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CRUISE REPORTS *DR FRIDTJOF NANSEN*
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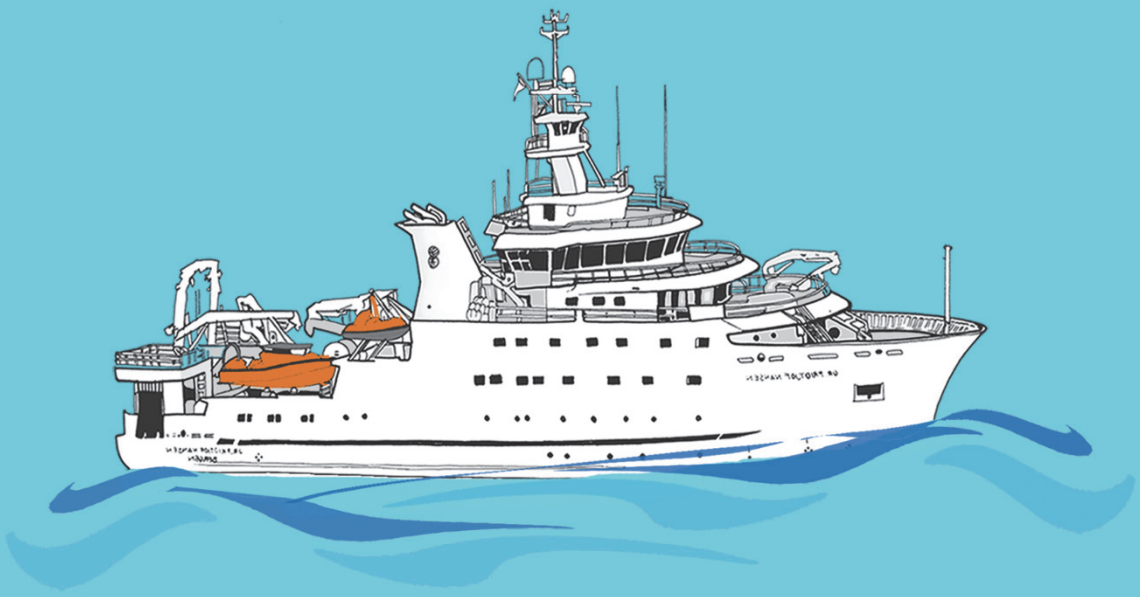

TRANSBOUNDARY DEMERSAL SURVEY IN THE SOUTHEAST ATLANTIC

Namibia

11–26 May 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 » appui 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.

Nangolo, E., Michalsen, K., Estevão, V., Zaera-Pérez, D., Bruck, S.A., Gabrielsen, H., Ostrowski, M., Isari, S., Kalwenya, L., Gamatham, J., Mbangula, T., Kadhila, T., Ngutjinazo, T., Mwaala, L., Gasser, B., Fernandes Moises, B., Shikongo, A., Camarada, G., Kamwi, B., Santos, J., Shimhanda, M., Kisting, S., Panzo, P., Francisco, J.A., Costa, S., Moçambique, I., José, G. 2019. Transboundary demersal survey in the Southeast Atlantic. Namibia, 11–26 May 2019. NORAD-FAO PROGRAMME GCP/GLO/690/NOR, CRUISE REPORTS *DR FRIDTJOF NANSEN*, EAF-Nansen/CR/2019/5

CRUISE REPORTS *DR FRIDTJOF NANSEN*

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Namibia

11 – 26 May 2019

by

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EXECUTIVE SUMMARY

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 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 in this region 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 briefly several of the important bycatch species, for Leg 2.4, which covered the region from the Walvis Bay to the Cunene River. Much of the other 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 are for specialised groups to further analyse and utilise in their long-term time-series and research projects.

During a post-survey workshop 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 this factor has to be taken into account when comparing survey results. 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 and with a different vessel.

The estimate for Cape hake for the entire Namibian area is slightly higher than the recent estimates of the R/V *Mirabilis,* while for *M. paradoxus* 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 dominated by the fishable sized fish, although by number these represented just 12.6% of the stock. 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.

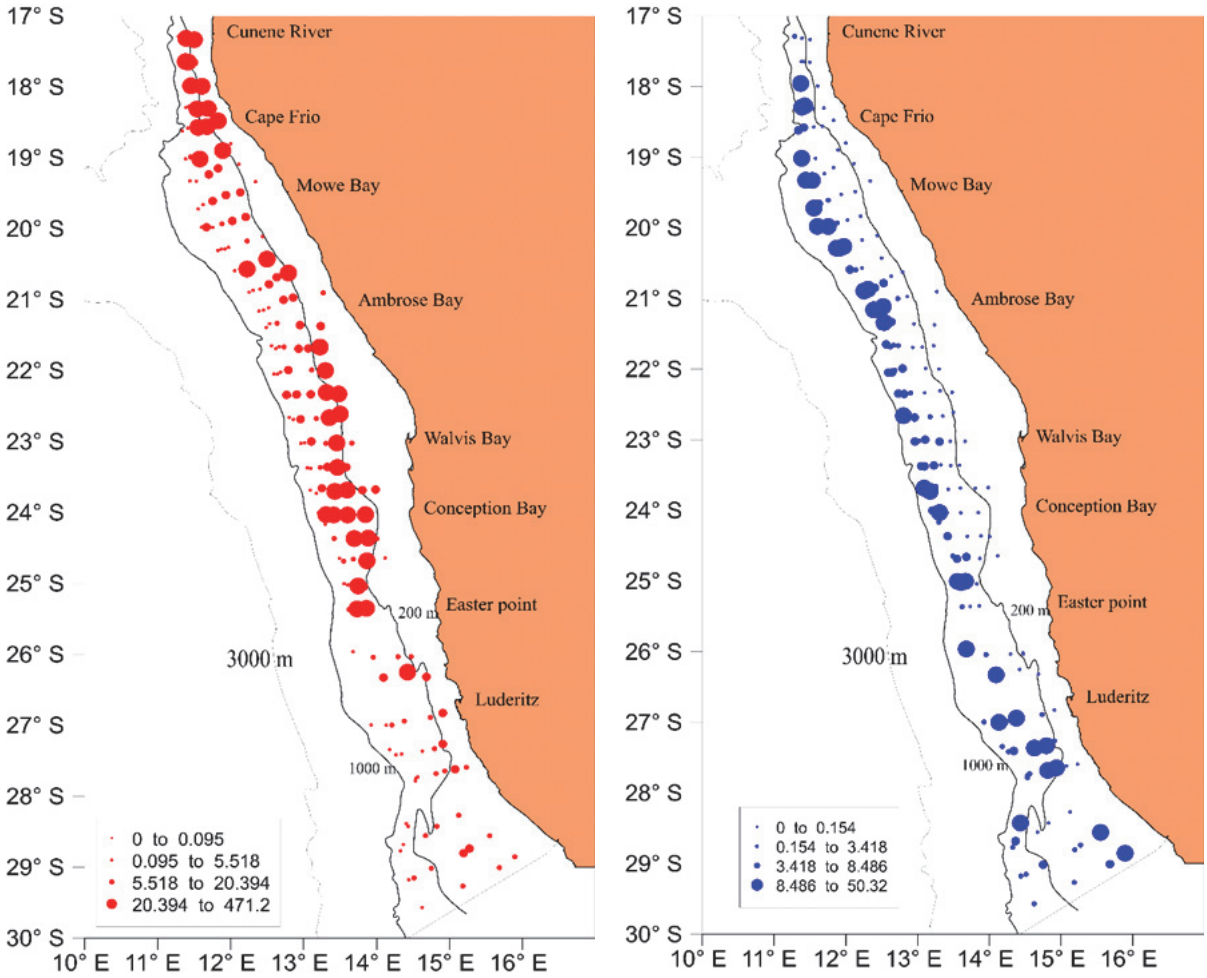
Total biomass indices and associated CV's (%) for *M. capensis* off Namibia since 2000

Period	R/V *Dr Fridtjof Nansen*		Commercial Fishing Vessels		R/V *Mirabilis*	
	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
Apr-May 2019	***1 145 034***	***30***				

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

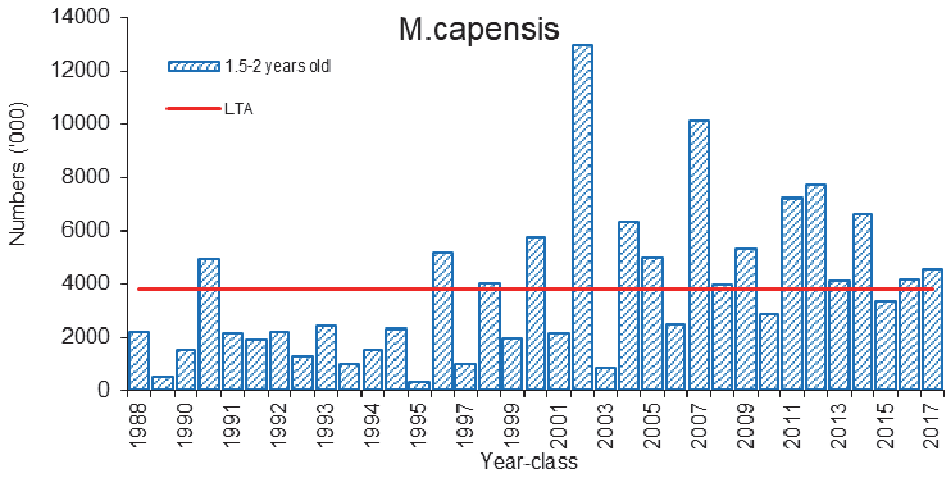
Period	R/V *Dr Fridtjof Nansen*		Commercial Fishing Vessels		R/V *Mirabilis*	
	Biomass	**CV**	**Biomass**	**CV**	**Biomass**	**CV**
Jan-Feb 2000			194 000	23		
Jan-Feb 2001			161 000	16		
Jan-Feb 2002			124 000	17		
Jan-Feb 2003			109 000	19		
Jan-Feb 2004			135 000	22		
Jan-Feb 2005			106 000	19		
Jan-Feb 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
Apr/May 2019	***140 221***	***17***				

During this survey, areas of high-densities for *M. capensis* (>20 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 t/NM^2) were scattered along the entire coast.



Density distributions (t/NM^2) for hake: *M. capensis* (left) and *M. paradoxus* (right)

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). 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.



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.

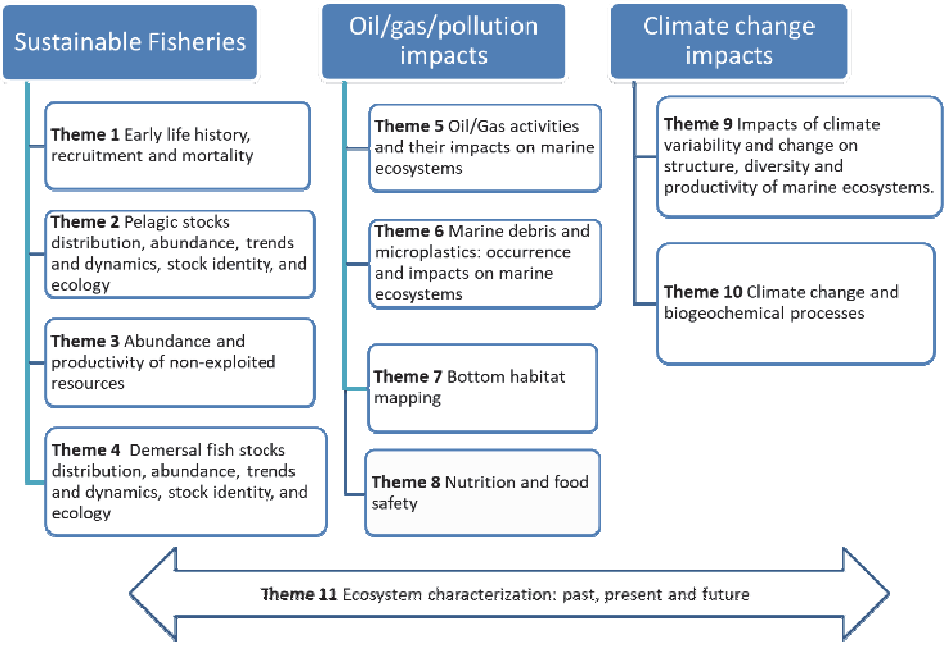


Figure 1. Research themes of the EAF-Nansen Science Plan

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-α, nutrients and pH) and to obtain information on the dissolved oxygen concentrations, ocean acidification state and aragonite saturation state relevant for calcifying organisms.
- 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 Fish resources

As the Namibian R/V *Mirabilis* was unable to conduct the annual hake biomass survey and collect biological data on the hake stocks in 2019, the key objective of Leg 2.2 and Leg 2.4 was 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, whilst Leg 2.4 covered the area from Walvis Bay to Luanda, Angola. In this way legs 2.2 and 2.4 have provided a synoptic coverage of the demersal resources off Namibia.

The survey was a standard swept-area bottom trawl survey replicating as closely as possible surveys conducted by the R/V *Mirabilis* since 2015, as well as previous surveys onboard commercial vessels and the R/V *Dr Fridtjof Nansen*. The key objectives of Leg 2.4 were to provide information on the biomass, distribution and stock structure of both species of hake, the species composition (catch composition), as well as the following:

- To collect standard biological data (length frequency, length-weight, sex and maturity) for both species of hake (*Merluccius capensis* and *Merluccius paradoxus*), and length freqency and length-weight for monkfish (*Lophius vomerinus*) and kingklip (*Genypterus capensis*), 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 collect genetic samples to enable studies of the stock structure of hakes and key by-catch species: monkfish, kingklip, horse mackerel (*Trachurus capensis*) and chub mackerel (*Scomber colias*).

- To collect whole fish of hakes, monkfish and kingklip to enable the study of parasite assemblages as biotags, and morphometric studies supporting data already collected, also allowing comparisons with South African samples.

- 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 Microplastics and neuston communities

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

1.1.5 Marine mammals and seabirds

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

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 of the Discovery Seamounts in the SEAFO Convention Area 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.

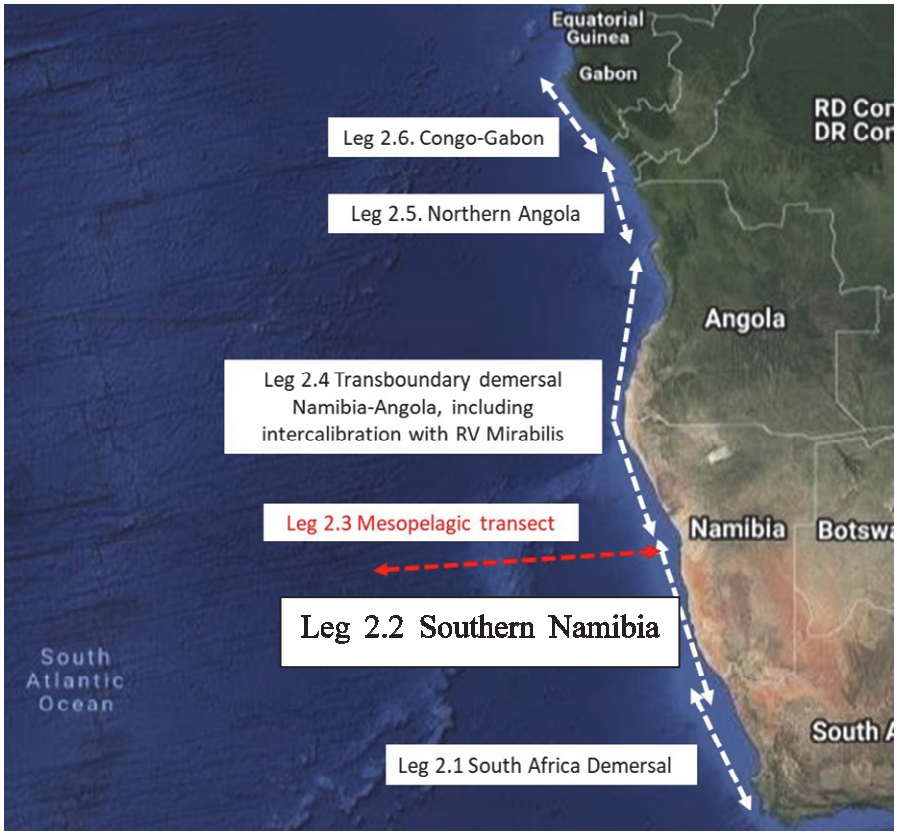


Figure 2. The *Dr Fridtjof Nansen* survey plan for Leg 2

Leg 2.4 covered the continental shelf and slope in Namibia between the 30 m and 700 m isobaths, from Walvis Bay to the border of Angola. The survey design that was followed, was first developed by the Nansen Programme in the 1990s for hake biomass assessment (Strømme *et al.*, 2010) and it is still used by the Namibian research vesse *Mirabilis* during the hake biomass survey.

1.3 Participation

A total of 28 scientists and technicians from Namibia, Angola and Norway participated in the survey. The full list of the participants and their affiliations are given in Table 1.

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

Name	**Role**	**Affiliation**
Kathrine Michalsen	Cruise leader	IMR
Ester Nangolo	Local cruise leader	MFMR
Diana Zaera-Perez	Fish sampling TL	IMR
Sarah Bruck	Fish sampling TL	IMR
Virgilio Estevão	Local cruise leader	INIP
Tarah Mbangula	Fish biology	MFMR
Jan Frode Wilhelmsen	Acoustic engineer	IMR
Fredrik Madsen	Acoustic engineer	IMR
Saskia Kisting	Water Chemistry	MFMR
Irene Moçambique	Water Chemistry	INIPM
Beat Gasser	Water Chemistry	IAEA
Blessing Kamwi	Water Chemistry	MFMR
Geraldina José	Fish biology	INIPM
Sténia Isais da Costa	Plankton biology	INIPM
Timoteus Kadhila,	Fish biology	MFMR
Johnny Gamatham	Fish biology	MFMR
Pedro Panzo	Fish biology	INIPM
Guilherme Camarada	Fish biology	INIPM
Lessyn Kalwenya	Fish biology	MFMR
Thusnelde Ngutjinazo	Plankton biology	MFMR
Bernardo Moises Fernandes	Plankton biology	INIPM
Joao Gouveia Eusebio Dias Dos Santos	Plankton biology	INIPM
Leevi Mwaala,	Plankton biology	MFMR
Malakia Shimhanda	Fish biology	MFMR
José Amaro Francisco	Hydrography	INIPM
Arariky Shikongo (UNAM student)	Whale and bird observer	UNAM
Marek Ostrowski	Hydrography TL	IMR
Heidi Gabrielsen	Plankton TL	IMR

List of institution abbreviations:

IMR – Institute of Marine Research, Bergen, Norway
MFMR – Ministry of Fisheries and Marine Resources, Namibia
INIP – Instituto Nacional de Investigação Pesqueira E Marinha, Luanda, Angola
IAEA – International Atomic Energy Agency
UNAM – University of Namibia

1.4 Narrative

The vessel left Walvis Bay in the morning of 11 May 2019. Calibration of the echo sounders was conducted just outside Walvis Bay on 11 and 12 May 2019. The first trawl station was conducted in deep waters at 08:30 UTC on 13 May 2019.

The survey coverage off the northern part of the Namibian coast was completed on 26 May 2019 at 11:00 UTC. The vessel continued the survey covering the southern and central part of Angola.

1.5 Survey design and survey effort

Demersal trawling was carried out on predetermined positions within predetermined depth strata (as summarized in Table 3). All hauls shallower than 300 m were done during daytime, generally between 05:30 and 15:30 UTC, because hake (especially *M. capensis*) is known to lift off the bottom at night (Iilende *et al.*, 2001) possibly in search for prey. In deeper waters, where night lifting of hakes (*M. paradoxus*) from the bottom is considered to be minimal (Ingólfsson *et al*., 2005), trawling was also conducted during the night.

Hydrographic variables (depth, temperature, salinity and oxygen) were measured with a CTD at almost every bottom trawl station; several were dropped when the 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 was carried out with 3 superstations (at 30 m, 100 m and 500 m depth, Figure 7). 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 20° and 18°S degree lines, and at several prescribed near-shore stations.

Acoustic echograms were continually recorded throughout the survey. 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, plankton and hydrographic stations can be found in Figure 3 to Figure 5.

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

DATE	**12–26 May**
DISTANCE (NM)	1 609
TRANSECTS	18
BOTTOM TRAWLS	93*
CTD	97
SUPER STATIONS AT 6 TRANSECTS	18
AT WHICH THE FOLLOWING SAMPLES WERE TAKEN:	**
BONGO	17
WP2	18
MANTA	18

* Note that 4 trawls were not valid for biomass estimation because the trawl net was torn or had too short towing time

** Number of samples collected at super stations for the different hydrographic parameters are available in Annex II

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

Effort	Depth strata (m)					
	100-200	200-300	300-400	400-500	500-600	600-700
No trawl hauls	11	23	17	16	15	8
Sampling intensity (NM^2/trawl)	704	192	244	76	71	125
Area (NM^2)	7 750	4 407	4 148	1 216	1 063	998

* Note that depth strata 600-700 was not included in the biomass estimation because in the National survey density from that strata are not included in the biomass calculation.

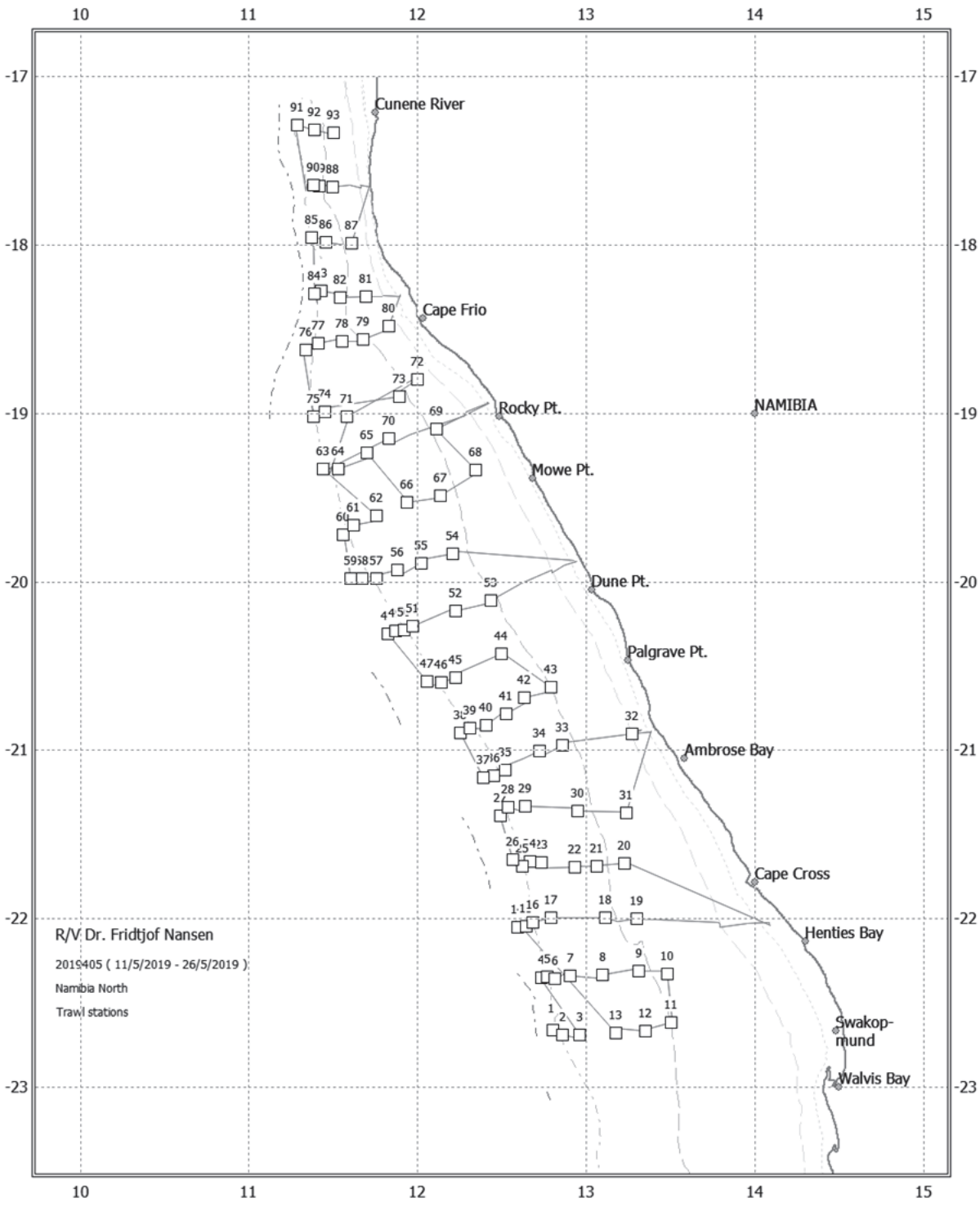


Figure 3. Cruise track and trawl stations

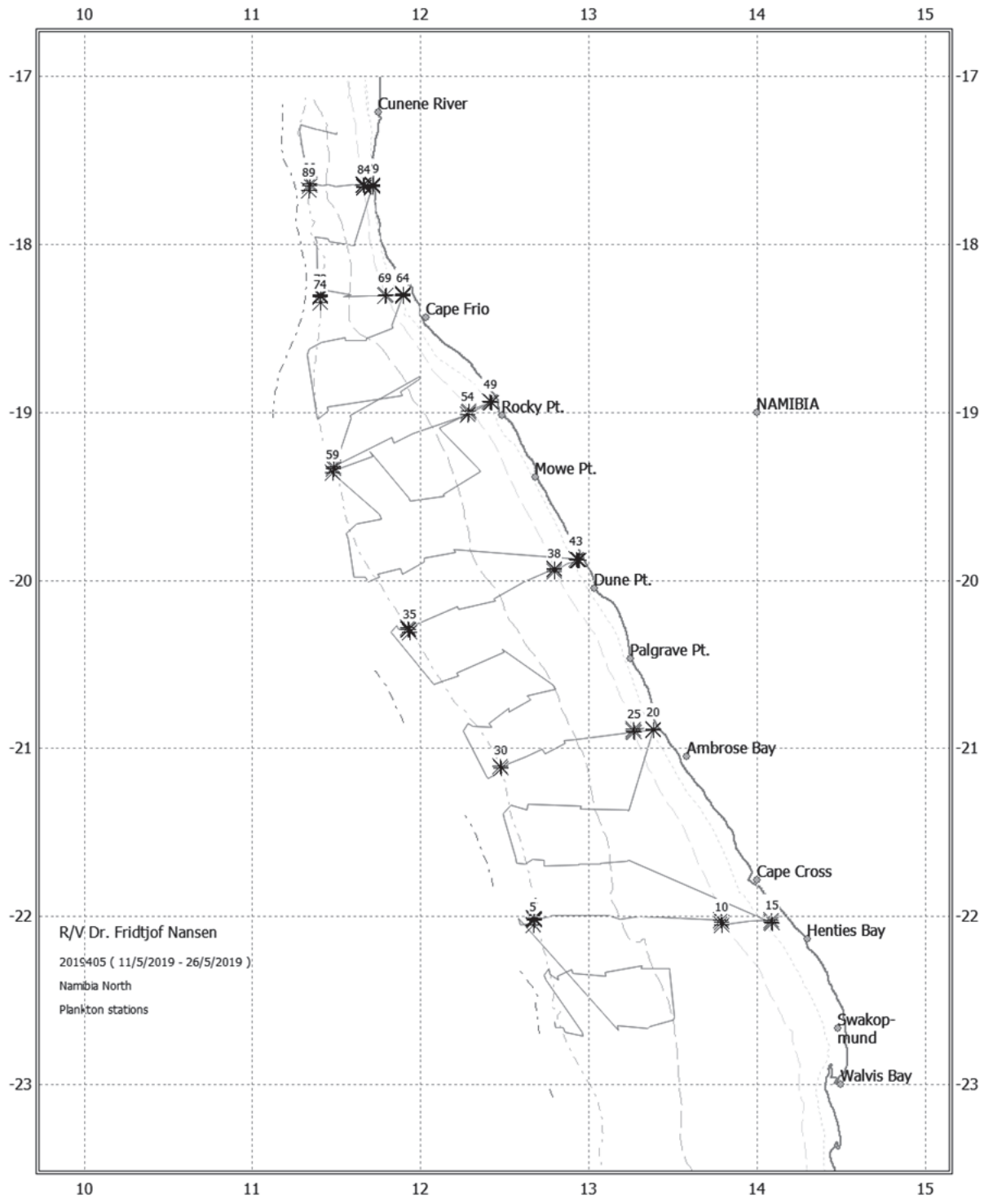


Figure 4. Cruise track and plankton stations

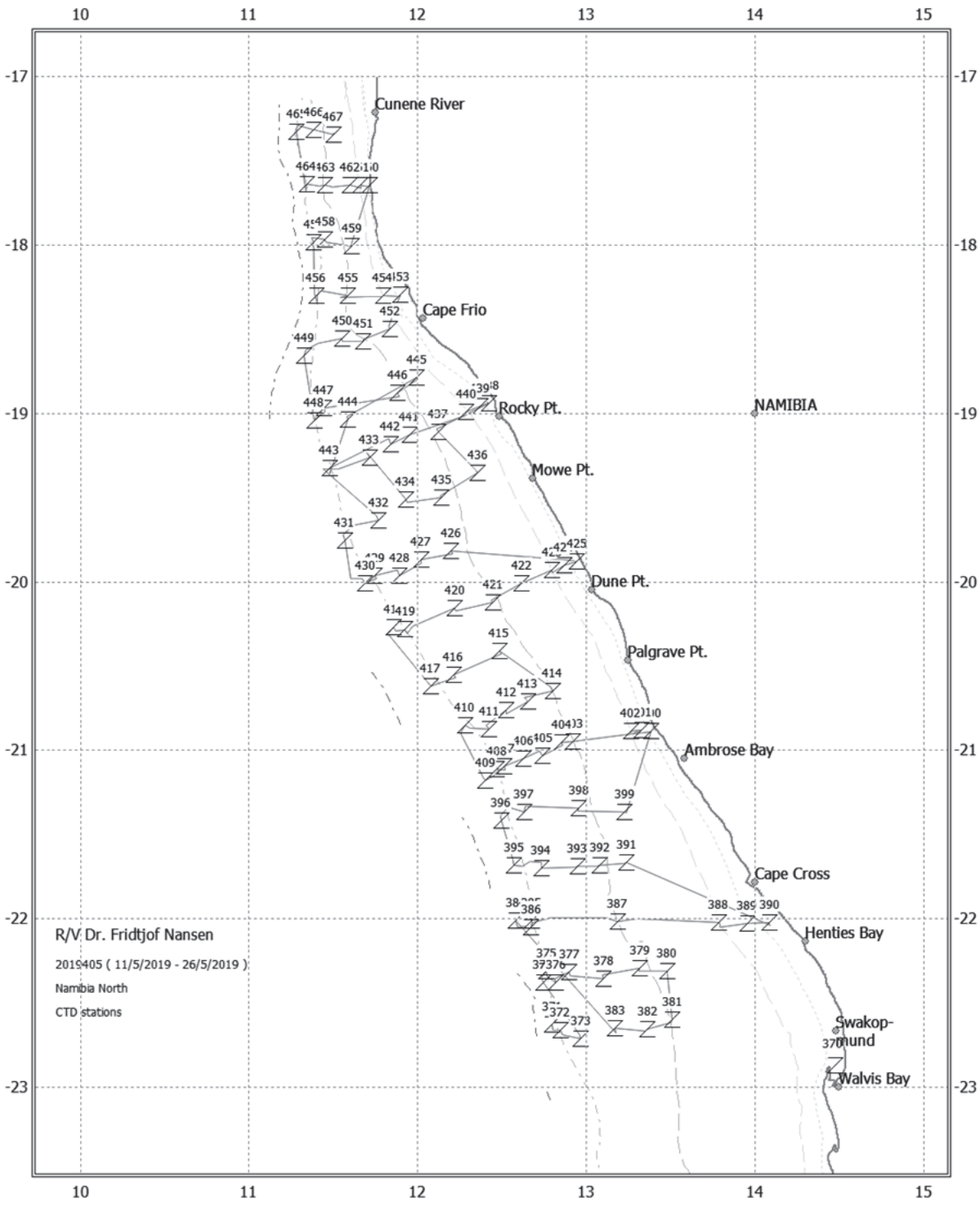


Figure 5. Cruise track and CTD stations

CHAPTER 2. METHODS

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 seconds. The wind channels (wind speed and wind direction) experienced about 500 invalid data sections; 10 percent of these were longer than 10 minutes. The maximum gap, 1 hour and 20 minutes occurred on May 15, 9:09 UCT. The invalid data sections were characterized by a sudden drop to zero in the recorded data, which affected both wind channels. As the zero denotes a valid wind speed and direction value, there was a need to exclude these data before the usage. It was done by replacing the cases when both channels showed zero with the NaN (not a number) symbol and filtering the flagged data cycles from the subsequent analysis. It worked in the case of this particular survey because of the very steady speed and direction ranges of the dominating southeasterly trade wind (cf. section 3.1.1). However, the adopted method may lead to an exclusion of valid data in the case of surveys experiencing low or strongly variable wind conditions. To avoid such situations, it is necessary to eliminate the zero-gaps in the wind recording channels, by the technical service of the AANDERAA meteorological station.

2.1.2 Thermosalinograph

Continuous underway observations of temperature and salinity were carried out with two thermosalinograph (TSG) units, one connected to the intake of the engine cooling water (4 m depth) and the other receiving seawater from the intake at the retractable keel holding the acoustic transducers (6 m depth). The TSG provides the calculated values of salinity on the basis of measurement of the internal temperature and conductivity flowing through its piping system. Both units installed on board also measured the ambient seawater temperature using the second thermometer installed externally in the hull at the inlets of the seawater feeding pipes. Additionally, the 4m-depth unit was equipped with a fluorometer.

The daily screening of the data revealed a systematic offset between in the salinity measured by each of the TSG units. We validated this offset relative to the recently calibrated CTD-mounted sensor (S/N 42037), by matching the 10-second TSG salinity values recorded during each oceanographic station to the salinity measured with the CTD probe at that station, at the time when the CTD probe passed the TSG depth (4 and 6m, respectively). The accuracy of the time matching relied on the precise time synchronisation, The TSG and CTD data logging systems on board of the vessel are synchronised with an accuracy in the order of 1 second.

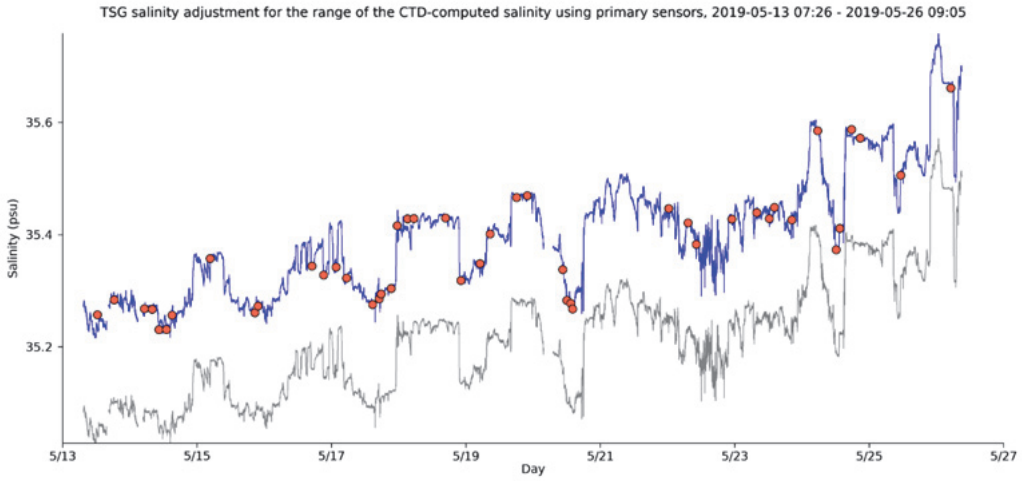


Figure 6. Intercomparing the TSG 10-second salinity record at 4 m record (the grey line) with the 1 m CTD salinity samples (the red circles) collected at the same time and depth during the oceanographic stations, survey 2019405. The blue lines denote the corrected TSG salinity data as used in this report

The inter-calibration indicated large offset from the CTD sensor for the 4 m depth TSG unit. For this reason, the 4 m depth TSG data were adjusted to the CTD levels using coefficients derived with the linear regression model. The model results were statistically significant in the case of both units. Figure 6 demonstrates the correction applied to the salinity derived from the 4 m TSG unit.

Identical inter-calibrations were performed for the external temperature and fluorescence sensors. No drift was detected in the case of the temperature sensors for both TSG units. In contrast, the fluorescence sensor required an adjustment of about 1.6 times to match the fluorescence values recorded with the CTD probe mounted fluorometer. These adjusted underway fluorescence values have been subsequently used in this report.

Unfortunately, the offset was not the only issue deteriorating the performance of the TSG-mounted sensors. Both units displayed periods of biased recording, presumably induced by disturbances in the rates of seawater flow past the sensors. There was no possibility to investigate and remove the source of this bias during the survey. Nonetheless, the spurious data sections recognized during the daily screening were removed from the record and thus eliminated from influencing the result.

The 4 m depth TSG tended to display the biased data 1-2 times a day. The long sectors of biased data were discovered during the daily data screening sessions and removed interactively in software. In the case of the TSG unit at 6 m, the number of biased data sections per day increased substantially from 20 May. The bias has the form of a ten-minute long, spurious drop in the recorded conductivity (and the derived salinity) occurring each time after the vessel had completed a station and increased the speed. Given the high-intensity trawling and oceanographic stations during the survey, data from the 6 m depth TSG unit were exluded from analysis. The reported results are obtained from the 4 m depth TSG unit data that were edited and adjusted with the CTD data.

2.1.3 Current speed and direction measurements (ADCP)

The ocean current data were collected with Teledyne RDI Ocean Surveyor ADCP OS150, operating at the frequency of 150 kHz. The 75 kHz ADCP, which is also fitted onboard was not operational during this survey. RDI's VmDAS data logging software was run in narrow band mode and averaged data in 8 m vertical bins. Heading, pitch, roll and positional data were acquired by a Kongsberg Marine SEAPATH unit. The VmDAS software used these data to convert the ADCP's along beam velocities into earth coordinates.

Screening of raw ADCP data to identify and eliminate spurious data sections was carried out throughout the survey on a daily basis. The screened ping-based data were ensemble-averaged into 2-minute along-track ensembles. The misalignment between the transducers' orientation and the ship's centre line were estimated based on the properties of the ensemble-averaged current velocities during the vessel's turns and acceleration periods. For this postprocessing stage, we used the OSSI software developed by GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel. The following table shows the results of the misalign estimation using the data collected during the survey.

Table 4. The transducer misalignment with the ship centreline estimated from the ADCP data collected during the 2019405 survey. The mean misalign angle data are in the rightmost column

ADCP unit	Bin size	Reference layer	Amplitude	Angle
OS 150 kHz	8 m	100 – 200 m	1.0094	-0.093°

According to the result in Table 4, the misalignment was below 0.1°, suggesting the good quality of the uncorrected data. The estimates from previous surveys through 2017 and 2018 campaigns estimated the misalignment for OS150 to ~ -0.22°. The change in the misalignment value suggests possible shifts in the orientation ADCP transducer or of the GPS antenna, which could have occurred in the course of the maintenance procedures during the vessel's recent service at shipyards. The misalignment could have also been reduced by changes in the VmDAS configuration files, which were not documented. However, we note the change in the estimated misalignment purely for the maintenance record, as the change in this value does not lead to errors, as long as the proper software is used to post-process the raw data. The misalign amplitude and angle values estimated during the survey are presented in Table 4.

Because the vessel performed frequent trawl hauls and sampling stations, the speed and sailing direction was variable. The survey track segments crossing the shelf between the inshore and offshore waters were highly meandering; the distance covered per unit time stalled for 30 minutes or so to perform a trawl, to increase sharply during transit to the next trawl station. To compare the flow patterns along the vessel's path with such an uneven spatio-temporal coverage between different survey lines, the 2-minute ADCP ensembles obtained after the post-processing in the OSSI software were averaged into equal-distance segments. For each survey line, nominally perpendicular to the coast but in practice meandering due to the trawl stations, the data were binned into the 5 NM even-distance

blocks running along the straight line fitted using the least square root method through the centre of the meandering vessel's track. This final part of the postprocessing was carried out using the XADCP software developed at IMR.

2.2 Fixed station hydrographic sampling

A series of biological and oceanographic transects were sampled along every 3rd trawl transect on each degree of latitude, noting that the trawl transects in the northern part of the area were not east-west (they were perpendicular to the coast). 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 an additional station was placed approximately mid-way between these two stations, usually at the 200 m isobaths. In addition, the distance between the 100 m and 200 m station was more than 50 NM and so an extra station was added.

Six transects with three sampling stations on each were completed on the cruise, thus 18 "super-stations" were sampled during the cruise. An overview of the number of samples collected is given in Table 2. The samples collected on these transects are shown in Figure 7.

In addition to the transect 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 a reasonable horizontal resolution of the hydrographic parameters measured by the CTD. A map of all the CTD stations sampled is shown in Figure 5.

At each super-station deployment, the 12-bottle rosette collected water at predefined depths during the upcast to obtain vertical profiles of pH, total alkalinity, nutrients, and chlorophyll-α. 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.

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 were performed using Seabird's Seasave software.

Water was collected from low-gradient depths of 300 m and below to perform onboard validations of 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 the Guideline Portasal Salinometer 8410A was not working (one of two thermistors was out of service), thus no water samples were collected and analysed to validate the sensor salinity values during this survey.

The results for CTD sensor validations and water chemistry quality assurance are shown in Annex II.

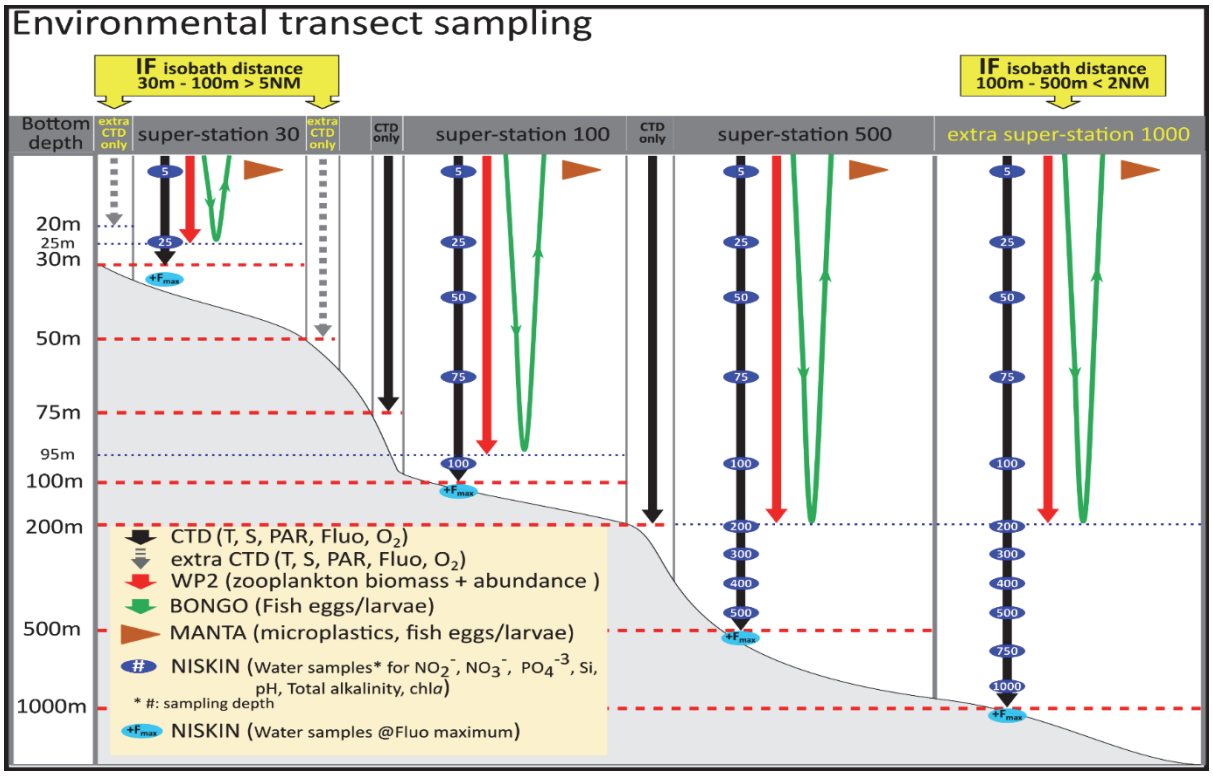


Figure 7. Sampling diagram showing the depth and the equipment used at the superstations transects, from the inshore (left side) towards the deep 500 m stations (right side). Note, phytoplankton samples were not taken during the survey

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 during analyses 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 during analyses 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 (one sample 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. Analysis was performed using a Skalar San++ Continuous Flow Analyser while following standard procedures (Grasshoff *et al*., 1999). Storage and transport may have introduced a loss of accuracy for the results.

2.2.3 Plankton sampling

Water for chlorophyll-α samples were collected in 1 000 ml polyethylene bottles and transferred into 260 ml bottles for filtration. Three replicates were filtered on depths where sensor data from the bottle files indicated values higher than 0.5 ug/l. In areas with very low chlorophyll concentration (all below 0.5 µg/l), double amount of water (2 x 260ml) was filtered. At all other depths, one replicate of 260 ml was done. These water samples were collected from 200 m to the surface and filtered using a 0.7 µm filtration system (Munktell glass-fibre filters Grade: MGF, vacuum 200 mm Hg). The filters were stored in a freezer at -80°C until further analysis.

Qualitative phytoplankton samples with an algae net were not collected during the survey.

Zooplankton samples were collected with vertical tows of a WP2 net (180µm). Sample collection and processing followed the sailing orders of the survey. Specifically, the net was towed within 5 m from the bottom to the surface, or from 200 m depth to the surface at deep stations. Each sample was split into halves with a Motoda splitter. One half was size-fractionated through 2 000 µm, 1 000 µm and 180 µm mesh sizes, and dried in the oven (60ºC) in pre-weighed aluminium trays. The second half was preserved in a 4% borax buffered formaldehyde solution.

Ichthyoplankton was collected with double oblique tows using a Bongo (405µm). 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.

In all cases, once the Bongo was on board the sample from the two nets was treated as follows:

a) One of the nets, the Bongo V, was sieved on a 180 µm sieve and transferred to a 100 ml bottle (or bigger) and preserved immediately in 4% formaldehyde.

b) From the other net, the Bongo H, was examined under the microscope and ichthyoplankton was sorted. Sorting was done at all of the Bongo stations. The sorted larvae were photographed and preserved in 96% ethanol in small labelled scintillation vials or cryovials indicating clearly the part of the sample used (i.e. 50%), the preservative, station etc. When sorting was finished, the bulk sample was preserved in 4%

borax buffered formaldehyde (specially made for ichthyoplankton) in labelled bottles (as "sorted").

Samples from the Manta trawl were collected and processed according to the sailing orders. All samples were sorted on board for microplastics and ichthyoplankton. Sorted microplastics were photographed, washed in fresh water, dried in aluminium trays, individually packed in aluminium foil and stored frozen. Sorted fish larvae and eggs were sorted, photographed, preserved in 96% ethanol for genetics in small scintillation vials. The bulk of neuston samples after sorting was preserved in 96% ethanol. An overview of the sampling procedures in the plankton lab can be found in Annex III.

2.3 Bottom mapping echocounder

The EM 710 multibeam echo sounder is a high-resolution seabed mapping system. The EM 710 is mounted on the drop keel and the operational depths of the EM 710 are 3 to 2 000 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 710 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 inputted 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.

2.4 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 08h00 to 18h00 (with breaks). Marine mammal observations were the main objective of seabirds' 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. An overview of time spent on primary observations for cetaceans and seabirds can be found in Annex IX.

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. For seabirds, a field guide (ACAP, 2015; Onley & Scofield, 2007; Bianchi *et al.*, 1999) was used to assist with species identification of unknown seabird species.

2.4.1 Cetaceans

Observation of sea mammals was carried out along the entire Namibian northern coast from 22° 2' 11" S and 12° 40' 23" E to 17° 12' 2" S and 11° 44' 0" E. This was performed by using either naked eye or Trinovio (8×42) binoculars to an approximate distance of 2.5 km from the vessel to locate and identify different species as well as to determine group sizes. Species identification was carried out through careful observation and photography. A Nikon AF-S Nikkor camera with 80-400mm telephoto lens was used to take images which were used for further species identification, where, specific features such as shape and height of the blow, body shape and size, the position of seabird bill, colour patterns and animal behaviour were observed. Two cetacean field and identification guides were consulted for more challenging identifications (Sea Search, n.d. and Jefferson *et al.*, 2015).

All significant sighting data for cetacean were recorded on a Data form prepared by Sea Search-Namibian Dolphin Project. Where, the following data were recorded every time a cetacean was spotted; time, date, location, sea surface temperature (SST), cloud cover, depth (m), weather condition which included sightability, speed and direction of the wind, number of boats/vessels and interaction/behaviour of cetacean with the vessel and the group size.

2.4.2 Seabirds

Seabird observations were conducted in a similar approach, Data recorded from the date the survey commenced to the date it ended, species were identified and counted based on two method codes; accuracy (ACC) and estimation (EST). Unit codes were also used to represent individuals flying over sea (IFS) and individuals sitting on the water (ISW). Moreover, other parameters recorded were; the location, depth, SST, visibility and sea state. A GPS-position was recorded every time seabirds were observed. These parameters were recorded from a Toktlogger v1.1.0 software. Sightings were only recorded while the vessel was in transit between research stations. Observations started at least 20 minutes 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

2.5 Bottom trawl fish sampling

2.5.1 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 with each transect, trawls were placed at

approximately 15 NM intervals, ensuring that each 100 m depth zone contained at least one trawl. 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 300 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 as standard procedure, however, for this survey, in particular, we used the 300 m mark following various consultations. As most valid trawl stations were less than 400 m depth (62%) 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. 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 contacts were not used for density estimation (see below).

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

2.5.2 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 the relevant *FAO Species Identification Sheets for Fisheries Purposes* (Bianchi *et al.*, 1999; Carpenter *et al.*, 2016), and *Smith's Sea Fishes* (Smith *et al*., 1999). In addition, several online databases were used for confirmation of systematics and species distribution, such as the *Eschmeyer database* (Ficke *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) along with *FAO Species catalogues*.

