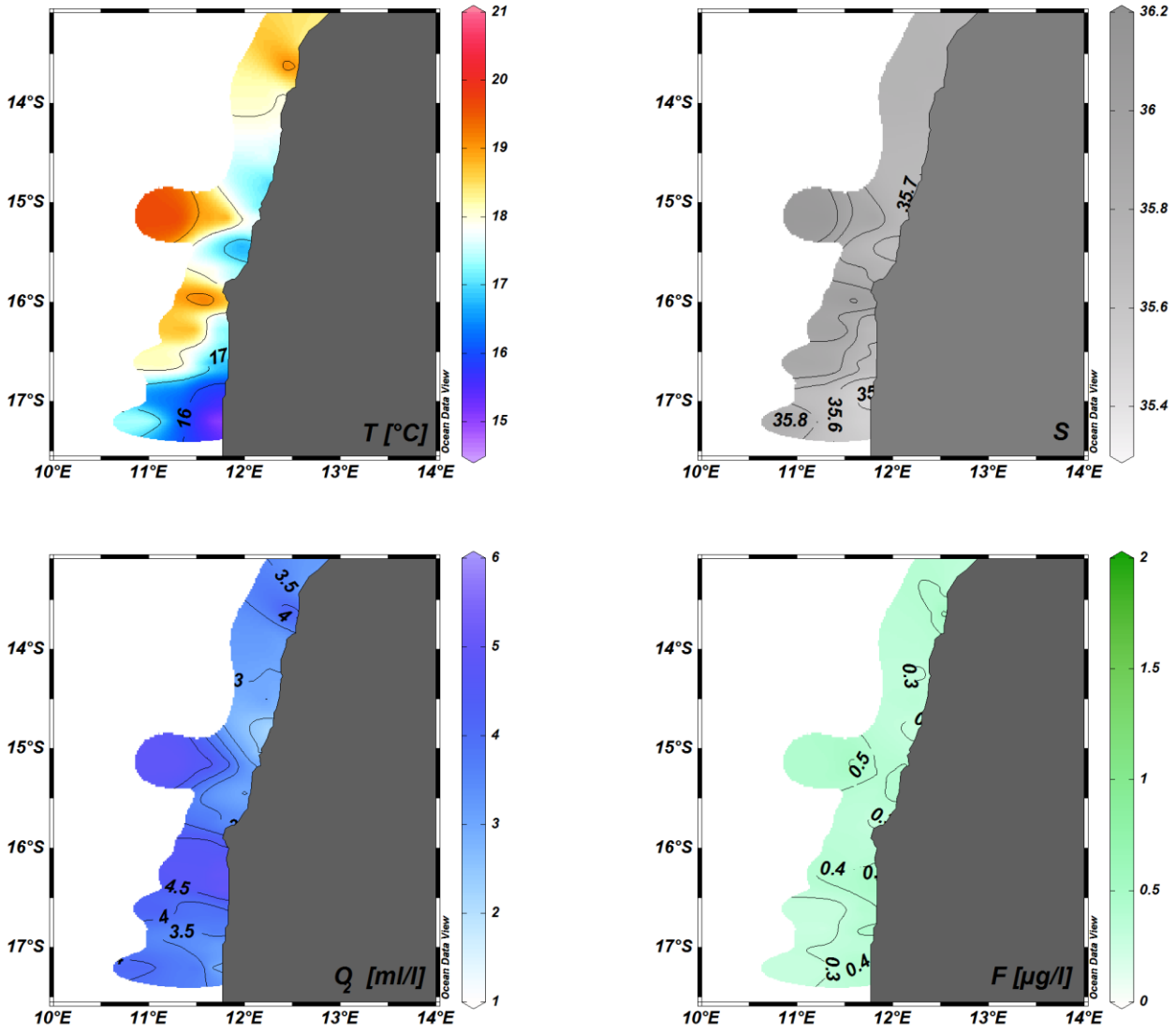


Figure 3c. Surface distribution of water temperatures, salinity, oxygen and fluorescence at 5m depth in the southern region.

3.2 Standard sections

Northern Region

The section off **Moita Seca** (Figure 4a) is located south of the Congo River's mouth. The presence of less saline water (≤ 35.6) offshore, can be probably attributed to The Congo River. The water column appears stratified and in the upper layers, the influence of the wind can be seen. Oceanographic parameters values don't differ between inshore and offshore waters. Oxygen content is higher at the surface (4.5 ml/l) with a minimum (1 ml/l) located between 250-450m depth.

Sections off **N'Zeto** and **Ambriz** (Figures 4b and 4c, respectively) show common trends and will be therefore, analyzed together. Temperature near the surface decreased towards the south**,** with offshore values of 22°C in N'Zeto and 20°C in Ambriz. In these two sections temperature dropped to 15°C at about 150m depth and to 10°C at around 350m. The thermocline and oxycline were located around 20 m depth. Surface salinity was about 35.8, both inshore and offshore. The oxygen content ranged from 4.5 ml/l (offshore) to 3.5 ml/l (inshore), and decreased to 1 ml/l at around 250m depth. Surface fluorescence varied from 0.3µg/l inshore to 0.4µg/l offshore and was highest offshore Ambriz.

In the section off **Pta. das Palmerinhas** south for Luanda (Figure 4d), the sea surface temperature was more or less similar to the one in previous sections (21ºC), while the salinity was lower inshore (35.2) possibly influenced by the Kwanza River. Surface oxygen values were similar to those found in the previous sections while surface fluorescence was slightly lower (0.3 µg/l). As in the previous sections, the water column also showed stratification.

Central Region

The section off **Cabo Ledo** (Figure 4e), located south off Kwanza River's mouth, shows a stratify water column. Surface parameter's values were the same inshore and offshore: temperature 19ºC, salinity 35.7, oxygen 3.5 ml/l and fluorescence 0.3µg/l.

The section off **Cabo São Braz** (Figure 4f) is similar to the previous ones except for the salinity which was slightly higher at the surface (35.8). In this section the isolines show a slight uplift offshore, but the values remained constant from the innermost station to the outermost ones.

The section off **Ponta do Morro** (Figure 4g) showed a weak elevation of the sub-surface water indicating the occurrence of a moderate upwelling. Temperature, salinity and oxygen showed lower values near the coast increasing offshore.

The section off **Lobito** (Figure 4h) also showed a rather stratified water column with little variation between inshore and offshore values. The offshore-inshore variation for the different oceanographic parameters was: temperature varied from 20°C to 18°C, salinity from 36.0 to 35.8, oxygen from 4.5 ml/l to 3.5 ml/l while fluorescence increased from 0.2µg/l to 0.3µg/l. The isoclines show a slight uplift inshore indicating the occurrence of a weak upwelling. The deepest water layer (250-450 m) showed the same characteristics as in the last years, with temperatures below the 9ºC, salinities between 34.8 and 34.9 and oxygen at around 0.5 ml/l.

Southern Region

In the section off **Santa Marta** (Figure 4i) the isoclines are bent downwards indicating a downwelling. The mixed layer is less thick offshore (0-25 m) than in the coastal zone (0≥50m) with a reversed

thermocline/halocline. It was also observed a rapid depletion of the oxygen content in the upper 100m. Most of the surface layer (0-30m) of the continental shelf was dominated by temperatures ≥17°C and salinities of 35.7.

The behaviour of the oceanographic parameters in the **Namibe** and **Tômbwa** sections is similar in terms of subsurface water and therefore, they will be analyzed together (Figures 4j and 4k respectively). The shape of both isolines for temperature and salinity shows a weak sign of upwelling. However Namibe showed warmer and more saline waters (19ºC and 36 respectively) offshore compared with Tômbwa (17ºC and 35.7 respectively). Namibe inshore waters had higher florescence values (0.5 µg/l) pointing to a more intensive biological activity in this area.

The figure 4I shows the vertical distribution of temperature, salinity, oxygen and fluorescence at **Baía dos Tigres**. In this section the degree of the isolines uplift (temperature and salinity) indicates a stronger upwelling. Offshore oceanographic parameters values are slightly higher than those of the previous section (temperature was 18ºC and salinity 35.9). Otherwise, the water column was stratified. The minimum oxygen value was located between 350 and 450m, and the higher fluorescence value (0.3µg/l) was found inshore.

The section off Cunene River (Figure 4m) is located close to the border between Angola and Namibia. The structure of the water column and the distribution of surface parameters were similar to the one at Baía dos Tigres, but with slight different values. The isolines show a sharp uplift indicating the presence of upwelling. Low values of surface temperature (15°C) and salinity (35.5) were recorded inshore probably due to the influence of the Cunene River and the upwelling. Oxygen content values of 4-2.5 ml/l prevailed at the surface layer while the lowest values appeared below the 350-450m depth.

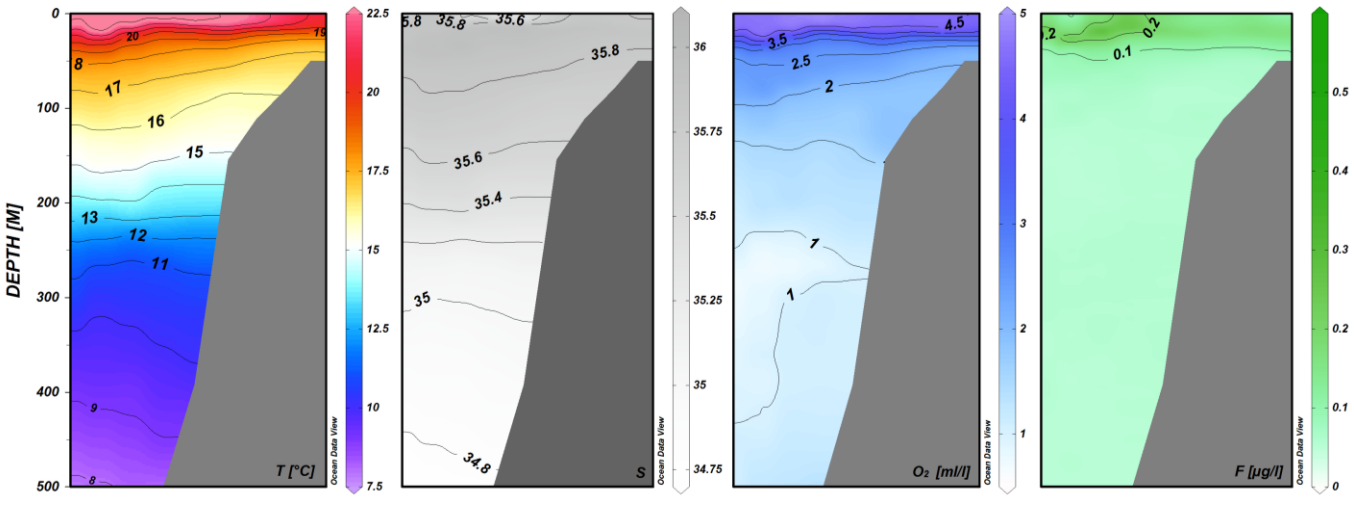


Figure 4a. Vertical sections of temperature, salinity, oxygen and fluorescence off Pta. da Moita Seca, Congo River.

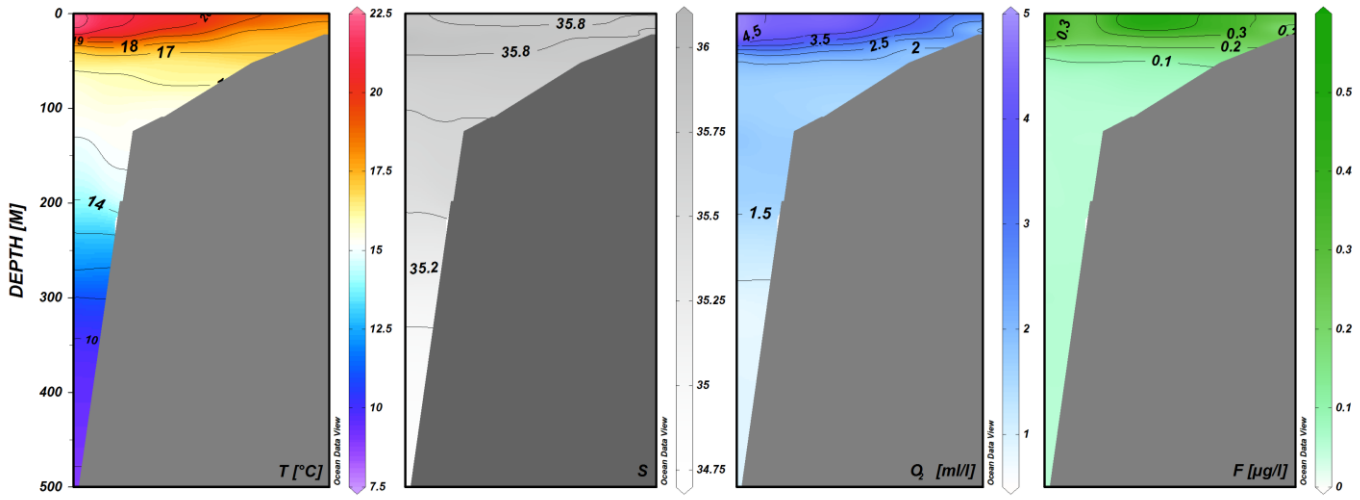


Figure 4b. Vertical sections of temperature, salinity, oxygen and fluorescence off N'Zeto.

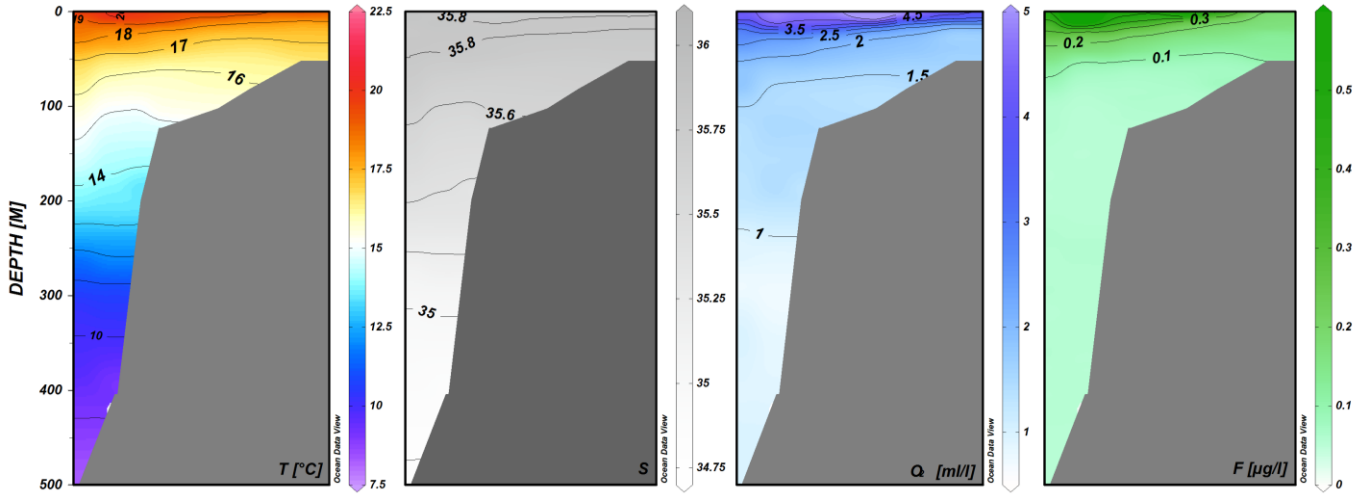


Figure 4c. Vertical sections of temperature, salinity, oxygen and fluorescence off Ambriz.

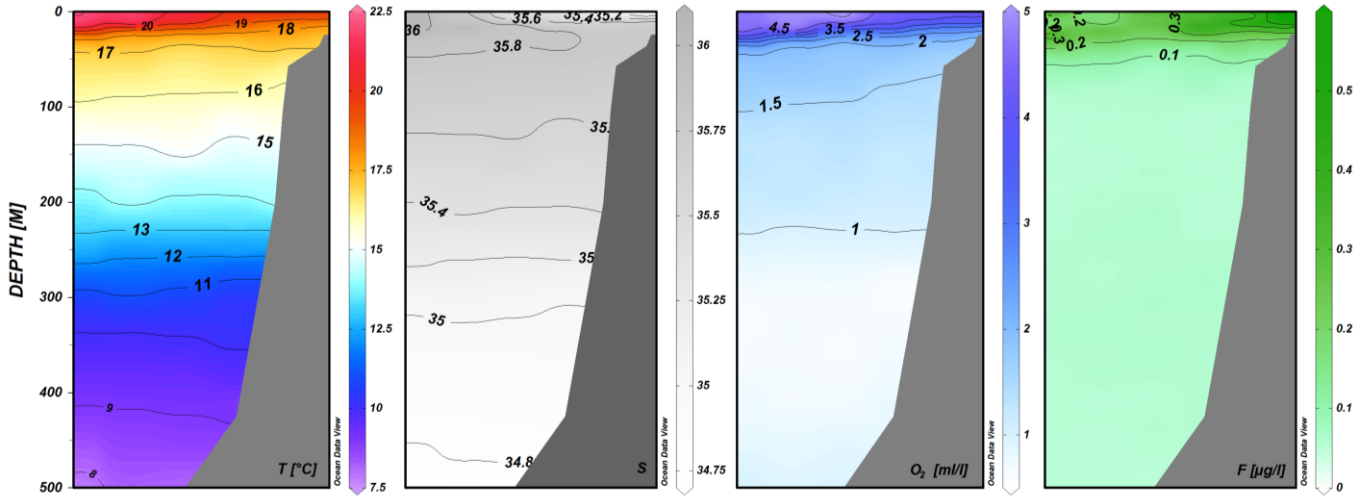


Figure 4d. Vertical sections of temperature, salinity, oxygen and fluorescence off Pta. Palmerinhas.

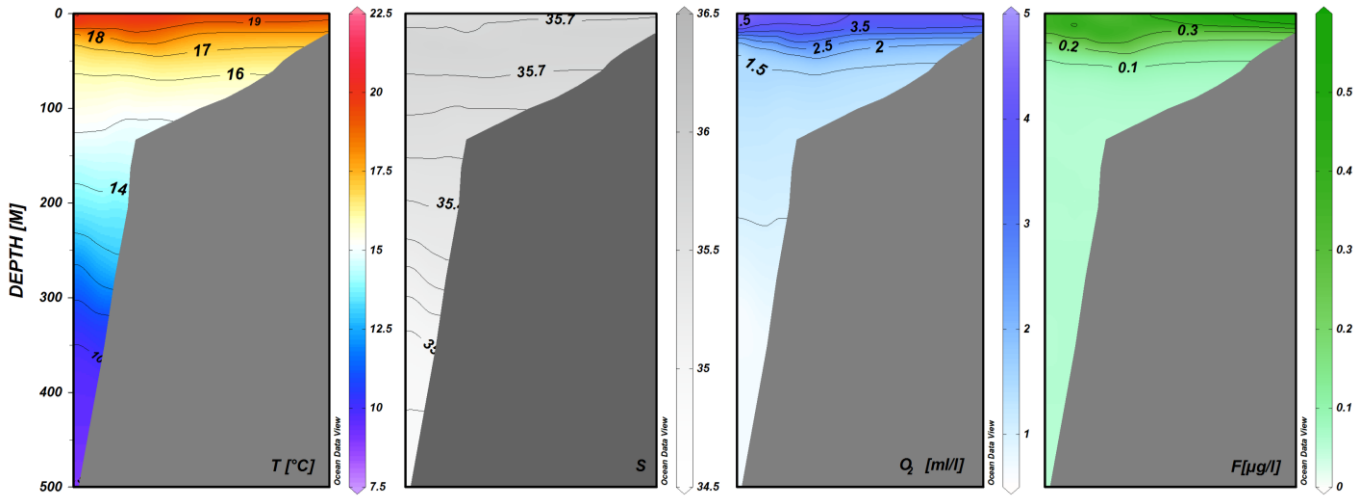


Figure 4e. Vertical sections of temperature, salinity, oxygen and fluorescence off Cabo Ledo.

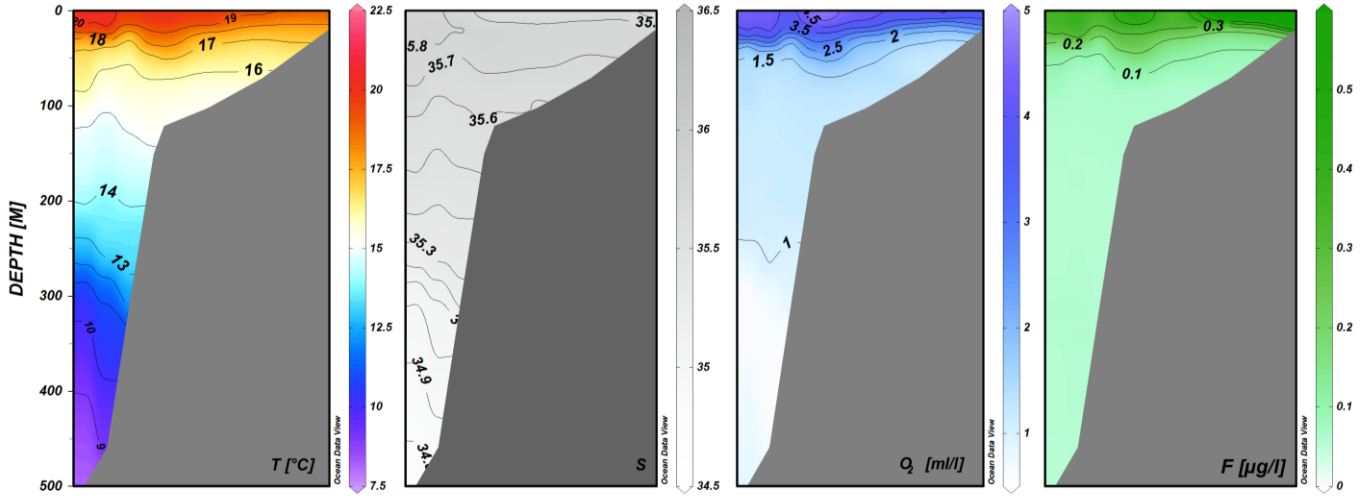


Figure 4f. Vertical sections of temperature, salinity, oxygen and fluorescence off south Cabo São Braz.

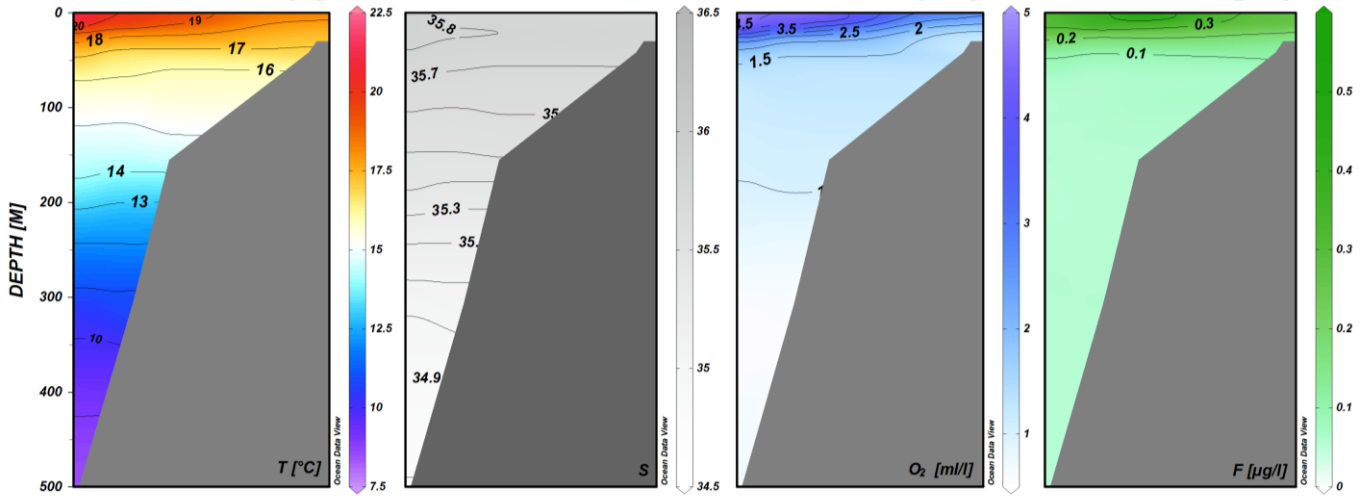


Figure 4g. Vertical sections of temperature salinity, oxygen and fluorescence off Pta. do Morro**.**

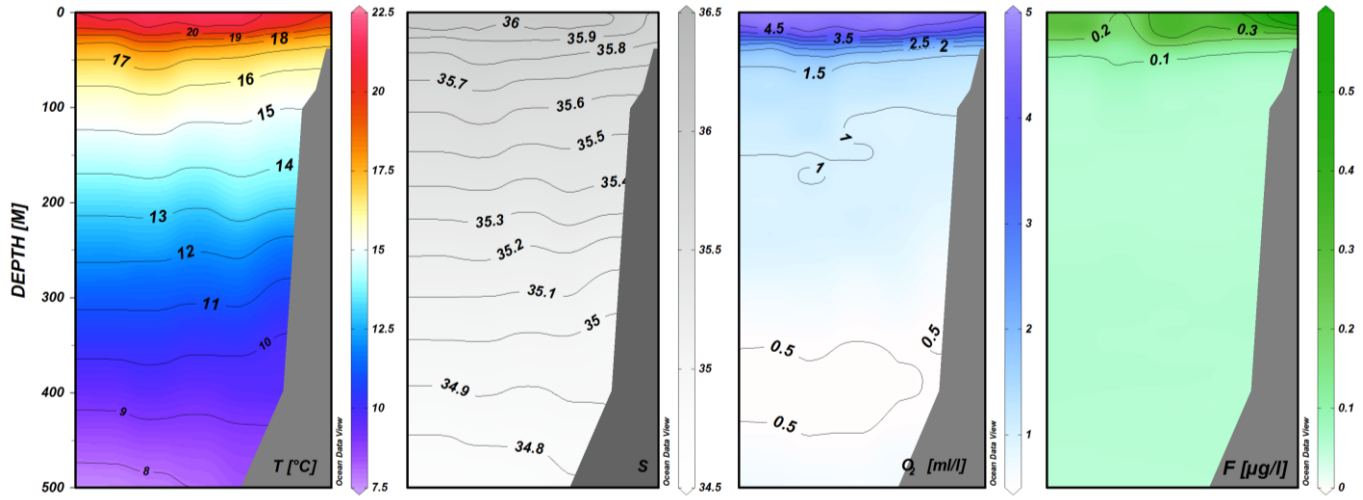


Figure 4h. Vertical sections of temperature salinity, oxygen and fluorescence off Lobito.

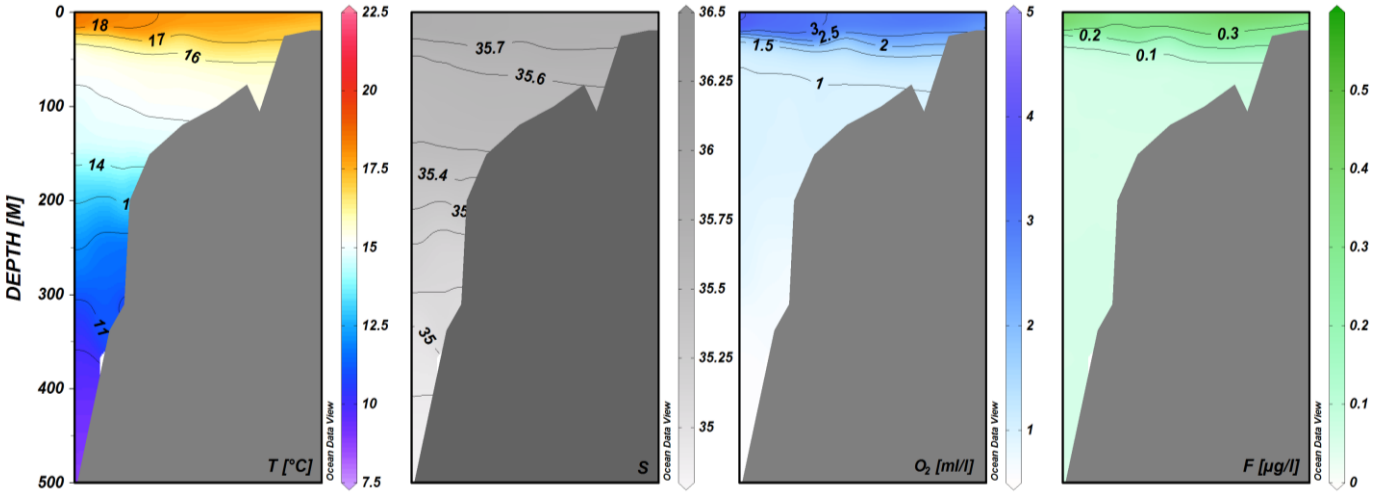


Figure 4i. Vertical sections of temperature salinity, oxygen and fluorescence off Santa Marta.

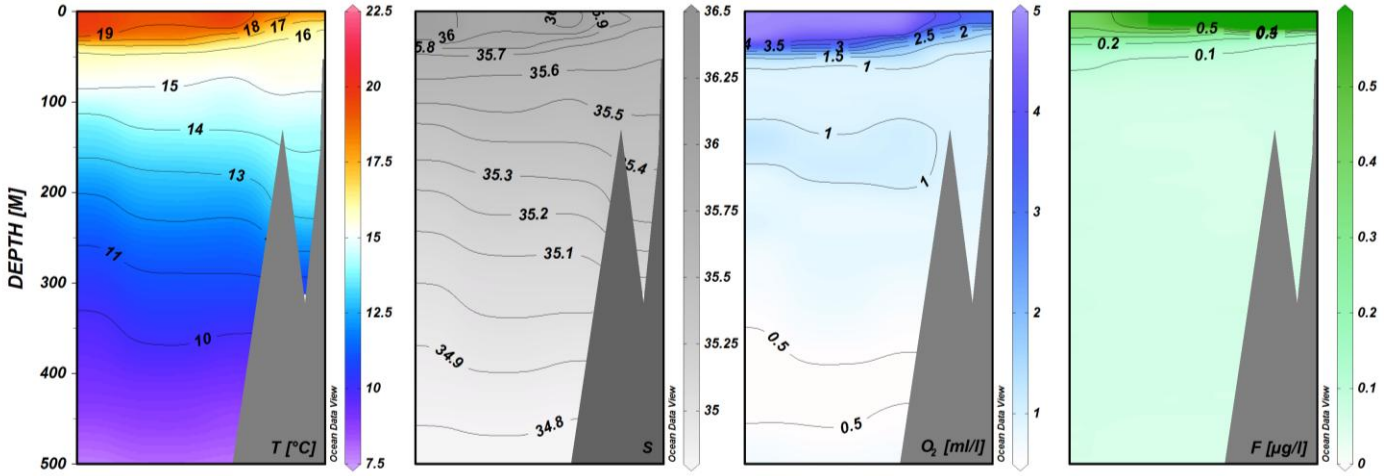


Figure 4j . Vertical sections of temperature salinity, oxygen and fluorescence off Namibe.

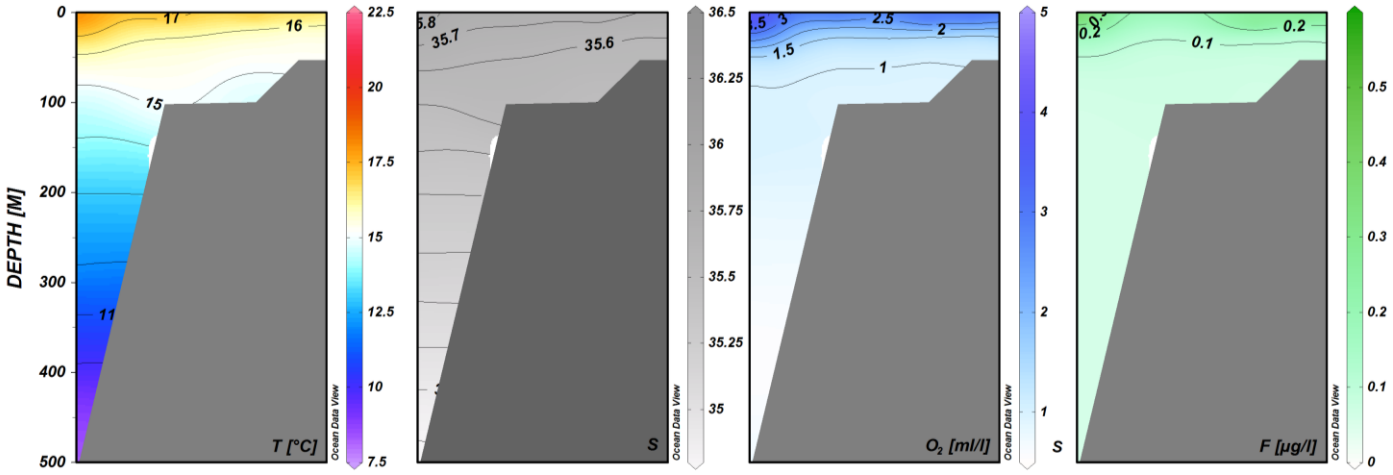


Figure 4k Vertical sections of temperature salinity, oxygen and fluorescence off Tômbwa.

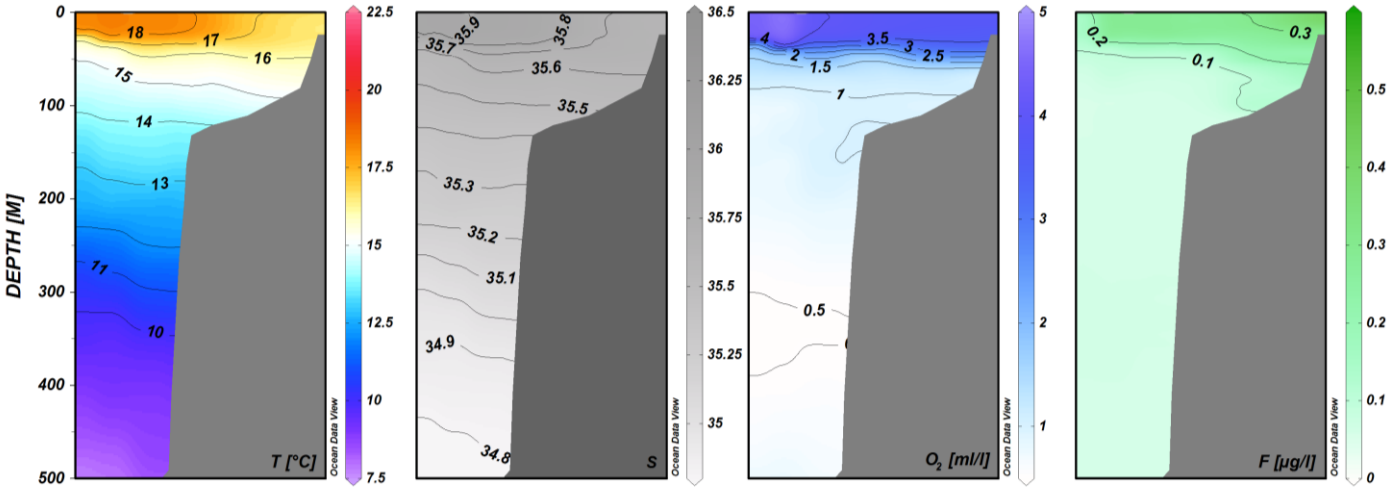


Figure 4l Vertical sections of temperature salinity, oxygen and fluorescence off Baía dos Tigres.

