

SURVEYS OF THE FISH RESOURCES OF ANGOLA

Cruise Report No 2/2005

**Survey of the pelagic resources
16 July – 24 August 2005**

**Institute of Marine Research
IMR
Bergen**

**Instituto Nacional de Investigação Pesqueira
INIP
Luanda**

The DR FRIDTJOF NANSEN RESEARCH PROGRAMME is sponsored by the Norwegian Agency for Development Cooperation (NORAD). The Food and Agriculture Organization of the United Nations (FAO) provide support to the Programme through Project GCP/INT/730/NOR: International Cooperation with the Nansen Programme: Fisheries Management and Marine Environment. This project is the follow-up to the Project NORAD/FAO/UNDP GLO/92/013. The Institute of Marine Research (IMR), Bergen, Norway is responsible for the implementation of the Programme in cooperation with FAO Fisheries Department and the local fisheries administrations. The aim of the Nansen Programme is to assist developing countries in fisheries research, management and institutional strengthening.

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

Area		Period	
January 1985	-	June 1986	(6 surveys)
January 1989	-	December 1989	(3 surveys)
May 1991	-	September 1992	(3 surveys)
January 1994	-	August 2004	(14 surveys)

SURVEYS OF THE FISH RESOURCES OF ANGOLA

Cruise Report No 2/2005

**Survey of the pelagic resources
16 July – 24 August 2005**

by

**Bjørn Erik Axelsen
Diana Zaera**

**N'kosi Luyeye
Filomena Vaz-Velho**

**Institute of Marine Research
P.O. Box 1870 Nordnes N-5817 Bergen
Norway**

**Instituto Nacional de Investigação Pesqueira
P.O. Box 2601 Luanda
Angola**

Bergen, 2005

This report has been revised and substitutes an earlier issued version.

TABLE OF CONTENTS

CHAPTER 1	INTRODUCTION.....	2
1.1	Objectives.....	2
1.2	Participation.....	2
1.3	Narrative.....	3
1.4	Survey effort.....	4
CHAPTER 2	METHODS.....	8
2.1	Hydrographic sampling.....	8
2.2	Fish sampling.....	8
2.3	Plankton sampling.....	9
2.4	Acoustic sampling.....	9
CHAPTER 3	OCEANOGRAPHIC CONDITIONS.....	13
3.1	Surface distribution.....	13
3.2	Standard sections.....	32
CHAPTER 4	DISTRIBUTION, SIZE COMPOSITION AND BIOMASS ESTIMATES	30
4.1	Congo River - Pta das Palmeirinhas.....	30
4.2	Pta das Palmerinhas -Benguela.....	38
4.3	Benguela - Cunene.....	47
CHAPTER 5	SUMMARY OF SURVEY RESULTS.....	52
5.1	Sardinella.....	54
5.2	Cunene horse mackerel.....	56
5.3	Conclusions.....	58
REFERENCES.....		60
Annex I	Fishing gear	
Annex II	Records of fishing stations	
Annex III	Number of fish per length class	
Annex IV	Acoustic instruments	
Annex V	Seabirds and marine mammals distribution and patterns of abundance	

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.

The main objectives of the survey were the following:

- To estimate the abundance and to map the distribution of the main commercially important pelagic and semi-pelagic fish species in Angolan waters, including the two kilt sardine species *Sardinella aurita* and *S. maderensis*, the Cunene horse mackerel *Trachurus trecae*, the Cape horse mackerel *Trachurus trachurus capensis* and other pelagic species.
- To study the biological condition of the main species, including length weight-relationships, reproductive stages and stomach fullness.
- To collect gonads, stomachs and otoliths from both horse mackerel species and to collect depth stratified samples of zoo and phytoplankton in order to continue the studies of horse mackerel feeding biology, relating stomach contents to estimated zooplankton compositions and densities.
- To map the general meteorological, hydrographical and biological conditions in the survey area by means of continuous recordings of weather data, CTD-casts (Temperature, Salinity and Oxygen), ADCP measurements (Acoustic Doppler Current Profiler) and plankton sampling along acoustical and hydrographical transect lines.
- On-the-job training for the Angolan participants on the main survey routines, including using the NAN-SIS and Hydrobase software, scrutinizing acoustical data (BEI) and producing acoustical biomass estimates.
- Visual mapping of seabirds and marine mammals.

The aim of the time series that this survey is part of is to map fluctuations in stock levels in the main pelagic species and to improve the understanding of these fluctuations in terms of the biology of the main species in relation to the environment. Pelagic management decisions for 2005 will be based on the results obtained from this survey.

1.2 Participation

The scientific staff consisted of:

From INIP, Luanda:

N'kosi LUYEYE (Team Leader 16/7–27/7), Henriette LUTUBA_NSILULU (16/7-27/7), Filomena VAZ-VELHO (Team Leader, 27/7–24/8), António BARRADAS (16/7–27/7), Bomba BAZIKA (16/7–27/7), Geraldina de ASSUNÇÃO (16/7–27/7), Miguel André ANTONIO (27/7-24/8), Pedro PANZO (27/7-24/8), Domingos PEDRO (27/7-24/8), Manuel DOMINGOS (27/7-24/8).

From CRIM, Lobito:

Vanaquissa JONICO (27/7-24/8).

From CRIM, Namibie:

Pedro TCHIPALANGA (27/7-24/8).

From University Agostinho Neto, Luanda:

José da SILVA (16/7–24/8).

Miguel MORAIS (16/7–27/7).

From Museum of Natural History, Luanda:

Esteves AFONSO (16/7–24/8).

From , R.D. Congo:

Manara KAMITENGA (16/7–27/7)

From NatMIRC, Lüderitz:

Jean-Paul ROUX (27/7–24/8).

From NatMIRC, Swakopmund:

Helvi MUPUPA (27/7-24/8), Martha UUMATI (27/7-24/8), Benedict DUNDEE (27/7-24/8).

From IMR, Bergen:

Bjørn Erik AXELSEN (Cruise leader, 16/7-24/8), Diana ZAERA (16/7–24/8), Jan Frode WILHELMSEN (16/7-24/8), Ole Sverre FOSSHEIM (16/7-27/7), Tore Mørk (27/7-24/8).

1.3 Narrative

The vessel departed Pointe Noire 16 July at 16:00 UTC and steamed south to 4°07'S where the survey started at 13:10 UTC the same day. A systematic survey track with equally spaced transect lines (6 nautical miles apart) perpendicular to the coast was followed for the duration of the survey. The surveyed area was divided into four regions:

Congo-Cabinda: the area between 4° and 5°S; ANGOLA NORTH: from Congo River to north of Pta. das Palmerinhas (6°-9°S); ANGOLA CENTRAL: the region between 9° and 13°S; ANGOLA SOUTH: the region limited by the parallel of 13°S and Cunene River (17°15'S). The Northern region was completed on the 26 July at 14:00 UTC, and the Central region was started immediately after this. The ship called on Luanda on 27 July at 16:00 UTC and departed next day 28 July at 17:30 UTC. The survey was resumed same day at 20:00 UTC. The coverage of the Central region was completed on the 04 August 10:30 and the vessel reached the end of the Southern region and the survey grid at the Cunene River outlet on 13 August at 15:30 UTC. Right after the coverage of the transboundary area between Angola and Namibia started.

The acoustic transducers (18, 38 and 120 kHz (split beam, EK500 1) and 200 kHz (single beam, EK500 2)) were calibrated on the 17 August in Baía dos Elefantes. The sampling trawls used were the small pelagic trawl, the mid-sized (15 m vertical opening) pelagic trawl fitted with the codend multisampler and the demersal trawl (5 m).

A standardized survey strategy applied in 2002 is now implemented and a systematic survey track with equally spaced transect lines (6 nautical miles, NM) perpendicular to the coast was followed.

The acoustic transects generally cover a depth range of 20-500 m. In certain areas in the central region surveying is stopped at about 50 m depth due to extreme steepness of the shelf. The shallowest part of the shelf between N'zeto and the Congo River is partly inaccessible for trawling due to oil platforms and wells. This year this region was only partly covered.

CTD sections that have been covered routinely over the past few years are included in the new, standardized survey grid. ADCP (Acoustic Doppler Current Profiler) recordings were logged continuously along specific transects of the survey track and on CTD stations. Additional CTD and ADCP stations were added on an *ad hoc* basis in each sixth transect. In these areas zooplankton samples were obtained using *Hydrobios Multinet* plankton sampler.

1.4 Survey effort

Figures 1a-c show the cruise tracks with fishing and hydrographic stations for the Congo-Cabinda - northern, central and southern regions of Angola respectively. Table 1 summarizes the survey effort by regions.

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

Area	BT	PT	Total trawls	CTD casts	Multinet stations	Log (NM)
Cabinda - Congo	0	2	2	17	3	848
Pta. Palmerinhas - Congo River	9*	11	20	61	18	1574.9
Benguela - Pta. Palmerinhas	11*	10	21	88	15	1382.2
Cunene River - Benguela	13*	20	33	85	19	1136.3
Total	33	43	76	251	55	4941.4

*One BT taken for demersal purposes, not valid

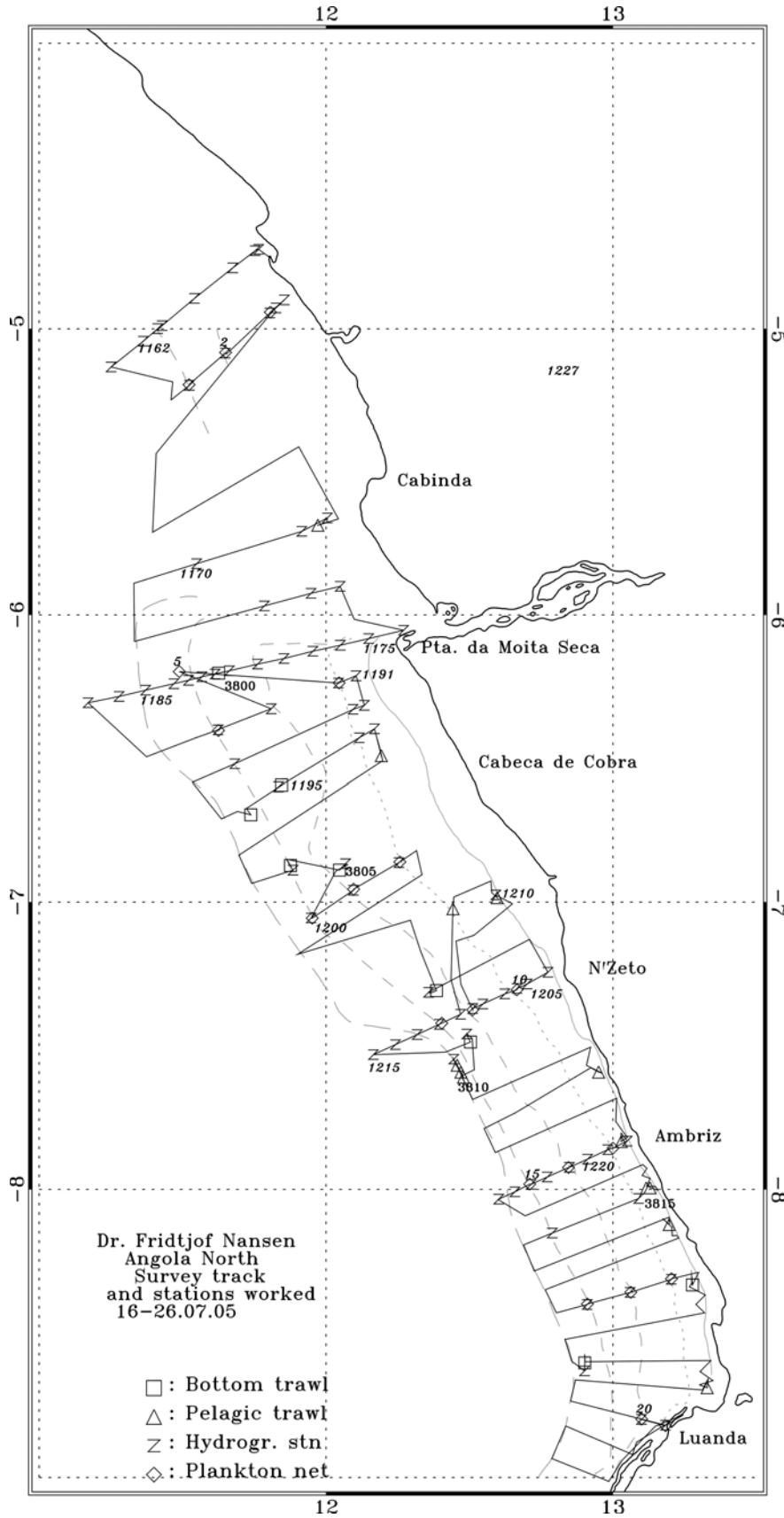


Figure 1a. Course track with fishing, plankton and hydrographic stations: Pta. das Palmerinhas- Congo River, including Cabinda. Depth contours at 20, 50, 100, 200, and 500 m.

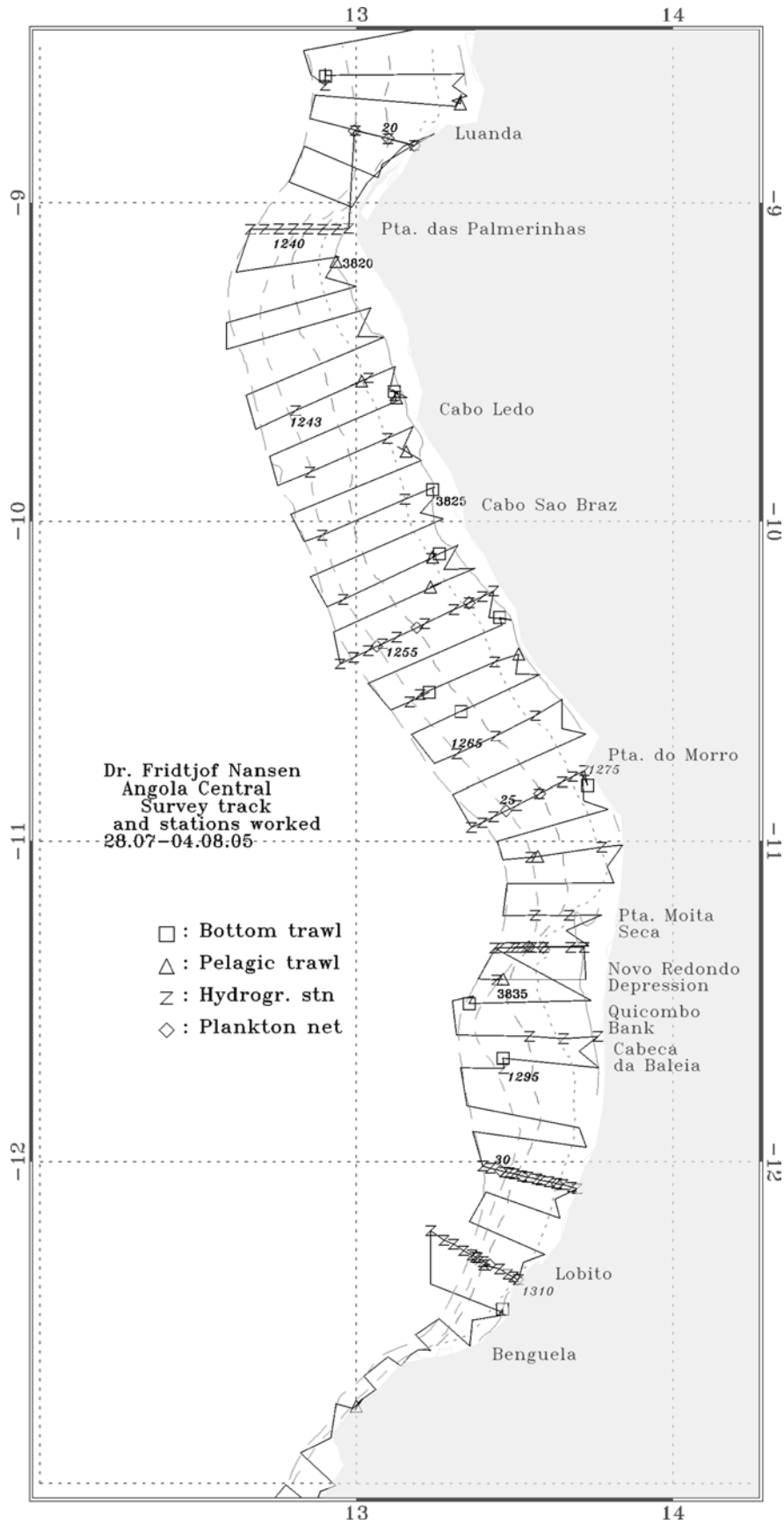


Figure 1b. Course track with fishing, plankton and hydrographic stations: Benguela -Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200, and 500 m.



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

CHAPTER 2 METHODS

2.1 Hydrographic sampling

A Seabird 911+ CTD probe was used to obtain vertical profiles of the temperature, salinity and oxygen. Real time logging was carried out using the PC based Seabird Seasave software. CTD casts were conducted along the cruise track, and *ad hoc* as deemed necessary. The casts were stopped a few meters above the bottom, and at a maximum of 500 m depth.

Measurements were carried out on CTD stations and selected transects only, using the hull-borne Acoustic Doppler Profiler (ADCP). The ADCP was set to ping every 8 seconds, the depth bins were set to 8 m and the number of bins was 40. Data were averaged at 300 seconds intervals and stored on an IBM compatible PC using Transect v. 2.70 software.

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

2.2 Fish sampling

Annex I gives a brief description of the sampling trawls. All trawl catches were sampled for species composition by weights and numbers. Records of catch rates are given in Annex II. Length frequencies were taken for the two species of sardinella, two species of horse mackerel, pilchard and some species of the Carangidae family, such as African moonfish and Atlantic bumper.

Biological samples were obtained for the two species of sardinella and the two species of horse mackerel. Total length and body weight were determined to the nearest 1 cm and 1 g below, respectively. Sex and reproductive stages were determined by means of macroscopic examination, scoring each fish according to the five-point classification scale first proposed by Holden and Raitt (1974) (Table 2).

Table 2. The five-point gonad maturity scale proposed for partial spawners by Holden and Raitt (1974). Additional information specific for Cunene horse mackerel (*Trachurus trecae*) as described by Dr. Isabel Afonso Dias during the 2001 survey are included (***bold italic***)

Stage	Maturity status	Description
I	Immature	Ovary and testis lengths about 1/rd of body cavity length. Ovaries pinkish, translucent; testis whitish. Ova not visible to the naked eye. <i>Ovary and testis quite narrow and have a tubular shape.</i>
II	Maturing virgin and recovering spent	Ovary and testis about ½ length of body cavity length. Ovary pinkish, translucent; testis whitish, more or less symmetrical. Ova not visible to the naked eye. <i>Ovary more opaque; small specks make gonad appear more granular. Testes develop lobules, hence loosing the tubular shape. Some recovering spent ovaries have conspicuous blood vessels.</i>
III	Ripening	Ovary and testis about 2/3rds length of body cavity length. Ovary pinkish-yellow colour with granular appearance, testis whitish to creamy. No transparent ova visible.

		<i>Milt can be seen inside testes when cut. Ovaries granular due to the presence of opaque oocytes. First time spawners have very swollen gonads. Ovaries that have spawned once lose consistency, but maintain the external appearance typical for this stage.</i>
IV	Ripe	Ovary and testis from 2/3rds to full length of body cavity. Ovary orange-pink in colour with conspicuous superficial blood vessels. Large transparent, ripe ova visible. Testis whitish to creamy, soft. <i>Ovaries jelly-like due to the presence of translucent oocytes. Gonads extrude oocytes or milt when gently pressed.</i>
V	Spent	Ovary and testis shrunken to about ½ length of body cavity. Walls loose. Ovary may contain remnants of disintegrating opaque and ripe ova, darkened or translucent. Testis bloodshot and slack. <i>Testes may have sperm remaining in the seminal duct. Pinkish areas appear in the periphery of the testes. Ovaries bloodshot and slack.</i>

Stomach samples of horse mackerel were collected for further analysis at INIP, Luanda. Feeding biology will be investigated in more detail at a later stage by relating the stomach contents to recorded availability of zooplankton. Gonads and otoliths were collected for *ad-hoc* examination.

2.3 Plankton sampling

Zooplankton

The zooplankton sampling was conducted by means of HYDROBIOS Multinet, at three depths, 50, 100 and 200 m, each sixth line of the survey track. The nets (405 µm) were fitted with a flowmeter to estimate sample volume. A SCANMAR depth sensor gave real-time information of the depth. The nets were opened and closed remotely from the bridge of the vessel. The samples were preserved in formalin 4%.

2.4 Acoustic sampling

Acoustic equipment

The acoustic recordings were conducted using two Simrad EK 500 echosounders (Bodholt *et al.* 1989) running keel mounted transducers at nominal operating frequencies of 18, 38, 120 (EK500 1) and 200 kHz (EK500 2). Few locations along the Angolan coast are favourable for transceiver calibration (essentially Baía dos Tigres and Baía dos Elephantes), and the survey was therefore started without *a priori* calibration. All transceivers were calibrated in Baía dos Elephantes 17 August.

Acoustic raw-data were logged on two different systems, the Sun-Unix based Bergen Echo Integrator (BEI) (Knudsen 1996) version 2000 and Sonardata Echolog® version 2.20.05. The technical specifications and operational settings of the echosounders used during the survey are given in Annex IV together with the results from the calibration in Baía dos Elephantes.

Allocation of acoustic energy to target taxii

The acoustic data were scrutinized using the post-processing module of the BEI software. Scatterers were displayed at 38 kHz, standardized to 5 NM echograms with 1 000 pings (horizontal) by 500 bins (vertical). The mean 5 NM area backscattering coefficients s_A (m^2/NM^2) was allocated to a predefined set of taxii on the basis established echogram features. Acoustic groups and respective taxii are listed in Table 3. Ground truthing and estimation of mean length and weight were accomplished by means of targeted pelagic and demersal trawling.

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

Group	Taxon	Species
Sardinella	<i>Sardinella</i> sp.	<i>S. aurita</i> <i>S. maderensis</i>
Horse mackerel	<i>Trachurus</i> sp.	<i>T. trecae</i> <i>T. trachurus capensis</i>
Pilchard	Sardinops	<i>S. ocellatus</i>
Big-eye grunt		<i>Brachydeuterus auritus</i>
Pelagic species 1	Clupeiformes ₁	<i>Ilisha africana</i> <i>Etrumeus whiteheadi</i> <i>Engraulis encrasicolus</i>
Pelagic species 2	Carangidae ₂	<i>Selene dorsalis</i> <i>Chloroscombrus chrysurus</i> <i>Decapterus rhonchus</i> <i>Seriola carpenteri</i>
	Scombridae	<i>Auxis thazard</i> <i>Sarda sarda</i> <i>Scomber japonicus</i>
	Sphyraenidae	<i>Sphyraena guachancho</i>
	Others	<i>Trichiurus lepturus</i> <i>Lepidopus caudatus</i>
Other demersal species	Sparidae ₃	<i>Dentex angolensis</i> <i>D. macrophthalmus</i> <i>D. congoensis</i> <i>D. canariensis</i> <i>D. barnardi</i> <i>Pagellus bellottii</i> <i>Sparus caeruleostictus</i> <i>S. pagrus africanus</i>
	Other taxii	<i>Saurida brasiliensis</i> <i>Arioma bondi</i> <i>Pomadasys incisus</i> <i>Galeoides decadactylus</i>
Mesopelagic species	Myctophidae ₃	<i>Diaphus dumerili</i>
	Other mesopelagic fish	<i>Trachinocephalus myops</i>
Plankton	Calanoidae	<i>Calanus</i> sp.
	Euphausiidae	<i>Meganyctiphanes</i> sp.
	Other plankton	

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

Estimation of biomass

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

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

or

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

where C_F is the conversion factor from acoustic density to fish biomass and L is the mean total fish length. This target strength function was originally established for North Sea herring, but has later been attributed to clupeids in general (Foote *et al.* 1986, Foote 1987). No specific target strength relations presently are available for the species at hand, and equation (2) has therefore been applied consequently for all targeted species in this time series. The biomass was calculated by multiplying the number of fish by the expected length at weight, estimated by regressing the log-length (total) against total weight. Separate length-weight relationships were worked for each region (north, central, south), pooling all data within each region.

The boundaries of encountered fish aggregations (post strata) were determined by means of contouring within the inner and outer zero-value limits of the transect lines. The strata contours were digitised using a CalBoard III digitising board / Atlas Draw v. 2.03 PC based software. Distribution plots and aerial calculations on the strata were carried out using IDL 5.6 for MS Windows. Sub-stratification was used to isolate areas of similar densities, using the following pre-defined, standard categories: 1: $s_A = 0-300$; 2: $s_A = 301-1\ 000$; 3: $s_A = 1\ 001-3\ 000$; 4: $s_A > 3\ 000$.

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

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

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

Cabinda and the northern region

From Point Noire to north off Cabinda (Chinga, 5°15'S), the wind condition shows a calm weather while between Cabinda and Congo River's mouth, the south easterly trade wind was relatively strong (with about 10 knots) dominating over the survey area (Figure 3a). South of Congo River, there was also a moderate strong wind (around 10 knots) flowing northward, except off Ponta Moita Seca, where a condition of wind relaxation (1 – 2 m/s) was observed along the survey track. Around Cabeça de Cobra there was a similar wind pattern like last year. From Luanda to Ambriz, the wind direction became progressively concentrated southeast and the recorded velocities increased to 18 knots (9.5 m/s).

The sea surface temperature and sea surface salinity (taken at 5m depth) are shown in Figures 4a and 5a. The large-scale distribution was dominated by an intensive upwelling process observed from south of Pointe Noire to south of Cabinda and from Cabeça de Cobra to Luanda, exhibiting low temperatures (19°- 20°C) and high salinities (35.6 – 35.8 psu). This phenomenon is abruptly interrupted by the intrusion of warm water from Congo River and offshore, a usual feature observed in the Congo River mouth at this time of the year. On a meso-scale, the isotherms were oriented alongshore, often revealing pools of colder waters confined to the inshore areas. The cold water pools observed inshore on the SST maps in the south coincides with the strong wind event oriented alongshore showing the impact of the wind-driven coastal upwelling process in the Angolan water during the southern winter, except at Pointe Noire zone with rather calm wind conditions (Figure 3a).

Central Region

In the central region, Pta. das Palmerinhas-Benguela (Figures 4b and 5b), temperatures values between 17°C and 21°C, and salinities between 35.6 and 35.7 psu. Along the coast, cells of cold water were observed with temperature values of 17-18°C, indication of an upwelling process. The salinity is a most conservative parameter, but influence of freshwater runoff can be seen off Pta. das Palmerinhas, bellow Cabo de São Braz and Pta. do Morro, with values of 35.6 psu.

Southern Region

In the southern region, south of Benguela–Cunene River (Figures 4c and 5c), where the shelf is narrow, the surface temperature from Benguela and Tombua ranged between 15-17° C and the surface salinity between 35.5 and 35.7 psu. The strong horizontal gradients of temperature and salinity corresponding to the Angola-Benguela front can be seen north of Cape of Santa Marta. In the southern area (off Baía dos Tigres) the temperature decreases until 14°C and the salinity values are around 35.4 psu. This indicates that the upwelled waters dominated the area.

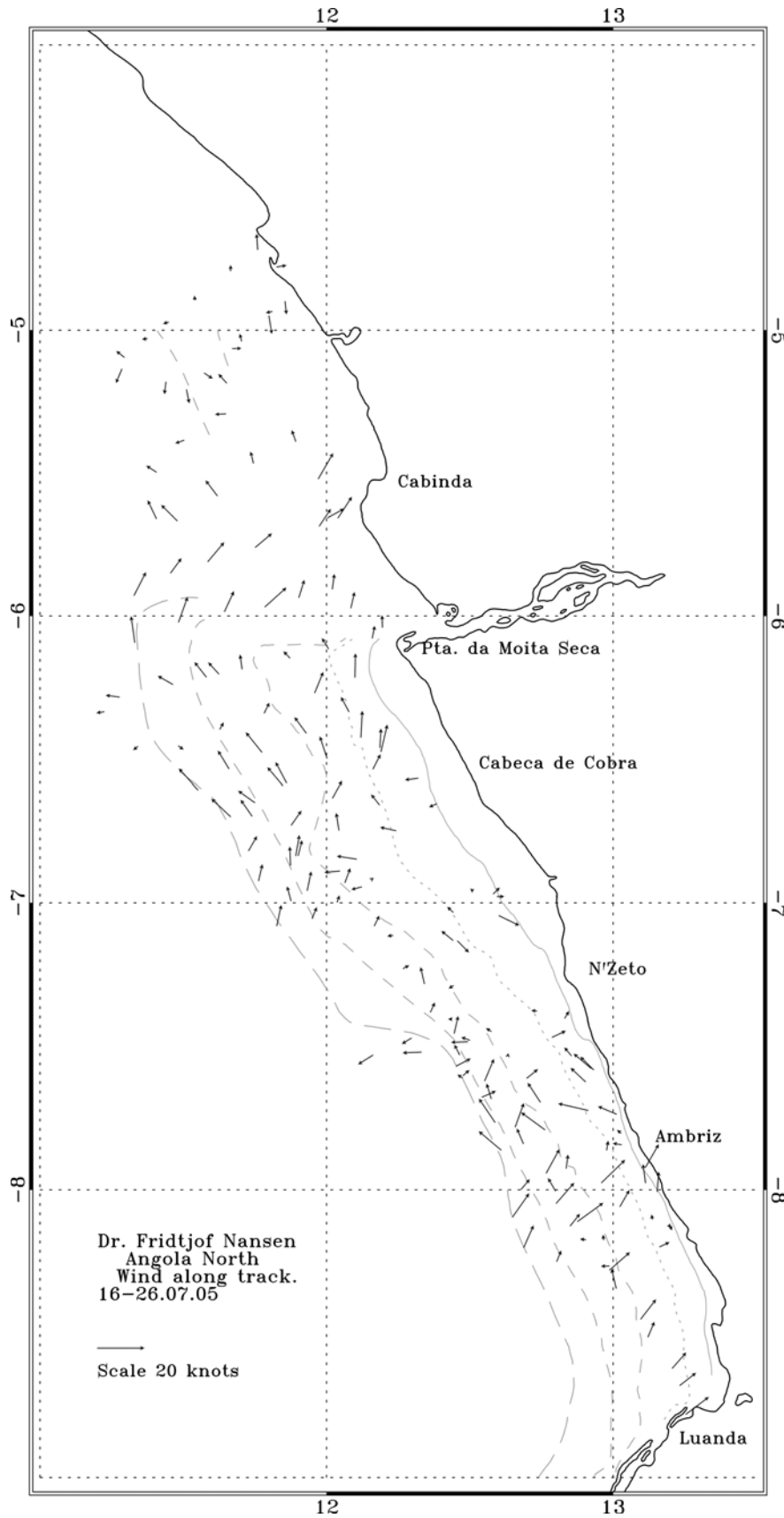


Figure 3a. Distribution of wind velocities along the survey track for the northern region, including Cabinda. Depth contours at 20, 50, 100, 200, and 500 m

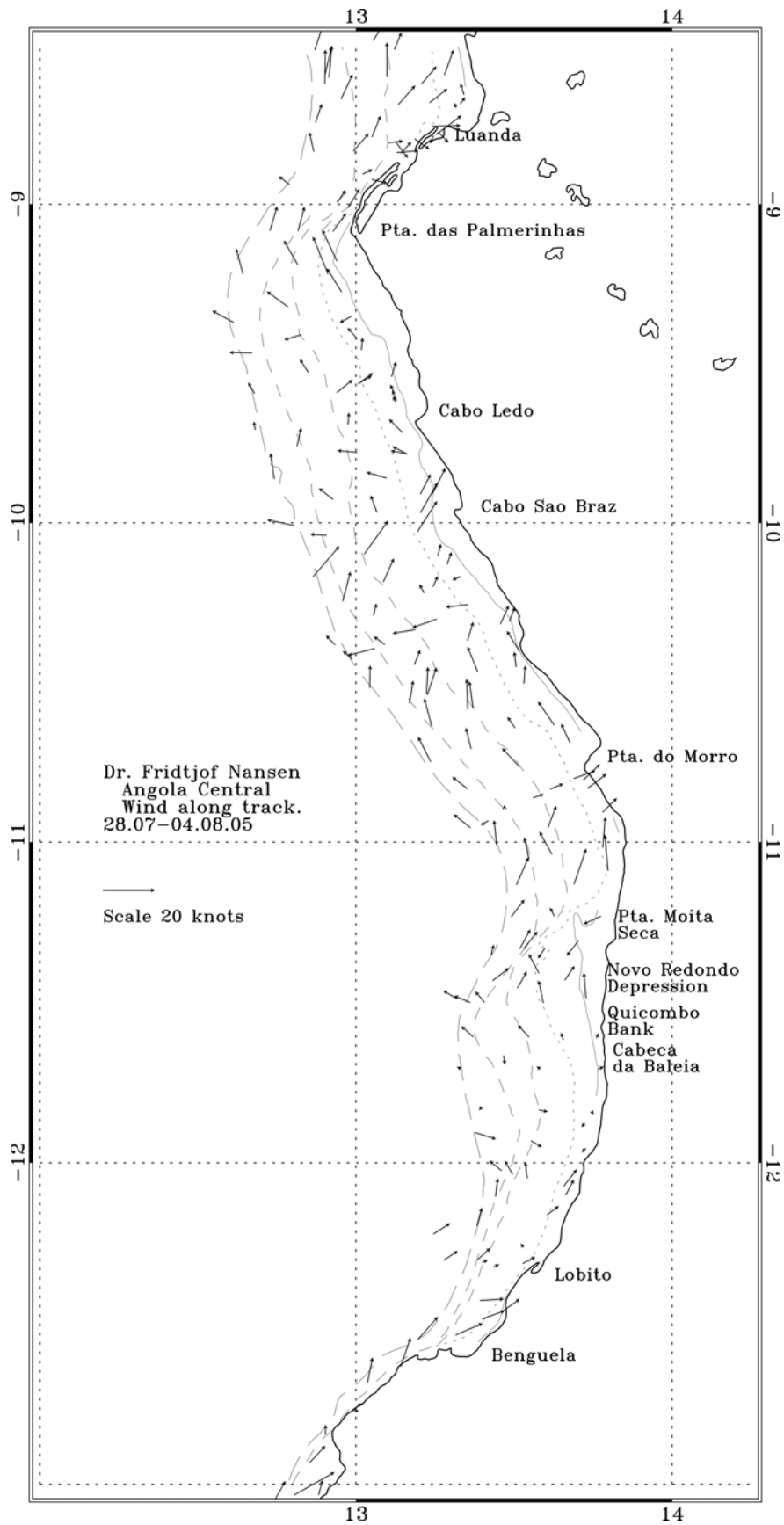


Figure 3b. Distribution of wind velocities along the survey track for the central region. Depth contours at 20, 50, 100, 200, and 500m

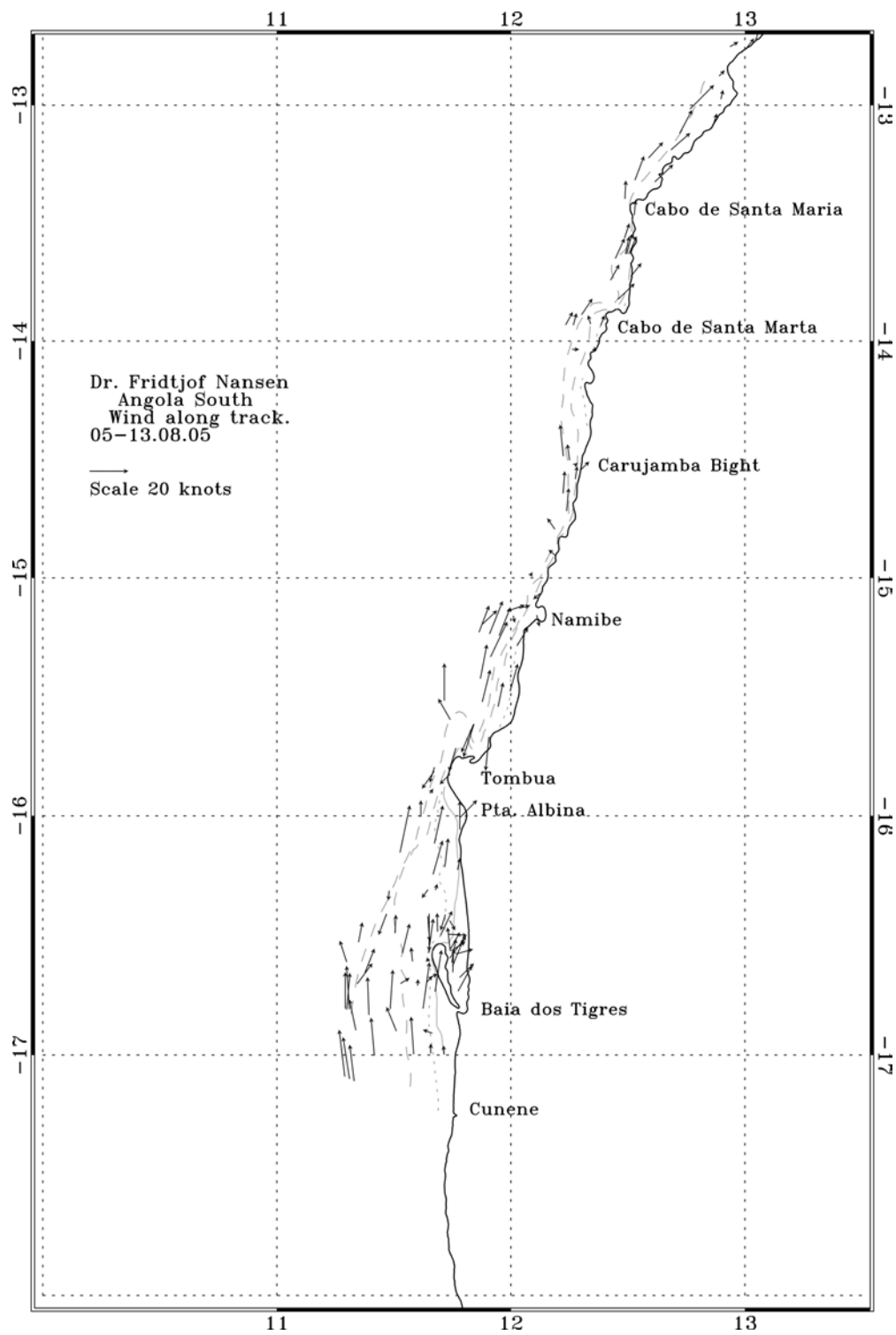


Figure 3c. Distribution of wind velocities along the survey track for the southern region. Depth contours at 10, 20, 50, 100, 200 and 500 m.