Biological data of both hake species were 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 V). Length (total length to the nearest cm) and weight (to the nearest 0,5 g) were recorded using the onboard electronic measuring boards 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* collected in southern Angola.

Length frequencies and length-weight parameters were also recorded for all other priority species. The main 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, a set number of individuals from predefined priority species were collected per 1° latitude for the examination of population structure (Table 5). Fin clip samples were collected for genetic analysis be done at the IMR. The rest of the fish was frozen for the study of parasite assemblages as biotags, morphometrics, and biological parameters at the NatMIRC in Namibia.

Table 5. Genetic and biological sampling of priority species

Species	**Specific sampling**	**Number of samples**
M. paradoxus	Whole fish (for parasites + standard sampling of maturity, stomach, otoliths) Fin clips samples for genetic analysis	5 specimens <40cm/degree 5 specimens >40cm/degree
M. capensis	Whole fish (for parasites + standard sampling of maturity, stomach, otoliths) Fin clips samples for genetic analysis	5 specimens <40 m/degree 5 specimens >40cm/degree
D. macrophtalmus	Whole frozen fish for morphometric analysis Fin clips samples for genetic analysis	30 specimens/degree
L. vomerinus	Whole fish (for parasites + standard sampling of maturity, stomach, otoliths) Fin clips samples for genetic analysis	10 specimens/degree
G. capensis	Whole fish (for parasites + standard sampling of maturity, stomach, otoliths) Fin clips samples for genetic analysis	10 specimens/degree
Trachurus capensis and *Scomber colias*	Whole frozen fish for morphometric analysis Fin clips samples for genetic analysis	20 specimens/degree

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

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

2.5.3 Demersal invertebrate sampling

The two stainless steel cylinders (approx. 2 litres in volume) were not mounted on the footrope of the trawl during this survey because nobody had the capacity to analyse these samples (nor for grain size neither for demersal invertebrate species identification).

2.5.4 Swept-area estimation

An index of stock abundance was estimated by using the swept-area method multiplying the density of fish per haul with the area of a given depth strata (Gunderson, 1993; Jakobsen *et al*., 1997 and Pennington and Strømme, 1998).

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

$$B = \frac{A}{a}.\frac{\overline{X}}{q}$$

where A is the total area surveyed, a is the swept-area of the net per haul, $\overline{X}$ 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 $\overline{X}_i$ and s_i^2 respectively, then an unbiased estimate of the population mean $\overline{X}$ is the stratified mean $\overline{X}_{st}$, which is given by:

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

where $Wi = \frac{Ni}{N} = \frac{A_i}{A}$ is the statistical weighting factor expressed as relative size of the i^{th} stratum with A_i the area of the i^{th} stratum and A is the total area surveyed. The variance of the stratified mean is given by

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

where n_i is the number of hauls in the i^{th} stratum and n is the total number of hauls in the survey.

For conversion of catch rates (kg/h) to fish densities (t/NM²), 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 NM²/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 NM². Diagrams of the bottom trawl used are shown in Annex IV.

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 flatfishes 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^2 by latitude for southern Namibia (the area covered during Leg 2.4). Based on echo soundings from Nansen surveys 1996-2003. Depths from surface to bottom (Strømme *et al.*, 2010).

Latitude	100-200	200-300	300-400	400-500	500-600	600-700	Total all strata
17°15'-18°	490	243	95	63	65	46	1 002
18°-19°	783	822	154	128	119	101	2 107
19°-20°	1 259	810	1 090	328	287	266	4 040
20°-21°	1 378	883	987	286	265	258	4 057
21°-22°	1 644	563	893	257	201	200	3 758
22°-23°	2 196	*1 086*	929	154	126	127	4 618
Total area 17°15'-23°	7 750	4 407	4 148	1 216	1 063	998	19 582
All Namibia	20 091	9 842	8 848	3 543	2 200	1 960	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*. Values in italics are those for areas obtained with interpolation usin only few soundings.

Length-based Swept area estimation

For target species, where length-based estimates are more useful, a slightly different procedure was followed. The total biomass in the two methods is 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 (Gunderson, 1993; Jakobsen *et al*., 1997; and Pennington and Strømme, 1998).

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 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:

$$Lp, l = \frac{A_p}{S_p} * \sum P_s, l$$

Where:

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

A_p is the area (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.

$w = a*l^b$

2.6 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.

For every 1 degree, five jellyfish were preserved for further analysis. A small section of the oral arm tissue was removed and preserved in 96% ethanol (EtOH) and stored at -20°C. The rest of the specimen was stored in formalin.

2.7 Acoustic sampling

2.7.1 Sonar data

No sonars were used during the survey.

2.7.2 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. Calibration of the sensors was conducted off Walvis Bay on 11 and 12 May 2019, but these will not be used until the next survey in order to avoid any changes in methods within Namibia. Annex IV gives the details of the acoustic settings used during the survey.

2.7.3 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. The acoustic data are available for subsequent analysis although it must be noted that the scrutinization 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 experience of similar surveys in Namibia, and guided by the catches of the bottom trawls in that area.

Table 7. Allocation of acoustic densities to species groups

Group	**Taxon**	**Key species**
Hake	Merluccidae	*Merluccius capensis* *M. paradoxus*
Horse mackerel	Carangidae	*Trachurus capensis*
Mackerel	Scombridae	*Scomber colias* *(S. japonicus)*
Pelagic 1	Clupeiformes	*Etrumeus whiteheadii*
Pelagic 2	Gempylidae	*Thyrsites atun* *Lepidopus caudatus*

Group	Taxon	Key species
Other demersal and semi-pelagic species		*Chelidonichthys capensis* *C. queketti* *Brama brama* *Helicolenus dactylopterus* *Zeus capensis* *Emmilichthys nitidus nitidus* *and other species*
Mesopelagic species (most abundant species recorded)	Gobidae Myctophidae	*Sufflogobius bibarbatus* *Symbolophorus boops* *Lampanyctodes hectoris* *Phosichthys argenteus* *Diaphus hudsonii*
Plankton	Various	
Jellyfish	Various	*Aequorea forskalae* *Pelagia notiluca*

2.8 Radiochemistry and trace metals

A series of 10 L water samples were collected to capture contrasting water masses (inshore / offshore, oxygenated / deoxygenated, surface/bottom) using the CTD / Niskin rosette. These water samples were filtered on board and will be shipped back to IAEA Monaco and analysed for radio-isotopic signatures to assess land-ocean exchange processes (pollution, eutrophication). Water samples were also taken at selected depths for the analysis of trace metals. However, no water was collected for coccolithophores during this survey due to logistic and methodological reasons.

Several sediment cores were collected using the ship's large box corer at strategic sites along with the transit from Namibia to Angola. The sites for sediment coring were selected based on past experience and to also capture contrasting sediment profiles (inshore / offshore, oxygenated / deoxygenated). Successful boxscores were subsampled using a series of two to three 10 cm core tubes, which were sectioned on board. The cores will be used for the analysis of different environmental and paleontological parameters (inorganics, geochronologist, archives, forams). The frozen core slices will also be returned to IAEA Monaco post-cruise.

CHAPTER 3. RESULTS

3.1 Oceanography

3.1.1 Wind speed and directions

The southeasterly trade wind dominated the atmospheric conditions experienced during the survey. With the average wind speed of 7 m s^{-1} and the wind direction aligned with the coast (Figure 8), the wind conditions were favourable to the development upwelling almost throughout the entire survey. The only significant wind relaxation events were recorded prior to the start of the survey between 9 and 12 May and briefly on 22 May, on crossing the 19°S. The strongest wind gust, of nearly 19 m s-1, was recorded prior to the last wind relaxation event, on 21 May at 4h30. The entire 21 May was characterized by the significantly stronger wind compared to other survey days (15 m s^{-1}, cf. Figure 8 and Figure 9).

It is generally accepted that the wind speed in the range 6-7 m s^{-1} forms the so-called optimum environmental window for small pelagic fish recruitment in the major upwelling systems. The weaker winds impede upwelling, which leads to a reduction in plankton production, thus reduced feeding opportunities to planktivorous fish. The stronger winds, on the other hand, enhance the dispersion and offshore transport to the levels that are no longer supportive of productivity and retention in a coastal ecosystem.

According to the environmental window concept, the observed wind conditions suggest that the climatological conditions were favourable to fish recruitment in the northern Benguela upwelling in May 2019.

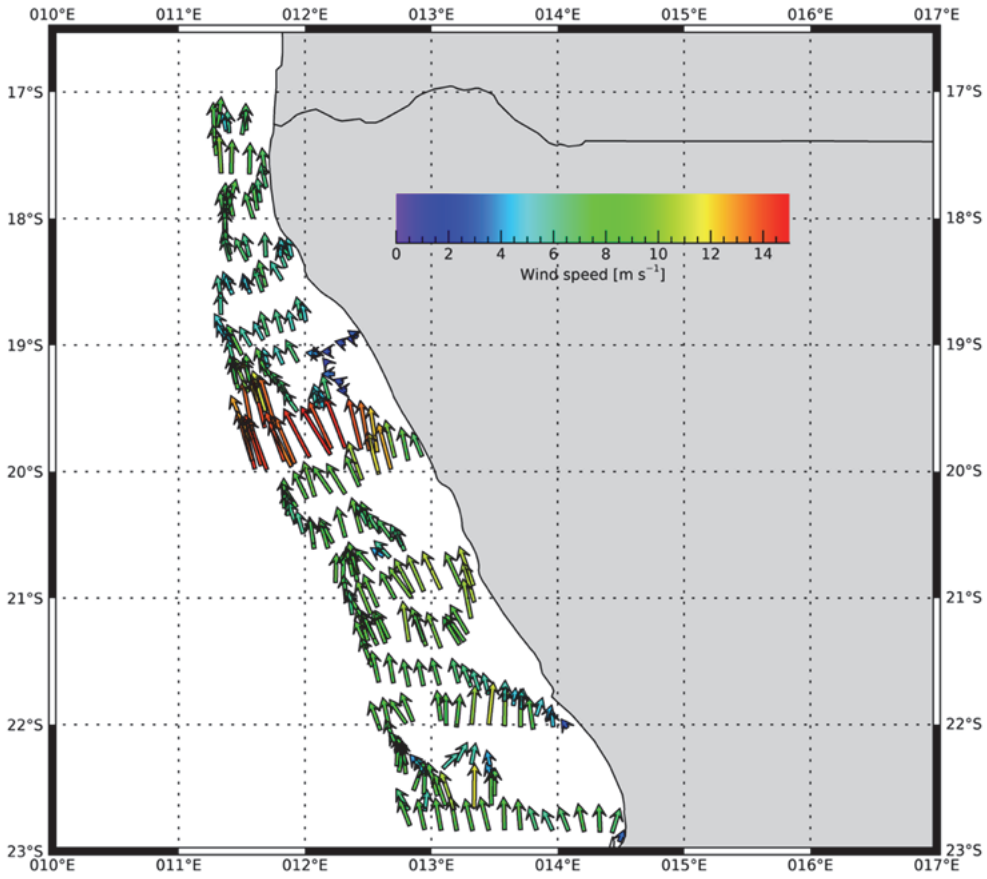


Figure 8. Distribution of wind speed and direction along the survey track. Each vector represents the spatial average wind within a 14x14 km cell of a rectangular grid covering the survey area (not shown)

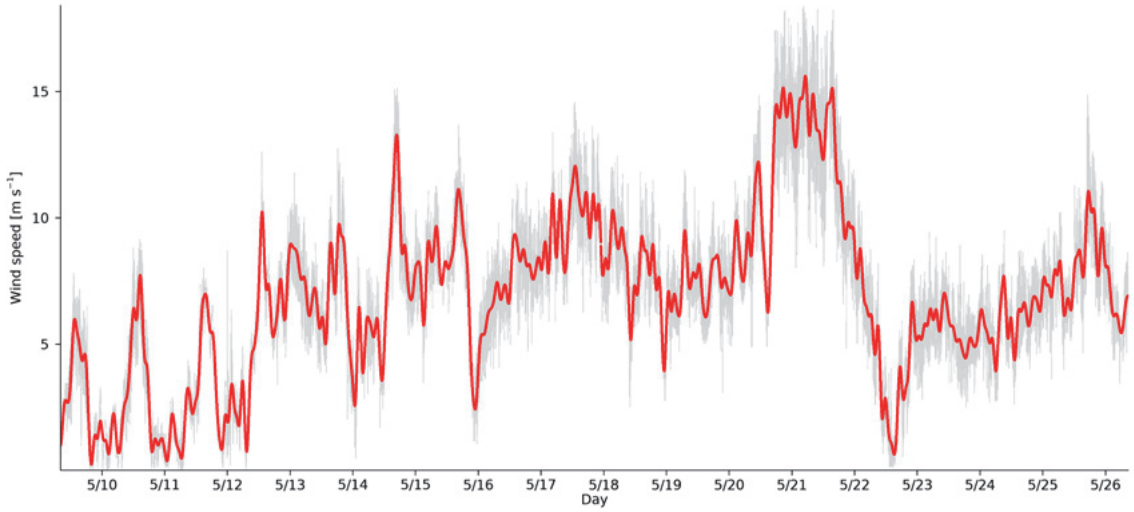


Figure 9. Wind speed, the original 1-minute data shown in the grey colour overlaid with the 1-hour averaged record shown as the red line

3.1.2 Distributions of near-surface temperature, salinity and fluorescence

The maps of near-surface temperature, salinity and fluorescence is presented in Figure 10. Here, the salinity and fluorescence is adjusted to the CTD-mounted sensor ranges according to the procedure described in Section 2.1.2. The temperature distribution depicts the classical upwelling pattern. Alongshore trade winds generate offshore Ekman transport; the offshore surface transport removes warm water from the coast forming a mass deficit; the mass deficit induces the uplift of cold water from the bottom layers forming the inshore upwelling plume. In Figure 10 (left), the inshore band of cold upwelled waters extends from the southern perimeter of the mapped area at Cape Cross to Rocky Pt. The lowest temperature, less than 14°C, can be observed at the two isolated spots off Ambrose Bay and Dune Pt. The two separate temperature minima mapped at these two spots could be a part of a continuous band of very cold inshore water (~13°C), connecting the two locations but it was not captured on our maps. The maps were derived with an optimal interpolation approach, a robust method which however does not work well if there are large gaps in the spatial data coverage. As indicated by the survey tracks shown in Figure 8 on top of the interpolated maps, the coverage of the inshore waters during this survey was very sparse, limited to one data point per one-degree (60 NM) of latitude.

The cold temperature signature of the inshore upwelling plume weakens as the survey crosses the latitude of Rocky Pt., heading towards the border with Angola. The observed reduction in the inshore-offshore temperature contrast observed in the northern region could be due to the wind relaxation after 22 May (cf. Figure 8 and Figure 9). However, the salinity distribution (Figure 10, centre) offers an alternative explanation. It shows a decrease in salinity from the north towards the south. There is a well-manifested salinity front across the continental shelf, located just north of Cape Frio. To the south of that front, high salinity surface water (S >35.4 psu) is spreading along the offshore boundary of the shelf. This salinity pattern is indicative of intrusion of high salinity waters from Angola into Namibian shelf peaking in February-March. But the survey is in May and the observed high salinity signature weakens to the south of Cape Frio to vanish altogether at Cape Cross. The presented image appears therefore to indicate the receding phase of seasonal advection event, which would be the expected seasonal condition. However, to the north of the Cape Frio salinity front, high salinity waters remain dominant, being a potential driver of the reduction in the upwelling intensity at the northern extremity of the Namibian shelf.

The fluorescence distribution is presented using Fluorescence Relative Units (FRU). These units are believed to correspond to the true chlorophyll concentrations, but as the fluorescence validation data were not accessible by the time of this writing, only the relative distributional patterns are described, presented in Figure 10 (right). The FRU levels are the highest in the southmost region covered during this survey. Characteristically, the highest FRU is not observed nearshore where upwelling is the strongest, but at the offshore perimeter of the cold-water plume where temperature increases, and the stratification becomes stronger. The FRU levels decrease from the south to the north, being the lowest in the northern most region to the north of the Cape Front.

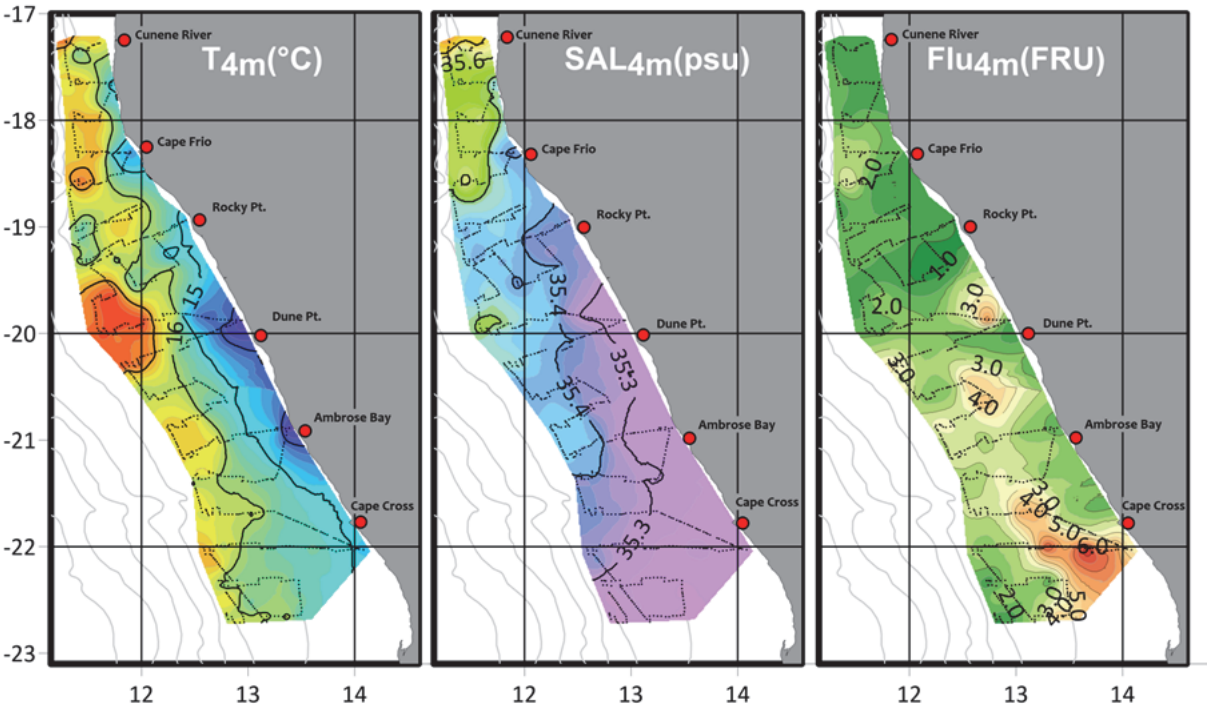


Figure 10. Horizontal distribution of temperature (left), salinity (centre) and fluorescence at 4 m depth obtained from the data collected underway. The track of the vessel is marked by the dot symbols. The continuous distributions derived using the kriging with moving neighbourhood method, using spherical variogram models best fitting the data. The salinity and fluorescence range adjusted to the ranges of the CTD probe-mounted sensors. Prior to 10-second data underway record was regularized on the 1 x 1 NM grid prior to the interpolation

3.1.3 Near-bottom distributions of temperature and oxygen

The temperature and oxygen close to the sea bottom are an important determinant of the environmental niche for many demersal and benthic species. Figure 11. shows the distributions of these parameters obtained using the level nearest to the bottom from the CTD casts. In order to demonstrate the relationship to the bathymetry the figure also presents selected bottom contours. The near-bottom temperature distribution (left) becomes colder as the bottom descends. Within the shallowest depth range of less than 200 m, the rate in the temperature decrease with depth is small, changing from about 13.5 to 12°C. The small variation in the bottom temperature over the inner shelf region is caused by the presence of upwelled waters. The 13.5°C observed near-the bottom matches the temperature observed at the sea surface near the coast (Figure 10, left), which manifests the well-mixed character and the lack of stratification with the coastal upwelling plume.

Figure 11 (right) exhibits the oxygen-deficient bottom waters, DO < 0.6 ml l^{-1}, dominating the broad section of the inner continental shelf in the broad region located to the south of Rocky Pt. To the north of Rocky Pt., as the continental shelf narrows, the near-bottom oxygen levels increase. The increase in the bottom oxygen coincides, in this region, with the increase in surface salinity associated with the advection from Angola (cf. Figure 10, centre).

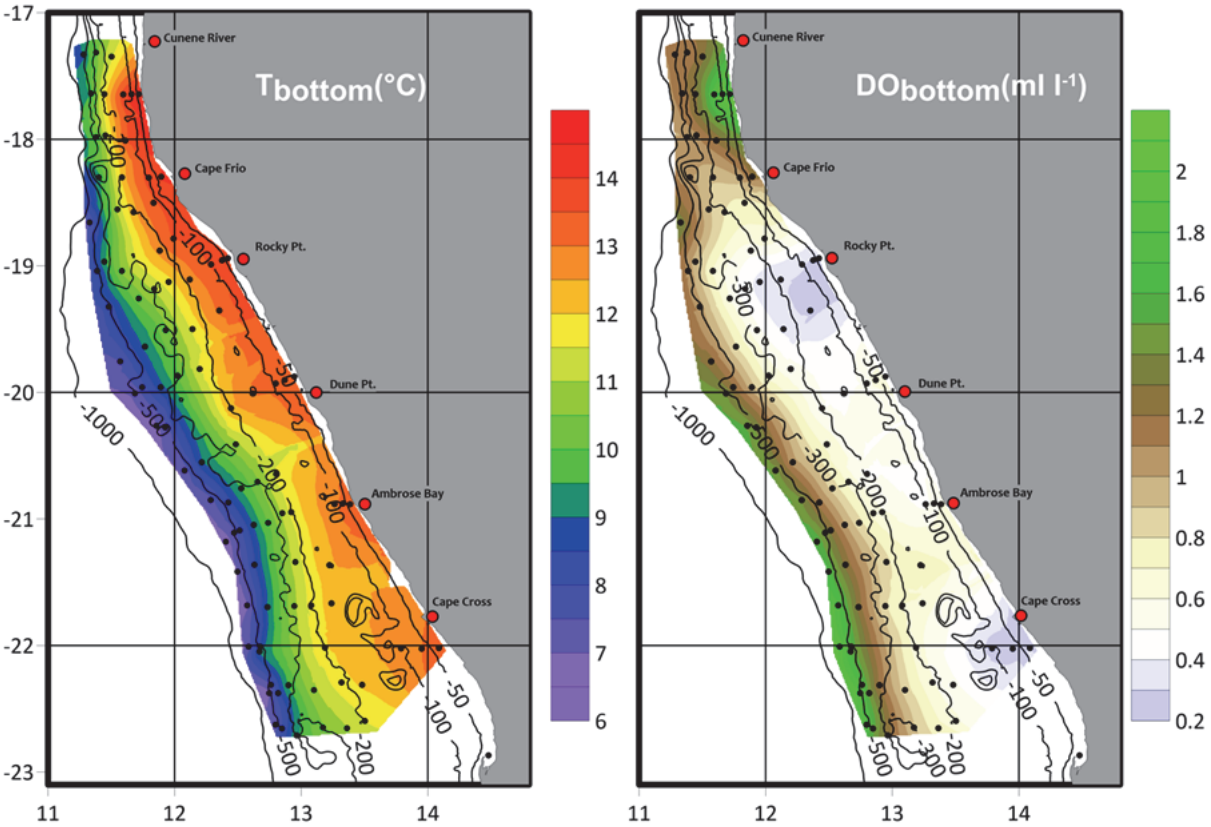


Figure 11. Distributions of near-bottom temperature (left) and dissolved oxygen concentration (right) overlaid with the approximate bottom contours representing the Namibian continental shelf bathymetry. The temperature and oxygen data were extracted from the CTD cast levels nearest to the bottom. The spatial prediction to the continuous distribution is achieved using the kriging with moving neighbourhood method. Bottom contours are generated from the GEBCO Global bathymetry 30-minute gridded dataset

According to the generally accepted threshold of 2 ml l^{-1} for denoting the hypoxic conditions (lethal to most of marine life barring the adaptations), the near-bottom oxygen conditions observed during this survey above the 500 m bottom depth and to the south of Rocky Pt. are to be classified as hypoxic. Furthermore, within this hypoxic region, the objectively interpolated map in Figure 11 (right) reveals two regions of totally anoxic conditions (DO < 0.2 ml l^{-1}), located off Cape Cross and Rocky Pt.

3.1.4 Vertical distribution of oceanographic parameters

The survey occupied the six principal hydrographic sections, spaced approximately equidistant along the Namibian coast, between Cape Cross (22°S) and the Cunene River (17° 15'S). The results from each of these sections are shown in Figure 12a-f.

These results indicate the typical oceanographic seasonal conditions off northern Namibia during autumn, characterized by the decreasing influence of warm Angolan waters, receding northwards, and the increasing influence of the upwelling induced advection advancing from the south driven by the seasonally intensifying, upwelling favourable, southeasterly trade wind.

In temperature distributions (Figure 12a), the shape of the 14°C isotherm describes the vertical structure of the upwelling plume across the shelf. Off Cape Cross, Ambrose Bay and Dune Pt., this isotherm outcrops to the sea surface. At Rocky Pt., this isotherm is still found in the inshore region (Sta. 238, Figure 12d, top), but not reaching the sea surface. At the two northernmost sections (off Cape Frio and Cunene, Figure 12e) the 14°C isotherm descends towards greater depths as the coastal waters have become warmer. However, the slopes of the overlay in the 15°C and 16°C isotherms are oriented upwards, indicating that also to the north of the Cape Frio salinity front (cf. Figure 9, centre) the upwelling is in the active phase.

The salinity distributions shown in Figure 12a-e are characterized by strong differences in the volume of high saline water (S >35.4 psu) occupying each section. Off Cape Cross, the high salinity range is not observed; off Ambrose Bay and Dune Pt. the high salinity layer is present, but as a thin surface layer located at the far offshore end of these sections. Off Rocky Pt., high saline water expands considerably to dominate the 30 NM region on the section's offshore end; the thickness of this layer reaches a 100 m depth. Off Cape Frio and Cunene River, high saline water is the dominant water mass observed in the upper water column across the entire sections. The diminishing volumes of high saline water observed across the occupied sections from the north to the south are another indicator that the survey data have captured the process of the seasonal relaxation of the advection from the north and the intensification of upwelling driven advection from the south.

The vertical structure of dissolved oxygen distribution observed during this survey (Figure 12a- e) depicts the seasonal maximum of hypoxia, peaking in May-June; the reasons severely depleted oxygen levels on this shelf are both local and remote. The local depletion is the consequence of intense upwelling supplying nutrients leading to increases in surface phytoplankton growth but also to reduced oxygen concentrations in the bottom waters as the sinking organic material decays. This decaying sinking organic material is degraded by planktonic respiration, which causes the reduced oxygen concentrations, producing CO_2 and therefore decreasing pH (Figure 12f). On the Namibian shelf, the bottom oxygen depletion process is further enhanced remotely, by the poleward advection of low oxygen water compensating the upwelling-driven equatorward flow in the surface layers.

For all sections occupied in the broad shelf region, to the south of Rocky Pt., the oxygen distribution displays severe hypoxia (DO < 0.5 ml l^{-1}) along the bottom and pockets of anoxic conditions (DO < 0.2 ml l^{-1}) throughout the survey. pH follows this same pattern of minima displaying pH below 7.5 in the hypoxic areas and below 7.45 in the anoxic pockets, supporting respiration claims (Figure 12f). In contrast, extreme hypoxic conditions are absent along the two northernmost sections at Cape Frio and Cunene (Figure 12e). The presence of higher oxygen concentrations and pH levels in the bottom waters imply less intense decay processes at the bottom, which in turn, suggests a lower upwelling intensity in the northernmost region compared with other locations along the northern Namibian coast.

The distribution of chlorophyll pigment over the northern Namibian shelf has already been discussed using fluorescence underway data (Section 3.1.2). The distribution of chlorophyll

along the hydrographic sections adds little new information to that analysis. The Namibian system exhibits high primary productivity at the sea surface because of the persistent fertilisation of surface waters by upwelling. The presented sections indicate that high productivity region extends vertically across the top mixed layer. Otherwise, the chlorophyll distribution patterns observed across the sections are the same as those presented in the map of the near-surface fluorescence (Figure 10, right).

Overall, the analysis of the hydrographic sections presented in this section has lead to the same conclusions already expressed for the near-surface and near-bottom data presentation: (1) the survey period fell in the season of the receding Angola waters and intensifying upwelling; (2) the spread of hypoxia over the bottom waters of the inner shelf was approaching the annual peak and (3) the oceanographic conditions in the northernmost section of the Namibian shelf were distinct from those in the south, upwelling was weaker, bottom oxygen levels higher, and the presence of high salinity Angolan waters was dominant.

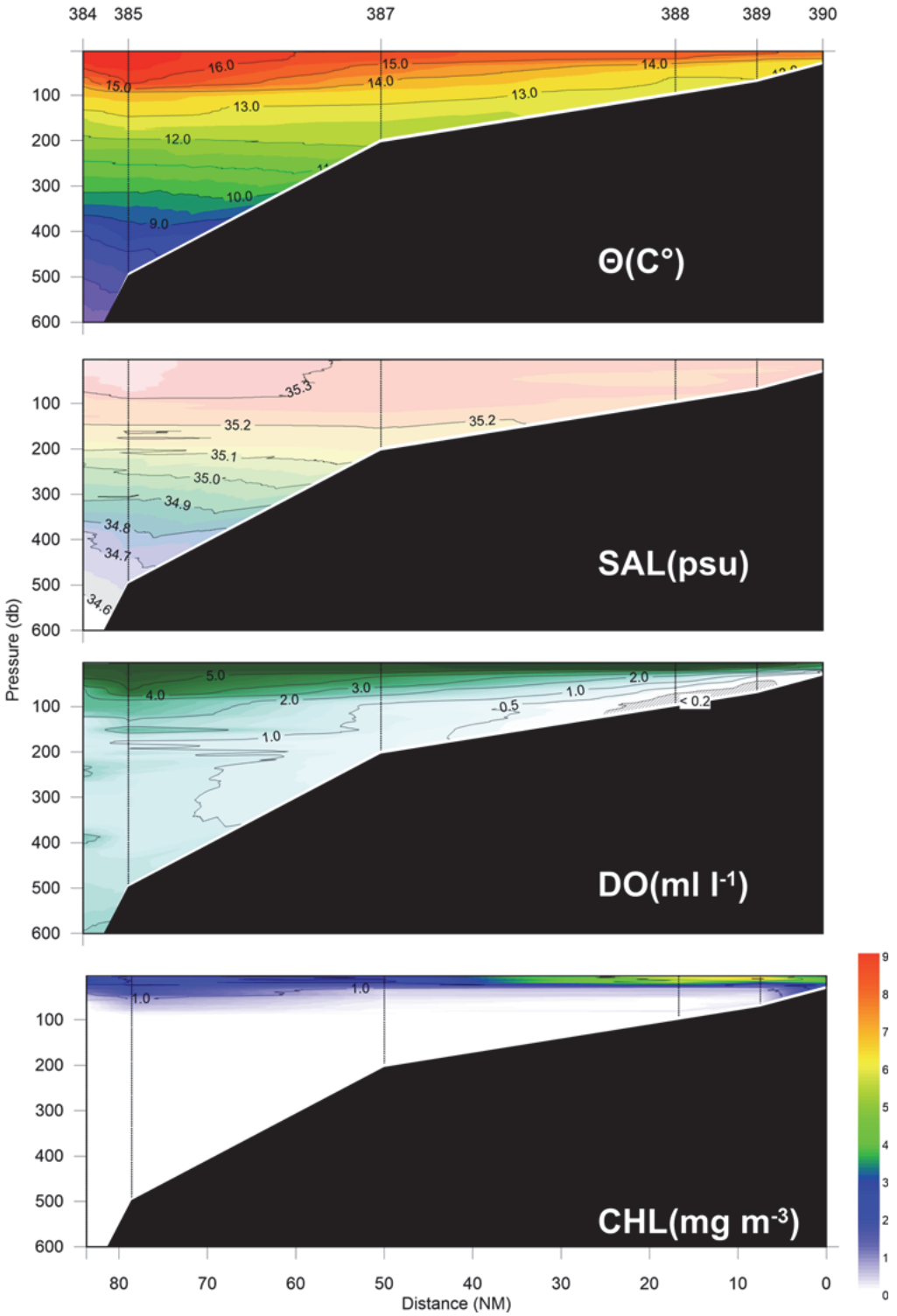


Figure 12a. Distributions (from the top to the bottom) of potential temperature, salinity, dissolved oxygen along with the 22°S section (south of Cape Cross). The stations' locations along the section are marked by the vertical lines. The respective station numbers are labelled above the topmost figure. The colour scale pertains to the chlorophyll (fluorescence) distribution

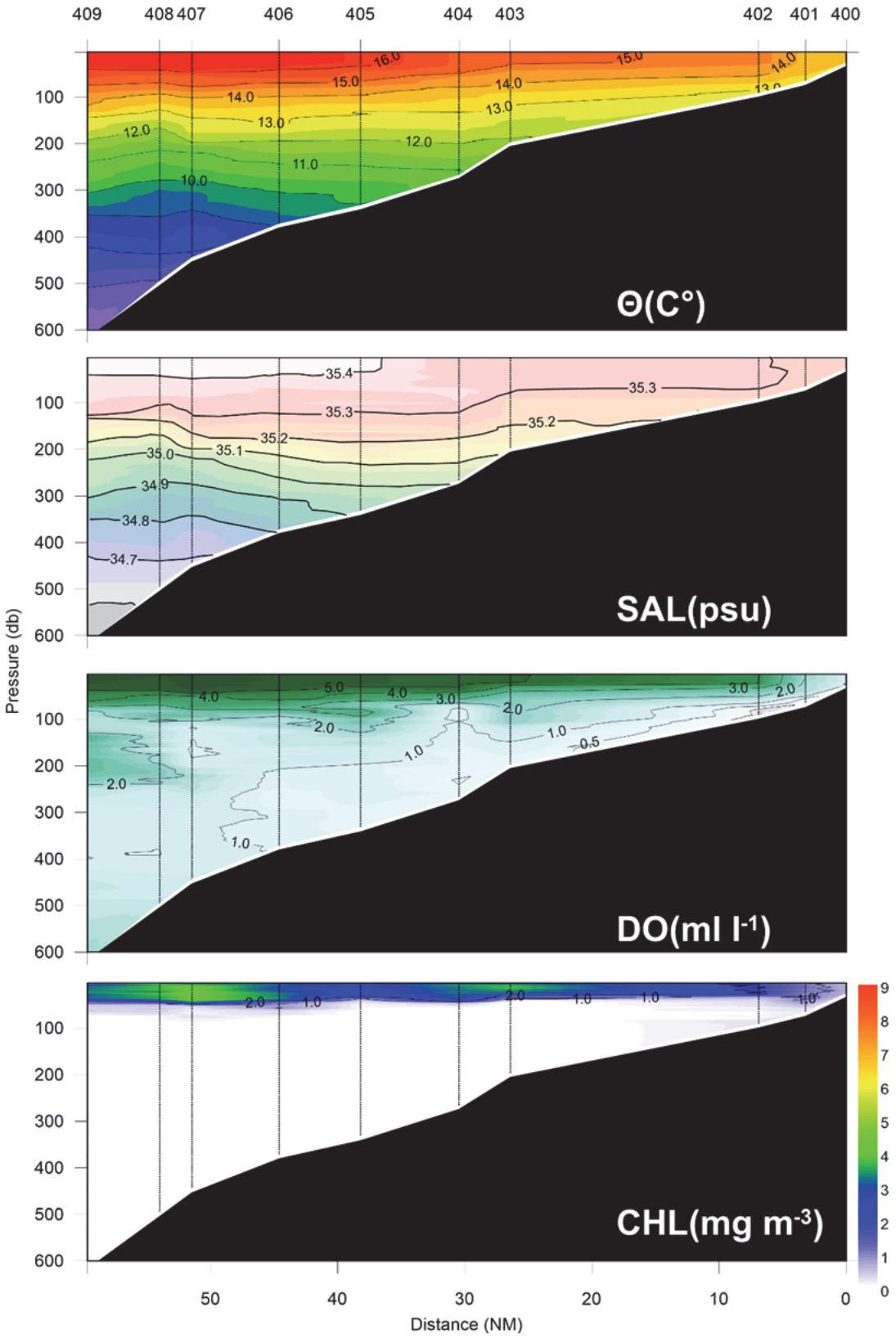


Figure 12b. Distributions (from the top to the bottom) of potential temperature, salinity, dissolved oxygen along the Ambrose Bay section (21°S). See Figure 12a for the detailed description

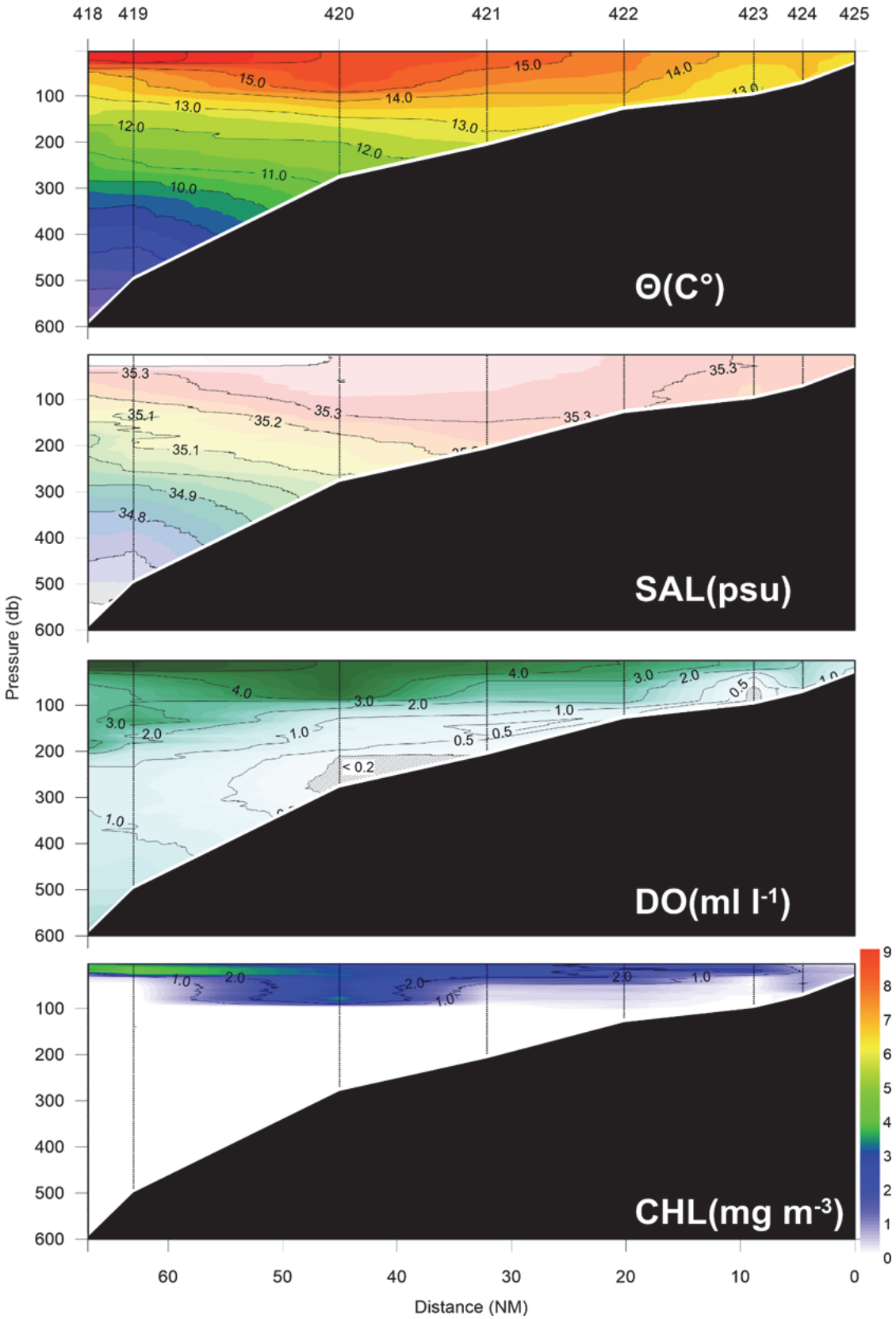


Figure 12c. Distributions (from the top to the bottom) of potential temperature, salinity, dissolved oxygen along the Dune Pt. section located just north of 20°S. See Figure 12a for the detailed description

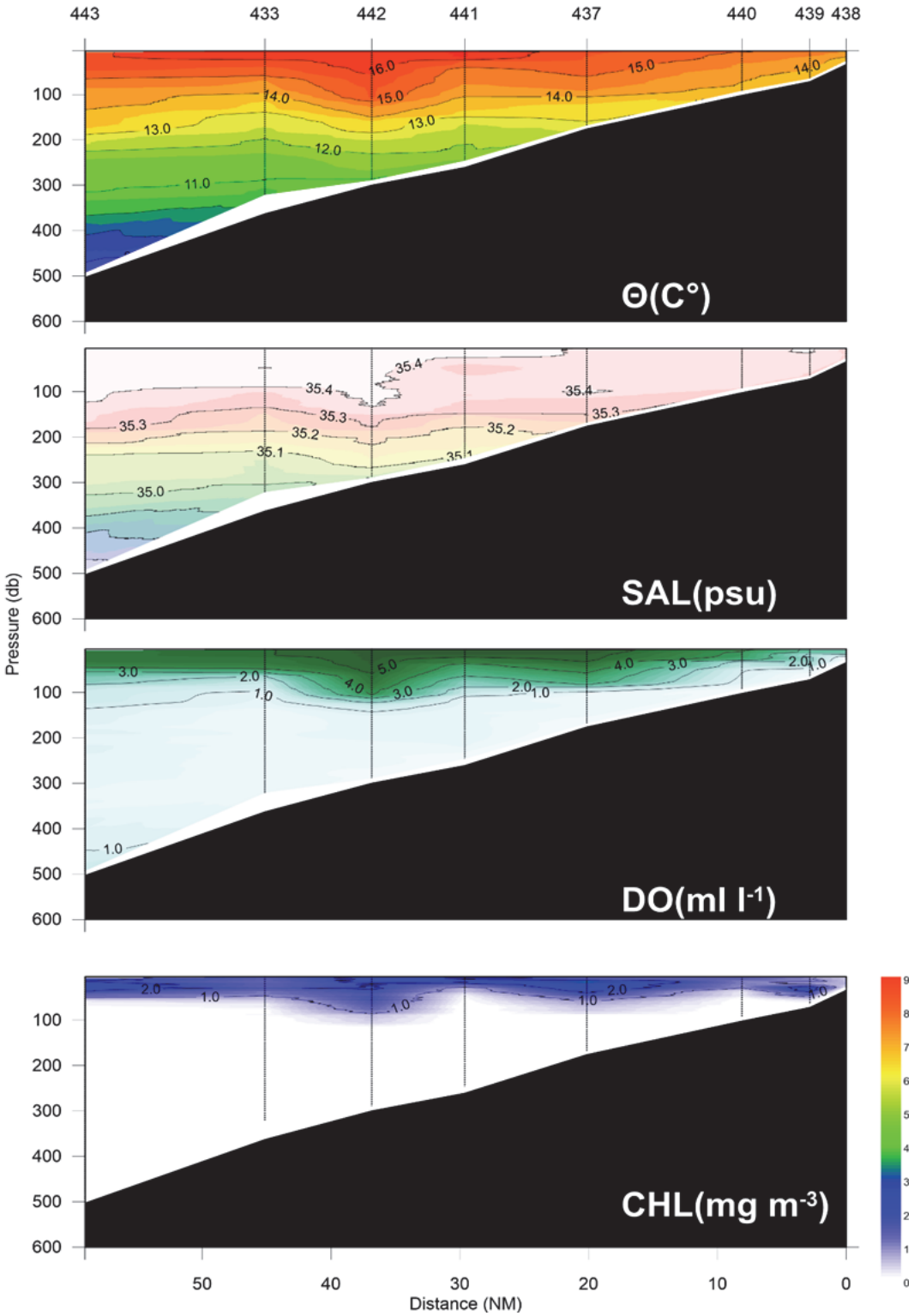


Figure 12d. Distributions (from the top to the bottom) of potential temperature, salinity, dissolved oxygen along the Rocky Pt. section (19°S). See Figure 12a for the detailed description

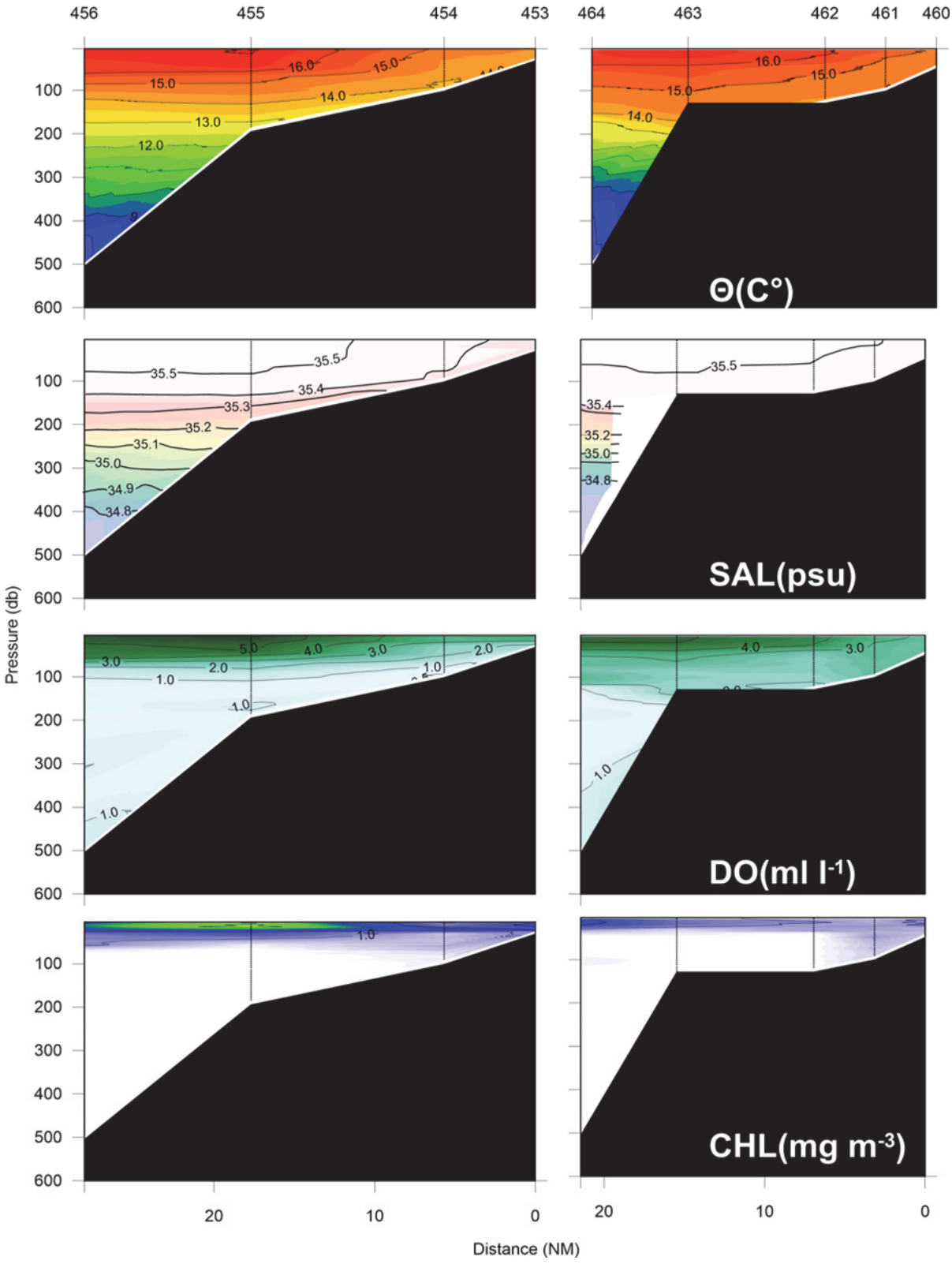


Figure 12e. Distributions (from the top to the bottom) of potential temperature, salinity, dissolved oxygen along the Cape Frio section (left column) and the section just south of the Cunene River (17° 15'S). See Figure 12a for the detailed description

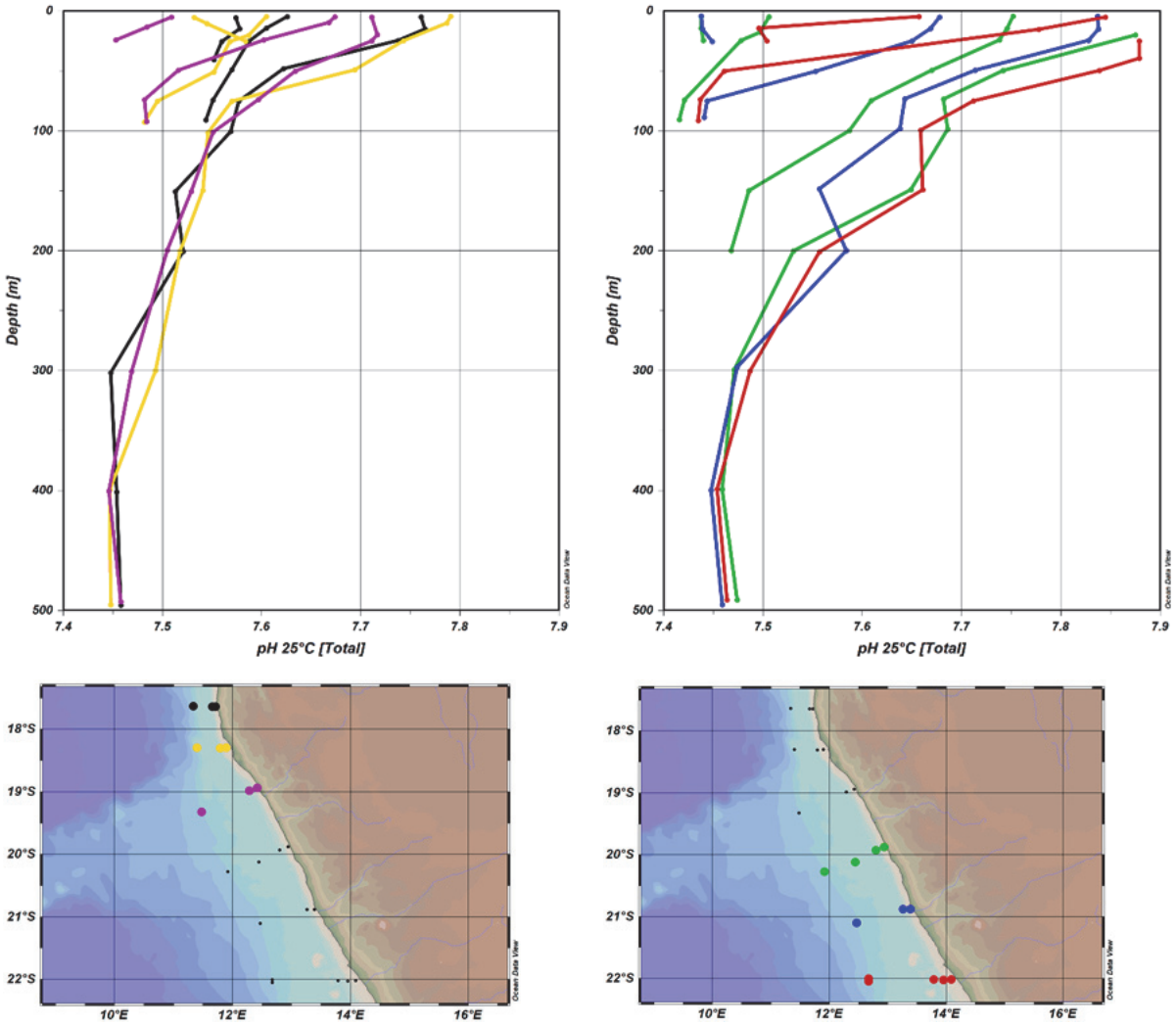


Figure 12f. Distributions of pH and in the water column as observed by station comparisons north and south of 19.5°S

3.1.5 Ocean currents

Distribution of the ADCP-measured currents from the layer recorded nearest to the surface (18-26 m) and below the thermocline (98-105 m) is shown in Figure 13. The northward near-surface current dominates the near-surface layer; the expected seasonal condition. During May, the southeasterly trade wind blowing along the coastline induces the offshore Ekman transport. A front sets in between the cold upwelled water inshore and warm water removed from the coast by Ekman transport. The density gradient along that front drives the alongshore current, often termed coastal jet. Figure 13 shows, south of 20°S, a generally weak current, ~ 15 cm s-1, flowing northwards, consistent with the coastal jet dynamics. There are however departures from the alongshore direction, presumably related to mesoscale activity not resolved with our data. In this section of the coast, the current co-occurs with moderate surface wind speeds (5 – 6 m s-1, cf. Figure 8).

