

SURVEY OF THE FISH RESOURCES OF ANGOLA
Survey of the pelagic fish resources

16 June – 17 July 2014

by

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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 EAF-Nansen project offers an opportunity to coastal countries in sub-Saharan Africa, working in partnership with the project, to receive technical support from FAO for the development of national and regional frameworks for the implementation of Ecosystem Approach to Fisheries management and to acquire additional knowledge on their marine ecosystems for their use in planning and monitoring. The project contributes to building the capacity of national fisheries management administrations in ecological risk assessment methods to identify critical management issues and in the preparation, operationalization and tracking the progress of implementation of fisheries management plans consistent with the ecosystem approach to fisheries.

LE PROJET EAF-NANSEN

La FAO a initié la mise en oeuvre du projet "Renforcement de la base des connaissances pour mettre en œuvre une approche écosystémique des pêcheries marines dans les pays en développement (EAF-Nansen GCP/INT/003/NOR)" en décembre 2006. Le projet est financé par de l'Agence norvégienne de coopération pour le développement (Norad). Le projet EAF-Nansen fait suite aux précédents projets/ programmes dans le cadre du partenariat entre la FAO, Norad et l'Institut de recherche marine (IMR) de Bergen en Norvège, sur l'évaluation et l'aménagement des ressources halieutiques dans les pays en développement. Le projet est mis en oeuvre en partenariat avec les gouvernements et en collaboration avec les projets grands écosystèmes marins (GEM) soutenus par le Fonds pour l'Environnement Mondial (FEM) et d'autres projets régionaux qui ont le potentiel de contribuer à certains éléments du projet EAF-Nansen.

Le projet EAF-Nansen offre l'opportunité aux pays côtiers de l'Afrique subsaharienne partenaires de recevoir un appui technique de la FAO pour le développement de cadres nationaux et régionaux visant une approche écosystémique de l'aménagement des pêches et la possibilité d'acquérir des connaissances complémentaires sur leurs écosystèmes marins. Ces éléments seront utilisés pour la planification et le suivi des pêcheries et de leurs écosystèmes. Le projet contribue à renforcer les capacités des administrations nationales responsables de l'aménagement des pêches en introduisant des méthodes d'évaluation des risques écologiques pour identifier les questions d'aménagement d'importance majeure ainsi que la préparation, la mise en œuvre et le suivi des progrès de la mise en œuvre de plans d'aménagement des ressources marines conformes à l'approche écosystémique des pêches.



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Cruise Report No 5/2014

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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 echo integration is the principal tool for estimating relative stock abundance of pelagic species, and the time series of survey estimates can therefore form a basis for recommendation on the Total Allowable Catch (TAC).

The specific objectives of the survey were the following:

- To estimate the relative 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 horse mackerel species for analyses of diet composition and length-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 compositions and densities.
- To observe and make records of sea birds and sea mammals in the survey area.
- To map the general meteorological, hydrographical and biological conditions in the survey area by means of continuous recordings of weather data, CTD-casts (Temperature, Salinity and Oxygen), ADCP measurements (Acoustic Doppler Current Profiler) and plankton sampling along acoustical and hydrographical transect lines.
- On-the-job training of cruise participants on the main survey routines, including use of the Nansis database and scrutinizing acoustical observation (echograms) with the post-processing system, the Large Scale Survey System (LSSS).

1.2 Participation

The scientific staff consisted of:

From INIP, Angola:

16.06-17.07.2014: António Barradas (Angola Team leader), Francisco de Almeida, Jose da Siva, Geraldina de A. S. José, Willian Augusto, João Morais Domingos, Eusébio Dias dos Santos and Silvana Faria (16-25.06).

26.06-17.07.2014: Marisa Macueria, Sonia da Silva and Pedro Panzo.

From Imr, Norway:

16.06-17.07.2014: Knut Korsbrekke (Cruise Leader), Inês Bernardes, Jan Frode Wilhelmsen, Håkon Langøen

1.3 Narrative

The vessel departed Luanda on the 16th of June at 16:55 UTC and steamed northwards to the Congo River where the survey started with the monitoring line off Moita Seca (Congo River) on the 17th of June at 04:00 UTC. The survey area has been divided into three regions:

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

After a reduction in survey effort in 2013 the total survey duration was sufficient for a complete coverage of the survey area in 2014.

The northern region was completed on the 24th of June with the monitoring line off Pta. das Palmerinhas and steamed to Luanda. The vessel continued the coverage of the central region on 27th June and completed on the 4th of July. The coverage of the Southern region was completed on the 14th of July.

Calibration of the Simrad ER 60 Scientific echo sounder (18, 38, 120 and 200 kHz transducers) was done in Baía dos Elephantes on the 5th of July.

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, 2 and 3 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 depth levels of zooplankton samples per station) and distance surveyed (log).

Survey region	Trawl stations			CTD	Multinet	Log (NM)
	BT	PT	Total			
Congo River - Pta. Palmerinhas	5	15	20	77	16	1178
Pta. Palmerinhas - Benguela	9	12	21	93	8	1611
Benguela - Cunene River	19	15	34	117	19	1216
Total	33	42	75	287	43	4005

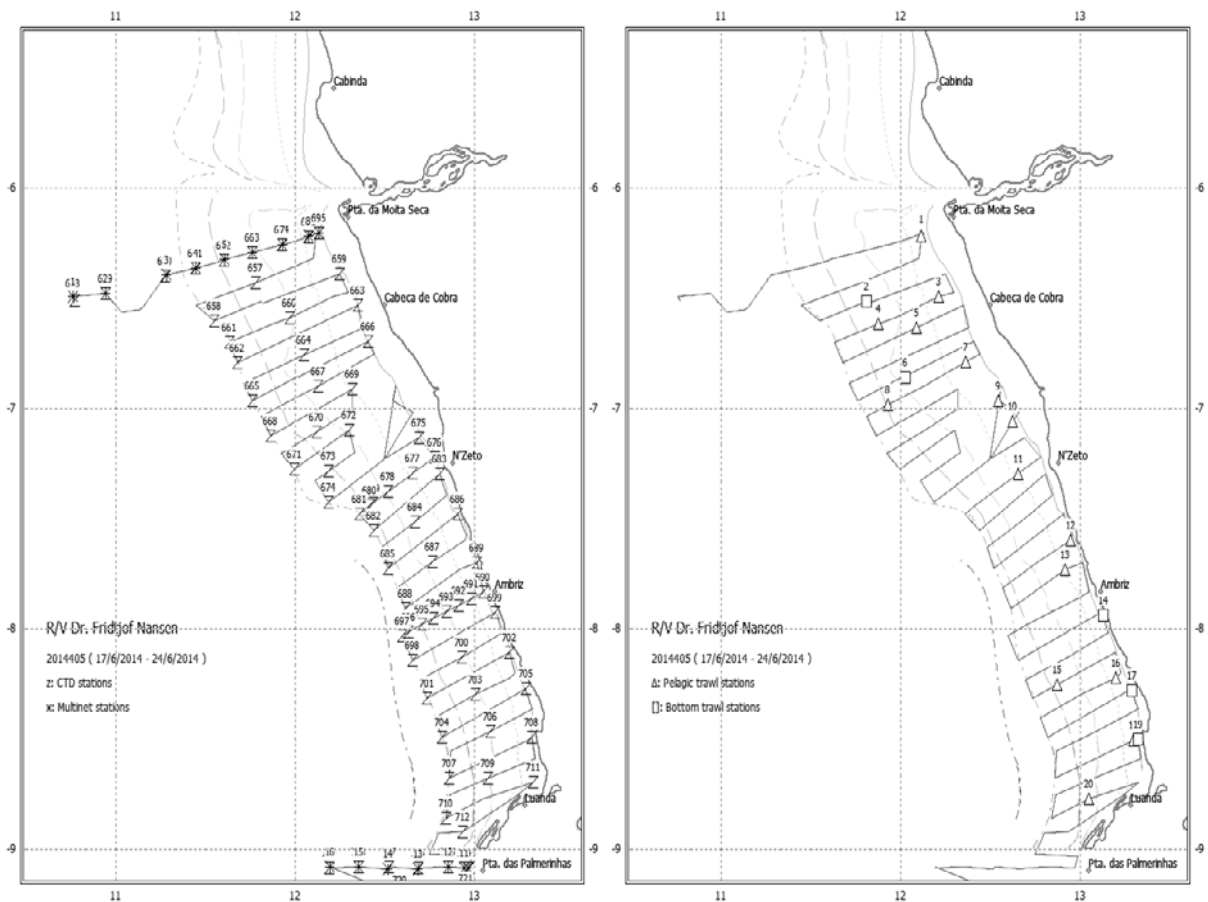


Figure 1. Course track with hydrographical and multinet stations (left panel) and trawl stations (right panel), Congo River - Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200, and 500m.

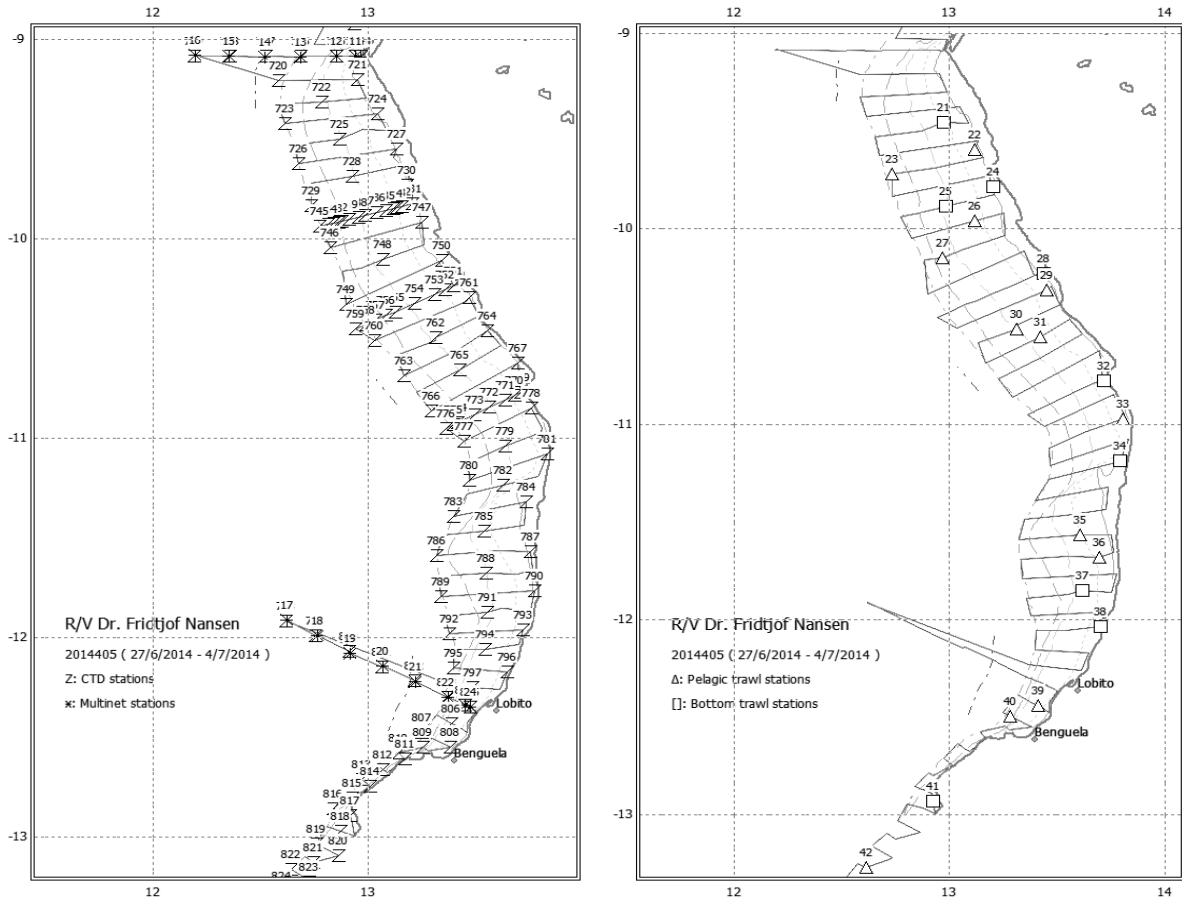


Figure 2. Course track with hydrographical and multinet stations (left panel) and trawl stations (right panel), Pta. das Palmerinhas - Benguela. Depth contours at 20, 50, 100, 200, and 500m.

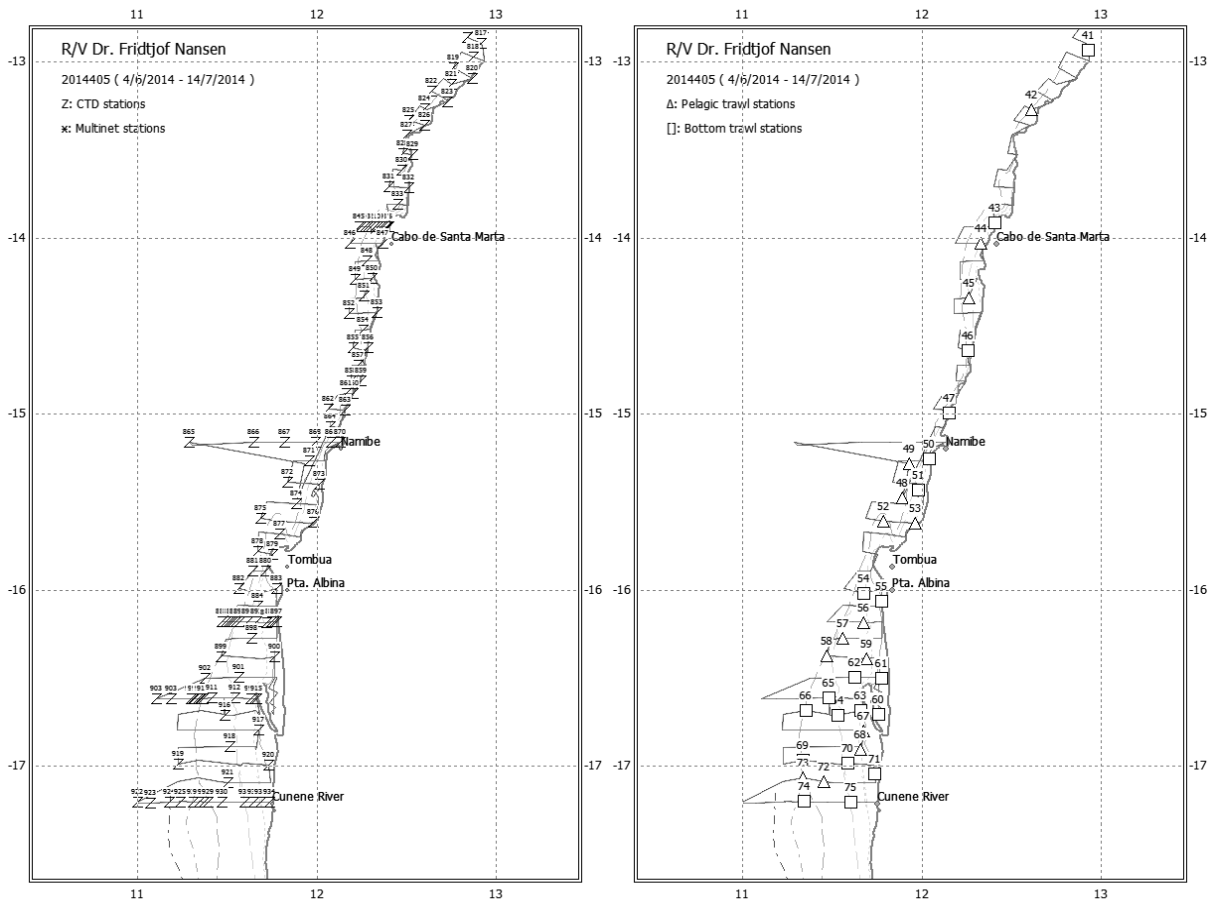


Figure 3. Course track with hydrographical and multinet stations (left panel) and trawl stations (right panel), Benguela-Cunene River. Depth contours at 20, 50, 100, 200, and 500m.

CHAPTER 2 METHODS

2.1 Hydrographical sampling

Location of stations belonging to monitoring lines or to standard hydrographical sections can be found in Table 11, ANNEX VII. Additional CTD stations were cast along acoustic transects with typically either one CTD station in the middle of the transect or two casts in each end of the transect.

The general monitoring of the oceanographic condition along the Angola coast includes Main monitoring lines of highest priority (Red) (CRML, PML, LBML, NML, CML): Multinet, bottles and CTD (Figure 4).

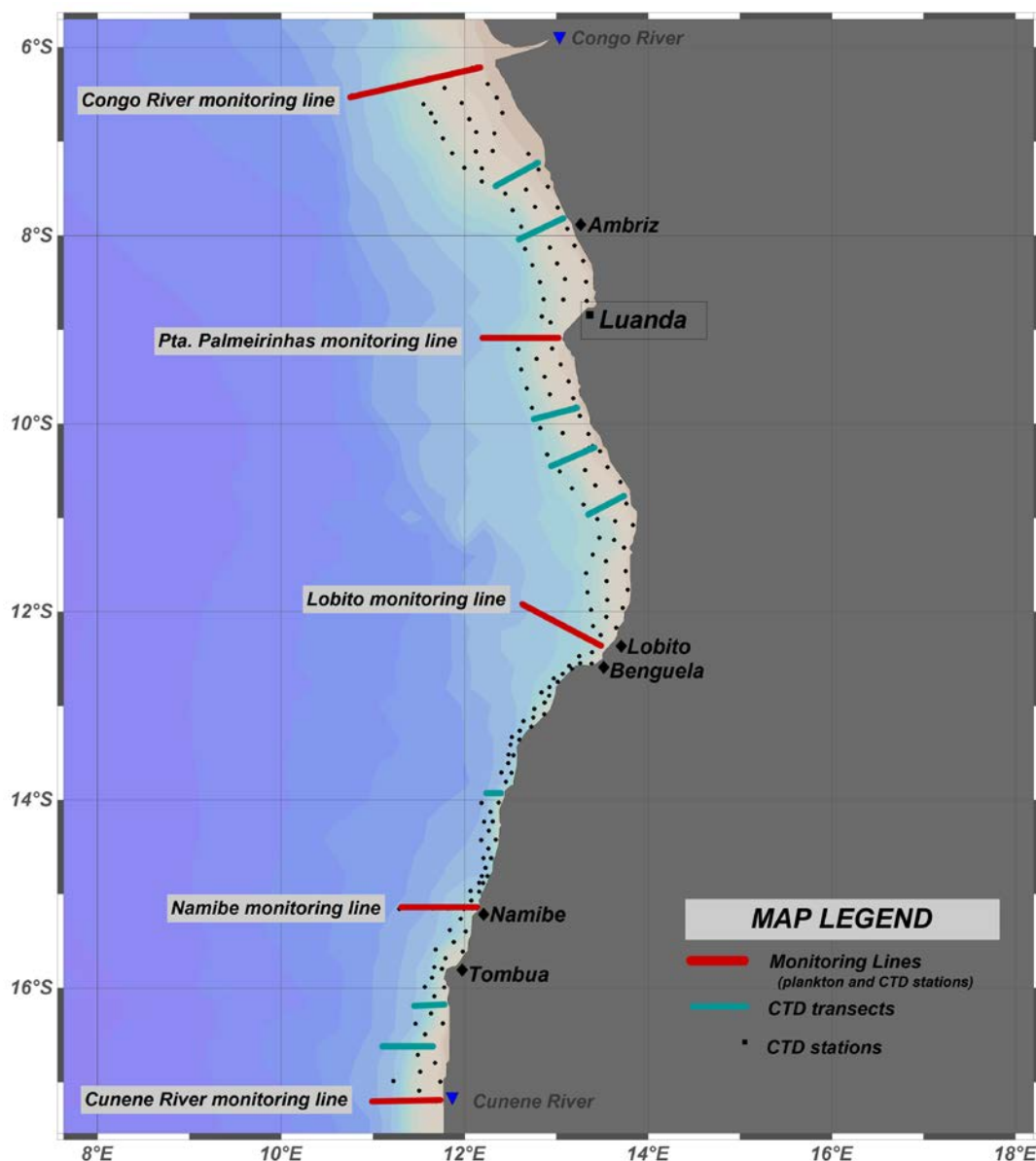


Figure 4. Monitoring lines and CTD transects in Angola. Additional CTD stations were carried out on the acoustic transects. See also Figure 1, Figure 2 and Figure 3.

2.1.1 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 the maximum observing depth on this survey was close 2600m. The oxygen sensor has shown to be stable, and no calibration was conducted during the survey. The CTD samples were conducted along the 5 main monitoring lines off Congo River, Pta. das Palmerinhas, Lobito, Namibe and Cunene River and 21 standards transects (for more detail see Figure 4 and ANNEX VII). CTD stations were conducted at bottom depths 20, 50, 100, 200 and 500 m along the standard transects and at different depths at main monitoring lines.

Attached to the CTD was also a Chelsea fluorometer of the type Mk III Aquatrack. It measures chlorophyll A in microgram per litre with an uncertainty of 3%. Factory slope and offset was 1.000 and -0.00.

2.1.2 Thermosalinograph

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

2.1.3 Current speed and direction measurements (ADCP)

The vessel-mounted Acoustic Doppler Current Profiler (VMADCP) from RD Instruments was functioning and recorded information throughout the entire survey.

2.1.4 Meteorological observations

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

2.1.5 Mapping

To compare hydrological and biological condition between seasons, years and regions it's necessarily to produce map of comparable scales. From this survey we produce maps with scales shown in Table 2. The map scales were selected based on long term monitoring of hydrological and biological condition in the Angola waters, and the minimum and maximum observed values were selected as scale boundaries.

Table 2. Scales for temperature, salinity, oxygen and FLU (chlorophyll a) mapping.

Type of maps	Minimum value	Maximum value	Intervals
Temperature	10	32	1
Salinity	32	37	0.25
Oxygen	0	7	0.5
FLU (chlorophyll a)	0	3	0.1

2.2 Fish sampling

A brief description of the fishing gear is provided in ANNEX VI. 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.*

Biological samples were obtained for the sardinella, *Sardinops sagax* and horse mackerel species. Total length (TL) and body weight were determined to the nearest 1cm and 1g below, respectively. Sex and reproductive stages were determined by means of macroscopic examination, scoring each fish according to the six-point classification scale used by INIP (Table 7, ANNEX III). Length and weight was recorded for the species: *Selene dorsalis*, *Caranx rhonchus*, *Chloroscombrus chrysurus*, *Engraulis encrasicolus*, *Ilisha africana*, *Etrumeus Whiteheadi*, *Scomber japonicas* and other tunas.

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

2.3 Plankton sampling

2.3.1 Phytoplankton

Samples of phytoplankton were collected on main monitoring lines using CTD bottles at 5, 15, 25, 50 and 75 meter depths.

2.3.2 Zooplankton

The zooplankton sampling was conducted by means of HYDROBIOS Multinet (180 μ m), at five depths intervals, 0-25, 25-50, 50-75, 75-100 and 100-200 m, at 5 main monitoring lines off Congo River, Pta. das Palmerinhas, Lobito, Namibe and Cunene River (see Figure 4 and ANNEX VII). Data from the flow meter was 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 4% formalin.

2.4 Acoustic sampling

2.4.1 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 Elefantes on the 5th of July and all results were within specifications. Technical specifications and operational settings of the echo sounder used during the survey are given in ANNEX VI.

2.4.2 Allocation of acoustic energy to species group

The acoustic data were scrutinized using the LSSS version 1.6.1 (built on August 22, 2012) (Korneliussen et al. 2006). 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 species groups on the basis established echogram features. Acoustic groups and respective species are listed in ANNEX VI. Ground truthing and estimation of mean length and weight were accomplished by means of targeted pelagic and demersal trawling.

2.4.3 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:

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

$$\text{or} \quad CF = \frac{10^{7.2}}{4\pi} \cdot \bar{L}^{-2} \quad (2)$$

$$\text{and on the simplest form} \quad CF = \frac{1.2612 \cdot 10^6}{\bar{L}^2} \quad (3)$$

where CF is the conversion factor from acoustic density to fish biomass and \bar{L}^2 is the mean of squared fish lengths. This target strength function was originally established for North Sea herring, but has later been attributed to clupeids in general (Foote *et al.*, 1986; Foote, 1987).

No specific target strength relations presently are available for the species at hand, and equation (3) 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 1.8. Sub-stratification was used to isolate areas of similar densities, using the following pre-defined, standard categories:

1: $0 < s_A < 300$; 2: $300 \leq s_A < 1000$; 3: $1000 \leq s_A < 3000$; 4: $3000 \leq s_A$ (m^2/NM^2)

The basis for contouring is averages of five 1NM values along transects. At the end of transects and in connection with trawl stations the averaging may include fewer (from 1 to 4 single NM observations). This is a source of bias, but this bias is limited due to observations within strata having similar values. Other sources of bias of concern are the shallow distribution pattern (above integration limit), vessel avoidance behaviour of sardinella (Misund and Aglen, 1992) and inshore distribution (at depths smaller than 20meters). 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:

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

where: ρ_i = estimated number of fish in length group i
 $\langle s_A \rangle$ = 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

Wind, sea surface temperature (SST, 5m depth), salinity (SSS, 5m depth), oxygen (SSO, 5m depth) and fluorescence (SSF, 5m depth) were continuously recorded, during the survey. The Figures in subsections 3.1.1, 3.1.2 and 3.1.3 shows the horizontal distribution of these variables.

Standardization for map presentation is needed to avoid misunderstanding and to facilitate comparisons between annual and seasonal distribution of observations, and therefore we use the same scale for all surveys in this area (for more information see Table 2 in section 2.1 Hydrographical sampling).

3.1.1 Northern region

Figure 5 shows the spatial distribution of wind in the North Angolan region. It was observed a predominance of southwest winds along the region. Weak winds (1 – 2 knots) were recorded in the coastal area north from N'Zeto to Cabeça da Cobra as south of N'Zeto until Luanda. Along most of the region, moderate winds (14 knots) have been registered, the majority coming from the North, due to the influence of Coriolis effect, which causes a left deflection of winds. In Ambriz section, strong winds were recorded, causing the stacking of water near the coast and facilitating the coastal upwelling. Strong winds were registered offshore in the areas near Congo River and Luanda while weak winds were observed closer to shore.

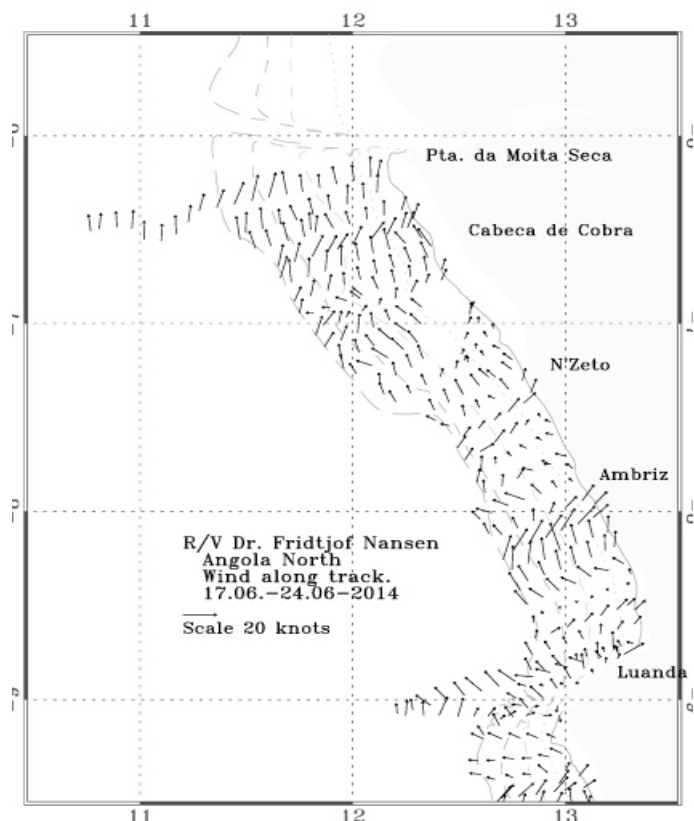


Figure 5. Distribution of wind velocities along the survey track for the northern region. Depth contours at 20, 50, 100, 200, and 500 m.

Figure 6 shows the surface distribution of temperature, salinity, oxygen and fluorescence of the North region of Angola. Most of the observed area is constituted by water bodies with temperatures ranging between 22 and 23

°C. The lowest temperatures (22 °C) were recorded along N'Zeto coast and the area between Luanda and Ponta das Palmeirinhas. The highest temperatures (26 °C) were recorded in Ponta da Moita Seca and offshore waters. Salinity ranged between 35 and 35.75. Low salinity was observed in the area of Ponta das Palmeirinhas, which might be associated to the water flow from Kwanza River.

Oxygen values ranged between 3.5 and 5.5 ml/l. The water mass with highest observed dissolved oxygen (5.5 ml/l) were observed offshore between N'Zeto and Ambriz, and offshore in Ponta das Palmeirinhas.

The high fluorescence values varying between 0.5 and 2.2 µg/l indicates high primary production.

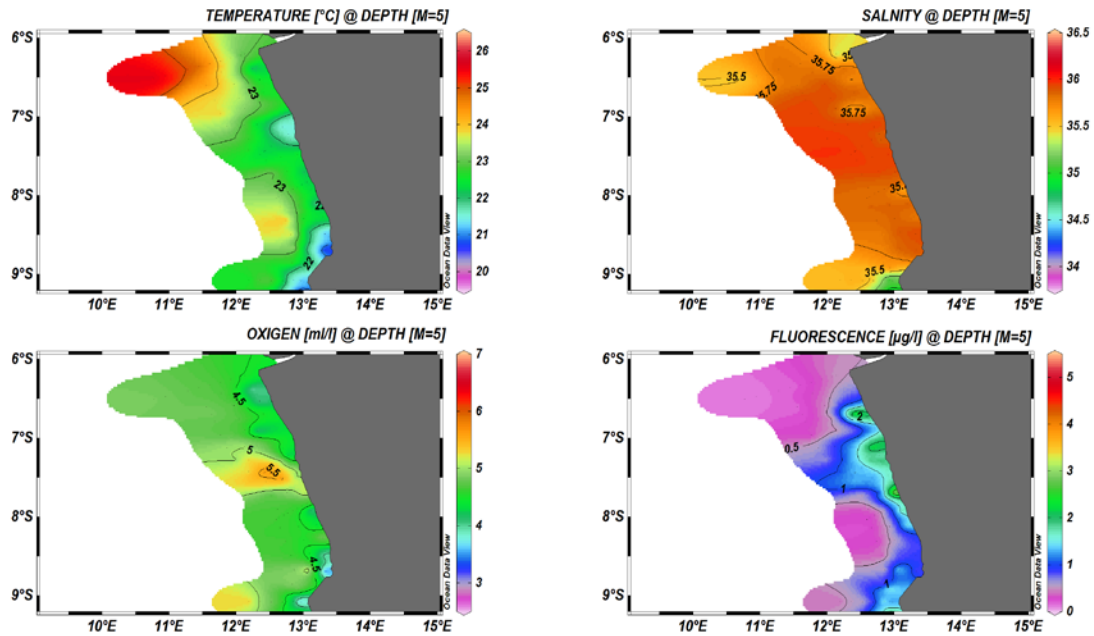


Figure 6. Surface distribution of water temperatures, salinity, oxygen and fluorescence at 5m depth in the northern region (17 June- 24 June 2014).

