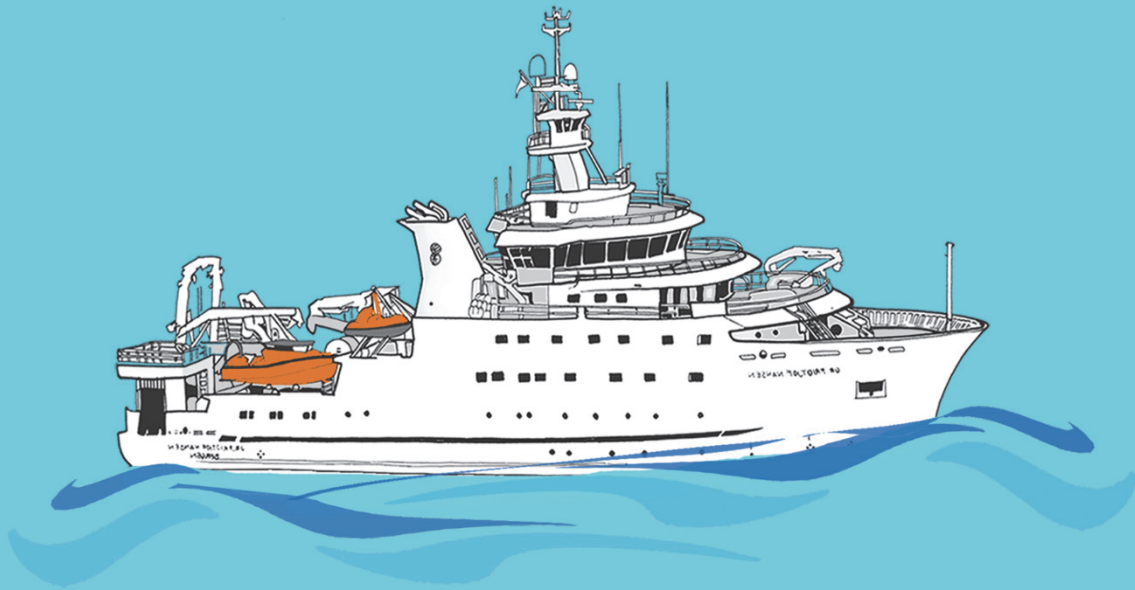


**NORAD-FAO PROGRAMME  
GCP/GLO/690/NOR**

**CRUISE REPORTS *DR FRIDTJOF NANSEN*  
EAF-Nansen/CR/2019/3**



**TRANSBOUNDARY DEMERSAL SURVEY IN THE SOUTHEAST ATLANTIC**

**Namibia**

**4–24 April 2019**



**National Marine Information Research Centre  
Swakopmund, Namibia**

**Institute of Marine Research  
Bergen, Norway**



## THE EAF-NANSEN PROGRAMME (2017–2021)

The EAF-Nansen Programme “Supporting the Application of the Ecosystem Approach to Fisheries Management considering Climate and Pollution Impacts” supports partner countries and regional organizations in Africa and the Bay of Bengal improving their capacity for the sustainable management of their fisheries and other uses of marine and coastal resources through the implementation of the Ecosystem Approach to Fisheries (EAF), taking into consideration the impacts of the climate and pollution.

The Programme is executed by the Food and Agriculture Organization of the United Nations (FAO) in close collaboration with the Institute of Marine Research (IMR) of Bergen, Norway, and funded by the Norwegian Agency for Development Cooperation (Norad). This Programme is the current phase (2017–2021) of the Nansen Programme which started in 1975.

The aim of the Programme is that sustainable fisheries improve food and nutrition security for people in partner countries. It builds on three pillars, Science, Fisheries Management, and Capacity Development, and supports partner countries to produce relevant and timely evidence-based advice for management, to manage fisheries according to the EAF principles and to further develop their human and organizational capacity to manage fisheries sustainably. In line with the EAF principles, the Programme adopts a broad scope, taking into consideration a wide range of impacts of human activities and natural processes on marine resources and ecosystems including fisheries, pollution, climate variability and change.

A new state of the art research vessel, the *Dr Fridtjof Nansen*, is an integral part of the Programme. A comprehensive science plan, covering a broad selection of research areas, and directed at producing knowledge for informing policy and management decisions, guides the Programme’s scientific work.

The Programme works in partnership with countries, regional organizations, other UN agencies as well as other partner projects and institutions.

## LE PROGRAMME EAF-NANSEN (2017-2021)

Le programme EAF-Nansen « Soutenir l'application de l'approche écosystémique pour la gestion des pêches compte tenu des impacts du climat et de la pollution » appuie les pays partenaires et les organisations régionales en Afrique et dans le golfe du Bengale pour améliorer leur capacité de gestion durable de leurs pêcheries et d'autres usages de la mer ainsi que les ressources côtières, grâce à la mise en œuvre de l'Approche écosystémique des pêches (AEP), en tenant compte des impacts du climat et de la pollution.

Le programme est exécuté par l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO) en étroite collaboration avec l'Institut de recherche marine (IMR) de Bergen, en Norvège, et financé par l'Agence norvégienne de coopération au développement (Norad). Ce programme est la phase actuelle (2017-2021) du programme Nansen qui a débuté en 1975.

L'objectif du programme est que la pêche durable améliore la sécurité alimentaire et nutritionnelle des populations des pays partenaires. Il s'appuie sur trois piliers, la science, la gestion des pêches et le développement des capacités, et aide les pays partenaires à produire des avis pertinents et opportuns fondés sur des données factuelles pour la gestion, à gérer les pêcheries conformément aux principes de l'AEP et à développer davantage leur capacité humaine et organisationnelle à gérer durablement les pêches. Conformément aux principes de l'AEP, le programme adopte une large vision, prenant en considération un large éventail d'impacts des activités humaines et des processus naturels sur les ressources et les écosystèmes marins, y compris la pêche, la pollution, la variabilité et le changement climatique.

Un nouveau navire de recherche de pointe, le *Dr Fridtjof Nansen*, fait partie intégrante du programme. Un plan scientifique complet, couvrant un large éventail de domaines de recherche et visant à produire des connaissances pour éclairer les décisions de politique et de gestion, guide les travaux scientifiques du programme.

Le programme travaille en partenariat avec des pays, des organisations régionales, d'autres agences des Nations Unies ainsi que d'autres projets et institutions partenaires.

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**CRUISE REPORTS *DR FRIDTJOF NANSEN***

**TRANSBOUNDARY DEMERSAL SURVEY IN THE SOUTHEAST ATLANTIC**

**Namibia**

**4–24 April 2019**

**by**

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## EXECUTIVE SUMMARY

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The area surveyed in 2019 by the research vessel (R/V) *Dr Fridtjof Nansen* includes the continental shelf and upper slope of West Africa from South Africa to Morocco. Legs 2.2 and 2.4 covered the continental shelf and upper slope in Namibia between the 30 m and 600 m isobaths, from the border with South Africa to the border of Angola. The design of the survey was based on the hake swept-area surveys developed during the 1990s and 2000s by the R/V *Dr Fridtjof Nansen* and subsequently adapted by MFMR during annual surveys by the FV *Blue Sea* and other commercial vessels and more recently the R/V *Mirabilis*.

Hydrographic variables (depth, temperature, salinity and oxygen) were measured with a CTD at almost every bottom trawl station and along every degree of latitude an ecosystem transect was carried out with plankton, egg and larvae, micro-plastics and water for chemical analyses sampled at predefined bathymetric depths.

This report summarises the key data on the hake stocks, and several of the important bycatch species, for Leg 2.4, which covered the region from the Walvis Bay to the Cunene River. Results for other data collected, i.e. oceanographic, plankton, top predator, jellyfish, benthic invertebrate and hake biological data will be analysed in the context of research projects as part of the EAF-Nansen Science Plan.

During a post-survey meeting held in November 2019 the data from the surveys of southern and northern Namibia were combined and are presented in Chapters 4 and 5. A further section, Chapter 6, briefly investigates the transboundary distribution of the key demersal stocks between South Africa, Namibia and Angola.

This survey was conducted in April and May; all previous surveys since 1996 have been conducted in January-February. Hence the comparability of the results from this survey with previous surveys has to take into account this factor. The methodologies used by the 2018 survey were replicated as faithfully as possible during the 2019 survey, the main differences being, in addition to being conducted at different times of year, that the vessels were different. It should be noted however that the gear used on the R/V *Dr Fridtjof Nansen* and the R/V *Mirabilis* are the same, which strengthens comparability.

The estimate for Cape hake for the entire Namibian area is slightly higher than the recent estimates of the R/V *Mirabilis*, while for the deep-water hake the biomass appears somewhat lower. When compared to the longer time-series both estimates are broadly similar and suggest no overall trend in abundance.

Cape hake largely consisted of a single length-group from about 25 cm to 35 cm, showing that this species consists almost entirely of a non-fishable component. On the other hand, the biomass of deepwater hake was dominated by the fishable sized fish, although by number these represented just 12.6% of the total. For both species, very few fish greater than 75 cm were observed; these large fish are more accessible by long liners. Further, a cohort at around 17 cm (about one year old) was observed for both species.

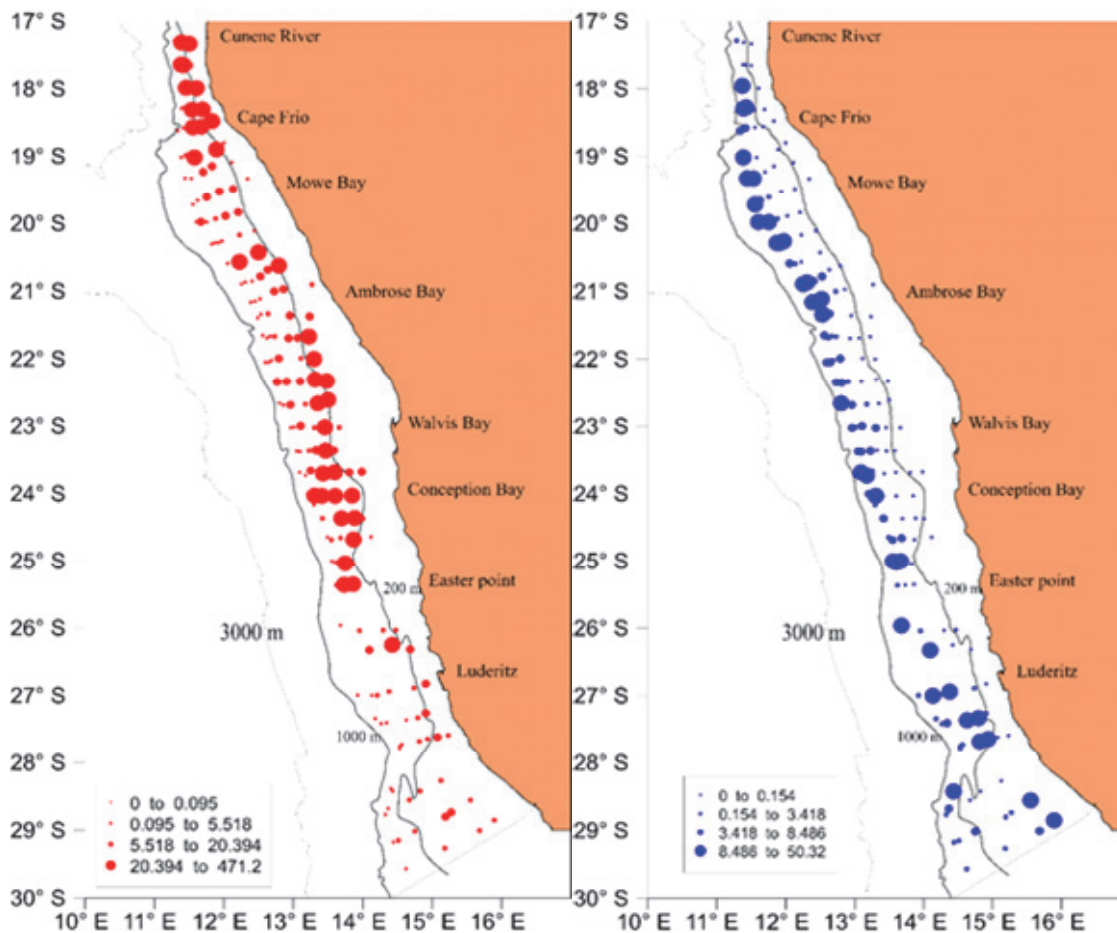
Total biomass indices and associated CV's (%) for *M. capensis* off Namibia since 2000

Period	<i>R/V Dr. F. Nansen</i>		Commercial Fishing Vessels		<i>R/V Mirabilis</i>	
	Biomass	CV	Biomass	CV	Biomass	CV
Jan-Feb 2000			1 079 000	12		
Jan-Feb 2001			426 000	22		
Jan-Feb 2002			601 000	23		
Jan-Feb 2003			667 000	16		
Jan-Feb 2004			1 022 000	19		
Jan-Feb 2005			495 000	17		
Jan-Feb 2006			734 000	14		
Jan-Feb 2007			573 000	26		
Jan-Feb 2008			768 000	30		
Jan-Feb 2009			1 365 000	13		
Jan-Feb 2010			957 000	18		
Jan-Feb 2011			864 000	10		
Jan-Feb 2012			617 000	14		
Jan-Feb 2013			1 247 000	16		
Jan-Feb 2014			936 000	11		
Jan-Feb 2015			839 000	14		
Jan-Feb 2016					824 000	15
Jan-Feb 2017					687 000	18
Jan-Feb 2018					710 394	16
<b>Apr-May 2019</b>	<b>1 145 034</b>	<b>30</b>				

Total biomass indices and associated CV's (%) for *M. paradoxus* off Namibia since 2000

Period	<i>R/V Dr. F. Nansen</i>		Commercial Fishing Vessels		<i>R/V Mirabilis</i>	
	Biomass	CV	Biomass	CV	Biomass	CV
Jan-Feb 2000			194 000	23		
Jan-Feb 2001			161 000	16		
Jan-Feb 2002			124 000	17		
Jan-Feb 2003			109 000	19		
Jan-Feb 2004			135 000	22		
Jan-Feb 2005			106 000	19		
Jan-Feb 2006			164 000	18		
Jan-Feb 2007			129 000	19		
Jan-Feb 2008			168 000	19		
Jan-Feb 2009			111 000	18		
Jan-Feb 2010			84 000	19		
Jan-Feb 2011			223 000	18		
Jan-Feb 2012			203 000	19		
Jan-Feb 2013			145 000	13		
Jan-Feb 2014			132 000	13		
Jan-Feb 2015			276 000	16		
Jan-Feb 2016					185 000	20
Jan-Feb 2017					192 000	30
Jan-Feb 2018					210 711	37
<b>Apr-May 2019</b>	<b>140 221</b>	<b>17</b>				

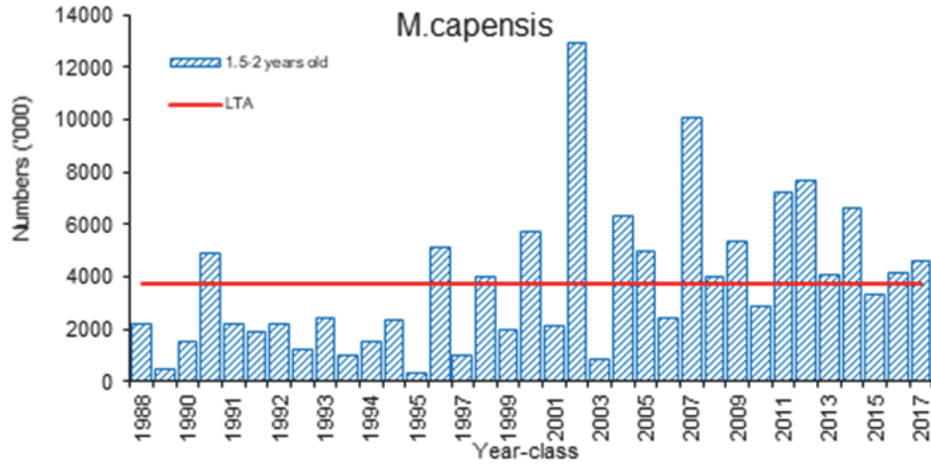
During this survey, areas of high densities for *M. capensis* ( $>20$  t/NM<sup>2</sup>) were found primarily inshore along 200 m isobath between 22°S and 25°S and between 17°S and 19°S. For *M. paradoxus* high-density stations ( $>8$  t/NM<sup>2</sup>) were scattered along the entire coast.



Density distributions (t/NM<sup>2</sup>) for hake: *M. capensis* (left) and *M. paradoxus* (right). Different scales are used to represent the two density distributions.

Recruits to the *M. capensis* stock are estimated from the numerical abundance of the cohort of fish with a modal length of about 22 cm (between 17 and 27 cm). These recruits are assumed to be about 1.5-2 years old. The recruitment of *M. capensis* at around 4.5 billion fish detected during the survey (the 2017-year class) was slightly higher than the long-term average. These fish are expected to fully recruit to the fishery by the second half of 2020, although some may currently be available to the bottom trawl gear. The strength of the *M. paradoxus* cohort cannot be estimated from the Namibian survey data, as the species does not appear to spawn in the Namibian waters.





Estimated number of recruits (1.5-2 years old) of *M. capensis* from the hake surveys off Namibia

## CHAPTER 1. INTRODUCTION

The research activities under the EAF-Nansen Programme are guided by the EAF-Nansen Science Plan. The science plan is intended to ensure good scientific use of the wealth of data generated by the R/V *Dr Fridtjof Nansen* and other related data, addressing key research questions in support of tactical and strategic fisheries management.

The science plan covers 11 research themes, presented in Figure 1.

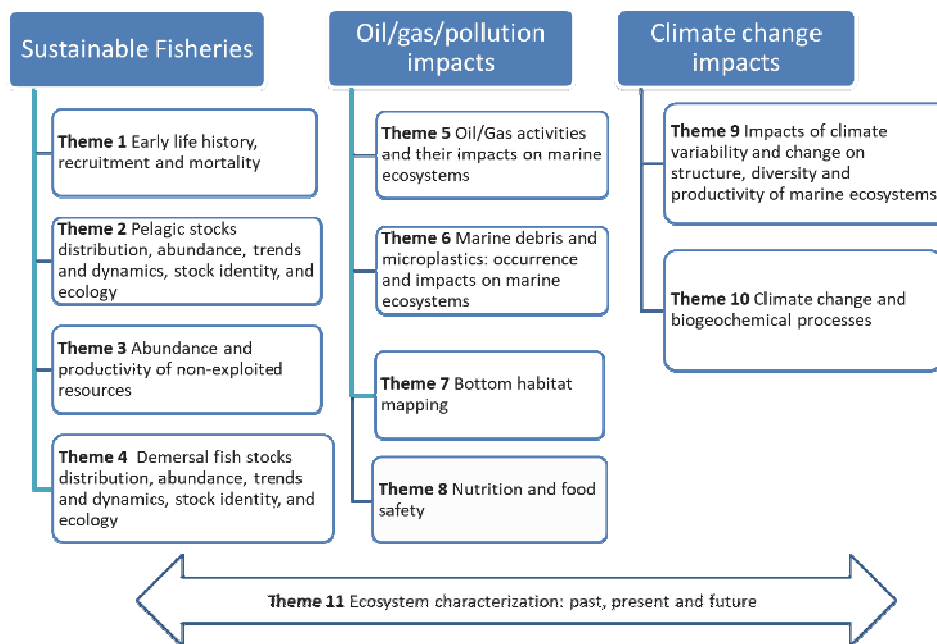


Figure 1. Research themes of the EAF-Nansen Science Plan

Leg 2.2 covered the continental shelf and upper slope of Namibia between the 30 m and 600 m isobaths, from the border with South Africa to Walvis Bay. The survey design followed that first developed by the Nansen Programme in the 1990s for hake biomass assessment (Sætersdal *et al.*, 1999) and used most recently by the Namibian research vessel *Mirabilis* (Paulus *et al.*, 2018).

### 1.1 Survey objectives

#### 1.1.1 Hydrography

- To map the hydrographic and environmental conditions (temperature, salinity, dissolved oxygen, chlorophyll- $\alpha$ , nutrients and pH) and to obtain information on the dissolved oxygen concentrations, ocean acidification state and aragonite saturation state relevant for calcifying organisms.
- To identify oceanographic links of the Orange Bank with adjacent regions north and south.

- To collect data for the oceanographic model of the Orange Bank.
- Collect hydrographic data along standard MFMR Monthly Oceanographic Monitoring (MOM) lines as part of the Ministry's oceanographic time-series.

#### 1.1.2 Zooplankton, ichthyoplankton and jellyfish

- To describe the abundance and biomass patterns of the mesozooplankton community, as well as its species composition.
- To provide information on the abundance patterns of the ichthyoplankton community (fish eggs and larvae), at the lowest possible taxonomic level.
- To collect samples of jellyfish for:
  - morphological identification and taxonomic studies,
  - genetic studies for the purposes of confirming identity, determining population structure and establishing regional and global connectivity,
  - histological examination of reproductive maturity to determine reproductive synchronicity and semelparity within populations and individuals, and
  - stable isotope analysis to determine trophic position and role.

#### 1.1.3 Demersal resources

As the Namibian R/V *Mirabilis* was unable to conduct an adult hake biomass survey in 2019 and collect biological data on the hake stocks, the key objectives of Leg 2.2 and Leg 2.4 were therefore to assess the demersal resources of Namibia. Leg 2.2 covered the area from the border between Namibia and South Africa northwards to Walvis Bay. In this way legs 2.1, 2.2 and 2.4 provide a synoptic coverage of the demersal resources off Namibia and South Africa.

The survey was a standard swept-area bottom trawl survey replicating, as closely as possible, surveys conducted by the R/V *Mirabilis* in 2016, 2017 and 2018 and, previous to that, commercial vessels and the R/V *Dr Fridtjof Nansen*, and also the survey design used by the R/V *Dr Fridtjof Nansen* in South Africa in Leg 2.1. The key objective of Leg 2.2 was therefore to provide information on the biomass, distribution and stock structure of both species of hake, the species composition (catch composition) and also to provide data on the following:

- To collect standard biological data (length frequency, length-weight, sex and maturity) for both species of hake, also length and length-weight for monkfish and kingklip, as well as any other commercial species that may be abundant in the trawls.

- To collect environmental data using CTD casts at most trawl stations to enable subsequent studies investigating the distribution of the key demersal stocks and the environment.
- To monitor the acoustic data to ascertain if the target species (primarily hakes) occur above the trawl headline and hence are not available to the gear, and also for subsequent studies that are relevant to the distribution patterns of the above-mentioned species.
- To collect genetic samples to enable studies of the stock structure of hakes and key by-catch species: monkfish, kingklip, horse mackerel and Spanish mackerel.
- To collect samples of hakes, monkfish and kingklip to enable the study of parasite assemblages as biotags, and morphometric studies, supporting data already collected, and also allowing comparisons with South African samples.
- To collect gonad samples for fecundity studies of the spawning patterns of both species of hake.
- To opportunistically collect data on the distribution and species identification of juvenile hake for comparative studies of the distribution and size structure of catches of juvenile hake by the two vessels (R/V *Africana* and R/V *Dr Fridtjof Nansen*).
- To collect samples of juveniles of both species of hake as part of an investigation into identification using vertebrae counts.
- To collect benthic invertebrates from both trawls and sediment samples for species identification and species composition studies.

#### 1.1.4 Pelagic resources

- To opportunistically collect samples of Cape horse mackerel (*T. capensis*) and *Scomber colias* for genetic analysis and morphometric studies.

#### 1.1.5 Microplastics and neuston communities

- To map the occurrence and abundance of microplastics and the associated neustonic communities.

#### 1.1.6 Marine mammals and seabirds

- To establish the distribution (including migratory) and relative abundance of whales, dolphins and seabirds off the coast of southern Namibia.

#### 1.1.7 Mesopelagic fish, cephalopods and crustaceans

Mesopelagic fish, cephalopods and crustaceans have been sampled around the coast of Africa for a number of years by the Nansen Programme for the University of Western Cape in South

Africa. The samples collected are being used to determine the species' population structures, their trophic positions and ecological roles in the ecosystem, as well as establishing their regional and global connectivity. A recent loss of a large collection of frozen samples has jeopardized this programme and therefore extra effort was made during Leg 2.2 to collect a wide range of samples of these groups.

## 1.2 Survey area

The area surveyed in 2019 by the R/V *Dr Fridtjof Nansen* includes the continental shelf and upper slope of West Africa from South Africa to Morocco. Furthermore, a dedicated survey to the Discovery sea mounts in collaboration with SEAFO was carried out and mesopelagic transects were repeated off Walvis Bay and Morocco following the sampling strategy used in 2017. Figure 2 shows the overall survey programme for 2019 in southwest Africa.



Figure 2. The *Dr Fridtjof Nansen* survey plan for Leg 2

## 1.3 Participation

A total of 23 scientists and technicians from Namibia, South Africa and Norway participated in the survey. The full list of the participants and their affiliations is given in Table 1.

Table 1. List of participants, their role and affiliation during the survey off southern Namibia

<b>Name</b>	<b>Role</b>	<b>Affiliation</b>
Dave Boyer	Cruise leader	IMR
Sarah Paulus	Co-cruise leader, fish team	MFMR
Fredik Madsen	Acoustic engineer	IMR
Geir Landa	Acoustic engineer	IMR
Anja Alvestad	Fish team	IMR
Diana Zaera-Perez	Fish team	IMR
Henrik Søiland	Oceanography	IMR
Susie Jagger	CTD, water chemistry	MFMR
Lusia Hamata	CTD, water chemistry	MFMR
Tor Ensrud	Plankton	IMR
Selma Nuuyoma	Phyto/zoo, fish team	MFMR
Ferdi Hamukuaya	Phyto/zoo, fish team	MFMR
Suama Kashava	Fish team leader	MFMR
Malakia Shimhanda	Fish team, taxonomy	MFMR
Fannie Shabangu	Fish team	DAFF
Manga Simasiku	Fish team	MFMR
Lennox Maliza	Fish team	DAFF
Ernest Frans	Fish team leader	MFMR
Johnny Gamatham	Fish team, taxonomy	MFMR
Beata Sikongo	Fish team	MFMR
Ndamona Mateus	Fish team, bottom sediments	MFMR
Drikus Kuyper	Fish team, jellyfish, myctophids	UWC
Steven McCue	Marine mammals	DEA

List of institution abbreviations:

- IMR – Institute of Marine Research, Bergen, Norway
- MFMR – Ministry of Fisheries and Marine Resources, Namibia
- DAFF – Department of Agriculture, Forestry and Fisheries, Cape Town, South Africa
- DEA – Department of Environmental Affairs, South Africa
- UWC – University of Western Cape

#### 1.4 Narrative

The vessel left Walvis Bay in the morning of 5 April 2019, 18 hours later than planned due to visa problems with one of the joining scientists, and steamed southwards towards the Orange Bank near the border with South Africa. Owing to strong south-westerly winds and a subsequent large swell, this region was only reached at sunrise on 7 April 2019. Intensive

CDT sampling was conducted along several transects across the Orange Bank during the next 24 hours. Trawling started at sunrise on 8 April 2019 and was the primary focus for the remainder of the survey.

The survey coverage off the southern part of the Namibian coast was completed on 23 April 2019 in the evening. The vessel came in to port at Walvis Bay at 08:00 local time on 24 April 2019 (Table 2).

## 1.5 Survey effort

The design of the survey was based on the hake swept-area surveys developed during the 1990s and 2000s for the R/V *Dr Fridtjof Nansen* (see Strømme *et al.*, 2015; also Anon, 2000; Anon, 2006; Axelsen & Johnsen, 2015) and subsequently adapted by MFMR during annual surveys by the *FV Blue Sea* and other commercial vessels and more recently the R/V *Mirabilis* (Paulus *et al.*, 2018).

A swept-area survey of this type usually takes 18-20 days to complete, from the first trawl off the Orange River until the final trawl on the 23°S transect off Walvis Bay. Only 16 days were available to complete this part of the survey as the original vessel schedule was to focus on the study of the ecology of juvenile hakes during Leg 2.2. In addition to the standard trawling, an array of plankton stations (known as super-stations) were also planned (Table 2).

Demersal trawling was carried out on predetermined positions within predetermined depth strata (as summarized in Table 3).

Hydrographic variables (depth, temperature, salinity and oxygen) were measured with a CTD at almost every bottom trawl station; several were dropped when time was particularly short and when there were two trawls within a couple of NM of each other – those in the 400 m and 500 m strata.

Along every degree of latitude (every 60 NM) an ecosystem transect (colloquially known as a “super-transect”) was carried out with CTD and zooplankton sampling stations at predefined bathymetric depths (Annex I). At each super-station, in addition to the CTD sampling, plankton, egg and larvae, micro-plastics and water for chemical analyses were all sampled. Some extra CTD data were collected at stations on the NatMIRC Monthly Oceanographic Monitoring lines, namely along the 28°, 26° and 23°S degree lines, and at several prescribed near-shore stations.

Acoustic echograms were continually recorded throughout the survey; the data was used to confirm, or otherwise, whether hake occurred more than about 5 m from the bottom, i.e. above the headrope, and were therefore not available to the trawl gear.

Table 2 summarises the overall survey effort, while Table 3 shows the area covered and effort per strata as used in the swept-area analyses. The cruise tracks with bottom-trawls, trawls, plankton and hydrographic stations can be found in Figure 3 to 5.

Table 2. Survey effort - number of CTD, multinet, Manta and bottom trawl stations

<b>DATE</b>	<b>4-24 April</b>
DISTANCE (NM)	2 654
TRANSECTS	18
BOTTOM TRAWLS	87
CTD	131
SUPER STATIONS	19
WHERE THE FOLLOWING SAMPLES WERE TAKEN:	
MULTINET	18
WP2	19
MANTA	14

Table 3. Survey effort - number of valid trawl hauls for swept-area analysis by depth strata

Effort	Depth strata (m)				
	100-200	200-300	300-400	400-500	500-600
N trawl hauls	19	19	17	17	10
Sampling intensity (NM <sup>2</sup> /trawl)	649	286	279	136	114
Area (NM <sup>2</sup> )	12 341*	5 435	4 698	2 326	1 139

\* Note that all but one trawl in this stratum are deeper than 150 m



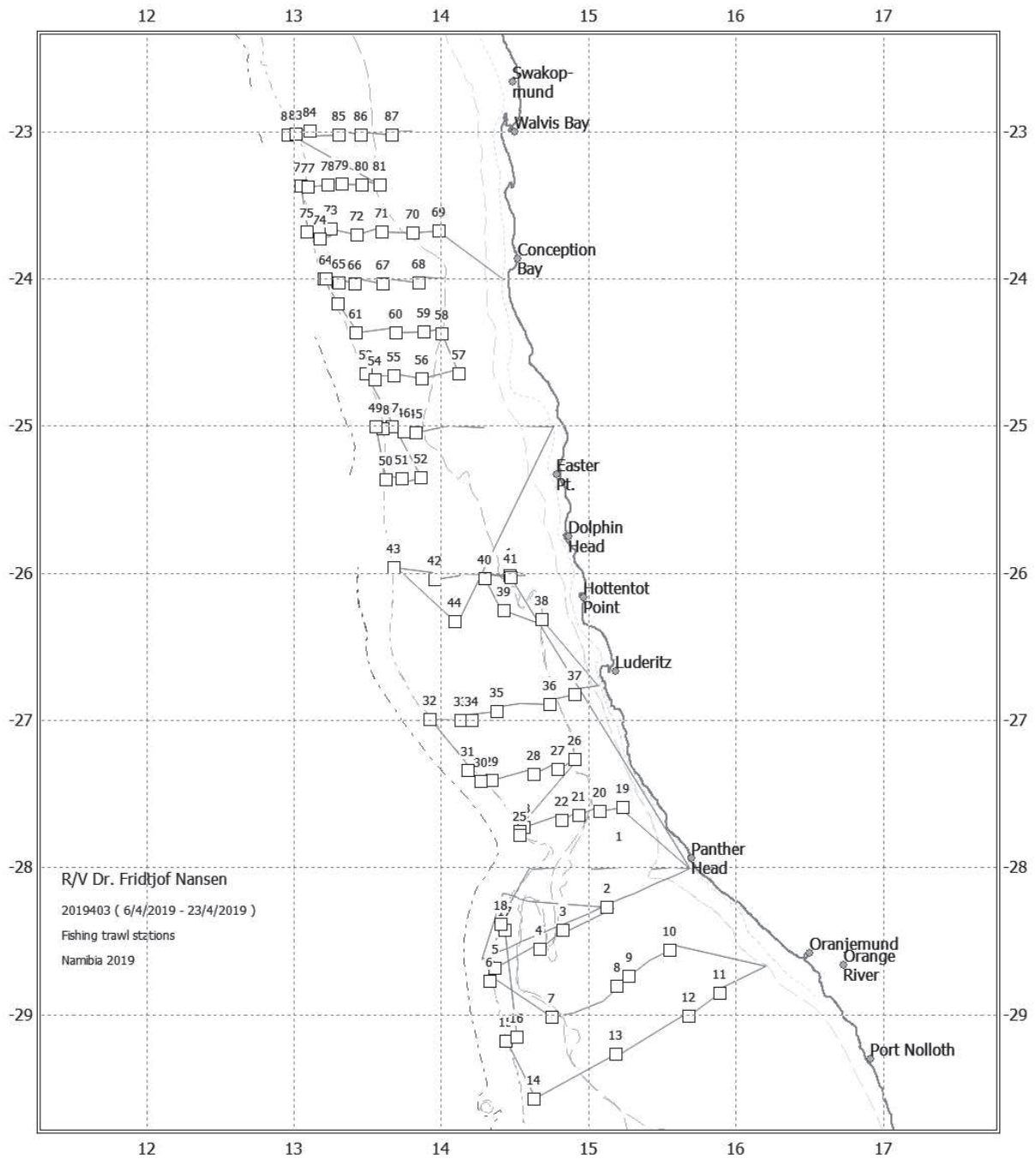


Figure 3. Cruise track and trawl stations

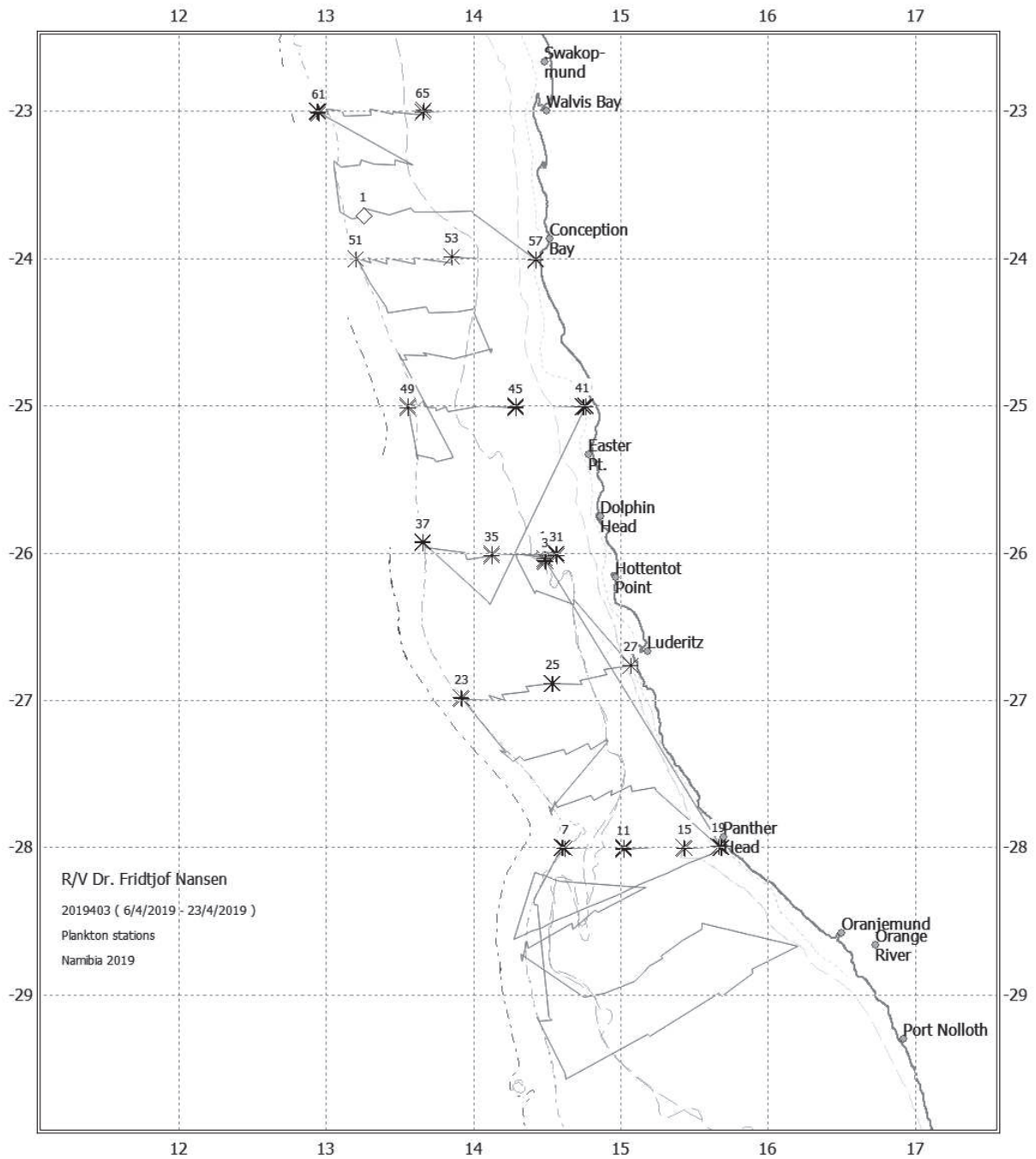


Figure 4. Cruise track and plankton stations

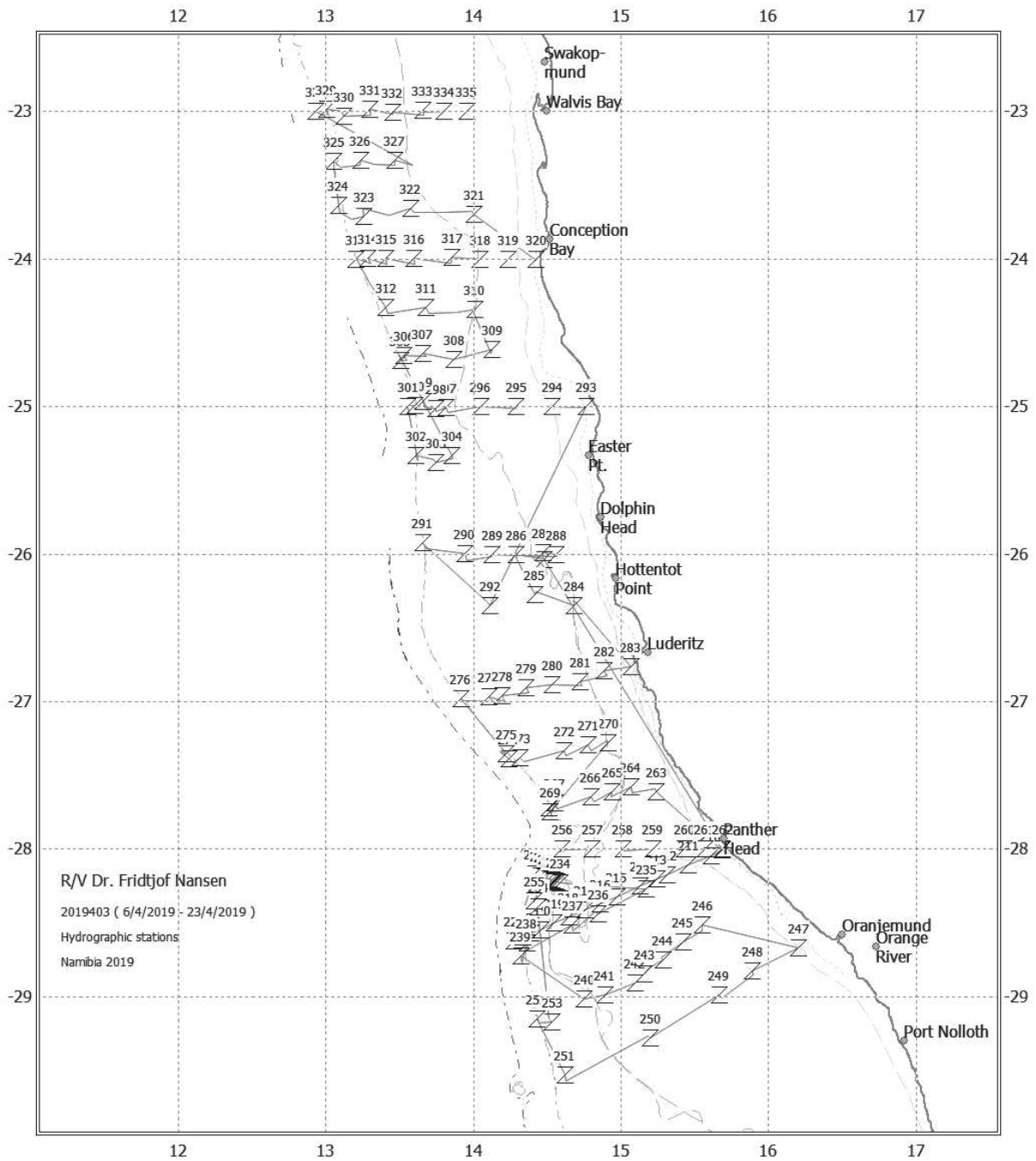


Figure 5. Cruise track and CTD stations

## CHAPTER 2. METHODS

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### 2.1 Underway hydrographic sampling

#### 2.1.1 Meteorological data recording

Meteorological data were logged continuously from the AANDERAA Smartguard meteorological station and included wind direction and speed, air pressure, relative humidity, air temperature and solar radiation. All data were logged to the Nansis tracklog system averaged every 60 sec.

#### 2.1.2 Thermosalinograph

A SBE 21 SeaCAT Thermosalinograph ran continuously during the survey, obtaining samples at 4 meters depth to measure salinity and temperature every 10 seconds. A Sea-Bird WETStar Fluorometer was also attached in-line to measure sub-surface fluorescence levels. There is a secondary temperature sensor close to the intake was used to report surface temperature.

Visual inspection of the salinity record showed periods with large ( $\pm 0.1\text{‰}$ ) high frequency variations. These high frequency variations were probably caused by variable flow rates through the sensor. A few sudden jumps in salinity were also seen in the record, the largest was  $0.17\text{‰}$ . Comparison with salinity measured by the CTD showed that the thermosalinograph salinity was typically  $0.10\text{--}0.20\text{‰}$  low, and variable. The surface salinity in the survey area is typically between  $34.9\text{‰}$  and  $35.1\text{‰}$ , thus the signal to noise ratio was considered too small for the salinity measurements from the thermosalinograph to be reliable.

High frequency variations were also seen in the temperature records, but the amplitude was only of a few hundredths of a degree and as the surface temperature varied between  $12^{\circ}\text{C}$  and  $19^{\circ}\text{C}$ , thus the signal to noise ratio was good. To remove the high frequency variations, the temperature data were filtered with a 31-point median filter (5 minutes long).

#### 2.1.3 Current speed and direction measurements (ADCP)

The ship is equipped with two vessel-mounted Acoustic Doppler Current Profilers (VMADCP) from Teledyne RD Instruments mounted in the drop-keel and the frequency of the VMADCPs are 75 and 150 kHz. The data were collected by VmDas (Teledyne RDI) and processed on board using CODAS software from University of Hawaii (<http://currents.soest.hawaii.edu>). Data will be taken to IMR for horizontal distribution descriptions of ocean current velocity.

It was intended to run the 75 kHz ADCP in narrowband mode with 16 m vertical bins to a maximum 800 m depth and the 150 kHz ADCP in broadband mode with 4 m vertical bins to a maximum 250 m depth. The 75 kHz ADCP failed completely 3 days into the cruise, and we collected only about 36 hours of good data. The 150 kHz ADCP was run according to plan the first three days of the cruise, but for the remainder of the cruise it was run in narrowband

mode with 8 m vertical bins to a maximum 500 m depth. The heading data to convert the current recorded in the ship-referenced coordinates to the absolute zonal and meridional components were obtained from the vessel's differential GPS system, Seapath.

Most of the cruise was conducted in waters shallower than the maximum depth observable with the 150 kHz ADCP. Thus, the failure of the 75 kHz ADCP did not impact the ADCP data seriously. It was only at the deepest offshore end of the transects that we did not have coverage down to the bottom and the vertical resolution close to the surface was somewhat reduced.

#### 2.1.4 Bottom mapping echo sounder

The EM 710 and EM 302 multibeam echo sounders are both high to very high-resolution seabed mapping systems. The EM 302 is hull-mounted whereas the EM 710 is mounted on the drop keel. The operational depths of the EM 710 are 3 to 2 000 m and of the EM 302 are 10 to 7 000 m. Across track coverage (swath width) is up to 5.5 times water depth and may be limited by the operator either in angle or in swath width without reducing the number of beams. The operating frequencies are between 70 to 100 kHz. There are 128 beams with dynamic focusing employed in the near field. The transmitting fan is divided into three sectors to maximize range capability and to suppress interference from multiples of strong bottom echoes. The sectors are transmitted sequentially within each ping and use distinct frequencies or waveforms. The along-track beam width is 1 degree. Ping rate is set according to depth. The receiving beam width is 2 degrees. Sound profiles were set manually in the system according to the area of operation. The EM 710 was not operational for most of the survey. Data from the EM 302 was logged to the on-board Olex plotting system and to raw data files.

During the survey, swath coverage and depth range settings were adjusted regularly to optimize the mapping. The measured sound speed profile was also input in the system when CTD measurements were carried out. Tide correction was not done.

The recorded data were viewed on Olex, the onboard navigation planning system.

## 2.2 Fixed station hydrographic sampling

A series of biological and oceanographic transects were sampled along every 3<sup>rd</sup> trawl transect on each degree of latitude, noting that the trawl transects in the southern part of the area were not east-west (they were perpendicular to the coast) and so the 28° transect was not along a trawl transect. These stations were referred to as "super-stations". The standard Nansen sampling protocol is for super-stations to be at the 30 m, 100 m, and 500 m depths. In Namibia the continental shelf is particularly wide such that the 30 m and 100 m isobaths are often within a few NMs of each other, while the 500 m isobath is 50 NM or more away. Hence samples were collected at water depths of 30 m and 500 m, with an additional station approximately mid-way between these two stations, usually between the 100 m and 200 m isobaths. In addition, the distance between the 100 m and 200 m station was more than

50 NM on the 28° line and so an extra station was added at around the 250 m isobath. The 29° line was not sampled as much of this line fell within South African waters.

One test station was sampled at the beginning of the cruise. Four transects with three sampling stations on each, plus one transect with four stations, were completed on the cruise, thus 19 “super-stations” were sampled during the cruise. An overview of the number of samples collected is given in Annex IX

The samples collected on these transects are shown in Figure 6.

In addition to the transects stations where water samples were taken, additional CTD stations without water samples were sampled between the “super-stations”. Most of these were at trawl stations, but some were added to obtain reasonable horizontal resolution of the hydrographic parameters measured by the CTD. A summary of all the CTD stations sampled is shown in Annex II.

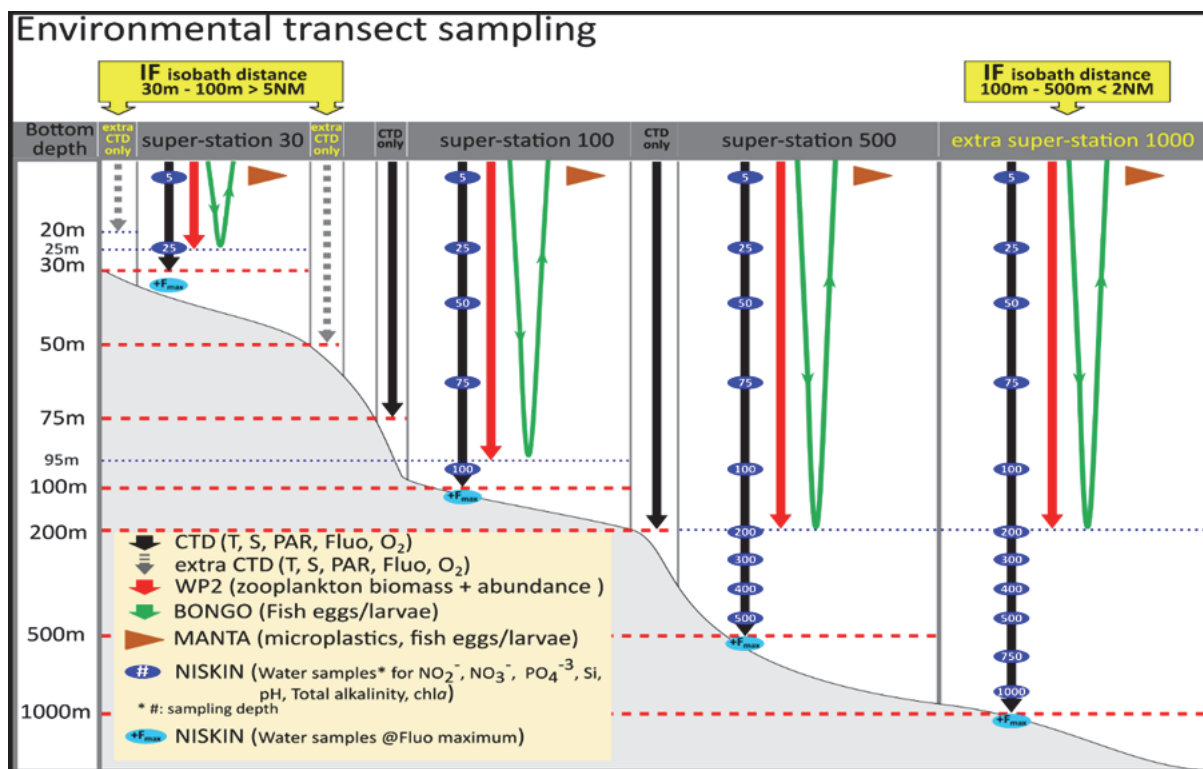


Figure 6. Sampling diagram showing the depth and the equipment used at the super stations transects, from the inshore (left side) towards the deep 500 m stations (right side).

At each super-station deployment, the 12-bottle rosette collected water at predefined depths during the up cast to obtain vertical profiles of pH, total alkalinity, nutrients, and chlorophyll-  $\alpha$ . The CTD stopped at each predefined depth for at least 20 seconds to allow the bottles to rinse with the surrounding water as it reached equilibrium to best represent the water composition at that depth. In addition, further CTD stations were sampled at nearly all bottom trawl stations.

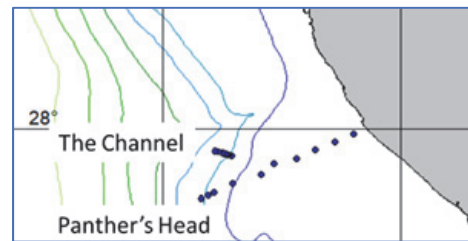
A Sea-Bird 911plus CTD containing two SBE 3plus temperature sensors, two SBE 4C conductivity sensors, a Digiquarts pressure sensor, a SBE 43 dissolved oxygen sensor, a

WET Labs ECO-AFL fluorometer and a Satlantic Photosynthetically Active Radiation LOG ICSW sensor were mounted to a 12-bottle rosette for every CTD deployment. All sensor logging and profiling was performed using Seabird's Seasave software.

Water was collected from low-gradient depths of 300 m and below to perform onboard validations of the conductivity sensor derived salinity values and the dissolved oxygen sensor values. The dissolved oxygen sensor measurements were validated using a Metrohm 916 Ti-Touch potentiometric titrator performing Winkler (Grasshoff *et al.*, 1983) and Karl Fischer titrations. The thermistor circuitry of Guildline Portasal Salinometer 8410A was not working (one of two thermistors were out of service), thus no water samples were analysed to validate the sensor salinity values.

Results of sensor calibrations of the hydrography sensors for water chemistry quality assurance are shown in Annex III.

Two high resolution hydrographic transects, will be used in a study aimed at identifying oceanographic links of Orange Bank with adjacent regions to the north and south and specifically to observe an anomaly noted in this area previously of a plume of cold waters that were being funnelled in against the coast from upwelling and the Benguela Current. Firstly, the Panther Head transect starting at 28°S and crossing the shelf in a west-south-westerly direction to the 650 m isobath at shelf slope was sampled. A second short high resolution transect was sampled at the shelf just north of the Panther Head transect, known as the Channel. These data will be analysed at a later date and be used as input to the oceanographic model of Orange Bank.



### 2.2.1 Ocean acidification parameters (pH and total alkalinity)

Water samples for pH and total alkalinity analyses were collected in the same 250 ml borosilicate glass bottle using silicone tubing. Since no preservative was used, it was necessary to keep the samples in the dark while waiting to stabilise at 25°C (with a water bath) for analysis. pH was determined using an Agilent Cary 8454 UV-Vis Diode Array spectrophotometer and a 2-mM m-cresol purple indicator dye solution. The indicator dye was measured every 24 hours to determine the correction factor appropriate for sample measurements (Clayton and Byrne, 1993; Chierici *et al.*, 1999). All pH spectrophotometric measurements were performed in duplicates on board. Total alkalinity was measured via an open-cell potentiometric titration using a 0.05M HCl solution with a sodium chloride background as the titrant (Dickson *et al.*, 2007). A Metrohm 888 Titrando equipped with an Aquatrode plus pH electrode with Pt1000 temperature sensor was used in combination with the Metrohm tiamo software to measure the change in pH and perform the total alkalinity titrations. Certified Reference Material of known total alkalinity from Scripps Institution of Oceanography was measured every 24 hours to determine the correction factor appropriate for sample measurements. All total alkalinity titrations were performed in triplicates on board.



### 2.2.2 Nutrient samples

Seawater samples for nutrient analyses (nitrite, nitrate, silicate and phosphate) were collected at standard depths (two samples at each depth) at each super-station in 20 ml polyethylene vials. Samples were preserved with 0.2 ml chloroform and kept refrigerated and dark (Hagebø and Rey, 1984) until being sent to the Institute of Marine Research for analysis. Analyses will be performed using a Skalar San++ Continuous Flow Analyser while following standard procedures (Grasshoff *et al.*, 1999). Storage and transport may introduce loss of accuracy of the results.

Once analyses are complete, phosphate and silicate concentrations combined with the on-board measurements of pH and total alkalinity will be used to calculate the area's inorganic carbon components along with the aragonite saturation state to update the ocean acidification status of the region.

### 2.2.3 Phytoplankton sampling

Water for chlorophyll- $\alpha$  samples were collected in 1 000 ml polyethylene bottles and subsequently divided into two 260 ml bottles for duplicate analyses. These water samples were collected from 200 m to the surface and filtered using a 0.7 $\mu$ m glass-fibre filter (Munktell glass-fibre filters Grade: MGF, vacuum 200 mm Hg). The filters were stored in a freezer until they were transferred to centrifuge tubes with 10 ml of 90% acetone for 15 hours of extraction at 4°C. Samples were then centrifuged and transferred to cuvettes for measurement on a Turner Designs 10AU Fluorometer, according to Welshmeyer (1994) and Jeffrey and Humphrey (1975). First measured without acid for chlorophyll- $\alpha$  determination and then a second time with two drops of 5% HCl for phaeopigment determination. The 10AU is calibrated approximately every three months with standards created from a chlorophyll- $\alpha$  solid (from spinach).

Qualitative phytoplankton samples were not collected during the survey.

### 2.2.4 Plankton sampling

As described above, the environmental sampling grid consisted of 19 super-stations. Due to adverse weather conditions the deployment of all sampling devices was not possible at every station. The total number of stations sampled with each sampling device are summarized in Table 4.

Table 4. Overview of the plankton stations sampled

<b>Sampling device</b>	<b>Number of stations sampled</b>	<b>Stations not sampled</b>
Manta trawl (335 $\mu$ m)	14	5
Multinet midi (405 $\mu$ m)	18	1

Zooplankton samples were collected with vertical tows of a WP2 net (180  $\mu$ m). The net was towed within 5-10 m of the bottom to the surface, or from 200 m depth to the surface at deep stations. Each sample was halved with a Motoda splitter. One half was size fractionated



through 2 000, 1 000 and 180 µm mesh sizes, and dried in the oven (60°C) in pre-weighed aluminium trays. The second half was preserved in 4% borax buffered formaldehyde solution.

Samples from the Manta trawl were sorted on board for microplastics and ichthyoplankton and sent to Bergen (IMR) and Cape Town (UWC), respectively for further analysis.

Ichthyoplankton was collected with double oblique tows of a Multinet midi net (405 µm). Samples were collected at most of the super-stations using double oblique tows within 5-10 m from the bottom to the surface, or a maximum depth of 200 m to the surface at deep stations. The double oblique hauls were performed differently on this leg opposed to the previous cruise due to different routines between the operators. The details can be found in the Multinet metafiles or scanned sampling sheets.

As stated in the sailing orders, once the Multinet was on board the sample was divided into two parts by use of a Motoda plankton splitter. Each part was treated as follows:

- a) One half of the sample was sieved on a 180 µm sieve and transferred to a 100 ml bottle (or bigger) and preserved immediately in 4% borax buffered formaldehyde (especially made for ichthyoplankton). These samples were labelled as “Not sorted” with a few exceptions.
- b) The other half was examined under the microscope and ichthyoplankton was sorted. Sorting was made at all of the Multinet stations. The sorted larvae were photographed and preserved in 96% ethanol in small labelled scintillation vials indicating clearly the part of the sample used (e.g. 50%), the preservative, station etc. When sorting was finished, the bulk sample was preserved in 4% borax buffered formaldehyde (especially made for ichthyoplankton) in bottles labelled as “Sorted”.

A few exceptions to this procedure were made since samples and fish larvae were relatively few. Samples containing fish larvae, juvenile fish or myctophids visible to the naked eye were picked from the sample before splitting and transferred to vials. These are therefore from the whole sample.

An overview of the sampling procedures followed in the plankton lab is given in Annex IV.

### **2.3 Top predator observations**

Observations were carried out when weather permitted from the observation platform of the vessel, situated 21.5 m above sea level, during daylight hours between 07h30 to 17h30 (with breaks). Marine mammal observations were the main objective with seabird observations of secondary importance.