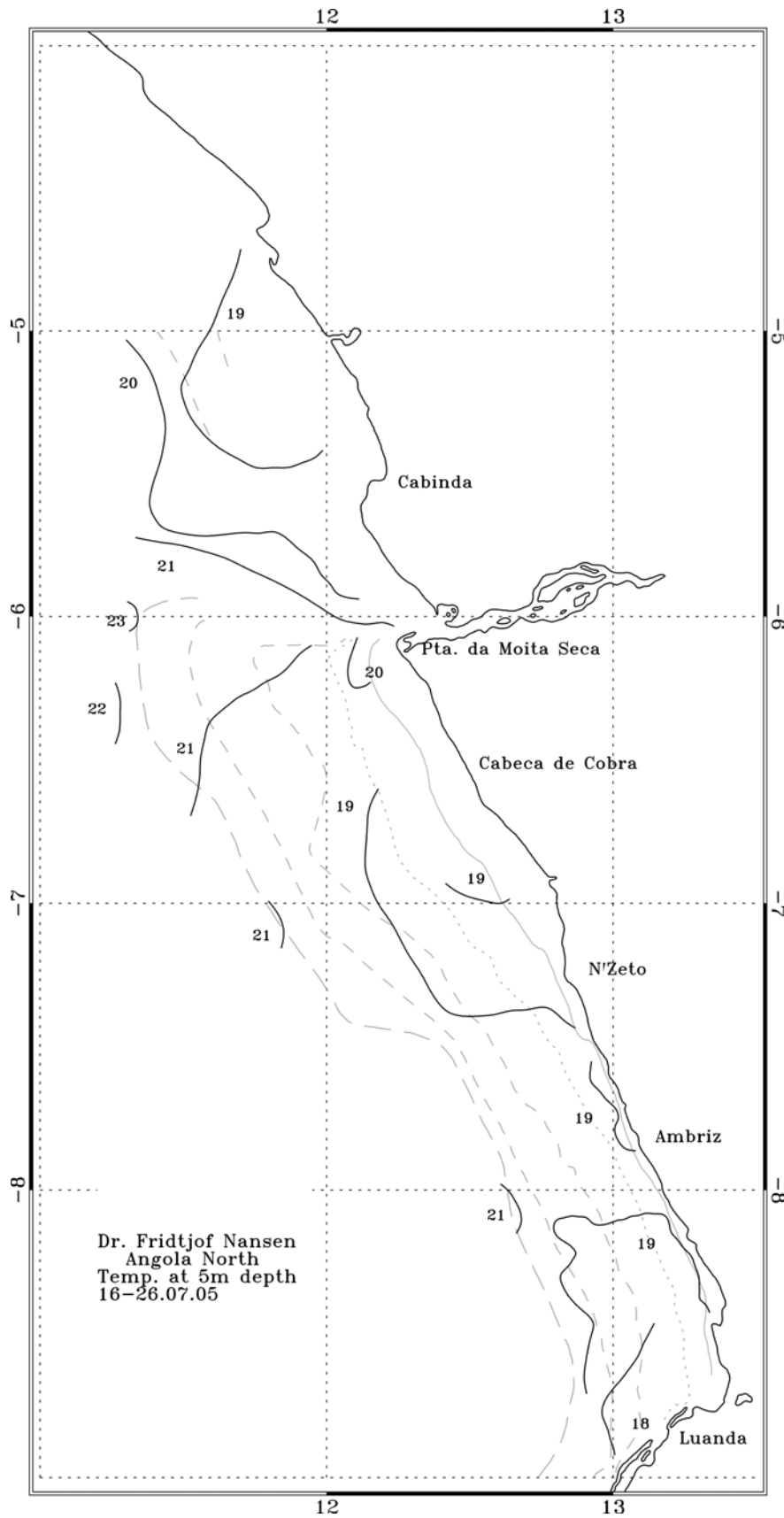


Figure 4a. Distribution of water temperatures (°C) at 5m depth in the northern region, including Cabinda. Depth contours at 20, 50, 100, 200, and 500 m.

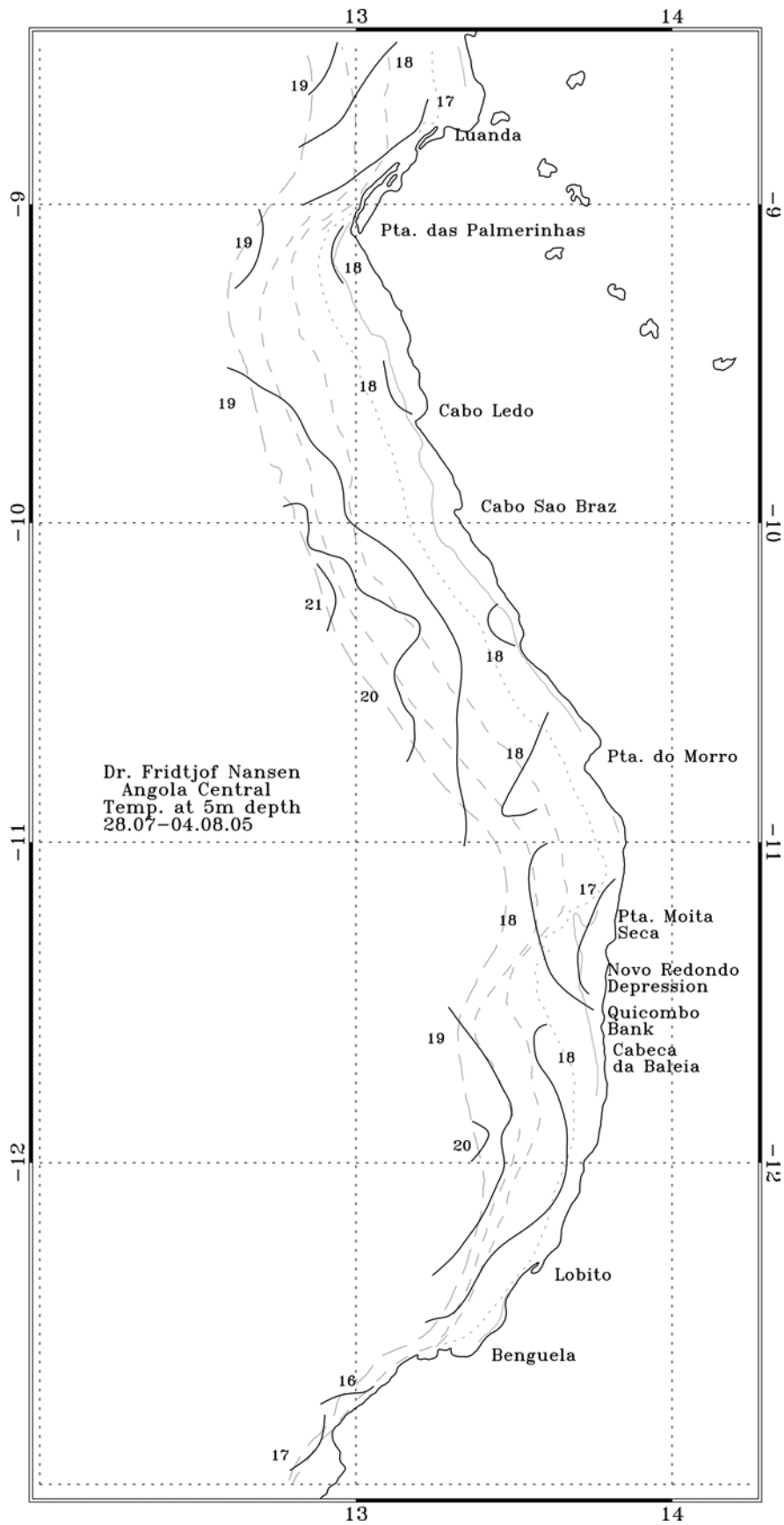


Figure 4b. Distribution of water temperatures ($^{\circ}\text{C}$) at 5m depth in the central region. Depth contours at 20, 50, 100, 200, and 500 m.

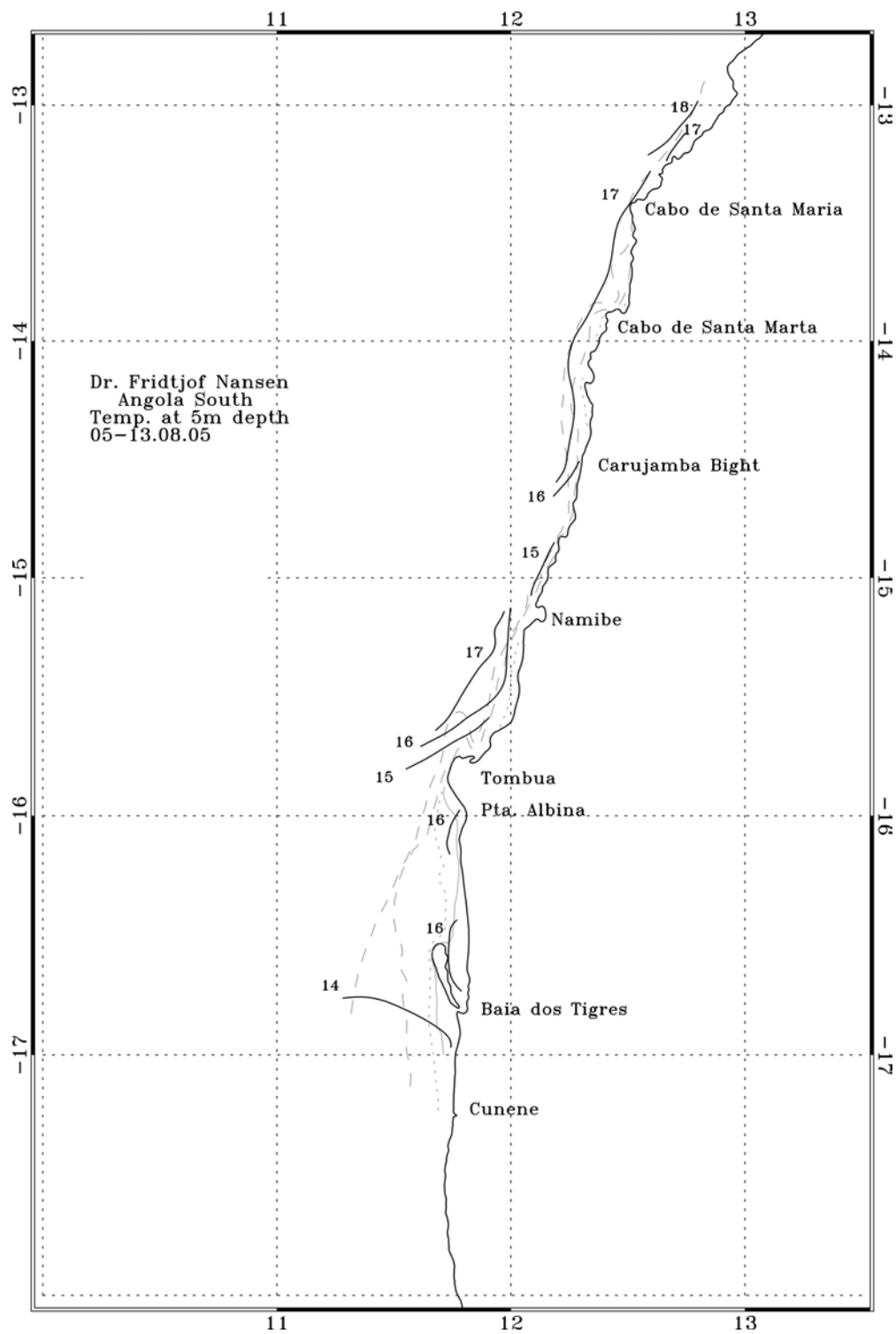


Figure 4c. Distribution of water temperatures (°C) at 5m depth in the southern region. Depth contours at 20, 50, 100, 200, and 500 m.

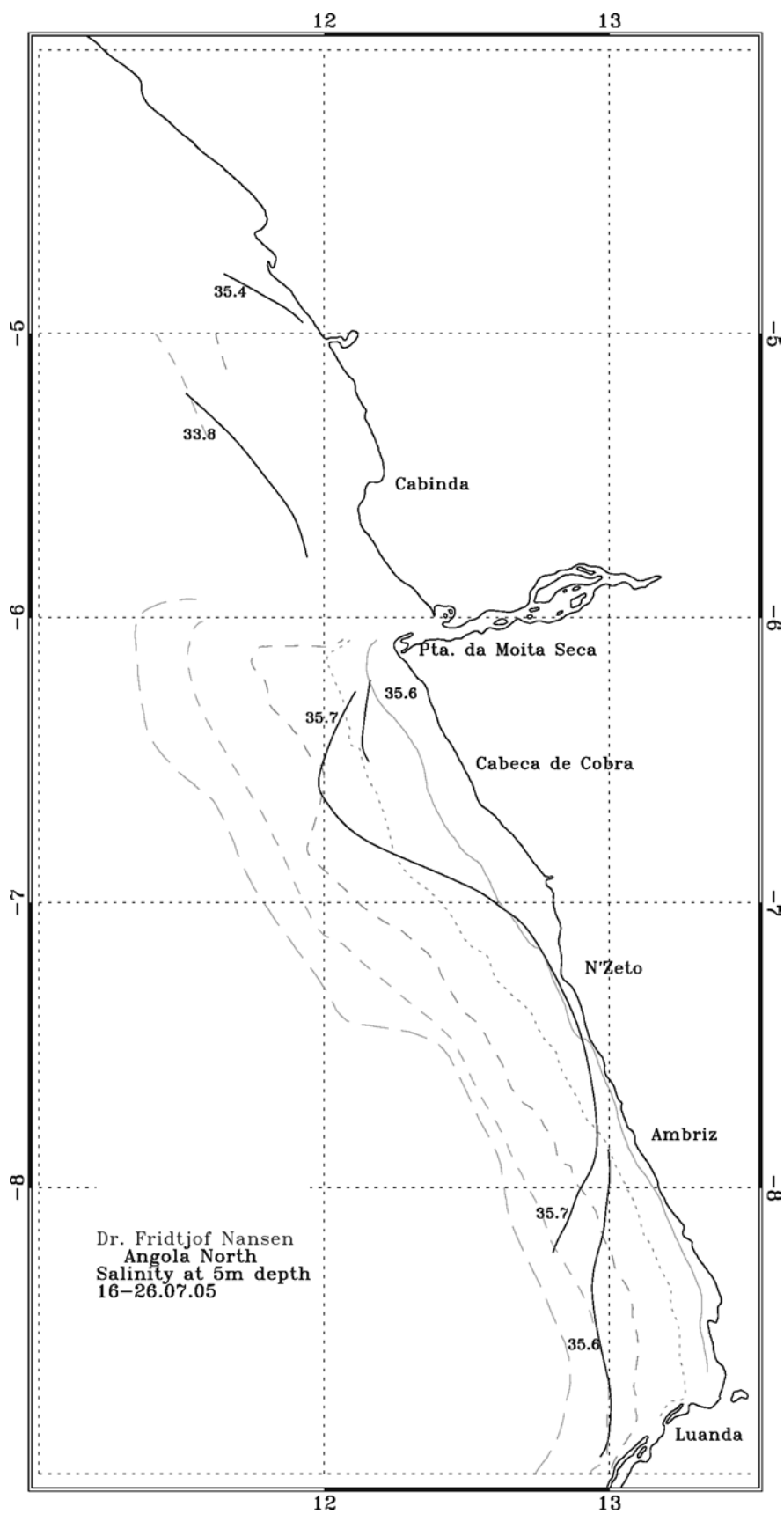


Figure 5a. Distribution of water salinity at 5m depth in the northern region. Depth contours at 20, 50, 100, 200, and 500m.

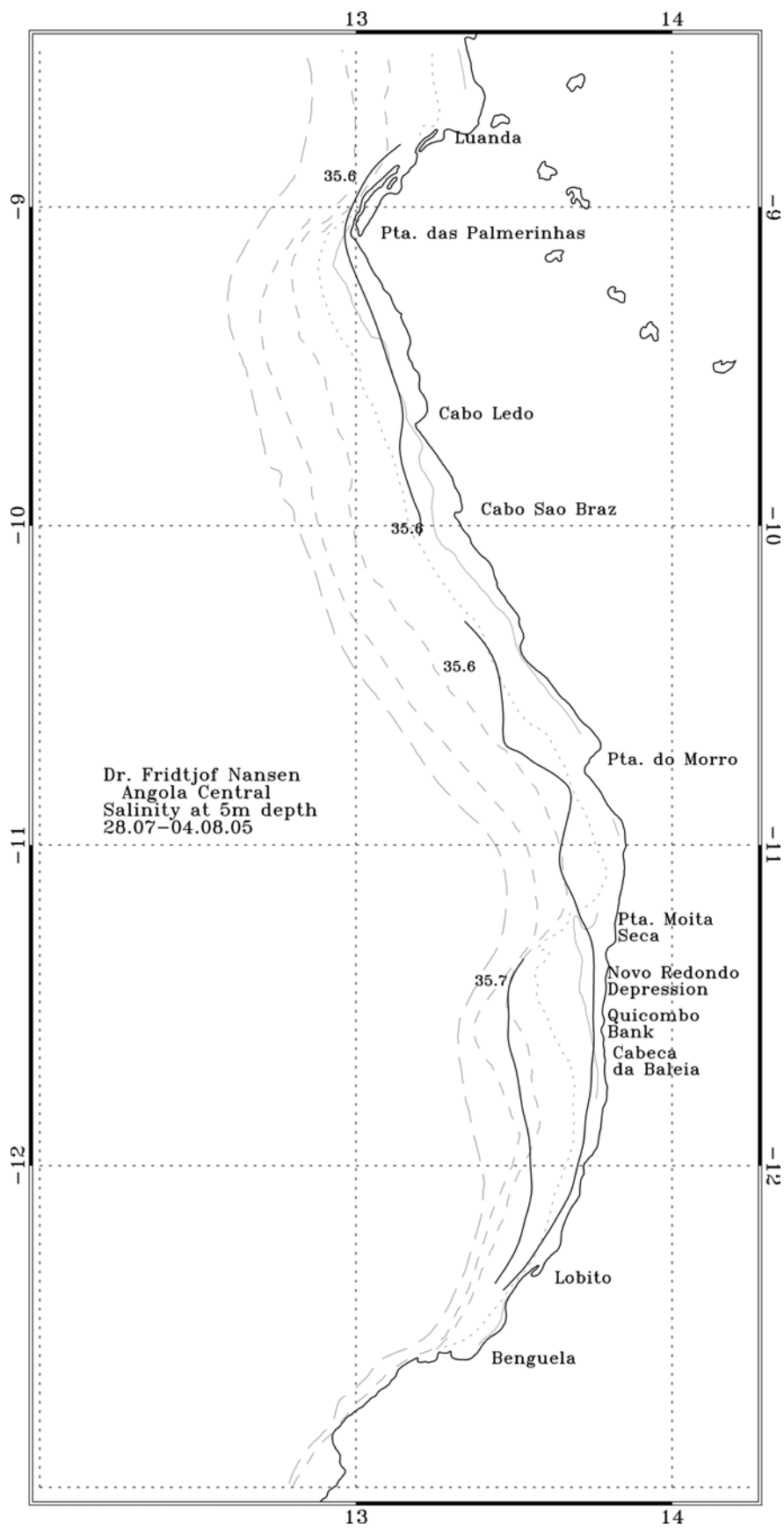


Figure 5b. Distribution of water salinity (psu) at 5m depth in the central region. Depth contours at 20, 50, 100, 200, and 500 m.

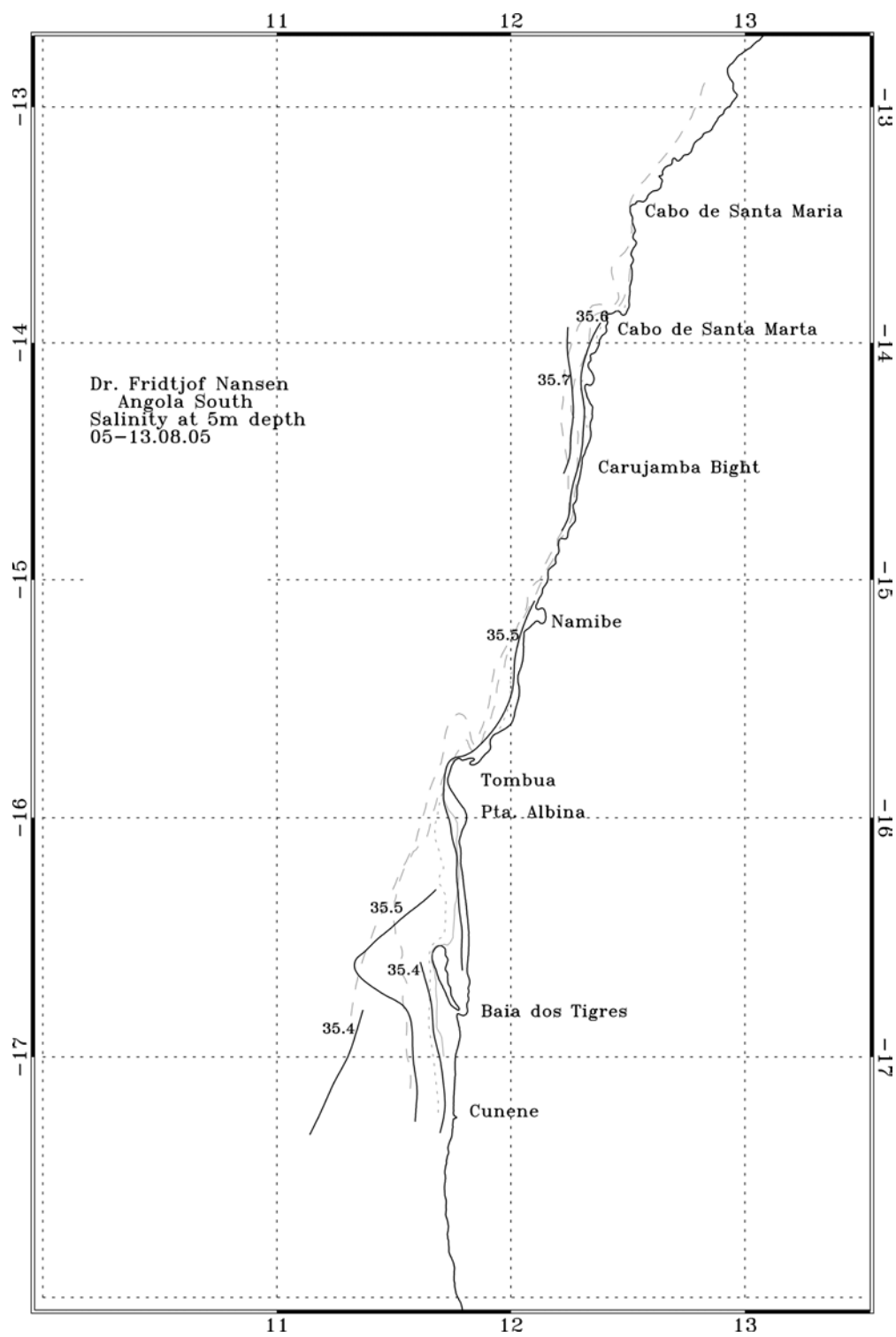


Figure 5c. Distribution of water salinity at 5m depth in the southern region. Depth contours at 20, 50, 100, 200, and 500 m.

3.2 Standard sections

Figure 6a shows the section located south off **Pointe Noire** (4°01'S). The surface temperature was 20°C, and the thermocline was at about 20m depth offshore. Salinity varied from 35.0 to 35.6 at the surface, increasing to 35.8 psu from 25m to 60m and then decreasing to below 35.6 psu at 120m. This section confirms the presence of a mixing process in the upper 20 meters and the isolines toward the surface suggest that a weak process of coastal upwelling was taking place. The dissolved oxygen revealed an abrupt drop in values from 3-5 ml/l near the surface to less than 2 ml/l below from 30m to 130m depth.

The vertical distribution of temperature, salinity and oxygen off **Moita Seca**, (6°04'-7°40'S, Figure 6b) shows the presence of low salinity content ($S < 32$) close to the mouth of Congo River while the highest values of temperature (21°C) and salinity (35.6) were found in the continental slope. Although during the winter season it is expected some discharge of fresh water offshore, the salinity diagram shows that the region of fresh, low salinity water is confined to a 10 m-thick layer, extending only some 15-20 NM offshore.

In the section off **Ambrizete** (Figure 6c), distributions of oceanographic parameters are very similar at the above sections, indicative of an upwelling event. As observed from the horizontal temperature distribution, in the station 1206 a gyre occurs with the lowest values of temperature and salinity. It was also observed an abrupt decrease in oxygen values (< 2 ml/l) nearly at the surface at the same station.

Section off **Ambriz**, (7°49'-9°60'S, Figure 6d). At the surface the temperature increased from 19°C inshore to 20.4°C offshore, while salinity reached values of 35.7. The thermocline and pycnocline were located at the same depth (20 m) coinciding with the vertical salinity maximum. As in all transects, the observations also revealed an abrupt drop in oxygen values from 3-5 ml/l near the surface to less than 2 ml/l at 50 m depth.

The section off **Pta. das Palmerinhas** (Figure 6e) shows a strong stratified mixed layer up to 30 meters depth, with variation of the temperature and salinity between 20°-17°C and 35.6–35.1. The thermocline is observed at about 10-15 meters. Oxygen concentration drops in value from 5 ml/l to 2 ml/l at 30 meters depth. The layer of low oxygen appears below the 200m, where values are below 1 ml/l.

South Cabo São Braz (Figure 6f). We found a well-mixed layer from the surface to 15m depth, with temperatures of 20°C and salinities of 36.0. The thermocline and halocline develop below the 15 m. The oxygen values reach a maximum at the surface (4 ml/l). The layer of low oxygen appears shallower than in the northern stations.

Figures 6(g to j) shows the vertical distributions of temperature, salinity and oxygen of the four sections worked out in the central region during the survey: off **Ponta do Morro**, **Novo Redondo**, **Ponta do Egito** and **Lobito**. In this region, the stratification is not well pronounced. The surface temperature is 20°C and the salinity is about 35.8, decreasing toward to the coast. The thermocline and halocline are below 10 m. Signal of weak upwelling is observed in Novo Redondo, Ponta do Egito and Lobito, as manifested on the upward tilt of the isolines.

The **Namibe** section (Figure 6k) displays a similar temperature and salinity distribution than the previous sections. The surface temperature varies from 16 to 18°C, with decreasing values towards to the coast. The salinity also decreases towards to the coast, with values between 35.9-35.6. The thermocline and halocline are below the 10 meters. A weak upwelling is observed in this profile. The layer of low oxygen (1 ml/l) was found offshore at the shelf break, at depths below 200 m.

The sections off **Ponta Albina**, **Baía dos Tigres** and **Cunene River** (Figures 6l-n), are the most southern profiles in Angola. The vertical profiles (temperature, salinity, oxygen) exhibit the presence of upwelling. The surface temperatures are lower than elsewhere off Angola, with values of 14-15°C and a surface salinity of 35.4-35.5. The layer of low oxygen appears below the 100 m.

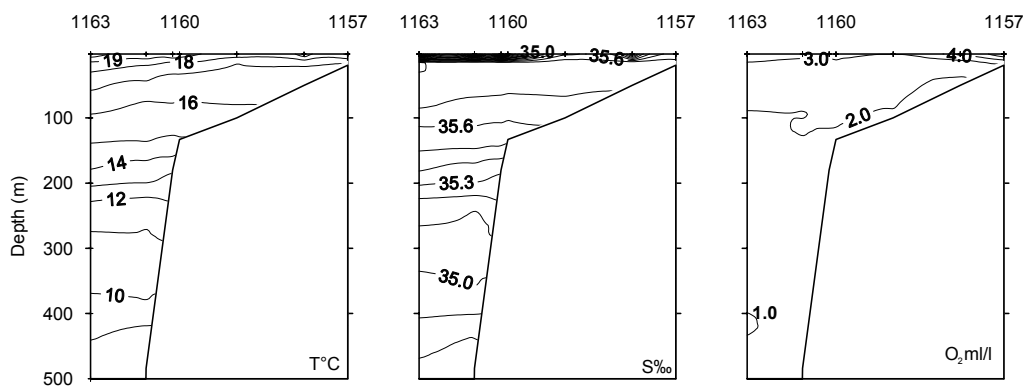


Figure 6a Vertical sections of temperature, salinity and oxygen off Pointe Noire.

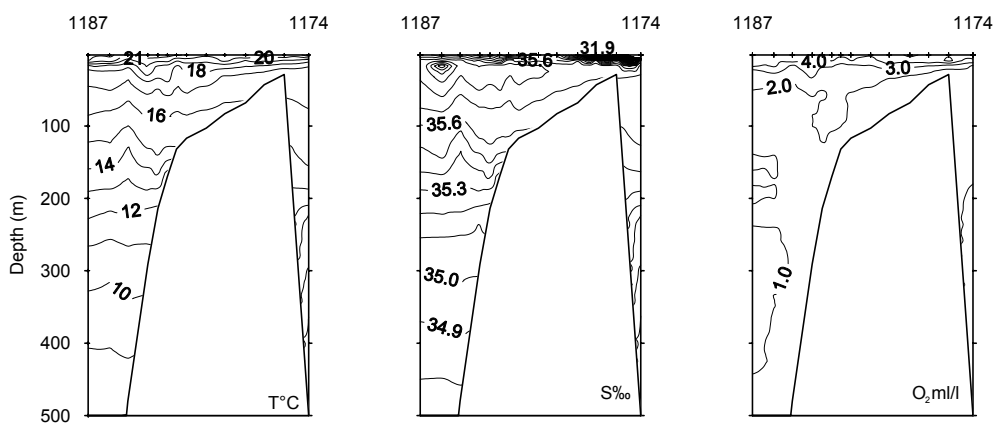


Figure 6b Vertical sections of temperature, salinity and oxygen off Pta. da Moita Seca.

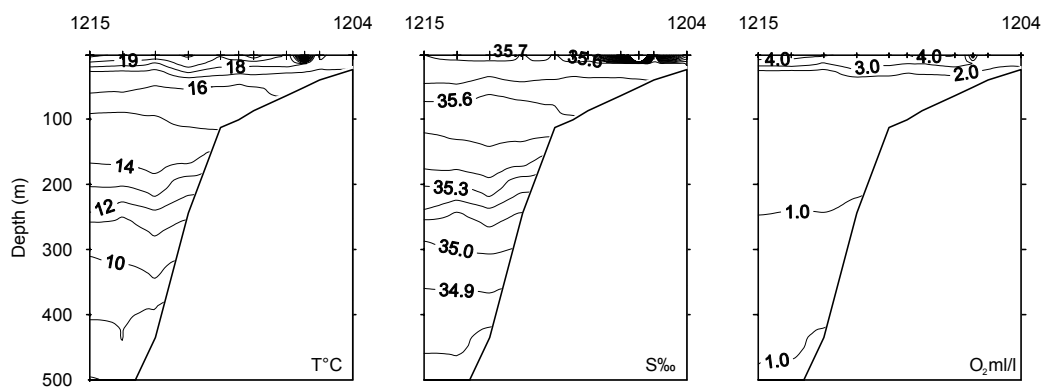


Figure 6c Vertical sections of temperature, salinity and oxygen off Ambrizete.

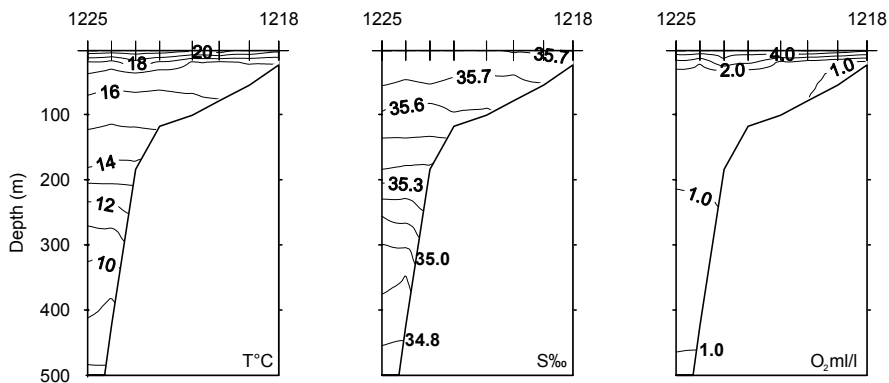


Figure 6d Vertical sections of temperature, salinity, and oxygen off Ambriz.

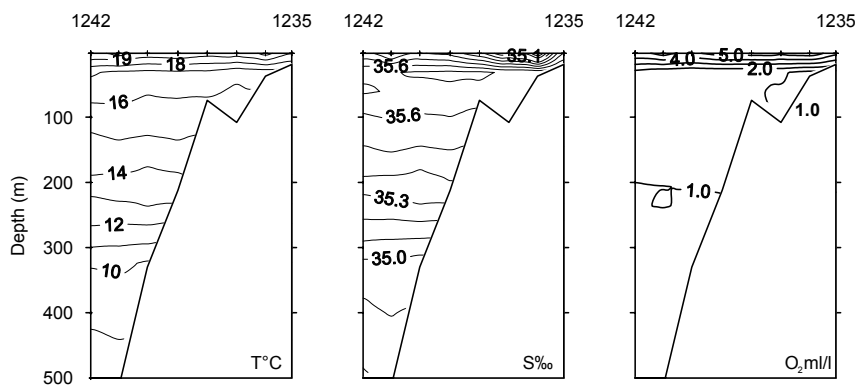


Figure 6e Vertical sections of temperature, salinity and oxygen off Pta. das Palmerinhas.

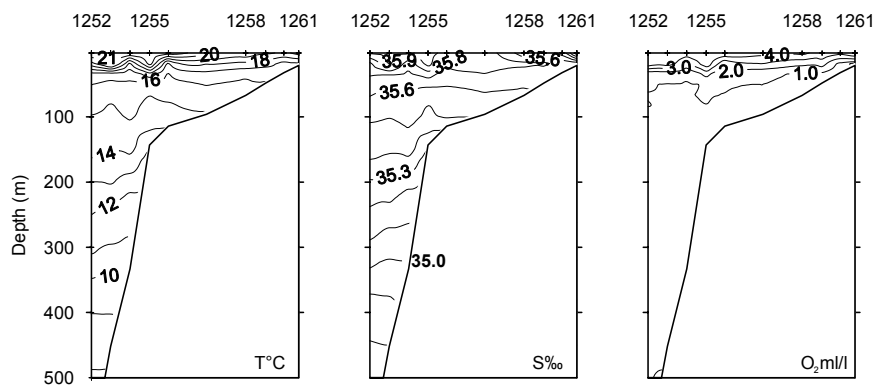


Figure 6f Vertical sections of temperature, salinity and oxygen off south Cabo São Braz.

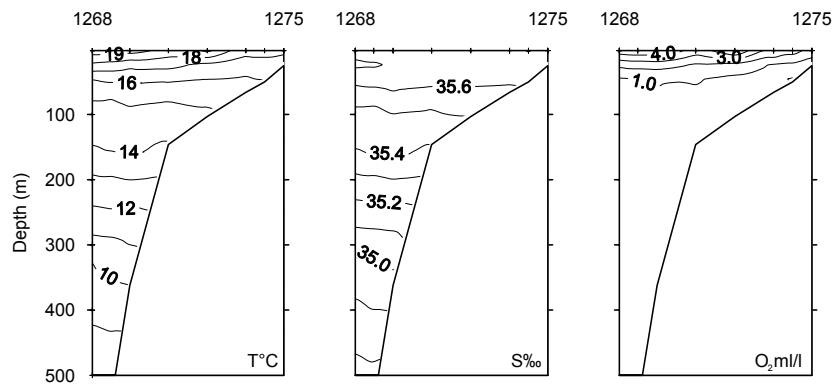


Figure 6g. Vertical sections of temperature, salinity and oxygen off Pta. do Morro.

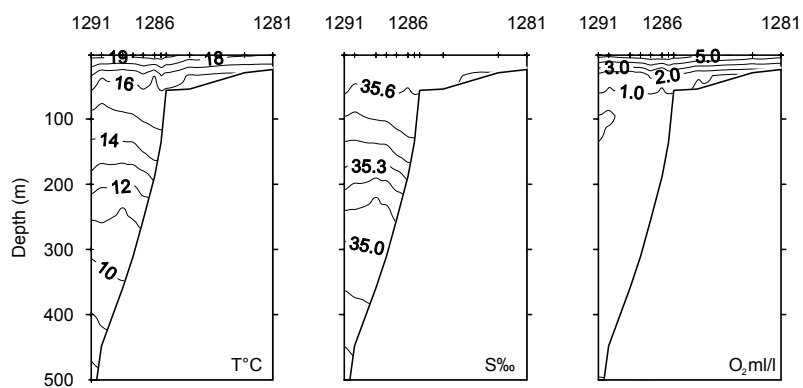


Figure 6h. Vertical sections of temperature, salinity and oxygen off Novo Redondo.

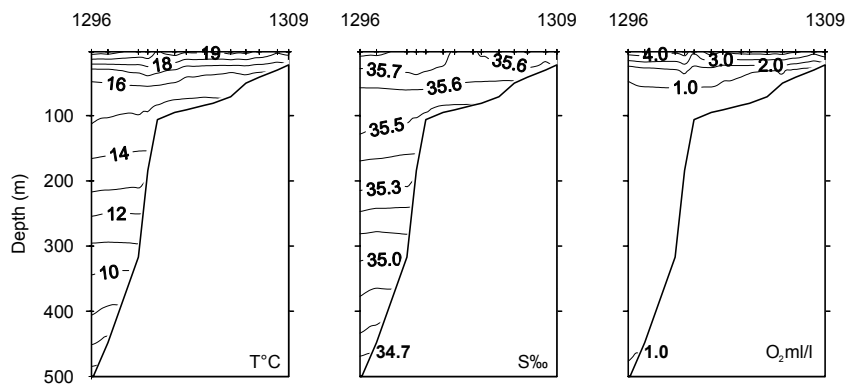


Figure 6i. Vertical sections of temperature, salinity and oxygen off Ponta do Egito.

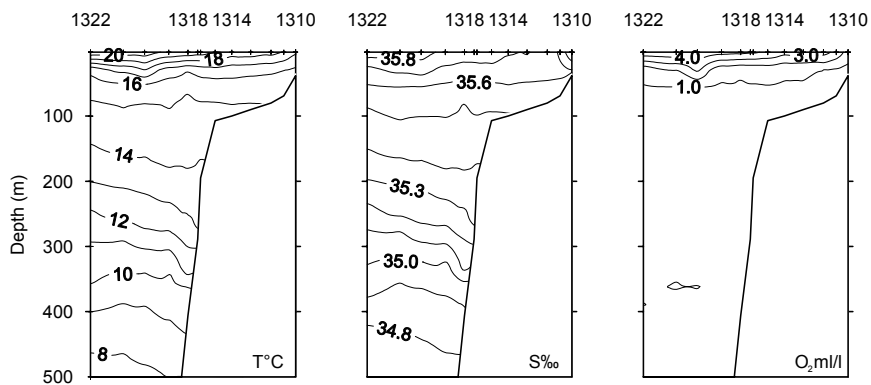


Figure 6j. Vertical sections of temperature, salinity and oxygen off Lobito.

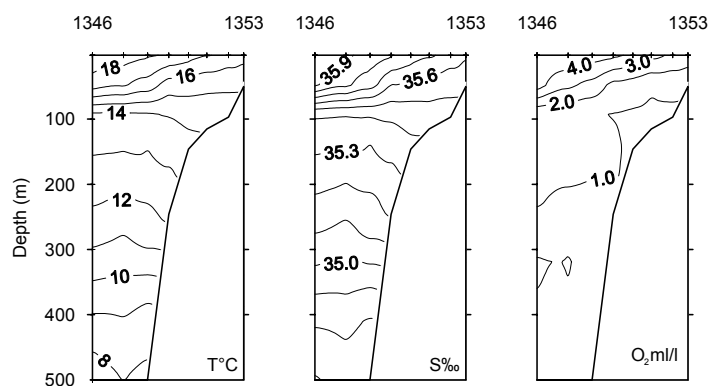


Figure 6k. Vertical sections of temperature, salinity and oxygen off Namibe.

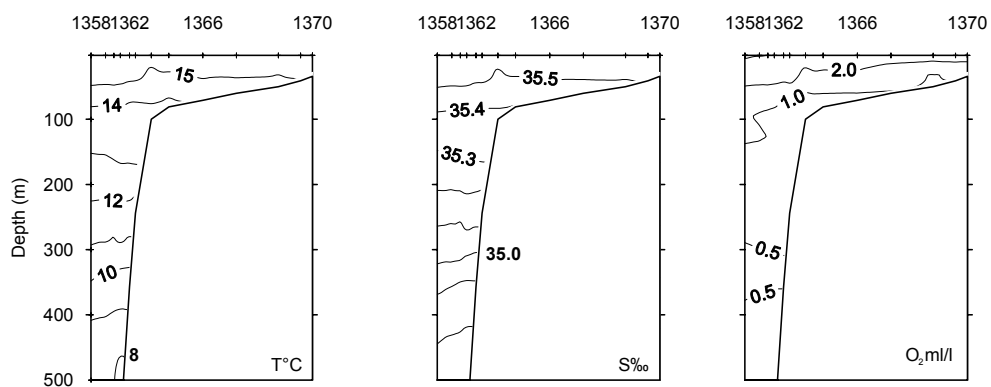


Figure 6l. Vertical sections of temperature, salinity and oxygen off Pta. Albina.

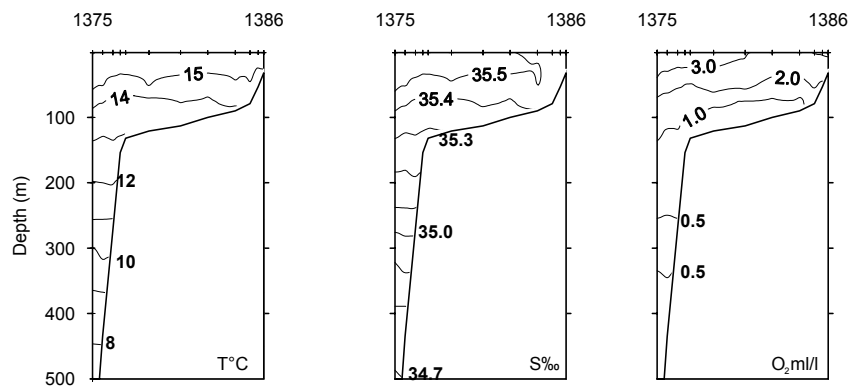


Figure 6m. Vertical sections of temperature, salinity and oxygen off Baía dos Tigres.