3.1.2 Central Region

The wind recorded along the Central Angolan region varied both in strength and direction (Figure 7). Stronger winds (15 knots) were observed mostly along Cabo Ledo section, where the formation of anti-cyclonic winds can be observed. This transports the atmospheric warm air down, warming the sea surface; while the warm air flows from the high pressure areas (A), is deflected by coriolis effect in such a way that the winds circulate, around the high pressure area, in an anti-clockwise direction. Winds with moderate intensity (≈ 14.5 knots) were observed around Ponta do Morro, North from Cabeça da Baleia and both north and south of Lobito.

To summarize, in the central region there was a predominance of the Southwest winds, together with influence of the fisical forces which have determined the dynamic changes in the region.

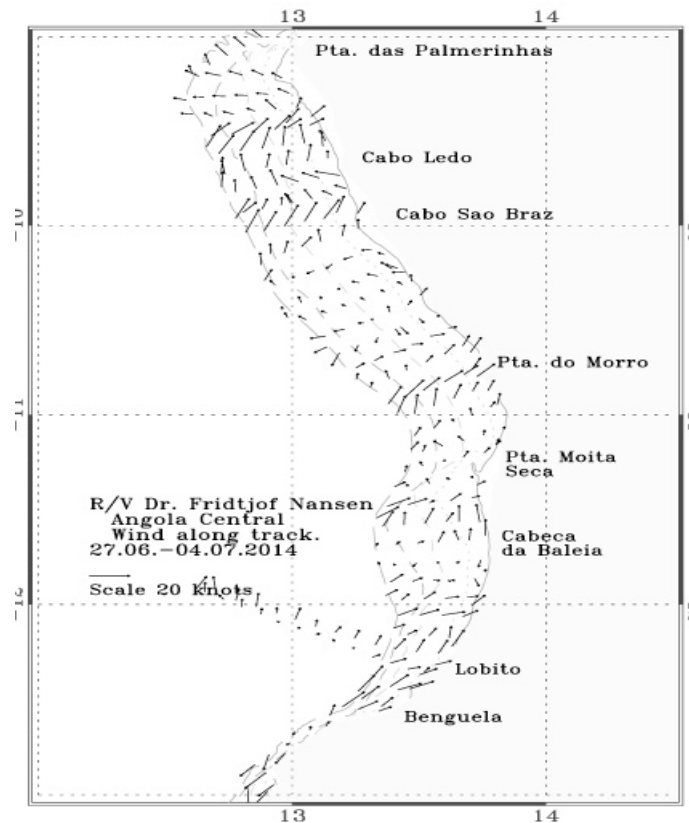


Figure 7. Distribution of wind velocities along the survey track for the central region. Depth contours at 20, 50, 100, 200, and 500 m.

The hydrographical condition in the central region is shown in Figure 8. The water surface temperature ranged between 19 and 24° C except for the coastal upwelling areas south of Benguela and the corresponding cold front. Low temperatures (19 - 21° C) were observed along the coast, between 09°49' - 13°00' S (Cabo Ledo and south of Benguela). High values were observed north of Lobito (23° C) and in Cabo de S. Braz (24° C more offshore).

Less variation was recorded for salinity (35-36). The highest levels (35.5 – 36) were observed near the coast. Oxygen concentration varied between 3 and 6 ml/l in the region. Low values (3 - 3.5 ml/l) were observed near the coast, from north of Lobito to south of Benguela, while higher values (5.5 - 6 ml/l) were found offshore along the Ponta do Morro section.

Fluorescence registrations recorded peaks in biological activity near the coast (2 - 3µg/l) between 10°14' - 10°00' S (Cabo de S. Braz e Ponta do Morro).

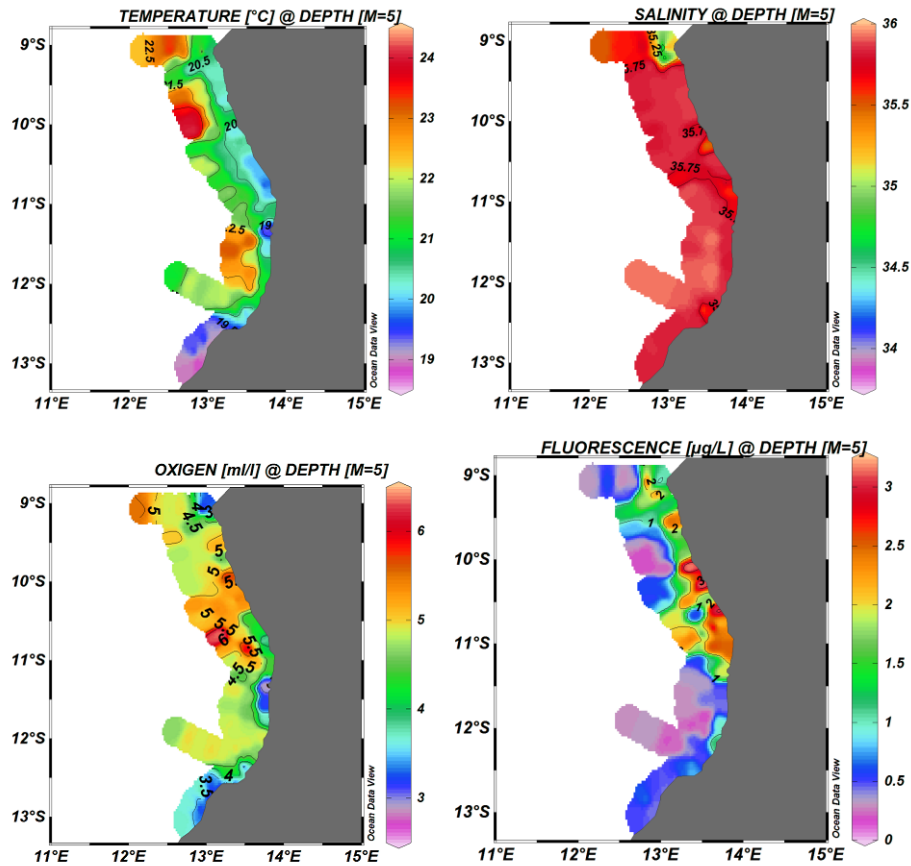


Figure 8. Surface distribution of water temperatures, salinity, oxygen and fluorescence at 5m depth in the central region (26 June- 04 July 2014).

3.1.3 Southern Region

In this region, southerly winds have predominated. Coriolis and anticyclonic winds have shown to be important for the dynamic of the area. A mix of weak (5 knots, 2 m/s) and moderated winds (14 knots, 8 m/s) were observed in the sections of Santa Marta, Tombua, Ponta Albina as south of Cunene River. In Namibe section, winds of 15 knots (10 m/s) were observed on the formation of an anticyclone offshore, directed to the coast. Along the sections of Baia dos Tigres and north of Cunene River, the strongest winds in the region were registered, reaching 50 knots (30 m/s).

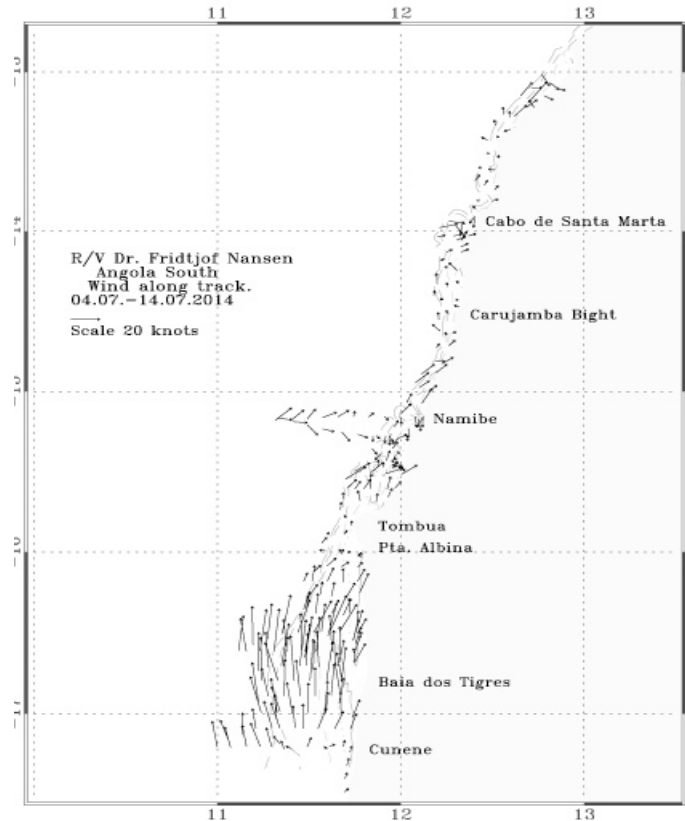


Figure 9. Distribution of wind velocities along the survey track for the southern region. Depth contours at 10, 20, 50, 100, 200 and 500 m.

The influence of the cold Benguela front can be observed in the isotherms from Figure 10. Temperature varied between 20 and 15 ° C along the South Angolan coast. The highest value (20 ° C), consequence of anticyclonic winds, was observed offshore in the Namibe section decreasing gradually towards the coast. The lowest value (15 ° C) was observed in the sections of Baia dos Tigres and Cunene River.

Salinity showed little variation (35.4 – 36.25), with the highest value (36.25) observed in Namibe section whereas the lowest (35.4) in Cunene River.

High oxygen values (3.5 - 5ml/l) were observed along the whole region; lower concentrations <3.5 ml/l were recorded between 13° 00 – 14° 50 S and higher (> 4 ml/l) was observed in Namibe, Tombua, south from Baia dos Tigres and in the mouth of Cunene River.

Peaks in biological activity (2.5µg/l) were recorded in Baia dos Tigres.

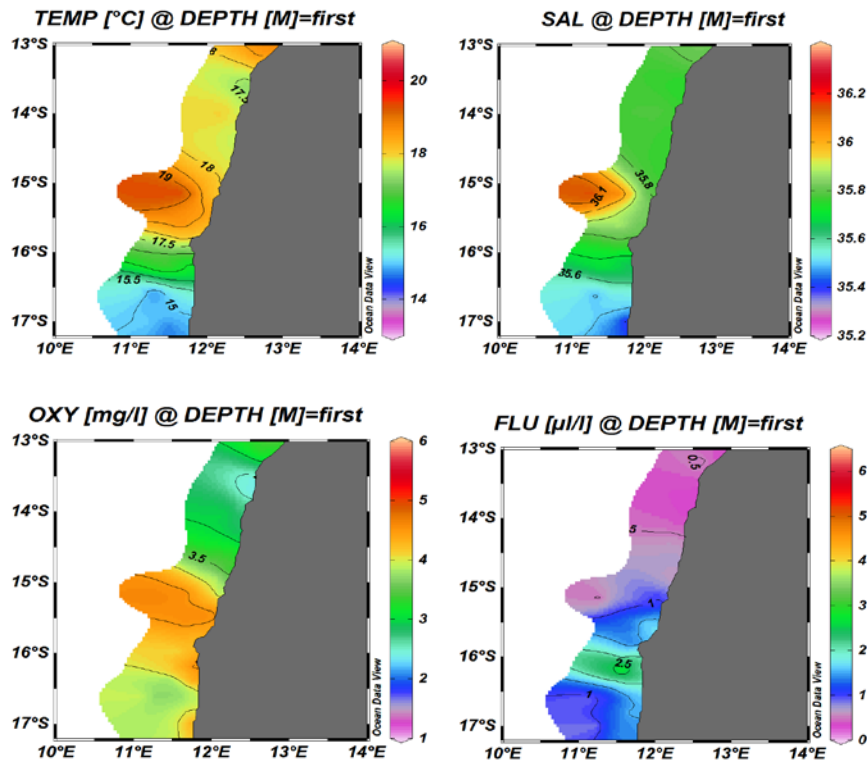


Figure 10. Surface distribution of water temperatures, salinity, oxygen and fluorescence at 5m depth in the southern region (05-14 July 2014).

3.2 Main monitoring lines

3.2.1 Northern Region

Figure 11 shows the vertical distribution of temperature, salinity, oxygen and fluorescence along monitoring line of the Congo River.

The surface temperature increases from the coast to the offshore parts (20-24 ° C) and decreases with depth reaching 8 °C at 500 meters, which indicates a well-defined thermal stratification without evidence of upwelling.

The high salinity values above 35.5 in the surface layer show that there is no flow of fresh water to the south of the Congo River. A similar situation was observed last year (June 2013). The intermediate waters dominate the layers below 200 m where salinity reaches the minimum values of 34.8. Oxygen in the surface layers (0-20 m) shows values of 4.5 to 4 ml / l. A layer of low levels of dissolved oxygen (<1 ml / l) was observed at depths 220 to 400 m.

The fluorescence inshore, from surface down to 50 m varied from 0.5 to 0.25 mg / l. Between 5-40 m offshore, there is a layer of higher concentration of fluorescence (> 0.5 mg / l).

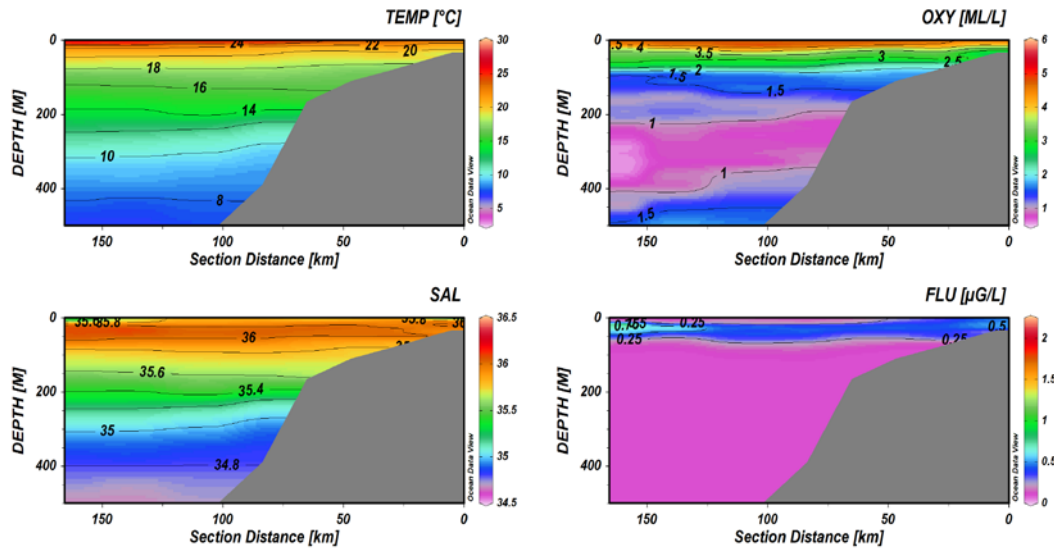


Figure 11. Vertical sections of temperature, salinity, oxygen and fluorescence off Congo River (17 June 2014).

In the Ponta das Palmeirinhas monitoring line (Figure 12), the temperature of the surface layer (0 - 20 m) was constant (17.5°C) both inshore as offshore decreasing with depth (7.5 degrees around 500 m depth). Observed salinity at surface (0 - 200 m) was 35.5 and, near shore the values recorded were 35.75. Below 200 m depth, the salinity decreased gradually down to 34.75. At surface, between 0 – 20 m, low oxygen levels (2 ml/l) were observed. These reached 3 ml/l near shore and below 60 m depth; the minimum oxygen zone was evident. Fluorescence values have varied between 1 – 0.5 µg/l inshore.

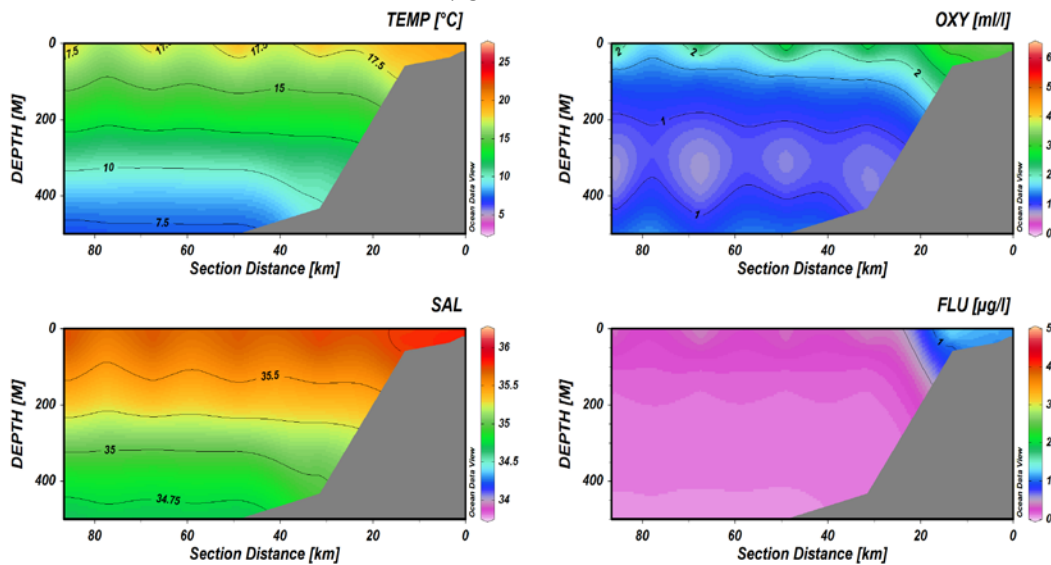


Figure 12. Vertical sections of temperature, salinity, oxygen and fluorescence off Pta. Palmeirinhas (23 June 2014).

3.2.2 Central Region

In Lobito section (Figure 13), the temperature of the sea surface ranged between 20 - 22.5° C, from 0 to 25 m depth. Below this depth, the values decreased with increasing depths (15° C at 100 m, 10° C at 300 and 7.5 ° C at 500 m).

Salinity values were stable in the surface (35.75), between 0 - 50 m, below which salinity decreased gradually reaching 35 below 250 m.

Oxygen values ranged between 3.5 and 5 ml/l in the surface waters (0 - 40 m) while lower values (<1.5 ml/l) occurred between 60 and 400 m depth.

The biological activity, showed by fluorescence levels (0.5 - 0.75 $\mu\text{g/l}$), occurred in the sub-surface layer (10 - 40 m). Near the coast and in the surface layer we observed lower values (0.25 $\mu\text{g/l}$) and similar levels were observed below 50 m depth.

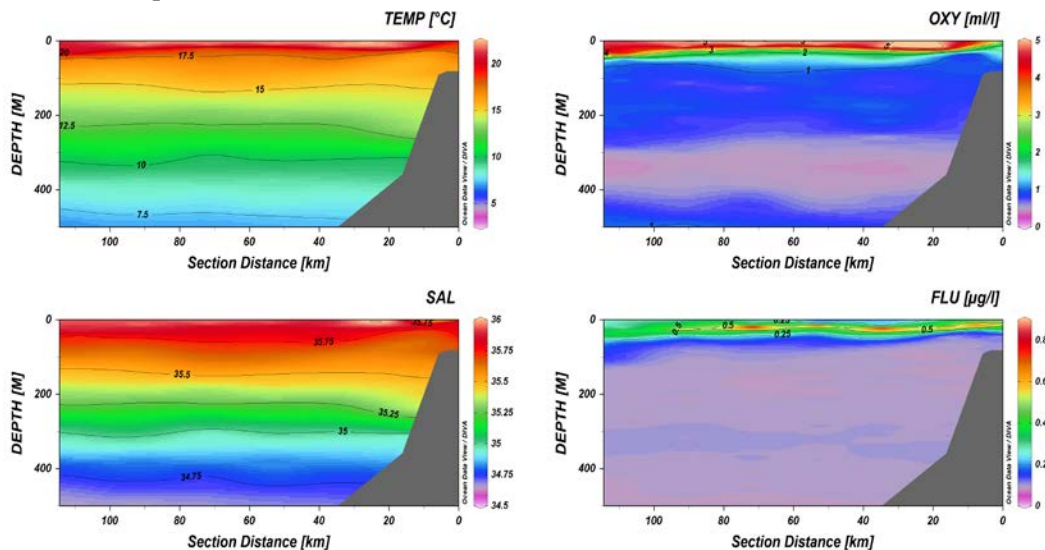


Figure 13. Vertical sections of temperature, salinity, oxygen and fluorescence off Lobito (3 July 2014)

3.2.3 Southern Region

In Namibe section (Figure 14), temperature varied from 0-50 m (20 - 17.5 °C). The highest value (20 °C), was observed at the deepening of the isobar offshore due to the anticyclonic winds along the section. Below 50 m, temperature decreases gradually with depth reaching 7.5 °C below 400 m.

Salinity shows the same profile as temperature, with high values (36.5 - 36) observed in the superficial layer offshore, while along the coast salinity stayed around 35.75. Below 50 m, salinity decreases with depth.

High oxygen values (4 - 5ml/l) were recorded all over the superficial layer, both offshore and close to shore. Below 45 m, the oxygen decreases rapidly reaching a minimum oxygen zone (<1 ml/L) at 75 m depth.

Peaks in fluorescence were recorded next to shore, with values between 2 - 1.5 $\mu\text{g/l}$.

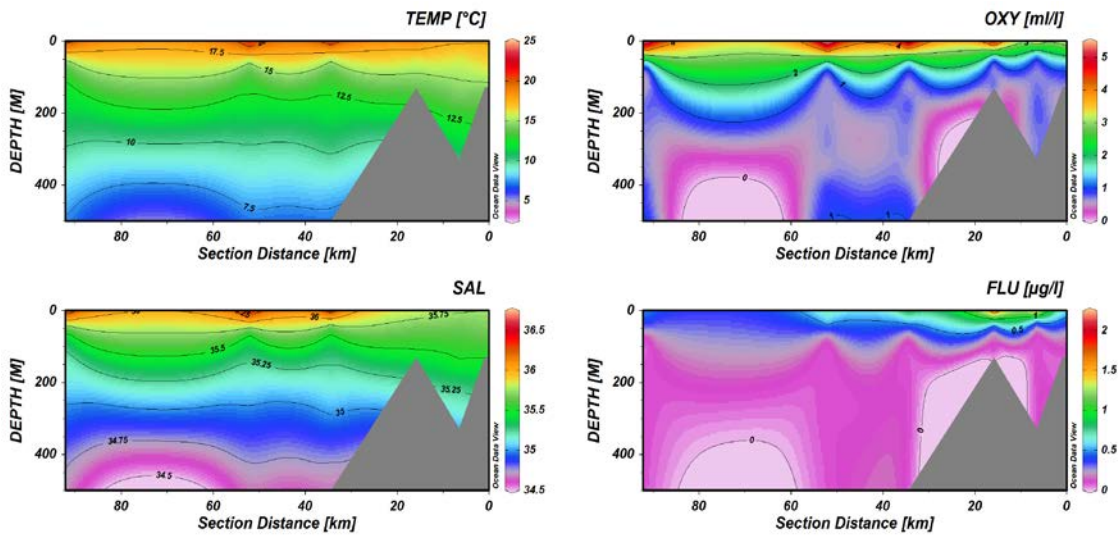


Figure 14. Vertical sections of temperature salinity, oxygen and fluorescence off Namibe (9 July 2014)

Temperature in the section of Cunene River (Figure 15) was stable (14°C) all over the superficial layer. Below 90 m, the temperature decreases gradually reaching 7.5 °C at 450 m depth.

Small water pockets were observed at the surface, where the salinity was around 34.5 and, below 50 m, salinity is gradually decreasing.

Oxygen also presented stable values around 3.5 ml/L in the surface layer offshore. Near the coast, below 50 m, the values ranged between 3 and 2.5 ml/L, being the lowest value (<1 ml/L) registered at 100 m depth.

The peak of biological activity, determined by fluorescence, was registered in a sinking of superficial waters close to the shore, where the values ranged between 1 and 1.5 µg/L.

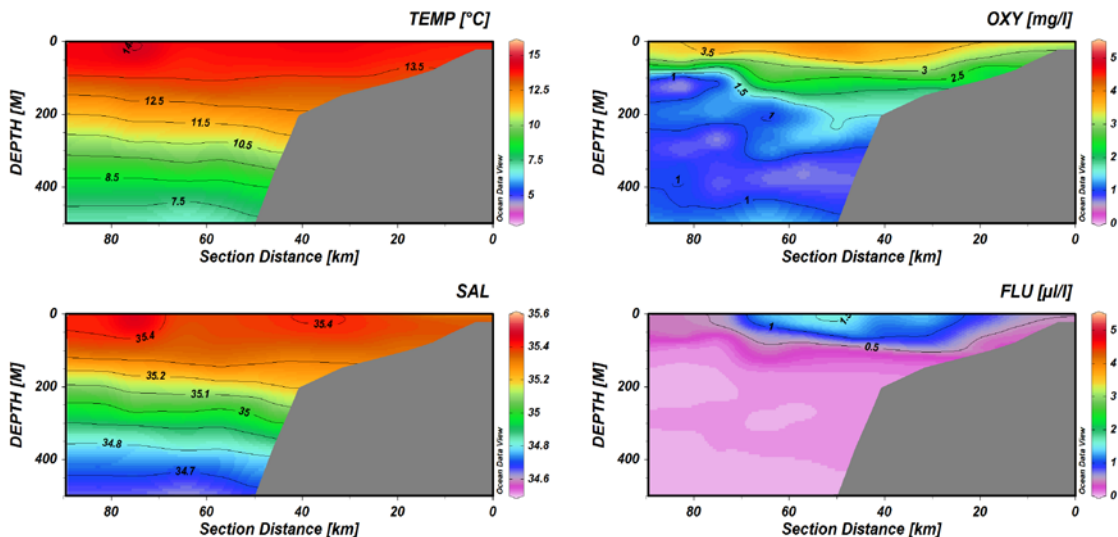


Figure 15. Vertical sections of temperature salinity, oxygen and fluorescence off Cunene River (14 July 2014)

CHAPTER 4 DISTRIBUTION, SIZE COMPOSITION AND BIOMASS ESTIMATES

4.1 Congo River - Pta. Palmerinhas

4.1.1 *Sardinella*

The sardinella were distributed over two separated areas (Figure 16). The northernmost area was located near the Cabeça da Cobra, while the other extended from South of Cabeça da Cobra to Ponta das Palmeirinhas. Both areas showed low densities ($0 < s_A < 300 \text{ m}^2/\text{NM}^2$). Some areas with slightly higher concentrations ($301 < s_A < 1\ 000 \text{ m}^2/\text{NM}^2$) were patchily distributed south from Cabeça da Cobra to Ponta das Palmeirinhas.

The sardinella occupied a larger area than in 2013, but with considerably lower echo densities. The more widespread distribution is a lot more similar to the 2012 distribution with substantial registrations made beyond the 100m depth contour.

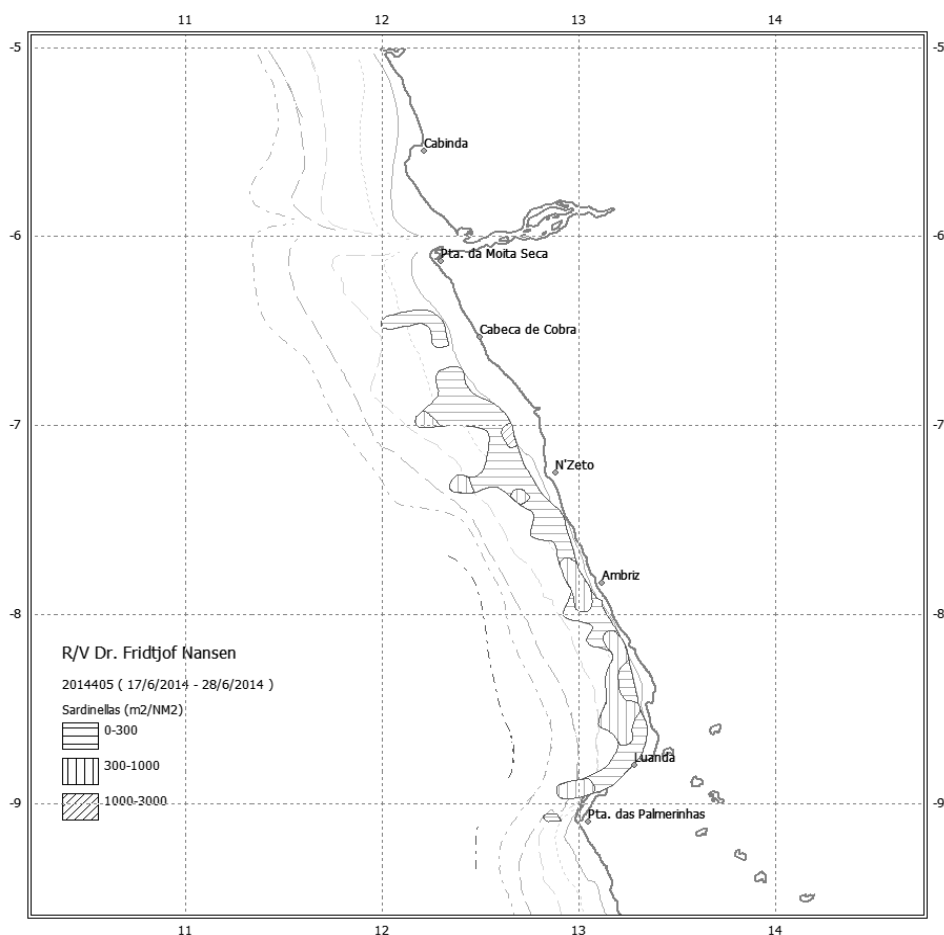


Figure 16. Distribution of *Sardinella maderensis* and *Sardinella aurita*. Congo River-Pta. das Palmerinhas Depth contours at 20, 50, 100, 200, and 500m.