Primary observations were carried out in “passing mode”, meaning that the ship did not deviate from its track while sailing between oceanographic and fisheries sampling stations. The search effort changed from primary to secondary during such stations. Both marine mammal and seabird observations covered a forward angle of 180° from port to starboard.

The findings from this cruise will contribute to and improve the understanding of the recovery and distribution patterns of these threatened species in the region. These data sets will be submitted to the International Whaling Commission and Birdlife International, contributing to the decision making and conservation strategies with respect to these two groups of marine fauna.

### 2.3.1 Cetaceans

Scanning for animals to an approximate distance of 2.5 km from the vessel was performed by using either the naked eye or handheld Pentax (7 x 35, 9.3°) and Lynx reticular binoculars to locate and identify different species as well as to determine group sizes. In cases where a slightly spread out group of cetaceans was observed, the observation time, ship's position and the distance between the ship and first animal were recorded as if for the entire group. Sighting positions were obtained from a Garmin etrex 30 GPS. Species identification was carried out through the careful observation and photography (Canon EOS 80D camera with 100-400 mm telephoto lens) of specific features such as shape and height of the blow, body shape and size, colour patterns and animal behaviour. Two cetacean field and identification guides were consulted for more challenging identifications (Folkens, 2017 and Jefferson *et al.*, 2015).

All relevant sightings data were recorded on the standard International Whaling Commission's Cetacean Data Record Sighting form. Additional data such as ship's time (GMT+2), position of the ship, orientation (bearing) and distance of the animal(s) relative to the ship were also noted. Since adverse weather conditions negatively affects sight and visibility, parameters such as cloud cover, wind speed and direction, swell size, rainfall, water and air temperature and sea state were recorded hourly. Primary observations only ceased during oceanographic and fisheries sampling stations, dense fog, rain or wind speeds in excess of 20 knots in strength.

### 2.3.2 Seabirds

Seabird observations were conducted in similar fashion during daylight hours but at 10-minute increments, meaning that a GPS-position was recorded every 10 minutes and all seabirds observed during that period recorded. Observation area covered the forward angle of 180° from the port to starboard side and within a 300 m distance from the vessel. Observations were not carried out during oceanographic and fisheries sampling stations or during unfavourable weather conditions. Birds were recorded as in-flight or sitting on the water at the time of the sighting. Sightings were only recorded while the vessel was in transit between research stations. Observations started at least 30 mins after a trawl had been completed to give the vessel time to move away from the birds that gathered for the trawl pickings. Birds following the vessel between stations were not recorded. Searches for seabirds were performed either by naked eye or with handheld Pentax (7 x 35, 9.3°) and Lynx reticular binoculars. A Garmin etrex 30 GPS was used to obtain accurate ships positions. Seabirds were identified using their body shape and size, colour patterns and characteristics of flight. A Nikon D7000 camera with 80-200 m telephoto lens were used to further assist

with confirmation of species identification. A seabird field guide (Ryan, 2017) was also used to assist with species identification of unknown seabird species.

## **2.4 Bottom trawl fish sampling**

### **2.4.1 Trawling strategy**

A stratified semi-random design was used with depth and area as stratification factors. Trawl stations were located along a systematic survey track with approximately parallel transect lines perpendicular to the coastline, from 100 m to 600 m depth, equally spaced approximately 20 nautical miles apart. Along each transect trawls were placed at approximately 15 NM intervals, ensuring that each 100 m depth zone contained at least one trawl (as recommended at BENEFIT/BCLME survey design workshops, Anon 2000 & Anon 2006). These trawl positions were originally (in the early 1990s) randomly placed along the transects within each depth zone, but in recent surveys the same positions have been used in all years, thus these “random” positions have become fixed positions.

Trawls where the bottom depth was less than 400 m were carried out during daylight hours (07h00 to 19h00), as during the night hake and many other organisms lift off the bottom, a behaviour known as diurnal vertical migration (DVM), and are therefore not available to the trawl gear. This behaviour is believed to be less marked in waters deeper than 400 m (Kainge *et al.*, 2015). As most trawl positions were less than 400 m depth (66%) this presented special challenges in designing the course track, especially given the limited time available. It was not possible to conduct the survey on a transect-by-transect basis, but a certain amount skipping stations and then back-tracking at a later time was required.

Some trawl positions have in previous surveys proven to be on grounds where gear damage, and even loss, has occurred; these were usually, but not always, the deep trawls on the shelf-break or the shallow inshore stations on anoxic muddy bottoms to the south of Walvis Bay (Paulus *et al.*, 2018; Paulus *et al.*, 2016). Trawls were not attempted at these positions, but occasionally, when time allowed, alternative positions a few miles away, but within the same depth strata, were sampled.

Some trawls were hauled early as the door spread was declining and the net opening increasing, clear indications that the meshes of the codend were clogged with either jellyfish or sediments and benthic sea urchins and shell-fish. Trawls that had less than 10 minutes bottom contact were not used for density estimation (see below).

Following the Namibian protocol (Paulus *et al.*, 2018), all trawls that lasted longer than 10 minutes on the bottom were considered valid for biomass estimation regardless of the efficiency of the trawl. Trawls that were unstable with poor bottom contact or distorted gear configuration were included, as were trawls that dragged up large amounts of mud and boulders. Also, trawls where the catching efficiency was compromised by large amounts of jellyfish or small fish (myctophids or gobies) clogging the meshes were also used.

A detailed description of instruments and fishing gear is given Annex V. The complete records of fishing stations and catches are shown in Annex X.

#### 2.4.2 Biological sampling

Biological sampling of fish was carried out from all bottom trawls.

All catches were sampled for composition by weight and numbers of each species caught. Species identification followed *FAO Species Identification Sheets for Fisheries Purposes*, and *Smith's Sea Fishes* (Smith *et al.*, 1988) in addition to several online databases especially the *Eschmeyer database* (Fricke *et al.*, 2019), *WoRMS database* (WoRMS Ed. Board, 2018) and *FishBase* (Froese and Pauly, 2018). Invertebrates were identified using the *Field Guide to Offshore Marine Invertebrates of South Africa* (Atkinson and Sink, 2018).

Biological data of both hake species was recorded from 20 specimens per species per trawl, selected randomly. Parameters recorded were length, weight, sex and gonad maturity stage, while otoliths were removed for later analysis (see Annex VII). Length (total length to the nearest cm) and weight (to the nearest 0.5 g) were recorded using the onboard electronic fish meters and scales. Length and weight were measured for up to 100 fish and were used to estimate the length-weight relationship and together with length frequency distributions, were applied in the biomass calculations.

Juvenile hakes (i.e. those measuring less than 15 cm) were frozen whole for subsequent vertebrate counts to differentiate between the two species. These data will also be used to compare with the vertebrae count of *M. polli* due to be collected during Leg 2.4 in northern Namibia and southern Angola.

Length frequencies and length-weight parameters were recorded for all other priority species, up to a maximum of 10 fish per degree latitude. The species sampled were:

- *Lophius vomerinus*
- *Genypterus capensis*
- *Helicolenus dactylopterus*
- *Chelidonichthys capensis*

Relatively few of the following priority species were caught and although sampled, the results are not presented in this report:

- *Beryx splendens*
- *Austroglossus microlepis*

In addition, samples for genetic analysis at IMR, including parasite biotags, were collected for NatMIRC, and gonad samples were taken for Lungelwa Nomxego at DAFF in Cape Town (Table 5).

Table 5. Main target species sampled and preserved for future genetic and gonadal studies

Species	Specific sampling
<i>M. paradoxus</i> and <i>M. capensis</i>	Genetics 5 small fish (<40 cm TL) and 5 large fish (>40 cm TL) per degree The distal 5 mm of the left pectoral fin was removed (fin-clipped) and preserved in 95% ethanol The remainder of the fish was frozen whole Gonads: The ovaries of 30 females per degree (with a maximum of 10 fish per trawl) were removed from fish >45 cm and stored in 4% formalin. Note that trawls often contained insufficient large fish for both genetic and gonad samples; the genetic sampling was prioritised
<i>L. vomerinus</i> and <i>G. capensis</i>	Genetics 10 fish per degree The distal 5 mm of the left pectoral fin was removed (fin-clipped) and preserved in 97% ethanol The remainder of the fish was frozen
<i>Trachurus capensis</i> and <i>Scomber colias</i> ( <i>S. japonicus</i> )	Genetics 10 fish per degree The distal 5 mm of the left pectoral fin was removed (fin-clipped) and preserved in 97% ethanol The remainder of the fish was frozen

Mesopelagic fishes, cephalopods and crustaceans caught as part of a trawl haul were identified to the lowest taxonomic level where possible. Ten individuals (if available) of each taxa present were rinsed with fresh water, dried using paper towel and stored in zip-lock bags at -20°C.

A flow diagram of the sampling procedures used in the fish lab is shown in Annex VIII.

A summary of the samples collected, including the purpose of collection and the receiving laboratories is shown in Annex IX.

#### 2.4.3 Demersal invertebrate sampling

Two stainless steel cylinders (approx. 2 litres in volume) were mounted on the footrope of the trawl to collect bottom sediment samples at every trawl station. A few stations were not sampled as the cylinders created an injury risk for the deck-crew in very rough weather. The samples were collected from the cylinder when the trawl was on deck and all macro-invertebrates removed and fixed in 97% ethanol for later analysis at UNAM. All invertebrates in the trawl, or the sampled part of the catch if large, were also identified, if possible, and

counted. All unidentified specimens were photographed and fixed in 97% ethanol, also for later analysis at UNAM.

#### 2.4.4 Swept-area biomass calculations

Stock biomasses were estimated by the swept-area method with catch per haul as the index of abundance (see Strømme, 1992).

The general formula to estimate biomass B, using this method is:

$$B = \frac{A}{a} \cdot \frac{\bar{X}}{q}$$

where A is the total area surveyed, a is the swept-area of the net per haul,  $\bar{X}$  is the average catch per haul (the index of abundance) and q (trawl catchability) is the proportion of fish in the path of the net that are actually caught. The density of the resource is estimated as biomass per unit area. In a stratified survey of k non-overlapping strata, if the mean catch per haul in stratum *i* and its variance are denoted by  $\bar{X}_i$  and  $s_i^2$  respectively, then an unbiased estimate of the population mean  $\bar{X}$  is the stratified mean  $\bar{X}_{st}$ , which is given by:

$$\bar{X}_{st} = \frac{1}{N} \sum_{i=1}^k N_i \bar{X}_i = \sum_{i=1}^k W_i \bar{X}_i$$

where  $W_i = \frac{N_i}{N} = \frac{A_i}{A}$  is the statistical weighting factor expressed as relative size of the *i*<sup>th</sup> stratum with  $A_i$  the area of the *i*<sup>th</sup> stratum and A is the total area surveyed. The variance of the stratified mean is given by

$$\text{var}(\bar{X}_{st}) = \sum_{i=1}^k W_i^2 \text{var} \bar{X}_i = \sum_{i=1}^k W_i^2 \frac{s_i^2}{n_i}$$

where  $n_i$  is number of hauls in the *i*<sup>th</sup> stratum and n is the total number of hauls in the survey.

For conversion of catch rates (kg/h) to fish densities (t/NM<sup>2</sup>), the effective fishing area was considered as the product of the wing spread and the haul length, or distance over the bottom, as measured by means of the SCANMAR® equipment based on GPS readings. The area swept for each haul was thus 18.5 m (traditionally applied wing spread for the “Nansen” bottom trawl) times the distance trawled, raised to NM<sup>2</sup>/hour. In most hauls the trawling time (with the gear at the bottom) was around 30 min, which with a towing speed of 3.0 knots and an average horizontal trawl opening of 18.5 m efficient net width gives an area swept by the trawl net of typically around 0.015 NM<sup>2</sup>. Diagrams of the bottom trawl used are shown in Annex V.

The catchability coefficient ( $q$ ), i.e. the fraction of the fish encountered by the 18.5 m horizontal opening of the trawl that was actually caught, was assumed equal to 1, which leads to an estimation of the biomass which allows for comparison with previous surveys. Catchability may vary depending on the type of gear used and the type of species (e.g. gears with bobbins are less efficient for species such as flat fishes and octopus, as compared to gears without bobbins and with footrope touching the bottom). For this reason, biomass estimates are to be considered indices of abundance and not absolute values.

Mean fish densities by species and strata were calculated by the traditional method used in previous surveys (Excel spreadsheets). The newly developed StoX software was not used as the area maps for Namibia in the format required by StoX were not available. The biomass estimates per strata were also calculated using the Namibian spreadsheets (which had originally been developed by the Nansen Programme); the same answers were obtained using both methods.

Table 6 shows the areas used in the swept-area method to estimate biomass for the different regions. Estimated total biomass by species/group was obtained by summing estimates for each depth stratum.

Table 6. Depth strata in NM<sup>2</sup> by latitude for southern Namibia (the area covered during Leg 2.2). Based on echosoundings from Nansen surveys 1996-2003. Depths from surface to bottom (Strømme *et al.*, 2010)

	100-200	200-300	300-400	400-500	500-600	Total all strata
23°-24°	2 006	1 074	670	238	153	4 141
24°-25°	1 343	822	753	238	149	3 305
25°-26°	1 580	1 102	529	227	166	3 604
26°-27°	894	986	1 408	744	140	4 172
27°-28°	1 269	527	858	480	205	3 339
28°-29°	4 207	391	153	123	164	5 038
29°-30°	1 042	533	327	276	162	2 340
Total area 23°-30°	12 341	5 435	4 698	2 326	1 139	25 939
All Namibia	20 091	9 842	8 848	3 543	2 200	44 524

NB. The total area for all of Namibia as reported by Strømme *et al.*, 2010, is 0.7% greater than that used in the Namibian hake surveys conducted by the R/V *Mirabilis*. It is not clear why this difference exists.

#### 2.4.5 Calculation of swept-area fish density estimates and conversion to biomass

For target species, where length-based estimates are more useful, a slightly different procedure was followed. The total biomass in the two methods are the same.

Swept-area fish density estimation by species and length are used to calculate density and biomass of target species from the bottom trawl catches (Jacobsen, 1997).

The calculations are carried out as follows.

$$p_{s,l} = \frac{f_{s,l}}{a_{s,l}}$$

Where:

$p_{s,l}$  = number of fish of length  $l$  per  $\text{NM}^2$  observed on trawl station  $s$

$f_{s,l}$  = estimated frequency of length  $l$

$a_{s,l}$  = swept-area:

$$a_{s,l} = \frac{d_s * EW_l}{1852}$$

Where:

$d_s$  = towed distance

$EW_l$  = length dependent effective fishing width.

The length dependent effective fishing width incorporates the  $q$  catchability coefficient described in the previous section and is kept constant at 18.5 m during the R/V *Dr Fridtjof Nansen* surveys. The parameter corresponds with the width of the Gisund super bottom trawl used during swept-area surveys.

Stratified abundance indices for each length group and strata can then be calculated from:

$$L_{p,l} = \frac{A_p}{S_p} * \sum P_{s,l}$$

Where:

$L_{p,l}$  is the index (total number of fish estimated) for stratum  $p$ , length group  $l$

$A_p$  is the area ( $\text{NM}^2$ ) of stratum  $p$

$S_p$  is the number of stations in stratum  $p$

The length frequencies used for estimating numbers at length, and illustrated in this report, were calculated from the length frequencies of individual trawls raised to the density of fish at that station (i.e. raised by the sample size compared to the total catch and the length of the trawl).

The abundance per length group is then converted to density by applying a calculated weight at length ratio using regression analyses on the measured ( $l$ ) and weighted ( $w$ ) fish in the trawl catches.

$$w = a * l^b$$



## 2.5 Jellyfish collection

Jellyfish were sampled from the trawl hauls. When the total catch was considered too big, the catch (fish, jellyfish, etc.) was sub-sampled. Thereafter, all jellyfish specimens caught, or representative random samples thereof, were identified to the lowest possible taxon.

*Chrysaora fulgida* and *C. hysocella* specimens were measured and weighed. Two small sections of the oral arm tissue were removed and preserved in both 96% ethanol (EtOH) and FDL Storage Buffer and stored at -20°C. This will be used to compare effectiveness of the storage methods of DNA material as well as for genetic analysis. After 24 hours, the 96% EtOH was drained from each sample and replaced with fresh 96% EtOH and the sample was stored at -20°C until analysis. The gonads were removed from each individual and stored in 7% seawater formalin. A few whole specimens were also stored in 8% sea water formalin.

*Pelagia noctiluca* specimens were measured and preserved whole in 96% EtOH and stored at -20°C. After 24 hours, the 96% EtOH was drained from each sample and replaced with fresh 96% EtOH and the sample was stored at -20°C until analysis. This species is relatively small and preserves well in EtOH which allows both morphometrics and genetic analysis back on land.

*Aequorea forskalea*, *Chirodropus gorilla* and *Discomedusa lobata* specimens were measured and preserved whole in 10% seawater formalin.

## 2.6 Acoustic sampling

### 2.6.1 Sonar data

No sonars were used during the survey.

### 2.6.2 Echo sounder

Acoustic data were recorded using a Simrad EK80 Scientific Split Beam Echo Sounder equipped with keel-mounted transducers at nominal operating frequencies of 18, 38, 70, 120, 200 and 333 kHz. A calibration conducted in Walvis Bay on 28 and 29 March 2019 gave spurious results and hence the echosounder gains were retained from the previous calibration, conducted in Bergen on the 23 January 2017. Annex V gives the details of the acoustic settings used during the survey.

### 2.6.3 Allocation of acoustic energy to species group

Acoustic data were logged and post-processed on board using the latest acoustic data post-processing software, the Large-Scale Survey System (LSSS) Version 2.5.0.

Scatters were displayed at 38 kHz. The mean 5 NM area backscattering coefficient  $s_A$  ( $m^2/NM^2$ ) was allocated to a predefined set of species groups on the basis of established echogram features and stored as mean values per 1 NM. The species groups and respective species are listed in Table 7.

The acoustic data were only used as supporting information to the trawl data; no acoustic biomass estimation was attempted. The echograms were scrutinised during the survey primarily to indicate if large amounts of hake occurred above the trawl headrope and therefore were potentially not available to the trawl sampling gear. Such trawls have been flagged in the data (see Annex X), but all valid trawls were used in calculating the biomasses.

The acoustic data are available for subsequent analysis although it must be noted that the scrutinisation carried out on board was done without any targeted midwater trawls to identify the targets; the identifications recorded in the LSSS system were the best assessments of the scrutinisers, based on many years of accumulated experience of similar surveys in Namibia, and guided by the catches of the bottom trawls in that area, but these identifications must be used with caution.

Table 7. Allocation of acoustic densities to species groups

<b>Group</b>	<b>Taxon</b>	<b>Key species</b>
Hake	Merlucciidae	<i>Merluccius capensis</i> <i>M. paradoxus</i>
Horse mackerel	Carangidae	<i>Trachurus capensis</i>
Mackerel	Scombridae	<i>Scomber colias</i> <i>S. japonicus</i>
Pelagic 1	Clupeiformes	<i>Etrumeus whiteheadii</i>
Pelagic 2	Gempylidae	<i>Thyrsites atun</i> <i>Lepidopus caudatus</i>
Other demersal and semi-pelagic species		<i>Chelidonichthys capensis</i> <i>C. queketti</i> <i>Brama brama</i> <i>Helicolenus dactylopterus</i> <i>Zeus capensis</i> <i>Emmelichthys nitidus nitidus</i> <i>and other species</i>
Mesopelagic species (most abundant species recorded)	Gobies Myctophidae	<i>Sufflogobius bibarbatus</i> <i>Symbolophorus boops</i> <i>Lampanyctodes hectoris</i> <i>Phosichthys argenteus</i> <i>Diaphus hudsonii</i>
Plankton	Various	
Jellyfish	Various	<i>Aequorea forskalae</i> <i>Pelagia notiluca</i>

## CHAPTER 3. RESULTS

### 3.1 Oceanography

#### 3.1.1 Wind speed and directions

Wind data presented in Figure 7 and Figure 8 show that the wind was predominantly from the south and generally strong, with two extended periods of winds averaging more than 20 knots.

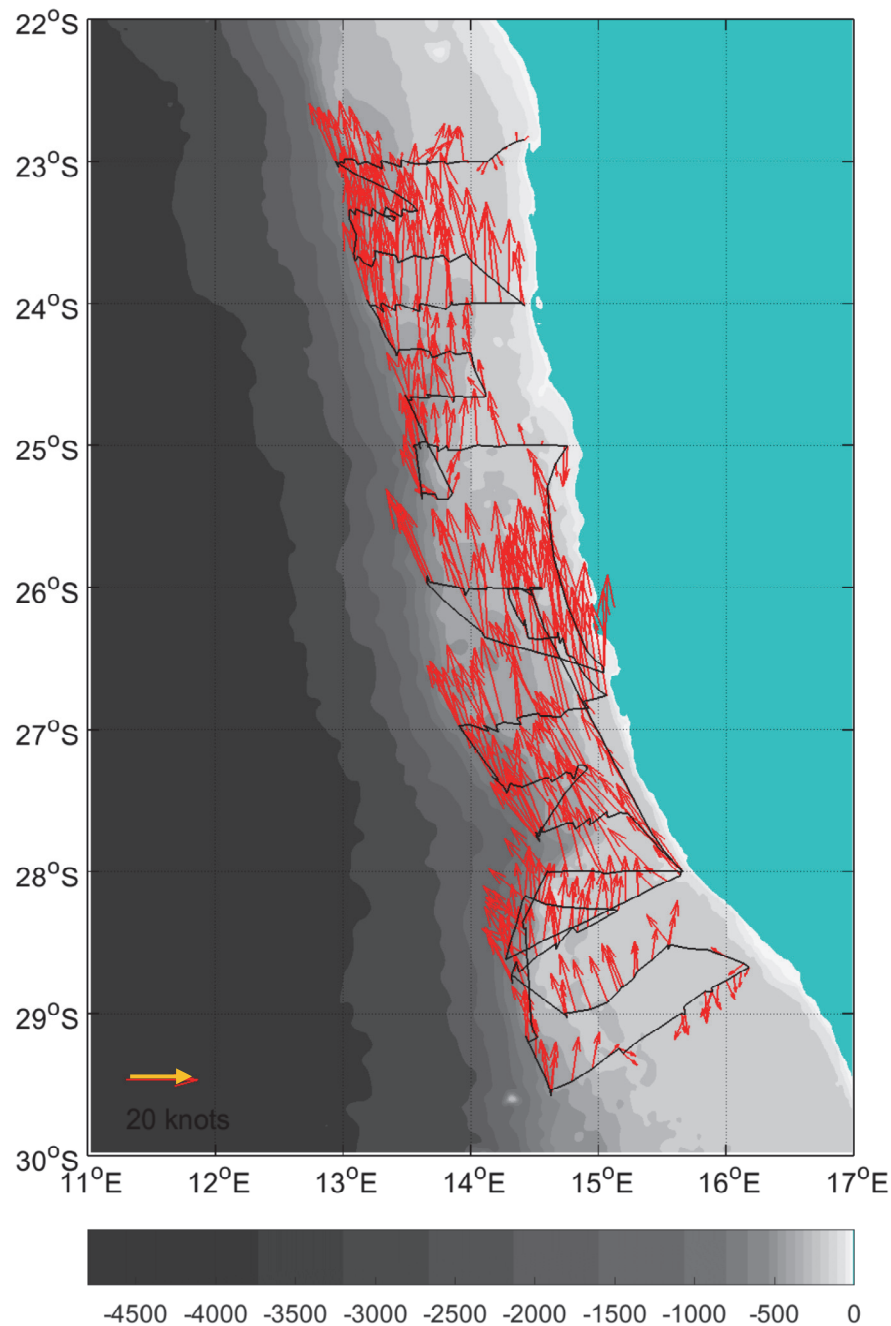


Figure 7. Wind vectors (10 minute averages, an arrow every 3 hours)

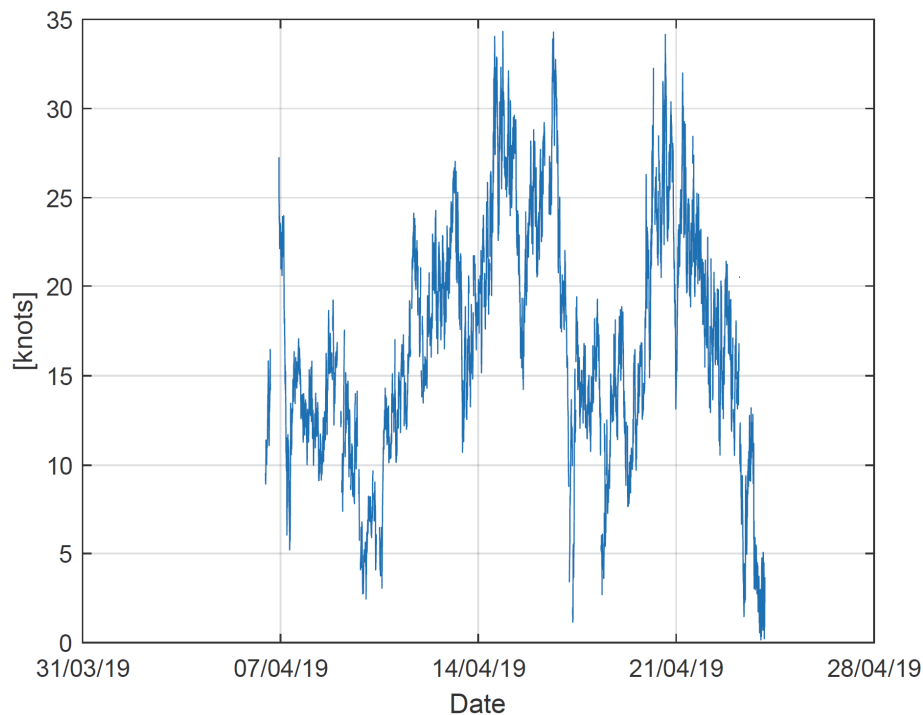


Figure 8. Wind speed (10 minute averages) as function of time

### 3.1.2 Horizontal distribution of oceanographic parameters

Six hydrographic super-transects were occupied where water was collected for chemical analyses in addition to 129 normal CTD sensor measurements. Summarised data of the oceanographic parameters are presented in Figures 9 to 15.

Lowest sea surface temperatures were recorded at the coast, increasing offshore. The highest surface temperatures were observed south of 26° S, with temperatures above 18 °C in the south-western corner of the survey area. In contrast, the highest bottom temperatures were inshore and to the north of the area.

A large area of hypoxic waters occurred north of 26°S from inshore to beyond the 300 m isobath. This water was essentially anoxic at depth.

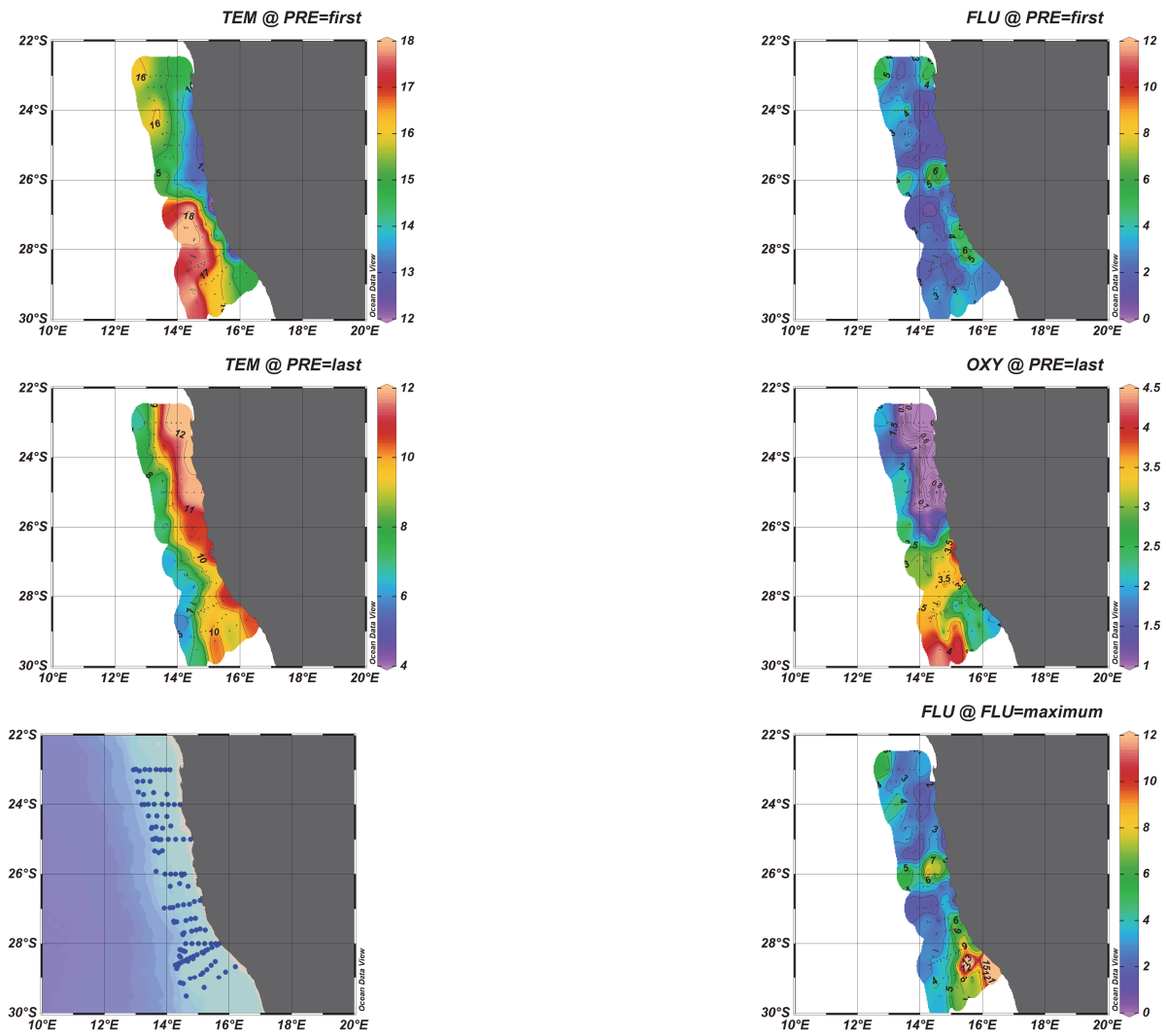


Figure 9. Horizontal distribution of oceanographic parameters. Temperature and fluorescence at shallowest CTD observation depth (~5 m, top panels). Temperature and dissolved oxygen station at bottom depths (mid panels). Fluorescence maximum in the water column (bottom right). Note different temperature scales for surface and bottom temperatures. Position of CTD stations shown at bottom left

### 3.1.3 Vertical distribution of oceanographic parameters

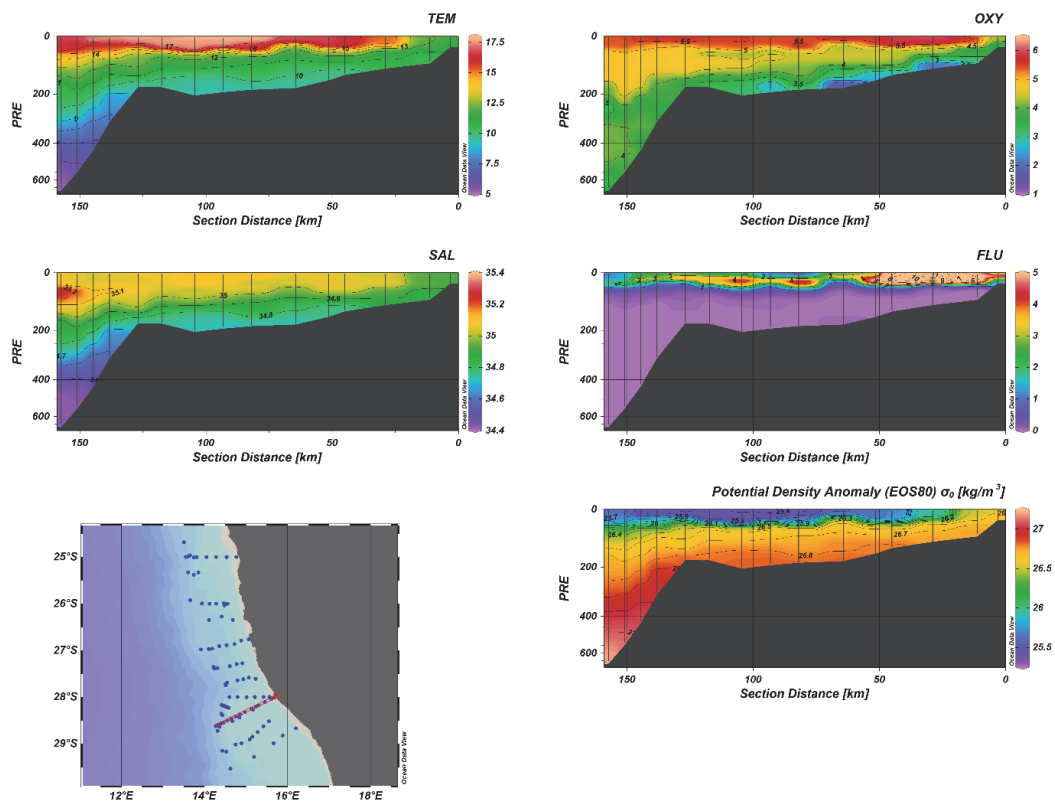


Figure 10. Temperature, salinity, dissolved oxygen, fluorescence and potential density of cross-shelf sections from the Panther Head transect at 28°S in west-southwesterly direction

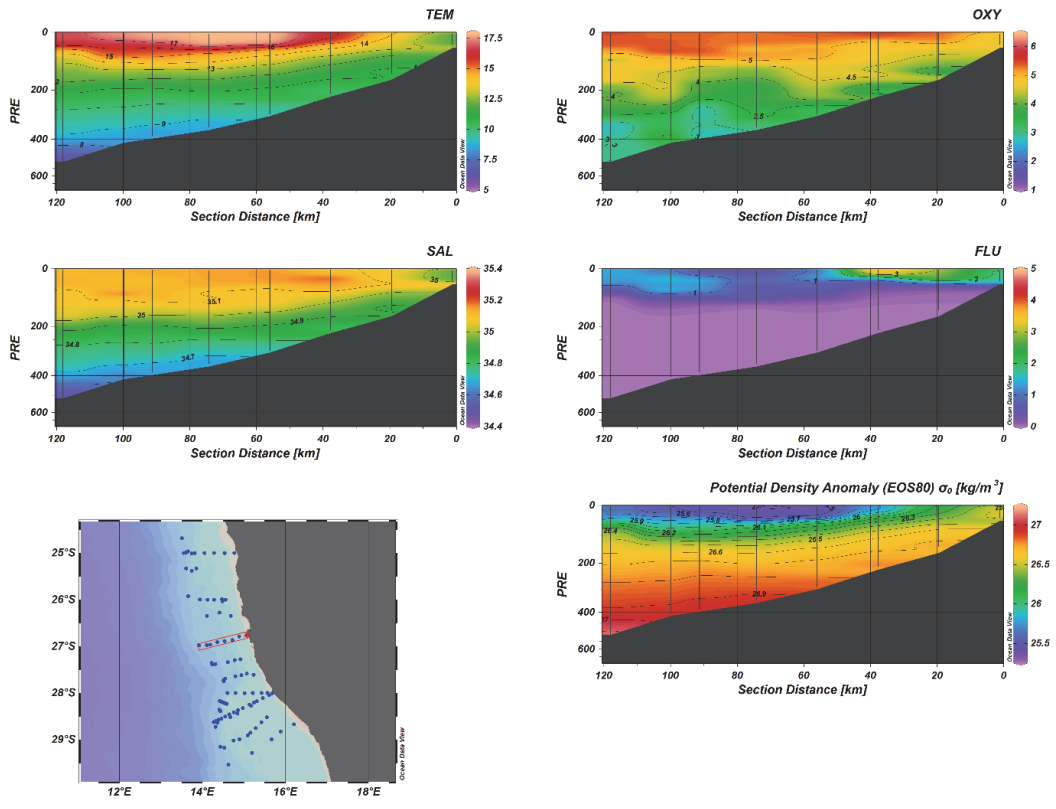


Figure 11. Temperature, salinity, dissolved oxygen, fluorescence and potential density of cross-shelf sections at 27°S in west southwesterly direction

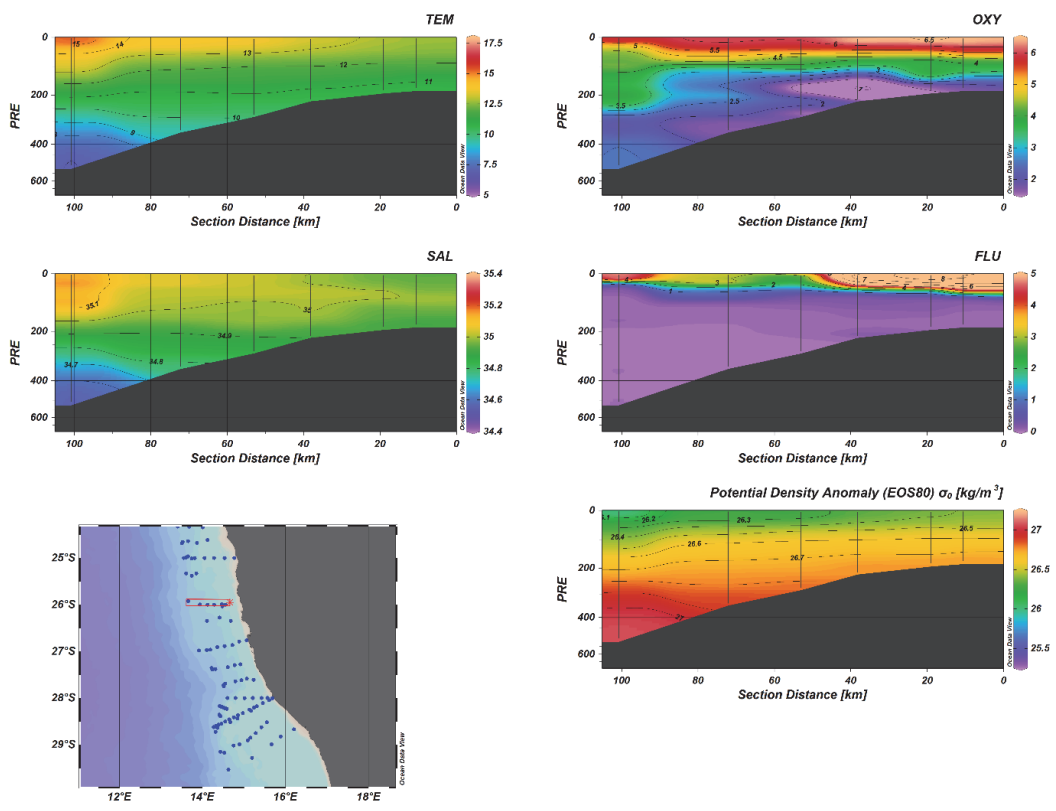


Figure 12. Temperature, salinity, dissolved oxygen, fluorescence and potential density of cross-shelf sections at 26°S in westerly direction, starting from the 200 m isobath

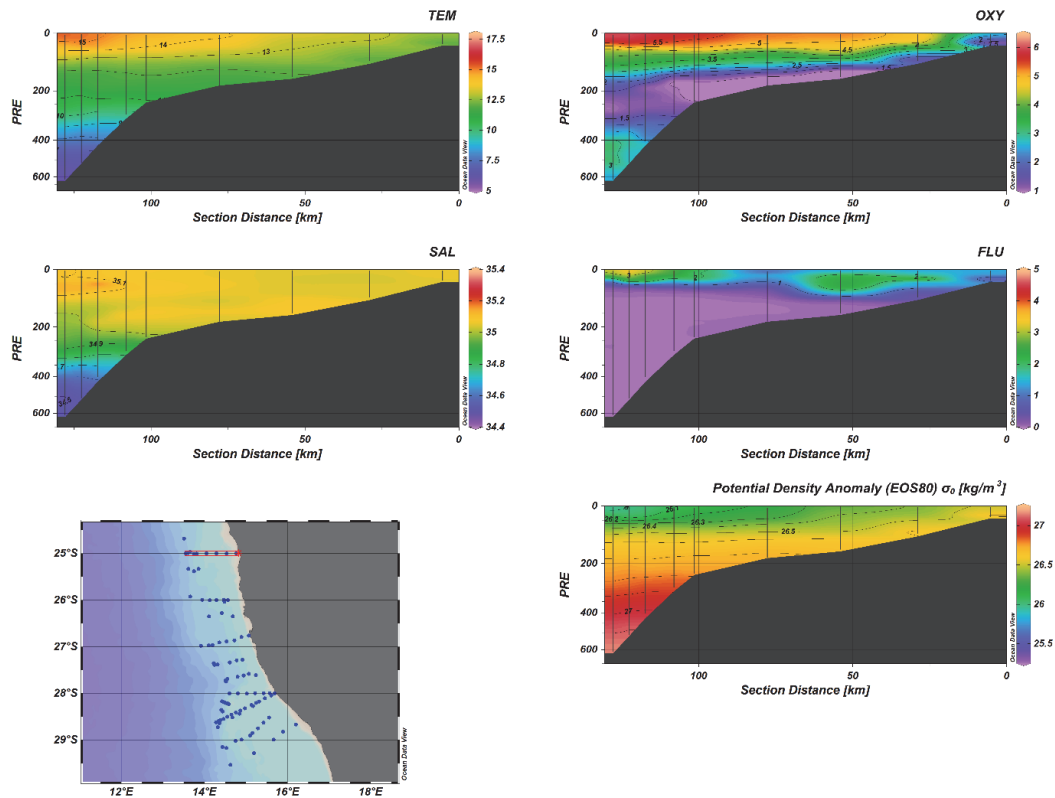


Figure 13. Temperature, salinity, dissolved oxygen, fluorescence and potential density of cross shelf sections at 25°S from the coast in westerly direction

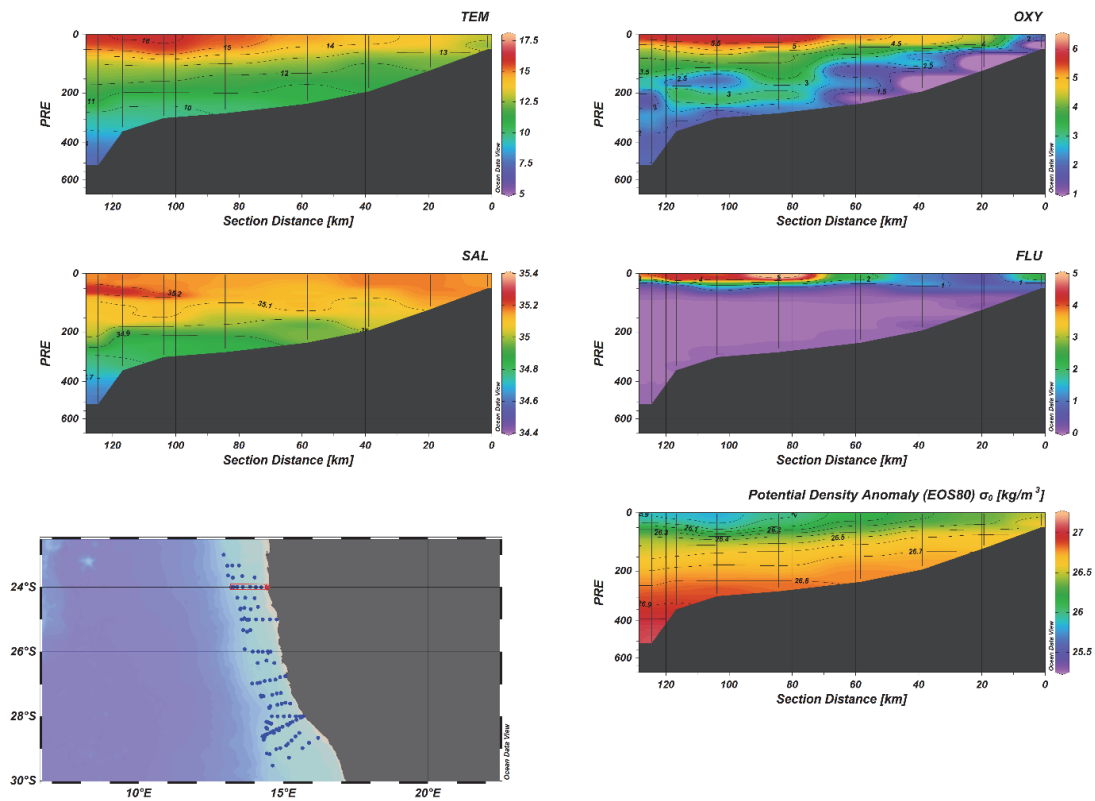


Figure 14. Temperature, salinity, dissolved oxygen, fluorescence and potential density of cross shelf sections at 24°S from the coast in westerly direction



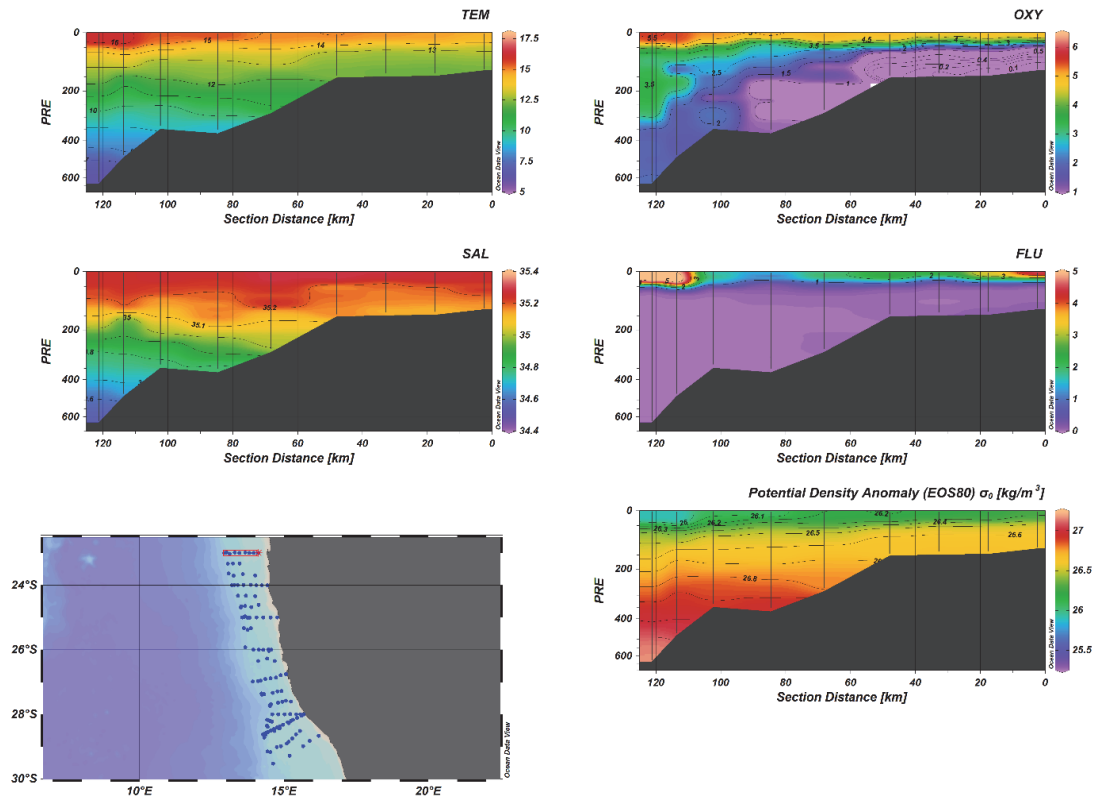


Figure 15. Temperature, salinity, dissolved oxygen, fluorescence and potential density of cross shelf sections at 23°S in westerly direction, starting from the 125 m isobaths

## 3.2 Plankton and microplastic sampling

### 3.2.1 Zooplankton

A total of 58 aluminium trays for zooplankton dry weight estimation were produced during the survey and transferred to IMR for zooplankton biomass estimation. A total of 19 WP2 samples (4% borax buffered formaldehyde) was transferred to NatMIRC in Namibia for future zooplankton taxonomic identification.

### 3.2.2 Ichthyoplankton

A total of 18 unsorted bulk Multinet samples preserved in ethanol were transferred to NatMIRC for future ichthyoplankton sorting and identification.

A total of 19 jars with bulk plankton and 10 scintillations vials with fish larvae and eggs (all preserved in 4% formaldehyde solution) were transferred to NatMIRC for rechecking ichthyoplankton presence and taxonomic identification of the ichthyoplankton, respectively.

Fish eggs and fish larvae abundances collected with a Manta trawl and Multinet sampler during the survey period, are given in Table 8. Some examples of the eggs and larvae, and juvenile fish and myctophids captured, are shown in Figures 16 to 18.

Table 8. Numbers of ichthyoplankton collected in the Manta trawl and Multinet sampler

Station	Manta		Multinet	
	Larvae	eggs	Larvae	eggs
256	0	0	0	0
258	0	14	0	0
260	2	0	0	0
262	0	0	0	0
276	31	0	3	0
280			0	0
283			0	0
288	2	0	1	0
289	5	0	3	0
291			0	0
293	0	0	0	0
295	0	0	0	0
301	29	0	0	0
313			0	0
317			1	0
320	0	0	0	0
328	34	0	0	0
333	1	0	1	0
336	41	0		

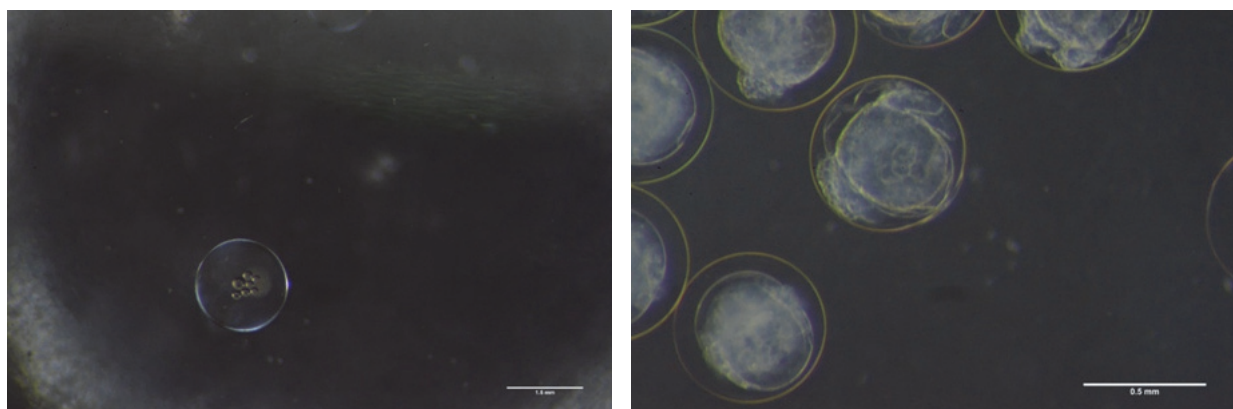


Figure 16. Examples of fish (left) and crustacean (right) eggs collected in the Manta net

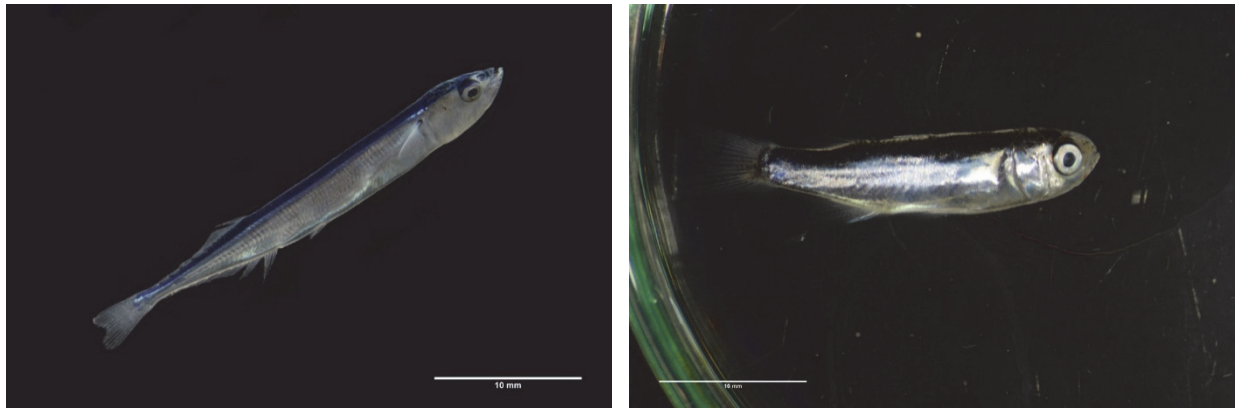


Figure 17. Examples of fish larvae collected in the Manta net

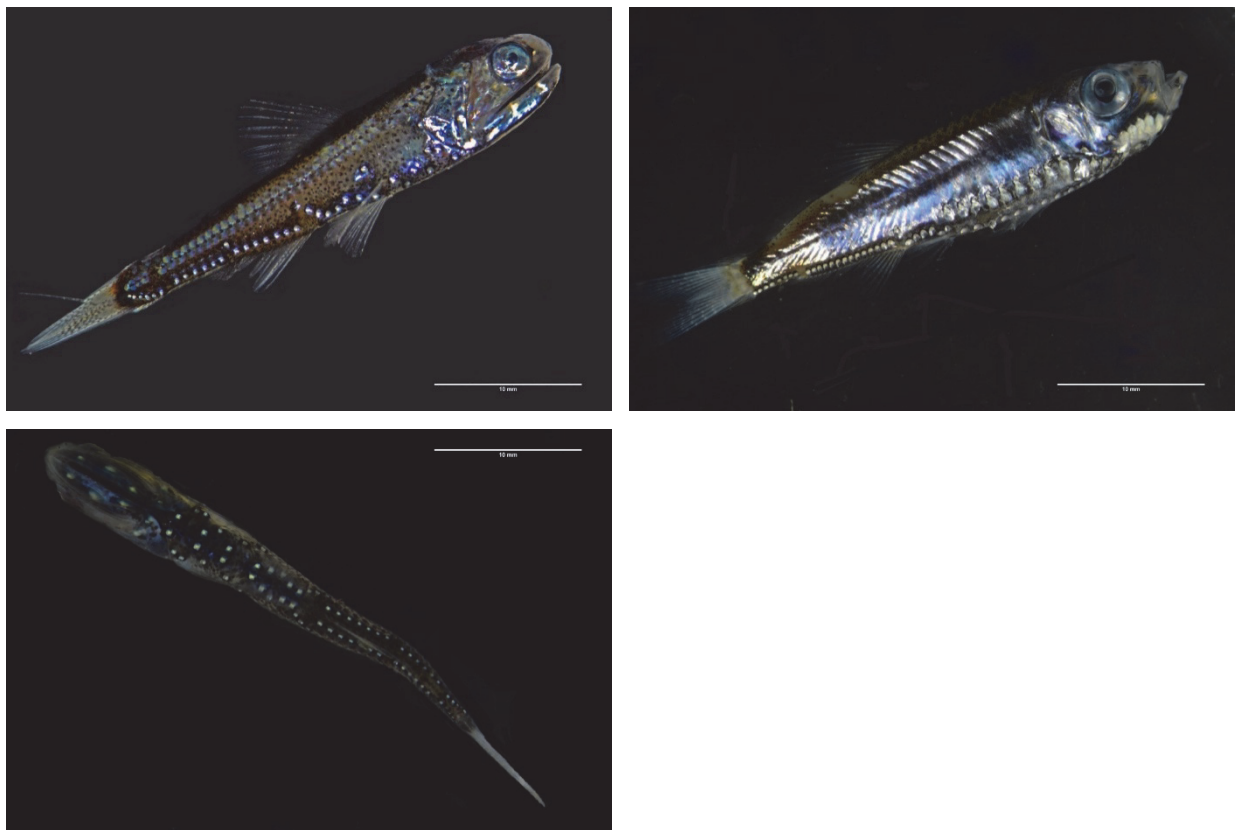


Figure 18. Examples of myctophids collected in the Manta net

### 3.2.3 Microplastics and Debris

From the Manta trawl hauls a total of 15 aluminium trays with microplastics were transferred to IMR for further processing. A total of 10 scintillation vials, and one 100 ml bottle with sorted larvae and eggs preserved in 96% ethanol and one 100 ml bottle with sorted larvae and eggs preserved in 4% formaldehyde were transferred to IMR for taxonomic identification and genetic analysis. A total of 15 bulk Manta trawl samples (14 x 100 ml and 1 x 500 ml bottles) preserved in 96% ethanol were transferred to the University of Western Cape, South Africa, for future analysis.

Little plastic debris was collected during the survey. The foreign objects that were found were photographed under the microscope and packed on aluminium trays. Most of these objects were paint from the ship, a few were identified as plastic, mostly micro-fibres also from the ship. Some examples are shown in Figure 19.

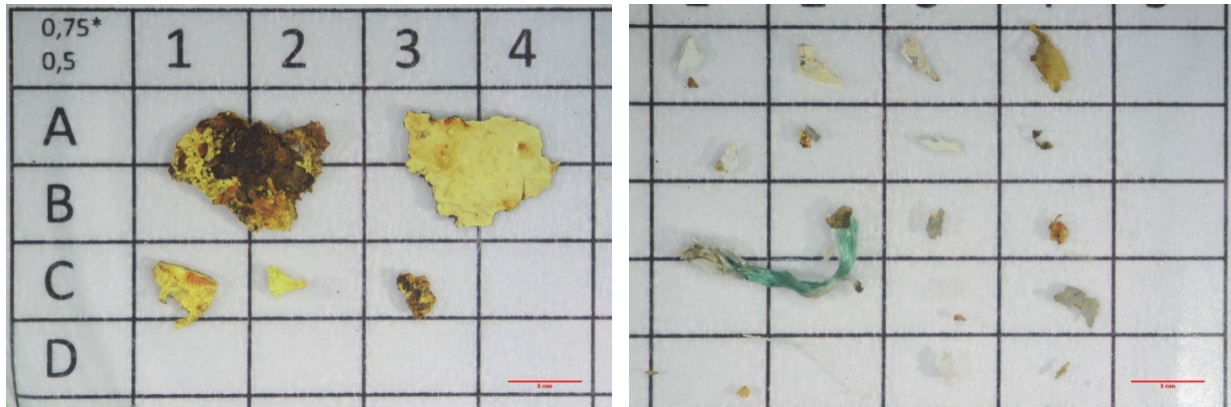


Figure 19. Examples of microplastics found in the Manta net

### 3.3 Top predator observations

#### 3.3.1 Cetaceans

The area of observation, both for primary (when the vessel was steaming) and secondary (when the vessel was fishing or on stationary) observations for both cetaceans and birds is displayed in Figure 20. Fifty-three hours and 25 minutes were spent on primary observations, averaging 2.80 hours per day over the duration of the cruise. Unfavourable weather conditions such as strong winds, mist and rain were all factors that contributed negatively to the low hours on watch (Annex XII). A total of 16 sightings of 273 individual whales and dolphins belonging to 8 different species were made (Figure 21). Figure 22 illustrates the position of the sightings. Dusky dolphins *Lagenorhynchus obscurus*, were seen on six occasions, sometimes in large groups. The rarely seen Southern Right Whale dolphin *Lissodelphis peronei*, was briefly seen on two occasions and a Cuvier's Beaked Whale *Ziphius cavirostris*, was seen on one occasion. Minke Whale *Balaenoptera acutorostrata*, Sperm Whale *Physeter macrocephalus*, and Sei Whale *Balaenoptera borealis* were also identified. Three species that were seen and could not be positively identified were recorded as “Like” Minke Whale *Balaenoptera acutorostrata*, Fin Whale *Balaenoptera physalus* and Bottlenose dolphin *Tursiops truncatus*.