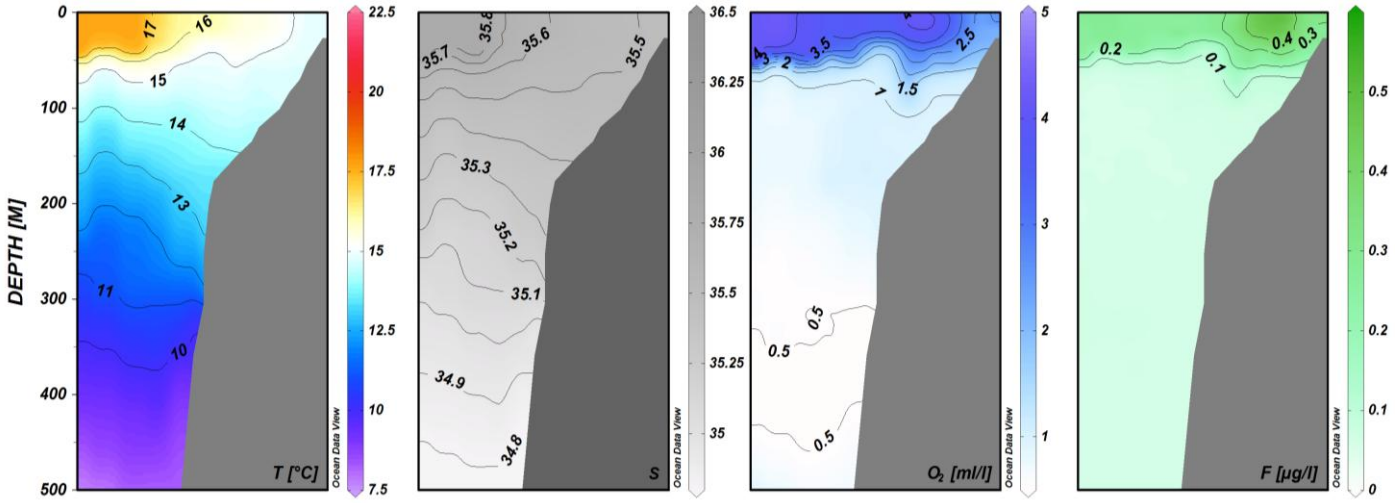


Figure 4m. Vertical sections of temperature salinity, oxygen and fluorescence off Cunene River.

CHAPTER 4 DISTRIBUTION, SIZE COMPOSITION AND BIOMASS ESTIMATES

4.1 Congo River - Pta. Palmerinhas

Sardinella

The sardinellas were continuously distributed from north of Cabeça da Cobra to south of Luanda (Figure 5). Most of the area shows low density values ($0<s_A<300$ m^2/NM^2) with some medium-low density ($301<s_A<1\ 000$ m^2/NM^2) registrations between Cabeça da Cobra and N'Zeto and between Ambriz and Luanda. Areas of medium-of high density ($1\ 001<s_A<3\ 000$ m^2/NM^2) were found off N'Zeto and North off Luanda.

Figure 6 shows the length distribution of the sardinellas in the northern region. *S. aurita* (Figure 6a) shows two modal peaks at around 7 and 30 cm TL, while *S. maderensis* shows three modal peaks around 11, 17 and 28 cm TL (Figure 6b).

The estimated biomass for the species in this region was 70 900 tonnes, which is around 20% lower than the biomass estimated in 2010 (93 000 tonnes and among the lowest in the time series). *S. maderensis* dominated the total biomass, contributing with 63% (44 800 tonnes) while *S. aurita* represented 37 % (26 100 tonnes).

The biological samples showed that 88% of the *S. maderensis* and 84% of the *S. aurita* were mature.

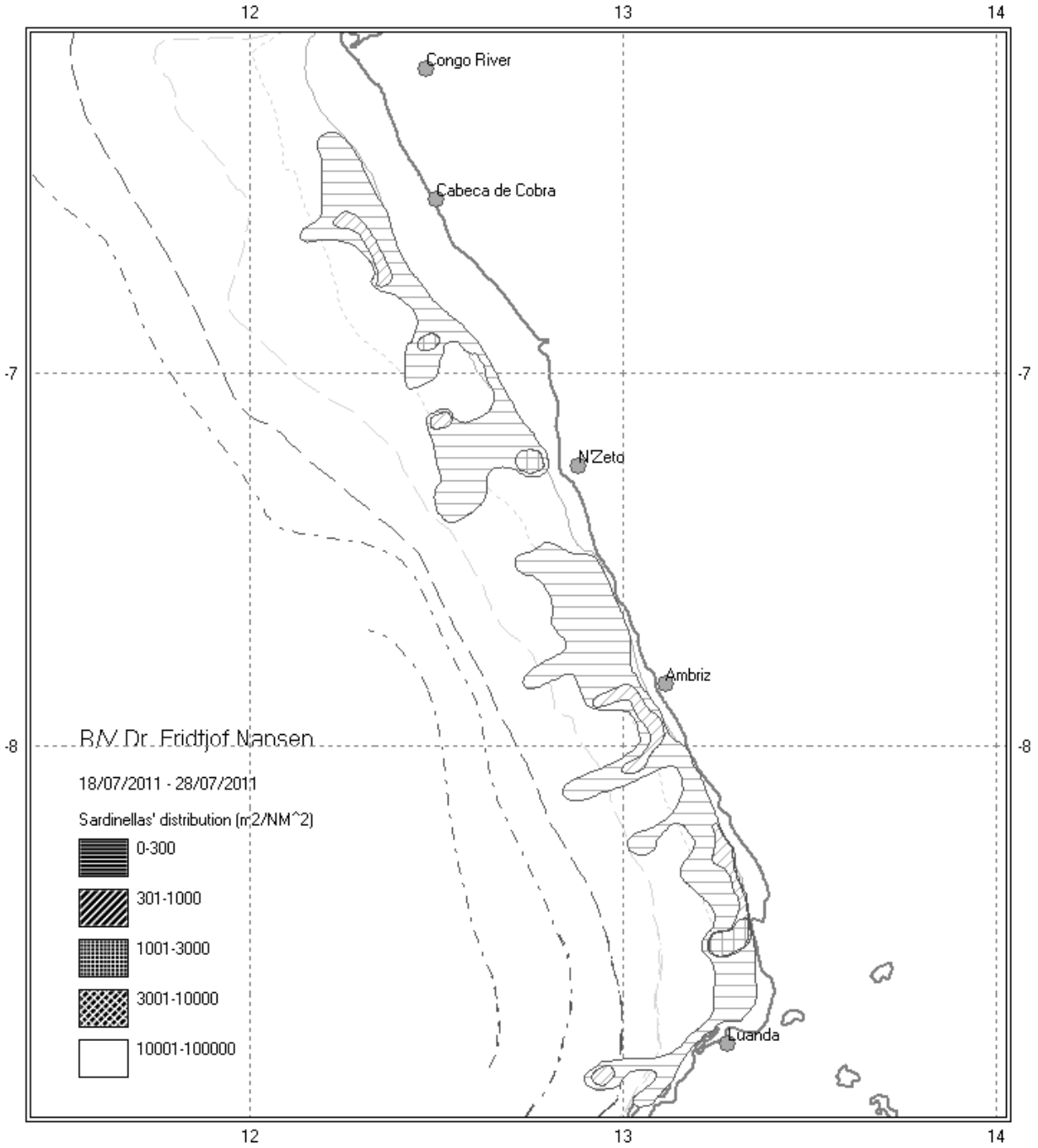


Figure 5. Distribution of *Sardinella* spp. Congo River- Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200, and 500m.

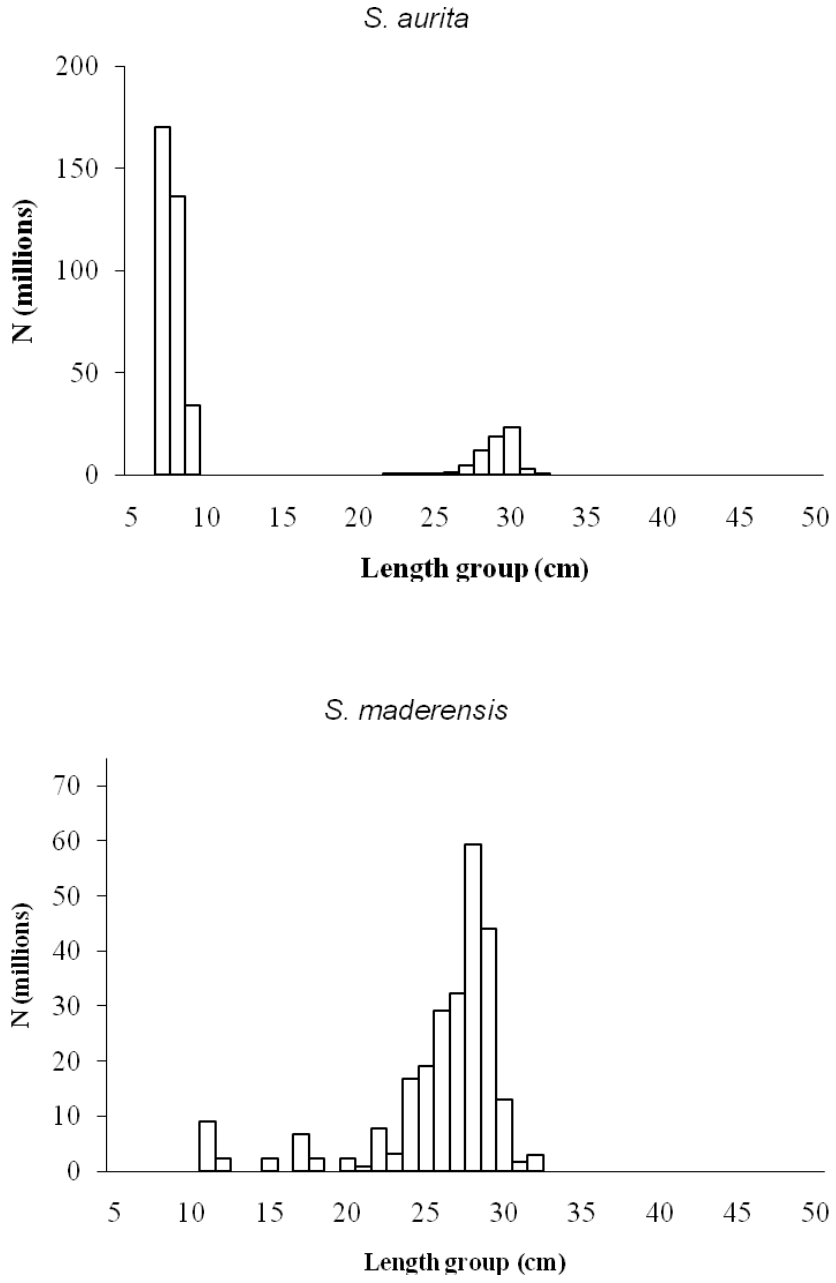


Figure 6. Total length distribution of *Sardinella aurita* and *S. maderensis*, Congo River - Pta. das Palmerinhas.

Horse mackerel

Cunene horse mackerel, *T. trecae* was the only species caught in this area, and it was found discontinuously distributed in low-density areas ($0<s_A<300$ m^2/NM^2) from Pta. da Moita Seca to Luanda, (Figure 7). It was generally caught in bottom trawls mixed with demersal species, mainly Sparidae species. Compared with last year, the species shows the same geographical distribution but seems to be distributed closer to the coast at depth less than 100 m (Fig. 9).

The size distribution of Cunene horse mackerel shows six modal peaks at about 6, 17, 24, 30, 37 and 43 cm TL (Figure 8). Small size fish (TL< 10 cm) were only found in shallow waters (<100m) (Figure 7). This year biomass' estimate was of 17 500 tonnes which can be considered within the same level as last year's estimate (21 000 tonnes).

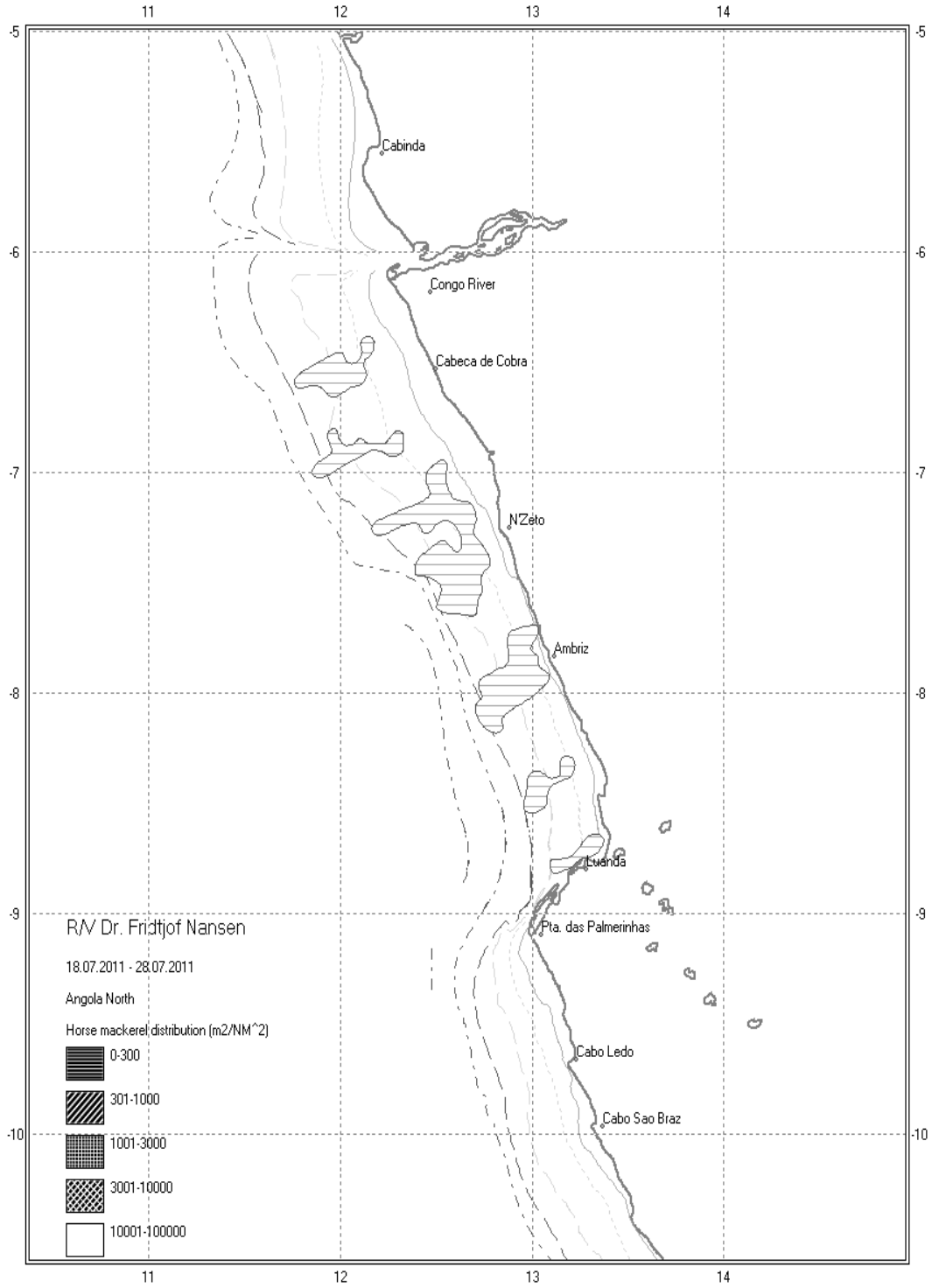


Figure 7. Distribution of Cunene horse mackerel (*Trachurus trecae*), Congo River - Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200, and 500m.

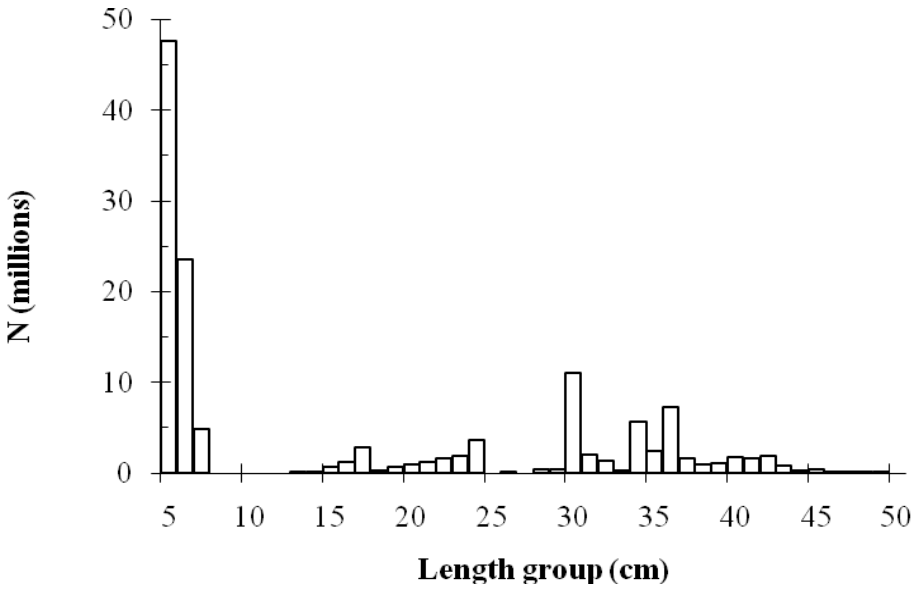


Figure 8. Total length frequency distribution of Cunene horse mackerel, Congo River - Pta. das Palmerinhas

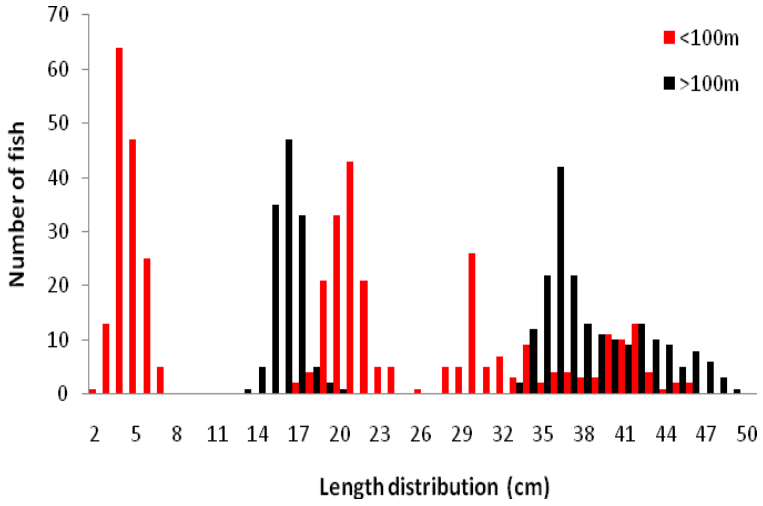


Figure 9 Length distribution (simple adding) of Cunene horse mackerel (*Trachurus trecae*) by depths strata, Congo River - Pta. das Palmerinhas (depths >100 and <100 m).

Pelagic species Group 1

This group was mainly continuously distributed near the coast in a low density area ($0<s_A<300$ m^2/NM^2) between Ambriz and Luanda (Fig. 10). Two more areas, of low density, were also found south of Congo River and off Pta. das Palmerinhas. The species found belonging to this group were *Ilisha africana* and *Engraulis encrasicolus.*

The biomass in the area, based on an average fish size of 16 cm TL (based on caught fish) and an average condition factor of 0.01, was estimated to be 5 200 tonnes.

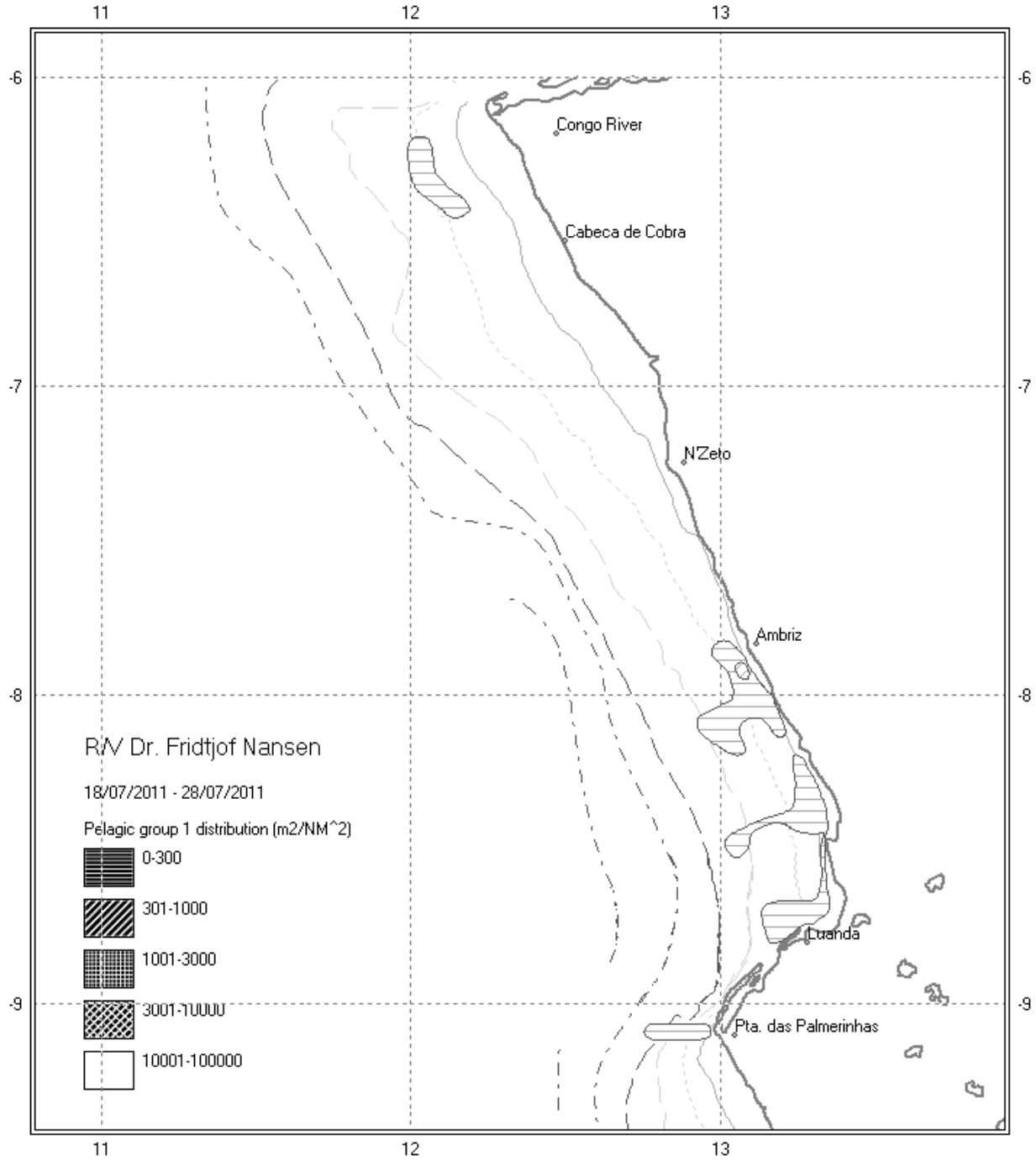


Figure 10. Distribution of Pelagic 1, Congo River - Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200 and 500m.

Pelagic species Group 2

This group was continuously distributed in a low density area ($0<S_A<300$ m^2/NM^2) extending from north of Cabeça de Cobra to Pta. das Palmerinhas (Figure 11). This year the dominant species belonged to the Trichiuridae (Hairtails, *Trichiurus lepturus*) followed by Scombrids (mainly *Scomber japonicus*) and Carangids *Selene dorsalis* as the dominating species (Table 4).

The biomass calculation was based on an average fish size of 30 cm (based on caught fish) and average condition factor of 0.01 and was estimated to be 2 000 tonnes

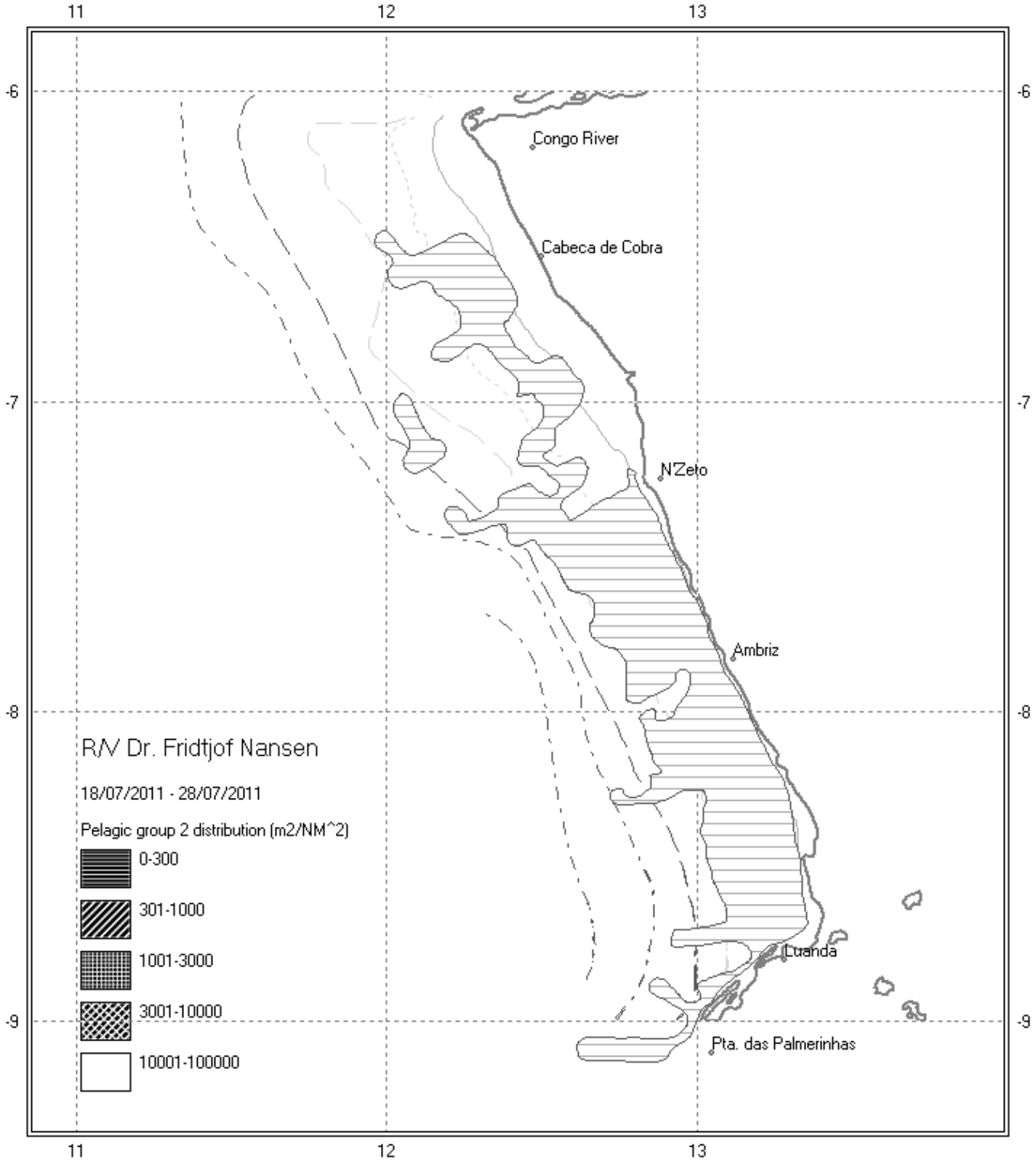


Figure 11. Distribution of Pelagic 2, Congo River - Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200 and 500m.

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

Station	Gear depth	Barracuda	Carangids	Clupeiods	Hairtails	Horse mackerel	Sardinella	Scombrids	Other	Total
1	132					55.9			155	211
2	43.5					49.6			41.3	90.9
3	273.5								574.5	574.5
4	10						5.4		103.5	108.9
5	99.5					0.1			168.1	168.2
6	5						17.7		0.7	18.4
7	5				22.9	1.3			77.2	101.5
8	92.5									
9	45.5		1.1			1.7			74.3	77
10	5				16.2	14.7		0.1	9.6	40.6
11	107.5		4.6		6.8	154.4			170.5	336.3
12	5				14.5	11.4	0.4	5.6	77.5	109.6
13	48		29.4	0.2	36.4	5.9	0.6		1038.6	1111
14	10			6.3	6.9	1	480.8		74.8	569.9
15	5				3.7				9.9	13.6
16	27.5									
17	23		0.1	157.5	24.2	264.5	1.4		1445.7	1893.4
18	5			4.1	18.6	211.4	1.4	31.3	199.6	466.4
Mean	52.4		2	9.3	8.3	42.9	28.2	2.1	234.5	327.3
Std dev			6.9	37	11.1	80.9	113	7.4	396	485.1
%Catch			0.6	2.8	2.5	13.1	8.6	0.6	71.6	

4.2 Pta. das Palmerinhas - Benguela

Sardinella

In this region the sardinella was continuously distributed. Most of the distribution area showed low densities ($1<s_A<300$ m^2/NM^2) (Figure 12). Patches of medium-low densities ($301<s_A<1000$ m^2/NM^2) were found inshore off Cabo São Braz, north of Pta. do Morro and between south Pta. do Morro and north Cabeça da Baleia. Some small high-density patches ($3001<s_A<1000$ m^2/NM^2) were recorded north Pta. do Morro and north Cabeça da Baleia. The sardinella was distributed between bottom depths of approximately 15 to 200 m depth. It was observed in the upper water layers, schooling near the surface during daytime and it was caught during the night in loose aggregations.

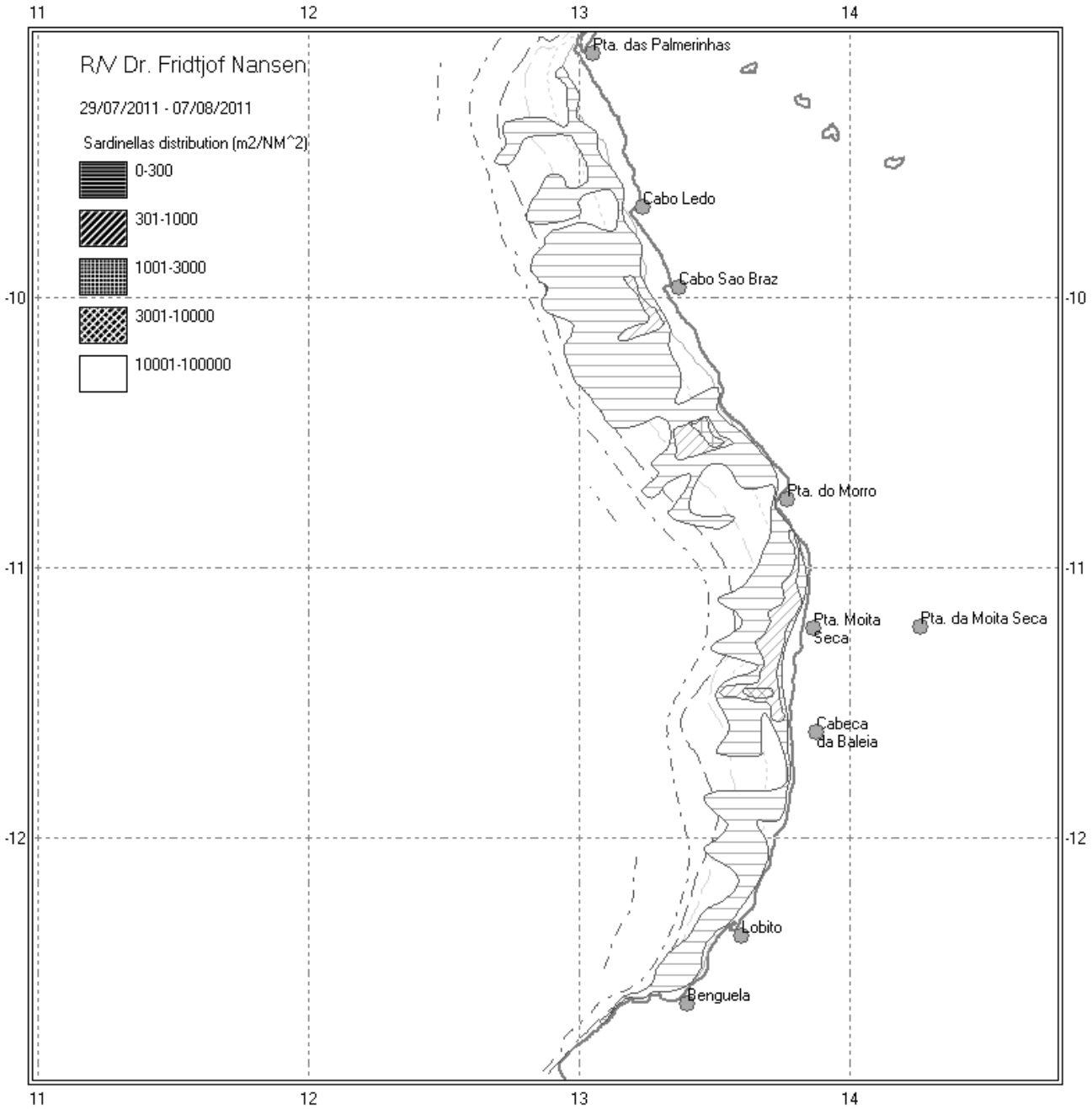


Figure 12. Distribution of *Sardinella* spp. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100 and 200 m.

The length distribution of *S. maderensis* showed three cohorts (Fig. 13), peaking at 14, 23 and 28cm TL. On the other hand, the distribution of *S. aurita* was dominated by adult individuals showing three modal peaks at 11/12, 24 and 29cm TL (Figure 13). None of the length distributions show clear signs of recruitment in the region. The smallest individuals for both species were found in shallow waters, at bottom depths of around 20m close to the coast and north of Pta. do Morro

The total biomass for both species of sardinella was estimated at 181 200 tonnes. This is lower than last year's estimate (293 000 tonnes) representing a decrease of around 37%.

In previous years the biomass of sardinella in this region has been dominated by *S. maderensis*, which has represented around 55% of the total biomass. This year however, as last year, *S. aurita* dominated the catches with an estimated biomass of 139 300 tonnes, representing around 77% of the total catch, while the estimated biomass for *S. maderensis* was of 41 900 tonnes, around 23% of the total biomass.