Figure 17 shows the length distribution of the sardinellas in the northern region. *S. maderensis* showed two modal peaks around 16 and 26 cm TL, and 50 % of the fish were dominated by fish of 8-20 cm. *S. Aurita* showed four modal peaks around 7, 17, 26 and 31 cm TL, and the total abundance dominated by fish of 6-20 cm length (86%).

The estimated biomass for this region was 140 208 tonnes, (*Sardinella maderensis* was 124 380 tonnes and *Sarinella aurita* was 15 828 tonnes). The total biomass is somewhat higher than for the same period in 2013 (117 mil tonnes), but lower than the biomass estimated in 2012 (210 mil tonnes). *Sardinella maderensis* represented about 89% and *S. aurita* 11% in the northern area.

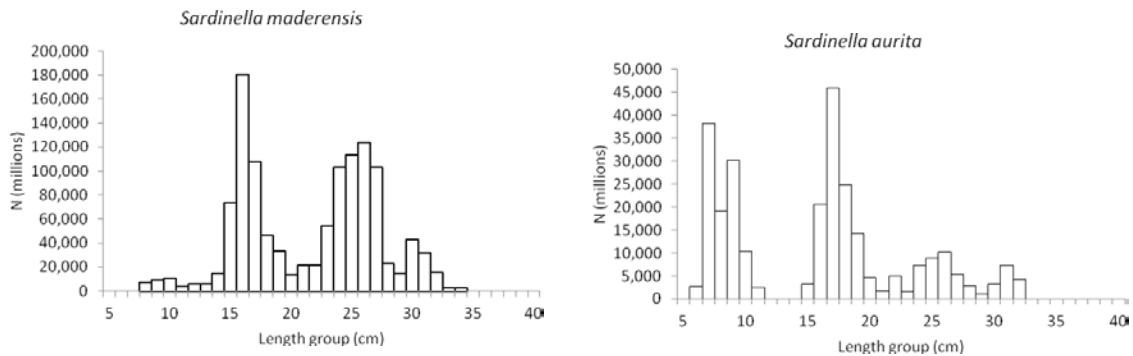


Figure 17. Total length distribution of *Sardinella maderensis* and *Sardinella aurita*, Congo River-Pta. das Palmerinhas.

4.1.2 Horse mackerel

Cunene horse mackerel, *T. trecae*, was found in scattered and in small areas offshore, from Pta. da Moita Seca to Luanda (Figure 18). The fish were observed in low-density areas ($0 < s_A < 300 \text{ m}^2/\text{NM}^2$). Compared with last year, between south of Ambriz and Luanda, there is a reduction of the area of distribution of *Trachurus trecae*. During this survey, the species occupied only two small areas, located more offshore. Along the North region, most fish were captured between 25-130 m depth. The horse mackerel was generally caught with bottom trawl during the day and pelagic trawl during the night, and mixed with Clupeiods, Hairtails and Sardinellas, depending on depth.

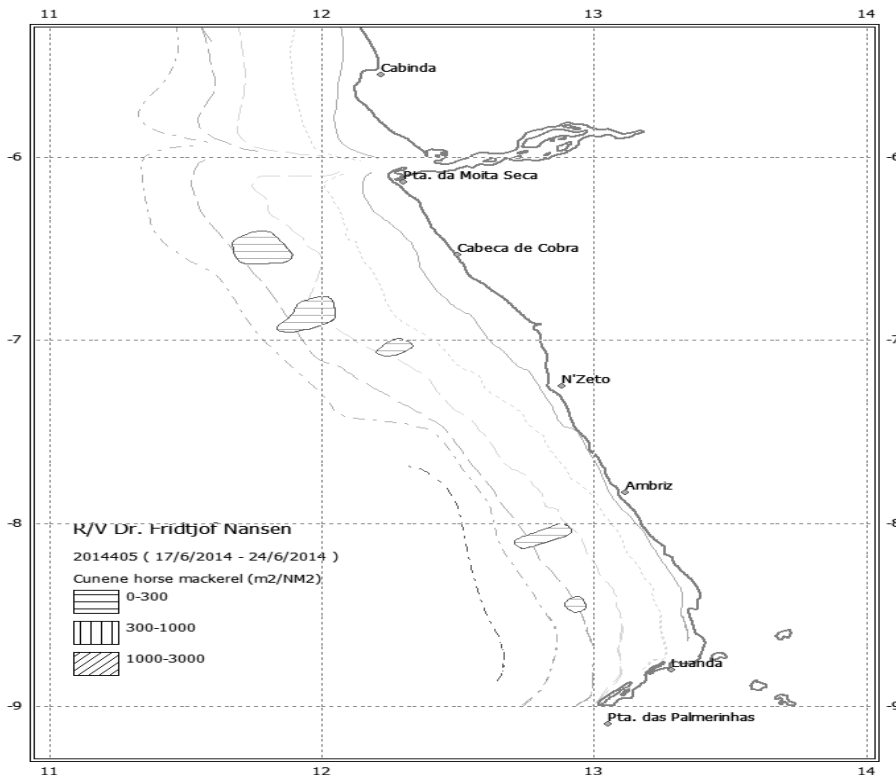


Figure 18. Distribution of Cunene horse mackerel (*Trachurus trecae*), Congo River-Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200, and 500 m.

The length frequency of Cunene horse mackerel, *T. trecae*, consisted mainly of juveniles with lengths ranging from 10-17 cm, and a few adult specimens. The juveniles dominated with about 97% of the fish in the region (Figure 19).

The biomass of Cunene horse mackerel was estimated to 862 tonnes, corresponding to approximately 28 million fish. The bulk of biomass belongs to juvenile fish of 10-20 cm length, while the adult fish of 21-50 cm contributed 3% only. The observed biomass was much lower in comparison to the last three years of the time series. The observation and estimation of fish at such low densities and abundance is highly uncertain and the point estimate should be used with caution.

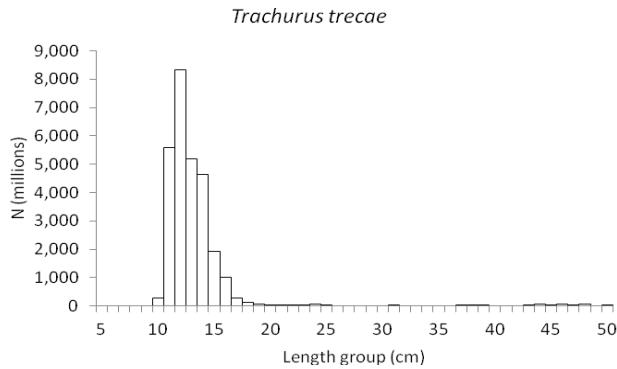


Figure 19. Total length frequency distribution of Cunene horse mackerel, Congo River - Pta. das Palmerinhas.

In 375 biological samples from the north area, 27% of the fish were found to be mature, 73 were immature. The majority of the fish were found in stage I and II for both female and males, but for stage V most fish were females. The length at 50% maturity of *Trachurus trecae*, of this region, was 20 cm (Figure 20). Please note that the number of sampled fish above 20cm is low and that results are given with some uncertainty.

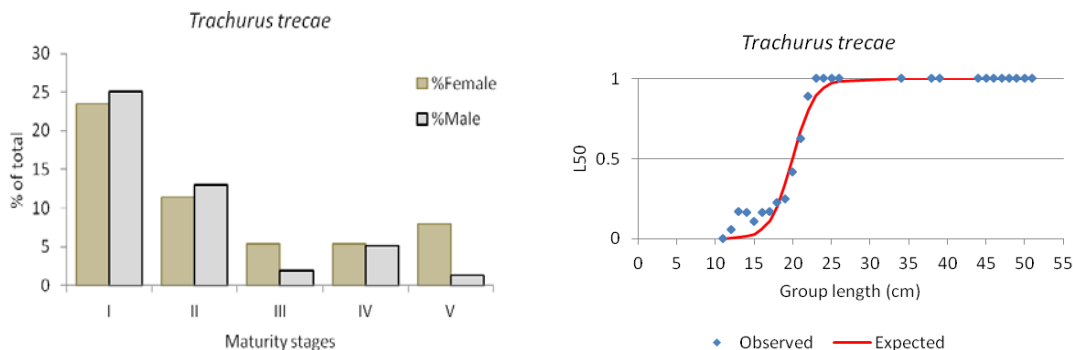


Figure 20. Maturity stages by sex and first length at maturity of *Trachurus trecae* in the Northern region.

4.1.3 Pelagic species Group I

During the survey in 2014, *Ilisha africana* was the only species found belonging to this group. *Ilisha africana* was patchily distributed between Pta. da Moita Seca and Cabeça da Cobra, offshore. The species was found in inshore waters between south of NZeto and Ambriz to Pta. Das Palmerinhas. In all areas we observed low densities ($0 < S_A < 300 \text{ m}^2/\text{NM}^2$) of *Ilisha africana* (Figure 21). Only a few *Engraulis encrasicolus* were found in the area.

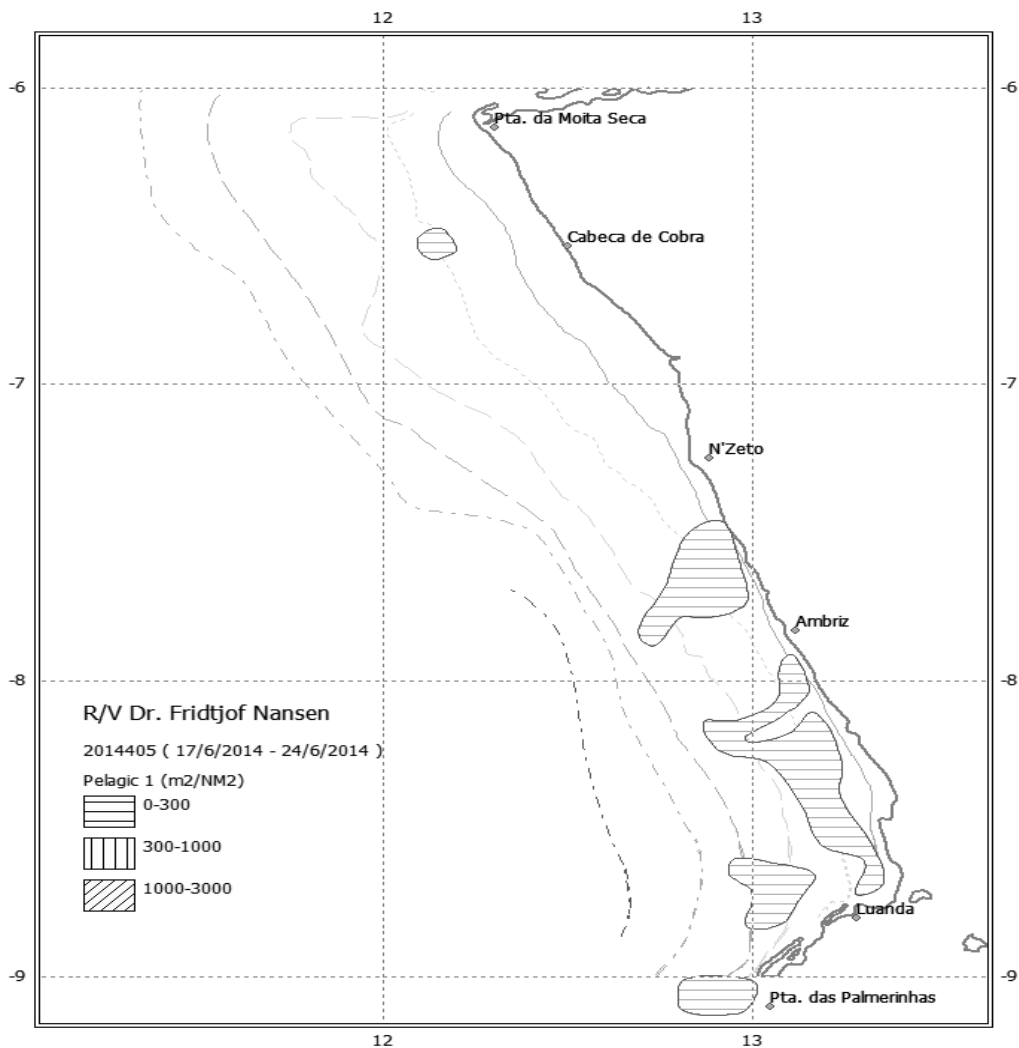


Figure 21. Distribution of Pelagic 1, Congo River-Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200 and 500m.

The length distribution of the *Ilisha Africana* showed two modal peaks around 6 and 17 cm TL (Figure 22). The biomass of *Ilisha africana* in the northern area, based on the length distribution presented in Figure 22, was estimated to be 12 000 tonnes.

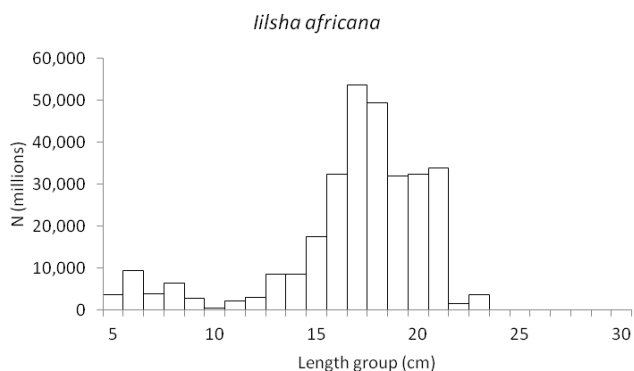


Figure 22. Total length distribution of *Ilisha africana*, Congo River-Pta. das Palmerinhas.

4.1.4 Pelagic species Group 2

This year the dominant species belonged to the Carangidae, *Chloroscombrus chrysuru* and *Selene dorsalis*. *Trichiurus lepturus* was also found in most of the trawl stations. The main acoustic registrations were found in two areas offshore Ponta da Moita Seca, being one of the areas with medium ($301 < S_A < 1000 \text{ m}^2/\text{NM}^2$) and high concentrations ($1001 < S_A < 3000 \text{ m}^2/\text{NM}^2$).

This group distributed continuously, in low densities ($0 < S_A < 300 \text{ m}^2/\text{NM}^2$), from Pta. da Moita Seca to Pta. das Palmerinhas (Figure 23).

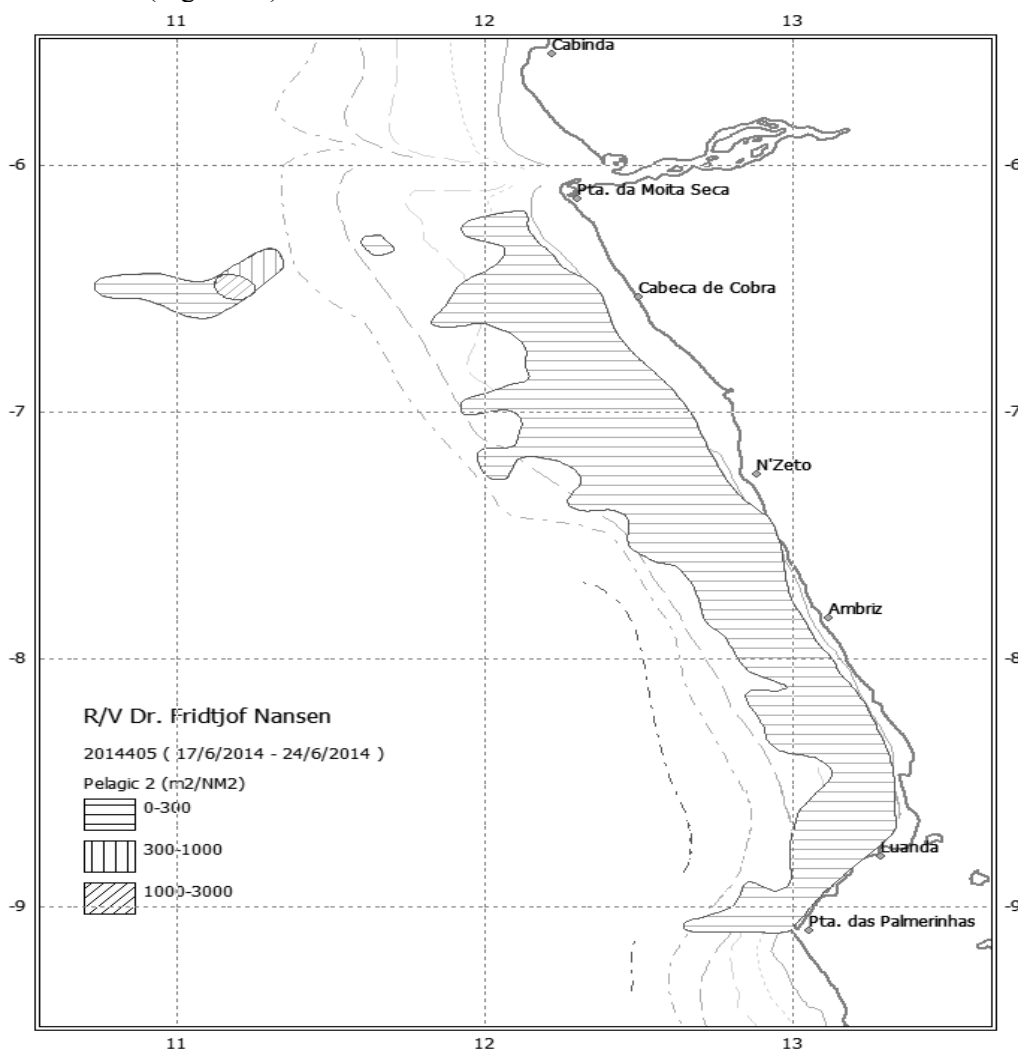


Figure 23. Distribution of Pelagic 2, Congo River-Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200 and 500m.

The biomass calculation was based on an assumed average fish size of 30 cm and average condition factor of 1.0 and was estimated to be 77 379 tonnes. Further comments regarding the use of assumptions relating to average size and implications for potential bias (varying over time) will be given in chapter 5.3.

Table 3 shows the summary of the estimated abundance of main commercial species or species groups in northern region.

Table 3. Estimated abundance of pelagic fish, Congo River– Pta. das Palmerinhas.

Sardinella maderensis	Sardinella aurita	Trachurus trecae	Pelagic 1	Pelagic 2
124 380	15 828	862	12 000	77 379

4.2 Pta. das Palmerinhas - Benguela

4.2.1 *Sardinella*

In the central area *Sardinella* was distributed continuously along the coast. Over most of the area, low ($1 < s_A < 300 \text{ m}^2/\text{NM}^2$) and medium ($301 < s_A < 1000 \text{ m}^2/\text{NM}^2$) densities of *Sardinella* was observed. Additionally, several small areas with high ($1001 < s_A < 3000 \text{ m}^2/\text{NM}^2$) densities of sardinella were observed along the coast (Figure 24). Mostly small fish (<10 cm length), from both *Sardinella* species, were found in the coastal waters from 20-50 meters.

Sardinella was observed in the upper layer of the water column, schooling near the surface during daytime. During the day was not possible to trawl on *Sardinella* schools due to trawl avoidance. This is to some extent limiting the ability to observe size composition, especially in the areas with the shortest transects.

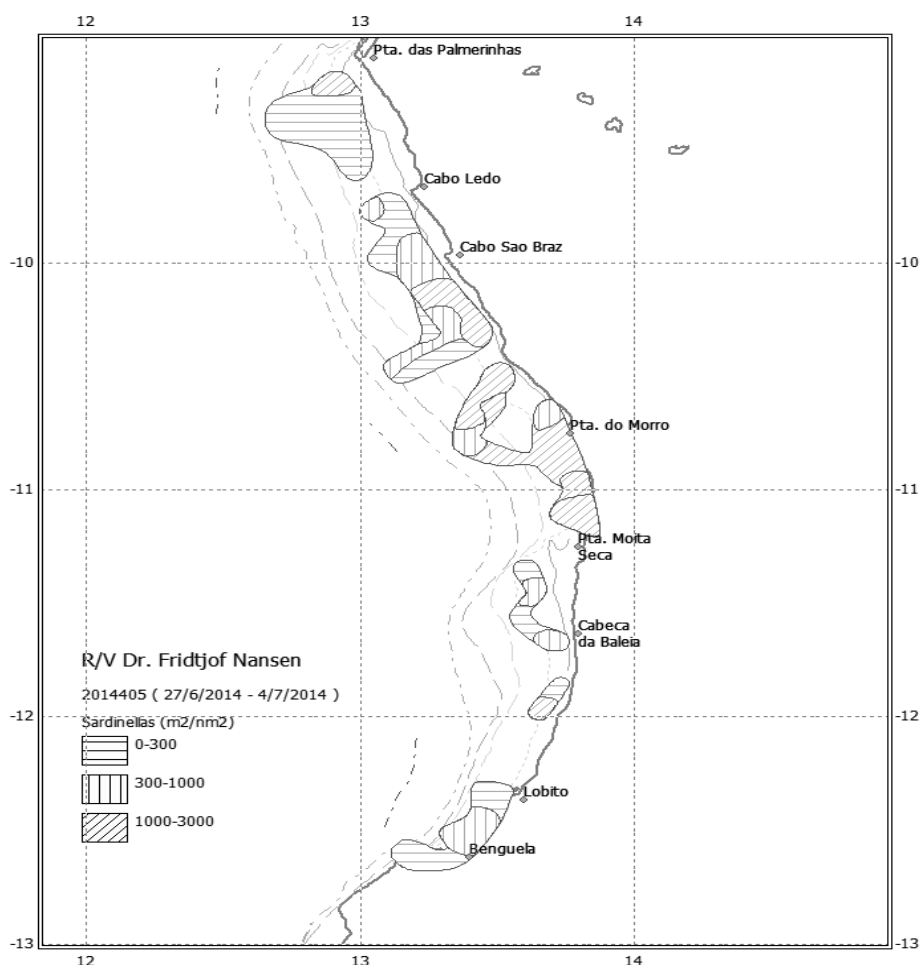


Figure 24. Distribution of *Sardinella* spp. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100 and 200 m.

The length distribution of *S. maderensis* showed four cohorts, peaking at 10, 14, 23 and 30 cm, while *S. aurita* showing three peaks at 7, 18 and 26 cm (Figure 25). Both species was distributed along the central area of the Angolan coast.

The total biomass for both species of sardinella was estimated at 272 069 tonnes. Of this 91 584 was allocated for *S. aurita* and 180 485 was *S. maderensis*.

This year's estimated biomass, was 8% less than the estimated biomass for 2013 (295 thousand tons) and 9% higher than the estimated biomass in the 2014 summer season (247mil tonnes).

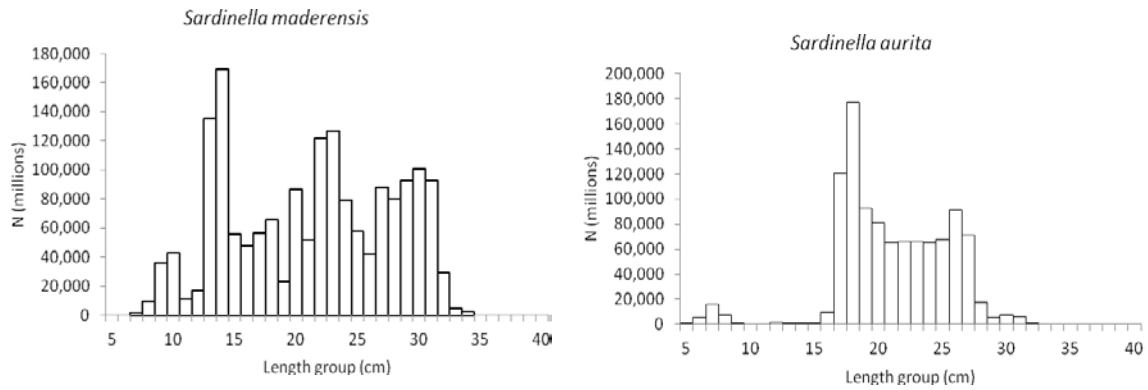


Figure 25. Total length distribution of *S. maderensis* and *S. aurita*. Pta. das Palmeirinhas - Benguela.

4.2.2 Horse mackerel

Cunene horse mackerel, *Trachurus trecae*, was found in the Angolan central region. *T. trecae* distributed in patches, of low densities ($0 < s_A < 300 \text{ m}^2/\text{NM}^2$), from Pta. das Palmeirinhas and Southern Benguela. Its distribution ranged from, approximately, 20 to 150 m depth bottom (Figure 26).

The biomass of Cunene horse mackerel was estimated at 24 mil tonnes. This biomass in this region was 79% less compared to 2013 (117 mil tonnes), in the same season, and 31% lower than the biomass estimated in the summer season this year (77 mil tonnes).

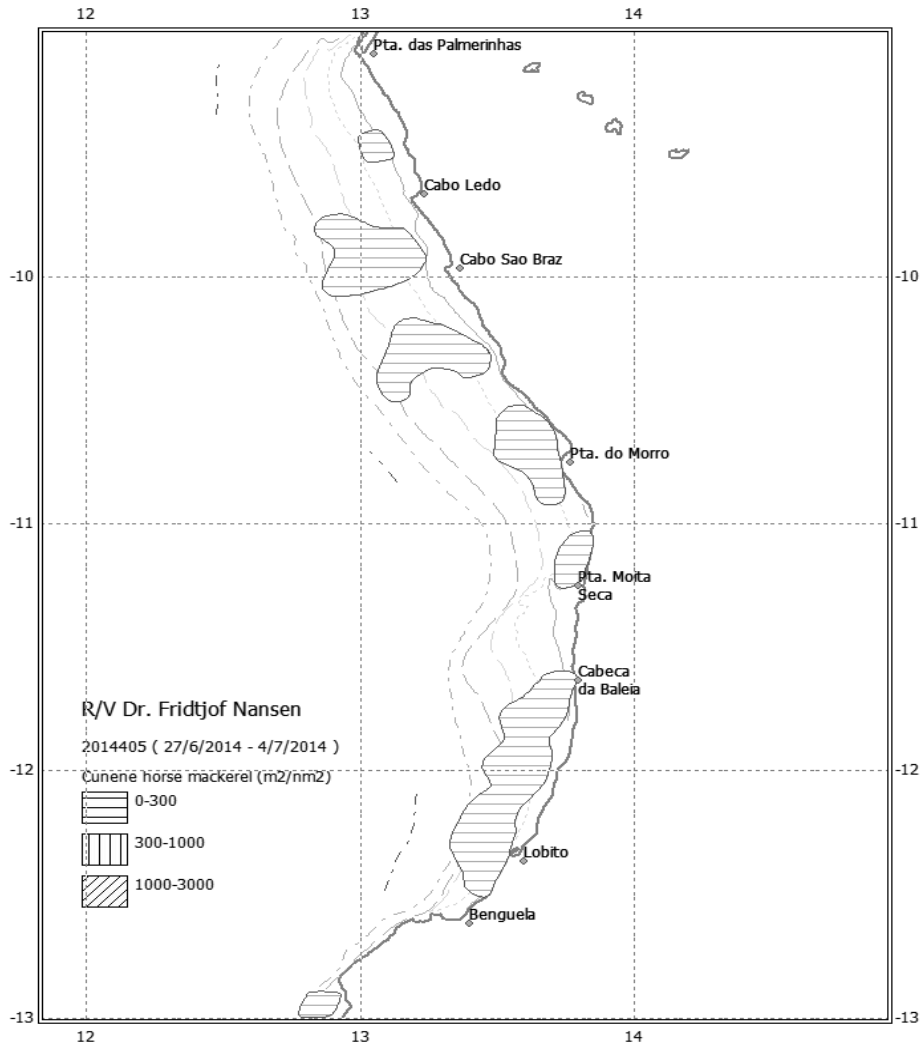


Figure 26. Distribution of horse mackerel (*Trachurus trecae*). Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500 m.

The length frequency distribution is shown in Figure 27. The length frequency ranged between 13 and 47 cm with a well-defined peak at 19 cm. 48% of the biomass estimated comprised of fish <21 cm length.

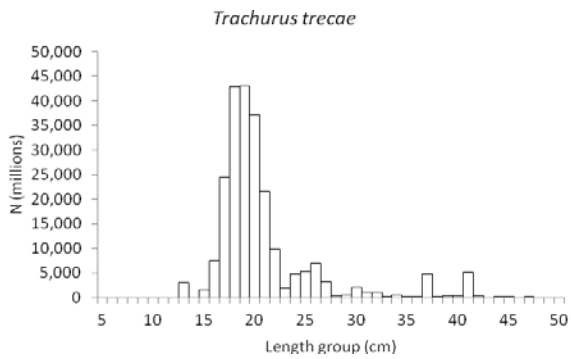


Figure 27. Total length distribution of horse mackerel (*Trachurus trecae*), Pta. das Palmerinhas- Benguela.

In the central region, biological sampling was conducted on a total of 396 fishes. From these, 71.46 % were immature; among these individuals, 38.38 % female and 33 % male, from the stages I and II mostly. The mature individuals comprised 28.5 %, from which 15.4 % were females and 13.1 % males. These were mainly in stage IV. Post-spawning individuals consisted mainly of females, however they were found in low numbers (Figure 28). The length at 50% maturity was 24 cm.

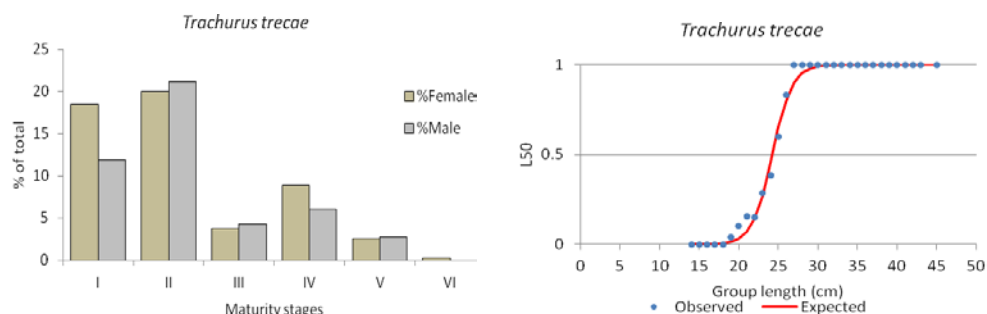


Figure 28. Maturity stages by sex and first length at maturity for *Trachurus trecae* in the Central region.

4.2.3 Pelagic species Group 1

In the central area, two species were found belonging to this group: *Ilisha africana* and *Engraulis encrasicolus*. However, *I. africana* dominated the catches and *E. encrasicolus* was only captured in one trawl catch (small quantity). Therefore, results presented mostly represent *I. africana*.

Pelagic fish in low densities ($0 < S_A < 300 \text{ m}^2/\text{NM}^2$) distributed sparsely from Pta. das Palmeirinhas to Benguela, while medium densities ($300 < S_A < 1000 \text{ m}^2/\text{NM}^2$) were only found in a small area, south from Cabo Sao Braz (Figure 29).