The low number of sightings can largely be attributed to the majority of the region’s whales being in the southern oceans this time of the year during the whales’ annual summer feeding migration.



Figure 20. Top predator observations area during the survey

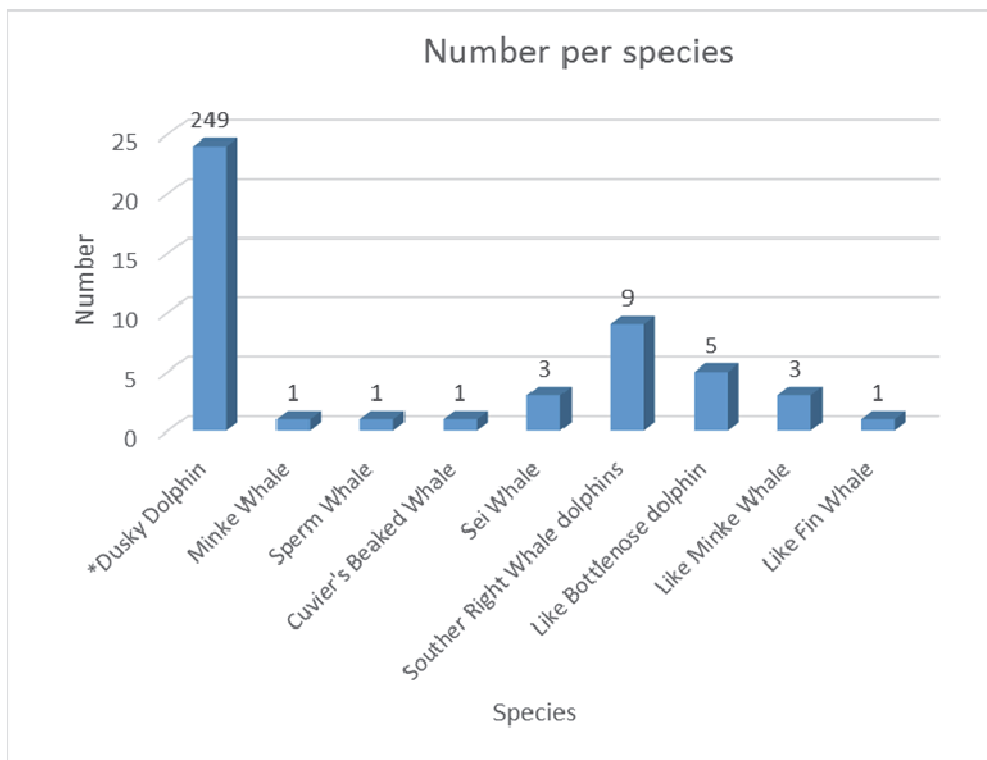


Figure 21. Number of cetaceans observed per species  
 (\*The count for Dusky dolphin has been deliberately reduced 249 to 24 in order to improve the appearance of the graph)

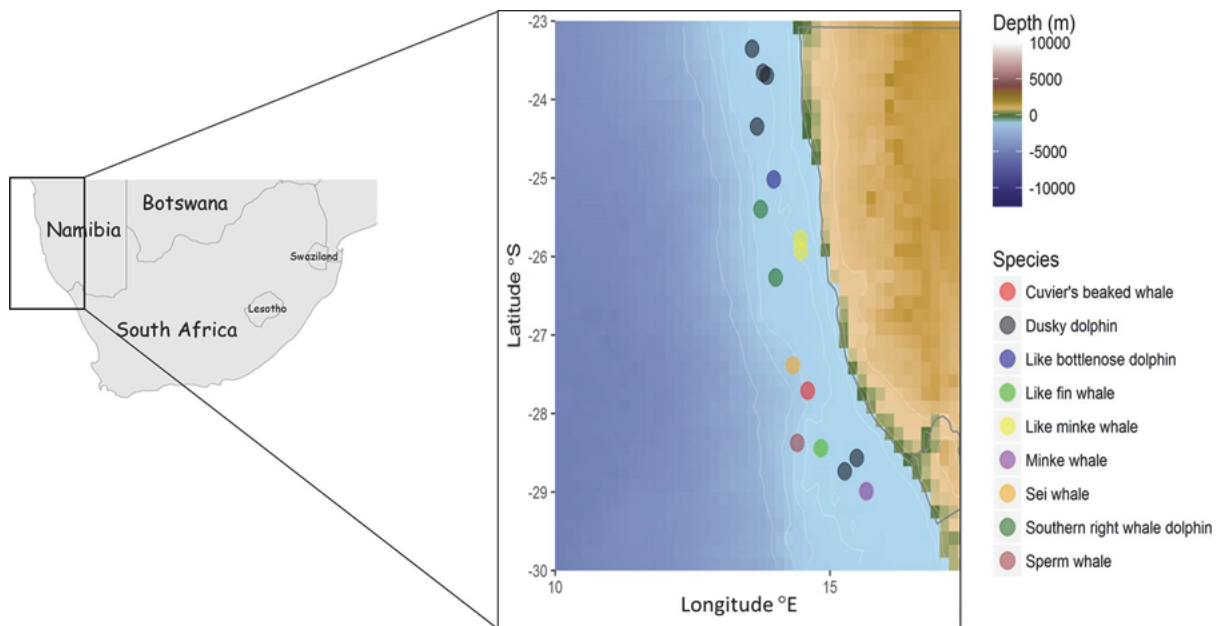


Figure 22. Distribution of marine mammals sighted along the southern Namibian coast

### 3.3.2 Seabirds

A total of 330 birds from 19 different seabird species were identified and counted in 99 (10 min) transects during the 16 hours 43 minutes of primary observations for seabirds carried out during this cruise (Table 9). White-chinned Petrels (*Procellaria aequinoctialis*) were the most abundant species encountered with 377 individuals recorded. Although not rare, several species that are not often seen in southern African waters were recorded; Salvin's Albatross (*Thalassarche salvini*) and Spectacled Petrel (*Procellaria conspicillata*) were seen each on two occasions while not on effort. Spectacled Petrel was seen on 11 April 2019 at 28°23'S and 014°26'E and 28°00'S and 014°36'E. On 12 April 2019 at 27°39'S and 14°48'E an Antarctic Tern (*Sterna vittata*) was seen around the vessel. On 17 April 2019 at 25°04'E and 14°01'E and on 18 April 2019 at 25°20'S and 13°37'E a Salvin's Albatross was seen.

Table 9. Seabird species and numbers observed during primary observations

<b>Species</b>	<b>No.</b>
African Penguin ( <i>Spheniscus demersus</i> )	2
Artic Tern ( <i>Sterna paradisaea</i> )	26
Common Tern ( <i>Sterna hirundo</i> )	23
Swift Tern ( <i>Thalasseus bergii</i> )	1
Unidentified terns	40
Kelp Gull ( <i>Larus dominicanus</i> )	14
Sabine's Gull ( <i>Xema sabini</i> )	15
Cape Gannet ( <i>Morus capensis</i> )	102
Sooty Shearwater ( <i>Ardenna grisea</i> )	53
Cory's Shearwater ( <i>Calonectris borealis</i> )	30
Great Shearwater ( <i>Ardenna gravis</i> )	23
Wilson's Storm-Petrel ( <i>Oceanites oceanicus</i> )	131
Subantarctic Skua ( <i>Stercorarius antarcticus</i> )	27
South Polar Skua ( <i>Stercorarius maccormicki</i> )	3
White-chinned Petrel ( <i>Procellaria aequinoctialis</i> )	377
Yellow-nosed Albatross ( <i>Thalassarche chlororhynchos</i> )	20
Black-browed Albatross ( <i>Thalassarche melanophris</i> )	125
Shy Albatross ( <i>Thalassarche cauta</i> )	87
Unidentified albatrosses	6
<b>Total</b>	<b>1 105</b>



### 3.4 Fish sampling

#### 3.4.1 Swept-area abundance and distribution

Figure 23 shows densities of Cape hake along the southern coast of Namibia. The mean density for all valid trawl stations was 12.75 tonnes/NM<sup>2</sup>.

Cape hake, *Merluccius capensis*, occurred almost entirely in depths less than 400 m with the highest densities between the 200 m and 300 m isobaths. The densest concentrations were found between Lüderitz and Walvis Bay.

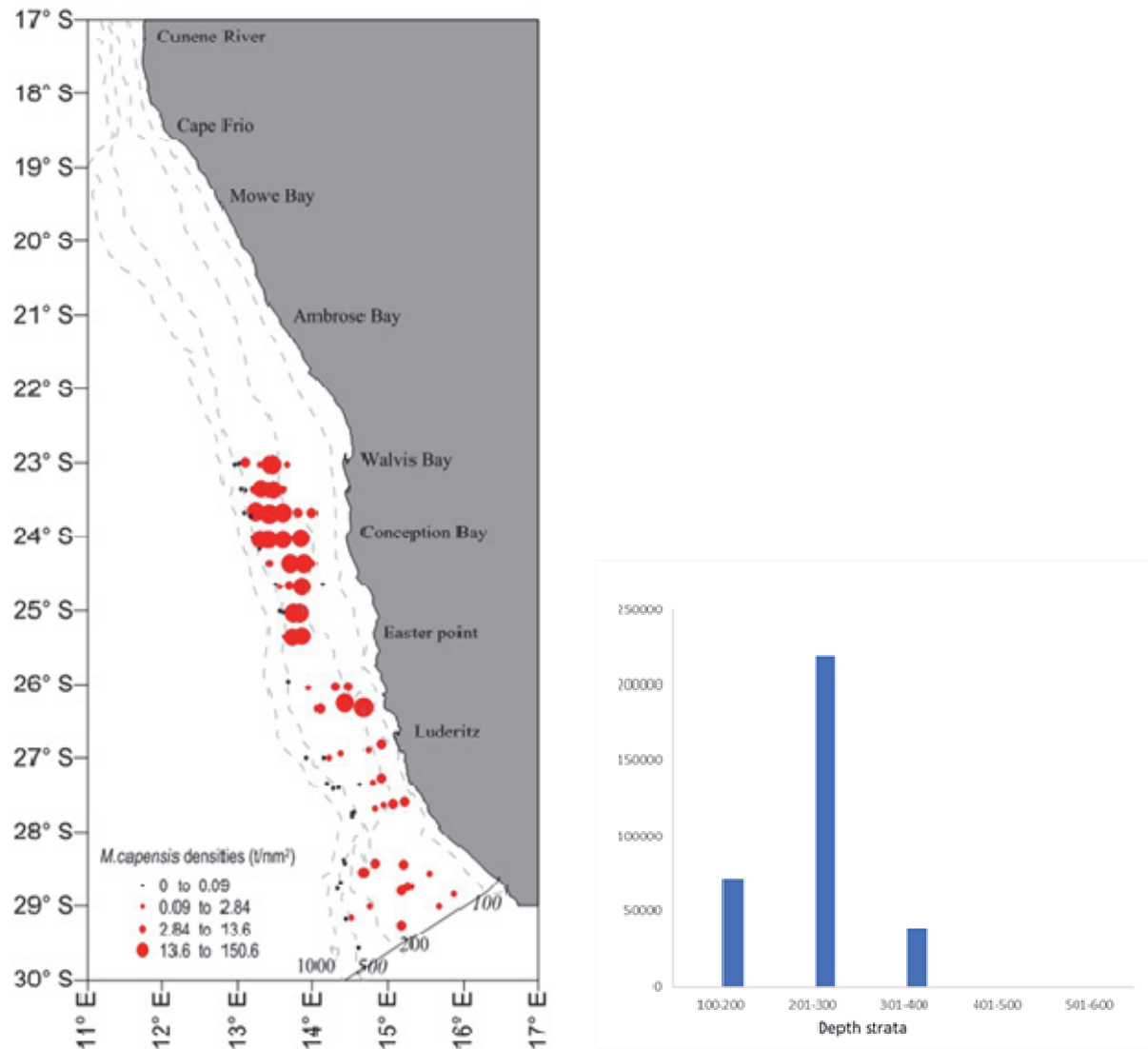


Figure 23. Spatial and depth distribution (density, tonnes/NM<sup>2</sup>) of Cape hake (*M. capensis*) off southern Namibia



The mean density for deep-water hake, *Merluccius paradoxus*, was 4.19 tonnes/NM<sup>2</sup>. This species occurred at all depths to the south of Lüderitz but farther north was largely confined to waters deeper than 300 m, especially between the 300 m and 400 m isobaths (Figure 24).

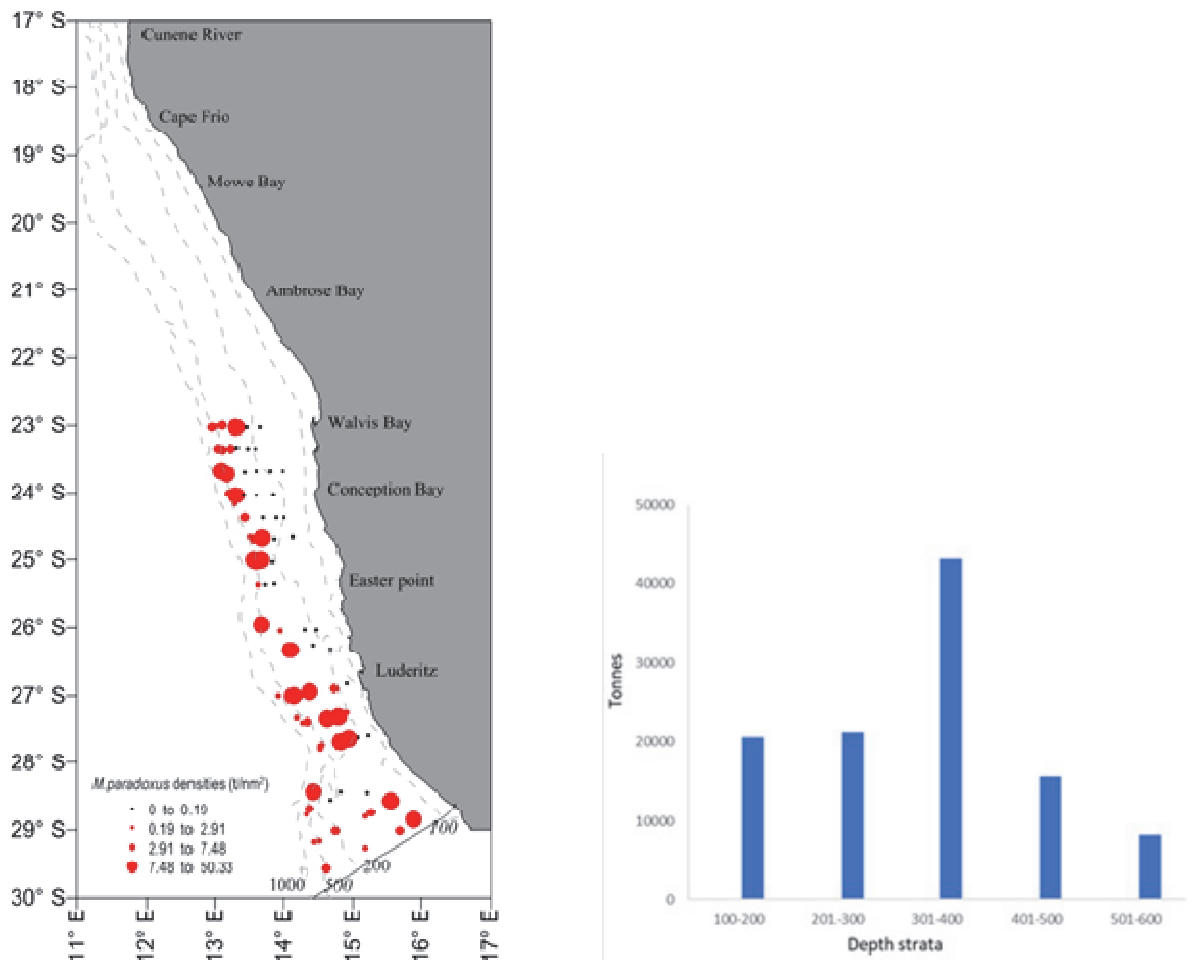


Figure 24. Spatial and depth distribution (density, tonnes/NM<sup>2</sup>) of deep-water hake (*M. paradoxus*) off southern Namibia

Significant amounts of several other targeted or potentially commercially important species were also caught at a number of stations, namely monkfish (*Lophius vomerinus*), jacobever (*Helicolenus dactylopterus*), kingklip (*Genypterus capensis*) and Cape gurnard (*Chelidonichthys capensis*). Data on these species are presented within this report. Other commercially important species, such west coast sole (*Austroglossus microlepis*), west coast rock lobster (*Jasus lalandii*), snoek (*Thyrstites atun*) and deep-sea red crab (*Chaceon maritae*) occur in the area and within the depth zones sampled but few were caught. This was primarily because the gear is not designed to catch these species and so the few incidental specimens captured are not expected to reflect the underlying population. The data are available in the Nansis database, but they are not reported herein. Maps showing trawling locations with associated densities and the size distributions of monkfish, jacobever, kingklip and Cape gurnard are shown in Figure 25 to Figure 28.

Monkfish was sampled in small densities on the slope throughout the surveyed area, with the highest catch rates between 300 and 400 m depth (Figure 25).

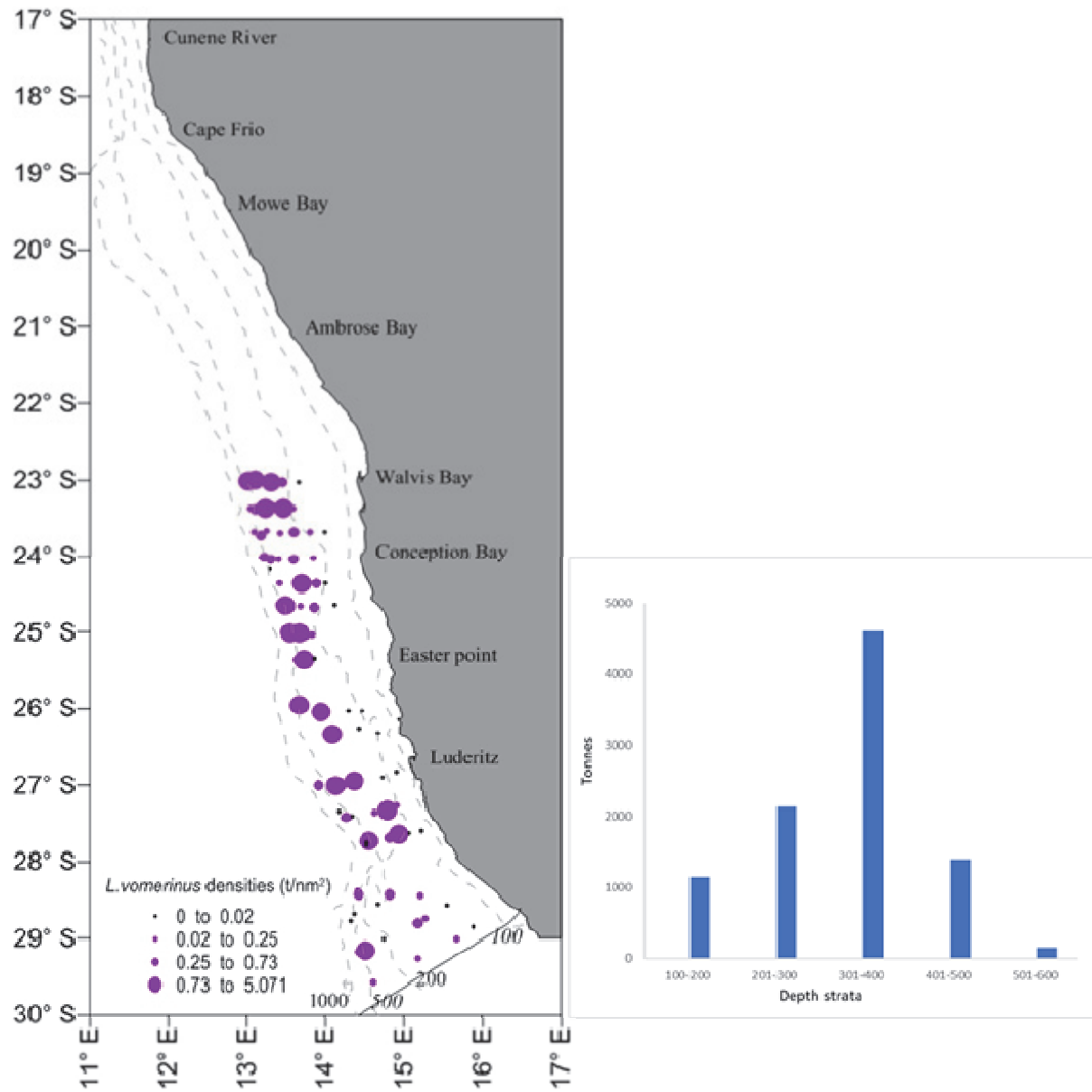


Figure 25. Spatial and depth distribution (density, tonnes/NM<sup>2</sup>) of monkfish (*Lophius vomerinus*) off southern Namibia

Kingklip were sampled offshore mostly between the 300 m and 500 m isobaths (Figure 26).

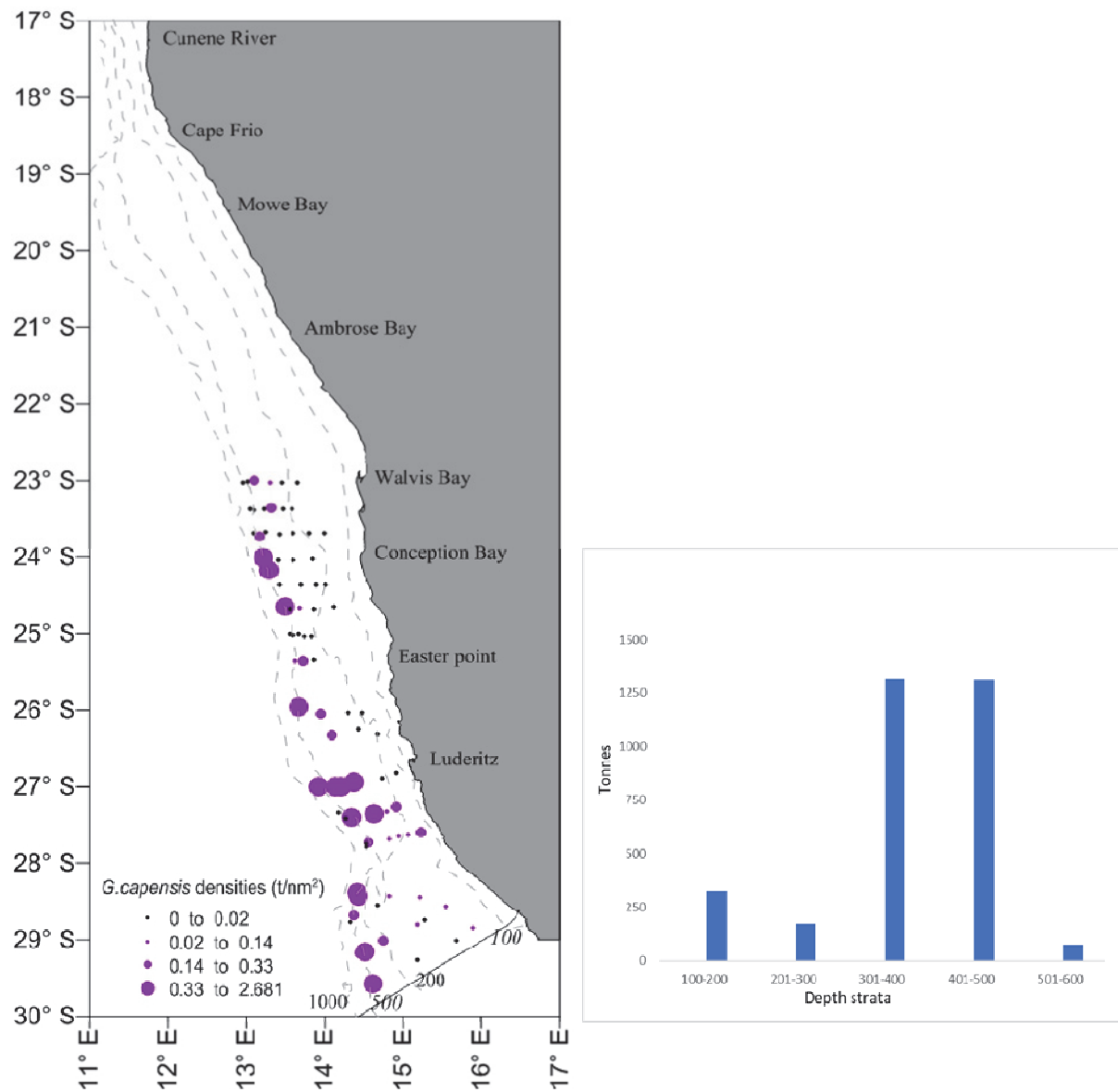


Figure 26. Spatial and depth distribution (density, tonnes/NM<sup>2</sup>) of kingklip (*Genypterus capensis*) off southern Namibia

Jacopever were sampled primarily between the 200 m and 400 m isobaths and to the north of Lüderitz (Figure 27).

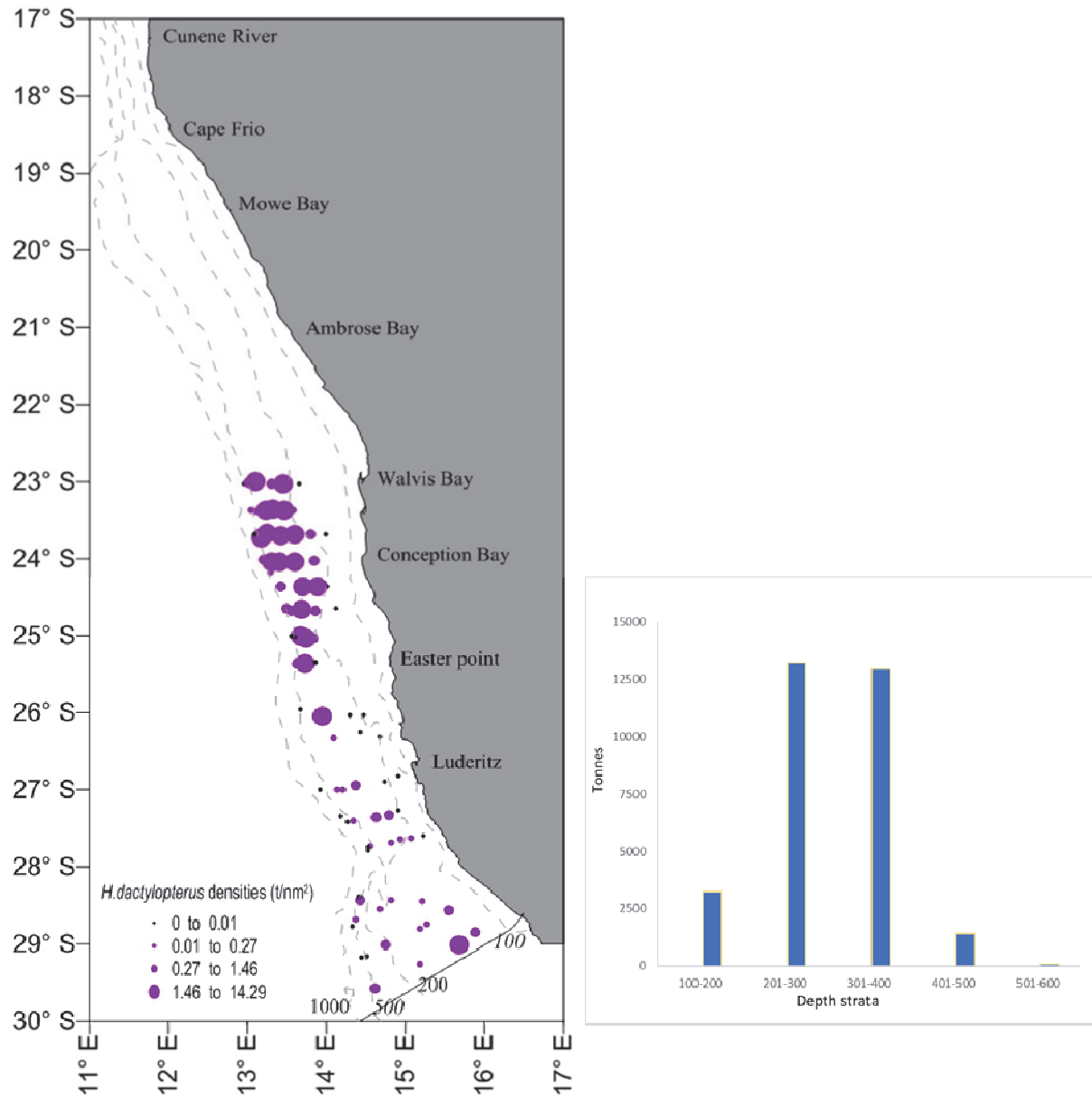


Figure 27. Spatial and depth distribution (density, tonnes/NM<sup>2</sup>) of jacopever (*Helicolenus dactylopterus*) off southern Namibia

Cape gurnard occurred primarily in the southern part of the area surveyed, and almost entirely in waters less than 200 m deep (Figure 28).

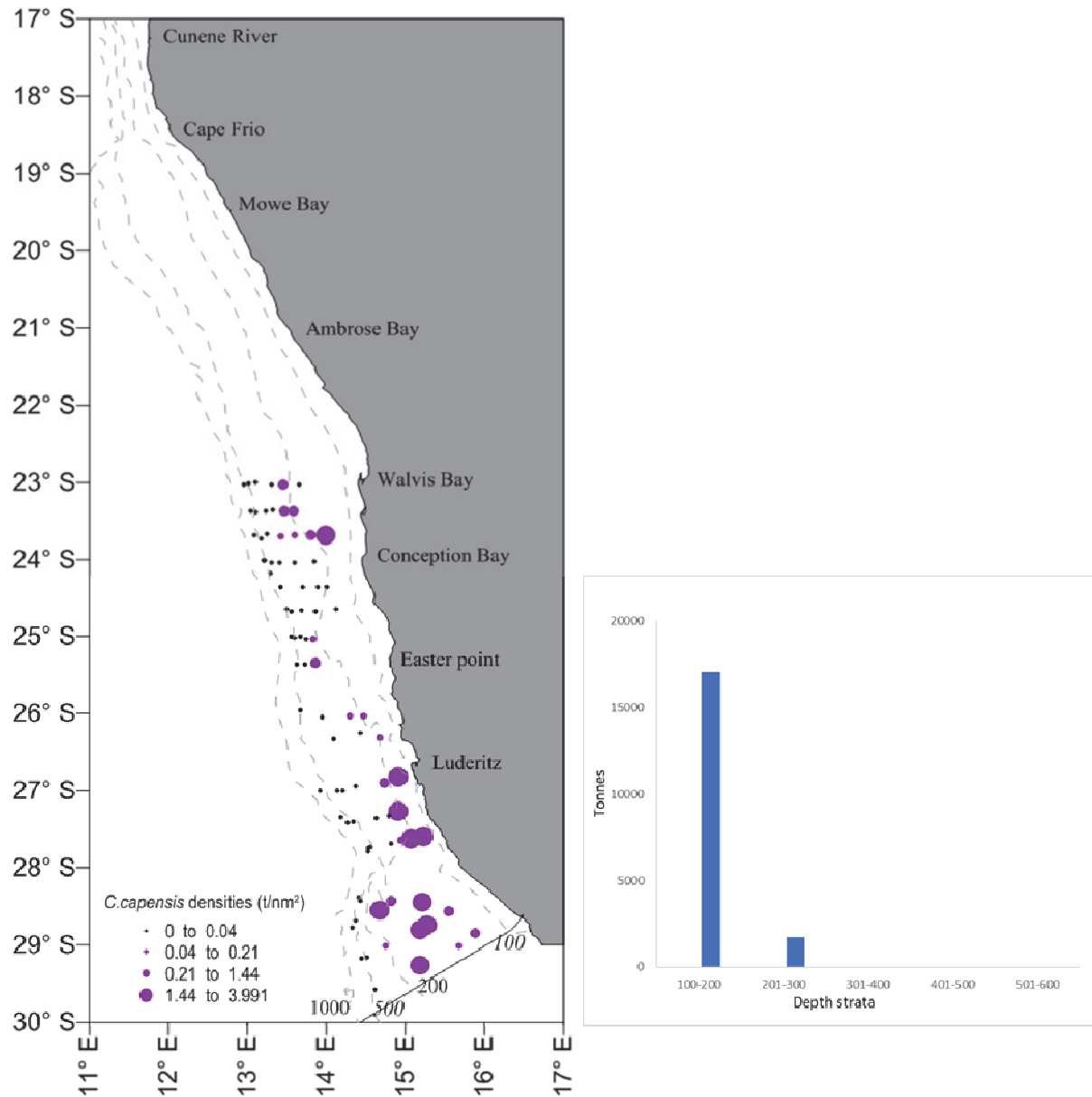


Figure 28. Spatial and depth distribution (density, tonnes/NM<sup>2</sup>) of Cape gurnard (*Chelidonichthys capensis*) off southern Namibia

Few pelagic fish species were recorded, either in the trawls or acoustically. Round herring, *Etrumeus whiteheadii*, were sampled in inshore stations to the south of Lüderitz, while a single sardine, *Sardinops sagax*, was caught at 27°35'S in 130 m water depth, with several very small sardine-like acoustic marks also seen in this area. Adult horse mackerel, *Trachurus capensis*, were sampled throughout the region (Figure 29), and acoustic registrations were often seen in the vicinity of these trawl stations. No biomass estimates of these species are provided as the survey methodology is not suitable for assessing meso- or epi-pelagic species.

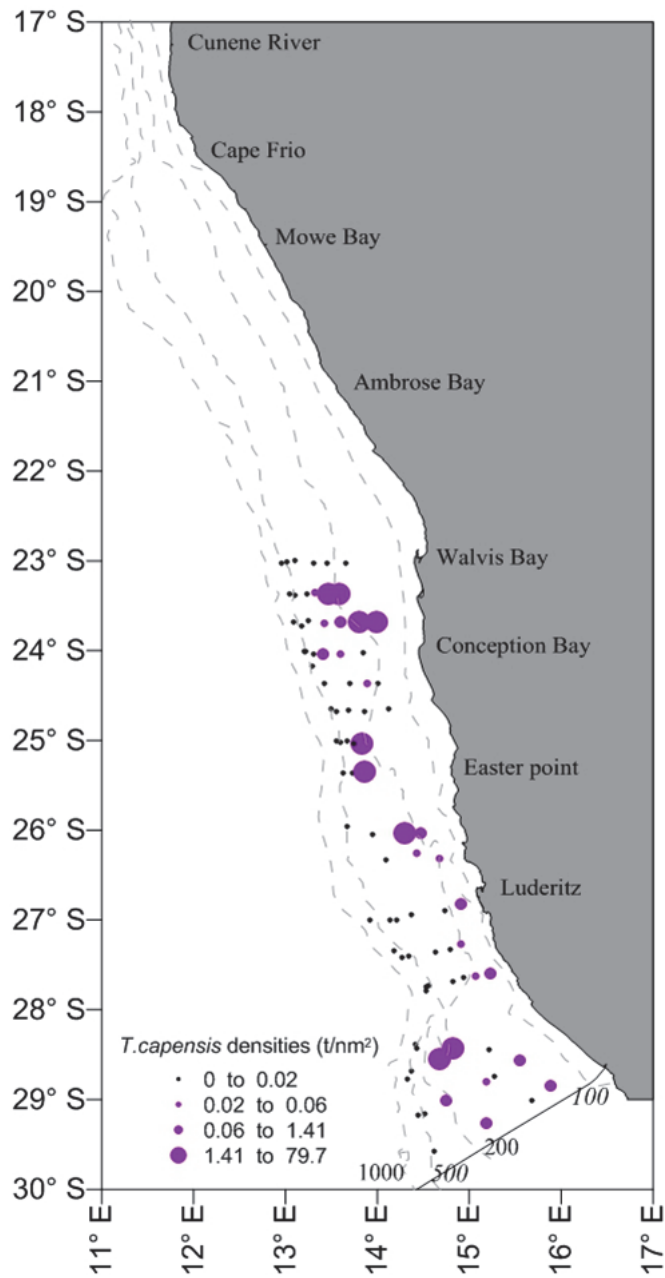


Figure 29. Spatial distribution (density, tonnes/NM<sup>2</sup>) of Cape horse mackerel (*Trachurus capensis*) off southern Namibia

### 3.4.2 Biomass

Biomass was calculated for the key species for each depth strata throughout the area covered by the survey. These “key” species were the two hakes and the four most common other commercially important, or potentially important, demersal species that were caught by the gear; *Lophius vomerinus*, *Genypterus capensis*, *Helicolenus dactylopterus* and *Chelidonichthys capensis*.

As noted in the Methodology section, the acoustic signal from the water column above the headrope was carefully scrutinised for each trawl. A small number of trawls indicated that a few hake (or other large swim-bladdered fish) occurred above the headrope, although it is not believed that these fish would have had added substantially to the overall estimate.

Table 10 describes the length-weight relationships of these species, as measured during the survey, and used in the calculation of biomass per length-class.

Table 10. Length-weight relationships, where length = a x weight<sup>b</sup>, r = fit, n = sample size

Species	a	b	r	N
<i>M. capensis</i>	0,0062	3,0341	0,9605	3 199
<i>M. paradoxus</i>	0,0083	2,9606	0,9637	3 954
<i>Lophius vomerinus</i>	0,0188	2,9294	0,9592	357
<i>Genypterus capensis</i>	0,0110	3,3242	0,9495	143
<i>Helicolenus dactylopterus</i>	0,0177	2,9249	0,9534	987
<i>Chelidonichthys capensis</i>	0,0050	3,1747	0,8201	241

Table 11 presents the calculated numbers and biomass of the two hake species. The estimated biomass of *M. capensis* was 330 000 tonnes, while the biomass estimate of *M. paradoxus* was 109 000 tonnes. Figure 30 and Figure 31 show the size distributions, while Annex XI shows the total number and biomass per length-class.

Table 11. Total biomass of *M. capensis* and *M. paradoxus* in southern Namibia

Species	Numbers (millions)	Biomass (tonnes)	CV
<i>Merluccius capensis</i>	2 346 820	330 687	0,16
<i>Merluccius paradoxus</i>	928 674	108 645	0,20

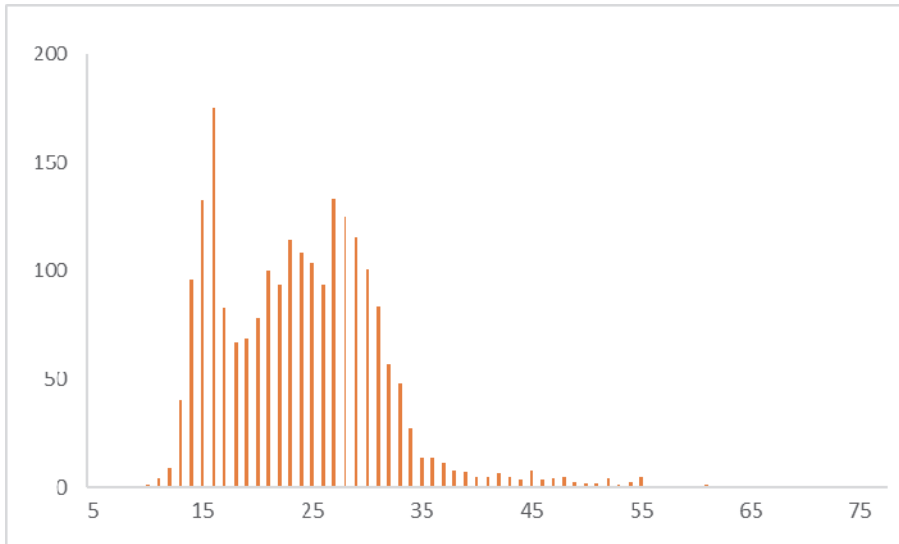


Figure 30. Size distribution of *Merluccius capensis* in the survey area (numbers in millions, raised to the total population, sample size = 3 351, from 56 trawls)

Cape hake largely consisted of a single length-group from about 20 cm to 30 cm, which are assumed to be several cohorts that have now fully recruited to the demersal component of the stock (although not necessarily to the mature breeding stock, which is considered to be fish greater than 35 cm). A further cohort, 13 cm to 18 cm, is clearly recruiting to the stock. These are presumably from the mid-year (winter) 2018 spawning. Whether this cohort is fully recruited to the demersal zone, or this represents just part of the cohort, is not known.

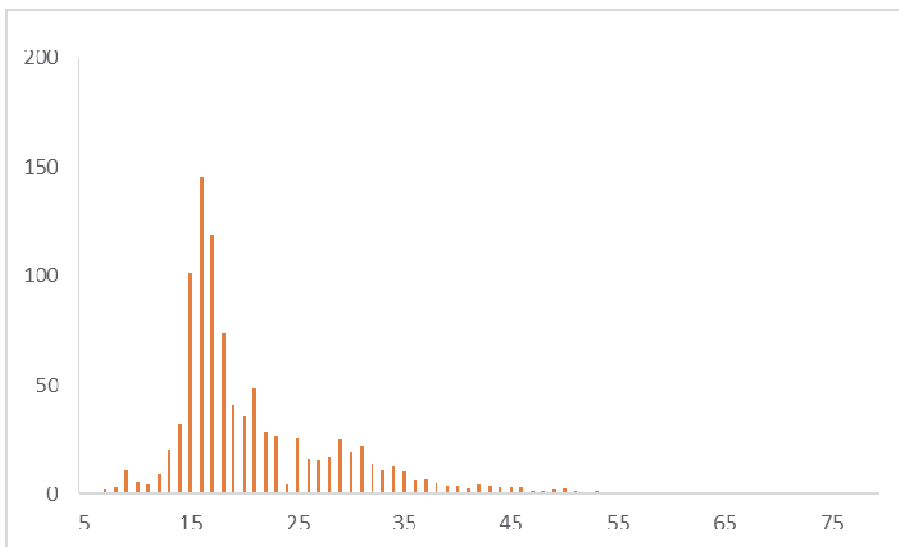


Figure 31. Size distribution of *Merluccius paradoxus* in the survey area (numbers in millions, raised to the total population, sample size = 3 724, from 45 trawls)

The deep-water hake assessed during this survey were dominated by smaller fish; between about 15 cm and 19 cm. It is assumed that these represent the newly arrived young cohort from South Africa (see Discussion).



After previous surveys, the hake data have been divided in fishable (>35 cm) and non-fishable  $\leq 35$  cm) portions in Namibia; the fish < 35 cm are considered to be recruits and should therefore not be part of the fishable stock.

While around a third by weight of both species have recruited to the fishable stock, this represents just 6% of the number of fish assessed during this survey (Table 12).

Table 12. Fishable and non-fishable components for hakes in southern Namibia

	<i>M. capensis</i>		<i>M. paradoxus</i>	
	Number (millions)	Biomass (tonnes)	Number (millions)	Biomass (tonnes)
Non-fishable $\leq 35$	2 208 270	236 211	863 452	67
Fishable >35	138 550	94 476	65 222	41
Proportion >35 cm	6%	28%	7%	38%
Total	2 346 820	330 687	984 776	109

### 3.4.3 Bycatch species

Four species of the demersal “bycatch” species were recorded in sufficient quantities to warrant estimation of their abundance. Of these, Jacopever, *Helicolenus dactylopterus*, and Cape gurnard, *Chelidonichthys capensis*, had by far the largest biomasses (Table 13). These species have never been subject to a targeted fishery in Namibia. Monkfish, *Lophius vomerinus*, and kingklip, *Genypterus capensis*, have both previously been targeted but their biomasses are somewhat lower. The size distributions of these four species are shown in Figure 32 and Figure 35 (note all numbers are raised to the total estimated biomass).

Table 13. Estimated biomass of other commercially important demersal species

Species	Biomass (tonnes)	CV
<i>Lophius vomerinus</i>	9 331	0,16
<i>Genypterus capensis</i>	3 202	0,20
<i>Helicolenus dactylopterus</i>	30 914	0,21
<i>Chelidonichthys capensis</i>	18 750	0,21

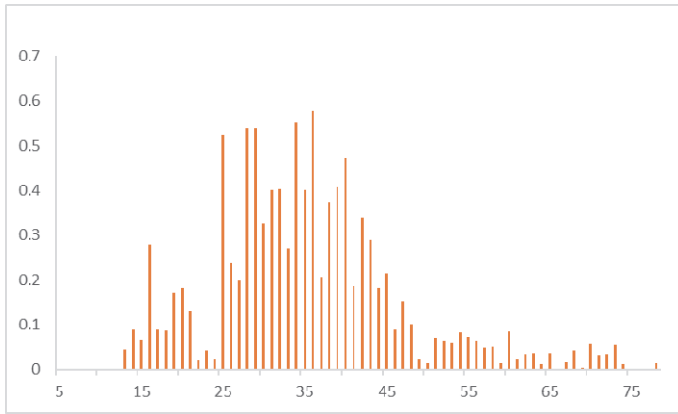


Figure 32. Size distribution of *Lophius vomerinus* in the survey area (numbers in millions) (sample size = 357, from 54 trawls)

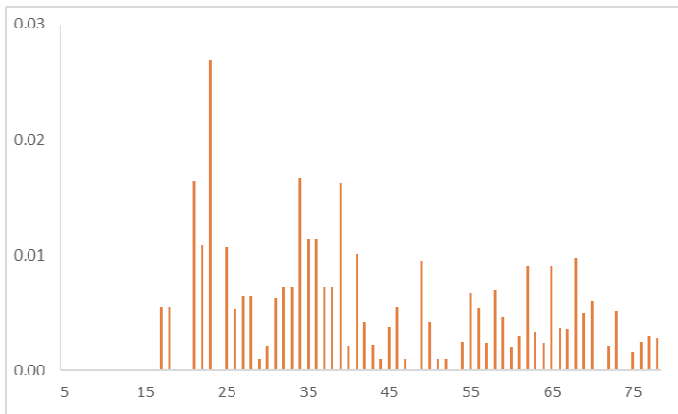


Figure 33. Size distribution of *Genypterus capensis* in the survey area (numbers in millions) (sample size = 143, from 34 trawls)

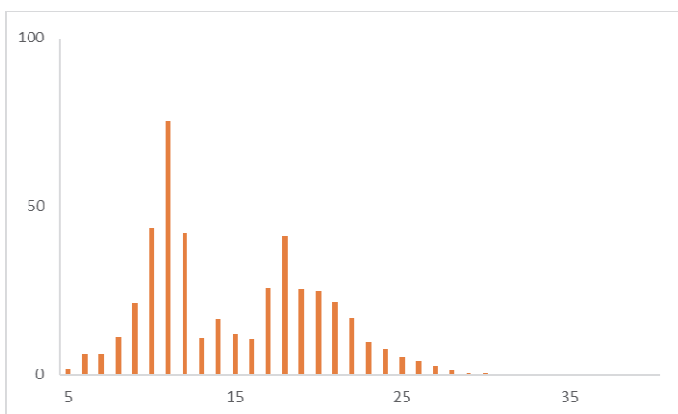


Figure 34. Size distribution of *Helicolenus dactylopterus* in the survey area (numbers in millions) (sample size = 240, sampled from 35 trawls)

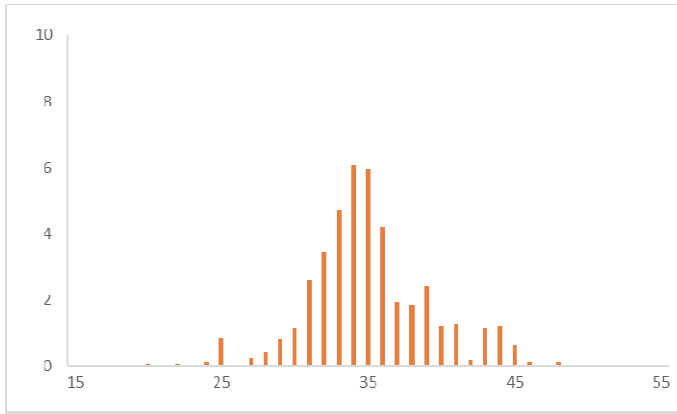


Figure 35. Size distribution of *Chelidonichthys capensis* in the survey area (numbers in millions) (sample size = 241, from 21 trawls)

#### 3.4.4 Taxonomy

During the survey identification of fish and invertebrate species was made to the lowest taxonomic level possible by experienced taxonomists as described in the methods section. The fish species off the coast of Namibia are relatively well known and hence, not unsurprisingly, no new species were found as part of the survey.

#### 3.4.5 Cephalopods, crustaceans and mesopelagic fish

Cephalopods, crustaceans and mesopelagic fish were collected and will be processed at the University of the Western Cape. Specimens were identified to the lowest taxonomic level when possible. Sampling only commenced at station 38 when a request to collect these species was received. Two unidentified species of Euphausiids were collected and one unidentified species of squid. *Todarodes sagittatus* were collected at 16 different stations (106 individuals in total). A total of 10 species of mesopelagic fish (Table 14) were collected, one of which was also unidentified. Species identification will take place at the University of the Western Cape.

Table 14. Mesopelagic fish species collected (from station 38 onwards), including the total number of individuals of each species collected

Species	No. of stations	Total individuals
<i>Diaphus meadi</i>	1	1
<i>Lampanyctodes australis</i>	6	45
<i>Lampanyctodes hectoris</i>	23	230
<i>Maurolucus muelleri</i>	13	124
<i>Photichthys argenteus</i>	7	37
<i>Stomias boa boa</i>	7	38
<i>Sufflogobius bibarbatus</i>	9	83
<i>Symbolophorus boops</i>	12	94
<i>Yarella blackfordi</i>	4	40
Unidentified sp.	4	34

### 3.4.6 Sediment samples

Benthic invertebrates were collected from sediment samples from almost all demersal trawls. For a few trawls during very rough weather it was deemed unsafe for the crew on deck to be handling the stainless-steel tubes, while the tubes were mounted incorrectly on a couple of other trawls. The benthic invertebrates were removed by filtration and provisionally identified (Figure 36 and Figure 37). 27 samples were frozen and a further 85 preserved in ethanol. All samples will be analysed at SANUMARC (University of Namibia) in Henties Bay and reported separately.

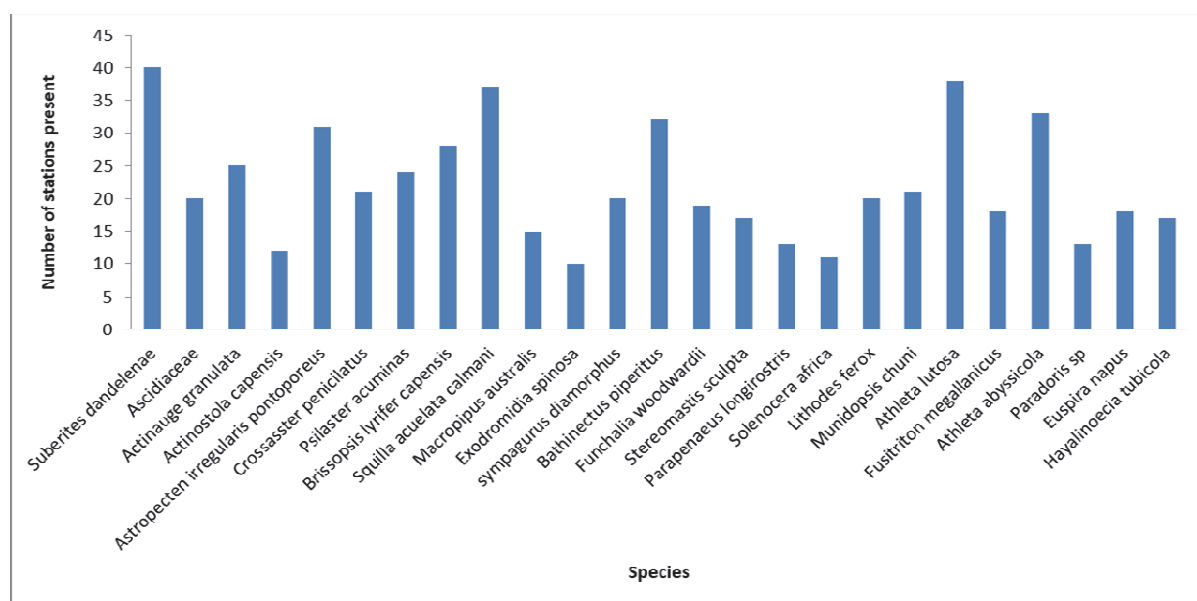


Figure 36. Frequency of occurrence of benthic organisms collected from sediment samples that occurred in more than 10 trawls

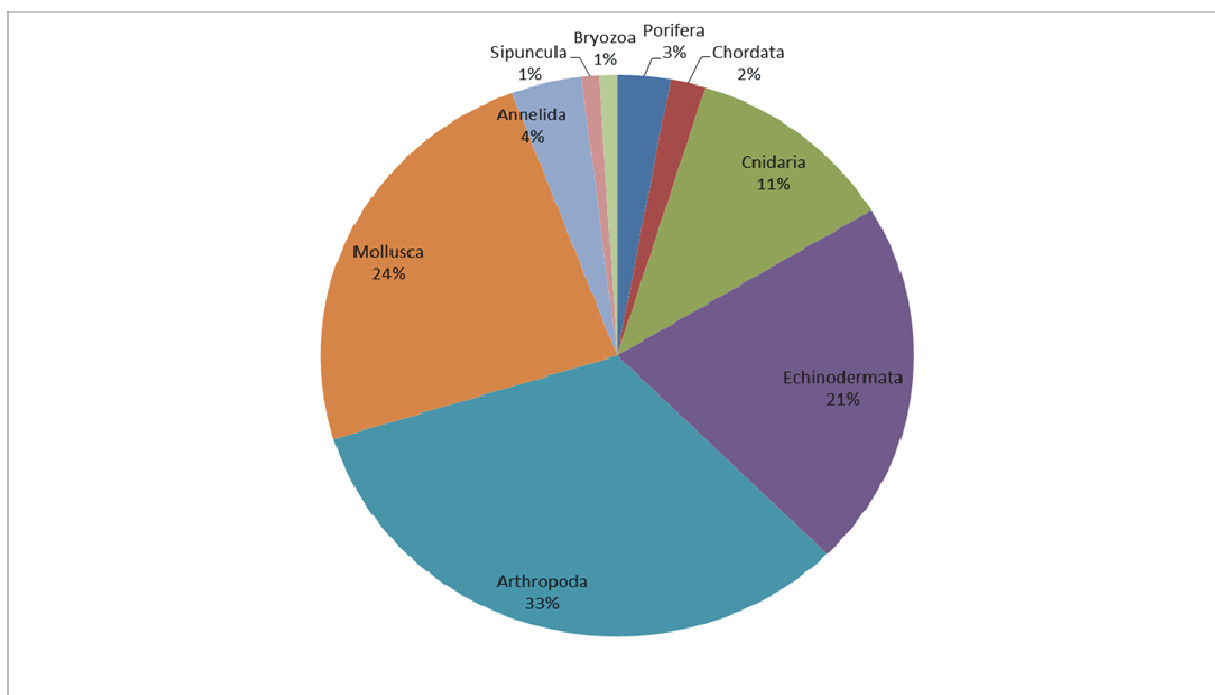


Figure 37. Species occurrence (%) per phylum of benthic invertebrates from sediment samples of all stations combined

### 3.5 Jellyfish

The jellyfish caught in trawls were generally much damaged. Samples of five species of scyphomedusae were collected during this cruise (Table 15). Large numbers of *Aequora forskalea* (Figure 38 (left)) were caught but only intact individuals were collected and measured. *Chrysaora fulgida* (Figure 38 (right)) were very abundant and often made up the highest biomass in the codend. *Pelagia noctiluca* (Figure 39 (left)) were also very abundant but were only present south of 27°S. Two rarer species: *Chirodopus gorilla* and *Discomedusa lobata* (Figure 39 (right) and Figure 40) were also collected but in very low numbers (Table 15).