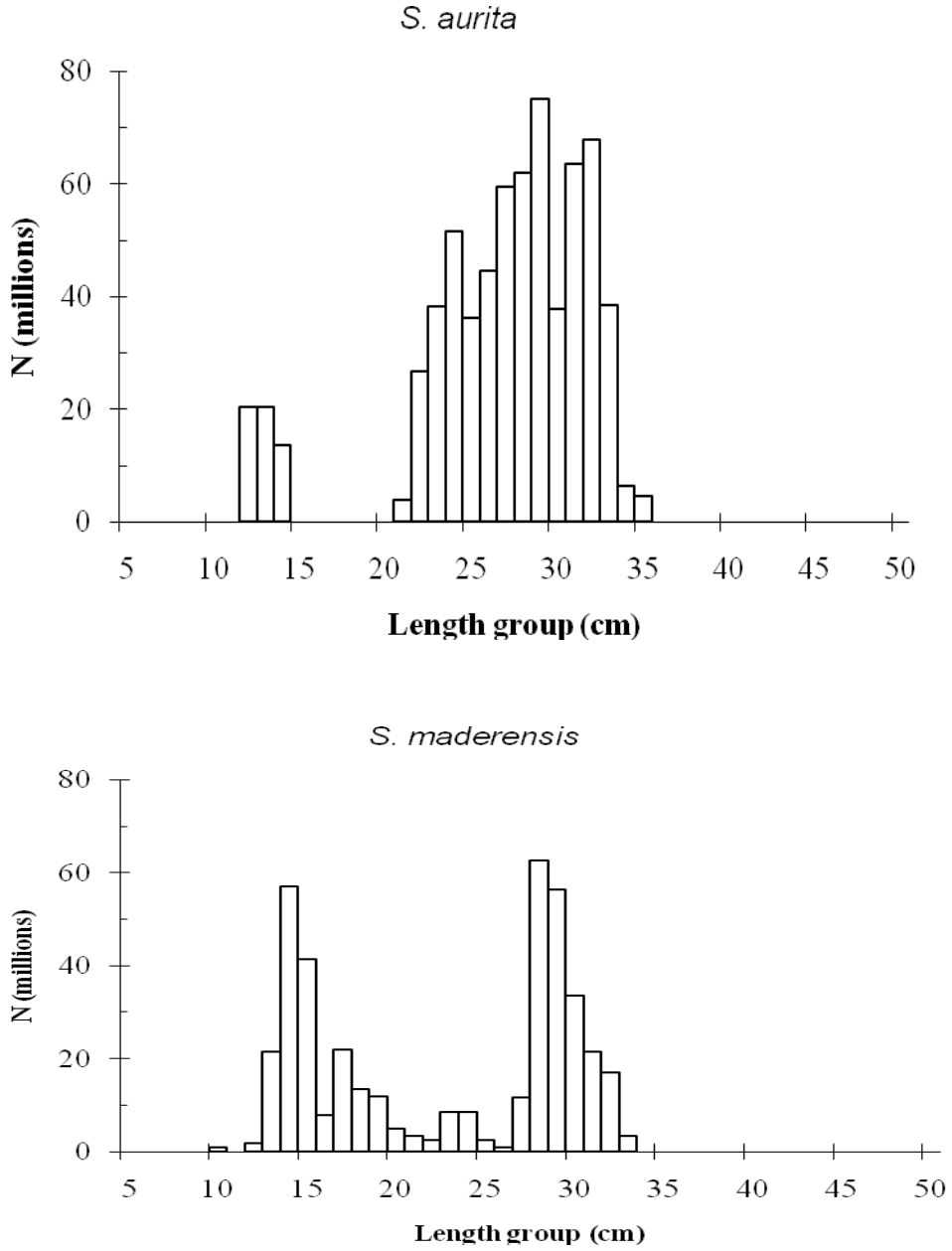


Figure 13. Total length distribution of *Sardinella aurita* and *S.maderensis.* Pta. das Palmerinhas - Benguela.

Horse mackerel

Only Cunene horse mackerel was found in this region, and it was found in low-densities patches ($0<s_A< 300$ m^2/NM^2). Its distribution ranged from around 20m to approximately 200m bottom depth (Figure 14).

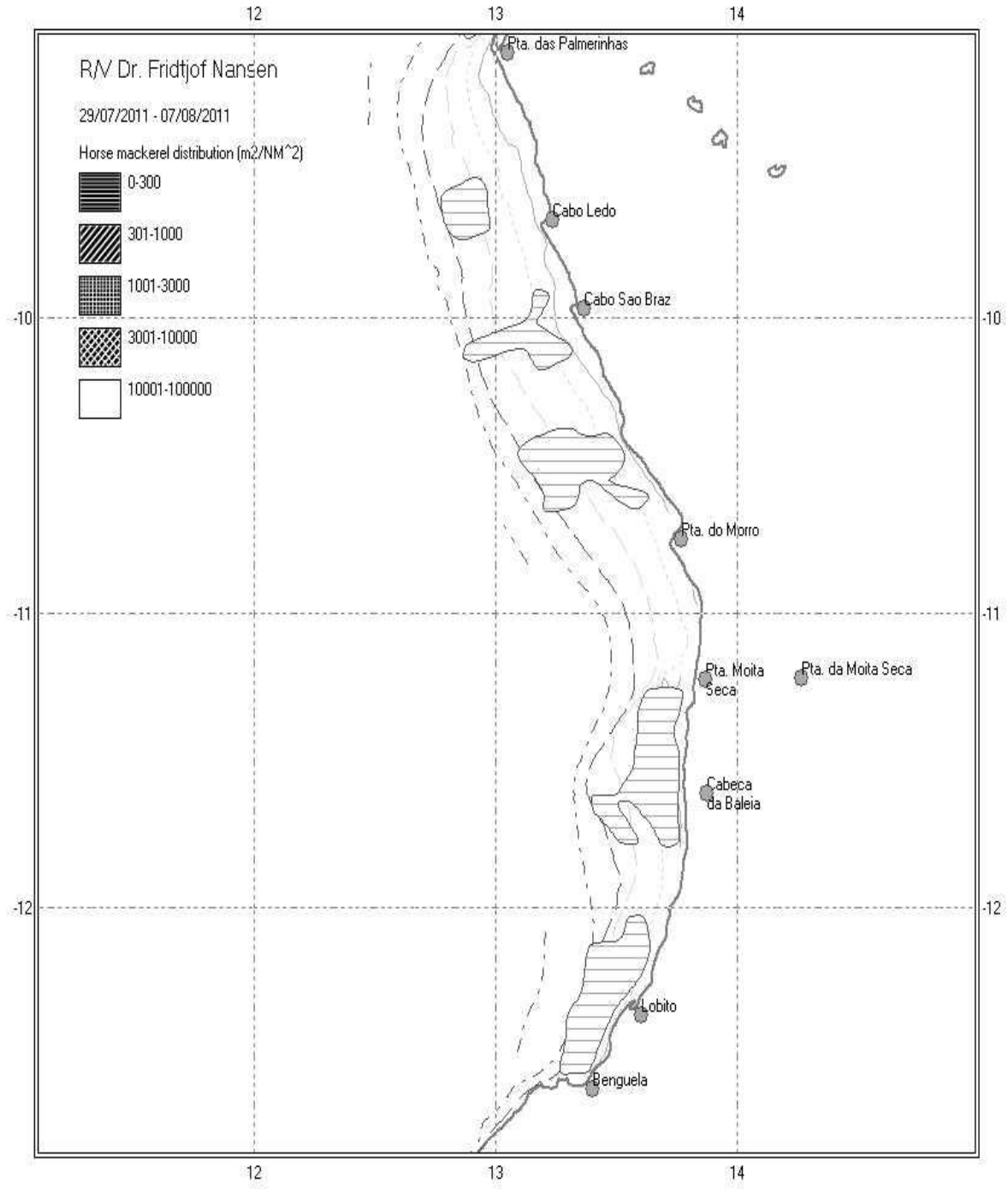


Figure 14. Distribution of horse mackerel (*Trachurus trecae*). Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500m.

The length frequency distribution for the species, is shown in Figure 15. The population shows 6 possible cohorts with peaks at around 5, 18, 25, 32, 40 and 45cm TL. Although some overlap in the intermediate sizes, there is a clear segregation in size according to depth: smaller fish (TL<15cm) were found in shallower waters (<100m) (Figure 16).

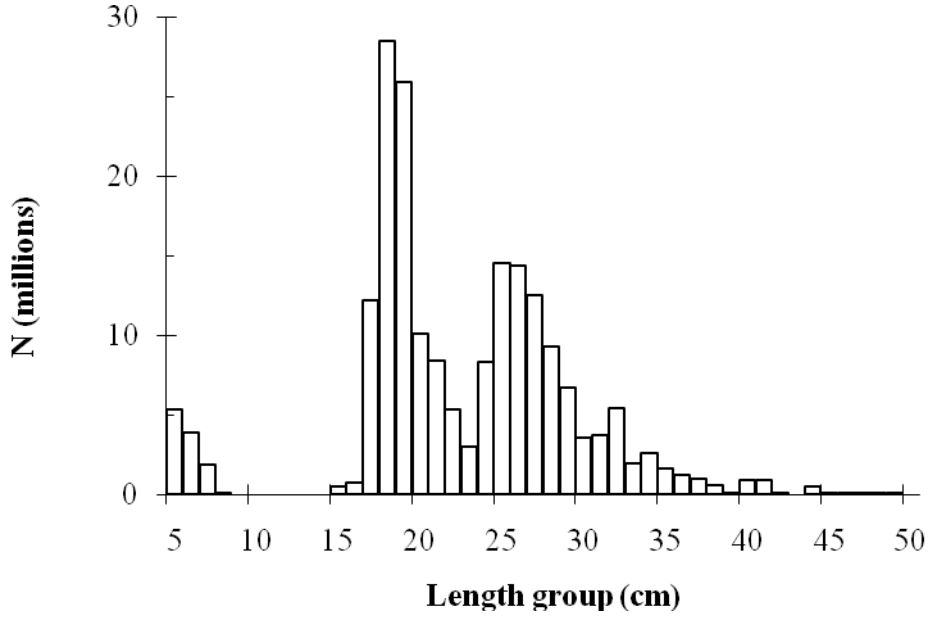


Figure 15. Total length distribution of horse mackerel (*Trachurus trecae*), Pta. das Palmerinhas- Benguela.

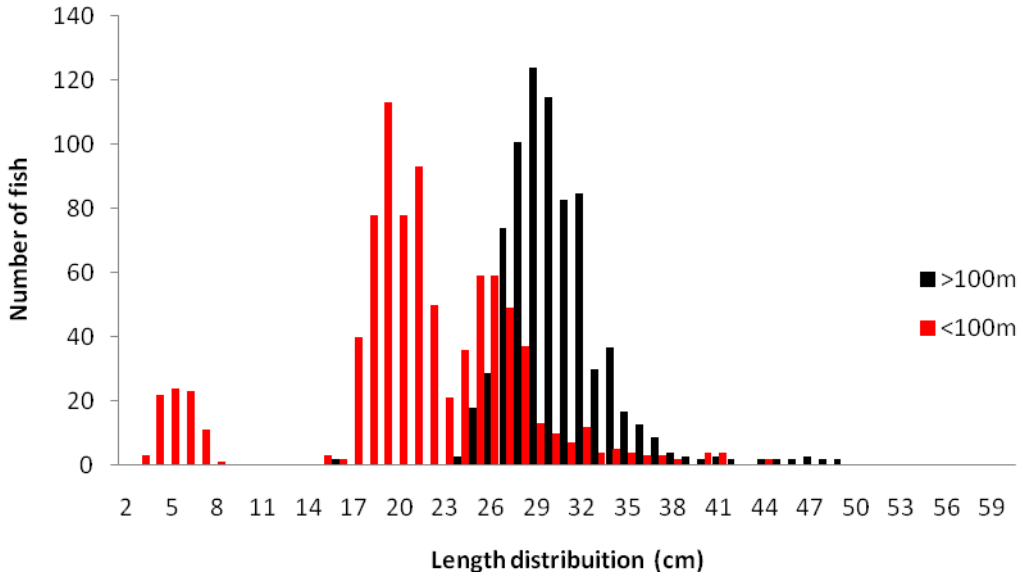


Figure 16. Length distribution (simple adding) of Cunene horse mackerel (*Trachurus trecae*) by depths strata. Pta. das Palmerinhas- Benguela (depths <100m and >100 m)

The biomass of Cunene horse mackerel was estimated at 25 500 tonnes, which is higher than last year's estimate (15 000 tonnes).

Other pelagic species

Pelagic species Group 1

This group was not abundant in the region and it was found in relatively small low-density patches ($0<s_A< 300$ m^2/NM^2) along the coast (Figure 17). The two most abundant species were *Ilisha africana* and *Engraulis encrasicolus*. The biomass estimated for the group in the central Angolan coast region was around 2 000 tonnes (based on an average fish length of 16 cm TL (based on caught fish) and a condition factor equal to 0.01).

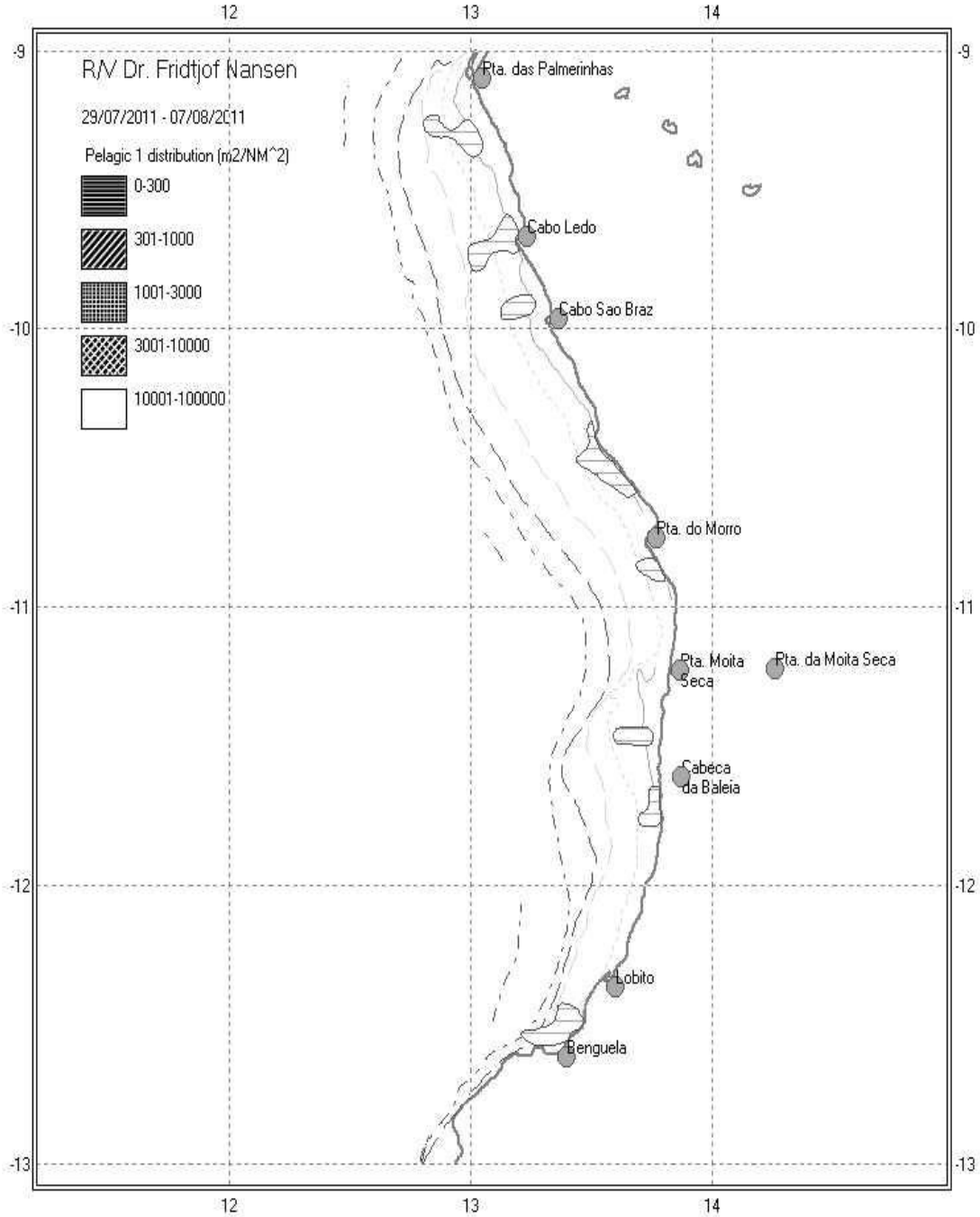


Figure 17. Distribution of other pelagic species, group 1. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500 m.

Pelagic species Group 2

This group was found continuously distributed along the coast at low densities ($0<s_A<300$ m^2/NM^2) (Figure 18). The most common species in this group were the hairtails (*T. lepturus*) together with different Carangidae species (Table 5).

The biomass estimate, based on an average fish length of 30 cm TL (based on caught fish) and a condition factor equal to 0.01, was 51 000 tonnes, a value that is higher than the one found the last two years (12 000 and 25000 tonnes for 2010 and 2009 respectively).

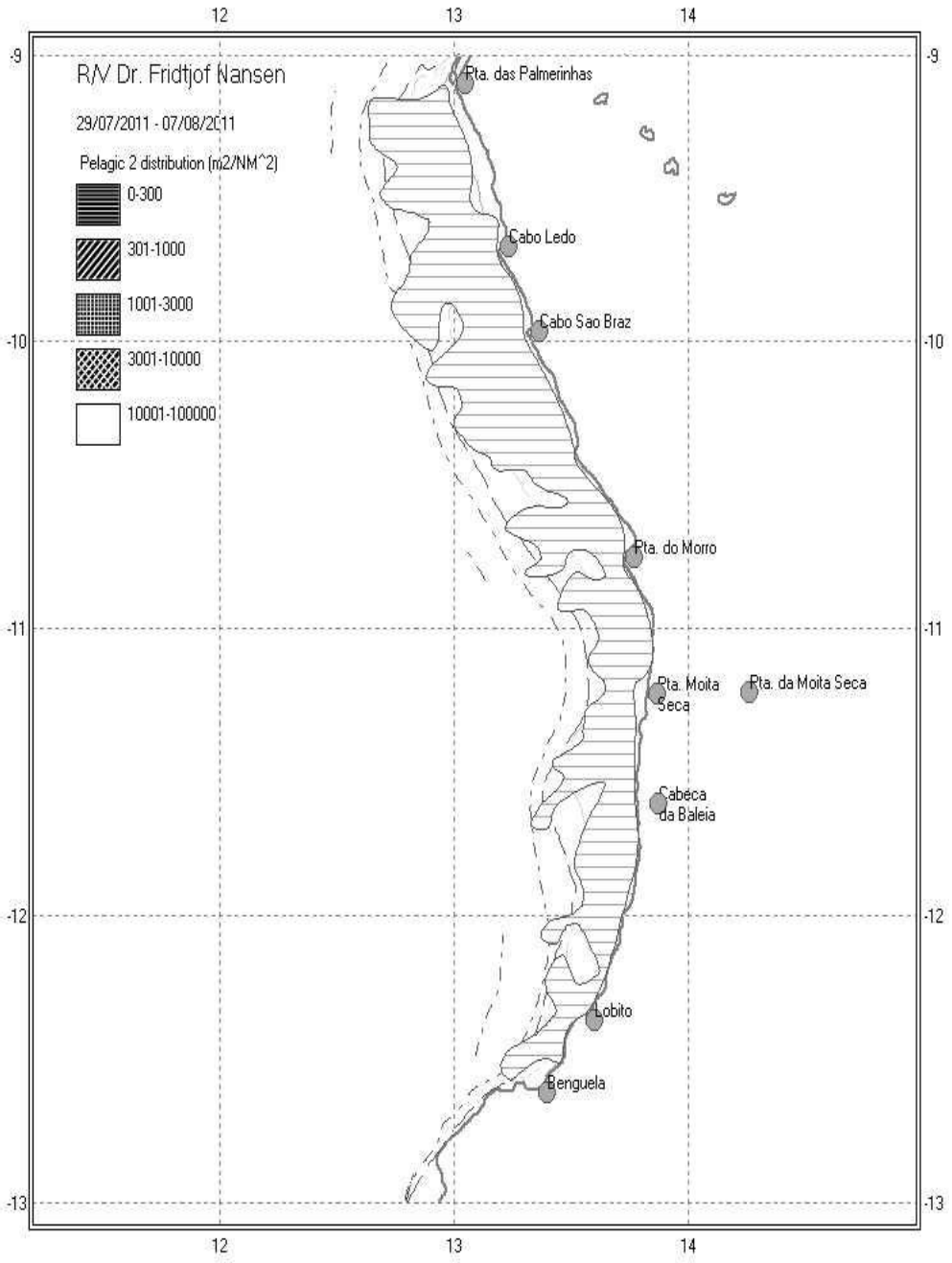


Figure 18. Distribution of other pelagic species, group 2. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500 m.

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

Station	Gear depth	Barracuda	Carangids	Clupeiods	Hairtails	Horse mackerel	Sardinellas	Scombrids	Other	Total
19	10		169.5			62.3	1109.5	6.9	1213.5	2561.6
20	5		375.3		122.3	448.6	47.2	1.4	45.7	1040.5
21	16.5		2.6	0.1	2.6	8.4	1329.8		8.1	1351.6
22	47		85.2		150.4	345.7	3.2		3298.2	3882.7
23	121.5								347.9	347.9
24	5				10.7	92.4		14.7	3.8	121.6
25	10	5.6	5.6	6.7	5.6		0.8		54.6	78.9
26	40							1.9		1.9
27	10	5.4	0.7	13	4.2	38.8	13.9		300.7	376.8
28	10	2			10.4	54.6	190.5	6.6	5.7	269.7
29	10	7.9	1.7	26	9.4	54.5	4335.2	6.9	321.1	4762.7
30	24.5	0.6	2.9	6.6	13	2.7	18.8		907.7	952.3
31	5				1.5	0.6	7.8	0.7	8.1	18.6
32	117.5					4020.8			2570.9	6591.7
33	94.5									
34	87					7890.4		15.4	3223.7	11129.6
35	5				0.1				145.7	145.8
36	10	1.3							5.8	7.1
37	110				0.2	75.9			525.8	602
Mean	38.9	1.2	33.9	2.8	17.4	689.3	371.4	2.9	683.5	1802.3
Std dev		2.4	92.8	6.6	42.4	1968.4	1033.1	5	1103.5	2929.6
%Catch		0.1	1.9	0.2	1.0	38.2	20.6	0.2	37.9	

4.3 Benguela - Cunene

Sardinella

No *sardinellas* were found in the area. We have to go back to the year 2005 to find a similar situation.

This absence could be attributed to changes in environmental conditions which influences the behaviour of the species. This year (as found in 2005 and in contrast with previous years) inshore temperatures were lower while offshore temperatures were higher.

During the present survey the environmental conditions can be characterized by the presence of an upwelling along the coast, with cold-low-salinity waters confined inshore.

Horse mackerel

Both species of horse mackerel, the Cape horse mackerel (*Trachurus capensis*) and the Cunene horse mackerel (*Trachurus trecae*) were found off southern Angola (Figure 19). Both species were continuously distributed from northern Namibe and until Cunene River, although Cunene horse mackerel was also caught further north, around Cabo de Santa Marta area. They were generally caught with bottom trawl and mixed with demersal species, mainly *Dentex*. Most of the distribution area showed low densities values ($0< s_A < 300$ m^2/NM^2). Nevertheless, denser areas were also found: medium-low ($300< s_A< 1\ 000$ m^2/NM^2) north off Namibe, between Namibe and Tombua, south Pta.

Albina and between Tiger Bay and Cunene River; medium-high densities areas (1 000 < s_A < 3 000 m^2/NM^2) off Cabo de Santa Marta, north of Tombua and inside Tiger Bay. A small but very dense area (10 000 < s_A< 100 000 m^2/NM^2) was found just at the northern opening of Tiger Bay.

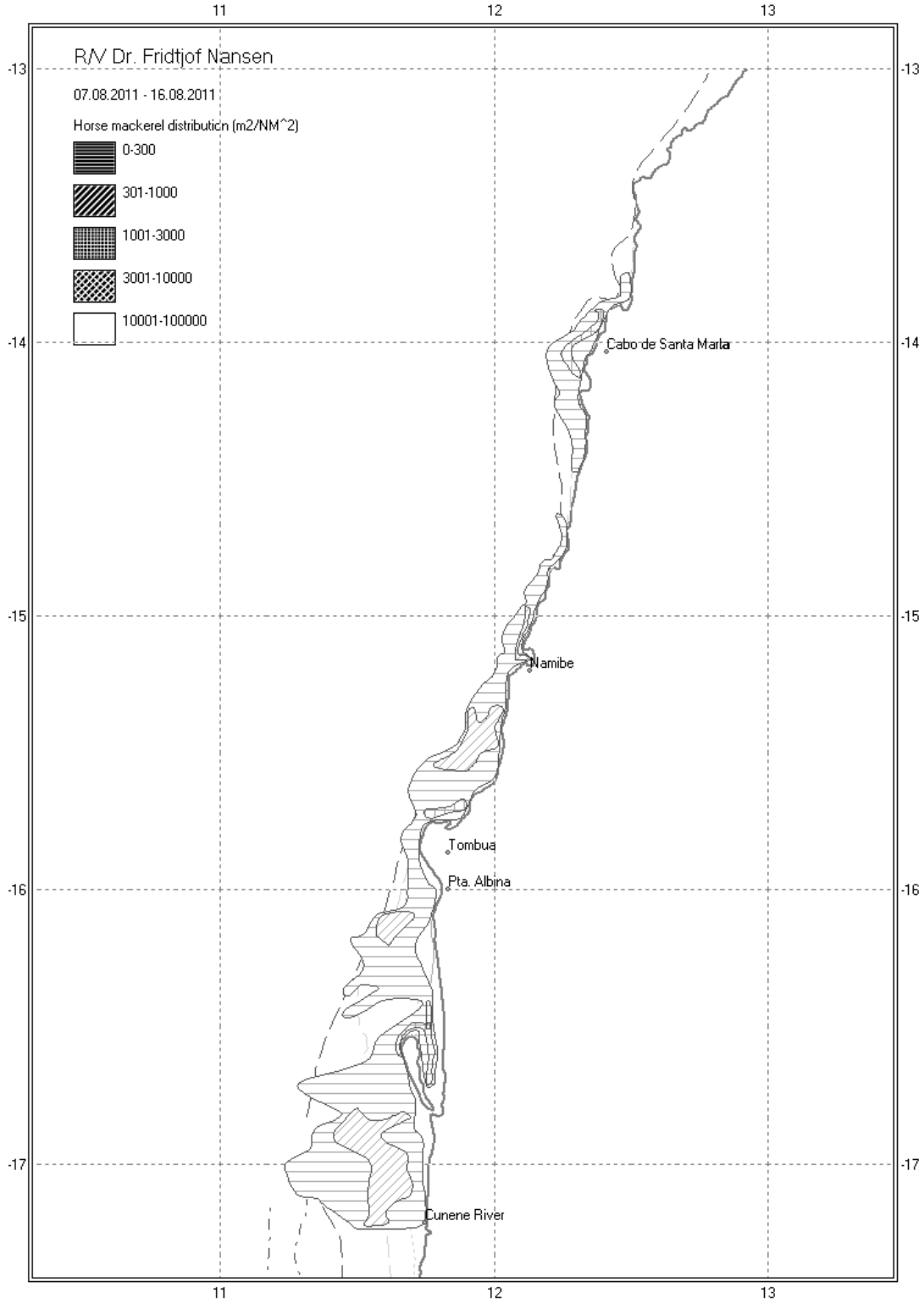
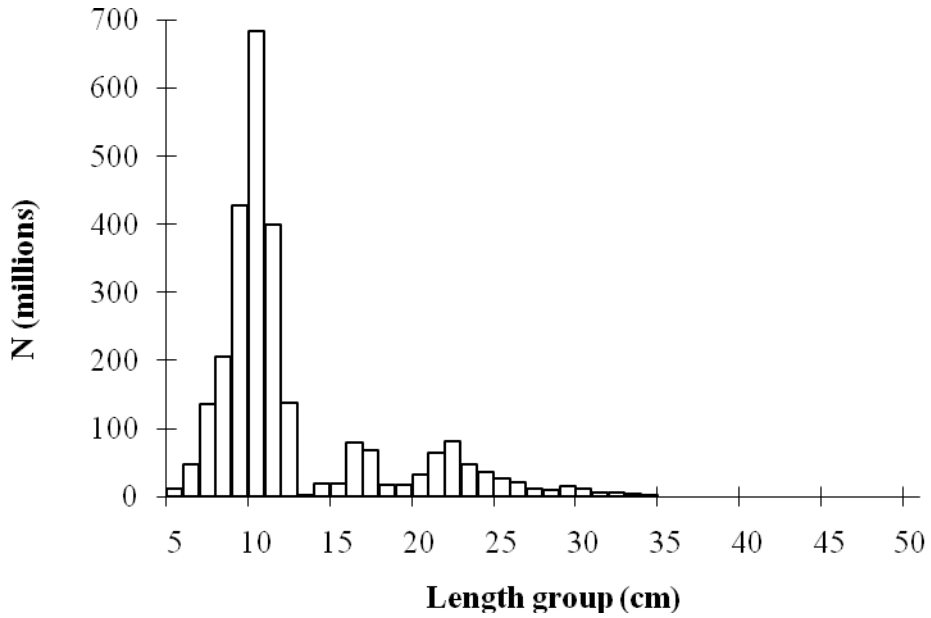


Figure 19. Distribution of horse mackerel (both species). Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 m.

Figure 20 (a and b) shows the length frequency distribution of the Cunene and Cape horse mackerels, respectively. Cunene horse mackerel has four modes, peaking at about 10, 16, 22 and 29 cm TL (Figure 20 a). Cape horse mackerel shows three modes at around 5, 10 and 31 cm TL (Figure 22 b). Fish sizes between 20 and 30 cm TL were practically absent from the catches.

a) *Trachurus trecae*



b) *Trachurus capensis*

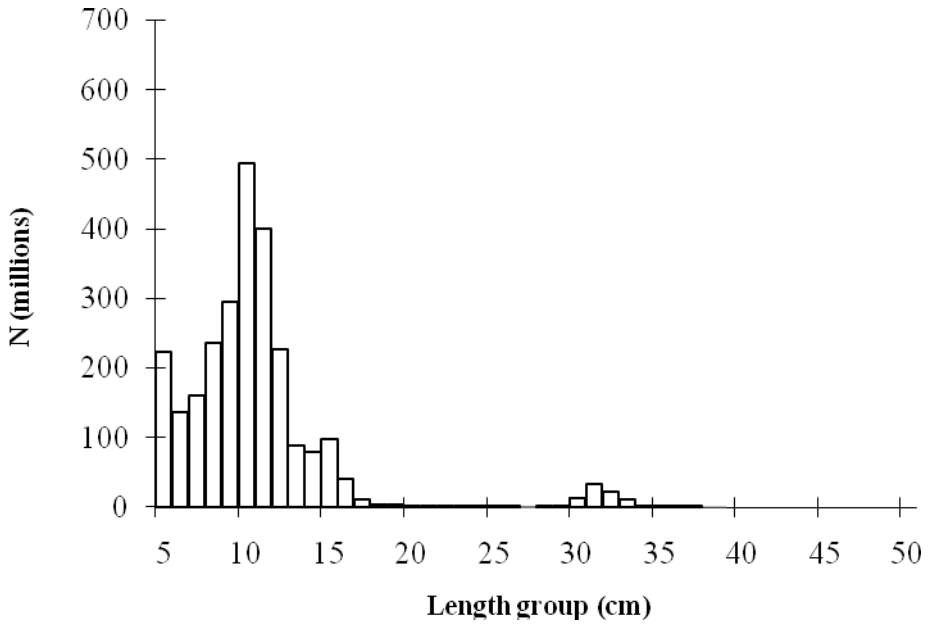


Figure 20. Total length distributions of (a) *Trachurus trecae* and (b) *T. capensis* (b), Benguela-Cunene.

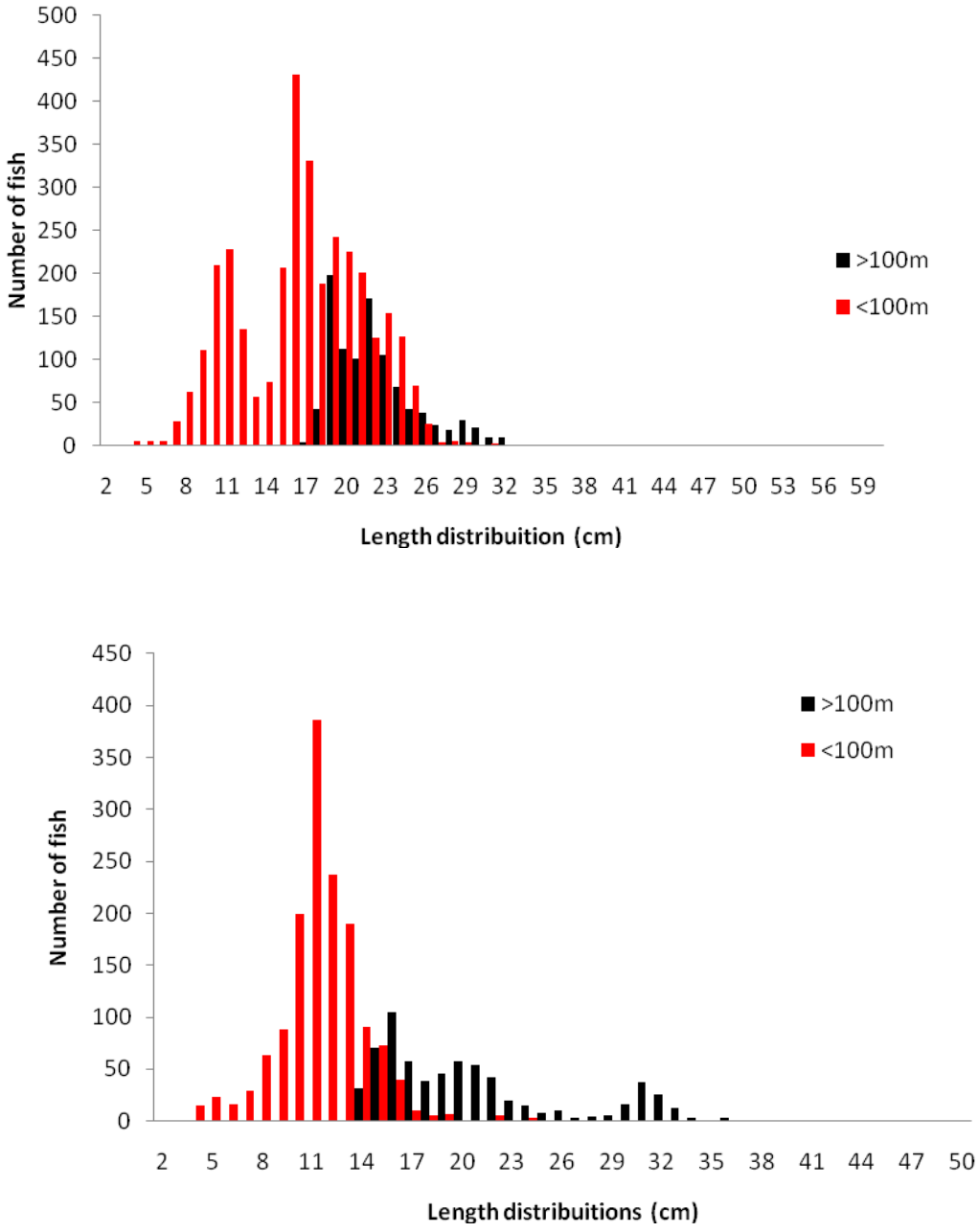


Figure 21. Length distribution (simple adding) of (a) Cunene horse mackerel (*Trachurus trecae*) and (b) Cape horse mackerel (*T. capensis*) by depths strata Benguela-Cunene (depths <100m and >100 m).

Small fish (TL< 15 cm) of *T. trecae* were only caught in waters shallower than 100m (Figure 21), and although the biggest sizes were found all over the distribution's depth range, they were more abundant in waters deeper than 100 m. There is a wide size range (18cm<TL<26cm) that overlaps, with fish being caught both in waters shallower and deeper than 100m.

The situation for *T. capensis* is clearer (Figure 21), with smaller fish in shallower waters (<100m) and bigger fish in deeper waters (>100m).