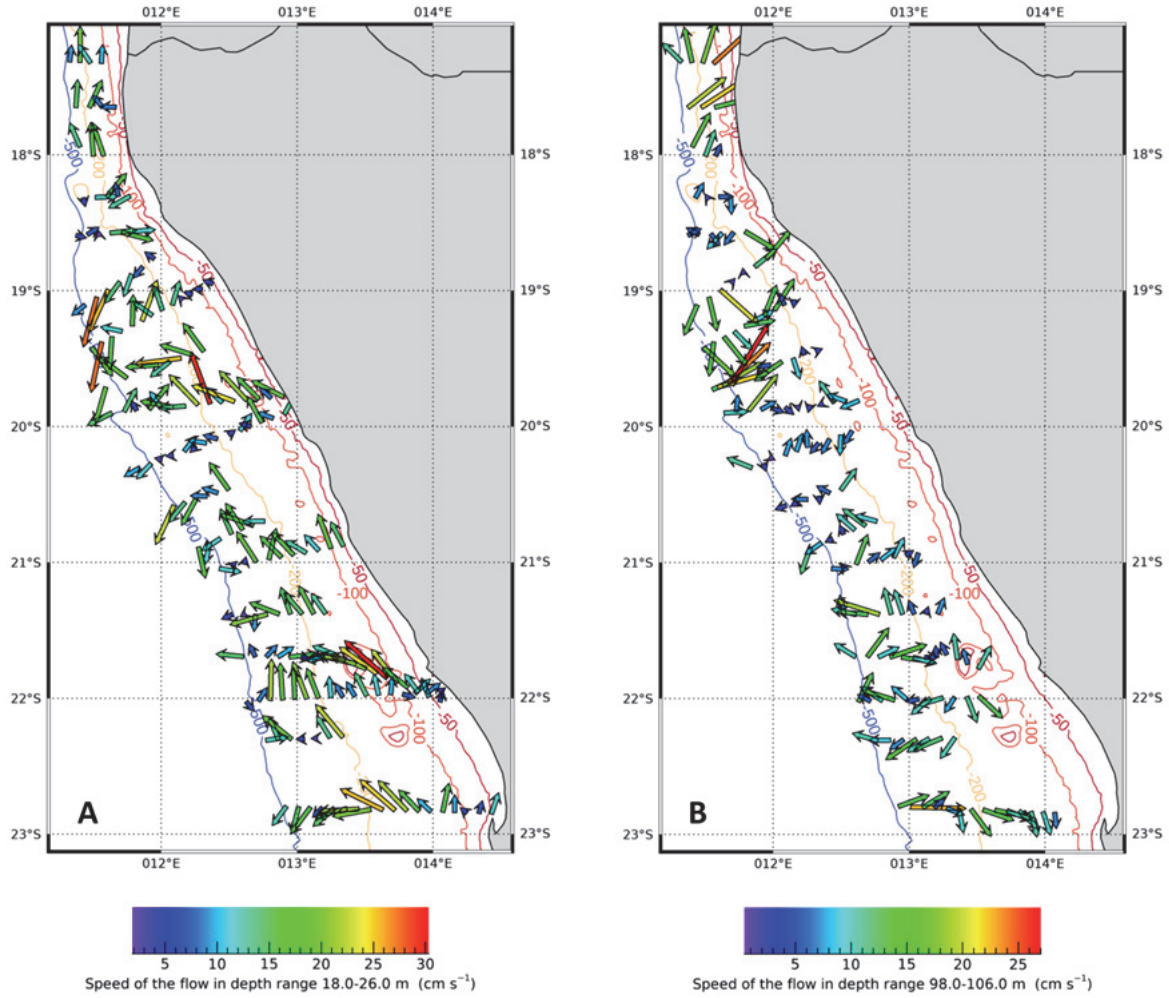


Figure 13. Distribution of mean current speed and direction in the 18-26 m (A) and 98-106 m (B) depth layers. For visual clarity, only the results collected along the transect lines perpendicular to the coast are shown. The straight lines shown are estimated by the linear fit from the vessel's positional data, which, during the trawl hauls, included significant departures from the main surveying direction. Each arrow denotes the average current from 1-minute along-track ADCP data projected onto a 5 NM segment along the estimated straight transect lines

Just north of 20°S, the wind speed doubles (cf. Figure 7) and the near-surface current speed increases to over 20 cm s-1 and the current direction veers seaward. The abrupt offshore shift in the direction of the flow, apparently connected to the increase in wind speed, suggests that the survey data captured a major upwelling event characterized by a massive offshore transport. This suggestion is further confirmed in Figure 13b, showing a strong onshore transport of sub-thermocline transport during the period of the strongest wind.

3.1.6 Nutrients

Nutrient samples for nitrite, nitrate, phosphate and silicate determination were sent to the Institute of Marine Research for analysis. Data is available upon request.

3.1.7 Ocean acidification

On board analysis of pH and total alkalinity were performed during the survey to observe the oceanic CO_2 characteristics of the region. In combination with the nutrient samples that were analysed at IMR, the aragonite saturation state of the region can be determined to observe the effects of ocean acidification. Data is available upon request.

3.2 Plankton and microplastic sampling

The plankton sampling grid of the survey consisted of 18 superstations located over the isobaths of 30 m, 100 m and 500 m (Station 385 to Station 464, Figure 14). The total number of stations sampled with each sampling device but also the stations where sampling was not conducted due to weather conditions are summarized in Table 8.

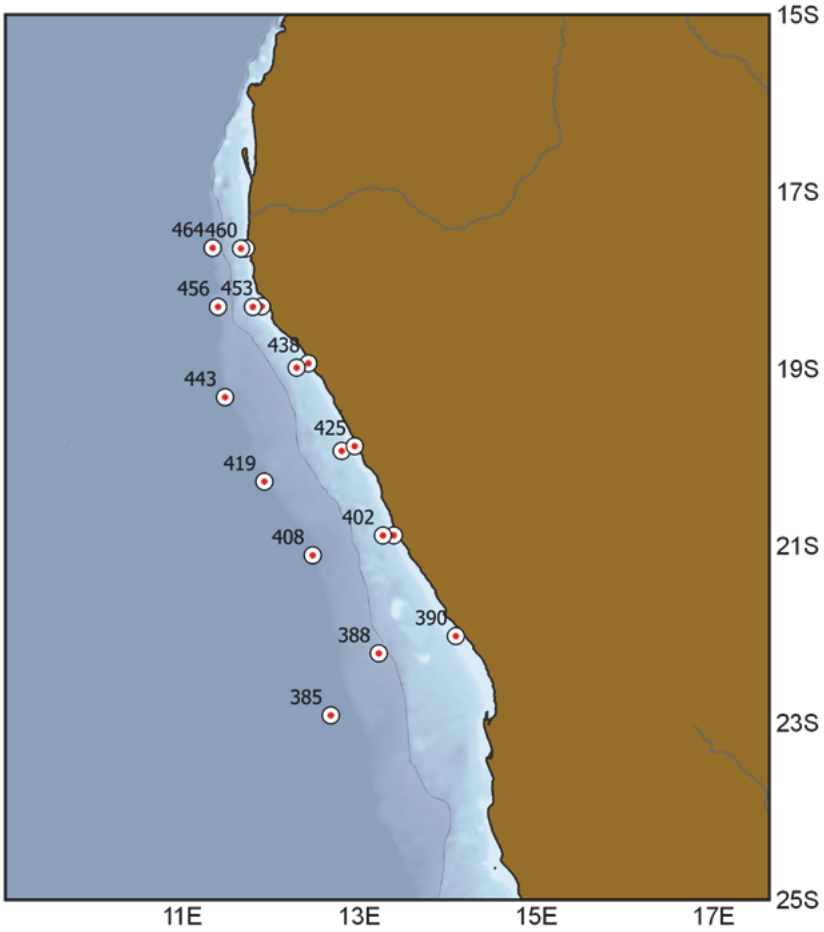


Figure 14. Superstation sampling grid in the surveyed area

Table 8. Overview of plankton stations sampled during the survey

Sampling device	Number of sampled stations	Not sampled stations
WP2 (180 µm)	18	-
Manta trawl (335 µm)	18	-
Bongo (405 µm)	17	St423

3.2.1 Zooplankton

A total of 52 aluminium trays for zooplankton dry weight estimation were produced during the survey and transferred to IMR for zooplankton biomass estimation. Based on these measurements the horizontal distribution pattern of mesozooplankton biomass has been presented in Figure 15 (left panel). Total zooplankton biomass ranged between 0.86-11.36 g m^{-2}, showing overall higher values at coastal stations.

Size fractionation of samples revealed that organisms smaller than 1 mm in size comprised most of the biomass, although for some stations in the northern part of the surveyed area the contribution of organisms larger than 2 mm was also important (Figure 15, right panel). The future taxonomic analysis of the preserved in formalin (4% borax buffered formaldehyde) fraction of the samples (18 WP2 samples was transferred to NatMIRC) will provide insight in the group composition of the samples.

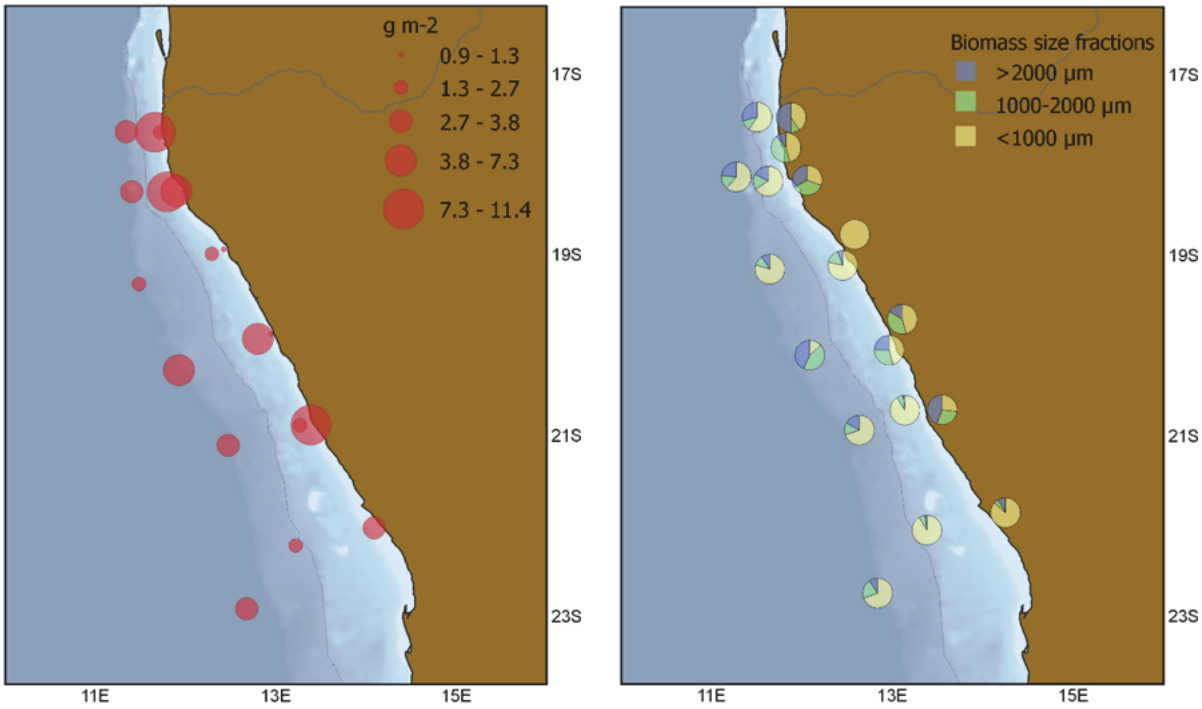


Figure 15. Horizontal distribution of total zooplankton biomass (g m^{-2}) in the superstation grid (left panel) and the contribution of different size fractions at each station (right panel)

3.2.2 Ichthyoplankton

Bongo-net & Manta net

All Bongo-H samples and manta samples collected during the survey were processed under the stereomicroscope onboard. The number of fish larvae and eggs sorted from the samples of both sampling devices was particularly small, indicating a mismatch between the sampling period and the spawning season for most of the fish species in the area. It is also worth mentioning that high abundances of jellyfish and salps in the surveyed area reduced considerably the sampling efficiency of the bongo sampler (frequent clogging of the nets).

The number of sorted eggs and larvae from both nets per station is presented in Table 9. Only 17 larvae and 9 eggs were sorted out from the 17 bongo samples. Some pictures of the sorted specimens are provided in Figure 16. All sorted specimens from the bongo collections as well as the bulk of sorted (bongo H samples) and unsorted samples (bongo V samples) were transferred to NatMIRC for future identification of specimens and further analysis. The manta collections were sorted for fish larvae but also post-larval and juvenile stages. Fish larvae were only found sporadically and in low numbers in the manta samples, except for two stations in the northern part (st 461, st 646) that presented increased numbers. A total of 62 posts larval- juvenile stages were sorted from the Manta collections, mainly representing the family Scomberecosidae (genus *Scomberesox*).

Table 9. Numbers of egg and larvae sorted from the bongo and manta samples

	Bongo net		Manta net	
Station	Larvae	Eggs	Larvae/ Post larvae-juveniles	Eggs
385	4	0	0/1	3
388	0	3	0/14	0
390	0	0	0/0	0
400	0	1	3/0	2
402	1	0	1/11	0
408	0	0	2/0	0
419	1	2	1/4	0
423	sample not collected		0/0	0
425	0	0	2/0	0
438	0	2	0/0	0
440	0	0	1/5	0
443	5	0	0/0	0
453	1	1	2/0	1
454	0	0	5/0	0
456	5	0	3/17	0
460	0	0	0/0	0

Station	Bongo net		Manta net	
	Larvae	Eggs	Larvae/ Post larvae-juveniles	Eggs
461	0	0	27/0	0
464	0	0	35/10	0
TOTAL	17	9	82/62	6

All sorted specimens from the manta collections were transferred to IMR for detailed taxonomic identification. The bulk plankton of Manta net after sorting (18 samples) were transferred to the University of Western Cape, South Africa for future analysis.

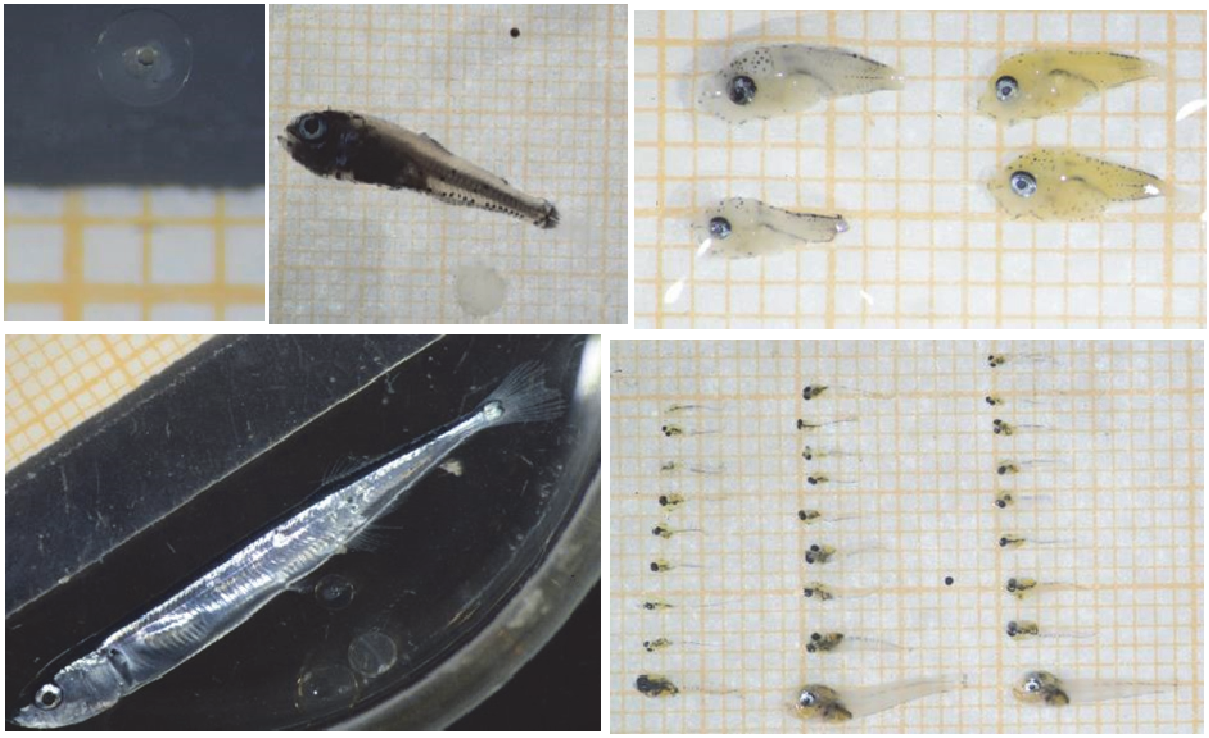


Figure 16. The panel above: fish egg (st400) and larvae collected with the Bongo net (one myctophid larva at st419 and carangid larvae found at st385). The panel below: specimens sorted from the manta collections (*Scomberesox* sp. juvenile at st385 and fish larvae found at st461)

3.2.3 Microplastics and debris

Items resembling microplastics were found at all manta samples except for st. 461. A total of 147 items were isolated from the samples, however many of these seemed to be paint and rust from the ship. A few only items were identified with high certainty as plastic. These involved micro-fibres that possibly have been derived from the equipment of the vessel (Figure 17). Figure 18 shows the number of microplastic per sample within the 6 sampling transects at different station depths (i.e. shallow, intermediate, deep).

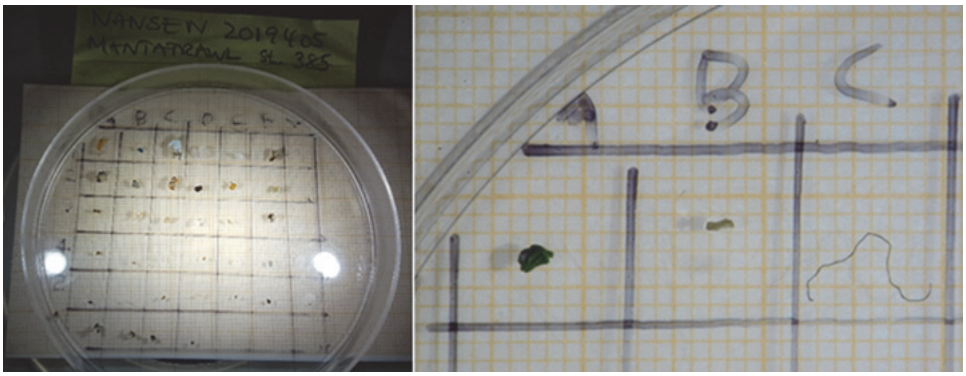


Figure 17. Examples of microplastics found in the Manta net

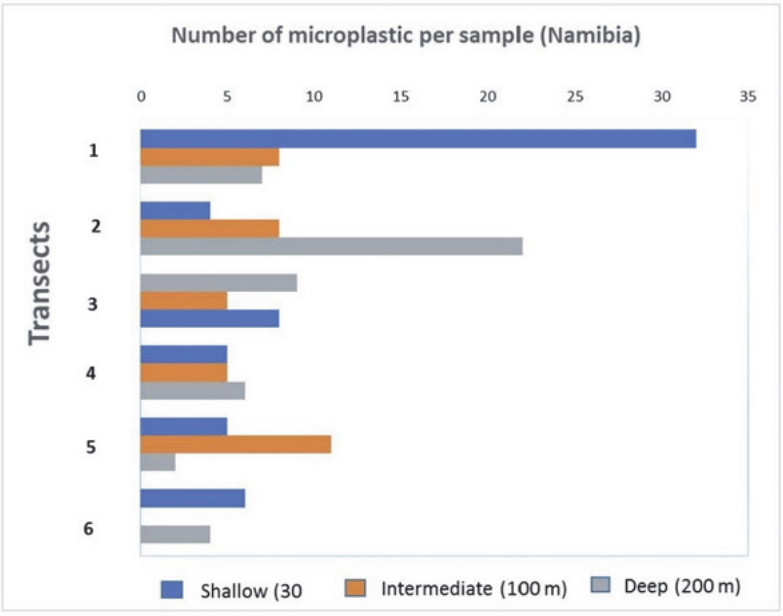


Figure 18. Distribution of microplastics from shallow to deep water along six transects taken from Walvis Bay to Angolan border

3.3 Top predator observations

3.3.1 Cetaceans

A total number of seven sighting of 122 individuals of whales and dolphins belonging to two different species were made. Dusky dolphins (*Lagenorhynchus obscurus*) were seen on five occasions, sometimes in large groups, whereas, Pilot whales (*Globicephala* sp.) were seen on two occasions. Dusky dolphins dominated with an estimated total number of 102 individuals. (Figure 20). Pilot whales dominated the least with an estimated total number of 20 individuals (Figure 20). 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. Below is the spatial distribution of the sightings (Figure 19).

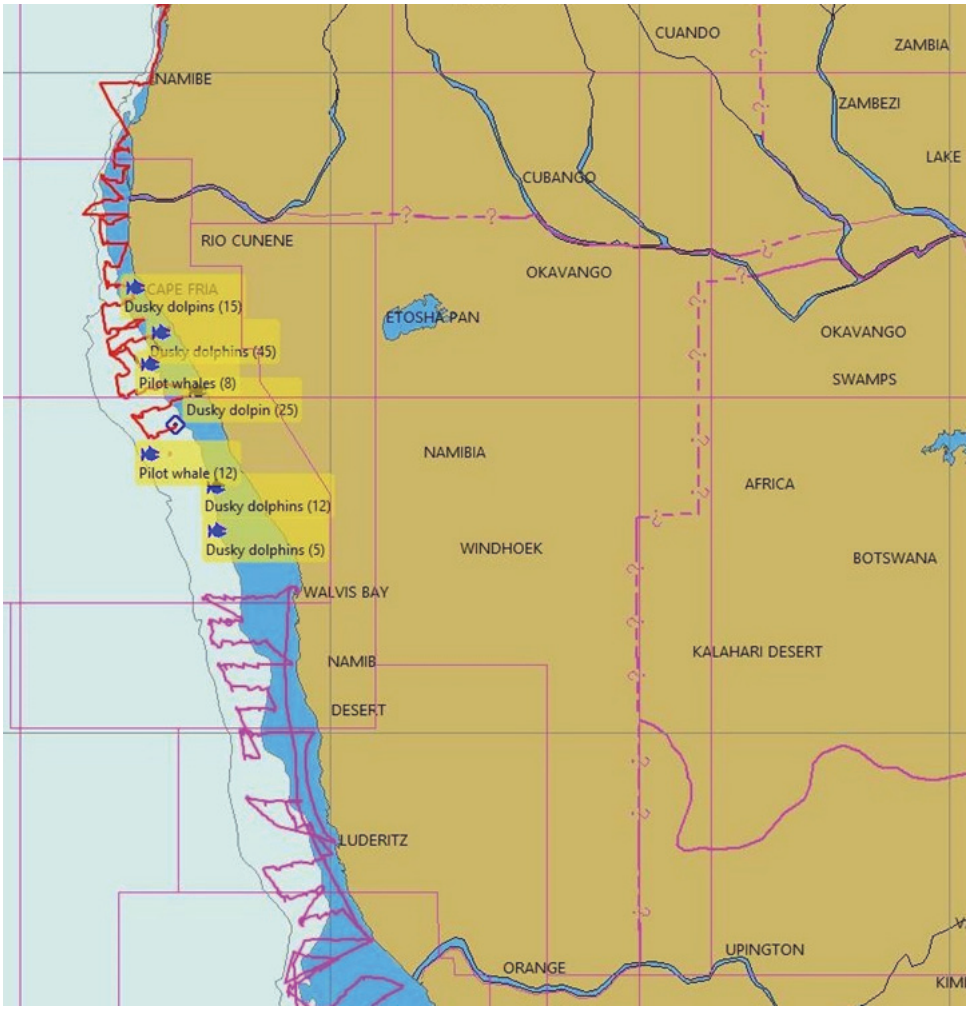


Figure 19. Distribution of cetaceans along the entire northern coastline of Namibia (indicated by a blue fish)

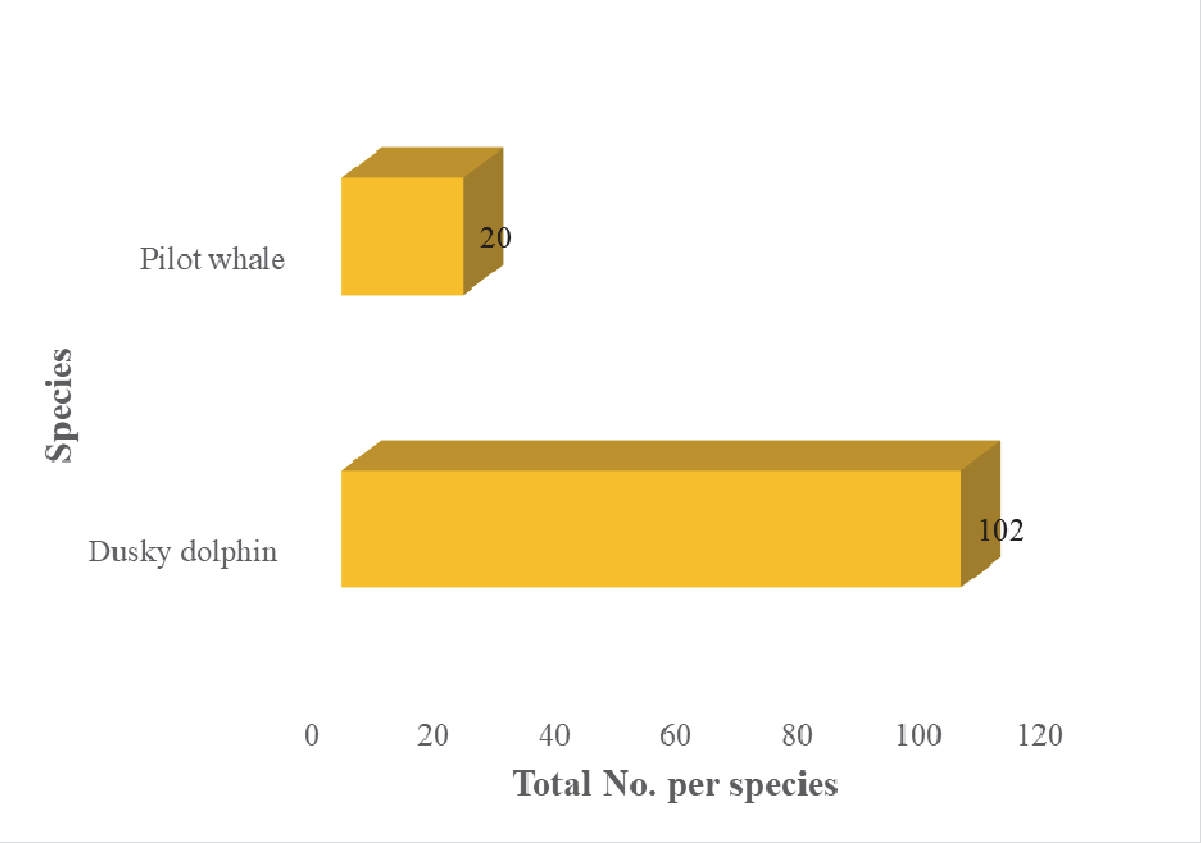


Figure 20. Number of cetaceans observed per species along the northern Namibian coast

3.3.2 Seabirds

A total number of 124 sighting of 3 201 individuals of seabirds belonging to 15 different species were made. Cape gannets (*Morus capensis*) were seen the most, with a total of 29 sighting occasions. Whereas, Juvenile Northern giant petrel plus the unidentified Shearwaters and Albatross were seen the least, with a total sighting occasion of 1 for each (Table 10). Cape gannets dominated with a total of 659 individuals (Figure 21). The Juvenile Northern giant petrel dominated the least with a total number of 4 individuals (Figure 21). The least sighting of some seabird species could be attributed to the fact that most seabirds migratory and they probably have migrated to the south in search for food and breeding grounds.

Table 10. Seabird species, the total number observed and sighting occasions along the Namibian coast

Species	**No.**	**Sighting occasion**
Atlantic yellow-nosed albatross (*Thalassarche chlororhynchos*)	504	19
Black-browned albatross (*Thalassarche melanophris*)	421	16
Cape cormorant (*Phalacrocorax capensis*)	70	4
Cape gannet (*Morus capensis*)	659	29
Cape petrel (*Daption capense*)	254	9
Flesh-footed shearwater (*Puffinus carnipes*)	22	3

Species	No.	Sighting occasion
Juvenile northern giant petrel	4	1
Shy albatross (*Thalassarche cauta*)	115	7
Sooty shearwater (*Ardenna grisea*)	404	14
Subantarctic skua (*Stercorarius antarcticus*)	283	5
Unidentied shearwaters	45	1
Unidentified Albatross	32	1
Wedged-tailed shearwater (*Puffinus pacificus*)	160	6
White-capped albatross (*Thalassarche steadi*)	99	5
White-chinned petrel (Procellaria aequinoctialis)	129	4
Total	3201	124

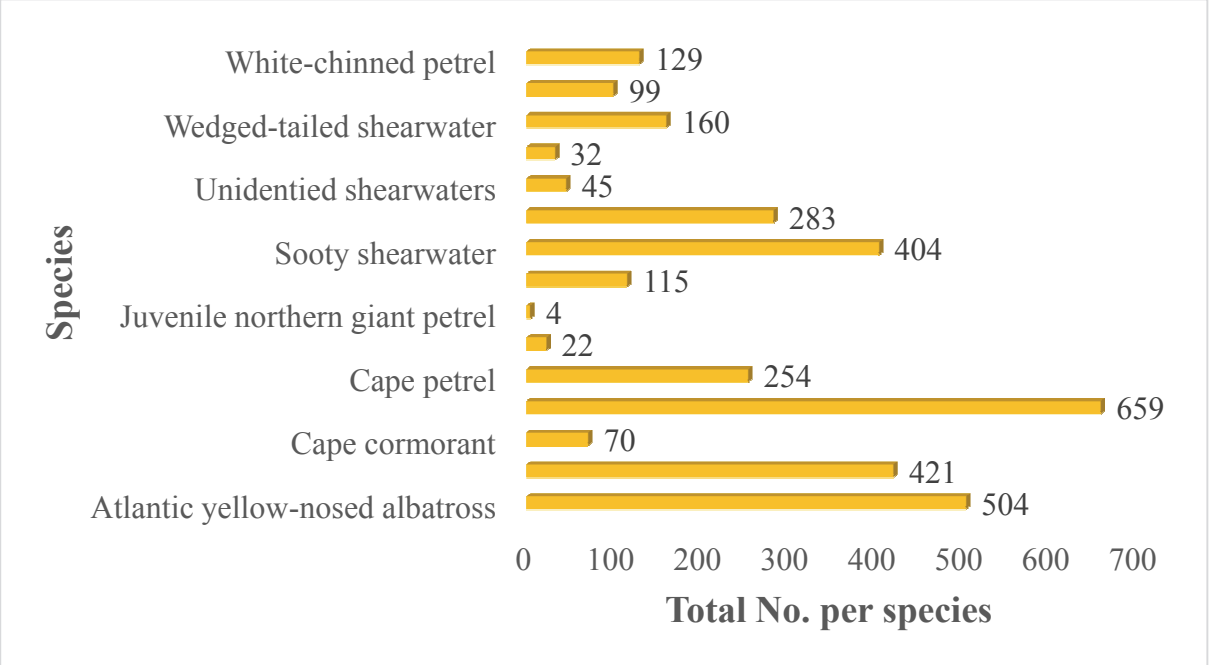


Figure 21. Total number of seabirds observed along the Northern Namibian coast

3.4 Fish sampling

3.4.1 Swept-area abundance and distribution

Figure 22 shows the densities of Cape hake along the northern coast of Namibia.

Cape hake, *Merluccius capensis,* occurred almost entirely in depths less than 500 m with the highest densities between the 200 m and 500 m isobaths. The density concentrations were found between Walvis Bay and Cape Frio.

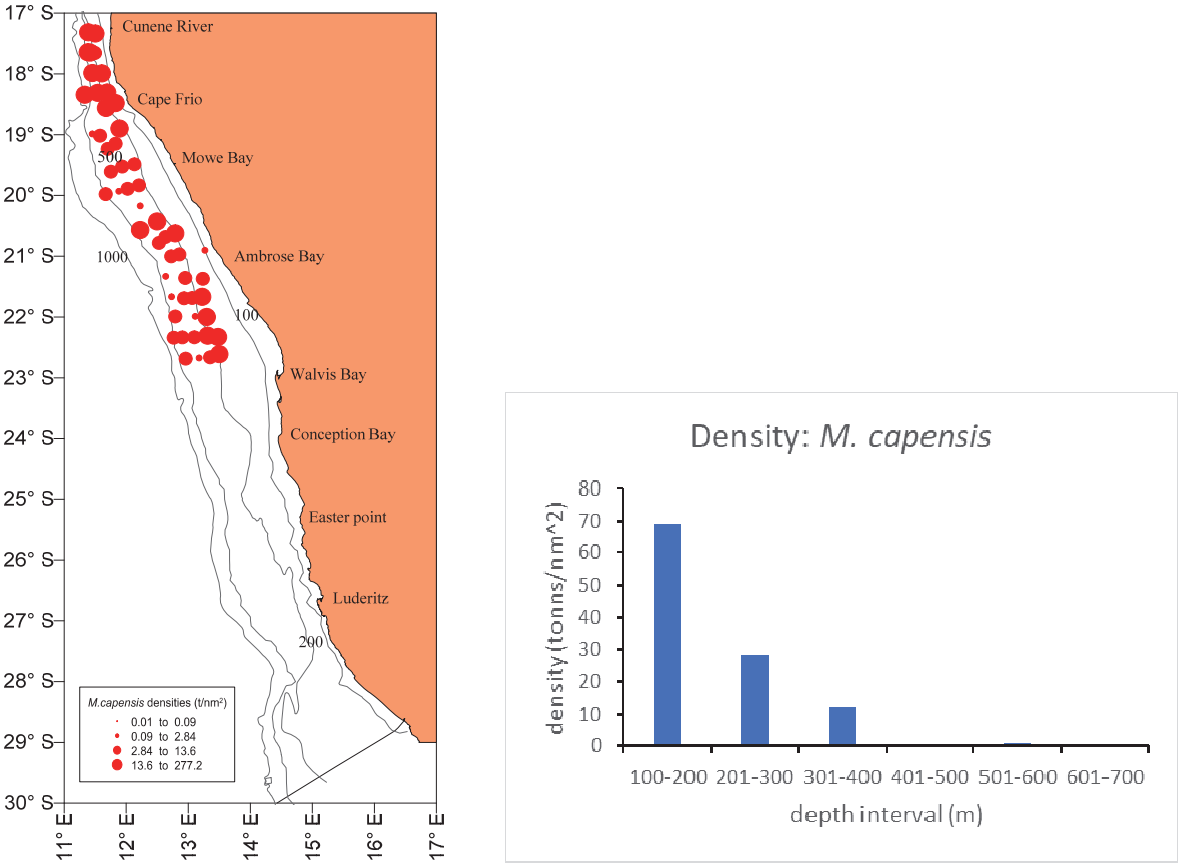


Figure 22. Spatial and depth distribution (density, tonnes/NM^2) of Cape hake (*M. capensis*) off northern Namibia

Deep-water hake, *Merluccius paradoxus,* occurred at depths greater than 300 m north of Walvis Bay to the northern border with Angola, with denser concentrations between 400 m and 600 m (Figure 23).

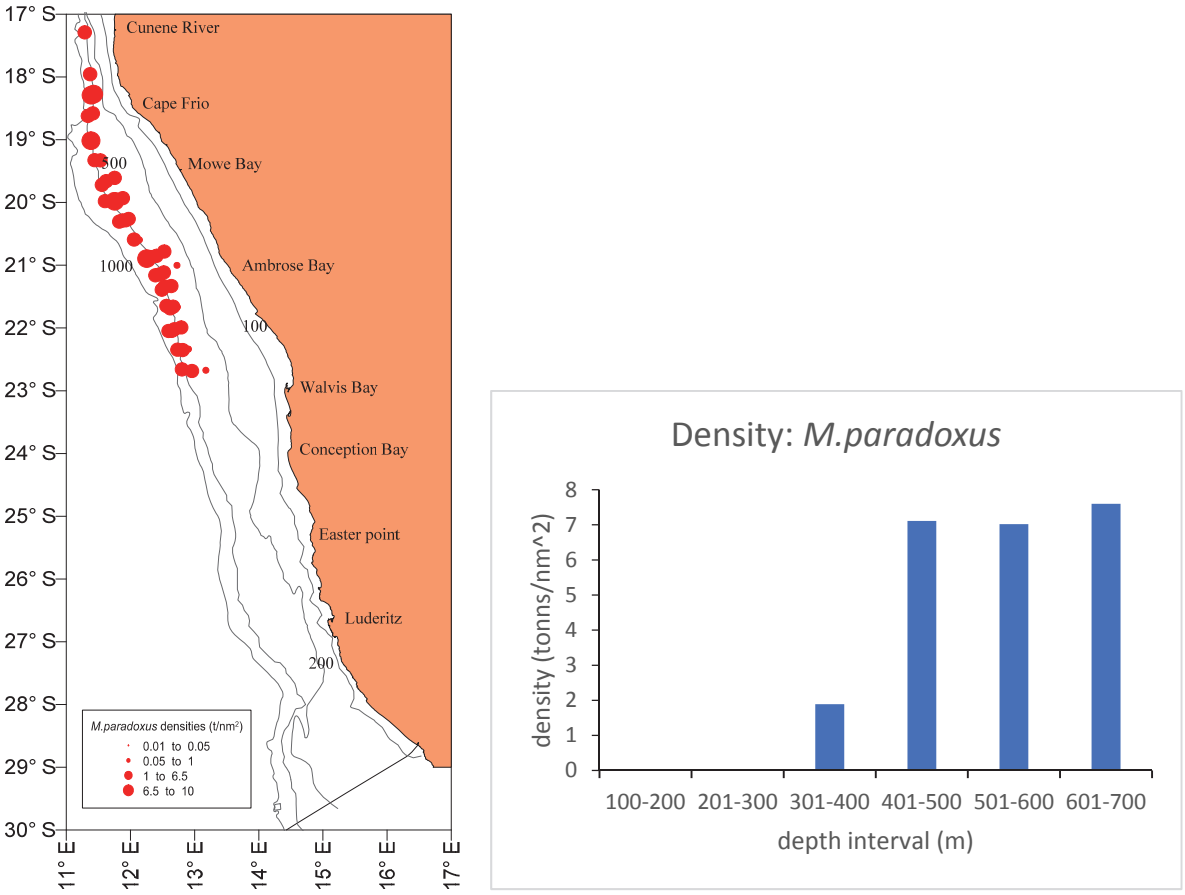


Figure 23. Spatial and depth distribution (density, tonnes/NM^2) of deep-water hake (*M. paradoxus*) off northern Namibia

Significant amounts of several other targeted or potentially commercially important species were also caught at a number of stations, namely monkfish (*Lophius vomerinus*), jacopever (*Helicolenus dactylopterus*) and Cape gurnard (*Chelidonichthys capensis*). Data on these species are presented later this report. Kingklip (*Genypterus capensis*) is not presented as only two individuals were caught. Of special interest is also the deep-sea red crab *(Chaceon maritae),* which also yielded good catches (Figure 27). Other commercially important species, such as the west coast sole (*Austroglossus microlepis*) and the monk (*Lophius vaillanti)* also occur in the area and within the depth zones sampled, but only 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, jacopever, and Cape gurnard are shown in Figure 24 to Figure 26, as well as a spatial distribution of deep-sea red crab (Figure 27).

Monkfish was sampled in small densities throughout the surveyed area (Figure 24).

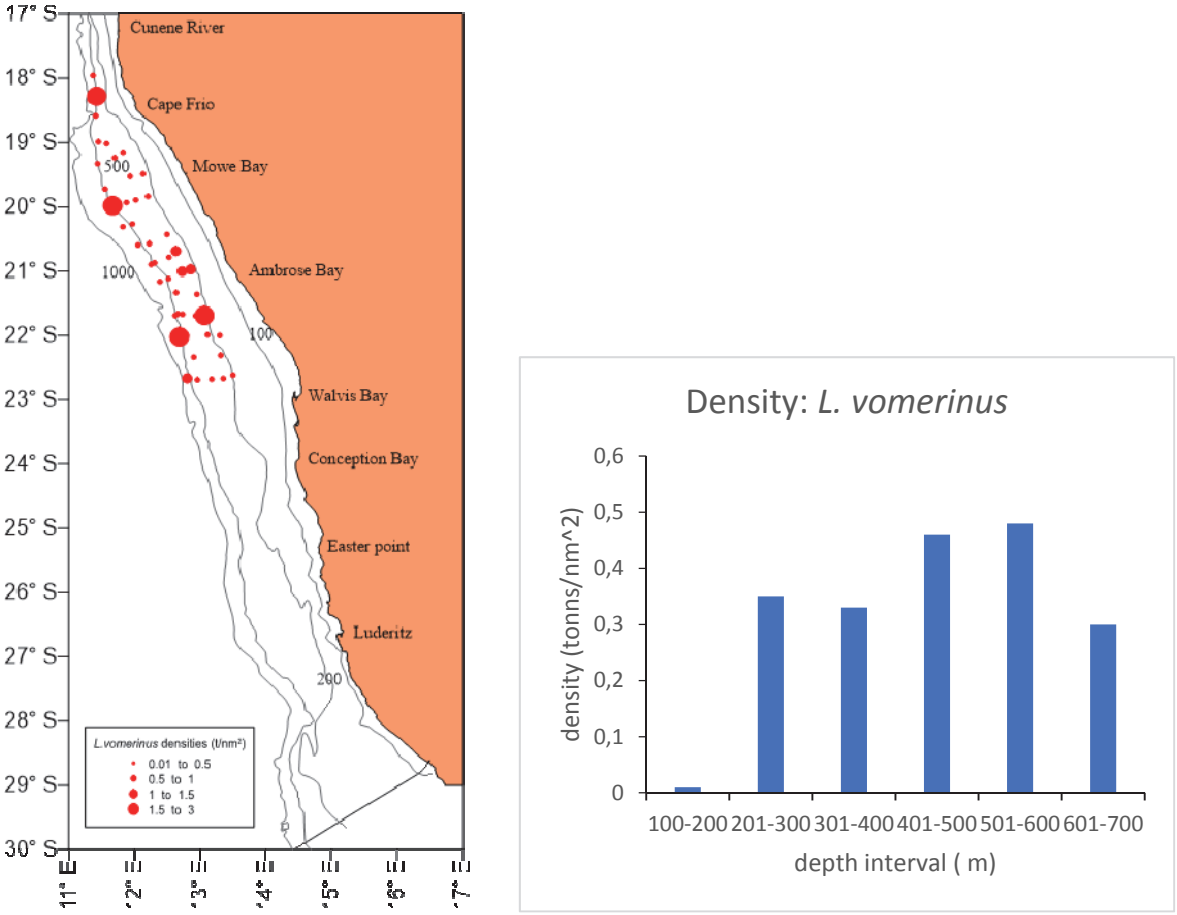


Figure 24. Spatial and depth distribution (density, tonnes/NM^2) of monkfish (*Lophius vomerinus*) off northern Namibia

Jacopever were sampled primarily between the 200 m and 500 m isobaths and to the north of Walvis Bay (Figure 25).

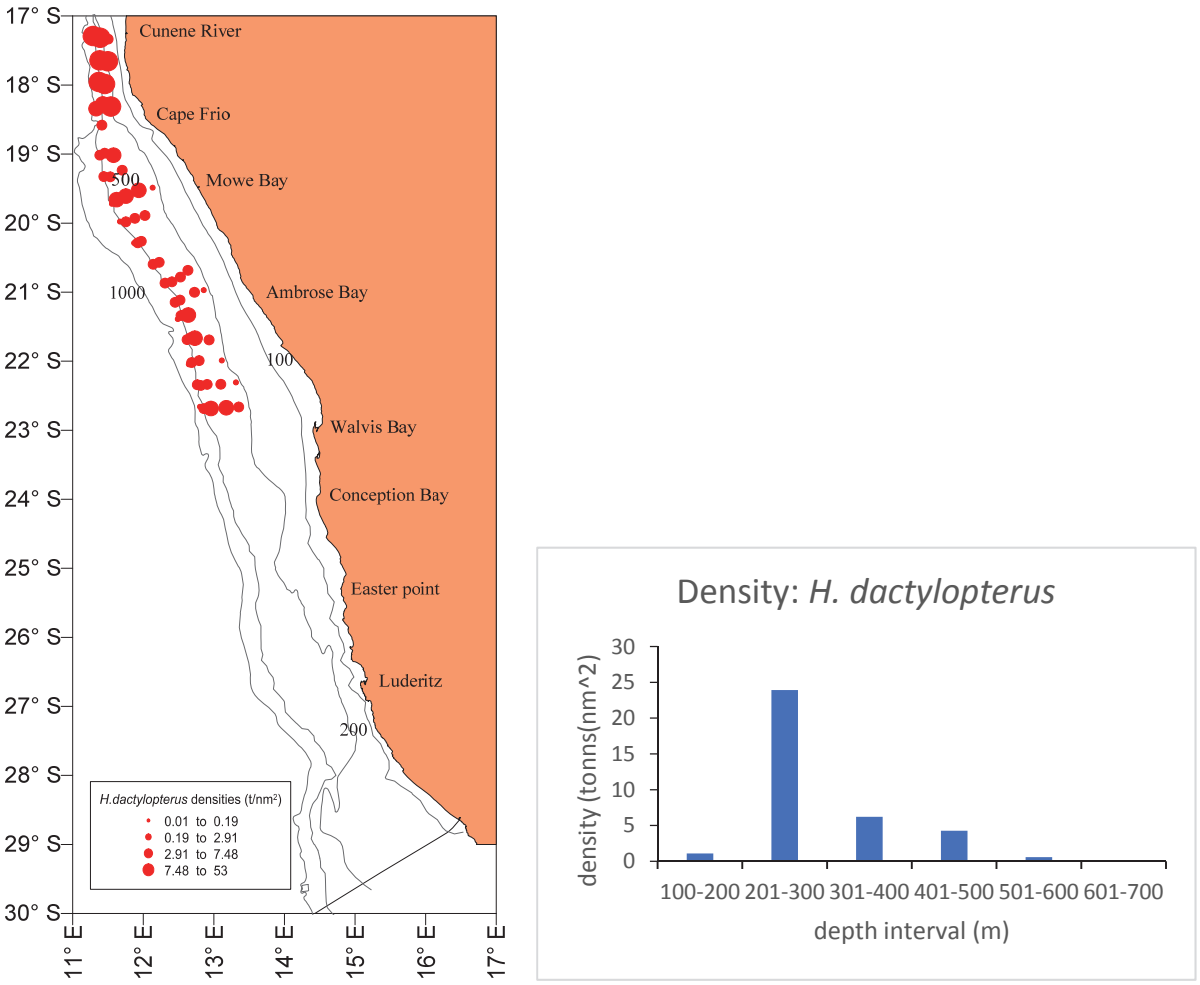


Figure 25. Spatial and depth distribution (density, tonnes/NM^2) of jacopever (*Helicolenus dactylopterus*) off northern Namibia

Cape gurnard occurred primarily in the area just north of Walvis Bay, and almost entirely on the 200 m isobaths (Figure 26).