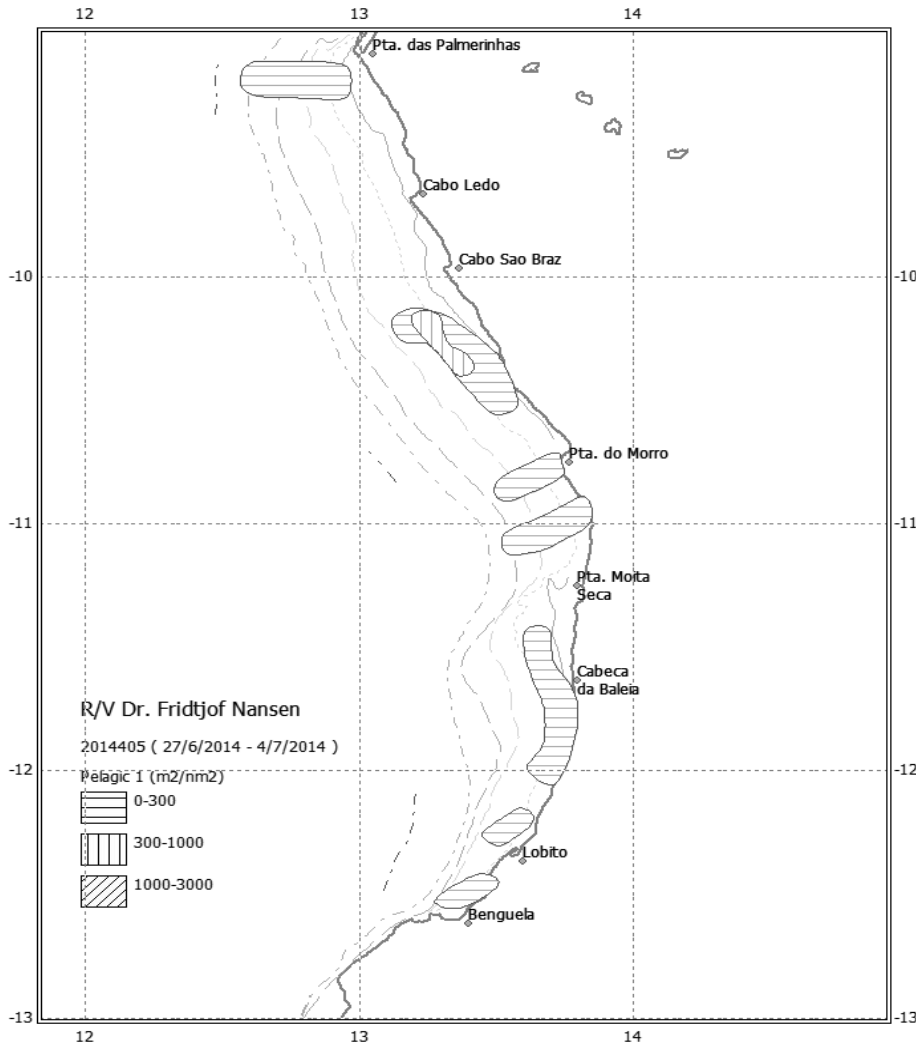


Figure 29. Distribution of pelagic species, group 1. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500 m.

Length distribution from *I. africana* varied between 7 and 25 cm, with two peaks at 9 and 16 cm (Figure 30).

The biomass estimated in the central area was 17 103 tonnes.

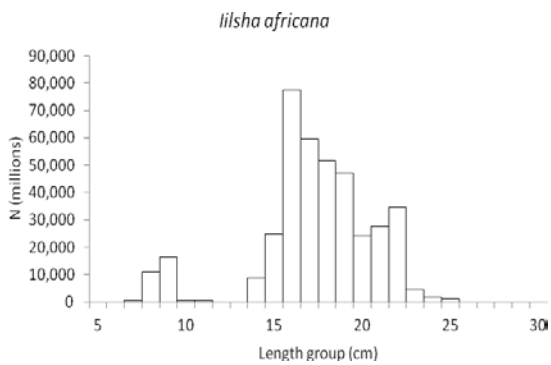


Figure 30. Total length distribution of mostly *Ilisha africana* and some few *Engraulis encrasicolus*, Pta. das Palmerinhas- Benguela.

4.2.4 Pelagic species Group 2

This group was found in two main areas but distributed along the coast, with low densities ($0 < S_A < 300 \text{ m}^2/\text{NM}^2$) (Figure 31). The most common species, from this group, caught in the trawl were Carangids: *Chloroscombrus chrysurus*, *Selene dorsalis*, *Caranx rhoncus* and other species as *Trachurus lepturus*, *Scomber japonicus* and *Sphyraena sp.*

The biomass estimate, was 55 193 tonnes, based on an average length of 30 cm. Additional comments regarding potential sources of bias related to this method is given in chapter 5.3.

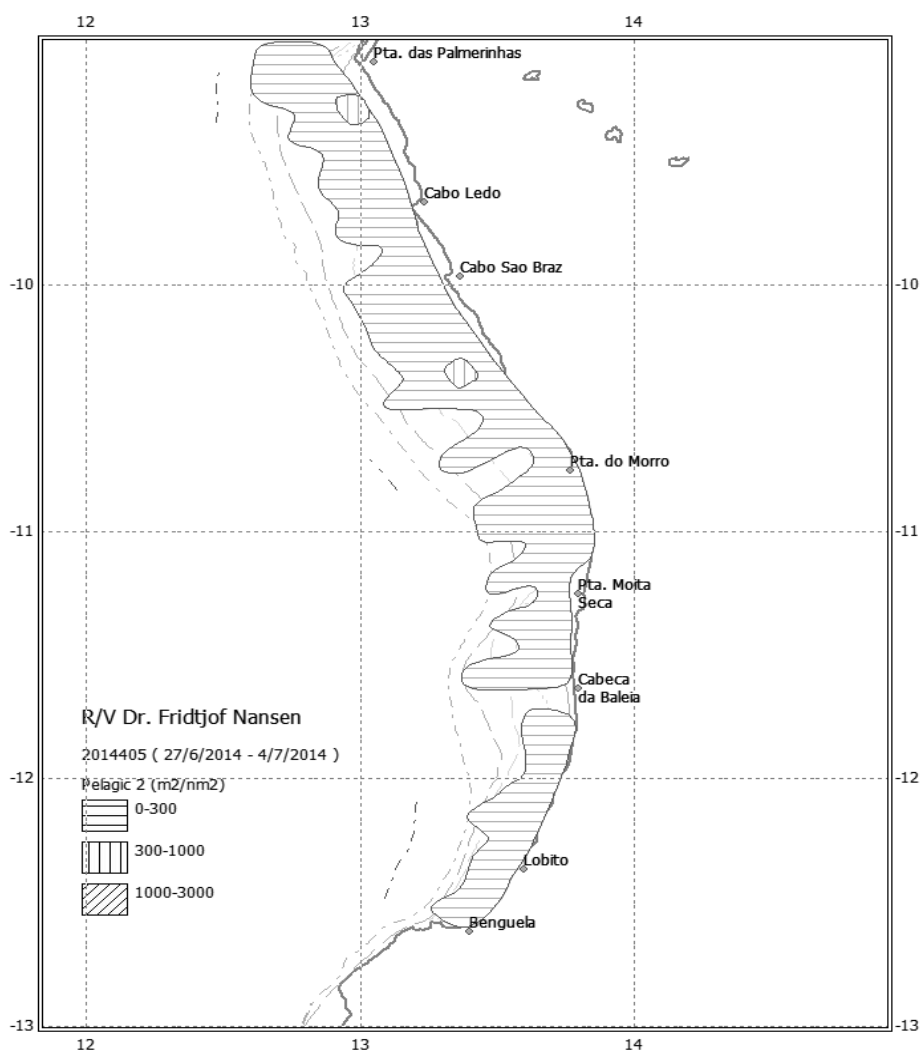


Figure 31. Distribution of pelagic species, group 2. Pta. das Palmerinhas- Benguela. Depth contours at 20, 50, 100, 200 and 500 m.

Table 4 shows the summary of the abundance estimated of main commercial species in central region.

Table 4. Estimated abundance of pelagic fish (tonnes), Pta. das Palmeirinhas-Benguela.

Sardinella maderensis	Sardinella aurita	Trachurus trecae	Pelagic 1	Pelagic 2
180 485	91 584	23 915	17 103	55 193

4.3 Benguela - Cunene

4.3.1 *Sardinella*

Both species of *Sardinella* (*S. aurita* and *S. maderensis*) were found in the coastal waters from Cabo de Santa Marta to Namibe in small areas, with low density ($0 < s_A < 300 \text{ m}^2/\text{NM}^2$). The small area of medium fish density was found in the north of Tombwa ($300 < s_A < 1000 \text{ m}^2/\text{NM}^2$) (Figure 32).

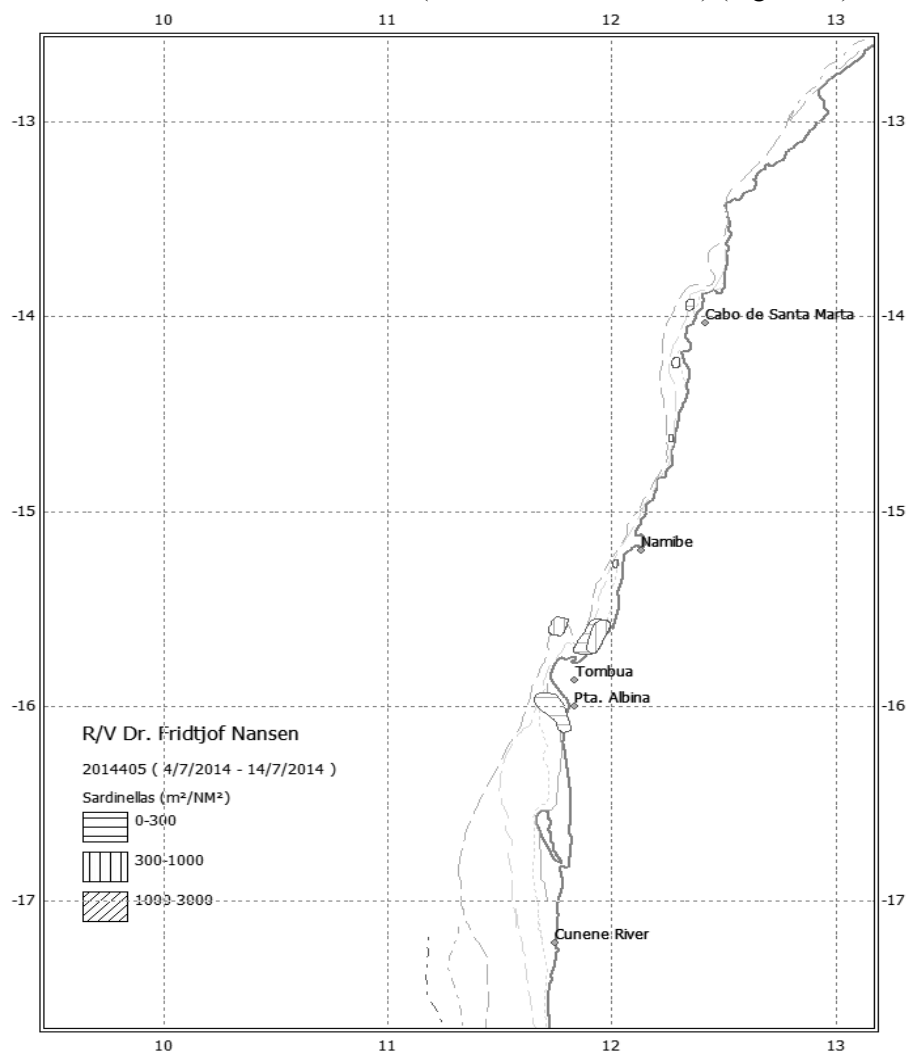


Figure 32. Distribution of *Sardinella aurita* and *S. maderensis*. Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 m.

Figure 33 shows the distribution of the length frequencies of both sardinellas. The juvenile of *S. maderensis* was found in the northern parts of the southern region. Length distribution of *S. maderensis* shows two cohorts. Juvenile with peaks at 13 cm and adult at 32 cm. The distribution of *S. aurita* shows two modal peaks at 18 and 22.

The total biomass for both species of sardinella was estimated at 14 314 tonnes. The biomass estimated this year is slightly higher than the winter 2013 estimate (10 thousand tonnes) and 45% less than estimated in summer 2014 (31 thousand tonnes). The *S. aurita* dominated (88%) in the southern region, and their biomass was 12 634 tonnes, while the biomass of *S. maderensis* was only 1 680 tonnes. The low biomass of *S. maderensis* in the region may be due to distributional shifts caused by the Angola-Benguela front.

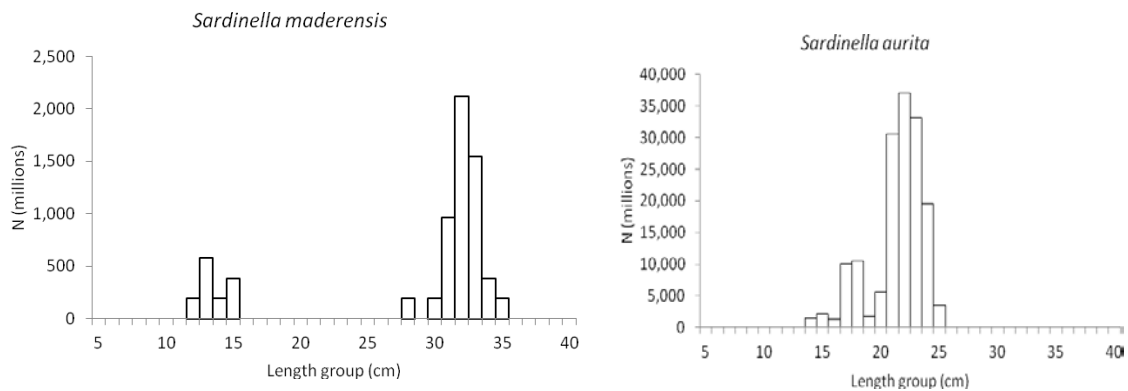


Figure 33. Total length distributions of *S. maderensis* and *S. aurita* in the Benguela-Cunene River.

4.3.2 Horse mackerel

Both species of horse mackerel, the Cunene horse mackerel (*Trachurus trecae*) and the Cape horse mackerel (*Trachurus capensis*) were found in southern region and had a continuous distribution (Figure 34). North of Namibe we found only *Trachurus trecae* at low density values ($0 < s_A < 300 \text{ m}^2/\text{NM}^2$) while both species were found in a mix between Namibe and Cunene River at considerable higher densities and amounts. We observed large areas of both medium ($300 < s_A < 1000 \text{ m}^2/\text{NM}^2$) and high densities ($1000 < s_A < 3000 \text{ m}^2/\text{NM}^2$).

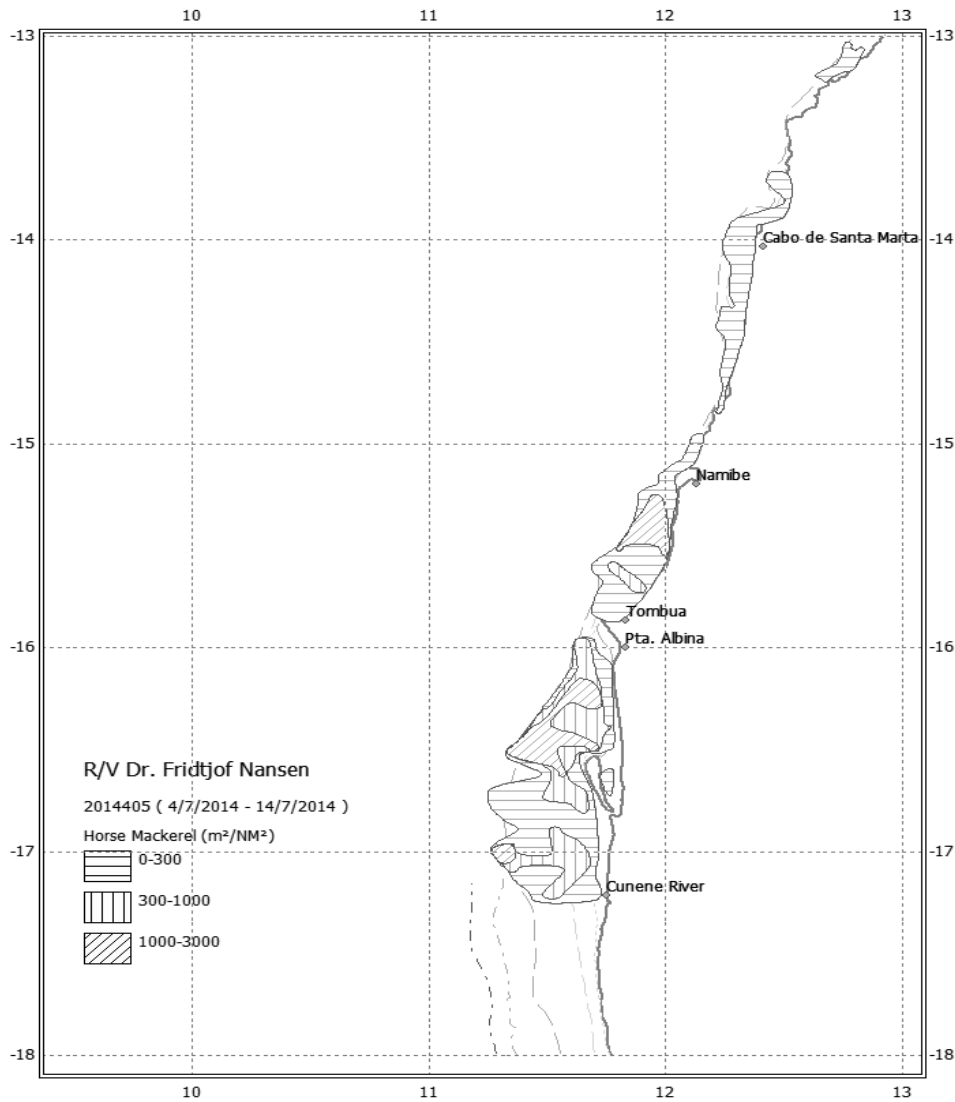


Figure 34. Distribution of horse mackerel (both species). Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 m.

Figure 35 shows the length frequency distributions of the Cunene and Cape horse mackerels, respectively. Cunene horse mackerel has a mode, peaking at about 16 cm TL. Cape horse mackerel shows three modes at around 10, 15 and 36 cm TL.

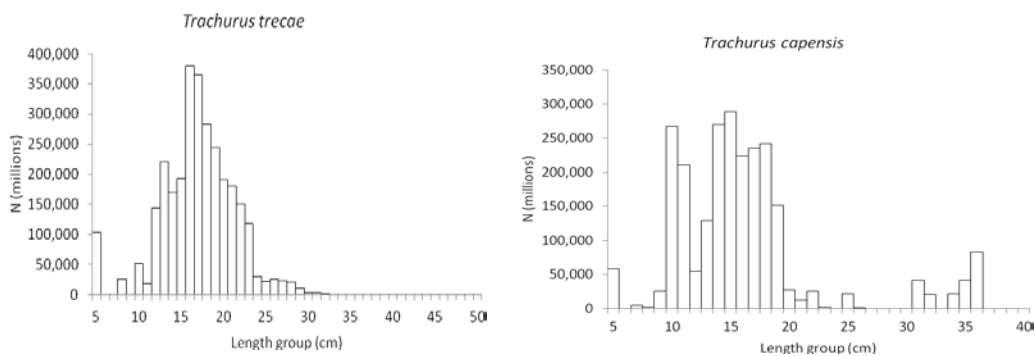


Figure 35. Total length distributions of *Trachurus trecae* and *T. capensis* Benguela-Cunene.

The biomass estimated for both horse mackerel species in the region, was 297 833 tonnes, while 54% for Cunene horse mackerel and 46% for Cape horse mackerel. Juveniles dominate the estimate in numbers for both species, but is just below half of the biomass (48% of biomass from fish <21 cm TL).

In 801 biological samples from the south area, 45% were female, 41% male and 14% indeterminate. 16% of the fish were found to be mature, 84 were immature. The majority of the fish were found in stage I and II for female and males. The length at 50% maturity of *Trachurus trecae*, of this region, was 25 cm TL (Figure 36).

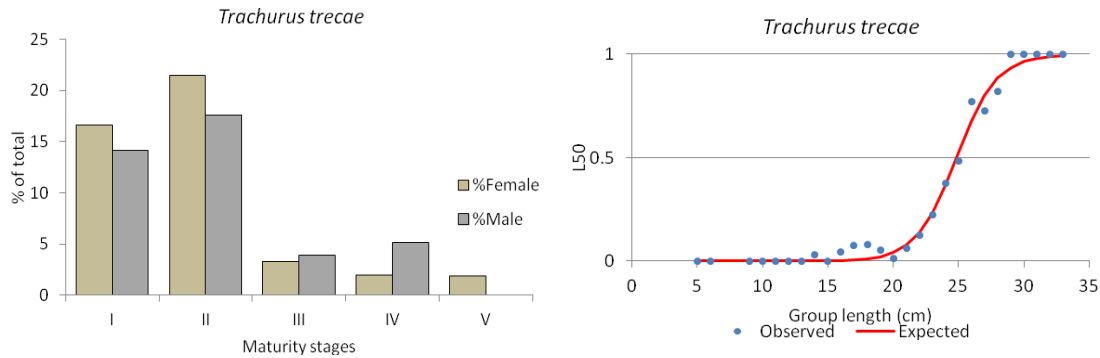


Figure 36. Maturity stages by sex and first length at maturity for *Trachurus trecae* in the South region.

4.3.3 Pelagic species Group 1

The dominant species belonging to this group were round herring (*Etrumeus whiteheadi*) and anchovy (*Engraulis encrasicolus*). They were found in the area between Namibe and Cunene River of low densities areas ($0 < s_A < 300 \text{ m}^2/\text{NM}^2$), (Figure 37).

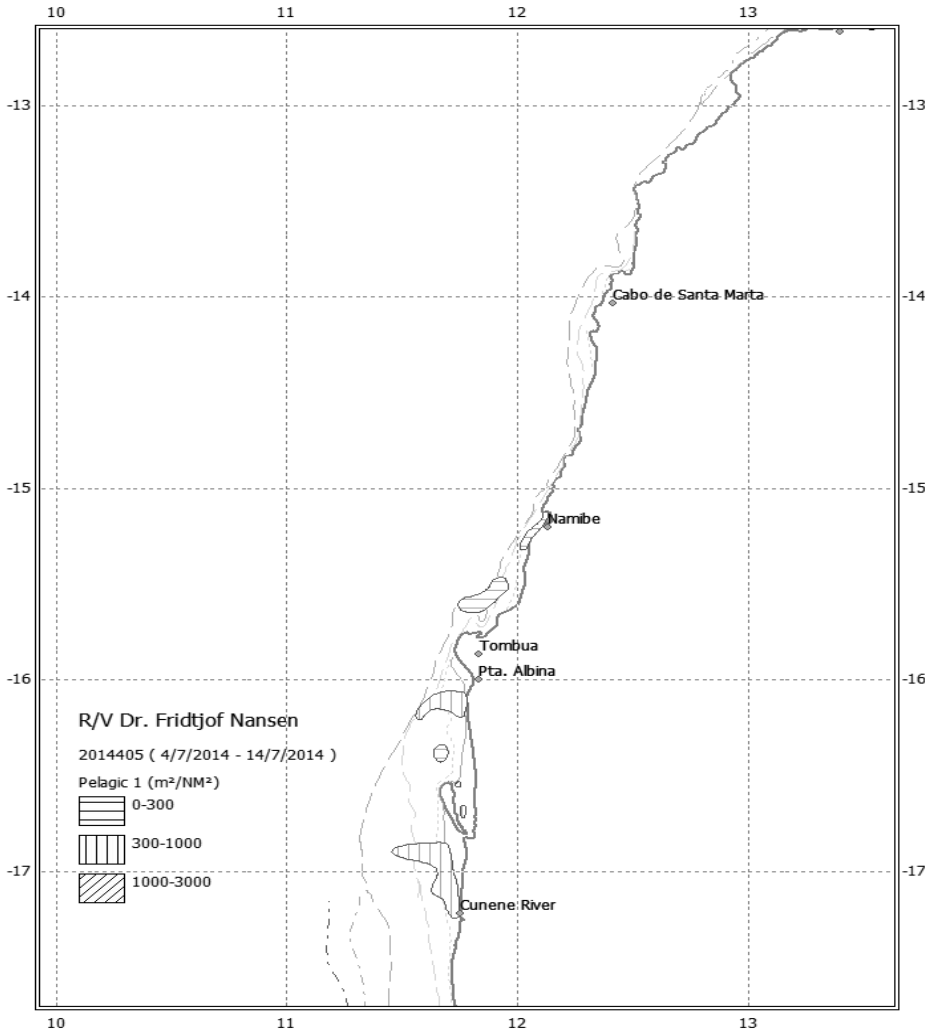


Figure 37. Distribution of Pelagic 1. Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 meters.

The biomass for this group was estimated to be 15 883 tonnes mostly *Etrumeus whiteheadi* and *Engraulis encrasicolus* were caught at only one trawl station. The length distribution of *Etrumeus whiteheadi* has three modes at around 10, 13 and 16 cm TL (Figure 38) and was used as basis for the biomass estimate together with an observed length-weight relationship.

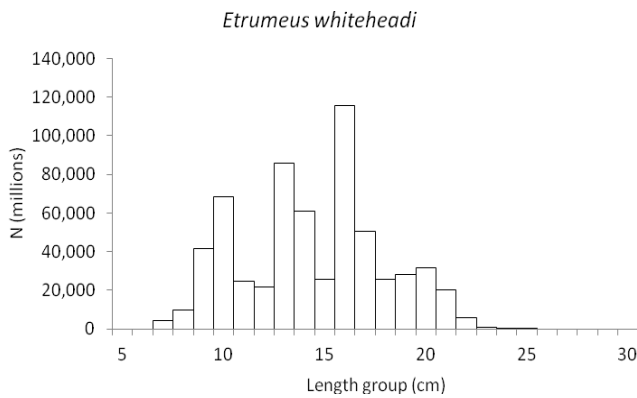


Figure 38. Total length distribution of *Etrumeus whiteheadi*, Benguela-Cunene.

4.3.4 Pelagic species Group 2

This group was found distributed along the coast between Cabo de Santa Marta and Cunene in patched area with low densities areas ($0 < s_A < 300 \text{ m}^2/\text{NM}^2$) (Figure 36). The group was dominated by Carangids and other species as *Trachurus lepturus*, *Scomber japonicus* and *Sphyræna sp.*.

The biomass estimated was 18 541 tonnes, based on an average length of 30 cm TL. See also subsection 5.3 regarding assumptions and possible sources of bias.

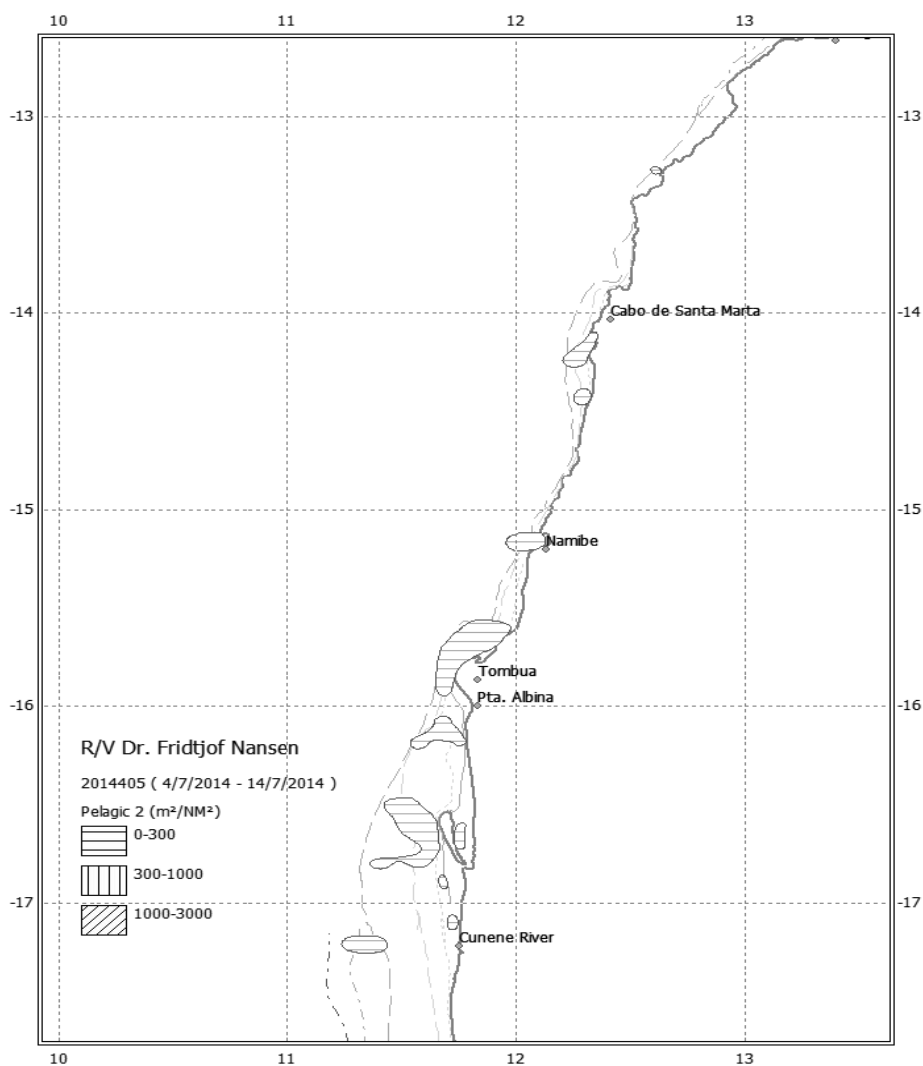


Figure 39. Distribution of Pelagic 2. Benguela–Cunene. Depth contours at 10, 20, 50, 100, 200 and 500 meters.

Table 5 shows the summary of the abundance estimated of main commercial species in the southern region.

Table 5. Estimated abundance of pelagic fish (tonnes), Benguela-Cunene (1000 tonnes).

Sardinella maderensis	Sardinella aurita	Trachurus trecae	Trachurus capensis	Pelagic 1	Pelagic 2
1 680	12 634	161 187	136 646	15 883	18 541

CHAPTER 5 SUMMARY OF SURVEY RESULTS

5.1 Sardinella

The estimated biomass of sardinella shows a cyclic fluctuating pattern throughout the time series (Figure 40). 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 relatively good condition. The total biomass estimate for sardinellas was 426 591 tonnes. This is at the same level as the winter 2013 survey (422 000 tonnes) and higher than in the summer 2014 (363 000 tonnes).