The biomass estimate for both horse mackerel species in the region, was 124 500 tonnes, which is

lower than the biomass estimated in 2010 (277 000 tonnes). The share of each species was of 74 100 tonnes for Cunene horse mackerel (136 000 tonnes in 2010) and 50 300 tonnes for Cape horse mackerel (141 000 tonnes in 2010).

It is important to consider that the biomass of the two species of horse mackerel cannot be evaluated without considering the seasonal fluctuations of the position of the Angola-Benguela front and the upwelling intensity in this region. This year, as described in the present report, it was observed a strong superficial upwelling that could have facilitated the offshore northward migration of the two species. This process was evident for the Cape horse mackerel, considering that 86% of the total biomass of this species is from the offshore component estimated between Tiger Bay and Cunene River, though its distribution extends into Namibian waters.

Sardine

Sardine or pilchard (*Sardinops sagax)*, was found in a relatively small area between south off Tiger Bay and north off Cunene River (Figure 22). The area had a medium-low density (300< s_A<1000 m^2/NM^2) with a inner high density area (3 000< s_A<10 000 m^2/NM^2) and a core of very high density values (s_A>10 000 m^2/NM^2). The length distribution ranged from 8 to 24cm total length with one mode at 18 cm TL (Figure 23). The total biomass was estimated in 132 300 tonnes.

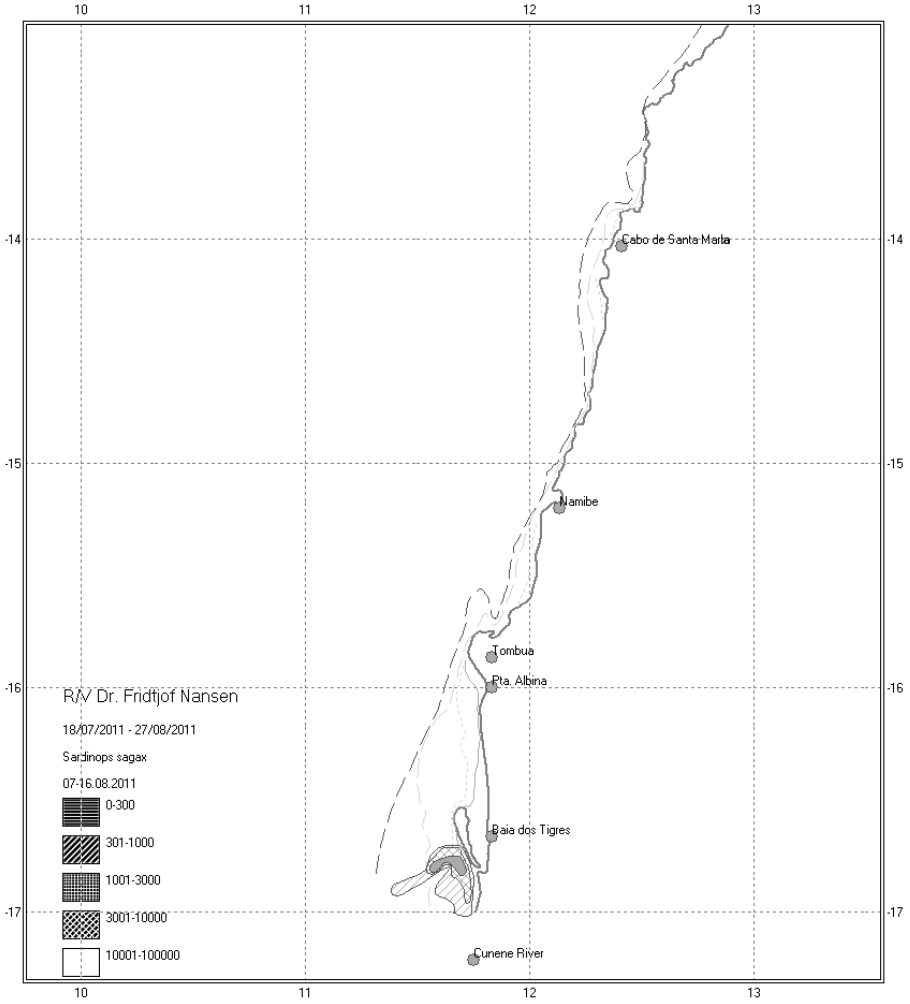


Figure 22. Distribution of sardine. Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500m.

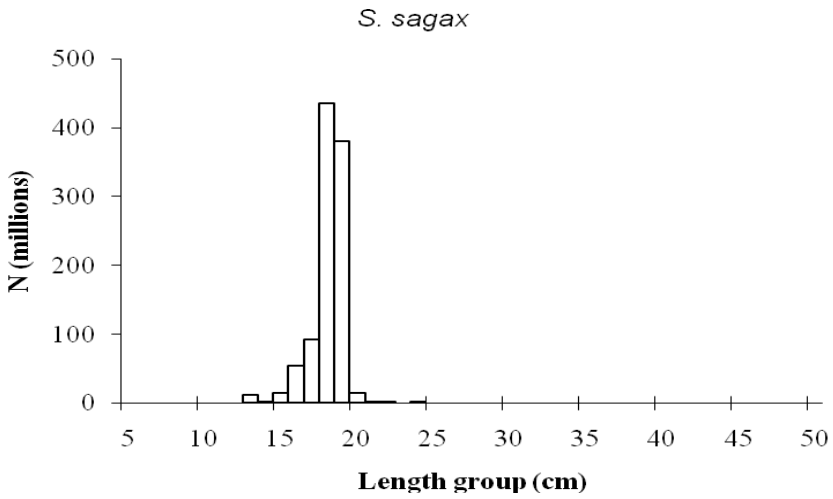


Figure 23 Total length distribution of *Sardinops sagax*, Benguela-Cunene.

Pelagic species Group 1

The dominant species belonging to this group were herring (*Etrumeus whiteheadi*) and anchovy (*Engraulis encrasicolus*). They were found in three low densities areas ($0< s_A<300$ m^2/NM^2) between southern Namibe and the Cunene River and three small medium-high densities ($1\ 000< s_A<3\ 000$ m^2/NM^2) around Tiger Bay area (Figure 24). The biomass for this group was estimated in 55 687 tonnes, considering an average TL of 16 cm (based on caught fish) and a condition factor of 0.01.

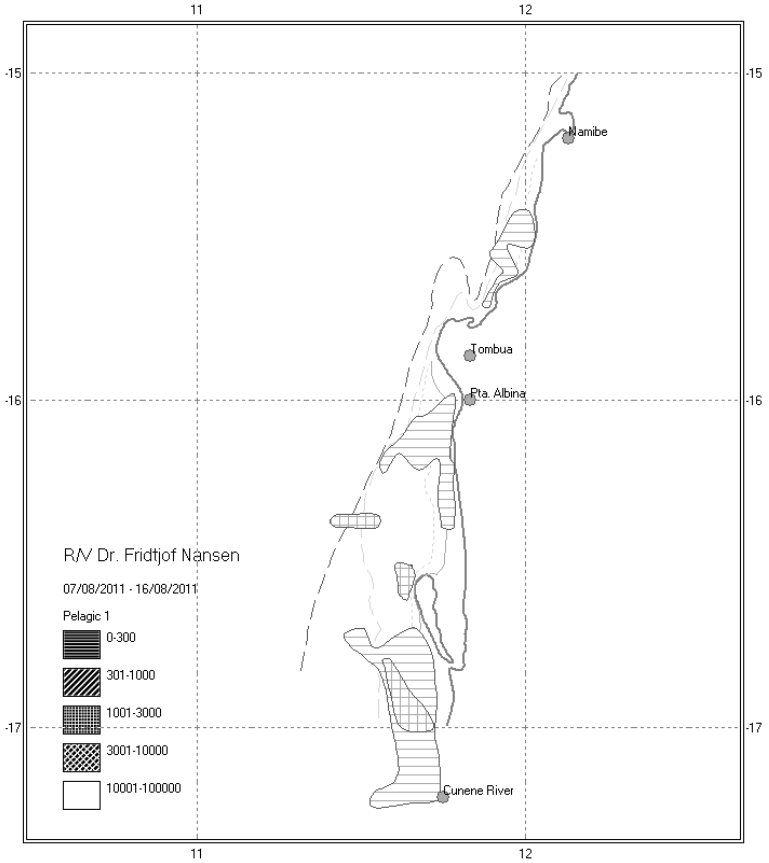


Figure 24. Distribution of Pelagic 1. Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500m.

Pelagic species Group 2

This group was found continuously distributed along the coast, between Namibe and Cunene River in two main low densities areas ($0<s_A<300$ m^2/NM^2) (Figure 25). The group was not abundant in this region being the most common species *Scomber japonicus* (Scombridae) and hairtails (*T. lepturus*) (Table 6).

The biomass estimate, based on an average length of 30 cm TL (based on caught fish) and a condition factor equal to 0.01, was of 17 500 tonnes.

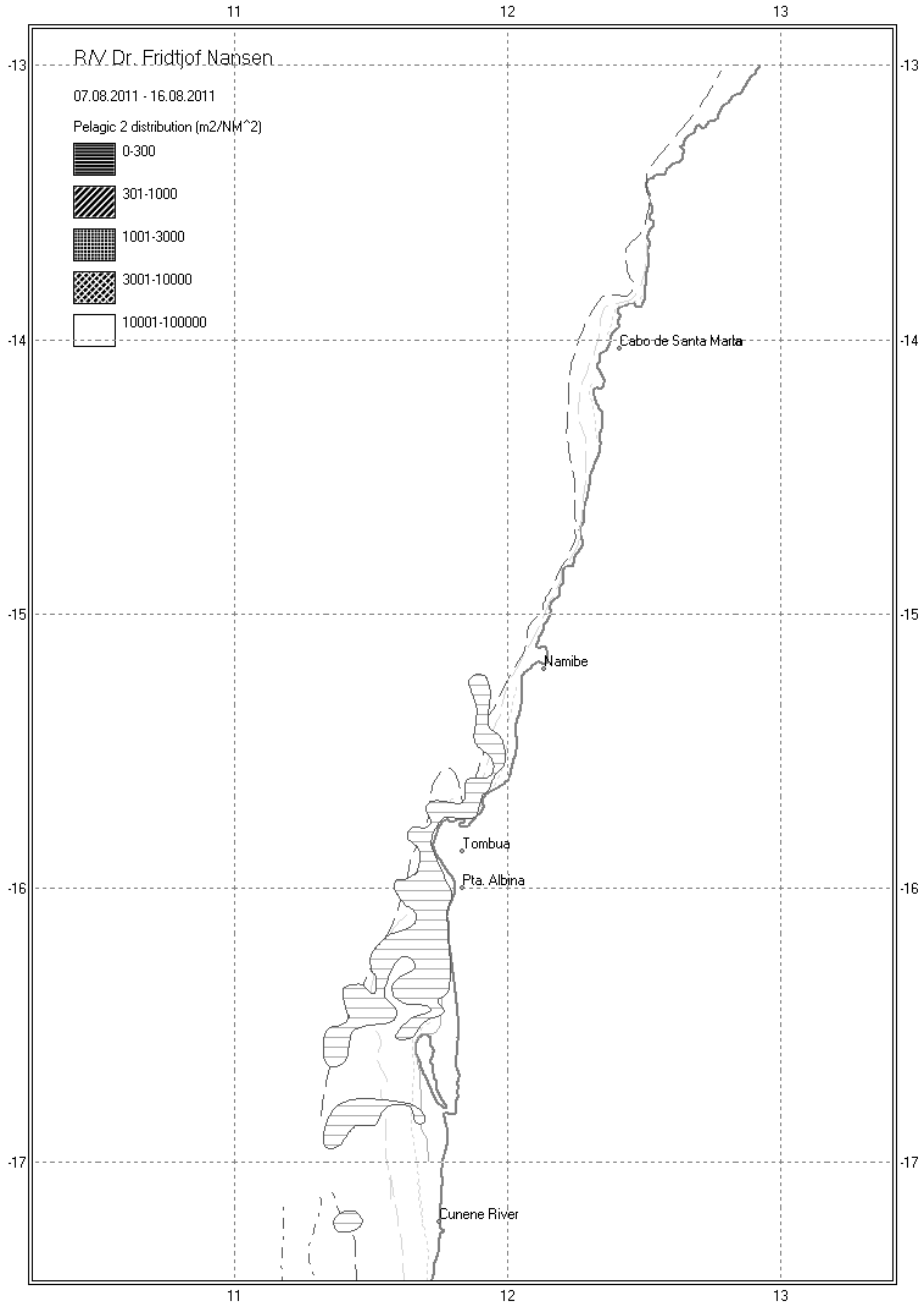


Figure 25. Distribution of Pelagic 2. Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500m.

Table 6. Catch rates (kg/h) of the main groups of pelagic fish, Benguela - Cunene River.

Station	Depth	Barracuda	Carangids	Clupeiods	Hairtails	Horse mackerel	Sardinella	Scombrids	Other	Total
38	5								79.1	79.1
39	22					1569.8		11	13.3	1594
40	143					52.2			2373.1	2425.3
41	87		1.6			77.2			1634.8	1713.6
42	5					0.2			0.2	0.4
43	60							0.2	2.5	2.7
44	96.5					960.4			682.4	1642.9
45	124					3090			5477.4	8567.4
46	10								4.3	4.3
47	115			0.2		293		0.5	4654.9	4948.6
48	112			9.9		427.2			1480.2	1917.3
49	10			4.7	3.2	654.9		1.9		664.8
50	17.5			13		2024.6		88	12.9	2138.5
53	98			11.8		503.3		29.2	156.2	700.6
54	27.5			33		254.1		19.1	3.3	309.5
57	18					4730		1.7	3.3	4735
63	10			42843.7						42843.7
67	5			0.4						0.4
68	18			63.2	0.1	1.6		0.5	16	81.4
74	140					36.1			7.9	44
76	5			419	0.4	30			1.4	450.8
80	60			57.3				0.1	5.7	63.1
Mean	54		0.1	1975.3	0.2	668.4		6.9	755	3405.8
Std dev	50.4		0.3	9128.5	0.7	1207.2		19.6	1544.9	9061.3
%Catch				58.0		19.6		0.2	22.2	

CHAPTER 5 SUMMARY OF SURVEY RESULTS

5.1 Sardinella

The estimated biomass of the sardinellas shows a cyclically fluctuating pattern throughout the time series (Figure 26). This is commonly found in pelagic species, usually reflecting actual changes in abundance but also variation in the availability of the surveyed populations, often caused by changes in the environmental conditions. On the overall, the Sardinella stocks presently seem to be in reasonably good condition. The total biomass estimate for the sardinellas was 252 000 tonnes. This is, however, almost 40% lower than the biomass estimated in 2010 (428 000 tonnes) and the tendency continues the downward trend that began in 2007. The current downward trend warrants for some caution in the management of these stocks and it is therefore important to carefully follow the landings and the development of the biomass levels over the next years. Thus, at the moment, it is not advisable to increase the fishing pressure on these stocks.

During the present survey the environmental conditions were characterized by the occurrence of an upwelling phenomenon along the coast, with cold-low-salinity waters confined into inshore areas. This feature makes the aggregation pattern of Sardinella different from that of previous surveys: acoustically Sardinella was observed more dispersed throughout the distribution area than previously recorded. Only a few, very dense schools were recorded, making difficult to follow the day/nigh pattern.

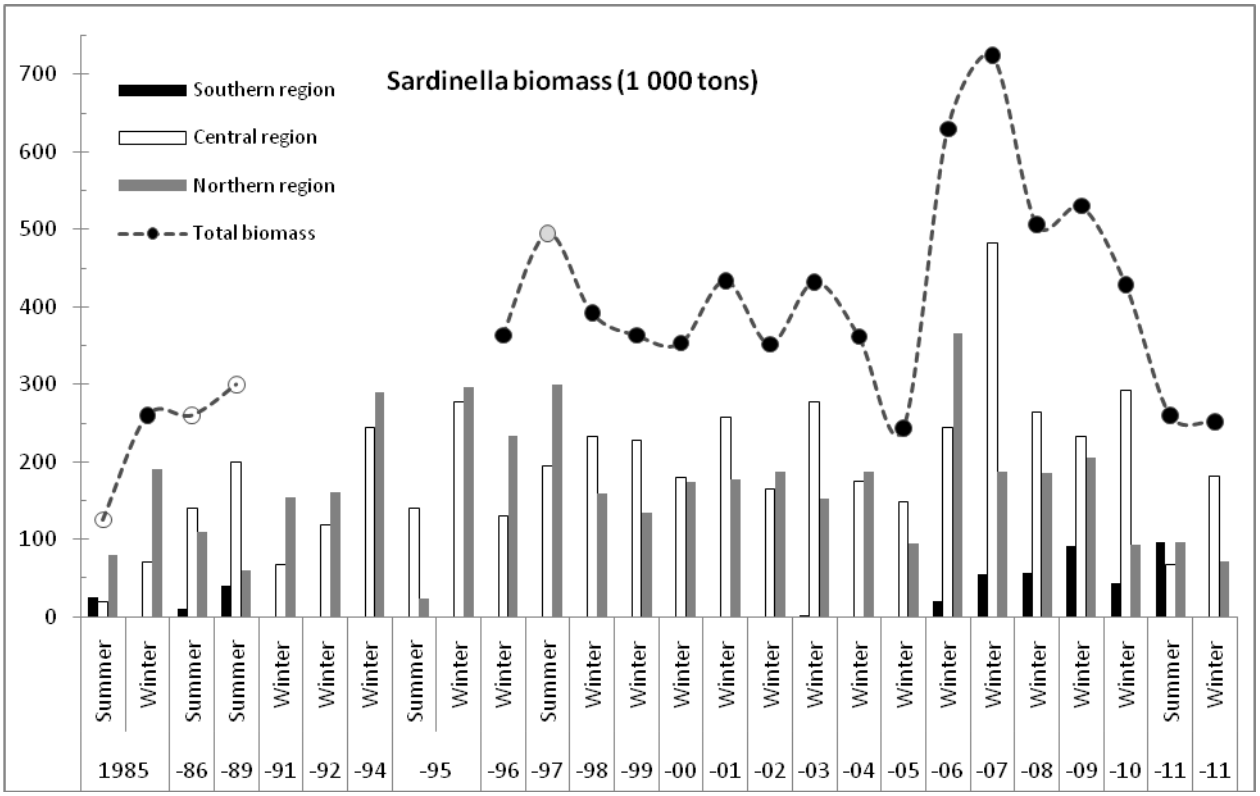
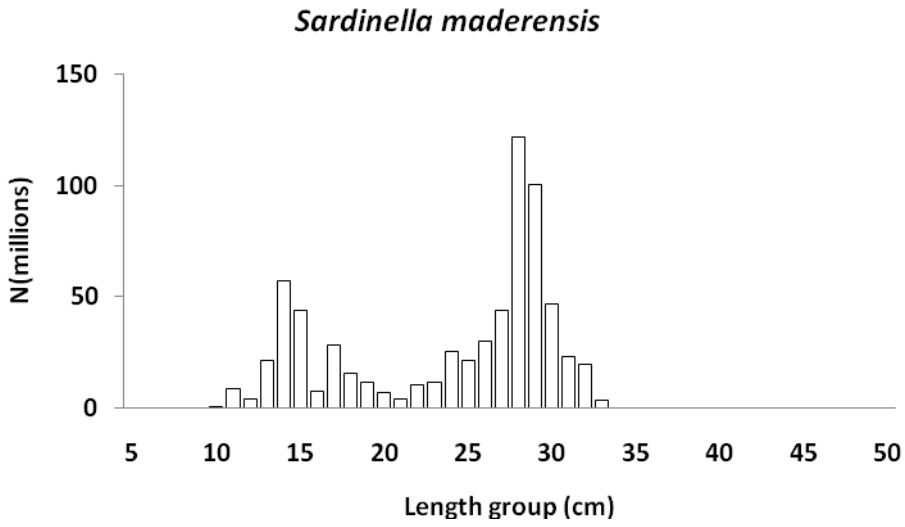


Figure 26. Biomass estimates of Sardinella by regions and surveys (1 000 tons).

In contrast to what has been found for most of the previous years, *S. aurita* dominated the relative proportion of the total biomass (65 %). Both species were found in the northern and central regions, being completely absent from the southern region. *S. aurita* was found primarily in the central region, while *S. maderensis* was found approximately equally both, in the northern and central regions (last year it was only found in the northern region).

The overall length frequency distributions of the two Sardinella species show both juvenile and adult cohorts (Figure 27). The distribution of *S. maderensis* shows well-defined cohorts with modal peaks around 11, 14, 17 and 28 cm total length. For *S. aurita*, the distribution shows modal peaks at 8, 24 and 29 cm TL. The distributions also indicate that *S. maderensis* enters into the fishery at around 10 cm TL for while *S. aurita* does it at around 8 cm TL.

a)



b)

S

Figure 27. Overall total length distribution of *S. maderensis* (a) and *S. aurita* (b).

5.2 Cunene horse mackerel

The total biomass of Cunene horse mackerel was estimated at 117 100 tonnes. This is a low estimate in the time series (Figure 28) although somewhat higher than the lowest estimate in the times series (69000 tonnes in 2008).

The bulk of the biomass was this year found in the southern part of the southern region (74 100 tonnes). The biomass levels in the northern and central regions are still at a low level (17 500 and 25 470 tonnes respectively) contributing with 37% to the total biomass. Comparing this value with those of previous surveys carried out during the same period (July-August), this year's estimate is about the same as the one in 2010 (36 000 tonnes) but lower than the 2007's estimated (84 000 tonnes). The current Cunene horse mackerel biomass is very low compared with the reference year of 1996, when the biomass was estimated at around 360 000 tonnes for the winter survey.

The overall length frequency distributions of the two horse mackerel species show that the juvenile cohorts are dominants (Figure 29). Particularly, the distribution of *T. trecae* shows well-defined cohorts with modal peaks around 10, 16, 22 and 30 cm total length, while *T. capensis*' distribution shows modal peaks at 5, 10, 15 and 31 cm TL. The distributions also indicate a good recruitment level.

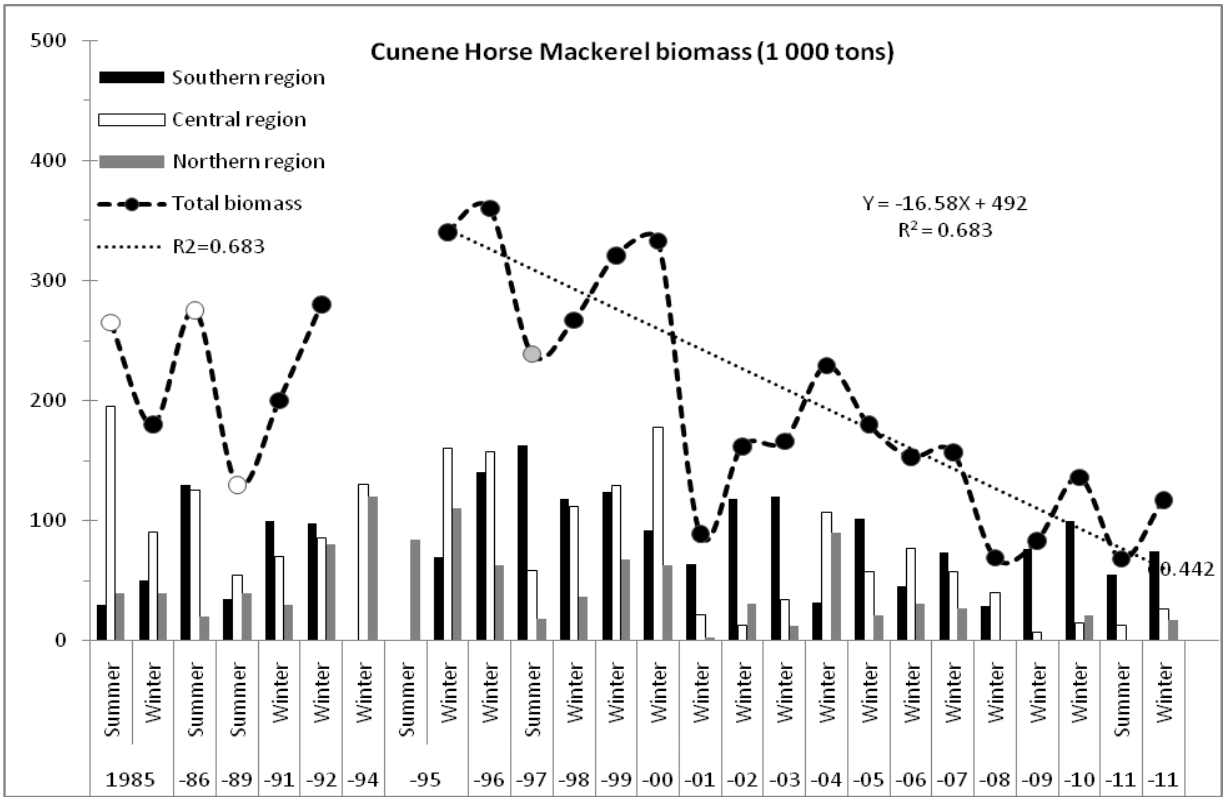


Figure 28. Biomass estimates of Cunene horse mackerel by regions and surveys (1 000 tons).

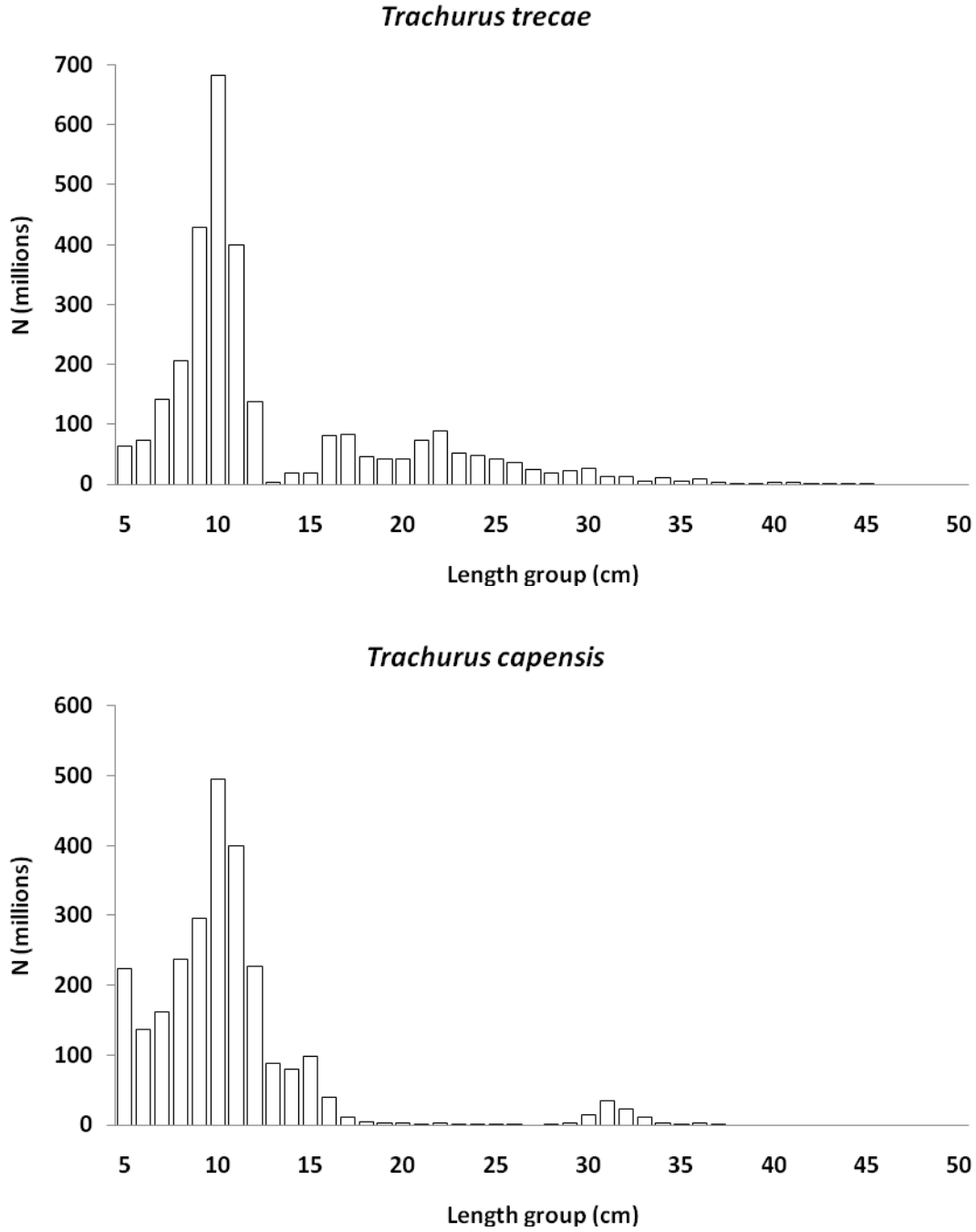


Figure 29. Overall total length distribution of (a) *T trecae* and (b) *T. capensis*.

The total biomass of Cape horse mackerel was estimated at 50 300 tonnes. This is about 64% lower than the biomass estimated in 2010 (141 000 tonnes, winter survey).

The reported biomass levels should be treated with caution, since they are relative indices rather than absolute estimates of abundance, and the natural cyclic variation pattern may be accentuated by changes in behaviour related to the environmental conditions. This variation is particularly evident in

the Benguela Current frontal zone in the Southern region, where the cold Benguela waters meet the warm, subtropical Angola current.

Although the general picture is of decreasing biomass values, the time series shows a weak indication that the stock is increasing from its historic low value in 2008. However, this trend should be interpreted with great caution, as the increase in biomass this year, represents almost entirely an increase in the near-border area in the south. This trend does not necessarily reflect an ongoing recovery of the stock, but could as well be a result of the influence of the strong superficial upwelling observed throughout the Southern region. The Angolan-Benguela front (ABF) was at the time of the survey located around the Baía dos Tigres-Cunene River patch. The upwelling caused by the position of the ABF seemed to have facilitated the offshore migration of Cunene horse mackerel. The position of the ABF has also likely caused Cunene horse mackerel in Namibian waters to migrate northwards and into Angolan waters. The northwards migration of pelagic fish from Namibia and into Angolan waters at the time of the survey could also be seen from the higher abundance of Cape horse mackerel and the presence of *Sardinops sagax*.

Favourable conditions may increase the availability to the fishing gear. This is important for the management of the stocks, as an increment in the availability may be taken as a sign of increased abundance, which is not always the case. An increase in the fish availability does not necessarily mean an increase in abundance, and sometimes the availability may increase even with a decreasing abundance. Increasing the fishing pressure on the basis of high availability, involves therefore a risk. This risk is particularly evident for Cunene horse mackerel as 75% of its total biomass was found in the Southern region and, as in previous surveys, 99 % of the biomass in this region is comprised by juveniles (TL < 21 cm).

Other biological parameters also clearly indicate that the Cunene horse mackerel stock is still under considerable fishing pressure. From the reference year of 1996, the length distributions have been shifting towards smaller fish, indicating high fishing pressure on the adult stock (Figure 29). In addition, for most of the last five years, recruitment hasn’t been high and the size at first maturity has been declining from 23 cm TL in 1996 to 14 cm TL in recent years. With this frame, an increase in the fishing pressure could threaten the long-term recovery of the Cunene horse mackerel stock in Angolan waters.