Table 15. Jellyfish species collected

Species	No. of stations	Total individuals
<i>Aequoria forskalea</i>	2	4
<i>Chirodopus gorilla</i>	2	2
<i>Chrysaora fulgida</i>	13	66
<i>Discomedusa lobata</i>	1	3
<i>Pelagia noctiluca</i>	8	26

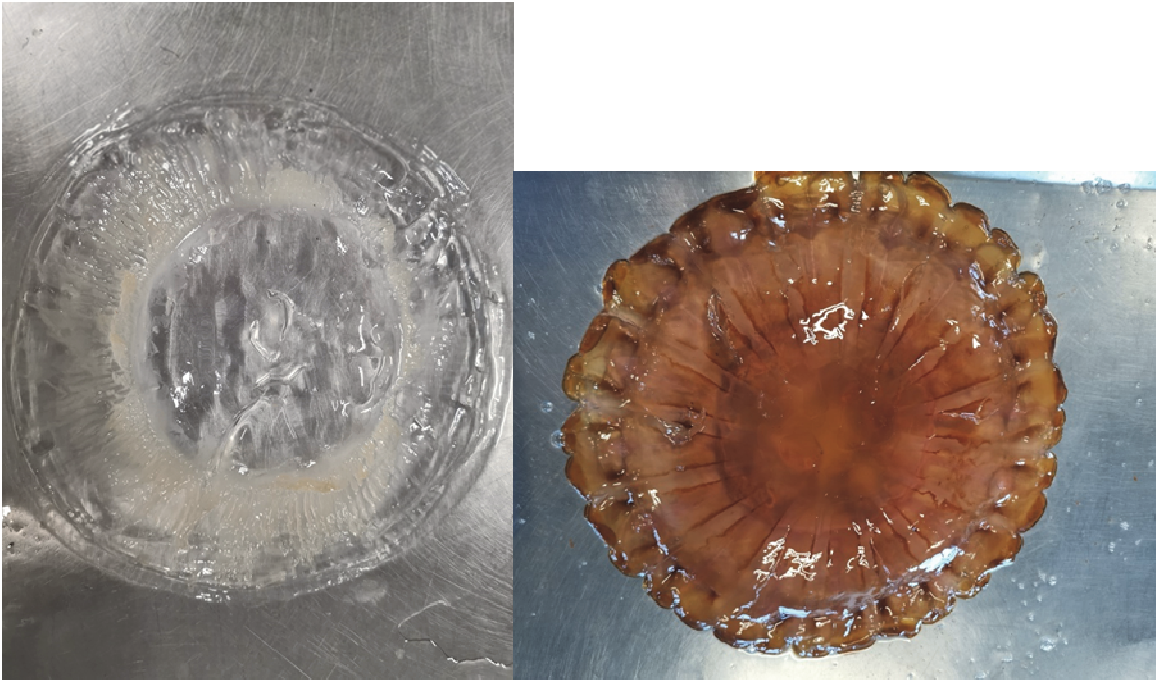


Figure 38. *Aequorea forskalea* (left) and *Chrysaora fulgida* (right)



Figure 39. *Pelagia noctiluca* (left) and *Chirodropus gorilla* (right)

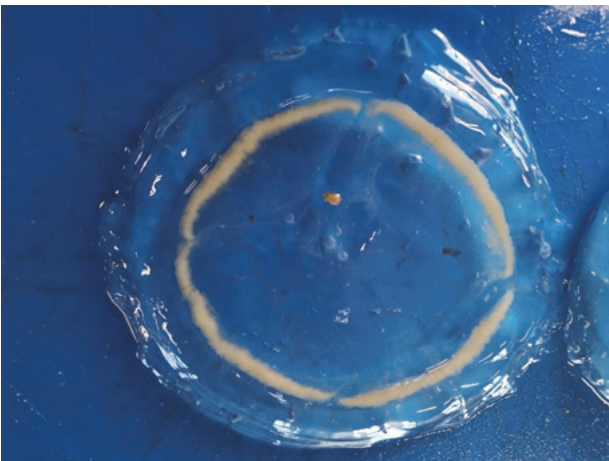


Figure 40. *Discomedusa lobata*

## CHAPTER 4. NATIONAL PERSPECTIVE

This chapter combines the results of both legs of the survey along the Namibian coast, Legs 2.2 and 2.4, providing a summary that is comparable to the standard Namibian hake survey reports.

The methodology used by the two surveys was essentially identical, the relevant chapters of each survey report should be consulted for the details. Any differences that are of importance are noted here.

The total survey effort is summarised in Tables 16 and 17. Nine trawls were conducted in waters deeper than 600 m;

Table 16. Survey effort - number of CTD, multinet, Manta and bottom trawl stations

Dates	4–24 April & 12–26 May
Distance (NM)	4 263
Transects	36
Bottom trawls (including “invalid” trawls)	180
CTD	228
Super stations	37
where the following samples were taken:	
Multinet	35
WP2	37
Manta	32

Several trawls were omitted from the analyses as the bottom contact time was less than 10 minutes or were deemed invalid as large amounts of rocks, mud or benthic debris were hauled up and, together with evidence from the Scanmar trawl geometry data, it was decided that the fishing efficiency of the trawl had been compromised.

Table 17. Survey effort - number of valid trawl hauls for swept-area analysis by depth strata

Effort	Depth strata (m)					Total
	100-200	200-300	300-400	400-500	500-600	
N trawl hauls	30	42	34	33	27	166
Sampling intensity (NM <sup>2</sup> /trawl)	670	234	260	107	81	268
Area (NM <sup>2</sup> )	20 091*	9 842	8 848	3 543	2 200	44 524

\* Note that all but one trawl in the south and six trawls in the north were deeper than 150 m. Hence the inshore part of this area was not representatively sampled



#### 4.1 Biomass estimates

Tables 18 and 19 show the number and biomass of both species of hake for the two surveys, and then the total number and biomass combined. In terms of both number and biomass, *M. capensis* provided by far the largest amount. For the whole of Namibia, a little less than one third (29 %) of the biomass of *M. capensis* was “fishable” (larger than 35 cm), but this only equated to 1% of the total population. For *M. paradoxus* the same numbers are 50% and 11%, respectively (representing fishable biomass and numbers in stock, respectively).

Table 18. Number of hakes (millions) off Namibia by fishable and non-fishable components

	<i>M. capensis</i>	<i>M. paradoxus</i>
<b>NORTH</b>		
Fishable (>35)	215 491	45 421
Non-fishable (≤35)	53 328 118	10 681
Total	53 543 609	56 102
<b>SOUTH</b>		
Fishable (>35)	138 550	65 222
Non-fishable (≤35)	2 208 270	863 452
Total	2 346 820	928 674
<b>TOTAL NUMBER</b>		
Fishable (>35)	354 041	110 643
Non-fishable (≤35)	55 536 388	874 133
Total	55 890 429	984 776

Table 19. Biomass (tonnes) of hake of the entire Namibian stock by fishable and non-fishable components

	<i>M. capensis</i>	<i>M. paradoxus</i>
<b>NORTH</b>		
Fishable (>35)	111	29 612
Non-fishable (≤35)	703	2 310
Total	814	31 922
<b>SOUTH</b>		
Fishable (>35)	94 476	41 201
Non-fishable (≤35)	236 211	67 444
Total	330 687	108 645
<b>TOTAL BIOMASS</b>		
Fishable (>35)	94 586	70 813
Non-fishable (≤35)	236 914	69 754
Total	331 500	140 567

#### 4.2 Species distribution

The two species of hake occur on the shelf and upper slope in the Namibian waters (Figure 41 and Figure 42). A depth-related size distribution, with the smaller fish of both species occurring shallower than the larger fish, has been recorded in both hake species. *M. capensis* typically occurs at depths from about 100 m to 350 m and overlaps with the



shallow end of the distribution range of *M. paradoxus*, which occurs mainly at depths of 300 m to 600 m. In past surveys, low catches of *M. paradoxus* have also been recorded at depths exceeding 600 m.

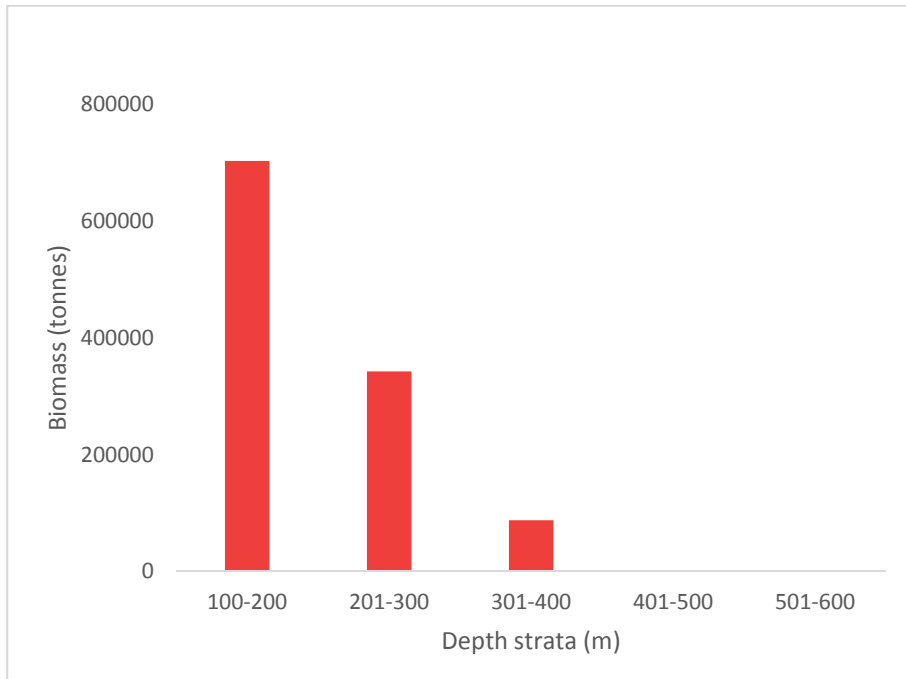


Figure 41. Biomass per depth strata for *M. capensis*

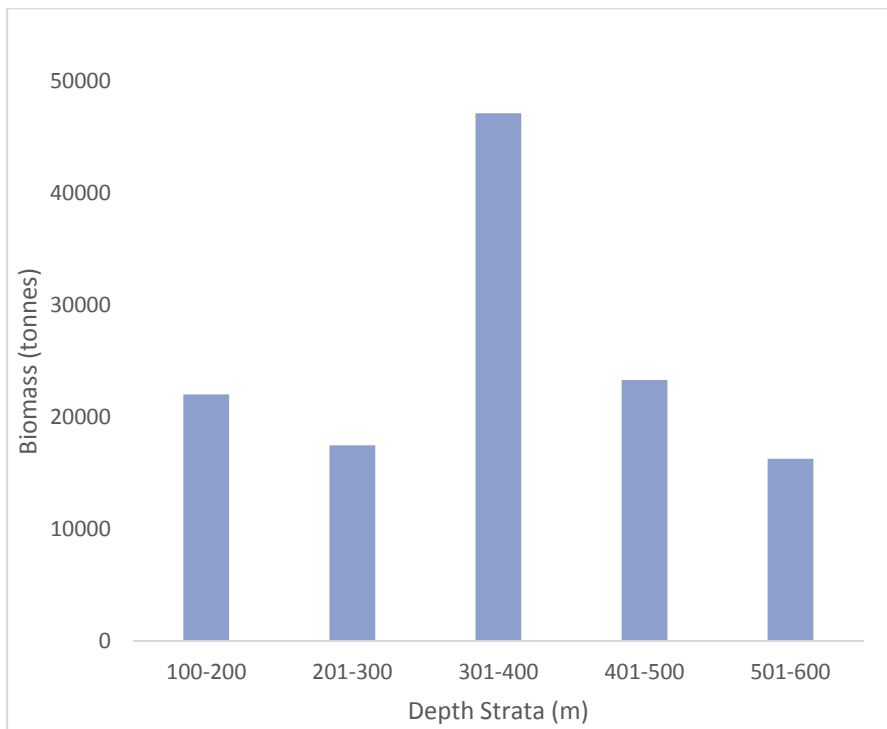


Figure 42. Biomass per depth strata for *M. paradoxus*

The catches of this survey matched previous surveys, namely that *M. capensis* was most abundant in the shallowest depth strata, all but disappearing from 400 m and deeper (Figure 43). *M. paradoxus* on the other hand occurred in all depth strata with the biomass being highest at 300-400 m depths.

During this survey, areas of high-densities for *M. capensis* ( $>20 \text{ t/nm}^2$ ) were found primarily inshore along 200 m isobath between 22°S and 25°S and between 17°S and 19°S. For *M. paradoxus* high-density stations ( $>8 \text{ t/nm}^2$ ) were scattered along the entire coast.

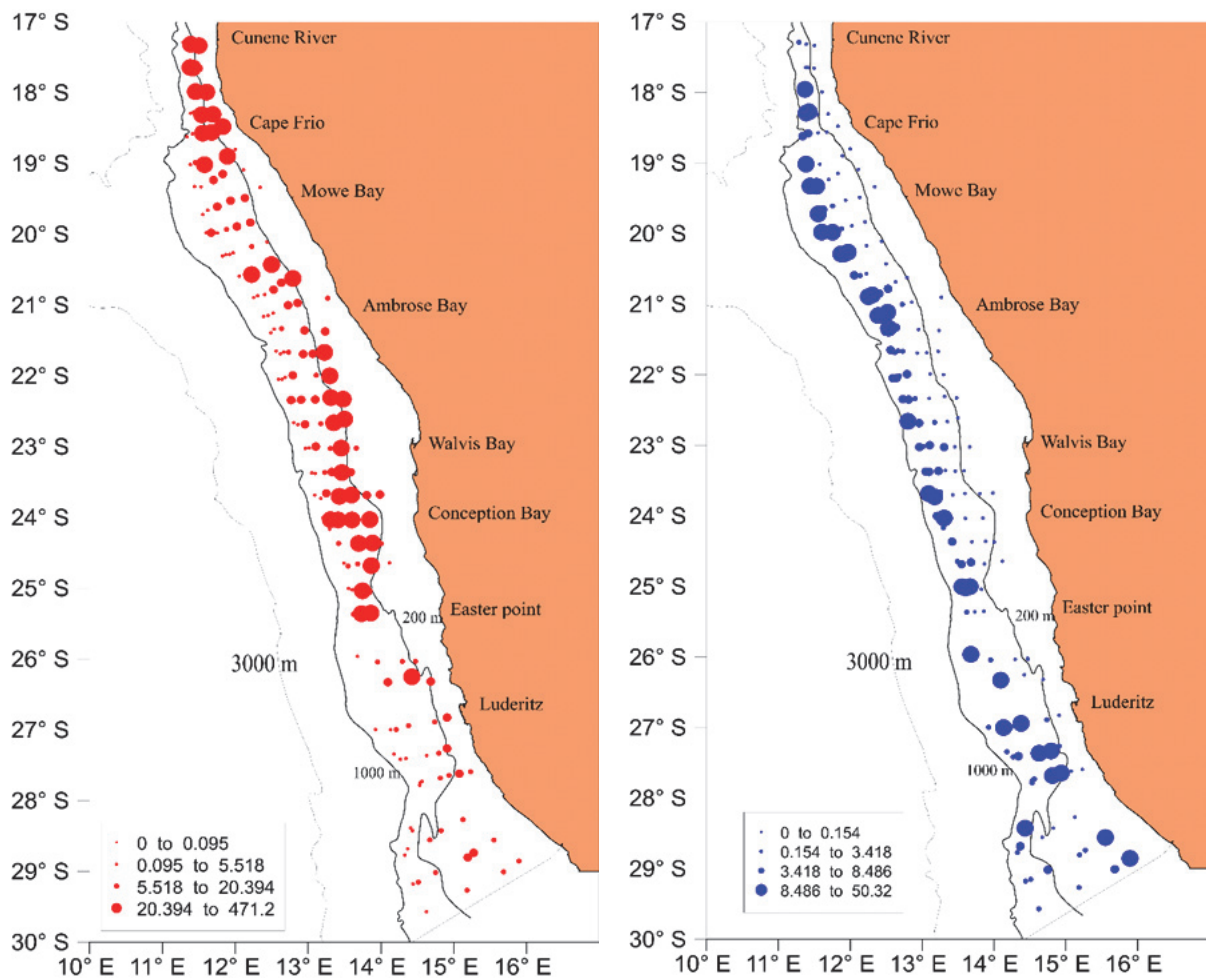


Figure 43. Density distributions ( $\text{t/NM}^2$ ) for the two species of hake: *M. capensis* (left) and *M. paradoxus* (right)

### 4.3 Size composition

Cape hake largely consisted of a single length-group from about 25 cm to 35 cm, showing that this species consists almost entirely of a non-fishable component (Figure 44 and Figure 45). On the other hand, the biomass of deepwater hake dominated by the fishable sized fish, although by number these represented just 12.6% of the fish found in Namibian waters (Figure 46 and Figure 47). For both species, very few fish greater than 75 cm were observed; these large fish are more accessible by long liners. Further, a cohort at around 17 cm is seen in both species and these fish should be close to one year old.

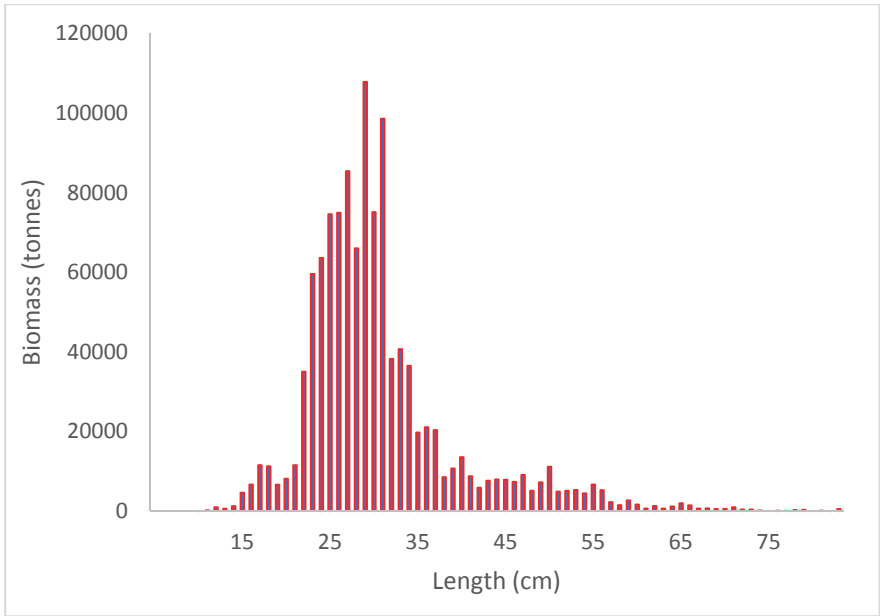


Figure 44. Size distribution in tonnes per cm of *M. capensis* for the entire Namibian region

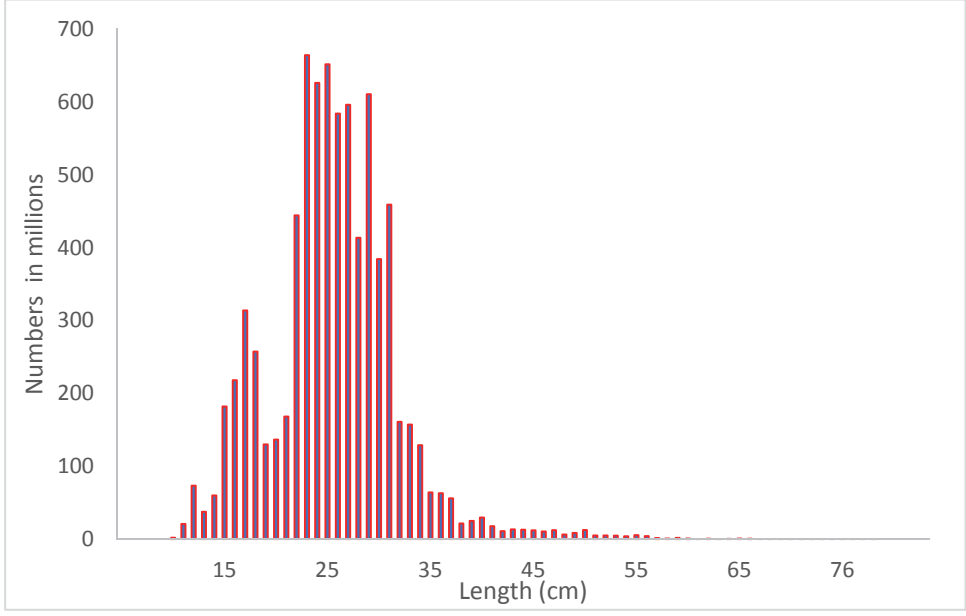


Figure 45. Size distribution in numbers per cm of *M. capensis* for the entire Namibian region

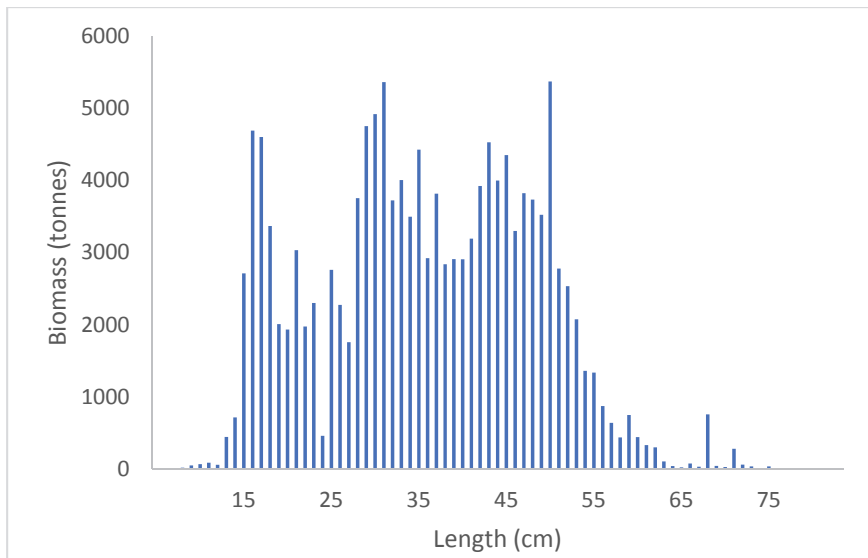


Figure 46. Size distribution in tonnes per cm of *M. paradoxus* for the entire Namibian region

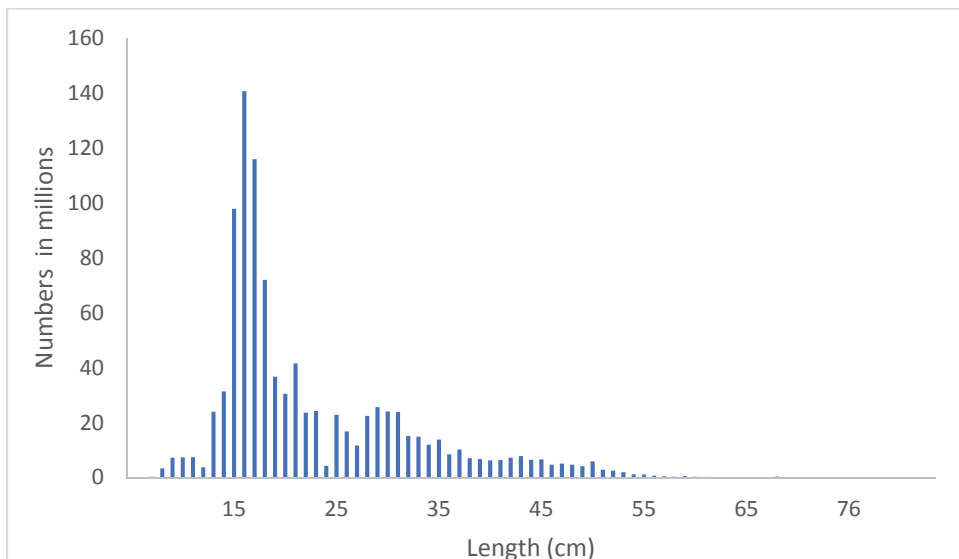


Figure 47. Size distribution in numbers per cm of *M. paradoxus* for the entire Namibian region

#### 4.4 Recruitment estimates

Recruits to the *M. capensis* stock are estimated from the numerical abundance of the cohort of fish with a modal length of about 22 cm (between 17 cm and 27 cm, Figure 48). These recruits are assumed to be about 1.5-2 years old when caught by the survey gear. The recruitment of *M. capensis* at around 4.5 billion fish detected during the survey (the 2017-year class) was slightly higher than the long-term average. These fish are expected to fully recruit to the fishery by the second half of 2020, although some may currently be available to the bottom trawl gear. The strength of the *M. paradoxus* cohort cannot be estimated from the Namibian survey data, as the species does not appear to spawn in the Namibian waters.

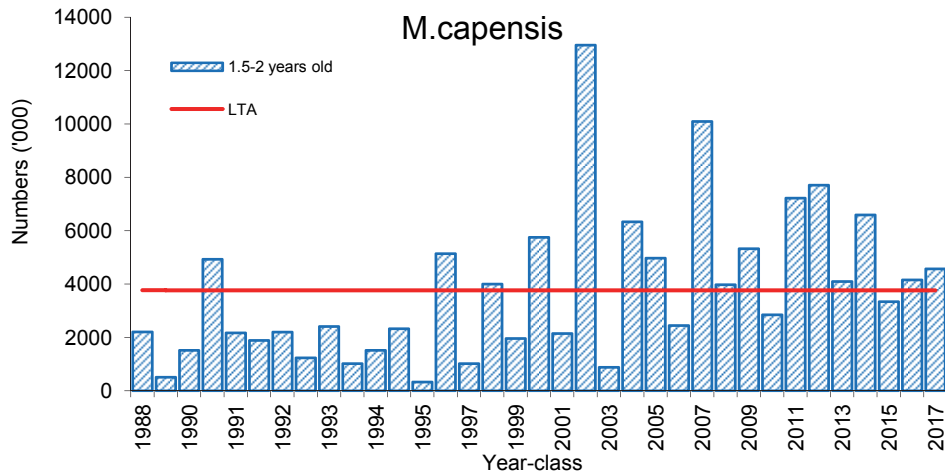


Figure 48. Estimated number of recruits (1.5-2 years old) for *M. capensis* from the hake surveys off Namibia

#### 4.5 Survey trends of some bycatch species

Figure 49 shows the density distributions for three important hake bycatch species. The monk was well distributed along the entire Namibian coast with high densities especially in the central area and far north. Kingklip occurred primarily in the south while jacopever was found mostly from 25°S northwards.

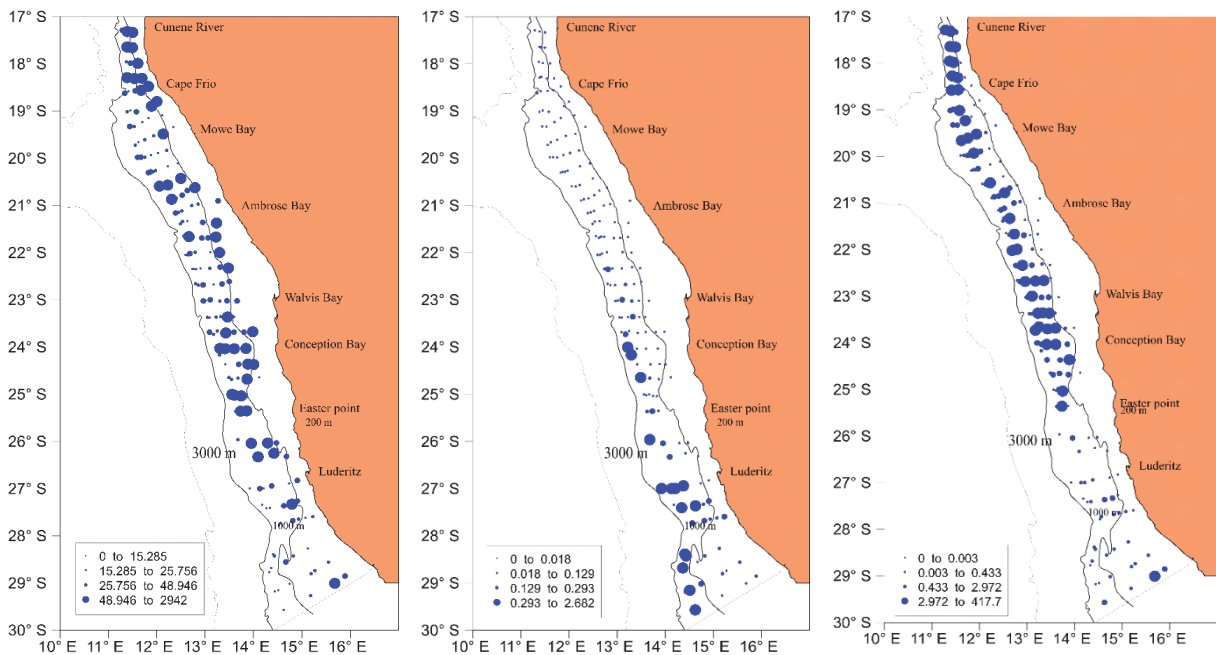


Figure 49. Density distributions (t/NM<sup>2</sup>) for monk (left), kingklip (middle) and jacopever

## CHAPTER 5. DISCUSSION

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This report details the methods and data collected during the first part of the 2019 hake swept- area survey of the entire Namibian coast, Leg 2.2, which covered the region from the Orange River to Walvis Bay. Much of the data collected are presented with little analysis or comment, i.e. the oceanographic, plankton, top predator, jellyfish, benthic invertebrate and hake biological data; these data will be further analysed in the context of the EAF-Nansen Science Plan.

The hake biomass data, as the primary focus of the survey, have been briefly analysed, but it is difficult to make comparisons with the long-term time-series of Namibian hake biomass estimates as the reports from previous surveys cover the entire coastline, from the Orange River to the Cunene River.

### 5.1 Are the hake biomass estimates comparable to previous surveys?

This survey was conducted in April; all previous surveys of the southern part of Namibia since 1996 have been conducted in January-early February. Hence this aspect has to be taken into consideration when comparing the results with previous surveys. It should also be noted that this survey was planned to provide a synoptic coverage of hake stocks in the Benguela and useful comparisons can be made at the regional level, also to unveil possible migration patterns.

In order to enhance comparability with the survey carried out in January 2018 by the R/V *Mirabilis*, the biomass data from the southern part of Namibia from the 2018 survey were re-analysed, as previously the data had only been presented for the entire Namibian area (Paulus *et al.*, 2018). The methodologies used by the 2018 survey were replicated as faithfully as possible during the 2019 survey, the main differences being that the surveys were conducted at different times of year; January compared to April, and with a different vessel.

Tables 20 and 21 show the biomass estimates from these two surveys. Clearly the estimates for both hake species for the current survey by the R/V *Dr Fridtjof Nansen* are considerably lower than those estimated by the January 2018 survey; 19% and 45% lower for *M. capensis* and *M. paradoxus* respectively.

Table 20. *M. capensis* – comparison between the January 2018 and April 2019 surveys of biomass per depth stratum in southern Namibia

Depth strata (m)	2018	2019
100-200	303 234	72 084
201-300	79 777	219 171
301-400	21 062	39 018
401-500	0	413
501-600	0	0
Total	406 091	330 687

Table 21. *M. paradoxus* - comparison between the January 2018 and April 2019 surveys of biomass per depth stratum in southern Namibia

Depth strata (m)	2018	2019
100-200	7 378	20 525
201-300	21 030	21 148
301-400	130 399	43 119
401-500	33 327	15 553
501-600	5 572	8 300
Total	199 724	108 645

These differences may of course represent real changes in the abundance of the two stocks. Equally, it is entirely possible that a portion of the fish has moved away from the southern region or was unavailable to the survey gear. For example, it is possible that the fish have moved northwards. As the current survey was conducted several months after peak water temperatures in late summer, it seems entirely plausible that the hakes have a small-scale local migration following the cooler waters southwards in summer and northwards in winter. Once the survey of northern Namibia has been completed this may become clearer. A comparison with commercial CPUE data may also be useful.

The survey covered the region from around the 150 m isobath to the shelf edge at 600 m. Fish were found at both the shallow and deep ends of the surveyed area, indicating that the zero-density line had not been reached. It is possible that significant amounts of fish were therefore outside of the surveyed region. Unfortunately, there was insufficient time to extend the survey beyond the core area of 150 m to 600 m and therefore this possibility could not be investigated.

The length frequencies of both species of hake seem to be rather different to the length frequencies of recent years (see Paulus *et al.*, 2018), although as noted previously, comparing the results from the southern part of Namibia with those from earlier surveys of the entire coastline may be misleading.

In brief, the current survey sampled a young cohort of *M. capensis* with a mean length of around 15 cm total length. It can be assumed that this cohort has not yet recruited fully to the demersal zone and so has only been partially sampled. The remainder of the fish were between 20 and 30 cm and presumably represented a series of cohorts. The majority of the fish sampled during the 2017 survey were between about 25 cm and 35 cm, while in 2018 they measured from 20 cm to 28 cm. This suggests that some of the larger *M. capensis* (>30 cm) were missing from both the 2018 and the current surveys.

With *M. paradoxus* each survey seems to sample one or more cohorts of less than about 23 cm total length, with the current survey sampling a large number of fish between 20 cm and 23 cm. The remainder of the *M. paradoxus* stock seems to be made up of a series of cohorts, with large fish greater than 40 cm being common in the 2017 and 2018 surveys (Paulus *et al.*, 2018), but rare in the current survey.

The *M. paradoxus* in Namibian waters are believed to be part of a single stock shared with South Africa, with spawning occurring off the west coast of South Africa and then juveniles migrating to Namibia, before returning to South Africa several years later to form part of the spawning stock (e.g. Strømme *et al.*, 2016; Burmeister, 2005; Iilende *et al.*, 2001; and Kainge *et al.*, 2007). The estimated biomass of *M. paradoxus* was considerably less than previous recent surveys. As the timing and extent of migration between South African waters and Namibian waters is poorly understood this reduced biomass may be a reflection of the timing of when newly arriving juveniles join the Namibian stock, and/or that a large portion of the adult stock, which might have been surveyed in January, had left on their return migration to South Africa. A comparison of the results of the survey conducted in South Africa during March 2019, Leg 2.1, with the results of this survey might help to resolve these issues.

## 5.2 Some brief comments on the methodology

One of the “rules” of hake surveys in Namibia is for all trawls inside the 400 m isobath to be completed during day-time as in these shallower waters Cape hake lift off the bottom during night-time and hence are unavailable to the trawl gear. It is believed that this diurnal vertical migration (DVM) is less marked in deeper waters and so deep stations can be trawled at any time of day or night (Kainge *et al.*, 2015). The Namibian surveys with R/V *Mirabilis* entail the vessel drifting or steaming for some hours mostly at night, often from around midnight to sunrise. In January “day-time” is defined as 06h00 to 20h00 (actual sunrise and sunset were 06h30 and 19h50 respectively at Walvis Bay on 15 January 2019). During this survey 07h00 to 19h00 was used (actual sunset was 07h15 to 18h47 respectively on 15 April 2019). Darkness occurs at least an hour before and after these times at depth and hence it is not surprising that the acoustic data clearly showed that the DVM started at around 17h00 each evening with fish and plankton returning to the demersal zone after 09h00 the next morning. Is it possible that the DVM changes seasonally and started farther from sunset and sunrise during the current survey than in summer? If so, during the current survey less fish would have been available to the trawl gear of stations conducted during the early mornings and late afternoons than during the summer surveys.

A final comment on the weather conditions during the survey, which were often rough, with large swells and gale-force winds making trawling difficult. Such conditions negatively impact the performance of bottom trawl gear and could potentially have affected catch rates. As these conditions are much less frequently encountered during summer months, this could be another factor partly accounting for the reduced biomass estimates.

The current methodology has been used for more than 25 years, and as such provides an invaluable time-series of biomass estimates and biological information about the Namibian hake stocks, and associated demersal community. However, these surveys are expensive in terms of both manpower and vessel costs and their use has to be maximised.



## CHAPTER 6. REGIONAL SYNTHESIS

### 6.1 *Merluccius capensis*

Cape hake occurred from Cape Town to northern Namibia. The trawl data, with all size classes aggregated, indicate three possible separate stocks; off central Namibia, the Orange River basin and southwards and off Cape Point (Figure 50).

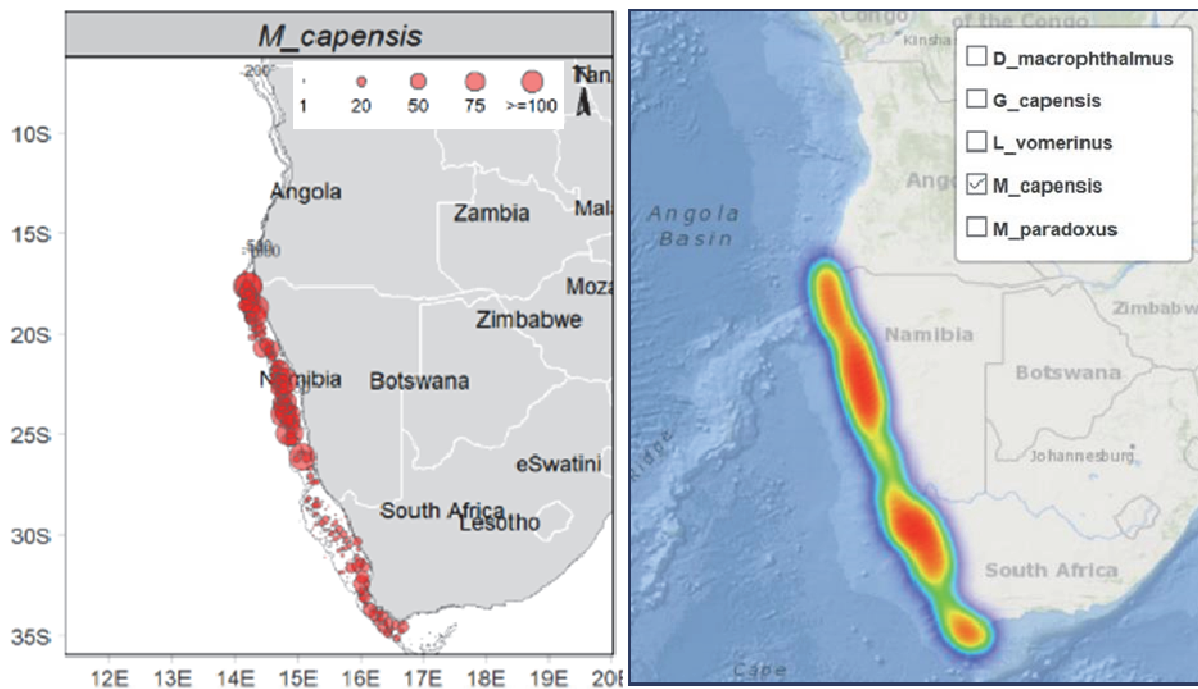


Figure 50. Distribution map for *Merluccius capensis* showing trawl catch rates (CPUE) in tonnes/NM<sup>2</sup> (left panel) and as a density heat-map (right panel)

Presenting these data in 10 cm length-classes (Figure 51) seems to support the pattern of three separate stocks. The smallest fish, in the <10 cm length-class (upper left panel), were found in small areas at the core of these three distributional areas (central Namibia, the Orange River basin and off Cape Point). As the fish grow/age these areas expand, until by the time the fish are in the 31-40 cm length-class the distribution is widespread throughout the area from Cape Point to the Cunene River (top right and middle panels). However, even at this stage there still seems to be a separation between the areas, although it would seem entirely possible that there is a transfer of fish between areas. The older fish, >41 cm (two lower panels), then seem to return to the core of these three areas, although these larger fish were less common off Cape Point.

Note that a single trawl in Angolan waters, offshore of Baía dos Tigres, contained a small quantity of *M. capensis* (5 kg/NM<sup>2</sup>) in the size range 21-55 cm. Hence, based on these data, while technically this may qualify this species as shared with Angola, for management purposes this would not normally be considered, especially if such low densities in Angolan waters are recorded in other surveys.

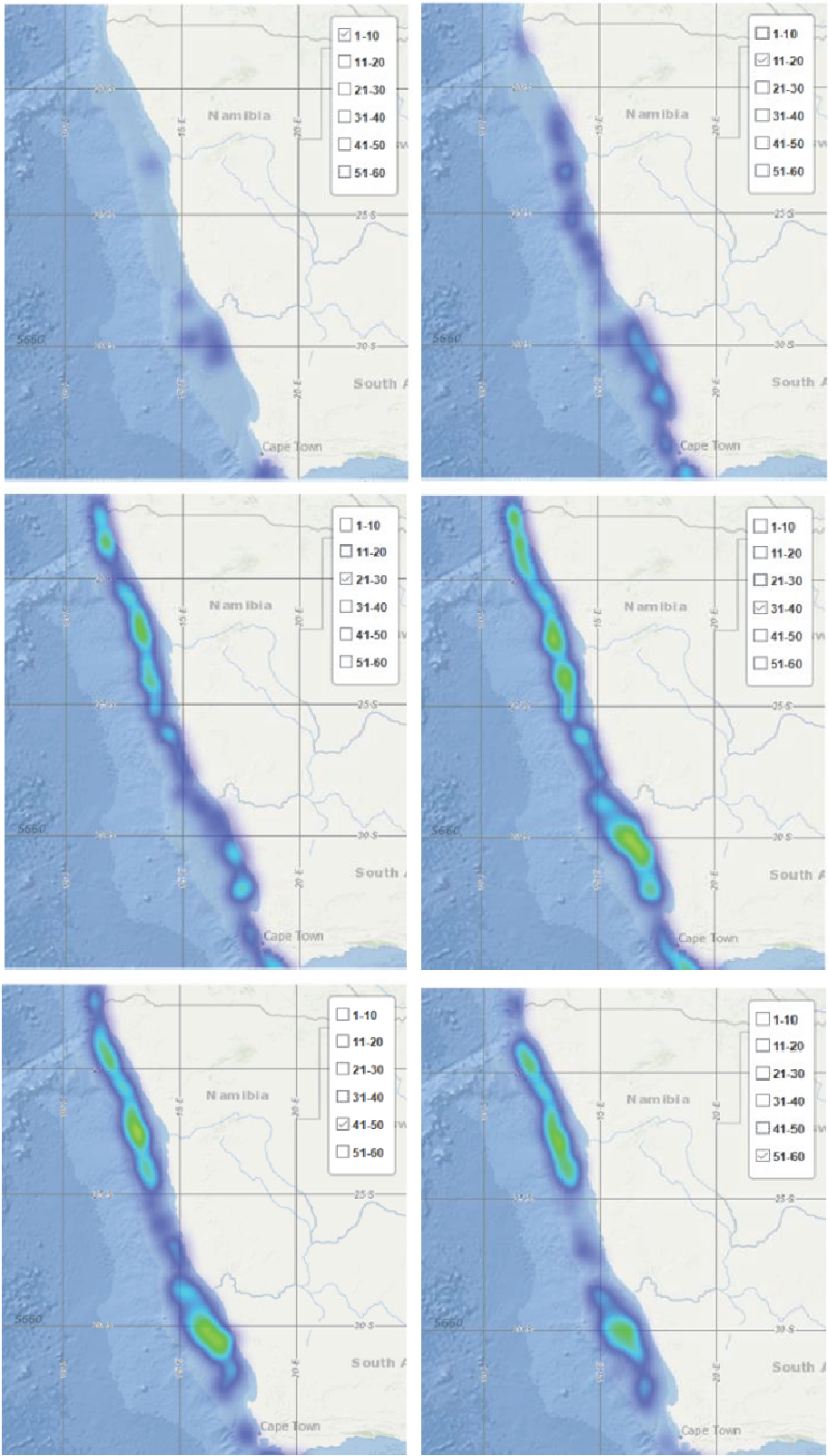


Figure 51. *Merluccius capensis* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

In summary, the data collected during the March-May 2019 surveys would seem to lend some support the hypothesis that Cape hake occur as three stocks. The two southernmost areas seem to be essentially within the South African EEZ while the northern area is entirely within the Namibian zone, hence any issues of managing shared stocks may not be a concern of this species. However, more data are needed to properly assess the stock structure and migration of this species.

## 6.2 Merluccius paradoxus

Deepwater hake occurred from Cape Town to northern Namibia. The trawl data, presented with all size classes aggregated, suggest that this constitutes a single stock (Figure 52).

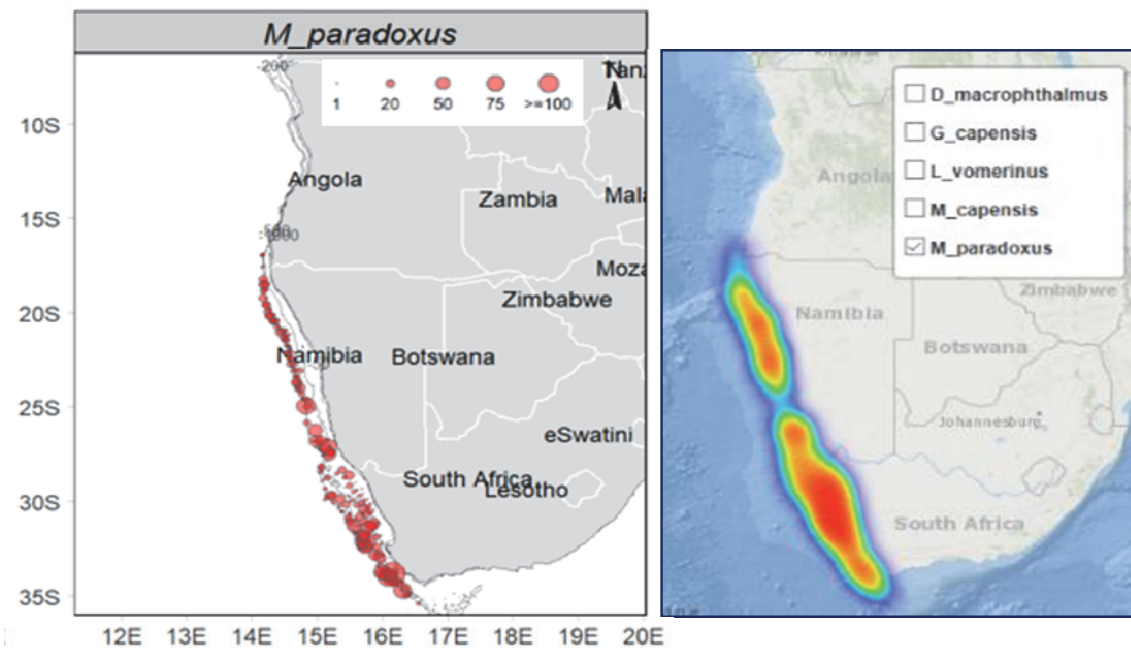


Figure 52. Distribution map for *Merluccius paradoxus* showing trawl catch rates (CPUE) in tonnes/NM<sup>2</sup> (left panel) and as a density heat-map (right panel)

When the data are analysed in more depth, by length-classes (Figure 53), a clear migration pattern emerges. All small fish, less than 11 cm, were found in South African waters, widespread between the Orange River and Cape Columbine. As the fish grew they dispersed both northwards and southwards, although few fish in the size class 11-20 cm occurred north of the Orange River border. Fish larger than this were widely spread throughout Namibia and the South African West coast.

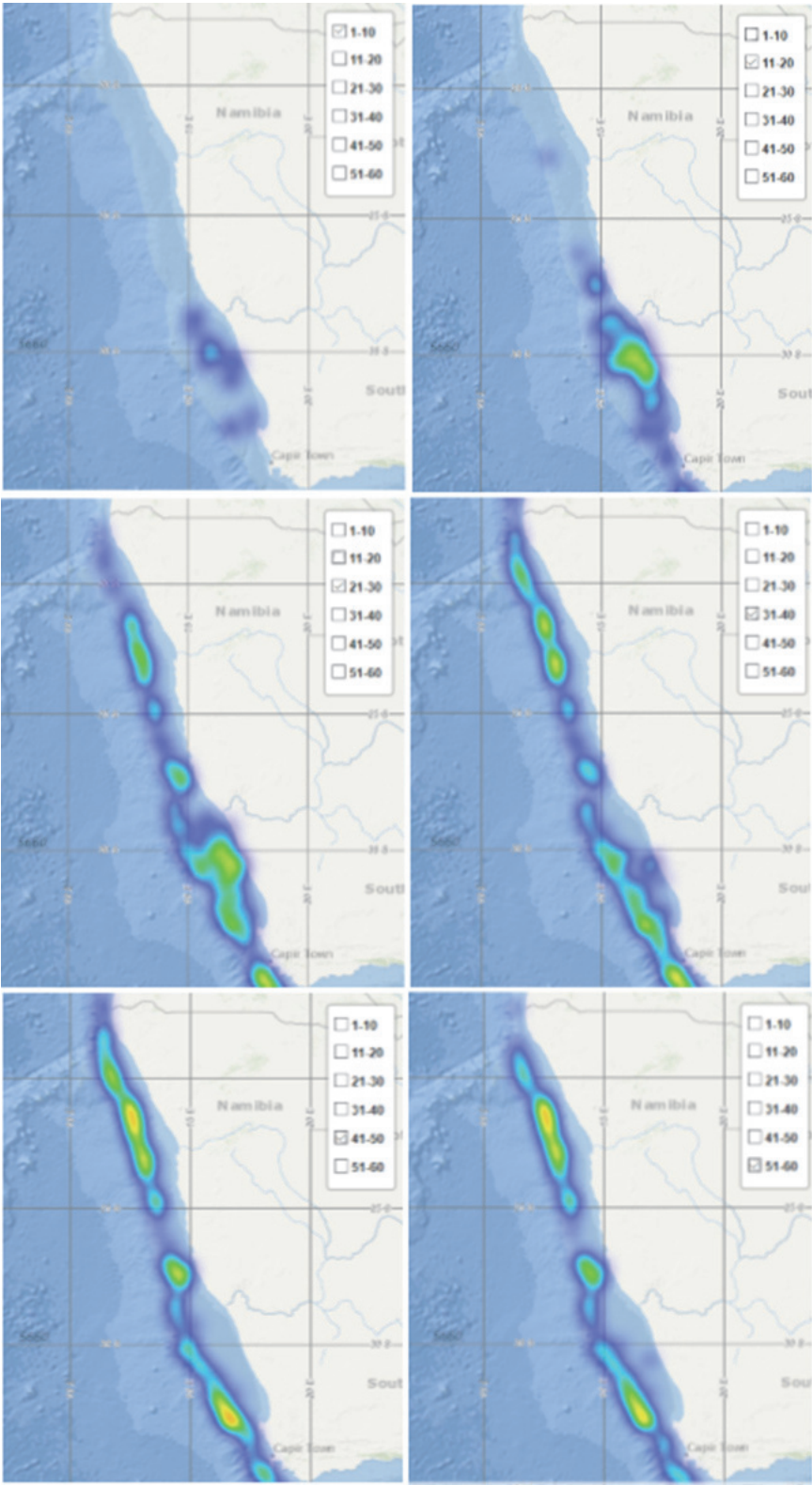


Figure 53. *Merluccius paradoxus* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri



This is consistent with the theory that *M. paradoxus* spawns in South Africa and then disperses into Namibia as the fish grow. However, the theory also predicts that larger fish migrate to the spawning grounds in South Africa. These data show no evidence of this.

Note that three trawls in Angolan waters, all offshore of Baía dos Tigres, contained small quantities of *M. paradoxus* (between 2 and 5 kg/NM<sup>2</sup>) in the size range 31-55 cm. While technically this may qualify this stock as shared with Angola, for management purposes such low rates of movement across the border would not normally make shared management protocols necessary. However, more data need to be analysed to ascertain whether these densities in Angola rates are typical.

In summary, the data strongly support the hypothesis that deepwater hake occur as a single stock in the Benguela region, shared between Namibia and South Africa. It would therefore seem important for the long-term sustainability of the stock that current initiatives for collaborative approaches to research and management are further strengthened. However, further research is required to determine the full migration cycle of this species, notably whether Namibian fish return to South African waters to spawn.

### 6.3 Kingklip

Kingklip occurred from Cape Town to central Namibia. The trawl data, with all size classes aggregated show no clear patterns within this area of distribution beyond a dense region around 30°S to 33°S and decreasing densities to the north and south of this (Figure 54).

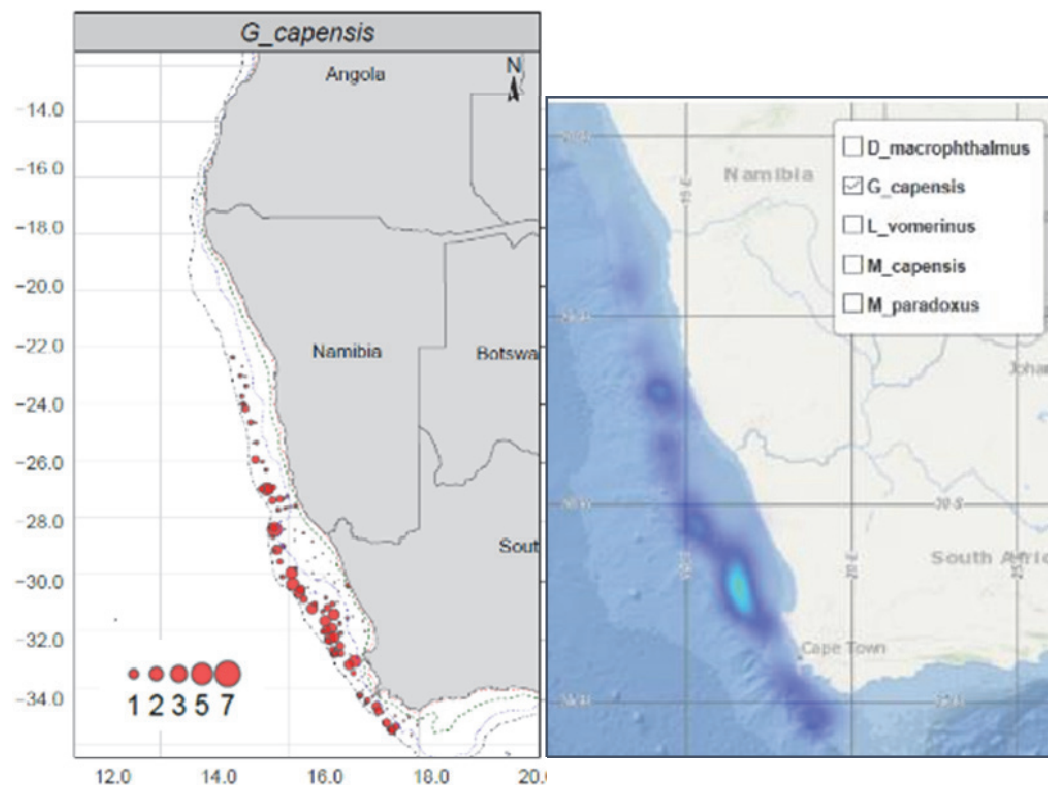


Figure 54. Distribution map for *Genypterus capensis* showing trawl catch rates (CPUE) in tonnes/NM<sup>2</sup> (left panel) and as a density heat-map (right panel)

When the data are presented in 10 cm length-classes (Figure 55) several possible patterns emerge. The smallest fish captured, in the 11-20 cm length-class, were found off the Orange River. By the time the fish had grown to 21-30 cm and 31-40 cm a second area, off Cape Point, was evident, suggestive of that the Orange River may be a spawning and/or recruitment area, some of these fish then recruiting to Cape Point. By the time the fish reached 41 cm and larger the population had expanded into the central West Coast region and also northwards into central Namibia. This species, based on the limited evidence presented here, appears to be a shared stock, albeit mostly occurring in South African waters.

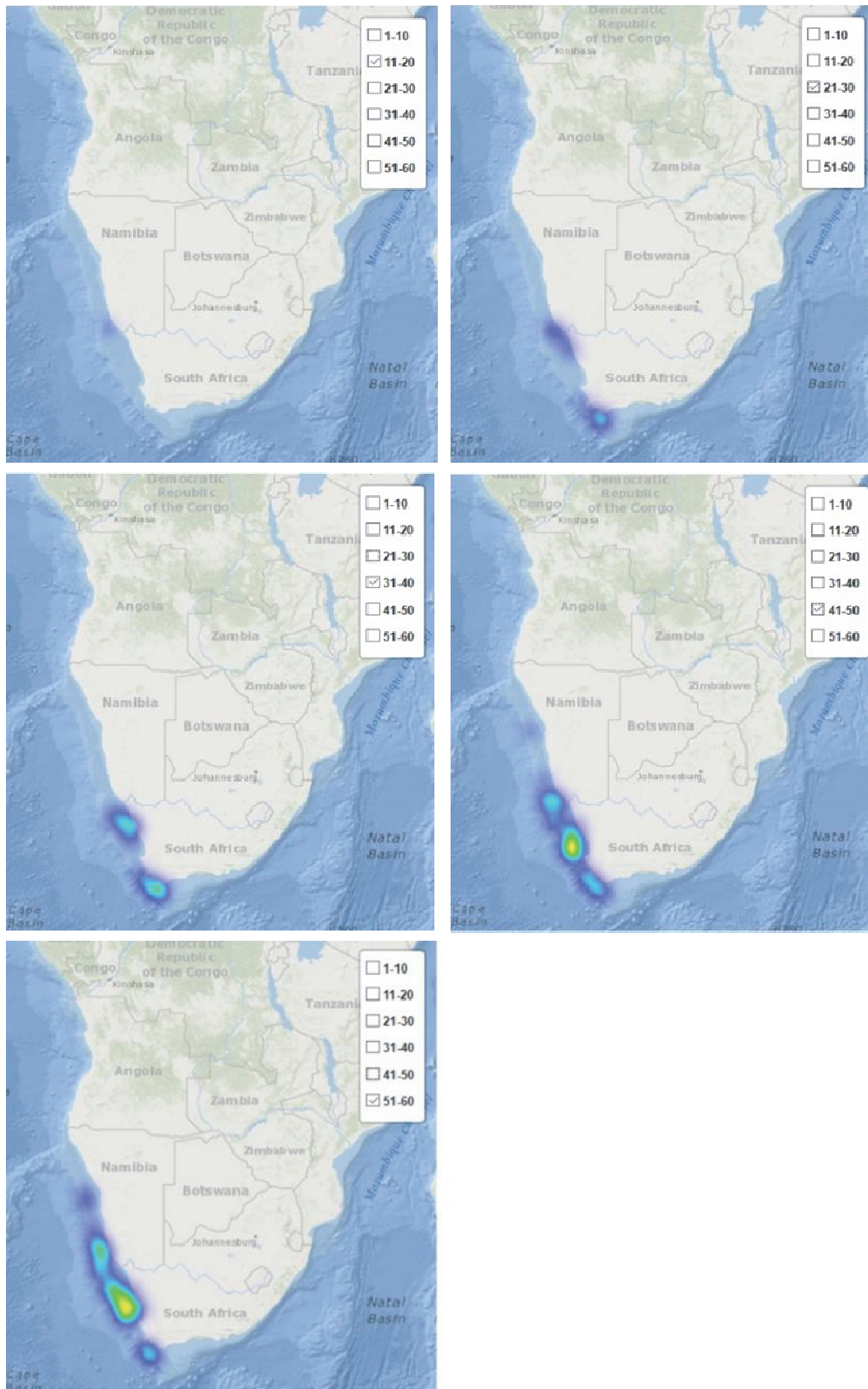


Figure 55. *Genypterus capensis* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

## 6.4 Monk

Monk seems to have a continuous distribution from Cape Town to northern Namibia, although a lower density around the Lüderitz upwelling cell could indicate some stock separation (Figure 56).