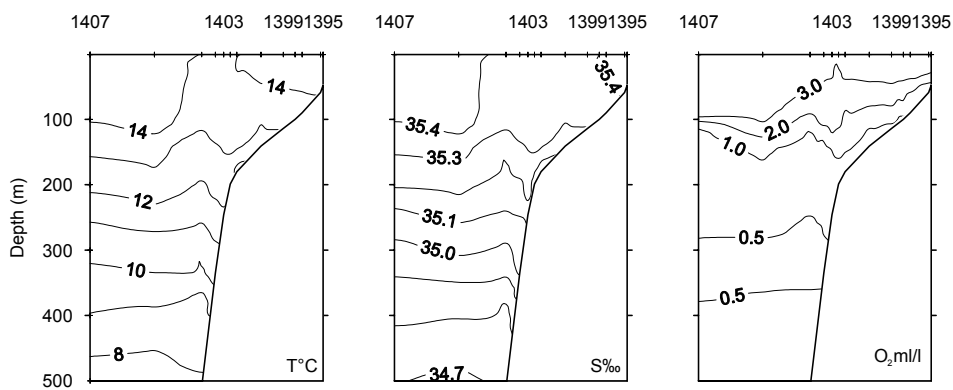


Figure 6n. Vertical sections of temperature, salinity and oxygen off Cunene River.

CHAPTER 4 DISTRIBUTION, SIZE COMPOSITION AND BIOMASS ESTIMATES

4.1 Cabinda – Congo (south of Pointe Noire)

Pelagic species 2 (PEL2)

Only PEL2 were found in this region in areas of low density ($1 < S_A < 300 \text{ m}^2 / \text{NM}^2$). The biomass of PEL2 was estimated at 53 000 tonnes. Figure 13 shows the distribution of PEL2.

Due to oil exploration activities, several areas within the surveyed region could not be sampled. As a consequence, some pelagic species, and in particular sardinella could have been missed inshore in this area.

4.2 Pta. das Palmerinhas - Congo River

Sardinella

Both *Sardinella maderensis* and *S. aurita* were found throughout the northern region (Figure 7). Compared to last year, the area of distribution of both sardinellas was smaller. The densities are lower than those in 2004 (average density in 2005 lays $1 < S_A < 300 \text{ m}^2 / \text{NM}^2$), although small areas of medium and relatively high density ($301 < S_A < 1000$, and $1001 < S_A < 3000 \text{ m}^2 / \text{NM}^2$, respectively) were found south of Ambriz. Patchy concentrations were found deeper on the shelf south of N'zeto and off Ambriz.

As observed in the last year's surveys, the sardinella was usually schooling near the surface during daytime, and formed loose aggregations at night. The sardinella was hard to sample at daytime.

Figure 8 shows the length frequency distribution of *S. maderensis* and *S. aurita*. *S. maderensis* ranged from 17 to 32 cm total length (TL). The distribution shows two clear modal peaks at 22 and 28 cm TL. The length distribution for *S. aurita* ranged between 22 and 33 cm TL showing two modal peaks at around 24 and 30 cm TL. No small fish were found in this area, the smallest size caught was 17 cm for *S. maderensis* and 22 cm for *S. aurita*

The biomass of sardinella was estimated at 93 800 tonnes, which is half last year's estimate (187 000 tonnes). Out of the 93 800 tonnes, around 54 400 were *S. aurita* and 39 300 tonnes *S. maderensis*. For both species the gross biomass consisted of individuals larger than 25 cm. (Fig. 9).

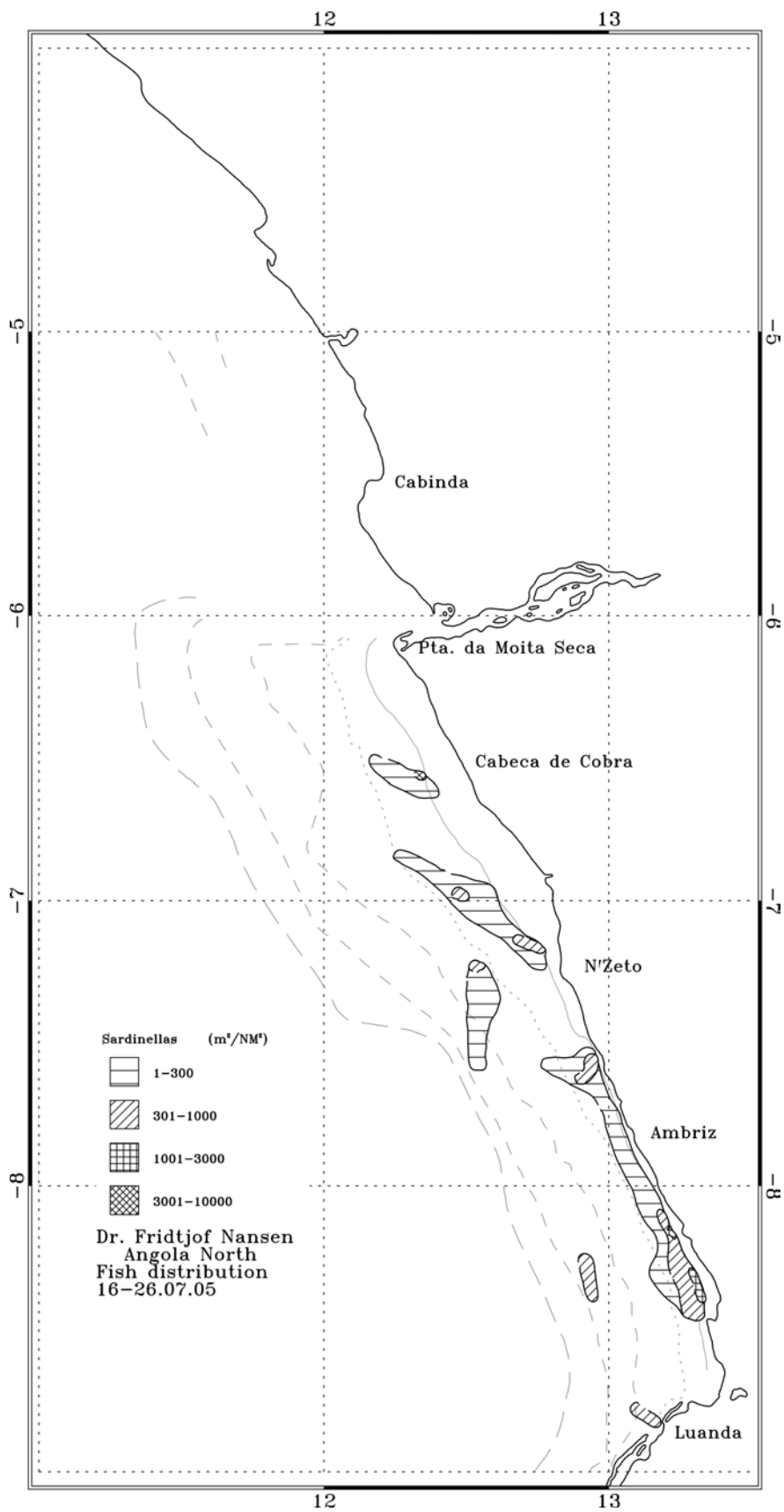


Figure 7. Distribution of *Sardinella* spp. Pta. das Palmerinhas-Congo River, including Cabinda. Depth contours at 20, 50, 100, 200, and 500 m.

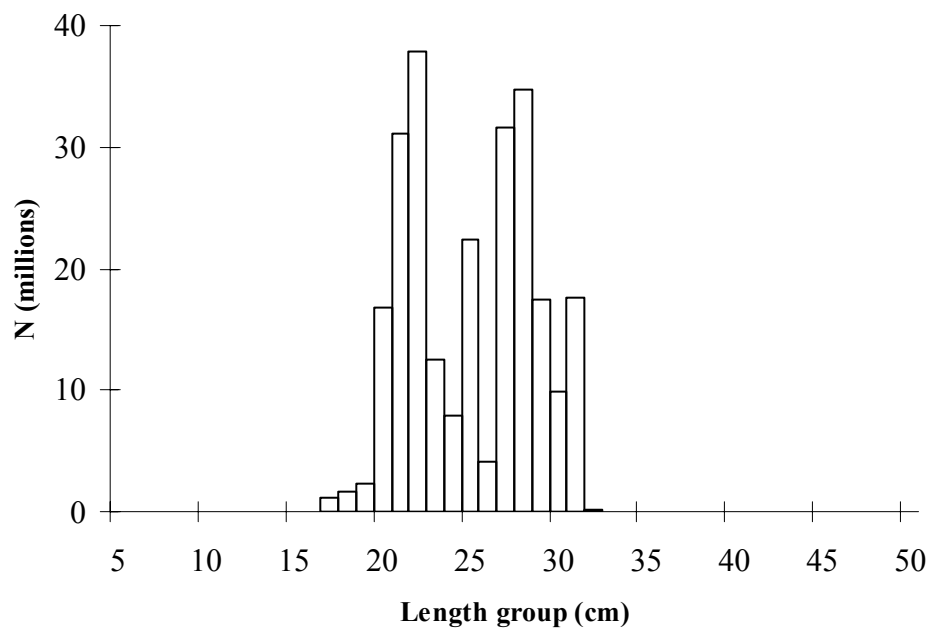
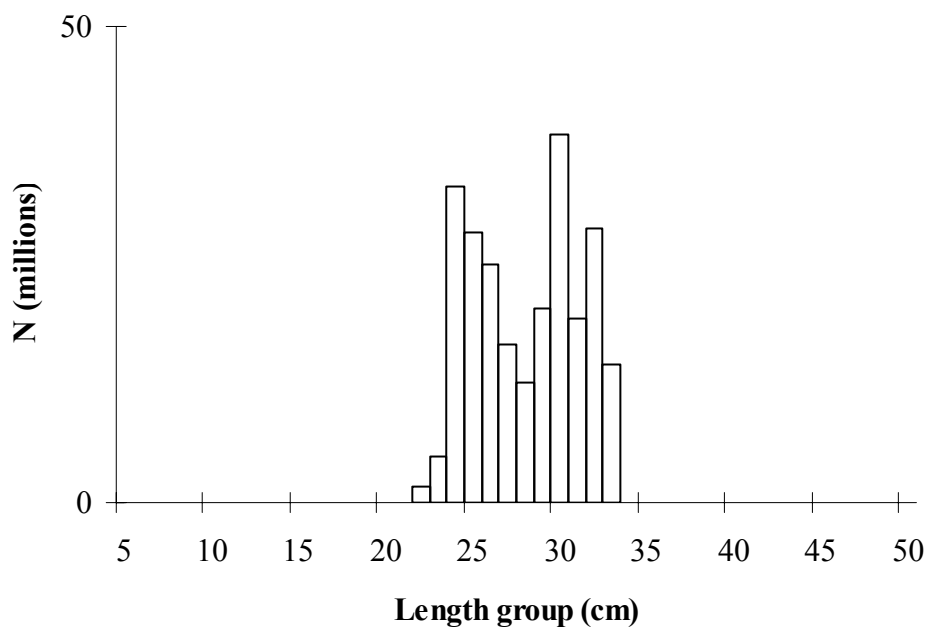
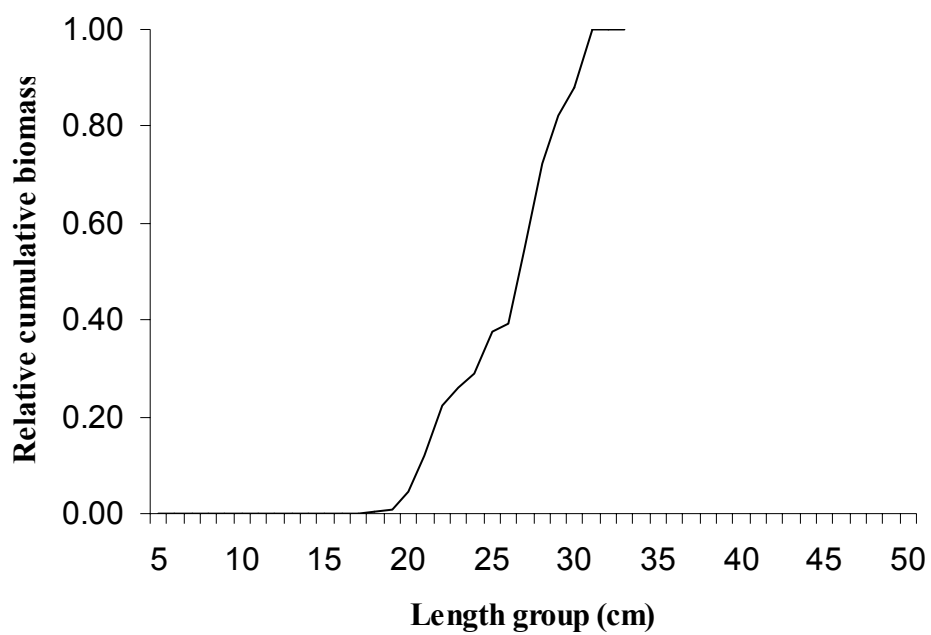
a) *Sardinella maderensis*b) *Sardinella aurita*

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

a) *Sardinella maderensis*



b) *Sardinella aurita*

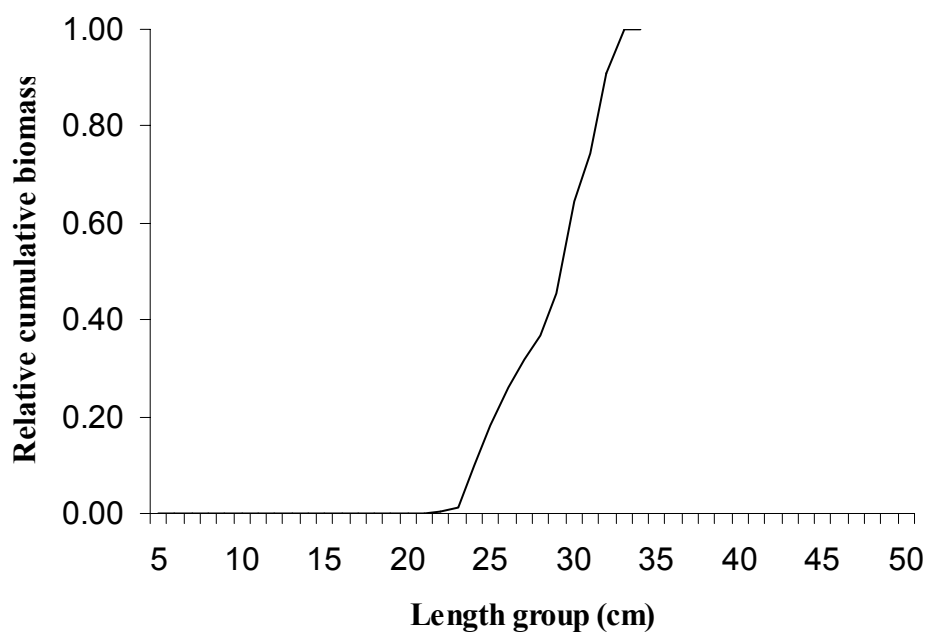


Figure 9. Relative cumulative biomass *Sardinella maderensis* (a) and *S. aurita* (b), Pta. das Palmerinhas-Congo River.

Cunene horse mackerel

The Cunene horse mackerel's (*T. trecae*) was distributed in patches along the northern Angolan coast, both inshore and near the shelf break (between 100 and 200 m depth). The average densities found were in the range of $1 < s_A < 300 \text{ m}^2/\text{NM}^2$, with an area of medium-high densities ($1\ 000 < s_A < 3\ 000 \text{ m}^2/\text{NM}^2$) off Cabeça da Cobra, and another area of medium-low densities ($301 < s_A < 1\ 000 \text{ m}^2/\text{NM}^2$) north of Ambriz, in shallow waters (Figure 10).

Figure 11 shows the length frequency distribution of horse mackerel for the region. The distribution shows three well-defined length groups: one numerous group between 5 and 6 cm TL, another group ranging between 14 and 30 cm TL, and a group ranging between 34 and 38 cm TL. Since the fish belonging to the smallest class (5-6 cm) is very abundant (up to 1 100 individuals), we have re-scaled the axes (Fig 12) in order to make visible the rest of the distribution. We probably have modes at 18, 21, 26 and 35 cm TL.

The estimated biomass of *T. trecae* was 21 000 tonnes around a fourth of last year's biomass (90 000 tonnes). This year the population comprises fish > 21 cm TL (Figure 12).

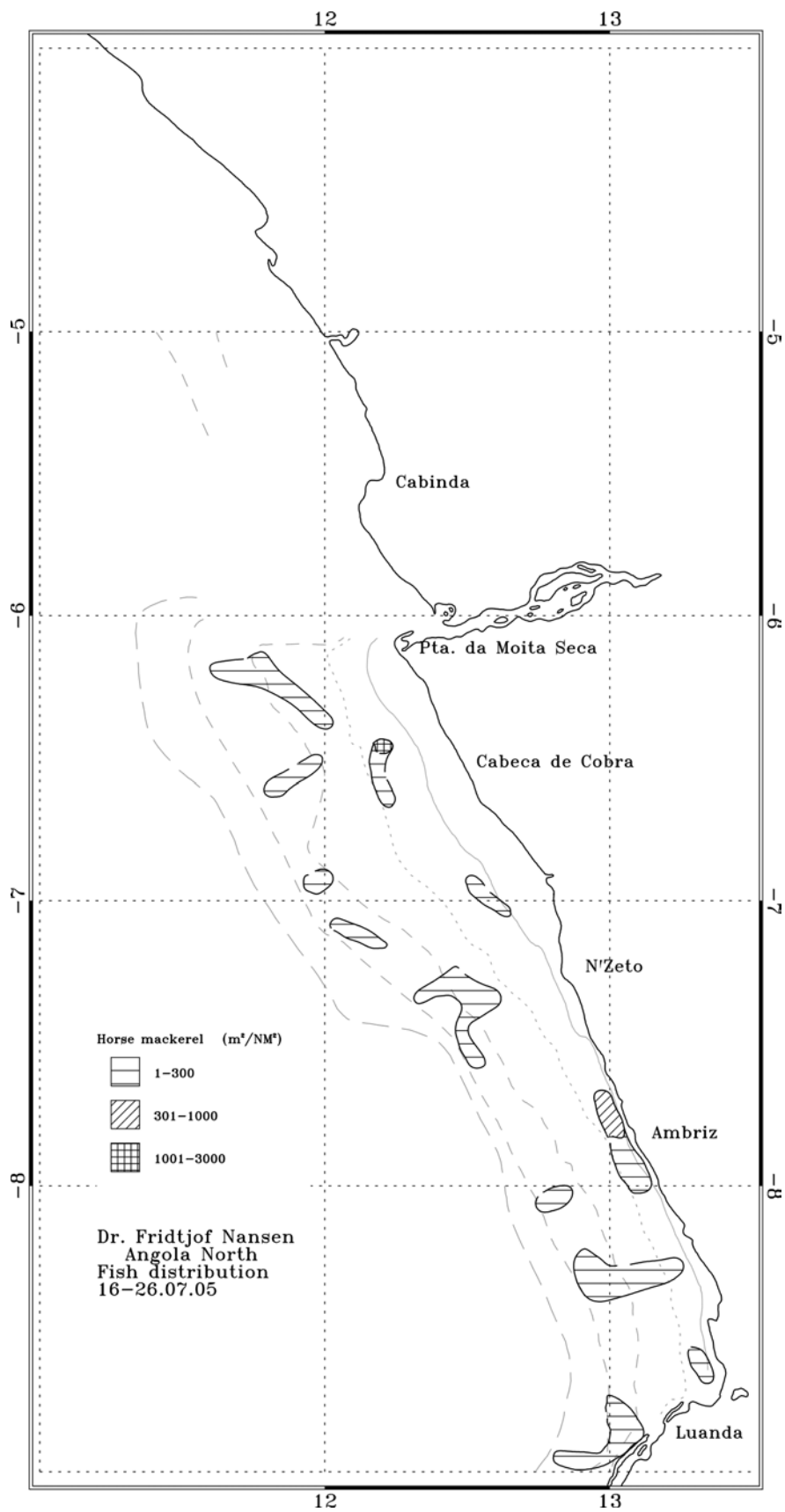


Figure 10. Distribution of Cunene horse mackerel (*Trachurus trecae*), Pta. das Palmerinhas-Congo River, including Cabinda Depth contours at 20, 50, 100, 200, and 500 m

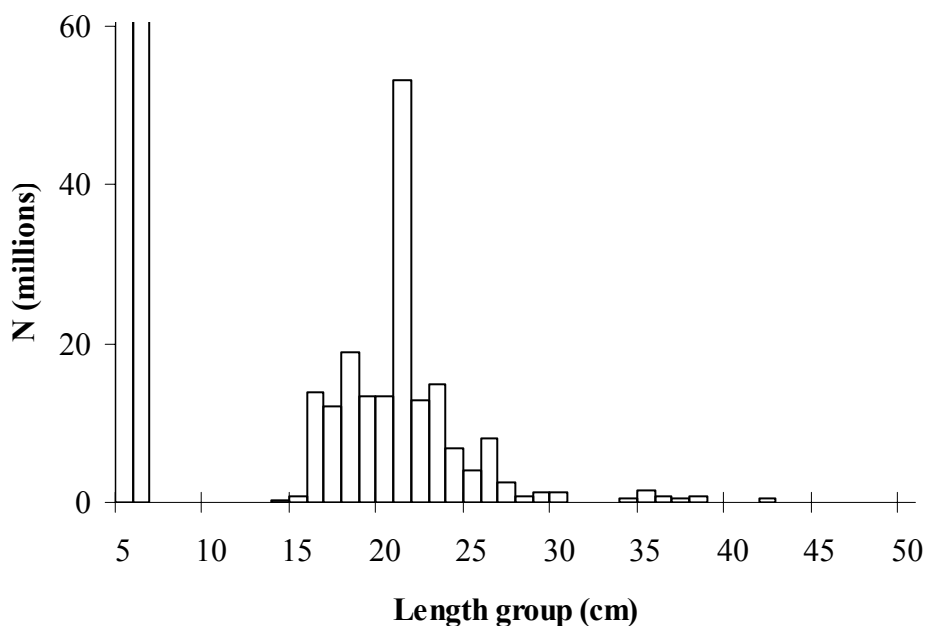


Figure 11. Total length distribution of Cunene horse mackerel (*Trachurus trecae*), Pta. das Palmerinhas-Congo River. Note: The X axis has been cut to allow a better view of the distribution (the 5 cm TL group had 1 100 individuals and the 6 cm TL group 258)

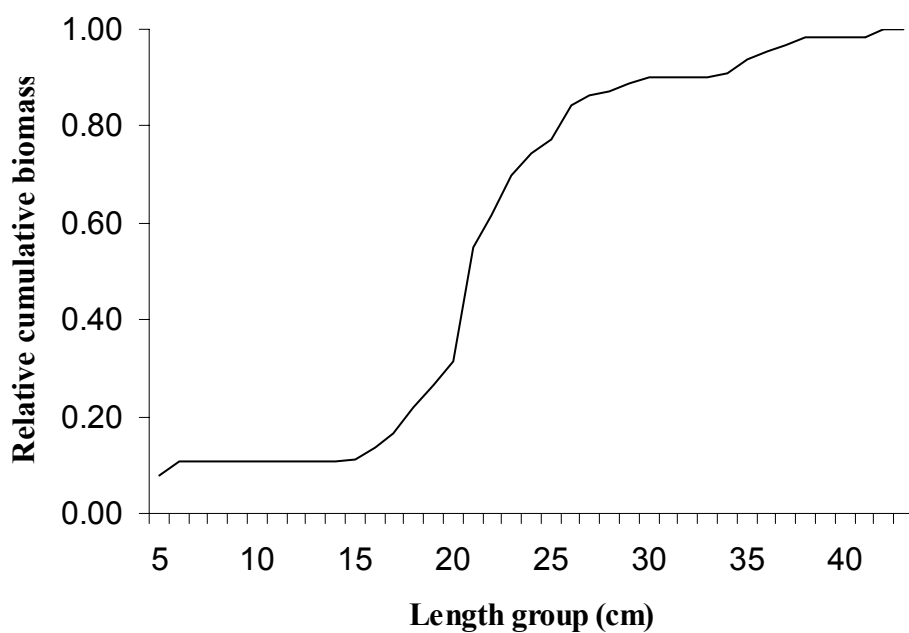


Figure 12. Cumulative percentage biomass by length group for *Trachurus trecae*. Pta. das Palmerinhas-Congo River.

Other pelagic species

Pelagic species Group 1

Pelagic species group 1 was not abundant enough for estimating the biomass in the northern region.

Pelagic species Group 2

This category, which includes members of the family Carangidae (other than *Trachurus* sp.), Scombridae, Sphyrænidae and *Trichiurus lepturus*, was found throughout the region (Table 4). The biomass of this group was estimated at 53 300 tonnes, with the hairtails *T. lepturus*) as the most abundant group.

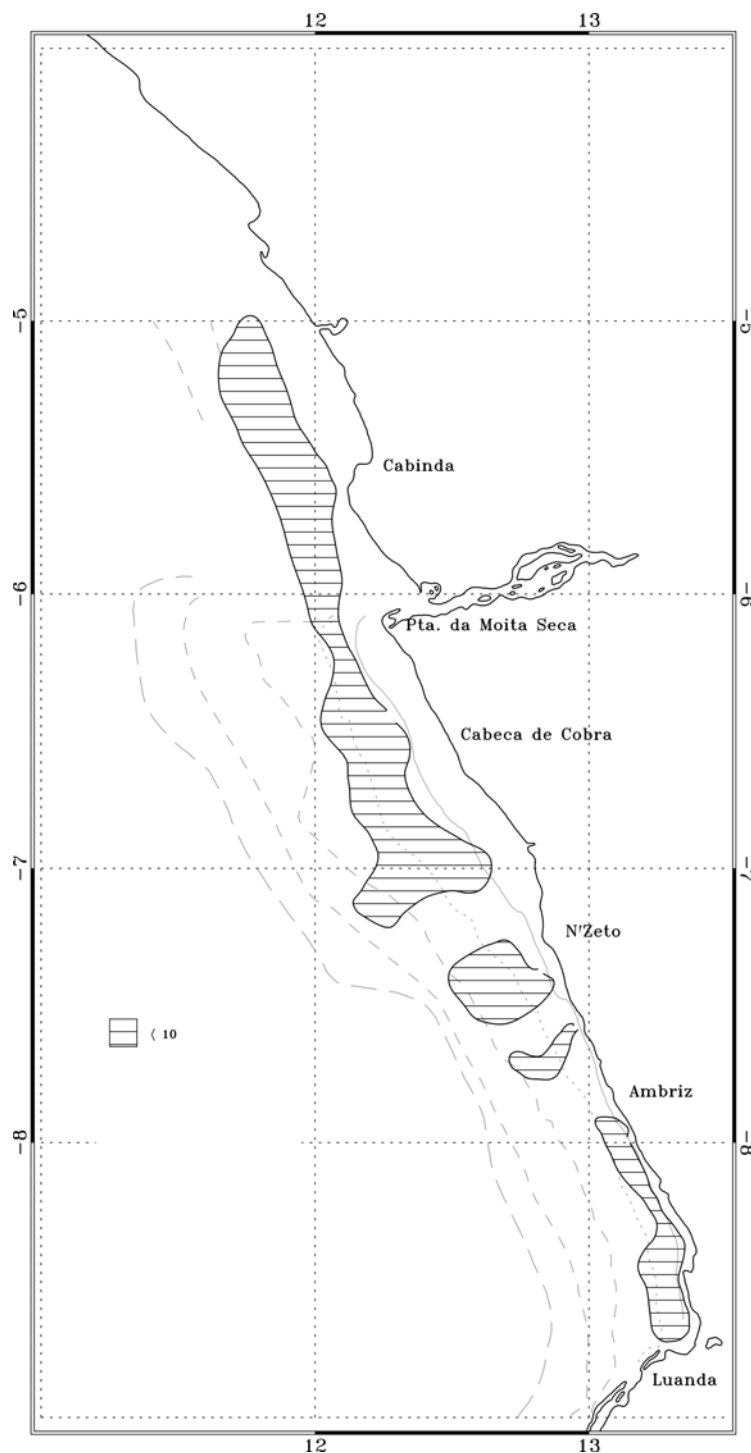


Figure 13. Distribution of Pelagic 2: Pta. das Palmerinhas-Congo River, including Cabinda. Depth contours at 20, 50, 100, 200 and 500 m.

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

Station	Depth	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other	Total
3798	5	3.0		3.9	44.5		49.7	101.1
3799	5	324.4	82.4	10.0	88.9	63.5	609.2	1178.5
3800	124		348.1		37.1		429.0	814.3
3801	280						8122.7	8122.7
3802	128		2.4		17.1		429.5	449.0
3803	10				3.9		0.3	4.2
3804	189		4.6				738.0	742.6
3805	93		5.6				465.7	471.3
3806	132		5.4		1.9		442.7	449.9
3807	5	7.6	10.4	6.2	1.0	19.5	1346.5	1391.1
3808	8		4.5	11.9	21.5		52.1	89.9
3809	117		7.9	5.4	7.7		505.9	526.9
3810	300				0.6		10.8	11.3
3811	140				1.7		396.0	397.7
3812	40			5.5	23.3		210.1	238.9
3813	5	54.3	28.0		13.2	6.2	1079.9	1181.6
3814	10		191.3	3.0	39.1		2335.1	2568.5
3815	5	52.3	9.2		39.2		178.9	279.6
3816	5	81.6	0.1		16.6		275.9	374.2
3817	31	172.9		2.8		2.0	2.0	179.7
3818	412						498.1	498.1
3819	5	195.6	24.4		46.1	0.3	20.9	287.4
Mean	93.1	40.5	32.9	2.2	18.3	4.2	827.2	925.4
STDEV		84.4	82.4	3.5	22.8	13.9	1716.5	1709.8
% Catch		4.4	3.6	0.2	2.0	0.4	89.4	

4.3 Benguela - Pta. das Palmerinhas

Sardinella

Both species of sardinella, *Sardinella maderensis* and *S. aurita*, were found throughout the central region, with a distribution pattern and average densities similar to those found last year. The main area of distribution was a continuous stripe between Cabo Ledo and Novo Redondo, with spots of medium and high densities ($301 < s_A < 1\ 000$ and $1\ 001 < s_A < 3\ 000\ m^2 / NM^2$) (Figure 14). Additionally, we found two other areas, one south Pta. das Palmerinhas and another south of Cabeça da Baleia. This year as opposite from last year, no sardinella was recorded around the Lobito area.

The length distributions are presented in Figure 15 (a and b) for both sardinellas species, *S. maderensis* and *S. aurita*, respectively. The size distribution of *S. maderensis* ranged between 9 and 34 cm TL, with three possible modal groups at 9-12 cm (peaking at 10 cm), 15-19 cm (peaking at 17 cm) and one at 12-24 cm (with a peak at 21 cm TL). Last year's adult cohort around 25 cm TL appeared strongly reduced this year. The recruitment is lower than last year's (about 970 millions of individuals). As for *S. aurita*, the distribution ranged between 16 and 31 cm TL showing a dominating distributional mode at 17-21 (peaking at 19-20 cm) and two more length groups at 25 to 28 cm and 28 to 31 cm with modes at 27 and 29 cm TL respectively.

The estimated biomass for sardinella was 149 000 tonnes which is slightly lower than last year's estimate (175 000 tonnes). Splitting by species, following the species distribution in the catches, the biomass for *S. maderensis* was 64 000 tonnes (lower than last year's 71 000 tonnes), and for *S. aurita* 85 000 tonnes (104 000 tonnes last year). Most of the biomass comprised individuals smaller than 25 cm for *S. maderensis* and smaller than 28 cm for *S. aurita* (Figure 16a and b respectively).

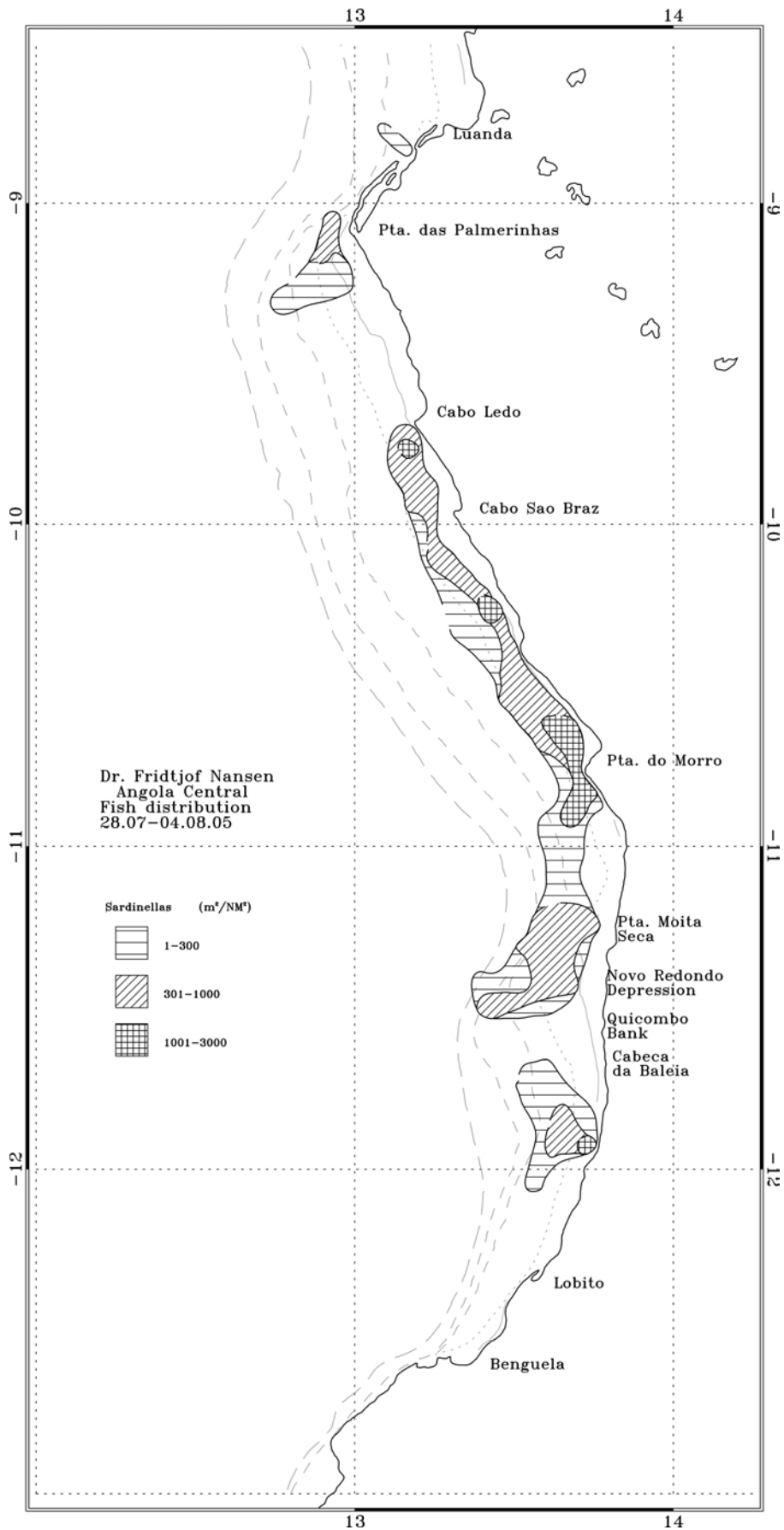


Figure 14. Distribution of *Sardinella* spp. Benguela - Pta. das Palmerinhas. Depth contours at 20, 50, 100 and 200 m.

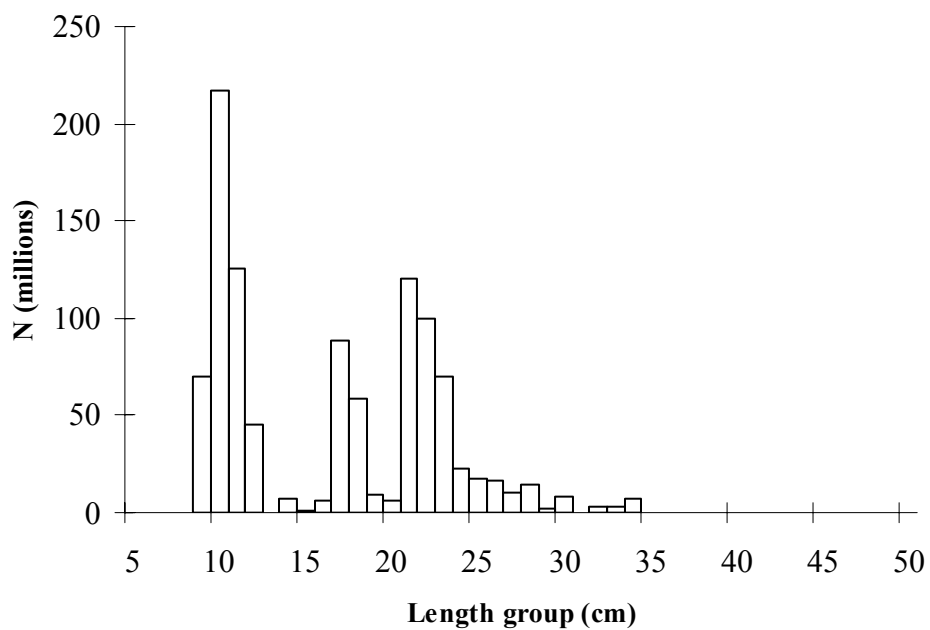
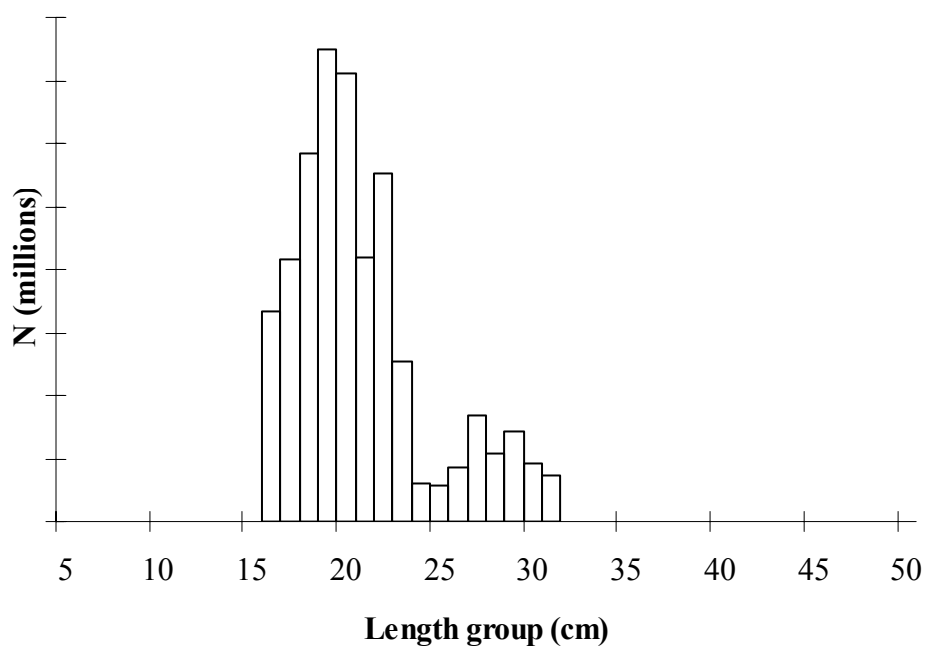
a) *Sardinella maderensis*b) *Sardinella aurita*

Figure 15. Total length distribution of *Sardinella maderensis* (a) and *S. aurita* (b). Benguela - Pta. das Palmerinhas

a) *Sardinella maderensis*

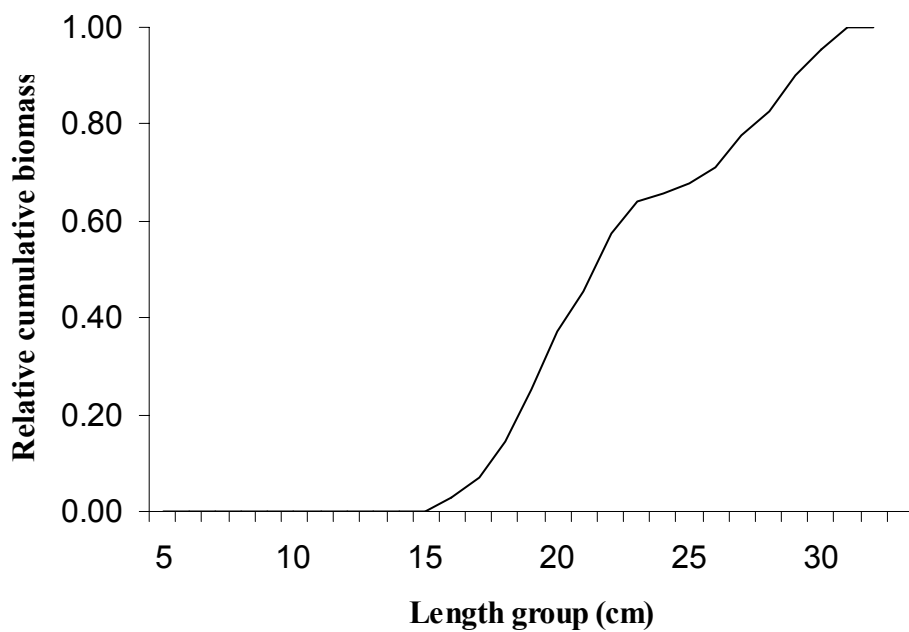
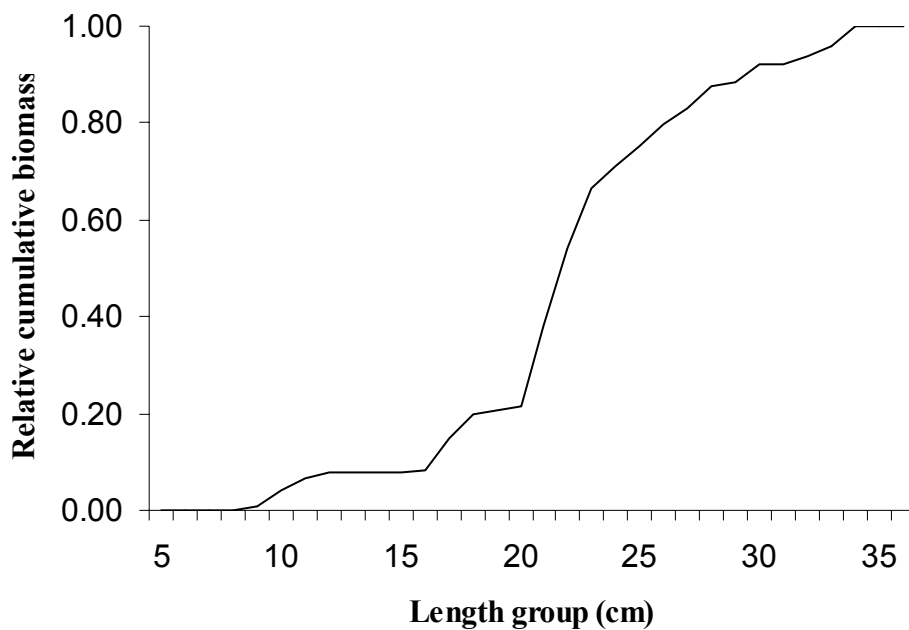


Figure 16. Relative cumulative biomass *Sardinella maderensis* (a) and *S. aurita* (b), Benguela - Pta. das Palmerinhas

Horse mackerel

Only *Trachurus trecae* was found in the region with a patchy distribution pattern similar to last year, mostly with low densities ($1 < s_A < 300 \text{ m}^2/\text{NM}^2$). Some areas of medium densities ($301 < s_A < 1\,000 \text{ m}^2/\text{NM}^2$) and high density ($1\,001 < s_A < 3\,000 \text{ m}^2/\text{NM}^2$) were found south of Cabeça de Baleia and Pta. das Palmerinhas at around 100 m depth (Figure 17).