The length/size composition for both species shows highest abundance (in numbers) of size groups (15-20 cm) soon entering the fishery. The estimated numbers for the lowest size range below 10 cm is somewhat higher than what is usually observed during this survey, but estimates are more uncertain and the survey coverage must be assumed to be poor for these size groups often found in more shallow waters than the survey covers.

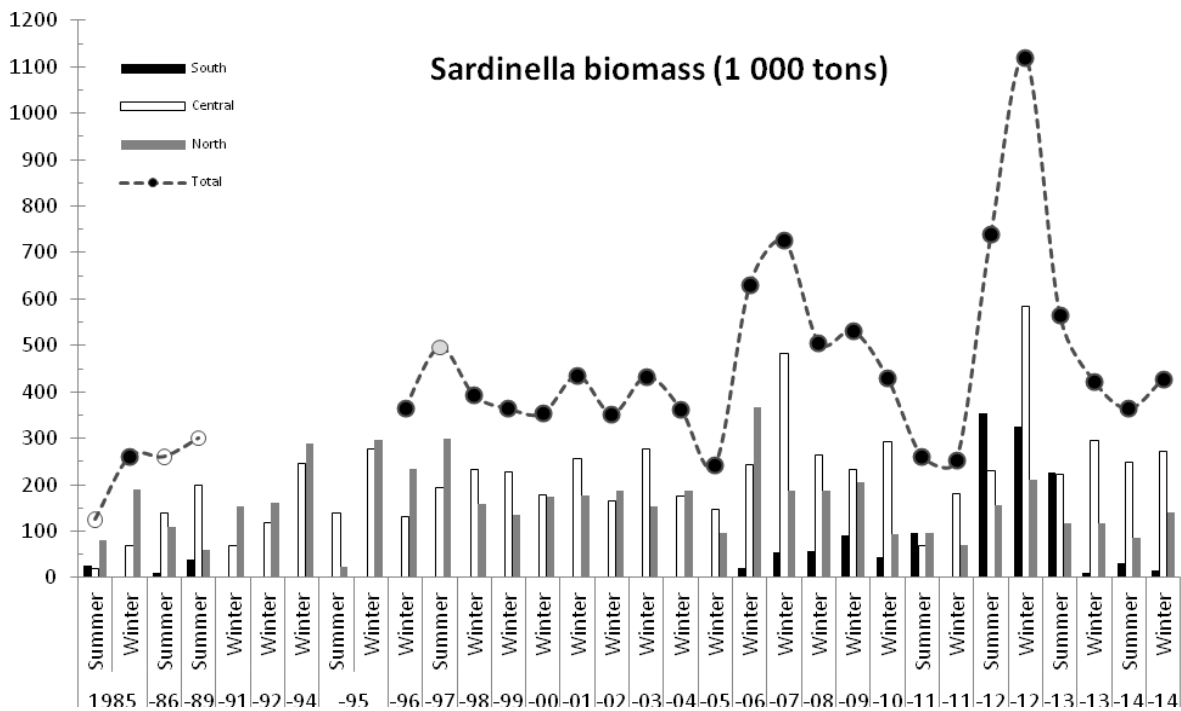


Figure 40. Biomass estimates of *Sardinella* by regions and surveys (1 000 tonnes).

The overall length frequency distributions of the two *Sardinella* species show both juvenile and adult cohorts (Figure 41). The distribution of *S. maderensis* shows well-defined cohorts with modal peaks around 10, 16 and 27 cm total length. For *S. aurita*, the distribution shows modal peaks at 7, 18 and 26 cm TL.

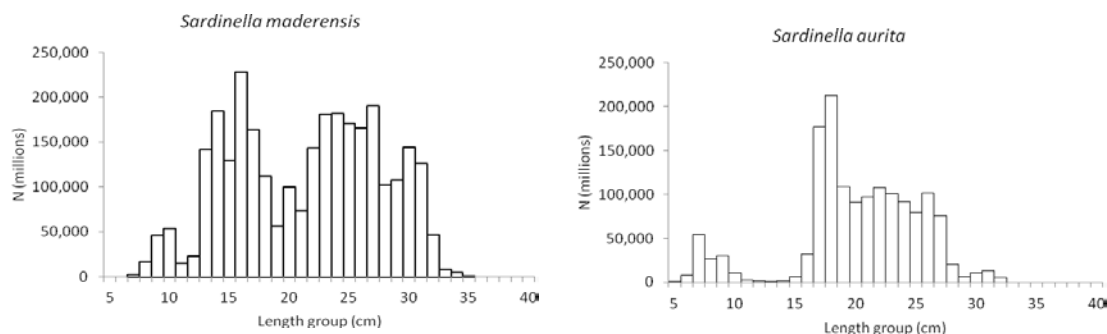


Figure 41. Overall total length distribution of *S. maderensis* and *S. aurita*.

5.2 Horse mackerel

The total biomass of Cunene horse mackerel was estimated at 185 964 tons (Figure 42). This is less than winter 2013 (257 000 tons) and summer 2014 (295 000) estimates, and less than long term mean (2000-2014) of 226 000 tons. The bulk of the biomass is found in the southern region which is similar to other years except last year when the biomass was centered in the central region. The most abundant size group ranges from 15-20cm and will soon recruit to the fishery. There is a marked lack of Cunene horse mackerel > 30cm in the survey results. We would like to point to three possible causes for this:

- The survey coverage has certain limitations and both an offshore as well as an inshore component may be outside the survey area.
- Larger horse mackerel have a higher swimming capacity and may have higher avoidance to the sampling trawls used. Such gear avoidance may differ between years due to differences in environmental conditions like feeding conditions. This can also be linked due to changes in diurnal behavioural patterns like depth preferences.
- The fishing activity is primarily targeting large sized horse mackerel.

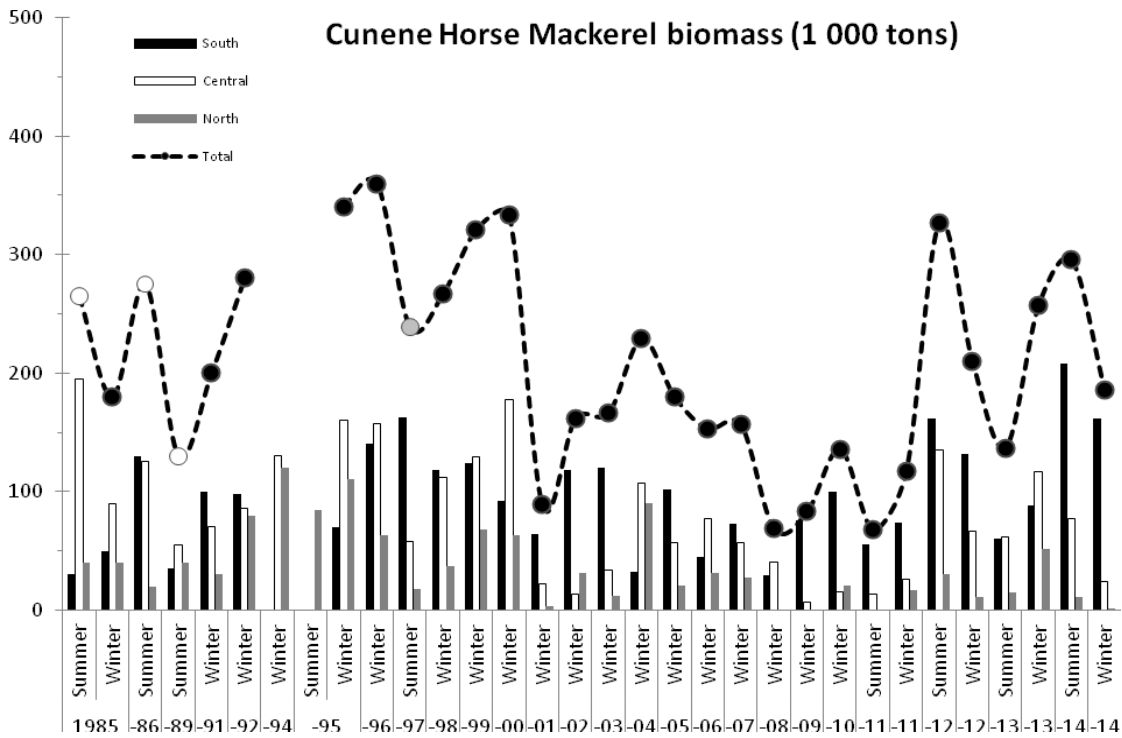


Figure 42. Biomass estimates of Cunene horse mackerel by regions and surveys (1 000 tonnes).

The overall length frequency distributions of the horse mackerel species include juvenile cohorts for both *T. trecae* and *T. capensis* (Figure 43). The distribution of *T. trecae* shows well-defined cohorts with modal peaks around 5, and 17 cm total length. For *T. capensis*, the distribution shows modal peaks at 5, 10, 15 and 36 cm TL.

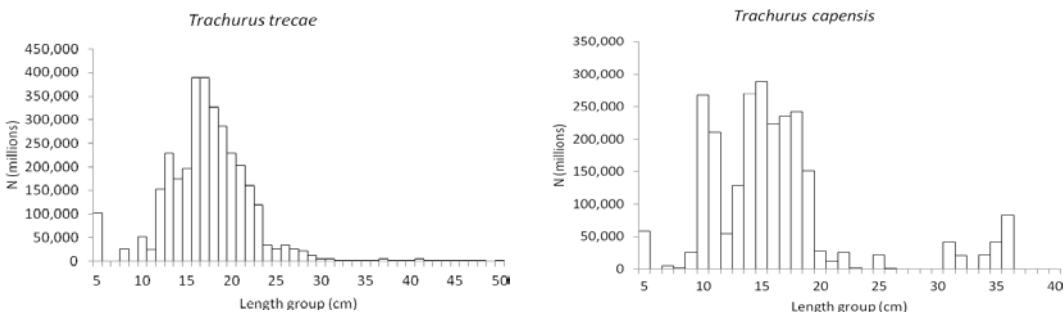


Figure 43. Overall total length distribution of *T. trecae* and *T. capensis*.

The total biomass of Cape horse mackerel was estimated at 136 646 tonnes. This is considerable higher than found in previous surveys in the winter 2013 (123 000 tonnes) and in the summer 2014 (66 757 tonnes). The result for Cape horse mackerel should not be interpreted as an increase in stock size since such an increase can be caused by distributional shifts. More thorough analysis would be needed including survey information from Namibian waters. The possible shift in distribution (also observed for Cunene horse mackerel last year) may be linked to the position of the Angolan-Benguela front (ABF) and corresponding upwelling influencing the availability of horse mackerel to the survey.

5.3 Regarding simplified biomass estimation

Estimates of species groups (pelagic 1 and pelagic 2) are based on less detailed sampling than sardinellas and horse mackerels. This year the pelagic 1 group was dominated by single species (in their respective regions, *Ilisha africana* in the northern and central regions and *Etrumeus whiteheadi* in the southern region of the survey area) and the biomass estimate corresponds to this single species with a small proportion added. Pelagic 1 species are usually found very close to the surface and the proportion of biomass found above the acoustic range may be considerable. This is a known source of bias and it is not known if this bias varies between years/seasons.

Pelagic 2 species are estimated assuming a fixed length and a mean condition factor. This practice introduces two potential sources of bias:

Conversion of echo abundance to number of fish depends on the average of squared lengths and this will change between years. This is a source of bias in the estimation of numbers of fish. Different length distributions may produce the same average squared length, but the corresponding biomass will be different.

Due to these bias issues overinterpretation of time series of pelagic 2 biomass estimates should be avoided.

5.4 Summary

A summary of main findings are presented in Table 6. The reported biomass levels should be viewed with considerable caution. The estimates are relative indices rather than absolute estimates of abundance, and the cyclic variation pattern for sardinellas and horse mackerels may be accentuated by changes in distributional 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 meets the warm, subtropical Angola current.

Observed variation in biomass may also be caused by favourable conditions increasing the availability to fishing gear. Increased availability does not necessarily mean increased abundance, sometimes availability may even increase with decreasing abundance. Continuing to fish on the basis of high availability therefore involves risk. It is particularly evident for Cunene horse mackerel confined to the Southern region and with the biomass in this region is comprised by juveniles (TL < 18 cm).

Other biological references also clearly indicate that the Cunene horse mackerel stock is still under considerable pressure. From the reference year 1996, the length distributions have been shifting towards smaller fish, indicating high fishing pressure on the adult stock (Figure 43).

In this situation, increasing fishing pressure could involve a high risk for failure of the long-term recovery the of the Cunene horse mackerel stock.

Table 6. Estimated abundance of pelagic fish (tonnes), Angolan coast Congo River-Cunene.

Species	North	Central	South	Total
Cunene horse mackerel	862	23 915	161 187	185 964
Cape horse mackerel			136 646	136 646
<i>Sardinella aurita</i>	15 828	91 584	12 634	120 046
<i>Sardinella maderensis</i>	124 380	180 485	1 680	306 545
Pelagic 1	12 000	17 103	15 883	44 986
Pelagic 2	77 379	55 193	18 541	151 113

CHAPTER 6 REFERENCES

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ANNEX I. Records of fishing stations

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 1
 DATE :18/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 6°13.09
 Lon E 12°7.01
 start stop duration Purpose : 1
 TIME :03:25:39 03:52:57 27.3 (min) Region : 4054
 LOG : 5182.74 5184.31 1.6 Gear cond.: 0
 FDEPTH: 20 20 Validity : 0
 BDEPTH: 38 42 Speed : 3.5 kn
 Towing dir: 0° Wire out : 0 m Catch/hour: 247.71
 Sorted : 0 Total catch: 112.71

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Alectis alexandrinus	142.55	264	57.55	6
Hemicaranx bicolor	93.32	154	37.67	
Stromateus fiatola	5.05	13	2.04	4
Scomberomorus tritor	2.68	2	1.08	
Selene dorsalis	2.33	15	0.94	1
Brachydeuterus auritus	1.23	15	0.50	3
Ilisha africana	0.42	11	0.17	2
Alloteuthis africana	0.09	42	0.04	
Engraulis encrasicolus	0.04	15	0.02	5
Total	247.71		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 2
 DATE :18/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 6°30.78
 Lon E 11°48.79
 start stop duration Purpose : 1
 TIME :12:34:05 13:07:50 33.8 (min) Region : 4054
 LOG : 5259.10 5260.84 1.7 Gear cond.: 0
 FDEPTH: 124 124 Validity : 0
 BDEPTH: 124 124 Speed : 3.1 kn
 Towing dir: 0° Wire out : 325 m Catch/hour: 288.36
 Sorted : 0 Total catch: 162.20

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex angolensis	70.47	437	24.44	9
Selene dorsalis	68.60	236	23.79	8
Trachurus trecae	58.84	3680	20.41	7
Dentex congoensis	38.40	631	13.32	10
Trigla lyra	10.63	164	3.69	
Brotula barbata	6.24	4	2.16	
Ariomma bondi	5.92	162	2.05	
Boops boops	5.90	124	2.05	
Pterothrissus belloci	5.53	44	1.92	
Septia orbignyana	3.56	21	1.23	
Zeus faber	3.52	12	1.22	
Raja miraletus	2.28	4	0.79	
Uranoscopus polli	1.39	9	0.48	
Peristodion cataphractum	1.37	25	0.47	
PATELLIDAE	1.10	123	0.38	
Trichiurus lepturus	1.01	2	0.35	
Spicara alta	0.82	11	0.28	
Octopus vulgaris	0.78	4	0.27	
Illex coindetii	0.52	27	0.18	
Scorpaena normani	0.36	5	0.12	
Scomber japonicus	0.34	2	0.12	
Citharus linguatula	0.27	11	0.09	11
Syacium microrum**	0.27	12	0.09	
MELONGENIDAE	0.12	7	0.04	
Arnoglossus imperialis	0.05	11	0.02	
Dicologlossa hexophthalma	0.05	2	0.02	
Saurida brasiliensis	0.02	2	0.01	
Total	288.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 3
 DATE :18/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°29.58
 Lon E 12°12.80
 start stop duration Purpose : 1
 TIME :17:41:25 18:12:26 31.0 (min) Region : 4054
 LOG : 5301.51 5303.02 1.5 Gear cond.: 0
 FDEPTH: 0 0 Validity : 0
 BDEPTH: 41 39 Speed : 2.9 kn
 Towing dir: 0° Wire out : 0 m Catch/hour: 89.17
 Sorted : 0 Total catch: 46.10

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	33.73	18400	37.83	
Ilisha africana	21.59	963	24.21	13
Trichiurus lepturus	8.12	17	9.11	
Brachydeuterus auritus	5.96	4	6.68	19
Euthynnus alletteratus	3.64	4	4.08	17
Sphyrna guanchancho	3.17	91	3.56	
Septia officinalis	2.69	6	3.02	
Stromateus fiatola	2.63	4	2.95	
Caranx crysos	2.21	2	2.47	
Trachurus trecae	1.49	44	1.67	14
Trachinotus ovatus	1.03	10	1.15	18
Caranx rhonchus	0.91	19	1.02	16
Lagocephalus laevigatus	0.74	2	0.82	
Sardinella aurita	0.70	15	0.78	15
Engraulis encrasicolus	0.46	19	0.52	12
Saurida brasiliensis	0.10	2	0.11	
Alloteuthis africana	0.02	6	0.02	
Total	89.17		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 4
 DATE :18/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°37.10
 Lon E 11°52.71
 start stop duration Purpose : 1
 TIME :21:07:49 21:40:00 32.2 (min) Region : 4054
 LOG : 5326.17 5327.85 1.7 Gear cond.: 0
 FDEPTH: 0 0 Validity : 0
 BDEPTH: 123 122 Speed : 3.1 kn
 Towing dir: 0° Wire out : 120 m Catch/hour: 34.09
 Sorted : 0 Total catch: 18.29

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	16.10	246	47.24	20
Trichiurus lepturus	13.16	17	38.60	
Auxis thazard thazard	2.35	7	6.89	21
Brachydeuterus auritus	1.03	9	3.01	
Trachinotus ovatus	0.91	6	2.68	
Ariomma bondi	0.41	11	1.20	
Saurida brasiliensis	0.13	41	0.38	
Total	34.09		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 5
 DATE :19/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 6°38.15
 Lon E 12°5.30
 start stop duration Purpose : 1
 TIME :03:44:44 04:15:53 31.1 (min) Region : 4054
 LOG : 5377.13 5378.94 1.8 Gear cond.: 0
 FDEPTH: 0 0 Validity : 0
 BDEPTH: 75 72 Speed : 3.5 kn
 Towing dir: 0° Wire out : 130 m Catch/hour: 23.87
 Sorted : 0 Total catch: 12.39

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trichiurus lepturus	13.56	17	56.82	
Trachurus trecae	5.78	272	24.21	22
Scomber japonicus	4.20	23	17.59	23
Saurida brasiliensis	0.21	52	0.89	
Alloteuthis africana	0.12	42	0.48	
Total	23.87		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 6
 DATE :19/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 6°51.48
 Lon E 12°1.69
 start stop duration Purpose : 1
 TIME :14:05:00 14:35:41 30.7 (min) Region : 4054
 LOG : 5467.46 5469.20 1.7 Gear cond.: 0
 FDEPTH: 92 94 Validity : 0
 BDEPTH: 92 94 Speed : 3.4 kn
 Towing dir: 0° Wire out : 230 m Catch/hour: 279.75
 Sorted : 57 Total catch: 143.09

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	145.16	6911	51.89	24
Pagellus bellottii	36.07	336	12.89	27
Dentex congoensis	26.78	317	9.57	26
Scomber japonicus	25.42	211	9.09	28
Trigla lyra	13.20	117	4.72	
Dentex angolensis	12.41	117	4.44	25
Lagocephalus laevigatus	6.69	4	2.39	
SEA URCHINS	3.23	4	1.15	
Zeus faber	3.23	10	1.15	
PATELLIDAE	3.03	371	1.08	
Fistularia petimba	1.80	4	0.64	
Illex coindetii	1.72	166	0.61	
SEA URCHINS	0.74	192	0.27	
Saurida brasiliensis	0.10	20	0.03	
Calappa pelii	0.10	4	0.03	
Alloteuthis africana	0.04	16	0.01	
Citharus linguatula	0.04	4	0.01	
Total	279.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 7
 DATE :19/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°47.29
 Lon E 12°21.74
 start stop duration Purpose : 1
 TIME :18:48:45 19:20:00 31.2 (min) Region : 4054
 LOG : 5506.60 5508.23 1.6 Gear cond.: 0
 FDEPTH: 0 0 Validity : 0
 BDEPTH: 30 35 Speed : 3.1 kn
 Towing dir: 0° Wire out : 110 m Catch/hour: 242.98
 Sorted : 0 Total catch: 126.51

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	109.61	1254	45.11	29
Selene dorsalis	55.89	323	23.00	30
Sphyrna guanchancho	27.39	36	11.27	
Caranx crysos	22.78	35	9.37	31
Euthynnus alletteratus	12.91	17	5.31	33
Sardinella maderensis	9.47	60	3.90	32
Septia officinalis	1.75	4	0.72	
Decapterus punctatus	1.29	31	0.53	34
Stromateus fiatola	0.90	2	0.37	
Boops boops	0.61	94	0.25	
Caranx rhonchus	0.29	6	0.12	
Alloteuthis africana	0.10	35	0.04	
Total	242.98		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 8
 DATE :19/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 6°58.96
 Lon E 11°55.83
 start stop duration Purpose : 1
 TIME :23:17:13 23:53:57 36.7 (min) Region : 4054
 LOG : 5536.78 5539.04 2.3 Gear cond.: 0
 FDEPTH: 12 15 Validity : 0
 BDEPTH: 127 175 Speed : 3.7 kn
 Towing dir: 0° Wire out : 0 m Catch/hour: 509.75
 Sorted : 78 Total catch: 312.05

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trichiurus lepturus	458.18	698	89.88	
Myctophidae sp. large	46.33	36753	9.09	
Synagrops microlepis	3.53	274	0.69	
Trachurus trecae	1.52	2	0.30	35
Saurida brasiliensis	0.20	39	0.04	
Total	509.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 9
 DATE :20/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 6°58.07
 Lon E 12°32.83
 start stop duration
 TIME :19:45:33 20:16:36 31.1 (min)
 LOG : 5719.29 5721.07
 FDEPTH: 0 1.8
 BDEPTH: 32 33
 Towing dir: 0° Wire out : 120 m
 Sorted : 0 Total catch: 81.13
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.4 kn
 Catch/hour: 156.72

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Caranx rhonchus	131.51	249	83.91	38
Sphyræna guachancho	8.42	27	5.37	
Brachydeuterus auritus	7.30	71	4.66	39
Hemiscaranx bicolor	2.20	8	1.41	
Sardinella maderensis	2.20	14	1.41	36
Stromateus fiatola	1.12	2	1.10	
Selene dorsalis	1.41	10	0.90	37
Boops boops	0.75	39	0.48	
Septia officinalis	0.64	6	0.41	
Alloteuthis africana	0.56	19	0.36	
Total	156.72		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 10
 DATE :20/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°3.66
 Lon E 12°37.65
 start stop duration
 TIME :21:54:17 22:04:40 10.4 (min)
 LOG : 5732.40 5733.02
 FDEPTH: 5 5
 BDEPTH: 32 32
 Towing dir: 0° Wire out : 120 m
 Sorted : 72 Total catch: 788.15
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.6 kn
 Catch/hour: 4560.17

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella maderensis	2319.86	59497	50.87	41
Sardinella aurita	1645.23	23803	36.08	40
Chloroscombrus chrysurus	271.76	4328	5.96	43
Brachydeuterus auritus	228.49	2800	5.01	42
Euthynnus alletteratus	29.91	64	0.66	45
Septia orbignyana	21.00	64	0.46	
Selene dorsalis	20.37	255	0.45	44
Sphyræna guachancho	15.27	64	0.33	
Pagellus bellottii	8.27	64	0.18	
Total	4560.17		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 11
 DATE :21/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 7°17.81
 Lon E 12°39.33
 start stop duration
 TIME :03:43:11 04:15:28 32.3 (min)
 LOG : 5776.19 5778.00
 FDEPTH: 16 13
 BDEPTH: 51 53
 Towing dir: 0° Wire out : 0 m
 Sorted : 0 Total catch: 51.95
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.4 kn
 Catch/hour: 96.56

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella maderensis	64.50	286	66.79	47
Sardinella aurita	15.61	78	16.17	46
Euthynnus alletteratus	12.04	22	12.47	48
Scomber japonicus	2.60	13	2.69	50
Trachinotus ovatus	0.80	7	0.83	
Septia orbignyana	0.28	56	0.29	
Chloroscombrus chrysurus	0.20	2	0.21	
Trachurus trcae	0.19	6	0.19	49
Echeneis naucrates	0.17	2	0.17	
Alloteuthis africana	0.17	2	0.17	
Total	96.56		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 12
 DATE :21/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 7°36.02
 Lon E 12°56.82
 start stop duration
 TIME :19:43:23 20:03:06 19.7 (min)
 LOG : 5908.80 5909.86
 FDEPTH: 0 0
 BDEPTH: 31 34
 Towing dir: 0° Wire out : 120 m
 Sorted : 59 Total catch: 278.41
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.3 kn
 Catch/hour: 847.09

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sardinella maderensis	298.75	4476	35.27	52
Brachydeuterus auritus	235.50	6928	27.80	56
Ilisha africana	187.58	6268	22.14	57
Euthynnus alletteratus	34.23	82	3.04	54
Stromateus fiatola	31.76	180	3.75	
Sardinella aurita	29.27	426	4.46	51
Trichurus lepturus	15.06	180	1.78	
Septia officinalis	9.65	15	1.14	
Selene dorsalis	2.74	55	0.32	55
Trachurus trcae	1.34	43	0.16	53
Chloroscombrus chrysurus	1.22	15	0.14	
Total	847.09		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 13
 DATE :22/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 7°43.92
 Lon E 12°54.93
 start stop duration
 TIME :02:58:13 03:22:34 24.4 (min)
 LOG : 5965.35 5966.81
 FDEPTH: 0 0
 BDEPTH: 50 53
 Towing dir: 0° Wire out : 0 m
 Sorted : 88 Total catch: 262.68
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.6 kn
 Catch/hour: 647.00

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	560.99	10527	86.71	58
Trachurus trcae	32.81	1034	5.07	59
Sardinella maderensis	29.63	229	4.58	61
Scomber japonicus	19.36	103	2.99	60
Sphyræna guachancho	2.59	7	0.40	
Ilisha africana	1.33	22	0.21	62
Engraulis encrasicolus	0.22	89	0.03	63
Alloteuthis africana	0.07	15	0.01	
Total	647.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 14
 DATE :22/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 7°56.30
 Lon E 13°7.88
 start stop duration
 TIME :14:30:13 15:01:32 31.3 (min)
 LOG : 6051.65 6053.73
 FDEPTH: 22 24
 BDEPTH: 22 24
 Towing dir: 0° Wire out : 110 m
 Sorted : 89 Total catch: 405.95
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 4.0 kn
 Catch/hour: 777.93

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	206.10	7090	26.49	64
Ilisha africana	158.15	7976	20.33	65
Pteroscion peli	83.30	259	10.71	
Galeoides decadactylus	67.61	241	8.69	
Pomadasy peroteti	50.53	121	6.50	
Pentanemus quinquarius	44.75	1303	5.75	
Pseudotolithus senegalensis	43.63	207	5.61	66
Pseudotolithus typus	20.01	121	2.57	70
Trichurus lepturus	16.56	537	2.13	
Drepane africana	15.35	27	1.97	
Dicologlossa cuneata	15.00	320	1.93	
Penaeus notialis	14.14	5946	1.82	
Trachurus trcae	11.38	366	1.46	69
Arius parkii	7.42	27	0.95	
Ephippion guttifer	7.32	17	0.94	
Chloroscombrus chrysurus	3.35	148	0.43	68
Selene dorsalis	2.41	79	0.31	67
Alloteuthis africana	1.97	65	0.25	
Todarodes angolensis	1.90	11	0.24	
Sepiella ornata	1.82	199	0.23	
Stromateus fiatola	1.72	17	0.22	
Caranx rhonchus	1.11	11	0.14	
Sphyræna guachancho	0.77	11	0.10	
Lagocephalus laevigatus	0.77	27	0.10	
Umbra canariensis	0.59	11	0.08	
Eucinostomus melanopterus	0.17	11	0.02	
Calappa pelii	0.08	17	0.01	
Total	777.93		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 15
 DATE :22/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°15.17
 Lon E 12°52.30
 start stop duration
 TIME :20:49:41 21:20:20 30.7 (min)
 LOG : 6101.14 6102.85
 FDEPTH: 0 0
 BDEPTH: 126 122
 Towing dir: 0° Wire out : 120 m
 Sorted : 77 Total catch: 295.52
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.4 kn
 Catch/hour: 578.32

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trichurus lepturus	541.68	873	93.67	71
Trachurus trcae	31.15	115	5.39	73
Sarda sarda	3.48	2	0.60	72
Scomber japonicus	2.00	4	0.35	
Total	578.32		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 16
 DATE :23/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°13.31
 Lon E 13°12.14
 start stop duration
 TIME :00:51:21 01:43:04 51.7 (min)
 LOG : 6131.30 6131.32
 FDEPTH: 18 18
 BDEPTH: 41 41
 Towing dir: 0° Wire out : 0 m
 Sorted : 134 Total catch: 608.17
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 0.0 kn
 Catch/hour: 705.67

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	266.40	8288	37.75	76
Sardinella maderensis	239.09	3135	33.88	74
Sardinella aurita	114.87	3270	16.28	75
Trachurus trcae	41.46	731	5.88	78
Ilisha africana	19.84	345	2.81	77
Trichurus lepturus	12.32	104	1.75	
Arius parkii	4.39	1	0.62	
Septia orbignyana	3.18	5	0.45	
Selene dorsalis	1.83	31	0.26	79
Chloroscombrus chrysurus	1.78	15	0.25	80
Sepiella ornata	0.31	31	0.04	
Sphyræna guachancho	0.15	10	0.02	
Engraulis encrasicolus	0.05	15	0.01	
Total	705.67		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 17
 DATE :23/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 8°16.74
 Lon E 13°17.37
 start stop duration
 TIME :09:11:42 09:42:21 30.6 (min)
 LOG : 6199.70 6201.65
 FDEPTH: 24 27
 BDEPTH: 24 27
 Towing dir: 0° Wire out : 110 m
 Sorted : 103 Total catch: 404.09
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.8 kn
 Catch/hour: 791.04