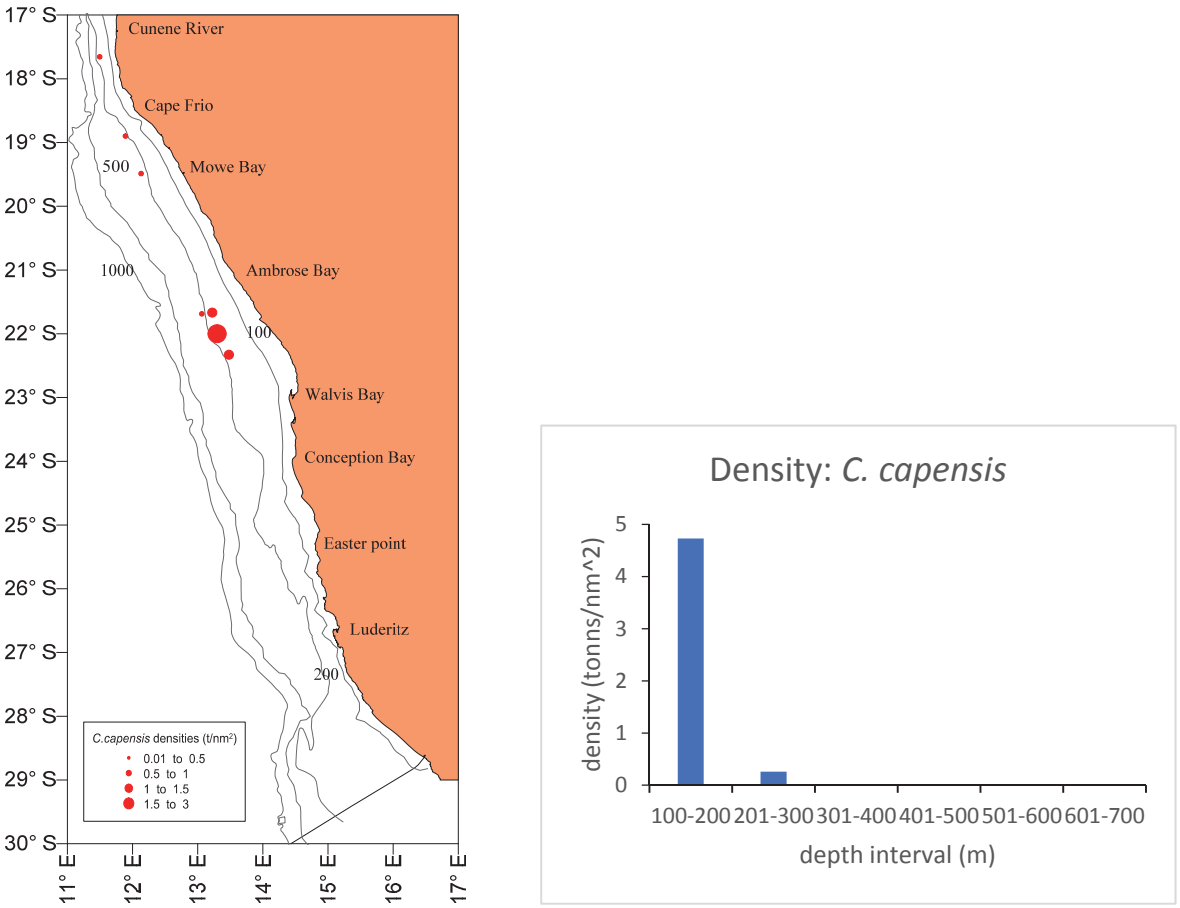


Figure 26. Spatial and depth distribution (density, tonnes/NM^2) of Cape gurnard (*Chelidonichthys capensis*) off northern Namibia

Deep-sea red crab was sampled offshore mostly between the 400 m and 700 m isobaths (Figure 27).

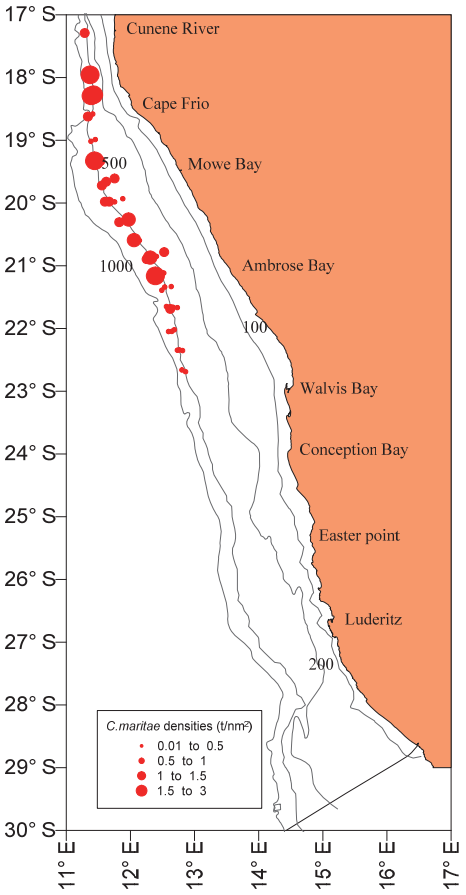


Figure 27. Spatial distribution (density, tonnes/NM^2) of deep-sea red crab (*Chaceon maritae*) off northern Namibia

Few pelagic fish species were recorded in the trawls. Adult horse mackerel, *Trachurus capensis*, were sampled at two distinct areas (see Figure 28), 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.

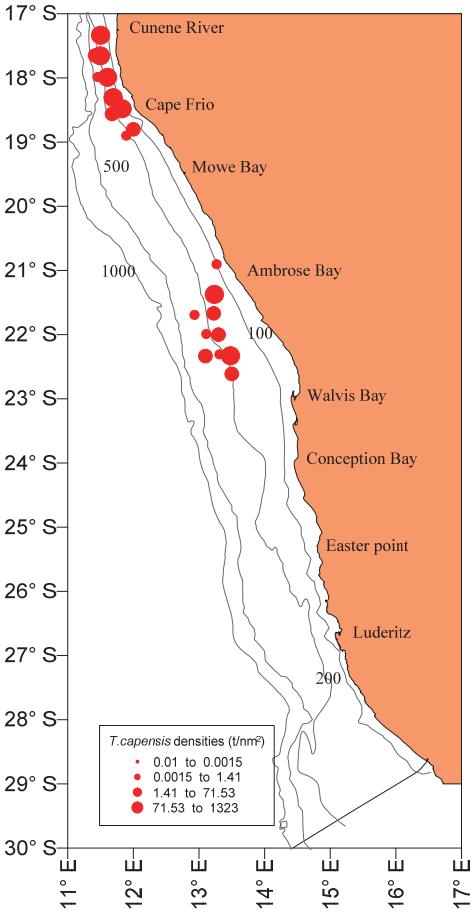


Figure 28. Spatial distribution (density, tonnes/NM^2) of Cape horse mackerel (*Trachurus capensis*) off northern Namibia

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 three other most common commercially important demersal species that were caught by the gear; *Lophius vomerinus*, *Helicolenus dactylopterus* and *Chelidonichthys capensis.*

Table 11 provides the length-weight relationships of these species, as measured during the survey, and used in the calculation of biomass per length-class.

Table 11. Length-weight relationships, where length = a x weight b, r = fit, n = sample size

Species	A		b	r	N
M. capensis	0,00763		2,9689	0,992	4 104
M. paradoxus	0,0041		3,1402	0,978	2 874
Lophius vomerinus	0,0227		2,899	0,0984	198
Helicolenus dactylopterus	0,0233		2,8452	0,939	2 288
Chelidonichthys capensis	0,0041		3,2364	0,9560	31

Table 12 describes the estimated numbers and biomass of the two hake species. The estimated biomass of *M. capensis* was 814 027 tonnes while the biomass estimate of *M. paradoxus* was 31 922 tonnes. Figure 29 and Figure 30 show the size distributions.

Table 12. Total numbers and biomass of *M. capensis* and *M. paradoxus* in northern Namibia.

Species	Numbers (millions)	Biomass (tonnes)	CV
Merluccius capensis	53 543 609	814 027	0,39
Merluccius paradoxus	56.1	31 922	0,10

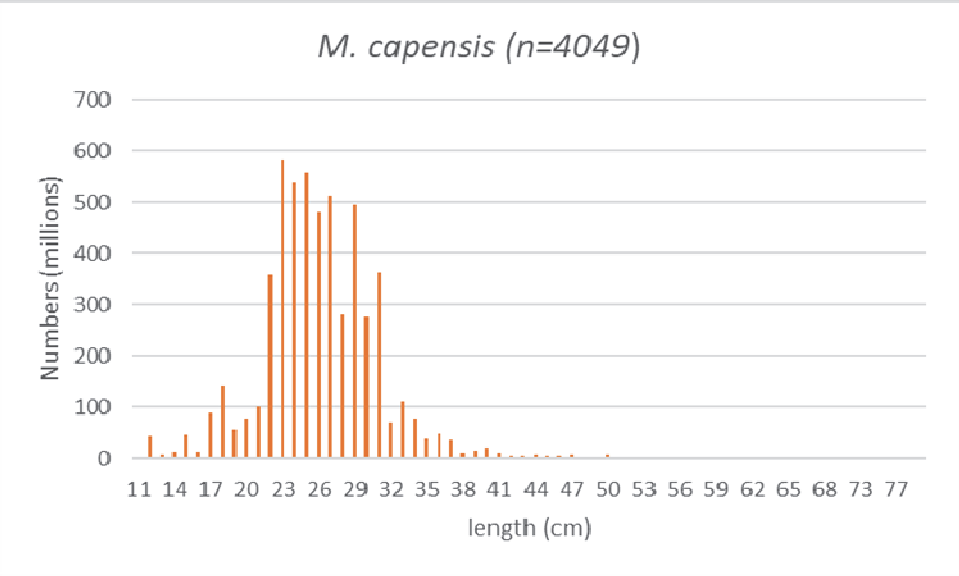


Figure 29. Size distribution of *Merluccius capensis* in the survey area (numbers in millions, raised to the total population, sample size = 4049, from 52 trawls)

Cape hake largely included fish from 11 cm to 56 cm. This is assumed to be several cohorts. One, with a mode of about 18 cm, is presumably representing jueniles from the mid-year (winter) 2018 spawning. Catches were dominated by fish between 22 cm and 31 cm.

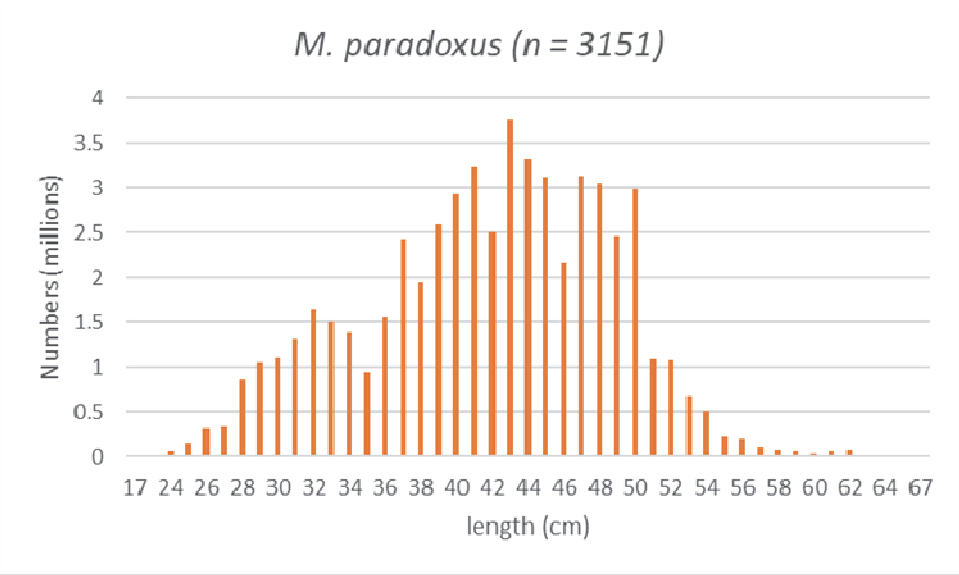


Figure 30. Size distribution of *Merluccius paradoxus* in the survey area (numbers in millions, raised to the total population, sample size = 3151, from 46 trawls)

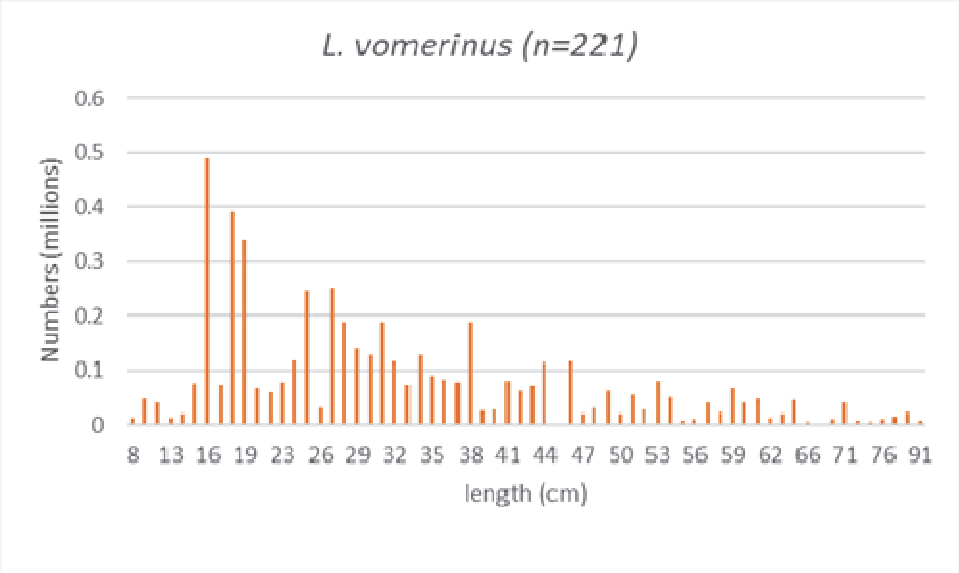
The deep-water hake was dominated by middle-sized fish; between about 40 cm and 50 cm, a size hardly found in the southern part of Namibia. The number and biomass of fish were calculated for "non-fishable" (≤35 cm) and fishable (≥35 cm) parts of the population. Comparison between the fishable and non-fishable parts of the stock for the two hake species, both in the southern and northern part of Namibia are presented in chapter 4 (National perspective, Table 18).

3.4.3 By-catch species

Four species of the demersal "bycatch" species were recorded in sufficient quantities to warrant estimation of their abundance. Of these, jacopever, *Helicolenus dactylopterus* had by far the largest biomasses (Table 13). Two of these species have never been subject to a targeted fishery. Monkfish, *Lophius vomerinus,* and deep-sea red crab, *Chaceon maritae,* have both previously been targeted but their biomasses are much less. The size distributions of these three species are shown in Figure 31 to Figure 33 (note all numbers are raised to the total estimated biomass). *Genypterus capensis* is not presented, as only two individuals were caught during the survey.

Table 13. Estimated biomass of other commercially important demersal species

Species	Biomass (tonnes)	CV
Lophius vomerinus	4 329	0,19
Helicolenus dactylopterus	151 293	0,54
Chelidonichthys capensis	44 543	0,76



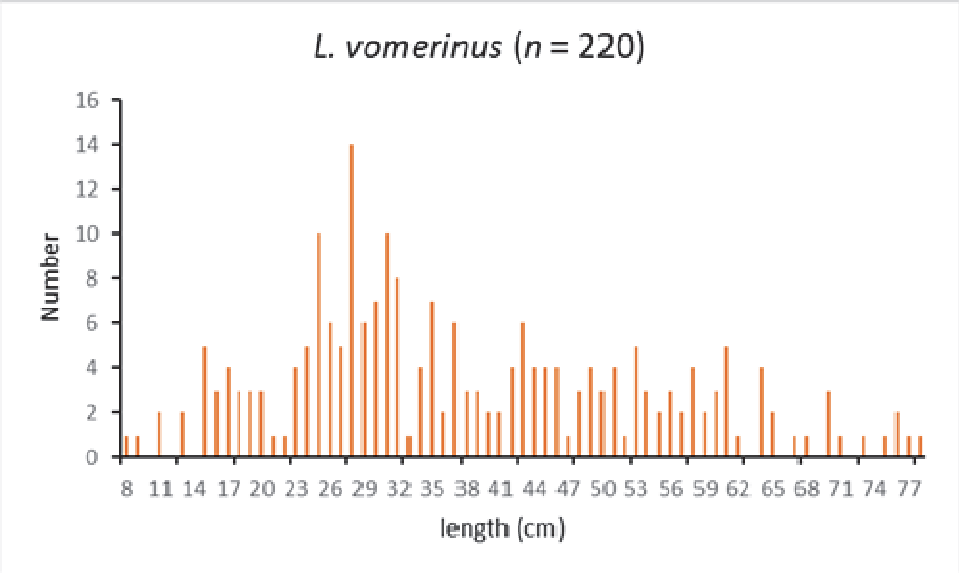
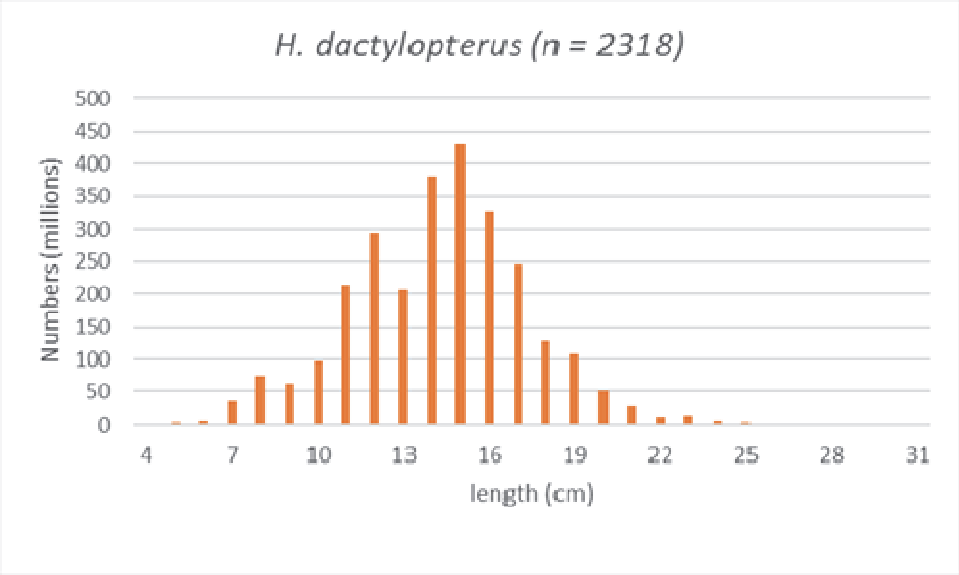


Figure 31. Size distribution of *Lophius vomerinus* in the survey area (numbers in millions) (sample size = 221, from 49 trawls)



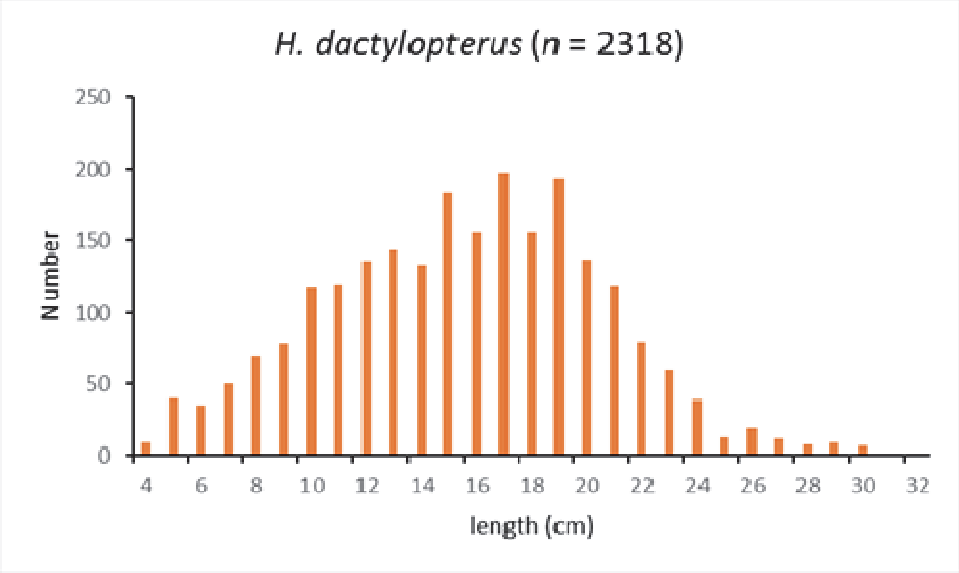


Figure 32. Size distribution of *Helicolenus dactylopterus* in the survey area (numbers in millions) (sample size = 2318, sampled from 63 trawls)

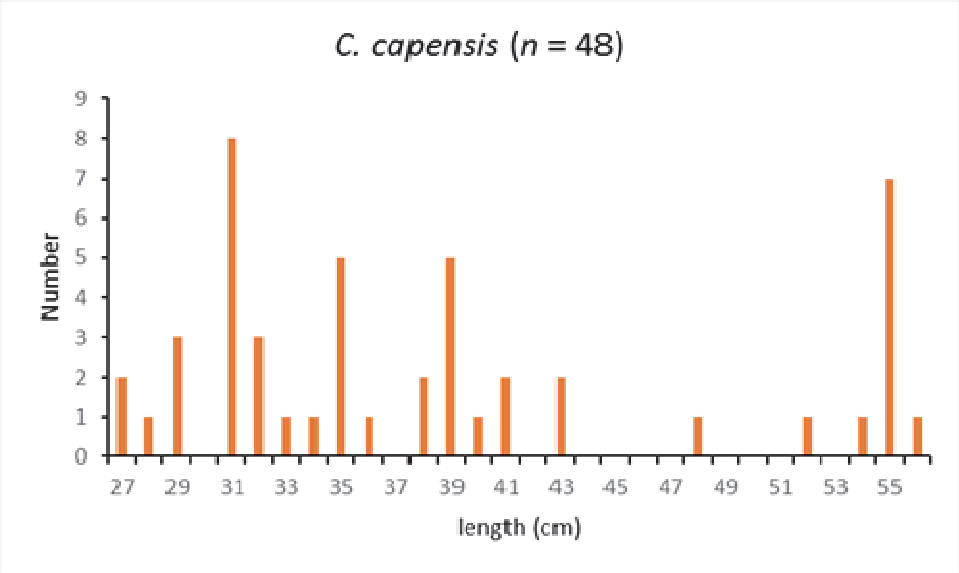


Figure 33. Size distribution of *Chelidonichthys capensis* in the survey area (numbers in millions) (sample size = 48, from 11 trawls)

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.

3.5 Jellyfish

Jellyfish was caught in trawls all along the coast of northern Namibia (Figure 34). Large numbers of *Chrysaora fulgida* were caught and often made up high biomass in the trawl (Table 14). In the cases where the jellyfish were intact, specimens were preserved as described in the methods. A total of 15 jellyfish were collected during the survey.

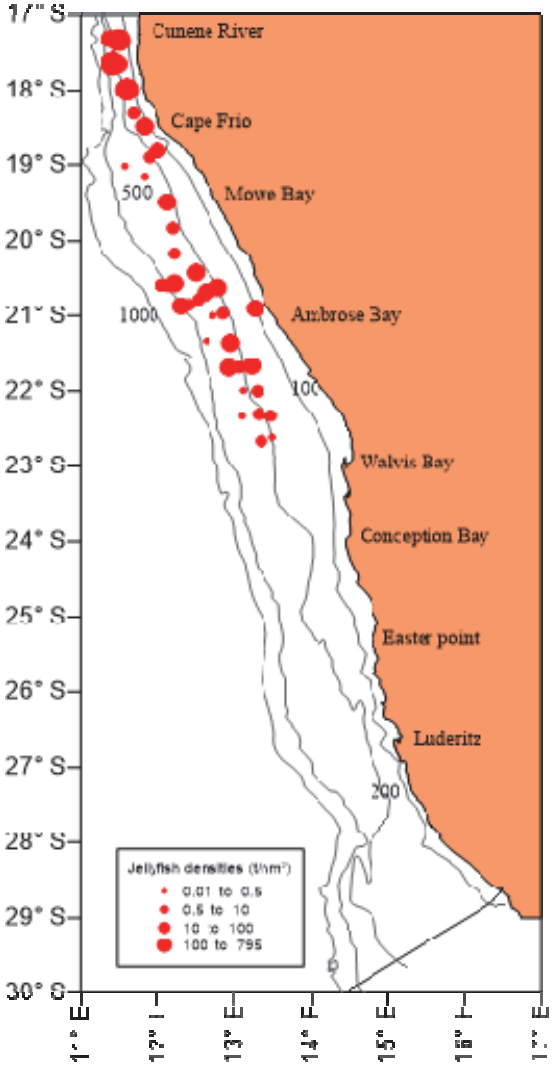


Figure 34. Spatial distribution (density, tonnes/NM^2) of jellyfish off northern Namibia

Table 14. Jellyfish species collected

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

3.6 Radiochemistry and trace metals

The super-transect at 22° S was chosen for the collection of water and sediment samples. At each of the three superstations, 10 L of seawater were taken from the Niskin bottles, which sampled at the standard depths of the Nansen survey protocol. Additionally, 250 ml were sampled at the nearshore and the offshore superstations and from the shallowest, the deepest and an intermediate depth. These samples will be analysed for trace metals. Table 15 gives an overview of the inventory of samples from this super-transect.

Table 15. Number and type of samples collected along the super-transect 22° S for radiochemical and trace metal analysis

	Water samples		Sediment samples	
	10 L	250 mL	Box core	slices
inshore	3	3	1	23
intermediate	5			
offshore	7	3	1	62

At these same two superstations, a box core was taken, and once onboard, sub-cores of Ø 10 cm were punched and sliced. One subcore will be used for radionuclides and geochronological investigations, one subcore for trace metals and one subcore for archives and foraminifera. Figure 35 shows the surface of the two box cores and examples of the sub-cores that were collected.

Figure 35. The surface of the two box cores and examples of the sub-cores that were collected

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)					
	100-200	200-300	300-400	400-500	500-600	Total
N trawl hauls	30	42	34	33	27	166
Sampling intensity (NM^2/trawl)	670	234	260	107	81	268
Area (NM^2)	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 in numbers. 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

	M. capensis	***M. paradoxus***
NORTH		
Fishable (>35)	215 491	45 421
Non-fishable (≤35)	53 328 118	10 681
Total	53 543 609	56 102
SOUTH		
Fishable (>35)	138 550	65 222
Non-fishable (≤35)	2 208 270	863 452
Total	2 346 820	928 674
TOTAL NUMBER		
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

	M. capensis	***M. paradoxus***
NORTH		
Fishable (>35)	111	29 612
Non-fishable (≤35)	703	2 310
Total	814	31 922
SOUTH		
Fishable (>35)	94 476	41 201
Non-fishable (≤35)	236 211	67 444
Total	330 687	108 645
TOTAL BIOMASS		
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 36 and Figure 37). 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.

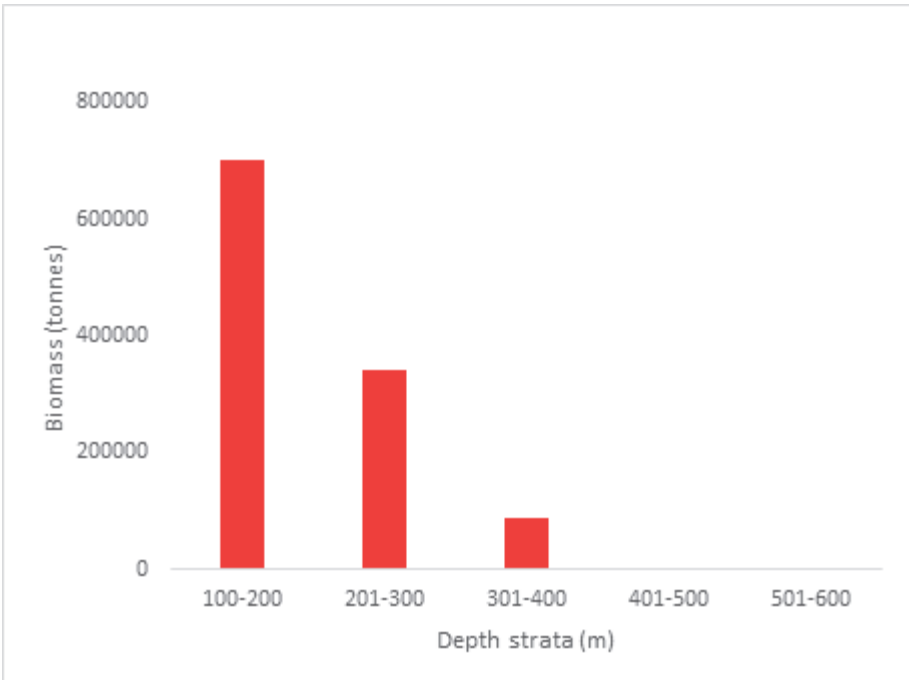


Figure 36. Biomass per depth strata for *M. capensis*

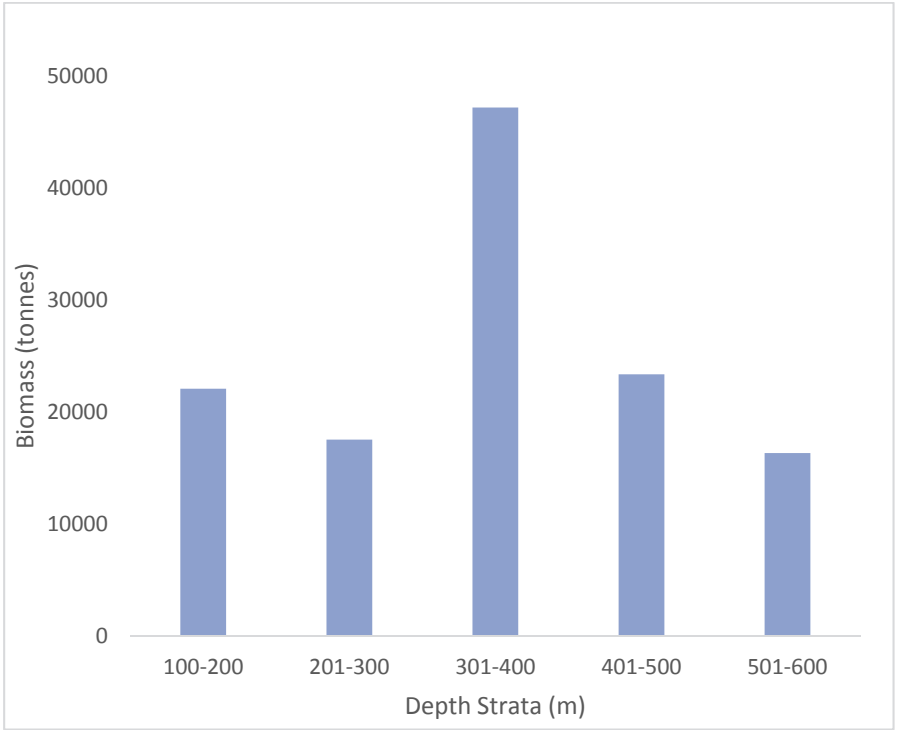


Figure 37. Biomass per depth strata for *M. paradoxus*

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 38). *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 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 t/nm^2) were scattered along the entire coast.

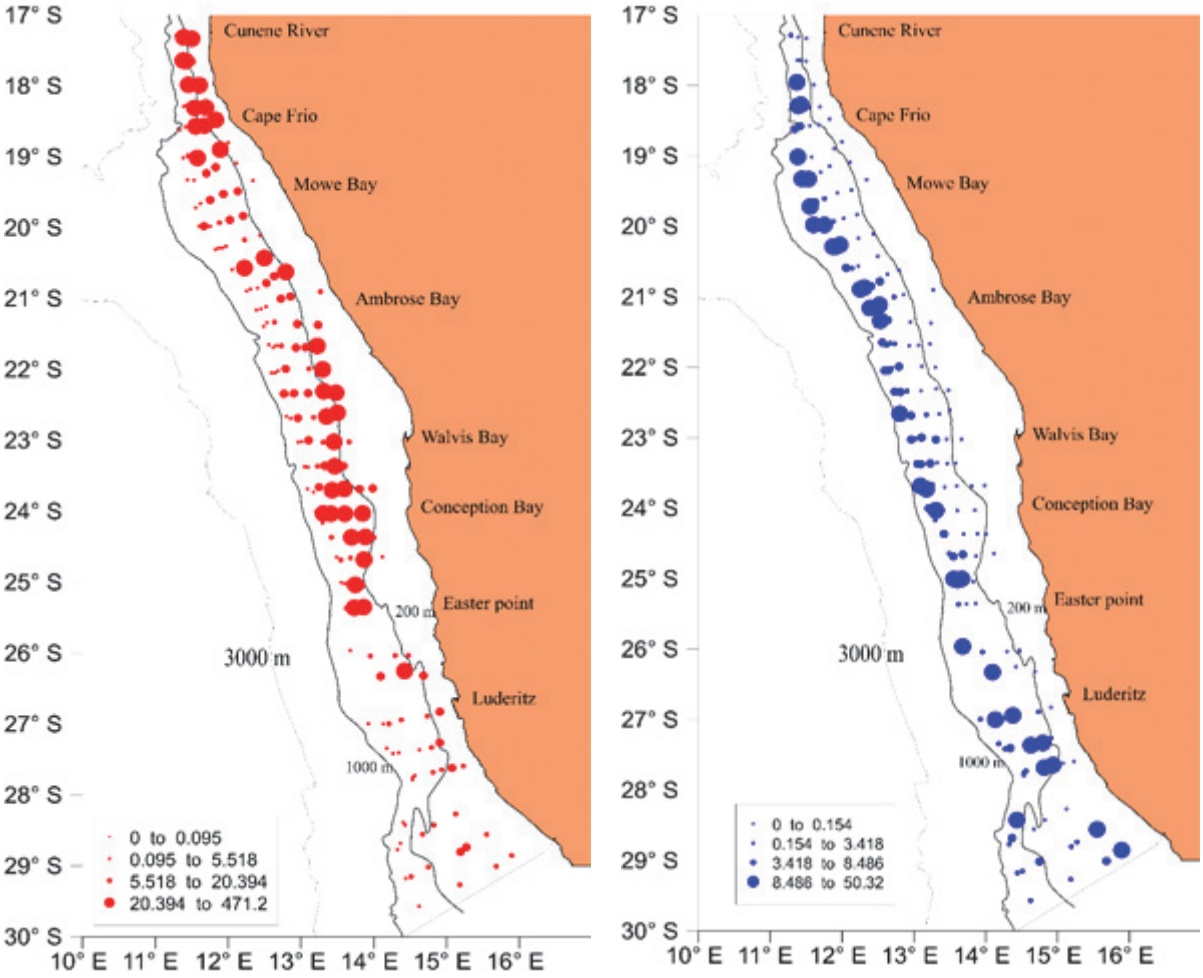


Figure 38. Density distributions (t/NM2) for the two species of hake: *M. capensis* (left) and *M. paradoxus* (right)

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 39 and Figure 40). 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 stock (Figure 41 and Figure 42). 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.

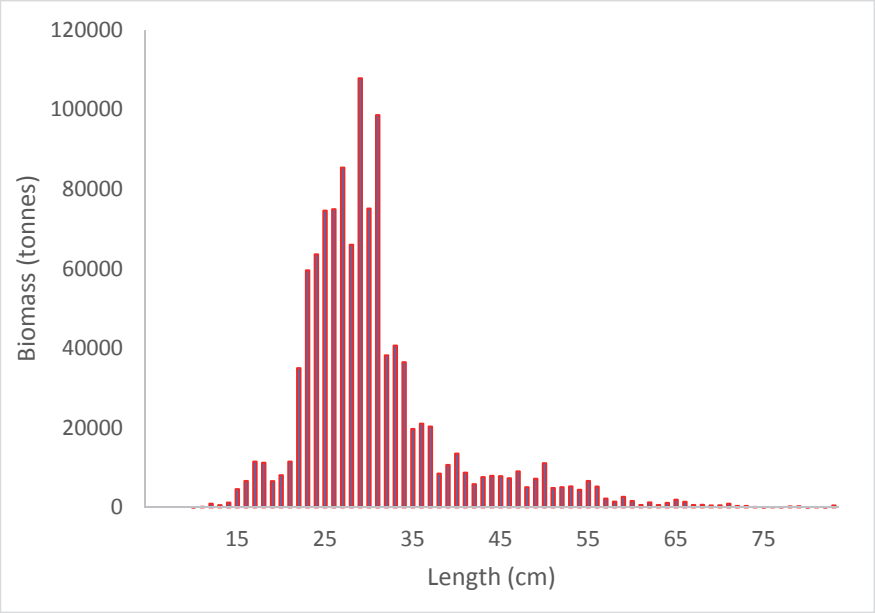


Figure 39. Size distribution in tonnes per cm of *M. capensis* for the entire Namibian region

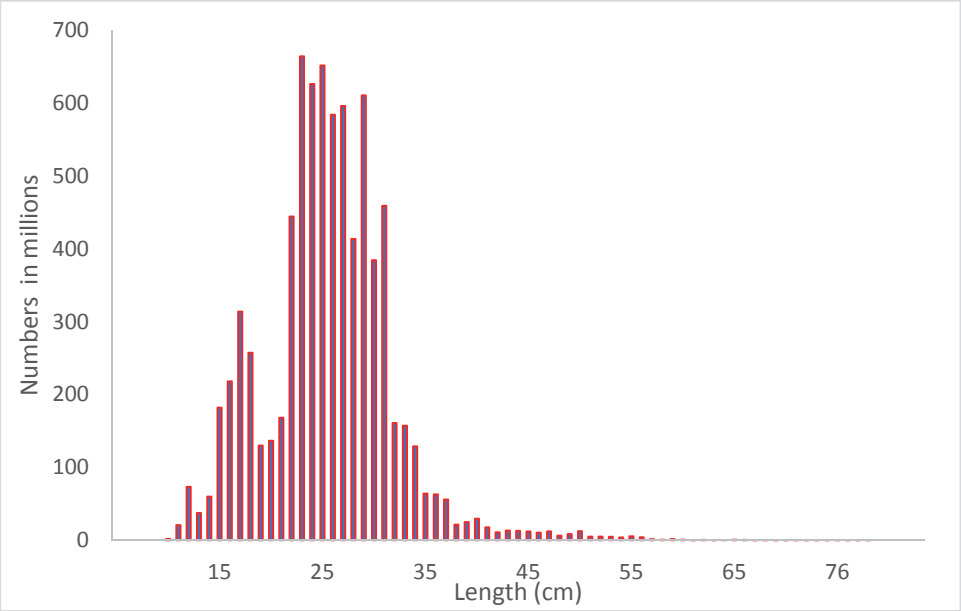


Figure 40. Size distribution in numbers per cm of *M. capensis* for the entire Namibian region

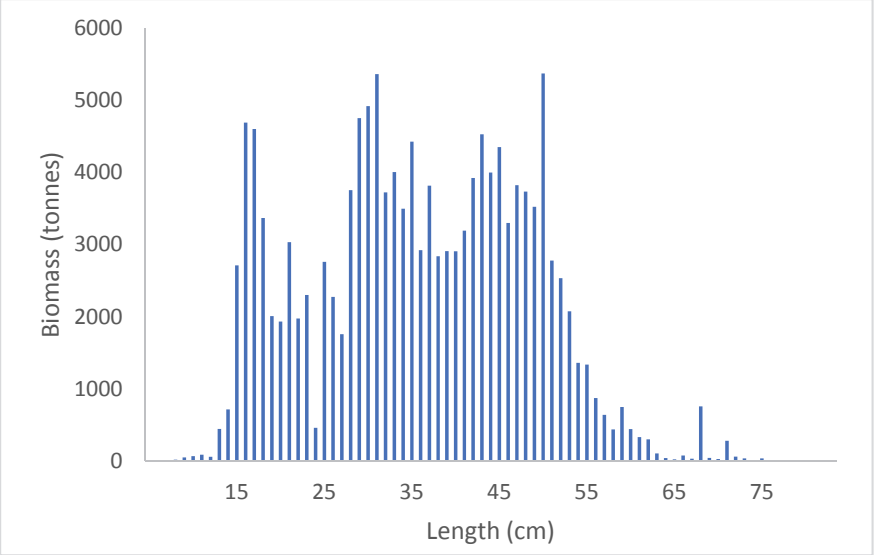


Figure 41. Size distribution in tonnes per cm of *M. paradoxus* for the entire Namibian region

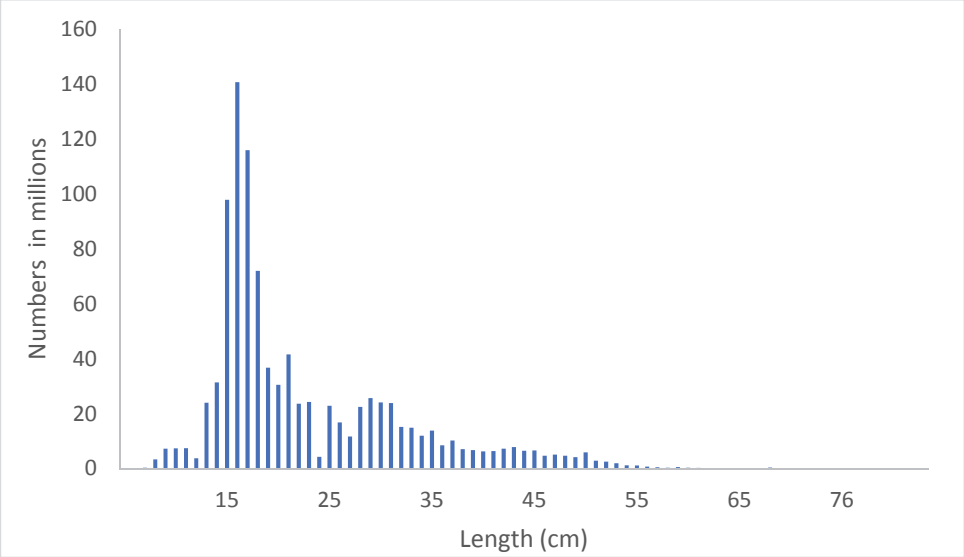


Figure 42. Size distribution in numbers per cm of *M. paradoxus* for the entire Namibian region

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). 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.

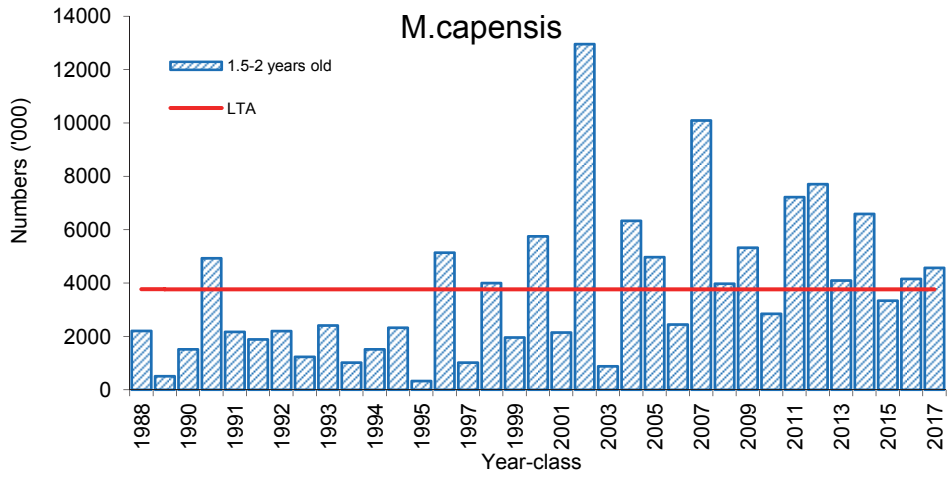


Figure 43. Estimated number of recruits (1.5-2 years old) for *M. capensis* from the hake surveys off Namibia

4.5 Survey trends of some bycatch species

Figure 44 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.

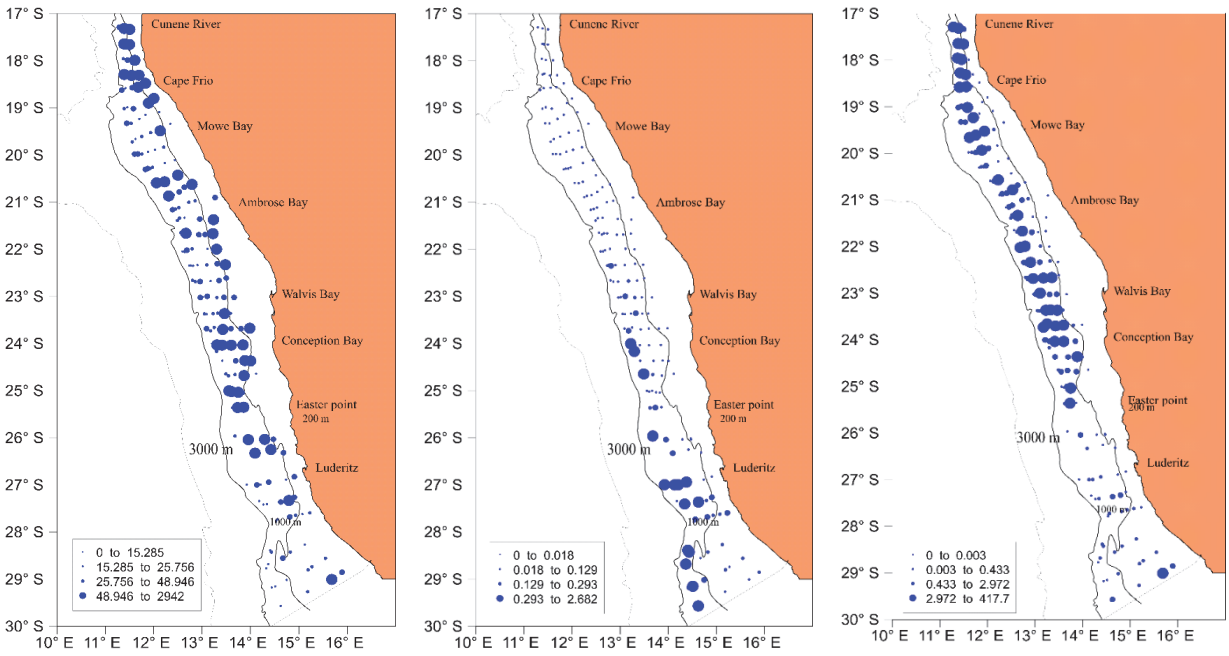


Figure 44. Density distributions (t/NM2) for monk (left), kingklip (middle) and jacopever (right)

CHAPTER 5. DISCUSSION

This chapter summarises the key data on the hake stocks, and briefly several of the important bycatch species, for the 2019 hake swept-area survey of Leg 2.4, which covered the region from Walvis Bay to the border with Angola. Much of the other data collected, and available in the specific survey reports, 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 all have slightly, but potentially different characteristics, as described below.

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.

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 and with a different vessel.

Tables 20 and 21 show the long time-series of biomass estimates. Clearly the estimate for Cape hake for the current survey by the R/V *Dr Fridtjof Nansen* is somewhat higher than the recent estimates of the R/V *Mirabilis,* while for *M. paradoxus* the biomass appears somewhat lower. When compared to the longer time-series both estimates are broadly similar and suggest no overall trend in abundance.

Table 20. Total biomass indices and associated CV's (%) for the *M. capensis* off Namibia since the beginning of Namibian surveys in 1990

Period	R/V *Dr Fridtjof Nansen*		Commercial Fishing Vessels		R/V *Mirabilis*	
	Biomass	CV (%)	Biomass	CV (%)	Biomass	CV (%)
Jan-Mar 1990	*606 000*	*15*				
Sep-Oct 1990	*776 000*	*13*				
Jan-Mar 1991	*603 000*	*15*				
Oct-Dec 1991	*824 000*	*14*				
Apr-Jun 1992	*962 000*	*11*				
Oct-Dec 1992	*1 111 000*	*10*				
Jan-Mar 1993	*762 000*	*12*				
Apr-May 1993	*775 000*	*14*				
Jan-Feb 1994	*655 000*	*15*				
Apr-Jun 1994	*928 000*	*10*				
Oct-Nov 1994	*398 000*	*14*				

Period	R/V *Dr Fridtjof Nansen*		Commercial Fishing Vessels		R/V *Mirabilis*	
	Biomass	**CV (%)**	**Biomass**	**CV (%)**	**Biomass**	**CV (%)**
Apr-Jun 1995	*459 000*	*14*				
Jan-Feb 1996	*623 000*	*18*				
Sep-Oct 1996	*515 000*	*16*				
Jan-Feb 1997	*458 000*	*15*				
Jan-Feb 1998	*1 384 000*	*18*				
Jan-Feb 1999	*1 277 000*	*35*				
Jan-Feb 2000			*1 218 000*	*15*		
Jan-Feb 2001			*1 299 000*	*25*		
Jan-Feb 2002			*1 079 000*	*12*		
Jan-Feb 2003			*426 000*	*22*		
Jan-Feb 2004			601 000	23		
Jan-Feb 2005			667 000	16		
Jan-Feb 2006			1 022 000	19		
Jan-Feb 2007			495 000	17		
Jan-Feb 2008			734 000	14		
Jan-Feb 2009			573 000	26		
Jan-Feb 2010			768 000	30		
Jan-Feb 2011			1 365 000	13		
Jan-Feb 2012			957 000	18		
Jan-Feb 2013			864 000	10		
			617 000	14		
			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
Apr-May 2019	***1 144 714***	***39***				

Table 21. Total biomass indices and associated CV's (%) *M. paradoxus* off Namibia since the beginning of Namibian surveys in 1990

Period	R/V *Dr Fridtjof Nansen*		Commercial Fishing Vessels		R/V *Mirabilis*	
	Biomass	**CV (%)**	**Biomass**	**CV (%)**	**Biomass**	**CV (%)**
Jan-Mar 1990	*29 000*	*29*				
Sep-Oct 1990	*26 000*	*28*				
Jan-Mar 1991	*15 000*	*34*				
Oct-Dec 1991	*82 000*	*16*				
Apr-Jun 1992	*172 000*	*28*				
Oct-Dec 1992	*132 000*	*15*				
Jan-Mar 1993	*205 000*	*41*				
Apr-May 1993	*91 000*	*21*				
Jan-Feb 1994	*181 000*	*19*				
Apr-Jun 1994	*229 000*	*19*				
Oct-Nov 1994	*139 000*	*15*				
Apr-Jun 1995	*160 000*	*15*				
Jan-Feb 1996	*231 000*	*18*				
Sep-Oct 1996	*213 000*	*17*				

Period	R/V *Dr Fridtjof Nansen*		Commercial Fishing Vessels		R/V *Mirabilis*	
	Biomass	**CV (%)**	**Biomass**	**CV (%)**	**Biomass**	**CV (%)**
Jan-Feb 1997	*205 000*	*14*				
Jan-Feb 1998	*209 000*	*20*				
Jan-Feb 1999	*215 000*	*16*	*251 000*	*17*		
Jan-Feb 2000			*190 000*	*17*		
Jan-Feb 2001			*194 000*	*23*		
Jan-Feb 2002			*161 000*	*16*		
Jan-Feb 2003			124 000	17		
Jan-Feb 2004			109 000	19		
Jan-Feb 2005			135 000	22		
Jan-Feb 2006			106 000	19		
Jan-Feb 2007			164 000	18		
Jan-Feb 2008			129 000	19		
Jan-Feb 2009			168 000	19		
Jan-Feb 2010			111 000	18		
Jan-Feb 2011			84 000	19		
Jan-Feb 2012			223 000	18		
Jan-Feb 2013			203 000	19		
			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
Apr/May 2019	***140 567***	***10***				

5.1 Are the hake biomass estimates comparable to previous surveys?

The differences in biomass estimates may of course represent real changes in the abundance of the two stocks. Equally, it is entirely possible that migration of fish between Namibia and South Africa (for both species) may be responsible for the different estimates, especially as the surveys were conducted in different seasons. It should be noted however that the surveys were planned as transboundary and comparisons are most meaningful at that scale.