The total length distribution shows three fairly well define cohorts with modes at 5, 22 and 30 cm TL (Figure 18). Fish between 10 and 15 cm were completely absent. Individuals smaller than 33 cm TL represented most of the biomass (Figure 19).

The biomass of the Cunene horse mackerel decreased from 107 000 tonnes (2004) to 57 000 tonnes, but it is higher than the biomass estimates of 2001 – 2003.

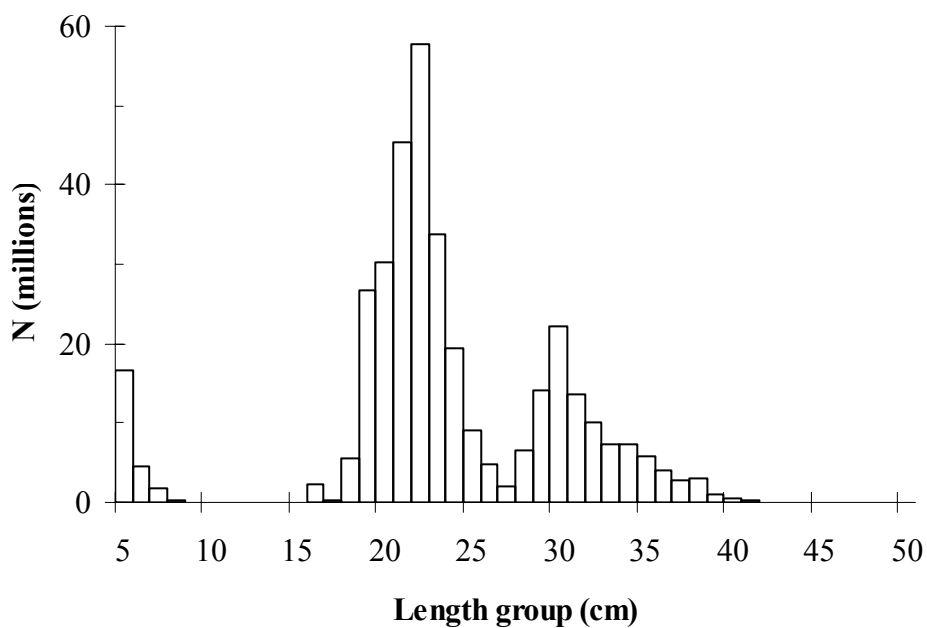


Figure 18. Total length distribution of horse mackerel (*Trachurus trecae*), Benguela - Pta. das Palmerinhas.

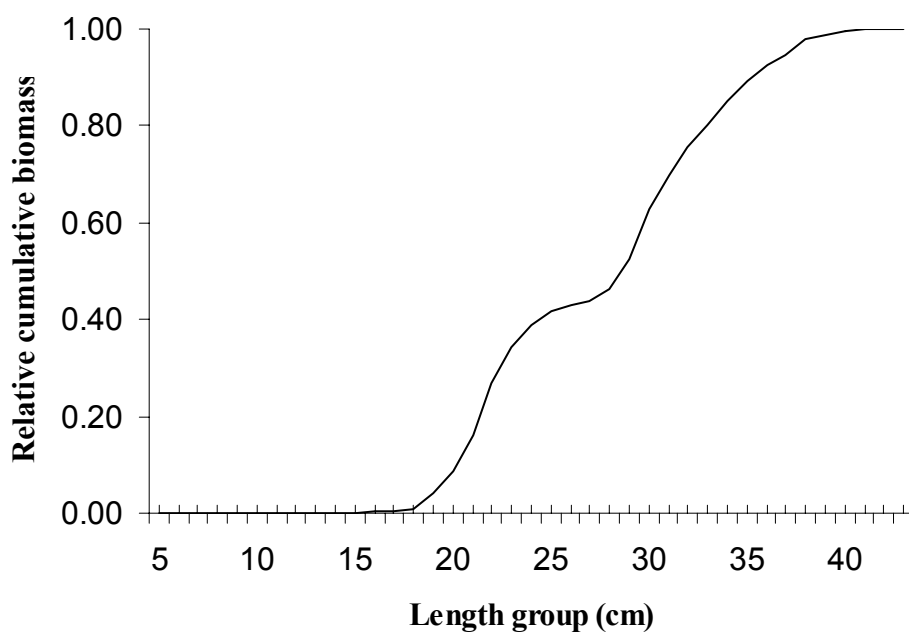


Figure 19. Relative cumulative biomass of horse mackerel (*Trachurus trecae*), Benguela - Pta. das Palmerinhas.

Other pelagic species

An overview of the main groups of other pelagic fish in the central region is given in Table 5

Group 1

Fish belonging to this group were found in few stations (Table 5).

Group 2

Pelagic fish type 2 was found in several, low-density ($1 < s_A < 300 \text{ m}^2/\text{NM}^2$), along the regional coast (Figure 20) being the most common species the hairtails (*Trichiurus lepturus*).

The biomass estimate, based on an average length of 30 cm and a condition factor equal to 0.01, was 10 000 tonnes much lower than the 35 000 tonnes in 2004.

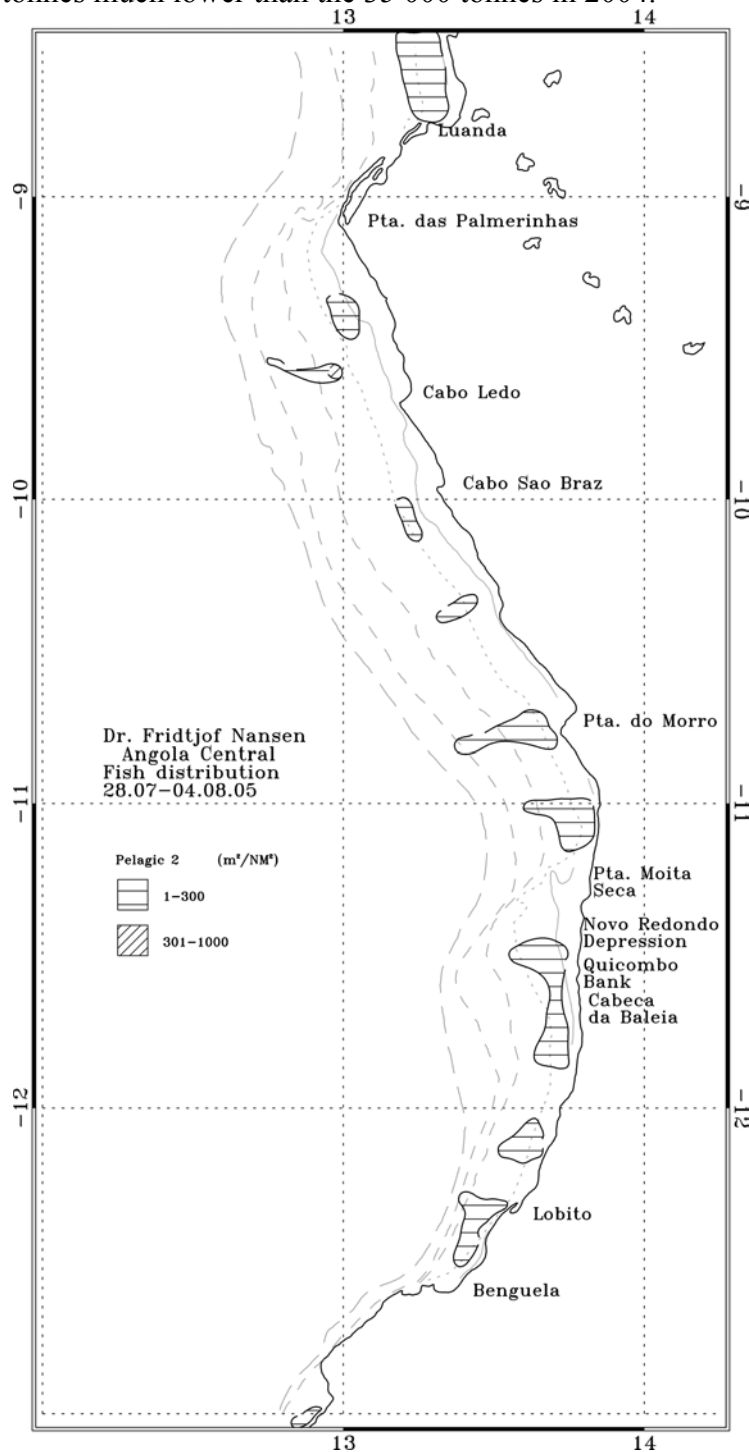


Figure 20. Distribution of other pelagic species, group 2. Benguela - Pta. das Palmerinhas. Depth contours at 20, 50, 100, 200 and 500 m.

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

Station	Depth	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other	Total
3820	10	2293.8	1308.9	13.3		3.8	3346.5	6966.3
3822	10	8.9	8.4		1.3	16.4	56.1	91.1
3823	32	1.1	6.4		0.5	20.4	1837.4	1865.8
3824	15	214.6	190.0				773.6	1178.2
3825	22	117.9	0.7		4.5		102.3	225.4
3826	44	17.3	0.8		1.8		530.2	550.2
3827	10	4.3	2.5		3.5	1.1	103.3	114.6
3828	10	0.6			21.4		356.2	378.2
3829	29		3222.3		214.2		7938.2	11374.7
3830	127		613.7		15.2		1591.5	2220.4
3831	10	27.7			2.1	2.0	1167.3	1199.1
3832	110		1.4		1.4		605.8	608.6
3833	25		2.1		1.1	1.6	235.1	239.9
3834	5		191.1	25.2	72.8		610.4	899.5
3835	20		0.8					0.8
3836	394				0.8		5037.4	5038.2
3837	138		2803.4		57.9		3491.3	6352.6
3838	25						12.4	12.4
3839	5						57.3	57.3
3840	69						352.0	351.9
Mean	55.50	134.3	417.6	1.9	19.9	2.3	1410.2	1986.2
STDEV		511.0	943.6	6.2	49.9	5.7	2067.7	3059.6
% Catch		6.8	21.0	0.1	1.0	0.1	71.0	

4.4 Benguela - Cunene

Sardinella

In one pelagic trawl (PT 3847, with a catch of 37.5 kg/h) south of Cabo de Santa Marta.

Horse mackerel

In southern region the pelagic environment is dominated by horse mackerel. Like in previous years both species of horse mackerel were found Cunene horse mackerel (*T. trecae*), a species that distributes in most of the Angolan continental shelf and the Cape horse mackerel (*T. capensis*) a species associated with the cold waters of the Benguela current. Horse mackerel was found along the regional coast in four patches (Figure 21). Between Cunene River and Tombua the densities were high ($3001 < s_A < 10\ 000\ m^2 / NM^2$) to very high ($s_A > 10\ 000\ m^2 / NM^2$), especially outside and inside Baía dos Tigres. For the other areas the average density was low ($1 < s_A < 300\ m^2 / NM^2$) to medium-low ($301 < s_A < 1\ 000\ m^2 / NM^2$). Cape horse mackerel were found dominating the slope area, while Cunene horse mackerel has more inshore distribution.

Figure 22 shows the size distributions of horse mackerel. The size distribution of *T. trachurus capensis* seems to have a cohort with a modal peak around 14 cm; few fish below 8 cm and above 20 cm were recorded. Last year, the area was also completely dominated by juveniles individuals (TL < 20 cm) with modal peak around 14 cm. *T. trecae*'s length distribution ranged from 5 to 39 cm TL, and shows two modal groups with modes at 9 and 16 cm. There is an indication of very small adult cohort with no clear modal peak.

The estimated biomass for horse mackerels in the southern region was 328 500 tonnes. The contribution from the two species was 102 000 tonnes for *T. trecae* and 226 500 tonnes for *T. trachurus capensis*. Last year the estimated biomass in this region was 71 000 tonnes (32 000 tonnes of *T. trecae* and 39 000 tonnes of *T. trachurus capensis*). This represents an increment of more than four times last year's biomass and is one of the highest values of the last five years.

Figure 23 shows that the population of *T. trachurus capensis* population in the area was almost entirely comprised of juveniles, (TL < 20 cm). As for *T. trecae*, around 80% of the biomass belongs to individuals < 24 cm.

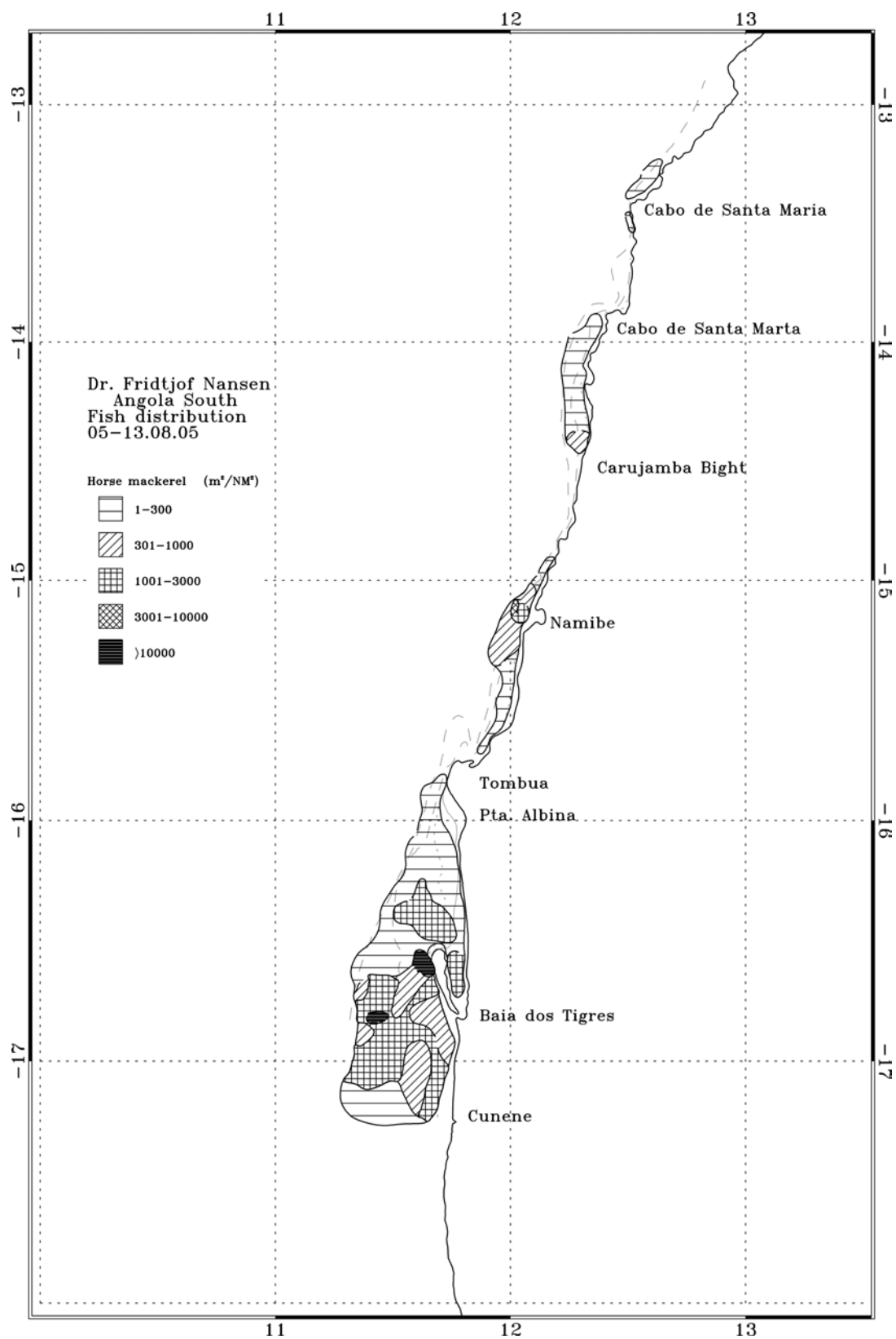


Figure 21. Distribution of horse mackerel. Cunene – Benguela. Depth contours at 10, 20, 50, 100, 200 and 500 m

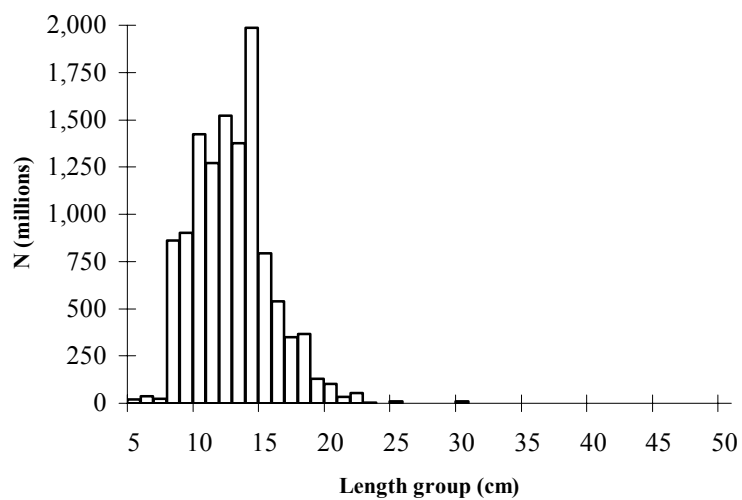
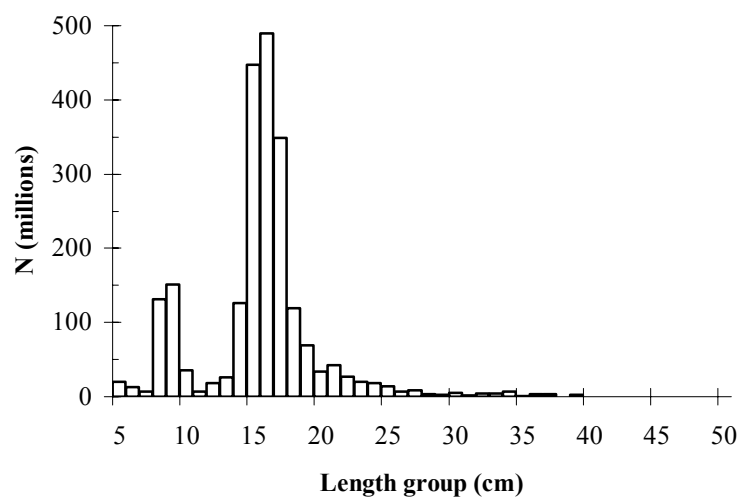
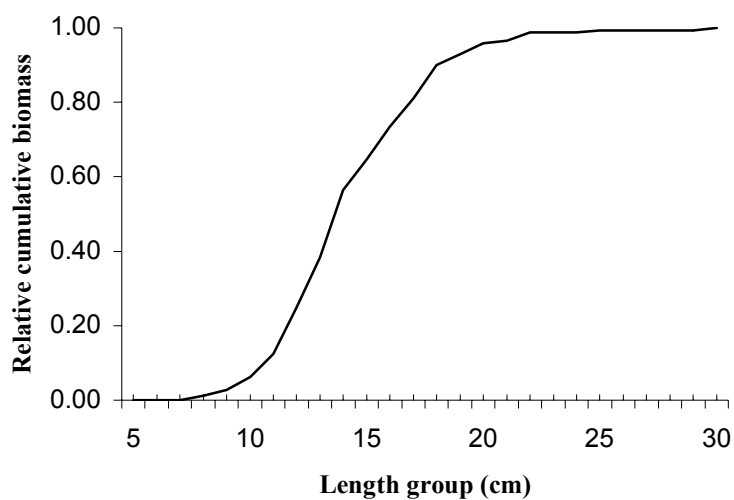
a) *Trachurus trachurus capensis*b) *Trachurus trecae*

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

a) *Trachurus trachurus capensis*



b) *Trachurus trecae*

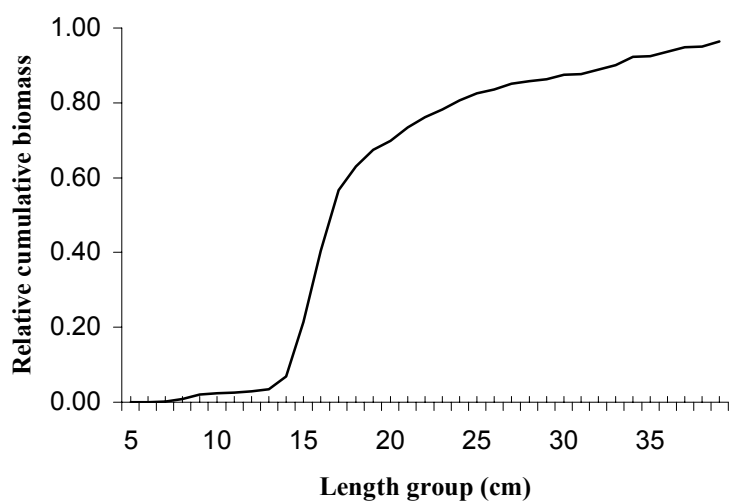


Figure 23. Relative cumulative biomass of *T. trachurus capensis* (a) and *T. trecae* (b).

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

Station	Depth	Clupeids	Carangids	Scombrids	Hairtails	Barracudas	Other	Total
3841	99		79.3		10.3		727.4	817.0
3842	100						61.7	61.9
3843	5		1.3		120.3		64.5	186.0
3844	130		712.2				188.4	900.6
3845	48		5340.0				1556.9	6896.9
3846	85		375.9		52.7		676.2	1104.8
3847	10	42.4	8046.8				116.0	8205.2
3848	87		4.0		4.0		1034.0	1042.0
3849	107		15.0				1561.6	1576.6
3850	58	3.7	442.7				3522.1	3968.5
3851	128		323.1				2122.5	2445.6
3852	29		148.8				2045.4	2194.2
3853	85		1.0				3051.1	3052.1
3854	0	78.1	6388.8	46.4	52.8		21.1	6587.3
3855	26	6.7	9954.0		14.2		7880.9	17855.8
3856	60		15365.6				461.8	15827.4
3857	72		23850.0				888.0	24738.0
3858	80		2097.6				77.1	2174.7
3859	16		968.7		69.1		3807.1	4844.9
3860	10	1.8	3.1				71.1	76.1
3861	15	158.7	1577.4				208.4	1944.5
3862	30	318.7	5721.3				129.2	6169.1
3863	140	165.0	14148.0				659.2	14972.2
3864	1		0.3				107.0	107.3
3865	1	94.3	748.8				333.2	1176.2
3866	100	13.4	29.5				13.1	55.9
3867	50						0.9	0.9
3868	358						3594.4	3594.4
3869	57	108.8	342.2		0.4		475.9	927.3
3870	159		5931.6				3118.0	9049.6
3871	200		120.1				147.0	267.1
3872	128		4005.3				707.0	4712.4
3873	100		26.3				295.2	321.6
3874	147		717.6				10315.2	11032.8
Mean	65.0	29.2	3161.4	1.4	9.5		1471.7	4673.1
STDEV		68.3	5483.9	8.0	25.8		2282.0	5966.2
% Catch		0.6	67.6	0.1	0.2		31.5	

Other pelagic species

An overview of the main groups of other pelagic fish in the central region is given in Table 6

Group 1

Fish belonging to this group were found in few stations. *Sardinops ocellatus* was found in three stations with an average catch rate of 30 kg/h).

Group 2

Pelagic fish type 2 was found in few stations, being the hairtails (*Trichiurus lepturus*) the dominant species.

CHAPTER 5 SUMMARY OF SURVEY RESULTS

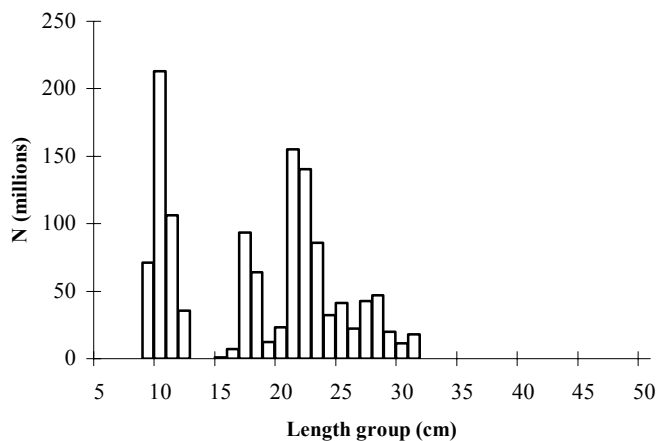
5.1 Sardinella

The total biomass estimate for sardinellas is 245 000 tonnes, is some 20% lower than last year's estimate (362 000 tonnes), and lower than previous years' estimates (Table 7). This reduction could be attributed to changes on behaviour pattern of the species, which is dependent on the prevailing environmental conditions. During the present survey the environmental condition observed were characterized by the occurrence of upwelling phenomena along the coast, with the cold waters confined to inshore areas,. This feature makes the aggregation pattern of *Sardinella* different from previous surveys. From the acoustic records the *Sardinella* was found more dispersed throughout the distribution region than previous years, but with a similar pattern as last year. Only a few, dense schools were recorded, making difficult to follow the day/nigh pattern of the *Sardinella*.

The proportion of biomass of the two *Sardinella* species was different from the typical pattern but similar to last year's: from the total biomass, around 60% belonged to *S. aurita* and around 40% to *S. maderensis*. However, this should not be necessarily interpreted as signal of the recovering of *S. aurita* in Angolan waters, this difference could also be associated with environmental conditions, as *S. maderensis*, is warm waters species (preferably > 23° C).

Figure 24 shows the overall length frequency distribution of the two species of *Sardinella*. For *S. maderensis*, four relatively well-defined cohorts with modal peaks at 10, 17, 21 and 28 cm can be seen. Following the modal progression from the last two years, the cohort with 21 cm modal length probably originates from 2003 strong cohort of juveniles (7-10 cm), which in 2004 gave the cohort of individuals between 16-18 cm. while the larger cohort (28 cm) could be from the less well-defined group of 15-20 cm in 2003 and 22-25 cm in 2004. Around 60% of the biomass corresponds to individuals smaller than 20 cm TL. *S. aurita* on other hand (Figure 25), shows a two modal distribution with modal peaks at around 19-20 cm and 29-30 cm. This last cohort probably corresponds to last year's 23-28 cm distributional group but cannot be traced further back. No fish under 20 cm was caught. The juvenile group represents < 5% of the total biomass.

a) Overall length distribution of *S. maderensis* in numbers.



b) Relative cumulative biomass of *S. maderensis*.

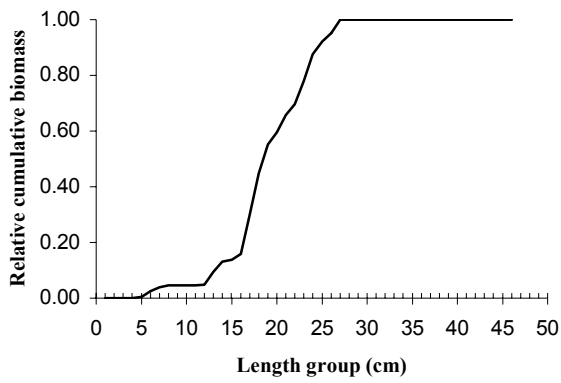
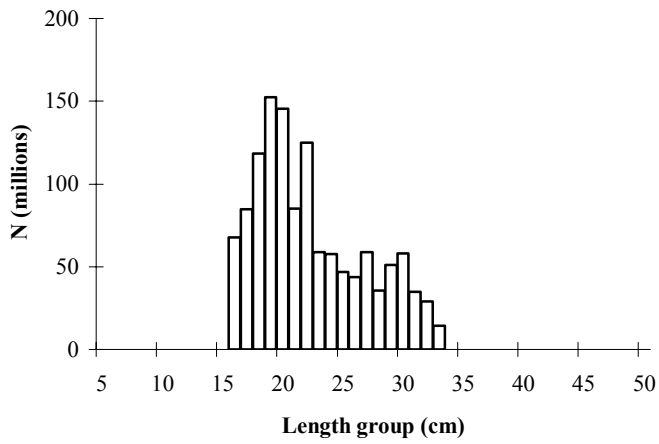


Figure 24 Overall length distribution (a) and relative cumulative biomass (b) of *S. maderensis*.

a) Overall length distribution of *S. aurita* by numbers



b) Relative cumulative biomass of *S. aurita*

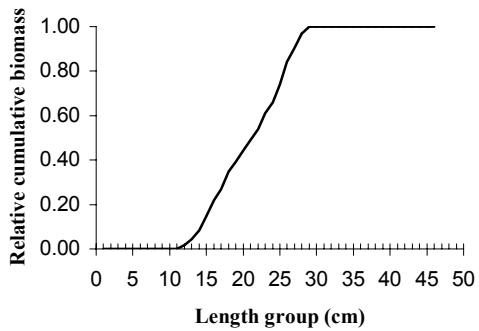


Figure 25 Overall length distribution (a) and relative cumulative biomass (b) of *S. aurita*.

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

Survey	Cunene- Benguela	Pta. Palm. - Benguela	Cabinda- Pta. Palm.	Benguela- Cabinda	Cunene- Cabinda
1/85	25	220	80	300	325
2/85	110	190	180	370	480
3/85	0	70	190	260	260
4/85	0	200	110	310	310
1/86	10	140	110	250	260
2/86	10	130	130	260	270
1/89	40	200	60	260	300
2/89	20	40	130	170	190
3/89	40	100	60	160	200
1/91	?	180	120	300	300
2/91	?	68	154	222	222
1/92	?	119	161	280	280
1/94	*	410	100	510	
2/94	*	245	290	535	
1/95	*	140	24	164	
2/95	?	277	297	574	574
1/96	49	175	70	245	294
2/96	0	130	233	363	363
1/97	0	195	300†	495	495
1/98	75	389	79†	468	543
3/98	0	233	159†	392	392
2/99	0	228	135†	363	363
2/2000	0	179	174†	353	353
2/2001	0	257	177†	434	434
9/2002	0	165	178	343	343
8/2003	2	277	153†	430	432
8/2004	0	175	187†	262	362
8/2005	0	150	94	245	245

* not surveyed

† surveyed from Congo River- Pta das Palmerinhas

5.2 Cunene horse mackerel

The total biomass of horse mackerel was estimated at 405 000 tonnes. Cunene horse mackerel stock was estimated at total of 178 000 tonnes which is lower than last year's estimate but around the same level as previous years (Table 8). However, the stock is far from the level of 2000 (330 000 tonnes), and it is important to point out that this estimate was already low if compared with the levels estimated in 1996 (about 500 000 tonnes).

From Figure 256(a) we can observe a good recruitment signal, but it is difficult to follow cohorts from previous years.

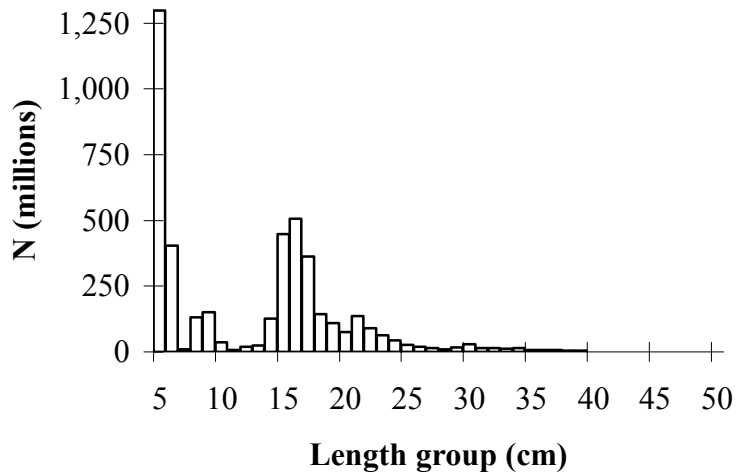
The overall length distribution appears dominated by fish < 20 cm TL (Figure 26-b). However, compared to last year we observed an increase in the proportion of individuals > 30 cm.

The increase in biomass of the stock can primarily be associated with the prevailing environmental conditions. The occurrence of upwelling phenomena throughout the Angolan

coast was observed. Under this circumstance the bias due to avoidance is lower: horse mackerel migrates from bottom habitats into the pelagic, making them more available for acoustic measurements.

Geographically, most of the stock (57%) was distributed in the southern region (13° – 17°S). Around 70% of the Cunene horse mackerel of this region was < 20 cm TL.

a) Overall length distribution of *T. Trecae* by numbers



b) Relative cumulative biomass of *T. trecae*

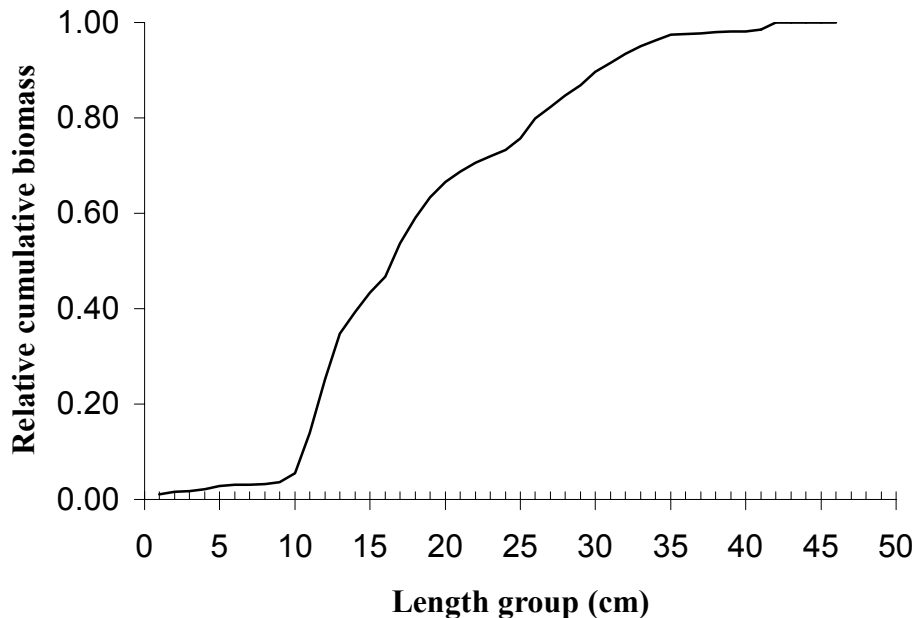


Figure 26 overall length distributions in numbers (a) and relative cumulative biomass (b) of *T. trecae*.

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

Survey	Cunene- Benguela	Palmerinhas- Benguela	Cabinda- Palmerinhas	Benguela- Cabinda	Cunene- Cabinda
1/85	30	195	40	235	265
3/85	50	90	40	130	180
4/85/86	100	125	20	145	245
1/89	35	55	40	95	130
3/89	170	40	35	75	245
1/91	100	80	20	100	200
2/91	100	70	30	100	200
1/92	98	86	80	166	264
1/94	*	238	1	239	
2/94	*	130	120	250	
1/95	*	?	84	84	
2/95	70	160	110	270	340
1/96	286	214	6	220	506
2/96	140	157	63	220	360
1/97	234	55	138†	193	427
1/98	163	58	18†	76	239
3/98	118	112	37†	149	267
2/99	124	129	68†	197	321
2/2000	92	178	63†	241	333
2/2001	64	22	3†	25	89
9/2002	118	13	31†	44	162
8/2003	120	34	12†	46	166
8/2004	32	107	90†	197	229
8/2005	102	56	21	78	178

* not surveyed

† surveyed from Congo River- Pta das Palmerinhas

5.3 Conclusions

In the present survey the environmental conditions were characterized by the impact of upwelling phenomena occurring throughout the Angolan coast and the intrusion of cold water inshore in the south. The range of temperatures encountered in the central and northern regions was 17° to 21°C, compared to a normal of about 21° to 25°C.

This environment affects the behaviour of the species, changing the distribution. Acoustically, sardinella was found more dispersed than previous surveys, and only a few dense schools were observed. The total biomass estimate for sardinellas (245 000 tonnes) was lower than last year (362 000 tonnes). This may, to some extent, be related to the distribution pattern, with higher probabilities of not detecting targets at low densities, particularly at night.

The proportion of biomass of the two-sardinella species, although like last year, was different from the typical pattern observed over the last 10 years. From the total biomass, as much as 60 % was *S. aurita* while 40 % belonged to *S. maderensis*. The relative increase observed in *S. aurita* may have been a consequence of the cold-water occurrence inshore, rather than a real increase in the biomass for this species. It is important to stress that it is very difficult to separate the two species, therefore the biomass estimates should only be considered as relative indexes rather than absolute estimates.

The total biomass of horse mackerel was estimated at 405 000 tonnes. The Cunene horse mackerel stock was estimated at 178 000 tonnes, which is lower than last year estimate (229 000 tonnes) and far from the level of 1996 (around 500 000 tonnes). Cape horse mackerel was found only in the southern region and its biomass was estimated at 227 000 tonnes.

The overall length distribution of Cunene horse mackerel was still dominated by fish <20 cm, and compare with last year, we observe an increase in the proportion of individuals >30 cm.

The recovery of the Cunene horse mackerel stock in Angolan waters requires that strong management measures be maintained during 2005. From a biological perspective an overall effort reduction compared to the 2004 level will be the main tool to achieve this goal.