SPECIES	weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Brachydeuterus auritus	198.91	2960	25.15	84
Galeoides decadactylus	178.69	893	22.59	
Ilisha africana	139.40	13940	17.62	82
Pteroscion peli	130.02	2737	16.44	
Pseudotolithus typus	54.60	431	6.90	
Gymnura micrura	14.19	4	1.79	
Penaeus notialis	12.12	1175	1.53	
Pomadasy peroteti	10.94	29	1.38	
Dicologlossa cuneata	10.18	260	1.29	
Stromateus fiatola	7.97	29	1.01	
Trichurus lepturus	5.36	82	0.68	
Trachurus trcae	4.19	117	0.53	81
Dasyatis marmorata	4.09	2	0.52	
Pseudotolithus senegalensis	3.56	29	0.45	
Septia orbignyana	3.05	8	0.39	
Eucinostomus melanopterus	2.68	29	0.34	
Pisodonophis semicinctus	2.60	16	0.33	
Torpedo marmorata	2.41	4	0.30	
Pentanemus quinquarius	1.78	37	0.23	
Raja miraletus	1.61	4	0.20	
Selene dorsalis	1.37	37	0.20	83
Pomadasy incisus	1.12	8	0.14	
Total	791.04		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 18
 DATE :23/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°30.35
 Lon E 13°17.79
 start stop duration
 TIME :17:46:53 18:18:29 31.6 (min)
 LOG : 6272.48 6274.24 1.8
 FDEPTH: 32 30
 BDEPTH: 32 30
 Towing dir: 0° Wire out : 110 m
 Sorted : 58 Total catch: 277.25
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.3 kn
 Catch/hour: 526.43

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Brachydeuterus auritus	423.42 12858	80.43	86
Sardinella maderensis	51.09 1189	9.71	85
Ilisha africana	11.28 180	2.14	87
Trachurus trecae	10.22 215	1.94	88
Sepia orbignyana	9.00 15	1.71	
Penaeus notialis	8.91 230	1.69	
Sphyræna guachancho	8.20 27	1.56	
Sardinella aurita	2.31 300	0.44	89
Pomadasy incisis	1.88 11	0.36	
Penaeus kerathurus	0.13 2	0.03	
Total	526.43	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 19
 DATE :23/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 8°30.20
 Lon E 13°19.42
 start stop duration
 TIME :19:07:37 19:39:05 31.5 (min)
 LOG : 6276.91 6278.77 1.9
 FDEPTH: 21 21
 BDEPTH: 21 21
 Towing dir: 0° Wire out : 110 m
 Sorted : 0 Total catch: 255.28
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.5 kn
 Catch/hour: 486.71

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Brachydeuterus auritus	165.95 5003	34.10	90
Pteroscion pelli	93.96 4896	19.30	
Pomadasy incisis	54.60 610	11.22	
Galeoides decadactylus	38.59 366	7.93	
Eucinostomus melanopterus	32.49 564	6.68	
Cymbium sp.	30.51 46	6.27	
Dicolloglossa cuneata	20.90 610	4.29	
Sepia orbignyana	15.56 31	3.20	
Penaeus notialis	14.95 610	3.07	
Ilisha africana	9.76 214	2.01	91
Pagellus bellottii	6.25 46	1.28	
Pseudupeneus prayensis	1.98 46	0.41	
Pisodonophis seminctus	0.61 15	0.13	
Syacium micrurum*	0.61 15	0.13	
Total	486.71	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 20
 DATE :24/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°46.30
 Lon E 13°3.00
 start stop duration
 TIME :02:09:49 02:42:46 33.0 (min)
 LOG : 6333.80 6335.86 2.0
 FDEPTH: 0 13
 BDEPTH: 127 114
 Towing dir: 0° Wire out : 0 m
 Sorted : 0 Total catch: 62.09
 Purpose : 1
 Region : 4054
 Gear cond.: 0
 Validity : 0
 Speed : 3.6 kn
 Catch/hour: 113.06

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Synagrops microlepis	49.93 9283	44.16	92
Trachurus trecae	34.42 790	30.44	
Trichurus lepturus	26.37 189	23.32	
Sarda sarda	1.29 2	1.14	93
Lagocephalus laevigatus	1.06 4	0.93	
Total	113.06	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 21
 DATE :27/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 9°27.11
 Lon E 12°58.54
 start stop duration
 TIME :14:35:47 15:07:45 32.0 (min)
 LOG : 6698.80 6700.48 1.7
 FDEPTH: 54 56
 BDEPTH: 54 56
 Towing dir: 0° Wire out : 160 m
 Sorted : 0 Total catch: 224.38
 Purpose : 1
 Region : 4040
 Gear cond.: 0
 Validity : 0
 Speed : 3.1 kn
 Catch/hour: 421.11

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Pomadasy incisis	309.67 1683	73.54	94
Pagellus bellottii	53.49 293	12.70	95
Pomadasy perotaei	20.38 15	4.84	96
Raja miraletus	12.12 17	2.88	
Chelidichthys gabonensis	5.33 30	1.27	
Octopus vulgaris	4.39 4	1.04	
Lagocephalus laevigatus	3.88 2	0.92	
Alectis alexandrinus	2.40 4	0.57	
Sepia orbignyana	1.97 6	0.47	
Syacium micrurum	1.63 9	0.39	
Pseudupeneus prayensis	1.50 8	0.36	
Chaetodon hoefleri	1.05 6	0.25	
Dentex barnardi	0.99 4	0.24	
Chilomycterus spinosus mauretanicus	0.73 4	0.17	
Grammolites gruvelli	0.68 15	0.16	
Alloteuthis africana	0.47 122	0.11	
Brachydeuterus auritus	0.15 2	0.04	
Calappa rubroguttata	0.09 2	0.02	
Dentex angolensis	0.08 8	0.02	
Citharus linguatula	0.06 4	0.01	
Arnoglossus imperialis	0.02 2	0.00	
Ephippion guttifer	0.02 2	0.00	
Total	421.11	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 22
 DATE :27/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 9°35.51
 Lon E 13°7.09
 start stop duration
 TIME :21:48:33 22:16:37 28.1 (min)
 LOG : 6757.31 6758.94 1.6
 FDEPTH: 0 0
 BDEPTH: 31 30
 Towing dir: 0° Wire out : 110 m
 Sorted : 69 Total catch: 241.32
 Purpose : 1
 Region : 4040
 Gear cond.: 0
 Validity : 0
 Speed : 3.5 kn
 Catch/hour: 515.82

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sardinella maderensis	497.51 3989	96.45	97
Sardinella aurita	6.58 592	1.28	98
Sphyræna guachancho	5.99 75	1.16	
Decapterus punctatus	4.34 113	0.84	99
Engraulis encrasicolus	0.81 209	0.16	100
Sepia orbignyana	0.36 9	0.07	
Brachydeuterus auritus	0.21 9	0.04	
Caranx rhonchus	0.02 24	0.00	
Total	515.82	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 23
 DATE :28/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 9°43.15
 Lon E 12°44.17
 start stop duration
 TIME :02:28:01 03:05:01 37.0 (min)
 LOG : 6790.36 6792.49 2.1
 FDEPTH: 25 25
 BDEPTH: 407 372
 Towing dir: 0° Wire out : 0 m
 Sorted : 0 Total catch: 401.19
 Purpose : 1
 Region : 4040
 Gear cond.: 0
 Validity : 0
 Speed : 3.4 kn
 Catch/hour: 650.75

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Mobula rochebrunei	609.08 8	93.60	
Myctophidae sp. silver	30.74 32582	4.72	
Regalecus glesne	9.33 54	1.43	
Illex coindetii	0.54 3	0.08	
Euprotomiscrus bispinatus	0.52 2	0.08	
Echeneis naucrates	0.36 10	0.05	
Ariomma bondi	0.10 3	0.01	
Scopelosaurus sp.	0.08 3	0.01	
Synagrops microlepis	0.02 2	0.00	
Total	650.75	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 24
 DATE :28/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 9°47.08
 Lon E 13°12.34
 start stop duration
 TIME :07:54:39 08:25:46 31.1 (min)
 LOG : 6832.76 6834.82 2.1
 FDEPTH: 23 20
 BDEPTH: 23 20
 Towing dir: 0° Wire out : 110 m
 Sorted : 134 Total catch: 979.33
 Purpose : 1
 Region : 4040
 Gear cond.: 0
 Validity : 0
 Speed : 4.0 kn
 Catch/hour: 1888.17

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Brachydeuterus auritus	651.11 10554	34.48	104
Sardinella maderensis	427.73 8443	22.65	107
Sardinella aurita	237.34 2967	12.57	101
Galeoides decadactylus	237.07 2279	12.56	
Chloroscombrus chrysurus	108.32 1594	5.74	102
Pomadasy incisis	67.10 868	3.55	
Pomadasy perotaei	35.22 197	1.87	
Dasyatis margarita	19.67 13	1.04	
Lagocephalus laevigatus	18.16 42	0.96	
Ilisha africana	15.23 322	0.81	103
Selene dorsalis	12.44 335	0.62	106
Sphyræna guachancho	11.74 112	0.66	
Pagellus bellottii	7.11 42	0.38	
Trichurus lepturus	6.84 56	0.36	
Sepia officinalis	6.40 4	0.34	
Pseudupeneus prayensis	5.73 85	0.30	
Cynoglossus canariensis	5.03 13	0.27	
Selar crumenophthalmus	3.49 29	0.18	
Pteroscion pelli	3.07 112	0.16	
Pentanemus quinarius	2.80 42	0.15	
Eucinostomus melanopterus	2.08 29	0.11	
Trachurus trecae	1.72 25	0.09	105
Pseudolithus senegalensis	1.39 13	0.07	
Trachinotus ovatus	0.83 13	0.04	
Dicolloglossa cuneata	0.56 13	0.03	
Total	1888.17	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 25
 DATE :28/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 9°53.05
 Lon E 12°59.08
 start stop duration
 TIME :11:34:21 12:06:52 32.5 (min)
 LOG : 6852.98 6854.73 1.8
 FDEPTH: 102 95
 BDEPTH: 102 95
 Towing dir: 0° Wire out : 270 m
 Sorted : 0 Total catch: 271.19
 Purpose : 1
 Region : 4040
 Gear cond.: 0
 Validity : 0
 Speed : 3.2 kn
 Catch/hour: 500.35

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus trecae	152.14 1168	30.41	108
Chelidichthys gabonensis	112.66 1159	22.52	
Dentex congensis	58.60 1312	11.71	
Dentex angolensis	36.57 576	7.31	109
Boops boops	25.35 679	5.07	
Sphaeroides pachgaster	23.99 35	4.79	
Spicara alta	22.25 1701	4.45	
Sea urchin, weak spines	13.76 1860	2.75	
Scomber japonicus	8.04 54	1.61	111
Citharus linguatula	7.84 456	1.57	
Raja miraletus	5.70 9	1.14	
Zeus faber	5.11 13	1.02	
Dentex barnardi	4.91 15	0.98	110
Pseudupeneus prayensis	4.54 63	0.91	
Sarda sarda	4.48 2	0.90	112
Ariomma bondi	4.32 48	0.86	
Illex coindetii	3.15 188	0.63	
Octopus vulgaris	2.14 2	0.43	
Sepia orbignyana	1.48 13	0.29	
Alloteuthis africana	0.85 234	0.17	
Pagellus bellottii	0.57 9	0.11	
Scorpaena normani	0.44 6	0.09	
Brotula barbata	0.37 2	0.07	
Dicolloglossa hexophthalma	0.35 7	0.07	
Pterothrissus belloci	0.31 2	0.06	
PATELLIDAE	0.13 13	0.03	
Uranoscopus polli	0.11 2	0.02	
Arnoglossus imperialis	0.11 4	0.02	
Saurida brasiliensis	0.07 4	0.01	
Total	500.35	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 26
 DATE :28/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 9°57.38
 start stop duration Purpose : 1
 TIME :19:30:52 20:01:26 30.6 (min) Region : 4040
 LOG : 6898.47 6900.24 1.8 Lon E 13°7.24
 FDEPTH: 10 10 Gear cond.: 0
 BDEPTH: 70 72 Validity : 0
 Towing dir: 0° Wire out : 110 m Speed : 3.5 kn
 Sorted : 0 Total catch: 217.69 Catch/hour: 427.26

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Sardinella maderensis	260.63	2139	61.00	113
Trichiurus lepturus	95.62	663	22.38	
Lagocephalus laevigatus	41.45	69	9.70	
Brachydeuterus auritus	10.99	82	2.57	116
Trachurus trecae	7.01	92	1.64	115
Scomber japonicus	3.26	14	0.76	117
Sardinella aurita	3.20	14	0.75	114
Saurida brasiliensis	1.81	355	0.42	
Alloteuthis africana	1.26	336	0.29	
Sphyræna guachancho	1.20	8	0.28	
Trachinotus ovatus	0.41	2	0.10	
Bregmaceros sp.	0.37	687	0.09	
Caranx rhonchus	0.06	2	0.01	
Echeneis naucrates	0.02	2	0.00	
Total	427.28		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 27
 DATE :29/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 10°8.77
 start stop duration Purpose : 1
 TIME :00:16:33 00:44:14 27.7 (min) Region : 4040
 LOG : 6935.11 6936.76 1.6 Lon E 12°58.09
 FDEPTH: 15 15 Gear cond.: 0
 BDEPTH: 117 120 Validity : 0
 Towing dir: 0° Wire out : 0 m Speed : 3.6 kn
 Sorted : 0 Total catch: 29.35 Catch/hour: 63.62

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Synagrops microlepis	40.43	6804	63.54	
Trichiurus lepturus	9.26	30	14.55	
Myctophid sp. A	8.69	3163	13.66	
Sepiella ornata	2.64	11	4.16	
Saurida brasiliensis	1.67	301	2.62	
Hemiramphus balao	0.82	4	1.29	
Ariomma bondi	0.11	4	0.17	
Total	63.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 28
 DATE :29/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 10°13.53
 start stop duration Purpose : 1
 TIME :07:41:39 08:12:42 31.0 (min) Region : 4040
 LOG : 6993.79 6995.77 2.0 Lon E 13°26.16
 FDEPTH: 22 19 Gear cond.: 0
 BDEPTH: 22 19 Validity : 0
 Towing dir: 0° Wire out : 100 m Speed : 3.8 kn
 Sorted : 61 Total catch: 226.56 Catch/hour: 437.94

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Ilisha africana	145.73	2950	33.28	122
Brachydeuterus auritus	136.53	2327	31.17	120
Pteroscion peli	51.42	2064	11.74	
Selene dorsalis	19.54	387	4.46	121
Pseudotolithus senegalensis	11.42	81	2.61	
Galeoides decadactylus	10.82	203	2.47	
Eucinostomus melanopterus	10.07	203	2.30	
Arius parkii	9.38	2	2.14	
Trichiurus lepturus	8.93	284	2.04	
Sepia orbignyana	6.86	27	1.57	
Trachurus trecae	4.64	79	1.06	118
Gymnura micrura	3.85	8	0.88	
Parapeneopsis atlantica	3.58	684	0.82	
Cynoglossus senegalensis	2.98	8	0.68	
Sardinella maderensis	2.90	95	0.66	119
Stromateus fiatola	2.63	8	0.60	
Ephippion guttifer	1.76	8	0.40	
Cynoglossus canariensis	1.55	8	0.35	
Pentaneus quinquefasciatus	0.95	27	0.22	
Pseudupeneus prayensis	0.81	8	0.19	
B I V A L V E S	0.46	89	0.11	
Pomadasy incisus	0.46	8	0.11	
Sardinella aurita	0.29	4	0.07	
Dicologlossa cuneata	0.19	8	0.04	
Sphyræna guachancho	0.14	14	0.03	
Maja squinado	0.07	8	0.02	
Total	437.95		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 29
 DATE :29/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°18.79
 start stop duration Purpose : 1
 TIME :17:43:05 18:14:58 31.9 (min) Region : 4040
 LOG : 7067.00 7068.89 1.9 Lon E 13°27.26
 FDEPTH: 5 5 Gear cond.: 0
 BDEPTH: 30 28 Validity : 0
 Towing dir: 0° Wire out : 110 m Speed : 3.6 kn
 Sorted : 165 Total catch: 331.02 Catch/hour: 622.61

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Sardinella aurita	243.46	2208	39.10	125
Brachydeuterus auritus	139.71	2265	22.44	126
Ilisha africana	80.73	1215	12.97	127
Sardinella maderensis	80.13	1106	12.87	124
Trachurus trecae	47.62	624	7.65	123
Pomadasy rogeri	14.45	34	2.32	
Trichiurus lepturus	6.47	94	1.04	
Stromateus fiatola	2.67	8	0.43	
Mugil bananensis	2.24	2	0.36	
Sphyræna guachancho	1.05	4	0.17	
Sepia officinalis	1.03	4	0.17	
Galeoides decadactylus	1.02	11	0.16	
Eucinostomus melanopterus	0.79	8	0.13	
Hyporhamphus picarti	0.49	4	0.08	
Penaeus notialis	0.34	4	0.05	
Pteroscion peli	0.23	4	0.04	
Decapterus punctatus	0.19	2	0.03	
Total	622.61		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 30
 DATE :29/06/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°30.70
 start stop duration Purpose : 1
 TIME :21:11:46 21:42:52 31.1 (min) Region : 4040
 LOG : 7090.84 7092.64 1.8 Lon E 13°18.88
 FDEPTH: 5 5 Gear cond.: 0
 BDEPTH: 100 100 Validity : 0
 Towing dir: 0° Wire out : 110 m Speed : 3.5 kn
 Sorted : 0 Total catch: 382.52 Catch/hour: 737.98

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Mobula rochebrunei	578.78	4	78.43	
Sardinella maderensis	144.58	683	19.59	129
Sphyræna sphyraena	9.45	8	1.28	
Trachurus trecae	3.41	66	0.46	128
Trachinotus ovatus	1.04	4	0.14	
Saurida brasiliensis	0.44	87	0.06	
Echeneis naucrates	0.15	6	0.02	
Alloteuthis sp.	0.10	33	0.01	
Sepia orbignyana	0.02	2	0.00	
Total	737.98		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 31
 DATE :30/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 10°33.17
 start stop duration Purpose : 1
 TIME :02:34:38 03:00:37 26.0 (min) Region : 4040
 LOG : 7132.86 7134.36 1.5 Lon E 13°25.38
 FDEPTH: 14 14 Gear cond.: 0
 BDEPTH: 82 81 Validity : 0
 Towing dir: 0° Wire out : 0 m Speed : 3.5 kn
 Sorted : 0 Total catch: 199.77 Catch/hour: 461.36

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Sardinella maderensis	385.70	1697	83.60	130
Lagocephalus laevigatus	52.98	95	11.48	
Sardinella aurita	9.98	25	2.16	131
Brachydeuterus auritus	4.34	28	0.94	132
Pomatomus saltatrix	2.47	2	0.54	
Saurida brasiliensis	2.12	397	0.46	
Alloteuthis africana	1.29	113	0.28	
Sepia orbignyana	1.18	5	0.26	
Trachurus trecae	0.85	16	0.19	
Synagrops microlepis	0.23	23	0.05	133
Trichiurus lepturus	0.21	2	0.05	
Total	461.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 32
 DATE :30/06/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 10°46.71
 start stop duration Purpose : 1
 TIME :13:07:25 13:30:04 22.6 (min) Region : 4040
 LOG : 7222.67 7224.01 1.3 Lon E 13°43.02
 FDEPTH: 27 30 Gear cond.: 0
 BDEPTH: 27 30 Validity : 0
 Towing dir: 0° Wire out : 110 m Speed : 3.5 kn
 Sorted : 116 Total catch: 1080.10 Catch/hour: 2861.19

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Sardinella maderensis	722.81	28307	25.26	134
Sardinella aurita	692.26	8819	24.19	135
Trachurus trecae	511.92	5642	17.89	136
Brachydeuterus auritus	33.17	4560	11.40	137
Galeoides decadactylus	221.22	2268	7.73	
Ilisha africana	115.28	2514	4.03	139
Pteroscion peli	54.20	1626	1.89	
Gymnura micrura	41.38	50	1.45	
Sepia orbignyana	41.14	74	1.44	
Cynoglossus senegalensis	33.99	24	1.19	
Ephippion guttifer	24.13	24	0.84	
Cynoglossus canariensis	20.21	24	0.71	
Pomatomus saltatrix	18.49	24	0.65	
Trichiurus lepturus	9.85	371	0.34	
Sphyræna guachancho	7.63	98	0.27	
Parapeneopsis atlantica	4.93	1181	0.17	
Raja miraletus	3.44	24	0.12	
Stromateus fiatola	3.18	24	0.11	
Dicologlossa cuneata	2.54	148	0.09	
Pseudotolithus senegalensis	2.46	24	0.09	
Penaeus notialis	2.23	24	0.08	
Lagocephalus laevigatus	1.25	50	0.04	
Sepiella ornata	0.24	74	0.01	
Selene dorsalis	0.24	196	0.01	138
Total	2861.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 33
 DATE :30/06/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 10°58.29
 start stop duration Purpose : 1
 TIME :23:13:00 23:39:41 26.7 (min) Region : 4040
 LOG : 7287.65 7289.31 1.6 Lon E 13°48.36
 FDEPTH: 13 13 Gear cond.: 0
 BDEPTH: 36 38 Validity : 0
 Towing dir: 0° Wire out : 0 m Speed : 3.7 kn
 Sorted : 106 Total catch: 4605.89 Catch/hour: 10358.07

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Sardinella aurita	10004.12	169039	96.58	140
Trachurus trecae	260.82	3726	2.52	142
Brachydeuterus auritus	50.98	686	0.49	143
Scomber japonicus	23.52	196	0.23	144
Sardinella maderensis	9.81	292	0.09	141
Penaeus notialis	4.90	99	0.05	
Trichiurus lepturus	3.91	99	0.04	
Total	10358.07		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 34
 DATE :01/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 11°11.18
 start stop duration Purpose : 1
 TIME :07:13:38 07:41:46 28.1 (min) Region : 4040
 LOG : 7349.40 7351.22 1.8 Lon E 13°47.57
 FDEPTH: 34 33 Gear cond.: 0
 BDEPTH: 34 33 Validity : 0
 Towing dir: 0° Wire out : 120 m Speed : 3.9 kn
 Sorted : 195 Total catch: 587.27 Catch/hour: 1252.62

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Trachurus trecae	472.24	6738	37.70	145
Brachydeuterus auritus	269.39	5413	21.51	149

R/V Dr. Fridtjof Nansen				SURVEY:2014405		STATION: 38	
DATE :02/07/14				GEAR TYPE: BT NO: 26		POSITION:Lat S 12°2.12 Lon E 13°42.21	
TIME	start	stop	duration	Purpose	Region	Gear cond.:	Validity
LOG	:14:32:26	15:00:09	27.7 (min)	1	4040	0	0
FDEPTH:	25	29	1.7	0	0	0	0
BDEPTH:	25	29		0	0	0	0
Towing dir:	0°	Wire out	: 110 m	Speed	: 3.7 kn		
Sorted	: 133	Total catch:	1593.12	Catch/hour:	3448.31		
SPECIES							
	weight	CATCH/HOUR	% OF TOT. C	SAMP	numbers		
Sardinella aurita	1049.61	12281	30.44	167			
Pomadasy peroteti**	813.51	3121	23.59				
Brachydeuterus auritus	562.60	30701	16.32	169			
Pomadasy rogeri**	285.71	104	8.29				
Pomadasy inciscus**	203.12	2026	5.89				
Sardinella fiatola	80.00	78	2.32				
Trachurus trecae	72.73	831	2.11	170			
Trichiurus lepturus	54.29	1610	1.57				
Lagocephalus laevigatus	42.60	130	1.24				
Ilisha africana	42.34	571	1.23	171			
Sphyræna guachancho	39.74	468	1.15				
Sardinella maderensis	38.18	935	1.11	168			
Sarda sarda	28.05	26	0.81	172			
Torpedo marmorata	24.68	26	0.72				
Raja miraletus	21.04	26	0.61				
Galeoides decadactylus	19.48	312	0.56				
Torpedo bauchotae	16.10	26	0.47				
Stromateus fiatola	14.29	26	0.41				
Pomatomus saltatrix	12.99	26	0.38				
Penaeus notialis	7.01	182	0.20				
Pteroscion pelli	4.16	130	0.12				
Pagellus bellottii	3.90	78	0.11				
Sponges - yellow	3.12	52	0.09				
Sepia orbignyana	3.12	26	0.09				
Dicologlossa cuneata	3.12	52	0.09				
Citharus linguatula	2.08	26	0.06				
Decapterus punctatus	0.78	26	0.02				
Total		3448.31	100.00				

R/V Dr. Fridtjof Nansen				SURVEY:2014405		STATION: 35	
DATE :01/07/14				GEAR TYPE: PT NO: 4		POSITION:Lat S 11°33.84 Lon E 13°36.55	
TIME	start	stop	duration	Purpose	Region	Gear cond.:	Validity
LOG	:20:36:14	20:42:19	6.1 (min)	1	4040	0	0
FDEPTH:	7456.19	7456.53	0.3	0	0	0	0
BDEPTH:	5	0		0	0	0	0
Towing dir:	0°	Wire out	: 120 m	Speed	: 3.3 kn		
Sorted	: 0	Total catch:	72.33	Catch/hour:	713.78		
SPECIES							
	weight	CATCH/HOUR	% OF TOT. C	SAMP	numbers		
Sardinella maderensis	338.49	1243	47.42	155			
Sardinella aurita	232.11	928	32.52	152			
Scomber japonicus	59.80	207	8.38	153			
Sarda sarda	40.56	39	5.68	156			
Euthynnus alletteratus	35.82	89	5.02	154			
Trachinotus ovatus	2.47	20	0.35				
Alloteuthis africana	1.58	434	0.22				
Trichiurus lepturus	1.58	10	0.22				
Sphyræna guachancho	1.28	20	0.18				
Saurida brasiliensis	0.10	30	0.01				
Total		713.78	100.00				

R/V Dr. Fridtjof Nansen				SURVEY:2014405		STATION: 36	
DATE :01/07/14				GEAR TYPE: PT NO: 1		POSITION:Lat S 11°40.72 Lon E 13°41.71	
TIME	start	stop	duration	Purpose	Region	Gear cond.:	Validity
LOG	:23:36:08	00:03:13	27.1 (min)	1	4040	0	0
FDEPTH:	7477.48	7479.23	1.8	0	0	0	0
BDEPTH:	40	49		0	0	0	0
Towing dir:	0°	Wire out	: 0 m	Speed	: 3.9 kn		
Sorted	: 0	Total catch:	150.92	Catch/hour:	334.39		
SPECIES							
	weight	CATCH/HOUR	% OF TOT. C	SAMP	numbers		
Sardinella maderensis	138.66	1130	41.47	157			
Sardinella aurita	68.88	142	20.60	158			
Trachurus trecae	44.84	228	13.41	159			
Trachinotus ovatus	40.19	443	12.02	160			
Scomber japonicus	26.68	71	7.98				
Lagocephalus laevigatus	9.66	13	2.89				
Sepia officinalis	3.12	2	0.33				
Alloteuthis africana	1.24	379	0.87				
Saurida brasiliensis	0.47	195	0.14				
Sphyræna guachancho	0.38	7	0.11				
Sphyræna sphyraena	0.27	2	0.08				
Total		334.39	100.00				

R/V Dr. Fridtjof Nansen				SURVEY:2014405		STATION: 40	
DATE :03/07/14				GEAR TYPE: PT NO: 4		POSITION:Lat S 12°29.60 Lon E 13°16.86	
TIME	start	stop	duration	Purpose	Region	Gear cond.:	Validity
LOG	:21:13:24	21:23:20	9.9 (min)	1	4040	0	0
FDEPTH:	7810.95	7811.49	0.6	0	0	0	0
BDEPTH:	391	400		0	0	0	0
Towing dir:	0°	Wire out	: 110 m	Speed	: 3.3 kn		
Sorted	: 0	Total catch:	35.34	Catch/hour:	213.53		
SPECIES							
	weight	CATCH/HOUR	% OF TOT. C	SAMP	numbers		
Sardinella aurita	111.30	779	52.12	179			
MYCTOPHIDAE	73.84	11624	34.58				
Ommastrephes pteropus	27.98	24	13.10				
Sardinops sagax	0.42	6	0.20				
Total		213.53	100.00				

R/V Dr. Fridtjof Nansen				SURVEY:2014405		STATION: 41	
DATE :04/07/14				GEAR TYPE: BT NO: 26		POSITION:Lat S 12°55.75 Lon E 13°37.02	
TIME	start	stop	duration	Purpose	Region	Gear cond.:	Validity
LOG	:08:22:18	08:54:10	31.9 (min)	1	4040	0	0
FDEPTH:	7549.44	7551.20	1.8	0	0	0	0
BDEPTH:	90	84		0	0	0	0
Towing dir:	0°	Wire out	: 250 m	Speed	: 3.3 kn		
Sorted	: 212	Total catch:	396.55	Catch/hour:	746.56		
SPECIES							
	weight	CATCH/HOUR	% OF TOT. C	SAMP	numbers		
Trachurus trecae	327.62	2559	43.88	164			
Boops boops	84.63	1222	11.34				
Saurida brasiliensis	81.24	17411	10.88				
Chelidonichthys gabonensis	56.69	623	7.59				
Dentex macropthalmus	30.35	200	4.07	161			
Sphaeroides pachgaster	17.79	40	2.38				
Sepia orbignyana	17.13	24	2.29				
Citharus linguatula	16.53	488	2.21				
Spicara alta	15.14	614	2.03				
Raja miraletus	11.73	21	1.57				
Umbrina canariensis	11.56	24	1.55	163			
Atractoscion aequidens	11.26	6	1.51				
Ilex coindetii	9.51	582	1.27				
Zeus faber	8.08	23	1.08				
Torpedo torpedo	7.61	21	1.02				
Fistularia petimba	6.29	13	0.84				
Dentex barnardi	6.19	36	0.83	165			
Chaetodon hoefleri	6.16	34	0.82				
Uranoscopus polli	6.12	17	0.82				
Octopus vulgaris	3.77	6	0.50				
Torpedo marmorata	3.46	4	0.46				
Pagellus bellottii	2.32	26	0.31				
Dentex angolensis	1.79	70	0.24	162			
Dentex congonsis	1.79	30	0.24				
Scomber japonicus	1.49	13	0.20	166			
Alloteuthis africana	0.36	79	0.05				
Total		746.56	100.00				