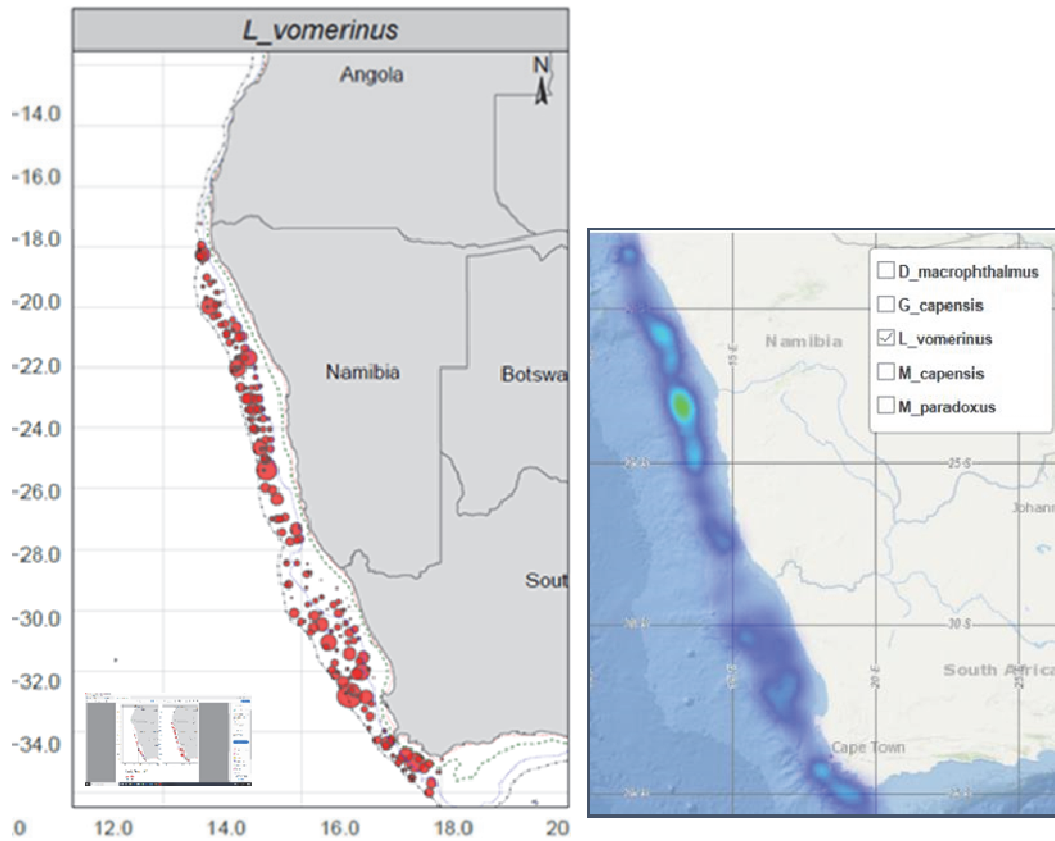


Figure 56. Distribution map for *Lophius vomerinus* showing trawl catch rates (CPUE) in tonnes/NM<sup>2</sup> (left panel) and as a density heat-map (right panel)

When the data are presented in 10 cm length-classes (Figure 57) two possible zones of recruitment seem to be present; one in central Namibia and a second off the South African West coast (upper two panels). These expand as the fish mature, with monk greater than 31 cm found throughout the Namibian and South African coasts. Whether this expansion of range results in a mixing of fish from these two recruitment areas, and hence this represents a single stock, is of course unknown. As this has consequences for management of this species further investigation should be undertaken.



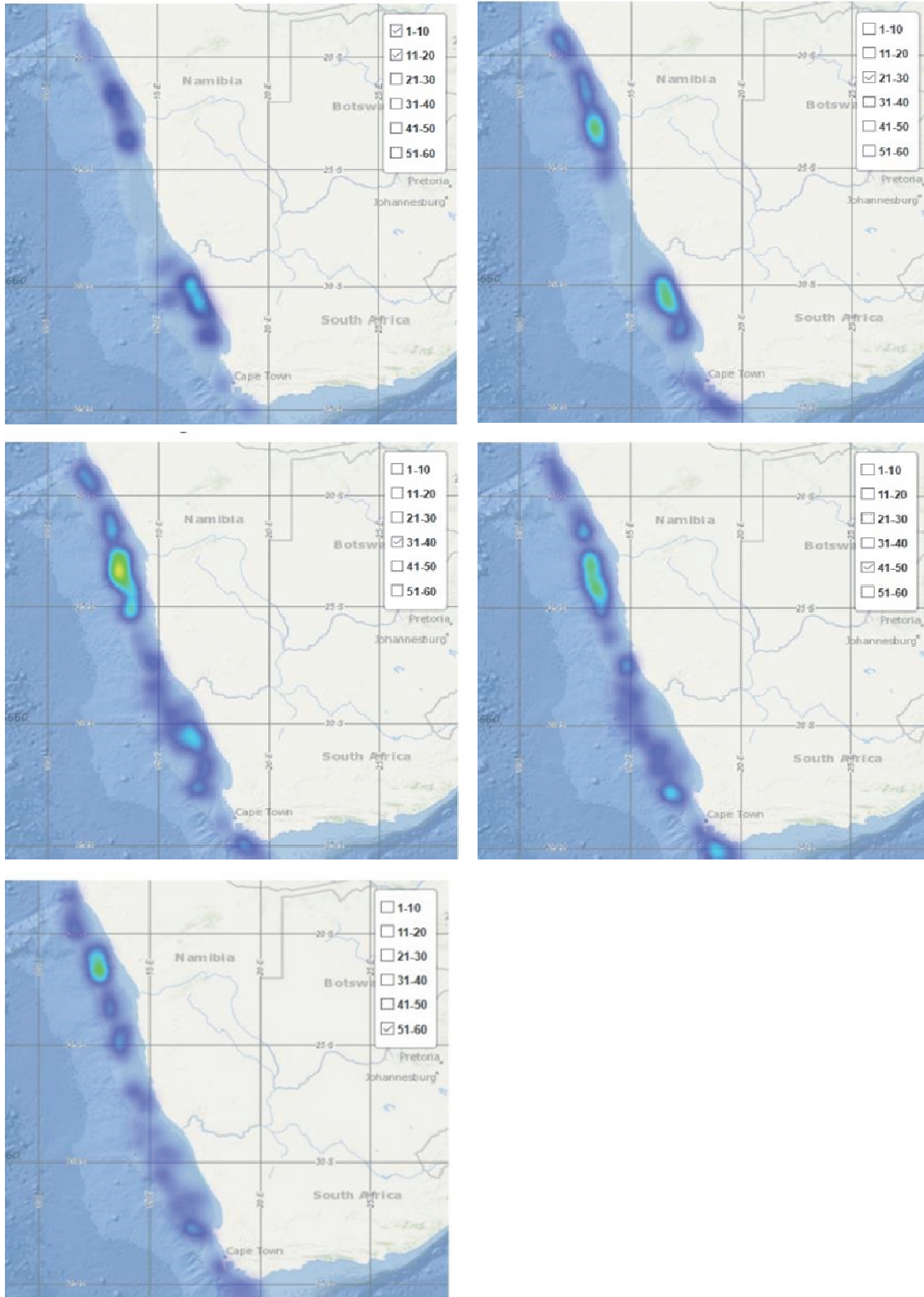


Figure 57. *Lophius vomerinus* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

## 6.5 Dentex

The large-eye dentex (*Dentex macrophthalmus*) occurred from the coastline up to 300 m along the Angolan coast as far north as Luanda. The highest concentration was observed in the southernmost part of Angola and northern Namibia, indicating that the species is not only typical of the Benguela System, but clearly has a transboundary distribution (Figure 58).

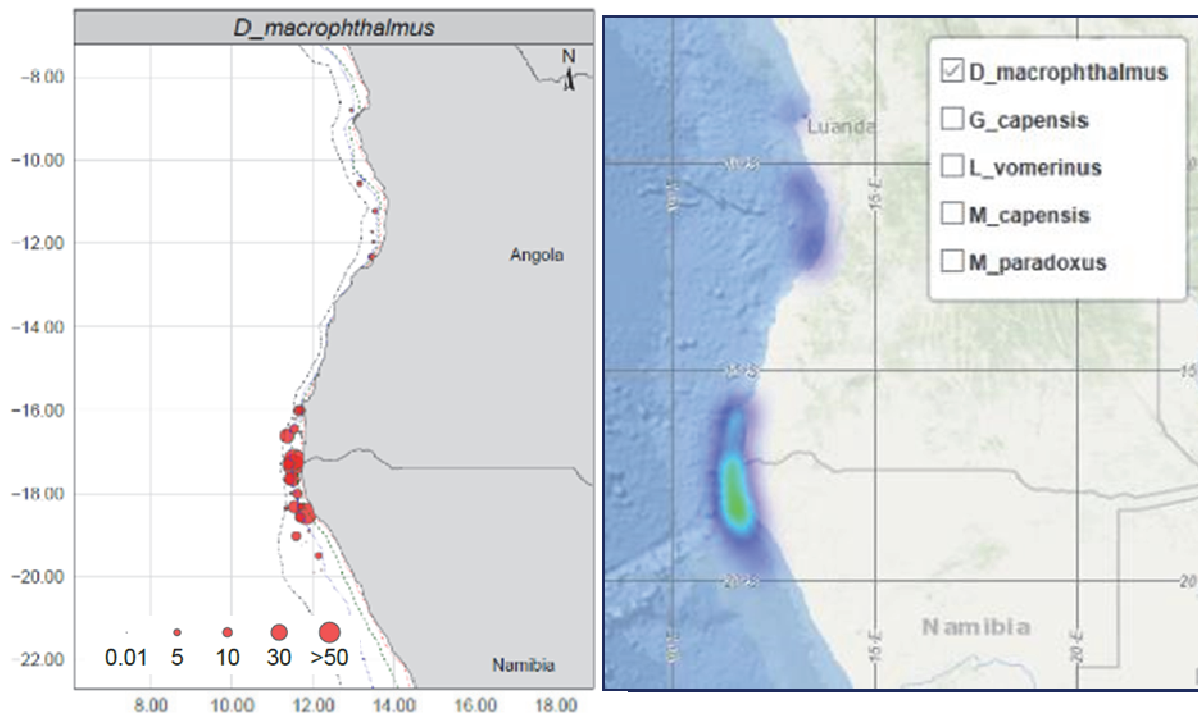


Figure 58. Distribution map for *Dentex macrophthalmus* showing trawl catch rates (CPUE) in tonnes/NM<sup>2</sup> (left panel) and as a density heat-map (right panel)

The CPUE data are presented in 5 cm length-classes (Figure 59, note that other species are presented in 10 cm length-classes). The smallest fish, less than 15 cm (upper left and central panels) were only observed in northern Namibia and the southern part of Angola. As the fish became larger greater and greater densities occurred in central Angola, and less in southern Angola and northern Namibia (top right panel and left and central panels in middle row). Virtually all the fish occurred off central Angola by the time they had reached 31 cm, although at a low density.

This pattern could indicate that the northern part of the Namibian coast and southern Angola is a nursery area for *Dentex*, with larger fish migrating northwards as they grow. These data do not suggest that large fish return southwards to spawn in the nursery area. Further analysis of these and other data are needed to investigate how the young fish arrive at the nursery area.

Large-eyed dentex is an important target fish species for the artisanal and industrial fisheries of Angola. If Namibia were to start encouraging harvesting of dentex, this could have an important impact on the sustainability of this transboundary stock. Hence understanding the dynamics of any possible cross-border movements is important.

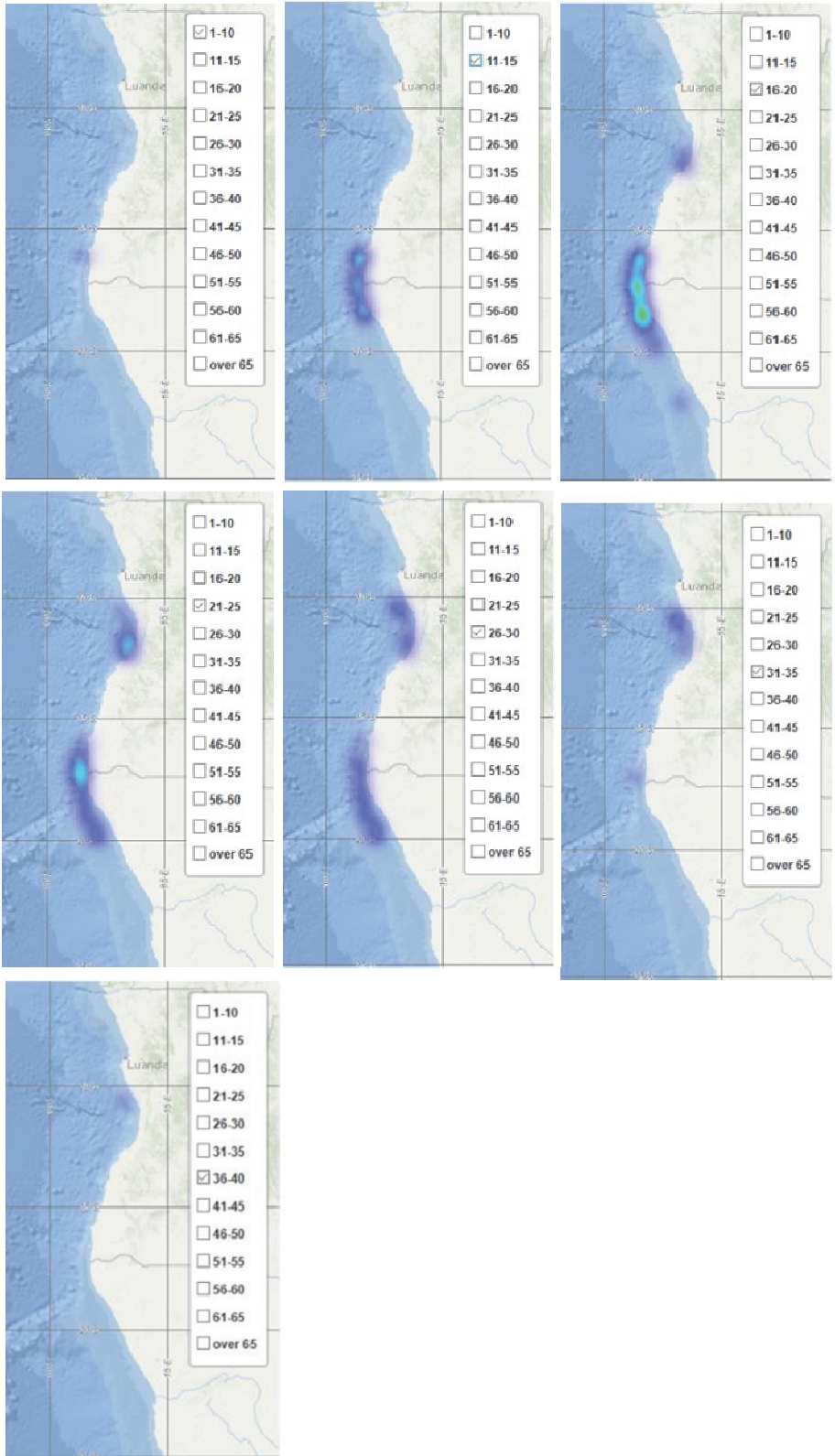


Figure 59. *Dentex macrophthalmus* distribution in 5 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

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## ANNEX I. CTD BOTTLE DEPTHS AT SUPER STATIONS

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Shallow stations depth ≈ 30 m	Intermediate stations depth ≈ 100 m	Deep stations depth ≈ 500 m
25	100	500
5	75	400
*FLU max	50	300
	25	200
	5	150
	*FLU max	100
		75
		50
		25
		5
		*FLU max

## ANNEX II. CTD CONTROL LIST

Stn No.	Date			Start time UTC		Start position				Depth (m)	Notes
	Year	Month	Day	Hour	Min	Lat	Long	Long			
208	2019	4	6	12	14	26	2.24	14	28.79	195	Trawl 1 - test station en route to start
209	2019	4	7	5	50	28	0.24	15	41.19	37	Marek CTD - Panther Head transect
210	2019	4	7	6	39	28	2.71	15	36.46	92	Marek CTD - Panther Head transect
211	2019	4	7	7	59	28	6.46	15	27.17	110	Marek CTD - Panther Head transect
212	2019	4	7	9	13	28	10.41	15	18.68	132	Marek CTD - Panther Head transect
213	2019	4	7	9	55	28	12.22	15	14.43	151	Marek CTD - Panther Head transect
214	2019	4	7	10	58	28	14.95	15	7.82	178	Marek CTD - Panther Head transect
215	2019	4	7	12	21	28	19.28	14	58.28	184	Marek CTD - Panther Head transect
216	2019	4	7	13	35	28	22.14	14	51.42	193	Marek CTD - Panther Head transect
217	2019	4	7	14	32	28	24.67	14	45.30	205	Marek CTD - Panther Head transect
218	2019	4	7	15	39	28	27.50	14	38.73	175	Marek CTD - Panther Head transect
219	2019	4	7	16	38	28	30.09	14	32.83	174	Marek CTD - Panther Head transect
220	2019	4	7	17	31	28	32.77	14	27.26	306	Marek CTD - Panther Head transect
221	2019	4	7	18	22	28	34.05	14	23.47	431	Marek CTD - Panther Head transect
222	2019	4	7	19	12	28	35.70	14	20.00	548	Marek CTD - Panther Head transect
223	2019	4	7	20	6	28	37.29	14	16.46	670	Marek CTD - Panther Head transect
224	2019	4	7	23	43	28	10.24	14	25.13	675	Marek CTD - Channel transect
225	2019	4	8	0	38	28	10.90	14	27.06	572	Marek CTD - Channel transect
226	2019	4	8	1	24	28	11.41	14	28.41	512	Marek CTD - Channel transect
227	2019	4	8	2	12	28	12.21	14	30.72	415	Marek CTD - Channel transect



Stn No.	Date			Start time UTC		Start position				Depth (m)	Notes
	Year	Month	Day	Hour	Min	Lat		Long			
228	2019	4	8	2	49	28	12.70	14	31.99	348	Marek CTD - Channel transect
229	2019	4	8	3	13	28	12.81	14	32.28	310	Marek CTD - Channel transect
230	2019	4	8	3	38	28	12.90	14	32.62	291	Marek CTD - Channel transect
231	2019	4	8	4	3	28	13.06	14	33.13	274	Marek CTD - Channel transect
232	2019	4	8	4	25	28	13.14	14	33.26	276	Marek CTD - Channel transect
233	2019	4	8	4	54	28	13.38	14	34.04	184	Marek CTD - Channel transect
234	2019	4	8	5	22	28	13.79	14	35.13	184	Marek CTD - Channel transect
235	2019	4	8	9	39	28	16.42	15	10.08	174	Trawl 2
236	2019	4	8	12	0	28	26.30	14	50.43	191	Trawl 3
237	2019	4	8	16	7	28	30.84	14	40.19	175	Trawl 4
238	2019	4	8	19	60	28	38.20	14	21.49	483	Trawl 5
239	2019	4	8	23	47	28	43.52	14	19.07	583	Trawl 6
240	2019	4	9	3	28	29	1.00	14	44.94	227	Trawl 7 - Marek CTD - Orange Bank repeat
241	2019	4	9	6	51	28	59.38	14	53.52	191	Marek CTD - Orange Bank repeat
242	2019	4	9	8	38	28	54.35	15	5.65	172	Marek CTD - Orange Bank repeat
243	2019	4	9	9	26	28	50.94	15	9.33	167	Trawl 8 - Marek CTD - Orange Bank repeat
244	2019	4	9	12	5	28	45.06	15	16.97	164	Trawl 9 - Marek CTD - Orange Bank repeat
245	2019	4	9	14	12	28	37.54	15	25.16	185	Marek CTD - Orange Bank repeat
246	2019	4	9	17	4	28	31.03	15	33.12	165	Trawl 10
247	2019	4	9	21	51	28	40.00	16	12.04	103	MFMR Orange River
248	2019	4	10	3	42	28	49.38	15	53.12	160	Trawl 11

Stn No.	Date			Start time UTC		Start position				Depth (m)	Notes
	Year	Month	Day	Hour	Min	Lat		Long			
249	2019	4	10	9	1	28	59.37	15	39.82	182	Trawl 12
250	2019	4	10	12	18	29	16.98	15	11.59	192	Trawl 13
251	2019	4	10	19	32	29	31.84	14	37.39	411	Trawl 14
252	2019	4	10	22	34	29	8.97	14	25.86	514	Trawl 15
253	2019	4	11	1	28	29	10.32	14	31.69	353	Trawl 16
254	2019	4	11	8	46	28	23.35	14	26.04	440	Trawl 17
255	2019	4	11	10	59	28	21.21	14	24.41	516	Trawl 18
256	2019	4	11	14	6	27	59.95	14	36.01	575	Super-station 04 - 28° line
257	2019	4	11	16	44	27	59.95	14	48.08	208	MOM 28° line
258	2019	4	11	18	14	28	0.04	15	0.97	188	Super-station 03 - 28° line
259	2019	4	11	20	31	27	59.90	15	12.92	153	MOM 28° line
260	2019	4	11	21	60	28	0.01	15	25.47	153	Super-station 02 - 28° line
261	2019	4	11	23	42	28	0.02	15	34.02	89	MOM 28° line
262	2019	4	12	0	36	28	0.06	15	40.92	36	Super-station 01 - 28° line
263	2019	4	12	4	47	27	36.50	15	14.03	133	Trawl 19
264	2019	4	12	8	11	27	34.78	15	4.07	171	Trawl 20
265	2019	4	12	10	54	27	36.84	14	56.44	273	Trawl 21
266	2019	4	12	13	46	27	38.57	14	47.72	343	Trawl 22
267	2019	4	12	17	13	27	41.31	14	32.93	461	Trawl 23
268	2019	4	12	20	14	27	43.34	14	30.55	552	Trawl 24
269	2019	4	12	23	28	27	44.72	14	30.86	575	Trawl 25

Stn No.	Date			Start time UTC		Start position				Depth (m)	Notes
	Year	Month	Day	Hour	Min	Lat		Long			
270	2019	4	13	4	33	27	16.60	14	54.83	196	Trawl 26
271	2019	4	13	8	50	27	17.60	14	46.38	290	Trawl 27
272	2019	4	13	11	52	27	20.11	14	36.58	345	Trawl 28
273	2019	4	13	15	11	27	22.69	14	18.77	447	Trawl 29
274	2019	4	13	18	13	27	23.43	14	14.35	552	Trawl 30
275	2019	4	13	21	23	27	21.35	14	13.26	522	Trawl 31
276	2019	4	14	0	37	26	58.86	13	54.93	511	Super-station 03 - 27° line
277	2019	4	14	7	2	26	58.20	14	6.16	414	Trawl 33 - 27° line
278	2019	4	14	9	39	26	57.70	14	11.54	395	Trawl 34 - 27° line
279	2019	4	14	12	48	26	54.51	14	21.32	357	Trawl 35 - 27° line
280	2019	4	14	14	9	26	53.10	14	31.92	299	Super-station 02 - 27° line
281	2019	4	14	17	49	26	51.92	14	43.28	224	Trawl 36 - 27° line
282	2019	4	14	20	36	26	47.54	14	53.17	163	Trawl 37 - 27° line
283	2019	4	14	22	11	26	45.66	15	3.97	53	Super-station 01 - 27° line
284	2019	4	15	6	18	26	21.03	14	40.92	173	Trawl 38
285	2019	4	15	10	34	26	16.50	14	24.93	220	Trawl 39
286	2019	4	15	14	36	26	0.20	14	17.07	223	Trawl 40 - 26° line
287	2019	4	15	17	38	25	59.53	14	28.08	194	Trawl 41 - 26° line
288	2019	4	15	18	32	26	0.05	14	33.57	185	Super-station 01 - 26° line
289	2019	4	15	22	22	26	0.03	14	7.54	283	Super-station 02 - 26° line
290	2019	4	16	2	42	25	59.92	13	56.46	346	Trawl 42 - 26° line

Stn No.	Date			Start time UTC		Start position				Depth (m)	Notes
	Year	Month	Day	Hour	Min	Lat		Long			
291	2019	4	16	6	32	25	55.51	13	39.43	522	Super-station 03 + Trawl 43 - 26° line
292	2019	4	16	13	36	26	21.04	14	6.47	354	Trawl 44
293	2019	4	17	6	29	25	0.10	14	45.89	42	Super-station 01 - 25° line
294	2019	4	17	8	35	25	0.00	14	31.93	104	MOM CTD - 25° line
295	2019	4	17	10	11	24	59.96	14	17.04	156	Super-station 02 - 25° line
296	2019	4	17	12	24	25	0.00	14	3.03	180	MOM CTD - 25° line
297	2019	4	17	15	13	25	0.34	13	48.86	242	Trawl 45 - 25° line
298	2019	4	17	17	14	25	0.58	13	44.57	306	Trawl 46
299	2019	4	17	20	34	24	58.01	13	39.19	423	Trawl 47
300	2019	4	17	23	20	24	59.64	13	36.02	515	Trawl 48
301	2019	4	18	0	9	24	59.97	13	33.09	621	Super-station 03 - 25° line
302	2019	4	18	7	26	25	19.97	13	36.60	501	Trawl 50
303	2019	4	18	10	34	25	22.94	13	44.55	334	Trawl 51
304	2019	4	18	12	39	25	19.86	13	51.28	269	Trawl 52
305	2019	4	18	19	35	24	41.02	13	30.48	496	Trawl 53
306	2019	4	18	22	10	24	39.36	13	31.41	453	Trawl 54
307	2019	4	19	1	18	24	38.45	13	39.23	398	Trawl 55
308	2019	4	19	3	43	24	40.73	13	52.02	244	Trawl 56
309	2019	4	19	7	41	24	36.74	14	7.37	157	Trawl 57 (no catch -anoxic mud)
310	2019	4	19	12	2	24	20.58	14	0.36	202	Trawl 58
311	2019	4	19	16	36	24	19.78	13	40.82	325	Trawl 60

Stn No.	Date			Start time UTC		Start position				Depth (m)	Notes
	Year	Month	Day	Hour	Min	Lat		Long			
312	2019	4	19	20	31	24	19.66	13	24.40	381	Trawl 61
313	2019	4	20	2	50	24	0.02	13	12.00	509	Super-station 03 - 24° line
314	2019	4	20	8	53	23	59.74	13	16.88	348	Trawl 65 - 24° line
315	2019	4	20	11	45	23	59.59	13	24.18	294	Trawl 66 - 24° line
316	2019	4	20	14	41	23	59.61	13	35.76	275	Trawl 67 - 24° line
317	2019	4	20	18	1	23	59.35	13	50.98	239	Trawl 68 - 24° line
318	2019	4	20	20	37	23	59.92	14	2.55	194	Super-station 02 - 24° line
319	2019	4	20	22	5	23	59.92	14	14.08	120	MOM CTD - 24° Inshore stations
320	2019	4	20	23	38	23	59.97	14	25.37	49	MOM CTD - 24° inshore stations
321	2019	4	21	4	2	23	41.86	14	0.17	175	Super-station 01 - 24° line
322	2019	4	21	9	58	23	39.19	13	34.42	229	Trawl 71
323	2019	4	21	14	41	23	42.4	13	15.19	333	Trawl 72
324	2019	4	21	19	57	23	38.17	13	5.13	553	Trawl 75
325	2019	4	21	23	50	23	19.99	13	3.29	550	Trawl 76
326	2019	4	22	4	43	23	19.65	13	14.03	385	Trawl 78
327	2019	4	22	13	39	23	19.87	13	27.86	246	Trawl 80
328	2019	4	22	20	37	22	59.95	12	55.96	631	Super-station 03 - 23° line
329	2019	4	23	2	12	22	59.04	13	0.46	477	Trawl 83 - 23° line
330	2019	4	23	4	33	23	1.72	13	7.14	346	Trawl 84 - 23° line
331	2019	4	23	7	41	22	59.2	13	17.92	365	Trawl 85 - 23° line
332	2019	4	23	10	35	23	0.04	13	27.22	282	Trawl 86 - 23° line

Stn No.	Date			Start time UTC		Start position				Depth (m)	Notes
	Year	Month	Day	Hour	Min	Lat		Long			
333	2019	4	23	13	12	22	59.27	13	39.48	152	Super-station 02+Trawl 87 - 23° line
334	2019	4	23	15	33	22	59.97	13	48.01	148	MOM CTD - 23° line
335	2019	4	23	17	27	22	59.97	13	57.1	146	MOM CTD - 23° line
336	2019	4	23	18	48	23	0.02	14	6.08	127	Super-station 01 - 23° line

## ANNEX III. HYDROGRAPHY SENSORS AND WATER CHEMISTRY QUALITY ASSURANCE

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pH, chlorophyll- $\alpha$  and phaeopigment samples were measured in duplicates (or greater if a value appeared suspect). Total alkalinity samples were measured in triplicates.

Parameter	Sample count	Average Coefficient of Variation
pH	122	
Total alkalinity	122	
chlorophyll- $\alpha$	196	
Phaeopigments	196	

CTD dissolved oxygen and salinity value validity statistics

Parameter	Sample Count	Average Coefficient of Variation
Dissolved Oxygen	28	
Salinity	0	

CTD sensors

Type	Serial Number	Model	Calibration Date
Deck unit	11-1082	SBE 11plus	
Pressure sensor	127957	DigiQuartz	22.07.2013
Underwater unit	09P75372-1160	SBE 9plus 6800m	20.10.2018
Water sampler	32-0972	SBE 32 6800m	
Conductivity sensor	42037	SBE 4C 6800m	04.12.2018
Conductivity sensor	43080	SBE 4C 6800m	04.12.2018
Oxygen sensor	43-3087	SBE 43 7000m	21.07.2017
Submersible pump	52147	SBE 5T	2014
Submersible pump	054196	SBE 5T	

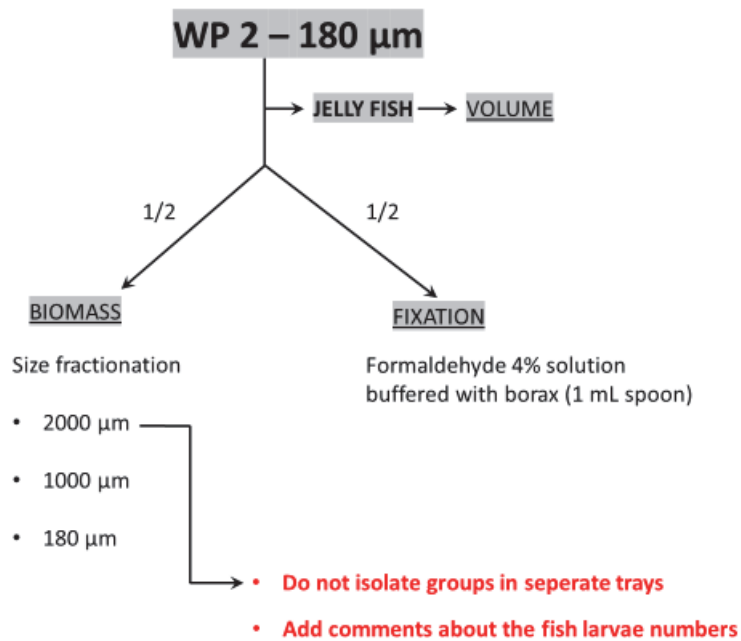
Type	Serial Number	Model	Calibration Date
Temperature sensor	31602	SBE 3plus 6800m	18.12.2018
Temperature sensor	03P4537	SBE 3plus 6800m	18.12.2018
Fluorometer	4892	WET Labs ECO-AFL fluorometer	08.11.2017
Sonar Altimeter	1186	Benthos PSA-916	08.2005
Par sensor	1123	PAR-LOG ICSW	12.10.2017

#### Thermosalinograph sensors

Type	Serial Number	Model	Calibration Date
Thermosalinograph	21-3418	SBE21	
Conductivity sensor	3418	SBE21	06.04.2016
Temperature sensor	3418	SBE21	06.04.2016
Temperature sensor	0880	SBE38	23.03.2016
Fluorometer	257S	9702011 WETStar	20.04.2015

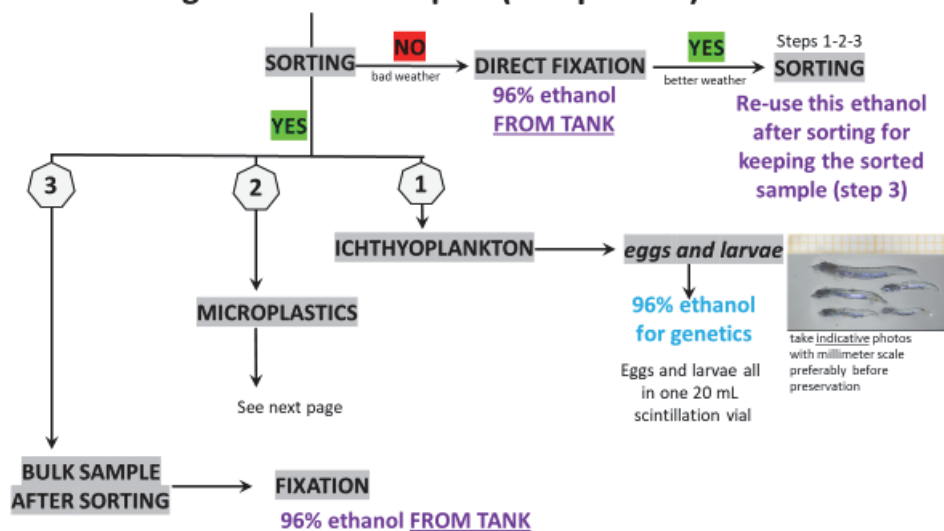


# ANNEX IV. OVERVIEW OF SAMPLING PROCEDURES IN THE PLANKTON LAB



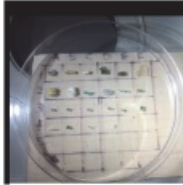
All manta samples should be sorted on board  
 Sorting of manta samples can be done even after preservation

## Processing of MANTA samples (335 μm net)



## Microplastics

- Put the sorted items in a small petri dish with **fresh water**
- Put a **lid (labelled with station number)** and keep it safe until processing (you may do it the day after)
- Place the items on a gridded petri dish
- Take a photo of the entire dish with the **millimeter paper** below
- Measure the dimensions of each item and fill the logsheet
- Pour all items in the aluminum tray with fresh water
- Put the tray in the oven 60° to dry (away from the fan)
- Cover **individually** each tray with aluminum foil and put it in the box in freezer



LOGSHEET FOR MICROPLASTICS (MANTA TRAWL)

Name: \_\_\_\_\_

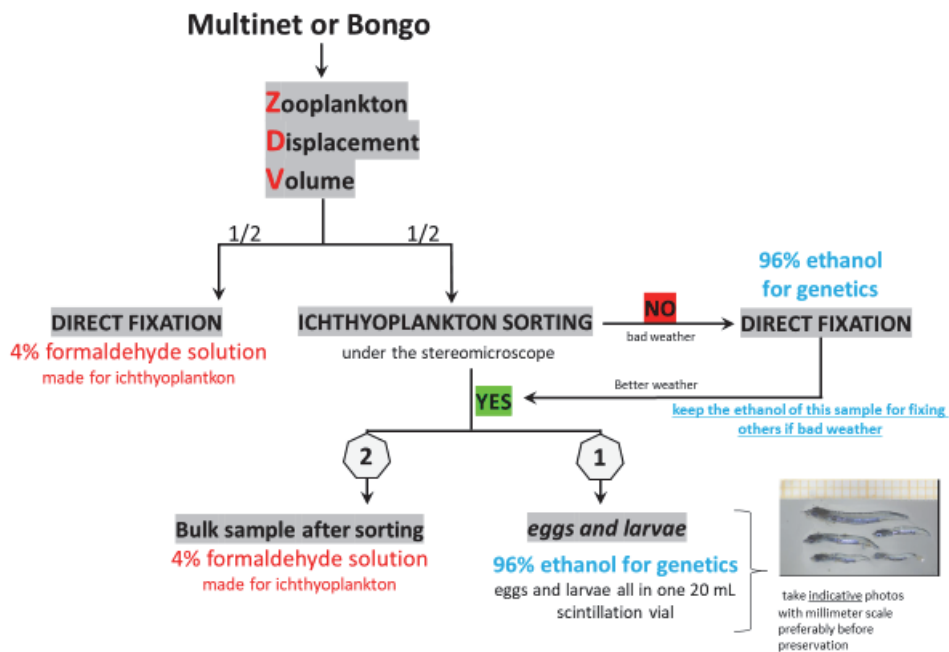
Date: \_\_\_\_\_

Station: \_\_\_\_\_

No.	Position	Colour	Length (mm)	Width (mm)	Shape (mm)	Remarks	Comments
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TOTAL OF MICROPLASTICS: \_\_\_\_\_ NUMBER OF AL. TRAYS: \_\_\_\_\_

## Processing of ichthyoplankton samples (405 µm net)



## Zooplankton Displacement Volume (ZDV)

- Pour the sample into a 250 or 500 ml graduated cylinder (depending on the volume of plankton present)
- Fill up the cylinder with **sea water** up to max (250 or 500 mL)
- Pour the sample through a 180 um sieve, and collect the sea water in a second cylinder to measure its volume

*Allow the sample to drain well before measuring the volume of water!*  
*Do not add extra water to rinse plankton any remainings in the cylinder!*

- The difference between the two volume measurements is the Zooplankton Displacement Volume. Note it down in the comments of the sampling logsheet
- **Collect all the zooplankton**, both from the seive and the remainings in the first cylinder and continue with the SAMPLE PROCESSING

## ANNEX V. DESCRIPTION OF ACOUSTIC INSTRUMENTS AND FISHING GEAR

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### Acoustic instruments

The Simrad EK80/18, 38, 70,120, 200 and 333 kHz scientific sounder was run during the survey. Scrutinizing was done in LSSS using the data from the 38-kHz transducer. Last standard sphere calibrations were checked on the 23.01.2017 in Sandviksflaket, Bergen, Norway using Cu64 for the 18 kHz, Cu60 for the 38 kHz, WC38.1 for the 70, 120 and 200 kHz, and the WC22 for the 333 kHz. The details of the settings for the 38-kHz echo sounder were as follows:

#### Transceiver2 menu (38 kHz)

Transducer depth	5 8 m
Absorption coeff.	8.3 dB/km
Pulse duration	medium (1,024ms)
Bandwidth	2.43 kHz
Max power	2000 Watt
2way beam angle	20,6dB
Gain	26,95 dB
SA correction	0.03 dB
Angle sensitivity	21.9
3 dB beamwidth	6.22° along ship 6.28 athwart ship
Alongship offset	0.10°
Athwardship offset	0.06°
Bottom detection menu	Minimum level 50 dB

## **Fishing gear**

The vessel has one small four-panel Åkrahamn pelagic trawl, one MultPelt 624 trawl (Figure V.1, new in 2017) and one 'Gisund super bottom trawl'. The Gisund trawl was the only gear used during the survey.

The bottom trawl has a 31-m headline and a 47-m footrope fitted with a 12" rubber bobbins gear. The codend has 20 mm meshes, and has an inner net with 10 mm mesh size. The vertical opening is about 5.5 m. The distance between the wing tips is about 18 m during towing. The sweeps are 40 m long. The trawl doors are 'Thyborøen' combi, 8 m<sup>2</sup> and weigh 2 000 kg. The door spreading is about 45 m when using restraining rope. Trawling was conducted for species identification only and no restraining rope was therefore used during the survey.

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

The all 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.

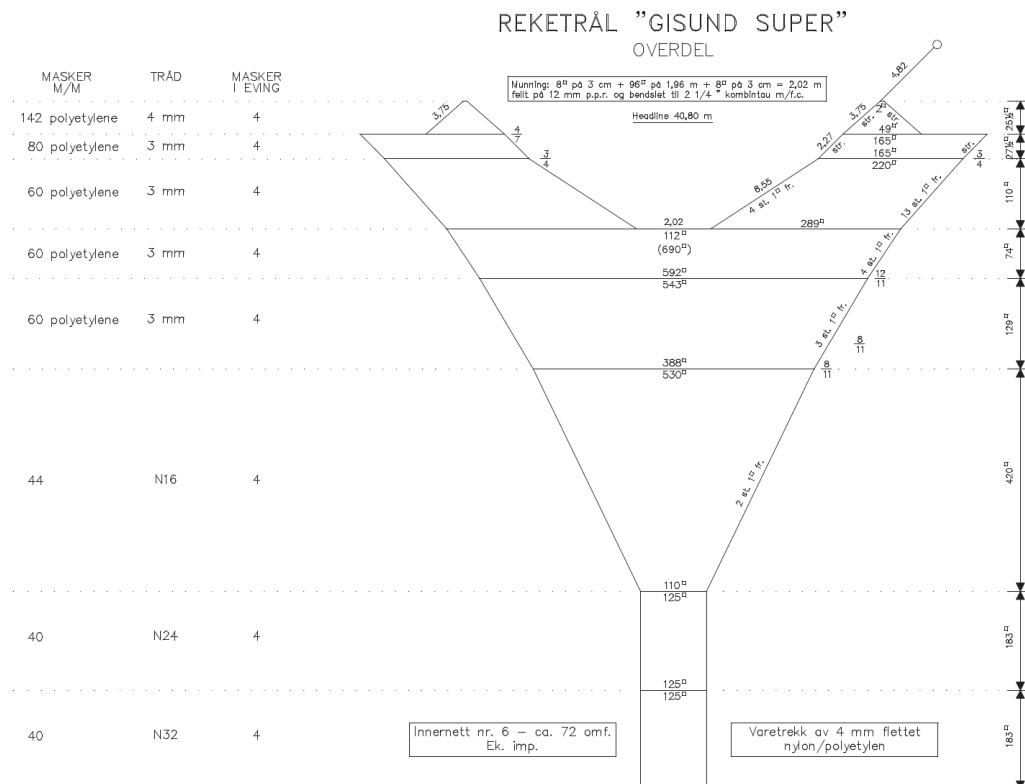
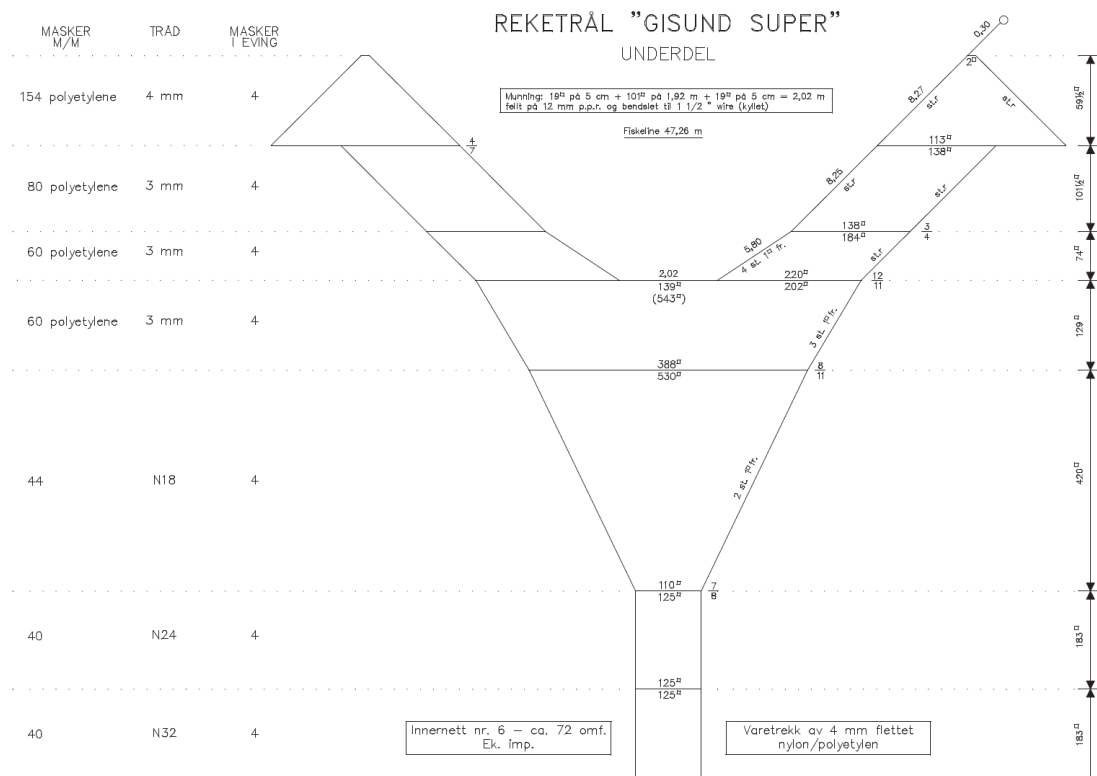


Figure V.1. Schematic drawing of the Super Gisund bottom trawl

**ANNEX VI. SUMMARY OF TRAWL STATIONS, CATCHES AND OCCURRENCE OF FISH ABOVE THE TRAWL HEADROPE**

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
1		28 40	16 12	99					Untrawlable ground - not attempted	
Orange	11	28 51	15 53	165	10.04.2019	05:15	447 kg	74% hake, 3% Pel 1, 19% mycto, 4% other	No fish	
River	12	29 00	15 40	182	10.04.2019	08:18	488 kg	12% hake, 88% mycto	Very few hake	Meshes clogging with small fish, hauled after 15 mins  Cancelled - seismic boat at station
	13	29 16	15 11	197	10.04.2019	12:52	234 kg	45% hake, 9% Pel 2, 47% other	No fish	
	14	29 35	14 37	424	10.04.2019	18:31	142 kg	77% hake, 22% other, 1% mycto	No fish	
		29 40	14 33	530						
2		28 22	15 56	94						Untrawlable ground - not attempted
	10	28 33	15 33	173	09.04.2019	16:06	274 kg	60% hake, 29% other, 11% mycto	No fish	
	9	28 44	15 16	167	09.04.2019	12:35	140 kg	64% hake, 36% other	No fish	
	8	28 48	15 11	168	09.04.2019	10:26	239 kg	48% hake, 0.2% HM, 52% other	No fish	Bottom rough, moved 10 nm eastwards

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
	7	29 01	14 45	228	09.04.2019	04:45	204 kg	60% hake, 2% HM, 38% other	Very few hake	Untrawlable ground - not attempted
	15	29 10	14 26	518	10.04.2019	23:32	107 kg	100% hake	No fish	
	16	29 09	14 30	359	11.04.2019	02:11	194 kg	100% hake	No fish	
		29 13	14 25	598						
3		27 58	15 32	87						
Panther	2	28 16	15 07	179	08.04.2019	08:46	242 kg	59% hake, 13% other, 29% meso	No fish	
Head	3	28 25	14 50	194	08.04.2019	12:30	271 kg	50% hake, 12% HM, 38% other	No fish	
	4	28 33	14 40	172	08.04.2019	15:13	567 kg	10% hake, 61% HM, 29% other	No fish	
	5	28 40	14 22	465	08.04.2019	18:57	104 kg	56% hake, 44% other	No fish	
	6	28 46	14 19	570	09.04.2019	22:35	104 kg	16% hake, 86% other	No echodata below 500 m	
	17	28 25	14 26	436	11.04.2019	07:45	255 kg	97% hake, 2% other, 1% mycto	No fish	
	18	28 23	14 24	492	11.04.2019	09:25	180 kg	98% hake, 2% mycto	No fish	
4	19	27 35	15 13	133	12.04.2019	05:17	302 kg	48% hake, 2% Pel 1, 20% Pel 2, 30% meso	No fish	
	20	27 37	15 04	171	12.04.2019	07:48	228 kg	74% hake, 2% Pel 1, 2% Pel 2, 1% HM, 23% meso	No fish	



Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
	21	27 38	14 56	269	12.04.2019	09:53	275 kg	79% hake, 12% Pel 2, 2% other, 4% meso	No fish	
	22	27 40	14 48	354	12.04.2019	12:41	643 kg	83% hake, 14% other, 3% meso	No fish	
	23	27 43	14 33	474	12.04.2019	16:12	99 kg	91% hake, 9% meso	No fish	
	24	27 45	14 32	540	12.04.2019	19:14	113 kg	90% hake, 10% meso	No echodata below 500 m	
	25	27 47	14 32	585	12.04.2019	22:20	129 kg	97% hake, 3% meso		
5		27 14	14 59	172						Untrawable ground - not attempted
	26	27 15	14 54	201	13.04.2019	05:09	468 kg	62% hake, 10% Pel 2, 28% meso	No fish	
	27	27 20	14 48	292	13.04.2019	07:50	1019 kg	99% hake, 1% meso	No fish	
	28	27 22	14 38	343	13.04.2019	10:52	500 kg	97% hake, 3% meso	No fish	
	29	27 24	14 20	449	13.04.2019	14:06	184 kg	94% hake, 6% meso	No fish	
	30	27 25	14 16	549	13.04.2019	17:06	124 kg	92% hake, 8% meso	No echodata below 500 m	
	31	27 21	14 11	579	13.04.2019	20:14	117 kg	92% hake, 8% meso	No echodata below 500 m	
6	37	26 50	14 54	160	14.04.2019	19:43	315 kg	31% hake, 67% meso, 2% Pel2	Small fish, probably gobies	Hauled early, large swell and rough bottom - trawl hopping
Lüderitz	36	26 53	14 44	220	14.04.2019	17:08	363 kg	48% hake, 52% meso	No fish	Trawl hopping on

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
	35	26 57	14 23	353	14.04.2019	11:46	669 kg	74% hake, 25% meso, 1% other	Very little fish, probably meso	bottom, hauled early
	34	27 00	14 13	397	14.04.2019	08:39	213 kg	98% hake, 2% other	No fish	
	33	27 00	14 08	413	14.04.2019	05:57	545 kg	99%hake, 1% other	No fish	
	32	27 00	13 55	522	14.04.2019	02:48	90 kg	94% hake, 6% meso	No echodata below 500 m	
7		26 40	14 22	335						Untrawlable ground - not attempted
		26 40	14 10	378						Untrawlable ground - not attempted
		26 40	14 01	407						Cancelled - rough bottom, bad weather & lack of time
		26 40	13 45	459						Cancelled - rough bottom, bad weather & lack of time
		26 40	13 40	547						Cancelled - rough bottom, bad weather & lack of time
8	38	26 19	14 41	172	15.04.2019	05:21	565 kg	77% hake, 0.2% HM, 23% meso	Small fish, probably gobies	
	39	26 15	14 25	217	15.04.2019	09:41	2557 kg	81% hake, 19% meso	Small fish,	

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
	44	26 20	14 06	352	16.04.2019	12:39	606 kg	96% hake, 2% meso, 1% other	probably gobies Small fish	Trawled, but bad weather, gear unstable Cancelled - to Lüderitz for medical emergency Cancelled - to Lüderitz for medical emergency Cancelled - to Lüderitz for medical emergency
		26 20	13 55	378						
		26 20	13 40	484						
		26 16	13 39	507						
9	41	26 01	14 28	196	15.04.2019	18:29	590 kg	24% hake, 2% HM, 62% meso	Small fish, probably gobies	
	40	26 02	14 18	214	15.04.2019	13:38	2000 kg	8% hake, 92% meso	Small fish, probably gobies	Untrawlable ground - not attempted
		26 00	14 11	261						
	42	26 02	13 57	343	16.04.2019	01:33	1000 kg	32% hake, 1% meso, 67% other	No fish	10t of rocks and sea urchins
	43	25 58	13 41	494	16.04.2019	05:24	289 kg	88% hake, 12% meso	No fish	SS2603 moved from Tr 44 to this position
		26 00	13 39	550						Bottom bad, previous trawls damaged, so cancelled
10		25 40	14 25	167						Untrawlable ground - not

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
Dolphin		25 36	13 45	346					attempted	
Head		25 40	13 40	421					Untrawlable ground - not attempted	
		25 40	13 36	528					Cancelled - rough bottom, bad weather & lack of time	
		25 40	13 33	636					Untrawlable ground - not attempted	
11		25 21	14 25	148					Untrawlable ground - not attempted	
Easter		25 20	14 02	204					Untrawlable ground - not attempted	
Point	52	25 21	13 52	268	18.04.2019	11:55	1015 kg	57% hake, 19% HM, 24% meso	No fish	
	51	25 22	13 44	355	18.04.2019	09:46	658 kg	63% hake, 31% other, 6% meso	Small fish, probably myctophids	
	50	25 22	13 37	478	18.04.2019	06:26	133 kg	44% hake, 49% meso, 7% other	No fish	
		25 20	13 34	588					Untrawlable ground - not attempted	

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
12		25 00	14 11	160					Untrawlable ground - not attempted	
		25 00	13 56	184					Untrawlable ground - not attempted	
	45	25 02	13 49	230	17.04.2019	14:12	677 kg	79% hake, 12% meso, 2% other, 7% HM	Small fish, probably gobies 1 t hake, HM	
	46	25 02	13 45	298	17.04.2019	16:27	2038 kg	88% hake, 11% other, 1% meso	Small fish, probably gobies 2 t mostly bottom sediments - trawl should not be valid	
	47	25 00	13 40	399	17.04.2019	19:35	391 kg	79% hake, 15% other, 6% meso	No fish	
	48	25 01	13 36	511	17.04.2019	22:26	574 kg	99% hake, 1% other	No echodata below 500 m	
	49	25 00	13 33	614	18.04.2019	02:27	755 kg	89% hake, 11% other, meso 0.3%	No echodata below 500 m 1 t mostly bottom sediments- trawl should not be valid	
13	57	24 38	14 07	158	19.04.2019	08:49		Small fish, probably gobies	Trawl abandoned after 4 minutes - mud, shells, jellies	
Hottentot	56	24 41	13 52	245	19.04.2019	04:34	1561 kg	95% hake, 3% meso, 2% other	Few small fish	
Point	55	24 39	13 41	390	19.04.2019	00:23	265 kg	86% hake, 13% other, 1% meso	Few large fish, probably hake	

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
	54	24 41	13 33	444	18.04.2019	21:10	259 kg	84% hake, 13% other, 3% meso	Few large fish, probably hake	
	53	24 39	13 29	498	18.04.2019	18:28	407 kg	70% hake, 18% meso, 12% other	Few large fish, probably hake	
14	58	24 22	14 00	197	19.04.2019	11:11	3341 kg	22% hake, 78% meso	No fish	Catch dominated by jellies - trawl should not be valid 2.5 t jellies, trawl hauled after 20 minutes
	59	24 21	13 53	280	19.04.2019	13:23	4345 kg	90% hake, 8% other, 2% meso	Very small fish or plankton	
	60	24 22	13 41	332	19.04.2019	15:35	1278 kg	89% hake, 9% other, meso 2%	Few small fish	
	61	24 22	13 25	444	19.04.2019	19:28	203 kg	86% hake, 11% other, 3% meso	Few small fish	
	62	24 10	13 18	247	19.04.2019	23:16	496 kg	73% hake, 5% other, 22% meso	No fish	
15		24 00	14 06	164						Untrawlable ground - not attempted
Conception	68	24 01	13 50	246	20.04.2019	16:58	859 kg	96% hake, 2% meso, 2% other	Possibly some hake	
Bay	67	24 02	13 36	280	20.04.2019	13:39	1394 kg	92% hake, 8% other, few HM	Few fish, possibly some hake	
	66	24 02	13 25	296	20.04.2019	10:42	2052 kg	93% hake, 7% other, few HM, few meso	No fish	

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
	65	24 01	13 18	338	20.04.2019	07 48	994 kg	94% hake, 3% other, 3% meso	No fish	Untrawlable ground - not attempted
	64	24 00	13 13	461	20.04.2019	05:06	210 kg	84% hake, 6% other, 10% meso	No fish	
	63	24 00	13 12	496	20.04.2019	01:27	241 kg	63% hake, 9% other, 27% meso	No fish	
		24 00	13 09	633						
16	69	23 40	13 59	174	21.04.2019	04:41	1014 kg	7% hake, 91% HM, 1% meso	No fish	Untrawlable ground - not attempted
	70	23 41	13 48	192	21.04.2019	06:45	358 kg	35% hake, 55% HM, 9% meso, 2% other	No fish	
	71	23 41	13 35	228	21.04.2019	09:01	681 kg	56% hake, 10% other, 7% meso, 0.5% HM	No fish	
	72	23 42	13 25	271	21.04.2019	11:29	1150 kg	76% hake, 0.25% P2, 6% other, 1% meso	Some marks- small fish	
	73	23 39	13 15	337	21.04.2019	13:39	409 kg	75% hake, 23% other, 2% meso	Possibly some small hake	
	74	23 43	13 10	422	21.04.2019	16:01	396 kg	82% hake, 17% other, 1% meso	No fish	
	75	23 41	13 05	570	21.04.2019	18:37	473 kg	97% hake, 3% meso	No echodata below 500 m	
		23 40	13 04	620						

Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
									attempted	
17		23 20	13 46	160					Cancelled after trawl wires broke	
Sandwich	81	23 21	13 35	187	22.04.2019	15:04	352 kg	64% hake, 7% HM, 1% other, 28% meso	Some small fish	
Harbour	80	23 21	13 27	241	22.04.2019	12:40	1549 kg	92% hake, 3% HM, 4% other, 1% meso	Small number of small fish	
	79	23 21	13 19	336	22.04.2019	10:33	338 kg	79% hake, 0.1% HM, 18% other, 1% meso	Possibly a few hake	
	78	23 21	13 13	385	22.04.2019	03:38	355 kg	63% hake, 3% other, 2% meso, 2% Pel2	No echodata below 500 m	
	77	23 22	13 05	456	22.04.2019	01:22	182 kg	94% hake, 3% other, 3% meso	Very little, possibly hake	
	76	23 22	13 03	553	21.04.2019	22:44	378 kg	79% hake, 4% other, 17% meso	No fish	
		23 20	13 00	620					Untrawlable ground - not attempted	
18	87	23 01	13 39	155	23.04.2019	12:18	485 kg	22% hake, 0.1% HM, 78% meso	No fish	
Walvis	86	23 01	13 27	282	23.04.2019	09:34	709 kg	81% hake, 7% other, 1% meso	No fish	
Bay	85	23 01	13 18	366	23.04.2019	06:39	403 kg	92% hake, 6% other, 2% meso	Very little fish, probably hake	



Transect	Trawl No.	Start trawl					Total catch	Species composition of pelagic component	Acoustic marks above headrope	Comments
		Lat	Long	Depth	Date	UTC				
	84	22 56	13 06	333	23.04.2019	03:34	515 kg	55% hake, 44% other, 2% meso	Few fish, possibly some hake	Untrawlable ground - not attempted
	83	23 01	13 00	493	23.04.2019	01:10	213 kg	52% hake, 19% other, 29% meso	No fish	
	82	23 01	12 57	579	22.04.2019	23:01	662 kg	87% hake, 2% meso	No echodata below 500 m	
		23 00	12 54	668						

## ANNEX VII. BIOLOGY SCALES

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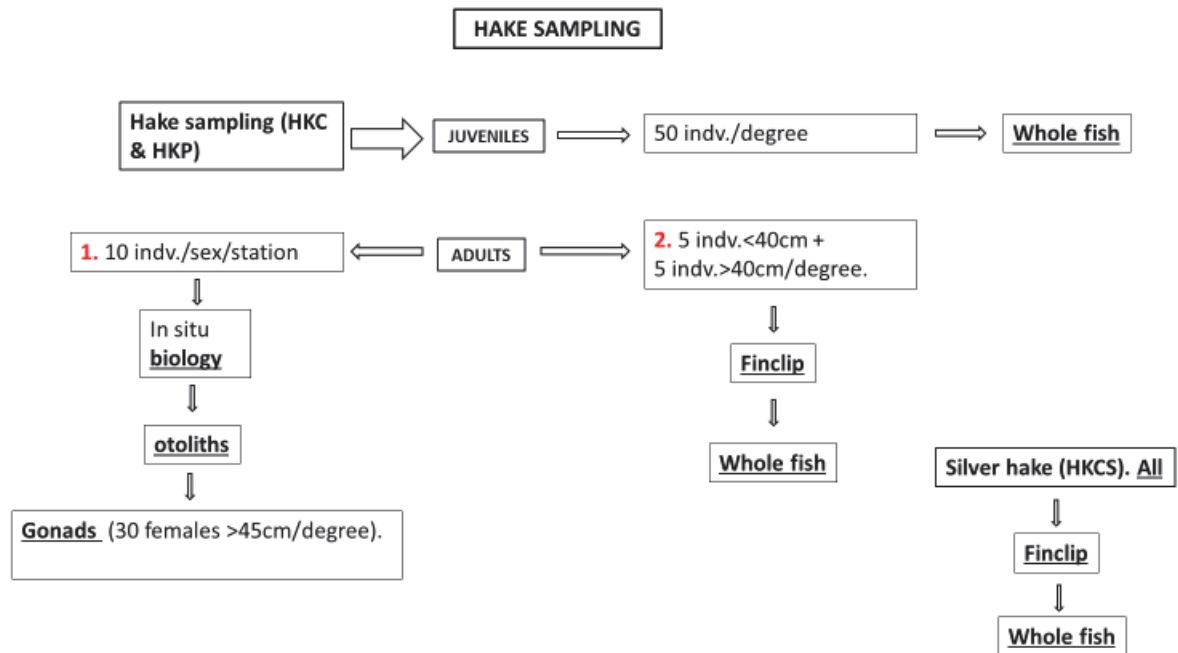
### Sexual maturity

Stage	State	Description
I	Immature	Ovary and testis about 1/3rd length of body cavity. Ovaries pinkish, translucent, testis whitish. Ova not visible to naked eye.
II	Maturing virgin and recovering spent	Ovary and testis about ½ length of body cavity. Ovary pinkish, translucent, testis whitish, symmetrical. Ova not visible to naked eye.
III	Ripening	Ovary and testis is about 2/3rds length of body cavity. Ovary pinkish yellow colour with granular appearance, testis whitish to creamy. No transparent or translucent ova visible.
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-creamy, soft.
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 flabby

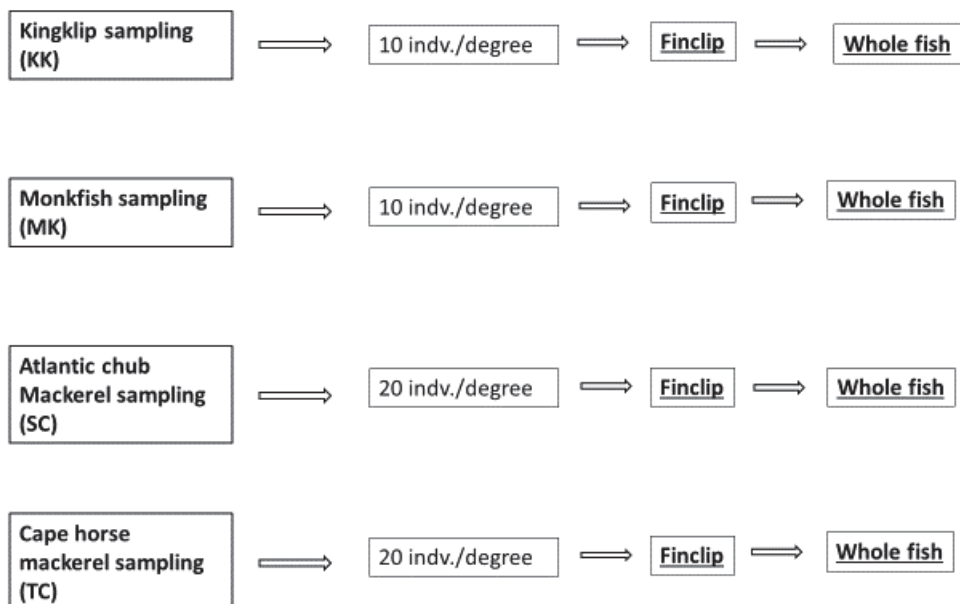
### Stomach contents

Scale	Designation	Description
0	Empty	Stomach empty except for water.
1	Very little content	Stomach is almost empty. Only traces of small organisms can be found.
2	Some content	Stomach not completely full and not dilated.
3	Stomach full	Stomach full, but not bloated/dilated.
4	Bloated/dilated	The stomach is visibly expanded and tight. Content can be observed from the outside.