REFERENCES

- BODHOLT, H., NES, H. and H. SOLLI 1989 — A new echo-sounder system. *Progress in Fisheries Acoustics*. Lowestoft, Proc. I. O. A., St. Alban, UK **11**(3): 123-130.
- FOOTE, K. G. 1987 — Fish target strengths for use in echo integrator surveys. *J. Acoust. Soc. Am.* **82**(3): 981-987.
- FOOTE, K. G., AGLLEN, A. and O. NAKKEN 1986 — Measurements of fish target strength with a split-beam echosounder. *J. Acoust. Soc. Am.* **80**(2): 612-621.
- HOLDEN, M.J. and D.F.S. RAITT (Eds) 1974 — Manual of fisheries science. Part 2- Methods of resource investigation and their application. FAO Fish. Tech. Pap. **115**(1). 214p.
- KNUDSEN, H. P. 1996 — The Bergen Echo Integrator.
- MISUND, O. A. and A. AGLLEN 1992 — Swimming behaviour of fish schools in the North Sea during acoustic surveying and pelagic trawl sampling. *ICES J. Mar. Sci.* **49**: 325-334.

ANNEX I Fishing gear

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

The bottom trawl has a 31 m headline and a 47 m footrope fitted with a 12" rubber bobbins gear. The codend has 20 mm meshes, and has an inner net with 10 mm mesh size. The vertical opening is about 5.7 m. The distance between the wing tips is about 18 m during towing. The sweeps are 40 m long. The trawl doors are 'Thyborøen' combi, 7,81 m² and weigh 1670 kg. The door spreading is about 50 m when using restraining rope.

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 a height sensor is fitted on the bottom trawl to measure the trawl opening and provide information on clearance and bottom contact.

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

ANNEX II Records of fishing stations

PROJECT STATION:3798
 DATE:17/ 7/05 GEAR TYPE: PT No: 1 POSITION:Lat S 456
 start stop duration Long E 1150
 TIME :03:20:32 03:20:43 9 (min) Purpose code: 1
 LOG : 9975.41 9975.90 0.49 Area code : 9
 FDEPTH: 5 5 GearCond.code: 1
 BDEPTH: 42 44 Validity code: 1
 Towing dir: 217ø Wire out: 180 m Speed: 35 kn*10
 Sorted: 15 Kg Total catch: 15.17 CATCH/HOUR: 101.13

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trichiurus lepturus	44.53	1380	44.03	
Brachydeuterus auritus	37.80	307	37.38	
Bregmaceros atlanticus	8.33	12220	8.24	
Scomberomorus tritor	3.67	7	3.63	
Sardinella aurita - Juveniles	3.00	240	2.97	8024
Pteroscion peli	2.33	100	2.30	
Parapanaeus longirostris	0.67	7	0.66	
Alloteuthis africana	0.60	53	0.59	
Scomber japonicus	0.20	7	0.20	
Total	101.13		100.00	

PROJECT STATION:3802
 DATE:19/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 636
 start stop duration Long E 1151
 TIME :12:32:36 12:52:46 20 (min) Purpose code: 1
 LOG : 446.14 447.19 1.05 Area code : 3
 FDEPTH: 126 130 GearCond.code: 1
 BDEPTH: 126 130 Validity code: 1
 Towing dir: 240ø Wire out: 350 m Speed: 30 kn*10
 Sorted: 149 Kg Total catch: 149.67 CATCH/HOUR: 449.01

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex congoensis	282.36	3015	62.89	8046
Dentex angolensis	78.12	390	17.40	8043
Chelidonichthys capensis	20.34	462	4.53	
Trichiurus lepturus	17.10	15	3.81	8047
Spicara alta	7.74	105	1.72	8044
Pterothrissus belloci	7.29	48	1.62	
Epinephelus aeneus	6.78	3	1.51	
Zenopsis conchifer	3.87	15	0.86	
Zeus faber	3.63	6	0.81	
Raja clavata	3.18	3	0.71	
Boops boops	3.06	78	0.68	8045
Sepia orbignyana	2.76	27	0.61	
Trachurus trecae	2.40	24	0.53	8042
Torpedo torpedo	2.19	3	0.49	
Todaropsis eblanae	2.10	45	0.47	
Arionna bondi	1.74	27	0.39	
Lagocephalus laevis	1.08	3	0.24	
Peristedion cataphractum	0.99	21	0.22	
Lophius sp.	0.90	6	0.20	
Scorpaena normani	0.42	3	0.09	
Ommastrephes bartrami	0.42	6	0.09	
Raja miraletus	0.36	3	0.08	
Microchirus frechkopi	0.18	3	0.04	
Total	449.01		99.99	

PROJECT STATION:3799
 DATE:17/ 7/05 GEAR TYPE: PT No: 1 POSITION:Lat S 541
 start stop duration Long E 1158
 TIME :16:46:59 17:20:42 34 (min) Purpose code: 1
 LOG : 101.71 103.80 2.04 Area code : 9
 FDEPTH: 5 5 GearCond.code: 1
 BDEPTH: 39 32 Validity code: 1
 Towing dir: 90ø Wire out: 180 m Speed: 35 kn*10
 Sorted: 194 Kg Total catch: 667.80 CATCH/HOUR: 1178.47

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	574.73	7228	48.77	8027
Ilisha africana	185.79	2654	15.77	8030
Sardinella maderensis	138.64	734	11.76	8028
Trichiurus lepturus	88.94	1835	7.55	8026
Sphyræna guachancho	63.53	4	5.39	8034
Selene dorsalis	55.62	854	4.72	8031
Stromateus fiatola	34.45	106	2.92	8033
Chloroscombrus chrysurus	25.34	346	2.15	8032
Scomberomorus tritor	10.02	14	0.85	8029
Trachurus trecae	1.41	7	0.12	8025
Total	1178.47		100.00	

PROJECT STATION:3803
 DATE:19/ 7/05 GEAR TYPE: PT No: 1 POSITION:Lat S 629
 start stop duration Long E 1212
 TIME :17:03:41 17:34:03 30 (min) Purpose code: 1
 LOG : 479.99 482.14 2.13 Area code : 3
 FDEPTH: 10 10 GearCond.code: 1
 BDEPTH: 43 41 Validity code: 1
 Towing dir: 350ø Wire out: 160 m Speed: 40 kn*10
 Sorted: 2 Kg Total catch: 2.11 CATCH/HOUR: 4.22

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trichiurus lepturus	3.94	8	93.36	8048
Alloteuthis africana	0.28	94	6.64	
Total	4.22		100.00	

PROJECT STATION:3800
 DATE:18/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 612
 start stop duration Long E 1138
 TIME :13:20:32 13:21:15 19 (min) Purpose code: 1
 LOG : 269.68 270.67 0.97 Area code : 9
 FDEPTH: 126 121 GearCond.code: 1
 BDEPTH: 126 121 Validity code: 1
 Towing dir: 70ø Wire out: 320 m Speed: 30 kn*10
 Sorted: 257 Kg Total catch: 257.86 CATCH/HOUR: 814.29

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	348.13	2722	42.75	8035
Dentex congoensis	168.88	1961	20.74	8038
Dentex angolensis	157.52	824	19.34	8037
Trichiurus lepturus	37.14	44	4.56	8036
Todaropsis eblanae	21.22	543	2.61	
Brotula barbata	19.45	19	2.39	
Chelidonichthys lastoviza	18.06	227	2.22	
B I V A L V E S	16.36	2684	2.01	
Spicara alta	13.89	129	1.71	
Arionna bondi	5.24	117	0.64	
Zenopsis conchifer	3.98	6	0.49	
Solenocera africana	1.45	3	0.18	
Raja miraletus	1.42	3	0.17	
Peristedion cataphractum	0.82	19	0.10	
Boops boops	0.25	3	0.03	
Saurida brasiliensis	0.13	95	0.02	
Citharus linguatula	0.13	6	0.02	
Uranoscopus cadenati	0.13	3	0.02	
Illex coindetii	0.06	9	0.01	
Microchirus frechkopi	0.03	3		
Total	814.29		100.01	

PROJECT STATION:3804
 DATE:20/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 652
 start stop duration Long E 1153
 TIME :00:25:57 00:54:58 29 (min) Purpose code: 1
 LOG : 545.81 547.30 1.49 Area code : 3
 FDEPTH: 181 197 GearCond.code: 1
 BDEPTH: 181 197 Validity code: 1
 Towing dir: 330ø Wire out: 480 m Speed: 30 kn*10
 Sorted: 358 Kg Total catch: 358.92 CATCH/HOUR: 742.59

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brotula barbata	109.84	87	14.79	8052
Spicara alta	101.71	948	13.70	8055
Merluccius polli	89.67	368	12.08	8053
Saurida brasiliensis	67.28	25076	9.06	
Dentex angolensis	64.92	228	8.74	8054
Pteroscion sp.	63.60	64	8.56	
Umbrina canariensis	46.39	108	6.25	8051
Pteroscion peli	35.05	213	4.72	
Bembrops heterurus	26.03	395	3.51	
Synagrops microlepis	16.82	683	2.27	
Todaropsis eblanae	13.08	203	1.76	
Squatina oculata	12.04	4	1.62	
Scorpaena normani	11.44	122	1.54	
Uranoscopus cadenati	10.41	66	1.40	
Peristedion cataphractum	5.98	242	0.81	
Zeus faber	5.54	8	0.75	
Calappa sp.	5.34	101	0.72	
Coelorrinchus sp.	5.21	163	0.70	
Dentex macrophthalmus	5.11	10	0.69	8050
Zenopsis conchifer	4.97	12	0.67	
Trachurus trecae	4.63	8	0.62	8049
Pterothrissus belloci	4.61	33	0.62	
B I V A L V E S	4.59	612	0.62	
Ommastrephes pteropus	3.43	39	0.46	
Parapanaeus longirostris	3.06	1376	0.41	
Pegusa lascaris	2.17	56	0.29	
Chlorophthalmus atlanticus	1.84	10	0.25	
NETTASTOMATIDAE	1.82	62	0.25	
Bassanago albescens	1.74	31	0.23	
Lophius sp.	1.63	6	0.22	
Pontinus accraensis	1.45	2	0.20	
Cynoponticus ferox	1.43	17	0.19	
Octopus sp.	1.37	2	0.18	
Trigla lyra	1.37	14	0.18	
Lamprogrammus exutus	1.24	58	0.17	
Torpedo torpedo	1.10	2	0.15	
Citharus linguatula	1.10	101	0.15	
Chelidonichthys capensis	1.10	10	0.15	
Torpedo marmorata	1.08	2	0.15	
Raja alba	0.81	8	0.11	
Raja miraletus	0.48	2	0.06	
Physiculus huloti	0.12	4	0.02	
Total	742.60		100.02	

PROJECT STATION:3801
 DATE:19/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 642
 start stop duration Long E 1144
 TIME :10:25:49 10:59:04 33 (min) Purpose code: 3
 LOG : 433.62 435.20 1.57 Area code : 3
 FDEPTH: 279 281 GearCond.code: 1
 BDEPTH: 279 281 Validity code: 1
 Towing dir: 324ø Wire out: 800 m Speed: 30 kn*10
 Sorted: 72 Kg Total catch: 4467.46 CATCH/HOUR: 8122.66

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Synagrops microlepis	5151.46	277376	63.42	8041
Chlorophthalmus atlanticus	1659.47	38356	20.43	8040
Merluccius polli	962.91	4438	11.85	8039
GALATHEIDAE *	117.24	15707	1.44	
Brotula barbata	83.09	115	1.02	
Todaropsis eblanae	50.07	342	0.62	
Hexanchus griseus	40.00	2	0.49	
Zeus faber	25.09	115	0.31	
MYCTOPHIDAE	19.35	6944	0.24	
Peristedion cataphractum	6.84	342	0.08	
Sepia sp.	6.00	5	0.07	
Nezumia aequalis	1.15	115	0.01	
Total	8122.67		99.98	

PROJECT STATION:3805
 DATE:20/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 653
 start stop duration Long E 1203
 TIME :08:31:39 09:01:52 30 (min) Purpose code: 1
 LOG : 619.81 621.30 1.49 Area code : 3
 FDEPTH: 95 90 GearCond.code:
 BDEPTH: 95 90 Validity code:
 Towing dir: 54ø Wire out: 300 m Speed: 30 kn*10
 Sorted: 235 Kg Total catch: 235.64 CATCH/HOUR: 471.28

PROJECT STATION:3808
 DATE:22/ 7/05 GEAR TYPE: PT No: 1 POSITION:Lat S 701
 start stop duration Long E 1227
 TIME :22:30:00 23:00:47 31 (min) Purpose code: 1
 LOG :1190.57 1192.36 1.80 Area code : 3
 FDEPTH: 10 5 GearCond.code:
 BDEPTH: 50 51 Validity code:
 Towing dir: 181ø Wire out: 160 m Speed: 40 kn*10
 Sorted: 46 Kg Total catch: 46.43 CATCH/HOUR: 89.86

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Dentex congoensis	193.16 8188	40.99	8060
Umbrina canariensis	83.16 192	17.65	8056
Trigla lyra	70.00 852	14.85	
Pagellus bellottii	24.88 168	5.28	8057
Rhinobatos albomaculatus	14.80 4	3.14	
B I V A L V E S	13.00 812	2.76	
Squatina oculata	9.40 6	1.99	
Mustelus mustelus	9.00 6	1.91	
Alloteuthis africana	6.20 1500	1.32	
Trachurus trecae	5.60 82	1.19	8058
Raja miraletus	4.90 10	1.04	
Epinephelus aeneus	4.72 2	1.00	
Zeus faber	4.64 14	0.98	
Raja alba	4.16 6	0.88	
Dentex angolensis	3.38 56	0.72	8059
Octopus vulgaris	3.06 6	0.65	
Citharus linguatula	2.46 464	0.52	
Lagocephalus laevigatus	2.44 4	0.52	
Sepia orbignyana	2.12 32	0.45	
Torpedo torpedo	1.86 4	0.39	
Todaropsis eblanae	1.60 34	0.34	
Bassanago albescens	1.56 10	0.33	
Peristedion cataphractum	0.84 40	0.18	
Priacanthus arenatus	0.78 2	0.17	
Chaetodon hoefleri	0.72 4	0.15	
Dicologlossa cuneata	0.60 8	0.13	
Grammolites gruvelli	0.60 16	0.13	
Illex coindetil	0.58 14	0.12	
Saurida brasiliensis	0.48 112	0.10	
Bemrops greyi	0.32 6	0.07	
Ariomma bondi	0.20 10	0.04	
Spicara alta	0.06 16	0.01	
Total	471.28	100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Stromateus fiatola	49.86 60	55.49	8075
Trichiurus lepturus	21.45 27	23.87	
Scomberomorus tritor	11.85 8	13.19	8073
Selene dorsalis	4.43 15	4.93	8074
Alloteuthis africana	2.21 1434	2.46	
Trachurus trecae, juvenile	0.08 37	0.09	8076
Total	89.88	100.03	

PROJECT STATION:3809
 DATE:23/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 729
 start stop duration Long E 1230
 TIME :08:38:47 09:08:33 30 (min) Purpose code: 1
 LOG :1262.16 1263.58 1.40 Area code : 3
 FDEPTH: 117 116 GearCond.code:
 BDEPTH: 117 116 Validity code:
 Towing dir: 335ø Wire out: 330 m Speed: 30 kn*10
 Sorted: 263 Kg Total catch: 263.44 CATCH/HOUR: 526.88

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Umbrina canariensis	235.08 490	44.62	8077
Dentex angolensis	145.96 748	27.70	8084
Dentex congoensis	50.56 748	9.60	8083
Trigla lyra	12.32 114	2.34	
Brotula barbata	9.46 6	1.80	8078
Branchiostegus semifasciatus	8.52 8	1.62	
Zenopsis conchifer	8.36 16	1.59	
Trichiurus lepturus	7.70 4	1.46	
Dentex barnardi	6.92 14	1.31	
Trachurus trecae	6.70 84	1.27	8082
Todaropsis eblanae	6.40 128	1.21	
Atractoscion aequidens	5.72 2	1.09	8080
Sarda sarda	5.38 4	1.02	8079
Squatina oculata	4.40 2	0.84	
Ariomma bondi	3.44 44	0.65	
Pagrus africanus	2.76 2	0.52	
Lagocephalus lunaris	1.62 2	0.31	
Spicara alta	1.26 22	0.24	
Sepia orbignyana	1.14 10	0.22	
Trachinotus ovatus	1.14 6	0.22	
Saurida brasiliensis	0.88 210	0.17	
Citharus linguatula	0.48 12	0.09	
Illex coindetil	0.36 6	0.07	
Chaetodon hoefleri	0.28 2	0.05	
Trachurus trecae, juvenile	0.04 20	0.01	8081
Total	526.88	100.02	

PROJECT STATION:3806
 DATE:22/ 7/05 GEAR TYPE: OT No:14 POSITION:Lat S 718
 start stop duration Long E 1223
 TIME :07:57:47 08:25:45 28 (min) Purpose code: 1
 LOG :1083.34 1084.71 1.34 Area code : 3
 FDEPTH: 121 143 GearCond.code:
 BDEPTH: 121 143 Validity code:
 Towing dir: 260ø Wire out: 360 m Speed: 30 kn*10
 Sorted: 210 Kg Total catch: 209.96 CATCH/HOUR: 449.91

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Dentex angolensis	203.40 1487	45.21	8062
Dentex congoensis	87.69 939	19.49	8066
Epinephelus goreensis	51.64 2	11.48	
Brotula barbata	29.40 30	6.53	8065
BIVALVE	16.01 1601	3.56	
Dentex macropthalmus	7.29 19	1.62	8064
Trigla lyra	7.22 71	1.60	
Umbrina canariensis	6.30 13	1.40	8063
Trachurus trecae	5.36 54	1.19	8061
Zeus faber	4.63 4	1.03	
Peristedion cataphractum	4.48 94	1.00	
Raja miraletus	4.20 6	0.93	
Todaropsis eblanae	3.62 114	0.80	
Zenopsis conchifer	3.43 9	0.76	
Citharus linguatula	3.11 116	0.69	
Raja alba	2.89 2	0.64	
Trichiurus lepturus	1.93 2	0.43	
Branchiostegus semifasciatus	1.80 2	0.40	
Scorpaena normani	1.61 6	0.36	
Chaetodon hoefleri	0.86 6	0.19	
Spicara alta	0.62 24	0.14	
Octopus sp.	0.62 24	0.14	
Ariomma bondi	0.60 13	0.13	
Uranoscopus sp.	0.56 2	0.12	
Sepia orbignyana	0.30 2	0.07	
Serranus cabrilla	0.28 2	0.06	
Saurida brasiliensis	0.09 19	0.02	
Total	449.94	99.99	

PROJECT STATION:3810
 DATE:23/ 7/05 GEAR TYPE: PT No: 2 POSITION:Lat S 737
 start stop duration Long E 1229
 TIME :16:31:45 16:43:56 12 (min) Purpose code: 1
 LOG :1326.52 1327.19 0.66 Area code : 3
 FDEPTH: 300 300 GearCond.code:
 BDEPTH: 516 471 Validity code:
 Towing dir: 335ø Wire out: 700 m Speed: 30 kn*10
 Sorted: 2 Kg Total catch: 2.26 CATCH/HOUR: 11.30

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
J E L Y F I S H	9.65 1930	85.40	
MYCTOPHIDAE	0.80 875	7.08	
Benthodesmus tenuis	0.55 50	4.87	
Stomias sp.	0.15 5	1.33	
Brotula barbata	0.05 5	0.44	
OMMASTREPHIDAE	0.05 5	0.44	
Krill	0.05 25	0.44	
Total	11.30	100.00	

PROJECT STATION:3811
 DATE:23/ 7/05 GEAR TYPE: PT No: 2 POSITION:Lat S 736
 start stop duration Long E 1228
 TIME :16:54:36 17:06:47 12 (min) Purpose code: 1
 LOG :1327.71 1328.43 0.71 Area code : 3
 FDEPTH: 140 140 GearCond.code:
 BDEPTH: 476 485 Validity code:
 Towing dir: 335ø Wire out: 400 m Speed: 35 kn*10
 Sorted: 79 Kg Total catch: 79.53 CATCH/HOUR: 397.65

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
MYCTOPHIDAE	396.00 83160	99.59	
Trichiurus lepturus	1.60 5	0.40	
Benthodesmus tenuis	0.05 5	0.01	
Total	397.65	100.00	

PROJECT STATION:3807
 DATE:22/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 659
 start stop duration Long E 1236
 TIME :20:17:32 20:44:39 27 (min) Purpose code: 1
 LOG :1175.56 1176.98 1.56 Area code : 3
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 25 26 Validity code:
 Towing dir: 330ø Wire out: 150 m Speed: 30 kn*10
 Sorted: 625 Kg Total catch: 625.98 CATCH/HOUR: 1391.07

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
J E L Y F I S H	1287.82 924	92.58	
Brachydeuterus auritus	45.64 551	3.28	8069
Sphyræna guachancho	19.49 40	1.40	8067
Caranx crysos	6.38 7	0.46	
Scomberomorus tritor	6.16 4	0.44	
Pagellus bellottii	5.51 29	0.40	8072
Sardinella aurita	4.60 13	0.33	8070
Stromateus fiatola	3.07 4	0.22	
Sardinella maderensis	3.00 13	0.22	8071
Sepia orbignyana	2.82 4	0.20	
Caranx hippos	2.20 2	0.16	
Elops lacerta	1.40 2	0.10	
Trichiurus lepturus	0.96 2	0.07	
Decapterus rhonchus	0.80 2	0.06	
Trachinotus ovatus	0.62 4	0.04	
Trachurus trecae	0.36 2	0.03	8068
Boops boops	0.24 67	0.02	
Total	1391.07	100.01	

PROJECT STATION:3812
 DATE:23/ 7/05 GEAR TYPE: PT No: 2 POSITION:Lat S 734
 start stop duration Long E 1227
 TIME :17:24:12 17:36:32 12 (min) Purpose code: 1
 LOG :1329.37 1330.16 0.78 Area code : 3
 FDEPTH: 40 40 GearCond.code:
 BDEPTH: 460 454 Validity code:
 Towing dir: 335ø Wire out: 160 m Speed: 37 kn*10
 Sorted: 47 Kg Total catch: 47.77 CATCH/HOUR: 238.85

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
MYCTOPHIDAE	198.50 114285	83.11	
Trichiurus lepturus	23.30 40	9.76	
J E L Y F I S H	11.60 405	4.86	
Auxis thazard	5.45 5	2.28	
Total	238.85	100.01	

PROJECT STATION:3813
 DATE:23/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 735
 start stop duration Long E 1257
 TIME :22:59:37 23:30:51 31 (min) Purpose code: 1
 LOG :1376.68 1378.55 1.85 Area code : 3
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 27 33 Validity code:
 Towing dir: 304ø Wire out: 150 m Speed: 36 kn*10
 Sorted: Kg Total catch: 610.47 CATCH/HOUR: 1181.55

PROJECT STATION:3817
 DATE:25/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 820
 start stop duration Long E 1317
 TIME :13:19:26 13:48:29 29 (min) Purpose code: 1
 LOG :1701.01 1702.72 1.69 Area code : 3
 FDEPTH: 32 30 GearCond.code:
 BDEPTH: 32 30 Validity code:
 Towing dir: 350ø Wire out: 150 m Speed: 35 kn*10
 Sorted: 86 Kg Total catch: 86.86 CATCH/HOUR: 179.71

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Brachydeuterus auritus	1072.34	11748	90.76 8087
Sardinella maderensis	49.32	190	4.17 8090
Selene dorsalis	17.15	106	1.45 8086
Trichurus lepturus	13.24	23	1.12
Sphyræna guachancho	6.15	10	0.52
Chloroscombrus chrysurus	5.94	33	0.50
Pomadasys incisus	5.19	6	0.44
Sardinella aurita	4.57	15	0.39 8089
Trachurus trecae	4.24	52	0.36 8085
Sepla orbignyana	1.26	2	0.11
Lagocephalus laevigatus	0.58	2	0.05
Trachurus trecae, juvenile	0.54	370	0.05 8091
Ilisha africana	0.35	4	0.03
Brachydeuterus auritus Juv.	0.31	77	0.03 8088
Echeneis naucrates	0.19	2	0.02
Decapterus rhonchus	0.14	4	0.01
Sardinella aurita - Juveniles	0.06	4	0.01
Total	1181.57	100.02	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Sardinella aurita	122.28	482	68.04 8101
Sardinella maderensis	50.65	300	28.18 8103
Scomberomorus tritor	2.79	2	1.55
Brachydeuterus auritus	2.01	33	1.12 8102
Sphyræna guachancho	1.99	6	1.11
Total	179.72	100.00	

PROJECT STATION:3818
 DATE:25/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 836
 start stop duration Long E 1254
 TIME :18:20:10 20:01:07 33 (min) Purpose code: 1
 LOG :1756.48 1758.06 1.57 Area code : 3
 FDEPTH: 415 409 GearCond.code:
 BDEPTH: 415 409 Validity code:
 Towing dir: 1ø Wire out:1100 m Speed: 30 kn*10
 Sorted: 25 Kg Total catch: 273.96 CATCH/HOUR: 498.11

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius polli	213.82	536	42.93 8104
Parapenaeus longirostris	175.20	54153	35.17
Laemonema laureysi	41.24	327	8.28
Neoharriotta pinnata	34.69	22	6.96
Nezumia micronychodon	10.47	131	2.10
Etmopterus spinax	9.09	524	1.82
Todaropsis eblanae	5.67	44	1.14
Conger conger	2.62	44	0.53
Trachyrincus scabrus	2.18	55	0.44
Hoplostethus cadenati	1.31	76	0.26
Chaux pictus	1.20	22	0.24
Galeus polli	0.27	9	0.05
Triplophos sp.	0.22	120	0.04
Dibranchius atlanticus	0.11	33	0.02
Halosaurus ovenii	0.02	11	
Total	498.11	99.98	

PROJECT STATION:3814
 DATE:24/ 7/05 GEAR TYPE: PT No: 4 POSITION:Lat S 750
 start stop duration Long E 1302
 TIME :07:37:59 08:08:04 30 (min) Purpose code: 1
 LOG :1456.71 1458.61 1.80 Area code : 3
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 36 32 Validity code:
 Towing dir: 350ø Wire out: 150 m Speed: 37 kn*10
 Sorted: 146 Kg Total catch: 1284.29 CATCH/HOUR: 2568.58

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Brachydeuterus auritus	2310.48	23310	89.95 8097
Trachurus trecae	187.56	792	7.30 8092
Trichurus lepturus	39.06	306	1.52
J E L Y F I S H	15.48	36	0.60
Ephippion guttifer	5.40	2	0.21
Boops boops	3.78	18	0.15
Selene dorsalis	3.78	36	0.15
Scomberomorus tritor	3.04	2	0.12
Total	2568.58	100.00	

PROJECT STATION:3819
 DATE:26/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 841
 start stop duration Long E 1320
 TIME :00:34:39 01:06:06 31 (min) Purpose code: 1
 LOG :1799.46 1801.27 1.79 Area code : 3
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 28 29 Validity code:
 Towing dir: 10ø Wire out: 150 m Speed: 35 kn*10
 Sorted: 148 Kg Total catch: 148.52 CATCH/HOUR: 287.46

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Sardinella aurita	123.14	525	42.84 8108
Sardinella maderensis	72.46	358	25.21 8109
Trichurus lepturus	46.14	161	16.05
Trachurus trecae	24.27	199	8.44 8105
Brachydeuterus auritus	13.57	105	4.72 8107
Stromateus fiatola	7.26	17	2.53
Sphyræna guachancho	0.33	2	0.11
Trachurus trecae, juvenile	0.19	58	0.07 8106
Boops boops	0.10	2	0.03
Total	287.46	100.00	

PROJECT STATION:3815
 DATE:24/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 800
 start stop duration Long E 1308
 TIME :19:30:33 19:55:32 25 (min) Purpose code: 1
 LOG :1542.06 1543.51 1.75 Area code : 3
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 30 30 Validity code:
 Towing dir: 330ø Wire out: 150 m Speed: 35 kn*10
 Sorted: 116 Kg Total catch: 116.50 CATCH/HOUR: 279.60

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Brachydeuterus auritus	168.91	2959	60.41 8093
Ilisha africana	46.46	564	16.62
Trichurus lepturus	39.17	250	14.01
Trachurus trecae	9.00	29	3.22 8095
Sardinella maderensis	5.86	29	2.10 8096
Stromateus fiatola	5.42	19	1.94
J E L Y F I S H	1.99	7	0.71
Remora sp.	1.82	5	0.65
Pomadasys incisus	0.72	2	0.26
Trachurus trecae, juvenile	0.24	14	0.09 8094
Total	279.59	100.01	

PROJECT STATION:3820
 DATE:29/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 911
 start stop duration Long E 1256
 TIME :01:18:50 01:30:40 12 (min) Purpose code: 1
 LOG :2028.20 2028.99 0.79 Area code : 2
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 20 21 Validity code:
 Towing dir: 215ø Wire out: 140 m Speed: 40 kn*10
 Sorted: 183 Kg Total catch: 1393.22 CATCH/HOUR: 6966.10

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Brachydeuterus auritus	3147.00	30665	45.18
Sardinella aurita	1750.50	6800	25.13 8111
Chloroscombrus chrysurus	1063.00	8435	15.26
Sardinella maderensis	345.80	2355	4.96 8110
Ilisha africana	197.50	2620	2.84
Galeoides decadactylus	167.20	800	2.40
Selene dorsalis	166.50	1445	2.39
Trachurus trecae	76.00	800	1.09 8112
Scomber japonicus	13.30	40	0.19
Sepla orbignyana	11.80	40	0.17
Pomadasys rogeri	9.10	40	0.13
Pagellus bellottii	7.60	40	0.11
Pentheroscion mbizi	3.80	75	0.05
Sphyræna sphyraena	3.80	40	0.05
Hemicaranx bicolor	3.40	40	0.05
Total	6966.30	100.00	

PROJECT STATION:3816
 DATE:25/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 807
 start stop duration Long E 1312
 TIME :03:25:05 03:55:52 31 (min) Purpose code: 1
 LOG :1617.31 1619.17 1.84 Area code : 3
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 27 32 Validity code:
 Towing dir: 350ø Wire out: 150 m Speed: 36 kn*10
 Sorted: 52 Kg Total catch: 193.31 CATCH/HOUR: 374.15

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Brachydeuterus auritus	262.45	4701	70.15 8100
Sardinella aurita	47.61	168	12.72 8098
Sardinella maderensis	23.38	143	6.25 8099
Trichurus lepturus	16.55	163	4.42
Ilisha africana	10.63	300	2.84
Pomadasys peroteti	6.79	12	1.81
Sepla orbignyana	6.50	6	1.74
Trachurus trecae, juvenile	0.12	21	0.03
Brachydeuterus auritus Juv.	0.12	12	0.03
Total	374.15	99.99	

PROJECT STATION:3821
 DATE:29/ 7/05 GEAR TYPE: PT No: 1 POSITION:Lat S 934
 start stop duration Long E 1301
 TIME :15:40:49 16:15:49 35 (min) Purpose code: 1
 LOG :2166.32 2168.69 2.37 Area code : 2
 FDEPTH: 20 20 GearCond.code:
 BDEPTH: 63 82 Validity code:
 Towing dir: 245ø Wire out: 140 m Speed: 40 kn*10
 Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Total			

PROJECT STATION:3822
 DATE:29/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 937
 start stop duration Long E 1308
 TIME :18:53:39 19:24:43 31 (min) Purpose code: 1
 LOG :2190.57 2192.25 1.65 Area code : 2
 FDEPTH: 10 10 GearCond.code: 2
 BDEPTH: 31 32 Validity code:
 Towing dir: 330ø Wire out: 150 m Speed: 30 kn*10
 Sorted: 47 Kg Total catch: 47.08 CATCH/HOUR: 91.12

PROJECT STATION:3825
 DATE:30/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 954
 start stop duration Long E 1314
 TIME :11:40:45 12:10:35 30 (min) Purpose code: 1
 LOG :2335.75 2337.29 1.53 Area code : 2
 FDEPTH: 22 21 GearCond.code:
 BDEPTH: 22 21 Validity code:
 Towing dir: 175ø Wire out: 140 m Speed: 30 kn*10
 Sorted: 53 Kg Total catch: 112.71 CATCH/HOUR: 225.42

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Boops boops	46.30	989	50.81	8113
Sphyræna guachancho	16.45	70	18.05	8115
Trachurus trecae	6.31	68	6.92	8118
Brachydeuterus auritus	6.15	56	6.75	8116
Sardinella maderensis	4.47	14	4.91	8120
Engraulis encrasicolus	2.75	401	3.02	8114
Sepia bertheloti	1.76	8	1.93	
Chloroscombrus chrysurus	1.55	2	1.70	
Trichiurus lepturus	1.32	6	1.45	
Ilisha africana	1.30	14	1.43	8117
C E P H A L O P O D A	0.91		1.00	
Pomadasy incisus	0.43	2	0.47	
Decapterus punctatus	0.43	6	0.47	
Sardinella maderensis - Juv.	0.39	25	0.43	8119
J E L L Y F I S H	0.39	8	0.43	
Alloteuthis africana	0.14	108	0.15	
Trachurus trecae, juvenile	0.08	31	0.09	8121
Bregmaceros nectabanus	0.02	4	0.02	
Total	91.15		100.03	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Sardinella aurita	64.32	328	28.53	8138
Sardinella maderensis	48.60	448	21.56	8137
Brachydeuterus auritus	47.68	722	21.15	8139
Pteroscion peli	23.52	678	10.43	
Galeoides decadactylus	9.12	58	4.05	
Sepia orbignyana	5.28	8	2.34	
Ilisha africana	4.98	74	2.21	
Pseudotolithus typus	4.60	40	2.04	
Trichiurus lepturus	4.48	72	1.99	
Ephippion guttifer	2.82	2	1.25	
Torpedo marmorata	2.02	4	0.90	
Dicologlossa cuneata	1.78	28	0.79	
Sepiella ornata	1.46	2	0.65	
Pomadasy jubelini	1.28	2	0.57	
Zeus faber	0.98	2	0.43	
Eucinostomus melanopterus	0.92	10	0.41	
Pomadasy incisus	0.56	6	0.25	
Selene dorsalis	0.54	12	0.24	
Parapenaeopsis atlantica	0.30	72	0.13	
Chloroscombrus chrysurus	0.18	4	0.08	
Total	225.42		100.00	

PROJECT STATION:3823
 DATE:29/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 936
 start stop duration Long E 1307
 TIME :19:54:54 20:04:57 10 (min) Purpose code: 1
 LOG :2193.69 2194.08 0.32 Area code : 2
 FDEPTH: 31 32 GearCond.code: 8
 BDEPTH: 31 32 Validity code:
 Towing dir: 160ø Wire out: 150 m Speed: 30 kn*10
 Sorted: 311 Kg Total catch: 310.92 CATCH/HOUR: 1865.52

PROJECT STATION:3826
 DATE:30/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 1006
 start stop duration Long E 1316
 TIME :19:20:04 19:49:31 29 (min) Purpose code: 1
 LOG :2406.07 2407.58 1.48 Area code : 2
 FDEPTH: 37 51 GearCond.code:
 BDEPTH: 37 51 Validity code:
 Towing dir: 240ø Wire out: 150 m Speed: 30 kn*10
 Sorted: 147 Kg Total catch: 265.92 CATCH/HOUR: 550.18

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex canariensis	869.04	2454	46.58	8122
Dentex gibbosus	149.16	192	8.00	8127
Atractoscion aequidens	141.36	162	7.58	8125
Brachydeuterus auritus	129.00	1338	6.91	8129
Pagellus bellottii	114.36	462	6.13	8126
Pseudupeneus prayensis	106.92	1434	5.73	
Pomadasy incisus	46.80	186	2.51	
Raja miraletus	32.88	24	1.76	
Aluterus monoceros	30.00	48	1.61	
Scorpaena stephanica	28.32	714	1.52	
Pagrus caeruleostictus	23.04	60	1.24	
Sphyræna guachancho	20.40	60	1.09	8128
Boops boops	18.12	600	0.97	
Lithognathus mormyrus	17.88	66	0.96	8130
Raja miraletus	15.84	30	0.85	
Spondyllosoma cantharus	13.92	66	0.75	
Fagrus africanus	12.72	6	0.68	
Rhinobatos albomaculatus	11.76	12	0.63	
Octopus vulgaris	11.22	12	0.60	
Citharus linguatula	10.74	234	0.58	
Lagocephalus lagocephalus	9.60	498	0.51	
Chilomycterus spinosus mauret.	8.76	48	0.47	
Fistularia petimba	8.40	18	0.45	
Epigonus pandionis	6.66	1356	0.36	
Trachurus trecae	6.36	12	0.34	
J E L L Y F I S H	4.20	18	0.23	
Chaetodon hoefleri	3.96	78	0.21	
Umbrina canariensis	2.34	18	0.13	
Sepia orbignyana	2.22	18	0.12	
Chelidonichthys capensis	2.10	6	0.11	
Grammolites gruvelli	1.98	30	0.11	
Pisodonophis semicinctus	1.32	6	0.07	
Ilisha africana	1.08	12	0.06	
Bodianus speciosus	1.08	42	0.06	
Chaetodon marcellae	0.54	18	0.03	
Trichiurus lepturus	0.48	6	0.03	
Rypticus saponaceus	0.42	6	0.02	
Pegusa lascaris	0.42	18	0.02	
Squilla sp.	0.36	6	0.02	
Chaetodon marcellae	0.00			
Total	1865.76		100.03	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Pteroscion peli	132.54	1332	24.09	8146
Pagellus bellottii	109.55	718	19.91	8144
Pseudotolithus typus	72.39	339	13.16	
Cynoglossus canariensis	48.85	52	8.88	
Pomadasy incisus	45.81	604	8.33	8145
Bembrops heterurus	22.49	544	4.09	
Brachydeuterus auritus	16.30	372	2.96	
Calappa sp.	15.85	118	2.88	
Sardinella maderensis	14.69	236	2.67	8140
Citharus linguatula	12.81	381	2.33	
Rhinobatos albomaculatus	10.06	10	1.83	
Umbrina canariensis	9.93	101	1.80	
Raja miraletus	6.85	33	1.25	
Octopus sp.	5.17	19	0.94	
Chelidonichthys gabonensis	5.13	33	0.93	
Conger conger	3.56	112	0.65	
Torpedo torpedo	2.94	48	0.53	
Torpedo marmorata	2.11	41	0.38	
Sardinella aurita	2.09	19	0.38	8141
Trichiurus lepturus	1.82	37	0.33	
Synphobranchius kaupii	1.74	56	0.32	
Sepia officinalis hierredda	1.59	23	0.29	
Penaeus notialis	1.22	27	0.22	
Dentex barnardi	1.14	10	0.21	
Monolele microstoma	1.14	19	0.21	
Squilla mantis	1.03	46	0.19	
Trachurus trecae	0.83	4	0.15	
Ilisha africana	0.56	8	0.10	
Total	550.19		100.01	

PROJECT STATION:3824
 DATE:30/ 7/05 GEAR TYPE: PT No: 1 POSITION:Lat S 947
 start stop duration Long E 1309
 TIME :03:54:23 04:18:41 24 (min) Purpose code: 1
 LOG :2263.48 2265.27 1.79 Area code : 2
 FDEPTH: 15 15 GearCond.code: 2
 BDEPTH: 38 44 Validity code: 1
 Towing dir: 300ø Wire out: 140 m Speed: 42 kn*10
 Sorted: 168 Kg Total catch: 471.26 CATCH/HOUR: 1178.15

PROJECT STATION:3827
 DATE:30/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 1007
 start stop duration Long E 1314
 TIME :20:25:31 20:55:33 30 (min) Purpose code: 1
 LOG :2408.82 2410.37 1.53 Area code : 2
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 50 36 Validity code:
 Towing dir: 64ø Wire out: 150 m Speed: 30 kn*10
 Sorted: 57 Kg Total catch: 57.32 CATCH/HOUR: 114.64