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MISUND, O. A. and A. AGLEN 1992 — Swimming behaviour of fish schools in the North Sea during acoustic surveying and pelagic trawl sampling. *ICES J. Mar. Sci.* **49**: 3

ANNEX I FISHING STATIONS

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 1
DATE :21.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 6°34.12
start stop duration Lon E 11°49.66
TIME :07:00:15 07:31:44 31.5 (min) Purpose : 1
LOG : 6290.12 6291.77 1.7 Region : 4054
FDEPTH: 129 135 Gear cond.: 0
BDEPTH: 129 135 Validity : 0
Towing dir: 0° Wire out : 315 m Speed : 3.1 kn
Sorted : 111 Total catch: 110.72 Catch/hour: 210.96

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	55.92	253	26.51	1
Dentex angolensis	98.98	575	46.92	2
Ariomma bondi	29.34	1345	13.91	
Spicara alta	1.96	27	0.93	
Pterothrissus belloci	0.91	8	0.43	
Dentex congoensis	13.24	192	6.28	3
Umbrina canariensis	0.51	2	0.24	
Chelidonichthys gabonensis	2.55	32	1.21	
Zeus faber	5.22	8	2.47	
Citharus linguatula	0.13	8	0.06	
Squatina oculata	1.35	2	0.64	
Sepia orbignyana	0.17	2	0.08	
Peristedion cataphractum	0.13	2	0.06	
Illex coindetii	0.48	27	0.23	
FISH LARVAE	0.04	15	0.02	
Total	210.96		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 2
DATE :21.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 6°24.56
start stop duration Lon E 12°9.29
TIME :10:27:01 10:56:43 29.7 (min) Purpose : 1
LOG : 6317.18 6318.73 1.6 Region : 4054
FDEPTH: 42 45 Gear cond.: 0
BDEPTH: 42 45 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.1 kn
Sorted : 45 Total catch: 45.02 Catch/hour: 90.92

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	49.58	83	54.53	6
Lagocephalus laevigatus	14.90	14	16.39	
Pagellus bellottii	9.84	85	10.82	5
Fistularia petimba	2.58	8	2.84	
Dentex barnardi	3.74	10	4.11	4
Dentex angolensis	1.03	6	1.13	
Zeus faber	1.03	2	1.13	
Stromateus fiatola	2.08	2	2.29	
Pagrus caeruleostictus	0.50	2	0.56	
Chelidonichthys gabonensis	0.57	2	0.62	
Uranoscopus polli	0.30	2	0.33	
Ariomma bondi	0.10	6	0.11	
Syacium micrurum	0.30	2	0.33	
Loligo vulgaris	0.12	4	0.13	
Rhinobatos albomaculatus	0.42	2	0.47	
Sepia orbignyana	3.21	6	3.53	
Trachinus araneus	0.61	2	0.67	
Total	90.92		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 3
DATE :21.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 6°43.02
start stop duration Lon E 11°45.18
TIME :17:34:00 17:54:26 20.4 (min) Purpose : 1
LOG : 6375.93 6376.95 1.0 Region : 4054
FDEPTH: 277 270 Gear cond.: 0
BDEPTH: 277 270 Validity : 0
Towing dir: 0° Wire out : 680 m Speed : 3.0 kn
Sorted : 33 Total catch: 195.72 Catch/hour: 574.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius polli	71.33	898	12.42	7
Synagrops microlepis	132.09	5513	22.99	
Chlorophthalmus atlanticus	251.86	7080	43.84	
Parasudis truculentus	35.05	933	6.10	
Epigonus telescopus	20.61	247	3.59	
Brotula barbata	8.10	18	1.41	
Pontinus accraensis	4.76	53	0.83	
Peristedion cataphractum	1.23	194	0.21	
Dentex angolensis	7.40	18	1.29	
Illex coindetii	12.68	229	2.21	
Parapenaeus longirostris	11.80	2078	2.05	
MYCTOPHIDAE	14.97	12646	2.61	
Lestidium atlanticum	2.29	106	0.40	
Malacocephalus laevis	0.35	18	0.06	
Total	574.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 4
DATE :22.07.2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 6°34.41
start stop duration Lon E 12°21.17
TIME :00:25:06 00:55:08 30.0 (min) Purpose : 1
LOG : 6434.78 6436.49 1.7 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 23 24 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 3.4 kn
Sorted : 19 Total catch: 54.50 Catch/hour: 108.89

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	59.24	116	54.40	
Sardinella maderensis	5.39	52	4.95	8
Brachydeuterus auritus	44.06	438	40.46	9
Sepia orbignyana	0.20	2	0.18	
Total	108.89		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 5
DATE :22.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 6°53.79
start stop duration Lon E 12°2.43
TIME :10:05:54 10:36:59 31.1 (min) Purpose : 1
LOG : 6508.30 6509.85 1.6 Region : 4054
FDEPTH: 98 101 Gear cond.: 0
BDEPTH: 98 101 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.0 kn
Sorted : 87 Total catch: 87.14 Catch/hour: 168.22

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex angolensis	71.04	0	42.23	12
Dentex congoensis	35.71	907	21.23	10
Dentex barnardi	4.44	14	2.64	11
Pagellus bellottii	3.36	37	2.00	13
Umbrina canariensis	7.39	14	4.40	
Raja miraletus	2.74	4	1.63	
Ariomma bondi	0.31	6	0.18	
Chaetodon hoefleri	0.97	6	0.57	
Chelidonichthys gabonensis	25.87	210	15.38	
Mustelus mustelus	4.05	2	2.41	
Peristedion cataphractum	0.19	31	0.11	
Squatina oculata	11.29	2	6.71	
Saurida brasiliensis	0.04	8	0.02	
Trachurus trecae	0.10	2	0.06	
J E L L Y F I S H	0.68	145	0.40	
Illex coindetii	0.04	12	0.02	
Total	168.22		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 6
DATE :22.07.2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°43.49
start stop duration Lon E 12°22.88
TIME :14:02:59 14:30:30 27.5 (min) Purpose : 1
LOG : 6537.46 6539.24 1.8 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 27 28 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.9 kn
Sorted : 8 Total catch: 8.42 Catch/hour: 18.37

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	5.19	24	28.27	15
Sardinella maderensis	12.52	52	68.17	14
J E L L Y F I S H	0.65	2	3.56	
Total	18.37		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 7
DATE :23.07.2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°4.35
start stop duration Lon E 12°17.66
TIME :00:16:28 00:46:30 30.0 (min) Purpose : 1
LOG : 6635.31 6636.90 1.6 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 89 96 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.2 kn
Sorted : 51 Total catch: 50.79 Catch/hour: 101.48

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1.34	8	1.32	
Trachinotus ovatus	47.05	122	46.37	
Trichiurus lepturus	22.88	28	22.54	
Saurida brasiliensis	0.88	220	0.87	
Scomber japonicus	0.04	10	0.04	
Selene dorsalis	0.02	6	0.02	
Alloteuthis africana	2.74	821	2.70	
Lagocephalus laevigatus	2.18	16	2.15	
J E L L Y F I S H	0.08	2	0.08	
Isurus oxyrinchus	24.28	2	23.92	
Total	101.48		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 8
DATE :23.07.2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 7°14.94
start stop duration Lon E 12°22.83
TIME :07:32:33 08:09:18 36.8 (min) Purpose : 1
LOG : 6691.19 6693.05 1.9 Region : 4054
FDEPTH: 90 95 Gear cond.: 0
BDEPTH: 113 115 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 3.0 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:2011408 STATION: 9
DATE :23.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 7°10.54
start stop duration Lon E 12°36.54
TIME :16:52:37 17:22:42 30.1 (min) Purpose : 1
LOG : 6776.11 6777.71 1.6 Region : 4054
FDEPTH: 45 46 Gear cond.: 0
BDEPTH: 45 46 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.2 kn
Sorted : 39 Total catch: 38.64 Catch/hour: 77.05

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1.66	4	2.15	16
Pagellus bellottii	24.63	128	31.96	19
Fistularia petimba	7.04	6	9.14	
Pomadasys incisus	12.46	64	16.17	18
Brachydeuterus auritus	7.04	56	9.14	17
Pagrus caeruleostictus	2.43	10	3.16	
Pseudupeneus prayensis	1.79	6	2.33	
Seriola carpenteri	1.06	4	1.37	
Raja miraletus	0.92	2	1.19	
Chelidonichthys gabonensis	2.05	10	2.67	
Trachinus armatus	0.24	2	0.31	
Trachinocephalus myops	2.59	8	3.36	
Syacium micrurum	0.72	4	0.93	
Dicologoglossa hexophthalma	0.38	4	0.49	
Bothus podas africanus	0.62	10	0.80	
Rhinobatos albomaculatus	6.98	4	9.06	
Pegusa lascaris	0.22	2	0.28	
Sepia orbignyana	4.23	4	5.49	
Total	77.05		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 10
DATE :24.07.2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°22.43
start stop duration Lon E 12°31.98
TIME :02:48:05 03:18:40 30.6 (min) Purpose : 1
LOG : 6849.52 6851.30 1.8 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 94 84 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.5 kn
Sorted : 21 Total catch: 20.69 Catch/hour: 40.58

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	14.69	24	36.20	20
Trichiurus lepturus	16.18	20	39.87	
Trachinotus ovatus	5.94	14	14.64	
Saurida brasiliensis	0.86	196	2.13	
Scomber japonicus	0.06	8	0.14	
Alloteuthis africana	2.65	730	6.52	
Selene dorsalis	0.04	8	0.10	
Lagocephalus laevigatus	0.04	2	0.10	
Sepia officinalis	0.12	4	0.29	
Total	40.58		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 11
DATE :24.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 7°27.55
start stop duration Lon E 12°32.89
TIME :08:28:13 08:59:00 30.8 (min) Purpose : 1
LOG : 6896.40 6898.01 1.6 Region : 4054
FDEPTH: 107 108 Gear cond.: 0
BDEPTH: 107 108 Validity : 0
Towing dir: 0° Wire out : 270 m Speed : 3.1 kn
Sorted : 173 Total catch: 172.50 Catch/hour: 336.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	154.39	380	45.91	21
Dentex angolensis	24.85	331	7.39	22
Selene dorsalis	4.64	10	1.38	23
Dentex congoensis	63.16	2037	18.78	24
Dentex barnardi	0.86	2	0.26	
Trichiurus lepturus	6.76	8	2.01	
Atractoscion aequidens	5.07	4	1.51	
Chelidonichthys gabonensis	29.14	230	8.67	
Boops boops	11.62	415	3.46	
Spicara alta	5.56	316	1.65	
Lagocephalus laevigatus	9.65	16	2.87	
Raja miraletus	8.81	16	2.62	
Zeus faber	1.19	4	0.35	
Citharus linguatula	0.47	4	0.14	
Bothus podas africanus	0.16	2	0.05	
Uranoscopus polli	0.84	4	0.25	
Sepia orbignyana	0.60	6	0.18	
Illex coindetii	6.04	181	1.80	
Chaetodon hoefleri	0.35	2	0.10	
Alloteuthis africana	1.97	2	0.59	
Saurida brasiliensis	0.08	21	0.02	
Ariomma bondi	0.04	2	0.01	
Arnoglossus imperialis	0.02	2	0.01	
Total	336.26		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 12
DATE :24.07.2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°45.72
start stop duration Lon E 12°53.74
TIME :22:33:07 23:03:16 30.2 (min) Purpose : 1
LOG : 7022.27 7023.92 1.6 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 63 75 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.3 kn
Sorted : 55 Total catch: 55.05 Catch/hour: 109.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	11.44	38	10.45	25
Brachydeuterus auritus	68.36	416	62.40	26
Scomber japonicus	5.63	16	5.14	27
Trichiurus lepturus	14.53	26	13.26	
Alloteuthis africana	7.66	2617	6.99	
Sardinella aurita	0.44	2	0.40	28
Sepia orbignyana	1.41	12	1.29	
Saurida brasiliensis	0.08	24	0.07	
Total	109.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 13
DATE :25.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 7°50.04
start stop duration Lon E 12°59.99
TIME :09:28:44 09:59:25 30.7 (min) Purpose : 1
LOG : 7086.76 7088.24 1.5 Region : 4054
FDEPTH: 48 48 Gear cond.: 0
BDEPTH: 48 48 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 2.9 kn
Sorted : 586 Total catch: 568.30 Catch/hour: 1111.05

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Zeus faber	5.57	12	0.50	
Sepia orbignyana	11.40	16	1.03	
Brachydeuterus auritus	826.39	17889	74.38	29
Rhinobatos albomaculatus	53.96	35	4.86	
Trachurus trecae	5.87	1760	0.53	30
Sardinella aurita	0.59	117	0.05	31
Engraulis encrasicolus	0.23	59	0.02	
Pseudupeneus prayensis	4.46	47	0.40	
Selene dorsalis	28.62	340	2.58	32
Pagellus bellottii	20.76	211	1.87	33
Raja miraletus	16.66	23	1.50	
Stromateus fiatola	59.94	176	5.40	
Trichiurus lepturus	36.36	117	3.27	
Pomadasys incisus	15.72	106	1.41	
Citharus linguatula	0.59	12	0.05	
Galeoides decadactylus	16.54	47	1.49	
Boops boops	0.47	12	0.04	
Alloteuthis africana	1.88	2311	0.17	
Epinephelus aeneus	4.11	12	0.37	
Penaeus notialis	0.12	12	0.01	
Decapterus rhonchus	0.82	12	0.07	
Total	1111.05		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 14
DATE :25.07.2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°1.40
start stop duration Lon E 13°6.41

TIME :18:02:45 18:27:54 25.1 (min) Purpose : 1
LOG : 7161.56 7163.05 1.5 Region : 4054
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 42 54 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.6 kn
Sorted : 239 Total catch: 238.79 Catch/hour: 569.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	255.01	1179	44.75	34
Sardinella maderensis	225.78	1232	39.62	35
Trachurus trecae	0.98	19	0.17	36
Ilisha africana	6.35	64	1.11	37
Brachydeuterus auritus	70.29	1976	12.33	38
Trichiurus lepturus	6.95	131	1.22	
Lagocephalus laevigatus	0.02	19	0.00	
Sepia orbignyana	4.39	1136	0.77	
Penaeus notialis	0.12	2	0.02	
Penaeus kerathurus	0.02	2	0.00	
Total	569.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 15
DATE :26.07.2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°14.91
start stop duration Lon E 13°5.69
TIME :02:40:27 03:10:34 30.1 (min) Purpose : 1
LOG : 7232.97 7234.63 1.7 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 78 68 Validity : 0
Towing dir: 0° Wire out : 116 m Speed : 3.3 kn
Sorted : 7 Total catch: 6.82 Catch/hour: 13.58

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	9.46	68	69.65	39
Trichiurus lepturus	3.72	36	27.42	
Alloteuthis africana	0.34	219	2.49	
Saurida brasiliensis	0.04	8	0.29	
Lagocephalus laevigatus	0.02	2	0.15	
Total	13.58		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 16
DATE :26.07.2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°26.04
start stop duration Lon E 13°11.68
TIME :12:50:59 13:21:02 30.1 (min) Purpose : 1
LOG : 7311.28 7313.13 1.9 Region : 4054
FDEPTH: 24 31 Gear cond.: 0
BDEPTH: 64 74 Validity : 0
Towing dir: 0° Wire out : 90 m Speed : 3.7 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:2011408 STATION: 17
DATE :26.07.2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 8°27.21
start stop duration Lon E 13°19.51
TIME :15:29:33 16:01:16 31.7 (min) Purpose : 1
LOG : 7327.60 7329.39 1.8 Region : 4054
FDEPTH: 23 23 Gear cond.: 0
BDEPTH: 23 23 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.4 kn
Sorted : 279 Total catch: 1000.65 Catch/hour: 1893.38

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	264.50	2744	13.97	40
Brachydeuterus auritus	1037.14	22320	54.78	41
Ilisha africana	157.48	3027	8.32	42
Pseudotolithus senegalensis	115.84	596	6.12	
Pteroscion peli	88.40	3082	4.67	
Pentanemus quinquarius	26.28	522	1.39	
Cynoglossus senegalensis	3.50	6	0.18	
Sepia orbignyana	46.05	1016	2.43	
Gymnura micrura	42.67	8	2.25	
Torpedo marmorata	23.03	40	1.22	
Scorpaena stephanica	0.06	8	0.00	
Pisodonophis semicinctus	12.87	81	0.68	
Galeoides decadactylus	7.78	89	0.41	
J E L L Y F I S H	15.04	21	0.79	
Dicologoglossa cuneata	11.18	271	0.59	
Pomadasys incisus	1.48	21	0.08	
Sardinella maderensis	1.42	8	0.07	
Penaeus notialis	13.34	1315	0.70	
Trichiurus lepturus	24.18	772	1.28	
Stromateus fiatola	0.74	34	0.04	
Selene dorsalis	0.08	47	0.00	43
FISH LARVAE	0.32	202	0.02	
Total	1893.38		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 18
DATE :27.07.2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°46.78
start stop duration Lon E 13°12.35
TIME :00:09:17 00:39:35 30.3 (min) Purpose : 1
LOG : 7404.78 7406.43 1.7 Region : 4054
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 62 78 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.3 kn
Sorted : 236 Total catch: 235.52 Catch/hour: 466.38

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	211.39	659	45.33	44
Brachydeuterus auritus	197.52	1055	42.35	45
Scomber japonicus	31.29	73	6.71	46
Trichiurus lepturus	18.61	38	3.99	
Sardinella maderensis	1.41	6	0.30	47
Sepia orbignyana	1.94	4	0.42	
Engraulis encrasicolus	4.06	628	0.87	48
Saurida brasiliensis	0.16	44	0.03	
Total	466.38		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 19
DATE :29/07/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 9°10.53
start stop duration Lon E 12°53.03
TIME :17:58:33 18:29:00 30.5 (min) Purpose : 1
LOG : 7644.74 7646.37 1.6 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 55 35 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.2 kn
Sorted : 243 Total catch: 1300.02 Catch/hour: 2561.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	946.31	3675	36.94	51
Brachydeuterus auritus	944.20	8839	36.86	50
J E L L Y F I S H	264.04	981	10.31	
Selene dorsalis	169.52	1848	6.62	53
Sardinella maderensis	163.17	686	6.37	52
Trachurus trecae	62.27	327	2.43	49
Scomber japonicus	6.86	20	0.27	54
Sepia orbignyana	2.11	22	0.08	
Penaeus notialis	1.48	22	0.06	
Pagellus bellottii	1.36	32	0.05	
Saurida brasiliensis	0.22	75	0.01	
Lagocephalus laevigatus	0.10	71	0.00	
Total	2561.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 20
DATE :30/07/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 9°21.78
start stop duration Lon E 12°48.84
TIME :01:49:46 02:19:49 30.0 (min) Purpose : 1
LOG : 7712.30 7713.93 1.6 Region : 4040
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 106 119 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.3 kn
Sorted : 521 Total catch: 520.94 Catch/hour: 1040.49

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	448.60	1292	43.11	55
Selene dorsalis	373.10	2517	35.86	57
Trichiurus lepturus	122.28	358	11.75	
Sardinella maderensis	45.94	142	4.42	56
Trachinotus ovatus	18.30	58	1.76	
Synagrops microlepis	14.42	7077	1.39	
Lagocephalus laevigatus	12.66	22	1.22	
Selar crumenophthalmus	2.18	4	0.21	
Scomber japonicus	1.42	4	0.14	
Sardinella aurita	1.26	4	0.12	
Saurida brasiliensis	0.34	64	0.03	
Total	1040.49		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 21
DATE :31/07/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 9°56.42
start stop duration Lon E 13°9.09
TIME :02:46:05 03:01:30 15.4 (min) Purpose : 1
LOG : 7902.43 7903.40 1.0 Region : 4040
FDEPTH: 18 15 Gear cond.: 0
BDEPTH: 54 46 Validity : 0
Towing dir: 0° Wire out : 70 m Speed : 3.8 kn
Sorted : 347 Total catch: 347.36 Catch/hour: 1351.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	1196.93	8883	88.56	58
Sardinella maderensis	132.88	1654	9.83	59
Trachurus trecae	8.40	128	0.62	60
Sepia officinalis	4.24	35	0.31	
Brachydeuterus auritus	3.54	35	0.26	61
Trichiurus lepturus	2.61	16	0.19	
Selene dorsalis	1.87	19	0.14	
Chloroscombrus chrysurus	0.78	8	0.06	
Alloteuthis africana	0.19	47	0.01	
Engraulis encrasicolus	0.08	0	0.01	
Lagocephalus laevigatus	0.08	8	0.01	
Total	1351.60		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 22
DATE :31/07/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 10°0.03
start stop duration Lon E 13°11.32
TIME :08:39:14 09:11:10 31.9 (min) Purpose : 1
LOG : 7955.84 7957.56 1.7 Region : 4040
FDEPTH: 47 47 Gear cond.: 0
BDEPTH: 47 47 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.2 kn
Sorted : 385 Total catch: 2065.60 Catch/hour: 3882.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	3045.86	32936	78.45	63
Trachurus trecae	345.71	4098	8.90	62
Trichiurus lepturus	150.39	2372	3.87	
J E L L Y F I S H	124.36	212	3.20	
Pagellus bellottii	79.74	746	2.05	64
Selene dorsalis	75.70	1303	1.95	65
Boops boops	10.00	171	0.26	
Decapterus rhonchus	9.49	71	0.24	66
Rhinobatos albomaculatus	9.29	9	0.24	
Argyrosomus hololepidotus	8.98	21	0.23	
Pomadasys incisus	5.55	30	0.14	
Sardinella maderensis	3.23	21	0.08	
Sepia orbignyana	3.03	9	0.08	
Syacium micrurum	2.93	39	0.08	
Pseudupeneus prayensis	2.42	21	0.06	
Dentex barnardi	2.31	21	0.06	
Citharus linguatula	1.41	30	0.04	
Scorpaena stephanica	1.20	21	0.03	
Alloteuthis africana	0.39	120	0.01	
GOBIIDAE	0.21	81	0.01	
Penaeus notialis	0.21	9	0.01	
Lagocephalus laevigatus	0.09	21	0.00	
Bembrops heterurus	0.09	9	0.00	
Scyllarides herklotsii	0.09	21	0.00	
Total	3882.71		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 23
DATE :31/07/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 10°11.20
start stop duration Lon E 12°58.35
TIME :13:38:17 13:49:25 11.1 (min) Purpose : 1
LOG : 7991.05 7991.58 0.5 Region : 4040
FDEPTH: 122 121 Gear cond.: 0
BDEPTH: 122 121 Validity : 0
Towing dir: 0° Wire out : 220 m Speed : 2.8 kn
Sorted : 65 Total catch: 64.54 Catch/hour: 347.92

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Anthias anthias	340.43	582	97.85	
Gephyroberyx darwini	4.15	5	1.19	
Erythrocles monodi	2.91	5	0.84	
Boops boops	0.38	5	0.11	
Dicologoglossa hexophthalma	0.05	5	0.02	
Total	347.92		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 24
DATE :01/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°25.63
start stop duration Lon E 13°11.80
TIME :03:11:00 03:41:08 30.1 (min) Purpose : 1
LOG : 8089.78 8091.43 1.7 Region : 4040
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 114 107 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.3 kn
Sorted : 61 Total catch: 61.03 Catch/hour: 121.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	92.43	402	76.03	67
Auxis thazard	14.70	52	12.09	68
Trichiurus lepturus	10.66	16	8.77	
Illex coindetii	1.29	36	1.07	
Saurida brasiliensis	1.08	608	0.88	
Sepia orbignyana	0.86	10	0.70	
J E L L Y F I S H	0.36	2	0.29	
PORIFERA (Sponges)	0.20	48	0.16	
Total	121.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 25
DATE :01/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 10°24.50
start stop duration Lon E 13°31.14
TIME :06:24:51 06:56:29 31.6 (min) Purpose : 1
LOG : 8114.64 8116.60 2.0 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 21 23 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.7 kn
Sorted : 42 Total catch: 41.60 Catch/hour: 78.91

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	43.06	1747	54.57	71
Ilisha africana	6.70	178	8.49	72
Sphyraena guachancho	5.63	40	7.14	74
Trichiurus lepturus	5.56	89	7.04	
Ephippion guttifer	4.80	2	6.08	
Selene dorsalis	3.59	72	4.54	75
Galeoides decadactylus	2.20	30	2.79	
Decapterus rhonchus	2.01	23	2.55	73
Pomadasys peroteti	1.84	8	2.33	
Pomadasys incisus	0.68	11	0.87	
Sardinella aurita	0.64	6	0.82	69
Pisodonophis semicinctus	0.57	2	0.72	
Atractoscion aequidens	0.42	2	0.53	
Dentex angolensis	0.32	2	0.41	
Eucinostomus melanopterus	0.21	6	0.26	
Lagocephalus laevigatus	0.21	4	0.26	
Sardinella maderensis	0.17	6	0.22	70
Pteroscion peli	0.17	6	0.22	
Sepiella ornata	0.09	8	0.12	
Trachurus trecae	0.04	8	0.05	
Total	78.91		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 26
DATE :01/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 10°33.06
start stop duration Lon E 13°27.90
TIME :15:29:04 16:04:42 35.6 (min) Purpose : 1
LOG : 8178.83 8181.11 2.3 Region : 4040
FDEPTH: 35 45 Gear cond.: 0
BDEPTH: 63 62 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.8 kn
Sorted : 1 Total catch: 1.10 Catch/hour: 1.85

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sarda sarda	1.85	2	100.00	76
Total	1.85		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 27
DATE :01/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 10°32.21
start stop duration Lon E 13°37.56
TIME :18:23:54 18:54:48 30.9 (min) Purpose : 1
LOG : 8197.47 8199.31 1.8 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 22 21 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.6 kn
Sorted : 194 Total catch: 193.99 Catch/hour: 376.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	242.70	10553	64.41	77
Trachurus trecae	38.85	625	10.31	78
Ephippion guttifer	21.66	10	5.75	
Ilisha africana	13.01	200	3.45	82
Pomadasys incisus	12.06	124	3.20	
Sardinella maderensis	11.85	468	3.14	79
Sepia orbignyana	11.13	14	2.95	
Galeoides decadactylus	7.81	142	2.07	
Sphyraena guachancho	5.40	54	1.43	81
Trichiurus lepturus	4.20	56	1.11	
Pisodonophis semicinctus	2.14	6	0.57	
Sardinella aurita	2.06	27	0.55	80
Parapenaeus longirostris	1.07	602	0.28	
Arius parkii	0.87	4	0.23	
Selar crumenophthalmus	0.62	6	0.16	
Pteroscion peli	0.60	17	0.16	
Lagocephalus laevigatus	0.43	2	0.11	
Pomadasys peroteti	0.17	2	0.05	
Decapterus punctatus	0.06	2	0.02	
Sepiella ornata	0.04	2	0.01	
Selene dorsalis	0.04	17	0.01	83
Penaeus notialis	0.04	2	0.01	
Total	376.80		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 28
DATE :02/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 11°16.81
start stop duration Lon E 13°37.10
TIME :21:07:26 21:38:06 30.7 (min) Purpose : 1
LOG : 8427.29 8428.98 1.7 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 50 49 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.3 kn
Sorted : 138 Total catch: 137.87 Catch/hour: 269.72

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	187.90	734	69.67	85
Trachurus trecae	54.58	221	20.24	84
Trichiurus lepturus	10.37	29	3.84	
Sarda sarda	3.52	4	1.31	89
Scomber japonicus	3.07	8	1.14	88
Sardinella aurita	2.58	8	0.96	87
Synagrops microlepis	2.09	1444	0.78	
Sphyraena guachancho	2.01	12	0.75	90
Brachydeuterus auritus	1.35	8	0.50	86
MYCTOPHIDAE	1.12	608	0.41	
Sepia orbignyana	0.57	4	0.21	
Alloteuthis africana	0.33	157	0.12	
J E L L Y F I S H	0.14	2	0.05	
FISH LARVAE	0.04	18	0.01	
Saurida brasiliensis	0.02	4	0.01	
Erythrocles monodi	0.02	2	0.01	
Total	269.72		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 29
DATE :03/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 11°27.42
start stop duration Lon E 13°40.32
TIME :04:22:17 04:32:33 10.3 (min) Purpose : 1
LOG : 8484.13 8484.77 0.6 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 35 38 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.7 kn
Sorted : 313 Total catch: 815.22 Catch/hour: 4762.73

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella aurita	4335.19	24105	91.02	91
Brachydeuterus auritus	205.82	3570	4.32	93
Sepia orbignyana	82.78	76	1.74	
Trachurus trecae	54.51	835	1.14	92
Ilisha africana	26.00	590	0.55	95
Pomadasys incisus	26.00	169	0.55	
Trichiurus lepturus	9.41	76	0.20	
Sphyraena guachancho	7.89	169	0.17	96
Sarda sarda	6.89	6	0.14	94
Mugil cephalus	5.49	6	0.12	
Selar crumenophthalmus	1.69	18	0.04	
Pagellus bellottii	1.05	18	0.02	
Total	4762.73		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 30
DATE :03/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 11°42.67
start stop duration Lon E 13°46.06
TIME :14:13:01 14:43:14 30.2 (min) Purpose : 1
LOG : 8559.58 8561.44 1.9 Region : 4040
FDEPTH: 24 25 Gear cond.: 0
BDEPTH: 24 25 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.7 kn
Sorted : 480 Total catch: 479.65 Catch/hour: 952.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	700.36	21006	73.54	99
Pomadasys jubelini	156.35	387	16.42	
Sardinella aurita	18.76	145	1.97	98
Sepia orbignyana	16.28	20	1.71	
Trichiurus lepturus	13.00	258	1.37	
Argyrosomus hololepidotus	11.61	79	1.22	
Pagellus bellottii	7.84	60	0.82	101
Ilisha africana	6.55	149	0.69	
Galeoides decadactylus	4.77	50	0.50	
Dicologoglossa cuneata	3.18	79	0.33	
Trachurus trecae	2.74	50	0.29	97
Selene dorsalis	2.12	18	0.22	100
Penaeus notialis	2.08	60	0.22	
Epinephelus aeneus	1.99	10	0.21	
Dentex barnardi	1.29	10	0.14	
Pteroscion peli	1.09	30	0.11	
Boops boops	0.89	10	0.09	
Selar crumenophthalmus	0.79	10	0.08	
Sphyraena guachancho	0.60	20	0.06	
Total	952.32		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 31
DATE :04/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 12°3.20
start stop duration Lon E 13°33.47
TIME :02:28:01 02:58:35 30.6 (min) Purpose : 1
LOG : 8663.81 8665.64 1.8 Region : 4040
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 90 79 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.6 kn
Sorted : 9 Total catch: 9.48 Catch/hour: 18.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinella maderensis	7.75	31	41.67	102
Lagocephalus laevigatus	6.32	16	33.97	
Trichiurus lepturus	1.51	2	8.12	
Trachinotus ovatus	0.84	6	4.54	
Auxis thazard	0.67	2	3.59	
Trachurus trecae	0.61	10	3.27	103
Alloteuthis africana	0.31	94	1.69	
Sepia orbignyana	0.27	4	1.48	
PORIFERA (Sponges)	0.22	4	1.16	
Saurida brasiliensis	0.10	14	0.53	
Total	18.61		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 32
DATE :04/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 12°7.59
start stop duration Lon E 13°26.40
TIME :06:21:46 06:32:32 10.8 (min) Purpose : 1
LOG : 8694.83 8695.37 0.5 Region : 4040
FDEPTH: 119 116 Gear cond.: 0
BDEPTH: 119 116 Validity : 0
Towing dir: 0° Wire out : 290 m Speed : 3.0 kn
Sorted : 274 Total catch: 1182.12 Catch/hour: 6591.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	4020.84	16043	61.00	104
Dentex macrophthalmus	1339.18	7673	20.32	105
Boops boops	773.03	4868	11.73	
Spicara alta	182.23	742	2.76	
Erythrocles monodi	120.11	190	1.82	
Zenopsis conchifer	65.97	22	1.00	
Zeus faber	34.80	72	0.53	
Lagocephalus laevigatus	18.23	50	0.28	
Atractoscion aequidens	13.61	6	0.21	
Dentex angolensis	10.82	50	0.16	
PORIFERA (Sponges)	3.62	22	0.05	
Illex coindetii	3.35	123	0.05	
Chaetodon hoefleri	3.35	22	0.05	
Aulopus cadenati	2.62	22	0.04	
Total	6591.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 33
DATE :05/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 12°24.77
start stop duration Lon E 13°20.95
TIME :11:28:42 11:56:24 27.7 (min) Purpose : 1
LOG : 8849.44 8851.16 1.7 Region : 4040
FDEPTH: 96 93 Gear cond.: 0
BDEPTH: 111 107 Validity : 0
Towing dir: 0° Wire out : 245 m Speed : 3.7 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:2011408 STATION: 34
DATE :05/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 12°29.78
start stop duration Lon E 13°20.60
TIME :14:46:36 14:49:17 2.7 (min) Purpose : 1
LOG : 8873.53 8873.66 0.1 Region : 4040
FDEPTH: 87 87 Gear cond.: 0
BDEPTH: 87 87 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 2.8 kn
Sorted : 142 Total catch: 497.13 Catch/hour: 11129.73

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	7890.45	53127	70.90	106
Synagrops microlepis	1514.01	902172	13.60	
Dentex macrophthalmus	507.72	5015	4.56	107
Zeus faber	322.39	694	2.90	
Chelidonichthys gabonensis	296.87	2351	2.67	
Lagocephalus laevigatus	253.48	537	2.28	
Torpedo torpedo	80.69	157	0.72	
Chaetodon hoefleri	41.10	224	0.37	
Raja miraletus	40.34	67	0.36	
Illex coindetii	35.78	2351	0.32	
Citharus linguatula	31.21	604	0.28	
Pterothrissus belloci	30.45	313	0.27	
Brotula barbata	25.88	67	0.23	
Scomber japonicus	15.45	918	0.14	108
Octopus vulgaris	10.07	22	0.09	
BATRACHOIDIDAE	9.40	45	0.08	
Umbrina canariensis	7.61	67	0.07	
Dentex angolensis	4.57	67	0.04	
G A S T R O P O D S	3.81	157	0.03	
Spicara alta	3.04	67	0.03	
Pontinus accraensis	3.04	67	0.03	
Bembrops greyi	2.28	67	0.02	
Total	11129.64		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 35
DATE :06/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 12°50.85
start stop duration Lon E 12°54.80
TIME :02:18:16 02:48:13 30.0 (min) Purpose : 1
LOG : 8942.45 8944.32 1.9 Region : 4040
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 202 415 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.7 kn
Sorted : 73 Total catch: 72.78 Catch/hour: 145.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	115.63	1478394	79.31	
Parapandalus narval	15.57	53962	10.68	
Sphyrna zygaena	5.91	2	4.05	
Unidentified fish	5.35	12	3.67	
Synagrops microlepis	1.48	222	1.02	
Lestidium atlanticum	0.74	148	0.51	
PORIFERA (Sponges)	0.42	2	0.29	
Trachinotus ovatus	0.38	4	0.26	
J E L L Y F I S H	0.24	12	0.16	
Trichiurus lepturus	0.08	4	0.05	
Total	145.80		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 36
DATE :06/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 12°57.27
start stop duration Lon E 12°55.75
TIME :05:50:33 06:10:38 20.1 (min) Purpose : 1
LOG : 8960.12 8961.19 1.1 Region : 4040
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 31 27 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.2 kn
Sorted : 2 Total catch: 2.37 Catch/hour: 7.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Lagocephalus laevigatus	5.82	15	82.28	
Sphyraena guachancho	1.25	3	17.72	
Total	7.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 37
DATE :06/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 12°56.91
start stop duration Lon E 12°50.45
TIME :07:50:55 08:22:31 31.6 (min) Purpose : 1
LOG : 8975.01 8976.64 1.6 Region : 4040
FDEPTH: 110 110 Gear cond.: 0
BDEPTH: 110 110 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 3.1 kn
Sorted : 317 Total catch: 316.94 Catch/hour: 601.98

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	358.59	2879	59.57	110
Trachurus trecae	75.88	330	12.60	109
Raja alba	45.01	17	7.48	
Chelidonichthys gabonensis	44.54	429	7.40	
Illex coindetii	32.29	152	5.36	
Pontinus accraensis	10.64	156	1.77	
Zeus faber	9.17	11	1.52	
Dentex angolensis	8.62	32	1.43	
Citharus linguatula	2.36	42	0.39	
Pterothrissus belloci	2.34	21	0.39	
Brotula barbata	2.30	2	0.38	
Trigla lyra	2.07	11	0.34	
Lagocephalus laevigatus	1.77	6	0.29	
Torpedo torpedo	1.77	2	0.29	
Octopus vulgaris	0.93	2	0.15	
Uranoscopus polli	0.91	4	0.15	
BATRACHOIDIDAE	0.74	2	0.12	
Pagellus bellottii	0.74	2	0.12	
Umbrina canariensis	0.72	2	0.12	
Trichiurus lepturus	0.25	2	0.04	
Merluccius polli	0.25	2	0.04	
Grammoplites gruveli	0.09	2	0.02	
Total	601.98		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 38
DATE :08/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 13°48.86
start stop duration Lon E 12°29.66
TIME :00:39:15 01:09:16 30.0 (min) Purpose : 1
LOG : 9094.37 9096.18 1.8 Region : 4050
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 489 952 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.6 kn
Sorted : 40 Total catch: 39.57 Catch/hour: 79.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	69.60	45935	87.97	
Parapenaeus longirostris	5.64	16473	7.13	
S H R I M P S	2.82	6118	3.56	
Thyrsites atun	0.94	2	1.19	
Stomias boa boa	0.10	2	0.13	
Lagocephalus laevigatus	0.02	2	0.03	
Total	79.11		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 39
DATE :08/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 13°54.26
start stop duration Lon E 12°24.59
TIME :03:37:31 03:46:26 8.9 (min) Purpose : 1
LOG : 9117.29 9117.85 0.6 Region : 4050
FDEPTH: 22 22 Gear cond.: 0
BDEPTH: 30 31 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.8 kn
Sorted : 236 Total catch: 236.45 Catch/hour: 1594.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1569.78	14946	98.48	111
Scomber japonicus	10.99	81	0.69	112
Lagocephalus laevigatus	7.28	20	0.46	
Atractoscion aequidens	6.00	13	0.38	
Total	1594.04		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 40
DATE :08/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 14°2.75
start stop duration Lon E 12°15.03
TIME :09:01:26 09:29:07 27.7 (min) Purpose : 1
LOG : 9145.25 9146.69 1.4 Region : 4050
FDEPTH: 140 146 Gear cond.: 0
BDEPTH: 140 146 Validity : 0
Towing dir: 0° Wire out : 390 m Speed : 3.1 kn
Sorted : 59 Total catch: 1119.29 Catch/hour: 2425.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	1888.08	15073	77.85	114
Boops boops	346.76	2165	14.30	
Trachurus trecae	52.22	236	2.15	113
Chelidonichthys gabonensis	26.46	321	1.09	
Dentex angolensis	26.46	80	1.09	
Scorpaena stephanica	22.45	41	0.93	
Lagocephalus laevigatus	16.42	41	0.68	
Squalus megalops	14.08	20	0.58	
Zenopsis conchifer	11.61	0	0.48	
Squatina oculata	6.18	2	0.25	
Trigla lyra	5.61	80	0.23	
Illex coindetii	4.01	41	0.17	
Umbrina canariensis	4.01	41	0.17	
Zeus faber	0.98	2	0.04	
Total	2425.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 41
DATE :08/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 14°17.83
start stop duration Lon E 12°16.87
TIME :16:59:58 17:30:16 30.3 (min) Purpose : 1
LOG : 9195.85 9197.36 1.5 Region : 4050
FDEPTH: 86 88 Gear cond.: 0
BDEPTH: 86 88 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 3.0 kn
Sorted : 77 Total catch: 865.38 Catch/hour: 1713.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	1171.74	14154	68.38	117
Chelidonichthys gabonensis	153.98	1836	8.99	
Pagellus bellottii	107.07	897	6.25	118
Umbrina canariensis	85.47	489	4.99	
Trachurus trecae	77.23	778	4.51	115
Atractoscion aequidens	49.31	83	2.88	116
Citharus linguatula	21.01	550	1.23	
Dentex angolensis	16.51	123	0.96	
Sepia orbignyana	9.17	10	0.54	
Branchiostegus semifasciatus *	4.71	4	0.28	
Saurida brasiliensis	3.27	592	0.19	
Brotula barbata	2.26	2	0.13	
Squatina oculata	2.26	2	0.13	
Alloteuthis africana	2.24	1123	0.13	
Pontinus accraensis	2.04	20	0.12	
Octopus vulgaris	1.92	2	0.11	
Boops boops	1.84	20	0.11	
Decapterus rhonchus	1.60	4	0.09	
Total	1713.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 42
DATE :09/08/2011 GEAR TYPE: PT NO: 5 POSITION:Lat S 14°48.24
start stop duration Lon E 12°13.83
TIME :02:34:29 03:04:29 30.0 (min) Purpose : 1
LOG : 9257.58 9259.23 1.7 Region : 4050
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 88 63 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.3 kn
Sorted : 0 Total catch: 0.21 Catch/hour: 0.42