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. This is discussed further in the following chapter (Chapter 6) which combines the Namibian and South African data and briefly discusses whether the data supports the above described migration theory.

The fact that Cape hake occurred as far south as the Orange River makes it highly that there is some movement across the border, although the level of transboundary migration may be relatively small, especially compared to M. paradoxus. This is also discussed further in the Chapter 5.

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). As noted above, this may simply be a reflection of the different components of the stocks being in Namibian waters at the time of the survey, particularly for *M. capensis* with the occurrence of a 17 cm cohort, which is not normally present in surveys done earlier in the year. The length frequency of *M. paradoxus* was completely different to the past couple of surveys; in 2018 this species had a broad distribution from around 14 cm to 40 cm, while in 2019 the distribution was similarly broad but seemed to be divided into various cohorts with peaks at around 10 cm, 17 cm, 25 cm and then from 29-37 cm. This year the stock was dominated by a single cohort of 15-18 cm, and then a much smaller, but broad distribution of larger fish from 20 cm to 35 cm. As has been previously noted, relatively few fish of "fishable" size were present for either stock.

5.2 Some brief comments on the methodology

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.

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* entails the vessel drifting or steaming for some hours most nights, often from around midnight to sunrise; a rather inefficient use of expensive ship's time. 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 result in reduced biomass estimates for surveys such as this compared to summer surveys.

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. The effects of using different vessels and technological creep has recently been reviewed (Axelsen & Johnsen, 2015); a similar discussion on the survey strategy to ascertain whether the effort and money put into these

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 45).

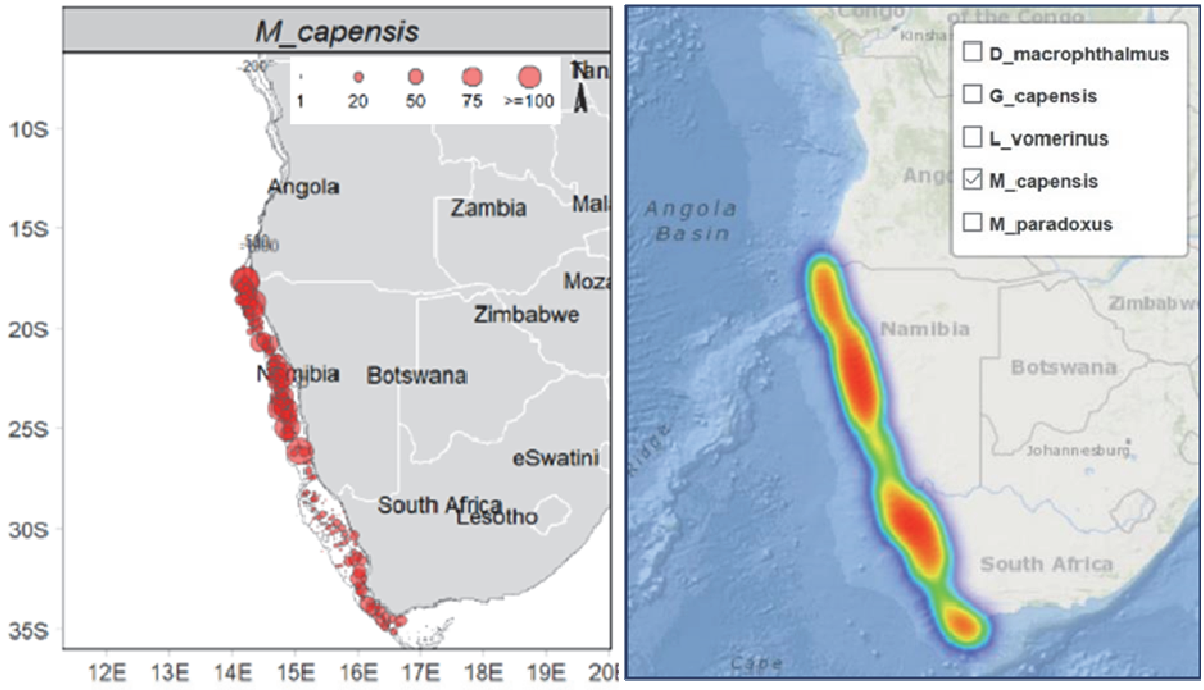


Figure 45. Distribution map for *Merluccius capensis* showing trawl catch rates (CPUE) in tonnes/NM^2 (left panel) and as a density heat-map (right panel)

Presenting these data in 10 cm length-classes (Figure 46) 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 Baia dos Tigres, contained a small quantity of *M. capensis* (5 kg/NM^2) 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.

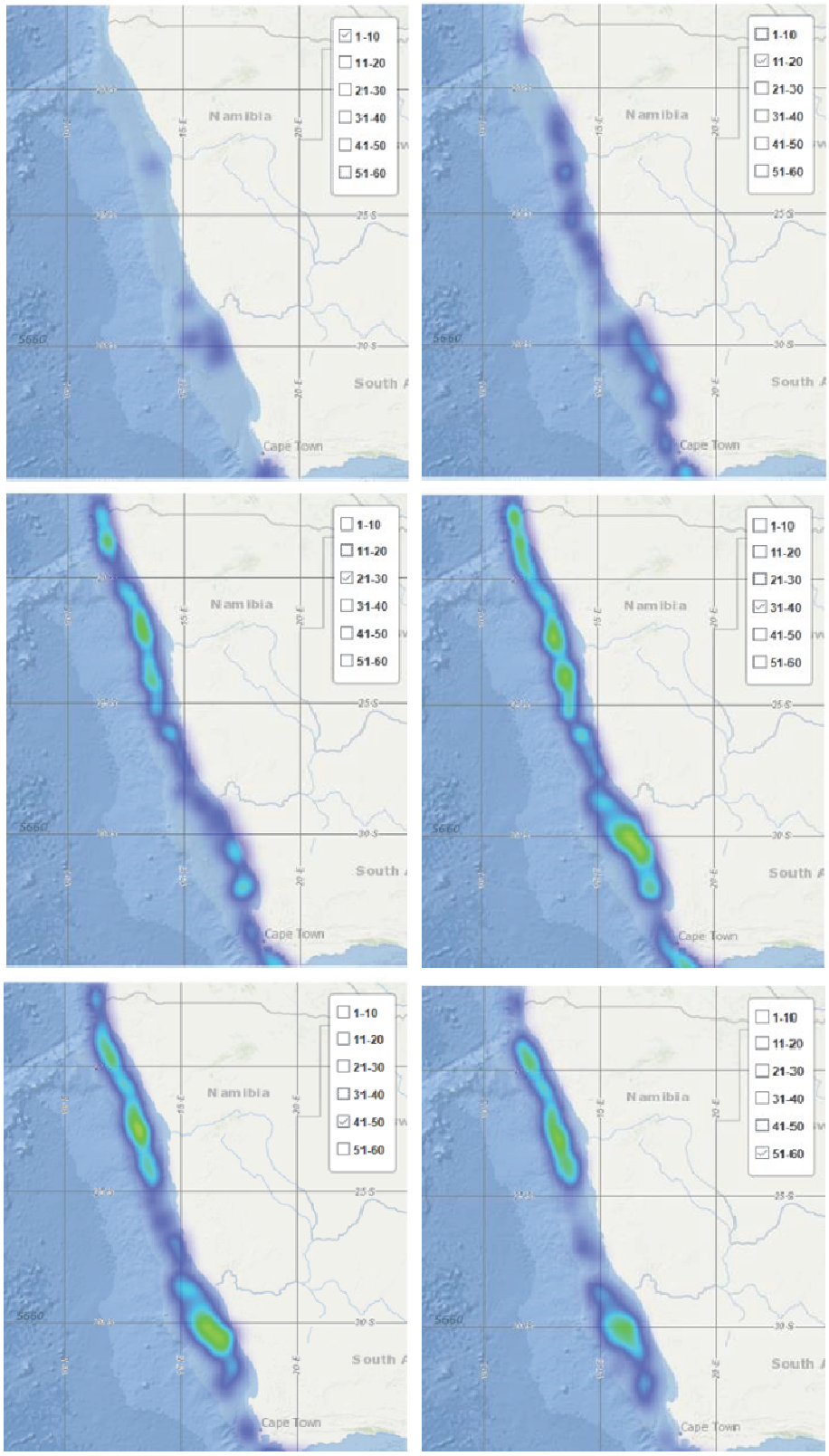


Figure 46. *Merluccius capensis* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

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 47).

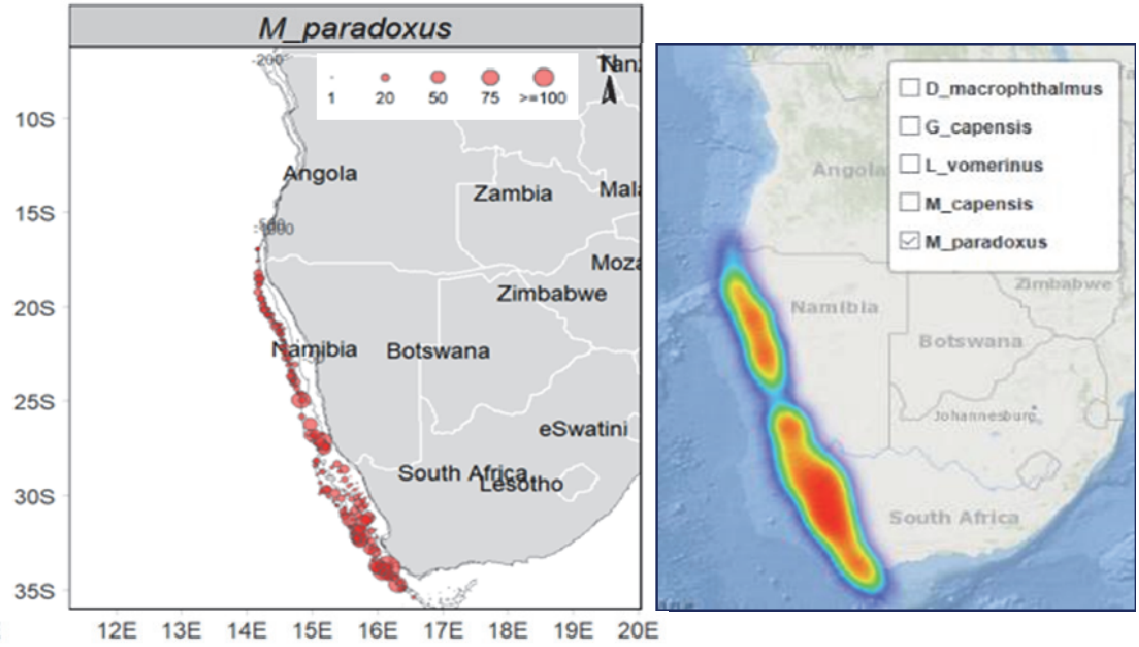


Figure 47. Distribution map for *Merluccius paradoxus* showing trawl catch rates (CPUE) in tonnes/NM^2 (left panel) and as a density heat-map (right panel)

When the data are analysed in more depth, by length-classes (Figure 48), 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 grow, they disperse 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.

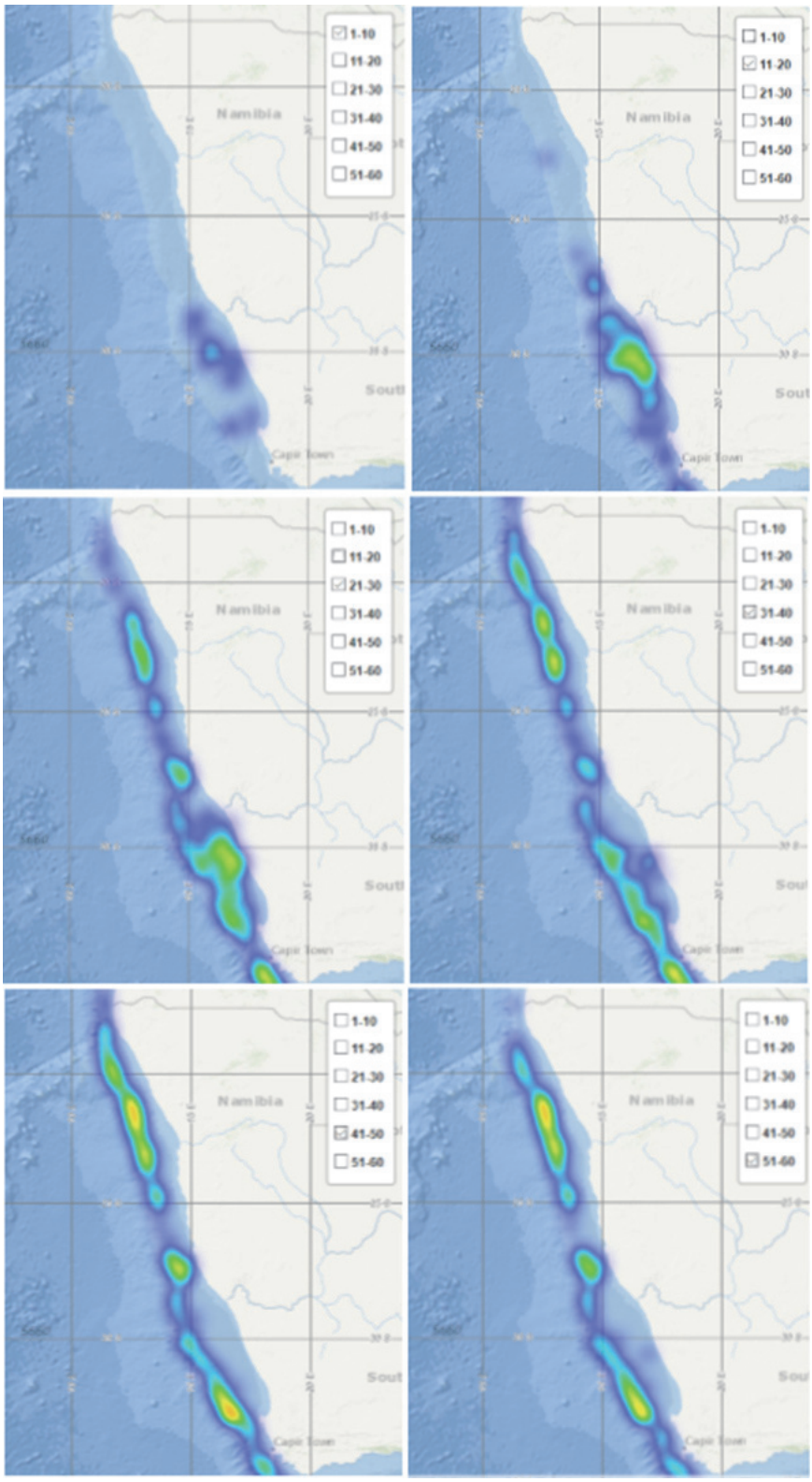


Figure 48. *Merluccius paradoxus* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

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^2) 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 49).

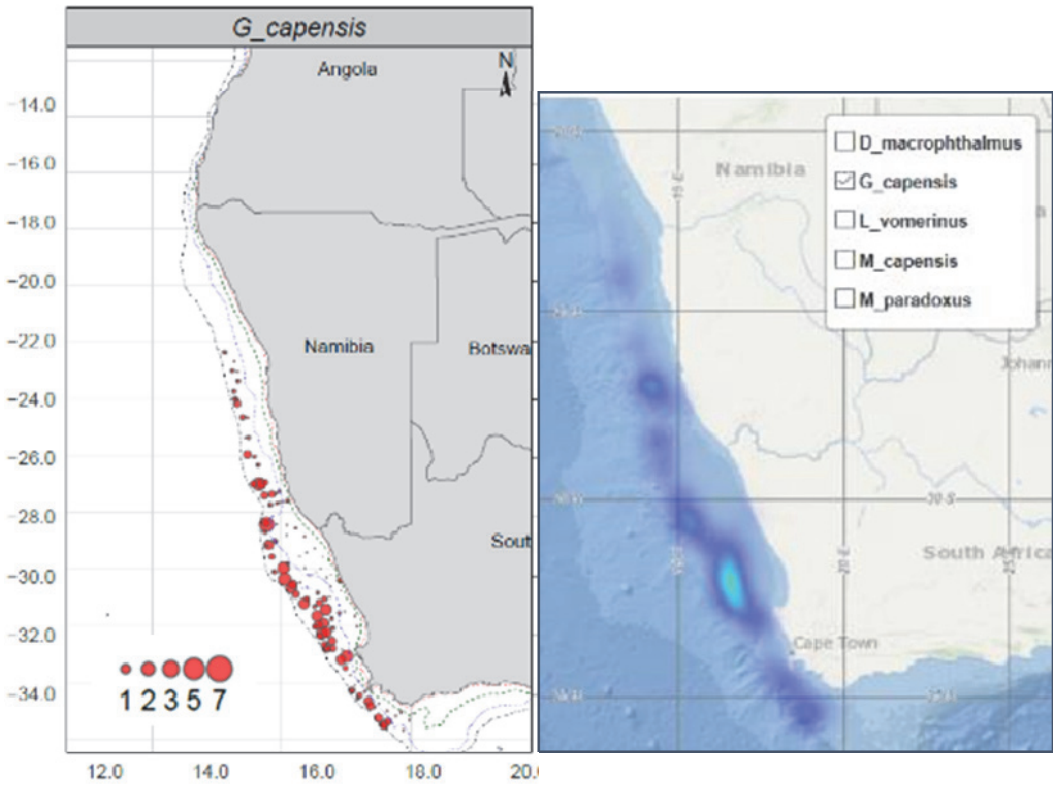


Figure 49. Distribution map for *Genypterus capensis* showing trawl catch rates (CPUE) in tonnes/NM^2 (left panel) and as a density heat-map (right panel)

When the data are presented in 10 cm length-classes (Figure 50) 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 Nambia. This species, based on the limited evidence presented here, appears to be a shared stock, albeit mostly occuring in South African waters.

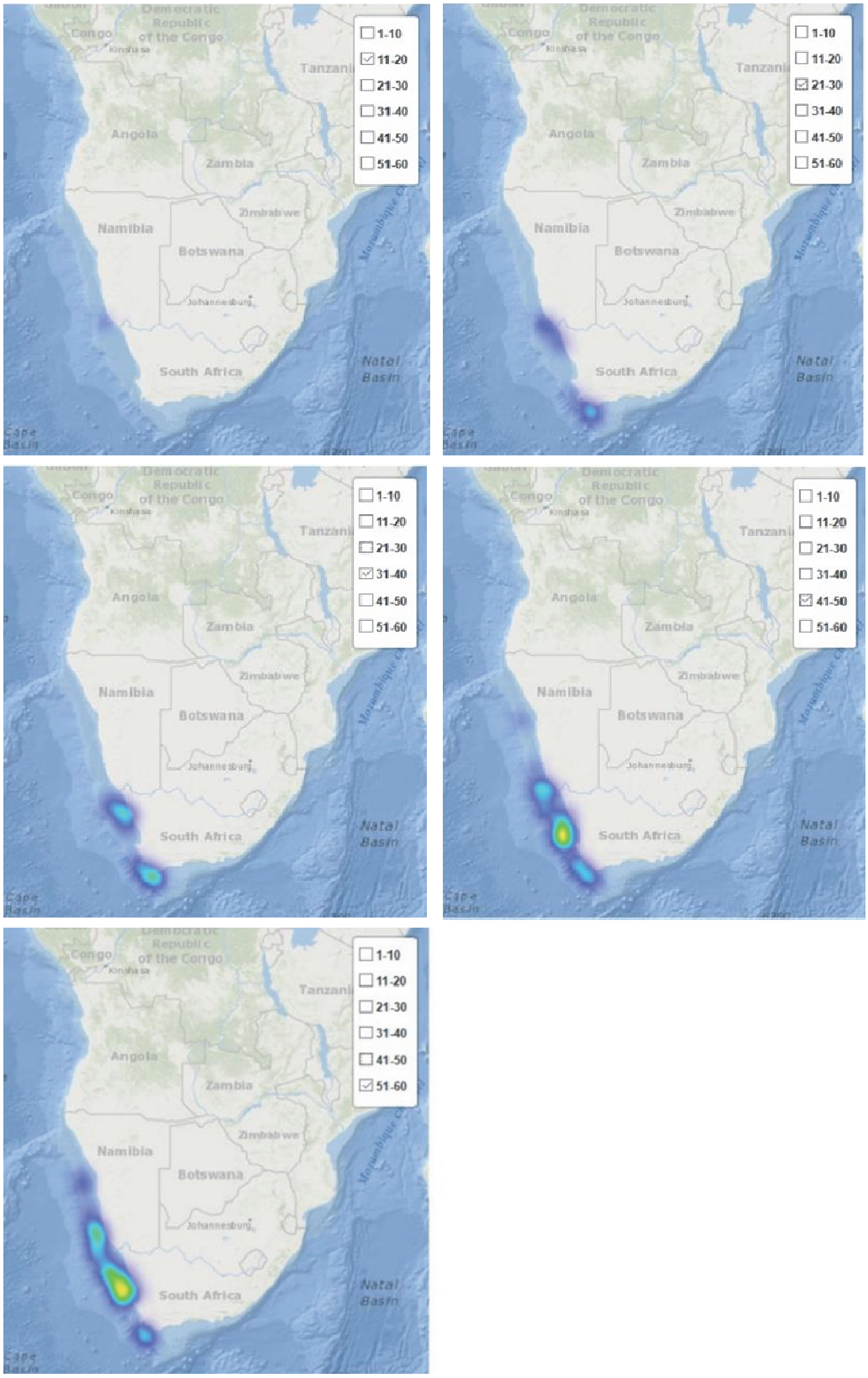


Figure 50. *Genypterus capensis* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

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 51).

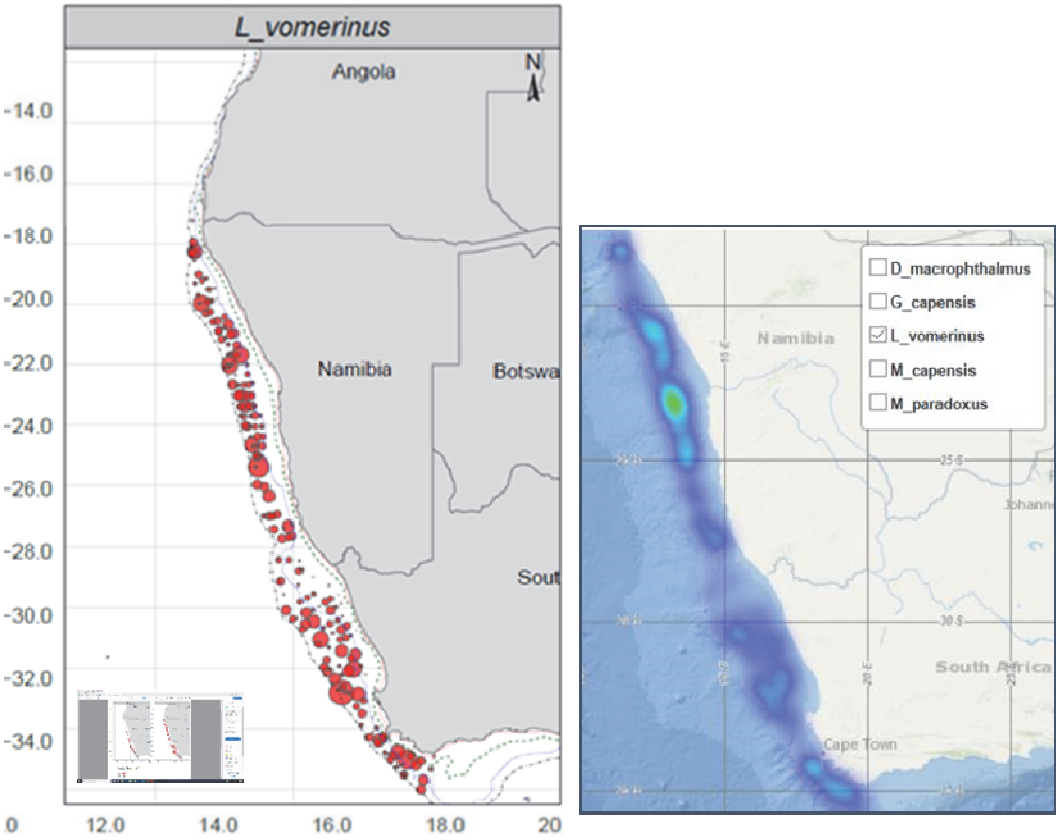


Figure 51. Distribution map for *Lophius vomerinus* showing trawl catch rates (CPUE) in tonnes/NM^2 (left panel) and as a density heat-map (right panel)

When the data are presented in 10 cm length-classes (Figure 52) 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.

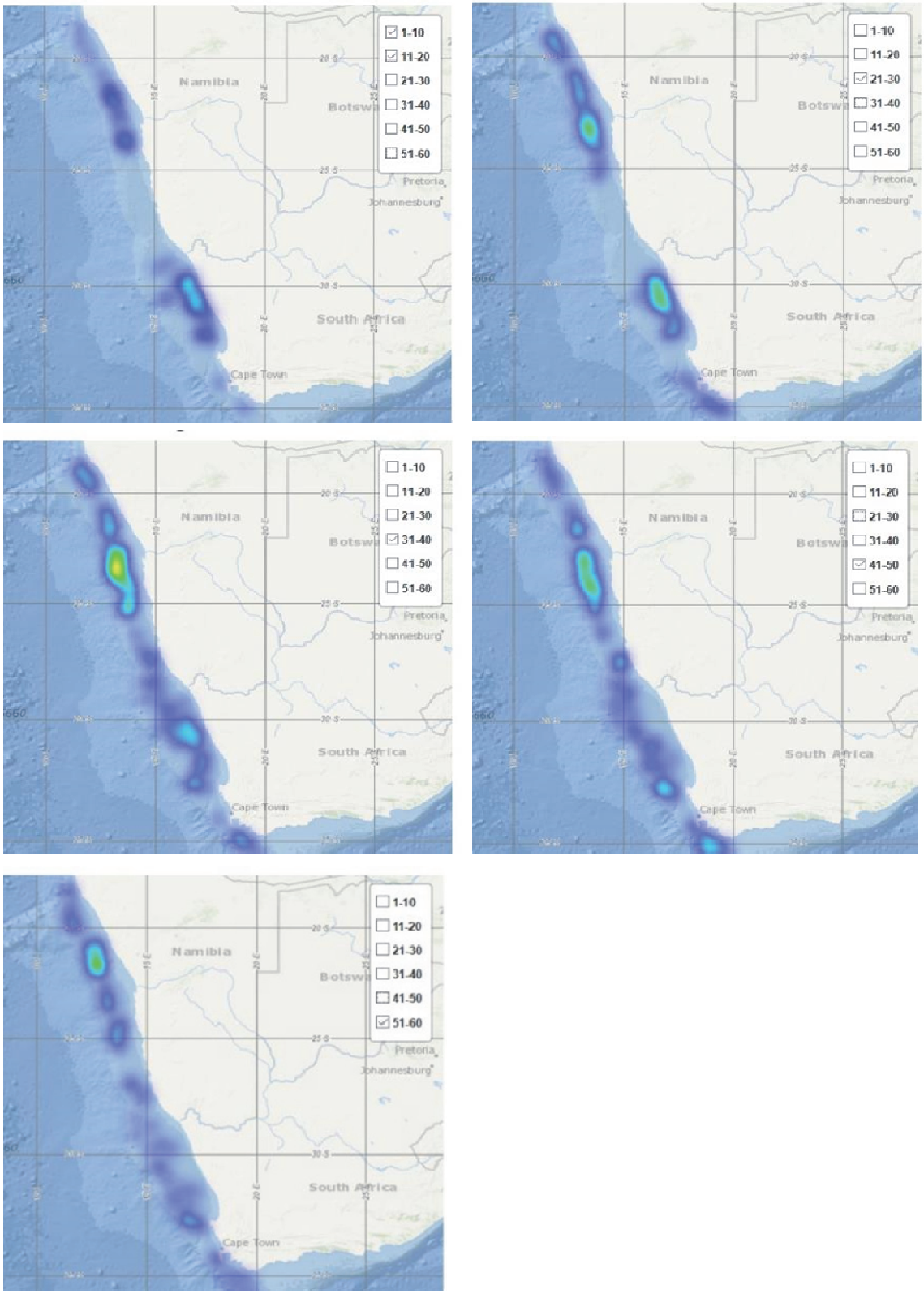


Figure 52. *Lophius vomerinus* distribution in 10 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

6.5 Dentex

The large-eye dentex (*Dentex macrophthalmus*) occurred from the coast line 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 53).

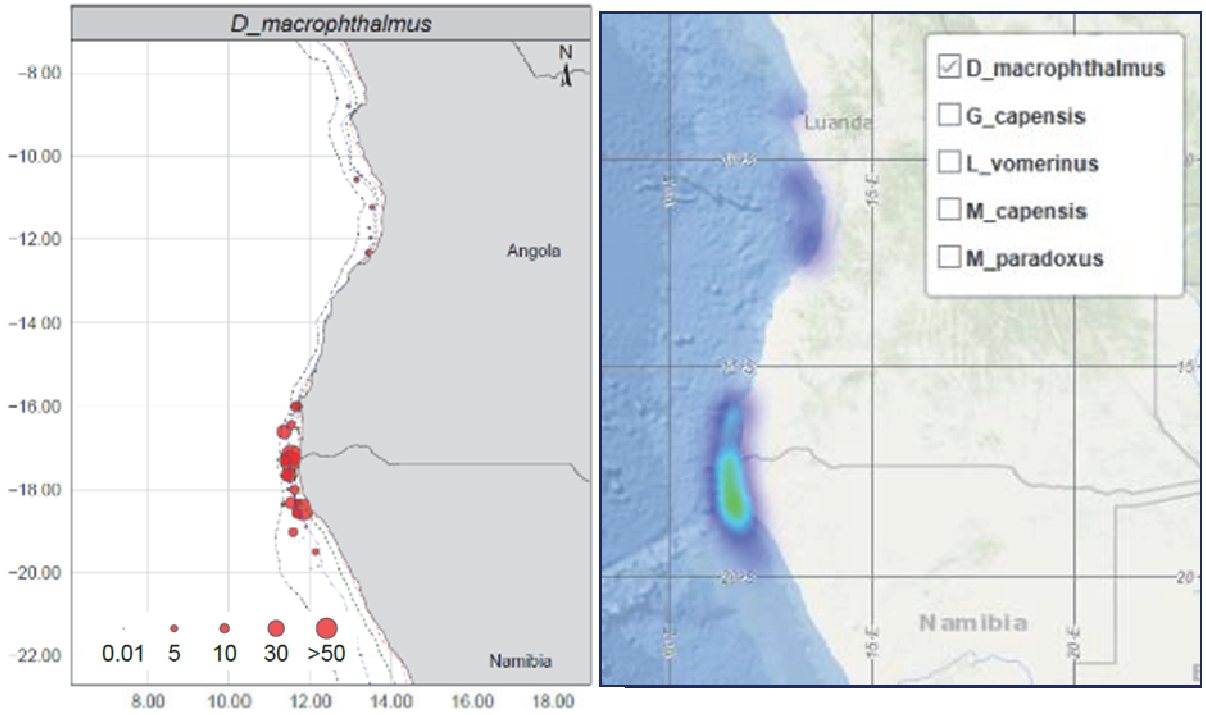


Figure 53. Distribution map for *Dentex macrophthalmus* showing trawl catch rates (CPUE) in tonnes/NM^2 (left panel) and as a density heat-map (right panel)

The CPUE data are presented in 5 cm length-classes (Figure 54, 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.

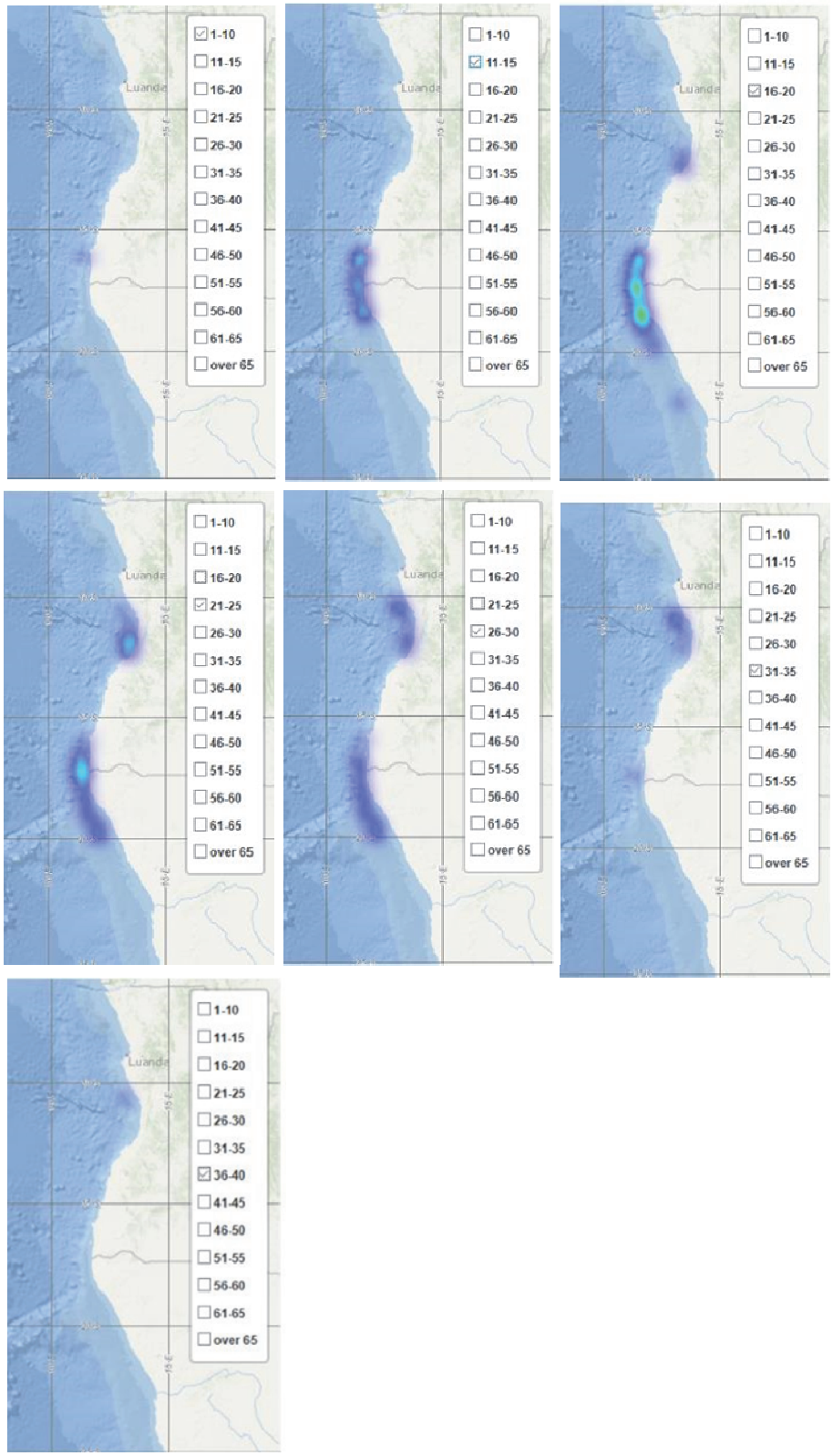


Figure 54. *Dentex macrophthalmus* distribution in 5 cm length classes. Base map data sources: GEBCO, NOAA, CHS, OSU, CSUMB, National Geographic, DeLorme, NAVTEQ and Esri

CHAPTER 7. REFERENCES

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ANNEX I. CTD BOTTLE DEPTHS AT SUPER STATIONS

Shallow Stations with depth 30m	Intermediate Stations with depth 100m	Deep Stations with depth 500m	Extra deep Stations with depth 1000m	Extra deep Stations with depth 2000m
25	100	500	1 000	2 000
5	75	400	750	1 500
*FLU max	50	300	500	1 000
	25	200	400	750
	5	150	300	500
	*FLU max	100	200	200
		75	100	100
		50	75	75
		25	50	50
		5	25	25
		*FLU max	5	5
			*FLU max	*FLU max

ANNEX II. HYDROGRAPHY SENSORS AND WATER CHEMISTRY QUALITY ASSURANCE

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	
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 4 m water intake

Type	Serial Number	Model	Calibration Date	Usage Start Date
Thermosalinograph	21-3418	SBE21	06.04.2016	15.04.2017
Conductivity sensor	3418	SBE21	06.04.2016	15.04.2017
Temperature sensor (Int)	3418	SBE21	06.04.2016	15.04.2017
Temperature sensor (Ext)	0880	SBE38	23.03.2016	15.04.2017
Fluorometer	257S	9702011 WETStar	20.04.2015	02.01.2019

Thermosalinograph sensors 6 m water dropkeel

Type	Serial Number	Model	Calibration Date	Usage Start Date
Thermosalinograph	21-3419	SBE21	06.04.2016	04.04.2019
Conductivity sensor	3419	SBE21	06.04.2016	04.04.2019
Temperature sensor (Int)	3419	SBE21	06.04.2016	04.04.2019
Temperature sensor (Ext)	878	SBE38	31.03.2016	04.04.2019

pH and total alkalinity samples were measured in triplicates

Parameter	Sample count	Average Triplicate* Standard Deviation
pH	124	0.004
Total alkalinity	124	2.37

Fluorometric standard measurements were performed to quality check chlorophyll a measurements

Parameter	Low Standard	High Standard
Standard Measurement Count	8	8
Standard Average	492	4242
Standard Standard Deviation	7	63
Standard Average Drift	-3	-60
	Collected	**Measured***
Chlorophyll a	107	50

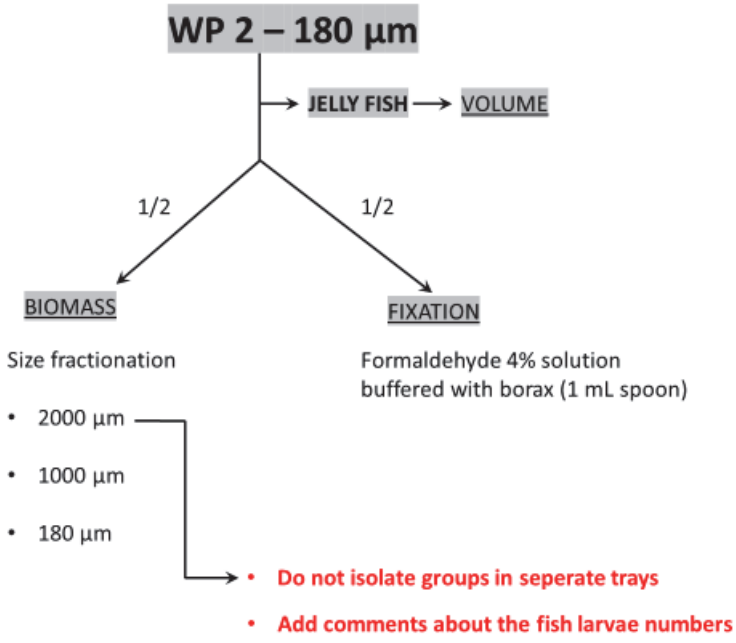
CTD dissolved oxygen and salinity value validity statistics

Parameter	Sample Count	Offset from factory calibration
Dissolved Oxygen	16	15.0%*
Salinity	0	**

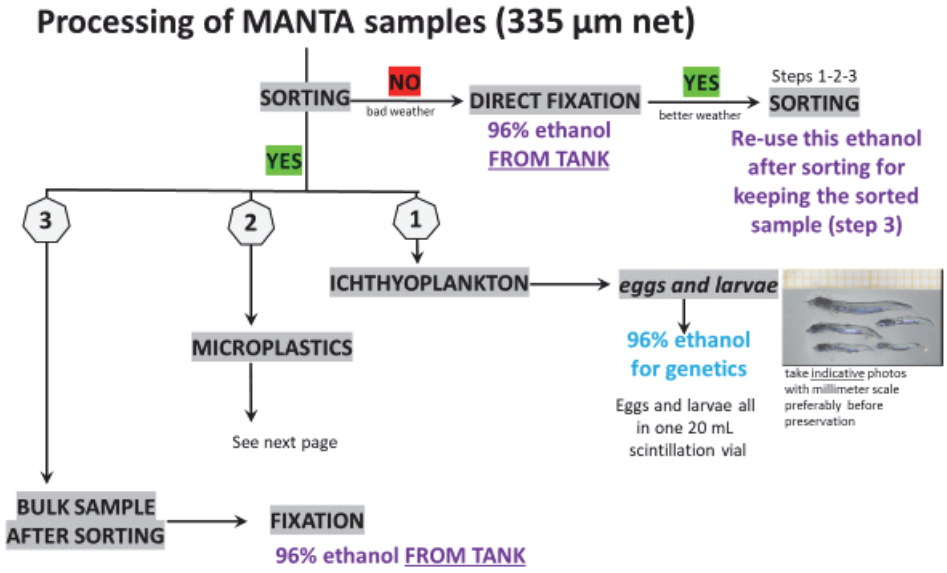
*Although it is possible that the Winkler titration data for 2019405 is valid, because of a lack of personnel on board with laboratory experience specific to Winkler titrations, this value should be considered suspect. Survey 2019404 had an offset of 2.9% with the same SBE 43-3087 sensor for example. However, it is important to note that during survey 2019406, the oxygen sensor was changed to SBE 43-3525 before station 609. This was performed by the instrument group but additional titration data cannot be found to give reason to this change. However, if this 15% off is true, then that could have lead to the sensor change.

**The salinometer was unoperational during the survey and thus, no samples were collected for salinity sensor validations

ANNEX III. OVERVIEW OF SAMPLING PROCEDURES IN THE PLANKTON LAB

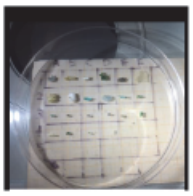


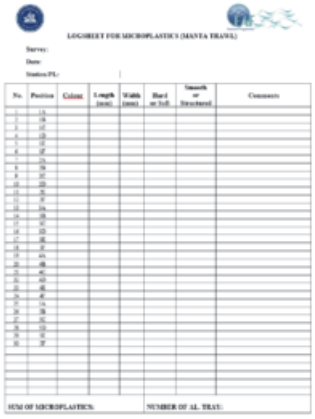
All manta samples should be sorted on board
Sorting of manta samples can be done even after preservation



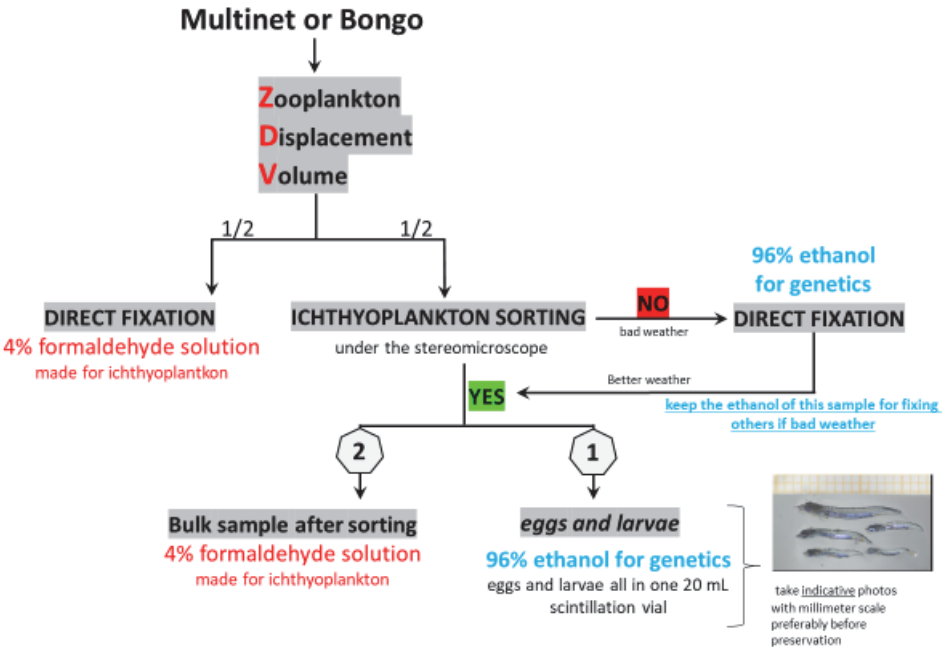
Microplastics

1. Put the sorted items in a small petri dish with **fresh water**
2. Put a **lid (labelled with station number)** and keep it safe until processing (you may do it the day after)
3. Place the items on a gridded petri dish
4. Take a photo of the entire dish with the **millimiter paper** below
5. Measure the dimensions of each item and fil the loghseet
6. Pour all items in the aluminum tray with fresh wáter
7. Put the tray in the oven 60° to dry (away from the fan)
8. Cover **individually** each try with aluminum foil and put it in the box in freezer





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 plankon 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 form the seive and the remainings in the first cylinder and continue with the SAMPLE PROCESSING

ANNEX IV. DESCRIPTION OF ACOUSTIC INSTRUMENTS AND FISHING GEAR

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	6.22º along ship
	6.28 athwart ship
Alongship offset	0.10º
Athwardship offset	0.06º
Bottom detection menu	Minimum level 50 dB

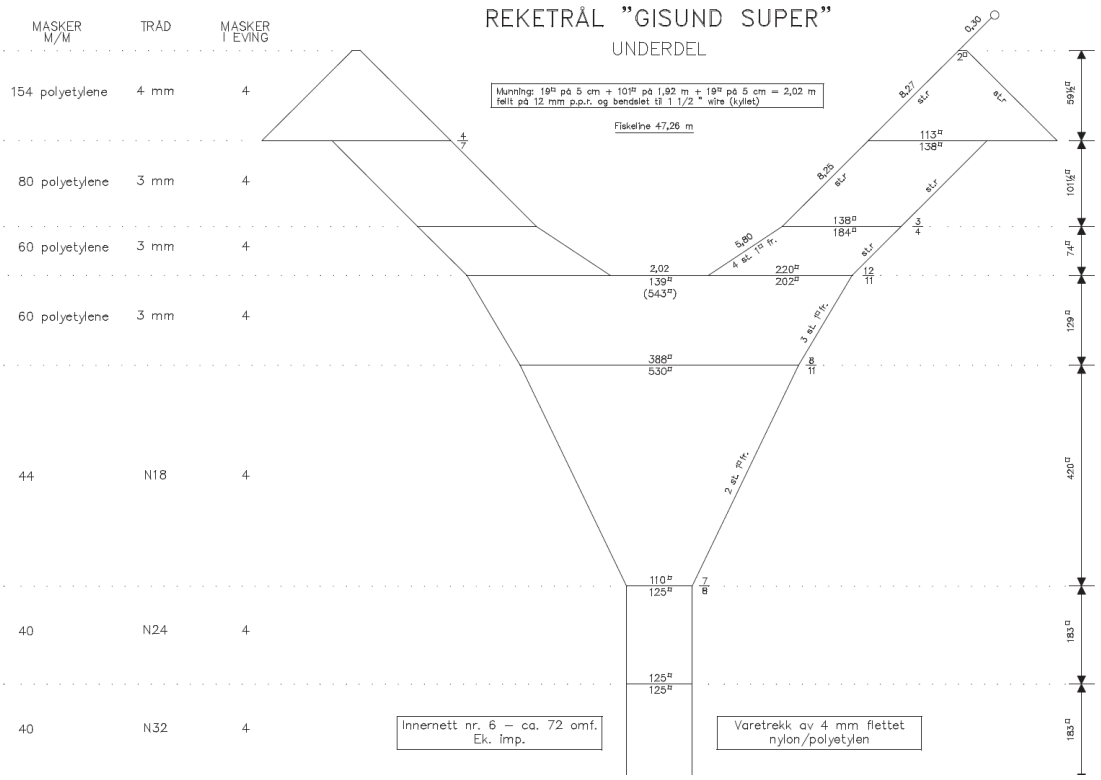
Fishing gear

The vessel has one small four-panel Åkrahamn pelagic trawl, one MultPelt 624 trawl (Figure IV.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 m2 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.