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	733.18	7580	62.23	8136
Trachurus trecae	186.90	1695	15.86	8131
Sardinella maderensis	142.65	925	12.11	8135
Sardinella aurita	71.95	343	6.11	8134
Boops boops	38.58	448	3.27	8133
Trachurus trecae, juvenile	3.13	313	0.27	8132
Sepia officinalis hierredda	0.98	8	0.08	
Sepia orbignyana	0.85	8	0.07	
Total	1178.22		100.00	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Brachydeuterus auritus	90.64	624	79.06	
Raja miraletus	9.38	22	8.18	
Ilisha africana	3.80	22	3.31	
Trichiurus lepturus	3.48	58	3.04	
Trachurus trecae	1.82	14	1.59	8142
Galeoides decadactylus	1.28	2	1.12	
Sphyræna sphyraena	1.08	2	0.94	
Sepia officinalis hierredda	0.74	6	0.65	
Trachurus trecae, juvenile	0.66	12	0.58	
Maja squinado	0.58	172	0.51	
Sardinella maderensis	0.54	6	0.47	
Brachydeuterus auritus Juv.	0.42	16	0.37	
Alloteuthis africana	0.22	102	0.19	
Total	114.64		100.01	

PROJECT STATION:3828
 DATE:31/ 7/05 GEAR TYPE: PT No: 4 POSITION:Lat S 1012
 start stop duration Long E 1314
 TIME :23:20:58 00:00:47 30 (min) Purpose code: 1
 LOG :2435.82 2437.89 2.02 Area code : 2
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 75 62 Validity code:
 Towing dir: 65ø Wire out: 160 m Speed: 40 kn*10

Sorted: 189 Kg Total catch: 189.09 CATCH/HOUR: 378.18

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Brachydeuterus auritus	347.28 2354	91.83	8143
Trichiurus lepturus	21.40 38	5.66	
Sepia officinalis hierredda	3.40 20	0.90	
Lagocephalus laevigatus	2.14 4	0.57	
Mugil cephalus	1.94 2	0.51	
Stromateus fiatola	0.84 2	0.22	
Engraulis encrasicolus	0.56 426	0.15	
Illex sp.	0.42 216	0.11	
Saurida brasiliensis	0.16 90	0.04	
Merluccius polli, juveniles	0.04 12	0.01	
Total	378.18	100.00	

PROJECT STATION:3832
 DATE:31/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 1036
 start stop duration Long E 1320
 TIME :23:21:43 23:51:33 30 (min) Purpose code: 1
 LOG :2612.35 2613.95 1.58 Area code : 2
 FDEPTH: 113 106 GearCond.code:
 BDEPTH: 113 106 Validity code:
 Towing dir: 65ø Wire out: 380 m Speed: 30 kn*10

Sorted: 304 Kg Total catch: 304.28 CATCH/HOUR: 608.56

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Trigla lyra	118.60 914	19.49	
Dentex angolensis	106.24 682	17.46	8157
Umbria canariensis	67.36 114	11.07	
Brotula barbata	62.96 112	10.35	
Dentex macrophthalmus	40.52 214	6.66	8158
Pterothrissus belloci	38.88 286	6.39	
Raja miraletus	32.72 54	5.38	
Peristedion cataphractum	29.28 630	4.81	
Cynoponticus ferox	24.88 10	4.09	
Citharus linguatula	18.32 320	3.01	
Uranoscopus polli	14.08 86	2.31	
Scorpaena normani	11.48 98	1.89	
Zeus faber	6.40 24	1.05	
Squatina oculata	6.12 2	1.01	
Dasyatis marmorata	5.68 2	0.93	
Torpedo torpedo	4.14 8	0.68	
Rhinobatos albomaculatus	4.00 2	0.66	
Conger conger	3.22 34	0.53	
Pagellus bellottii	2.88 16	0.47	8159
Branchiostegus semifasciatus	2.18 6	0.36	
Lophiodes kempi	1.92 2	0.32	
Trichiurus lepturus	1.40 4	0.23	
Trachurus trecae	1.38 4	0.23	
Miracorvina angolensis	1.22 4	0.20	
Scyliorhinus cervigoni	1.10 2	0.18	
Microchirus freckhopsi	0.70 16	0.12	
Dicologlossa cuneata	0.46 2	0.08	
Boops boops	0.28 2	0.05	
Bembrops greyi	0.16 10	0.03	
Total	608.56	100.04	

PROJECT STATION:3829
 DATE:31/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 1018
 start stop duration Long E 1327
 TIME :11:30:25 12:00:13 30 (min) Purpose code: 1
 LOG :2517.12 2518.62 1.49 Area code : 2
 FDEPTH: 28 30 GearCond.code:
 BDEPTH: 28 30 Validity code:
 Towing dir: 165ø Wire out: 150 m Speed: 30 kn*10

Sorted: 265 Kg Total catch: 5687.34 CATCH/HOUR: 11374.68

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Brachydeuterus auritus	7772.00 103778	68.33	8147
Trachurus trecae	3212.00 25704	28.24	8148
Trichiurus lepturus	214.20 772	1.88	
Brachydeuterus auritus Juv.	72.00 13580	0.63	8149
Pseudotolithus typus	39.40 42	0.35	
Pagellus bellottii	17.98 128	0.16	
Epinephelus aeneus	10.72 42	0.09	
Pteroscion peli	10.28 258	0.09	
Selene dorsalis	10.28 128	0.09	
Boops boops	6.42 42	0.06	
Dicologlossa cuneata	5.98 42	0.05	
Umbria canariensis	3.42 42	0.03	
Total	11374.68	100.00	

PROJECT STATION:3833
 DATE: 1/ 8/05 GEAR TYPE: PT No:14 POSITION:Lat S 1050
 start stop duration Long E 1344
 TIME :14:53:30 15:24:55 31 (min) Purpose code: 1
 LOG :2731.38 2733.71 2.32 Area code : 2
 FDEPTH: 20 30 GearCond.code:
 BDEPTH: 35 33 Validity code:
 Towing dir: 2ø Wire out: 120 m Speed: 45 kn*10

Sorted: 123 Kg Total catch: 123.93 CATCH/HOUR: 239.86

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Brachydeuterus auritus	224.69 1761	93.68	8160
Sepia orbignyana	10.41 6	4.34	
Trachurus trecae	2.07 14	0.86	
Sphyræna sphyraena	1.59 4	0.66	
Trichiurus lepturus	1.10 4	0.46	
Total	239.86	100.00	

PROJECT STATION:3830
 DATE:31/ 7/05 GEAR TYPE: BT No:14 POSITION:Lat S 1032
 start stop duration Long E 1314
 TIME :16:43:19 17:13:06 30 (min) Purpose code: 1
 LOG :2562.78 2564.23 1.41 Area code : 2
 FDEPTH: 124 129 GearCond.code:
 BDEPTH: 124 129 Validity code:
 Towing dir: 245ø Wire out: 400 m Speed: 30 kn*10

Sorted: 360 Kg Total catch: 1110.21 CATCH/HOUR: 2220.42

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Dentex macrophthalmus	858.20 3104	38.65	8150
Trachurus trecae	585.20 4750	26.36	8153
Umbria canariensis	182.96 530	8.24	8154
Boops boops	159.66 2796	7.19	8152
Dentex angolensis	148.08 666	6.67	8151
Chelidonichthys gabonensis	43.62 400	1.96	
Spicara alta	40.40 1122	1.82	
Brotula barbata	40.28 44	1.81	
Alectis alexandrinus	28.52 18	1.28	
Raja miraletus	17.98 36	0.81	
Citharus linguatula	17.18 352	0.77	
Argyrosomus regius	16.88 12	0.76	
Trichiurus lepturus	15.22 24	0.69	
Peristedion cataphractum	14.96 326	0.67	
Raja alba	9.68 6	0.44	
Uranoscopus albesca	9.68 6	0.44	
Uranoscopus polli	8.20 44	0.37	
Sepia orbignyana	6.46 104	0.29	
Pseudupeneus prayensis	6.16 24	0.28	
Branchiostegus semifasciatus	4.80 6	0.22	
Torpedo torpedo	2.04 6	0.09	
Torpedo marmorata	1.60 6	0.07	
Zeus faber	1.42 6	0.06	
Parapristipoma octolineatum	1.24 6	0.06	
Total	2220.42	100.00	

PROJECT STATION:3834
 DATE: 1/ 8/05 GEAR TYPE: PT No: 1 POSITION:Lat S 1103
 start stop duration Long E 1334
 TIME :20:21:30 20:51:02 30 (min) Purpose code: 1
 LOG :2779.28 2780.90 1.60 Area code : 2
 FDEPTH: 4 5 GearCond.code:
 BDEPTH: 167 228 Validity code:
 Towing dir: 260ø Wire out: 150 m Speed: 30 kn*10

Sorted: 42 Kg Total catch: 449.74 CATCH/HOUR: 899.48

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	589.20 525750	65.50	
Trachurus trecae	191.12 566	21.25	8161
Trichiurus lepturus	72.80 2280	8.09	
Sarda sarda	25.20 30	2.80	
Isurus oxyrinchus	21.16 2	2.35	
Total	899.48	99.99	

PROJECT STATION:3831
 DATE:31/ 7/05 GEAR TYPE: PT No: 7 POSITION:Lat S 1025
 start stop duration Long E 1331
 TIME :20:06:19 20:35:38 29 (min) Purpose code: 1
 LOG :2586.33 2587.79 1.44 Area code : 2
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 24 30 Validity code:
 Towing dir: 190ø Wire out: 150 m Speed: 30 kn*10

Sorted: 211 Kg Total catch: 579.53 CATCH/HOUR: 1199.03

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Brachydeuterus auritus	1157.79 15811	96.56	8156
Ilisha africana	15.58 240	1.30	
Sardinella aurita	10.61 91	0.88	8047
Arius parkii	7.12 17	0.59	
Trichiurus lepturus	2.07 10	0.17	
Sphyræna sphyraena	1.97 17	0.16	
Sardinella maderensis	1.53 43	0.13	8155
Pomadasy incisus	1.51 6	0.13	
Pomadasy jubelini	0.89 6	0.07	
Total	1199.07	99.99	

PROJECT STATION:3835
 DATE: 2/ 8/05 GEAR TYPE: PT No: 1 POSITION:Lat S 1126
 start stop duration Long E 1328
 TIME :09:24:14 09:52:07 28 (min) Purpose code: 1
 LOG :2897.14 2899.18 2.01 Area code : 2
 FDEPTH: 20 20 GearCond.code:
 BDEPTH: 131 310 Validity code:
 Towing dir: 268ø Wire out: 140 m Speed: 45 kn*10

Sorted: 1 Kg Total catch: 0.36 CATCH/HOUR: 0.77

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Trachurus trecae	0.77 2	100.00	8162
Total	0.77	100.00	

PROJECT STATION:3836
 DATE: 3/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1130
 start stop duration Long E 1321
 TIME :23:42:15 00:12:11 30 (min) Purpose code: 1
 LOG :2994.60 2996.19 1.57 Area code : 2
 FDEPTH: 390 398 GearCond.code:
 BDEPTH: 390 398 Validity code:
 Towing dir: 35ø Wire out:1121 m Speed: 30 kn*10
 Sorted: 252 Kg Total catch: 2519.08 CATCH/HOUR: 5038.16

PROJECT STATION:3840
 DATE: 5/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1305
 start stop duration Long E 1251
 TIME :01:42:29 02:04:27 22 (min) Purpose code: 1
 LOG :3367.41 3368.54 1.04 Area code : 2
 FDEPTH: 69 69 GearCond.code:
 BDEPTH: 69 69 Validity code:
 Towing dir: 60ø Wire out: 222 m Speed: 30 kn*10
 Sorted: 26 Kg Total catch: 129.05 CATCH/HOUR: 351.95

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Merluccius polli	4491.20	11190	89.14	8163
Solenocera africana	305.60	85568	6.07	
Ommastrephes pteropus	56.60	780	1.12	
Hoplostethus cadenati	51.20	1900	1.02	
Laemonema laureysi	44.40	1160	0.88	
Aristeus varidens	17.20	1660	0.34	
Yarellia blackfordi	12.40	420	0.25	
Chlorophthalmus punctatus	12.40	300	0.25	
Etmopterus polli	10.70	1070	0.21	
Pterothrissus bellocci	5.80	20	0.12	
Stomias boa boa	4.60	60	0.09	
Nezumia milleri	4.40	140	0.09	
Coelorrhinus sp.	3.20	60	0.06	
Bathymectes piperitus	2.80	80	0.06	
Bassanago albescens	2.80	20	0.06	
Halosaurus ovenii	2.60	320	0.05	
Chaceon maritae	2.26	8	0.04	
Lophius vomerinus	2.20	20	0.04	
Chaunax pictus	1.40	20	0.03	
Nezumia aequalis	1.40	20	0.03	
Benthodesmus tenuis	0.80	20	0.02	
Scylliorhinus cervigoni	0.80	4	0.02	
Galeus polli	0.40	2	0.01	
Malacocephalus laevis	0.20	20		
Triplophos hemingi	0.20	20		
Lamprogrammus sp.	0.20	20		
MYCTOPHIDAE	0.20	20		
Physiculus capensis	0.20	20		
Total	5038.16	100.00		

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Dentex macrophthalmus	161.45	845	45.87	8167
Trigla lyra	41.32	341	11.74	
Citharus linguatula	34.50	764	9.80	
Umbrina canariensis	28.23	82	8.02	
Atractoscion aequidens	13.23	14	3.76	
Bembrops greyi	13.09	136	3.72	
Pagellus bellottii	10.50	109	2.98	
Epinephelus goreensis	9.00	14	2.56	
Boops boops	8.18	68	2.32	
Dentex angolensis	8.18	123	2.32	
Dicologlossa hexophthalma	7.09	109	2.01	
Pomadourus incisus	6.68	82	1.90	
Dentex barnardi	2.86	27	0.81	
Monolene microstoma	2.59	177	0.74	
Chaetodon hoefleri	2.45	14	0.70	
Brotula barbata	2.32	14	0.66	
Scorpaena normani	0.27	14	0.08	
Total	351.94	99.99		

PROJECT STATION:3837
 DATE: 3/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1141
 start stop duration Long E 1328
 TIME :08:03:47 08:33:01 29 (min) Purpose code: 1
 LOG :3066.21 3067.70 1.46 Area code : 2
 FDEPTH: 132 144 GearCond.code:
 BDEPTH: 132 144 Validity code:
 Towing dir: 180ø Wire out: 430 m Speed: 30 kn*10
 Sorted: 326 Kg Total catch: 3070.46 CATCH/HOUR: 6352.68

PROJECT STATION:3841
 DATE: 6/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1320
 start stop duration Long E 1237
 TIME :12:35:42 13:05:33 30 (min) Purpose code: 1
 LOG :3420.02 3421.60 1.57 Area code : 2
 FDEPTH: 89 109 GearCond.code:
 BDEPTH: 89 109 Validity code:
 Towing dir: 359ø Wire out: 313 m Speed: 30 kn*10
 Sorted: 54 Kg Total catch: 408.52 CATCH/HOUR: 817.04

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Trachurus trecae	2803.45	11934	44.13	8166
Dentex macrophthalmus	2145.52	8141	33.77	8164
Dentex angolensis	256.86	753	4.04	8165
Pterothrissus bellocci	215.17	474	3.39	
Todaropsis eblanae	138.62	3101	2.18	
Argyrosomus regius	99.31	39	1.56	
Umbrina canariensis	86.90	157	1.37	
Zeus faber	81.99	99	1.29	
Argyrosomus inodorus	71.17	39	1.12	
Brotula barbata	63.10	99	0.99	
Merluccius polli	61.24	455	0.96	
Trichiurus lepturus	57.93	139	0.91	
Scorpaena normani	39.72	217	0.63	
Bembrops heterurus	33.10	335	0.52	
Synagrops microlepis	30.41	7508	0.48	
Galeus melastomus	29.79	257	0.47	
Branchiostegus semifasciatus	25.86	21	0.41	
Misacorvina angolensis	25.03	21	0.39	
Citharus linguatula	21.72	691	0.34	
Torpedo torpedo	16.97	139	0.27	
Scylliorhinus cervigoni	11.05	21	0.17	
Saurida brasiliensis	9.10	2272	0.14	
Peristedion cataphractum	6.91	139	0.11	
Pteroscion peli	6.62	21	0.10	
Conger conger	5.17	39	0.08	
Uranoscopus polli	5.17	21	0.08	
Monolene microstoma	4.76	60	0.07	
Total	6352.64	99.97		

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Dentex macrophthalmus	542.10	2730	66.35	8169
Trigla lyra	110.84	886	13.57	
Trachurus trecae	79.28	242	9.70	8168
Dentex angolensis	27.30	166	3.34	
Pagellus bellottii	16.64	106	2.04	
Umbrina canariensis	12.90	30	1.58	
Citharus linguatula	11.10	270	1.36	
Trichiurus lepturus	10.34	16	1.27	
Dentex barnardi	5.40	16	0.66	
Squatina oculata	1.12	2	0.14	
Total	817.02	100.01		

PROJECT STATION:3838
 DATE: 4/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1228
 start stop duration Long E 1328
 TIME :14:45:29 15:07:18 22 (min) Purpose code: 1
 LOG :3269.17 3270.23 1.06 Area code : 2
 FDEPTH: 26 24 GearCond.code:
 BDEPTH: 26 24 Validity code:
 Towing dir: 180ø Wire out: 120 m Speed: 30 kn*10
 Sorted: 4 Kg Total catch: 4.53 CATCH/HOUR: 12.35

PROJECT STATION:3842
 DATE: 6/ 8/05 GEAR TYPE: PT No: 1 POSITION:Lat S 1338
 start stop duration Long E 1229
 TIME :19:23:42 20:00:25 37 (min) Purpose code: 1
 LOG :3471.62 3473.67 2.02 Area code : 1
 FDEPTH: 90 110 GearCond.code:
 BDEPTH: 139 145 Validity code:
 Towing dir: 240ø Wire out: 250 m Speed: 34 kn*10
 Sorted: 38 Kg Total catch: 38.15 CATCH/HOUR: 61.86

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Lithognathus mormyrus	7.64	25	61.86	
Epinephelus aeneus	3.25	5	26.32	
Brachydeuterus auritus	1.47	8	11.90	
Total	12.36	100.08		

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
MYCTOPHIDAE	19.98	5199	32.30	
Merluccius polli	18.78	114	30.36	
Dentex macrophthalmus	17.12	277	27.68	8170
Shrimps, small, non comm.	3.58	1693	5.79	
Hepttranchias perlo	2.08	5	3.36	
Bassanago albescens	0.32	13	0.52	
Total	61.86	100.01		

PROJECT STATION:3839
 DATE: 4/ 8/05 GEAR TYPE: PT No: 7 POSITION:Lat S 1246
 start stop duration Long E 1300
 TIME :20:53:54 21:23:00 29 (min) Purpose code: 1
 LOG :3325.65 3327.17 1.46 Area code : 2
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 140 161 Validity code:
 Towing dir: 40ø Wire out: 150 m Speed: 30 kn*10
 Sorted: 27 Kg Total catch: 27.69 CATCH/HOUR: 57.29

PROJECT STATION:3843
 DATE: 6/ 8/05 GEAR TYPE: PT No: 4 POSITION:Lat S 1339
 start stop duration Long E 1227
 TIME :20:32:31 21:02:27 30 (min) Purpose code: 1
 LOG :3475.18 3477.01 1.81 Area code : 2
 FDEPTH: 5 5 GearCond.code:
 BDEPTH: 154 136 Validity code:
 Towing dir: 70ø Wire out: 150 m Speed: 35 kn*10
 Sorted: Kg Total catch: 93.02 CATCH/HOUR: 186.04

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
MYCTOPHIDAE	57.02	51046	99.53	
Calappa sp.	0.27	2	0.47	
Total	57.29	100.00		

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Trichiurus lepturus	120.28		64.65	
MYCTOPHIDAE	64.48	23212	34.66	
Trachurus trecae	1.28	4	0.69	8171
Total	186.04	100.00		

PROJECT STATION:3844
 DATE: 7/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1402
 start stop duration Long E 1215
 TIME :09:02:52 09:33:18 30 (min) Purpose code: 1
 LOG :3552.97 3554.48 1.50 Area code : 1
 FDEPTH: 138 121 GearCond.code:
 BDEPTH: 138 121 Validity code:
 Towing dir: 90ø Wire out: 400 m Speed: 30 kn*10

PROJECT STATION:3848
 DATE: 7/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1432
 start stop duration Long E 1218
 TIME :23:43:58 23:46:47 3 (min) Purpose code: 1
 LOG :3651.36 3651.45 0.09 Area code : 1
 FDEPTH: 87 86 GearCond.code:
 BDEPTH: 87 86 Validity code:
 Towing dir: 360ø Wire out: 287 m Speed: 30 kn*10

Sorted: 197 Kg Total catch: 450.30 CATCH/HOUR: 900.60

Sorted: 52 Kg Total catch: 52.10 CATCH/HOUR: 1042.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	712.20	5314	79.08	8172
Dentex angolensis	49.10	226	5.45	8173
Chelidonichthys gabonensis	40.00	416	4.44	
Squalus megalops	32.00	30	3.55	
Trigla lyra	31.90	236	3.54	
Raja miraletus	8.50	16	0.94	
Atractoscion aequidens	7.90	6	0.88	
Branchiostegus semifasciatus	4.36	6	0.48	
Dentex macrophthalmus	3.60	16	0.40	
Loligo vulgaris	3.56	156	0.40	
Setarches guentheri	2.86	6	0.32	
Dentex barnardi	2.10	6	0.23	
Peristedion cataphractum	1.56	20	0.17	
Scorpaena stephanica	0.96	6	0.11	
Total	900.60		99.99	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex barnardi	360.40	1040	34.59	
Dentex macrophthalmus	252.40	1720	24.22	8181
Pagellus bellottii	158.00	780	15.16	8182
Umbrina canariensis	95.60	360	9.17	
Raja miraletus	70.60	100	6.78	
Trigla lyra	55.60	360	5.34	
Plectorhinchus mediterraneus	14.00	20	1.34	
Epigonus telescopus	13.40	20	1.29	
Dentex gibbosus	12.40	40	1.19	
Trichiurus lepturus	4.00	60	0.38	
Trachurus trecae	4.00	80	0.38	
Citharus linguatula	1.60	60	0.15	
Total	1042.00		99.99	

PROJECT STATION:3845
 DATE: 7/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1409
 start stop duration Long E 1220
 TIME :12:30:12 13:01:26 31 (min) Purpose code: 1
 LOG :3578.95 3580.49 1.52 Area code : 1
 FDEPTH: 50 46 GearCond.code:
 BDEPTH: 50 46 Validity code:
 Towing dir: 220ø Wire out: 176 m Speed: 30 kn*10

PROJECT STATION:3849
 DATE: 8/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1445
 start stop duration Long E 1215
 TIME :03:12:06 03:27:09 15 (min) Purpose code: 1
 LOG :3674.84 3675.61 0.77 Area code : 1
 FDEPTH: 102 112 GearCond.code:
 BDEPTH: 102 112 Validity code:
 Towing dir: 5ø Wire out: 333 m Speed: 30 kn*10

Sorted: 166 Kg Total catch: 3563.50 CATCH/HOUR: 6897.10

Sorted: 81 Kg Total catch: 394.15 CATCH/HOUR: 1576.60

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	5253.48	56911	76.17	8174
Spondyliosoma cantharus	400.94	1409	5.81	
Pomadasys incisus	374.42	4556	5.43	
Pagellus bellottii	236.09	2816	3.42	8175
Lithognathus mormyrus	193.84	662	2.81	
Dentex barnardi	156.56	662	2.27	
Boops boops	130.05	745	1.89	
Decapterus rhonchus	86.55	207	1.25	
Atractoscion aequidens	55.49	83	0.80	
Chelidonichthys capensis	9.52	83	0.14	
Total	6896.94		99.99	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex macrophthalmus	700.80	4620	44.45	8183
Trigla lyra	472.80	4800	29.99	
Pagellus bellottii	178.00	1840	11.29	8185
Umbrina canariensis	120.00	560	7.61	
Brotula barbata	28.40	20	1.80	
Dentex angolensis	23.00	100	1.46	
Zeus faber	19.00	20	1.21	
Atractoscion aequidens	16.40	20	1.04	
Trachurus trecae	15.00	112	0.95	8184
Citharus linguatula	3.20	140	0.20	
Total	1576.60		100.00	

PROJECT STATION:3846
 DATE: 7/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1420
 start stop duration Long E 1218
 TIME :15:47:15 16:17:21 30 (min) Purpose code: 1
 LOG :3606.79 3608.47 1.67 Area code : 1
 FDEPTH: 87 82 GearCond.code:
 BDEPTH: 87 82 Validity code:
 Towing dir: 85ø Wire out: 299 m Speed: 30 kn*10

PROJECT STATION:3850
 DATE: 8/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1504
 start stop duration Long E 1208
 TIME :07:55:36 08:13:43 18 (min) Purpose code: 1
 LOG :3716.04 3716.98 0.93 Area code : 1
 FDEPTH: 50 65 GearCond.code:
 BDEPTH: 50 65 Validity code:
 Towing dir: 208ø Wire out: 180 m Speed: 30 kn*10

Sorted: 147 Kg Total catch: 552.38 CATCH/HOUR: 1104.76

Sorted: 149 Kg Total catch: 1190.56 CATCH/HOUR: 3968.53

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	375.90	2572	34.03	8176
Dentex macrophthalmus	260.70	1568	23.60	8177
Mustelus mustelus	91.50	60	8.28	
Atractoscion aequidens	65.56	46	5.93	
Trichiurus lepturus	52.66	210	4.77	
Chelidonichthys capensis	50.70	556	4.59	
Pagellus bellottii	50.40	368	4.56	8178
Rhinobatos albomaculatus	37.36	38	3.38	
Raja miraletus	28.66	46	2.59	
Umbrina canariensis	27.16	98	2.46	
Citharus linguatula	23.26	556	2.11	
Rhinobatos sp.	10.20	8	0.92	
Dentex angolensis	9.76	82	0.88	
Scyliorhinus cervigoni	7.50	8	0.68	
Dentex barnardi	3.38	16	0.31	
Lophiodes kempfi	2.62	8	0.24	
Scorpaena normani	2.32	30	0.21	
Zeus faber	2.26	8	0.20	
Sepia orbignyana	1.88	8	0.17	
Sepia officinalis hierredda	0.98	30	0.09	
Total	1104.76		100.00	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Pomadasys incisus	1494.40	11653	37.66	
Trachurus trecae	442.67	5280	11.15	8188
Pagellus bellottii	434.13	4987	10.94	8186
Lithognathus mormyrus	395.20	853	9.96	8187
Dentex barnardi	279.47	1760	7.04	8189
Spondyliosoma cantharus	172.27	480	4.34	
Atractoscion aequidens	141.87	80	3.57	
Mustelus mustelus	133.33	133	3.36	
Rhinoptera marginata	117.07	27	2.95	
Myliobatis aquila	103.47	27	2.61	
Pseudupeneus prayensis	47.47	213	1.20	
Diplodus cervinus cervinus	46.40	80	1.17	
Dentex macrophthalmus	36.53	160	0.92	
Epinephelus aeneus	33.87	27	0.85	
Raja miraletus	26.13	53	0.66	
Zeus faber	24.00	27	0.60	
Chelidonichthys gabonensis	20.27	213	0.51	
Dentex angolensis	9.33	80	0.24	
Trigla lyra	6.93	53	0.17	
Sardinops ocellatus	3.73	27	0.09	
Total	3968.54		99.99	

PROJECT STATION:3847
 DATE: 7/ 8/05 GEAR TYPE: PT No: 4 POSITION:Lat S 1426
 start stop duration Long E 1217
 TIME :18:41:06 19:00:34 19 (min) Purpose code: 1
 LOG :3625.29 3626.55 1.29 Area code : 1
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 100 99 Validity code:
 Towing dir: 350ø Wire out: 150 m Speed: 40 kn*10

PROJECT STATION:3851
 DATE: 8/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1509
 start stop duration Long E 1202
 TIME :11:44:09 11:59:10 15 (min) Purpose code: 1
 LOG :3739.84 3740.58 0.74 Area code : 1
 FDEPTH: 129 126 GearCond.code:
 BDEPTH: 129 126 Validity code:
 Towing dir: 208ø Wire out: 390 m Speed: 30 kn*10

Sorted: 131 Kg Total catch: 2598.32 CATCH/HOUR: 8205.22

Sorted: 133 Kg Total catch: 611.39 CATCH/HOUR: 2445.56

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus trecae	8046.79	87129	98.07	8179
Atractoscion aequidens	116.02	63	1.41	
Sardinella aurita	37.42	287	0.46	8180
Etrumeus whiteheadi	4.99	126	0.06	
Total	8205.22		100.00	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Dentex macrophthalmus	1650.64	13960	67.50	8123
Trachurus trecae	323.08	2888	13.21	8124
Spicara alta	256.12	884	10.47	
Zeus faber	75.60	128	3.09	
Zenopsis conchifer	64.76	72	2.65	
Scorpaena angolensis	27.40	72	1.12	
Dentex barnardi	15.08	20	0.62	
Trigla lyra	11.04	128	0.45	
Pagellus bellottii	8.08	72	0.33	
Peristedion cataphractum	5.88	72	0.24	
Dentex angolensis	4.96	20	0.20	
Umbrina canariensis	2.92	20	0.12	
Total	2445.56		100.00	

PROJECT STATION:3852
 DATE: 8/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1516
 start stop duration Long E 1202
 TIME :18:52:04 19:04:35 13 (min) Purpose code: 1
 LOG :3769.80 3770.43 0.63 Area code : 1
 FDEPTH: 29 28 GearCond.code:
 BDEPTH: 29 28 Validity code:
 Towing dir: 360° Wire out: 130 m Speed: 30 kn*10
 Sorted: 71 Kg Total catch: 475.41 CATCH/HOUR: 2194.20

PROJECT STATION:3856
 DATE: 9/ 8/05 GEAR TYPE: OT No:14 POSITION:Lat S 1614
 start stop duration Long E 1140
 TIME :22:34:26 22:41:44 7 (min) Purpose code: 1
 LOG :3964.82 3965.17 0.34 Area code : 1
 FDEPTH: 60 60 GearCond.code:
 BDEPTH: 60 60 Validity code:
 Towing dir: 355° Wire out: 200 m Speed: 30 kn*10
 Sorted: 65 Kg Total catch: 1846.53 CATCH/HOUR: 15827.40

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Pagellus bellottii	956.49 24120	43.59	8193
Dasyatis marmorata	451.38 498	20.57	
Lithognathus mormyrus	188.31 1412	8.58	
Squatina aculeata	129.23 46	5.89	
Boops boops	95.82 2742	4.37	
Trachurus trecae	79.48 965	3.62	8192
Decapterus rhonchus	66.74 332	3.04	
Pomadasy inciscus	60.92 554	2.78	
Umbrina canariensis	31.85 138	1.45	
Mustelus mustelus	27.69 32	1.26	
Raja miraletus	19.94 28	0.91	
Squalus megalops	18.46 18	0.84	
Lophiodes kempi	18.00 28	0.82	
Zeus faber	14.95 28	0.68	
Rhinobatos rhinobatos	13.57 28	0.62	
Trigla lyra	10.25 111	0.47	
Chilomycterus sp.	4.43 55	0.20	
Sepia officinalis hierredda	3.05 28	0.14	
Trachurus capensis	2.54 23	0.12	8191
Dentex barnardi	1.11 55	0.05	
Total	2194.21	100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	15365.57 850114	97.08	8197
Dentex macrophthalmus Juv.	346.89 29803	2.19	8198
Sepia orbignyana	92.83 1714	0.59	
Serranus accraensis	7.37 489	0.05	
Trigla lyra	7.37 489	0.05	
Dicologlossa cuneata	7.37 249	0.05	
Total	15827.40	100.01	

PROJECT STATION:3857
 DATE:10/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1619
 start stop duration Long E 1139
 TIME :01:53:56 02:03:40 10 (min) Purpose code: 1
 LOG :3986.45 3986.91 0.46 Area code : 1
 FDEPTH: 73 70 GearCond.code:
 BDEPTH: 73 70 Validity code:
 Towing dir: 90° Wire out: 245 m Speed: 30 kn*10
 Sorted: 206 Kg Total catch: 4123.00 CATCH/HOUR: 24738.00

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	23832.00 1839972	96.34	8199
Dentex macrophthalmus Juv.	273.60 28548	1.11	8200
Dicologlossa cuneata	202.80 12360	0.82	
Mustelus mustelus	162.00 240	0.65	
Merluccius pollii, juveniles	136.80 840	0.55	
Sepia orbignyana	44.40 360	0.18	
Atractoscion aequidens	34.80 240	0.14	
Diaphus dumerili	21.60 7680	0.09	
Trachurus trecae	18.00 360	0.07	
Chelidonichthys capensis	10.80 240	0.04	
Serranus accraensis	1.20 120		
Total	24738.00	99.99	

PROJECT STATION:3853
 DATE: 8/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1533
 start stop duration Long E 1157
 TIME :23:45:59 23:57:19 11 (min) Purpose code: 1
 LOG :3814.27 3814.82 0.54 Area code : 1
 FDEPTH: 85 84 GearCond.code:
 BDEPTH: 85 84 Validity code:
 Towing dir: 15° Wire out: 299 m Speed: 30 kn*10
 Sorted: 93 Kg Total catch: 559.55 CATCH/HOUR: 3052.09

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Atractoscion aequidens	1068.87 1178	35.02	
Dentex macrophthalmus	954.33 796	31.27	
Pagellus bellottii	380.29 3633	12.46	
Trigla lyra	208.80 1898	6.84	
Umbrina canariensis	200.29 1407	6.56	
Brotula bardata	82.47 65	2.70	
Chelidonichthys lucerna	40.91 229	1.34	
Mustelus mustelus	30.00 5	0.98	
Ballistes capriscus	28.15 33	0.92	
Boops boops	18.98 131	0.62	
Chelidonichthys capensis	12.76 164	0.42	
Dentex gibbosus	9.16 65	0.30	
Scyliorhinus cervigoni	5.95 5	0.19	
Sepia orbignyana	5.24 33	0.17	
Dentex angolensis	2.62 33	0.09	
Squalus megalops	2.29 5	0.08	
Trachurus trecae	0.98 16	0.03	
Total	3052.09	99.99	

PROJECT STATION:3858
 DATE:10/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1625
 start stop duration Long E 1139
 TIME :05:47:00 05:54:06 7 (min) Purpose code: 1
 LOG :4020.00 4020.33 0.32 Area code : 1
 FDEPTH: 79 80 GearCond.code:
 BDEPTH: 79 80 Validity code:
 Towing dir: 270° Wire out: 245 m Speed: 30 kn*10
 Sorted: 51 Kg Total catch: 253.70 CATCH/HOUR: 2174.57

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	1861.89 162900	85.62	8202
Trachurus trecae	235.71 5786	10.84	8203
Merluccius capensis	27.00 129	1.24	
Dentex macrophthalmus	26.14 1286	1.20	8201
Monolene microstoma	11.57 514	0.53	
Calappa sp.	9.00 386	0.41	
GOBIIDAE	3.00 1629	0.14	
Chelidonichthys capensis	0.43 86	0.02	
Total	2174.74	100.00	

PROJECT STATION:3854
 DATE: 9/ 8/05 GEAR TYPE: PT No: 4 POSITION:Lat S 1537
 start stop duration Long E 1151
 TIME :03:26:55 03:56:43 30 (min) Purpose code: 1
 LOG :3844.51 3846.49 1.98 Area code : 1
 FDEPTH: 0 0 GearCond.code:
 BDEPTH: 363 110 Validity code:
 Towing dir: 281° Wire out: 150 m Speed: 40 kn*10
 Sorted: 62 Kg Total catch: 3293.66 CATCH/HOUR: 6587.32

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis	5839.68 164710	88.65	8195
Trachurus trecae	549.12 5068	8.34	8194
Sardinops ocellatus	78.14 1796	1.19	
Trichurus lepturus	52.80 1056	0.80	
Scomber japonicus	46.46 422	0.71	
MYCTOPHIDAE	21.12 6652	0.32	
Total	6587.32	100.01	

PROJECT STATION:3859
 DATE:10/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1644
 start stop duration Long E 1147
 TIME :14:21:49 14:33:07 11 (min) Purpose code: 1
 LOG :4067.93 4068.55 0.60 Area code : 1
 FDEPTH: 15 16 GearCond.code:
 BDEPTH: 15 16 Validity code:
 Towing dir: 322° Wire out: 100 m Speed: 30 kn*10
 Sorted: 148 Kg Total catch: 888.24 CATCH/HOUR: 4844.95

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
MISCELLANEOUS	3471.05	71.64	
Trachurus trecae, juvenile	968.73 16331	19.99	8204
Dicologlossa cuneata	110.62 4615	2.28	
Arius parkii	79.85 164	1.65	
Callorhynchus capensis	76.58 33	1.58	
Trichurus lepturus	69.05 2520	1.43	
Atractoscion aequidens	49.09 753	1.01	
Sepia orbignyana	17.67 229	0.36	
Umbrina canariensis	2.29 164	0.05	
Total	4844.93	99.99	

PROJECT STATION:3855
 DATE: 9/ 8/05 GEAR TYPE: BT No:14 POSITION:Lat S 1604
 start stop duration Long E 1147
 TIME :13:11:20 13:21:14 10 (min) Purpose code: 1
 LOG :3920.48 3921.00 0.51 Area code : 1
 FDEPTH: 26 25 GearCond.code:
 BDEPTH: 26 25 Validity code:
 Towing dir: 2° Wire out: 140 m Speed: 30 kn*10
 Sorted: 238 Kg Total catch: 2975.97 CATCH/HOUR: 17855.82

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus trecae	9954.00 211950	55.75	8196
JELLYFISH	7524.00 118200	42.14	
Atractoscion aequidens	203.22 1428	1.14	
Dicologlossa cuneata	116.22 5730	0.65	
Rhinobatos albomaculatus	26.22 78	0.15	
Trichurus lepturus	14.22 528	0.08	
Umbrina canariensis	9.00 300	0.05	
Sardinops ocellatus	6.72 150	0.04	
Raja miraletus	2.22 78	0.01	
Total	17855.82	100.01	

PROJECT STATION:3860
 DATE:10/ 8/05 GEAR TYPE: PT No: 7 POSITION:Lat S 1637
 start stop duration Long E 1145
 TIME :17:52:55 18:12:41 20 (min) Purpose code: 1
 LOG :4086.28 4087.46 1.17 Area code : 1
 FDEPTH: 10 10 GearCond.code:
 BDEPTH: 24 25 Validity code:
 Towing dir: 357° Wire out: 140 m Speed: 34 kn*10
 Sorted: Kg Total catch: 25.36 CATCH/HOUR: 76.08

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
J E L L Y F I S H	71.10 723	93.45	
Trachurus capensis, juvenile	2.01 258	2.64	8207
Engraulis encrasicolus	1.83 219	2.41	8205
Trachurus trecae, juvenile	1.14 168	1.50	8206
Total	76.08	100.00	

PROJECT STATION:3861
 DATE:27/ 7/03 GEAR TYPE: PT No: 7 POSITION:Lat S 818
 start stop duration Long E 1318
 TIME :07:05:14 07:16:30 11 (min) Purpose code: 1
 LOG :4910.08 4910.52 0.14 Area code : 1
 FDEPTH: 0 0 GearCond.code:
 BDEPTH: 24 24 Validity code: 1
 Towing dir: 155ø Wire out: 50 m Speed: 20 kn*10
 Sorted: 36 Kg Total catch: 356.50 CATCH/HOUR: 1944.55

PROJECT STATION:3866
 DATE:11/ 8/05 GEAR TYPE: PT No: 2 POSITION:Lat S 1649
 start stop duration Long E 1124
 TIME :23:39:17 23:59:21 20 (min) Purpose code: 1
 LOG :4298.47 4299.54 1.07 Area code : 1
 FDEPTH: 100 100 GearCond.code:
 BDEPTH: 128 127 Validity code:
 Towing dir: 360ø Wire out: m Speed: kn*10
 Sorted: 19 Kg Total catch: 18.62 CATCH/HOUR: 55.86

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	1577.45 248236	81.12	8208
JELLYFISH	208.36 3327	10.72	
Etrumeus whiteheadi	158.73 9000	8.16	8209
Total	1944.54	100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	29.46 1782	52.74	8220
Etrumeus whiteheadi	13.38 321	23.95	8221
Chelidonichthys capensis	9.84 9	17.62	
Trigla lyra	3.24 33	5.80	
Total	55.92	100.11	

PROJECT STATION:3862
 DATE:11/ 8/05 GEAR TYPE: PT No: 1 POSITION:Lat S 1643
 start stop duration Long E 1139
 TIME :08:08:08 08:15:36 7 (min) Purpose code: 1
 LOG :4170.75 4171.21 0.45 Area code : 1
 FDEPTH: 30 30 GearCond.code:
 BDEPTH: 60 62 Validity code:
 Towing dir: 340ø Wire out: 130 m Speed: 34 kn*10
 Sorted: 65 Kg Total catch: 719.73 CATCH/HOUR: 6169.11