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	0.20	2	0.00	
Trachurus trecae	0.22	2	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 43
DATE :09/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 14°48.51
start stop duration Lon E 12°14.45
TIME :04:15:19 04:42:55 27.6 (min) Purpose : 1
LOG : 9263.51 9264.92 1.4 Region : 4050
FDEPTH: 60 60 Gear cond.: 0
BDEPTH: 62 69 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.1 kn
Sorted : 1 Total catch: 1.23 Catch/hour: 2.67

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	0.91	11	34.15	
Pagellus bellottii	0.74	9	27.64	
TETRAODONTIDAE	0.43	15	16.26	
Citharus linguatula	0.37	7	13.82	
Scomber japonicus	0.22	2	8.13	
Total	2.67		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 44
DATE :09/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 15°1.91
start stop duration Lon E 12°7.06
TIME :08:31:54 09:07:14 35.3 (min) Purpose : 1
LOG : 9295.67 9297.51 1.8 Region : 4050
FDEPTH: 104 89 Gear cond.: 0
BDEPTH: 104 89 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.1 kn
Sorted : 968 Total catch: 967.65 Catch/hour: 1642.87

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	960.44	8888	58.46	119
Dentex macrophthalmus	214.04	1766	13.03	120
Dentex angolensis	90.14	438	5.49	121
Dentex barnardi	86.06	348	5.24	122
Umbrina canariensis	64.92	504	3.95	123
Myliobatis aquila	49.75	34	3.03	
Atractoscion aequidens	42.67	75	2.60	124
Squatina oculata	30.73	10	1.87	
Gymnura micrura	21.82	2	1.33	
Spondyliosoma cantharus	19.44	44	1.18	
Sepia orbignyana	13.70	10	0.83	
Chelidonichthys gabonensis	12.61	88	0.77	
Pagrus africanus	10.95	5	0.67	
Pagellus bellottii	7.71	59	0.47	
Dasyatis marmorata	7.35	7	0.45	
Loligo vulgaris	4.23	51	0.26	
Mustelus mustelus	3.06	3	0.19	
Zeus faber	1.94	3	0.12	
Raja miraletus	1.32	2	0.08	
Total	1642.87		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 45
DATE :09/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 15°9.12
start stop duration Lon E 12°2.55
TIME :15:09:21 15:28:14 18.9 (min) Purpose : 1
LOG : 9331.92 9332.80 0.9 Region : 4050
FDEPTH: 124 124 Gear cond.: 0
BDEPTH: 124 124 Validity : 0
Towing dir: 0° Wire out : 270 m Speed : 2.8 kn
Sorted : 352 Total catch: 2697.29 Catch/hour: 8567.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	5167.75	53041	60.32	125
Trachurus trecae	1825.98	15815	21.31	126
Trachurus capensis	1263.97	4695	14.75	127
Lagocephalus laevigatus	105.36	340	1.23	
Umbrina canariensis	86.62	632	1.01	
Zenopsis conchifer	28.94	22	0.34	
Pagellus bellottii	26.27	241	0.31	
Zeus faber	25.54	22	0.30	
Atractoscion aequidens	19.95	22	0.23	
Dentex barnardi	6.32	22	0.07	
Chelidonichthys gabonensis	5.34	73	0.06	
Illex coindetii	3.65	48	0.04	
Trigla lyra	1.68	22	0.02	
Total	8567.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 46
DATE :10/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 15°17.27
start stop duration Lon E 12°2.22
TIME :06:08:18 06:20:47 12.5 (min) Purpose : 1
LOG : 9428.21 9428.96 0.8 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 32 33 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.6 kn
Sorted : 1 Total catch: 0.89 Catch/hour: 4.28

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Thyrsites atun	4.28	10	100.00	
Total	4.28		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 47
DATE :10/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 15°22.32
start stop duration Lon E 11°56.93
TIME :07:58:08 08:11:54 13.8 (min) Purpose : 1
LOG : 9442.00 9442.67 0.7 Region : 4050
FDEPTH: 113 117 Gear cond.: 0
BDEPTH: 113 117 Validity : 0
Towing dir: 0° Wire out : 260 m Speed : 2.9 kn
Sorted : 75 Total catch: 1135.70 Catch/hour: 4948.58

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	4099.35	35442	82.84	129
Trachurus trecae	293.03	2553	5.92	128
Dentex angolensis	143.36	488	2.90	130
Umbrina canariensis	136.03	732	2.75	131
Atractoscion aequidens	80.52	122	1.63	
Zeus faber	60.78	78	1.23	
Lagocephalus laevigatus	42.70	61	0.86	
Zenopsis conchifer	29.28	61	0.59	
Dentex canariensis	23.18	61	0.47	
Squatina oculata	18.30	17	0.37	
Chelidonichthys gabonensis	12.20	122	0.25	
Squalus megalops	9.15	13	0.18	
Scomber japonicus	0.48	4	0.01	
Etrumeus whiteheadi	0.22	4	0.00	
Total	4948.58		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 48
DATE :10/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 15°33.25
start stop duration Lon E 11°53.88
TIME :13:42:31 13:47:28 5.0 (min) Purpose : 1
LOG : 9483.62 9483.87 0.3 Region : 4050
FDEPTH: 112 112 Gear cond.: 0
BDEPTH: 112 112 Validity : 0
Towing dir: 0° Wire out : 260 m Speed : 3.0 kn
Sorted : 158 Total catch: 158.18 Catch/hour: 1917.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	1101.82	9406	57.47	133
Trachurus trecae	427.15	3491	22.28	132
Squatina oculata	146.67	36	7.65	
Umbrina canariensis	131.52	897	6.86	135
Dentex angolensis	62.30	255	3.25	134
Zenopsis conchifer	13.70	12	0.71	
Zeus faber	12.97	24	0.68	
Pagellus bellottii	11.27	48	0.59	136
Etrumeus whiteheadi	9.94	170	0.52	137
Total	1917.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 49
DATE :10/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 15°43.75
start stop duration Lon E 11°51.44
TIME :19:22:43 19:47:25 24.7 (min) Purpose : 1
LOG : 9527.96 9529.20 1.2 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 119 113 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.0 kn
Sorted : 137 Total catch: 273.68 Catch/hour: 664.81

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	654.90	5713	98.51	138
Etrumeus whiteheadi	4.71	83	0.71	139
Trichiurus lepturus	3.21	63	0.48	
Scomber japonicus	1.94	10	0.29	140
MYCTOPHIDAE	0.05	15	0.01	
Total	664.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 50
DATE :11/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 15°54.85
start stop duration Lon E 11°43.00
TIME :00:45:00 00:58:13 13.2 (min) Purpose : 1
LOG : 9562.26 9563.12 0.9 Region : 4050
FDEPTH: 15 20 Gear cond.: 0
BDEPTH: 28 46 Validity : 0
Towing dir: 0° Wire out : 90 m Speed : 3.9 kn
Sorted : 471 Total catch: 470.83 Catch/hour: 2138.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2024.56	42304	94.67	141
Scomber japonicus	88.02	881	4.12	142
Sardinops ocellatus	12.04	200	0.56	143
Loligo vulgaris	5.00	23	0.23	
PORIFERA (Sponges)	4.72	55	0.22	
Pagellus bellottii	2.54	64	0.12	
Etrumeus whiteheadi	0.91	23	0.04	144
Boops boops	0.64	9	0.03	
Engraulis encrasicolus	0.09	55	0.00	
Total	2138.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 51
DATE :11/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.41
start stop duration Lon E 11°36.22
TIME :08:45:14 09:15:22 30.1 (min) Purpose : 3
LOG : 9628.96 9630.40 1.4 Region : 4050
FDEPTH: 73 71 Gear cond.: 0
BDEPTH: 73 71 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 2.9 kn
Sorted : 203 Total catch: 202.50 Catch/hour: 403.12

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Thyrsites atun	85.50	315	21.21	
Squalus megalops	70.77	141	17.56	
Dentex macrophthalmus	66.69	1827	16.54	145
Etrumeus whiteheadi	61.61	1117	15.28	146
Chelidonichthys capensis	42.40	84	10.52	
Pagellus bellottii	14.83	271	3.68	149
Sepia orbignyana	11.67	16	2.89	
Sphyrna lewini	10.85	2	2.69	
Loligo vulgaris	9.34	78	2.32	
Lagocephalus laevigatus	4.84	16	1.20	
Mustelus mustelus	4.38	8	1.09	
Dentex gibbosus	4.38	68	1.09	
Merluccius capensis	3.56	12	0.88	
Alloteuthis africana	2.59	912	0.64	
Trachurus trecae	2.33	56	0.58	147
Spondyliosoma cantharus	2.21	10	0.55	
Dentex barnardi	1.95	22	0.48	148
Raja miraletus	1.51	2	0.38	
Zeus faber	0.94	4	0.23	
Scomber japonicus	0.60	2	0.15	
Citharus linguatula	0.12	2	0.03	
Illex coindetii	0.06	2	0.01	
Total	403.12		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 52
DATE :11/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°12.39
start stop duration Lon E 11°43.75
TIME :10:43:27 11:13:31 30.1 (min) Purpose : 3
LOG : 9640.67 9642.18 1.5 Region : 4050
FDEPTH: 47 48 Gear cond.: 0
BDEPTH: 47 48 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.0 kn
Sorted : 239 Total catch: 238.75 Catch/hour: 476.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	284.85	6587	59.77	150
Trachurus capensis	46.83	1864	9.83	151
Myliobatis aquila	42.91	8	9.01	
Trigla lyra	27.54	82	5.78	
Loligo vulgaris	21.08	561	4.42	
J E L L Y F I S H	13.39	28	2.81	
Dasyatis marmorata	11.08	4	2.32	
Dentex macrophthalmus	5.83	409	1.22	153
Pagellus bellottii	4.41	206	0.93	
Atractoscion aequidens	3.39	18	0.71	
Raja miraletus	3.31	6	0.70	
Arius heudelotii	2.61	4	0.55	
Umbrina canariensis	2.30	56	0.48	
Thyrsites atun	2.12	4	0.44	
Merluccius capensis	1.74	10	0.36	
Etrumeus whiteheadi	1.14	28	0.24	152
Pontinus accraensis	0.60	4	0.13	
Scomber japonicus	0.42	4	0.09	
Boops boops	0.36	10	0.08	
Dentex gibbosus	0.32	4	0.07	
Spondyliosoma cantharus	0.32	10	0.07	
Total	476.55		100.0	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 53
DATE :11/08/2011 GEAR TYPE: BT NO: 21 POSITION:Lat S 16°16.05
start stop duration Lon E 11°31.20
TIME :15:15:06 15:45:27 30.4 (min) Purpose : 1
LOG : 9669.48 9671.09 1.6 Region : 4050
FDEPTH: 101 95 Gear cond.: 0
BDEPTH: 101 95 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.2 kn
Sorted : 102 Total catch: 354.48 Catch/hour: 700.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	503.26	5733	71.84	154
Squalus megalops	58.50	97	8.35	
Scomber japonicus	29.25	302	4.18	155
Dentex macrophthalmus	24.25	326	3.46	157
Zeus faber	24.01	34	3.43	
Isurus oxyrinchus	17.09	2	2.44	
Mustelus mustelus	14.72	6	2.10	
Etrumeus whiteheadi	11.80	180	1.68	156
Spondyliosoma cantharus	8.32	16	1.19	
Pagellus bellottii	3.54	16	0.50	
Chelidonichthys capensis	2.61	12	0.37	
Lagocephalus laevigatus	0.97	6	0.14	
Dentex barnardi	0.93	6	0.13	
Sepia orbignyana	0.71	6	0.10	
Syacium micrurum	0.59	12	0.08	
Total	700.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 54
DATE :11/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°26.76
start stop duration Lon E 11°41.81
TIME :23:22:42 23:34:55 12.2 (min) Purpose : 1
LOG : 9714.41 9715.21 0.8 Region : 4050
FDEPTH: 25 30 Gear cond.: 0
BDEPTH: 62 57 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 4.0 kn
Sorted : 63 Total catch: 62.99 Catch/hour: 309.53

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	135.14	5641	43.66	159
Trachurus trecae	118.92	5725	38.42	158
Scomber japonicus	19.12	246	6.18	162
Etrumeus whiteheadi	16.31	595	5.27	160
Sardinops ocellatus	14.50	290	4.68	161
Loligo vulgaris	2.70	20	0.87	
Engraulis encrasicolus	2.21	98	0.71	163
Merluccius capensis	0.64	5	0.21	
Total	309.53		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 55
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°21.40
start stop duration Lon E 11°43.89
TIME :05:37:18 06:07:45 30.5 (min) Purpose : 3
LOG : 9770.07 9771.64 1.6 Region : 4050
FDEPTH: 46 46 Gear cond.: 0
BDEPTH: 46 46 Validity : 0
Towing dir: 0° Wire out : 115 m Speed : 3.1 kn
Sorted : 64 Total catch: 185.43 Catch/hour: 365.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	166.64	13627	45.62	164
Trachurus capensis	67.66	4544	18.52	165
Pagellus bellottii	54.96	3144	15.05	170
Dentex macrophthalmus	22.40	1897	6.13	166
Loligo vulgaris	16.55	585	4.53	
Scomber japonicus	15.31	248	4.19	167
Chelidonichthys capensis	5.67	18	1.55	
J E L L Y F I S H	4.67	6	1.28	
Merluccius capensis	3.19	18	0.87	169
Alloteuthis africana	2.84	1105	0.78	
Etrumeus whiteheadi	2.01	53	0.55	168
Sepia orbignyana	1.18	12	0.32	
Schedophilus pemarco	0.77	6	0.21	
Dentex barnardi	0.71	18	0.19	
Umbrina canariensis	0.24	6	0.06	
Trachinocephalus myops	0.18	6	0.05	
Cepola pauciradiatus	0.18	6	0.05	
Spondyliosoma cantharus	0.12	6	0.03	
Total	365.26		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 56
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°24.11
start stop duration Lon E 11°45.60
TIME :06:37:45 07:09:41 31.9 (min) Purpose : 3
LOG : 9774.46 9776.10 1.7 Region : 4050
FDEPTH: 21 20 Gear cond.: 0
BDEPTH: 21 20 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.1 kn
Sorted : 30 Total catch: 212.10 Catch/hour: 398.43

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	209.08	8442	52.48	171
Trachurus capensis	127.55	6180	32.01	172
Loligo vulgaris	39.97	3721	10.03	
J E L L Y F I S H	9.34	39	2.34	
Calappa rubroguttata	3.94	26	0.99	
Scomber japonicus	2.63	39	0.66	173
Etrumeus whiteheadi	1.84	53	0.46	174
Alloteuthis africana	1.18	552	0.30	
Spondyliosoma cantharus	0.92	26	0.23	
Pegusa lascaris	0.92	39	0.23	
Trachinocephalus myops	0.39	13	0.10	
Engraulis encrasicolus	0.39	26	0.10	
Scomberesox saurus	0.26	13	0.07	
Total	398.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 57
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°41.96
start stop duration Lon E 11°45.80
TIME :10:35:49 10:40:08 4.3 (min) Purpose : 1
LOG : 9802.03 9802.27 0.2 Region : 4050
FDEPTH: 18 18 Gear cond.: 0
BDEPTH: 18 18 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.3 kn
Sorted : 28 Total catch: 340.92 Catch/hour: 4735.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	4250.00	385333	89.76	175
Trachurus capensis	480.00	57333	10.14	176
Scomberesox saurus	3.33	167	0.07	
Scomber japonicus	1.67	167	0.04	
Total	4735.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 58
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°35.72
start stop duration Lon E 11°37.40
TIME :15:14:42 15:44:20 29.6 (min) Purpose : 3
LOG : 9833.79 9835.16 1.4 Region : 4050
FDEPTH: 85 86 Gear cond.: 0
BDEPTH: 85 86 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 2.8 kn
Sorted : 59 Total catch: 590.30 Catch/hour: 1195.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	609.52	19055	50.99	178
Etrumeus whiteheadi	241.98	8566	20.24	179
Dentex macrophthalmus	125.55	5650	10.50	181
Trachurus trecae	88.09	3199	7.37	177
Loligo vulgaris	41.71	385	3.49	
Merluccius capensis	36.85	283	3.08	180
Chelidonichthys capensis	20.25	61	1.69	
J E L L Y F I S H	16.81	20	1.41	
Trichiurus lepturus	5.06	142	0.42	
Sepia officinalis	3.04	20	0.25	
B I V A L V E S	2.83	162	0.24	
Scomber japonicus	1.62	20	0.14	
Calappa pelii	1.01	101	0.08	
Dicologoglossa cuneata	0.61	20	0.05	
Brotula barbata	0.20	20	0.02	
GOBIIDAE	0.20	40	0.02	
Total	1195.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 59
DATE :12/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°36.27
start stop duration Lon E 11°29.88
TIME :17:08:21 17:22:33 14.2 (min) Purpose : 3
LOG : 9845.08 9845.79 0.7 Region : 4050
FDEPTH: 110 110 Gear cond.: 7
BDEPTH: 0 110 Validity : 4
Towing dir: 0° Wire out : 275 m Speed : 3.0 kn
Sorted : 252 Total catch: 572.17 Catch/hour: 2417.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1797.76	28863	74.36	182
Dentex macrophthalmus	388.35	8489	16.06	184
Merluccius capensis	46.94	161	1.94	185
Chelidonichthys capensis	36.21	68	1.50	
Pterothrissus belloci	35.75	351	1.48	
Trigla lyra	28.44	249	1.18	
Trachurus capensis	19.48	237	0.81	183
Mustelus mustelus	13.94	4	0.58	
Trichiurus lepturus	13.48	173	0.56	
Pagellus bellottii	11.58	85	0.48	186
Zeus faber	8.87	25	0.37	
Chelidonichthys gabonensis	4.86	275	0.20	
Squalus megalops	2.70	8	0.11	
Spondyliosoma cantharus	1.90	8	0.08	
Illex coindetii	1.52	8	0.06	
Scorpaena stephanica	1.52	59	0.06	
Arnoglossus imperialis	0.93	76	0.04	
Umbrina canariensis	0.76	8	0.03	
Sepia orbignyana	0.76	8	0.03	
Citharus linguatula	0.55	59	0.02	
Syacium micrurum	0.46	59	0.02	
Etrumeus whiteheadi	0.30	8	0.01	
Saurida brasiliensis	0.30	38	0.01	
Pegusa lascaris	0.17	8	0.01	
GOBIIDAE	0.08	30	0.00	
Total	2417.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 60
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°37.45
start stop duration Lon E 11°17.67
TIME :00:21:05 00:48:00 26.9 (min) Purpose : 3
LOG : 9872.82 9874.06 1.2 Region : 4050
FDEPTH: 612 617 Gear cond.: 0
BDEPTH: 612 617 Validity : 0
Towing dir: 0° Wire out : 1250 m Speed : 2.8 kn
Sorted : 62 Total catch: 313.83 Catch/hour: 699.47

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	195.27	435	27.92	187
Trachyrincus scabrus	143.42	802	20.50	
Aristeus varidens, female	132.68	12062	18.97	
Shrimps, small, non comm.	43.02	25676	6.15	
Alepocephalus rostratus	40.01	154	5.72	
Nezumia aequalis	29.64	793	4.24	
Helicolenus dactylopterus	21.55	198	3.08	
Hoplostethus cadenati	19.64	537	2.81	
Centrophorus squamosus	16.49	25	2.36	
Stomias affinis	8.02	183	1.15	
Chaceon maritae	7.36	13	1.05	
Lamprogrammus exutus	6.62	109	0.95	
Etmopterus pusillus	4.52	16	0.65	
Anemones, white	4.03	7	0.58	
Aristeus varidens, male	3.90	649	0.56	
Bathyuroconger vicinus	3.61	103	0.52	
Deania calcea	2.79	4	0.40	
Raja alba	2.72	7	0.39	
Anemones, pink	2.63	7	0.38	
Diaphus effulgens	2.63	96	0.38	
DICERATIIDAE	1.92	22	0.27	
Yarrella blackfordi	1.76	80	0.25	
Tetragonurus cuvieri	1.03	7	0.15	
Centroscymnus crepidater *	0.80	7	0.11	
Gadella imberbis	0.65	22	0.09	
OCTOPOTEUTHIDAE	0.65	7	0.09	
Benthodesmus tenuis	0.58	13	0.08	
Diastobranchus capensis	0.42	7	0.06	
Chlamydoselachus anguineus	0.42	2	0.06	
Galeus polli	0.36	2	0.05	
Triplophos hemingi	0.20	36	0.03	
Chlorophthalmus atlanticus	0.13	7	0.02	
Total	699.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 61
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°38.74
start stop duration Lon E 11°24.00
TIME :08:02:06 08:32:51 30.8 (min) Purpose : 3
LOG : 9914.65 9916.13 1.5 Region : 4050
FDEPTH: 125 123 Gear cond.: 0
BDEPTH: 125 123 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 2.9 kn
Sorted : 287 Total catch: 286.81 Catch/hour: 559.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	301.56	4205	53.90	215
Dentex macrophthalmus	169.60	3037	30.32	216
Merluccius capensis	34.04	90	6.08	239
Squalus megalops	12.78	33	2.28	
Zeus faber	8.97	29	1.60	
Trigla lyra	5.77	31	1.03	
Mustelus mustelus	5.75	4	1.03	
Etrumeus whiteheadi	4.80	66	0.86	189
Loligo vulgaris	3.65	20	0.65	
Raja miraletus	3.37	4	0.60	
Trachurus capensis	1.95	16	0.35	238
Scorpaena normani	1.52	18	0.27	
Chelidonichthys gabonensis	1.50	20	0.27	
Scomber japonicus	1.17	12	0.21	188
Chelidonichthys capensis	1.03	2	0.18	
Pagellus bellottii	0.55	4	0.10	
Zenopsis conchifer	0.47	2	0.08	
Trichiurus lepturus	0.43	4	0.08	
Scorpaena stephanica	0.41	2	0.07	
Illex coindetii	0.12	4	0.02	
Total	559.45		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 62
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°37.56
start stop duration Lon E 11°29.78
TIME :09:31:54 10:02:41 30.8 (min) Purpose : 3
LOG : 9922.55 9924.02 1.5 Region : 4050
FDEPTH: 111 111 Gear cond.: 0
BDEPTH: 111 111 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 2.9 kn
Sorted : 52 Total catch: 631.89 Catch/hour: 1231.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	832.63	15097	67.60	192
Merluccius capensis	101.11	343	8.21	195
Trachurus trecae	98.65	1456	8.01	194
Chelidonichthys capensis	44.29	57	3.60	
Trigla lyra	29.06	240	2.36	
Mustelus mustelus	22.03	12	1.79	
Zeus faber	21.64	62	1.76	
Sepia orbignyana	16.08	0	1.31	
Trachurus capensis	14.81	154	1.20	191
Raja miraletus	10.16	25	0.82	
Loligo vulgaris	9.57	97	0.78	
Pagellus bellottii	9.57	41	0.78	193
Atractoscion aequidens	5.89	8	0.48	
Etrumeus whiteheadi	5.32	212	0.43	190
Squalus megalops	4.97	14	0.40	
Umbrina canariensis	2.12	33	0.17	
Chelidonichthys gabonensis	1.23	16	0.10	
Scomber japonicus	1.05	16	0.09	
Lagocephalus laevigatus	0.82	8	0.07	
Trichiurus lepturus	0.74	8	0.06	
Total	1231.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 63
DATE :13/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°47.18
start stop duration Lon E 11°41.85
TIME :13:15:15 13:20:59 5.7 (min) Purpose : 1
LOG : 9952.42 9952.78 0.4 Region : 4050
FDEPTH: 10 10 Gear cond.: 0
BDEPTH: 21 21 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.7 kn
Sorted : 85 Total catch: 4084.43 Catch/hour: 42843.67

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinops ocellatus	32272.45	505899	75.33	196
Etrumeus whiteheadi	10571.22	511448	24.67	197
Total	42843.67		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 64
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°50.18
start stop duration Lon E 11°41.04
TIME :14:27:38 14:30:59 3.4 (min) Purpose : 3
LOG : 9959.64 9959.83 0.2 Region : 4050
FDEPTH: 26 26 Gear cond.: 0
BDEPTH: 26 26 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.6 kn
Sorted : 67 Total catch: 699.92 Catch/hour: 12535.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	5425.43	681904	43.28	199
Sardinops ocellatus	3990.63	61487	31.83	200
Etrumeus whiteheadi	1937.01	96842	15.45	201
Trachurus trecae	1062.45	145558	8.48	198
Scomber japonicus	75.22	2060	0.60	202
J E L L Y F I S H	33.85	179	0.27	
Pagellus bellottii	11.28	752	0.09	
Total	12535.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 65
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°48.00
start stop duration Lon E 11°34.86
TIME :15:52:55 16:13:40 20.8 (min) Purpose : 3
LOG : 9969.07 9969.93 0.9 Region : 4050
FDEPTH: 95 95 Gear cond.: 0
BDEPTH: 95 95 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 2.5 kn
Sorted : 59 Total catch: 556.58 Catch/hour: 1609.39

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	730.70	13764	45.40	203
Dentex macrophthalmus	456.00	9149	28.33	205
Holothuria spp.	67.03	7307	4.16	
Merluccius capensis	66.51	440	4.13	204
Chelidonichthys capensis	63.44	359	3.94	
G A S T R O P O D S	62.08	40629	3.86	
B I V A L V E S	52.45	74085	3.26	
Pegusa lascaris	22.27	879	1.38	
Synagrops microlepis	20.33	1897	1.26	
Pythonichthys microphthalmus	15.09	413	0.94	
Galeichthys sp.	12.35	29	0.77	
Atractoscion aequidens	10.44	55	0.65	
Loligo vulgaris	8.24	110	0.51	
Engraulis encrasicolus	4.94	249	0.31	206
Brotula barbata	4.40	84	0.27	
Calappa pelii	3.30	55	0.20	
GOBIIDAE	3.01	688	0.19	
Umbrina canariensis	1.91	55	0.12	
Zeus faber	1.65	55	0.10	
Citharus linguatula	1.36	110	0.08	
Squilla mantis	1.36	55	0.08	
Arnoglossus imperialis	0.55	55	0.03	
Total	1609.39		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 66
DATE :13/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°49.90
start stop duration Lon E 11°17.95
TIME :19:08:46 19:38:51 30.1 (min) Purpose : 3
LOG : 9990.61 9992.24 1.6 Region : 4050
FDEPTH: 338 354 Gear cond.: 0
BDEPTH: 338 354 Validity : 0
Towing dir: 0° Wire out : 815 m Speed : 3.3 kn
Sorted : 172 Total catch: 602.34 Catch/hour: 1201.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	523.07	915	43.55	207
Helicolenus dactylopterus	478.40	7914	39.83	
Laemonema laureysi	63.85	1103	5.32	
Chlorophthalmus atlanticus	31.55	941	2.63	
PORIFERA (Sponges)	24.35	237	2.03	
Nezumia aequalis	15.13	329	1.26	
S H R I M P S	14.38	12040	1.20	
Pterothrissus belloci	11.09	64	0.92	
Trigla lyra	8.30	8	0.69	
Dentex macrophthalmus	8.16	36	0.68	208
Trachurus capensis	6.28	36	0.52	209
Dicologoglossa hexophthalma	2.79	78	0.23	
Holothuria spp.	2.01	413	0.17	
Galeus polli	1.93	10	0.16	
B I V A L V E S	1.81	70	0.15	
CALAPPIDAE	1.60	28	0.13	
Illex coindetii	1.32	8	0.11	
Bathynectes sp.	0.84	22	0.07	
MYCTOPHIDAE	0.84	455	0.07	
Scyliorhinus cervigoni	0.76	2	0.06	
G A S T R O P O D S	0.70	343	0.06	
Anemones, pink	0.62	22	0.05	
MURAENIDAE	0.56	8	0.05	
Malacocephalus occidentalis	0.42	8	0.03	
Pythonichthys microphthalmus	0.20	8	0.02	
Epigonus telescopus	0.14	8	0.01	
Total	1201.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 67
DATE :14/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 16°54.06
start stop duration Lon E 11°36.27
TIME :01:24:40 01:54:39 30.0 (min) Purpose : 1
LOG : 24.52 26.13 1.6 Region : 4050
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 84 69 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.2 kn
Sorted : 0 Total catch: 0.18 Catch/hour: 0.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinops ocellatus	0.36	8	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 68
DATE :14/08/2011 GEAR TYPE: PT NO: 7 POSITION:Lat S 16°53.60
start stop duration Lon E 11°41.18
TIME :03:23:54 03:40:25 16.5 (min) Purpose : 1
LOG : 35.93 36.77 0.8 Region : 4050
FDEPTH: 18 18 Gear cond.: 0
BDEPTH: 25 26 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.1 kn
Sorted : 22 Total catch: 22.40 Catch/hour: 81.41

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	60.51	3271	74.33	210
Sepia officinalis	9.19	4	11.29	
J E L L Y F I S H	2.58	40	3.17	
Chelidonichthys capensis	1.85	4	2.28	
Sardinops ocellatus	1.85	47	2.28	213
Trachurus trecae	1.64	124	2.01	212
Arius parkii	1.38	4	1.70	
Engraulis encrasicolus	0.84	76	1.03	211
Scomber japonicus	0.51	15	0.63	214
Sepia orbignyana	0.36	7	0.45	
Loligo vulgaris	0.25	18	0.31	
Bembrops greyi	0.18	4	0.22	
Pagellus bellottii	0.15	11	0.18	
Trichiurus lepturus	0.11	4	0.13	
Total	81.41		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 69
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.20
start stop duration Lon E 11°43.00
TIME :05:31:16 05:40:42 9.4 (min) Purpose : 3
LOG : 47.89 48.38 0.5 Region : 4050
FDEPTH: 23 22 Gear cond.: 0
BDEPTH: 23 22 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
Sorted : 60 Total catch: 2573.19 Catch/hour: 16372.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sardinops ocellatus	15984.31	215555	97.63	217
Trachurus trecae	288.61	11873	1.76	218
Raja alba	88.76	6	0.54	
Pagellus bellottii	5.34	267	0.03	
Pomadasys incisus	5.34	267	0.03	
Total	16372.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 70
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.48
start stop duration Lon E 11°40.81
TIME :06:28:21 06:48:51 20.5 (min) Purpose : 3
LOG : 53.16 54.10 0.9 Region : 4050
FDEPTH: 36 35 Gear cond.: 0
BDEPTH: 36 35 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 2.8 kn
Sorted : 65 Total catch: 1023.00 Catch/hour: 2995.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis encrasicolus	1559.30	81962	52.05	222
Trachurus trecae	700.59	34788	23.39	219
Etrumeus whiteheadi	419.47	20600	14.00	223
Sardinops ocellatus	272.33	5095	9.09	221
Illex coindetii	18.01	835	0.60	
Myliobatis aquila	11.42	3	0.38	
Trachurus capensis	6.15	615	0.21	220
Chelidonichthyes capensis	6.15	88	0.21	
Trichiurus lepturus	1.32	44	0.04	
Schedophilus pemarco	0.88	44	0.03	
Total	2995.61		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 71
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°58.93
start stop duration Lon E 11°39.03
TIME :08:04:17 08:24:29 20.2 (min) Purpose : 3
LOG : 61.11 62.15 1.1 Region : 4050
FDEPTH: 60 60 Gear cond.: 0
BDEPTH: 60 60 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.1 kn
Sorted : 143 Total catch: 3031.50 Catch/hour: 9004.46

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	3659.17	169393	40.64	226
Trachurus trecae	2712.83	64096	30.13	224
Trachurus capensis	1583.52	139550	17.59	225
Pegusa lascaris	239.08	8011	2.66	
Starfish	162.12	23153	1.80	
Chelidonichthys capensis	140.67	630	1.56	
Engraulis encrasicolus	118.60	5299	1.32	228
Atractoscion aequidens	99.03	630	1.10	232
Loligo vulgaris	65.58	3154	0.73	
Trichiurus lepturus	46.04	1450	0.51	
Merluccius capensis	32.79	252	0.36	231
Sardinops ocellatus	29.02	820	0.32	227
Umbrina canariensis	27.74	630	0.31	230
Galeichthys sp.	25.22	62	0.28	
Scomber japonicus	24.59	630	0.27	229
Bathynectes sp.	10.07	1262	0.11	
Sepia orbignyana	7.57	62	0.08	
G A S T R O P O D S	5.67	2522	0.06	
Pythonichthys microphthalmus	5.67	125	0.06	
Pterothrissus belloci	5.67	62	0.06	
Squilla cadenati	2.52	62	0.03	
Goneplax angulata	1.25	62	0.01	
Total	9004.46		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 72
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 16°59.00
start stop duration Lon E 11°35.17
TIME :09:31:53 10:02:13 30.3 (min) Purpose : 3
LOG : 69.19 70.71 1.5 Region : 4050
FDEPTH: 90 91 Gear cond.: 0
BDEPTH: 90 91 Validity : 0
Towing dir: 0° Wire out : 230 m Speed : 3.0 kn
Sorted : 115 Total catch: 2586.99 Catch/hour: 5116.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	2765.40	81338	54.05	234
Trachurus trecae	1270.34	57399	24.83	
Dentex macrophthalmus	302.57	4226	5.91	236
Etrumeus whiteheadi	279.43	7608	5.46	235
Merluccius capensis	180.20	1068	3.52	237
Loligo vulgaris	109.46	1157	2.14	
Chelidonichthys capensis	104.56	577	2.04	
Sepia officinalis	21.36	44	0.42	
Zeus faber	16.91	89	0.33	
Sepia orbignyana	16.45	89	0.32	
Starfish	15.13	2759	0.30	
Scomber japonicus	12.00	132	0.23	
Umbrina canariensis	10.22	44	0.20	
B I V A L V E S	3.10	933	0.06	
Brotula barbata	2.67	44	0.05	
Trichiurus lepturus	2.21	44	0.04	
Squilla mantis	2.21	44	0.04	
Maja squinado	1.32	132	0.03	
MAJIDAE	0.44	221	0.01	
Total	5116.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 73
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°0.09
start stop duration Lon E 11°22.11
TIME :13:34:48 14:04:49 30.0 (min) Purpose : 3
LOG : 100.51 101.99 1.5 Region : 4050
FDEPTH: 144 144 Gear cond.: 0
BDEPTH: 144 144 Validity : 0
Towing dir: 0° Wire out : 340 m Speed : 2.9 kn
Sorted : 302 Total catch: 302.32 Catch/hour: 604.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	370.03	3317	61.26	242
Myliobatis aquila	60.44	14	10.01	
Zeus faber	32.77	114	5.42	
Trichiurus lepturus	30.07	569	4.98	
Trachurus trecae	24.98	336	4.13	240
Pterothrissus belloci	22.18	316	3.67	
Merluccius capensis	19.18	48	3.18	243
Squalus megalops	7.39	14	1.22	
Chelidonichthys capensis	6.33	6	1.05	
Helicolenus dactylopterus	5.69	54	0.94	
Mustelus mustelus	4.20	2	0.69	
Loligo vulgaris	3.82	36	0.63	
Trachurus capensis	3.22	42	0.53	241
Raja miraletus	2.94	4	0.49	
Umbrina canariensis	1.92	8	0.32	
Chelidonichthys gabonensis	1.54	14	0.25	
Etrumeus whiteheadi	1.32	18	0.22	244
Atractoscion aequidens	1.00	2	0.17	
Dentex angolensis	0.96	2	0.16	
Trigla lyra	0.94	12	0.16	
Galeichthys sp.	0.68	2	0.11	
Illex coindetii	0.68	4	0.11	
Sepia orbignyana	0.48	2	0.08	
Zenopsis conchifer	0.46	2	0.08	
Brotula barbata	0.38	2	0.06	
Dicologoglossa cuneata	0.24	4	0.04	
Starfish	0.18	32	0.03	
G A S T R O P O D S	0.04	4	0.01	
Total	604.04		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 74
DATE :14/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 17°4.98
start stop duration Lon E 11°17.77
TIME :18:53:58 19:35:32 41.6 (min) Purpose : 1
LOG : 136.60 138.70 2.1 Region : 4050
FDEPTH: 125 155 Gear cond.: 0
BDEPTH: 477 611 Validity : 0
Towing dir: 0° Wire out : 375 m Speed : 3.0 kn
Sorted : 30 Total catch: 30.49 Catch/hour: 44.02