## ANNEX VIII. OVERVIEW OF SAMPLING PROCEDURES IN THE FISH LAB



### OTHER SPECIES



## ANNEX IX. OVERVIEW OF SAMPLES AND INSTITUTIONS

	Analyses	Samples	Preservation	Port of offloading	Type of transport	Institution	Contact person	Deadline for analysis
Niskin bottles on CTD		Nutrients	0.2 ml chloroform (keep cool)			IMR		
Niskin bottles on CTD		Chlorophyll- $\alpha$	Frozen (-18 to -20 C, best -80)			IMR		
WP2 (180 $\mu$ m) from max 200 m 1/2 Split	Zooplankton biomass estimation	Aluminium trays	Dried and then frozen			IMR	Stamatina Isari	
WP2 (180 $\mu$ m) from max 200 m 1/2 Split	Zooplankton community identification	Bottles with 1/2 of bulk WP2 sample	4% formaldehyde	Walvis Bay	mail	NatMIRC	Richard Horaeb	September 2019
Multinet (Mammoth, 1 x 405 $\mu$ m), oblique tow from max 200 m 1/2 Split	Ichthyoplankton community identification	Bottles with 1/2 of bulk multinet sample	96% ethanol	Walvis Bay	mail	NatMIRC	Richard Horaeb/Josephine	September 2019
Multinet (Mammoth, 1 x 405 $\mu$ m), oblique tow from max 200 m	Ichthyoplankton community identification	Bottles with 1/2 of bulk multinet sample	4% formaldehyde	Walvis Bay	mail	NatMIRC	Richard Horaeb/Josephine	September 2019

	<b>Analyses</b>	<b>Samples</b>	<b>Preservation</b>	<b>Port of offloading</b>	<b>Type of transport</b>	<b>Institution</b>	<b>Contact person</b>	<b>Deadline for analysis</b>
1/2 Split		Scintillation vials with sorted ichthyoplankton from ½ of bulk multinet sample	4% formaldehyde	Walvis Bay	mail	NatMIRC	Richard Horaeb/Josephine	September 2019
Manta trawl (375 µm): surface tow for 15 mins	Ichthyoplankton community identification	Neuston community identification	70% ethanol	Walvis Bay	mail	UWC	Mark Gibbons	
	Species identification, Genetics	Scintillation vials with sorted ichthyoplankton from the bulk manta sample	96% ethanol			IMR	Stamatina Isari	
	Abundance and chemical composition of microplastics	Aluminium trays with sorted	Photographed, dried and frozen			IMR	Bjørn Einar Grøsvik,	

	<b>Analyses</b>	<b>Samples</b>	<b>Preservation</b>	<b>Port of offloading</b>	<b>Type of transport</b>	<b>Institution</b>	<b>Contact person</b>	<b>Deadline for analysis</b>
		microplastics from the bulk manta sample						
Trawl samples	Species identification	Jellyfish whole individual	Dried + frozen	Walvis Bay	Plane	UWC	Mark Gibbons	
Trawl samples	Genetic analyses?	Jellyfish arm	96% Ethanol + frozen	Walvis Bay	Plane	UWC	Mark Gibbons	
Trawl samples	??	Jellyfish the rest	4% formaldehyde	Walvis Bay	Plane	UWC	Mark Gibbons	
Trawl samples	Genetic analyses (stock identity)	Finclips juvenile hake	96% Ethanol	Walvis Bay	Plane	IMR Link to Romina's project	Geir/Maria	
Trawl samples (juvenile hake)	Morphometric analyses/otoliths/Stomachs/vertebrae	Whole specimens	frozen	Walvis Bay	Car	NatMIRC	Paul/Sarah/Beata	
Trawl samples	Age reading	Otoliths	dry	Walvis Bay	Car	NatMIRC	Paul/Sarah/Beata	
Trawl samples	Genetic analyses (stock identity)	Finclips of priority species	96% Ethanol	Walvis Bay		IMR Link to	Geir/Maria	

	<b>Analyses</b>	<b>Samples</b>	<b>Preservation</b>	<b>Port of offloading</b>	<b>Type of transport</b>	<b>Institution</b>	<b>Contact person</b>	<b>Deadline for analysis</b>
Trawl samples	Morphometric analyses/parasites/otoliths ) Stomachs (Hakes, Lophius, Genypterus, T. capensis and S.colias)	(Hakes, Lophius, Genypterus, T. capensis and S.colias) Whole specimens (same specimens sampled for genetics)	Frozen	Walvis Bay	Car	Romina's project  NatMIRC	Paul/Sarah/Berata Theopolina/Latoya (NatMIRC for Trachurus and Scomber)	
Trawl samples	Benthic epifauna	Whole specimen	Ethanol or formalin	Walvis Bay	Plane	DAFF	Lara Aktinson	
Trawl samples	Taxonomy	Whole fish, for species that cannot be identified	Frozen	Walvis Bay	Car	NatMIRC	Johny/Malakia	
Trawl samples	Benthic epifauna	Whole specimen	Ethanol or formalin	Walvis Bay	Car	NatMIRC	Sarah Paulus	
Trawl sediment pipe	chemical analyses	Trawl cylinder	Frozen / 4%			NatMIRC	Sarah Paulus	

	<b>Analyses</b>	<b>Samples</b>	<b>Preservation</b>	<b>Port of offloading</b>	<b>Type of transport</b>	<b>Institution</b>	<b>Contact person</b>	<b>Deadline for analysis</b>
	/granulometric analyses	sediment	formaldehyde					



# ANNEX X. RECORDS OF FISHING STATIONS

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 1  
 DATE :06/04/19 GEAR TYPE: NO: 0 POSITION: Lat S 26°0.18  
 start stop duration Lon E 14°47.00  
 TIME :11:23:03 11:43:51 20.8 (min) Purpose : 0  
 LOG : 8524.09 8525.04 0.9 Region : 5030  
 FDEPTH: 196 196 Gear cond.: 0  
 BDEPTH: 196 196 Validity : 4  
 Towing dir: 0° Wire out : 0 m Speed : 0.0 kn  
 Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus capensis	0.00	0	0.00	4
Merluccius capensis	0.00	0	0.00	1
Austroglossus microlepis	0.00	0	0.00	3
Todarodes sagittatus	0.00	0	0.00	2
<b>Total</b>				

Helicolenus dactylopterus \*\*\* 3.16 168 0.28 11  
 Todaropsis eblanae 2.95 42 0.26  
 Leucoraja wallacei 2.45 2 0.22  
 Hermits, mixed 2.31 905 0.21  
 Emmelichthys nitidus nitidus 2.25 107 0.20  
 Congiopodus spinifer 1.90 10 0.17  
 G A S T R O P O D S 1.68 73 0.15  
 Cynoglossus zanzibarensis 1.66 42 0.15  
 Etrumeus whiteheadi 1.29 14 0.11  
 Loligo vulgaris 1.19 2 0.11  
 Zeus capensis 0.55 6 0.05  
 Ophiurus serpens 0.24 2 0.02  
 Scyliorhinus capensis 0.20 2 0.02  
 Unknown fish 0.10 10 0.01

**Total** 1120.98 100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 2  
 DATE :08/04/19 GEAR TYPE: BT NO: 1 POSITION: Lat S 28°27.00  
 start stop duration Lon E 15°13.00  
 TIME :08:46:54 09:18:11 31.3 (min) Purpose : 3  
 LOG : 0.00 1.60 1.6 Region : 5030  
 FDEPTH: 179 176 Gear cond.: 0  
 BDEPTH: 179 176 Validity : 0  
 Towing dir: 0° Wire out : 235 m Speed : 3.0 kn  
 Sorted : 291 Total catch: 343.78 Catch/hour: 659.42

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Myctophidae sp. small/mix	98.50	0	14.94	
PORIFERA (Sponges)	75.84	0	11.50	
Merluccius sp.	62.65	0	9.50	0
Merluccius capensis	61.99	359	9.40	168
Merluccius capensis	48.68	1155	7.38	171
Chelidonichthys capensis	47.11	121	7.14	170
Rajella leopardus	17.95	13	2.72	164
Chelidonichthys queketti	9.51	69	1.44	169
Callorhinchus capensis	8.63	4	1.31	162
Paracallionymus costatus	7.75	0	1.18	
Brama brama	7.02	4	1.06	163
Thyrssites atun	5.37	2	0.81	161
Cynoglossus zanzibarensis	2.34	54	0.35	167
Lophius vomerinus	1.96	4	0.30	165
Helicolenus dactylopterus ***	1.75	199	0.26	
Zeus capensis	1.65	25	0.25	166
Lepidopus caudatus	1.29	42	0.19	
Sufflogobius bibarbatatus	1.25	224	0.19	0
Genypterus capensis	1.15	13	0.17	172
Sepia australis	0.88	90	0.13	173
Sufflogobius bibarbatatus	0.86	142	0.13	
Squid unidentified	0.59	251	0.09	
Holohalaelurus regani	0.35	2	0.05	
Todaropsis eblanae	0.27	10	0.04	
Pelagia noctiluca	0.15	10	0.02	
Etrumeus whiteheadi	0.12	2	0.02	174
Aequorea forskalea	0.12	12	0.02	
<b>Total</b>	465.73		70.63	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 5  
 DATE :08/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 28°40.85  
 start stop duration Lon E 14°21.95  
 TIME :18:57:04 19:28:38 31.6 (min) Purpose : 3  
 LOG : 8882.12 8883.61 1.5 Region : 5030  
 FDEPTH: 465 470 Gear cond.: 0  
 BDEPTH: 465 470 Validity : 0  
 Towing dir: 0° Wire out : 1030 m Speed : 2.8 kn  
 Sorted : 0 Total catch: 104.26 Catch/hour: 198.21

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius paradoxus	111.22	160	56.11	13
Funchalia woodwardi	24.14	4829	12.18	
Rajella barnardi	18.56	21	9.36	
Coeliorinchus simorhynchus	14.33	205	7.23	
Genypterus capensis	8.29	4	4.18	14
Helicolenus dactylopterus ***	5.32	19	2.69	15
Nezumia milleri	5.17	574	2.61	
Coeliorinchus acanthiger	2.97	270	1.50	
Starfish	1.10	0	0.56	
Ebinania costaecanarie	0.95	13	0.48	
Unknown fish	0.95	29	0.48	
Malacocephalus laevis	0.72	4	0.36	
Phosichthys argenteus	0.68	49	0.35	
Etmopterus brachyurus	0.57	15	0.29	
Notacanthus sexspinis	0.38	10	0.19	
Tripteroptychys gilchristi	0.34	23	0.17	
Myxine capensis	0.34	6	0.17	
Sympagurus dimorphus	0.27	53	0.13	
Anemones, white	0.27	0	0.13	
Epigonus telescopus**	0.23	8	0.12	
G A S T R O P O D S	0.23	0	0.12	
Selachophidium guentheri	0.23	2	0.12	
Scomberox saurus	0.19	2	0.10	
Symbolophorus boops	0.15	25	0.08	
Polycheles sp.	0.11	25	0.06	
Sea urchin, weak spines	0.11	0	0.06	
Physiculus capensis	0.11	4	0.06	
Bathynectes pipperitus	0.08	4	0.04	
Lycoteuthis diadema *	0.08	8	0.04	
Nephropsis atlantica	0.04	2	0.02	
Bathylagus sp.	0.04	2	0.02	
Hoplostethus cadenati	0.04	6	0.02	
<b>Total</b>	198.21		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 3  
 DATE :08/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 28°25.51  
 start stop duration Lon E 14°49.52  
 TIME :12:30:06 13:00:26 30.3 (min) Purpose : 3  
 LOG : 8839.34 8840.86 1.5 Region : 5030  
 FDEPTH: 194 196 Gear cond.: 0  
 BDEPTH: 194 196 Validity : 0  
 Towing dir: 0° Wire out : 480 m Speed : 3.0 kn  
 Sorted : 180 Total catch: 271.21 Catch/hour: 536.34

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
PORIFERA (Sponges)	155.75	0	29.04	
Merluccius capensis	121.70	0	22.69	
Trachurus capensis	44.14	2413	8.23	24
Merluccius capensis	41.13	42	7.67	25
Chelidonichthys capensis	36.62	75	6.83	16
Squalus megalops	31.32	28	5.84	
Leucoraja wallacei	14.32	0	2.67	
Lepidopus caudatus	11.47	293	2.14	
Lophius vomerinus	10.64	10	1.98	21
Rajella leopardus	9.41	16	1.76	
Thyrssites atun	8.86	12	1.65	22
Paracallionymus costatus	8.31	922	1.55	
Scyliorhinus capensis	8.07	0	1.50	0
Callorhinchus capensis	7.67	4	1.43	20
Etrumeus whiteheadi	6.72	95	1.25	18
Scomber colias	3.96	4	0.74	23
Chelidonichthys queketti	3.80	79	0.71	17
Zeus capensis	3.01	36	0.56	
Cynoglossus zanzibarensis	2.69	24	0.50	
Congopodus spinifer	2.25	8	0.42	
Sepia australis	1.98	146	0.37	
Todaropsis eblanae	1.03	162	0.19	
Genypterus capensis	0.55	2	0.10	19
Helicolenus dactylopterus ***	0.40	91	0.07	
Scyliorhinus capensis	0.20	2	0.04	
Pelagia noctiluca	0.18	16	0.03	
Emmelichthys nitidus nitidus	0.16	8	0.03	
<b>Total</b>	536.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 6  
 DATE :08/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 28°46.22  
 start stop duration Lon E 14°19.65  
 TIME :22:35:32 23:05:15 29.7 (min) Purpose : 3  
 LOG : 889.28 8899.74 1.5 Region : 5030  
 FDEPTH: 570 578 Gear cond.: 0  
 BDEPTH: 570 578 Validity : 0  
 Towing dir: 0° Wire out : 1280 m Speed : 3.0 kn  
 Sorted : 0 Total catch: 104.14 Catch/hour: 210.31

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius paradoxus	34.41	28	16.36	41
Cruriraja parcomaculata	33.02	61	15.70	
Coeliorinchus acanthiger	29.57	57	14.06	
Selachophidium guentheri	29.12	297	13.85	
Coeliorinchus simorhynchus	19.87	79	9.45	
Funchalia woodwardi	16.52	4130	7.85	
Nezumia micronychodon	9.57	125	4.55	
Etmopterus brachyurus	7.55	95	3.59	
Centrophorus sp.	7.39	18	3.51	
Bristle worms	6.38	188	3.03	
Scomber chuni	3.59	40	1.71	
Neoscolepis macrolepidotus	2.56	145	1.22	
Ebinania costaecanarie	2.46	16	1.17	
Notacanthus sexspinis	1.94	101	0.92	
Aristeus varidens	1.90	380	0.90	
Phosichthys argenteus	1.45	85	0.69	
Bassanago albescens	0.69	4	0.33	
Myxine capensis	0.48	6	0.23	
Opisthoteuthis agassizi	0.48	2	0.23	
Symbolophorus boops	0.20	14	0.10	
Anemones, white	0.16	2	0.08	
Kuronezumia leonis	0.16	20	0.08	
Sergia sp.	0.16	38	0.08	
Scopelosaurus meadi	0.12	4	0.06	
Heterocarpus sp.	0.12	6	0.06	
Malacosteus niger	0.12	2	0.06	
Stereomastis sp.	0.08	2	0.04	
Diaphus hudsoni	0.08	44	0.04	
Lycoteuthis diadema *	0.04	4	0.02	
Paraliparis australis	0.04	2	0.02	
Pasiphaea unispinosa	0.04	6	0.02	
<b>Total</b>	210.31		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 4  
 DATE :08/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 28°33.31  
 start stop duration Lon E 14°40.25  
 TIME :15:13:12 15:43:33 30.4 (min) Purpose : 3  
 LOG : 8856.73 8858.44 1.7 Region : 5030  
 FDEPTH: 172 173 Gear cond.: 0  
 BDEPTH: 172 173 Validity : 0  
 Towing dir: 0° Wire out : 430 m Speed : 3.4 kn  
 Sorted : 168 Total catch: 567.03 Catch/hour: 1120.98

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachurus capensis	63.74	1054	61.00	9
Merluccius capensis	108.55	109	9.68	5
Chelidonichthys capensis	88.51	212	7.90	10
Sea urchin, weak spines	56.70	0	5.06	
Scomber japonicus	52.39	136	4.67	7
Chelidonichthys queketti	42.37	275	3.78	
Sepia australis	20.22	959	1.80	
Starfish	9.69	0	0.86	
Lepidopus caudatus	6.72	87	0.60	
Squalus megalops	6.37	14	0.57	
Thyrssites atun	4.90	6	0.44	6
Callorhinchus capensis	4.45	2	0.40	12
Raja straeleni	4.35	2	0.39	
Histioteuthis reversa	3.58	854	0.32	
Holohalaelurus regani	3.36	10	0.30	
PORIFERA (Sponges)	3.16	0	0.28	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 7  
 DATE :09/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 29°0.95  
 start stop duration Lon E 14°44.93  
 TIME :04:55:26 05:26:24 31.0 (min) Purpose : 3  
 LOG : 8932.76 8934.39 1.6 Region : 5030  
 FDEPTH: 228 230 Gear cond.: 0  
 BDEPTH: 4 228 230 Validity : 0  
 Towing dir: 0° Wire out : 550 m Speed : 3.2 kn  
 Sorted : 107 Total catch: 204.86 Catch/hour: 396.76

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius paradoxus	20.06	387	51.68
Merluccius capensis	40.52	35	10.21
Holohalaelurus regani	20.53	66	5.17
Helicolenus dactylopterus ***	13.17	4702	3.32
Sea urchin, weak spines	12.70	0	3.20
Callorhynchus capensis	12.63	8	3.18
Squalus megalops	12.24	23	3.09
Chelidonichthys queketti	12.24	89	3.09
Sepia australis	10.54	810	2.66
Genypterus capensis	9.14	10	2.30
Lepidopus caudatus	8.60	132	2.17
Trachurus capensis	7.05	35	1.78
Cynoglossus zanzibarensis	6.43	97	1.62
Sympagurus dimorphus	6.12	767	1.54
Starfish	3.41	0	0.86
Bassanago albescens	2.63	112	0.66
Todarodes sagittatus	2.56	35	0.64
Chelidonichthys capensis	2.40	4	0.61
Malacocephalus laevis	2.25	19	0.57
Paracallionymus costatus	1.86	279	0.47
Histioteuthis reversa	1.24	414	0.31
Rajella barnardi	1.16	4	0.29
Loligo vulgaris	0.85	4	0.21
Lampancyctodes hectoris	0.54	542	0.14
Unknown fish	0.46	153	0.12
Squilla acuelata calmani	0.23	27	0.06
G A S T R O P O D S	0.15	8	0.04
Eggs of ray	0.04	0	0.01
<b>Total</b>	<b>396.76</b>	<b>100.00</b>	

R/V Dr. Fridtjof Nansen	SURVEY:2019403	STATION: 8
DATE :09/04/19	GEAR TYPE: BT NO: 27	POSITION:Lat S 28°48.19
		Lon E 15°11.45
start stop duration		
TIME :10:26:32 10:56:28		
LOG : 8968.02 8969.44	1.4	
Purpose : 3		
Region : 5030		
FDEPTH: 168 168		
BDEPTH: 168 168		
Towing dir: 0°	wire out : 400 m	
Sorted : 0	Total catch: 239.01	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius capensis	153.47	20	32.04
Chelidonichthys capensis	88.06	164	18.38
Merluccius paradoxus	62.40	122	13.03
Sea urchin, weak spines	32.22	0	6.73
Sepia australis	23.65	13246	4.94
Rajella leopardus	20.44	14	4.27
Lophius vomerinus	17.72	12	3.70
Thyrssites atun	17.52	22	3.66
Paracallionymus costatus	13.63	1703	2.85
Merluccius paradoxus	11.86	792	2.48
Holohalaelurus regani	10.46	32	2.18
Chelidonichthys queketti	7.54	74	1.57
Lepidopus caudatus	4.77	14	1.00
Cynoglossus zanzibarensis	3.77	36	0.79
Todaropsis eblanae	2.85	136	0.59
Etrumeus whiteheadi	2.44	44	0.51
Zeus capensis	1.80	48	0.38
Aequorea forskalea	1.74	112	0.36
Trachurus capensis	1.16	6	0.24
Genypterus capensis	0.52	2	0.11
Helicolenus dactylopterus ***	0.40	160	0.08
Bathyrroconger vicinus	0.36	20	0.08
Sepia elegans	0.20	20	0.04
<b>Total</b>	<b>478.98</b>	<b>100.00</b>	

R/V Dr. Fridtjof Nansen	SURVEY:2019403	STATION: 9
DATE :09/04/19	GEAR TYPE: BT NO: 27	POSITION:Lat S 28°44.27
		Lon E 15°16.32
start stop duration		
TIME :12:35:24 12:48:26		
LOG : 8978.65 8979.30	0.7	
Purpose : 3		
Region : 5030		
FDEPTH: 167 167		
BDEPTH: 167 167		
Towing dir: 0°	wire out : 400 m	
Sorted : 106	Total catch: 140.55	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius capensis	227.21	410	35.13
Chelidonichthys capensis	103.62	248	16.02
Merluccius paradoxus	94.23	6957	14.57
Merluccius capensis	90.74	37	14.03
Sea urchin, weak spines	43.25	0	6.69
Aequorea forskalea	20.61	101	3.19
Sepia australis	13.25	469	2.05
Chelidonichthys queketti	8.83	64	1.37
Etrumeus whiteheadi	8.10	129	1.25
Rajella leopardus	7.18	18	1.11
Lophius vomerinus	5.11	5	0.79
Thyrssites atun	4.97	5	0.77
Paracallionymus costatus	3.68	451	3.07
G A S T R O P O D S	3.68	9	0.57
Holohalaelurus regani	3.68	18	0.57
Todaropsis eblanae	3.31	230	0.51
Helicolenus dactylopterus ***	2.58	589	0.40
Lepidopus caudatus	1.66	37	0.26
Starfish	0.46	9	0.07
Zeus capensis	0.37	18	0.06
Bassanago albescens	0.18	18	0.03
<b>Total</b>	<b>646.70</b>	<b>100.00</b>	

R/V Dr. Fridtjof Nansen	SURVEY:2019403	STATION: 10
DATE :09/04/19	GEAR TYPE: BT NO: 27	POSITION:Lat S 28°33.45
		Lon E 15°33.03
start stop duration		
TIME :16:06:45 16:37:33		
LOG : 9003.43 9005.03	1.6	
Purpose : 3		
Region : 5030		
FDEPTH: 173 168		
BDEPTH: 173 168		
Towing dir: 0°	wire out : 430 m	
Sorted : 63	Total catch: 274.44	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius paradoxus	291.82	1364	54.58
Myctophidae sp. small/mix	60.82	48655	11.38
Sepia australis	33.55	3723	6.27
Merluccius capensis	26.77	53	5.01
PORIFERA (Sponges)	23.45	0	4.36
Aequorea forskalea	21.00	109	3.93
Chelidonichthys capensis	15.31	35	2.86
Helicolenus dactylopterus ***	10.64	791	1.99
Squilla acuelata calmani	9.82	1418	1.84
Etrumeus whiteheadi**	6.27	95	1.17
Starfish	5.45	0	1.02
Trachurus capensis	4.44	25	0.83
Todarodes sagittatus	4.36	109	0.82
Genypterus capensis	3.78	6	0.71
Lepidopus caudatus	3.00	286	0.56
Rajella leopardus	2.96	2	0.55
Holohalaelurus regani	2.18	14	0.41
<b>Total</b>	<b>646.74</b>	<b>100.00</b>	

R/V Dr. Fridtjof Nansen	SURVEY:2019403	STATION: 11
DATE :10/04/19	GEAR TYPE: BT NO: 27	POSITION:Lat S 28°51.20
		Lon E 15°53.53
start stop duration		
TIME :05:08:02 05:39:54		
LOG : 9064.82 9066.48	1.7	
Purpose : 3		
Region : 5030		
FDEPTH: 165 163		
BDEPTH: 165 163		
Towing dir: 0°	wire out : 430 m	
Sorted : 76	Total catch: 447.50	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius paradoxus	421.34	122411	50.00
Squilla acuelata calmani	123.88	8851	14.70
Myctophidae sp. small/mix	97.68	32561	11.59
Sepia australis	42.84	2853	5.08
PORIFERA (Sponges)	30.36	0	3.60
Chelidonichthys capensis	20.32	73	2.41
Helicolenus dactylopterus ***	20.32	1017	2.41
Etrumeus whiteheadi**	20.08	331	2.38
Todarodes sagittatus	13.95	0	1.66
Sufflogobius bibarbus	10.53	881	1.25
Merluccius capensis	8.14	24	0.97
Zeus capensis	6.61	87	0.78
Aequorea sp.	5.14	0	0.61
Paracallionymus costatus	4.65	343	0.55
Cynoglossus zanzibarensis	4.16	73	0.49
Callorhynchus capensis	3.28	2	0.39
Merluccius capensis	2.15	23	0.25
Trachurus capensis	1.81	9	0.21
Lepidopus caudatus	1.47	73	0.17
Sea urchin, weak spines	0.98	0	0.12
Sepia elegans	0.73	13	0.09
Coeliorhynchus simorhynchus	0.73	13	0.09
Raja straeleni	0.56	2	0.07
Dromidia sp.	0.49	38	0.06
Scorpenoid sp.**	0.41	2	0.05
G A S T R O P O D S	0.13	0	0.02
<b>Total</b>	<b>842.75</b>	<b>100.00</b>	

R/V Dr. Fridtjof Nansen	SURVEY:2019403	STATION: 12
DATE :10/04/19	GEAR TYPE: BT NO: 27	POSITION:Lat S 29°0.42
		Lon E 15°40.90
start stop duration		
TIME :08:18:44 08:37:40		
LOG : 9087.76 9088.70	0.9	
Purpose : 3		
Region : 5030		
FDEPTH: 182 183		
BDEPTH: 182 183		
Towing dir: 0°	wire out : 450 m	
Sorted : 61	Total catch: 488.91	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Myctophidae sp. small/mix	1142.19	1142187	73.71
Merluccius paradoxus	117.15	10	7.56
Helicolenus dactylopterus ***	91.35	6520	5.89
Paracallionymus costatus	78.10	5997	5.04
Merluccius capensis	31.89	60	2.06
Etrumeus whiteheadi**	19.14	269	1.24
Aequorea forskalea	16.04	0	1.03
Squilla acuelata calmani	10.46	697	0.67
Lepidopus caudatus	7.67	628	0.49
Sea urchin, weak spines	6.28	0	0.40
PORIFERA (Sponges)	5.58	0	0.36
Sepia australis	5.58	697	0.36
Todarodes sagittatus	5.58	279	0.36
Chelidonichthys capensis	4.75	10	0.31
Cynoglossus zanzibarensis	2.79	105	0.18
Macropodus australis	2.09	35	0.13
Mursia cristimanus	1.39	70	0.09
Starfish	0.70	105	0.04
Lophius vomerinus	0.57	6	0.04
Sepia elegans	0.35	0	0.02
<b>Total</b>	<b>1549.64</b>	<b>100.00</b>	

R/V Dr. Fridtjof Nansen	SURVEY:2019403	STATION: 13
DATE :10/04/19	GEAR TYPE: BT NO: 27	POSITION:Lat S 29°15.99
		Lon E 15°10.95
start stop duration		
TIME :12:52:18 13:22:32		
LOG : 9121.14 9122.65	1.5	
Purpose : 3		
Region : 5030		
FDEPTH: 197 197		
BDEPTH: 197 197		
Towing dir: 0°	wire out : 485 m	
Sorted : 169	Total catch: 234.15	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sea urchin, weak spines	82.17	0	17.68
Merluccius capensis	81.46	111	17.53
Chelidonichthys capensis	49.06	32	10.56
Brama brama	39.89	22	8.58
Zeus capensis	28.82	298	6.20
Merluccius paradoxus	19.81	113	4.26
Merluccius paradoxus	18.10	2515	3.89
Raja straeleni	15.64	18	3.37
PORIFERA (Sponges)	12.86	0	2.77
Thyrssites atun	11.75	8	2.53
Holohalaelurus regani	11.67	42	2.51
Todaropsis eblanae	11.55	429	2.49
Lepidopus caudatus	9.19	22	1.98
Squalus megalops	7.98	10	1.72
Trachurus capensis	7.70	30	1.66
Leucoraja wallacei	7.66	2	1.65
Paracallionymus costatus	6.31	703	1.36
Chelidonichthys queketti	6.03	16	1.30
Cynoglossus zanzibarensis	5.95	65	1.28
Sepia australis	5.48	363	1.18
Lophius vomerinus	3.77	6	0.81
Merluccius capensis	3.69	6	0.79
Callorhynchus capensis	3.02	2	0.65
Sebastes capensis**	2.98	30	0.64
Starfish	2.50	0	0.54
Torpedo nobiliana	2.42	4	0.52
Starfish	2.38	0	0.51
Aequorea forskalea	2.32	6	0.50
Helicolenus dactylopterus ***	2.26	566	0.49
Squilla acuelata calmani	0.12	12	0.03
G A S T R O P O D S	0.12	0	0.03
Sympagurus dimorphus	0.06	6	0.01
<b>Total</b>	<b>464.74</b>	<b>100.00</b>	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 14  
 DATE :10/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 29°34.16  
 start stop duration Lon E 14°37.48  
 TIME :18:31:29 19:01:20 29.8 (min) Purpose : 3  
 LOG : 9163.90 9165.45 1.6 Region : 5030  
 FDEPTH: 424 420 Gear cond.: 0  
 BDEPTH: 424 420 Validity : 0  
 Towing dir: 0° Wire out : 970 m Speed : 3.1 kn  
 Sorted : 94 Total catch: 142.55 Catch/hour: 286.63

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius paradoxus	90.68	161	31.64
Coelorinchus simorhynchus	35.49	985	12.38
Helicolenus dactylopterus ***	25.03	197	8.73
Notacanthus sexspinis	21.51	308	7.51
Bassanago albescens	21.11	26	7.37
Sympagurus dimorphus	15.88	664	5.54
Anemones, yellow	11.86	0	4.14
Genypterus capensis	11.54	4	4.03
Octopus vulgaris	10.54	4	3.68
Malacocephalus laevis	7.44	52	2.60
Anemones, white	6.43	0	2.24
Starfish	3.92	0	1.37
Anemones, pink	2.92	0	1.02
Hoplostethus mediterraneus	2.71	60	0.95
Rajella barnardi	2.71	6	0.95
Holohalaelurus regani	2.71	10	0.95
Lophius vomerinus	1.97	2	0.69
Nezumia milleri	1.71	217	0.60
Rajella leopardenus	1.61	6	0.56
Phosichthys argenteus	1.51	16	0.53
Myxine capensis	1.31	20	0.46
Symbolophorus boops	1.11	131	0.39
Scorpaenopsis saurus	0.80	6	0.28
Polycheles sp.	0.60	167	0.21
Epigonus denticulatus**	0.50	30	0.18
Ebinania costaecanarie	0.40	2	0.14
Paracallionymus costatus	0.40	66	0.14
Todaropsis eblanae	0.40	20	0.14
Tripteroptychus gilchristi	0.40	16	0.14
Shrimps, small, non comm.	0.40	0	0.14
Bathynectes parietus	0.36	30	0.13
Sea urchin, weak spines	0.30	0	0.11
Mursia cristimanus	0.10	6	0.04
Coelorinchus acanthiger	0.10	6	0.04
Nezumia micronychodon	0.06	6	0.02
Selachophidium guentheri	0.06	10	0.02
Total	286.63	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 15  
 DATE :10/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 29°10.62  
 start stop duration Lon E 14°26.38  
 TIME :23:32:22 00:05:58 33.6 (min) Purpose : 3  
 LOG : 9193.61 9195.10 1.5 Region : 5030  
 FDEPTH: 518 521 Gear cond.: 0  
 BDEPTH: 518 521 Validity : 0  
 Towing dir: 0° Wire out : 1230 m Speed : 2.7 kn  
 Sorted : 0 Total catch: 107.17 Catch/hour: 191.38

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius paradoxus	37.57	36	19.63
Cruriraja parcomaculata	34.14	46	17.84
Selachophidium guentheri	20.79	225	10.86
Funchalia woodwardi	17.32	3486	9.05
Starfish	12.14	0	6.35
Nezumia micronychodon	10.43	718	5.45
Bathyrhaja smithi	9.25	2	4.83
Lophius vomerinus	9.00	25	4.70
Coelorinchus acanthiger	4.79	229	2.50
Anemones, pink	4.21	11	2.20
Notacanthus sexspinis	4.14	100	2.16
Genypterus capensis	3.68	2	1.92
Sympagurus dimorphus	3.64	261	1.90
Parapenaeus longirostris	3.50	439	1.83
Raja straeleni	3.00	4	1.57
Anemones, white	2.14	11	1.12
Neoscolepis macrolepidotus	1.93	71	1.01
Myxine capensis	1.43	18	0.75
Ebinania costaecanarie	1.29	4	0.67
Bassanago albescens	1.00	2	0.52
Phosichthys argenteus	0.93	36	0.49
Etmopterus brachyurus	0.80	21	0.42
Kuronezumia leonis	0.79	129	0.41
Holohalaelurus regani	0.75	2	0.39
Chaceon chuni	0.54	5	0.28
Bristle worms	0.50	0	0.26
Epigonus denticulatus**	0.29	11	0.15
Scorpaenopsis saurus	0.25	2	0.13
Lycoteuthis diadema *	0.21	7	0.11
Sympagurus dimorphus	0.21	21	0.11
Sebastes capensis**	0.21	4	0.11
Eggs of ray	0.11	11	0.06
Lampanyctodes hectortis	0.11	11	0.06
Lycoteuthis diadema *	0.11	7	0.06
Homola barbata	0.07	4	0.04
Polycheles sp.	0.07	18	0.04
Diaphus hudsoni	0.04	7	0.02
Total	191.37	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 16  
 DATE :11/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 29°9.13  
 start stop duration Lon E 14°30.70  
 TIME :02:11:39 02:41:03 29.4 (min) Purpose : 3  
 LOG : 9203.82 9205.37 1.5 Region : 5030  
 FDEPTH: 359 365 Gear cond.: 0  
 BDEPTH: 359 365 Validity : 0  
 Towing dir: 0° Wire out : 870 m Speed : 3.1 kn  
 Sorted : 124 Total catch: 396.33 Catch/hour: 396.33

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Sebastes capensis**	95.88	429	24.18
Epigonus denticulatus**	74.94	1336	18.90
Merluccius paradoxus	52.69	278	13.29
Genypterus capensis	36.00	18	9.08
Octopus vulgaris	33.88	6	8.54
Lophius vomerinus	23.39	4	5.90
Coelorinchus simorhynchus	21.43	1592	5.40
Merluccius capensis	15.43	6	3.89
Scyliorhinus capensis	9.51	12	1.39
Cruriraja parcomaculata	5.43	8	1.37
Holohalaelurus regani	5.31	16	1.34
Squalus megalops	3.96	2	1.00
Starfish	3.43	0	0.86
Anemones, white	3.06	0	0.77
Malacocephalus laevis	2.89	86	0.68
Cynoglossus zanzibarensis	1.96	6	0.49
Anemones, pink	1.90	0	0.48
Sympagurus dimorphus	1.71	24	0.43
Pasipheid	1.59	80	0.40
Exodromidia sp.	1.47	12	0.37

Sea urchin, weak spines 0.86 0 0.22  
 Stereomastis sculpta 0.86 288 0.22  
 Histiotethis reversa 0.73 37 0.19  
 Lepidopus caudatus 0.65 2 0.16  
 Tripteroptychus gilchristi 0.49 18 0.12  
 G A S T R O P O D S 0.37 0 0.09  
 PORIFERA (Sponges) 0.37 0 0.09  
 Hoplostethus mediterraneus 0.12 18 0.03  
 Bathynectes parietus 0.12 6 0.03  
 Mursia cristimanus 0.12 12 0.03  
 Parapenaeus longirostris 0.12 6 0.03  
 Coelorinchus karrerae 0.06 6 0.02

Total 396.53 100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 17  
 DATE :11/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 28°25.54  
 start stop duration Lon E 14°25.99  
 TIME :07:45:08 08:15:15 30.1 (min) Purpose : 3  
 LOG : 9248.17 9249.57 1.4 Region : 5030  
 FDEPTH: 436 434 Gear cond.: 0  
 BDEPTH: 436 434 Validity : 0  
 Towing dir: 0° Wire out : 1000 m Speed : 2.8 kn  
 Sorted : 0 Total catch: 255.79 Catch/hour: 509.71

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius paradoxus	294.20	644	57.72
Genypterus capensis	74.81	38	14.68
Coelorinchus simorhynchus	33.24	462	6.52
Bathyrhaja smithi	12.55	2	2.46
Lophius vomerinus	12.47	6	2.45
Hydrolagus sp.	12.08	12	2.37
Helicolenus dactylopterus ***	8.49	24	1.67
Sympagurus dimorphus	7.33	407	1.44
Rajella barnardi	5.42	4	1.06
Cruriraja parcomaculata	4.94	2	0.97
Todarodes sagittatus	4.50	10	0.88
Trachipterus trachipterus	4.42	2	0.87
Funchalia woodwardi	3.59	897	0.70
Scyliorhinus capensis	3.25	4	0.64
Starfish	3.19	0	0.63
Miscellaneous fishes	3.11	0	0.61
Squalus megalops	2.47	2	0.48
Myctophidae sp. small/mix	2.07	295	0.41
Anemones, pink	2.07	0	0.41
Phosichthys argenteus	2.07	347	0.41
Nezumia milleri	1.91	239	0.38
Malacocephalus laevis	1.67	20	0.33
Nezumia micronychodon	1.20	116	0.23
Epigonus telescopus**	1.12	8	0.22
Raja sp.	1.00	2	0.20
G A S T R O P O D S	0.96	0	0.19
Holohalaelurus regani	0.96	2	0.19
Tripteroptychus gilchristi	0.72	56	0.14
Anemones, white	0.64	0	0.13
Notacanthus sexspinis	0.64	56	0.13
Etmopterus brachyurus	0.48	36	0.09
Starfish	0.32	0	0.06
Scorpaenopsis saurus	0.32	16	0.06
Beryx splendens	0.28	2	0.07
Lampadena portifex	0.24	16	0.05
Maja squinado	0.24	24	0.05
Bathophilus longipinnis	0.16	4	0.03
Stereomastis sculpta	0.16	44	0.03
Todaropsis eblanae	0.16	16	0.03
Sea pens	0.08	0	0.02
Coelorinchus acanthiger	0.08	12	0.02
Bassanago albescens	0.08	4	0.02
Physiculus capensis	0.04	4	0.01
Total	509.71	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 18  
 DATE :11/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 28°23.14  
 start stop duration Lon E 14°24.44  
 TIME :09:55:20 10:25:12 29.9 (min) Purpose : 3  
 LOG : 9254.33 9255.70 1.4 Region : 5030  
 FDEPTH: 492 500 Gear cond.: 0  
 BDEPTH: 492 500 Validity : 0  
 Towing dir: 0° Wire out : 1110 m Speed : 2.7 kn  
 Sorted : 0 Total catch: 180.24 Catch/hour: 362.05

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
	weight numbers		
Merluccius paradoxus	164.55	203	45.45
Etmopterus brachyurus	38.81	2157	10.72
Rajella barnardi	29.57	32	8.17
Coelorinchus simorhynchus	26.51	201	7.32
Genypterus capensis	22.98	16	6.35
Hydrolagus sp.	12.57	16	3.47
Miscellaneous fishes	6.75	0	1.86
Gonostoma elongatum	6.43	92	1.78
Parapenaeus longirostris	6.35	1057	1.75
Nezumia micronychodon	6.19	325	1.71
Todarodes sagittatus	5.14	10	1.42
Selachophidium guentheri	4.50	48	1.24
Coelorinchus acanthiger	4.02	225	1.11
Anemones, pink	2.81	0	0.78
Phosichthys argenteus	2.65	241	0.73
Kuronezumia leonis	2.57	285	0.71
Funchalia woodwardi	2.33	583	0.64
Lophius vomerinus	1.81	2	0.50
Notacanthus sexspinis	1.77	48	0.49
Starfish	1.69	0	0.47
Epigonus denticulatus**	1.37	20	0.38
G A S T R O P O D S	1.37	0	0.38
Ebinania costaecanarie	1.37	32	0.38
Sea urchin, weak spines	1.29	0	0.36
Thysanoteuthis rhombus	0.88	4	0.24
Myxine capensis	0.84	16	0.23
Sympagurus dimorphus	0.72	84	0.20
Conger wilsoni	0.64	4	0.18
Myctophidae sp. small/mix	0.48	68	0.13
Malacoestheus niger	0.48	12	0.13
Hoplostethus mediterraneus	0.48	16	0.13
Beryx splendens	0.48	4	0.13
Tripteroptychus gilchristi	0.40	28	0.11
Neoscolepis macrolepidotus	0.24	32	0.07
Symbolophorus boops	0.24	28	0.07
Stoloteuthis leucoptera	0.24	32	0.07
Lycoteuthis diadema *	0.16	16	0.04
Eggs of ray	0.12	32	0.03
Anemones, white	0.08	4	0.02
Helicolenus dactylopterus ***	0.08	4	0.02
Chlorophthalmus agassizii	0.04	4	0.01
Pelagia noctiluca	0.04	4	0.01
Total	362.05	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 19  
 DATE :12/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 27°35.61  
 start stop duration Lon E 15°13.76  
 TIME :05:17:03 05:48:55 31.9 (min) Purpose : 3  
 LOG : 9374.81 9376.56 1.8 Region : 5030  
 FDEPTH: 133 133 Gear cond.: 0

BDEPTH: 133 133 Validity : 0  
 Towing dir: 0° Wire out : 340 m Speed : 3.3 kn  
 Sorted : 133 Total catch: 302.86 Catch/hour: 570.18

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius capensis	180.81	34	111
Cheilodichthys capensis	131.52	606	114
Sufflogobius bibarbatatus	110.04	1839	
Thyrssites atun	73.76	30	
Galeorhinus galeus	26.47	2	
Sepia australis	13.44	640	
Etrumeus whiteheadi**	6.85	62	115
Genypterus capensis	6.63	68	
Trachurus capensis	4.18	24	112
Dromidia sp.	2.64	26	
Austroglossus microlepis	2.60	2	113
Callorhynchus capensis	2.49	2	
Cynoglossus zanzibarensis	1.58	13	
Histioteuthis reversa	1.32	442	
Etmopterus brachyurus	1.05	87	
Squilla aculeata calmani	1.05	105	
Zeus capensis	0.92	26	
Starfish	0.79	0	
Maja squinado	0.53	66	
Squalus megalops	0.38	2	
Lepidopus caudatus	0.26	8	
G A S T R O P O D S	0.26	0	
Sea pens	0.26	0	
Aequorea sp.	0.13	0	
Anemones, pink	0.13	0	
Sardinops sagax	0.08	2	
Total	570.18		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 20  
 DATE :12/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°37.19  
 start stop duration Lon E 15°44.46  
 TIME :07:18:19 07:48:44 30.4 (min) Purpose : 3  
 LOG : 9387.19 9388.80 1.6 Region : 5030  
 FDEPTH: 171 171 Gear cond.: 0  
 BDEPTH: 171 171 Validity : 0  
 Towing dir: 0° Wire out : 425 m Speed : 3.2 kn  
 Sorted : 99 Total catch: 228.79 Catch/hour: 451.26

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius capensis	135.44	3657	0
Cheilodichthys capensis	87.16	426	121
Merluccius capensis	86.63	396	118
Sufflogobius bibarbatatus	60.18	15045	
Sepia australis	31.95	1225	
Galeorhinus galeus	23.43	2	
Myctophidae sp. small/mix	7.99	0	
Thyrssites atun	5.40	2	117
Etrumeus whiteheadi**	3.55	178	
Todarodes eblanae	3.20	99	
Genypterus capensis	1.66	95	
Histioteuthis reversa	1.07	533	
Austroglossus microlepis	0.95	6	120
Dromidia sp.	0.71	28	
Holohalaelurus regani	0.63	2	
Trachurus capensis	0.59	4	116
Etmopterus brachyurus	0.18	18	
Helicolenus dactylopterus ***	0.18	45	119
Lepidopus caudatus	0.10	10	
Squilla aculeata calmani	0.10	0	
Sea pens	0.10	0	
Total	451.26		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 21  
 DATE :12/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°38.68  
 start stop duration Lon E 14°56.08  
 TIME :09:53:41 10:15:42 22.0 (min) Purpose : 3  
 LOG : 9400.81 9401.92 1.1 Region : 5030  
 FDEPTH: 269 271 Gear cond.: 0  
 BDEPTH: 269 271 Validity : 0  
 Towing dir: 0° Wire out : 670 m Speed : 3.0 kn  
 Sorted : 161 Total catch: 275.40 Catch/hour: 750.75

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius paradoxus	378.43	4648	110
Squilla aculeata calmani	119.95	13314	
Lepidopus caudatus	64.17	1469	
G A S T R O P O D S	41.98	0	
Lampyctodes hectoris	25.79	8606	
Miscellaneous fishes	25.19	0	
Lophius vomerinus	23.17	11	105
Merluccius capensis	11.83	25	104
Brama brama	9.49	5	109
Starfish	9.00	0	
Sufflogobius bibarbatatus	5.40	990	
Sepia australis	4.80	120	
Sepia elegans	4.80	90	
Malacocephalus laevis	4.80	60	
Todarodes sagittatus	4.74	11	
Coelorinchus simorhynchus	3.60	390	
Helicolenus dactylopterus ***	3.22	22	106
Cheilodichthys capensis	3.16	5	108
Genypterus capensis	2.02	3	107
Exodromidia sp.	1.20	180	
Etmopterus brachyurus	1.20	120	
Galeus polli	1.04	8	
Todaropsis eblanae	0.90	150	
Maurolicus muelleri	0.60	270	
Pelagia noctiluca	0.30	30	
Total	750.75		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 22  
 DATE :12/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°40.85  
 start stop duration Lon E 14°48.89  
 TIME :12:41:06 13:15:21 34.2 (min) Purpose : 3  
 LOG : 9412.98 9414.69 1.7 Region : 5030  
 FDEPTH: 354 346 Gear cond.: 0  
 BDEPTH: 354 346 Validity : 0  
 Towing dir: 0° Wire out : 830 m Speed : 3.0 kn  
 Sorted : 0 Total catch: 634.32 Catch/hour: 1111.54

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius paradoxus	797.73	701	127
Brama brama	138.57	88	130
PORIFERA (Sponges)	38.97	0	
Lophius vomerinus	19.63	7	129
Coelorinchus simorhynchus	17.80	470	
Lampyctodes hectoris	17.52	8762	
Symbolophorus boops	17.38	1451	
Miscellaneous fishes	12.76	0	
Merluccius capensis	10.86	4	131

Todarodes sagittatus 10.51 5 0.95  
 Bathynectes piperitus 4.91 203 0.44  
 Anemones, white 4.07 35 0.37  
 Starfish 4.00 0 0.36  
 Genypterus capensis 3.86 5 0.35 128  
 Anemones, pink 2.80 14 0.25  
 Helicolenus dactylopterus \*\*\* 2.10 154 0.19 132  
 Paracallionymus costatus 1.82 98 0.16  
 Starfish 1.16 0 0.10 0  
 Lepidopus caudatus 0.70 14 0.06  
 Galeus polli 0.70 7 0.06  
 Lycoteuthis diadema \* 0.70 91 0.06  
 Beryx splendens 0.60 5 0.05 133  
 G A S T R O P O D S 0.56 0 0.05  
 Kuronezumia leonis 0.56 63 0.05  
 Malacocephalus laevis 0.42 7 0.04  
 Todaropsis eblanae 0.28 7 0.03  
 Myxine capensis 0.28 7 0.03  
 Sepia elegans 0.28 7 0.03  
 Total 1111.54 100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 23  
 DATE :12/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°43.74  
 start stop duration Lon E 14°33.75  
 TIME :16:12:32 16:42:36 30.1 (min) Purpose : 3  
 LOG : 9433.14 9434.69 1.6 Region : 5030  
 FDEPTH: 474 471 Gear cond.: 0  
 BDEPTH: 474 471 Validity : 0  
 Towing dir: 0° Wire out : 1080 m Speed : 3.1 kn  
 Sorted : 0 Total catch: 99.74 Catch/hour: 199.02

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius paradoxus	60.26	60	122
Coelorinchus simorhynchus	27.58	377	
Lophius vomerinus	26.94	2	124
Coelorinchus acanthiger	20.23	810	
Hydrolagus sp.	17.24	20	
Selachophidium guentheri	8.62	116	
Genypterus capensis	7.74	4	123
Starfish	4.23	0	
Phosichthys argenteus	3.43	192	
Deepwater fish mixture	3.19	0	
Myxine capensis	2.63	40	
Rajella barnardi	1.92	2	
Notacanthus sexspinis	1.84	28	
Etmopterus brachyurus	1.80	64	
Helicolenus dactylopterus ***	1.72	8	125
Nezumia milleri	1.60	160	
Ebinania costaeacarie	1.48	20	
Malacocephalus laevis	1.04	16	
Shark eggs	0.88	0	
Epigonus denticulatus**	0.56	40	
Nezumia micronychodon	0.52	38	
Funchalia woodwardi	0.44	122	
Galeus polli	0.44	4	
Plesioneneus edwardsianus	0.40	86	
PORIFERA (Sponges)	0.36	0	
Coelorinchus matama	0.32	4	
G A S T R O P O D S	0.32	0	
Sympagus dimorphus	0.28	52	
Myctophidae sp. small/mix	0.24	80	
Tripterygion cristati	0.20	16	
Lepidion guentheri	0.16	24	
Macroparalepis macrogeneion	0.16	8	
Symbolophorus boops	0.12	14	
Unknown fish	0.08	4	
Lithodes ferrox	0.04	8	
Dromidia sp.	0.02	2	
Munidopsis sp.	0.02	2	
Total	199.02		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 24  
 DATE :12/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°45.09  
 start stop duration Lon E 14°32.05  
 TIME :19:14:01 19:41:24 27.4 (min) Purpose : 3  
 LOG : 9445.57 9446.93 1.4 Region : 5030  
 FDEPTH: 540 550 Gear cond.: 0  
 BDEPTH: 540 550 Validity : 0  
 Towing dir: 0° Wire out : 1250 m Speed : 3.0 kn  
 Sorted : 78 Total catch: 113.27 Catch/hour: 248.22

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Funchalia woodwardi	47.88	14364	19.29
Merluccius paradoxus	43.43	46	126
Coelorinchus acanthiger	34.84	1026	
Bathyrja smithii	17.18	2	6.92
Rajella barnardi	17.01	20	6.85
Selachophidium guentheri	16.44	197	6.62
Centrophorus squamosus	12.97	5	5.23
Rajella leopardus	11.00	22	4.43
Nezumia micronychodon	9.64	373	3.88
Cruriraja parcomaculata	9.38	13	3.78
Starfish	4.93	0	1.99
Todarodes sagittatus	4.60	7	1.85
Phosichthys argenteus	4.16	263	1.68
Notacanthus sexspinis	4.05	66	1.63
Chaceon maritae	3.16	2	1.27
Myctophidae sp. small/mix	1.42	478	0.57
Deepwater fish mixture	1.10	0	0.44
Coelorinchus matama	0.99	7	0.40
Aristostomias sp.	0.99	28	0.40
Bassanago albescens	0.66	7	0.26
Bristle worms (straws)	0.66	0	0.26
Sepia hieronis	0.44	7	0.18
Myxine capensis	0.33	11	0.13
Shark eggs	0.22	0	0.09
Phlostethus cadenati	0.18	2	0.07
Lycoteuthis diadema *	0.11	22	0.04
Neoscopelus macrolepidotus	0.11	7	0.04
Etmopterus brachyurus	0.11	7	0.04
PORIFERA (Sponges)	0.11	0	0.04
Stomias boa boa	0.07	11	0.03
Munidopsis chuni	0.07	18	0.03
Total	248.22		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 25  
 DATE :12/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°47.01  
 start stop duration Lon E 14°31.92  
 TIME :22:20:14 22:52:02 31.8 (min) Purpose : 3  
 LOG : 9457.24 9458.90 1.7 Region : 5030  
 FDEPTH: 583 585 Gear cond.: 0  
 BDEPTH: 583 585 Validity : 0  
 Towing dir: 0° Wire out : 1320 m Speed : 3.1 kn  
 Sorted : 0 Total catch: 129.89 Catch/hour: 245.08