PROJECT STATION:3867
 DATE:12/ 8/05 GEAR TYPE: PT No: 2 POSITION:Lat S 1648
 start stop duration Long E 1124
 TIME :00:04:59 00:24:38 20 (min) Purpose code: 1
 LOG :4299.81 4300.93 1.11 Area code : 1
 FDEPTH: 50 50 GearCond.code:
 BDEPTH: 128 128 Validity code:
 Towing dir: 360ø Wire out: 160 m Speed: 40 kn*10
 Sorted: Kg Total catch: 0.31 CATCH/HOUR: 0.93

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	5721.26 667449	92.74	8210
Etrumeus whiteheadi	318.69 11786	5.17	8211
JELLYFISH	129.17	2.09	
Total	6169.12	100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Centrolophus niger	0.90 3	96.77	
Pteroscion pelli	0.03 36	3.23	
Total	0.93	100.00	

PROJECT STATION:3863
 DATE:17/ 9/10 GEAR TYPE: BT No:15 POSITION:Lat S 1643
 start stop duration Long E 1121
 TIME :11:12:30 11:22:32 10 (min) Purpose code: 1
 LOG :4196.18 4196.68 0.50 Area code : 1
 FDEPTH: 140 140 GearCond.code:
 BDEPTH: 140 140 Validity code:
 Towing dir: 360ø Wire out: 400 m Speed: 35 kn*10
 Sorted: 199 Kg Total catch: 2495.36 CATCH/HOUR: 14972.16

PROJECT STATION:3868
 DATE:12/ 8/05 GEAR TYPE: BT No:15 POSITION:Lat S 1650
 start stop duration Long E 1118
 TIME :02:09:43 02:37:03 27 (min) Purpose code: 1
 LOG :4311.71 4313.11 1.38 Area code : 1
 FDEPTH: 353 362 GearCond.code:
 BDEPTH: 353 362 Validity code:
 Towing dir: 360ø Wire out:1000 m Speed: 30 kn*10
 Sorted: 32 Kg Total catch: 1617.50 CATCH/HOUR: 3594.44

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	14148.00 548802	94.50	8212
Dentex macrophthalmus	315.00 2250	2.10	8213
Etrumeus whiteheadi	165.00 2928	1.10	
Zeus faber	66.78 300	0.45	
Pterothrissus belloci	54.78 528	0.37	
Merluccius polli	43.50 150	0.29	
Zenopsis conchifer	43.50 300	0.29	
Scorpaena normani	38.40 450	0.26	
Mustelus mustelus	34.20 6	0.23	
Trigla lyra	19.50 150	0.13	
Squalus megalops	18.00 30	0.12	
Sepia orbignyana	16.50 78	0.11	
Monolele microstoma	9.00 300	0.06	
Total	14972.16	100.01	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius capensis	1355.56 2356	37.71	8222
Scorpaena normani	1184.44 164000	32.95	
Nematocarcinus africanus	238.89 184556	6.65	
Pterothrissus belloci	234.44 1333	6.52	
Aristeus varidens	217.78 2667	6.06	
Hoplostethus cadenati	125.56 5556	3.49	
Gadella imberbis	102.22 1889	2.84	
Chlorophthalmus atlanticus	76.67 2222	2.13	
Dentex macrophthalmus	35.56 111	0.99	
MARME03	23.33 667	0.65	
Total	3594.45	99.99	

PROJECT STATION:3864
 DATE:11/ 8/05 GEAR TYPE: PT No: 7 POSITION:Lat S 1636
 start stop duration Long E 1145
 TIME :16:44:15 17:19:01 35 (min) Purpose code: 1
 LOG :4249.17 4251.58 2.40 Area code : 1
 FDEPTH: 1 1 GearCond.code:
 BDEPTH: 25 24 Validity code:
 Towing dir: 358ø Wire out: 150 m Speed: 40 kn*10
 Sorted: 62 Kg Total catch: 62.59 CATCH/HOUR: 107.30

PROJECT STATION:3869
 DATE:12/ 8/05 GEAR TYPE: BT No:15 POSITION:Lat S 1700
 start stop duration Long E 1140
 TIME :08:11:58 08:30:29 19 (min) Purpose code: 1
 LOG :4357.04 4357.97 0.49 Area code : 1
 FDEPTH: 57 57 GearCond.code:
 BDEPTH: 57 57 Validity code:
 Towing dir: 350ø Wire out: 200 m Speed: 30 kn*10
 Sorted: 65 Kg Total catch: 293.67 CATCH/HOUR: 927.38

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
J E L L Y F I S H	106.97 1565	99.69	
Trachurus capensis, juvenile	0.24 45	0.22	8214
Trachurus trecae, juvenile	0.09 9	0.08	8215
Total	107.30	99.99	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
J E L L Y F I S H	371.46 60	40.05	
Trachurus trecae, juvenile	250.67 7775	27.03	8223
Engraulis encrasicolus	108.85 6666	11.74	8225
Dicologlossa cuneata	98.05 12322	10.57	
Trachurus capensis, juvenile	91.52 6041	9.87	8224
Maja squinado	5.12 512	0.55	
Atractoscion aequidens	1.26 16	0.14	
Trichurus lepturus	0.41 28	0.04	
Total	927.34	99.99	

PROJECT STATION:3865
 DATE:11/ 8/05 GEAR TYPE: PT No: 4 POSITION:Lat S 1631
 start stop duration Long E 1144
 TIME :18:04:09 18:26:37 22 (min) Purpose code: 1
 LOG :4254.73 4256.19 1.36 Area code : 1
 FDEPTH: 1 1 GearCond.code:
 BDEPTH: 29 52 Validity code:
 Towing dir: 335ø Wire out: 150 m Speed: 40 kn*10
 Sorted: 36 Kg Total catch: 431.28 CATCH/HOUR: 1176.22

PROJECT STATION:3870
 DATE:12/ 8/05 GEAR TYPE: BT No:15 POSITION:Lat S 1701
 start stop duration Long E 1120
 TIME :11:25:36 11:34:19 9 (min) Purpose code: 1
 LOG :4380.46 4380.90 0.44 Area code : 1
 FDEPTH: 159 158 GearCond.code:
 BDEPTH: 159 158 Validity code:
 Towing dir: 360ø Wire out: 515 m Speed: 30 kn*10
 Sorted: 95 Kg Total catch: 1357.44 CATCH/HOUR: 9049.60

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus trecae, juvenile	416.29 54251	35.39	8217
J E L L Y F I S H	333.16 4582	28.32	
Trachurus capensis, juvenile	332.51 41793	28.27	8216
Etrumeus whiteheadi	89.35 4876	7.60	8218
Engraulis encrasicolus	4.91 785	0.42	8219
Total	1176.22	100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Trachurus capensis, juvenile	5931.60 207733	65.55	8226
Dentex macrophthalmus	2074.40 14300	22.92	8227
Merluccius capensis	266.93 1713	2.95	8228
Scorpaena normani	241.13 2193	2.66	
J E L L Y F I S H	239.27 8007	2.64	
Dentex angolensis	112.47 193	1.24	
Cynoglossus capensis	97.20 12300	1.07	
Pterothrissus belloci	20.00 380	0.22	
Zeus faber	20.00 287	0.22	
Ubrina canariensis	18.07 93	0.20	
Dicologlossa cuneata	10.47 2480	0.12	
Trigla lyra	9.53 287	0.11	
Bothus podas africanus	7.60 193	0.08	
Chlorophthalmus atlanticus	0.93 193	0.01	
Total	9049.60	99.99	

PROJECT STATION:3871
 DATE:12/ 8/05 GEAR TYPE: PT No: 1 POSITION:Lat S 1707
 start stop duration Long E 1119
 TIME :13:28:12 13:58:19 30 (min) Purpose code: 1
 LOG :4395.29 4397.05 1.75 Area code : 1
 FDEPTH: 200 200 GearCond.code:
 BDEPTH: 441 387 Validity code:
 Towing dir: 360ø Wire out: 600 m Speed: 40 kn*10
 Sorted: 134 Kg Total catch: 133.54 CATCH/HOUR: 267.08

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
J E L L Y F I S H	146.96	3010	55.02	
Trachurus capensis, juvenile	120.12	2458	44.98	8229
Total	267.08		100.00	

PROJECT STATION:3872
 DATE:12/ 8/05 GEAR TYPE: BT No:15 POSITION:Lat S 1707
 start stop duration Long E 1129
 TIME :16:06:34 16:16:13 10 (min) Purpose code: 1
 LOG :4413.55 4414.08 0.54 Area code : 1
 FDEPTH: 129 127 GearCond.code:
 BDEPTH: 129 127 Validity code:
 Towing dir: 360ø Wire out: 325 m Speed: 30 kn*10
 Sorted: 132 Kg Total catch: 785.40 CATCH/HOUR: 4712.40

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus capensis, juvenile	4005.36	176484	85.00	8230
Dentex macrophthalmus	385.92	2988	8.19	8231
Merluccius capensis	231.12	1404	4.90	8232
Synagrops microlepis	34.20	5220	0.73	
Trigla lyra	21.24	108	0.45	
Zeus faber	19.08	72	0.40	
Saurida brasiliensis	15.48	540	0.33	
Total	4712.40		100.00	

PROJECT STATION:3873
 DATE:13/ 8/05 GEAR TYPE: PT No: 1 POSITION:Lat S 1713
 start stop duration Long E 1130
 TIME :23:52:20 00:22:22 30 (min) Purpose code: 1
 LOG :4455.03 4456.84 1.81 Area code : 1
 FDEPTH: 100 100 GearCond.code:
 BDEPTH: 140 135 Validity code:
 Towing dir: 360ø Wire out: 300 m Speed: 40 kn*10
 Sorted: Kg Total catch: 160.78 CATCH/HOUR: 321.56

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
J E L L Y F I S H	295.20	5496	91.80	
Trachurus capensis, juvenile	26.36	1582	8.20	8233
Total	321.56		100.00	

ANNEX III Number of fish per length class

Sardinella

Sardinella maderensis

North (Congo River to Luanda, 5°S-9°S) and, Central (Luanda to Benguela, 9°S-13°S)

Length group (cm)	North		Central	
	N	W	N	W
5				
6				
7				
8				
9	2		3	
10	4		4	
11	7	0.1	1	
12	4	0.1	6	0.1
13	1		7	0.2
14			25	0.7
15			49	1.6
16	6	0.2	160	6.3
17	8	0.4	190	9.0
18	12	0.7	84	4.7
19	22	1.4	37	2.5
20	14	1.0	45	3.5
21	14	1.2	65	5.8
22	78	7.9	74	7.6
23	117	13.4	24	2.8
24	96	12.5	45	6.0
25	61	8.9	69	10.5
26	17	2.8	26	4.3
27	17	3.1	21	3.9
28	15	3.1	6	1.2
29	13	3.0	2	0.5
30	29	7.1		0.1
31	11	2.9		
32	9	2.7		
33	3	1.1		
34	23	8.2		
35	1	0.2		
36				

Sardinella aurita

North (Congo River to Luanda, 5°S - 9°S), and Central (Luanda to Benguela, 9°S – 13°S)

Length group (cm)	North		Central	
	N	W	N	W
5				
6				
7				
8				
9	1		1	
10	1		4	
11	1		3	
12	3	0.1		
13	7	0.2		
14	3	0.1		
15				
16	1	0.1		
17	2	0.1	13	0.6
18	11	0.7		
19	5	0.3	32	2.0
20			37	2.7
21	1	0.1	64	5.5
22	8	0.9	60	5.9
23	5	0.6	126	13.9
24	25	3.6	87	10.8
25	89	14.5	135	19.0
26	130	23.5	87	13.6
27	84	17.1	84	14.6
28	93	21.0	40	7.7
29	52	12.9	22	4.8
30	16	4.4	4	1.0
31	8	2.5		
32	5	1.8	6	1.6
33			1	0.4
34		0.1		
35				
36				

Trachurus trecae

North (Congo River to Luanda, 5°S - 9°S), Central (Luanda to Benguela, 9°S – 13°S), and South (Benguela to Cunene River, 13° - 17°15'S)

Length group (cm)	North		Central		South	
	N	W	N	W	N	W
5	7		12	0.02		
6	9		40	0.11	8	
7	10		48	0.19	33	0.1
8	8		14	0.08	36	0.1
9	12	0.1	8	0.06	88	0.4
10	28	0.3	4	0.05	70	0.4
11	100	1.5	2	0.03	88	0.6
12	23	0.4	2	0.03	144	1.3
13	14	0.3	4	0.08	175	2.0
14	7	0.2	4	0.10	185	2.5
15	12	0.4	2	0.05	166	2.7
16	69	3.0	1	0.05	141	2.7
17	133	6.9	1	0.04	141	3.2
18	39	2.4	1	0.07	129	3.4
19	26	1.9	2	0.17	116	3.5
20	18	1.5	13	1.06	72	2.5
21	13	1.2	24	2.28	45	1.8
22	6	0.7	13	1.35	20	0.9
23	10	1.2	7	0.90	10	0.5
24	8	1.1	6	0.89	17	0.9
25	5	0.7	5	0.85	10	0.6
26	1	0.3	8	1.46	9	0.6
27	1	0.3	10	1.86	7	0.6
28	7	1.5	27	5.90	4	0.4
29	9	2.3	57	13.71	1	0.1
30	7	2.0	56	14.98	3	0.3
31	15	4.7	28	8.12	1	0.2
32	13	4.5	24	7.73	1	0.2
33	21	7.5	11	3.87		
34	16	6.2	8	3.03		
35	21	9.0	17	7.07		
36	7	3.5	22	10.20		
37	4	2.2	16	7.71		
38	11	6.1	2	1.23		
39			3	1.92		
40	9	5.7	1	0.69		
41						

Tracurus capensis
South (Benguela to Cunene River, 13° - 17°15'S)

South		
Length group (cm)	N	W
5		
6		
7		
8	21	0.1
9	29	0.2
10	166	1.8
11	111	1.5
12	83	1.4
13	136	2.8
14	115	2.9
15	140	4.2
16	200	7.1
17	128	5.3
18	102	4.9
19	30	1.6
20	13	0.8
21	11	0.8
22	10	0.8
23	10	0.9
24	3	0.4
25	1	0.1
26		
27	1	0.1
28	1	0.1
29		
30		
31	1	0.1
32		
33		
34	1	0.2
35	1	0.2
36		
37		
38		
39		
40		
41		

Sardinops ocellatus

South (Benguela to Cunene River, 13° - 17°15'S)

South		
Length group (cm)	N	W
5		
6		
7		
8		
9		
10		
11	131	2.7
12	424	10.8
13	196	6.0
14		
15	114	4.9
16		
17	3	0.2
18	39	2.6
19	3	0.2
20	41	3.5
21	139	13.2
22	440	46.8
23	1 000	118.4
24	342	44.8
25	5	0.7
26		

ANNEX IV Acoustic instruments

Echo sounder

The SIMRAD EK500/38 kHz scientific sounder was used during the survey for fish abundance estimation. The Bergen Echo Integrator system (BEI) was used to scrutinise the acoustic records. The settings of 38 kHz echo sounder were as follows:

Tranceiver-1 menu (38 kHz, mounted in lowering keel)

Transducer depth	20.07-1508: 5.5 m (keel not submerged), 16.08-17.08: 8.0 m (subm.)
Absorption coeff.	10 dB/km
Pulse length	Medium (1 ms)
Bandwidth	Wide
Max Power	2000 Watt
2-way beam angle	-21.0 dB
Sv Transducer gain	27.37 dB
TS Transducer gain	27.49 dB
Angle sensitivity	21.9
3 dB beam width	7.0 ° along ship 6.7 ° athwardship
Along ship offset	0.14 °
Athwardship effect	-0.02 °

Display menu

Echogram	1 (38 kHz)
Bottom range	15 m
Bottom range start	10 m
Sv colour min	-67 dB

Printer menu

Echogram	1 (38 kHz)
Range	100 m, 250 m, 500 m
Range start	0
Bottom range	12 m
Bottom range start	10 m
TVG	20 log R
Sv Colour min	- 67 dB

Bottom detection menu Minimum level -50 dB

ANNEX V Seabirds and Marine Mammals distribution and patterns of abundance

(Contribution to the 'Top Predator' BCLME Project LMR/EAF/03/02)

Participants from 28 July 2005:

Trainees: Jean-Paul Roux, MFMR Lüderitz,
Benedictus Dundee, MFMR Lüderitz
Jose da Silva, University Agostinho Neto, Luanda

AIMS

1. Make an inventory of seabird and marine mammal species present in the survey area
2. Estimate relative density of the different seabird species along the transect lines
3. Analyse patterns of distribution and abundance in relation to oceanographic features and fish distribution
4. Training on bird identification at sea and seabird survey methods
5. Record additional visual information on surface oceanographic features (slicks, water discoloration, flotsam lines) and fish (presence of pelagic sharks, surface aggregations of pelagic fish).

METHODS

Counts of seabirds were made during daylight hours from the top-deck of the vessel, which offers excellent viewing conditions. The viewing height above sea level, measured in Luanda harbour, was 14.96 m at mid-deck.

When possible, standard "10-minute-counts" of the birds present around the vessel were effected while the vessel was steaming at constant speed and heading. During each count period, all birds detected were counted, discriminating between birds seen actively following the vessel (within an arc of 60° aft), birds flying and birds sitting or feeding. During the counts, scans with binoculars were effected at least once every two minutes to detect inconspicuous species. Care was taken to count individual birds only once particularly for species prone to follow or circle the vessel and not to conduct 10 minute counts soon after a station or a trawl which have attracted birds to the vessel. This method was chosen in order to record all species seen including the scarce and rare species. The results of this method give a species-specific index of abundance rather than absolute densities.

Additional "incidental observations" were made, between counts when scarce or unusual species were observed and while the vessel was on station or during trawling when standardized quantification of abundance was not possible. The time and duration of each observation and count was recorded with watches synchronized to the vessel's in order to match them with the data recorded by the electronic log and weather station (position, speed, depth, heading, sea temperature etc.) as well as environmental and biological parameters recorded during the survey. Additional information on the age classes of some species was noted (albatrosses, gannets, gulls)

Sightings of Cape fur seals were recorded following the same format. Each cetacean sighting was recorded in a way similar to the 'incidental sightings' of uncommon bird species above. A measure of effort was obtained by recording the periods of continuous observations (and relating them to the vessel route) to be modified by estimated sea state and visibility.

Fish schools visible at the surface were recorded following an estimated relative four-point scale: small (a few to 100 m²), medium (between 100 and 250 m²), large (between 250 and 500 m²) and very large (> 500 m²). Pelagic shark sightings were also recorded. Additional visual information as flotsam lines, slicks, water discoloration etc. was also logged in the same format as well as photographically documented.

RESULTS

A total of 266 “10-minute counts” were effected between 28 July and 16 August. In addition, 130 incidental observations were logged, including 12 during Multinet sampling, 23 during CTD stations, and 18 during trawling. The summary of the distribution of the observations is given in Fig 1

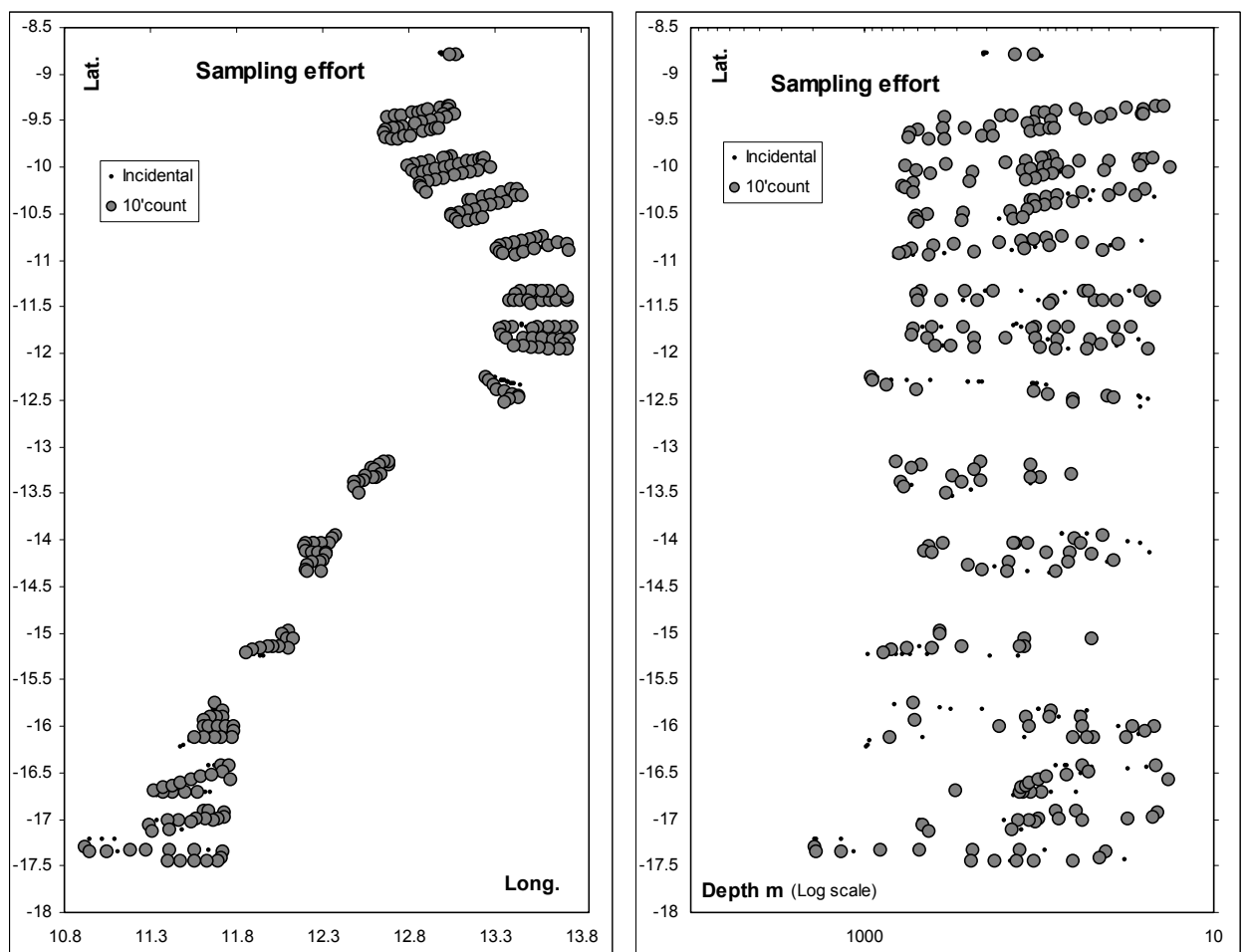


Figure 1. Distribution of the sampling effort (10 min counts and incidental observations on the left and Latitude-Depth plot (log scale) on the right.

Species accounts

The list species and numbers identified during the survey are given in Table 1 for birds and seals.

Table 1: Seabird species and numbers of individuals identified during the 10' observation periods and in total (including incidental sightings). The overall percentage of occurrence (% FO) in the 10-minute count periods (N=266) and Cape fur seal numbers are also given. *Several tens of thousands of Cape cormorant roosting and feeding in Baia dos Tigres excluded.

Species		Bird numbers		10' count
		All records	10 min counts	FO %
<i>Thalassarche melanophris</i>	Black-browed albatross	4	2	0.75
<i>Thalassarche chlororhynchos</i>	Yellow-nosed albatross	231	127	14.66
<i>Thalassarche chrysostoma</i>	Grey-headed albatross	1	1	0.38
<i>Daption capense</i>	Pintado petrel	8	5	1.88
<i>Procellaria aequinoctialis</i>	White-chinned petrel	2296	1396	36.84
<i>Puffinus gravis</i>	Great shearwater	1	0	0.00
<i>Puffinus griseus</i>	Sooty shearwater	30	10	3.76
<i>Puffinus puffinus</i>	Manx shearwater	7	3	1.13
<i>Pterodroma mollis</i>	Soft-plumaged petrel	2	1	0.38
<i>Oceanites oceanicus</i>	Wilson's storm-petrel	1930	1567	55.26
<i>Phalacrocorax capensis</i> *	Cape cormorant	889	648	4.51
<i>Phalacrocorax lucidus</i>	White-breasted cormorant	31	26	0.75
<i>Morus capensis</i>	Cape gannet	6299	5106	74.81
<i>Stercorarius sp.</i>	jaegger sp.	2	2	0.38
<i>Stercorarius pomarinus</i>	Pomarine jaeger	2	1	0.38
<i>Stercorarius parasiticus</i>	Arctic jaeger	1	0	0.00
<i>Catharacta antarctica</i>	Subantarctic skua	77	36	8.27
<i>Xema sabini</i>	Sabine's gull	4	1	0.38
<i>Larus dominicanus vetula</i>	Kelp gull	992	400	23.68
<i>Larus cirrocephalus</i>	Grey-headed gull	16	9	1.13
<i>Sterna hirundo/paradisaea</i>	Common/Arctic tern	194	110	18.42
<i>Sterna maxima</i>	Royal tern	2	1	0.38
<i>Sterna sandvicensis</i>	Sandwich tern	8	3	0.75
<i>Chlidonias niger</i>	Black tern	5	5	1.88
<i>Arctocephalus pusillus</i>	Cape fur seal	417	255	28.57

Diomedeidae, Albatrosses:

Three species of albatrosses were encountered, all migrants from the southern ocean. The Atlantic Yellow-nosed albatross *T. chlororhynchos* breeds at Gough Island and Tristan da Cunha group. They were absent in the north of the survey area, a few sightings of *T. chlororhynchos* were made in deep water between 12°13'S and 13°25'S but the species became regular only south of 15°S in water deeper than 100m and was absent in shallow water (< 50 m). Most individuals seen at close range were immature and juvenile birds, but the proportion of adults increased with latitude. The Black-browed albatross was very scarce, seen only four times (all juveniles) in the

extreme south of the survey area (south of 17°S) and the Shy albatross (*Thalassarche cauta*) recorded in previous surveys in the same area was not sighted during this survey.

The Grey-headed albatross (*Thalassarche chrysostoma*) was seen once at 16°07'S in about 50 m of water. This latitude probably constitutes the northernmost limit of the normal winter range of this species.

***Procellariidae*, Petrels and Shearwaters:**

Out of six species of this group sighted during the survey, the Manx shearwater (*Puffinus puffinus*) is a northern hemisphere migrant; the Great shearwater (*Puffinus gravis*) is endemic to the Tristan and Gough group of Islands in the south Atlantic. The other species are migrants from the sub-Antarctic region of the southern ocean.

The Pintado petrel (*Daption capense*) was very scarce and present only in the south, with 7 sightings (of 8 birds in total) all south of 16°26'S.

Only 7 sightings (of single birds) were made of the Manx shearwater (*P. puffinus*), four between 12°15'S and 15°09'S off the shelf in water deeper than 400m. The others sightings were all south of 16°S.

Only one sighting of Great shearwater (*P. gravis*) was made, the first one in Angolan waters during the last four surveys. The sighting was of a single bird at 12°19'S over mid shelf (108m depth).

The Sooty shearwater (*Puffinus griseus*), migrant from the sub-Antarctic, was uncommon on the outer shelf and beyond the shelf break becoming more widespread over the shelf south of 16°S south. There was, however, a noticeable cluster of sightings (10 out of 24) in deep water (9 sightings between 500m and 920m) between 12°13'S and 12°23'S.

The White-chinned petrel (*Procellaria aequinoctialis*) was one of the most abundant and widespread species encountered. It was found at low densities and mostly offshore (outer-shelf and shelf break) north of 13°S. South of 15°S this species is found regularly also inshore and in higher densities at depth greater than 100m and to the south.

The Soft-plumaged petrel (*Pterodroma mollis*) was seen for the first time during these surveys, only in the extreme south of the survey area (17°20'S) and in very deep water (the two sightings were in 1915 m and 1154 m respectively). This species is not normally seen on the shelf.

***Hydrobatidae*, Storm-petrels:**

Only one species of this group was recorded: the Wilson's storm petrel (*Oceanites oceanicus*), a migrant from the southern ocean. This species was widespread and abundant but with marked variations in densities. It was most abundant at the shelf break and offshore between 10°50'S and 12°30'S, and south of 15°00'S, while far less common between 12°30 and 15°00'S. This species is mainly a zooplankton surface-feeder and its association with frontal zones and surface slicks is an indication of areas of zooplankton concentration at the surface. The observed distribution pattern is remarkably similar to that found during previous surveys, an

indication that the zones of zooplankton availability at the surface are stable in space from year to year.

Sulidae, Gannets:

The Cape gannet, *Morus capensis*, proved to be the most abundant and widespread seabird during the survey, present in nearly 75% of the observations. The proportion of young birds accounted for nearly half the total (3.3% of subadults, 27.5% of immatures and 14.2% of juveniles out of 1346 aged birds) and this is consistent with observations made during previous cruises. This proves that Angolan waters are an important feeding and wintering area for all age classes and might be a key area for the survival of young birds of this vulnerable southern African endemic species. North of 10°30'S and between 12°30' and 14°30'S densities were low. The highest densities were observed in two clusters, one on the inner shelf (water shallower than 50 m) between 10°30'S and 11°30'S as well as on the outer shelf south of 15°S.

Phalacrocoracidae, Cormorants:

Only two cormorant species were recorded during the survey, and only in coastal waters. The White-breasted cormorant (*Phalacrocorax [carbo] lucidus*) is suspected to breed at several locations in the southern region from 13°15' to Baia dos Tigres. The Cape cormorant (*P. capensis*), an endemic species from the Benguela Current region, was observed only in the south (from about 14°13'S) and becoming abundant around Baia dos Tigres. This species breeds and roosts in large numbers at Baia dos Tigres and feeding aggregations counting tens of thousand birds were observed in the bay as during previous years.

A third species, the Reed cormorant, (*Phalacrocorax africanus*), more associated with fresh inland waters, was observed in Luanda bay but not included in the survey.

Pelecanidae; Pelicans:

The Great-white pelican (*Pelecanus onocrotalus*) was not seen at sea during this survey, but several birds were seen onshore on the southeastern part of the Island at Baia dos Tigres and this species probably breeds there. During previous surveys the species has been seen in the same area as well as off several estuaries.

Stercoraridae, Skuas and Jaegers:

Two species of Jaegers (*Stercorarius*) were recorded in extremely low numbers, the Pomarine jaeger (*S. pomarinus*) and the Arctic jaeger (*S. parasiticus*), with 2 and 1 record of single individuals respectively. One additional record of two jaegers, which could not be identified to species level, refers to probably *St. parasiticus* or possibly to *S. longicaudus*. All three species have been recorded in previous surveys and the low number of observations during the present survey is probably due to the seasonality of migration of these northern hemisphere migrants.

The bulk of the palaeartic migrants is expected to pass through the region in September to October.

The Subantarctic skua, *Catharacta antarctica* on the other hand, a visitor from the southern ocean, was slightly more frequent than in previous surveys (48 sightings of 77 individuals). The geographical distribution was remarkably similar to the previous surveys: this species has a discontinuous distribution in Angolan waters at this time of the year. South of 16°S, as further south in Namibian waters, the Subantarctic skua is fairly common over the shelf. It is scarce but regular between 15°S and 16°S and absent further north. This corresponds to the known northernmost distribution of the species in the Southeast Atlantic. However a small isolated area about 350km further north, centered around the northern edge of the Quicombo Bank (around 11°20'S) has been the site of a small cluster of observations of this species during all previous surveys. This year seven sightings of single individuals were made between 10°52'S and 12°13'S. Figure 2 illustrates this unusual distribution pattern observed in the past 4 surveys.

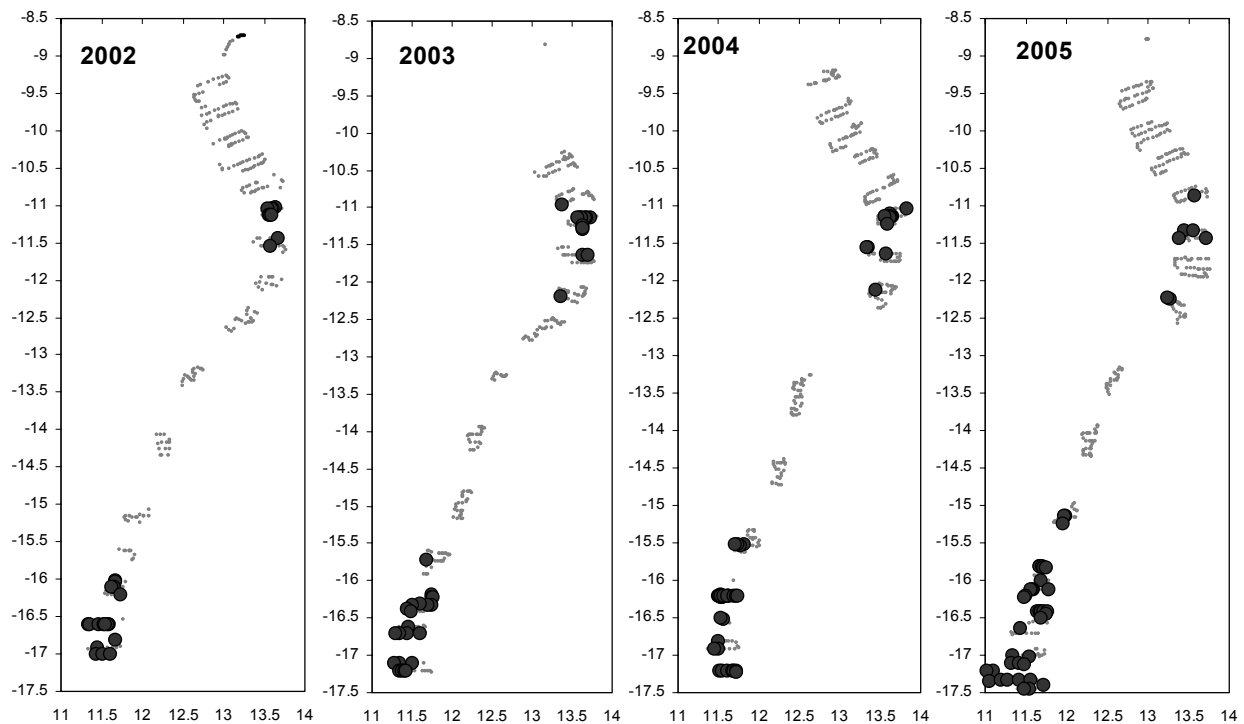


Figure 2. Geographical distribution (Latitudes and Longitudes in decimal degrees) of the subantarctic skua, *Catharacta antarctica*, during the past four surveys illustrating the discontinuous distribution of this species in Angolan waters.

Laridae, Gulls:

The Grey-headed gull (*Larus cirrocephalus*), is a resident associated with coastal and inland waters as well as along the coast in the vicinity of estuaries. It was sighted on 5 occasions in shallow water (24 to 53m), around 12°29'S in the vicinity of a river mouth and in the Baia dos Tigres area between 16°07'S and 16°29'S.

The Kelp gull (*L. dominicanus vetula*), is an endemic subspecies from Southern Africa and the Benguela system was widespread throughout the survey area. Kelp gulls were scarce in the north, becoming regular from 11°30'S and abundant particularly inshore south of 16°S.

The Sabine's gull (*Xema sabini*), a northern hemisphere migrant, was sighted only 3 times with a total of 4 individuals at 13°20'S, 16°07'S and 17°06'S. This low abundance is probably due to the early date of the survey as this species' southward migration through the area is peaking in September-October.

Sternidae, Terns:

Four of the five tern species recorded, are palearctic migrants (*Sterna hirundo*, *S. paradisaea*, *S. sandvicensis*, and *Chlidonias niger*). *S. hirundo* was widespread throughout the area but in much lower numbers than in some of the previous surveys; again probably the effect of an earlier date on the abundance of palearctic migrants. *C. niger* was very scarce with only 5 sightings of single individuals. August must correspond to the extreme beginning of the migration through this area (more than 300 individuals were sighted in September 2002).

The Royal tern (*Sterna maxima*) is a tropical species breeding in West Africa and dispersing to southern Angola in summer. During the survey it was sighted only twice at 14°19'S and 15°08'S. This low occurrence contrasts with previous surveys when the species was regularly seen north of 13°S.

Marine mammals:

Cape fur seal: *Arctocephalus pusillus*:

Fur seals were distributed fairly uniformly in small numbers in the entire study area but were more frequent over the inner shelf (depth < 150 m). Higher densities were found south of 15°S and particularly near Baia dos Tigres which harbours a fairly large non-breeding colony.

Cetaceans:

The summary of the cetacean sightings made during this part of the survey is given in Table 2 and Fig 3.

The sightings of Killer whales (*Orcinus orca*) confirm the presence of this species in Angolan waters. They have been observed in two previous surveys (2002 and 2003), which were the first confirmed records for this area.

The presence of Dusky dolphins (*Lagenorhynchus obscurus*) on the shelf in the area of Baia dos Tigres is also a confirmation that the previous sightings of this species in the same region during the last two surveys and represents the northern limit of their normal range in the Southeast Atlantic. This species is probably the most common small odontocete on the shelf of the Benguela upwelling ecosystem from South Africa and Namibia. Its extended distribution in southern Angola south of the Benguela-Angola Front is not surprising, however had not been documented before.

The lack of observation of dolphins of the genera *Delphinus* and *Stenella* was surprising during this survey, and possibly a consequence of the anomalously cold conditions prevalent in the region at the time of this survey.

Turtles:

Only one sighting of one single unidentified marine turtle was made during this survey in (40m of water at 10°18'S, 13°25'E). This is in sharp contrast with previous surveys when turtle sightings were regular particularly Olive Ridley (*Lepidochelis olivacea*) turtles in approximately the same area, between 10° 23'S and 11°08'S.

Patterns of abundance:

On a broad scale and according to seabird and marine mammal distribution observed during the previous surveys, southern Angolan waters can be divided in 4 distinct zones (the latitudinal limits given below are approximate and the description of the patterns only for late winter and spring).

a) 9°30'S to 12°30'S

This area is characterized at this time of the year by:

- Presence of the Sooty shearwater *P. griseus* at low densities in deep water
- Presence of White-chinned petrel at low density over the outer shelf and beyond
- Absence of Albatrosses, Cape Petrel, Cape cormorant
- Low densities of the Cape fur seal *A. pusillus*, on the shelf,
- Presence of Bryde's whale, *Balaenoptera edeni*.

In the southern half of this zone, a small area stands out at around 11°10'S –11°15'S (the northwestern edge of the Quicombo bank). In this area seabird densities are generally higher than either north or south of it. This is particularly the case for Cape gannets and Wilson's storm petrels. This indicates a high availability of zooplankton near the surface as well as higher availability of pelagic fish characteristics of a divergent frontal zone, or local upwelling. This interpretation is supported by the negative sea temperature anomaly extending offshore observed in this area year after year. In addition the sightings of flotsam lines offshore in this area (contrasting with flotsam being seen inshore further north or south) seems to indicate a surface offshore transport located there. Also associated with this feature is the unexpected presence of the Subantarctic skua (*C. antarctica*) noted during the previous 3 surveys as well as during this one (Fig X2). This species is otherwise found only south of the Angola-BenguelaFront.