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	35.44	407	80.52	245
Hoplostethus cadenati	4.01	3684	9.12	
Vitreledonella richardi	1.23	1	2.79	
S H R I M P S	1.17	1340	2.66	
MELANOSTOMIATIDAE	0.95	25	2.16	
Trachurus trecae	0.66	7	1.51	246
Saurida brasiliensis	0.33	185	0.75	
MYCTOPHIDAE	0.17	84	0.39	
Avocettina sp.	0.04	3	0.10	
Total	44.02		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 75
DATE :14/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°0.42
start stop duration Lon E 11°15.27
TIME :21:01:19 21:22:38 21.3 (min) Purpose : 3
LOG : 145.86 146.86 1.0 Region : 4050
FDEPTH: 742 733 Gear cond.: 0
BDEPTH: 742 733 Validity : 0
Towing dir: 0° Wire out : 1470 m Speed : 2.8 kn
Sorted : 295 Total catch: 295.38 Catch/hour: 831.28

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Malacocephalus occidentalis	182.22	5952	21.92	
Trachyrincus scabrus	118.20	4503	14.22	
Merluccius capensis	101.03	110	12.15	249
Talismania sp.	86.54	1365	10.41	
Ebinania costaecanarie	57.69	42	6.94	
Geryon maritae	56.99	87	6.86	
Yarrella blackfordi	45.03	1351	5.42	
Raja confundens	39.40	56	4.74	
Deania calcea	26.45	23	3.18	
MELANOSTOMIATIDAE	25.61	661	3.08	
Hoplostethus cadenati	23.22	844	2.79	
Paramola cuvieri	15.90	65	1.91	
Anemones, pink	10.41	28	1.25	
Lophiodes kempi	5.63	14	0.68	
Trachurus capensis	4.81	51	0.58	247
Centrophorus squamosus	4.78	6	0.58	
Bathyuroconger vicinus	4.64	56	0.56	
Centroscymnus crepidater	4.08	28	0.49	
Apristurus sp.	3.66	6	0.44	
Selachophidium guentheri	3.38	70	0.41	
Trachurus trecae	3.29	34	0.40	248
Plesiopenaeus edwardsianus	3.24	521	0.39	
OCTOPOTEUTHIDAE	1.69	14	0.20	
Zenion sp.	1.27	3	0.15	
Aristeus varidens, female	0.84	70	0.10	
SYNAPHOBRANCHIDAE	0.56	14	0.07	
Benthodesmus tenuis	0.42	14	0.05	
Halosaurus ovenii	0.14	14	0.02	
Aristeus varidens, male	0.14	14	0.02	
Total	831.28		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 76
DATE :15/08/2011 GEAR TYPE: PT NO: 4 POSITION:Lat S 17°5.93
start stop duration Lon E 11°37.37
TIME :01:17:40 01:47:45 30.1 (min) Purpose : 1
LOG : 173.52 175.14 1.6 Region : 4050
FDEPTH: 5 5 Gear cond.: 0
BDEPTH: 81 68 Validity : 0
Towing dir: 0° Wire out : 116 m Speed : 3.2 kn
Sorted : 65 Total catch: 226.10 Catch/hour: 450.85

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	408.61	20867	90.63	251
Trachurus capensis	30.01	2136	6.66	250
Sardinops ocellatus	10.39	64	2.30	252
Loligo vulgaris	1.42	14	0.31	
Trichiurus lepturus	0.42	6	0.09	
Total	450.85		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 77
DATE :15/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°11.81
start stop duration Lon E 11°43.75
TIME :05:40:57 06:10:52 29.9 (min) Purpose : 3
LOG : 190.16 191.73 1.6 Region : 4050
FDEPTH: 27 26 Gear cond.: 0
BDEPTH: 27 26 Validity : 0
Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
Sorted : 146 Total catch: 679.63 Catch/hour: 1362.89

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	1039.37	26043	76.26	253
Chelidonichthys capensis	64.07	96	4.70	
Callorhinchus capensis	51.54	40	3.78	
Galeichthys sp.	49.63	201	3.64	
Pegusa lascaris	26.19	710	1.92	
J E L L Y F I S H	24.53	34	1.80	
Stromateus fiatola	18.27	84	1.34	
Raja miraletus	17.69	24	1.30	
Mustelus mustelus	14.34	20	1.05	
Trichiurus lepturus	13.01	517	0.95	
Sphyrna zygaena	12.83	6	0.94	
Merluccius capensis	7.00	92	0.51	254
Pomatomus saltatrix	5.68	16	0.42	
White sea cucumber	4.17	201	0.31	
Atractoscion aequidens	3.59	34	0.26	
Sepia orbignyana	3.17	24	0.23	
Schedophilus pemarco	2.09	24	0.15	
Maja squinado	1.66	158	0.12	
Penaeus notialis	1.24	42	0.09	
Etrumeus whiteheadi	1.00	34	0.07	
Cynoglossus canariensis	0.58	66	0.04	
Pterothrissus belloci	0.50	34	0.04	
Pteroscion peli	0.34	34	0.03	
Umbrina canariensis	0.24	16	0.02	
Squilla mantis	0.16	8	0.01	
Total	1362.89		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 78
DATE :15/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°11.16
start stop duration Lon E 11°41.82
TIME :07:08:15 07:32:29 24.2 (min) Purpose : 3
LOG : 197.46 198.79 1.3 Region : 4050
FDEPTH: 42 41 Gear cond.: 0
BDEPTH: 42 41 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.3 kn
Sorted : 148 Total catch: 1206.71 Catch/hour: 2988.14

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	2029.55	50952	67.92	255
Chelidonichthys capensis	168.39	381	5.64	
Engraulis encrasicolus	127.78	7211	4.28	256
Galeichthys sp.	126.98	634	4.25	
Callorhinchus capensis	112.92	99	3.78	
Pomadasys jubelini	73.30	317	2.45	259
Raja miraletus	66.56	99	2.23	
Myliobatis sp.	64.78	20	2.17	
Argyrosomus hololepidotus	48.91	10	1.64	258
Pegusa lascaris	42.39	1030	1.42	
Dasyatis marmorata	41.60	40	1.39	
Rhinobatos albomaculatus	24.37	20	0.82	
Trichiurus lepturus	23.57	713	0.79	
Atractoscion aequidens	9.11	79	0.30	
Pomatomus saltatrix	7.73	59	0.26	
Merluccius capensis	7.53	59	0.25	
Sardinops ocellatus	3.37	99	0.11	257
ANTENNARIIDAE	2.77	40	0.09	
Umbrina canariensis	2.58	79	0.09	
C R A B S	1.98	79	0.07	
Loligo vulgaris	0.99	59	0.03	
Dentex barnardi	0.59	20	0.02	
Tetradonthidae	0.40	20	0.01	
Total	2988.14		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 79
DATE :15/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°11.19
start stop duration Lon E 11°37.89
TIME :09:39:33 09:53:53 14.3 (min) Purpose : 3
LOG : 209.68 210.37 0.7 Region : 4050
FDEPTH: 84 85 Gear cond.: 9
BDEPTH: 84 85 Validity : 4
Towing dir: 0° Wire out : 200 m Speed : 2.9 kn
Sorted : 30 Total catch: 272.70 Catch/hour: 1141.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus trecae	707.95	14272	62.05	260
B I V A L V E S	104.31	149121	9.14	
Merluccius capensis	50.84	414	4.46	263
Pegusa lascaris	32.38	1167	2.84	
Pythonichthys microphthalmus	28.24	565	2.48	
Atractoscion aequidens	25.61	188	2.24	265
Squilla cadenati	22.97	828	2.01	
Trachurus capensis	21.09	1393	1.85	261
Chelidonichthys capensis	19.58	188	1.72	
G A S T R O P O D S	18.45	45866	1.62	
Galeichthys sp.	17.32	38	1.52	
Raja miraletus	17.32	38	1.52	
Umbrina canariensis	13.93	377	1.22	264
Brotula barbata	13.56	264	1.19	
GOBIIDAE	13.56	1506	1.19	
Pterothrissus belloci	10.92	188	0.96	
Dentex macrophthalmus	9.41	264	0.83	262
Calappa pelii	9.04	151	0.79	
Trichiurus lepturus	3.01	113	0.26	
Citharus linguatula	1.51	151	0.13	
Total	1141.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 80
DATE :15/08/2011 GEAR TYPE: PT NO: 1 POSITION:Lat S 17°11.17
start stop duration Lon E 11°37.79
TIME :10:25:38 11:01:43 36.1 (min) Purpose : 1
LOG : 211.98 213.97 2.0 Region : 4050
FDEPTH: 60 60 Gear cond.: 0
BDEPTH: 85 81 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.3 kn
Sorted : 38 Total catch: 37.98 Catch/hour: 63.14

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	48.38	2086	76.62	266
Sardinops ocellatus	5.84	186	9.24	268
J E L L Y F I S H	5.44	2	8.61	
Engraulis encrasicolus	3.06	150	4.84	267
Lagocephalus laevigatus	0.27	8	0.42	
Scomber japonicus	0.13	3	0.21	
BRAMIDAE	0.03	2	0.05	
Total	63.14		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 81
DATE :15/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°13.15
start stop duration Lon E 11°30.93
TIME :14:11:59 14:36:12 24.2 (min) Purpose : 3
LOG : 230.00 231.22 1.2 Region : 4050
FDEPTH: 134 131 Gear cond.: 0
BDEPTH: 134 131 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 3.0 kn
Sorted : 93 Total catch: 4999.49 Catch/hour: 12385.19

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	11237.61	327696	90.73	269
Dentex macrophthalmus	749.16	12220	6.05	270
Merluccius capensis	213.84	1063	1.73	271
Trichiurus lepturus	58.44	1063	0.47	
Squalus megalops	50.46	265	0.41	
Scomber japonicus	35.85	399	0.29	
Trigla lyra	13.28	131	0.11	
Loligo vulgaris	11.94	131	0.10	
Pterothrissus belloci	7.98	131	0.06	
Dicologoglossa cuneata	3.99	530	0.03	
G A S T R O P O D S	2.65	131	0.02	
Total	12385.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 82
DATE :15/08/2011 GEAR TYPE: BT NO: 25 POSITION:Lat S 17°12.73
start stop duration Lon E 11°28.76
TIME :15:26:44 15:47:05 20.4 (min) Purpose : 3
LOG : 235.08 236.06 1.0 Region : 4050
FDEPTH: 148 152 Gear cond.: 0
BDEPTH: 148 152 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 2.9 kn
Sorted : 203 Total catch: 842.16 Catch/hour: 2481.81

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	1027.90	12306	41.42	273
Trachurus capensis	787.66	15908	31.74	272
Squalus megalops	192.85	660	7.77	
Merluccius capensis	175.40	896	7.07	274
Zeus faber	104.20	283	4.20	
Chelidonichthys capensis	75.44	141	3.04	
Loligo vulgaris	27.82	94	1.12	
Synagrops microlepis	22.16	5092	0.89	
Pterothrissus belloci	21.69	330	0.87	
Trichiurus lepturus	12.26	141	0.49	
Helicolenus dactylopterus	10.37	566	0.42	
Zenopsis conchifer	9.43	47	0.38	
Squilla mantis	5.19	141	0.21	
Chlorophthalmus atlanticus	2.83	424	0.11	
Alloteuthis africana	2.83	47	0.11	
Dicologoglossa cuneata	1.89	141	0.08	
GOBIIDAE	1.89	141	0.08	
Total	2481.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 83
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°11.89
start stop duration Lon E 11°25.40
TIME :16:39:18 16:59:27 20.1 (min) Purpose : 3
LOG : 241.08 242.08 1.0 Region : 4050
FDEPTH: 171 174 Gear cond.: 0
BDEPTH: 171 174 Validity : 0
Towing dir: 0° Wire out : 420 m Speed : 3.0 kn
Sorted : 47 Total catch: 718.63 Catch/hour: 2140.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	1050.30	20908	49.06	276
Merluccius capensis	483.37	2073	22.58	275
Dentex macrophthalmus	210.06	2163	9.81	277
Zenopsis conchifer	70.13	328	3.28	
Squalus megalops	58.39	164	2.73	
Trigla lyra	39.32	295	1.84	
Zeus faber	38.28	191	1.79	
Synagrops microlepis	31.79	7275	1.48	
Mustelus mustelus	28.75	12	1.34	
Helicolenus dactylopterus	20.97	885	0.98	
Pterothrissus belloci	19.33	197	0.90	
Squilla mantis	19.01	754	0.89	
Pegusa lascaris	13.11	1213	0.61	
Saurida brasiliensis	11.80	3408	0.55	
Scomber japonicus	11.47	131	0.54	278
Trichiurus lepturus	8.85	98	0.41	
Macropipus australis	5.24	262	0.24	
Malacocephalus occidentalis	4.26	197	0.20	
Bembrops heterurus	4.26	131	0.20	
Atractoscion aequidens	3.69	3	0.17	
Illex coindetii	3.60	98	0.17	
Chlorophthalmus atlanticus	1.97	131	0.09	
Diastobranchus capensis	1.64	33	0.08	
SCYLLARIDAE	1.31	197	0.06	
Total	2140.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 84
DATE :15/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°13.36
start stop duration Lon E 11°21.46
TIME :21:11:53 21:42:14 30.3 (min) Purpose : 3
LOG : 261.33 262.82 1.5 Region : 4050
FDEPTH: 322 321 Gear cond.: 0
BDEPTH: 322 321 Validity : 0
Towing dir: 0° Wire out : 780 m Speed : 2.9 kn
Sorted : 413 Total catch: 413.42 Catch/hour: 817.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	395.81	664	48.41	280
Chlorophthalmus atlanticus	209.03	6589	25.57	
Helicolenus dactylopterus	51.91	3101	6.35	
Laemonema laureysi	34.61	1357	4.23	
S H R I M P S	27.69	9773	3.39	
Bathynectes piperitus	16.75	761	2.05	
Galeus polli	15.52	182	1.90	
Lophius vomerinus	12.76	6	1.56	
Pterothrissus belloci	12.74	69	1.56	
Malacocephalus occidentalis	8.03	305	0.98	
Nezumia aequalis	5.68	305	0.69	
Trachurus capensis	5.06	67	0.62	279
RHINOCHIMAERIDAE	4.55	2	0.56	
Macropipus australis	3.60	152	0.44	
Dentex macrophthalmus	2.69	8	0.33	281
Pegusa lascaris	2.49	69	0.30	
Parapenaeus longirostris,femal	2.35	360	0.29	
GOBIIDAE	1.66	360	0.20	
B I V A L V E S	1.25	69	0.15	
MYCTOPHIDAE	0.69	208	0.08	
Scyliorhinus cervigoni	0.63	2	0.08	
Solenocera africana	0.55	97	0.07	
Munidopsis sp.	0.55	194	0.07	
Synagrops microlepis	0.42	28	0.05	
Parapenaeus longirostris, male	0.42	69	0.05	
Saurida brasiliensis	0.14	28	0.02	
Garbage	0.00	4	0.00	
Total	817.57		100.00	

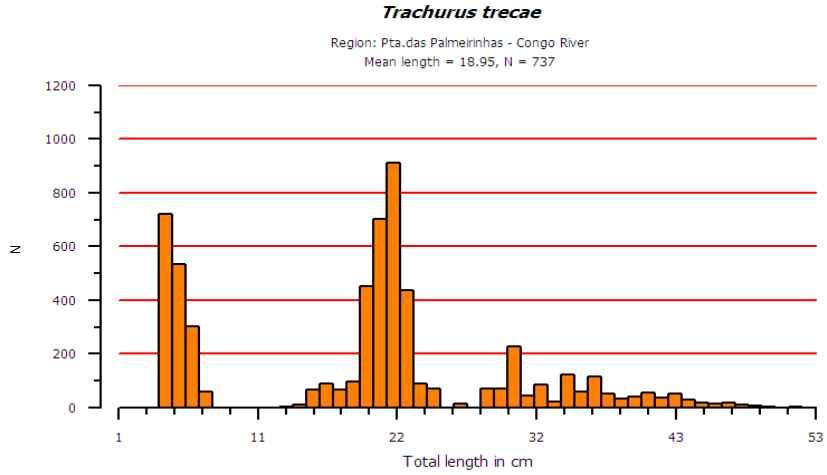
R/V Dr. Fridtjof Nansen SURVEY:2011408 STATION: 85
DATE :16/08/2011 GEAR_TYPE: BT NO: 25 POSITION:Lat S 17°10.85
start stop duration Lon E 11°15.01
TIME :02:06:52 02:36:58 30.1 (min) Purpose : 3
LOG : 280.16 281.52 1.4 Region : 4050
FDEPTH: 732 729 Gear cond.: 0
BDEPTH: 732 729 Validity : 0
Towing dir: 0° Wire out : 1670 m Speed : 2.7 kn
Sorted : 129 Total catch: 1375.24 Catch/hour: 2741.34

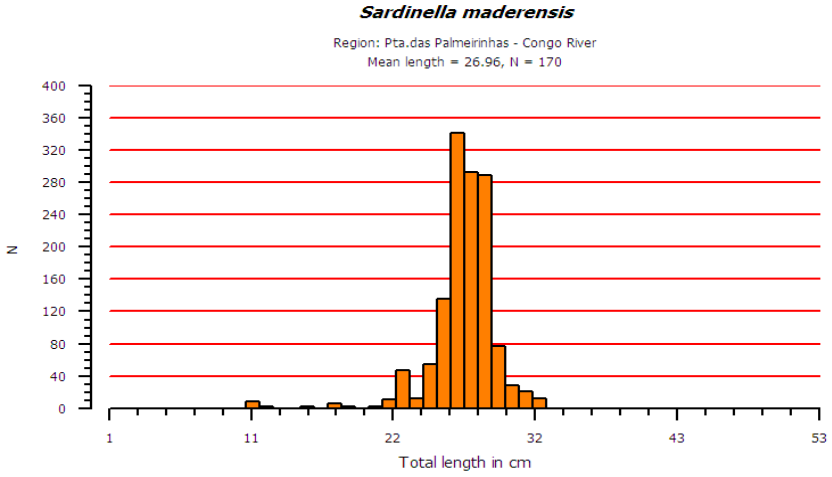
SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Raja confundens	743.02	148	27.10	
Nezumia aequalis	441.63	14484	16.11	
Trachyrincus scabrus	393.69	1549	14.36	
Merluccius capensis	373.59	419	13.63	282
Chaceon maritae, male	130.80	293	4.77	
Raja sp.	129.77	22	4.73	
Paramola cuvieri	69.69	42	2.54	
Talismania sp.	65.92	1214	2.40	
Bathyuroconger vicinus	46.47	544	1.69	
Deania calcea	44.05	16	1.61	
Chaceon maritae, female	41.02	231	1.50	
Anemones, pink	40.39	126	1.47	
UNIDENTIFIED FISH	26.99	22	0.98	
Hoplostethus cadenati	25.32	1256	0.92	
Aristeus varidens, female	22.39	1443	0.82	
Ebinania costaecanarie	19.67	42	0.72	
Yarrella blackfordi	15.49	795	0.56	
Todarodes sp.	14.65	22	0.53	
RHINOCHIMAERIDAE	11.42	2	0.42	
Selachophidium guentheri	11.30	231	0.41	
Stomias boa boa	10.25	524	0.37	
Scymnodon squamulosus	8.69	30	0.32	
Lamprogrammus exutus	7.73	64	0.28	
Anemones, white	7.73	22	0.28	
UNIDENTIFIED FISH	6.28	1027	0.23	
Apristurus sp.	5.82	16	0.21	
Aristeus varidens, male	5.22	460	0.19	
Heterocarpus grimaldi	5.22	273	0.19	
Neocyttus sp.	3.55	42	0.13	
Notacanthus sexspinis	3.55	42	0.13	
SYNAPHOBRANCHIDAE	3.35	126	0.12	
HOMOLIDAE	3.35	22	0.12	
Bathynectes piperitus	1.26	22	0.05	
Caresproctus sp.	0.84	22	0.03	
B I V A L V E S	0.62	22	0.02	
Triplophos hemingi	0.62	64	0.02	
Total	2741.34		100.00	

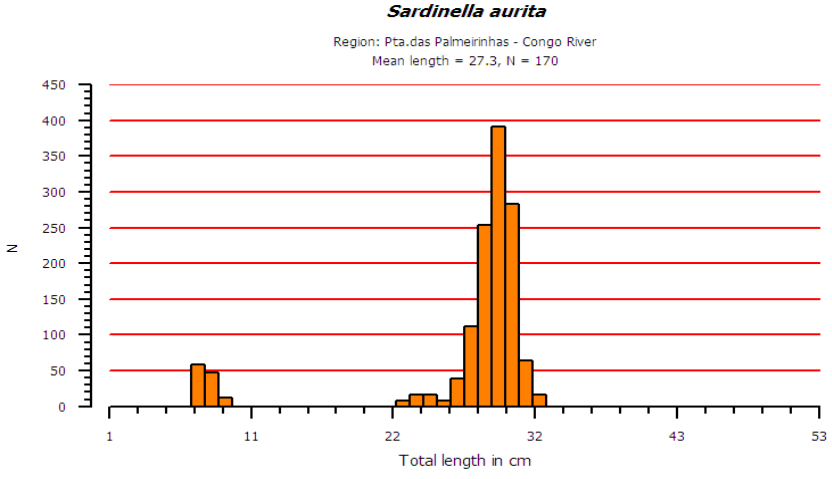
ANNEX II LENGTH FREQUENCY AND LENGTH-WEIGHT RELATION OF THE MOST COMMON PELAGIC SPECIES

Angola North: Congo River – Pta. Palmerinhas

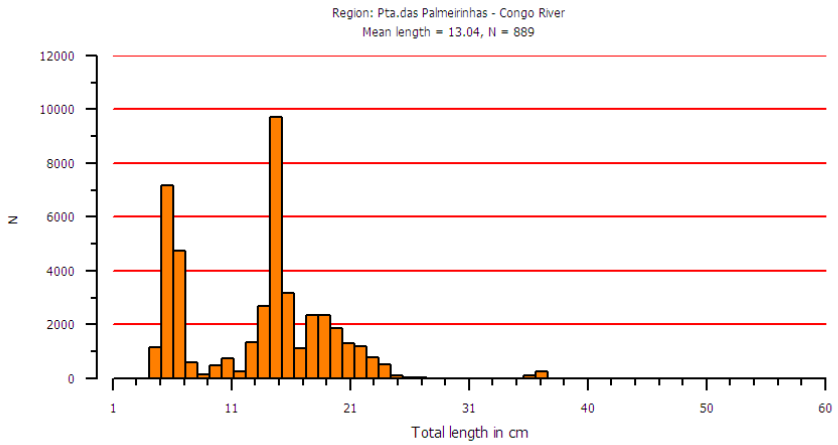
Lenght frequency distribution



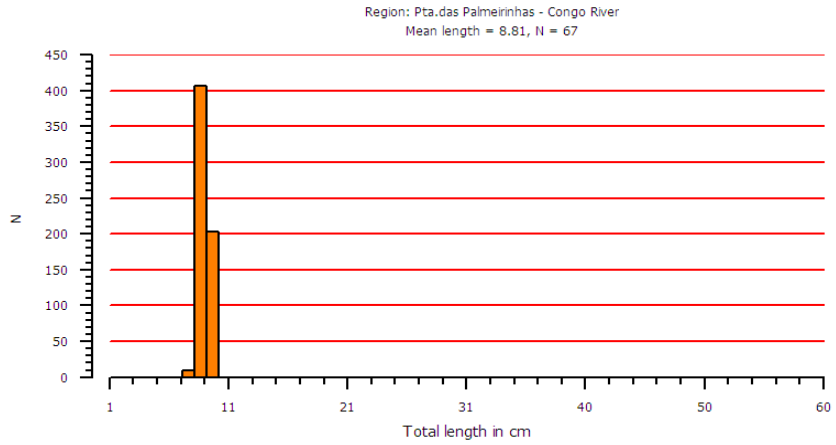




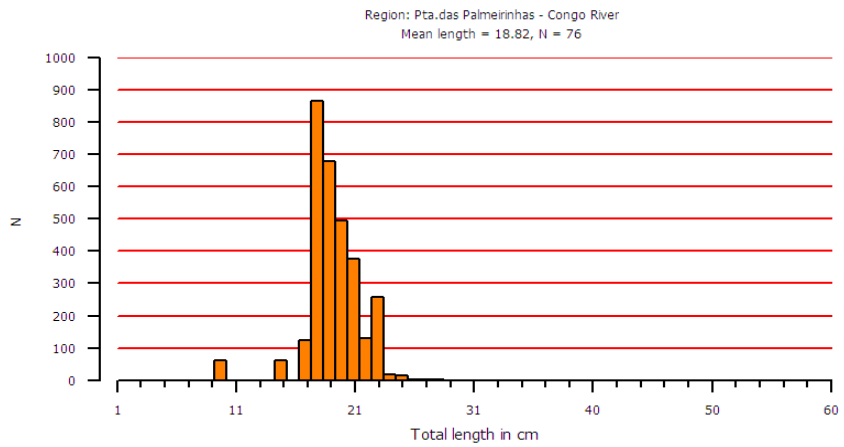
Brachydeuterus auritus

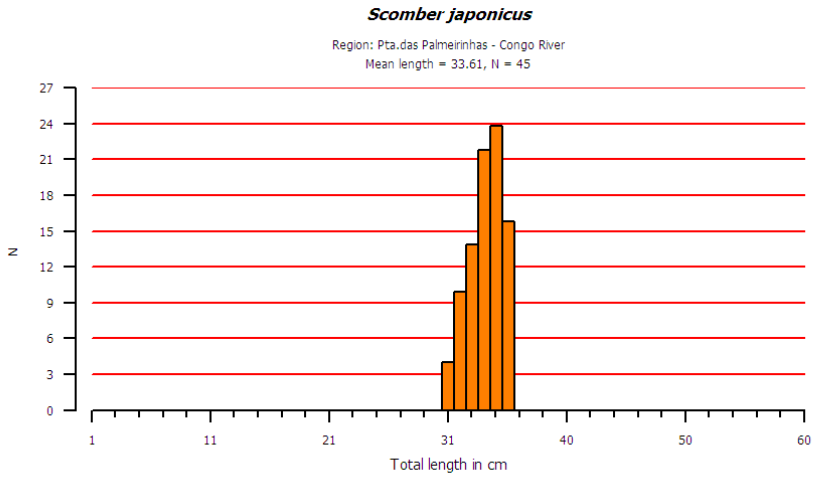


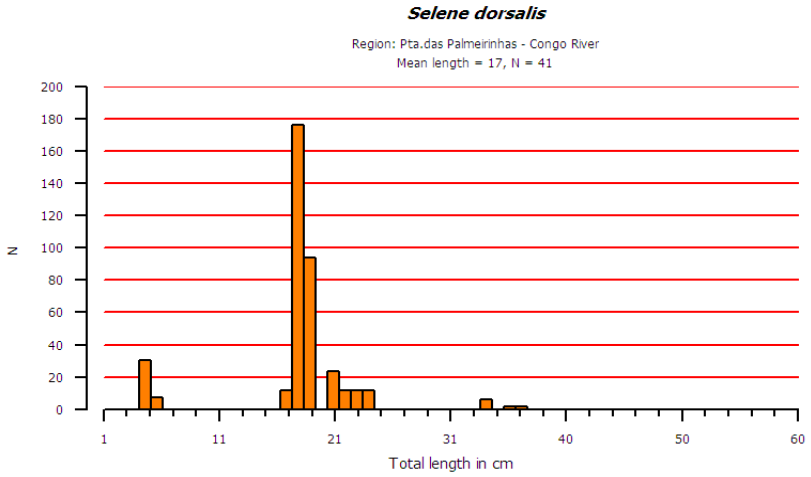
Engraulis encrasicolus



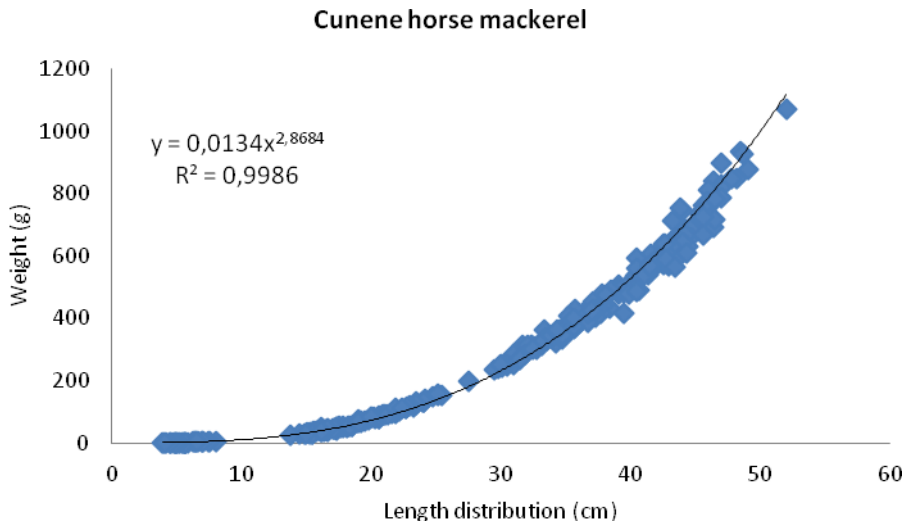
Ilisha africana

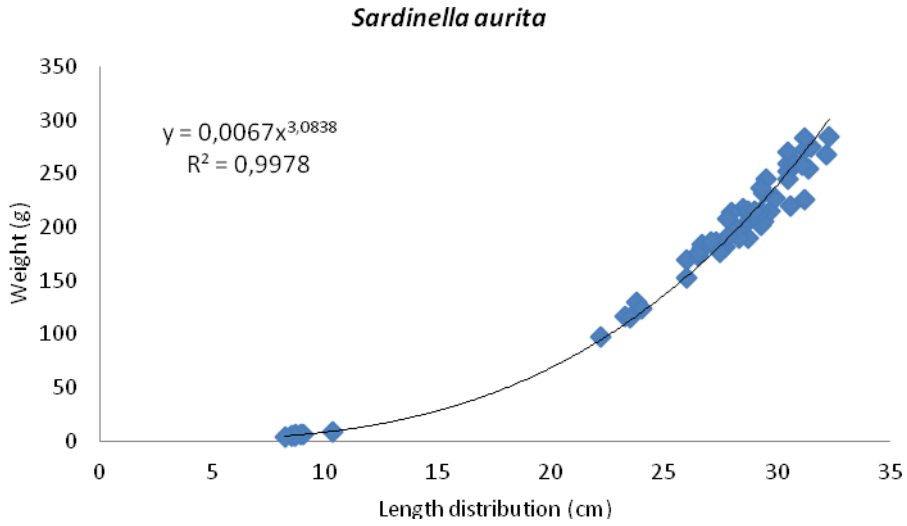


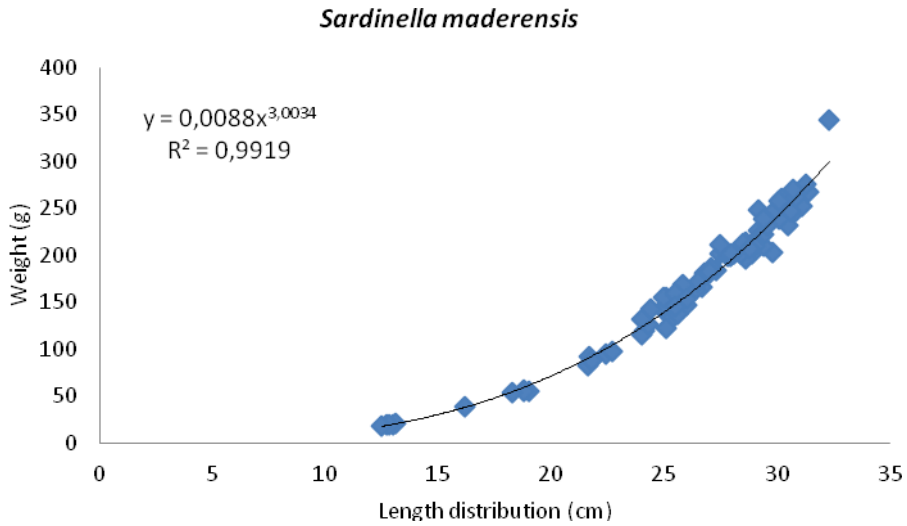




Length-weight relationships for Cunene horse mackerel (*Trachurus trecae*) and the two *Sardinella* species (*S. aurita* and *S. madeirensis*)