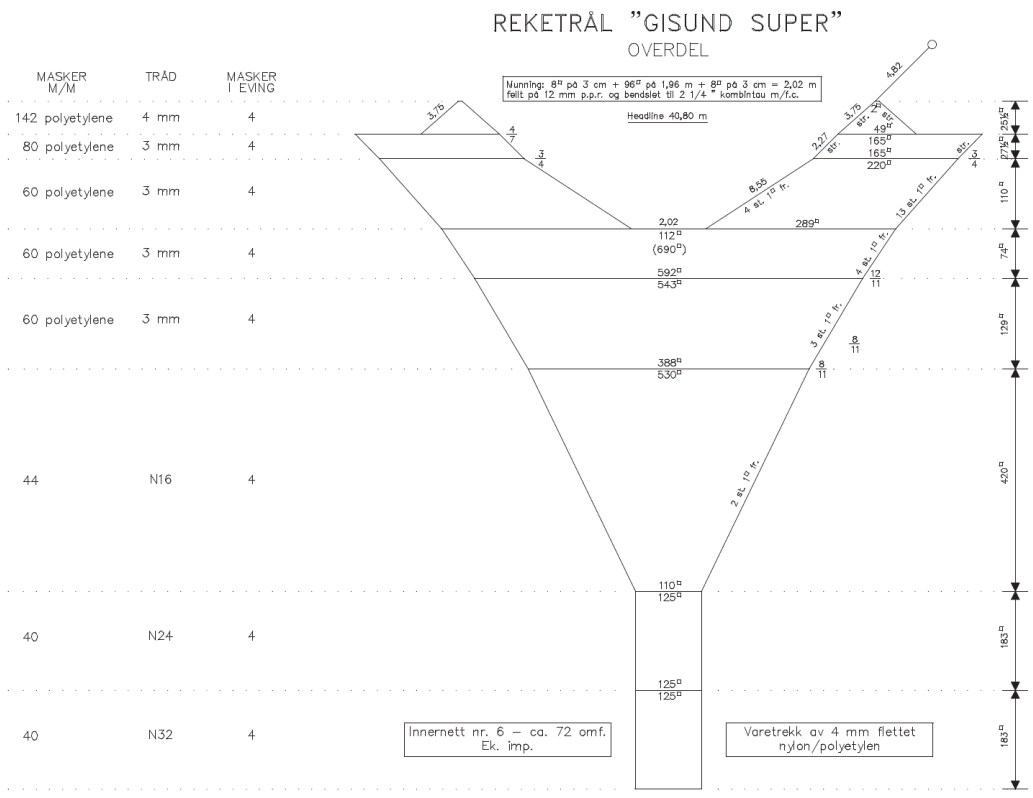


Figure IV.1. Schematic drawing of the Super Gisund bottom trawl

ANNEX V. BIOLOGY SCALES

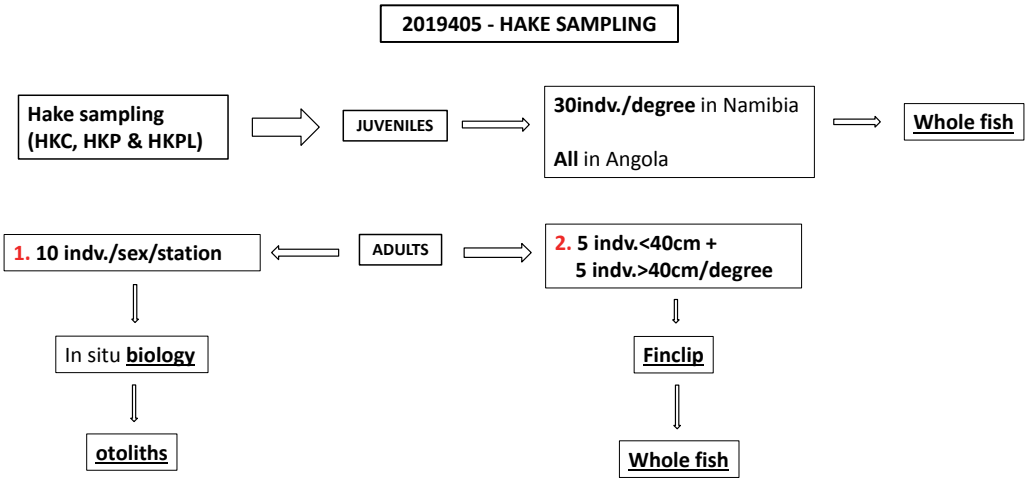
Sexual maturity

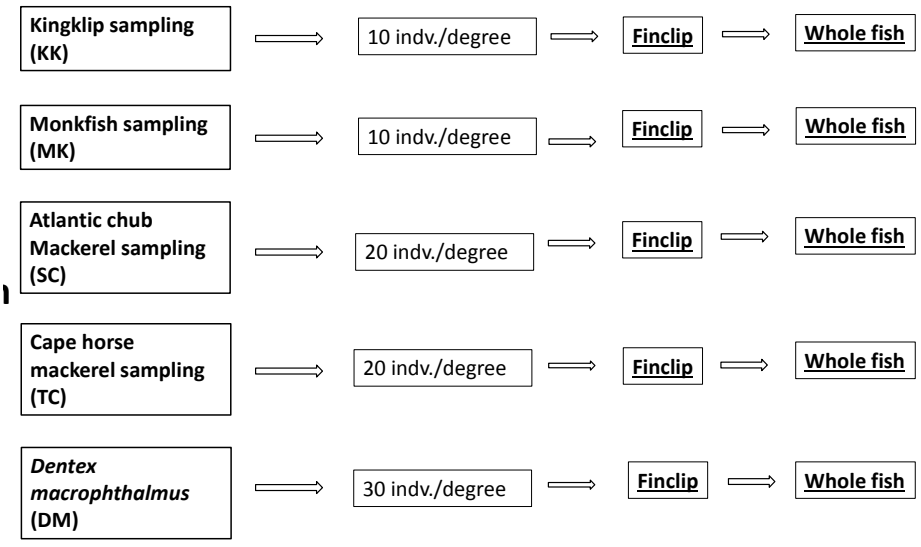
Stage	State	Description
I	Immature	Ovary and testis about 1/3rd length of body cavity. Ovaries pinkish, translucent, testis whitish. Ova not visible to naked eye.
II	Maturing virgin and recovering spent	Ovary and testis about ½ length of body cavity. Ovary pinkish, translucent, testis whitish, symmetrical. 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 VI. OVERVIEW OF SAMPLING PROCEDURES IN THE FISH LAB





ANNEX VII. OVERVIEW OF SAMPLES AND INSTITUTIONS

Gear/ equipment	Analysis	Samples	Preservation	Port of offloading	Institution address	Contact person Leg 3.1 (e-mail, phone no)	Deadline for analysis
Niskin bottles on CTD		Nutrients	0.2 ml chloroform (keep cool)	Tema	IMR		
Niskin bottles on CTD		Chlorophyll a	Frozen (-18 to -20 C, best -80)	On board	IMR		
WP2 (180 µm) from max 200 m 1/2 Split	Zooplankton biomass estimation	Aluminium trays	Dried and then frozen	Tema	IMR	Stamatina Isari	
WP2 (180 µm) from max 200 m 1/2 Split	Zooplankton community identification	Bottles with ½ of bulk WP2 sample	4% formaldehyde	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street, Swakopmund	Richard Horaeb	September 2019
Bongo V (left net, 405 µm), double oblique tow from max 200 m	Ichthyoplankton community identification	Bottles with the bulk of the sample	4% formaldehyde	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street, Swakopmund	Richard Horaeb	
Bongo H (right net 405 µm), double oblique tow from max 200 m	Ichthyoplankton community identification	Bottles with the bulk of the sample after sorting ichthyoplankton	4% formaldehyde	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street, Swakopmund	Richard Horaeb	

Gear/ equipment	Analysis	Samples	Preservation	Port of offloading	Institution address	Contact person Leg 3.1 (e-mail, phone no)	Deadline for analysis
	Ichthyoplankton community identification	Scintillation vials with sorted larval fish and eggs from one of right bongo net (H)	96% ethanol	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street, Swakopmund	Richard Horaeb	September 2019
Manta trawl (335 µm): surface tow for 15 mins	Neuston community identification	Neuston community identification	96% ethanol	Tema	UWC	Mark Gibbons	
	Species identification, Genetics	Scintillation vials with sorted larval fish and eggs from the bulk manta sample	96% ethanol	Tema	IMR	Stamatina Isari	
	Abundance and chemical composition of microplastics	Aluminium trays with sorted microplastics form the bulk manta sample	Photographed, dried and frozen	Tema	IMR	Bjørn Einar Grøsvik,	
Trawl samples	Genetic analysis	Jellyfish arm	96% Ethanol + frozen	Tema	UWC	Mark Gibbons	
Trawl samples	Morphometric analysis	Jellyfish the rest	4% formaldehyde	Tema	UWC	Mark Gibbons	
Trawl samples (juvenile hake)	Morphometric analyses/otoliths/ Stomachs/vertebrae	Whole specimens	frozen	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street,	Paulus Kainge Sarah Paulus	September 2019

Gear/ equipment	Analysis	Samples	Preservation	Port of offloading	Institution address	Contact person Leg 3.1 (e-mail, phone no)	Deadline for analysis
					Swakopmund		
Trawl samples	Age reading	Otoliths	dry	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street, Swakopmund	Paulus Kainge Sarah Paulus	September 2019
Trawl samples	Genetic analyses (stock identity)	Finclips of priority species (Hakes, Lophius, Genypterus, T. capensis and S.colias)	96% Ethanol	Luanda	IMR	Geir Dahle	
Trawl samples	Morphometric analyses/parasites/otoliths) Stomachs (Hakes, Lophius, Genypterus, T. capensis and S.colias)	Whole specimens (same specimens sampled for genetics)	Frozen	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street, Swakopmund	Paulus Kainge Sarah Paulus	September 2019
Trawl samples	Benthic epifauna	Whole specimen	Ethanol or formalin	Luanda	NatMIRC (P.O. Box 912, Swakopmund, Namibia) Ministry of Fisheries and Marine Resources, Strand Street, Swakopmund	Johnny Gamatham	September 2019
Box corer	OMZ/OA	Sediments	Frozen	Tema	IAEA	Beat Gasser	

ANNEX VIII. RECORDS OF FISHING STATIONS

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 1

DATE :13/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 22°39.62
start stop duration Lon E 12°48.16
TIME :08:43:57 09:16:00 32.0 (min) Purpose : 3
LOG : 1881.83 1883.34 1.5 Region : 5010
FDEPTH: 591 604 Gear cond.: 0
BDEPTH: 591 604 Validity : 0
Towing dir: 0° Wire out : 1250 m Speed : 2.8 kn
Sorted : 310 Total catch: 310.40 Catch/hour: 581.27

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	295.17	191	50.78	1
Selachophidium guentheri	64.23	730	11.05	
Nezumia micronychodon	36.18	723	6.22	
Lophius vomerinus	30.90	4	5.32	2
Trachyrincus scabrus	21.39	103	3.68	
Deania profundorum	15.81	21	2.72	
Schedophilus huttoni	12.66	7	2.18	
Chaceon maritae	9.63	9	1.66	
Deania calcea	7.49	7	1.29	
Rajella barnardi	7.30	9	1.26	
Rajella caudaspinosa	6.63	2	1.14	
Cruriraja parcomaculata	6.37	7	1.10	
Yarrella blackfordi	6.14	307	1.06	
Centrophorus squamosus	6.10	7	1.05	
Chimera sp.	5.96	7	1.02	
Ebinania costaecanarie	5.17	15	0.89	
Todarodes sagittatus	5.02	11	0.86	
Plesionika sp.	4.01	1335	0.69	
Bajacalifornia magalops	3.56	273	0.61	
Helicolenus dactylopterus	3.33	9	0.57	
Hoplostethus cadenati	2.70	99	0.46	
Bathyuroconger vicinus	1.99	47	0.34	
ANTHOZOA (Sea anemones)	1.95	6	0.34	
Coelorinchus matamua	1.91	4	0.33	
Apristurus microps	1.84	2	0.32	
Galeus polli	1.46	13	0.25	
Notacanthus sexspinis	1.39	37	0.24	
Gonostoma denudatum	1.39	174	0.24	
Aristeus varidens	1.35	150	0.23	
Etmopterus sculptus	1.31	6	0.23	
Bathylagus antarcticus	1.16	167	0.20	
Bassanago albescens	1.09	2	0.19	
Etmopterus pusillus	1.05	4	0.18	
Synaphobranchus kaupii	0.97	2	0.17	
S H R I M P S	0.79	262	0.14	
Heterocarpus grimaldii	0.71	37	0.12	
Starfish	0.71	0	0.12	
Stomias boa boa	0.64	52	0.11	
Lithodes ferox	0.60	9	0.10	
GEMPYLIDAE	0.60	2	0.10	
Thysanoteuthis rhombus	0.60	9	0.10	
Munidopsis chuni	0.41	412	0.07	
Neoscopelus macrolepidotus	0.30	9	0.05	
Lampanyctus australis	0.30	36	0.05	
Lamprogrammus exutus	0.30	17	0.05	
Myxine capensis	0.15	2	0.03	
Rostroraja alba	0.15	2	0.03	
POLYCHAELIDAE	0.15	15	0.03	
MYCTOPHIDAE	0.11	43	0.02	
Chauliodus sloani	0.07	11	0.01	
Astronesthes niger	0.07	4	0.01	
Nemichthys scolopaceus	0.04	2	0.01	
Total	581.27		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 2

DATE :13/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°41.26
start stop duration Lon E 12°51.55
TIME :10:58:37 11:28:35 30.0 (min) Purpose : 3
LOG : 1888.41 1889.97 1.6 Region : 5010
FDEPTH: 456 464 Gear cond.: 0
BDEPTH: 456 464 Validity : 0
Towing dir: 0° Wire out : 1200 m Speed : 3.1 kn
Sorted : 136 Total catch: 420.00 Catch/hour: 840.84

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Epigonus telescopus	341.82	2945	40.65	
Trachyrincus scabrus	128.95	384	15.34	
Nezumia micronychodon	100.06	1512	11.90	
Hoplostethus cadenati	39.48	2192	4.70	
Helicolenus dactylopterus	38.70	140	4.60	4
S H R I M P S	38.02	19009	4.52	
Merluccius paradoxus	35.52	40	4.22	3
Epigonus denticulatus	27.65	62	3.29	
Selachophidium guentheri	23.68	248	2.82	
Schedophilus huttoni	10.49	12	1.25	
Cruriraja parcomaculata	9.01	6	1.07	
Heptranchias perlo	8.65	2	1.03	
Aristeus varidens	7.67	174	0.91	
Ruvettus pretiosus	7.27	6	0.86	
Chaceon maritae	6.61	6	0.79	
Rajella caudaspinosa	4.80	2	0.57	
Deania profundorum	2.44	2	0.29	
Gonostoma denudatum	2.14	186	0.25	
Centrophorus squamosus	1.64	4	0.20	
Notacanthus sexspinis	1.12	40	0.13	
Stomias boa boa	1.02	130	0.12	
Lampanyctus australis	0.68	96	0.08	
Munidopsis chuni	0.68	705	0.08	
Coelorinchus simorhynchus	0.68	6	0.08	
Bathyuroconger vicinus	0.46	6	0.05	
Galeus polli	0.46	12	0.05	
Ebinania costaecanarie	0.46	6	0.05	
Nemichthys scolopaceus	0.22	22	0.03	
Yarrella blackfordi	0.22	12	0.03	
Astronesthes sp	0.12	6	0.01	
Phosichthys argenteus	0.12	12	0.01	
Total	840.84		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 3

DATE :13/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°41.12
start stop duration Lon E 12°57.49
TIME :13:08:45 13:40:04 31.3 (min) Purpose : 3
LOG : 1897.06 1898.58 1.5 Region : 5010
FDEPTH: 309 306 Gear cond.: 0
BDEPTH: 309 306 Validity : 0
Towing dir: 0° Wire out : 720 m Speed : 2.9 kn
Sorted : 269 Total catch: 610.00 Catch/hour: 1168.21

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	413.72	475	35.41	7
Helicolenus dactylopterus	247.55	3133	21.19	
Merluccius paradoxus	214.95	479	18.40	6
Deepwater fish mixture	86.93	0	7.44	
Chlorophthalmus agassizi	86.26	2779	7.38	
E C H I N O D E R M A T A	27.88	0	2.39	
Galeus polli	20.89	431	1.79	
Todarodes angolensis	18.02	67	1.54	
PORIFERA (Sponges)	13.33	0	1.14	
Schedophilus huttoni	7.16	4	0.61	
Lophius vomerinus	6.86	8	0.59	5
Coelorinchus simorhynchus	4.69	96	0.40	
Epigonus denticulatus	4.21	182	0.36	
Coelorinchus polli	4.12	105	0.35	
Nezumia micronychodon	2.97	92	0.25	
Beryx splendens	2.87	15	0.25	8
Squalus megalops	2.01	6	0.17	
PANDALIDAE	1.02	249	0.09	
Bathynectes piperitus	0.86	25	0.07	
Malacocephalus laevis	0.77	10	0.07	
Krill	0.48	96	0.04	
Lampadena pontifex	0.19	15	0.02	
Nemichthys scolopaceus	0.19	15	0.02	
Symbolophorus boops	0.19	15	0.02	
Phosichthys argenteus	0.10	25	0.01	
Total	1168.21		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 4

DATE :13/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°20.77
start stop duration Lon E 12°43.93
TIME :17:10:32 17:40:50 30.3 (min) Purpose : 3
LOG : 1921.37 1922.98 1.6 Region : 5010
FDEPTH: 620 637 Gear cond.: 0
BDEPTH: 620 637 Validity : 0
Towing dir: 0° Wire out : 1470 m Speed : 3.2 kn
Sorted : 190 Total catch: 242.97 Catch/hour: 481.29

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	129.19	129	26.84	9
Nezumia micronychodon	73.05	1179	15.18	
Deania calcea	70.00	63	14.55	
Todarodes sagittatus	51.86	93	10.77	
Centroscymnus coelolepis	27.83	10	5.78	
Notacanthus sexspinis	26.23	244	5.45	
Centroscyllium fabricii	19.65	24	4.08	
Coelorinchus matamua	18.22	38	3.79	
Selachophidium guentheri	13.67	160	2.84	
Schedophilus huttoni	6.66	6	1.38	
Centroscymnus crepidater	6.22	6	1.29	
Bajacalifornia magalops	5.94	14	1.23	
Bathylagus sp.	4.79	8	1.00	
Rajella barnardi	4.36	8	0.91	
Allocyttus verrucosus	4.36	69	0.91	
Deepwater fish mixture	4.00	0	0.83	
Coelorinchus acanthiger	3.53	44	0.73	
Bathyuroconger vicinus	1.98	26	0.41	
Chaceon maritae	1.35	2	0.28	
Lampanyctus australis	1.19	63	0.25	
Opisthoteuthis agassizi	1.11	2	0.23	
Aristeus varidens	0.83	73	0.17	10
Trachyrincus scabrus	0.79	4	0.16	
Hoplostethus cadenati	0.52	22	0.11	
Neocyttus rhomboidalis	0.48	2	0.10	
Plesionika martia	0.40	139	0.08	
Ebinania costaecanarie	0.40	2	0.08	
Benthodesmus tenuis	0.32	4	0.07	
Bathylagus sp.	0.28	12	0.06	0
Chlorophthalmus agassizi	0.24	4	0.05	
PORIFERA (Sponges)	0.20	0	0.04	
Glyphus marsupialis	0.20	22	0.04	
Symbolophorus boops	0.20	22	0.04	
Yarrella blackfordi	0.16	6	0.03	
Galeus polli	0.16	8	0.03	
Dicrolene intronigra	0.12	4	0.02	
Lampadena pontifex	0.12	12	0.02	
Stomias boa boa	0.12	10	0.02	
Bathynectes piperitus	0.12	2	0.02	
Bathylagus antarcticus	0.08	2	0.02	
POLYCHAELIDAE	0.08	10	0.02	
Neoscopelus macrolepidotus	0.08	2	0.02	
ASTRONESTHIDAE	0.04	2	0.01	
Phosichthys argenteus	0.04	2	0.01	
Nemichthys scolopaceus	0.04	4	0.01	
Aristaeopsis edwardsiana	0.04	2	0.01	
G A S T R O P O D S	0.02	2	0.00	
Triplophos hemingi	0.02	2	0.00	
Munidopsis chuni	0.02	16	0.00	
Nephropsis atlantica	0.02	2	0.00	
Total	481.29		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 5
DATE :13/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°20.48
start stop duration Lon E 12°45.93
TIME :19:18:50 19:49:15 30.4 (min) Purpose : 3
LOG : 1927.50 1929.04 1.5 Region : 5010
FDEPTH: 510 508 Gear cond.: 0
BDEPTH: 510 508 Validity : 0
Towing dir: 0° Wire out : 1265 m Speed : 3.0 kn
Sorted : 119 Total catch: 229.99 Catch/hour: 453.63

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	173.18	215	38.18	11
Nezumia micronychodon	62.80	722	13.84	
Todarodes sagittatus	47.97	81	10.57	
Selachophidium guentheri	33.98	475	7.49	
Helicolenus dactylopterus	22.74	97	5.01	
Centroscyllium fabricii	20.91	18	4.61	
Centrophorus squamosus	17.44	8	3.84	
Trachyrincus scabrus	12.64	93	2.79	
Chaceon maritae	12.62	14	2.78	
Deepwater fish mixture	9.63	0	2.12	
Bassanago albescens	8.62	6	1.90	
Plesionika martia	7.69	1538	1.70	
Symbolophorus boops	4.62	462	1.02	
Genypterus capensis	3.31	2	0.73	
Aristeus varidens	3.02	288	0.67	12
Deania profundorum	2.49	4	0.55	
UNIDENTIFIED FISH	2.03	4	0.45	
Lithodes ferox	1.70	4	0.37	
Beryx splendens	1.34	4	0.30	
Notacanthus sexspinis	1.20	30	0.27	
Hoplostethus cadenati	1.20	43	0.27	
Epigonus telescopus	1.07	39	0.23	
Nemichthys scolopaceus	0.39	24	0.09	
Myxine capensis	0.28	4	0.06	
Bathyuroconger vicinus	0.28	4	0.06	
Yarrella blackfordi	0.20	6	0.04	
Stomias boa boa	0.14	10	0.03	
Glyphus marsupialis	0.06	10	0.01	
Munidopsis chuni	0.06	57	0.01	
Triplophos hemingi	0.04	4	0.01	
Total	453.63		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 6
DATE :13/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°21.10
start stop duration Lon E 12°48.76
TIME :21:20:35 21:50:46 30.2 (min) Purpose : 3
LOG : 1933.42 1935.07 1.6 Region : 5010
FDEPTH: 407 402 Gear cond.: 0
BDEPTH: 407 402 Validity : 0
Towing dir: 0° Wire out : 1090 m Speed : 3.3 kn
Sorted : 110 Total catch: 229.97 Catch/hour: 457.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	260.80	437	57.04	14
Helicolenus dactylopterus	43.54	229	9.52	15
Selachophidium guentheri	30.02	304	6.57	
Coelorinchus simorhynchus	23.26	312	5.09	
Centrophorus squamosus	18.35	12	4.01	
Galeus polli	17.44	183	3.81	
Todarodes sagittatus	15.43	38	3.37	24
Nezumia micronychodon	10.83	316	2.37	
Trachyrincus scabrus	6.50	151	1.42	
Genypterus capensis	6.16	4	1.35	16
Yarrella blackfordi	4.25	1064	0.93	
Chaceon maritae	3.26	4	0.71	13
Epigonus denticulatus	3.16	396	0.69	
Cruriraja parcomaculata	2.92	4	0.64	
Lampanyctus australis	1.83	258	0.40	
Lithodes ferox	1.51	4	0.33	
PANDALIDAE	1.51	376	0.33	
Laemonema laureysi	1.33	4	0.29	
Deepwater fish mixture	0.99	0	0.22	
Triplophos hemingi	0.91	171	0.20	
Histioteuthis reversa	0.68	12	0.15	
Hoplostethus cadenati	0.62	87	0.13	
Symbolophorus boops	0.58	68	0.13	
Aristeus varidens	0.42	72	0.09	
Thysanoteuthis rhombus	0.34	4	0.07	
Benthodesmus tenuis	0.16	50	0.03	
Stomias boa boa	0.16	16	0.03	
Notacanthus sexspinis	0.08	4	0.02	
Ebinania costaecanarie	0.08	4	0.02	
Maurolicus muelleri	0.04	4	0.01	
Munidopsis chuni	0.04	38	0.01	
Total	457.20		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 7
DATE :13/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°20.17
start stop duration Lon E 12°54.23
TIME :23:35:18 00:05:45 30.4 (min) Purpose : 3
LOG : 1942.28 1943.99 1.7 Region : 5010
FDEPTH: 328 319 Gear cond.: 0
BDEPTH: 328 319 Validity : 0
Towing dir: 0° Wire out : 870 m Speed : 3.4 kn
Sorted : 59 Total catch: 270.27 Catch/hour: 532.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	242.09	197	45.46	17
Helicolenus dactylopterus	127.35	991	23.91	19
Chlorophthalmus agassizi	69.38	1825	13.03	
Coelorinchus simorhynchus	25.02	481	4.70	
Todarodes sagittatus	18.74	33	3.52	25
Galeus polli	12.26	193	2.30	
Krill	8.59	11454	1.61	
Symbolophorus boops	7.92	792	1.49	
Merluccius paradoxus	5.20	2	0.98	18
Coelorinchus polli	4.53	130	0.85	
S H R I M P S	3.00	723	0.56	
Lophius vomerinus	1.93	4	0.36	21
Thyrsites atun	1.64	4	0.31	20
Nezumia micronychodon	1.24	71	0.23	
Epigonus denticulatus	1.16	87	0.22	
PANDALIDAE	0.77	264	0.14	
Stomias boa boa	0.57	37	0.11	
Solenocera africana	0.37	164	0.07	
G A S T R O P O D S	0.33	14	0.06	
Malacocephalus occidentalis	0.28	4	0.05	
Ebinania costaecanarie	0.14	8	0.03	
Triplophos hemingi	0.04	4	0.01	
Total	532.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 8
DATE :14/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°20.05
start stop duration Lon E 13°5.88
TIME :05:47:13 06:17:04 29.9 (min) Purpose : 3
LOG : 1957.21 1958.81 1.6 Region : 5010
FDEPTH: 258 256 Gear cond.: 0
BDEPTH: 258 256 Validity : 0
Towing dir: 0° Wire out : 720 m Speed : 3.2 kn
Sorted : 218 Total catch: 360.00 Catch/hour: 723.38

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	371.21	332	51.32	22
Chlorophthalmus agassizi	105.65	4226	14.61	
Trachurus capensis	93.42	338	12.91	23
Pterothrissus belloci	20.74	131	2.87	
Coelorinchus simorhynchus	18.35	199	2.54	
Galeus polli	17.22	392	2.38	
Helicolenus dactylopterus	17.16	1123	2.37	
Synagrops microlepis	16.82	1756	2.32	
Sufflogobius bibarbatus	16.22	1865	2.24	
Scomber colias	14.63	26	2.02	
Todarodes sagittatus	8.14	16	1.13	
J E L L Y F I S H	7.78	0	1.08	
Lophius vaillanti	6.71	4	0.93	
Macropipus australis	4.46	223	0.62	
Centrolophus niger	1.49	4	0.21	
Solenocera africana	0.92	442	0.13	
SOFT SPONGES	0.66	0	0.09	
Beryx splendens	0.60	4	0.08	
Sepia elegans	0.34	4	0.05	
Krill	0.34	0	0.05	
G A S T R O P O D S	0.34	0	0.05	
MYCTOPHIDAE	0.14	20	0.02	
Deepwater fish mixture	0.04	0	0.01	
Total	723.38		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 9
DATE :14/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°18.44
start stop duration Lon E 13°18.73
TIME :08:26:56 08:59:37 32.7 (min) Purpose : 3
LOG : 1973.02 1974.60 1.6 Region : 5010
FDEPTH: 222 227 Gear cond.: 0
BDEPTH: 222 227 Validity : 0
Towing dir: 0° Wire out : 560 m Speed : 2.9 kn
Sorted : 174 Total catch: 638.78 Catch/hour: 1172.43

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	945.43	11255	80.64	28
Chrysaora fulgida	85.92	0	7.33	
Synagrops microlepis	24.23	4240	2.07	
Pterothrissus belloci	19.47	167	1.66	
Chlorophthalmus agassizi	19.01	1377	1.62	
Coelorinchus simorhynchus	16.72	222	1.43	
Todarodes sagittatus	11.73	22	1.00	26
Macropipus australis	10.88	483	0.93	
Miscellaneous fishes	9.65	0	0.82	
Lophius vomerinus	8.99	26	0.77	
Sufflogobius bibarbatus	6.13	5211	0.52	
MYCTOPHIDAE	3.84	1966	0.33	
Scomber colias	3.52	4	0.30	
Helicolenus dactylopterus	2.44	288	0.21	29
Trachurus capensis	1.84	7	0.16	30
Austroglossus microlepis	0.99	2	0.08	27
Todaropsis eblanae	0.75	51	0.06	
Squilla acuelata calmani	0.29	15	0.03	
Aequorea forskalea	0.29	0	0.03	
Solenocera africana	0.15	15	0.01	
G A S T R O P O D S	0.15	7	0.01	
Total	1172.43		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 10
DATE :14/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°19.73
start stop duration Lon E 13°28.77
TIME :10:49:49 11:14:33 24.7 (min) Purpose : 3
LOG : 1985.89 1987.18 1.3 Region : 5010
FDEPTH: 165 169 Gear cond.: 0
BDEPTH: 165 169 Validity : 0
Towing dir: 0° Wire out : 500 m Speed : 3.1 kn
Sorted : 168 Total catch: 2987.01 Catch/hour: 7244.16

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus capensis	3804.37	37724	52.52	32
Merluccius capensis	2990.42	49530	41.28	31
Chrysaora fulgida	348.82	0	4.82	
Chelidonichthys capensis	33.73	133	0.47	33
Portunus validus	15.98	754	0.22	
Deepwater fish mixture	14.20	0	0.20	
Pterothrissus belloci	11.10	90	0.15	
Thyrsites atun	10.09	2	0.14	
Todaropsis eblanae	7.10	223	0.10	
Sufflogobius bibarbatus	2.66	621	0.04	
Synagrops microlepis	1.78	90	0.02	
Engraulis capensis	1.78	177	0.02	
Argonauta sp.	1.21	2	0.02	
Squilla acuelata calmani	0.89	310	0.01	
Total	7244.12		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 11
DATE :14/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°36.70
start stop duration Lon E 13°29.99
TIME :13:31:49 14:03:59 32.2 (min) Purpose : 3
LOG : 2003.14 2004.81 1.7 Region : 5010
FDEPTH: 199 207 Gear cond.: 0
BDEPTH: 199 207 Validity : 0
Towing dir: 0° Wire out : 520 m Speed : 3.1 kn
Sorted : 269 Total catch: 669.01 Catch/hour: 1247.76

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	1066.55	4840	85.48	34
Trachurus capensis	74.86	505	6.00	36
Pterothrissus belloci	30.74	196	2.46	
Todarodes sagittatus	18.11	103	1.45	37
Chrysaora fulgida	13.93	0	1.12	
Sufflogobius bibarbatus	10.13	1268	0.81	
Macropipus australis	6.77	205	0.54	
Synagrops microlepis	5.65	942	0.45	
Lophius vomerinus	5.39	32	0.43	35
Coelorinchus simorhynchus	4.92	69	0.39	
Deepwater fish mixture	4.46	0	0.36	
Lepidopus caudatus	2.87	28	0.23	
Todaropsis eblanae	2.14	65	0.17	
Lampanyctodes hectoris	1.21	604	0.10	
Total	1247.75		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 12
DATE :14/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°39.81
start stop duration Lon E 13°21.11
TIME :15:33:33 16:04:00 30.4 (min) Purpose : 3
LOG : 2013.46 2014.93 1.5 Region : 5010
FDEPTH: 273 277 Gear cond.: 0
BDEPTH: 273 277 Validity : 0
Towing dir: 0° Wire out : 670 m Speed : 2.9 kn
Sorted : 134 Total catch: 588.13 Catch/hour: 1158.88

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	641.71	2043	55.37	39
Chlorophthalmus agassizi	173.26	6201	14.95	
J E L L Y F I S H	106.05	0	9.15	
Helicolenus dactylopterus	97.50	1147	8.41	40
Coelorinchus simorhynchus	35.74	453	3.08	
SOFT SPONGES	25.14	102	2.17	
Galeus polli	17.95	410	1.55	
Lophius vomerinus	13.12	14	1.13	38
GOBIIDAE	11.98	573	1.03	
Todarodes sagittatus	10.96	26	0.95	
Macropipus australis	5.81	240	0.50	
Synagrops microlepis	5.30	573	0.46	
Centrolophus niger	4.45	8	0.38	
Squilla acuelata calmani	3.92	187	0.34	
Symbolophorus boops	3.59	958	0.31	
G A S T R O P O D S	1.54	102	0.13	
Solenocera africana	0.51	154	0.04	
Starfish	0.33	69	0.03	
Total	1158.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 13
DATE :14/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°40.46
start stop duration Lon E 13°10.49
TIME :17:57:13 18:27:28 30.3 (min) Purpose : 3
LOG : 2025.40 2026.95 1.6 Region : 5010
FDEPTH: 309 314 Gear cond.: 0
BDEPTH: 309 314 Validity : 0
Towing dir: 0° Wire out : 760 m Speed : 3.1 kn
Sorted : 107 Total catch: 310.16 Catch/hour: 615.19

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	175.16	2953	28.47	46
Merluccius capensis	132.73	244	21.58	43
E C H I N O D E R M A T A	88.64	0	14.41	
Coelorinchus simorhynchus	52.09	5520	8.47	45
Galeus polli	49.21	583	8.00	
Merluccius paradoxus	45.66	238	7.42	44
SOFT SPONGES	24.10	105	3.92	
Chlorophthalmus agassizi	16.11	540	2.62	
Lophius vomerinus	10.12	6	1.64	41
Trachipterus trachypterus	8.05	2	1.31	
Epigonus telescopus	4.66	234	0.76	
Coelorinchus caelorhincus	3.21	99	0.52	
Genypterus capensis	1.86	2	0.30	42
Malacocephalus laevis	1.55	16	0.25	
Solenocera africana	0.99	534	0.16	
Macropipus australis	0.44	22	0.07	
G A S T R O P O D S	0.22	28	0.04	
MYCTOPHIDAE	0.22	50	0.04	
Ebinania costaecanarie	0.12	6	0.02	
Sea anemone sp	0.06	56	0.01	
Total	615.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 14
DATE :15/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°2.88
start stop duration Lon E 12°35.62
TIME :01:24:05 01:54:10 30.1 (min) Purpose : 3
LOG : 2083.26 2084.82 1.6 Region : 5010
FDEPTH: 681 676 Gear cond.: 0
BDEPTH: 681 676 Validity : 0
Towing dir: 0° Wire out : 1570 m Speed : 3.1 kn
Sorted : 26 Total catch: 190.01 Catch/hour: 378.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	127.96	112	33.77	47
Todarodes sagittatus	33.86	64	8.94	52
Selachophidium guentheri	23.83	305	6.29	
Moroteuthis robsoni	21.77	8	5.75	
Chaceon maritae	20.58	28	5.43	
Nezumia micronychodon	20.16	411	5.32	
Rajella barnardi	15.77	36	4.16	
Ebinania costaecanarie	14.98	30	3.95	
Lophius vomerinus	13.68	2	3.61	53
Bathyraja smithii	12.68	2	3.35	
Cruriraja parcomaculata	12.62	26	3.33	
Centroscymnus crepidater	6.16	2	1.63	
Heterocarpus grimaldii	6.00	203	1.58	
Yarrella blackfordi	5.18	229	1.37	
Deania profundorum	5.10	4	1.35	
Bathylagus antarcticus	4.07	313	1.07	
Hoplostethus cadenati	3.97	82	1.05	
Deepwater fish mixture	3.57	0	0.94	
Centrophorus squamosus	3.27	4	0.86	
Etmopterus pusillus	3.25	6	0.86	
Plesionika acanthurus	2.75	917	0.73	
Bajacalifornia magalops	2.23	20	0.59	
Bristle worms yellow	2.13	0	0.56	
Allocyttus verrucosus	2.03	16	0.54	
Bathyuroconger vicinus	2.03	20	0.54	
Notacanthus sexspinis	1.83	20	0.48	
Lampanyctus australis	0.92	132	0.24	
POLYCHAELIDAE	0.92	46	0.24	
Munidopsis chuni	0.82	818	0.22	
Aristeus varidens	0.72	82	0.19	
Melanostomias sp.	0.72	36	0.19	
Lithodes ferox	0.68	2	0.18	
Gonostoma sp.	0.52	36	0.14	
Funchalia woodwardi	0.52	76	0.14	
S H R I M P S	0.52	148	0.14	
Anemones, pink	0.20	6	0.05	
Starfish	0.20	30	0.05	
Bathophilus longipinnis	0.20	6	0.05	
Lamprogrammus exutus	0.10	6	0.03	
Lampanyctodes hectoris	0.10	16	0.03	
Sergestes armatus	0.10	26	0.03	
Maurolicus muelleri	0.06	6	0.02	
Howella sherborni	0.06	6	0.02	
Argyropelecus affinis	0.06	6	0.02	
Total	378.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 15
DATE :15/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°2.75
start stop duration Lon E 12°38.68
TIME :03:15:16 03:45:37 30.4 (min) Purpose : 3
LOG : 2090.23 2091.96 1.7 Region : 5010
FDEPTH: 574 575 Gear cond.: 0
BDEPTH: 574 575 Validity : 0
Towing dir: 0° Wire out : 1425 m Speed : 3.4 kn
Sorted : 27 Total catch: 329.96 Catch/hour: 652.09

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	237.43	198	36.41	54
Trachyrincus scabrus	104.56	1030	16.03	
Hoplostethus cadenati	81.13	5245	12.44	
Yarrella blackfordi	71.46	13628	10.96	
Nezumia micronychodon	45.10	1941	6.92	
Selachophidium guentheri	26.94	694	4.13	
Todarodes sagittatus	21.67	71	3.32	
Cruriraja parcomaculata	9.67	47	1.48	
Deepwater fish mixture	9.08	0	1.39	
Lophius vomerinus	7.19	2	1.10	55
Etmopterus brachyurus	5.27	24	0.81	
Schedophilus huttoni	4.47	2	0.68	
Lampanyctus australis	4.39	862	0.67	
Chaceon maritae	4.39	2	0.67	
Ebinania costaecanarie	3.22	47	0.49	
Bajacalifornia magalops	2.34	24	0.36	
Helicolenus dactylopterus	1.76	24	0.27	
Aristeus varidens	1.46	528	0.22	56
MYCTOPHIDAE	1.46	1510	0.22	
Bathylagus antarcticus	1.46	47	0.22	
Galeus polli	1.17	24	0.18	
Heterocarpus grimaldii	1.17	383	0.18	
Munidopsis chuni	0.88	1484	0.13	
Glyphus marsupialis	0.58	623	0.09	
Octopus vulgaris	0.58	24	0.09	
Stomias boa boa	0.58	71	0.09	
Notacanthus sexspinis	0.58	47	0.09	
Bathylagus sp.	0.44	24	0.07	
Bathyuroconger vicinus	0.29	24	0.04	
Nephropsis atlantica	0.29	24	0.04	
Neoscopelus macrolepidotus	0.29	24	0.04	
ASTRONESTHIDAE	0.29	24	0.04	
Funchalia woodwardi	0.29	71	0.04	
Bufoceratias wedli	0.15	24	0.02	
Total	652.09		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 16
DATE :15/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 22°1.18
start stop duration Lon E 12°41.10
TIME :08:13:25 08:44:28 31.1 (min) Purpose : 3
LOG : 2100.17 2101.66 1.5 Region : 5010
FDEPTH: 480 486 Gear cond.: 0
BDEPTH: 480 486 Validity : 0
Towing dir: 0° Wire out : 1120 m Speed : 2.9 kn
Sorted : 113 Total catch: 650.00 Catch/hour: 1256.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Hoplostethus cadenati	364.93	26071	29.05	
Trachyrincus scabrus	269.08	1457	21.42	
Helicolenus dactylopterus	90.90	444	7.24	59
Lophius vomerinus	89.12	15	7.10	58
Merluccius paradoxus	87.73	129	6.98	57
Nezumia micronychodon	76.35	2184	6.08	
Plesionika sp.	61.80	30908	4.92	
Schedophilus huttoni	52.35	39	4.17	
Todarodes sagittatus	45.74	75	3.64	60
Deepwater fish mixture	16.06	1890	1.28	
Yarrella blackfordi	14.94	1871	1.19	
Lithodes ferox	13.80	29	1.10	
Epigonus denticulatus	12.29	425	0.98	
Chaceon maritae	8.97	14	0.71	
Bassanago albescens	8.89	10	0.71	
Epigonus telescopus	7.94	46	0.63	
Anemones, white	6.43	46	0.51	
Lampanyctus australis	6.43	804	0.51	
Aristeus varidens	5.86	1171	0.47	
Deania profundorum	3.98	2	0.32	
Rajella barnardi	2.84	10	0.23	
Notacanthus sexspinis	2.09	141	0.17	
Soft corals	1.89	39	0.15	
Galeus polli	1.51	19	0.12	
Anemones, pink	0.56	10	0.04	
Ebinania costaecanarie	0.39	10	0.03	
G A S T R O P O D S	0.39	10	0.03	
Nemichthys scolopaceus	0.39	10	0.03	
Astronesthes sp	0.39	10	0.03	
Thysanoteuthis rhombus	0.39	19	0.03	
POLYCHAELIDAE	0.39	10	0.03	
Funchalia woodwardi	0.29	19	0.02	
Bathyuroconger vicinus	0.19	10	0.02	
Histioteuthis reversa	0.19	10	0.02	
Howella sherborni	0.19	10	0.02	
Lampanyctodes hectoris	0.19	29	0.02	
Stomias boa boa	0.19	19	0.02	
Total	1256.04		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 17
DATE :15/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°59.50
start stop duration Lon E 12°47.42
TIME :10:01:14 10:31:18 30.1 (min) Purpose : 3
LOG : 2108.68 2110.26 1.6 Region : 5010
FDEPTH: 344 340 Gear cond.: 0
BDEPTH: 344 340 Validity : 0
Towing dir: 0° Wire out : 920 m Speed : 3.1 kn
Sorted : 20 Total catch: 384.94 Catch/hour: 768.09

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	189.04	231	24.61	63
Merluccius paradoxus	178.54	621	23.25	61
Helicolenus dactylopterus	142.99	1109	18.62	64
Schedophilus huttoni	78.00	58	10.15	
Deepwater fish mixture	68.82	0	8.96	
Galeus polli	34.02	479	4.43	
Neoharriotta pinnata	15.28	20	1.99	
Coelorinchus polli	10.32	325	1.34	
Nezumia micronychodon	10.32	535	1.34	
Todarodes sagittatus	10.10	32	1.31	65
Lophius vomerinus	5.27	4	0.69	62
Epigonus denticulatus	4.59	229	0.60	
Coelorinchus simorhynchus	4.59	58	0.60	
Rajella barnardi	4.01	20	0.52	
S H R I M P S	3.05	1165	0.40	
Stomias boa boa	2.67	459	0.35	
Hoplostethus cadenati	2.67	134	0.35	
E C H I N O D E R M A T A	2.29	172	0.30	
Krill	1.14	1261	0.15	
Lampanyctus australis	0.38	58	0.05	
Total	768.09		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 18
DATE :15/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°59.39
start stop duration Lon E 13°6.72
TIME :13:01:37 13:31:36 30.0 (min) Purpose : 3
LOG : 2128.53 2130.01 1.5 Region : 5010
FDEPTH: 232 232 Gear cond.: 0
BDEPTH: 232 232 Validity : 0
Towing dir: 0° Wire out : 580 m Speed : 3.0 kn
Sorted : 165 Total catch: 165.30 Catch/hour: 330.82

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Scomber colias	168.97	86	51.08	67
Merluccius capensis	87.42	308	26.42	66
Chrysaora fulgida	22.09	0	6.68	
Chlorophthalmus agassizi	18.61	839	5.63	
Beryx splendens	10.51	86	3.18	68
Deepwater fish mixture	5.28	0	1.60	
Myctophidae sp. small/mix	3.48	1269	1.05	
Sufflogobius bibarbatus	2.44	610	0.74	
Synagrops microlepis	2.04	318	0.62	
Coelorinchus simorhynchus	1.92	26	0.58	
Austroglossus microlepis	1.52	2	0.46	73
Todarodes sagittatus	1.32	2	0.40	72
Macropipus australis	1.12	82	0.34	
Galeus polli	0.96	22	0.29	
Pterothrissus belloci	0.92	8	0.28	
Trachurus capensis	0.80	4	0.24	69
Lophius vomerinus	0.72	6	0.22	71
Helicolenus dactylopterus	0.60	52	0.18	70
Squilla acuelata calmani	0.08	4	0.02	
Total	330.82		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 19
DATE :15/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°59.95
start stop duration Lon E 13°17.85
TIME :15:15:11 15:45:15 30.1 (min) Purpose : 3
LOG : 2140.56 2142.10 1.5 Region : 5010
FDEPTH: 175 175 Gear cond.: 0
BDEPTH: 175 175 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 3.1 kn
Sorted : 123 Total catch: 920.52 Catch/hour: 1836.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1299.03	1495	70.72	74
Chrysaora sp.	184.43	0	10.04	
Trachurus capensis	110.60	1271	6.02	75
Chelidonichthys capensis	102.82	269	5.60	76
Synagrops microlepis	40.65	8518	2.21	
Pterothrissus belloci	27.80	223	1.51	
Sufflogobius bibarbatus	22.71	4693	1.24	
Aequorea sp.	22.13	0	1.20	
Todarodes sagittatus	7.48	134	0.41	
Coelorinchus simorhynchus	6.58	120	0.36	
Lophius vomerinus	4.19	44	0.23	77
Macropipus australis	3.89	283	0.21	
Dentex macrophthalmus	2.10	30	0.11	78
G A S T R O P O D S	0.90	90	0.05	
CIDARIDAE	0.90	0	0.05	
Lepidopus caudatus	0.60	30	0.03	
Total	1836.79		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 20
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°40.08
start stop duration Lon E 13°13.42
TIME :05:31:09 06:01:06 29.9 (min) Purpose : 3
LOG : 2241.23 2242.78 1.6 Region : 5010
FDEPTH: 155 162 Gear cond.: 0
BDEPTH: 155 162 Validity : 0
Towing dir: 0° Wire out : 460 m Speed : 3.1 kn
Sorted : 136 Total catch: 1999.92 Catch/hour: 4006.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1561.26	19178	38.97	81
Trachurus capensis	1449.06	20823	36.17	79
Chrysaora sp.	904.56	1028	22.58	
Chelidonichthys capensis	30.54	58	0.76	80
Synagrops microlepis	26.43	4700	0.66	
Macropipus australis	13.51	823	0.34	
Pterothrissus belloci	7.64	146	0.19	
Sufflogobius bibarbatus	5.87	1587	0.15	
Lepidopus caudatus	2.94	88	0.07	
Todaropsis eblanae	1.76	58	0.04	
Aequorea sp.	1.76	88	0.04	
G A S T R O P O D S	1.17	118	0.03	
Total	4006.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 21
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°41.26
start stop duration Lon E 13°3.82
TIME :07:24:38 07:56:55 32.3 (min) Purpose : 3
LOG : 2250.44 2252.03 1.6 Region : 5010
FDEPTH: 250 265 Gear cond.: 0
BDEPTH: 250 265 Validity : 0
Towing dir: 0° Wire out : 610 m Speed : 3.0 kn
Sorted : 175 Total catch: 689.99 Catch/hour: 1282.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	511.31	4613	39.86	82
Chrysaora sp.	488.10	0	38.05	
Lophius vomerinus	91.66	177	7.14	83
Pterothrissus belloci	50.09	456	3.90	
Chlorophthalmus agassizi	46.56	2218	3.63	
Coelorinchus simorhynchus	24.09	234	1.88	
Synagrops microlepis	20.86	1887	1.63	
Deepwater fish mixture	11.16	0	0.87	
Galeus polli	10.65	192	0.83	
Macropipus australis	9.55	500	0.74	
Chelidonichthys capensis	5.73	7	0.45	
Sufflogobius bibarbatus	4.99	1329	0.39	
Krill	4.55	9905	0.35	
Solenocera africana	1.32	483	0.10	
Todaropsis eblanae	1.32	45	0.10	
G A S T R O P O D S	0.29	22	0.02	
Squilla acuelata calmani	0.29	15	0.02	
Myctophidae sp. small/mix	0.15	271	0.01	
Aequorea sp.	0.15	0	0.01	
Trachurus capensis	0.07	22	0.01	
Total	1282.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 22
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°41.52
start stop duration Lon E 12°55.91
TIME :09:21:11 09:50:39 29.4 (min) Purpose : 3
LOG : 2258.26 2259.66 1.4 Region : 5010
FDEPTH: 294 298 Gear cond.: 0
BDEPTH: 294 298 Validity : 0
Towing dir: 0° Wire out : 700 m Speed : 2.8 kn
Sorted : 62 Total catch: 580.76 Catch/hour: 1183.21