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius paradoxus	74.04	70	30.21
Coelorinchus karrerae	47.70	1223	19.46
Raja sp.	23.43	32	9.56
Nezumia micronychodon	19.25	506	7.85
Selachophidium guentheri	17.77	196	7.25
Bathyrja smithii	17.02	2	5.31
Todarodes pacificus	11.40	21	4.65
Starfish	5.74	0	2.34
Cruriraja parcomaculata	5.21	8	2.12
Phosichthys argenteus	3.51	153	1.43
Raja straeleni	3.28	0	1.34

SPESIES	weight	CATCH/HOUR	% OF TOT. C	SAMP
Miscellaneous fishes	3.28	0	1.34	
Coloconger scholesi	3.21	2	1.31	
Neoscolepis macrolepidotus	2.94	128	1.20	
Notacanthus sexspinitis	1.13	38	0.46	
Bassanago albescens	1.02	4	0.42	
Bristle worms	0.98	0	0.40	
Anemones, pink	0.98	0	0.40	
Sepioida sp.	0.91	17	0.37	
Gonostoma denudatum	0.87	96	0.35	
Chaceon chuni	0.87	13	0.35	
Etmopterus brachyurus	0.60	8	0.25	
Diaphus meadi	0.57	283	0.23	
Ebinania costaecanarie	0.45	4	0.18	
Malacocteus niger	0.42	15	0.17	
Funchalia woodwardi	0.34	0	0.14	
Chauliodus sloani**	0.30	19	0.12	
Melanocetus johnsoni	0.26	6	0.11	
Myxine capensis	0.23	4	0.09	
Hoplostethus cadenati	0.19	6	0.08	
Myctophid sp. B	0.19	42	0.08	
Eggs of ray	0.11	4	0.05	
Symbolophorus boops	0.11	9	0.05	
Bathophilus longipinnis	0.11	6	0.05	
Lycoteuthis diadema *	0.11	23	0.05	
G A S T R O P O D S	0.11	0	0.05	
Stoloteuthis leucoptera	0.11	13	0.05	
Callionymus regani	0.08	2	0.03	
Shrimps, small, non comm.	0.04	2	0.02	
Aristaeopsis edwardsiana	0.04	4	0.02	
Macroparalepis affinis	0.04	4	0.02	
Laemonema laureysi	0.04	2	0.02	
Plesionika sp.	0.04	4	0.02	
Conger wilsoni	0.02	2	0.01	
JELLYFISH	0.02	4	0.01	
Myctophid sp. A	0.02	2	0.01	
Total	245.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 26  
DATE :13/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°15.80  
Lon E 14°54.39  
TIME :05:09:20 05:41:37 32.3 (min) Purpose : 3  
LOG : 9496.93 9498.67 1.7 Region : 5030  
FDEPTH: 201 204 Gear cond.: 0  
BDEPTH: 201 204 Validity : 0  
Towing dir: 0° Wire out : 500 m Speed : 3.2 kn  
Sorted : 159 Total catch: 467.90 Catch/hour: 869.43

SPESIES	weight	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius capensis	275.60	1353	31.70	150
Chelidonichthys capensis	124.87	0	14.36	
Sufflogobius bibarbatu	94.54	31514	10.87	
Myctophidae sp. small/mix	78.49	39244	9.03	
Merluccius capensis	59.87	24	6.89	151
Thyriscites atun	58.94	30	6.78	148
Raja straeleni	42.07	11	4.84	
Merluccius paradoxus	38.06	1487	4.38	0
Sepia australis	25.87	1368	2.97	
Merluccius paradoxus	22.34	69	2.57	134
Galeorhinus galeus	22.30	2	2.56	
Todaropsis eblanae	12.49	282	1.44	
Genypterus capensis	4.57	4	0.53	
Dromidia sp.	3.57	253	0.41	
Lophius vomerinus	2.27	4	0.26	149
Ascidacea	1.49	0	0.17	
Trachurus capensis	1.23	32	0.14	147
Squilla acuelata calmani	0.89	74	0.10	
Total	869.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 27  
DATE :13/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°19.90  
Lon E 14°47.64  
TIME :07:50:54 08:20:57 30.1 (min) Purpose : 3  
LOG : 9512.99 9514.63 1.6 Region : 5030  
FDEPTH: 292 293 Gear cond.: 0  
BDEPTH: 292 293 Validity : 0  
Towing dir: 0° Wire out : 710 m Speed : 3.3 kn  
Sorted : 223 Total catch: 1019.43 Catch/hour: 2035.47

SPESIES	weight	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius paradoxus	164.92	383	80.81	136
PORIFERA (Sponges)	247.41	0	12.15	
Lophius vomerinus	53.23	22	2.62	139
Helicolenus dactylopterus ***	34.70	327	1.70	141
Merluccius capensis	8.47	6	0.42	137
Squilla acuelata calmani	7.83	603	0.38	
Thyriscites atun	7.47	2	0.37	140
Miscellaneous fishes	7.19	0	0.35	
Coelorrinchus simorhynchus	7.19	202	0.35	
Genypterus capensis	3.27	2	0.16	138
G A S T R O P O D S	2.96	0	0.15	
Bathynectes piperitus	2.76	180	0.14	
Brama brama	2.60	4	0.13	142
Sepia elegans	1.48	22	0.07	
Starfish	1.28	0	0.06	
Todaropsis eblanae	0.84	10	0.04	
Anemones, white	0.42	0	0.02	
Lepidopus caudatus	0.42	10	0.02	
Myctophidae sp. small/mix	0.42	180	0.02	
Dromidia sp.	0.42	22	0.02	
Sufflogobius bibarbatu	0.22	54	0.01	
Total	2035.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 28  
DATE :13/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°21.84  
Lon E 14°37.66  
TIME :10:52:37 11:22:09 29.5 (min) Purpose : 3  
LOG : 9529.34 9530.76 1.4 Region : 5030  
FDEPTH: 343 345 Gear cond.: 0  
BDEPTH: 343 345 Validity : 0  
Towing dir: 0° Wire out : 815 m Speed : 2.9 kn  
Sorted : 110 Total catch: 499.80 Catch/hour: 1015.51

SPESIES	weight	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius paradoxus	629.06	2560	61.94	143
PORIFERA (Sponges)	185.51	0	18.27	
Coelorrinchus simorhynchus	110.73	1656	10.90	
Helicolenus dactylopterus ***	24.18	406	2.38	144
Genypterus capensis	16.09	10	1.58	145
Symbolophorus boops	11.99	782	1.18	
Todaropsis pacificus	8.29	26	0.82	
Miscellaneous fishes	6.50	0	0.64	
Bathynectes piperitus	5.89	284	0.58	
Anemones, white	4.06	0	0.40	
Diaphus hudsoni	4.06	2032	0.40	
Squilla acuelata calmani	3.25	437	0.32	

Lophius vomerinus	1.91	2	0.19	146
Starfish	1.42	0	0.14	
Epigonus denticulatus**	0.61	71	0.06	
Sepia elegans	0.61	20	0.06	
Lycoteuthis diadema *	0.41	30	0.04	
Kuronezumia leonis	0.41	30	0.04	
Paracallionymus costatus	0.30	30	0.03	
Hoplostethus mediterraneus	0.10	10	0.01	
Stoloteuthis leucoptera	0.10	10	0.01	
Pelagia noctiluca	0.02	4	0.00	
Total	1015.51		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 29  
DATE :13/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°24.33  
Lon E 14°20.48  
TIME :14:06:45 14:36:39 29.9 (min) Purpose : 3  
LOG : 9547.77 9549.31 1.5 Region : 5030  
FDEPTH: 449 443 Gear cond.: 0  
BDEPTH: 449 443 Validity : 0  
Towing dir: 0° Wire out : 1040 m Speed : 3.1 kn  
Sorted : 121 Total catch: 184.29 Catch/hour: 369.69

SPESIES	weight	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius paradoxus	105.60	201	28.56	152
Coelorrinchus simorhynchus	99.14	2022	26.82	
Lophius vailanti	36.15	6	9.78	153
Genypterus capensis	20.22	8	5.47	154
Miscellaneous fishes	16.01	0	4.33	
Galeus pollii	13.48	134	3.65	
Todarodes sagittatus	9.63	20	2.60	
Starfish	8.14	0	2.20	
Anemones, white	7.90	72	2.14	
Cruriraja parcomaculata	7.74	4	2.09	
Selachophidium guentheri	6.32	112	1.71	
Symbolophorus boops	6.18	443	1.67	
Epigonus telescopus**	5.62	514	1.52	
Hydrolagus sp.	4.77	6	1.29	
Kuronezumia leonis	4.07	407	1.10	
Coelorrinchus karrerae	3.09	140	0.84	
Sympagurus dimorphus	2.11	239	0.57	
Macrorhaphosus scolopax ***	1.83	36	0.49	
Holohalaelurus regani	1.54	8	0.42	
Chrysaora sp.	1.54	0	0.42	
Plesionika sp.	1.34	514	0.42	
Anemones, pink	1.26	8	0.34	
PORIFERA (Sponges)	1.26	0	0.34	
Rajella barnardi	0.80	2	0.22	
Eggs of ray	0.70	140	0.19	
Squilla acuelata calmani	0.56	78	0.15	
Phosichthys argenteus	0.56	84	0.15	
Helicolenus dactylopterus ***	0.42	14	0.11	
Funchalia woodwardi	0.42	126	0.11	
Conger wilsoni	0.16	2	0.04	
Scopelosaurus ahlstromi	0.16	4	0.04	
Stoloteuthis sp.	0.14	14	0.04	
Bathynectes piperitus	0.14	22	0.04	
Lepidion guentheri	0.14	8	0.04	
Todaropsis eblanae	0.14	8	0.04	
Pelagia noctiluca	0.10	2	0.03	
Chlorophthalmus agassizi	0.08	8	0.02	
Total	369.69		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 30  
DATE :13/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°24.98  
Lon E 14°15.99  
TIME :17:06:43 17:36:47 30.1 (min) Purpose : 3  
LOG : 9560.09 9561.61 1.5 Region : 5030  
FDEPTH: 549 530 Gear cond.: 0  
BDEPTH: 549 530 Validity : 0  
Towing dir: 0° Wire out : 1220 m Speed : 3.0 kn  
Sorted : 94 Total catch: 124.28 Catch/hour: 247.98

SPESIES	weight	CATCH/HOUR	% OF TOT. C	SAMP
Bathyrāja smithii	30.93	4	12.47	
Merluccius paradoxus	28.89	30	11.65	155
Coelorrinchus acanthiger	25.46	942	10.27	
Centrophorus squamosus	23.86	2	9.62	
Chrysaora sp.	22.59	0	9.11	
Lophius vomerinus	19.59	2	7.90	156
Selachophidium guentheri	17.88	231	7.21	
Starfish	14.61	0	5.89	
Anemones, white	12.45	0	5.02	
Bristle worms (straws)	9.18	0	3.70	
Rajella leopardenus	8.06	18	3.25	
Nezumia micronychodon	5.75	259	2.32	
Lithodes ferox	5.03	10	2.03	
Todarodes sagittatus	4.47	10	1.80	
Cruriraja parcomaculata	4.23	6	1.71	
Notacanthus sexspinitis	2.39	76	0.97	
Phosichthys argenteus	2.39	239	0.97	
Deepwater fish mixture	2.15	0	0.87	
Etmopterus brachyurus	1.84	12	0.74	
Funchalia woodwardi	1.68	279	0.68	
Coelorrinchus simorhynchus	0.88	4	0.35	
Bassanago albescens	0.76	2	0.31	
Parapeneus longirostris	0.72	144	0.29	
Rajella barnardi	0.68	2	0.27	
Epigonus denticulatus**	0.40	8	0.16	
Myctophidae sp. small/mix	0.16	48	0.06	
Symbolophorus boops	0.16	16	0.06	
Sympagurus dimorphus	0.16	16	0.06	
Shark eggs	0.16	0	0.06	
Sepia hieronis	0.08	8	0.03	
Nansenia macrolepis**	0.08	4	0.03	
G A S T R O P O D S	0.08	0	0.03	
EUPHASIDAE *	0.08	72	0.03	
Howella shernborni**	0.08	12	0.03	
Bathynectes piperitus	0.04	8	0.02	
Paralepidae	0.04	4	0.02	
Total	247.98		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 31  
DATE :13/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 27°20.55  
Lon E 14°10.72  
TIME :20:14:13 20:45:01 30.8 (min) Purpose : 3  
LOG : 9571.69 9573.24 1.6 Region : 5030  
FDEPTH: 579 567 Gear cond.: 0  
BDEPTH: 579 567 Validity : 0  
Towing dir: 0° Wire out : 1300 m Speed : 3.0 kn  
Sorted : 69 Total catch: 116.71 Catch/hour: 227.36

SPESIES	weight	CATCH/HOUR	% OF TOT. C	SAMP
Coelorrinchus acanthiger	51.43	53	22.62	
Merluccius paradoxus	51.08	45	22.47	157
Nezumia micronychodon	33.31	777	14.65	
Selachophidium guentheri	30.27	327	13.32	
Centrophorus squamosus	17.77	2	7.81	
Todarodes sagittatus	6.08	10	2.67	
Neoscolepis macrolepidotus	5.03	12	2.21	
Bristle worms (straws)	3.39	0	1.49	
Rajella barnardi	3.39	12	1.49	
Anemones, white	3.16	0	1.39	
Ebinania costaecanarie	2.92	4	1.29	
Phosichthys argenteus	2.45	245	1.08	
Deepwater fish mixture	1.75	0	0.77	
G A S T R O P O D S	1.52	0	0.67	

Funchalia woodwardi	1.40	210	0.62	
Lithodes ferox	1.36	6	0.60	
Chaceon maritae	1.32	10	0.58	
Krill	1.17	1169	0.51	
Etmorepus brachyurus	1.17	6	0.51	
Hydrodalagus sp.	1.17	2	0.51	
Trachyrincus scabrus	0.90	4	0.39	
Starfish	0.70	0	0.31	
Symbolophorus boops	0.70	29	0.31	
Notacanthus sexspinis	0.70	6	0.31	
Plesionika martia	0.47	76	0.21	
Myctophidae sp. small/mix	0.47	99	0.21	
Hoplostethus cadenati	0.35	12	0.15	
Benthodesmus tenuis	0.23	2	0.10	
Paralepidae	0.23	6	0.10	
Rajella barnardi	0.23	6	0.10	0
Histioteuthis reversa	0.23	18	0.10	
Hoplostethus cadenati	0.23	6	0.10	0
Malacosteus niger	0.12	6	0.05	
Howella shernborni**	0.12	6	0.05	
Unidentified crustacean	0.12	6	0.05	
Aequorea sp.	0.12	0	0.05	
Epigonus denticulatus**	0.12	6	0.05	
Lampanyctus australis	0.12	6	0.05	
Plesiopenaeus edwardsianus	0.06	6	0.03	
Total	227.36		100.00	

Lophius vomerinus	17.22	4	4.05	181
Cruriraja parcomaculata	13.46	8	3.16	
Starfish	8.07	0	1.90	
Miscellaneous fishes	4.55	0	1.07	
PORIFERA (Sponges)	4.39	0	1.03	
Chrysaora hyosocella	4.23	0	0.99	
Helicolenus dactylopterus ***	3.68	48	0.86	183
Merluccius capensis	3.00	2	0.70	180
Anemones, white	2.64	48	0.62	
Bathynectes piperitus	2.56	120	0.60	
Kuronezumia leonis	2.32	224	0.54	
Epigonus denticulatus**	1.52	507	0.36	
Nezumia micronychodon	1.52	52	0.36	
Sea urchin, weak spines	1.44	36	0.34	
Selachophidium guentheri	1.28	44	0.30	
Plesionika sp.	1.12	1119	0.26	
Galeus polli	1.12	12	0.26	
Symbolophorus boops	0.80	68	0.19	
Phosichthys argenteus	0.80	104	0.19	
Bathyrucogaster vicinus	0.32	4	0.08	
Lampanyctodes hectoris	0.32	92	0.08	
Eggs of ray	0.16	8	0.04	
Scopelosaurus meadi	0.16	4	0.04	
Hoplostethus mediterraneus	0.08	8	0.02	
G A S T R O P O D S	0.08	12	0.02	
Total	425.59		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 32  
DATE :14/04/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 26°59.74  
Lon E 13°55.49  
start stop duration Purpose : 3  
TIME :02:48:44 03:18:13 29.5 (min) Region : 5030  
LOG : 9607.41 9608.93 1.5 Gear cond.: 0  
FDEPTH: 522 514 Validity : 0  
BDEPTH: 522 514 Speed : 3.1 kn  
Towing dir: 0° Wire out : 1200 m Catch/hour: 183.09  
Sorted : 0 Total catch: 89.96

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 35  
DATE :14/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 26°56.47  
Lon E 14°22.65  
start stop duration Purpose : 3  
TIME :11:46:04 12:16:38 30.6 (min) Region : 5030  
LOG : 9656.61 9658.16 1.6 Gear cond.: 0  
FDEPTH: 353 355 Validity : 0  
BDEPTH: 353 355 Speed : 3.0 kn  
Towing dir: 0° Wire out : 800 m Catch/hour: 1313.89  
Sorted : 164 Total catch: 669.21

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	30.69	33	16.76	159
Selachophidium guentheri	25.81	230	14.10	
Coelorinchus simorhynchus	25.69	427	14.03	
Genypterus capensis	16.28	4	8.89	158
Bathyraja smithii	14.49	4	7.91	
Chrysaora hyosocella	13.07	12	7.14	
Lophius vomerinus	8.79	2	4.80	160
Bristle worms (straws)	8.55	0	4.67	
Notacanthus sexspinis	5.94	104	3.25	
Lithodes ferox	5.86	18	3.20	
Funchalia woodwardi	5.17	1437	2.82	
Nezumia micronychodon	4.44	167	2.42	
Hydrodalagus sp.	3.87	6	2.11	
Coelorinchus acanthiger	2.40	181	1.31	
G A S T R O P O D S	1.63	0	0.89	
Deepwater fish mixture	1.55	0	0.84	
Starfish	1.34	0	0.73	
Eggs of ray	1.26	0	0.69	
Epigonus telescopus**	1.22	41	0.67	
Rajella barnardi	0.85	8	0.47	
Nezumia milleri	0.69	73	0.38	
Ebinania costaeannarie	0.57	6	0.31	
Anemones, white	0.41	0	0.22	
Tripterophycis gilchristi	0.33	2	0.18	
Histioteuthis reversa	0.24	8	0.13	
Parapanaeus longirostris	0.24	47	0.13	
Symbolophorus boops	0.24	20	0.13	
Aequorea sp.	0.20	0	0.11	
Rajella leopardus	0.20	2	0.11	
Phosichthys argenteus	0.16	12	0.09	
Plesiopenaeus edwardsianus	0.12	22	0.07	
Unidentified crustacean	0.12	37	0.07	
Myxiparus dimerus	0.12	4	0.07	
Neoscopelus macrolepidotus	0.12	8	0.07	
Myxine capensis	0.08	2	0.04	
Myctophidae sp. small/mix	0.08	8	0.04	
Plesionika martia	0.08	10	0.04	
Malacosteus niger	0.08	2	0.04	
Stomias boa boa	0.04	2	0.02	
Lampanyctus australis	0.04	2	0.02	
Total	183.09		100.00	

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	635.34	2641	48.36	188
Symbolophorus boops	222.64	22264	16.95	
Coelorinchus simorhynchus	136.65	1453	10.40	
PORIFERA (Sponges)	126.05	0	9.59	
Sea urchins (weak spines)	36.91	0	2.81	
Miscellaneous fishes	27.49	0	2.09	
Galeus polli	22.87	226	1.74	
Lophius vomerinus	22.42	8	1.71	191
Merluccius capensis	19.67	16	1.50	189
Helicolenus dactylopterus ***	12.76	98	0.97	192
Genypterus capensis	11.94	16	0.91	190
Bathynectes piperitus	8.05	452	0.61	
Todarodes sagittatus	6.91	20	0.53	
Rajella barnardi	6.87	4	0.52	
Merluccius paradoxus	6.71	4	0.51	187
Starfish	6.28	0	0.48	
Holohalaelurus regani	1.96	10	0.15	
Nezumia micronychodon	0.79	10	0.06	
Plesionika sp.	0.39	118	0.03	
G A S T R O P O D S	0.39	10	0.03	
Maia coelestis	0.39	10	0.03	
Stomatopoda	0.20	49	0.01	
Lycoteuthis diadema *	0.10	20	0.01	
Bristle worms (straws)	0.10	10	0.01	
Total	1313.89		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 33  
DATE :14/04/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 27°0.00  
Lon E 14°7.98  
start stop duration Purpose : 3  
TIME :05:57:11 06:28:09 31.0 (min) Region : 5030  
LOG : 9627.83 9629.45 1.6 Gear cond.: 0  
FDEPTH: 413 412 Validity : 0  
BDEPTH: 413 412 Speed : 3.1 kn  
Towing dir: 0° Wire out : 1000 m Catch/hour: 1057.25  
Sorted : 180 Total catch: 545.54

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 36  
DATE :14/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 26°53.36  
Lon E 14°44.20  
start stop duration Purpose : 3  
TIME :17:08:50 17:24:03 15.2 (min) Region : 5030  
LOG : 9683.12 9683.96 0.8 Gear cond.: 0  
FDEPTH: 220 222 Validity : 0  
BDEPTH: 220 222 Speed : 3.3 kn  
Towing dir: 0° Wire out : 540 m Catch/hour: 363.47  
Sorted : 39 Total catch: 92.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	76.33	775	72.10	175
Coelorinchus simorhynchus	66.82	767	6.32	
Genypterus capensis	66.67	25	6.31	176
Chrysaora sp.	55.35	0	5.24	
Lophius vomerinus	23.06	6	2.18	177
Sea urchin, weak spines	16.12	0	1.53	
Cruriraja parcomaculata	12.36	6	1.17	
Todarodes sagittatus	9.88	27	0.93	
Galeus polli	9.30	85	0.88	
Helicolenus dactylopterus ***	7.60	31	0.72	178
Starfish	7.44	0	0.70	
Selachophidium guentheri	4.50	132	0.43	
Bathynectes piperitus	4.19	209	0.40	
Deepwater fish mixture	3.88	0	0.37	
Anemones, white	3.26	0	0.31	
Nezumia micronychodon	1.63	155	0.15	
Epigonus denticulatus**	0.93	147	0.09	
Phosichthys argenteus	0.78	155	0.07	
Parapanaeus longirostris	0.47	171	0.04	
Eggs of ray	0.31	0	0.03	
Paralepidae	0.31	8	0.03	
Physiculus capensis	0.08	8	0.01	
Total	1057.25		100.00	

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sufflogobius bibarbatu	124.38	13817	34.22	
Merluccius paradoxus	97.37	769	26.79	184
Merluccius capensis	50.07	300	13.77	185
Aequorea sp.	36.86	0	10.14	
Myctophidae sp. small/mix	34.49	11503	9.49	
Chelidonichthys capensis	9.07	12	2.49	186
Callorhynchus capensis	5.68	4	1.56	
Coelorinchus simorhynchus	2.17	32	0.60	
Squilla aculeata calmani	1.38	79	0.38	
PORIFERA (Sponges)	0.99	0	0.27	
Bathynectes piperitus	0.39	39	0.11	
EUPHASIDAE *	0.39	1971	0.11	
Ophisurus serpens ***	0.24	4	0.07	
Total	363.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 34  
DATE :14/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 26°59.85  
Lon E 14°12.54  
start stop duration Purpose : 3  
TIME :08:39:53 09:09:55 30.0 (min) Region : 5030  
LOG : 9639.71 9641.29 1.6 Gear cond.: 0  
FDEPTH: 397 395 Validity : 0  
BDEPTH: 397 395 Speed : 3.2 kn  
Towing dir: 0° Wire out : 950 m Catch/hour: 425.59  
Sorted : 176 Total catch: 213.08

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 37  
DATE :14/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 26°49.58  
Lon E 14°54.42  
start stop duration Purpose : 3  
TIME :19:43:07 20:03:16 20.1 (min) Region : 5030  
LOG : 9698.01 9699.08 1.1 Gear cond.: 0  
FDEPTH: 160 161 Validity : 0  
BDEPTH: 160 161 Speed : 3.2 kn  
Towing dir: 0° Wire out : 400 m Catch/hour: 937.42  
Sorted : 71 Total catch: 314.66

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	181.64	346	42.68	179
Coelorinchus simorhynchus	106.74	1099	25.08	
Genypterus capensis	40.35	24	9.48	182
Todarodes sagittatus	20.05	44	4.71	

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sufflogobius bibarbatu	341.41	68282	36.42	
Aequorea sp.	304.23	0	32.45	
Merluccius capensis	175.89	2699	18.76	193
Myctophidae sp. small/mix	47.19	42471	5.03	
Chelidonichthys capensis	46.06	83	4.91	195
Thyrssites atun	11.80	6	1.26	196
Callorhynchus capensis	4.95	3	0.53	
Trachurus capensis	2.56	18	0.27	194
Raja straeleni	2.26	3	0.24	
DRÖMIDAE	0.36	18	0.04	
Todaropsis eblanae	0.36	54	0.04	
G A S T R O P O D S	0.36	0	0.04	
Total	937.42		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 38  
DATE :15/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 26°19.06

start stop duration Lon E 14°40.97  
 TIME :05:21:24 05:51:29 30.1 (min) Purpose : 3  
 LOG : 9761.24 9762.77 1.5 Region : 5030  
 FDEPTH: 172 172 Gear cond.: 0  
 BDEPTH: 172 172 Validity : 0  
 Towing dir: 0° wire out : 440 m Speed : 3.0 kn  
 Sorted : 59 Total catch: 565.02 Catch/hour: 1127.03

Total 2110.45 100.00  
 R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 43  
 DATE :16/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°57.77 Lon E 13°40.69  
 TIME :05:24:05 05:53:36 29.5 (min) Purpose : 3  
 LOG : 9897.61 9899.06 1.4 Region : 5030  
 FDEPTH: 494 501 Gear cond.: 0  
 BDEPTH: 494 501 Validity : 0  
 Towing dir: 0° wire out : 1140 m Speed : 3.0 kn  
 Sorted : 197 Total catch: 289.60 Catch/hour: 588.62

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Merluccius capensis	570.00	13833	50.58	197
Aequorea sp.	306.98	0	27.24	
Sufflogobius bibarbatu	167.51	18608	14.86	
Callorhinchus capensis	44.48	26	3.95	
Myctophidae sp. small/mix	15.92	5306	1.41	
Todarodes sagittatus	10.57	30	0.94	
Austroglossus microlepis	5.07	14	0.45	198
G A S T R O P O D S	3.03	0	0.27	
Chelidonichthys capensis	1.08	2	0.10	199
Trachurus capensis	0.88	6	0.08	200
Ascidacea	0.76	0	0.07	
B I V A L V E S	0.76	0	0.07	
Total	1127.03		100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Merluccius paradoxus	252.32	482	42.87	217
Nezumia micronychodon	81.95	1610	13.92	
Coeliorinchus simorhynchus	72.85	140	12.38	
Lophius vomerinus	31.50	2	5.35	219
Myctophidae sp. small/mix	29.76	19837	5.06	
Todarodes sagittatus	27.28	51	4.63	
Genypterus capensis	23.50	8	3.99	218
Notacanthus sepsipinis	19.35	569	3.29	
Rajella barnardi	16.42	8	2.79	
Selachophidium guentheri	7.48	106	1.27	
Galeus pollii	6.02	130	1.02	
G A S T R O P O D S	2.11	0	0.36	
Anemones, white	2.11	0	0.36	
Myxine capensis	2.11	33	0.36	
Bassanago albescens	1.83	4	0.31	
Lampanyctus australis	1.63	146	0.28	
Symbolophorus boops	1.63	203	0.28	
Hoplostethus cadenati	1.30	41	0.22	
Aequorea sp.	1.30	0	0.22	
Sympagurus dimorphus	1.14	106	0.19	
Epigonus telescopus**	0.81	65	0.14	
Chrysaora sp.	0.81	0	0.14	
Trachyrincus scabrus	0.81	8	0.14	
Bathylagus glaucii ***	0.49	8	0.08	
PORIFERA (Sponges)	0.49	0	0.08	
EUPHASIDAE *	0.49	1463	0.08	
Stomias boa boa	0.33	33	0.06	
Polychaetes sp.	0.16	24	0.03	
Parapenaeus longirostris	0.16	24	0.03	
Coeliorinchus acanthiger	0.16	16	0.03	
Phosichthys argenteus	0.16	8	0.03	
Sepia hieronis	0.16	8	0.03	
Total	588.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 39  
 DATE :15/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 26°15.07 Lon E 14°25.39  
 TIME :09:41:27 10:03:21 21.9 (min) Purpose : 3  
 LOG : 9787.92 9788.93 1.0 Region : 5030  
 FDEPTH: 217 218 Gear cond.: 0  
 BDEPTH: 217 218 Validity : 0  
 Towing dir: 0° wire out : 570 m Speed : 2.8 kn  
 Sorted : 192 Total catch: 2557.84 Catch/hour: 7007.78

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 44  
 DATE :16/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 26°19.66 Lon E 14°5.66  
 TIME :12:39:09 13:00:18 21.1 (min) Purpose : 3  
 LOG : 9935.64 9936.63 1.0 Region : 5030  
 FDEPTH: 352 354 Gear cond.: 0  
 BDEPTH: 352 354 Validity : 0  
 Towing dir: 0° wire out : 840 m Speed : 2.8 kn  
 Sorted : 143 Total catch: 606.53 Catch/hour: 1721.47

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Merluccius capensis	4165.48	15496	59.44	201
Chrysaora fulgida	1787.40	268	25.51	
Symbolophorus boops	564.60	51315	8.06	
Lampanyctodes hectoris	314.52	396712	4.49	
Sufflogobius bibarbatu	92.82	0	1.32	
Aequorea forskalea	34.52	0	0.49	
Ascidacea	19.18	0	0.27	
Todarodes sagittatus	14.63	41	0.21	
Callorhinchus capensis	8.49	3	0.12	
Raja straeleni	3.95	3	0.06	202
Trachurus capensis	1.42	11	0.02	
G A S T R O P O D S	0.77	77	0.01	
Total	7007.78		100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Merluccius paradoxus	781.36	3088	45.39	220
Merluccius capensis	248.34	412	14.43	221
Coeliorinchus simorhynchus	225.07	2342	13.07	
PORIFERA (Sponges)	108.99	0	6.33	
Chrysaora fulgida	90.54	0	5.26	
Lophius vomerinus	40.76	17	2.37	223
Miscellaneous fishes	40.02	0	2.32	
Aequorea forskalea	36.05	0	2.09	
Bathynectes piperitus	30.65	71	1.78	
Sea urchin, weak spines	30.65	0	1.78	
Lampanyctus australis	21.57	737	1.25	
Todarodes sagittatus	15.21	62	0.88	
Galeus pollii	11.07	99	0.64	
Raja straeleni	7.61	3	0.44	
Schedophilus huttoni	7.27	3	0.42	
Genypterus capensis	6.13	3	0.36	222
Helicolenus dactylopterus	5.70	71	0.33	224
Nezumia micronychodon	4.82	170	0.28	
Starfish	3.41	0	0.20	
Squilla acuelata calmani	2.27	128	0.13	
G A S T R O P O D S	1.14	0	0.07	
Plesionika sp.	1.14	270	0.07	
Anemones, white	1.14	0	0.07	
Maurolicus muelleri	0.57	213	0.03	
Total	1721.47		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 40  
 DATE :15/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 26°2.04 Lon E 14°17.64  
 TIME :13:38:28 14:05:44 27.3 (min) Purpose : 3  
 LOG : 9809.41 9810.77 1.4 Region : 5030  
 FDEPTH: 214 217 Gear cond.: 0  
 BDEPTH: 214 217 Validity : 0  
 Towing dir: 0° wire out : 540 m Speed : 3.0 kn  
 Sorted : 0 Total catch: 2000.00 Catch/hour: 4400.44

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 45  
 DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°2.55 Lon E 13°49.53  
 TIME :14:12:25 14:43:30 31.1 (min) Purpose : 3  
 LOG : 154.48 156.06 1.6 Region : 5030  
 FDEPTH: 230 237 Gear cond.: 0  
 BDEPTH: 230 237 Validity : 0  
 Towing dir: 0° wire out : 580 m Speed : 3.1 kn  
 Sorted : 171 Total catch: 677.20 Catch/hour: 1307.34

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Chrysaora fulgida	3297.91	0	74.95	
Trachurus capensis	1990.10	3061	22.50	203
Merluccius capensis	82.51	10284	1.88	204
Merluccius capensis	27.50	26713	0.63	207
Chelidonichthys capensis	1.98	2	0.04	205
Austroglossus microlepis	0.44	2	0.01	206
Total	4400.44		100.00	

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Merluccius paradoxus	466.60	51844	39.76	
Sufflogobius bibarbatu	189.62	0	16.16	
Aequorea sp.	168.75	1266	14.38	208
Merluccius capensis	164.02	0	13.98	
Chrysaora fulgida	112.27	334	9.57	
Todarodes sagittatus	32.00	31997	2.73	
Myctophidae sp. small/mix	18.64	147	1.59	210
Trachurus capensis	10.06	24	0.86	209
Austroglossus microlepis	5.56	2	0.47	
Callorhinchus capensis	4.41	8	0.38	211
Chelidonichthys capensis	0.70	0	0.06	
G A S T R O P O D S	0.42	0	0.04	
Ascidacea	0.24	2	0.02	
Lepidopus caudatus	0.14	0	0.01	
B I V A L V E S	0.08	0	0.01	
Snail	0.08	0	0.01	
Total	1173.51		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 41  
 DATE :15/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 26°1.91 Lon E 14°28.40  
 TIME :16:41:43 17:11:55 30.2 (min) Purpose : 3  
 LOG : 9826.30 9827.99 1.7 Region : 5030  
 FDEPTH: 196 195 Gear cond.: 0  
 BDEPTH: 196 195 Validity : 0  
 Towing dir: 0° wire out : 500 m Speed : 3.4 kn  
 Sorted : 176 Total catch: 590.47 Catch/hour: 1173.51

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 46  
 DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°2.16 Lon E 13°44.81  
 TIME :16:27:02 16:44:44 17.7 (min) Purpose : 3  
 LOG : 163.50 164.46 0.9 Region : 5030  
 FDEPTH: 298 299 Gear cond.: 0  
 BDEPTH: 298 299 Validity : 0  
 Towing dir: 0° wire out : 750 m Speed : 3.2 kn  
 Sorted : 119 Total catch: 2038.88 Catch/hour: 6911.46

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Sufflogobius bibarbatu	466.60	51844	39.76	
Aequorea sp.	189.62	0	16.16	
Merluccius capensis	168.75	1266	14.38	208
Chrysaora fulgida	164.02	0	13.98	
Todarodes sagittatus	112.27	334	9.57	
Myctophidae sp. small/mix	32.00	31997	2.73	
Trachurus capensis	18.64	147	1.59	210
Austroglossus microlepis	10.06	24	0.86	209
Callorhinchus capensis	5.56	2	0.47	
Chelidonichthys capensis	4.41	8	0.38	211
G A S T R O P O D S	0.70	0	0.06	
Ascidacea	0.42	0	0.04	
Lepidopus caudatus	0.24	2	0.02	
B I V A L V E S	0.14	0	0.01	
Snail	0.08	0	0.01	
Total	1173.51		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 45  
 DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°2.55 Lon E 13°49.53  
 TIME :14:12:25 14:43:30 31.1 (min) Purpose : 3  
 LOG : 154.48 156.06 1.6 Region : 5030  
 FDEPTH: 230 237 Gear cond.: 0  
 BDEPTH: 230 237 Validity : 0  
 Towing dir: 0° wire out : 580 m Speed : 3.1 kn  
 Sorted : 171 Total catch: 677.20 Catch/hour: 1307.34

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 42  
 DATE :16/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 26°2.45 Lon E 13°57.26  
 TIME :01:33:44 02:02:10 28.4 (min) Purpose : 3  
 LOG : 9875.95 9877.39 1.4 Region : 5030  
 FDEPTH: 343 344 Gear cond.: 0  
 BDEPTH: 343 344 Validity : 0  
 Towing dir: 0° wire out : 840 m Speed : 3.0 kn  
 Sorted : 31 Total catch: 1000.00 Catch/hour: 2110.45

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 46  
 DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°2.16 Lon E 13°44.81  
 TIME :16:27:02 16:44:44 17.7 (min) Purpose : 3  
 LOG : 163.50 164.46 0.9 Region : 5030  
 FDEPTH: 298 299 Gear cond.: 0  
 BDEPTH: 298 299 Validity : 0  
 Towing dir: 0° wire out : 750 m Speed : 3.2 kn  
 Sorted : 119 Total catch: 2038.88 Catch/hour: 6911.46

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Merluccius capensis	490.35	4880	37.51	226
PORIFERA (Sponges)	455.91	0	34.87	
Ascidacea	94.83	0	7.25	
Sufflogobius bibarbatu	62.24	7784	4.76	
Trachurus capensis	43.09	232	3.30	225
Macropodus australis	36.76	2826	2.81	
Myctophidae sp. small/mix	25.79	12896	1.97	
Deepwater fish mixture	19.92	0	1.52	
Squilla acuelata calmani	15.75	656	1.20	
Helicolenus dactylopterus ***	13.13	116	1.00	228
Aequorea sp.	11.58	0	0.89	
Dead shells	8.80	0	0.67	
Todarodes sagittatus	6.33	15	0.48	
Lophius vomerinus	5.25	14	0.40	227
G A S T R O P O D S	4.94	0	0.38	
Chelidonichthys capensis	4.32	8	0.33	229
Coeliorinchus simorhynchus	3.09	69	0.24	
Starfish	2.78	0	0.21	
Sympagurus dimorphus	0.93	46	0.07	
Todaropsis eblanae	0.77	15	0.06	
Snail	0.62	0	0.05	
Galeus pollii	0.15	8	0.01	
Total	1307.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 46  
 DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°2.16 Lon E 13°44.81  
 TIME :16:27:02 16:44:44 17.7 (min) Purpose : 3  
 LOG : 163.50 164.46 0.9 Region : 5030  
 FDEPTH: 298 299 Gear cond.: 0  
 BDEPTH: 298 299 Validity : 0  
 Towing dir: 0° wire out : 750 m Speed : 3.2 kn  
 Sorted : 119 Total catch: 2038.88 Catch/hour: 6911.46

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP	
weight	numbers			
Sea urchins (weak spines)	1843.67	0	87.36	
Chrysaora hyoscelata	59.49	0	2.82	
Helicolenus dactylopterus ***	96.54	283	2.68	215
Coeliorinchus simorhynchus	39.89	456	1.89	
Raja straeleni	32.23	13	1.53	
Lophius vomerinus	27.92	19	1.32	216
Merluccius capensis	22.69	61	1.07	212
Merluccius paradoxus	5.76	27	0.27	213
Genypterus capensis	5.00	6	0.24	214
G A S T R O P O D S	3.48	0	0.17	
Nezumia micronychodon	3.36	196	0.16	
Galeus pollii	2.81	32	0.13	
Bathynectes piperitus	2.41	108	0.11	
Todarodes sagittatus	1.60	6	0.08	
Myxine capensis	1.20	44	0.08	
Squilla acuelata calmani	1.20	51	0.06	
Symbolophorus boops	0.40	25	0.02	
Sufflogobius bibarbatu	0.40	32	0.02	
Todaropsis eblanae	0.40	6	0.02	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 46  
 DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°2.16 Lon E 13°44.81  
 TIME :16:27:02 16:44:44 17.7 (min) Purpose : 3  
 LOG : 163.50 164.46 0.9 Region : 5030  
 FDEPTH: 298 299 Gear cond.: 0  
 BDEPTH: 298 299 Validity : 0  
 Towing dir: 0° wire out : 750 m Speed : 3.

	weight	numbers		
Merluccius capensis	3189.53	6034	46.15	230
Sea urchin, weak spines	2138.41	0	30.24	
PORIFERA (Sponges)	737.36	0	10.67	
Helicolenus dactylopterus ***	417.56	3983	6.04	231
Coelorinchus simorhynchus	208.78	3559	3.02	
Todarodes sagittatus	78.44	424	1.13	
ASCIDIACEA	47.05	0	0.68	
Aequorea sp.	26.54	0	0.38	
Mycetophidae sp. small/mix	19.32	4827	0.28	
Lophius vomerinus	15.86	24	0.23	232
G A S T R O P O D S	10.85	0	0.16	
Lepidopus caudatus	9.66	61	0.14	
Chlorophthalmus agassizi	3.63	180	0.05	
Squilla acuelata calmani	3.63	180	0.05	
Macropipus australis	2.41	122	0.03	
Bathynectes piperitus	1.22	122	0.02	
Nezumia micronychodon	1.22	61	0.02	
Total	6911.46		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 47  
DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°0.15 Lon E 13°40.00  
start stop duration Purpose : 3  
TIME :19:35:06 20:05:10 30.1 (min) Region : 5030  
LOG : 178.16 179.68 1.5 Gear cond.: 0  
FDEPTH: 399 407 Validity : 0  
BDEPTH: 399 407 Speed : 3.0 kn  
Towing dir: 0° wire out : 970 m Catch/hour: 782.14  
Sorted : 128 Total catch: 391.98 SPECIES CATCH/HOUR % OF TOT. C SAMP

	weight	numbers		
Merluccius paradoxus	305.05	966	39.00	234
Coelorinchus simorhynchus	140.79	1261	18.00	
Galeus polli	77.90	1093	9.96	
Helicolenus dactylopterus ***	64.49	295	8.25	237
Nezumia micronychodon	32.24	3584	4.12	
Lophius vomerinus	30.93	24	3.95	233
Todarodes sagittatus	20.67	34	2.64	
Mycetophidae sp. small/mix	20.27	10136	2.59	
EUPHASIDAE *	18.84	23545	2.41	
Merluccius paradoxus	11.21	8	1.43	235
Merluccius capensis	9.30	4	1.19	236
Bathynectes piperitus	8.78	367	1.12	
Lithodes ferox	7.18	12	0.92	
PORIFERA (Sponges)	5.59	0	0.71	
Anemones, white	5.11	0	0.65	
Chrysaora sp.	4.63	0	0.59	
Aequorea sp.	4.31	0	0.55	
Symbolophorus boops	3.51	391	0.45	
Deepwater fish mixture	2.87	0	0.37	
Squilla acuelata calmani	1.92	176	0.24	
Selachophidium guentheri	1.76	32	0.22	
Hoplostethus cadenati	0.96	48	0.12	
Epigonus telescopus**	0.96	152	0.12	
Parapaneus longirostris	0.64	160	0.08	
Ebinania costaeacanarie	0.64	32	0.08	
Ophirusus serpens ***	0.48	8	0.06	
Myxine capensis	0.32	8	0.04	
Stomias boa boa	0.32	96	0.04	
Funchalia woodwardi	0.16	8	0.02	
G A S T R O P O D S	0.16	0	0.02	
Notacanthus sexspinis	0.16	16	0.02	
Total	782.14		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 48  
DATE :17/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°1.19 Lon E 13°36.29  
start stop duration Purpose : 3  
TIME :22:26:38 22:44:53 18.2 (min) Region : 5030  
LOG : 190.31 191.17 0.9 Gear cond.: 0  
FDEPTH: 511 514 Validity : 0  
BDEPTH: 511 514 Speed : 2.8 kn  
Towing dir: 0° wire out : 1180 m Catch/hour: 1890.92  
Sorted : 145 Total catch: 574.84 SPECIES CATCH/HOUR % OF TOT. C SAMP

	weight	numbers		
Merluccius paradoxus	1423.42	1138	75.28	238
Cruriraja parcomaculata	200.00	158	10.58	
Todarodes sagittatus	118.95	197	6.29	
Nezumia micronychodon	62.63	2316	3.31	
Selachophidium guentheri	20.26	342	1.07	
Galeus polli	17.63	303	0.93	
Lithodes ferox	13.22	33	0.70	
Bassanago albescens	10.79	26	0.57	
Lophius vomerinus	9.80	3	0.52	239
Lampanyctodes hectoris	4.47	1487	0.24	
Maurolicus muelleri	2.63	5263	0.14	
Deepwater fish mixture	2.37	0	0.13	
Myxine capensis	1.05	39	0.06	
Hoplostethus cadenati	0.79	26	0.04	
Bathynectes piperitus	0.79	39	0.04	
Symbolophorus boops	0.53	39	0.03	
G A S T R O P O D S	0.53	39	0.03	
Funchalia woodwardi	0.39	26	0.02	
Munidopsis chuni	0.26	53	0.01	
Stomias boa boa	0.26	53	0.01	
Epigonus denticulatus**	0.13	13	0.01	
Total	1890.92		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 49  
DATE :18/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°0.21 Lon E 13°33.23  
start stop duration Purpose : 3  
TIME :02:27:52 02:42:03 14.2 (min) Region : 5030  
LOG : 200.70 201.31 0.6 Gear cond.: 0  
FDEPTH: 614 613 Validity : 0  
BDEPTH: 614 613 Speed : 2.6 kn  
Towing dir: 0° wire out : 1350 m Catch/hour: 3278.90  
Sorted : 105 Total catch: 775.46 SPECIES CATCH/HOUR % OF TOT. C SAMP

	weight	numbers		
Trachyrincus scabrus	701.48	2575	21.39	
Ebinania costaeacanarie	399.58	266	12.19	
Nezumia micronychodon	387.15	12520	11.81	
Todarodes sagittatus	266.38	533	8.12	
Starfish	257.51	0	7.85	
Merluccius paradoxus	251.92	211	7.68	240
Selachophidium guentheri	243.30	5061	7.42	
Deepwater fish mixture	204.23	0	6.23	
Cruriraja parcomaculata	197.12	178	6.01	
Anemones, pink	90.57	444	2.76	
Sea urchin, weak spines	72.81	0	2.22	
Lophius vomerinus	52.35	4	1.60	241
Galeus polli	24.86	600	0.76	
Lithodes ferox	24.86	89	0.76	
Symbolophorus boops	23.09	1953	0.70	
B I V A L V E S	17.76	0	0.54	
Anemones, white	17.76	89	0.54	
Phosichthys argenteus	15.98	977	0.49	
Notacanthus sexspinis	7.10	444	0.22	
Funchalia woodwardi	5.33	89	0.16	
Aphroditae indetCV1	5.33	89	0.16	
Bristle worms (straws)	3.55	0	0.11	
Lampanyctodes hectoris	3.55	1598	0.11	
Epigonus denticulatus**	2.66	89	0.08	
Sea pens	0.89	89	0.03	

	weight	numbers		
Maurolicus muelleri	0.89	355	0.03	
Stomias boa boa	0.89	89	0.03	
Total	3278.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 50  
DATE :18/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°21.92 Lon E 13°37.29  
start stop duration Purpose : 3  
TIME :06:26:09 06:49:35 23.4 (min) Region : 5030  
LOG : 227.55 228.79 1.2 Gear cond.: 0  
FDEPTH: 478 480 Validity : 0  
BDEPTH: 478 480 Speed : 3.2 kn  
Towing dir: 0° wire out : 1150 m Catch/hour: 341.84  
Sorted : 67 Total catch: 133.49 SPECIES CATCH/HOUR % OF TOT. C SAMP

	weight	numbers		
Selachophidium guentheri	44.87	1544	13.12	
Galeus polli	43.02	1690	12.59	
Merluccius paradoxus	40.05	120	11.72	242
Nezumia micronychodon	39.33	1875	11.51	
Mycetophidae sp. small/mix	39.18	13060	11.46	
Deepwater fish mixture	23.51	0	6.88	
Merluccius capensis	16.82	20	4.92	243
Aequorea sp.	10.29	0	3.01	
EUPHASIDAE *	9.58	11908	2.80	
Helicolenus dactylopterus ***	8.55	41	2.55	246
Coelorinchus simorhynchus	7.84	77	2.29	
Todarodes sagittatus	6.71	18	1.96	
Anemones, white	6.45	0	1.89	
Torpedo nobiliana	6.09	3	1.78	
Starfish	5.53	0	1.62	
Lophius vomerinus	4.76	3	1.39	244
Myxine capensis	3.38	61	0.99	
G A S T R O P O D S	3.28	0	0.99	
Ebinania costaeacanarie	3.23	146	0.94	
Chrysaora sp.	3.23	0	0.94	
Genypterus capensis	3.07	3	0.90	245
Schedophilus huttoni	2.10	3	0.61	
Sepia hieronis	1.84	46	0.54	
Bathynectes piperitus	1.08	154	0.31	
Anemones, pink	1.08	0	0.31	
Epigonus telescopus**	0.92	192	0.27	
Symbolophorus boops	0.77	85	0.22	
Parapaneus longirostris	0.77	338	0.22	
Trachyrincus scabrus	0.61	8	0.18	
Rajella barnardi	0.46	8	0.13	
Munidopsis chuni	0.46	353	0.13	
Malacocephalus laevis	0.46	8	0.13	
Eggs of ray	0.46	0	0.13	
Stomias boa boa	0.31	92	0.09	
Lampanyctus australis	0.31	31	0.09	
Munida sp.*	0.31	146	0.09	
Sea urchin, weak spines	0.15	0	0.04	
Dead shells	0.15	0	0.04	
Hoplostethus cadenati	0.15	15	0.04	
Notacanthus sexspinis	0.15	23	0.04	
Funchalia woodwardi	0.15	23	0.04	
Aphroditae indetCV1	0.15	8	0.04	
Scomberesox saurus	0.10	3	0.03	
Total	341.84		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 51  
DATE :18/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°21.57 Lon E 13°43.95  
start stop duration Purpose : 3  
TIME :09:46:36 10:04:23 17.2 (min) Region : 5030  
LOG : 246.06 246.96 0.9 Gear cond.: 0  
FDEPTH: 335 334 Validity : 0  
BDEPTH: 335 334 Speed : 3.1 kn  
Towing dir: 0° wire out : 830 m Catch/hour: 2223.65  
Sorted : 341 Total catch: 658.57 SPECIES CATCH/HOUR % OF TOT. C SAMP

	weight	numbers		
Merluccius capensis	908.14	5389	40.84	247
Helicolenus dactylopterus ***	438.67	3025	19.73	250
Chrysaora fulgida	275.12	95	12.37	
Lophius vomerinus	155.66	209	7.00	248
Sea urchin, weak spines	82.25	0	3.70	
Deepwater fish mixture	80.36	0	3.61	
Aequorea forskalea	68.07	0	3.06	
G A S T R O P O D S	52.00	0	2.34	
Todarodes sagittatus	40.65	189	1.83	
Coelorinchus simorhynchus	32.14	51	1.45	
Bathynectes piperitus	28.36	1844	1.28	
Squilla acuelata calmani	25.53	1324	1.15	
Nezumia micronychodon	10.40	662	0.47	
Lampanyctodes hectoris	9.45	4727	0.43	
Myxine capensis	5.67	189	0.26	
Genypterus capensis	4.93	7	0.22	249
Galeus polli	1.42	331	0.06	
Guentherus altivela	1.05	3	0.05	
Selachophidium guentheri	0.95	236	0.04	
Aristaeomorpha foliacea	0.95	284	0.04	
Munidopsis chuni	0.47	142	0.02	
Sea pens	0.47	47	0.02	
Pontocaris lacazei ***	0.47	47	0.02	
Starfish	0.47	47	0.02	
Total	2223.65		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 52  
DATE :18/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 25°21.13 Lon E 13°51.58  
start stop duration Purpose : 3  
TIME :11:55:59 12:10:10 14.2 (min) Region : 5030  
LOG : 255.73 256.44 0.7 Gear cond.: 0  
FDEPTH: 268 270 Validity : 0  
BDEPTH: 268 270 Speed : 3.0 kn  
Towing dir: 0° wire out : 630 m Catch/hour: 4295.04  
Sorted : 86 Total catch: 1015.06 SPECIES CATCH/HOUR % OF TOT. C SAMP

	weight	numbers		
Aequorea forskalea	1203.72	0	28.03	
PORIFERA (Sponges)	1178.84	0	27.45	
Merluccius capensis	751.14	2463	17.49	251
Lampanyctodes hectoris	318.70	318618	7.42	
Chrysaora fulgida	276.05	0	6.43	
Trachurus capensis	244.06	711	5.68	253
Todarodes sagittatus	164.68	770	3.83	
ASCIDIACEA	59.24	0	1.38	
Squilla acuelata calmani	26.06	1422	0.61	
Bathynectes piperitus	21.33	355	0.50	
Macropipus australis	20.14	237	0.47	
Chelidonichthys capensis	8.46	13	0.20	252
Torpedo nobiliana	5.42	4	0.13	
Coelorinchus simorhynchus	4.74	178	0.11	
G A S T R O P O D S	4.74	0	0.11	
Starfish	4.74	0	0.11	
Sufflogobius bibaratus	2.37	415	0.06	
Dead shells	0.59	0	0.01	
Total	4295.04		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 53  
DATE :18/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 24°38.74 Lon E 13°29.46  
start stop duration Purpose : 3  
TIME :18:28:43 18:58:50 30.1 (min) Region : 5030



LOG : 306.91 308.51 1.6 Region : 5030  
 FDEPTH: 498 495 Gear cond.: 0  
 BDEPTH: 498 495 Validity: 0  
 Towing dir: 0° Wire out : 1150 m Speed : 3.2 kn  
 Sorted : 174 Total catch: 407.85 Catch/hour: 812.45

Total 702.53 100.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Trachyrincus scabrus	304.58	817	37.49	
Chrysaora sp.	187.85	0	23.12	
Lophius vomerinus	84.54	16	10.41	256
Merluccius paradoxus	63.07	52	7.76	254
Todarodes sagittatus	43.55	74	5.36	
Nezumia micronychodon	34.06	657	4.19	
Symbolophorus boops	13.94	1743	1.72	
Lithodes ferox	13.15	36	1.62	
Genypterus capensis	10.44	4	1.28	255
Helicolenus dactylopterus ***	10.16	28	1.25	257
Anemones, white	9.36	0	1.15	
Aequorea sp.	6.77	0	0.83	
Selachophidium guentheri	4.78	20	0.59	
Bryozoa indetCV1	3.59	0	0.44	
Deepwater fish mixture	3.59	0	0.44	
G A S T R O P O D S	3.19	0	0.39	
Coeliorinchus simorhynchus	2.99	30	0.37	
Galeus polli	2.19	30	0.27	
Centrophorus squamosus	1.99	2	0.25	
Epigonus telescopus**	1.39	219	0.17	
Myxine capensis	1.20	10	0.15	
Bassanago albescens	1.08	2	0.13	
Ebinania costaecanarie	0.84	2	0.10	
Myctophidae sp. small/mix	0.80	398	0.10	
PORIFERA (Sponges)	0.80	0	0.10	
Neolithodes asperrimus	0.68	4	0.08	
EUPHASIDAE *	0.60	578	0.07	
Starfish	0.40	0	0.05	
Phosichthys argenteus	0.40	70	0.05	
Snail	0.20	0	0.02	
Bathylagus glacilis ***	0.20	10	0.02	
Funchalia woodwardi	0.10	10	0.01	
Total	812.45		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 56  
 DATE :19/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°40.87  
 Lon E 13°51.99  
 start stop duration Purpose : 3  
 TIME :04:34:24 05:05:53 31.5 (min) Region : 5030  
 LOG : 350.59 352.18 1.6 Gear cond.: 0  
 FDEPTH: 245 241 Validity: 0  
 BDEPTH: 245 241 Speed : 3.0 kn  
 Towing dir: 0° Wire out : 625 m Catch/hour: 1561.22  
 Sorted : 108 Total catch: 819.12

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	1055.79	14047	67.63	264
PORIFERA (Sponges)	137.95	0	8.84	
Aequorea sp.	123.07	0	7.88	
Chrysaora sp.	71.51	0	4.58	
Sufflogobius bibarbatus	29.73	4952	1.90	
Helicolenus dactylopterus ***	24.68	269	1.58	266
Lophius vomerinus	19.75	34	1.26	265
Ascidacea	16.77	0	1.07	
Squilla acuelata calmani	14.87	680	0.95	
Myctophidae sp. small/mix	14.24	7119	0.91	
Todarodes sagittatus	12.98	63	0.83	
Deepwater fish mixture	11.07	0	0.71	
Macropipus australis	8.23	427	0.53	
G A S T R O P O D S	6.00	0	0.38	
Symbolophorus boops	4.75	412	0.30	
Coeliorinchus simorhynchus	2.53	111	0.16	
Starfish	2.21	0	0.14	
Galeus polli	1.91	143	0.12	
B I V A L V E S	0.95	0	0.06	
Snail	0.63	95	0.04	
Solenocera africana	0.63	253	0.04	
Munidopsis chuni	0.32	269	0.02	
Bathynectes piperitus	0.32	15	0.02	
Lepidopus caudatus	0.30	2	0.02	
Total	1561.22		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 54  
 DATE :18/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°41.12  
 Lon E 13°32.89  
 start stop duration Purpose : 3  
 TIME :21:10:46 21:33:44 23.0 (min) Region : 5030  
 LOG : 316.80 318.00 1.2 Gear cond.: 0  
 FDEPTH: 444 447 Validity: 0  
 BDEPTH: 444 447 Speed : 3.1 kn  
 Towing dir: 0° Wire out : 1150 m Catch/hour: 678.89  
 Sorted : 125 Total catch: 259.79