R/V Dr. Fridtjof Nansen				SURVEY:2014405		STATION: 41	
DATE :02/07/14				GEAR TYPE: BT NO: 26		POSITION:Lat S 12°55.75 Lon E 13°37.02	
TIME	start	stop	duration	Purpose	Region	Gear cond.:	Validity
LOG	:07:23:17	07:58:45	35.5 (min)	1	4050	0	0
FDEPTH:	7881.06	7883.16	2.1	0	0	0	0
BDEPTH:	25	32		0	0	0	0
Towing dir:	0°	Wire out	: 110 m	Speed	: 3.6 kn		
Sorted	: 93	Total catch:	943.07	Catch/hour:	1595.27		
SPECIES							
	weight	CATCH/HOUR	% OF TOT. C	SAMP	numbers		
Pomadasy inciscus	610.79	4339	38.29				
Pseudotolithus senegalensis	508.01	1324	31.84	180			
Brachydeuterus auritus	122.35	2681	7.67	187			
Selene dorsalis	67.71	945	4.24	186			
Trachurus trecae	55.67	360	3.49	183			
Pagellus bellottii	54.82	343	3.44	182			
Galeoides decadactylus	48.97	463	3.07				
Pomadasy rogeri	40.72	101	2.55	185			
Umbrina canariensis	35.57	257	2.23	184			
Atractoscion aequidens	14.94	29	0.94				
Dentex barnardi	13.57	101	0.85	181			
Sardinella maderensis	8.24	36	0.52				
Pteroscion pelli	4.63	29	0.29				
Sardinella aurita	4.30	36	0.27				
Pseudupeneus prayensis	2.74	29	0.17				
Syacium micrurum**	2.23	29	0.14				
Total		1595.27	100.00				

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 42
 DATE :05/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 13°16.13
 start stop duration Purpose : 1
 TIME :20:19:45 20:49:05 29.3 (min) Region : 4050
 LOG : 7945.63 7947.16 1.5 Gear cond.: 0
 FDEPTH: 30 50 Validity : 0
 BDEPTH: 116 116 Speed : 3.1 kn
 Towing dir: 0° Wire out : 130 m Catch/hour: 48.53
 Sorted : 0 Total catch: 23.73

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
MYCTOPHIDAE	44.54	68047	91.78	
Ommastrephes pteropus	3.39	8	7.00	
Scomber japonicus	0.53	8	1.10	
PARALEPIDIDAE	0.06	14	0.13	
Total	48.53		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 43
 DATE :06/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 13°54.63
 start stop duration Purpose : 1
 TIME :08:59:39 09:27:35 27.9 (min) Region : 4050
 LOG : 8027.87 8029.48 1.6 Gear cond.: 0
 FDEPTH: 52 79 Validity : 0
 BDEPTH: 52 79 Speed : 3.5 kn
 Towing dir: 0° Wire out : 190 m Catch/hour: 2779.66
 Sorted : 73 Total catch: 1293.93

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Pagellus bellottii	2202.19	29560	79.23	188
Sepia orbignyana	220.95	122	7.95	
Squatina sp.	178.73	69	6.43	
Dentex barnardi	54.31	412	1.95	189
Pomadasy inciscus	40.56	69	1.46	
Octopus zonatus	37.81	34	1.36	
Boops boops	18.90	137	0.68	
Caranx rhonchus	9.69	37	0.35	190
Pseudupeneus prayensis	9.62	103	0.35	
Chelidonichthys gabonensis	3.44	34	0.12	
Ephippion guttifer	2.06	69	0.07	
Loligo vulgaris	0.84	2	0.03	
Trachurus trecae	0.56	6	0.02	191
Total	2779.66		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 44
 DATE :06/07/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 14°1.81
 start stop duration Purpose : 1
 TIME :19:23:52 19:55:00 31.1 (min) Region : 4050
 LOG : 8080.26 8081.94 1.7 Gear cond.: 0
 FDEPTH: 5 5 Validity : 0
 BDEPTH: 89 68 Speed : 3.2 kn
 Towing dir: 0° Wire out : 120 m Catch/hour: 477.94
 Sorted : 0 Total catch: 247.97

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	408.28	4190	85.43	193
Pomatomus saltatrix	29.87	66	6.25	
Sardinella maderensis	17.50	69	3.66	192
Trachurus trecae	11.49	175	2.40	194
Sphyrna lewini	8.13	4	1.70	
Decapterus punctatus	1.19	42	0.25	195
Sardinops sagax	0.89	13	0.19	196
Scomber japonicus	0.56	4	0.12	
Engraulis encrasicolus	0.02	2	0.00	
Total	477.94		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 45
 DATE :07/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 14°20.28
 start stop duration Purpose : 1
 TIME :01:01:39 01:38:11 36.5 (min) Region : 4050
 LOG : 8117.10 8119.33 2.2 Gear cond.: 0
 FDEPTH: 14 14 Validity : 0
 BDEPTH: 109 113 Speed : 3.7 kn
 Towing dir: 0° Wire out : 0 m Catch/hour: 113.28
 Sorted : 0 Total catch: 68.97

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Scomber japonicus	106.37	729	93.90	197
Loligo vulgaris	5.40	5	4.77	
Sarda sarda	1.51	3	1.33	198
Total	113.28		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 46
 DATE :07/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 14°38.27
 start stop duration Purpose : 1
 TIME :08:04:32 08:28:55 24.4 (min) Region : 4050
 LOG : 8163.60 8164.90 1.3 Gear cond.: 0
 FDEPTH: 123 118 Validity : 0
 BDEPTH: 123 118 Speed : 3.2 kn
 Towing dir: 0° Wire out : 340 m Catch/hour: 667.95
 Sorted : 0 Total catch: 271.41

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	254.59	2582	38.12	203
Dentex angolensis	155.93	618	23.34	205
Dentex barnardi	70.02	251	10.48	199
Chelidonichthys gabonensis	59.61	822	8.92	
Pagellus bellottii	54.49	460	8.16	204
Trigla lyra	30.22	256	4.52	
Squatina oculata	7.75	7	1.16	
Zeus faber	7.58	20	1.13	
Dentex gibbosus	6.99	20	1.05	200
Dentex macrophthalmus	5.05	44	0.76	202
Atractoscion aequidens	3.49	5	0.52	
Umbrina canaricensis	3.20	12	0.48	201
Spherooides pachgaster	1.38	2	0.09	
Boops boops	1.16	7	0.17	
Raja miraletus	1.13	2	0.17	
Spondyliosoma cantharus	1.08	2	0.16	
Branchiostegus semifasciatus	1.01	2	0.15	
Octopus vulgaris	0.86	15	0.13	
Sepia orbignyana	0.59	2	0.09	
BATRACHOIDIDAE	0.54	2	0.08	
Citharus linguatula	0.47	15	0.07	
Brotula barbata	0.42	5	0.06	
Scomber japonicus	0.39	5	0.06	
Total	667.95		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 47
 DATE :07/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 14°59.42
 start stop duration Purpose : 1
 TIME :15:27:15 15:57:41 30.4 (min) Region : 4050
 LOG : 8210.38 8212.03 1.7 Gear cond.: 0
 FDEPTH: 62 64 Validity : 0
 BDEPTH: 62 64 Speed : 3.3 kn
 Towing dir: 0° Wire out : 190 m Catch/hour: 451.51
 Sorted : 51 Total catch: 228.99

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Pagellus bellottii	235.50	3644	52.16	207
Dentex barnardi	86.44	749	19.14	208
Trachurus trecae	46.04	554	10.20	206
Spondyliosoma cantharus	31.71	181	7.02	
Squatina oculata	18.93	8	4.19	
Myliobatis aquila	10.25	16	2.27	
Pomadasy inciscus	4.42	47	0.98	
Lithognathus mormyrus	3.94	24	0.87	
Chelidonichthys capensis	3.86	24	0.86	
Atractoscion aequidens	3.15	8	0.70	
Pomatomus saltatrix	3.00	8	0.66	
Pseudupeneus prayensis	2.60	16	0.58	
Trigla lyra	0.63	8	0.14	
Sepia orbignyana	0.55	8	0.12	
Sardinella aurita	0.24	8	0.05	
Citharus linguatula	0.24	8	0.05	
Total	451.51		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 48
 DATE :07/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 15°28.38
 start stop duration Purpose : 1
 TIME :23:24:19 23:43:34 19.3 (min) Region : 4050
 LOG : 8250.06 8251.25 1.2 Gear cond.: 0
 FDEPTH: 0 0 Validity : 0
 BDEPTH: 152 114 Speed : 3.7 kn
 Towing dir: 0° Wire out : 130 m Catch/hour: 817.75
 Sorted : 65 Total catch: 262.36

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	650.24	658	79.52	211
Etrumeus whiteheadi	60.87	1078	7.44	213
Trachurus trecae	52.61	527	6.43	210
Scomber japonicus	26.90	190	3.29	212
Sphyrna lewini	26.65	12	3.26	
Lagocephalus laevis	0.47	12	0.06	
Total	817.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 49
 DATE :08/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 15°16.72
 start stop duration Purpose : 1
 TIME :08:38:45 09:03:39 24.9 (min) Region : 4050
 LOG : 8292.88 8294.10 1.2 Gear cond.: 0
 FDEPTH: 9 9 Validity : 0
 BDEPTH: 123 121 Speed : 2.9 kn
 Towing dir: 0° Wire out : 250 m Catch/hour: 2.17
 Sorted : 0 Total catch: 0.90

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Zeus faber	1.45	2	66.67	
Trachurus trecae	0.72	7	33.33	214
Total	2.17		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 50
 DATE :09/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 15°15.08
 start stop duration Purpose : 1
 TIME :08:56:26 09:20:09 23.7 (min) Region : 4050
 LOG : 8403.64 8405.13 1.5 Gear cond.: 0
 FDEPTH: 27 31 Validity : 0
 BDEPTH: 27 31 Speed : 3.8 kn
 Towing dir: 0° Wire out : 110 m Catch/hour: 1748.80
 Sorted : 67 Total catch: 113.28

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Pagellus bellottii	1325.21	29487	75.78	216
Trachurus trecae	281.79	9172	16.11	215
Lichia amia	33.54	3	1.92	
Dasyatis marmorata	21.75	76	1.24	
Mustelus mustelus	19.63	15	1.12	
Stromateus fiatola	19.22	25	1.10	
Dentex barnardi	19.22	152	1.10	217
Loligo vulgaris	11.89	76	0.68	
Sardinella aurita	5.56	177	0.32	218
Pseudupeneus prayensis	3.79	25	0.22	
Squalus blainvillie	3.64	3	0.21	
Scomber japonicus	2.78	25	0.16	
Fistularia petimba	0.51	25	0.03	
Boops boops	0.25	25	0.01	
Total	1748.80		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 51
 DATE :09/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 15°25.68
 start stop duration Purpose : 1
 TIME :14:22:35 14:56:22 33.8 (min) Region : 4050
 LOG : 8444.82 8446.77 1.9 Gear cond.: 0
 FDEPTH: 76 78 Validity : 0
 BDEPTH: 76 78 Speed : 3.5 kn
 Towing dir: 0° Wire out : 200 m Catch/hour: 1615.70
 Sorted : 156 Total catch: 909.91

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex macrophthalmus	743.58	8937	46.02	219
Trachurus trecae	276.22	3946	17.10	225
Pagellus bellottii	139.44	1864	8.63	220
Myliobatis aquila	133.48	73	8.26	
Dentex barnardi	117.62	588	7.28	221
Atractoscion aequidens	114.10	185	7.06	223
Squalus megalops	39.54	11	2.45	
Loligo vulgaris	15.68	82	0.97	
Spondyliosoma cantharus	14.81	62	0.92	
Diplodus cervinus cervinus	11.03	11	0.68	
Pomatomus saltatrix	6.48	11	0.40	
Sardinella aurita	1.65	30	0.10	224
Etrumeus whiteheadi	1.24	41	0.08	222
Trigla lyra	0.82	11	0.05	
Total	1615.70		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 52
 DATE :09/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 15°36.42
 start stop duration Lon E 11°47.13
 TIME :19:40:30 20:08:36 28.1 (min)
 LOG : 8483.42 8489.27 1.9
 FDEPTH: 25 40
 BDEPTH: 113 118
 Towing dir: 0° wire out : 120 m
 Sorted : 0 Total catch: 135.75
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 4.0 kn
 Catch/hour: 289.86

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	221.00	1260	76.24	229
Scomber japonicus	52.44	128	18.09	226
Sardinella aurita	12.51	137	4.32	228
Etrumeus whiteheadi	2.60	38	0.90	227
Sarda sarda	1.15	2	0.40	
Sardinops sagax	0.15	2	0.05	
Total	289.86		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 53
 DATE :09/07/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 15°37.01
 start stop duration Lon E 11°57.75
 TIME :22:01:14 22:31:31 30.3 (min)
 LOG : 8499.55 8501.34 1.8
 FDEPTH: 5 5
 BDEPTH: 68 78
 Towing dir: 0° wire out : 120 m
 Sorted : 102 Total catch: 478.45
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.6 kn
 Catch/hour: 947.74

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	745.55	6192	78.67	231
Trachurus trecae	192.90	6899	20.35	230
Pomatomus saltatrix	4.83	18	0.51	
Sardinops sagax	3.90	55	0.49	232
Scomber japonicus	0.55	10	0.06	
Total	947.74		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 54
 DATE :10/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°0.89
 start stop duration Lon E 11°40.38
 TIME :07:25:35 07:37:10 11.6 (min)
 LOG : 8568.48 8569.09 0.6
 FDEPTH: 77 76
 BDEPTH: 77 76
 Towing dir: 0° wire out : 210 m
 Sorted : 122 Total catch: 213.88
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.2 kn
 Catch/hour: 1109.14

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	592.64	8857	53.43	233
Dentex macropthalmus	241.66	8899	21.79	234
Chelidonichthys capensis	65.45	1079	5.90	
Septia orbignyana	59.33	156	5.35	
Merluccius capensis	48.75	228	4.39	
Loligo vulgaris	21.57	124	1.95	
Pythoichthys micropthalmus	20.22	384	1.82	
Citharus linguatula	12.86	519	1.16	
Pomatomus saltatrix	12.55	41	1.13	
Scomber japonicus	7.57	83	0.68	235
Galappa pelii	7.36	176	0.66	
Dicologlossa cuneata	5.81	726	0.52	
G A S T R O P O D S	4.15	249	0.37	
Monolele microstoma	3.22	166	0.29	
Dentex barnardi	2.49	10	0.22	
Pagellus bellottii	1.35	21	0.12	
Etrumeus whiteheadi	1.14	21	0.10	
Boops boops	1.04	21	0.09	
Total	1109.14		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 55
 DATE :10/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°3.73
 start stop duration Lon E 11°46.53
 TIME :09:09:59 09:41:47 31.8 (min)
 LOG : 8580.38 8582.34 2.0
 FDEPTH: 28 24
 BDEPTH: 28 24
 Towing dir: 0° wire out : 110 m
 Sorted : 79 Total catch: 353.81
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.7 kn
 Catch/hour: 667.78

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	418.89	8688	62.73	236
J E L L Y F I S H	133.85	1266	20.04	
Pomatomus saltatrix	45.69	187	6.84	
Loligo vulgaris	24.12	315	3.61	
Spondylosoma cantharus	13.08	442	1.96	
Boops boops	7.81	119	1.17	
Argyrosomus hololepidotus	5.78	17	0.86	
Raja miraletus	4.68	9	0.70	
Dicologlossa cuneata	3.91	119	0.59	
Dentex barnardi	1.96	85	0.29	238
Pagellus bellottii	1.70	102	0.25	237
Pomadasy incisus	1.42	68	0.21	
Trachinus araneus	1.28	9	0.19	
Umbria canariensis	0.94	26	0.14	
Trachinus armatus	0.94	34	0.14	
Trichurus lepturus	0.94	51	0.14	
Sardinella aurita	0.60	9	0.09	
Engraulis encrasicolus	0.17	17	0.03	
Total	667.78		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 56
 DATE :10/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°11.02
 start stop duration Lon E 11°40.58
 TIME :17:51:47 18:10:18 18.5 (min)
 LOG : 8621.55 8622.68 1.1
 FDEPTH: 30 40
 BDEPTH: 57 55
 Towing dir: 0° wire out : 120 m
 Sorted : 67 Total catch: 374.83
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.7 kn
 Catch/hour: 1214.35

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	0.00	0	57.13	
Aequorea forskalea	0.00	0	42.50	
Trachurus trecae	0.00	0	0.27	255
Trachurus capensis	0.00	0	0.11	256
Total	0.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 61
 DATE :11/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°29.98
 start stop duration Lon E 11°46.45
 TIME :12:19:20 12:19:23 0.1 (min)
 LOG : 8725.49 8725.50 0.0
 FDEPTH: 17 17
 BDEPTH: 17 17
 Towing dir: 0° wire out : 110 m
 Sorted : 0 Total catch: 18.59
 Purpose : 1
 Region : 4050
 Gear cond.: 0

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	1181.37	47718	97.28	239
Etrumeus whiteheadi	21.38	483	1.76	241
Boops boops	5.70	89	0.47	
Trachurus capensis	3.21	233	0.26	240
Scomber japonicus	2.69	36	0.22	
Total	1214.35		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 57
 DATE :10/07/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 16°16.38
 start stop duration Lon E 11°33.41
 TIME :21:30:08 21:45:14 15.1 (min)
 LOG : 8646.02 8646.84 0.8
 FDEPTH: 10 10
 BDEPTH: 84 84
 Towing dir: 0° wire out : 120 m
 Sorted : 67 Total catch: 1405.32
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.3 kn
 Catch/hour: 5584.05

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus capensis	5134.29	138767	91.95	242
Etrumeus whiteheadi	287.88	6675	5.16	244
Scomber japonicus	156.04	1919	2.79	243
Trachurus trecae	5.84	83	0.10	
Total	5584.05		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 58
 DATE :10/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°22.27
 start stop duration Lon E 11°28.16
 TIME :23:52:19 00:21:20 29.0 (min)
 LOG : 8659.80 8661.51 1.7
 FDEPTH: 0 45
 BDEPTH: 398 301
 Towing dir: 0° wire out : 0 m
 Sorted : 84 Total catch: 884.53
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.5 kn
 Catch/hour: 1828.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus capensis	1812.72	34214	99.12	245
Scomber japonicus	7.61	66	0.42	246
Etrumeus whiteheadi	3.91	66	0.21	247
Mycotrophidae sp. large	2.83	1737	0.15	
Trachurus trecae	1.74	23	0.09	
Total	1828.80		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 59
 DATE :11/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°23.24
 start stop duration Lon E 11°41.44
 TIME :02:41:55 03:05:37 23.7 (min)
 LOG : 8676.81 8678.23 1.4
 FDEPTH: 0 35
 BDEPTH: 63 72
 Towing dir: 0° wire out : 0 m
 Sorted : 101 Total catch: 583.31
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.6 kn
 Catch/hour: 1476.73

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Engraulis encrasicolus	1325.04	68509	89.73	248
Etrumeus whiteheadi	137.44	5377	9.31	249
Trachurus capensis	9.70	557	0.66	252
Sardinops sagax	2.94	104	0.20	250
Scomber japonicus	1.32	30	0.09	251
Loligo vulgaris	0.30	15	0.02	
Total	1476.73		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 60
 DATE :11/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°42.20
 start stop duration Lon E 11°45.51
 TIME :09:32:22 10:01:57 29.6 (min)
 LOG : 8710.17 8711.79 1.6
 FDEPTH: 20 23
 BDEPTH: 20 23
 Towing dir: 0° wire out : 120 m
 Sorted : 0 Total catch: 140.45
 Purpose : 1
 Region : 4050
 Gear cond.: 0
 Validity : 0
 Speed : 3.3 kn
 Catch/hour: 284.89

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Pomatomus saltatrix	187.63	1502	65.86	
Stromateus fiatola	38.05	91	13.36	
Trachurus trecae	24.95	314	8.76	254
Etrumeus whiteheadi	18.13	329	6.37	253
J E L L Y F I S H	9.78	2	3.43	
Trichurus lepturus	3.31	124	1.16	
Diplodus capensis	1.68	108	0.59	
Dasyatis marmorata	0.77	2	0.27	
Loligo vulgaris	0.37	2	0.13	
Spondylosoma cantharus	0.14	4	0.05	
Pomadasy incisus	0.08	4	0.03	
Total	284.89		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 61
 DATE :11/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°29.98
 start stop duration Lon E 11°46.45
 TIME :12:19:20 12:19:23 0.1 (min)
 LOG : 8725.49 8725.50 0.0
 FDEPTH: 17 17
 BDEPTH: 17 17
 Towing dir: 0° wire out : 110 m
 Sorted : 0 Total catch: 18.59
 Purpose : 1
 Region : 4050
 Gear cond.: 0

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	0.00	0	57.13	
Aequorea forskalea	0.00	0	42.50	
Trachurus trecae	0.00	0	0.27	255
Trachurus capensis	0.00	0	0.11	256
Total	0.00		100.00	

BDEPTH: 17 17 Validity : 0
 Towing dir: 0° Wire out : 110 m Speed : 9.9 kn
 Sorted : 0 Total catch: 18.59 Catch/hour: 22308.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hyosocella	0.00	0	57.13	
Aegoreia forskalea	0.00	0	42.50	
Trachurus trecae	0.00	0	0.27	255
Trachurus capensis	0.00	0	0.11	256
Total	0.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 62
 DATE :11/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°29.67
 Longitude E 11°37.55
 TIME :15:36:12 16:05:05 28.9 (min) Purpose : 1
 LOG : 8744.66 8746.22 1.6 Region : 4050
 FDEPTH: 85 83 Gear cond.: 0
 BDEPTH: 85 83 Validity : 0
 Towing dir: 0° Wire out : 260 m Speed : 3.3 kn
 Sorted : 63 Total catch: 462.43 Catch/hour: 960.73

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex macrophthalms	389.02	11657	40.49	259
Merluccius capensis	220.18	1251	22.92	260
Trachurus trecae	210.00	3274	21.86	257
Mustelus mustelus	28.55	12	2.97	
Chelidonichthys capensis	28.21	160	2.94	
Loligo vulgaris	27.63	108	2.88	
GOBIDAE	18.76	8709	1.95	258
Trachurus capensis	9.74	698	1.01	
Synagrops sp.	9.16	1413	0.95	
Raja miraletus	8.58	15	0.89	
Sepia orbignyana	2.22	2	0.23	
Pterothrissus belloci	2.18	29	0.23	
Spondyliosoma cantharus	2.04	15	0.21	
Dentex barnardi	1.45	29	0.15	
Squalus megalops	1.18	4	0.12	
Dicologlossa cuneata	0.87	15	0.09	
Sepiella ornata	0.58	15	0.06	
G A S T R O P O D S	0.21	611	0.02	
Calappa sp.	0.15	15	0.02	
Total	960.73		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 63
 DATE :12/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°40.98
 Longitude E 11°39.47
 TIME :07:35:49 07:51:10 15.3 (min) Purpose : 1
 LOG : 8825.49 8826.30 0.8 Region : 4050
 FDEPTH: 43 43 Gear cond.: 0
 BDEPTH: 43 43 Validity : 0
 Towing dir: 0° Wire out : 150 m Speed : 3.2 kn
 Sorted : 61 Total catch: 153.52 Catch/hour: 600.08

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	373.09	9107	62.17	262
Chelidonichthys capensis	60.00	137	10.00	
Spondyliosoma cantharus	59.70	833	9.28	
Dicologlossa cuneata	37.45	1028	6.24	
Chrysaora hyosocella	15.64	109	2.61	
Umbria canariensis	13.41	579	2.23	263
Arius parkii	10.75	31	1.79	
Myliobatis aquila	9.69	12	1.62	
Trichiurus lepturus	5.47	195	0.91	
Sepia orbignyana	5.16	4	0.86	
Mustelus mustelus	4.50	4	0.75	
Dentex macrophthalms	3.52	481	0.59	261
Pterothrissus belloci	2.93	51	0.49	
G A S T R O P O D S	1.56	227	0.26	
Maja squinado	0.90	31	0.15	
Loligo vulgaris	0.31	12	0.05	
Total	600.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 64
 DATE :12/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°42.64
 Longitude E 11°31.91
 TIME :09:10:56 09:32:27 21.5 (min) Purpose : 1
 LOG : 8835.91 8837.06 1.1 Region : 4050
 FDEPTH: 102 103 Gear cond.: 0
 BDEPTH: 102 103 Validity : 0
 Towing dir: 0° Wire out : 280 m Speed : 3.2 kn
 Sorted : 79 Total catch: 681.62 Catch/hour: 1900.43

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex macrophthalms	719.92	15549	37.88	267
Trachurus trecae	389.36	7151	20.49	266
Trachurus capensis	337.44	8688	17.76	264
Merluccius capensis	187.00	1271	9.84	265
Sepia orbignyana	114.17	187	6.01	
Squalus megalops	38.36	8	2.02	
Pterothrissus belloci	38.14	583	2.01	
Loligo vulgaris	26.49	240	1.39	
Synagrops microlepis	14.58	2543	0.77	
Chelidonichthys capensis	13.77	81	0.72	
Dicologlossa cuneata	5.30	240	0.28	
Pagellus bellottii	5.30	81	0.28	
Citharus linguatula	5.30	106	0.28	
GOBIDAE	3.18	1882	0.17	
Squalus blainville	2.12	6	0.11	
Total	1900.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 65
 DATE :12/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°36.55
 Longitude E 11°28.72
 TIME :11:36:42 11:54:23 17.7 (min) Purpose : 1
 LOG : 8850.18 8851.10 0.9 Region : 4050
 FDEPTH: 113 113 Gear cond.: 0
 BDEPTH: 113 113 Validity : 0
 Towing dir: 0° Wire out : 315 m Speed : 3.1 kn
 Sorted : 0 Total catch: 690.19 Catch/hour: 2340.95

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	681.74	3968	29.12	271
Dentex macrophthalms	610.01	12007	26.06	270
Trachurus capensis	514.36	13458	21.97	269
Trachurus trecae	217.24	3436	9.28	268
Mustelus mustelus	103.62	31	4.43	
Chelidonichthys capensis	91.58	129	3.91	
Loligo vulgaris	43.75	407	1.87	
Trigla lyra	18.82	180	0.80	
Squalus megalops	10.41	24	0.44	

Pterothrissus belloci 9.16 102 0.39
 Sea urchin 8.41 509 0.36
 Etrumeus whiteheadi 8.14 153 0.35 272
 Dicologlossa cuneata 7.63 153 0.33
 Pagellus bellottii 6.31 51 0.27
 Citharus linguatula 2.82 51 0.12
 Scorpaena normani 2.11 51 0.10
 Spondyliosoma cantharus 2.31 27 0.10
 G A S T R O P O D S 1.80 153 0.08
 Starfish 0.27 27 0.01
 Synagrops microlepis 0.27 27 0.01
 Total 2340.95 100.00

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 66
 DATE :12/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°40.89
 Longitude E 11°21.28
 TIME :15:04:09 15:33:39 29.5 (min) Purpose : 1
 LOG : 8866.66 8868.29 1.6 Region : 4050
 FDEPTH: 134 0 Gear cond.: 0
 BDEPTH: 134 0 Validity : 0
 Towing dir: 0° Wire out : 360 m Speed : 3.3 kn
 Sorted : 122 Total catch: 2274.69 Catch/hour: 4626.49

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	2926.33	13767	63.25	276
Dentex macrophthalms	668.64	7188	14.45	273
Trachurus capensis	495.97	10041	10.72	274
Trachurus trecae	182.56	2473	3.95	275
Pterothrissus belloci	96.22	1216	2.08	
Squalus megalops	70.37	153	1.52	
Atractoscion aequidens	40.62	39	0.88	
Scorpaena normani	49.62	228	0.83	
Zeus faber	29.67	114	0.64	
Raja miraletus	26.62	39	0.58	
Arnoglossus imperialis	15.21	494	0.33	
Illex coindetii	10.66	75	0.23	
Trigla lyra	10.66	75	0.23	
Loligo vulgaris	4.72	191	0.10	
Chelidonichthys gabonensis	4.56	75	0.10	
PATELLIDAE	1.91	191	0.04	
Sea urchin	1.14	1	0.02	
Total	4626.49		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 67
 DATE :13/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°48.04
 Longitude E 11°40.61
 TIME :00:21:41 00:33:54 12.2 (min) Purpose : 1
 LOG : 8911.02 8911.67 0.7 Region : 4050
 FDEPTH: 25 30 Gear cond.: 0
 BDEPTH: 28 27 Validity : 0
 Towing dir: 0° Wire out : 0 m Speed : 3.2 kn
 Sorted : 0 Total catch: 103.30 Catch/hour: 507.20

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus capensis	351.26	49370	69.25	277
J E L L Y F I S H	102.27	5681	20.16	
Engraulis encrasicolus	29.62	3800	5.84	279
Chelidonichthys capensis	13.65	142	2.63	
Trachurus trecae	3.83	142	0.76	278
Loligo vulgaris	2.16	123	0.43	
Trichiurus lepturus	1.67	339	0.33	
Atractoscion aequidens	1.23	49	0.24	
Pagellus bellottii	0.49	74	0.10	
Starfish	0.49	49	0.10	
Dentex barnardi	0.49	25	0.10	
Spondyliosoma cantharus	0.25	25	0.05	
Total	507.20		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 68
 DATE :13/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 16°54.14
 Longitude E 11°39.45
 TIME :02:30:44 03:09:38 38.9 (min) Purpose : 1
 LOG : 8919.91 8922.13 2.2 Region : 4050
 FDEPTH: 0 13 Gear cond.: 0
 BDEPTH: 50 0 Validity : 0
 Towing dir: 0° Wire out : 0 m Speed : 3.4 kn
 Sorted : 59 Total catch: 175.53 Catch/hour: 270.81

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Etrumeus whiteheadi	253.87	13228	93.74	280
Engraulis encrasicolus	13.79	1194	5.09	281
Loligo vulgaris	1.67	32	0.62	
Merluccius capensis	1.20	14	0.44	282
Sardinops sagax	0.28	5	0.10	283
Total	270.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 69
 DATE :13/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°58.01
 Longitude E 11°20.31
 TIME :10:15:13 10:45:17 30.1 (min) Purpose : 1
 LOG : 8966.93 8968.59 1.7 Region : 4050
 FDEPTH: 147 148 Gear cond.: 0
 BDEPTH: 147 148 Validity : 0
 Towing dir: 0° Wire out : 430 m Speed : 3.3 kn
 Sorted : 116 Total catch: 2317.80 Catch/hour: 4624.81