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora fulgida	616.10	0	52.07	
Merluccius capensis	260.82	656	22.04	84
Chlorophthalmus agassizi	77.58	16971	6.56	
Pterothrissus belloci	36.79	242	3.11	
Helicolenus dactylopterus	28.52	471	2.41	86
PORIFERA (Sponges)	24.24	86	2.05	
Coelorinchus simorhynchus	22.82	357	1.93	
Deepwater fish mixture	19.97	0	1.69	
Galeus polli	18.54	214	1.57	
Lophius vomerinus	16.99	14	1.44	85
Scomber colias	16.05	0	1.36	
Todarodes angolensis	15.12	29	1.28	87
Macropipus australis	15.12	941	1.28	
Sufflogobius bibarbatus	4.56	314	0.39	
Coelorinchus polli	2.85	22	0.24	
Squilla acuelata calmani	2.57	100	0.22	
Trachurus capensis	2.57	4	0.22	106
SOFT SPONGES	0.86	143	0.07	
G A S T R O P O D S	0.86	143	0.07	
Malacocephalus occidentalis	0.29	43	0.02	
Total	1183.21		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 23
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°40.02
start stop duration Lon E 12°43.84
TIME :12:02:38 12:33:09 30.5 (min) Purpose : 3
LOG : 2271.34 2272.98 1.6 Region : 5010
FDEPTH: 355 355 Gear cond.: 0
BDEPTH: 355 355 Validity : 0
Towing dir: 0° Wire out : 880 m Speed : 3.2 kn
Sorted : 30 Total catch: 665.40 Catch/hour: 1308.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	399.29	1735	30.51	96
Hoplostethus cadenati	152.92	125133	11.69	
Galeus polli	125.31	34124	9.58	
Nezumia micronychodon	77.88	3186	5.95	
Deepwater fish mixture	68.67	0	5.25	
Merluccius capensis	67.02	53	5.12	93
Coelorinchus simorhynchus	59.47	1381	4.54	
Merluccius paradoxus	52.55	106	4.02	92
Todarodes sagittatus	49.56	142	3.79	107
Chlorophthalmus agassizi	42.48	1274	3.25	
Selachophidium guentheri	21.24	1027	1.62	
PORIFERA (Sponges)	20.53	106	1.57	
Stomias boa boa	20.53	2938	1.57	
Parapandalus spinifer	19.82	5558	1.51	
Chaceon maritae	18.13	22	1.39	
Schedophilus huttoni	16.76	10	1.28	
Malacocephalus occidentalis	13.45	142	1.03	
Bathynectes piperitus	11.33	389	0.87	
Lophius vomerinus	11.01	6	0.84	94
Laemonema laureysi	7.79	142	0.60	
Coelorinchus polli	7.79	212	0.60	
Cruriraja parcomaculata	7.08	6	0.54	
Macropipus australis	5.66	354	0.43	
Epigonus denticulatus	5.66	177	0.43	
Histioteuthis reversa	4.96	177	0.38	
G A S T R O P O D S	4.25	460	0.32	
Guentherus altivela	3.54	35	0.27	
Heptranchias perlo	3.38	2	0.26	
Hexanchus griseus	3.03	2	0.23	
Aristeus varidens	2.12	637	0.16	
Myctophidae sp. small/mix	1.42	673	0.11	
Neoharriotta pinnata	1.30	2	0.10	
Dentex macrophthalmus	0.87	4	0.07	
Ebinania costaecanarie	0.71	106	0.05	
Astronesthes sp	0.71	35	0.05	
Maurolicus muelleri	0.35	248	0.03	
Total	1308.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 24
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°39.68
start stop duration Lon E 12°39.88
TIME :13:43:01 14:14:51 31.8 (min) Purpose : 3
LOG : 2278.66 2280.09 1.4 Region : 5010
FDEPTH: 422 430 Gear cond.: 0
BDEPTH: 422 430 Validity : 0
Towing dir: 0° Wire out : 920 m Speed : 2.7 kn
Sorted : 22 Total catch: 780.04 Catch/hour: 1469.92

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Plesionika martia	548.17	274085	37.29	
Hoplostethus cadenati	448.50	23580	30.51	
Trachyrincus scabrus	94.81	1641	6.45	
Nezumia micronychodon	86.30	2371	5.87	
Merluccius paradoxus	78.51	121	5.34	98
Helicolenus dactylopterus	77.79	729	5.29	101
Deepwater fish mixture	26.74	0	1.82	
Todarodes sagittatus	19.45	60	1.32	102
Schedophilus huttoni	14.81	9	1.01	
Cruriraja parcomaculata	14.66	19	1.00	
Stomias boa boa	14.59	2067	0.99	
Chaceon maritae	10.29	15	0.70	
PANDALIDAE	9.72	2857	0.66	
Lophius vomerinus	5.01	4	0.34	99
Galeus polli	4.86	6	0.33	
Aristeus varidens	4.86	609	0.33	
Histioteuthis reversa	3.65	60	0.25	
Epigonus denticulatus	3.65	243	0.25	
Notacanthus sexspinis	1.22	60	0.08	
SERGESTIDAE	0.61	243	0.04	
Munidopsis chuni	0.61	1215	0.04	
Triplophos hemingi	0.61	60	0.04	
Beryx splendens	0.53	2	0.04	100
Total	1469.92		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 25
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°41.26
start stop duration Lon E 12°37.23
TIME :15:23:10 15:54:31 31.4 (min) Purpose : 3
LOG : 2284.98 2286.44 1.5 Region : 5010
FDEPTH: 520 522 Gear cond.: 0
BDEPTH: 520 522 Validity : 0
Towing dir: 0° Wire out : 1120 m Speed : 2.8 kn
Sorted : 27 Total catch: 430.19 Catch/hour: 823.06

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachyrincus scabrus	234.66	1839	28.51	
Nezumia micronychodon	128.14	6055	15.57	
Merluccius paradoxus	75.69	122	9.20	103
Rajella barnardi	50.82	109	6.17	
Schedophilus huttoni	45.96	80	5.58	
Eggs of ray	42.71	1270	5.19	
Selachophidium guentheri	27.03	486	3.28	
Hoplostethus cadenati	26.49	54	3.22	
Chaceon maritae	26.33	40	3.20	104
Galeus polli	25.41	270	3.09	
Lithodes ferox	24.87	189	3.02	
Nematocarcinus africanus	18.92	5298	2.30	
Anemones, white	16.22	54	1.97	
Todarodes sagittatus	15.14	54	1.84	
Deepwater fish mixture	13.52	0	1.64	
Helicolenus dactylopterus	9.73	27	1.18	
Etmopterus pusillus	8.65	27	1.05	
Lophius vomerinus	3.94	2	0.48	105
Yarrella blackfordi	3.78	243	0.46	
G A S T R O P O D S	3.78	216	0.46	
Myctophidae sp. small/mix	3.24	1676	0.39	
Bathyuroconger vicinus	3.24	163	0.39	
Bajacalifornia magalops	2.70	406	0.33	
Bathylagus sp.	2.70	189	0.33	
Opisthoteuthis agassizi	2.16	27	0.26	
Glyphus marsupialis	2.16	1460	0.26	
Notacanthus sexspinis	1.62	27	0.20	
Funchalia woodwardi	1.08	325	0.13	
Munidopsis chuni	1.08	1135	0.13	
Aristeus varidens	0.54	80	0.07	
Stomias boa boa	0.27	54	0.03	
ASTRONESTHIDAE	0.27	568	0.03	
Total	822.90		99.98	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 26
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°38.93
start stop duration Lon E 12°33.67
TIME :18:04:31 18:35:12 30.7 (min) Purpose : 3
LOG : 2292.60 2294.26 1.7 Region : 5010
FDEPTH: 618 613 Gear cond.: 0
BDEPTH: 618 613 Validity : 0
Towing dir: 0° Wire out : 1410 m Speed : 3.2 kn
Sorted : 30 Total catch: 380.02 Catch/hour: 742.96

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachyrincus scabrus	162.69	608	21.90	
Merluccius paradoxus	119.37	145	16.07	108
Todarodes sagittatus	82.56	182	11.11	
Rajella barnardi	64.75	61	8.72	
Nezumia micronychodon	55.04	2448	7.41	
Yarrella blackfordi	37.23	2326	5.01	
Bajacalifornia magalops	22.66	669	3.05	
Cruriraja parcomaculata	22.66	41	3.05	
Selachophidium guentheri	18.62	283	2.51	
Eggs of ray	18.21	0	2.45	
Deepwater fish mixture	17.81	0	2.40	
Bathylagus sp.	17.00	1275	2.29	
Hoplostethus cadenati	15.78	587	2.12	
Chaceon maritae	14.23	22	1.92	109
Holothuriidae	13.35	20	1.80	
Opisthoteuthis agassizi	10.93	41	1.47	
Heterocarpus grimaldii	10.93	829	1.47	
Benthodesmus tenuis	6.48	61	0.87	
Schedophilus huttoni	6.30	6	0.85	
Galeus polli	5.67	61	0.76	
Ebinania costaecanarie	4.05	20	0.54	
Lamprogrammus exutus	2.83	41	0.38	
Myxine capensis	2.02	20	0.27	
Myctophidae sp. small/mix	2.02	688	0.27	
Bathyuroconger vicinus	2.02	61	0.27	
Munidopsis chuni	2.02	1275	0.27	
Beryx splendens	1.68	2	0.23	110
Stomias boa boa	0.81	20	0.11	
Rajella leopardus	0.81	20	0.11	
Nephropsis atlantica	0.81	41	0.11	
Notacanthus sexspinis	0.40	20	0.05	
Starfish	0.40	20	0.05	
Aristeus varidens	0.40	41	0.05	
POLYCHAELIDAE	0.40	41	0.05	
Total	742.96		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 27
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°23.41
start stop duration Lon E 12°29.33
TIME :22:05:50 22:36:09 30.3 (min) Purpose : 3
LOG : 2308.63 2310.18 1.6 Region : 5010
FDEPTH: 595 595 Gear cond.: 0
BDEPTH: 595 595 Validity : 0
Towing dir: 0° Wire out : 1300 m Speed : 3.1 kn
Sorted : 127 Total catch: 320.02 Catch/hour: 633.28

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	144.34	166	22.79	111
Trachyrincus scabrus	126.19	596	19.93	
Selachophidium guentheri	75.10	1211	11.86	
Todarodes sagittatus	68.29	160	10.78	112
Nezumia micronychodon	53.63	1166	8.47	
Rajella barnardi	36.83	53	5.82	
Cruriraja parcomaculata	32.77	63	5.17	
Chaceon maritae	19.00	28	3.00	
Bathylagus antarcticus	13.61	851	2.15	
Heterocarpus grimaldii	8.73	582	1.38	
Ebinania costaecanarie	8.29	32	1.31	
Deepwater fish mixture	7.44	0	1.17	
Plesionika acanthurus	5.54	2770	0.87	
Bajacalifornia magalops	4.69	75	0.74	
Lamprogrammus exutus	4.47	44	0.71	
Yarrella blackfordi	3.84	309	0.61	
Gonostoma denudatum	2.99	170	0.47	
Helicolenus dactylopterus	2.14	22	0.34	
Stomias boa boa	2.14	2	0.34	
Symbolophorus boops	1.48	170	0.23	
Hoplostethus cadenati	1.29	44	0.20	
Dicrolene intronigra	1.07	10	0.17	
Galeus polli	1.07	10	0.17	
Thysanoteuthis rhombus	1.07	10	0.17	
Lampanyctodes hectoris	1.07	255	0.17	
Munidopsis chuni	0.95	950	0.15	
MASTIGOTEUTHIDAE	0.85	10	0.13	
Aristeus varidens	0.63	53	0.10	
Myxine capensis	0.63	10	0.10	
Paraliparis australis	0.63	10	0.10	
Astronesthes sp	0.44	22	0.07	
Eggs of ray	0.44	53	0.07	
Lampanyctus australis	0.44	44	0.07	
Nephropsis atlantica	0.22	10	0.03	
Nematocarcinus africanus	0.22	22	0.03	
Triplophos hemingi	0.22	22	0.03	
Starfish	0.22	10	0.03	
Melanocetus johnsoni	0.10	10	0.02	
Funchalia woodwardi	0.10	10	0.02	
Stereomastis talismani	0.10	10	0.02	
Total	633.25		99.99	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 28
DATE :16/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°20.35
start stop duration Lon E 12°32.06
TIME :23:58:40 00:28:56 30.3 (min) Purpose : 3
LOG : 2316.55 2318.00 1.4 Region : 5010
FDEPTH: 489 490 Gear cond.: 0
BDEPTH: 489 490 Validity : 0
Towing dir: 0° Wire out : 1070 m Speed : 2.9 kn
Sorted : 21 Total catch: 320.00 Catch/hour: 634.29

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	290.55	460	45.81	113
Deepwater fish mixture	39.58	0	6.24	
Helicolenus dactylopterus	38.12	272	6.01	115
Hoplostethus cadenati	35.40	842	5.58	
Aristeus varidens	28.74	2612	4.53	
Opisthoteuthis agassizi	20.28	63	3.20	
Selachophidium guentheri	17.86	408	2.82	
Todarodes sagittatus	17.86	61	2.82	116
Chaceon maritae	16.69	16	2.63	
Trachyrincus scabrus	15.12	303	2.38	
Epigonus denticulatus	14.83	303	2.34	
Nezumia micronychodon	13.62	303	2.15	
Cruriraja parcomaculata	13.32	16	2.10	
Brama brama	9.51	8	1.50	114
Galeus polli	9.38	105	1.48	
Lithodes ferox	8.46	16	1.33	
Bathyuroconger vicinus	6.66	61	1.05	
Notacanthus sexspinis	6.66	151	1.05	
Bajacalifornia magalops	6.36	787	1.00	
Yarrella blackfordi	4.54	151	0.72	
Rajella barnardi	3.92	61	0.62	
Munidopsis chuni	3.33	3330	0.52	
Stomias boa boa	3.03	309	0.48	
Symbolophorus boops	2.72	454	0.43	
Plesionika acanthurus	1.51	741	0.24	
Lampanyctodes hectoris	1.21	484	0.19	
Ebinania costaecanarie	1.21	16	0.19	
Octopus vulgaris	1.21	16	0.19	
Triplophos hemingi	0.61	61	0.10	
Lampanyctus australis	0.61	105	0.10	
Stoloteuthis leucoptera	0.61	30	0.10	
Stereomastis talismani	0.46	16	0.07	
Diaphus meadi	0.16	105	0.03	
Paraliparis australis	0.16	16	0.03	
Total	634.29		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 29
DATE :17/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°19.89
start stop duration Lon E 12°38.16
TIME :02:24:44 02:55:18 30.6 (min) Purpose : 3
LOG : 2326.44 2328.15 1.7 Region : 5010
FDEPTH: 376 377 Gear cond.: 0
BDEPTH: 376 377 Validity : 0
Towing dir: 0° Wire out : 965 m Speed : 3.3 kn
Sorted : 31 Total catch: 340.14 Catch/hour: 667.82

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	301.00	281	45.07	
Merluccius paradoxus	134.84	196	20.19	117
Cruriraja parcomaculata	40.32	47	6.04	
Aristeus varidens	36.26	7251	5.43	
Galeus polli	21.57	249	3.23	
Coelorinchus polli	19.07	312	2.85	
Chaceon maritae	16.77	24	2.51	119
Hoplostethus cadenati	14.69	454	2.20	
Deepwater fish mixture	14.07	0	2.11	
Hexanchus griseus	12.05	2	1.81	
Selachophidium guentheri	9.06	344	1.36	
Todarodes sagittatus	6.56	16	0.98	121
Lophius vomerinus	6.28	2	0.94	118
Merluccius capensis	5.89	2	0.88	120
Malacocephalus occidentalis	4.69	47	0.70	
Nezumia micronychodon	4.38	1219	0.66	
Epigonus denticulatus	3.75	126	0.56	
Bassanago albescens	2.81	16	0.42	
PANDALIDAE	2.50	703	0.37	
Coelorinchus simorhynchus	2.50	63	0.37	
Stomias boa boa	1.72	188	0.26	
Anemones, white	1.56	16	0.23	
Chrysaora sp.	1.56	0	0.23	
Chlorophthalmus agassizi	1.25	31	0.19	
Bathynectes sp.	1.25	16	0.19	
Notacanthus sexspinis	0.47	31	0.07	
Myctophidae sp. small/mix	0.31	218	0.05	
Lampanyctus australis	0.31	63	0.05	
Munidopsis chuni	0.31	406	0.05	
Total	667.82		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 30
DATE :17/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°21.50
start stop duration Lon E 12°57.06
TIME :05:56:04 06:26:04 30.0 (min) Purpose : 3
LOG : 2348.44 2349.92 1.5 Region : 5010
FDEPTH: 268 270 Gear cond.: 0
BDEPTH: 268 270 Validity : 0
Towing dir: 0° Wire out : 670 m Speed : 3.0 kn
Sorted : 39 Total catch: 709.83 Catch/hour: 1420.13

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	755.02	0	53.17	
Merluccius capensis	261.37	200	18.40	123
Chlorophthalmus agassizi	111.38	5334	7.84	
Pterothrissus belloci	85.58	586	6.03	
Aequorea sp.	52.17	0	3.67	
Sufflogobius bibarbatus	47.48	5744	3.34	
Todarodes sagittatus	32.83	88	2.31	
Macropipus australis	28.14	1553	1.98	
Lophius vomerinus	19.65	54	1.38	122
Deepwater fish mixture	7.62	0	0.54	
Coelorinchus simorhynchus	5.28	88	0.37	
Austroglossus microlepis	3.36	6	0.24	124
Galeus polli	2.93	30	0.21	
Synagrops microlepis	2.34	264	0.17	
Zenopsis conchifer	1.76	2	0.12	
Coelorinchus polli	1.76	176	0.12	
G A S T R O P O D S	0.59	88	0.04	
MYCTOPHIDAE	0.29	146	0.02	
Solenocera africana	0.29	58	0.02	
Squilla acuelata calmani	0.29	30	0.02	
Total	1420.13		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 31
DATE :17/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°22.33
start stop duration Lon E 13°14.07
TIME :08:54:27 09:21:27 27.0 (min) Purpose : 3
LOG : 2367.83 2369.41 1.6 Region : 5010
FDEPTH: 132 130 Gear cond.: 0
BDEPTH: 132 130 Validity : 0
Towing dir: 0° Wire out : 360 m Speed : 3.5 kn
Sorted : 36 Total catch: 3900.00 Catch/hour: 8663.46

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	7680.24	120524	88.65	125
Merluccius capensis	400.12	5611	4.62	127
Chelidonichthys capensis	219.59	975	2.53	126
Sufflogobius bibarbatus	126.86	21225	1.46	
Sardinops sagax	73.20	731	0.84	
Macropipus australis	68.31	5856	0.79	
G A S T R O P O D S	58.56	0	0.68	
Scomber colias	17.08	244	0.20	
Synagrops microlepis	14.64	3172	0.17	
Galeus polli	4.89	244	0.06	
Total	8663.48		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 32
DATE :17/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°54.17
start stop duration Lon E 13°16.10
TIME :16:00:20 16:13:00 12.7 (min) Purpose : 3
LOG : 2408.49 2409.12 0.6 Region : 5010
FDEPTH: 101 106 Gear cond.: 0
BDEPTH: 101 106 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 3.0 kn
Sorted : 63 Total catch: 259.89 Catch/hour: 1231.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	842.36	0	68.39	
Dead shells	271.41	0	22.04	
Sufflogobius bibarbatus	55.45	16948	4.50	
Merluccius capensis	41.00	1834	3.33	128
Trachurus capensis	17.57	100	1.43	129
Todaropsis eblanae	3.12	100	0.25	
Dicologoglossa cuneata	0.78	5	0.06	
Total	1231.71		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 33
DATE :17/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°58.26
start stop duration Lon E 12°51.35
TIME :21:51:52 22:22:06 30.2 (min) Purpose : 3
LOG : 2443.59 2445.01 1.4 Region : 5010
FDEPTH: 277 279 Gear cond.: 0
BDEPTH: 277 279 Validity : 0
Towing dir: 0° Wire out : 720 m Speed : 2.8 kn
Sorted : 101 Total catch: 280.00 Catch/hour: 555.56

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	311.31	538	56.04	130
Chrysaora fulgida	47.50	0	8.55	
Pterothrissus belloci	37.92	208	6.82	
Austroglossus microlepis	25.71	42	4.63	132
Lophius vomerinus	25.44	16	4.58	131
Todarodes sagittatus	21.63	34	3.89	133
Chlorophthalmus agassizi	18.37	873	3.31	
Macropipus australis	14.70	474	2.65	
Sufflogobius bibarbatus	12.34	1373	2.22	
Coelorinchus simorhynchus	11.35	159	2.04	
Galeus polli	8.49	159	1.53	
Neoharriotta pinnata	6.81	4	1.23	
Deepwater fish mixture	6.81	0	1.23	
Hexanchus griseus	3.61	2	0.65	
Coelorinchus polli	1.09	34	0.20	
Helicolenus dactylopterus	0.60	179	0.11	134
Solenocera africana	0.50	113	0.09	
Squilla mantis	0.50	14	0.09	
Histioteuthis reversa	0.40	10	0.07	
Malacocephalus occidentalis	0.20	4	0.04	
Synagrops microlepis	0.20	10	0.04	
Lampanyctodes hectoris	0.10	79	0.02	
Total	555.56		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 34
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°0.11
start stop duration Lon E 12°43.49
TIME :00:14:13 00:44:14 30.0 (min) Purpose : 3
LOG : 2454.29 2455.84 1.6 Region : 5010
FDEPTH: 345 347 Gear cond.: 0
BDEPTH: 345 347 Validity : 0
Towing dir: 0° Wire out : 820 m Speed : 3.1 kn
Sorted : 91 Total catch: 269.95 Catch/hour: 539.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	312.48	827	57.94	135
Merluccius paradoxus	50.15	106	9.30	136
Chlorophthalmus agassizi	42.03	1371	7.79	
Helicolenus dactylopterus	36.51	1269	6.77	138
Lophius vomerinus	27.93	16	5.18	137
Galeus polli	21.75	623	4.03	
Coelorinchus simorhynchus	11.49	278	2.13	
Nezumia micronychodon	6.54	166	1.21	
Deepwater fish mixture	5.52	0	1.02	
Coelorinchus polli	4.28	90	0.79	
Chrysaora sp.	3.83	0	0.71	
Epigonus denticulatus	2.93	70	0.54	
Bathynectes piperitus	2.71	90	0.50	
Sponge bristled	2.71	16	0.50	
PANDALIDAE	2.31	731	0.43	
Macropipus australis	2.03	118	0.38	
Ebinania costaecanarie	1.69	80	0.31	
Diaphus meadi	0.56	218	0.10	
Symbolophorus boops	0.45	48	0.08	
Malacocephalus occidentalis	0.45	10	0.08	
Maurolicus muelleri	0.34	278	0.06	
Stomias boa boa	0.23	22	0.04	
Lampanyctodes hectoris	0.23	128	0.04	
Laemonema laureysi	0.11	6	0.02	
CORAL	0.11	10	0.02	
Total	539.36		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 35
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°6.90
start stop duration Lon E 12°31.17
TIME :03:54:45 04:25:03 30.3 (min) Purpose : 3
LOG : 2471.63 2473.12 1.5 Region : 5010
FDEPTH: 453 451 Gear cond.: 0
BDEPTH: 453 451 Validity : 0
Towing dir: 0° Wire out : 1040 m Speed : 3.0 kn
Sorted : 114 Total catch: 280.00 Catch/hour: 554.27

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	255.68	396	46.13	139
Nezumia micronychodon	101.39	2457	18.29	
Helicolenus dactylopterus	32.17	243	5.80	140
Selachophidium guentheri	30.19	766	5.45	
Hoplostethus cadenati	22.47	614	4.05	
Notacanthus sexspinis	14.67	228	2.65	
Galeus polli	12.85	172	2.32	
Aristeus varidens	12.37	871	2.23	141
Chaceon maritae	9.62	14	1.74	142
Glyphus marsupialis	9.32	3733	1.68	
Trachyrincus scabrus	8.37	152	1.51	
Deepwater fish mixture	7.72	0	1.39	
Yarrella blackfordi	6.10	495	1.10	
Cruriraja parcomaculata	5.72	24	1.03	
Bathyuroconger vicinus	4.77	133	0.86	
Ebinania costaecanarie	4.20	34	0.76	
Lophius vomerinus	4.16	2	0.75	143
Todarodes sagittatus	2.47	4	0.45	
Funchalia woodwardi	2.20	1067	0.40	
Myctophidae sp. small/mix	2.20	1109	0.40	
Etmopterus brachyurus	1.52	4	0.28	
Anemones, white	1.33	4	0.24	
Nematocarcinus africanus	1.25	342	0.22	
Gadella imberbis	0.57	38	0.10	
Epigonus telescopus	0.48	20	0.09	
Stomias boa boa	0.20	20	0.04	
Munidopsis chuni	0.10	115	0.02	
Lampanyctus australis	0.10	38	0.02	
POLYCHAELIDAE	0.10	20	0.02	
Total	554.27		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 36
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°8.83
start stop duration Lon E 12°27.05
TIME :07:43:56 08:15:22 31.4 (min) Purpose : 3
LOG : 2484.20 2485.75 1.5 Region : 5010
FDEPTH: 543 541 Gear cond.: 0
BDEPTH: 543 541 Validity : 0
Towing dir: 0° Wire out : 1150 m Speed : 2.9 kn
Sorted : 28 Total catch: 370.00 Catch/hour: 706.56

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachyrincus scabrus	255.96	1587	36.23	
Merluccius paradoxus	115.88	147	16.40	144
Selachophidium guentheri	59.01	1079	8.35	
Nezumia micronychodon	54.54	3256	7.72	
Chaceon maritae	29.71	38	4.21	145
Yarrella blackfordi	26.45	1975	3.74	
Glyphus marsupialis	26.05	10417	3.69	
Bathylagus sp.	24.00	5595	3.40	
Bathyuroconger vicinus	16.69	244	2.36	
Helicolenus dactylopterus	14.65	122	2.07	146
Bajacalifornia magalops	11.80	590	1.67	
Deepwater fish mixture	10.58	0	1.50	
Funchalia woodwardi	9.36	813	1.32	
Hoplostethus cadenati	8.13	204	1.15	
Rajella barnardi	7.73	101	1.09	
Dicrolene intronigra	7.73	306	1.09	
Ebinania costaecanarie	5.29	21	0.75	
Opisthoteuthis agassizi	4.47	40	0.63	
Todarodes sagittatus	4.47	21	0.63	
Galeus polli	3.67	40	0.52	
Epigonus telescopus	2.85	40	0.40	
Munidopsis chuni	2.04	1505	0.29	
Aristeus varidens	2.04	183	0.29	
Myctophidae sp. small/mix	0.82	325	0.12	
POLYCHAELIDAE	0.82	61	0.12	
Nephropsis atlantica	0.40	21	0.06	
Lampadena pontifex	0.40	21	0.06	
Stomias boa boa	0.40	40	0.06	
Bufoceratias wedli	0.40	61	0.06	
Sudis sp.	0.21	21	0.03	
Total	706.56		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 37
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 21°9.67
start stop duration Lon E 12°23.30
TIME :10:07:56 10:38:09 30.2 (min) Purpose : 3
LOG : 2492.34 2493.72 1.4 Region : 5010
FDEPTH: 629 630 Gear cond.: 0
BDEPTH: 629 630 Validity : 0
Towing dir: 0° Wire out : 1250 m Speed : 2.7 kn
Sorted : 102 Total catch: 410.00 Catch/hour: 814.03

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	249.69	304	30.67	147
Trachyrincus scabrus	126.69	556	15.56	
Nezumia micronychodon	93.63	2837	11.50	
Chaceon maritae	92.30	32	11.34	148
Selachophidium guentheri	41.26	675	5.07	
Bajacalifornia magalops	37.56	403	4.61	
Yarrella blackfordi	32.54	2500	4.00	
Bathyuroconger vicinus	20.63	224	2.53	
Heterocarpus grimaldii	20.09	1342	2.47	
Lophius vomerinus	17.27	4	2.12	149
Cruriraja parcomaculata	15.72	32	1.93	
Ebinania costaecanarie	9.39	46	1.15	
Hoplostethus cadenati	7.27	151	0.89	
Rajella barnardi	6.83	10	0.84	
Neoharriotta pinnata	6.75	4	0.83	
Sea anemone sp	5.68	20	0.70	
Deania profundorum	4.37	6	0.54	
Opisthoteuthis agassizi	3.83	20	0.47	
Munidopsis chuni	3.57	3572	0.44	
Bathylagus antarcticus	3.43	312	0.42	
Trachipterus trachypterus	2.38	6	0.29	
Melanocetus johnsoni	2.24	119	0.28	
Plesionika acanthurus	1.85	615	0.23	
Octopus vulgaris	1.05	20	0.13	
Lamprogrammus exutus	0.93	20	0.11	
Coral - small	0.93	60	0.11	
Aristeus varidens	0.79	60	0.10	
Epigonus telescopus	0.79	6	0.10	
Dicrolene intronigra	0.79	6	0.10	
Stereomastis sp.	0.66	60	0.08	
Nephropsis atlantica	0.66	46	0.08	
Lampanyctus australis	0.54	93	0.07	
Notacanthus sexspinis	0.40	6	0.05	
Starfish	0.40	20	0.05	
Astronesthes sp	0.26	20	0.03	
Stomias boa boa	0.26	40	0.03	
Triplophos hemingi	0.14	20	0.02	
Phosichthys argenteus	0.14	14	0.02	
Bathophilus sp.	0.14	6	0.02	
Sergestes sp.	0.14	34	0.02	
Total	814.01		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 38
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°53.66
start stop duration Lon E 12°15.17
TIME :12:58:59 13:30:52 31.9 (min) Purpose : 3
LOG : 2510.03 2511.55 1.5 Region : 5010
FDEPTH: 622 621 Gear cond.: 0
BDEPTH: 622 621 Validity : 0
Towing dir: 0° Wire out : 1260 m Speed : 2.9 kn
Sorted : 57 Total catch: 630.00 Catch/hour: 1185.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	420.62	645	35.49	150
Trachyrincus scabrus	159.45	645	13.45	
Nezumia micronychodon	152.17	4608	12.84	
Selachophidium guentheri	122.93	1659	10.37	
Chaceon maritae	46.77	83	3.95	151
Schedophilus cf huttoni	45.11	36	3.81	
Heterocarpus grimaldii	37.95	2924	3.20	
Yarrella blackfordi	31.75	1445	2.68	
Deepwater fish mixture	26.50	0	2.24	
Rajella barnardi	21.72	83	1.83	
Sea anemone sp	16.71	47	1.41	
Lophius vomerinus	15.80	6	1.33	152
Todarodes sagittatus	15.28	36	1.29	
Bajacalifornia magalops	13.61	190	1.15	
Etmopterus pusillus	12.70	4	1.07	
Plesionika acanthurus	7.64	1910	0.64	
Deania profundorum	7.34	6	0.62	
Notacanthus sexspinis	6.68	47	0.56	
Aristeus varidens	3.82	239	0.32	
Myxine capensis	3.58	47	0.30	
Bufoceratias wedli	3.34	36	0.28	
Munidopsis chuni	2.86	2864	0.24	
Ebinania costaecanarie	1.91	11	0.16	
Bathylagus antarcticus	1.67	60	0.14	
Lampanyctus australis	1.43	154	0.12	
Bathyuroconger vicinus	1.43	11	0.12	
Hoplostethus cadenati	0.95	24	0.08	
Plesionika martia	0.72	190	0.06	
Stereomastis talismani	0.72	60	0.06	
Lampanyctodes hectoris	0.48	96	0.04	
Bathophilus sp.	0.48	11	0.04	
Coral - small	0.48	96	0.04	
Nephropsis atlantica	0.24	24	0.02	
Funchalia woodwardi	0.24	11	0.02	
PASIPHAEIDAE	0.12	11	0.01	
Sergestes sp.	0.12	11	0.01	
Total	1185.32		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 39
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°52.14
start stop duration Lon E 12°18.46
TIME :15:10:34 15:40:37 30.1 (min) Purpose : 3
LOG : 2516.77 2518.05 1.3 Region : 5010
FDEPTH: 538 532 Gear cond.: 0
BDEPTH: 538 532 Validity : 0
Towing dir: 0° Wire out : 1100 m Speed : 2.6 kn
Sorted : 64 Total catch: 1320.00 Catch/hour: 2635.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	1490.75	0	56.56	
Trachyrincus scabrus	265.55	1955	10.08	
Merluccius paradoxus	216.88	200	8.23	153
Nezumia micronychodon	165.97	10548	6.30	
Selachophidium guentheri	104.74	2138	3.97	
Chaceon maritae	58.46	88	2.22	
Schedophilus cf huttoni	58.27	36	2.21	
Rajella barnardi	48.68	294	1.85	
Anemones, white	41.31	74	1.57	
Deepwater fish mixture	36.88	0	1.40	
Lithodes ferox	35.41	36	1.34	
Yarrella blackfordi	26.55	1328	1.01	
Lophius vomerinus	14.86	4	0.56	154
Bajacalifornia magalops	13.28	885	0.50	
Notacanthus sexspinis	13.28	74	0.50	
Helicolenus dactylopterus	11.06	74	0.42	155
Munidopsis chuni	5.16	1659	0.20	
Aristeus varidens	4.43	294	0.17	
Glyphus marsupialis	3.69	1438	0.14	
Bathylagus sp.	2.95	258	0.11	
Galeus polli	2.95	36	0.11	
Nematocarcinus africanus	2.21	443	0.08	
Hoplostethus cadenati	2.21	74	0.08	
Bathyuroconger vicinus	2.21	36	0.08	
Brama brama	1.96	2	0.07	
Triplophos hemingi	1.48	184	0.06	
Bufoceratias wedli	1.48	74	0.06	
Gadella imberbis	1.48	110	0.06	
Stomias boa boa	0.74	36	0.03	
Heterocarpus grimaldii	0.74	36	0.03	
Total	2635.61		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 40
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°51.03
start stop duration Lon E 12°24.29
TIME :17:30:52 18:01:54 31.0 (min) Purpose : 3
LOG : 2525.55 2527.08 1.5 Region : 5010
FDEPTH: 417 419 Gear cond.: 0
BDEPTH: 417 419 Validity : 0
Towing dir: 0° Wire out : 880 m Speed : 2.9 kn
Sorted : 34 Total catch: 310.00 Catch/hour: 599.42

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	146.95	311	24.52	156
Chrysaora sp.	95.91	0	16.00	
Helicolenus dactylopterus	47.37	410	7.90	158
Glyphus marsupialis	37.32	17165	6.23	
Nezumia micronychodon	34.42	1984	5.74	
Hoplostethus cadenati	32.48	1547	5.42	
Schedophilus huttoni	32.29	39	5.39	
Rajella barnardi	25.52	64	4.26	
Yarrella blackfordi	25.14	524	4.19	
Selachophidium guentheri	18.95	1176	3.16	
Deepwater fish mixture	18.18	0	3.03	
Todarodes sagittatus	13.73	64	2.29	
Chaceon maritae	12.76	19	2.13	157
Galeus polli	12.18	244	2.03	
Aristeus varidens	10.44	1303	1.74	159
Prionace glauca	6.77	2	1.13	
Nematocarcinus africanus	5.61	1522	0.94	
Myctophidae sp. small/mix	5.41	946	0.90	
Coelorinchus polli	3.87	89	0.65	
Bathyuroconger vicinus	2.51	89	0.42	
Ebinania costaecanarie	2.32	14	0.39	
Chlorophthalmus agassizi	2.13	64	0.35	
Triplophos hemingi	1.74	307	0.29	
Laemonema laureysi	1.35	14	0.23	
Munidopsis chuni	0.77	563	0.13	
Thysanoteuthis rhombus	0.77	14	0.13	
Stomias boa boa	0.77	89	0.13	
Coelorinchus simorhynchus	0.77	14	0.13	
Lampanyctus australis	0.19	50	0.03	
Starfish	0.19	14	0.03	
Bathylagus sp.	0.19	14	0.03	
Gadella imberbis	0.19	25	0.03	
Trachyrincus scabrus	0.19	14	0.03	
Total	599.42		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 41
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°46.91
start stop duration Lon E 12°31.57
TIME :20:11:02 20:41:20 30.3 (min) Purpose : 3
LOG : 2538.42 2539.93 1.5 Region : 5010
FDEPTH: 335 341 Gear cond.: 0
BDEPTH: 335 341 Validity : 0
Towing dir: 0° Wire out : 880 m Speed : 3.0 kn
Sorted : 38 Total catch: 450.00 Catch/hour: 891.09

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	281.19	244	31.56	160
Galeus polli	164.55	2208	18.47	162
Helicolenus dactylopterus	105.58	3410	11.85	163
Merluccius paradoxus	104.95	253	11.78	161
Chrysaora sp.	52.87	0	5.93	
Chaceon maritae	28.69	53	3.22	
Nezumia micronychodon	24.97	531	2.80	
Nematocarcinus africanus	21.52	6604	2.42	
Coelorinchus polli	18.06	598	2.03	
Deepwater fish mixture	17.01	0	1.91	
Neoharriotta pinnata	16.22	34	1.82	
Bathynectes piperitus	11.43	279	1.28	
Todarodes sagittatus	7.98	14	0.90	
Malacocephalus laevis	6.38	67	0.72	
Chlorophthalmus agassizi	6.12	172	0.69	
Lophius vomerinus	5.23	4	0.59	
Epigonus telescopus	5.05	172	0.57	
PORIFERA (Sponges)	4.26	53	0.48	
MYCTOPHIDAE	3.98	798	0.45	
Coelorinchus simorhynchus	1.86	26	0.21	
Guentherus altivela	1.07	14	0.12	
G A S T R O P O D S	1.07	107	0.12	
Ebinania costaecanarie	0.53	14	0.06	
Munidopsis chuni	0.26	160	0.03	
Bathyuroconger vicinus	0.26	14	0.03	
Total	891.09		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 42
DATE :18/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°41.04
start stop duration Lon E 12°37.90
TIME :22:54:15 23:24:40 30.4 (min) Purpose : 3
LOG : 2552.57 2554.14 1.6 Region : 5010
FDEPTH: 309 309 Gear cond.: 0
BDEPTH: 309 309 Validity : 0
Towing dir: 0° Wire out : 720 m Speed : 3.1 kn
Sorted : 232 Total catch: 740.00 Catch/hour: 1459.09

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora hysoscella	645.76	0	44.26	
Merluccius capensis	471.03	29087	32.28	164
Sufflogobius bibarbatus	66.23	6623	4.54	
Chlorophthalmus agassizi	64.06	29117	4.39	
Macropipus australis	43.28	1800	2.97	
Lophius vomerinus	41.25	30	2.83	166
Deepwater fish mixture	33.97	0	2.33	
Helicolenus dactylopterus	29.38	296	2.01	167
Galeus polli	10.15	205	0.70	
Austroglossus microlepis	9.19	12	0.63	165
Todarodes sagittatus	8.10	18	0.56	168
Centrolophus niger	6.59	2	0.45	
Coelorinchus polli	6.53	327	0.45	
Bathynectes piperitus	6.17	126	0.42	
Squilla acuelata calmani	4.24	199	0.29	
PORIFERA (Sponges)	3.86	61	0.26	
Solenocera africana	3.63	726	0.25	
Malacocephalus laevis	3.14	35	0.21	
Allothunnus fallai	1.58	6	0.11	
Todaropsis eblanae	0.35	12	0.02	
Ascidiacea	0.24	30	0.02	
Lampanyctodes hectoris	0.18	138	0.01	
G A S T R O P O D S	0.12	12	0.01	
Diaphus meadi	0.06	24	0.00	
Total	1459.09		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 43
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°37.45
start stop duration Lon E 12°47.39
TIME :01:29:59 02:00:14 30.3 (min) Purpose : 3
LOG : 2567.05 2568.73 1.7 Region : 5010
FDEPTH: 198 206 Gear cond.: 0
BDEPTH: 198 206 Validity : 0
Towing dir: 0° Wire out : 520 m Speed : 3.3 kn
Sorted : 194 Total catch: 1720.00 Catch/hour: 3411.57

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora fulgida	1997.04	0	58.54	
Merluccius capensis	1276.22	10582	37.41	169
Macropipus australis	46.81	2340	1.37	
Pterothrissus belloci	37.67	801	1.10	
Sufflogobius bibarbatus	28.86	2220	0.85	
Deepwater fish mixture	19.00	0	0.56	
Todarodes sagittatus	4.22	18	0.12	
Ascidiacea	0.69	83	0.02	
Synagrops microlepis	0.69	101	0.02	
Sea anemone sp	0.36	18	0.01	
Total	3411.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 44
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°25.66
start stop duration Lon E 12°29.84
TIME :05:39:13 06:09:30 30.3 (min) Purpose : 3
LOG : 2590.05 2591.62 1.6 Region : 5010
FDEPTH: 278 279 Gear cond.: 0
BDEPTH: 278 279 Validity : 0
Towing dir: 0° Wire out : 730 m Speed : 3.1 kn
Sorted : 206 Total catch: 2150.00 Catch/hour: 4261.65

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	3000.54	0	70.41	
Merluccius capensis	963.28	2065	22.60	170
Pterothrissus belloci	125.16	682	2.94	
Galeus polli	59.89	515	1.41	
Coelorinchus simorhynchus	22.31	268	0.52	
Squalus megalops	21.89	42	0.51	
Macropipus australis	19.00	723	0.45	
Austroglossus microlepis	14.46	20	0.34	172
Lophius vomerinus	12.80	61	0.30	171
Sufflogobius bibarbatus	11.15	1300	0.26	
Chlorophthalmus agassizi	7.44	289	0.17	
Coelorinchus polli	2.07	61	0.05	
Malacocephalus laevis	1.65	20	0.04	
Total	4261.65		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 45
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°34.10
start stop duration Lon E 12°13.47
TIME :09:13:28 09:43:27 30.0 (min) Purpose : 3
LOG : 2612.76 2614.22 1.5 Region : 5010
FDEPTH: 345 346 Gear cond.: 0
BDEPTH: 345 346 Validity : 0
Towing dir: 0° Wire out : 830 m Speed : 2.9 kn
Sorted : 103 Total catch: 2230.00 Catch/hour: 4462.98

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	2653.99	0	59.47	
Merluccius capensis	1471.38	2700	32.97	173
Helicolenus dactylopterus	117.40	1371	2.63	174
Miscellaneous fishes	92.54	0	2.07	
Chlorophthalmus agassizi	30.00	1243	0.67	
Lophius vomerinus	21.37	26	0.48	
Plesionika martia	16.71	16711	0.37	
Ruvettus pretiosus	16.69	4	0.37	
Galeus polli	12.85	128	0.29	
Nezumia micronychodon	8.85	4	0.20	
Heptranchias perlo	7.04	2	0.16	
Todarodes sagittatus	6.00	42	0.13	
Aristeus varidens	2.56	600	0.06	
Bathynectes piperitus	2.14	42	0.05	
Synagrops microlepis	1.72	86	0.04	
Symbolophorus boops	0.86	86	0.02	
Ebinania costaecanarie	0.42	42	0.01	
Krill	0.42	428	0.01	
Total	4462.96		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 46
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°35.76
start stop duration Lon E 12°8.35
TIME :11:15:27 11:45:46 30.3 (min) Purpose : 3
LOG : 2622.47 2624.06 1.6 Region : 5010
FDEPTH: 463 472 Gear cond.: 0
BDEPTH: 463 472 Validity : 0
Towing dir: 0° Wire out : 1050 m Speed : 3.1 kn
Sorted : 68 Total catch: 320.00 Catch/hour: 633.25

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	87.57	113	13.83	
Nezumia micronychodon	81.75	1668	12.91	
Hoplostethus cadenati	62.00	1724	9.79	
Plesionika martia	57.63	28813	9.10	
Yarrella blackfordi	53.74	2557	8.49	
Merluccius paradoxus	48.68	89	7.69	175
Helicolenus dactylopterus	37.07	162	5.85	180
Cruriraja parcomaculata	27.68	49	4.37	
Centrolophus niger	27.03	16	4.27	
Selachophidium guentheri	23.79	663	3.76	
Ebinania costaecanarie	19.75	154	3.12	
Schedophilus huttoni	17.89	14	2.82	
Aristeus varidens	16.67	1189	2.63	
Chaceon maritae	14.29	40	2.26	176
Deepwater fish mixture	11.17	0	1.76	
Galeus polli	9.71	97	1.53	
Todarodes sagittatus	7.12	24	1.12	179
S H R I M P S	5.99	1561	0.95	
Opisthoteuthis agassizi	3.88	8	0.61	
Bathyuroconger vicinus	3.88	97	0.61	
Lamprogrammus exutus	3.24	57	0.51	
Rajella barnardi	2.27	8	0.36	
Sea anemone sp	1.94	8	0.31	
Stomias boa boa	1.78	194	0.28	
Epigonus telescopus	1.46	57	0.23	
Chlorophthalmus agassizi	1.13	32	0.18	
Trachyrincus scabrus	0.97	40	0.15	
Lampanyctus australis	0.97	139	0.15	
Notacanthus sexspinis	0.81	16	0.13	
Bathylagus antarcticus	0.65	73	0.10	
Aequorea forskalea	0.32	24	0.05	
MYCTOPHIDAE	0.16	97	0.03	
Triplophos hemingi	0.16	32	0.03	
Stereomastis sp.	0.08	16	0.01	
Total	633.25		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 47
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°35.46
start stop duration Lon E 12°3.35
TIME :13:29:50 14:00:16 30.4 (min) Purpose : 3
LOG : 2629.89 2631.35 1.4 Region : 5010
FDEPTH: 580 578 Gear cond.: 0
BDEPTH: 580 578 Validity : 0
Towing dir: 0° Wire out : 1200 m Speed : 2.9 kn
Sorted : 30 Total catch: 810.00 Catch/hour: 1597.11

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Sea anemone sp	407.46	2076	25.51	
Nezumia micronychodon	303.65	8910	19.01	
Trachyrincus scabrus	294.97	1341	18.47	
Merluccius paradoxus	150.64	211	9.43	177
Selachophidium guentheri	131.50	2250	8.23	
Chaceon maritae	68.77	134	4.31	
Chrysaora sp.	47.58	0	2.98	
Rajella barnardi	28.83	22	1.80	
Bathyraja smithii	18.26	2	1.14	
Miscellaneous fishes	17.31	0	1.08	
Neoharriotta pinnata	16.21	2	1.01	
Lophius vomerinus	12.97	4	0.81	178
Etmopterus pusillus	12.11	43	0.76	
Yarrella blackfordi	10.39	432	0.65	
Bajacalifornia magalops	8.66	347	0.54	
Schedophilus huttoni	8.16	10	0.51	
Notacanthus sexspinis	7.79	130	0.49	
Bathylagus antarcticus	6.92	304	0.43	
Bathyuroconger vicinus	6.92	87	0.43	
Hoplostethus cadenati	6.05	174	0.38	
Deania profundorum	5.99	4	0.38	
Stomias boa boa	5.19	174	0.32	
Heterocarpus grimaldii	4.32	217	0.27	
Bathynectes piperitus	4.32	43	0.27	
Triplophos hemingi	3.47	347	0.22	
Plesionika martia	2.60	1211	0.16	
MELANOCETIDAE	1.74	43	0.11	
Leptoderma sp.	1.74	43	0.11	
Munidopsis sp.	0.87	1254	0.05	
Stereomastis sp.	0.87	43	0.05	
Aristeus varidens	0.87	87	0.05	
Total	1597.11		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 48
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°18.31
start stop duration Lon E 11°49.51
TIME :16:45:11 17:15:30 30.3 (min) Purpose : 3
LOG : 2651.42 2652.89 1.5 Region : 5010
FDEPTH: 683 684 Gear cond.: 0
BDEPTH: 683 684 Validity : 0
Towing dir: 0° Wire out : 1370 m Speed : 2.9 kn
Sorted : 29 Total catch: 620.00 Catch/hour: 1226.51

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachyrincus scabrus	292.88	1215	23.88	
Merluccius paradoxus	233.39	212	19.03	181
Nezumia micronychodon	149.00	6619	12.15	
Selachophidium guentheri	147.08	2111	11.99	
Bathyraja smithii	118.30	32	9.65	
Deania quadrispinosa	55.63	32	4.54	
Chaceon maritae	36.32	109	2.96	182
Ebinania costaecanarie	30.70	59	2.50	
Bajacalifornia magalops	29.42	799	2.40	
Anemones, white	24.95	32	2.03	
Todarodes sagittatus	23.66	32	1.93	0
Lophius vomerinus	16.62	2	1.35	184
Bathyuroconger vicinus	14.07	95	1.15	
Cruriraja parcomaculata	11.51	63	0.94	
Dicrolene intronigra	7.68	63	0.63	
Heterocarpus grimaldii	7.04	671	0.57	
Bathylagus sp.	6.39	447	0.52	
Yarrella blackfordi	5.12	208	0.42	
Triplophos hemingi	2.87	32	0.23	
Lophius vaillanti	2.73	2	0.22	185
Munidopsis chuni	2.55	2659	0.21	
Todarodes sagittatus	2.55	415	0.21	
Stomias boa boa	2.55	32	0.21	
Stomias boa boa	2.55	95	0.21	0
POLYCHAELIDAE	0.63	32	0.05	
POLYCHAELIDAE	0.32	32	0.03	0
Total	1226.51		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 49
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°17.28
start stop duration Lon E 11°52.17
TIME :18:58:18 19:29:36 31.3 (min) Purpose : 3
LOG : 2658.16 2659.78 1.6 Region : 5010
FDEPTH: 599 598 Gear cond.: 0
BDEPTH: 599 598 Validity : 0
Towing dir: 0° Wire out : 1325 m Speed : 3.1 kn
Sorted : 180 Total catch: 630.00 Catch/hour: 1207.67

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius paradoxus	342.13	464	28.33	186
Trachyrincus scabrus	220.11	920	18.23	
Nezumia micronychodon	198.61	8856	16.45	
Selachophidium guentheri	133.44	2224	11.05	
Bathyraja smithii	130.48	21	10.80	
Centroscymnus coelolepis	53.08	21	4.40	
Chaceon maritae	24.46	54	2.03	187
Yarrella blackfordi	18.28	880	1.51	
Bajacalifornia magalops	15.18	174	1.26	
Miscellaneous fishes	14.51	0	1.20	
Moroteuthis robsoni	12.50	8	1.03	
Hoplostethus cadenati	8.60	222	0.71	
Bathyuroconger vicinus	5.51	48	0.46	
Anemones, pink	4.43	8	0.37	
Deania profundorum	4.17	8	0.34	
Bathylagus sp.	3.63	410	0.30	
Ebinania costaecanarie	3.63	21	0.30	
Rajella barnardi	2.69	8	0.22	
Todarodes sagittatus	2.68	8	0.22	
Munidopsis chuni	2.02	1250	0.17	
Chlorophthalmus agassizi	1.88	48	0.16	
Helicolenus dactylopterus	1.08	13	0.09	
MYCTOPHIDAE	0.81	155	0.07	
Stomias boa boa	0.81	54	0.07	
Lamprogrammus exutus	0.67	13	0.06	
Heterocarpus grimaldii	0.67	94	0.06	
Dicrolene intronigra	0.67	27	0.06	
Lampanyctus australis	0.40	54	0.03	
Aristeus varidens	0.27	21	0.02	
Guentherus altivela	0.13	8	0.01	
Histioteuthis reversa	0.07	8	0.01	
POLYCHAELIDAE	0.07	8	0.01	
Total	1207.67		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 50
DATE :19/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°17.13
start stop duration Lon E 11°55.29
TIME :20:38:29 21:09:07 30.6 (min) Purpose : 3
LOG : 2664.53 2666.25 1.7 Region : 5010
FDEPTH: 515 516 Gear cond.: 0
BDEPTH: 515 516 Validity : 0
Towing dir: 0° Wire out : 1270 m Speed : 3.4 kn
Sorted : 115 Total catch: 330.00 Catch/hour: 646.21