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 57  
 DATE :19/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°38.53  
 Lon E 14°7.01  
 start stop duration Purpose : 3  
 TIME :08:49:58 08:53:45 3.1 (min) Region : 5030  
 LOG : 377.93 378.12 0.2 Gear cond.: 0  
 FDEPTH: 158 158 Validity: 0  
 BDEPTH: 158 158 Speed : 3.0 kn  
 Towing dir: 0° Wire out : 500 m Catch/hour: 0.00  
 Sorted : 0 Total catch: 0.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Todarodes sagittatus	170.64	287	25.14	
Merluccius paradoxus	151.75	340	22.35	258
Nezumia micronychodon	76.83	2130	11.32	
Merluccius capensis	68.36	29	10.07	
Coeliorinchus simorhynchus	52.53	431	7.74	
Chrysaora fulgida	38.15	3	5.62	
Helicolenus dactylopterus ***	33.97	170	5.00	
Selachophidium guentheri	18.82	209	2.77	
Aequorea forskalea	15.42	0	2.27	
Lithodes ferox	11.03	26	1.62	
Miscellaneous fishes	10.71	0	1.58	
Lophius vomerinus	7.94	3	1.17	
Myxine capensis	6.27	118	0.92	
Symbolophorus boops	4.70	510	0.69	
Epigonus denticulatus**	3.40	470	0.50	
Phosichthys argenteus	1.57	222	0.23	
G A S T R O P O D S	1.31	0	0.19	
Anemones, white	1.31	13	0.19	
Lampanyctodes hectoris	1.05	222	0.15	
Sympagurus dimorphus	0.78	39	0.12	
Chlorophthalmus agassizi	0.52	13	0.08	
Notacanthus sexspinis	0.52	13	0.08	
Stereomastis sculpita	0.26	91	0.04	
Munidopsis chuni	0.26	196	0.04	
Diaphus meadi	0.26	78	0.04	
Lycoteuthis diadema *	0.13	13	0.02	
EUPHASIDAE *	0.13	274	0.02	
Maurolicus muelleri	0.13	78	0.02	
Stomias boa boa	0.13	39	0.02	
Total	678.89		100.00	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora fulgida	2665.69	0	79.79	
Aequorea forskalea	311.21	0	9.31	
Sufflogobius bibarbatus	228.37	19162	6.93	
Merluccius capensis	68.43	98	2.05	267
G A S T R O P O D S	57.03	0	1.71	
Ascidacea	3.26	0	0.10	
Starfish	1.63	244	0.05	
Squilla acuelata calmani	1.63	163	0.05	
Bathynectes piperitus	0.81	81	0.02	
Total	3341.07		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 59  
 DATE :19/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°21.71  
 Lon E 13°53.07  
 start stop duration Purpose : 3  
 TIME :13:23:07 13:43:49 20.7 (min) Region : 5030  
 LOG : 405.70 406.76 1.1 Gear cond.: 0  
 FDEPTH: 280 280 Validity: 0  
 BDEPTH: 280 280 Speed : 3.1 kn  
 Towing dir: 0° Wire out : 720 m Catch/hour: 4345.20  
 Sorted : 107 Total catch: 1498.37

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora fulgida	2588.21	0	59.56	
Merluccius capensis	1017.88	8042	23.43	272
PORIFERA (Sponges)	274.05	0	6.31	
Aequorea sp.	152.25	0	3.50	
Helicolenus dactylopterus ***	91.35	1479	2.10	274
Coeliorinchus simorhynchus	78.30	1021	1.80	
Chirodropus gortilla	30.45	116	0.70	
Lophius vomerinus	14.38	32	0.33	273
Lampanyctus australis	9.77	3584	0.22	
Solenocera africana	9.77	977	0.22	
Todarodes sagittatus	9.77	29	0.22	
Ascidacea	9.77	0	0.22	
Macropipus australis	9.77	244	0.22	
Squilla acuelata calmani	9.77	238	0.22	
Starfish	9.77	0	0.22	
G A S T R O P O D S	9.77	0	0.22	
Sufflogobius bibarbatus	9.77	7818	0.22	
DISCOMEDUSA LOBATA	9.77	29	0.22	
Trachurus capensis	0.61	3	0.01	
Total	4345.20		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 55  
 DATE :19/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°39.46  
 Lon E 13°40.83  
 start stop duration Purpose : 3  
 TIME :00:23:43 00:46:23 22.7 (min) Region : 5030  
 LOG : 331.79 332.89 1.1 Gear cond.: 0  
 FDEPTH: 390 397 Validity: 0  
 BDEPTH: 390 397 Speed : 2.9 kn  
 Towing dir: 0° Wire out : 870 m Catch/hour: 702.53  
 Sorted : 172 Total catch: 265.44

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius paradoxus	217.82	664	31.01	259
Merluccius capensis	132.28	116	18.83	260
Galeus melastomus	83.00	1154	11.81	
Coeliorinchus simorhynchus	54.42	498	7.75	
Helicolenus dactylopterus ***	53.57	66	7.63	263
Nezumia micronychodon	28.16	762	4.01	
Chrysaora fulgida	26.47	0	3.77	
Aequorea forskalea	23.93	0	3.41	
Todarodes sagittatus	17.36	53	2.47	
Bathynectes piperitus	14.72	487	2.09	
Cruriraja parcomaculata	13.47	13	1.92	
Selachophidium guentheri	5.72	222	0.81	
Myxine capensis	5.29	148	0.75	
Lophius vomerinus	5.13	5	0.73	261
Miscellaneous fishes	4.87	0	0.69	
Genypterus capensis	3.23	3	0.46	262
Lithodes ferox	2.62	5	0.37	
Lampanyctus tenuiformis	2.12	1059	0.30	
PORIFERA (Sponges)	2.12	0	0.30	
Aristaeomorpha foliacea	1.91	498	0.27	
G A S T R O P O D S	1.06	0	0.15	
Symbolophorus boops	0.85	74	0.12	
Munidopsis chuni	0.64	222	0.19	
Maurolicus muelleri	0.64	413	0.09	
Squilla acuelata calmani	0.53	53	0.08	
Sea urchin, weak spines	0.42	0	0.06	
Ebinania costaecanarie	0.11	11	0.02	
Notacanthus sexspinis	0.11	42	0.02	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 60  
 DATE :19/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°22.05  
 Lon E 13°41.62  
 start stop duration Purpose : 3  
 TIME :15:35:23 16:05:51 30.5 (min) Region : 5030  
 LOG : 419.69 421.24 1.6 Gear cond.: 0  
 FDEPTH: 332 330 Validity: 0  
 BDEPTH: 332 330 Speed : 3.1 kn  
 Towing dir: 0° Wire out : 840 m Catch/hour: 1278.71  
 Sorted : 170 Total catch: 649.37

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	673.39	2585	52.66	268
Coeliorinchus simorhynchus	187.34	1821	14.65	
Sea urchin, weak spines	151.88	0	11.89	
Todarodes sagittatus	124.21	366	9.71	
Helicolenus dactylopterus ***	68.61	859	5.37	271
Lophius vomerinus	23.83	20	1.86	270
Merluccius capensis	13.55	16	1.06	
Schedophilus huttoni	8.39	4	0.66	

PORIFERA (Sponges)	5.02	0	0.39	
Aequorea sp.	4.21	0	0.33	
Lampanyctus australis	4.21	1055	0.33	
Selachophidium guentheri	2.89	118	0.23	
Nezumia micronychodon	2.64	158	0.21	
Bathynectes piperitus	2.11	118	0.16	
G A S T R O P O D S	1.85	0	0.14	
Funcchia woodwardi	1.32	289	0.10	
Symbolophorus boops	1.32	146	0.10	
EUPHASIDAE *	0.79	792	0.06	
Ebinania costaecanarie	0.53	26	0.04	
Macropipus australis	0.26	14	0.02	
Galeus polli	0.26	14	0.02	
Total	1278.71		100.00	

Aristaeomorpha foliacea	0.71	321	0.15	
Epigonus denticulatus**	0.48	107	0.10	
Munidopsis sp.	0.24	571	0.05	
Pontocaris lacazei ***	0.12	155	0.02	
Phosichthys argenteus	0.12	12	0.02	
Total	479.41		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 61  
 DATE :19/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°21.94  
 Lon E 13°25.09  
 TIME :19:28:44 19:58:50 30.1 (min) Purpose : 3  
 LOG : 444.30 445.82 1.5 Region : 5030  
 FDEPTH: 389 385 Gear cond.: 0  
 BDEPTH: 389 385 Validity : 0  
 Towing dir: 0° Wire out : 980 m Speed : 3.0 kn  
 Sorted : 160 Total catch: 203.95 Catch/hour: 406.68

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 64  
 DATE :20/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°0.22  
 Lon E 13°13.14  
 TIME :05:06:14 05:36:30 30.3 (min) Purpose : 3  
 LOG : 483.95 485.59 1.6 Region : 5030  
 FDEPTH: 461 463 Gear cond.: 0  
 BDEPTH: 461 463 Validity : 0  
 Towing dir: 0° Wire out : 1100 m Speed : 3.3 kn  
 Sorted : 180 Total catch: 210.83 Catch/hour: 417.90

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Merluccius paradoxus	221.06 499	54.36	275
Coeliorinchus simorhynchus	76.07 514	18.71	
Helicolenus dactylopterus ***	28.71 146	7.06	278
Todarodes sagittatus	21.89 74	5.38	
Epigonus telescopus**	12.86 804	3.16	
Nezumia micronychodon	12.06 465	2.97	
Merluccius capensis	6.52 4	1.60	276
Lithodes ferox	5.86 8	1.44	
Lophius vomerinus	3.87 2	0.95	277
Lampyctodes hectoris	2.99 997	0.74	
Deepwater fish mixture	2.89 0	0.71	
Symbolophorus boops	2.49 279	0.61	
Beryx splendens	1.42 6	0.35	279
Myxine capensis	1.10 20	0.27	
Galeus polli	1.10 16	0.27	
Aequorea sp.	0.80 0	0.20	
Selachophidium guentheri	0.70 10	0.17	
Anemones, white	0.60 0	0.15	
G A S T R O P O D S	0.60 0	0.15	
Bathynectes piperitus	0.60 50	0.15	
EUPHASIDAE *	0.60 748	0.15	
PORIFERA (Sponges)	0.50 0	0.12	
Mystriophis rostellatus	0.44 2	0.11	
Funcchia woodwardi	0.30 90	0.07	
Polychaetes sp.	0.20 46	0.05	
Starfish	0.10 0	0.02	
Munidopsis chuni	0.10 46	0.02	
Lampanyctus australis	0.10 6	0.02	
Phosichthys argenteus	0.10 6	0.02	
Stomias boa boa	0.06 6	0.01	
Total	406.68	100.00	

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Merluccius paradoxus	237.26 396	56.78	283
Hoplostethus cadenati	25.93 1728	6.20	
Lophius vomerinus	19.39 4	4.64	285
Nezumia micronychodon	17.76 1269	4.25	
Helicolenus dactylopterus ***	16.89 91	4.04	286
Selachophidium guentheri	15.86 238	3.79	
Lampanyctus australis	11.26 1126	2.69	
Genypterus capensis	10.98 2	2.63	284
Rajella barnardi	9.32 2	2.23	
Lithodes ferox	9.12 16	2.18	
Symbolophorus boops	8.33 833	1.99	
Galeus polli	5.79 75	1.39	
Cruriraja parcomaculata	3.65 2	0.87	
Trachipterus trachipterus	3.65 2	0.87	
Lampyctodes hectoris	3.49 3489	0.83	
EUPHASIDAE *	2.54 3171	0.61	
Todarodes sagittatus	2.46 0	0.59	
Deepwater fish mixture	2.30 0	0.55	
Trachyrinchus scabrus	1.90 12	0.46	
Ebinania costaecanarie	1.74 16	0.42	
Epigonus denticulatus**	1.59 226	0.38	
Parapanaeus longirostris*	1.43 36	0.34	
Centrophorus squamosus	1.13 2	0.27	
Stomias boa boa	0.87 218	0.22	
Myxine capensis	0.63 4	0.15	
G A S T R O P O D S	0.56 0	0.13	
Plesionika martia	0.48 16	0.11	
Munidopsis sp.	0.40 396	0.09	
Polychaetes sp.	0.32 0	0.08	
Sudis hyalina	0.24 8	0.06	
Thysanophrys chiltonae	0.16 4	0.04	
Dicrolene intronigra	0.08 4	0.02	
Notacanthus sexspinitis	0.08 8	0.02	
Eggs of ray	0.08 0	0.02	
Starfish	0.08 0	0.02	
Starpagurus dimorphus	0.08 4	0.02	
Sepia hieronis	0.08 8	0.02	
Bathylagus glacialis ***	0.04 4	0.01	
Total	417.90	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 62  
 DATE :19/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°10.04  
 Lon E 13°17.77  
 TIME :23:16:51 23:46:42 29.8 (min) Purpose : 3  
 LOG : 462.05 463.59 1.5 Region : 5030  
 FDEPTH: 466 455 Gear cond.: 0  
 BDEPTH: 466 455 Validity : 0  
 Towing dir: 0° Wire out : 1130 m Speed : 3.1 kn  
 Sorted : 78 Total catch: 247.17 Catch/hour: 496.99

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 65  
 DATE :20/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°1.86  
 Lon E 13°18.37  
 TIME :07:48:44 08:19:10 30.4 (min) Purpose : 3  
 LOG : 497.92 499.47 1.6 Region : 5030  
 FDEPTH: 338 341 Gear cond.: 0  
 BDEPTH: 338 341 Validity : 0  
 Towing dir: 0° Wire out : 850 m Speed : 3.0 kn  
 Sorted : 197 Total catch: 994.02 Catch/hour: 1959.95

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Trachyrinchus scabrus	191.98 619	38.63	
Merluccius paradoxus	83.93 90	16.89	280
Nezumia micronychodon	47.01 1337	9.46	
Cruriraja parcomaculata	40.82 42	8.21	
Galeus polli	24.77 239	4.98	
Genypterus capensis	17.13 6	3.45	281
Miscellaneous fishes	16.89 0	3.40	
Selachophidium guentheri	14.08 352	2.83	
Bathynectes piperitus	9.85 28	1.98	
Symbolophorus boops	8.45 1464	1.70	
Myxine capensis	7.04 84	1.42	
Helicolenus dactylopterus ***	5.91 28	1.19	282
Todarodes sagittatus	5.07 14	1.02	
Scomberesox simulans	4.22 42	0.85	
Hoplostethus cadenati	2.82 113	0.57	
Plesionika martia	2.82 943	0.57	
Epigonus telescopus**	2.53 14	0.51	
Coeliorinchus simorhynchus	2.53 14	0.51	
Lampanyctus australis	1.97 211	0.40	
G A S T R O P O D S	1.97 0	0.40	
Epigonus denticulatus**	1.41 99	0.28	
Notacanthus sexspinitis	0.84 28	0.17	
Anemones, white	0.84 14	0.17	
Aristaeomorpha foliacea	0.56 141	0.11	
Phosichthys argenteus	0.56 84	0.11	
Munidopsis chuni	0.28 296	0.06	
Sea urchin, weak spines	0.28 28	0.06	
Sympagurus dimorphus	0.28 14	0.06	
Microstomias longibarbatatus	0.14 28	0.03	
Total	496.99	100.00	

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Merluccius capensis	962.41 3076	49.10	290
Merluccius paradoxus	546.76 1646	27.90	291
Todarodes sagittatus	189.29 592	9.66	
Coeliorinchus simorhynchus	82.81 1232	4.23	
Helicolenus dactylopterus ***	44.76 404	2.28	292
Lampyctodes hectoris	32.93 4121	1.68	
Galeus polli	32.14 631	1.64	
Lophius vomerinus	22.04 6	1.12	295
Sea urchin, weak spines	12.62 0	0.64	
Miscellaneous fishes	11.83 0	0.60	
Symbolophorus boops	3.55 394	0.18	
Genypterus capensis	3.39 2	0.17	294
Schedophilus huttoni	2.84 2	0.14	
Epigonus denticulatus**	2.56 118	0.13	
Selachophidium guentheri	1.38 69	0.07	
Parapanaeus longirostris*	1.38 365	0.07	
Polychaetes sp.	0.79 39	0.04	
Bathynectes piperitus	0.79 20	0.04	
Nezumia micronychodon	0.79 20	0.04	
Coeliorinchus caeliorhynchus	0.79 20	0.04	
Chlorophthalmus agassizi	0.79 10	0.04	
Sepia hieronis	0.79 20	0.04	
Stomias boa boa	0.79 79	0.04	
Munidopsis chuni	0.59 108	0.03	
Hoplostethus cadenati	0.39 20	0.02	
Beryx splendens	0.35 2	0.02	293
Bathylagichthys problematicus ***	0.20 20	0.01	
Snail	0.20 10	0.01	
Total	1959.95	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 63  
 DATE :20/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°0.18  
 Lon E 13°12.36  
 TIME :01:27:34 01:57:51 30.3 (min) Purpose : 3  
 LOG : 473.40 474.92 1.5 Region : 5030  
 FDEPTH: 496 512 Gear cond.: 0  
 BDEPTH: 496 512 Validity : 0  
 Towing dir: 0° Wire out : 1160 m Speed : 3.0 kn  
 Sorted : 121 Total catch: 241.94 Catch/hour: 479.41

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 66  
 DATE :20/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°2.08  
 Lon E 13°24.69  
 TIME :10:42:48 11:12:28 29.7 (min) Purpose : 3  
 LOG : 512.05 513.61 1.6 Region : 5030  
 FDEPTH: 296 295 Gear cond.: 0  
 BDEPTH: 296 295 Validity : 0  
 Towing dir: 0° Wire out : 720 m Speed : 3.2 kn  
 Sorted : 98 Total catch: 2052.90 Catch/hour: 4152.87

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Merluccius paradoxus	142.55 226	29.73	287
Trachyrinchus scabrus	99.39 321	20.13	
Nezumia micronychodon	54.69 1950	11.41	
Lampanyctus australis	44.94 4090	9.37	
Selachophidium guentheri	42.44 547	8.85	
Helicolenus dactylopterus ***	21.16 36	4.41	289
Hoplostethus cadenati	13.32 701	2.78	
Deepwater fish mixture	12.36 0	2.58	
Bathynectes piperitus	8.80 12	1.84	
Cruriraja parcomaculata	7.61 12	1.59	
Genypterus capensis	6.46 2	1.35	288
Galeus polli	5.23 119	1.09	
Ebinania costaecanarie	5.23 12	1.09	
Todarodes sagittatus	3.80 12	0.79	
Symbolophorus boops	3.57 476	0.74	
Lampyctodes hectoris	3.33 1664	0.69	
Stomias boa boa	1.19 190	0.25	
Myxine capensis	0.95 12	0.20	
Notacanthus sexspinitis	0.71 48	0.15	

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Merluccius capensis	3015.62 12239	72.62	296
PORIFERA (Sponges)	442.37 0	10.65	
Sea urchin, weak spines	309.75 0	7.46	
Helicolenus dactylopterus ***	225.19 3916	5.42	299
Todarodes sagittatus	64.09 267	1.54	
Coeliorinchus simorhynchus	33.82 668	0.81	
Galeus polli	10.68 178	0.26	
Coeliorinchus polli	10.68 223	0.26	
Myxine capensis	8.01 45	0.19	
Trachurus capensis	5.38 20	0.13	297
Malacocephalus laevis	5.34 45	0.13	
Lophius vomerinus	5.02 4	0.12	298
Miscellaneous fishes	4.45 0	0.11	
Epigonus denticulatus**	2.67 89	0.06	
Starfish	2.67 0	0.06	
Bathynectes piperitus	2.67 45	0.06	
Chlorophthalmus agassizi	1.78 45	0.04	
Sepia elegans	1.78 45	0.04	
G A S T R O P O D S	0.89 0	0.02	

Total 4152.87 100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 67  
 DATE :20/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°2.10 Lon E 13°36.08  
 start stop duration Purpose : 3  
 TIME :13:39:15 14:10:06 30.8 (min) Region : 5030  
 LOG : 527.77 529.46 1.7 Gear cond.: 0  
 FDEPTH: 280 276 Validity : 0  
 BDEPTH: 280 276  
 Towing dir: 0° Wire out : 720 m Speed : 3.3 kn  
 Sorted : 160 Total catch: 1394.22 Catch/hour: 2712.49

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius capensis	1870.04	68.94	300
PORIFERA (Sponges)	257.39	9.49	
Sea urchin, weak spines	208.37	7.68	
Helicolenus dactylopterus ***	153.04	5.64	301
Coelorinchus simorhynchus	135.18	4.98	
Chlorophthalmus agassizi	54.98	2.03	
Todarodes sagittatus	11.21	0.41	
Lophius vomerinus	10.00	0.37	303
Miscellaneous fishes	3.15	0.12	
Coelorinchus polli	2.80	0.10	
Sepia elegans	2.45	0.09	
G A S T R O P O D S	2.45	0.09	
Trachurus capensis	1.44	0.05	302
Total	2712.49	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 68  
 DATE :20/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 24°1.82 Lon E 13°50.74  
 start stop duration Purpose : 3  
 TIME :16:58:45 17:28:54 30.1 (min) Region : 5030  
 LOG : 546.24 547.84 1.6 Gear cond.: 0  
 FDEPTH: 246 242 Validity : 0  
 BDEPTH: 246 242  
 Towing dir: 0° Wire out : 625 m Speed : 3.2 kn  
 Sorted : 146 Total catch: 859.08 Catch/hour: 1710.18

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius capensis	1442.75	84.36	304
PORIFERA (Sponges)	100.71	5.89	
Coelorinchus simorhynchus	44.13	2.58	
Helicolenus dactylopterus ***	30.32	1.77	307
Todarodes sagittatus	30.02	1.76	
Mycophthiidae sp. small/mix	11.65	0.68	
Sufflogobius bibarbatu	10.01	0.59	
Merluccius capensis	8.00	0.47	305
Lophius vomerinus	7.01	0.41	306
Macropipus australis	5.95	0.35	
Chlorophthalmus agassizi	5.41	0.32	
Deepwater fish mixture	4.06	0.24	
Squilla acuelata calmani	3.78	0.22	
Ascidacea	2.99	0.17	
Sepia elegans	1.07	0.06	
Solenocera africana	0.82	0.05	
Dead shells	0.82	0.05	
G A S T R O P O D S	0.54	0.03	
Snail	0.14	0.01	
Total	1710.18	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 69  
 DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°40.59 Lon E 13°59.13  
 start stop duration Purpose : 3  
 TIME :04:41:37 05:00:16 18.6 (min) Region : 5030  
 LOG : 614.04 615.07 1.0 Gear cond.: 0  
 FDEPTH: 174 173 Validity : 0  
 BDEPTH: 174 173  
 Towing dir: 0° Wire out : 450 m Speed : 3.3 kn  
 Sorted : 118 Total catch: 1014.54 Catch/hour: 3263.94

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Trachurus capensis	2640.71	80.91	308
Dead shells	225.78	6.92	
Merluccius capensis	210.21	6.44	
Chelidonichthys capensis	80.75	2.47	312
Sufflogobius bibarbatu	33.97	1.04	
G A S T R O P O D S	24.77	0.76	
Starfish	19.82	0.61	
Ascidacea	6.37	0.20	
Merluccius capensis	6.05	0.19	310
Chrysaora sp.	3.54	0.11	
PORIFERA (Sponges)	3.54	0.11	
Macropipus australis	2.12	0.07	
Todarodes sagittatus	1.67	0.05	
Sea cucumber purple	1.42	0.04	
Coelorinchus simorhynchus	1.42	0.04	
Austroglossus microlepis	0.71	0.02	311
Squilla acuelata calmani	0.71	0.02	
Lepidopus caudatus	0.39	0.01	
Total	3263.94	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 70  
 DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°41.14 Lon E 13°48.27  
 start stop duration Purpose : 3  
 TIME :06:45:40 07:06:49 21.1 (min) Region : 5030  
 LOG : 626.34 627.48 1.1 Gear cond.: 0  
 FDEPTH: 192 192 Validity : 0  
 BDEPTH: 192 192  
 Towing dir: 0° Wire out : 510 m Speed : 3.2 kn  
 Sorted : 103 Total catch: 358.11 Catch/hour: 1015.91

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Trachurus capensis	519.57	51.14	314
Merluccius capensis	319.52	31.45	318
Sufflogobius bibarbatu	78.10	7.69	
Chlorophthalmus agassizi	15.74	1.55	
Helicolenus dactylopterus ***	13.84	1.36	319
Macropipus australis	13.22	1.30	
Dead shells	10.30	1.01	
Starfish	9.45	0.93	
Chelidonichthys capensis	7.66	0.75	317
Merluccius capensis	5.84	0.58	313
Lophius vomerinus	4.54	0.45	315
Todarodes sagittatus	4.14	0.41	
Aequorea sp.	2.95	0.29	
Austroglossus microlepis	2.38	0.23	316
Coelorinchus simorhynchus	2.20	0.22	
Deepwater fish mixture	1.90	0.19	
Ascidacea	1.90	0.19	
Lepidopus caudatus	1.08	0.11	
G A S T R O P O D S	1.05	0.10	
Squilla acuelata calmani	0.43	0.04	
Total	1015.91	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 71  
 DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°41.01

start stop duration Lon E 13°35.80  
 TIME :09:01:34 09:31:00 29.4 (min)  
 LOG : 639.95 641.48 1.5 Purpose : 3  
 FDEPTH: 228 228 Region : 5030  
 BDEPTH: 228 228 Gear cond.: 0  
 Towing dir: 0° Wire out : 600 m Validity : 0  
 Sorted : 153 Total catch: 681.27 Speed : 3.1 kn  
 Catch/hour: 1387.99

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius capensis	766.04	86.49	320
Helicolenus dactylopterus ***	134.67	9.70	322
Chlorophthalmus agassizi	130.59	6.21	
PORIFERA (Sponges)	98.81	7.12	
Todarodes sagittatus	64.38	4.64	
Sufflogobius bibarbatu	60.71	4.37	
Lampyctodes hectoris	29.34	2.11	
Coelorinchus simorhynchus	27.30	1.97	
Lophius vomerinus	19.60	1.41	323
Macropipus australis	18.13	1.31	
Merluccius capensis	13.73	0.99	
Trachipterus jacksonensis	9.98	0.72	
Trachurus capensis	6.97	0.50	330
Chelidonichthys capensis	2.12	0.15	324
G A S T R O P O D S	2.04	0.15	
Starfish	1.63	0.12	
Maurollicus muelleri	0.81	0.06	
Squilla acuelata calmani	0.61	0.04	
Sepia hieronis	0.31	0.02	
Ascidacea	0.20	0.01	
Total	1387.99	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 72  
 DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°42.13 Lon E 13°25.67  
 start stop duration Purpose : 3  
 TIME :11:29:20 11:59:39 30.3 (min) Region : 5030  
 LOG : 652.43 653.99 1.6 Gear cond.: 0  
 FDEPTH: 271 270 Validity : 0  
 BDEPTH: 271 270  
 Towing dir: 0° Wire out : 650 m Speed : 3.1 kn  
 Sorted : 98 Total catch: 1150.06 Catch/hour: 2275.84

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius capensis	1728.60	75.95	
PORIFERA (Sponges)	296.36	13.02	
Helicolenus dactylopterus ***	143.43	6.30	
Coelorinchus simorhynchus	28.34	1.25	
Todarodes sagittatus	18.92	0.83	
Pterothrissus bellioi	11.28	0.50	
Macropipus australis	6.49	0.29	
Lophius vomerinus	6.33	0.28	
Miscellaneous fishes	6.17	0.27	
Scomber colias	5.74	0.25	
Coelorinchus polli	5.34	0.24	
Lampyctodes hectoris	5.22	0.23	
Squilla acuelata calmani	3.96	0.17	
Starfish	2.37	0.10	
Lepidopus caudatus	1.74	0.08	
Chelidonichthys capensis	1.38	0.07	
Trachurus capensis	1.19	0.06	
Beryx splendens	0.95	0.04	
Sufflogobius bibarbatu	0.79	0.03	
G A S T R O P O D S	0.32	0.01	
Ascidacea	0.32	0.01	
Total	2275.84	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 73  
 DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°39.52 Lon E 13°14.95  
 start stop duration Purpose : 3  
 TIME :13:39:35 14:09:13 29.6 (min) Region : 5030  
 LOG : 665.49 667.03 1.5 Gear cond.: 0  
 FDEPTH: 337 336 Validity : 0  
 BDEPTH: 337 336  
 Towing dir: 0° Wire out : 850 m Speed : 3.1 kn  
 Sorted : 308 Total catch: 409.78 Catch/hour: 830.07

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius capensis	426.73	51.41	325
Helicolenus dactylopterus ***	151.20	18.21	328
Torpedo nobiliana	61.94	7.46	
Todarodes sagittatus	52.83	6.36	
Merluccius paradoxus	49.83	6.00	326
Coelorinchus simorhynchus	40.51	4.88	
Schedophilus huttoni	11.38	1.37	
Deepwater fish mixture	7.29	0.88	
Galeus polli	5.19	0.62	
Hoplostethus cadenati	4.54	0.55	
PORIFERA (Sponges)	3.24	0.39	
Brama brama	2.80	0.34	327
Lampyctodes australis	2.27	0.27	
Ebinamia costaecanarie	1.62	0.20	
Lophius vomerinus	1.42	0.17	329
Bathynectes piperitus	1.30	0.16	
Solenocera africana	1.13	0.14	
Coelorinchus polli	0.81	0.10	
Selachophidium guentheri	0.81	0.10	
Histioteuthis reversa	0.65	0.08	
Starfish	0.65	0.08	
Macropipus australis	0.49	0.06	
Epigonus denticulatus**	0.32	0.04	
Stomias boa boa	0.32	0.04	
Ascidacea	0.16	0.02	
Nezumia micronychodon	0.16	0.02	
Lampyctodes hectoris	0.16	0.02	
G A S T R O P O D S	0.16	0.02	
Total	830.07	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 74  
 DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°43.83 Lon E 13°10.49  
 start stop duration Purpose : 3  
 TIME :16:01:43 16:32:01 30.3 (min) Region : 5030  
 LOG : 675.59 677.10 1.5 Gear cond.: 0  
 FDEPTH: 413 422 Validity : 0  
 BDEPTH: 413 422  
 Towing dir: 0° Wire out : 960 m Speed : 3.0 kn  
 Sorted : 212 Total catch: 396.24 Catch/hour: 784.89

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
Merluccius paradoxus	536.81	68.39	331
Helicolenus dactylopterus ***	106.49	13.57	334
Coelorinchus simorhynchus	23.29	2.97	
Selachophidium guentheri	21.00	2.68	
Todarodes sagittatus	19.85	2.53	
Lithodes ferox	13.35	1.70	
Galeus polli	12.20	1.55	
Lophius vomerinus	10.93	1.39	332
Nezumia micronychodon	7.76	0.99	
Genypterus capensis	7.09	0.90	333
Ebinamia costaecanarie	6.02	0.77	
Parapanaeus longirostris	4.12	0.52	
Total	784.89	100.00	

Hoplostethus cadenati	3.33	258	0.42
Epigonus telescopus**	2.06	206	0.26
Lampanyctus australis	1.82	226	0.23
Myxine capensis	1.55	16	0.20
Bathynectes piperitus	1.27	55	0.16
Chaceon maritae	1.07	2	0.14
Neoharriotta pinnata	0.99	2	0.13
Caristius groenlandicus	0.87	2	0.11
G A S T R O P O D S	0.71	0	0.09
Anemones, white	0.55	0	0.07
Malacocephalus laevis	0.40	4	0.05
Myctophidae sp. small/mix	0.40	198	0.05
Munida sp. *	0.24	238	0.03
Stomias boa boa	0.24	52	0.03
Starfish	0.16	0	0.02
Polycheles sp.	0.08	48	0.01
Notacanthus sexspinis	0.08	8	0.01
Chlorophthalmus agassizi	0.08	4	0.01
Trachyrincus scabrus	0.04	12	0.01
Bristle worms (straws)	0.04	0	0.01
Total	784.89		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 75  
DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°41.05  
start stop duration Lon E 13°5.46  
TIME :18:37:03 19:07:32 30.5 (min) Purpose : 3  
LOG : 688.28 689.78 1.5 Region : 5030  
FDEPTH: 574 570 Gear cond.: 0  
BDEPTH: 574 570 Validity : 0  
Towing dir: 0° Wire out : 1350 m Speed : 2.9 kn  
sorted : 276 Total catch: 473.33 Catch/hour: 931.75

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius paradoxus	332.40	443	35.67
Trachyrincus scabrus	157.28	935	16.88
Selachophidium guentheri	96.06	1654	10.31
Nezumia micronychodon	86.42	3602	9.27
Todarodes sagittatus	68.86	167	7.39
Sea pens	27.17	0	2.92
Galeus polli	25.59	266	2.75
Lithodes ferox	20.55	37	2.21
Cruriraja parcomaculata	12.28	8	1.32
Ebinania costaecanarie	11.81	20	1.27
Bristle worms (straws)	10.04	0	1.08
Hoplostethus cadenati	9.65	640	1.04
Lampanyctus australis	7.87	876	0.85
Starfish	7.87	0	0.85
Deepwater fish mixture	5.51	0	0.59
Epigonus telescopus**	5.51	246	0.59
Lophius vomerinus	5.08	6	0.55
Opisthoteuthis agassizi	4.92	14	0.53
Plesionika martia	3.94	30	0.42
Funchalia woodwardi	3.94	39	0.42
Polycheles sp.	3.94	49	0.42
Anemones, white	3.94	0	0.42
Nephropsis atlantica	3.94	10	0.42
Schedophilus huttoni	3.74	2	0.40
Centrophorus squamosus	3.54	10	0.38
Notacanthus sexspinis	3.54	69	0.38
Bathylagus glacialis ***	1.38	108	0.15
Myxine capensis	0.98	10	0.11
Myctophidae sp. small/mix	0.79	207	0.08
Yarrella blackfordi	0.79	69	0.08
Heterocarpus grimaldii	0.63	16	0.07
Phosichthys argenteus	0.59	20	0.06
Munida sp.	0.59	266	0.06
Beryx splendens	0.41	2	0.04
Bathynectes piperitus	0.20	10	0.02
Total	931.75		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 76  
DATE :21/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°22.32  
start stop duration Lon E 13°2.99  
TIME :22:44:34 23:14:27 29.9 (min) Purpose : 3  
LOG : 708.70 710.21 1.5 Region : 5030  
FDEPTH: 553 553 Gear cond.: 0  
BDEPTH: 553 553 Validity : 0  
Towing dir: 0° Wire out : 1300 m Speed : 2.9 kn  
sorted : 103 Total catch: 378.07 Catch/hour: 759.18

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius paradoxus	147.59	175	19.44
Trachyrincus scabrus	132.09	1127	17.40
Selachophidium guentheri	106.91	1745	14.08
Nezumia micronychodon	99.40	2540	13.09
Hoplostethus cadenati	96.75	5699	12.74
Sea pens	25.62	0	3.38
Yarrella blackfordi	21.20	2363	2.79
Todarodes sagittatus	20.76	44	2.73
Ebinania costaecanarie	19.44	44	2.56
Anemones, pink	12.37	22	1.63
Bassanago albescens	9.72	22	1.28
Notacanthus sexspinis	9.28	199	1.22
Lithodes ferox	8.84	66	1.16
Miscellaneous fishes	8.39	0	1.11
Helicolenus dactylopterus ***	7.07	22	0.93
Galeus polli	5.30	44	0.70
Starfish	4.86	0	0.64
Cruriraja parcomaculata	4.86	22	0.64
Funchalia woodwardi	3.98	751	0.52
Bristle worms	3.98	376	0.52
Chaceon chuni	2.65	2	0.35
Epigonus denticulatus**	1.33	88	0.17
Bathylagus glacialis ***	1.33	110	0.17
Lophius vomerinus	1.29	2	0.17
Symbolophorus boops	0.88	486	0.12
Nephropsis atlantica	0.88	44	0.12
Polycheles sp.	0.44	44	0.06
Deep sea shrimps	0.44	133	0.06
Munidopsis chuni	0.44	133	0.06
Lampanyctodes hectoris	0.44	376	0.06
Bajacalifornia magalops	0.44	66	0.06
Aristeus varidens	0.22	22	0.03
Total	759.18		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 77  
DATE :22/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°22.59  
start stop duration Lon E 13°5.81  
TIME :01:21:24 01:51:07 29.7 (min) Purpose : 3  
LOG : 766.18 767.78 1.6 Region : 5030  
FDEPTH: 241 243 Gear cond.: 0

LOG : 717.98 719.41 1.4 Region : 5030  
FDEPTH: 456 464 Gear cond.: 0  
BDEPTH: 456 464 Validity : 0  
Towing dir: 0° Wire out : 1060 m Speed : 2.9 kn  
sorted : 95 Total catch: 182.63 Catch/hour: 368.70

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius paradoxus	112.75	162	30.58
Nezumia micronychodon	62.83	1583	17.04
Selachophidium guentheri	49.26	4926	13.36
Hoplostethus cadenati	28.43	1583	7.71
Deep sea shrimps	28.10	32	7.62
Lophius vomerinus	19.66	6	5.33
Todarodes sagittatus	17.60	32	4.77
Miscellaneous fishes	16.47	0	4.47
Lithodes ferox	5.17	16	1.40
Galeus polli	4.85	40	1.31
Sea pens	4.85	153	1.31
Helicolenus dactylopterus ***	3.96	194	1.07
Notacanthus sexspinis	2.91	105	0.79
Yarrella blackfordi	2.10	242	0.57
Anemones, white	1.94	8	0.53
Lampanyctodes hectoris	1.45	145	0.39
Epigonus denticulatus**	0.97	65	0.26
Funchalia woodwardi	0.97	113	0.26
Histioteuthis reversa	0.65	8	0.18
Lampanyctodes hectoris	0.65	371	0.18
Acanthephyra sp.	0.48	145	0.13
Benthodesmus tenuis	0.48	8	0.13
Phosichthys argenteus	0.48	32	0.13
Maurolicus muelleri	0.48	549	0.13
Symbolophorus boops	0.48	24	0.13
G A S T R O P O D S	0.40	16	0.11
Stomias boa boa	0.16	16	0.04
Plesionika martia	0.08	97	0.02
Starfish	0.08	16	0.02
Total	368.70		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 78  
DATE :22/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°21.83  
start stop duration Lon E 13°13.63  
TIME :03:38:05 04:09:30 31.4 (min) Purpose : 3  
LOG : 729.57 731.13 1.6 Region : 5030  
FDEPTH: 385 385 Gear cond.: 0  
BDEPTH: 385 385 Validity : 0  
Towing dir: 0° Wire out : 900 m Speed : 3.0 kn  
sorted : 217 Total catch: 355.06 Catch/hour: 678.24

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Galeus polli	158.17	1882	23.32
Merluccius paradoxus	130.24	493	19.20
Helicolenus dactylopterus ***	116.91	774	17.24
Merluccius capensis	97.92	44	14.44
Lophius vomerinus	83.83	27	7.94
Todarodes sagittatus	34.75	74	5.12
Scomber colias	14.17	8	2.09
Lithodes ferox	11.73	13	1.73
Nezumia micronychodon	11.46	458	1.69
Selachophidium guentheri	6.21	267	1.21
Chaceon longirostris	6.09	167	0.99
Deepwater fish mixture	4.78	0	0.70
Schedophilus huttoni	4.32	2	0.64
G A S T R O P O D S	4.01	0	0.59
Ebinania costaecanarie	3.44	29	0.51
Bathynectes piperitus	3.44	101	0.51
Coelorinchus simorhynchus	3.25	67	0.48
Lampanyctus australis	2.29	296	0.34
Sea urchin, weak spines	1.91	0	0.28
Thyrssites atun	1.76	2	0.26
Symbolophorus boops	1.34	134	0.20
Beryx splendens	0.88	4	0.13
Munidopsis chuni	0.57	392	0.08
PORIFERA (Sponges)	0.38	10	0.06
Sympagurus dimorphus	0.38	67	0.06
Stomias boa boa	0.38	57	0.06
Sea pens	0.38	0	0.06
Benthodesmus tenuis	0.19	10	0.03
Histioteuthis reversa	0.19	10	0.03
Epigonus denticulatus**	0.19	10	0.03
Sea cucumber purple	0.10	0	0.01
Total	678.24		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 79  
DATE :22/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°21.44  
start stop duration Lon E 13°19.45  
TIME :10:33:41 11:03:10 29.5 (min) Purpose : 3  
LOG : 754.40 755.92 1.5 Region : 5030  
FDEPTH: 336 334 Gear cond.: 0  
BDEPTH: 336 334 Validity : 0  
Towing dir: 0° Wire out : 780 m Speed : 3.1 kn  
sorted : 178 Total catch: 338.18 Catch/hour: 688.29

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight	numbers		
Merluccius capensis	420.65	623	61.12
Helicolenus dactylopterus ***	102.09	1311	14.83
Todarodes sagittatus	57.72	265	8.39
Lophius vomerinus	22.23	28	3.23
Coelorinchus simorhynchus	20.03	427	2.91
Chlorophthalmus agassizi	15.39	480	2.24
PORIFERA (Sponges)	6.84	0	0.99
Genypterus capensis	6.59	6	0.96
Sea urchin, weak spines	5.70	0	0.83
Echinorhinus brucus	5.62	2	0.82
Nezumia micronychodon	4.64	183	0.67
Miscellaneous fishes	4.40	0	0.64
Coelorinchus polli	4.40	151	0.64
Schedophilus huttoni	2.97	2	0.43
PANDALIDAE	1.47	277	0.21
Galeus polli	1.30	20	0.19
Malacocephalus laevis	1.22	16	0.18
Stomias boa boa	1.06	273	0.15
G A S T R O P O D S	0.90	0	0.13
Bathynectes piperitus	0.69	41	0.10
Ebinania costaecanarie	0.49	41	0.07
Trachurus capensis	0.49	2	0.07
Munidopsis chuni	0.24	167	0.04
Starfish	0.24	0	0.04
Epigonus denticulatus**	0.16	4	0.02
Lampanyctodes hectoris	0.16	85	0.02
Squilla acuelata calmani	0.16	4	0.02
Sea pens	0.16	0	0.02
Ascidacea	0.08	0	0.01
Solenocera africana	0.08	49	0.01
Krill	0.08	142	0.01
Symbolophorus boops	0.04	4	0.01
Total	688.29		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 80  
DATE :22/04/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 23°21.92  
start stop duration Lon E 13°27.82  
TIME :12:40:43 13:11:27 30.7 (min) Purpose : 3  
LOG : 766.18 767.78 1.6 Region : 5030  
FDEPTH: 241 243 Gear cond.: 0

BDEPTH: 241 243 Validity : 0  
Towing dir: 0° Wire out : 580 m Speed : 3.1 kn  
Sorted : 111 Total catch: 1549.38 Catch/hour: 3024.16

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	2333.09	24921	77.15	356
Chlorophthalmus agassizi	297.85	12953	9.85	
Helicolenus dactylopterus ***	101.65	2213	3.36	358
Trachurus capensis	65.04	0	2.15	360
PORIFERA (Sponges)	61.21	0	2.02	
Coelorinchus simorhynchus	31.15	601	1.03	
Todarodes sagittatus	29.51	82	0.98	
Lophius vomerinus	29.51	82	0.98	357
Chelidonichthys capensis	24.59	27	0.81	359
Sufflogobius bibarbatatus	18.58	0	0.61	
Macropodus australis	14.21	738	0.47	
Aequorea forskalea	10.38	0	0.34	
Miscellaneous fishes	3.28	0	0.11	
Lampyantodes hectoris	1.64	1202	0.05	
Ascidacea	0.55	82	0.02	
Squilla aculeata calmani	0.55	27	0.02	
Solenocera africana	0.55	55	0.02	
Starfish	0.55	0	0.02	
PANDALIDAE	0.27	27	0.01	
Total	3024.16		100.00	

Centrophorus squamosus 11.52 12 2.64  
Lithodes ferox 11.23 61 2.57  
Anemones, pink 6.34 0 1.50  
Rajella barnardi 4.70 20 1.08  
Notacanthus sexspinis 2.45 112 0.56  
Bassanago albescens 2.04 2 0.47  
Starfish 1.84 0 0.42  
Epigonus denticulatus\*\* 1.43 82 0.33  
Yarrella blackfordi 1.43 149 0.33  
Ebinania costaecanarie 1.43 41 0.33  
Aristeus varidens 1.43 296 0.33  
Opisthoteuthis agassizi 1.23 31 0.28  
PANDALIDAE 1.02 511 0.23  
MELANOSTOMIATIDAE 0.82 71 0.19  
Bathylagus glacialis \*\*\* 0.61 41 0.14  
G A S T R O P O D S 0.61 0 0.14  
Plesionika martia 0.61 317 0.14  
Munidopsis chuni 0.61 511 0.14  
Mastigoteuthis sp. 0.41 10 0.09  
Phosichthys argenteus 0.20 31 0.05  
Lampyantodes hectoris 0.20 174 0.05  
Plesionika acanthurus 0.20 153 0.05  
Chlorotocus crassicornis 0.10 31 0.02  
Acanthepra sp. 0.10 41 0.02  
Lampyantodes australis 0.10 20 0.02

Total 436.28 100.00

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 81  
DATE :22/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 23°21.65 Lon E 13°35.07  
TIME : 15:04:32 15:34:53 30.3 (min) Purpose : 3  
LOG : 776.66 778.23 1.6 Region : 5030  
FDEPTH: 187 184 Gear cond.: 0  
BDEPTH: 187 184 Validity : 0  
Towing dir: 0° Wire out : 480 m Speed : 3.1 kn  
Sorted : 73 Total catch: 352.25 Catch/hour: 696.61

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 84  
DATE :23/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 22°59.90 Lon E 13°6.33  
TIME : 03:34:13 04:05:16 31.1 (min) Purpose : 3  
LOG : 844.74 846.18 1.4 Region : 5030  
FDEPTH: 333 345 Gear cond.: 0  
BDEPTH: 333 345 Validity : 0  
Towing dir: 0° Wire out : 750 m Speed : 2.8 kn  
Sorted : 259 Total catch: 515.48 Catch/hour: 996.10

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	380.25	1078	54.59	361
Sufflogobius bibarbatatus	163.15	32630	23.42	
Trachurus capensis	43.72	338	6.28	365
Macropodus australis	31.32	1839	4.50	
Aequorea sp.	23.71	0	3.40	
Starfish	14.57	0	2.09	
Chelidonichthys capensis	10.92	32	1.57	364
Lophius vomerinus	6.72	40	0.97	363
Todarodes sagittatus	5.87	99	0.84	
G A S T R O P O D S	5.44	0	0.78	
Austroglossus microlepis	2.69	8	0.39	362
Helicolenus dactylopterus ***	2.61	36	0.37	366
Dead shells	2.39	0	0.34	
Deepwater fish mixture	1.31	0	0.19	
Ascidacea	0.87	0	0.12	
Lepidopus caudatus	0.59	6	0.09	
Squilla aculeata calmani	0.22	22	0.03	
Coelorinchus simorhynchus	0.12	12	0.02	
Chlorophthalmus agassizi	0.12	12	0.02	
Total	696.61		100.00	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Helicolenus dactylopterus ***	274.24	2381	27.53	377
Merluccius capensis	240.27	129	24.12	372
Galeus polli	160.77	1082	16.14	
Merluccius paradoxus	131.81	383	11.22	373
Coelorinchus simorhynchus	62.14	1221	6.24	
Lophius vomerinus	33.62	6	3.38	
Lithodes ferox	22.11	33	2.22	
Epigonus telescopus**	16.39	1020	1.65	
Polycheles sp.	15.61	15	1.57	
Selachophidium guentheri	9.58	124	0.96	
Todarodes sagittatus	9.31	21	0.94	
Deepwater fish mixture	8.66	0	0.87	376
Genypterus capensis	5.18	10	0.52	375
Brama brama	4.71	4	0.47	
Nezumia micronychodon	4.33	247	0.43	
Parapaneus longirostris	4.02	2010	0.40	
Schedophilus huttoni	3.59	2	0.36	
Anemones, white	2.78	0	0.28	
PORIFERA (Sponges)	1.55	0	0.16	
Chlorophthalmus agassizi	0.93	31	0.09	
Hoplostethus cadenati	0.93	77	0.09	
Myctophidae sp. small/mix	0.62	309	0.06	
Sea urchin, weak spines	0.62	0	0.06	
Bathynectes piperitus	0.62	15	0.06	
Lampyantodes australis	0.62	108	0.06	
Munidopsis chuni	0.31	201	0.03	
Todaropsis eblanae	0.31	15	0.03	
Symbolophorus boops	0.11	77	0.03	
Phosichthys argenteus	0.15	31	0.02	
Total	996.10		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 82  
DATE :22/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 23°1.50 Lon E 12°57.71  
TIME : 23:01:40 23:31:37 30.0 (min) Purpose : 3  
LOG : 826.71 828.15 1.4 Region : 5030  
FDEPTH: 597 596 Gear cond.: 0  
BDEPTH: 597 596 Validity : 0  
Towing dir: 0° Wire out : 1310 m Speed : 2.9 kn  
Sorted : 133 Total catch: 662.54 Catch/hour: 1326.85

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 85  
DATE :23/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 23°1.57 Lon E 13°18.32  
TIME : 06:39:12 07:09:38 30.4 (min) Purpose : 3  
LOG : 860.33 861.99 1.7 Region : 5030  
FDEPTH: 366 366 Gear cond.: 0  
BDEPTH: 366 366 Validity : 0  
Towing dir: 0° Wire out : 900 m Speed : 3.3 kn  
Sorted : 162 Total catch: 394.01 Catch/hour: 776.63

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Hoplostethus cadenati	391.92	20623	29.54	
Nezumia micronychodon	257.22	10730	19.39	
Merluccius paradoxus	174.95	192	13.19	368
Todarodes sagittatus	166.66	419	12.56	
Trachyrhynchus scabrus	126.33	913	9.52	
Selachophidium guentheri	57.84	1142	4.36	
Ebinania costaecanarie	25.87	114	1.95	
Starfish	15.98	0	1.20	
Notacanthus sexspinis	14.84	647	1.12	
Centrophorus squamosus	11.66	10	0.88	
Chaceon macphersoni	11.17	10	0.84	
Yarrella blackfordi	9.89	799	0.75	
Symbolophorus boops	9.13	1484	0.69	
Bathylagus glacialis ***	9.13	875	0.69	
Heterocarpus grimaldii	8.37	0	0.63	
Miscellaneous fishes	6.17	2	0.46	
Centroscymnus crepidater	4.21	6	0.32	
Chaceon chuni	3.04	0	0.23	
Bristle worms	1.52	38	0.11	
Nephropsis atlantica	1.52	495	0.11	
Deep sea shrimp	1.52	647	0.11	
Plesionika acanthurus	1.52	381	0.11	
Aristeus varidens	1.14	38	0.09	
Galeus polli	0.76	38	0.06	
Macropodus australis	0.76	38	0.06	
Bathophilus longipinnis	0.76	38	0.06	
Munidopsis chuni	0.76	609	0.06	
Funchalia woodwardi	0.76	152	0.06	
Phosichthys argenteus	0.38	76	0.03	
Plesionika martia	0.38	228	0.03	
Polycheles sp.	0.38	38	0.03	
Coelorinchus acanthiger	0.38	38	0.03	
Prawn	0.38	38	0.03	
Gonostoma denudatum	0.38	38	0.03	
Bajacalifornia magalops	0.38	38	0.03	
Lampyantodes hectoris	0.38	76	0.03	
Total	1326.85		100.00	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius paradoxus	257.62	641	33.17	383
Sea urchin, weak spines	98.36	0	12.66	
Merluccius capensis	81.45	55	10.49	378
Coelorinchus simorhynchus	67.02	1311	8.63	
Galeus polli	59.33	650	7.64	
Todarodes sagittatus	51.60	81	6.64	
Schedophilus huttoni	50.14	24	6.46	
Nezumia micronychodon	34.30	2020	4.42	
Lophius vomerinus	27.71	20	3.57	380
Helicolenus dactylopterus ***	24.84	591	3.20	382
G A S T R O P O D S	4.34	0	0.56	
Deepwater fish mixture	4.14	0	0.53	
Hoplostethus cadenati	3.15	128	0.41	
Selachophidium guentheri	2.56	128	0.33	
Genypterus capensis	2.09	2	0.27	381
Lampyantodes australis	1.58	148	0.20	
Parapaneus longirostris	1.38	404	0.18	
Malacocephalus laevis	1.18	10	0.15	
Epigonus telescopus**	0.99	89	0.13	
Ebinania costaecanarie	0.99	30	0.13	
Anemones, white	0.59	0	0.08	
Chlorophthalmus agassizi	0.20	10	0.03	
Stomias boa boa	0.20	49	0.03	
Lampyantodes hectoris	0.20	99	0.03	
Coelorinchus polli	0.20	10	0.03	
Bathynectes piperitus	0.20	39	0.03	
Nemichthys scolopaceus	0.10	10	0.01	
Munida sp.	0.10	30	0.01	
Histioteuthis reversa	0.10	10	0.01	
Total	776.63		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 83  
DATE :23/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 23°1.04 Lon E 13°0.86  
TIME : 01:10:41 01:40:03 29.4 (min) Purpose : 3  
LOG : 836.60 837.98 1.4 Region : 5030  
FDEPTH: 493 494 Gear cond.: 0  
BDEPTH: 493 494 Validity : 0  
Towing dir: 0° Wire out : 1120 m Speed : 2.8 kn  
Sorted : 84 Total catch: 213.63 Catch/hour: 436.28

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 86  
DATE :23/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 23°1.24 Lon E 13°27.23  
TIME : 09:34:53 10:04:59 30.1 (min) Purpose : 3  
LOG : 874.30 875.88 1.6 Region : 5030  
FDEPTH: 282 281 Gear cond.: 0  
BDEPTH: 282 281 Validity : 0  
Towing dir: 0° Wire out : 700 m Speed : 3.1 kn  
Sorted : 129 Total catch: 709.92 Catch/hour: 1415.59

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Nezumia micronychodon	72.29	1950	16.57	
Selachophidium guentheri	65.15	684	14.93	
Hoplostethus cadenati	53.71	2328	12.31	
Merluccius paradoxus	47.42	55	10.87	369
Todarodes sagittatus	31.25	61	7.16	
Lophius vomerinus	29.94	12	6.86	370
Galeus polli	23.89	184	5.48	
Miscellaneous fishes	16.95	0	3.89	
Helicolenus dactylopterus ***	16.34	82	3.74	371
Schedophilus huttoni	13.81	10	3.16	
Symbolophorus boops	12.66	2114	2.90	

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	1151.43	8126	81.34	384

Chlorophthalmus agassizi	88.53	3410	6.25	
Helicolenus dactylopterus ***	79.80	2357	5.64	387
Lophius vomerinus	17.47	32	1.23	385
Coelorinchus simorhynchus	15.79	323	1.12	
Squilla acuelata calmani	13.64	766	0.96	
Todarodes sagittatus	9.81	36	0.69	
Pterothrissus bellocci	9.33	72	0.66	
Chelidomichthys capensis	6.54	10	0.46	386
PORIFERA (Sponges)	5.02	0	0.35	
Miscellaneous fishes	4.55	0	0.32	
Macropipus australis	4.07	263	0.29	
Lampanyctodes hectoris	2.15	945	0.15	
Coelorinchus polli	1.91	48	0.14	
Starfish	0.96	0	0.07	
Galeus polli	0.96	12	0.07	
Sufflogobius bibarbatus	0.72	251	0.05	
Aequorea sp.	0.72	0	0.05	
Lepidopus caudatus	0.52	2	0.04	
Solenocera africana	0.48	84	0.03	
G A S T R O P O D S	0.48	0	0.03	
Maurollicus muelleri	0.48	487	0.03	
Sea pens	0.12	0	0.01	
Krill	0.12	179	0.01	
Total	1415.59		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019403 STATION: 87  
DATE :23/04/19 GEAR TYPE: BT NO: 27 POSITION: Lat S 23°1.32  
start stop duration Purpose : 3  
TIME :12:18:50 12:48:33 29.7 (min) Region : 5030  
LOG : 890.15 891.75 1.6 gear cond. : 0  
FDEPTH: 155 153 validity : 0  
BDEPTH: 155 153 Speed : 3.2 kn  
Towing dir: 0° Wire out : 385 m Catch/hour: 980.68  
Sorted : 97 Total catch: 485.60

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora fulgida	597.98	0	60.98	
Sufflogobius bibarbatus	270.11	5402	27.54	
Merluccius capensis	76.54	4502	7.80	388
Aequorea sp.	22.21	0	2.27	
Starfish	4.85	0	0.49	
G A S T R O P O D S	4.44	0	0.45	
Macropipus australis	1.62	91	0.16	
Squilla acuelata calmani	1.21	81	0.12	
Ascidacea	1.01	0	0.10	
Solenocera africana	0.40	91	0.04	
Dead shells	0.20	0	0.02	
Trachurus capensis	0.10	40	0.01	389
Total	980.68		100.00	

**ANNEX XI. BIOMASS AND NUMBER OF HAKES ESTIMATED PER LENGTH-GROUP**

Length Group	Merluccius capensis			Merluccius paradoxus		
	Number	Biomass	Mean wt	Number	Biomass	Mean wt
	('1000)	(tonnes)	(g)	('1000)	(tonnes)	(g)
5-10	0.766	6	8	22.005	144	7
10-15	151.336	3 505	23	168.142	4 123	25
15-20	528.435	21 627	41	419.171	17 735	42
20-25	496.394	45 836	92	135.495	12 207	90
25-30	574.191	94 012	164	94.797	16 337	172
30-35	318.328	79 770	251	70.307	18 607	265
35-40	54.131	21 238	392	27.132	10 945	403
40-45	25.125	14 428	574	18.156	10 681	588
45-50	21.543	16 943	786	10.128	8 211	811
50-55	11.130	12 158	1 092	5.260	5 619	1 068
55-60	7.439	10 116	1 360	1.798	2 541	1 413
60-65	2.946	5 433	1 844	0.178	305	1 716
65-70	1.264	2 882	2 280	0.359	813	2 263
70-75	0.638	1 743	2 733	0.144	377	2 614
75-80	0.226	790	3 487			
80-85	0.047	199	4 188			
Total	2 193.941	330 687	151	973.073	108 645	112

**ANNEX XII. TIME SPENT ON PRIMARY OBSERVATIONS FOR  
CETACEANS AND SEABIRDS**

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**Cetaceans**

Date	Hours	Minutes
05/04/2019	1	5
06/04/2019	3	26
07/04/2019	6	36
08/04/2019	5	39
09/04/2019	5	17
10/04/2019	3	56
11/04/2019	3	51
12/04/2019	2	59
13/04/2019	2	8
14/04/2019	0	0
15/04/2019	1	7
16/04/2019	0	0
17/04/2019	2	38
18/04/2019	4	49
19/04/2019	4	59
20/04/2019	0	0
21/04/2019	0	0
22/04/2019	2	17
23/04/2019	2	38
Time on primary watch	53 hours 25 minutes	



## Seabirds

Date	Minutes	Date	Minutes
05/04/2019	0	15/04/2019	50
06/04/2019	90	16/04/2019	50
07/04/2019	110	17/04/2019	60
08/04/2019	90	18/04/2019	60
09/04/2019	90	19/04/2019	80
10/04/2019	50	20/04/2019	30
11/04/2019	40	21/04/2019	50
12/04/2019	50	22/04/2019	30
13/04/2019	43	23/04/2019	30
14/04/2019	0		
		Time on primary watch	16 Hours 43 minutes