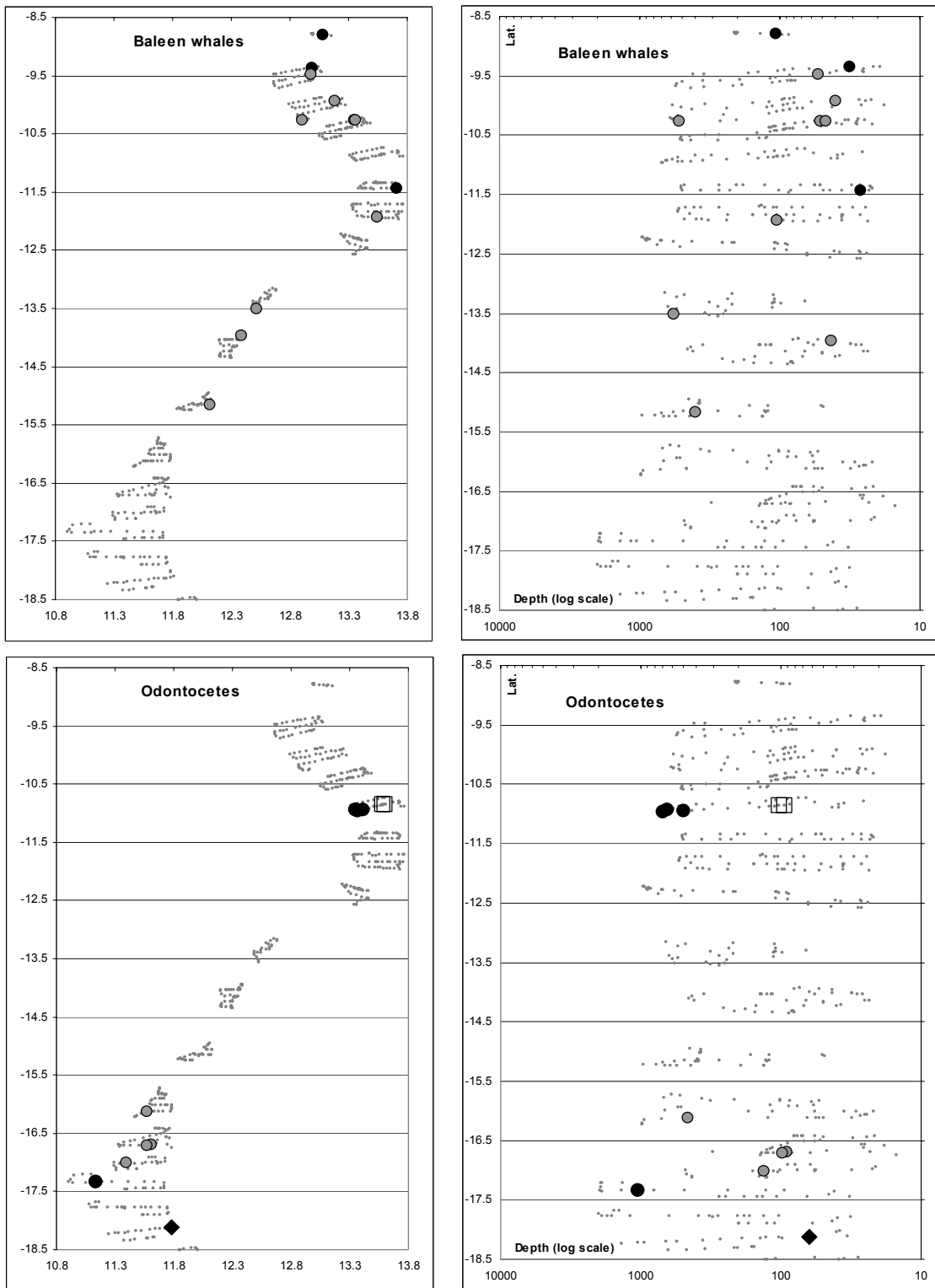


Figure 3. Humpback (grey circles) and Bryde's whale (black circles) distribution (Top) and Pilot whale (black circles), Orca (open squares), Dusky dolphin (grey circles) and Bottlenose dolphin (black diamond) distribution (Bottom).

b) 12°30'S to 14°30'S

This area is noticeable because of the general low densities of all seabird species and is characterized by

- Lowest density of the four most abundant and widespread species, Wilson's Storm petrel, White-chinned petrel, Kelp gull and Cape Gannet
- Absence of *Balaenoptera edeni* and Turtles
- Absence of Cape fur seal to 14°S, and very low abundance to 14°30'S

c) 14°30'S to 16°00'S

This area seems to constitute a transition zone with the appearance at low density of some species more common further south such as Yellow-nosed albatross *Thalassarche chlororhynchos*, Cape cormorant *Phalacrocorax capensis* and Pintado petrel *Daption capense* and a slight increase in fur seal abundance.

d) South of 16°00'S

South of 16°S, the avifauna changes dramatically and is marked by a large increase in density of many subantarctic species (Yellow-nosed albatross, Pintado petrel, Sooty shearwater, Subantarctic skua, White-chinned petrel) as well as Benguela current region endemics (Cape gannet, Cape cormorant, Kelp gull). The density of Cape fur seal increases dramatically as well at around 16°S.

New sub-Antarctic species, more common in Namibian waters at this time of the year, appear in this area (Black-browed albatross, Shy albatross) and marine mammals characteristic to the Benguela upwelling region are also present (Heaviside's dolphin inshore, Dusky dolphin on the shelf).

Table 2. Summary of cetacean sightings.

Species	Number	Date	Local time	Log	Depth	SST	Lat (dec ')	Long (dec ')	Remarks
<i>Balaenoptera edeni</i>	1	28-Jul-05	15:56	1951	108	19.1	-8.792	13.074	
<i>Balaenoptera sp.</i>	2	29-Jul-05	8:44	2092.3	32	19.4	-9.352	12.986	<i>B.sp</i> probable <i>B. Edeni</i>
<i>Megaptera novaeangliae</i>	1	29-Jul-05	11:02	2115	54	19.3	-9.475	12.977	Small size (sub adult)
<i>Megaptera novaeangliae</i>	1	30-Jul-05	11:40	2326.5	40	19.5	-9.923	13.177	Breaching
Unid.	2	30-Jul-05	15:18	2358	85	20	-10.062	13.115	Large baleen whale too far for ID
<i>Megaptera novaeangliae</i>	1	30-Jul-05	17:27	2381.2	529	22.1	-10.267	12.906	2 nm south
<i>Megaptera novaeangliae</i>	1	30-Jul-05	17:46	2384	265	22.1	-10.251	12.947	Possibly same individual as above
<i>Megaptera novaeangliae</i>	2	31-Jul-05	9:56	2497	52	19.5	-10.259	13.349	2 adults 10 m apart sounding in synchrony
<i>Megaptera novaeangliae</i>	2	31-Jul-05	10:08	2497.8	47	19.4	-10.252	13.358	2 adults possibly same individuals as above
<i>Globicephala sp.</i>	6-10	1-Aug-05	9:41	2698.2	650	20.1	-10.930	13.348	Associated with 8 <i>Tursiops</i>
<i>Tursiops truncatus</i>	8	1-Aug-05	9:41	2698.2	650	20.1	-10.930	13.348	Associated with <i>Globicephala</i>
<i>Globicephala sp.</i>	9	1-Aug-05	9:52	2700	696	19.7	-10.955	13.363	2 tight groups (4 and 5 indiv.) 200 m apart
<i>Globicephala sp.</i>	13-20	1-Aug-05	10:47	2703	495	19.4	-10.940	13.407	
<i>Orcinus orca</i>	4	1-Aug-05	13:30	2717	103	18.9	-10.853	13.580	2 ad females, 1 large male, 1 young
<i>Orcinus orca</i>	2	1-Aug-05	13:43	2718	95	19.2	-10.844	13.595	2 medium size (ad Females?) 1' South of previous group
<i>Balaenoptera edeni</i>	1	2-Aug-05	13:04	2919	27	18.1	-11.432	13.704	About 300 m
<i>Megaptera novaeangliae</i>	1	3-Aug-05	16:52	3128	105	19.9	-11.931	13.545	
<i>Megaptera novaeangliae</i>	4	6-Aug-05	17:24	3450	580	17.8	-13.506	12.515	4 large adults in a tight group
<i>Megaptera novaeangliae</i>	1	7-Aug-05	8:24	3538.9	43	17.1	-13.951	12.379	
<i>Megaptera novaeangliae</i>	1	8-Aug-05	10:30	3725.2	404	16.6	-15.156	12.110	Breaching
<i>Lagenorhynchus obscurus</i>	6	9-Aug-05	16:03	3937	468	15.9	-16.113	11.568	Minimum count
<i>Lagenorhynchus obscurus</i>	15-20	11-Aug-05	10:00	4177	91	15.3	-16.691	11.601	15 to 20 duskies
<i>Lagenorhynchus obscurus</i>	30-50	11-Aug-05	10:08	4179	98	15.2	-16.700	11.570	In 2 groups 100 m apart
<i>Lagenorhynchus obscurus</i>	24	12-Aug-05	11:40	4375	132	14.3	-17.003	11.396	One group
<i>Globicephala sp.</i>	12	13-Aug-05	10:47	4516	1058	14.4	-17.336	11.133	At least 1 very small young

Conservation aspects:

A number of seabirds present in Angolan waters in winter and spring are susceptible to by catch by long line fisheries (as well as direct catch from small crafts). These include particularly all species of albatrosses, and some petrels and shearwaters as well as the Cape gannet. By catch by long-line fisheries in the southern hemisphere has impacted widely on many species of seabirds and, despite major international efforts to limit the problem, is threatening the survival of several species of albatrosses and petrels. In Namibia, the Cape gannet continuing population decline and the deterioration of its conservation status (the population declined by half in the past decade) has been attributed to trophic factors (and particularly the decline in the sardine stock) as well as increased by catch by long-line fisheries, which have developed in Namibia since the early 1990s.

The sightings during the 2002 survey of small vessels using floating lines to catch seabirds in the southern part of the area (and targeting both White-chinned petrels and Cape gannets, together with the realization of the importance of Angolan waters for all age classes of gannets at this time of the year causes some concern. A high incidence of Cape gannets sighted in southern Angola during the 2003 and 2004 surveys (particularly around Tombua) with remnants of lines and hooks in their beaks attests to the reality of this potential threat which might be impacting negatively on the threatened Namibian gannet population.

The results gathered during the four surveys have shown that southern Angola is a key area for wintering gannets and particularly important for young birds. The Cape gannet is an endemic to the region with only six breeding sites worldwide, including three in Namibia. The Namibian population has declined drastically in the past decade and the recruitment of young birds seems to be insufficient to sustain the population. Given the importance of southern Angola to young gannets revealed by the last four surveys it seems important that Angola be included and involved together with Namibia and South Africa in a joint conservation effort regarding these seabirds.

The following figures give examples of distribution of the main species using all records (presence absence) and of the highest densities of the most common and widespread species, using the 10-minute counts only. These data are plotted against geographical coordinates as well as in latitude-depth (on a log scale) plots to visualize the distribution patterns on and off the shelf.

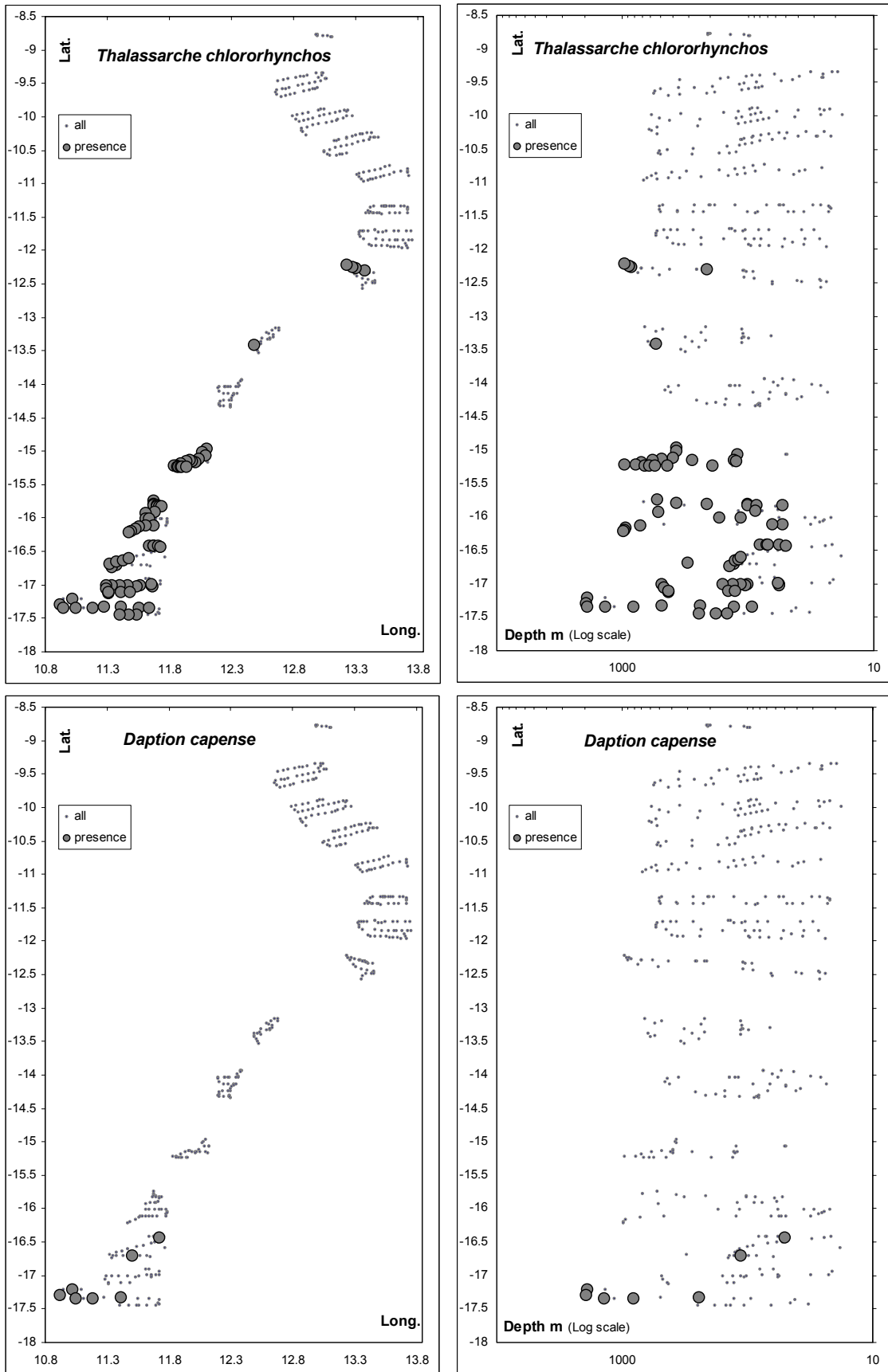


Figure 4. Distribution of the Yellownosed albatross (top) and the Pintado petrel (bottom).

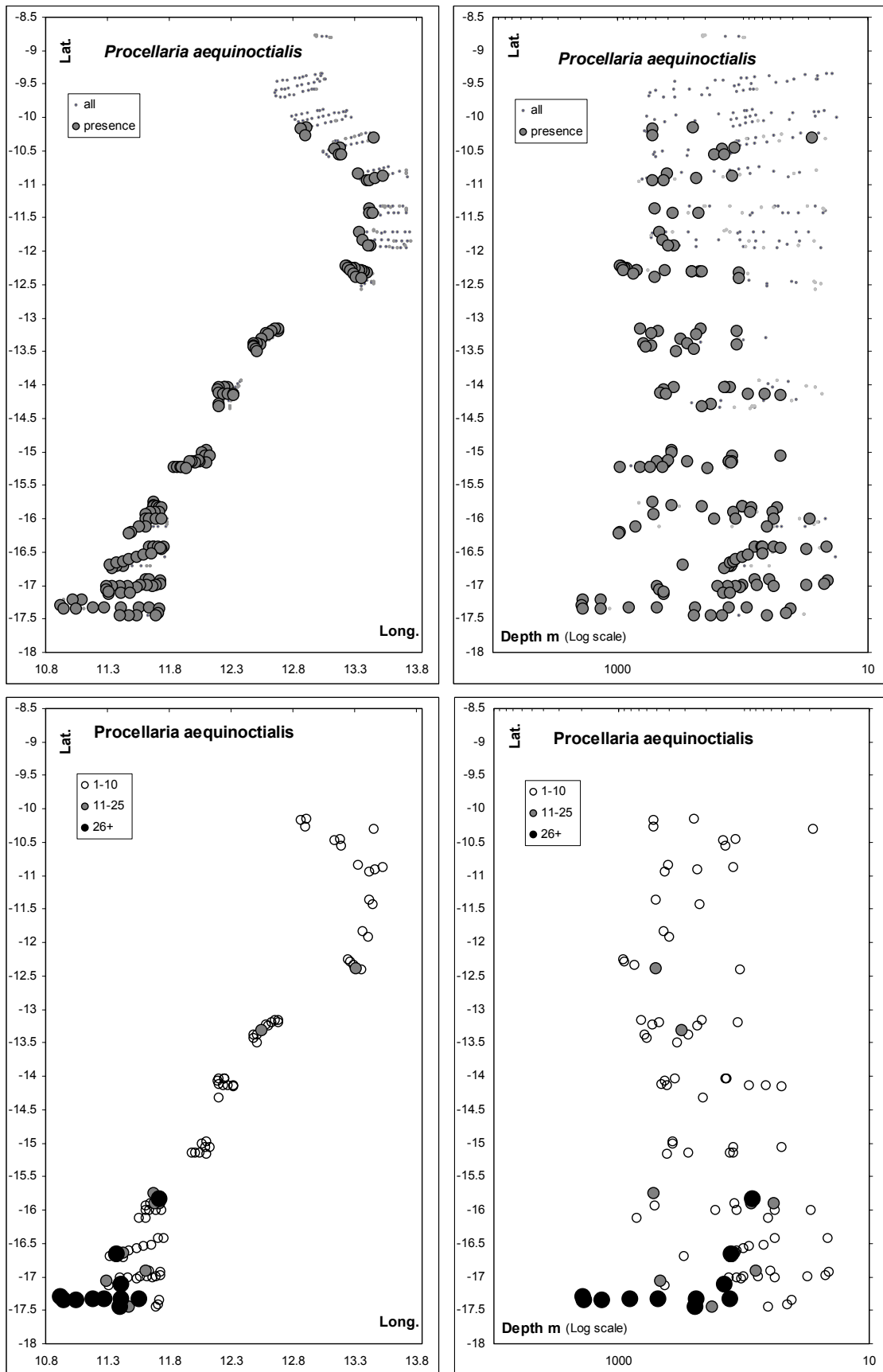


Figure 5. Distribution and patterns of abundance of the White-chinned petrel.

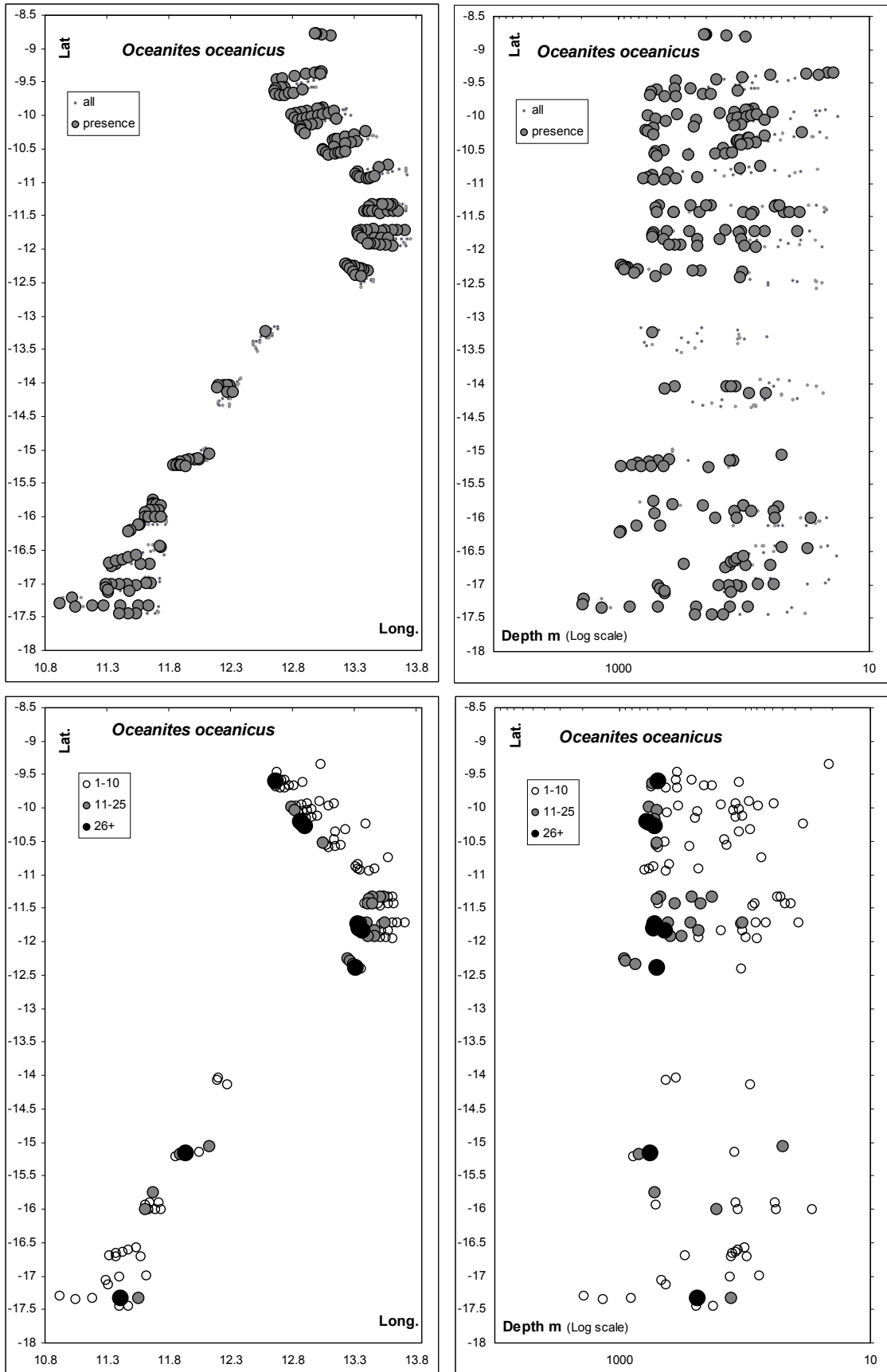


Figure 6. Distribution and patterns of abundance of the Wilson's storm-petrel.

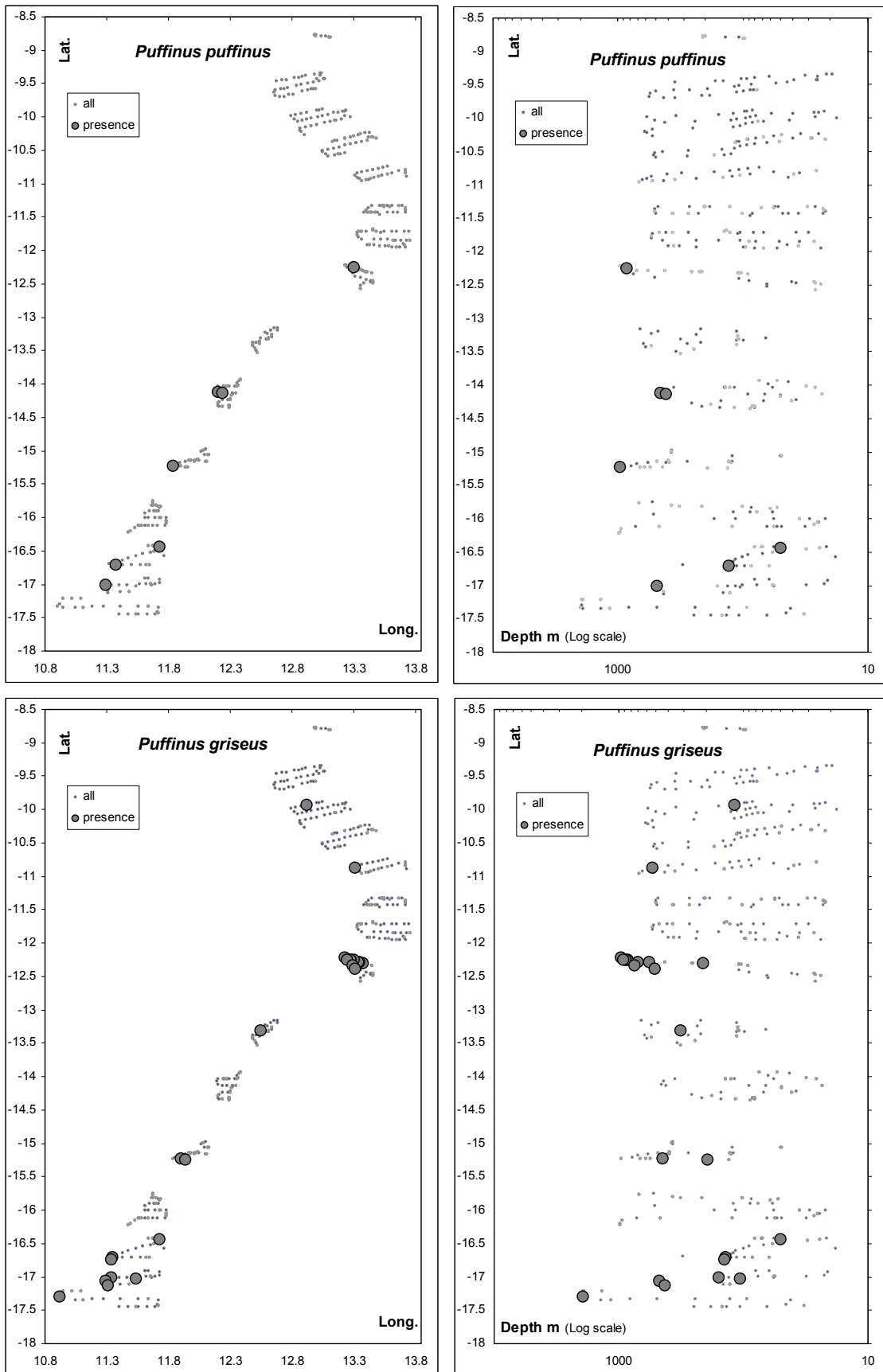


Figure 7. Distribution of the Manx shearwater (top) and the Sooty shearwater (bottom).

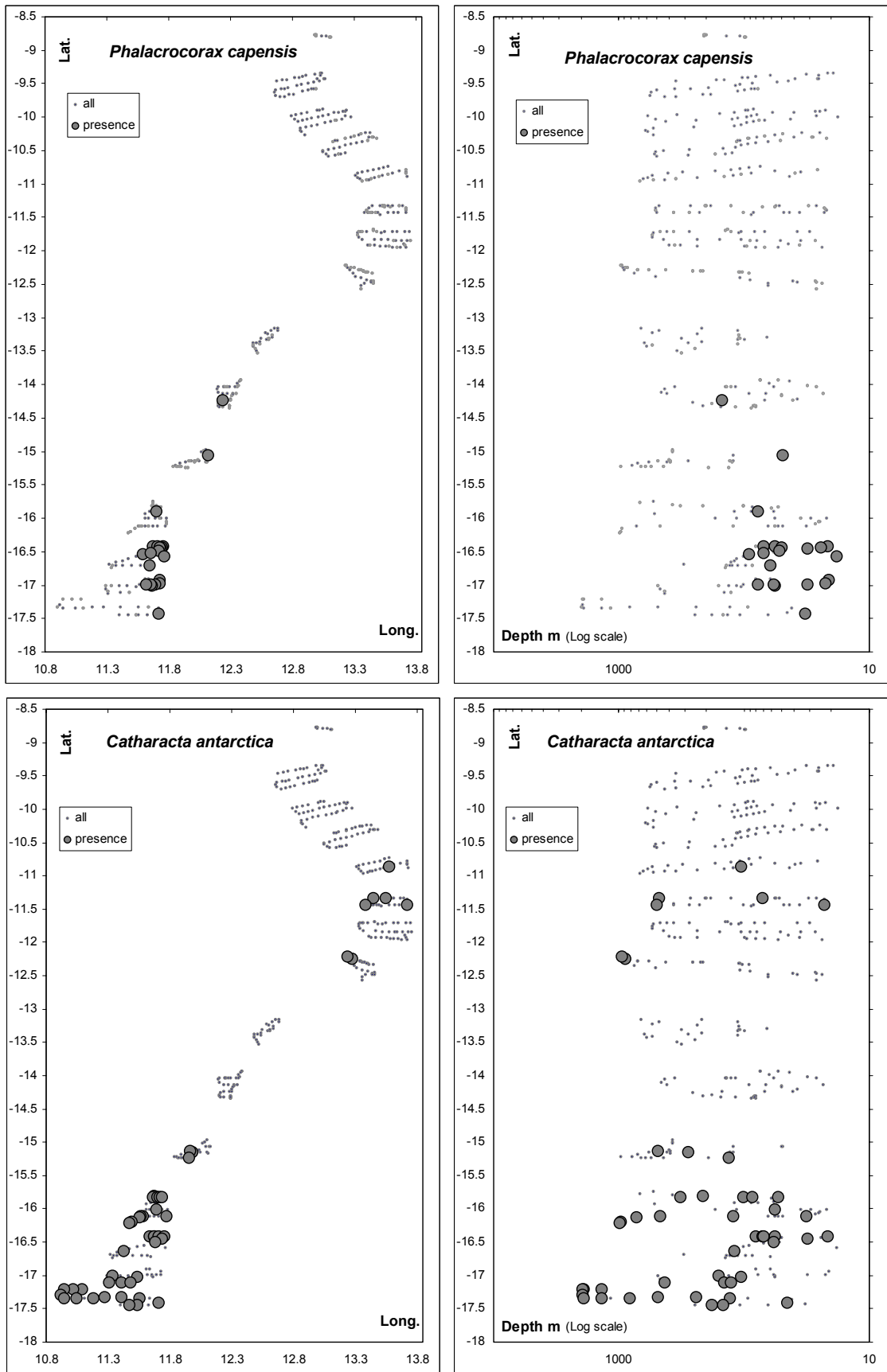


Figure 8. Distribution of the Cape cormorant (top) and the Subantarctic skua (bottom).

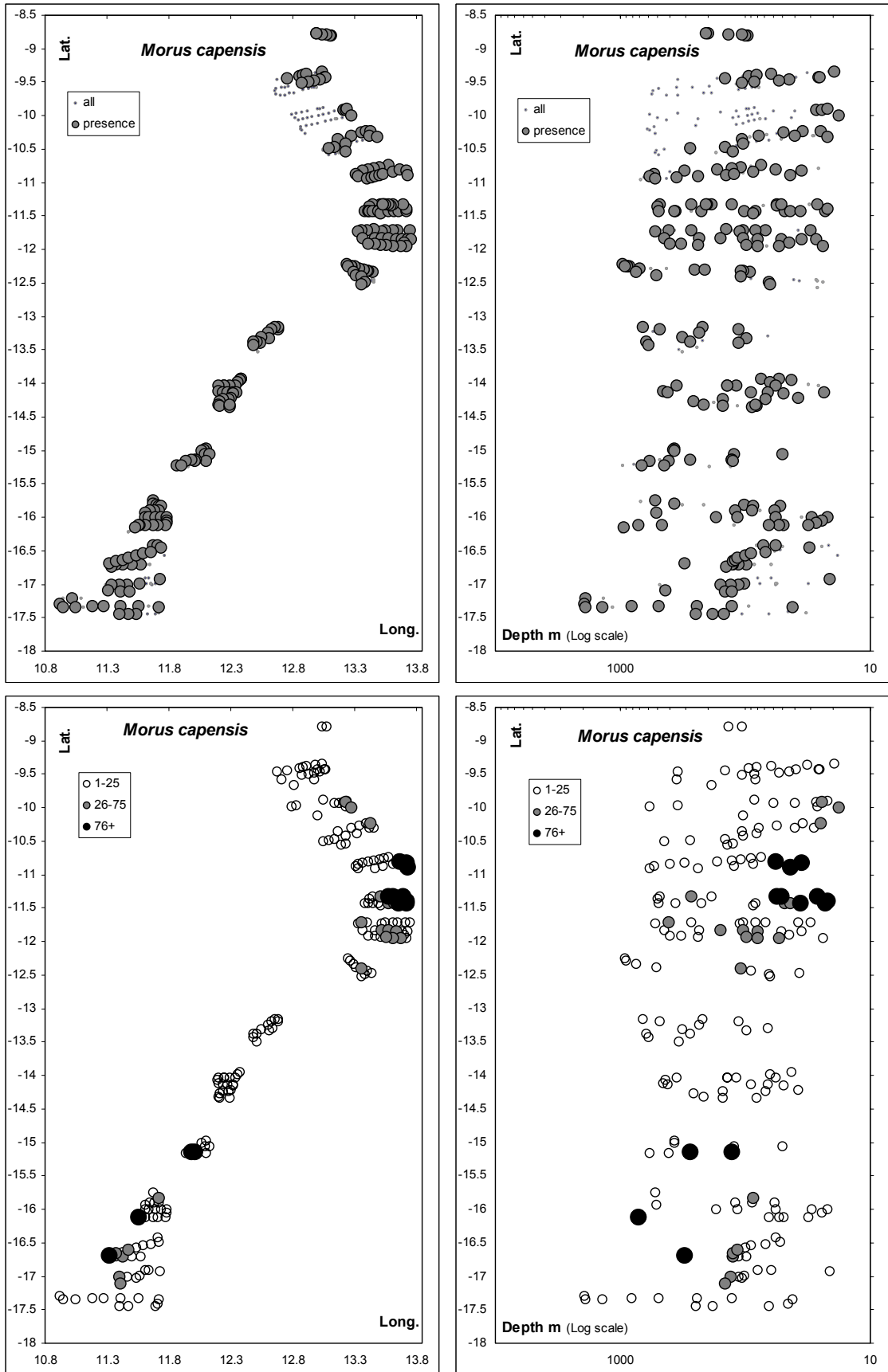


Figure 9. Distribution and patterns of abundance of the Cape gannet.

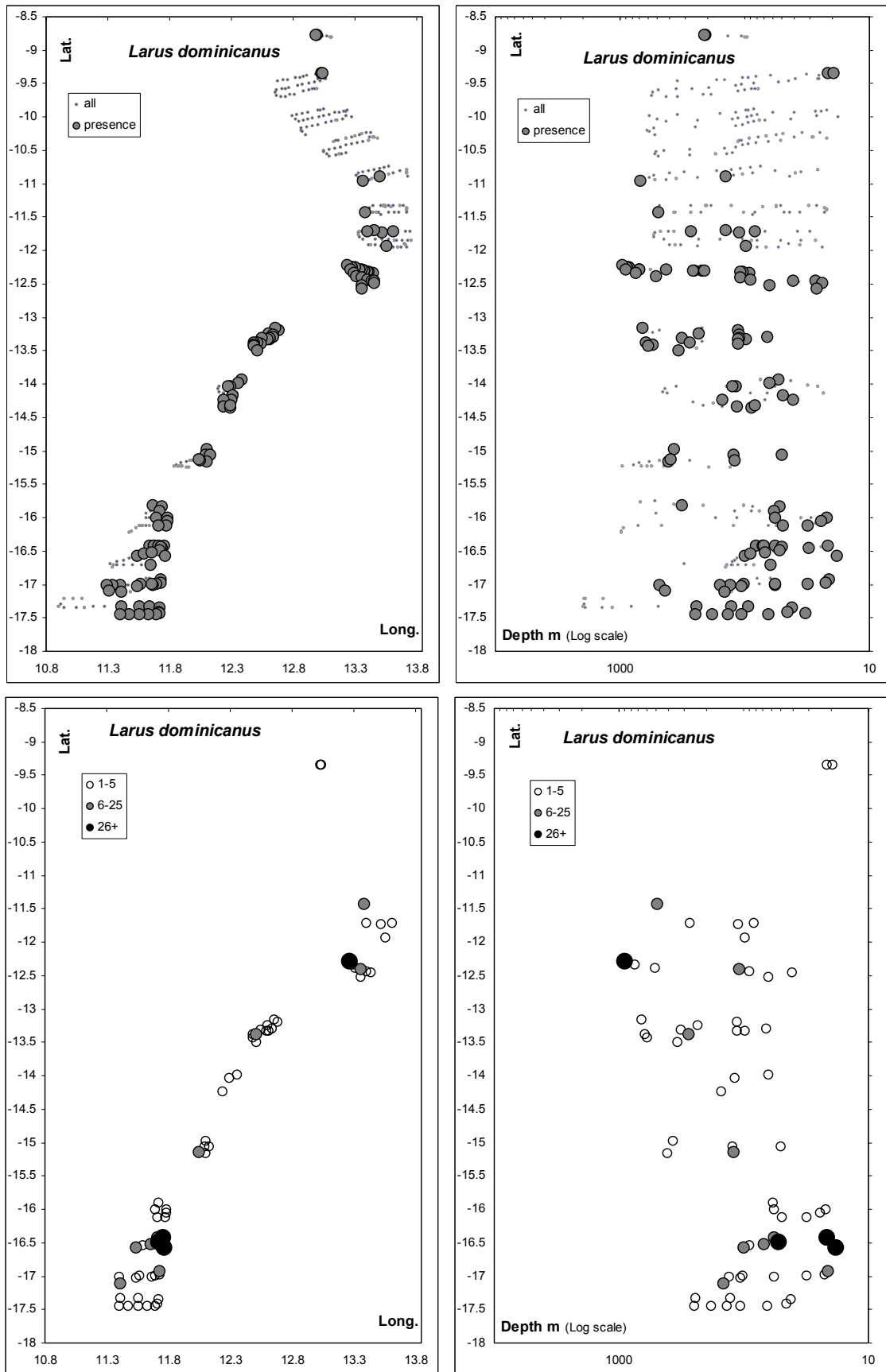


Figure 10. Distribution and patterns of abundance of the Kelp gull.

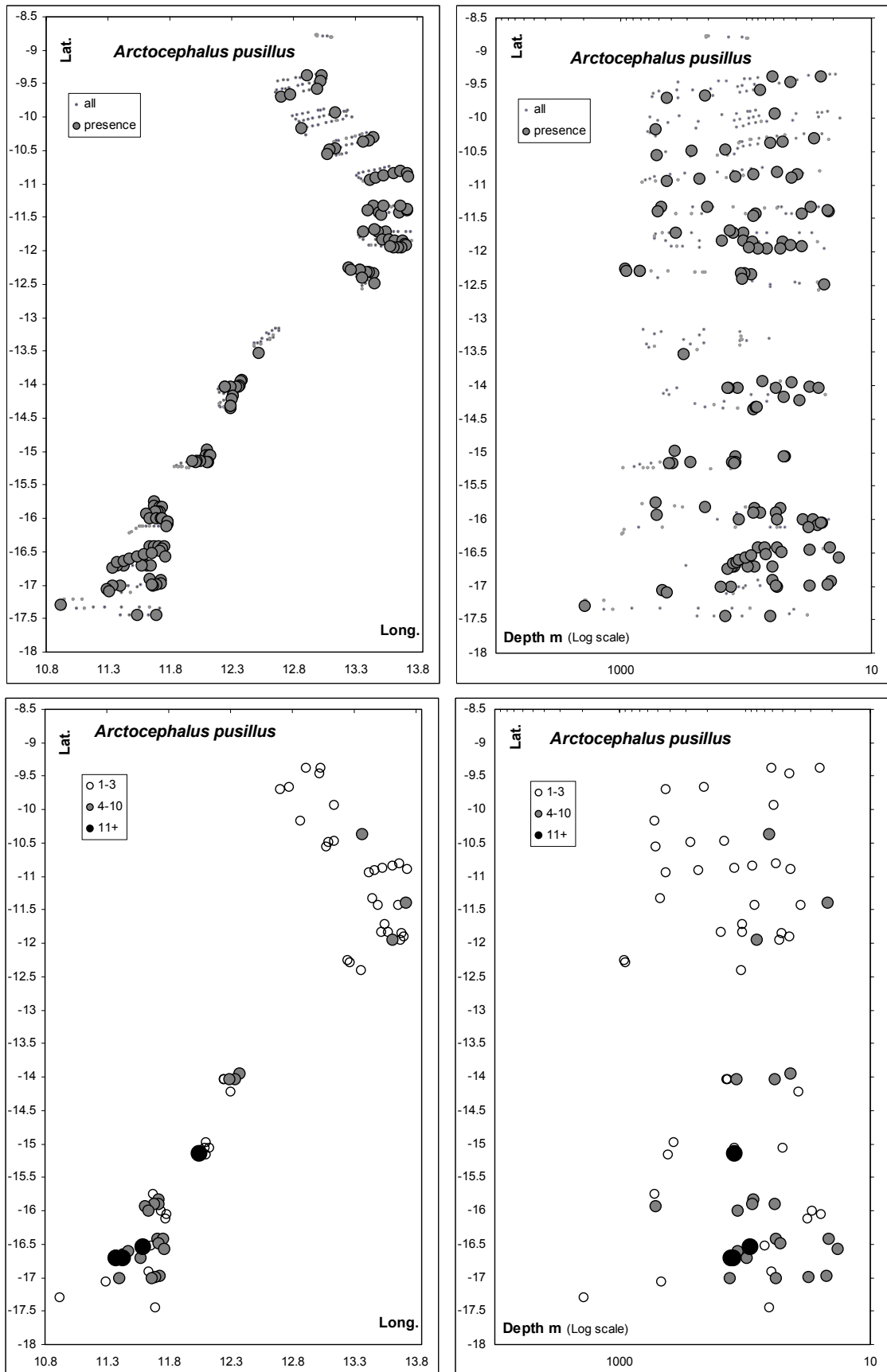


Figure 11. Distribution and patterns of abundance of the Cape fur seal.