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus capensis	1937.88	61656	41.90	284
Dentex macrophthalms	1433.46	12064	30.99	286
Merluccius capensis	672.83	3033	14.55	289
Atractoscion aequidens	289.72	239	6.26	287
Helicolenus dactylopterus	122.12	938	2.64	
Scomber japonicus	51.48	40	1.11	
Pterothrissus belloci	25.94	200	0.56	288
PATELLIDAE	23.55	2474	0.51	
Trachurus trecae	20.75	279	0.45	285
Thyrssites atun	19.55	40	0.42	290
Loligo vulgaris	11.97	40	0.26	
Trigla lyra	8.38	120	0.18	
Arnoglossus imperialis	3.19	239	0.07	
BUCCINIDAE	2.79	200	0.06	
Dicologlossa cuneata	1.20	80	0.03	
Total	4624.81		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 70
 DATE :13/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 16°58.75
 start stop duration Lon E 11°35.21
 TIME :13:27:27 13:53:56 26.5 (min) Purpose : 1
 LOG : 8985.76 8987.23 1.5 Region : 4050
 FDEPTH: 90 91 Gear cond.: 0
 BDEPTH: 90 91 Validity : 0
 Towing dir: 0° Wire out : 270 m Speed : 3.3 kn
 Sorted : 69 Total catch: 1571.03 Catch/hour: 3559.74

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
	weight numbers			
Trachurus capensis	1529.18	50302	42.96	291
Trachurus trecae	1137.60	13536	31.96	292
Merluccius capensis	240.75	2014	6.76	293
Argyrosomus hololepidotus	197.36	104	5.54	295
Chelidonicichthys capensis	148.78	723	4.18	
dentex macrophthalmus	90.63	2221	2.55	294
Loligo vulgaris	65.10	775	1.83	
Pterothrissus belloci	36.68	412	1.03	
Raja miraletus	23.25	52	0.65	
Dicologlossa cuneata	17.56	569	0.49	
TURBINELLIDAE (=VASIDAE)	16.54	8112	0.46	
Sponges - yellow	14.98	1396	0.42	
Arius laticutatus	13.44	52	0.38	
GOBIIDAE	10.33	2171	0.29	
Synagrops microlepis	8.27	1860	0.23	
Octopus vulgaris	7.23	104	0.20	
BUCCINIDAE	1.54	310	0.04	
PATELLIDAE	0.52	52	0.01	
Total	3559.74		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 71
 DATE :13/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 17°2.55
 start stop duration Lon E 11°44.26
 TIME :15:34:35 16:10:10 35.6 (min) Purpose : 1
 LOG : 8999.38 9001.42 2.0 Region : 4050
 FDEPTH: 19 18 Gear cond.: 0
 BDEPTH: 19 18 Validity : 0
 Towing dir: 0° Wire out : 110 m Speed : 3.4 kn
 Sorted : 0 Total catch: 354.25 Catch/hour: 597.22

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
	weight numbers			
Myliobatis aquila	212.76	76	35.62	
Arius laticutatus	70.30	371	11.77	
Aequorea sp.	56.06	368	9.39	
Callorhynchus capensis	53.36	25	8.93	
Aequorea forskalea	48.55	185	8.13	
Trachurus trecae	46.53	1045	7.79	296
Trichurus lepturus	29.84	2074	5.00	
Sepia orbignyana	11.55	8	1.93	
Argyrosomus hololepidotus	10.96	329	1.83	
Rhinobatos albomaculatus	8.77	8	1.47	
Octopus vulgaris	8.35	17	1.40	
Pomatomus saltatrix	8.01	17	1.34	
Raja miraletus	6.74	8	1.13	
Pterothrissus belloci	5.23	261	0.88	
Selene dorsalis	3.96	34	0.66	298
Stromateus fiatola	3.88	8	0.65	
Starfish	3.62	312	0.61	
Loligo vulgaris	2.36	17	0.40	
spondyliosoma cantharus	1.43	51	0.24	
Dicologlossa cuneata	1.35	51	0.23	
Cheilodactylus fasciatus	1.18	8	0.20	
Torpedo torpedo	0.93	25	0.16	
Etrumeus whiteheadi	0.59	25	0.10	297
sepiella ornata	0.51	8	0.08	
Pomadasyx incisus	0.42	8	0.07	
Total	597.22		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 72
 DATE :13/07/14 GEAR TYPE: PT NO: 4 POSITION:Lat S 17°5.12
 start stop duration Lon E 11°27.16
 TIME :18:34:11 18:50:03 15.9 (min) Purpose : 1
 LOG : 9019.13 9019.94 0.8 Region : 4050
 FDEPTH: 5 5 Gear cond.: 0
 BDEPTH: 5 5 Validity : 0
 Towing dir: 0° Wire out : 110 m Speed : 3.1 kn
 Sorted : 84 Total catch: 1069.41 Catch/hour: 4043.14

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
	weight numbers			
Sardinops sagax	3778.79	56926	93.46	299
Etrumeus whiteheadi	257.13	8529	6.36	300
Trachurus capensis	7.24	291	0.18	
Total	4043.15		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 73

DATE :13/07/14 GEAR TYPE: PT NO: 1 POSITION:Lat S 17°4.05
 start stop duration Lon E 11°20.24
 TIME :20:25:30 21:02:48 37.3 (min) Purpose : 1
 LOG : 9030.78 9032.74 2.0 Region : 4050
 FDEPTH: 50 70 Gear cond.: 0
 BDEPTH: 195 206 Validity : 0
 Towing dir: 0° Wire out : 170 m Speed : 3.2 kn
 Sorted : 32 Total catch: 96.51 Catch/hour: 155.24

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
	weight numbers			
Trachurus capensis	141.88	5136	91.39	301
Aequorea sp.	8.83	347	5.69	
Merluccius capensis	2.46	10	1.59	
Aequorea forskalea	1.83	39	1.18	
MYCTOPHIDAE	0.24	150	0.16	
Total	155.24		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 74
 DATE :14/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 17°11.79
 start stop duration Lon E 11°20.52
 TIME :08:45:18 09:32:01 46.7 (min) Purpose : 1
 LOG : 9084.17 9086.45 2.3 Region : 4050
 FDEPTH: 361 359 Gear cond.: 0
 BDEPTH: 361 359 Validity : 0
 Towing dir: 0° Wire out : 800 m Speed : 2.9 kn
 Sorted : 110 Total catch: 450.41 Catch/hour: 578.44

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
	weight numbers			
Scorpaena normani	233.03	4173	40.29	
Gadella maraldi	82.11	1783	14.20	302
Merluccius capensis	49.67	82	8.59	
Malacocephalus laevis	48.94	864	8.46	
Geryon maritae	36.11	60	6.24	
Galeus polli	26.99	347	4.67	
Nezumia aequalis	24.62	755	4.26	
Aequorea forskalea	19.82	950	3.43	
Todarodes angolensis	12.16	33	2.10	
Neoharriotta pinnata	11.79	5	2.04	
Bathynectes piperitus	10.60	385	1.83	
Chlorophthalmus atlanticus	7.13	229	1.23	
Parapandalus narval	5.03	1649	0.87	
Pterothrissus belloci	4.94	24	0.85	
Trachurus capensis	3.83	15	0.66	303
Hoplostethus cadonati	1.04	72	0.18	
Epigonus telescopus	0.57	5	0.10	
Gobioides sp.	0.05	5	0.01	
Total	578.44		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2014405 STATION: 75
 DATE :14/07/14 GEAR TYPE: BT NO: 26 POSITION:Lat S 17°12.13
 start stop duration Lon E 11°36.06
 TIME :13:44:53 14:03:35 18.7 (min) Purpose : 1
 LOG : 9107.43 9108.52 1.1 Region : 4050
 FDEPTH: 99 91 Gear cond.: 0
 BDEPTH: 99 91 Validity : 0
 Towing dir: 0° Wire out : 280 m Speed : 3.5 kn
 Sorted : 65 Total catch: 455.07 Catch/hour: 1459.34

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
	weight numbers			
Trachurus capensis	782.31	17307	53.61	306
Merluccius capensis	306.19	2110	20.98	307
Trachurus trecae	107.30	1886	7.35	305
Trachurus capensis	47.14	22	3.23	
Chelidonicichthys capensis	42.43	247	2.91	
Callorhynchus capensis	37.49	22	2.57	
Argyrosomus hololepidotus	37.04	45	2.54	
Pterothrissus belloci	18.86	224	1.29	
Gobioides sp.	11.22	2267	0.77	
Brotula barbata	10.55	112	0.72	
JELLYFISH	10.33	359	0.71	
Sponges - yellow	8.31	898	0.57	
Dicologlossa cuneata	7.86	202	0.54	
G A S T R O P O D S	7.86	965	0.54	
Atractoscion aequidens	7.18	22	0.49	
Dentex macrophthalmus	5.61	22	0.38	
Crabs - hairy	4.94	22	0.34	
Raja miraletus	4.27	22	0.29	
Synagrops microlepis	1.35	359	0.09	
Squilla mantis	1.12	45	0.08	
Total	1459.34		100.00	

ANNEX II. Length frequencies of pelagic 2

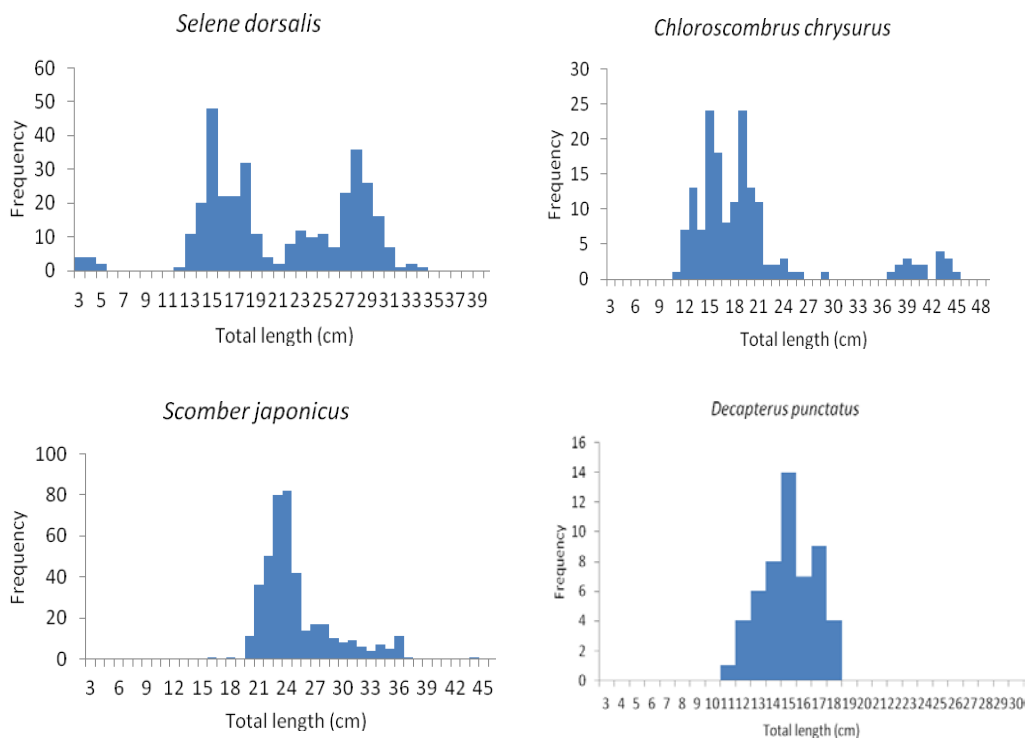


Figure 44 - Length frequencies of pelagic 2 species.

ANNEX III. Maturity stages for horse mackerel and sardinella

Table 7. Maturity stages for horse mackerel and sardinella

Stage	Maturity stage	Description
I	Immature	Small gonads, do not occupy more than 1/3 of abdominal cavity length. Ovary pinkish; testis whitish. Ovary not visible to naked eye
II	Maturing virgin and recovering spent	The gonads begin to develop, increasing substantially in size; about ½ length of the abdominal cavity. Gonads more opaque, small points visible to the naked eye (oocytes at the beginning of vitelogenese).The gonads in rest/recovery more flaccid with some more conspicuous blood than the gonads in development.
III	Mature. Before pre-spawning	At the beginning, oocytes 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. 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.

ANNEX IV. Allocation of acoustic densities to species groups.

Note that for the groups such as sardinella, horse mackerel, big-eye grunt and pilchard all encountered species are listed, while only examples are listed for the remaining groups.

Table 8. Species groups used for the acoustic scrutinizing.

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 Other mesopelagic fish	Diaphus dumerili Trachinocephalus myops
Plankton	Calanoidae Euphausiidae Other plankton	Calanus sp. Meganyctiphanes sp.

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

ANNEX V. Biomass of Sardinella and Cunene horse mackerel 1985-2014

Sardinella biomass (1 000 tons) estimated from acoustic indexes from surveys with research vessel Dr. Fridtjof Nansen from 1985-2014

Table 9. Sardinella acoustic biomass, 1985-2014

Year	Season	Dates	Survey number	South Cunene-Benguela	Central Palmerinhas-Benguela	North Cabinda-Palmerinhas	Total Cunene-Cabinda
1985	Summer	28.01-26.02	1	25	20	80	125
	Winter	08.08-10.09	3	0	70	190	260
-86	Summer	22.01-10.03	1	10	140	110	260
-89	Summer	13.02-16.03	1	40	200	60	300
-91	Winter	06.08-18.09	2	?	68	154	
-92	Winter	05.08-22.09	1	?	119	161	
-94	Winter	02.08-17.08	ANG2	**	245	290	
-95	Summer	28.02-02.04	ANG1	**	140	24	
	Winter	10.08-20.09	ANG4	?	277	297	
-96	Winter	16.07-06.09	ANG2	0	130	233	363
-97	Summer	22.02-20.03	ANG1	0	195	300	495
-98	Winter	07.05-22.05	ANG3	0	233	159	392
-99	Winter	02.08-26.08	ANG2	0	228	135	363
-00	Winter	28.07-20.07	ANG2	0	179	174	353
-01	Winter	20.07-17.08	ANG2	0	257	177	434
-02	Winter	17.08-16.09	ANG2	0	165	187	352
-03	Winter	20.07-19.08	ANG2	2	277	153	432
-04	Winter	28.07-27.08	ANG2	0	175	187	362
-05	Winter	16.07-24.08	2005408	0	148	95	243
-06	Winter	21.07-21.08	2006408	20	244	366	630
-07	Winter	07.07-10.08	2007406	55	483	187	725
-08	Winter	15.05-02.07	2008404	56	264	186	506
-09	Winter	23.05-04.07	2009406	92	232	206	530
-10	Winter	18.06-11.08	2010406	43	293	93	429
-11	Summer	20.02-20.03	2011402	96	68	96	260
-11	Winter	18.07-16.08	2011408	0	181	71	252
-12	Summer	01.03-30.03	2012402	353	230	156	739
-12	Winter	26.08-06.10	2012405	325	584	210	1119
-13	Summer	16.02-17.03	2013402	226	222	117	565
-13	Winter	20.06-17.07	2013406	10	295	117	422
-14	Summer	04.02-03.03	2014401	31	247	85	363
-14	Winter	16.06-17.07	2014405	14	272	140	427
	Average 06-14			102	278	156	536
	Average summer 2011-14			177	192	113	482
	Average winter 2010-14			98	406	158	662

Cunene Horse Mackerel biomass (1 000 tons) estimated from acoustic indexes from surveys from 1985-2014.

Table 10. Cunene Horse Mackerel acoustic biomass, 1985-2014

Year	Season	Dates	Survey number	South Cunene-Benguela	Central Palmerinhas-Benguela	North Cabinda-Palmerinhas	Total Cunene-Cabinda
1985	Summer	28.01-26.02	1	30	195	40	265
	Winter	08.08-10.09	3	50	90	40	180
-86	Summer	22.01-10.03	1	130	125	20	275
-89	Summer	13.02-16.03	1	35	55	40	130
-91	Winter	06.08-18.09	2	100	70	30	200
-92	Winter	05.08-22.09	1	98	86	80	280
-94	Winter	02.08-17.08	ANG2	**	130	120	
-95	Summer	28.02-02.04	ANG1	**	?	84	
	Winter	10.08-20.09	ANG4	70	160	110	340
-96	Winter	16.07-06.09	ANG2	140	157	63	360
-97	Summer	02.03-28.03	ANG1	163	58	18	239
-98	Winter	07.05-22.05	ANG3	118	112	37	267
-99	Winter	02.08-26.08	ANG2	124	129	68	321
-00	Winter	28.07-20.07	ANG2	92	178	63	333
-01	Winter	20.07-17.08	ANG2	64	22	3	89
-02	Winter	17.08-16.09	ANG2	118	13	31	162
-03	Winter	20.07-19.08	ANG2	120	34	12	166
-04	Winter	28.07-27.08	ANG2	32	107	90	229
-05	Winter	16.07-24.08	2005408	102	57	21	180
-06	Winter	21.07-21.08	2006408	45	77	31	153
-07	Winter	07.07-10.08	2007406	73	57	27	157
-08	Winter	15.05-02.07	2008404	29	40	0	69
-09	Winter	23.05-04.07	2009406	76	7	0	83
-10	Winter	18/06/2011	2010406	100	15	21	136
-11	Summer	20.02-20.03	2011402	55	13	0	68
-11	Winter	18.07-16.07	2011408	74	26	17	117
-12	Summer	01.03-30.03	2012402	162	135	30	327
-12	Winter	26.08-06.10	2012405	132	67	11	210
-13	Summer	16.02-17.03	2013402	60	62	15	137
-13	Winter	20.06-17.07	2013406	88	117	52	257
-14	Summer	04.02-03.03	2014401	208	77	11	295
-14	Winter	16.06-17.07	2014405	161	24	1	186
	Average 06-14			97	55	17	169
	Average summer 2011-14			121	72	14	207
	Average winter 2010-14			139	62	25	226

ANNEX VI. Instruments and fishing gear used

The Simrad EK60/18, 38, and 120 kHz scientific sounder was run during the survey for fish observation and bottom conditions. The 200 kHz was out of order at the start of the survey.

Standard sphere calibrations were carried out in Baía dos Elefantes 06.07.2013 using 64 and 60 mm diameter copper spheres and 38.1 mm tungsten carbide sphere for 18, 38 and 120 kHz, respectively. The details of the settings of the 38 kHz echo sounder were as follows:

Transceiver-2 menu (38 kHz)	
Transducer depth	5.50 m
Absorption coefficient (variable with conditions)	8.7 dB/km
Pulse length	medium (1,024ms)
Bandwidth	2.43 kHz
Max power	2000 Watt
2-way beam angle	-20.6dB
Gain	25.13 dB
SA correction	-0.55 dB
Angle sensitivity	21.9
3 dB beam width	7.01° along ship
6.98° athwart ship	
Along ship offset	0.12°
Athwart ship offset	0.02°
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 m², 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.

6	1	6	St	7°43.34'	12°31.01'	No multinet	No bottles	Yes	500	
6	2	6	St	7°42.18'	12°33.82'	No multinet	No bottles		200	
6	3	6	St	7°41.13'	12°38.41'	No multinet	No bottles	Yes	100	
6	4	6	St	7°49.97'	12°34.51'	No multinet	No bottles	Yes	50	
6	5	6	St	7°56.00'	12°31.78'	No multinet	No bottles	Yes	25	
7	1	Ambriz	St	8°00.41'	12°39.380'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
7	2	Ambriz	St	7°58.99'	12°42.650'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
7	3	Ambriz	St	7°57.30'	12°46.180'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	120	
7	4	Ambriz	St	7°55.48'	12°50.260'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
7	5	Ambriz	St	7°53.69'	12°54.680'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	80	
7	6	Ambriz	St	7°51.92'	12°58.820'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	60	
7	7	Ambriz	St	7°50.03'	13°02.940'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	25	
8	1	8	St	8°46.71'	13°12.26'	No multinet	No bottles	Yes	25	
8	1	8	St			No multinet	No bottles	Yes	50	
8	2	8	St			No multinet	No bottles	Yes	100	
8	3	8	St			No multinet	No bottles	Yes	200	
8	4	8	St	8°53.88'	12°49.98'	No multinet	No bottles	Yes	500	
9	1	Dande	St	8°25.20'	13°14.000'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
9	2	Dande	St	8°28.35'	13°05.400'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
9	3	Dande	St	8°31.32'	12°57.690'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	

9	4	Dande	St	8°33.57'	12°50.980'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
10	1	Luanda	St	8°17.28'	13°17.28'	No multinet	No bottles	Yes	25	
10	1	Luanda	St	8°46.68'	13°12.89'	No multinet	No bottles	Yes	50	
10	2	Luanda	St	8°47.28'	13°06.09'	No multinet	No bottles	Yes	100	
10	3	Luanda	St	8°47.75'	12°59.72'	No multinet	No bottles	Yes	200	
10	4	Luanda	St	8°28.71'	12°49.46'	No multinet	No bottles	Yes	500	
THE CENTRAL ANGOLA										
11	1	Palmerinh as	LDML	9°05.00'	12°58.314'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	21	
11	2	Palmerinh as	LDML	9°05.00'	12°56.52'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	36	
11	3	Palmerinh as	LDML	9°05.00'	12°51.26'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	59	
11	4	Palmerinh as	LDML	9°05.00'	12°41.52'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	425	
11	5	Palmerinh as	LDML	9°05.00'	12°31.52'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	953	
11	6	Palmerinh as	LDML	9°05.00'	12°21.52'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1353	
11	7	Palmerinh as	LDML	9°05.00'	12°11.52'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1734	
12	1	12	St	9°20.33'	13°01.02'	No multinet	No bottles	Yes	20	
12	2	12	St			No multinet	No bottles	Yes	50	
12	3	12	St			No multinet	No bottles	Yes	100	
12	4	12	St			No multinet	No bottles	Yes	200	
12	5	12	St	9°24.43'	12°36.62'	No multinet	No bottles	Yes	500	
13	1	Cabo Ledo	St	9°36.10'	13°09.15'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	

17	1	17	St	10°37.10'	13°09.15'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	
17	2	17	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
17	3	17	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
17	4	17	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
17	5	17	St	10°30.21'	13°36.88'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
18	1	18	St	10°46.75'	13°42.72'	No multinet	No bottles	Yes	50	
18	2	18	St			No multinet	No bottles	Yes	100	
18	3	18	St			No multinet	No bottles	Yes	200	
18	4	18	St	10°53.83'	13°19.45'	No multinet	No bottles	Yes	500	
19	1	19	St	11°02.05'	13°50.85'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
19	2	19	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
19	3	19	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
19	4	19	St	11°08.21'	12°28.48'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
20	1	20	St	11°21.75'	13°42.72'	No multinet	No bottles	Yes	20	
	2	20	St			No multinet	No bottles	Yes	50	
20	3	20	St			No multinet	No bottles	Yes	100	
20	4	20	St			No multinet	No bottles	Yes	200	
20	5	20	St	11°22.33'	13°24.45'	No multinet	No bottles	Yes	500	
21	1	21	St	11°39.85'	13°46.75'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	

21	2	21	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
21	3	21	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
21	4	21	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
21	5	21	St	11°39.21'	13°19.48'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
22	1	22	St	11°57.95'	13°43.72'	No multinet	No bottles	Yes	20	
22	2	22	St			No multinet	No bottles	Yes	50	
22	3	22	St			No multinet	No bottles	Yes	100	
22	4	22	St			No multinet	No bottles	Yes	200	
22	5	22	St	11°56.36'	13°22.35'	No multinet	No bottles	Yes	500	
23	1	Lobito	LBML	12°20.91'	13°28.60'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	81	
23	2	Lobito	LBML	12°20.15'	13°27.16'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	90	
23	3	Lobito	LBML	12°17.90'	13°22.20'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	370	
23	4	Lobito	LBML	12°13.00'	13°13.02'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	997	
23	5	Lobito	LBML	12°08.80'	13°04.00'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1259	
23	6	Lobito	LBML	12°04.80'	12°54.80'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1483	
23	7	Lobito	LBML	11°58.75'	12°45.45'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1837	
23	8	Lobito	LBML	11°54.80'	12°36.66'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1846	
24	1	24	St	12°32.53'	13°11.18'	No multinet	No bottles	Yes	50	

24	2	24	St			No multinet	No bottles	Yes	100	
24	3	24	St			No multinet	No bottles	Yes	200	
24	4	24	St	12°34.56'	13°16.27'	No multinet	No bottles	Yes	500	
25	1	25	St	12°43.72'	13°03.05'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	
25	2	25	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
25	3	25	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
25	4	25	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
25	5	25	St	12°36.60'	13°04.07'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
26	1	26	St	12°55.92'	12°55.92'	No multinet	No bottles	Yes	20	
26	2	26	St			No multinet	No bottles	Yes	50	
26	3	26	St			No multinet	No bottles	Yes	100	
26	4	26	St			No multinet	No bottles	Yes	200	
26	5	26	St	12°53.89'	12°49.82'	No multinet	No bottles	Yes	500	
THE SOUTHERN ANGOLA										
27	1	27	St	13°10.17'	12°47.38'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	
27	2	27	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
27	3	27	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
27	4	27	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
27	5	27	St	13°06.10'	12°41.68'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
28	1	28	St	13°21.35'	12°29.48'	No multinet	No bottles	Yes	20	

32	1	32	St	14°30.50'	12°18.30'	No multinet	No bottles	Yes	20	
32	2	32	St			No multinet	No bottles	Yes	50	
32	3	32	St			No multinet	No bottles	Yes	100	
32	4	32	St			No multinet	No bottles	Yes	200	
32	5	32	St	14°30.50'	12°12.20'	No multinet	No bottles	Yes	500	
33	1	33	St	14°48.80'	12°14.23'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	
33	2	33	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
33	3	33	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
33	4	33	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
33	5	33	St	14°47.78'	12°10.17'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
34	1	34	St	15°02.03'	12°08.13'	No multinet	No bottles	Yes	20	
34	2	34	St			No multinet	No bottles	Yes	50	
34	3	34	St			No multinet	No bottles	Yes	100	
34	4	34	St			No multinet	No bottles	Yes	200	
34	5	34	St	15°02.03	12°02.03'	No multinet	No bottles	Yes	500	
35	1	Namibe	NML	15°09.381'	12°07.827'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	130	
35	2	Namibe	NML	15°09.381'	12°04.725'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	322	
35	3	Namibe	NML	15°09.381'	11°59.554'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	133	
35	4	Namibe	NML	15°09.381'	11°49.216'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1133	
35	5	Namibe	NML	15°09.381'	11°39.000'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1780	

35	6	Namibe	NML	15°09.381'	11°17.360'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	2599	
36	1	36	St	15°26.43'	12°00.00'	No multinet	No bottles	Yes	20	
36	2	36	St			No multinet	No bottles	Yes	50	
36	3	36	St			No multinet	No bottles	Yes	100	
36	4	36	St			No multinet	No bottles	Yes	200	
36	5	36	St	15°26.43'	11°50.83'	No multinet	No bottles	Yes	500	
37	1	37	St	15°43.72'	11°53.88'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	
37	2	37	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
37	3	37	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
37	4	37	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
37	5	37	St	15°41.68'	11°41.68'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
38	1	38	St	15°59.98'	11°46.77'	No multinet	No bottles	Yes	20	
38	2	38	St			No multinet	No bottles	Yes	50	
38	3	38	St			No multinet	No bottles	Yes	100	
38	4	38	St			No multinet	No bottles	Yes	200	
38	5	38	St	15°59.98'	11°32.53'	No multinet	No bottles	Yes	500	
39	1	39	St	16°12.47'	11°28.75'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	
39	2	39	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
39	3	39	St			0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	

41	1	Ponta Albina	St	16°40.47'	11°45.75'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	20	
41	2	Ponta Albina	St	16°12.800'	11°45.850'	No multinet	No bottles	Yes	36	
41	3	Ponta Albina	St	16°12.800'	11°44.920'	No multinet	No bottles	Yes	42	
41	4	Ponta Albina	St	16°12.800'	11°43.110'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
41	5	Ponta Albina	St	16°12.800'	11°39.810'	No multinet	No bottles	Yes	61	
41	6	Ponta Albina	St	16°12.800'	11°37.030'	No multinet	No bottles	Yes	72	
41	7	Ponta Albina	St	16°12.800'	11°34.230'	No multinet	No bottles	Yes	82	
41	8	Ponta Albina	St	16°12.800'	11°32.920'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
41	9	Ponta Albina	St	16°12.800'	11°31.820'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	200	
41	10	Ponta Albina	St	16°12.800'	11°31.340'	No multinet	No bottles	Yes	347	
41	11	Ponta Albina	St	16°40.67'	11°45.75'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
41	12	Ponta Albina	St	16°12.800'	11°30.610'	No multinet	No bottles	Yes	570	
41	13	Ponta Albina	St	16°12.800'	11°30.610'	No multinet	No bottles	Yes	708	
41	14	Ponta Albina	St	16°12.800'	11°29.390'	No multinet	No bottles	Yes	850	
41	15	Ponta Albina	St	16°12.800'	11°28.240'	No multinet	No bottles	Yes	964	
42	1	42	St	16°40.67'	11°45.75'	No multinet	No bottles	Yes	20	
42	2	42	St			No multinet	No bottles	Yes	50	
42	3	42	St			No multinet	No bottles	Yes	100	

42	4	42	St			No multinet	No bottles	Yes	200	
42	5	42	St	16°32.53'	11°44.73'	No multinet	No bottles	Yes	500	
43	1	Cunene River	GML	17°12.160'	11°44.110'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	22	
43	2	Cunene River	GML	17°12.160'	11°41.210'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	50	
43	3	Cunene River	GML	17°12.160'	11°38.880'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	77	
43	4	Cunene River	GML	17°12.160'	11°35.870'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	100	
43	5	Cunene River	GML	17°12.160'	11°33.320'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	115	
43	6	Cunene River	GML	17°12.160'	11°28.180'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	150	
43	7	Cunene River	GML	17°12.160'	11°23.530'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	202	
43	8	Cunene River	GML	17°12.160'	11°22.210'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	263	
43	9	Cunene River	GML	17°12.160'	11°20.510'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	365	
43	10	Cunene River	GML	17°12.160'	11°18.530'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	500	
43	11	Cunene River	GML	17°12.160'	11°14.110'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	721	
43	12	Cunene River	GML	17°12.160'	11°10.630'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	989	
43	13	Cunene River	GML	17°12.160'	11°04.050'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	1499	
43	14	Cunene River	GML	17°12.160'	10°59.860'	0-25; 25-50; 50-75; 75-100; 100-200	5; 15; 25; 50; 75	Yes	2104	