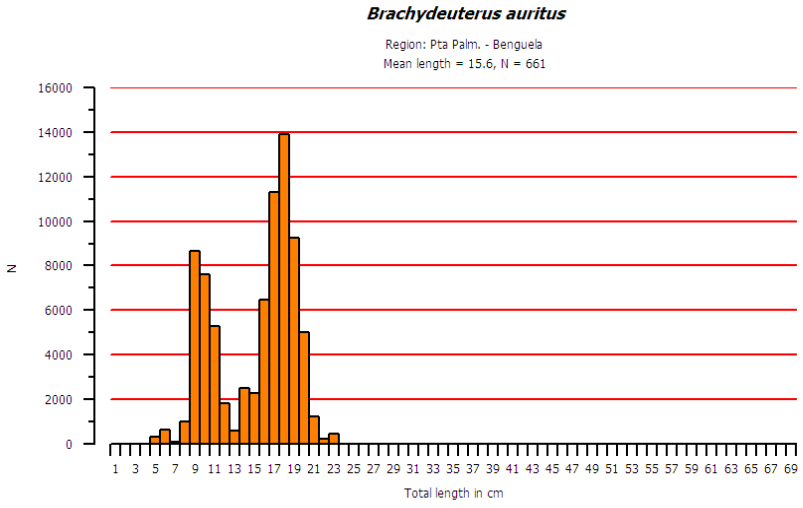






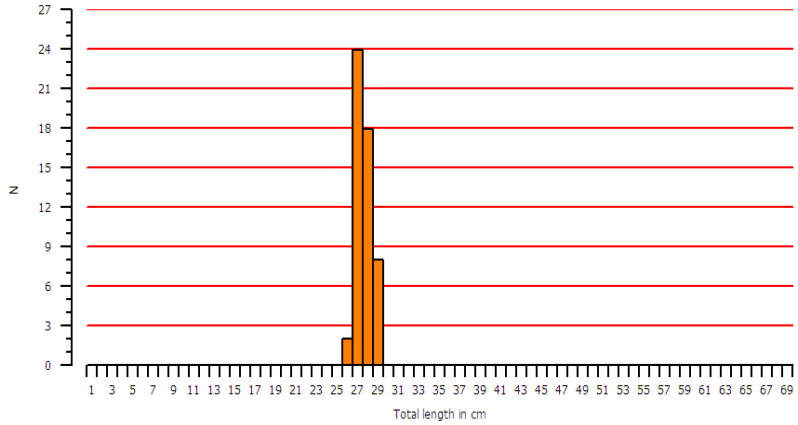
Angola Central: Pta. Palmerinhas – Benguela

Lenght frequency distribution



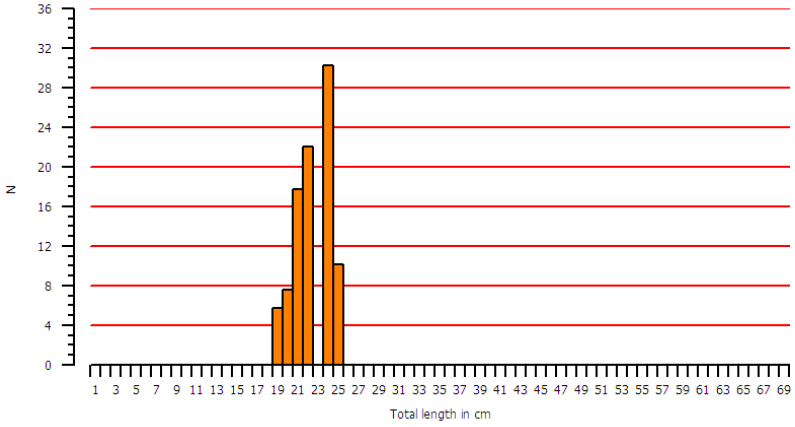
Auxis thazard

Region: Pta Palm. - Benguela
Mean length = 28.12, N = 26



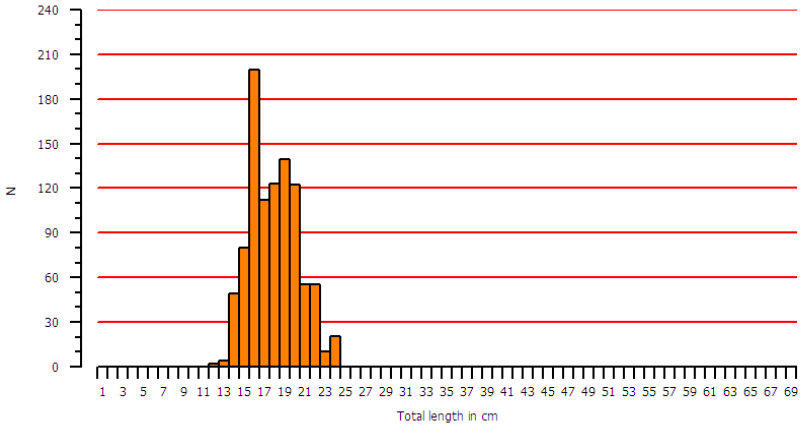
Decapterus rhonchus

Region: Pta Palm. - Benguela
Mean length = 22.94, N = 19



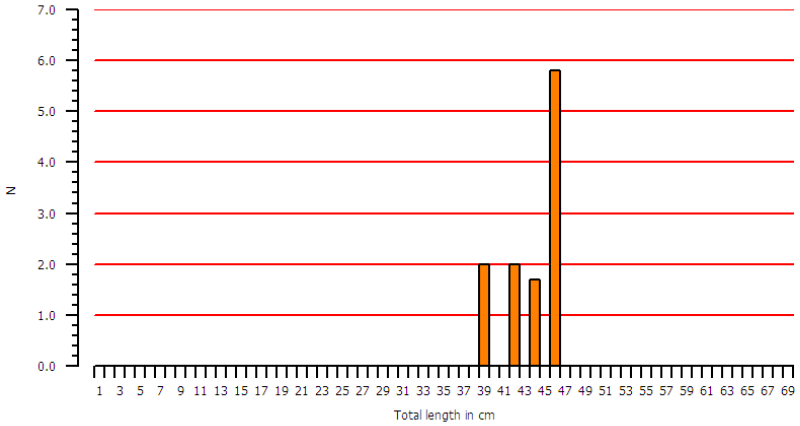
Ilisha africana

Region: Pta Palm. - Benguela
Mean length = 18.46, N = 173



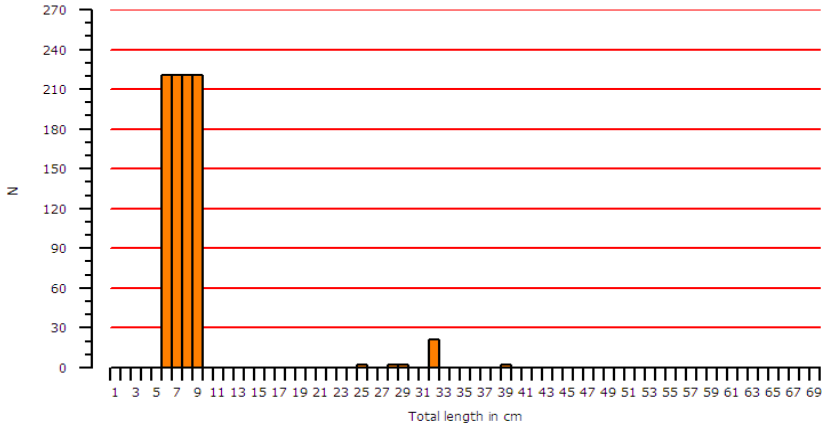
Sarda sarda

Region: Pta Palm. - Benguela
Mean length = 44.32, N = 4



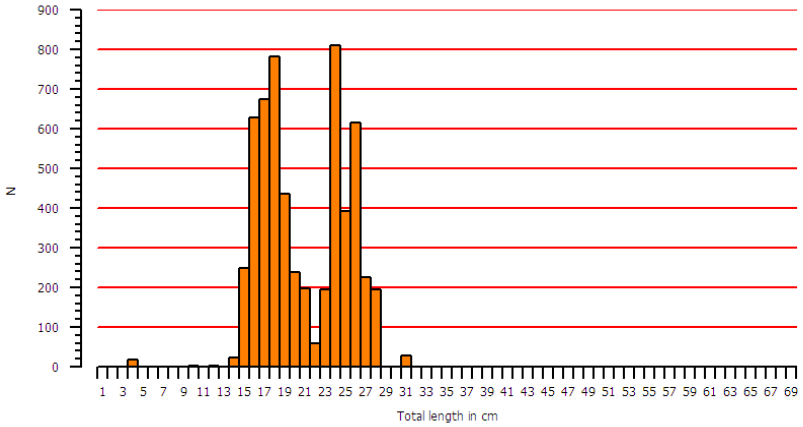
Scomber japonicus

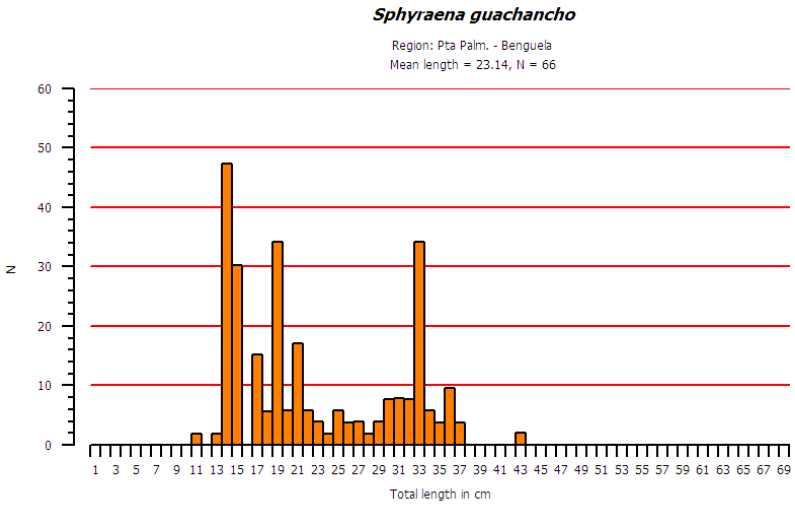
Region: Pta Palm. - Benguela
Mean length = 8.76, N = 10



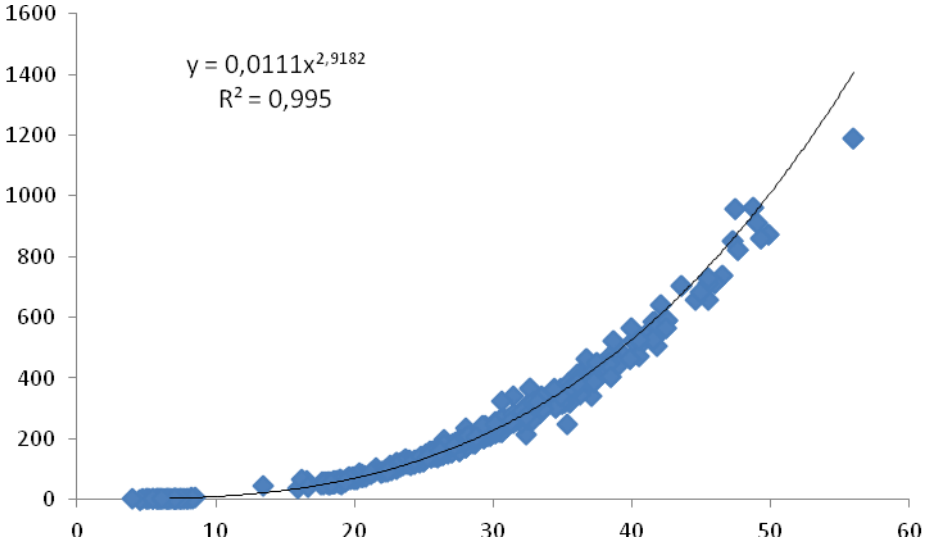
Selene dorsalis

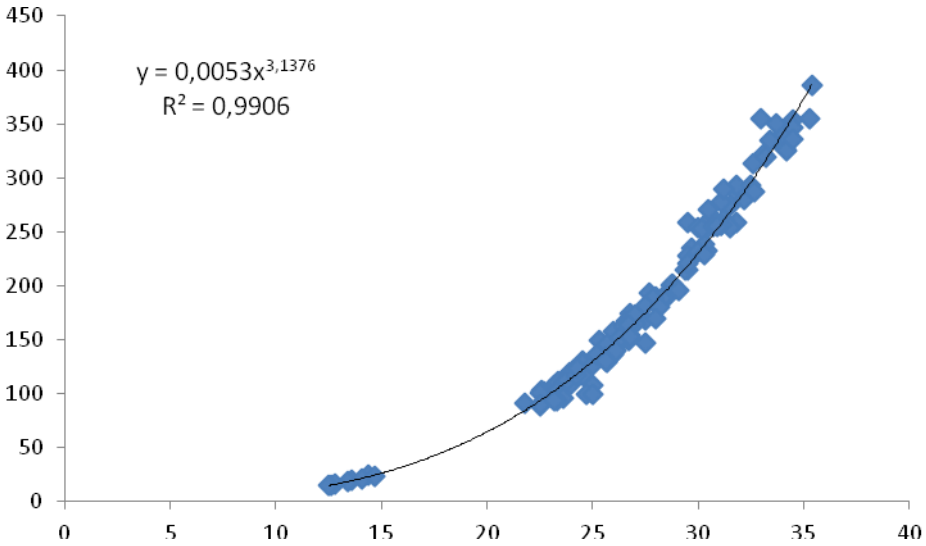
Region: Pta Palm. - Benguela
Mean length = 21.37, N = 322

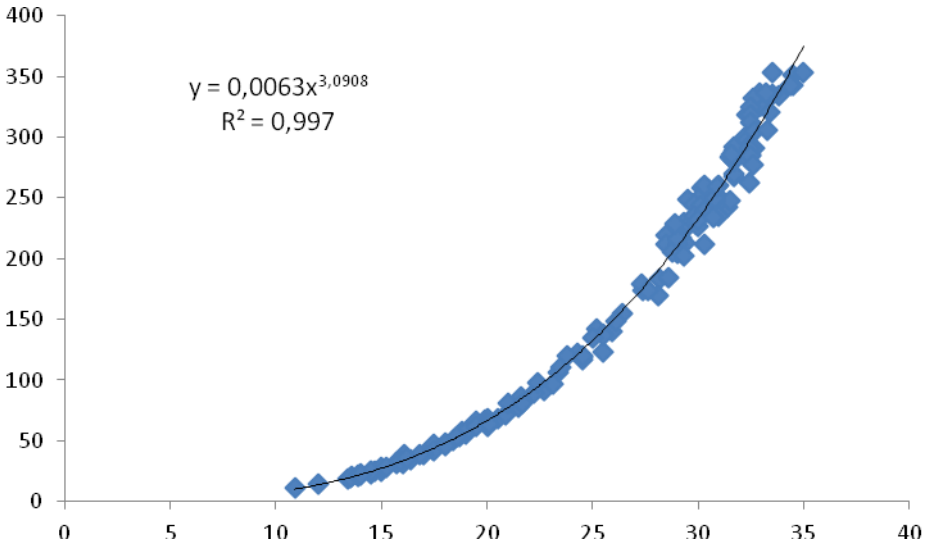




Length-weight relationships for Cunene horse mackerel (*Trachurus trecae*) and the two *Sardinella* species (*S. aurita* and *S. madeirensis*)

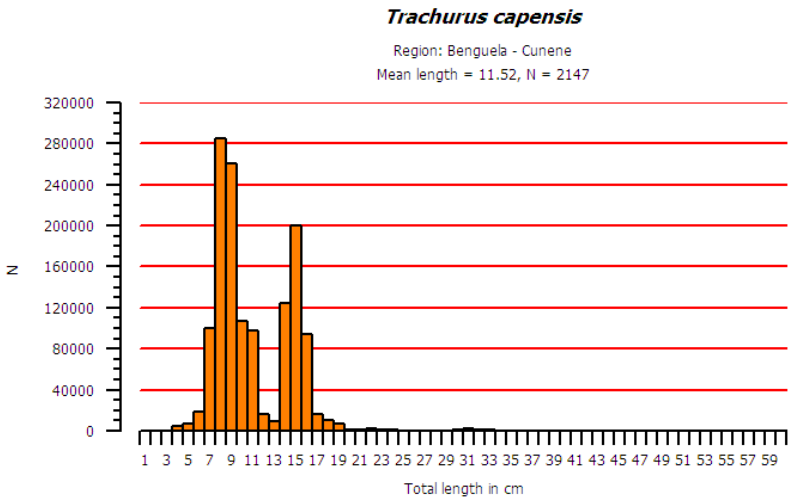






Angola South:

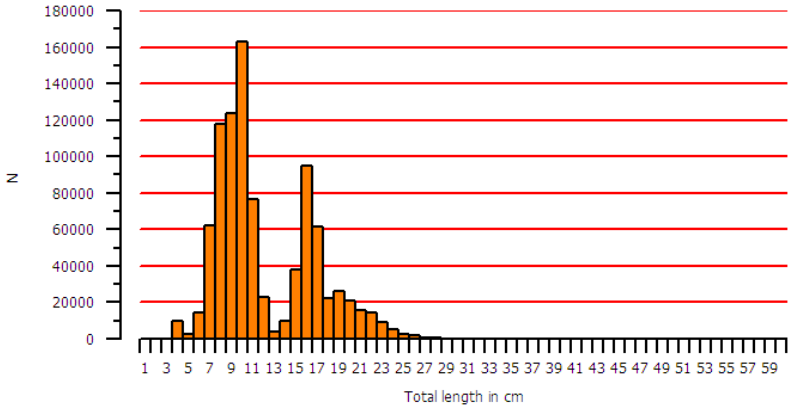
Lenght frequency distribution



Trachurus trecae

Region: Benguela - Cunene

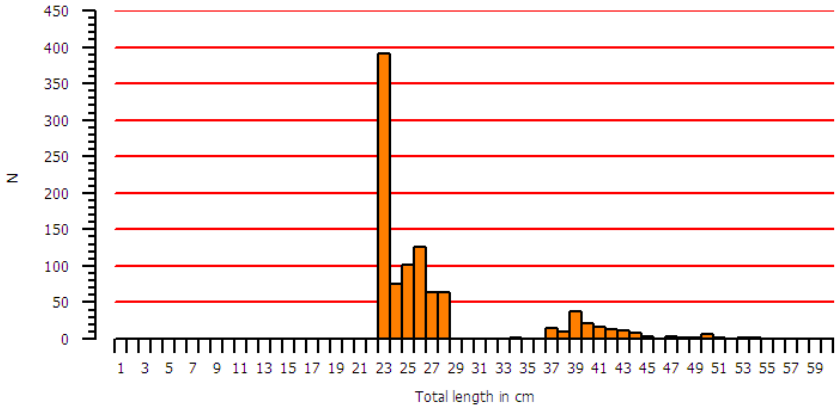
Mean length = 12.6, N = 4494



Atractoscion aequidens

Region: Benguela - Cunene

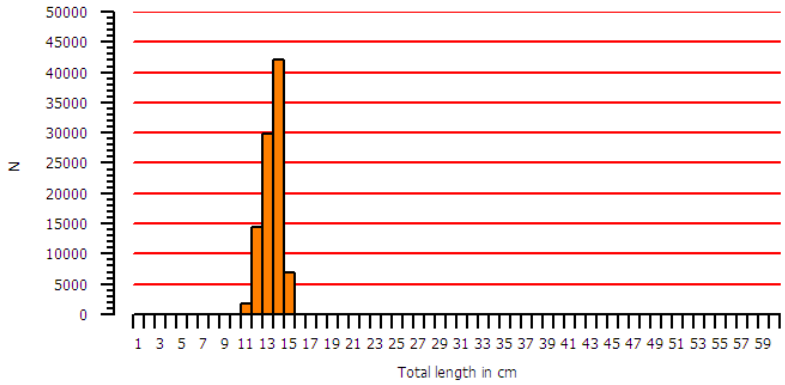
Mean length = 27.71, N = 67

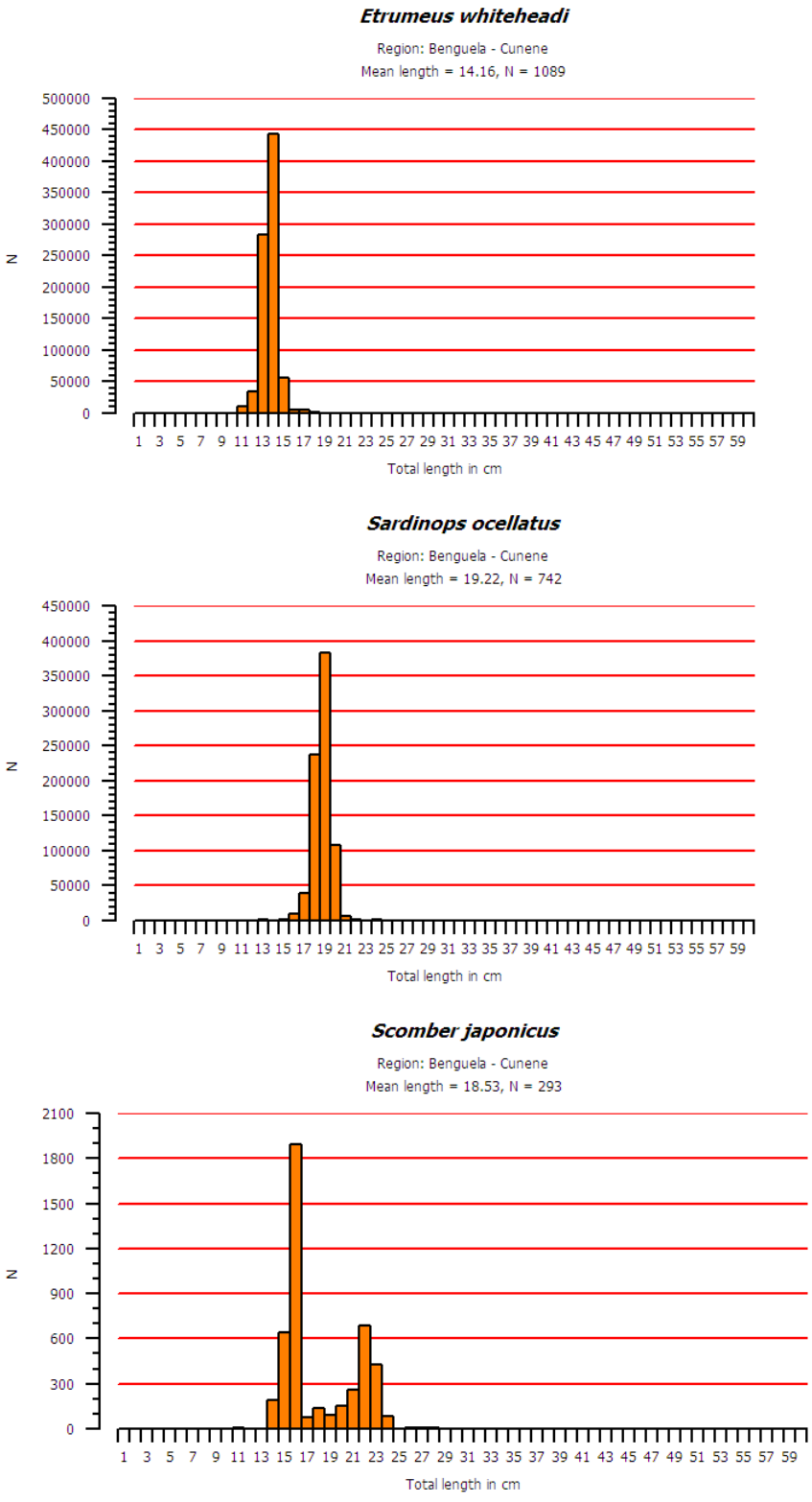


Engraulis encrasicolus

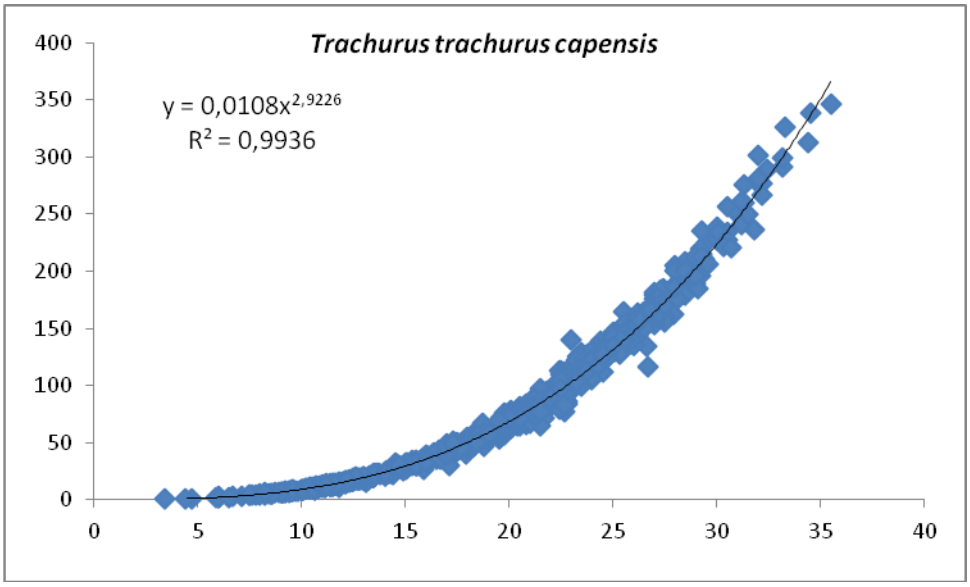
Region: Benguela - Cunene

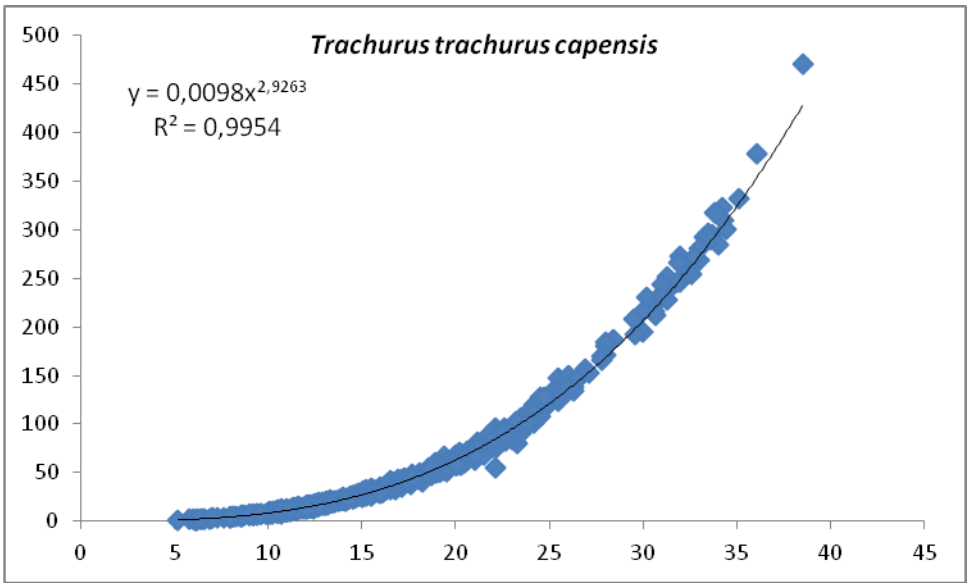
Mean length = 13.89, N = 442

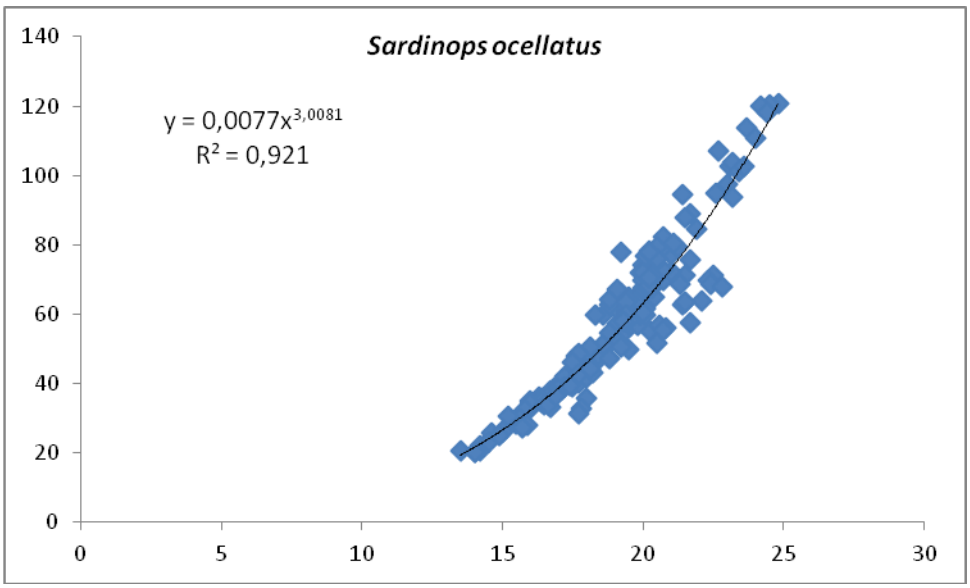




Length-weight relationships for Cunene horse mackerel (*Trachurus trecae*) and the two *Sardinella* species (*S. aurita* and *S. madeirensis*)


Trachurus trachurus capensis
y = 0,0108x^2,9226
R² = 0,9936
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40


Trachurus trachurus capensis
y = 0,0098x^2,9263
R² = 0,9954
500
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
45


Sardinops ocellatus
y = 0,0077x^3,0081
R² = 0,921
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30

ANNEX III BIOMASS BY REGIONS AND YEARS

Table of Sardinella biomass (1 000 tons) estimated from acoustic indexes from surveys with R/V 'Dr. Fridtjof Nansen' from 1985-2011.

Year	Season	Dates	Survey number	South Cunene-Benguela	Central Palmerinhas-Benguela	North Cabinda-Palmerinhas	Total Cunene-Cabinda	Notes
1985	Summer	28.01-26.02	1	25	20	80	125	
1985	Autumn	23.04-28.05	2	110	190	180	480	
1985	Winter	08.08-10.09	3	0	70	190	260	
1985	Spring	05.11-05.12	4	0	200	110	310	
1986	Summer	22.01-10.03	1	10	140	110	260	
1986	Autumn	22.04-05.06	2	10	130	130	270	
1989	Summer	13.02-16.03	1	40	200	60	300	
1989	Autumn	23.04-29.05	2	20	40	130	190	
1989	Spring	17.11-12.12	3	40	100	60	200	
1991	Autumn	04.05-19.06	1		180	120	300	1
1991	Winter	06.08-18.09	2		68	154	222	1
1992	Winter	05.08-22.09	1		119	161	280	1
1994	Autumn	21.02-16.03	ANG1		410	100	510	2
1994	Winter	02.08-17.08	ANG2		245	290	535	2
1995	Summer	28.02-02.04	ANG1		140	24	164	2
1995	Winter	10.08-20.09	ANG4		277	297	574	1
1996	Autumn	23.02-31.03	ANG1	49	175	70	294	
1996	Winter	16.07-06.09	ANG2	0	130	233	363	
1997	Autumn	22.02-20.03	ANG1	0	195	300	495	3
1998	Autumn	02.03-28.03	ANG1	75	389	79	543	3
1998	Winter	07.05-22.05	ANG3	0	233	159	392	3
1999	Winter	02.08-26.08	ANG2	0	228	135	363	3
2000	Winter	28.07-20.07	ANG2	0	179	174	353	3
2001	Winter	20.07-17.08	ANG2	0	257	177	434	3
2002	Winter	17.08-16.09	ANG2	0	165	187	352	3
2003	Winter	20.07-19.08	ANG2	2	277	153	432	3
2004	Winter	28.07-27.08	ANG2	0	175	187	362	3
2005	Winter	16.07-24.08	2005408	0	148	95	243	
2006	Winter	21.07-21.08	2006408	20	244	366	630	
2007	Winter	07.07-10.08	2007406	55	483	187	725	
2008	Winter	15.05-02.07	2008404	56	264	186	506	
2009	Winter	23.05-04.07	2009406	92	232	206	530	
2010	Winter	18.06-11.08	2010406	43	293	93	429	3
2011	Summer	20.02-20.03	2011402	96	68	96	260	3
2011	Winter	18.07-18.08	2011408					

1 Data error (Southern Region)
2 Southern Region not surveyed
3 Cabinda not surveyed

Table of Cunene Horse Mackerel biomass (1 000 tons) estimated from acoustic indexes from surveys from surveys with R/V 'Dr. Fridtjof Nansen' from 1985-2011.

Year	Season	Dates	Survey number	South Cunene-Benguela	Central Palmerinhas-Benguela	North Cabinda-Palmerinhas	Total Cunene-Cabinda	Notes
1985	Summer	28.01-26.02	1	30	195	40	265	
1985	Autumn	23.04-28.05	2	55				1
1985	Winter	08.08-10.09	3	50	90	40	180	
1985	Spring	05.11-05.12	4	70	125	20	215	
1986	Summer	22.01-10.03	1	130				5
1986	Autumn	22.04-05.06	2	30				1
1989	Summer	13.02-16.03	1	35	55	40	130	
1989	Autumn	23.04-29.05	2	25				1
1989	Spring	17.11-12.12	3	170	40	35	245	
1991	Autumn	04.05-19.06	1	100	80	20	200	
1991	Winter	06.08-18.09	2	100	70	30	200	
1992	Winter	05.08-22.09	1	98	86	80	280	
1994	Autumn	21.02-16.03	ANG1		238	1	239	
1994	Winter	02.08-17.08	ANG2		130	120	250	
1995	Summer	28.02-02.04	ANG1		?	84	84	
1995	Winter	10.08-20.09	ANG4	70	160	110	340	
1996	Autumn	23.02-31.03	ANG1	286	214	6	506	
1996	Winter	16.07-06.09	ANG2	140	157	63	360	
1997	Autumn	22.02-20.03	ANG1	234	55	138	193	3
1998	Autumn	02.03-28.03	ANG1	163	58	18	239	3
1998	Winter	07.05-22.05	ANG3	118	112	37	267	3
1999	Winter	02.08-26.08	ANG2	124	129	68	321	3
2000	Winter	28.07-20.07	ANG2	92	178	63	333	3
2001	Winter	20.07-17.08	ANG2	64	22	3	89	3
2002	Winter	17.08-16.09	ANG2	118	13	31	162	3
2003	Winter	20.07-19.08	ANG2	120	34	12	166	3
2004	Winter	28.07-27.08	ANG2	32	107	90	229	3
2005	Winter	16.07-24.08	2005408	102	57	21	180	
2006	Winter	21.07-21.08	2006408	45	77	31	153	
2007	Winter	07.07-10.08	2007406	73	57	27	157	
2008	Winter	15.05-02.07	2008404	29	40		69	4
2009	Winter	23.05-04.07	2009406	76	7		83	4
2010	Winter	18.06-11.08.	2010406	100	15	21	136	3
2011	Summer	20.02-20.03	2011402	55	13		69	3;4
2011	Winter	18.07-18.08	2011408					

1 Data error (Central and Northern Regions)

2 Southern region not surveyed

3 Cabinda not surveyed

4 Fish density too low to estimate abundance (Northern Region)

5 Estimates reported together with previous report

ANNEX IV INSTRUMENTS AND FISHING GEAR USED

The Simrad ER-60/18, 38, 120 and 200 kHz 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 last calibrations took place 07.03.2010, Baia dos Elefantes. The details of the settings of the 38 kHz echo sounder where as follows:

Transceiver-2 menu (38 kHz)

Transducer depth	5.50 m
Absorption coefficient	8.7 dB/km
Pulse length	medium (1,024ms)
Bandwidth	2.43 kHz
Max power	2000 Watt
2-way beam angle	-20,6dB
Gain	25.38 dB
SA correction	-0.48 dB
Angle sensitivity	21.9
3 dB beam width	7.12º along ship
	7.24º athwart ship
Along ship offset	0.17º
Athwart ship offset	0.05º

Bottom detection menu

Minimum level	-45 dB

Fishing gear

The vessel has two different sized "Åkrahamn" pelagic trawls and one "Gisund super bottom trawl". Trawls were used for identification of acoustic targets only.

The bottom trawl has a headline of 31 m, footrope 47 m and 20 mm mesh size in the cod end with an inner net of 10 mm mesh size. 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 equipped with a 12" rubber bobbins gear. New doors are 'Thyborøn' combi type, 7.41 m^2, 1720 kg. These have been in use onboard since 19.02.08.

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. A catch sensor on the cod-end indicated the size of the catch.