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius paradoxus	288.78	164	44.69	188
Hoplostethus cadenati	74.63	1821	11.55	
Nezumia micronychodon	59.33	1854	9.18	
Trachyrincus scabrus	48.09	370	7.44	
Chlorophthalmus agassizi	32.92	916	5.09	
Selachophidium guentheri	27.75	619	4.29	
Helicolenus dactylopterus	12.47	3830	1.93	189
Plesionika martia	11.24	4686	1.74	
Lophius vaillanti	11.01	6	1.70	191
Todarodes sagittatus	10.79	27	1.67	190
Sea pens	10.67	225	1.65	
Chaceon maritae	8.87	18	1.37	192
Rajella barnardi	7.09	51	1.10	
Ruvettus pretiosus	6.85	25	1.06	
Aristeus varidens	5.74	523	0.89	
Yarrella blackfordi	5.39	258	0.83	
Cruriraja parcomaculata	5.05	33	0.78	
Galeus polli	4.50	45	0.70	
Deania calcea	3.60	25	0.56	
Bathyuroconger vicinus	1.35	33	0.21	
Etmopterus pusillus	1.12	25	0.17	
Munidopsis sp.	1.12	1124	0.17	
Lampanyctodes hectoris	0.90	2581	0.14	
Bathylagus antarcticus	0.78	108	0.12	
Symbolophorus boops	0.78	102	0.12	
Lampanyctus australis	0.78	117	0.12	
Triplophos hemingi	0.78	108	0.12	
Melanostomias niger	0.78	33	0.12	
Stomias boa boa	0.78	84	0.12	
Laemonema laureysi	0.57	12	0.09	
Gonostoma denudatum	0.45	39	0.07	
Epigonus telescopus	0.45	12	0.07	
Myxine capensis	0.33	25	0.05	
Bathophilus longipinnis	0.22	22	0.03	
Stereomastis sp.	0.12	22	0.02	
Astronesthes sp	0.12	25	0.02	
Total	646.21		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 51
DATE :20/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°15.77
start stop duration Lon E 11°58.24
TIME :00:32:19 01:02:27 30.1 (min) Purpose : 3
LOG : 2676.26 2677.73 1.5 Region : 5010
FDEPTH: 416 418 Gear cond.: 0
BDEPTH: 416 418 Validity : 0
Towing dir: 0° Wire out : 900 m Speed : 2.9 kn
Sorted : 93 Total catch: 360.00 Catch/hour: 716.66

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	268.51	641	37.47	193
Helicolenus dactylopterus	62.75	792	8.76	195
Chaceon maritae	62.03	121	8.66	194
Chlorophthalmus agassizi	46.48	1368	6.49	
Lophius vaillanti	37.23	4	5.19	
Selachophidium guentheri	33.96	2126	4.74	
Galeus polli	27.77	245	3.88	
Deepwater fish mixture	25.90	0	3.61	
Aristeus varidens	25.46	3191	3.55	
Nezumia micronychodon	24.74	1123	3.45	
Cruriraja parcomaculata	13.52	22	1.89	
Lophius vomerinus	13.38	4	1.87	
S H R I M P S	12.08	4025	1.69	
Todarodes sagittatus	10.35	28	1.44	
Coelorinchus polli	8.34	231	1.16	
Schedophilus huttoni	8.06	8	1.13	
Rajella leopardus	7.62	72	1.06	
Ebinania costaecanarie	4.32	22	0.60	
Hoplostethus cadenati	4.18	129	0.58	
Lampanyctus australis	3.03	324	0.42	
Epigonus telescopus	2.89	129	0.40	
Etmopterus pusillus	2.15	8	0.30	
Plesionika martia	1.87	1873	0.26	
Trachyrincus scabrus	1.59	22	0.22	
Bathynectes piperitus	1.29	28	0.18	
Stomias boa boa	1.15	107	0.16	
Malacocephalus occidentalis	1.07	14	0.15	
SOFT SPONGES	1.02	8	0.14	
Triplophos hemingi	1.02	223	0.14	
Sea pens	0.72	0	0.10	
Munidopsis sp.	0.58	577	0.08	
Waste General	0.44	0	0.06	
Physiculus cyanostrophus	0.44	8	0.06	
Symbolophorus boops	0.44	44	0.06	
MYCTOPHIDAE	0.28	330	0.04	
Total	716.66		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 52
DATE :20/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°10.30
start stop duration Lon E 12°13.53
TIME :05:33:33 06:03:38 30.1 (min) Purpose : 3
LOG : 2695.74 2697.36 1.6 Region : 5010
FDEPTH: 280 280 Gear cond.: 0
BDEPTH: 280 280 Validity : 0
Towing dir: 0° Wire out : 720 m Speed : 3.2 kn
Sorted : 25 Total catch: 130.05 Catch/hour: 259.24

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	90.30	225	34.83	196
Sufflogobius bibarbatus	56.63	341	21.85	
Chrysaora sp.	50.95	0	19.65	
Macropipus australis	45.93	2601	17.72	
Miscellaneous fishes	8.83	0	3.41	
Bristle worms	3.27	0	1.26	
Squilla acuelata calmani	1.89	110	0.73	
Myctophidae sp. small/mix	0.96	1473	0.37	
G A S T R O P O D S	0.28	48	0.11	
Munidopsis chuni	0.14	510	0.05	
Chlorophthalmus agassizi	0.06	6	0.02	
Total	259.24		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 53
DATE :20/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 20°6.53
start stop duration Lon E 12°26.16
TIME :08:16:38 09:04:15 47.6 (min) Purpose : 3
LOG : 2711.27 2713.21 1.9 Region : 5010
FDEPTH: 207 209 Gear cond.: 6
BDEPTH: 207 209 Validity : 5
Towing dir: 0° Wire out : 0 m Speed : 2.5 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
NOCATOO	0.00	0	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 54
DATE :20/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°50.05
start stop duration Lon E 12°12.35
TIME :19:44:29 20:15:05 30.6 (min) Purpose : 3
LOG : 2791.72 2793.30 1.6 Region : 5010
FDEPTH: 243 240 Gear cond.: 0
BDEPTH: 243 240 Validity : 0
Towing dir: 0° Wire out : 610 m Speed : 3.1 kn
Sorted : 148 Total catch: 300.00 Catch/hour: 588.43

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	373.75	394	63.52	197
Chrysaora sp.	103.48	0	17.59	
Pterothrissus belloci	54.86	581	9.32	
Sufflogobius bibarbatus	26.52	1145	4.51	
Deepwater fish mixture	9.24	0	1.57	
Macropipus australis	7.41	530	1.26	
Dentex macrophthalmus	4.63	27	0.79	198
Squilla acuelata calmani	4.49	229	0.76	
Austroglossus microlepis	1.41	12	0.24	200
Galeus polli	0.65	8	0.11	
Lophius vomerinus	0.63	2	0.11	199
Dead shells	0.39	0	0.07	
Coelorinchus simorhynchus	0.31	8	0.05	
Sea urchin, weak spines	0.24	20	0.04	
Trigla lyra	0.24	4	0.04	
Synagrops microlepis	0.08	8	0.01	
Solenocera africana	0.08	20	0.01	
Metal waste	0.00	2	0.00	
Total	588.41		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 55
DATE :20/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°53.40
start stop duration Lon E 12°1.35
TIME :22:56:46 23:27:07 30.3 (min) Purpose : 3
LOG : 2806.93 2808.49 1.6 Region : 5010
FDEPTH: 323 325 Gear cond.: 0
BDEPTH: 323 325 Validity : 0
Towing dir: 0° Wire out : 740 m Speed : 3.1 kn
Sorted : 27 Total catch: 180.15 Catch/hour: 356.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	203.02	198	56.99	201
Helicolenus dactylopterus	58.58	1246	16.44	203
Coelorinchus simorhynchus	23.87	415	6.70	
Coelorinchus polli	12.89	3	3.62	
Macropipus australis	12.46	514	3.50	
Deepwater fish mixture	11.39	2	3.20	
Chlorophthalmus agassizi	8.07	338	2.26	
Lophius vomerinus	6.25	24	1.75	202
Squilla acuelata calmani	5.91	328	1.66	
Galeus polli	4.73	85	1.33	
Pterothrissus belloci	2.37	10	0.67	
Solenocera africana	2.16	429	0.61	
Dentex macrophthalmus	1.03	4	0.29	205
PORIFERA (Sponges)	0.97	6	0.27	
Bathynectes piperitus	0.97	38	0.27	
Lampanyctodes hectoris	0.53	291	0.15	
Austroglossus microlepis	0.24	2	0.07	204
Malacocephalus occidentalis	0.22	6	0.06	
Ascidiacea	0.22	22	0.06	
Krill	0.22	645	0.06	
Trigla lyra	0.06	6	0.02	
Ascidiacea	0.06	61	0.02	0
G A S T R O P O D S	0.06	6	0.02	
Total	356.26		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 56
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°55.86
start stop duration Lon E 11°52.82
TIME :01:32:27 02:02:42 30.3 (min) Purpose : 3
LOG : 2818.60 2820.19 1.6 Region : 5010
FDEPTH: 375 376 Gear cond.: 0
BDEPTH: 375 376 Validity : 0
Towing dir: 0° Wire out : 870 m Speed : 3.2 kn
Sorted : 81 Total catch: 270.00 Catch/hour: 535.54

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	151.97	1575	28.38	208
Merluccius capensis	119.07	145	22.23	206
Merluccius paradoxus	107.33	272	20.04	207
Galeus polli	29.36	385	5.48	
PORIFERA (Sponges)	29.12	89	5.44	
Nezumia micronychodon	20.29	700	3.79	0
Chlorophthalmus agassizi	13.11	353	2.45	
Lophius vomerinus	10.99	6	2.05	240
Chaceon maritae	7.66	16	1.43	211
MYCTOPHIDAE	6.31	1575	1.18	
Nezumia micronychodon	5.41	36	1.01	
Todarodes sagittatus	5.24	20	0.98	210
Epigonus denticulatus	4.54	171	0.85	
Coelorinchus simorhynchus	3.79	133	0.71	
Lophius vaillanti	3.05	2	0.57	209
Coelorinchus polli	3.01	101	0.56	
Malacocephalus occidentalis	2.78	38	0.52	
Deepwater fish mixture	2.78	0	0.52	
Cruriraja parcomaculata	2.50	2	0.47	
Bathynectes piperitus	2.14	20	0.40	
Macropipus australis	1.51	69	0.28	
S H R I M P S	1.39	347	0.26	
Aristeus varidens	1.01	101	0.19	
Laemonema laureysi	0.75	20	0.14	
Ebinania costaecanarie	0.44	50	0.08	
Total	535.54		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 57
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°58.87
start stop duration Lon E 11°45.19
TIME :04:15:04 04:46:42 31.6 (min) Purpose : 3
LOG : 2830.29 2831.88 1.6 Region : 5010
FDEPTH: 469 472 Gear cond.: 0
BDEPTH: 469 472 Validity : 0
Towing dir: 0° Wire out : 1110 m Speed : 3.0 kn
Sorted : 115 Total catch: 319.66 Catch/hour: 606.19

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	374.76	535	61.82	212
Galeus polli	51.34	412	8.47	
Nezumia micronychodon	30.48	1026	5.03	
Hoplostethus cadenati	28.98	1819	4.78	
Helicolenus dactylopterus	21.18	197	3.49	214
Chaceon maritae	11.98	34	1.98	213
Etmopterus brachyurus	10.48	38	1.73	
Funchalia woodwardi	9.63	979	1.59	
Deepwater fish mixture	7.81	0	1.29	
Selachophidium guentheri	7.49	229	1.24	
Rajella barnardi	7.06	9	1.16	
Schedophilus cf huttoni	6.61	6	1.09	
Aristeus varidens	5.77	802	0.95	215
Cruriraja parcomaculata	5.45	15	0.90	
Glyphus marsupialis	5.35	1293	0.88	
Yarrella blackfordi	5.35	423	0.88	
Ebinania costaecanarie	3.85	32	0.64	
Chlorophthalmus agassizi	3.64	112	0.60	
Symbolophorus boops	1.50	262	0.25	
Triplophos hemingi	1.39	224	0.23	
Anemones, white	1.28	6	0.21	
PORIFERA (Sponges)	1.07	6	0.18	
Bathyuroconger vicinus	0.86	27	0.14	
MYCTOPHIDAE	0.86	106	0.14	
Lampanyctus australis	0.64	112	0.11	
Nematocarcinus africanus	0.32	91	0.05	
Bathynectes piperitus	0.21	6	0.04	
Gadiculus argenteus	0.21	21	0.04	
ASTRONESTHIDAE	0.11	6	0.02	
Epigonus telescopus	0.11	6	0.02	
Phosichthys argenteus	0.11	6	0.02	
Thysanoteuthis rhombus	0.11	6	0.02	
Nemichthys scolopaceus	0.05	6	0.01	
Lampadena pontifex	0.05	6	0.01	
Halosaurus ovenii	0.05	6	0.01	
PARALEPIDIDAE	0.05	6	0.01	
Total	606.17		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 58
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°58.68
start stop duration Lon E 11°40.13
TIME :06:41:28 07:12:04 30.6 (min) Purpose : 3
LOG : 2838.72 2840.22 1.5 Region : 5010
FDEPTH: 564 565 Gear cond.: 0
BDEPTH: 564 565 Validity : 0
Towing dir: 0° Wire out : 1200 m Speed : 2.9 kn
Sorted : 109 Total catch: 420.19 Catch/hour: 823.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	296.61	288	36.00	216
Trachyrincus scabrus	153.91	1006	18.68	
Lophius vomerinus	83.84	22	10.18	
Nezumia micronychodon	48.24	2320	5.85	
Selachophidium guentheri	41.78	725	5.07	
Chaceon maritae	37.10	53	4.50	217
Lophius vaillanti	21.54	8	2.61	
Deania profundorum	21.54	35	2.61	
Anemones, white	16.65	0	2.02	
Cruriraja parcomaculata	10.05	94	1.22	
Galeus polli	9.76	86	1.18	
Etmopterus brachyurus	9.05	29	1.10	
Hoplostethus cadenati	8.61	388	1.05	
Helicolenus dactylopterus	7.46	65	0.91	
Deepwater fish mixture	6.32	0	0.77	
Yarrella blackfordi	6.03	618	0.73	
Schedophilus cf huttoni	5.89	8	0.71	
Neoharriotta pinnata	5.45	2	0.66	
Funchalia woodwardi	4.02	488	0.49	
Rajella barnardi	3.88	29	0.47	
Lamprogrammus exutus	3.59	22	0.44	
Bathyuroconger vicinus	3.30	78	0.40	
Howella sherborni	2.87	8	0.35	
Glyphus marsupialis	2.87	863	0.35	
Aristeus varidens	2.87	229	0.35	218
Notacanthus sexspinis	2.73	22	0.33	
Lampanyctus australis	2.01	245	0.24	
Rajella leopardus	1.15	29	0.14	
Benthodesmus tenuis	0.86	14	0.10	
Stomias boa boa	0.86	78	0.10	
Lampadena pontifex	0.72	29	0.09	
Triplophos hemingi	0.43	78	0.05	
Astropectinidae	0.43	35	0.05	
Beryx splendens	0.41	2	0.05	241
Gadella imberbis	0.29	22	0.03	0
Munidopsis chuni	0.14	73	0.02	
Bathophilus sp.	0.14	14	0.02	
Phosichthys argenteus	0.14	14	0.02	
Astronesthes indicus	0.14	8	0.02	
Sudis sp.	0.07	14	0.01	
Bajacalifornia magalops	0.07	14	0.01	
POLYCHAELIDAE	0.07	8	0.01	
Total	823.90		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 59
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°58.73
start stop duration Lon E 11°36.16
TIME :08:31:32 09:02:05 30.6 (min) Purpose : 3
LOG : 2846.15 2847.48 1.3 Region : 5010
FDEPTH: 641 642 Gear cond.: 0
BDEPTH: 641 642 Validity : 0
Towing dir: 0° Wire out : 1300 m Speed : 2.6 kn
Sorted : 122 Total catch: 480.00 Catch/hour: 942.41

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	246.01	275	26.10	219
Trachyrincus scabrus	160.80	593	17.06	
Nezumia micronychodon	140.97	3065	14.96	
Selachophidium guentheri	105.45	1406	11.19	
Bajacalifornia magalops	42.00	2980	4.46	
Hoplostethus cadenati	33.87	664	3.59	
Rajella caudaspinosa	33.18	22	3.52	
Chaceon maritae	31.53	63	3.35	220
Bathyraja smithii	29.84	4	3.17	
Lophius vaillanti	24.42	8	2.59	221
Cruriraja parcomaculata	13.76	27	1.46	
Deepwater fish mixture	8.82	0	0.94	
Todarodes sagittatus	8.27	14	0.88	223
Anemone - purple 2	7.85	8	0.83	
Anemones, red	6.07	22	0.64	
Centroscymnus crepidater	5.42	4	0.57	
Heterocarpus grimaldii	4.95	381	0.53	
Lophius vomerinus	4.83	2	0.51	222
Deania profundorum	4.24	4	0.45	
Anemones, white	3.57	8	0.38	
Bathylagus antarcticus	3.44	241	0.36	
Bathyuroconger vicinus	2.89	35	0.31	
Rajella barnardi	2.89	77	0.31	
Yarrella blackfordi	2.61	179	0.28	
Ebinania costaecanarie	2.34	27	0.25	
Galeus polli	1.65	14	0.18	
Plesionika martia	1.24	618	0.13	
Lamprogrammus exutus	1.24	55	0.13	
Sea pens	1.10	241	0.12	
Triplophos hemingi	1.04	132	0.11	
Tetragonurus atlanticus	0.82	8	0.09	
Stomias boa boa	0.82	69	0.09	
Munidopsis sp.	0.82	825	0.09	
Thysanoteuthis rhombus	0.82	8	0.09	
Aristeus varidens	0.69	35	0.07	
Melanocetus johnsoni	0.55	22	0.06	
Astronesthes sp	0.41	14	0.04	
Lampanyctus australis	0.41	49	0.04	
Phosichthys argenteus	0.27	8	0.03	
Argyropelecus affinis	0.14	8	0.01	
Bathophilus sp.	0.14	14	0.01	
Howella sherborni	0.14	8	0.01	
Total	942.31		99.99	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 60
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°43.22
start stop duration Lon E 11°33.29
TIME :11:51:37 12:21:36 30.0 (min) Purpose : 3
LOG : 2862.74 2864.28 1.5 Region : 5010
FDEPTH: 533 535 Gear cond.: 0
BDEPTH: 533 535 Validity : 0
Towing dir: 0° Wire out : 1220 m Speed : 3.1 kn
Sorted : 95 Total catch: 310.00 Catch/hour: 620.41

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	321.29	474	51.79	224
Nezumia micronychodon	44.23	2011	7.13	
Chaceon maritae	40.93	86	6.60	225
Galeus polli	37.26	348	6.01	
Trachyrincus scabrus	34.58	526	5.57	
Hoplostethus cadenati	29.03	1937	4.68	
Selachophidium guentheri	20.45	342	3.30	
Neoharriotta pinnata	16.37	6	2.64	
Rajella barnardi	10.17	46	1.64	
Deepwater fish mixture	10.17	0	1.64	
Ijimaia loppei	8.97	2	1.45	
Lophius vomerinus	7.28	2	1.17	226
Centrophorus squamosus	6.63	12	1.07	
Lamprogrammus exutus	5.14	22	0.83	
Etmopterus pusillus	4.92	18	0.79	
Deania profundorum	3.54	6	0.57	
Helicolenus dactylopterus	3.54	40	0.57	227
Cruriraja parcomaculata	2.52	6	0.41	
Plesionika martia	2.06	412	0.33	
Bathyuroconger vicinus	1.94	28	0.31	
Ebinania costaecanarie	1.82	22	0.29	
Schedophilus huttoni	1.60	2	0.26	
Sea pens	1.26	246	0.20	
Funchalia woodwardi	1.02	108	0.16	
Aristeus varidens	0.92	52	0.15	
Notacanthus sexspinis	0.58	6	0.09	
Epigonus telescopus	0.58	18	0.09	
Yarrella blackfordi	0.46	22	0.07	
Munidopsis sp.	0.46	456	0.07	
Lampanyctus australis	0.34	34	0.05	
Lampadena pontifex	0.22	12	0.04	
Stereomastis sp.	0.12	12	0.02	
Total	620.41		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 61
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°39.60
start stop duration Lon E 11°37.27
TIME :13:48:36 14:18:38 30.0 (min) Purpose : 3
LOG : 2872.12 2873.52 1.4 Region : 5010
FDEPTH: 436 436 Gear cond.: 0
BDEPTH: 436 436 Validity : 0
Towing dir: 0° Wire out : 980 m Speed : 2.8 kn
Sorted : 130 Total catch: 280.00 Catch/hour: 559.44

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	185.74	198	33.20	230
Merluccius paradoxus	165.35	294	29.56	228
Shrimps unidentified	48.78	0	8.72	
Chaceon maritae	43.08	94	7.70	229
Deepwater fish mixture	23.59	0	4.22	
Galeus polli	17.35	40	3.10	
Nezumia micronychodon	13.01	567	2.33	
Hoplostethus cadenati	9.74	464	1.74	
Rajella barnardi	8.83	22	1.58	
Schedophilus huttoni	7.91	4	1.41	
Neoharriotta pinnata	7.07	4	1.26	
Pterothrissus belloci	6.27	2	1.12	
Ebinania costaecanarie	5.94	54	1.06	
Selachophidium guentheri	4.79	178	0.86	
Aristeus varidens	3.80	476	0.68	
PORIFERA (Sponges)	2.97	76	0.53	
PANDALIDAE	1.29	430	0.23	
Etmopterus pusillus	1.14	4	0.20	
Funchalia woodwardi	0.76	156	0.14	
Stomias boa boa	0.53	50	0.10	
Bathynectes piperitus	0.46	8	0.08	
Yarrella blackfordi	0.38	50	0.07	
Triplophos hemingi	0.23	42	0.04	
Lampanyctus australis	0.23	20	0.04	
Lampadena pontifex	0.15	22	0.03	
Munidopsis sp.	0.04	22	0.01	
Total	559.44		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 62
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°36.52
start stop duration Lon E 11°45.18
TIME :16:37:24 17:07:33 30.1 (min) Purpose : 3
LOG : 2885.89 2887.55 1.7 Region : 5010
FDEPTH: 361 359 Gear cond.: 0
BDEPTH: 361 359 Validity : 0
Towing dir: 0° Wire out : 880 m Speed : 3.3 kn
Sorted : 134 Total catch: 390.00 Catch/hour: 776.12

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	250.28	388	32.25	232
Helicolenus dactylopterus	208.09	5686	26.81	234
Merluccius paradoxus	75.58	185	9.74	231
Chlorophthalmus agassizi	51.24	1512	6.60	
Chaceon maritae	44.86	24	5.78	233
PORIFERA (Sponges)	43.47	0	5.60	
Coelorinchus simorhynchus	23.07	527	2.97	
Galeus polli	17.16	261	2.21	
Rajella barnardi	15.07	12	1.94	
Lophius vaillanti	14.26	12	1.84	235
Todarodes sagittatus	7.30	30	0.94	
Deepwater fish mixture	5.22	0	0.67	
Solenocera africana	4.17	6	0.54	
Nezumia micronychodon	4.06	221	0.52	
Bathynectes piperitus	3.36	82	0.43	
Epigonus telescopus	2.78	121	0.36	
Laemonema laureysi	2.09	64	0.27	
Nematocarcinus africanus	1.85	418	0.24	
Malacocephalus occidentalis	0.81	12	0.10	
Symbolophorus boops	0.46	157	0.06	
Coelorinchus polli	0.46	52	0.06	
Squilla acuelata calmani	0.35	30	0.04	
G A S T R O P O D S	0.12	12	0.01	
Total	776.12		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 63
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°19.58
start stop duration Lon E 11°26.44
TIME :20:02:16 20:32:19 30.1 (min) Purpose : 3
LOG : 2911.10 2912.66 1.6 Region : 5010
FDEPTH: 547 550 Gear cond.: 0
BDEPTH: 547 550 Validity : 0
Towing dir: 0° Wire out : 1265 m Speed : 3.1 kn
Sorted : 85 Total catch: 490.00 Catch/hour: 978.37

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	280.07	419	28.63	236
Trachyrincus scabrus	181.96	1733	18.60	
Nezumia micronychodon	127.13	3931	12.99	
Chaceon maritae	117.16	170	11.98	
Selachophidium guentheri	54.85	771	5.61	
Galeus polli	42.37	419	4.33	
Helicolenus dactylopterus	26.28	272	2.69	239
Bajacalifornia magalops	26.06	216	2.66	
Centrophorus squamosus	14.06	12	1.44	
Anemones, white	13.38	56	1.37	
Bathyuroconger vicinus	11.32	148	1.16	
Lophius vaillanti	9.30	6	0.95	238
Ebinania costaecanarie	8.61	68	0.88	
Deania profundorum	8.39	12	0.86	
Etmopterus brachyurus	8.17	22	0.83	
Hoplostethus cadenati	6.57	170	0.67	
Lophius vomerinus	5.43	2	0.56	237
Lamprogrammus exutus	4.07	34	0.42	
Chlorophthalmus agassizi	3.85	90	0.39	
Funchalia woodwardi	3.63	317	0.37	
Cruriraja parcomaculata	3.17	22	0.32	
Rajella leopardus	3.17	34	0.32	
Rajella barnardi	3.17	12	0.32	
Deepwater fish mixture	2.96	0	0.30	
Aristeus varidens	2.96	329	0.30	
Bathynectes piperitus	2.04	46	0.21	
Notacanthus sexspinis	1.82	12	0.19	
Lampanyctus australis	1.58	260	0.16	
PORIFERA (Sponges)	1.58	12	0.16	
Nematocarcinus africanus	1.14	284	0.12	
Thysanoteuthis rhombus	0.68	12	0.07	
Bufoceratias wedli	0.46	12	0.05	
Triplophos hemingi	0.34	34	0.03	
POLYCHAELIDAE	0.22	12	0.02	
Stomias boa boa	0.22	22	0.02	
Bathylagus sp.	0.22	46	0.02	
Total	978.37		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 64
DATE :21/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°19.77
start stop duration Lon E 11°31.87
TIME :22:09:47 22:40:04 30.3 (min) Purpose : 3
LOG : 2921.42 2922.96 1.6 Region : 5010
FDEPTH: 452 453 Gear cond.: 0
BDEPTH: 452 453 Validity : 0
Towing dir: 0° Wire out : 1000 m Speed : 3.1 kn
Sorted : 77 Total catch: 365.00 Catch/hour: 723.49

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	297.66	561	41.14	242
Galeus polli	116.55	1225	16.11	
Nezumia micronychodon	73.89	2050	10.21	
Helicolenus dactylopterus	50.51	468	6.98	243
Chaceon maritae	38.16	83	5.27	
Aristeus varidens	23.19	2900	3.21	
Ebinania costaecanarie	15.52	103	2.15	
PANDALIDAE	14.41	3602	1.99	
Todarodes sagittatus	12.73	48	1.76	244
Cruriraja parcomaculata	11.97	10	1.65	
Deepwater fish mixture	11.42	0	1.58	
Rajella barnardi	11.04	83	1.53	
Selachophidium guentheri	10.11	355	1.40	
Hoplostethus cadenati	9.36	4678	1.29	
PORIFERA (Sponges)	6.74	178	0.93	
Coelorinchus polli	3.55	65	0.49	
Neoharriotta pinnata	3.25	2	0.45	
Chlorophthalmus agassizi	3.17	83	0.44	
Trachyrincus scabrus	2.99	83	0.41	
Laemonema laureysi	1.51	28	0.21	
Schedophilus huttoni	1.35	2	0.19	
Malacocephalus occidentalis	1.21	10	0.17	
Yarrella blackfordi	0.75	75	0.10	
Bathyuroconger vicinus	0.75	28	0.10	
Halosaurus ovenii	0.38	10	0.05	
Epigonus denticulatus	0.38	28	0.05	
Lampanyctus australis	0.38	65	0.05	
Symbolophorus boops	0.28	18	0.04	
Stomias boa boa	0.10	10	0.01	
Munidopsis chuni	0.10	10	0.01	
AXIIDAE	0.10	10	0.01	
Total	723.49		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 65
DATE :22/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°14.01
start stop duration Lon E 11°42.05
TIME :01:12:05 01:42:08 30.1 (min) Purpose : 3
LOG : 2938.43 2939.99 1.6 Region : 5010
FDEPTH: 337 337 Gear cond.: 0
BDEPTH: 337 337 Validity : 0
Towing dir: 0° Wire out : 720 m Speed : 3.1 kn
Sorted : 108 Total catch: 250.00 Catch/hour: 499.17

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	227.58	315	45.59	245
Helicolenus dactylopterus	146.52	2366	29.35	248
PORIFERA (Sponges)	54.65	284	10.95	
Chlorophthalmus agassizi	14.34	433	2.87	
Pterothrissus belloci	10.82	68	2.17	
Lophius vomerinus	10.62	8	2.13	246
Coelorinchus polli	8.75	301	1.75	
Bathynectes piperitus	7.13	168	1.43	
Miscellaneous fishes	3.97	0	0.80	
Galeus polli	3.43	72	0.69	
Malacocephalus occidentalis	1.44	40	0.29	
Nezumia micronychodon	1.36	94	0.27	
PANDALIDAE	1.36	451	0.27	
Laemonema laureysi	1.18	28	0.24	
Lophius vaillanti	1.12	2	0.22	247
MYCTOPHIDAE	0.90	451	0.18	
Guentherus altivela	0.90	4	0.18	
Coelorinchus simorhynchus	0.82	4	0.16	
G A S T R O P O D S	0.72	36	0.14	
Dentex macrophthalmus	0.56	2	0.11	
Bassanago albescens	0.46	14	0.09	
Solenocera africana	0.36	90	0.07	
Eumunida squamifera	0.10	4	0.02	
Squilla acuelata calmani	0.10	10	0.02	
Total	499.17		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 66
DATE :22/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°31.49
start stop duration Lon E 11°56.08
TIME :05:09:26 05:40:05 30.7 (min) Purpose : 3
LOG : 2964.68 2966.27 1.6 Region : 5010
FDEPTH: 318 319 Gear cond.: 0
BDEPTH: 318 319 Validity : 0
Towing dir: 0° Wire out : 765 m Speed : 3.1 kn
Sorted : 93 Total catch: 410.00 Catch/hour: 802.35

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	431.41	178	53.77	249
Helicolenus dactylopterus	205.29	845	25.59	251
Chlorophthalmus agassizi	48.40	2421	6.03	
Pterothrissus belloci	31.14	219	3.88	
Squilla acuelata calmani	17.26	8	2.15	
Coelorinchus simorhynchus	16.92	178	2.11	
Coelorinchus polli	16.92	499	2.11	
Macropipus australis	11.34	652	1.41	
Lophius vomerinus	8.61	14	1.07	252
Austroglossus microlepis	7.55	16	0.94	250
Solenocera africana	2.88	644	0.36	
Trigla lyra	1.57	4	0.20	
Bathynectes piperitus	1.18	29	0.15	
PORIFERA (Sponges)	1.02	0	0.13	
Galeus polli	0.51	18	0.06	
Synagrops microlepis	0.34	644	0.04	
Total	802.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 67
DATE :22/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°29.22
start stop duration Lon E 12°7.92
TIME :07:46:18 08:17:23 31.1 (min) Purpose : 3
LOG : 2979.63 2981.18 1.6 Region : 5010
FDEPTH: 248 249 Gear cond.: 0
BDEPTH: 248 249 Validity : 0
Towing dir: 0° Wire out : 620 m Speed : 3.0 kn
Sorted : 146 Total catch: 1140.00 Catch/hour: 2201.48

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora sp.	1343.78	0	61.04	
Merluccius capensis	570.56	1510	25.92	253
Dentex macrophthalmus	148.30	1360	6.74	254
Pterothrissus belloci	71.89	633	3.27	
Aequorea sp.	16.61	0	0.75	
Sufflogobius bibarbatus	15.10	1375	0.69	
Deepwater fish mixture	10.87	0	0.49	
Chelidonichthys capensis	7.70	15	0.35	
Synagrops microlepis	7.25	952	0.33	
Macropipus australis	6.64	407	0.30	
Lophius vomerinus	1.56	2	0.07	255
Helicolenus dactylopterus	0.60	122	0.03	
Solenocera africana	0.30	31	0.01	
Squilla acuelata calmani	0.30	15	0.01	
Total	2201.48		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 68
DATE :22/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°20.20
start stop duration Lon E 12°20.45
TIME :10:42:01 10:50:06 8.1 (min) Purpose : 3
LOG : 2998.05 2998.42 0.4 Region : 5010
FDEPTH: 135 135 Gear cond.: 7
BDEPTH: 135 135 Validity : 5
Towing dir: 0° Wire out : 350 m Speed : 2.8 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
NOCATCH	0.00	0	0.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 69
DATE :22/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°5.48
start stop duration Lon E 12°6.71
TIME :13:31:27 13:34:06 2.6 (min) Purpose : 3
LOG : 3018.02 3018.14 0.1 Region : 5010
FDEPTH: 176 175 Gear cond.: 6
BDEPTH: 176 175 Validity : 5
Towing dir: 0° Wire out : 0 m Speed : 2.7 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

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

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 70
DATE :22/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°8.89
start stop duration Lon E 11°49.69
TIME :23:45:44 00:15:59 30.2 (min) Purpose : 3
LOG : 3080.02 3081.57 1.6 Region : 5010
FDEPTH: 300 300 Gear cond.: 0
BDEPTH: 300 300 Validity : 0
Towing dir: 0° Wire out : 740 m Speed : 3.1 kn
Sorted : 60 Total catch: 203.71 Catch/hour: 404.19

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	198.55	236	49.12	256
Pterothrissus belloci	69.72	508	17.25	
Macropipus australis	25.87	956	6.40	
Sufflogobius bibarbatus	16.01	1458	3.96	
Coelorinchus polli	14.84	427	3.67	
Ascidans	14.44	1030	3.57	
Squilla acuelata calmani	11.17	657	2.76	
Deepwater fish mixture	8.02	0	1.98	
Solenocera africana	7.22	1444	1.79	
Coelorinchus simorhynchus	7.22	79	1.79	
Austroglossus microlepis	6.83	171	1.69	258
Lophius vomerinus	5.91	12	1.46	259
Chlorophthalmus agassizi	4.86	310	1.20	
Chrysaora fulgida	4.46	0	1.10	
Dentex macrophthalmus	4.25	16	1.05	257
Galeus polli	2.36	40	0.58	
Bristle worms	0.79	224	0.20	
MYCTOPHIDAE	0.65	657	0.16	
G A S T R O P O D S	0.52	85	0.13	
Macroparalepis affinis	0.14	26	0.03	
Eumunida squamifera	0.14	6	0.03	
Trigla lyra	0.14	14	0.03	
FISH LARVAE	0.06	6	0.01	
Waste General	0.00	2	0.00	
Total	404.19		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 71
DATE :23/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°0.98
start stop duration Lon E 11°34.66
TIME :08:27:55 08:58:54 31.0 (min) Purpose : 3
LOG : 3136.28 3137.87 1.6 Region : 5010
FDEPTH: 277 276 Gear cond.: 0
BDEPTH: 277 276 Validity : 0
Towing dir: 0° Wire out : 740 m Speed : 3.1 kn
Sorted : 138 Total catch: 820.00 Catch/hour: 1587.61

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	627.82	1946	39.55	260
Helicolenus dactylopterus	327.26	10230	20.61	263
Dentex macrophthalmus	291.73	1177	18.38	261
Chlorophthalmus agassizi	104.78	7696	6.60	
Pterothrissus belloci	79.44	407	5.00	
Synagrops microlepis	51.15	5115	3.22	
Galeus polli	44.14	79	2.78	
Lophius vomerinus	20.64	12	1.30	262
MYCTOPHIDAE	16.07	5353	1.01	
Bathynectes piperitus	12.22	271	0.77	
Schedophilus velaini	3.39	12	0.21	
Coelorinchus polli	3.18	136	0.20	
Eumunida squamifera	1.12	91	0.07	
PORIFERA (Sponges)	1.12	12	0.07	
Nematocarcinus africanus	1.12	350	0.07	
JELLYFISH	0.91	12	0.06	
Solenocera africana	0.45	136	0.03	
Sufflogobius bibarbatus	0.45	12	0.03	
G A S T R O P O D S	0.23	23	0.01	
Malacocephalus laevis	0.23	12	0.01	
Thorogobius angolensis	0.12	12	0.01	
Total	1587.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 72
DATE :23/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°48.02
start stop duration Lon E 11°59.99
TIME :12:45:57 13:01:03 15.1 (min) Purpose : 3
LOG : 3166.40 3167.11 0.7 Region : 5010
FDEPTH: 136 136 Gear cond.: 0
BDEPTH: 136 136 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 2.8 kn
Sorted : 39 Total catch: 1590.00 Catch/hour: 6322.07

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Chrysaora sp.	3144.89	0	49.74	
Trachurus capensis	2702.54	46819	42.75	264
Aequorea forskalea	461.71	19857	7.30	
Merluccius polli	12.92	485	0.20	265
Total	6322.07		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 73
DATE :23/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°53.94
start stop duration Lon E 11°53.50
TIME :14:41:22 15:11:07 29.8 (min) Purpose : 3
LOG : 3176.76 3178.30 1.5 Region : 5010
FDEPTH: 229 228 Gear cond.: 0
BDEPTH: 229 228 Validity : 0
Towing dir: 0° Wire out : 560 m Speed : 3.1 kn
Sorted : 101 Total catch: 1310.00 Catch/hour: 2642.02

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	2123.23	2614	80.36	266
JELLYFISH	373.21	0	14.13	
Synagrops microlepis	61.16	3057	2.31	
GOBIIDAE	29.27	3868	1.11	
Dentex macrophthalmus	27.18	288	1.03	267
Pterothrissus belloci	13.59	184	0.51	
Chelidonichthys capensis	5.75	26	0.22	268
Centrolophus niger	5.75	26	0.22	
G A S T R O P O D S	1.04	105	0.04	
Squilla acuelata calmani	1.04	52	0.04	
Macropipus australis	0.52	26	0.02	
Trachurus capensis	0.26	26	0.01	
Total	2642.01		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 74
DATE :23/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°59.24
start stop duration Lon E 11°27.12
TIME :18:59:23 19:32:15 32.9 (min) Purpose : 3
LOG : 3207.29 3209.08 1.8 Region : 5010
FDEPTH: 373 373 Gear cond.: 0
BDEPTH: 373 373 Validity : 0
Towing dir: 0° Wire out : 935 m Speed : 3.3 kn
Sorted : 34 Total catch: 300.00 Catch/hour: 547.78

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Nezumia micronychodon	126.34	65963	23.06	
Merluccius capensis	105.79	47	19.31	269
Helicolenus dactylopterus	85.38	1481	15.59	272
Coelorinchus polli	45.59	1561	8.32	
Chlorophthalmus agassizi	34.25	451	6.25	
Merluccius paradoxus	32.61	75	5.95	270
Malacocephalus laevis	24.30	475	4.44	
Laemonema laureysi	21.98	614	4.01	
Aristeus varidens	19.90	3922	3.63	
Chaceon maritae	19.03	55	3.47	
Deepwater fish mixture	7.63	0	1.39	
Hoplostethus cadenati	5.79	323	1.06	
Galeus polli	4.62	93	0.84	
Glyphus marsupialis	4.16	1457	0.76	
Ebinania costaecanarie	3.47	197	0.63	
Todarodes sagittatus	3.01	11	0.55	
Symbolophorus boops	1.15	163	0.21	
Bathynectes piperitus	1.15	11	0.21	
Lophius vomerinus	0.91	2	0.17	271
Solenocera africana	0.46	46	0.08	
Nematocarcinus africanus	0.24	58	0.04	
Total	547.78		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 75
DATE :23/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 19°0.94
start stop duration Lon E 11°23.05
TIME :21:07:58 21:40:52 32.9 (min) Purpose : 3
LOG : 3215.11 3216.88 1.8 Region : 5010
FDEPTH: 509 509 Gear cond.: 0
BDEPTH: 509 509 Validity : 0
Towing dir: 0° Wire out : 1220 m Speed : 3.2 kn
Sorted : 73 Total catch: 400.00 Catch/hour: 729.48

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	373.24	631	51.16	273
Nezumia micronychodon	119.38	3057	16.36	
Helicolenus dactylopterus	65.58	611	8.99	274
Galeus polli	34.36	321	4.71	
Todarodes sagittatus	24.66	55	3.38	275
Chaceon maritae	17.03	40	2.33	276
Trachyrincus scabrus	10.67	146	1.46	
Ebinania costaecanarie	9.90	108	1.36	
Nematocarcinus africanus	9.70	3232	1.33	
Miscellaneous fishes	9.32	0	1.28	
Hoplostethus cadenati	8.74	272	1.20	
Rajella barnardi	7.57	4	1.04	
Tetragonurus atlanticus	7.19	49	0.98	
Selachophidium guentheri	6.60	155	0.91	
Etmopterus pusillus	5.64	20	0.77	
Aristeus varidens	4.09	543	0.56	
Yarrella blackfordi	3.50	272	0.48	
Bathylagus sp.	3.10	359	0.43	
Anemones, white	2.13	9	0.29	
Bajacalifornia magalops	1.75	213	0.24	
Laemonema laureysi	1.75	29	0.24	
Bathyuroconger vicinus	1.55	49	0.21	
Symbolophorus boops	0.78	58	0.11	
Plesionika acanthurus	0.38	146	0.05	
Coelorinchus polli	0.29	9	0.04	
Diaphus hudsoni	0.20	49	0.03	
Lampanyctus australis	0.20	20	0.03	
AXIIDAE	0.09	9	0.01	
Bathynectes piperitus	0.09	9	0.01	
Total	729.48		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 76
DATE :24/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°37.27
start stop duration Lon E 11°20.22
TIME :01:38:35 02:08:38 30.0 (min) Purpose : 3
LOG : 3239.36 3240.80 1.4 Region : 5010
FDEPTH: 644 644 Gear cond.: 0
BDEPTH: 644 644 Validity : 0
Towing dir: 0° Wire out : 1420 m Speed : 2.9 kn
Sorted : 84 Total catch: 595.00 Catch/hour: 1188.42

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachyrincus scabrus	256.40	1498	21.57	
Merluccius paradoxus	229.83	256	19.34	277
Nezumia micronychodon	209.85	10492	17.66	
Selachophidium guentheri	167.44	1999	14.09	
Rajella barnardi	86.42	162	7.27	
Todarodes sagittatus	43.48	108	3.66	280
Bathyraja smithii	30.48	4	2.56	
Chaceon maritae	29.42	54	2.48	279
Deania calcea	28.36	14	2.39	
Anemones, pink	24.85	68	2.09	
Anemones, white	21.05	82	1.77	
Lophius vaillanti	19.13	10	1.61	278
Miscellaneous fishes	9.45	0	0.80	
Ebinania costaecanarie	8.10	54	0.68	
Bathylagus antarcticus	7.02	2337	0.59	
Notacanthus sexspinis	6.48	54	0.55	
Hoplostethus cadenati	6.21	94	0.52	
Thysanoteuthis rhombus	1.35	14	0.11	
Lampanyctus australis	0.81	108	0.07	
Laemonema laureysi	0.54	14	0.05	
Bajacalifornia magalops	0.54	40	0.05	
Heterocarpus grimaldii	0.54	28	0.05	
Bufoceratias wedli	0.14	14	0.01	
Munidopsis chuni	0.14	108	0.01	
Howella sherborni	0.14	14	0.01	
Stomias boa boa	0.14	14	0.01	
Diaphus hudsoni	0.14	14	0.01	
Total	1188.45		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 77
DATE :24/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°34.85
start stop duration Lon E 11°24.75
TIME :03:35:14 04:05:35 30.4 (min) Purpose : 3
LOG : 3247.55 3249.08 1.5 Region : 5010
FDEPTH: 425 428 Gear cond.: 0
BDEPTH: 425 428 Validity : 0
Towing dir: 0° Wire out : 1025 m Speed : 3.0 kn
Sorted : 88 Total catch: 290.00 Catch/hour: 573.31

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	193.49	617	33.75	283
Helicolenus dactylopterus	131.87	1671	23.00	284
Malacocephalus laevis	46.75	534	8.15	
Chlorophthalmus agassizi	44.34	1048	7.73	
Coelorinchus polli	23.25	445	4.06	
Galeus polli	19.18	190	3.35	
Laemonema laureysi	15.88	324	2.77	
Ebinania costaecanarie	12.70	89	2.22	
Rajella barnardi	11.81	26	2.06	
Todarodes sagittatus	11.31	38	1.97	
Nematocarcinus africanus	10.93	3600	1.91	
Epigonus telescopus	10.67	362	1.86	
Centrophorus squamosus	9.53	20	1.66	
Chaceon maritae	7.79	10	1.36	
Lophius vaillanti	5.38	4	0.94	282
Hoplostethus cadenati	3.43	215	0.60	
Aristeus varidens	3.30	476	0.58	
Lophius vomerinus	2.81	2	0.49	281
Deepwater fish mixture	2.03	0	0.35	
Coelorinchus simorhynchus	2.03	26	0.35	
Thysanoteuthis rhombus	1.14	12	0.20	
Selachophidium guentheri	1.02	69	0.18	
Lampanyctus australis	0.89	166	0.16	
Myctophidae sp. small/mix	0.51	198	0.09	
G A S T R O P O D S	0.51	255	0.09	
Trachyrincus scabrus	0.38	32	0.07	
Benthodesmus tenuis	0.13	6	0.02	
Munidopsis chuni	0.13	43	0.02	
Astronesthes sp	0.13	6	0.02	
Total	573.31		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 78
DATE :24/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°20.56
start stop duration Lon E 11°19.91
TIME :06:03:57 06:33:57 30.0 (min) Purpose : 3
LOG : 3259.59 3261.47 1.9 Region : 5010
FDEPTH: 229 233 Gear cond.: 0
BDEPTH: 229 233 Validity : 0
Towing dir: 0° Wire out : 580 m Speed : 3.0 kn
Sorted : 97 Total catch: 980.00 Catch/hour: 1960.00

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1155.52	6434	58.95	285
Helicolenus dactylopterus	432.41	10246	22.06	287
Synagrops microlepis	166.40	17532	8.49	
Dentex macrophthalmus	81.78	608	4.17	286
Lophius vomerinus	30.77	60	1.57	288
Pterothrissus belloci	20.65	202	1.05	
Dicologoglossa cuneata	14.98	242	0.76	
Coelorinchus polli	12.15	284	0.62	
Chlorophthalmus agassizi	9.72	648	0.50	
Macropipus australis	7.69	404	0.39	
Lophius vaillanti	5.26	20	0.27	289
Lepidopus caudatus	4.45	40	0.23	
Deepwater fish mixture	4.05	0	0.21	
Rajella barnardi	3.64	20	0.19	
Trigla lyra	3.64	20	0.19	
Chaceon maritae	2.83	20	0.14	
Sufflogobius bibarbatus	2.02	122	0.10	
Parapenaeus longirostris	0.81	60	0.04	
G A S T R O P O D S	0.81	40	0.04	
MYCTOPHIDAE	0.40	264	0.02	
Total	1960.00		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 79
DATE :24/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°33.61
start stop duration Lon E 11°40.48
TIME :08:02:42 08:32:48 30.1 (min) Purpose : 3
LOG : 3269.41 3270.94 1.5 Region : 5010
FDEPTH: 211 203 Gear cond.: 0
BDEPTH: 211 203 Validity : 0
Towing dir: 0° Wire out : 540 m Speed : 3.0 kn
Sorted : 128 Total catch: 1350.00 Catch/hour: 2691.92

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1085.03	5031	40.31	290
Trachurus capensis	584.44	8229	21.71	292
Dentex macrophthalmus	354.79	4423	13.18	291
Pterothrissus belloci	326.56	4193	12.13	
Chelidonichthys capensis	167.70	315	6.23	
Synagrops microlepis	46.77	12303	1.74	
Squalus megalops	44.24	526	1.64	
Trigla lyra	32.02	148	1.19	
Dicologoglossa cuneata	19.38	421	0.72	
Sufflogobius bibarbatus	12.22	802	0.45	
Todarodes sagittatus	10.11	42	0.38	
Perulibatrachus rossignoli	5.06	22	0.19	
Macropipus australis	2.53	106	0.09	
Lepidopus caudatus	0.84	22	0.03	
Parapenaeus longirostris	0.21	42	0.01	
Total	2691.93		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 80
DATE :24/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 18°28.79
start stop duration Lon E 11°49.67
TIME :10:16:31 10:26:56 10.4 (min) Purpose : 3
LOG : 3281.83 3282.34 0.5 Region : 5010
FDEPTH: 132 130 Gear cond.: 0
BDEPTH: 132 130 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 2.9 kn
Sorted : 53 Total catch: 15000.00 Catch/hour: 86455.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	66085.30	1396375	76.44	293
Merluccius capensis	13848.65	106905	16.02	294
Chrysaora fulgida	2993.43	0	3.46	
Dentex macrophthalmus	1973.66	39476	2.28	295
Chelidonichthys capensis	1447.38	6576	1.67	
Dicologoglossa cuneata	65.76	1643	0.08	
Aequorea forskalea	32.91	0	0.04	
Parapenaeus longirostris	8.24	1643	0.01	
Total	86455.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 81
DATE :24/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 18°18.36
start stop duration Lon E 11°41.51
TIME :14:55:39 14:58:20 2.7 (min) Purpose : 3
LOG : 3308.04 3308.18 0.1 Region : 5010
FDEPTH: 143 146 Gear cond.: 0
BDEPTH: 143 146 Validity : 0
Towing dir: 0° Wire out : 380 m Speed : 3.3 kn
Sorted : 102 Total catch: 1970.00 Catch/hour: 44269.66

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	42102.47	1223910	95.10	297
Merluccius capensis	1620.99	20067	3.66	296
Chrysaora fulgida	312.07	2607	0.70	
Dentex macrophthalmus	199.37	3461	0.45	298
Aequorea forskalea	17.33	1730	0.04	
Synagrops microlepis	8.67	1303	0.02	
Sufflogobius bibarbatus	8.67	876	0.02	
Total	44269.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 82
DATE :24/05/19 GEAR TYPE: BT NO: 27 POSITION:Lat S 18°18.69
start stop duration Lon E 11°32.41
TIME :16:22:17 16:52:26 30.1 (min) Purpose : 3
LOG : 3318.02 3319.48 1.5 Region : 5010
FDEPTH: 241 244 Gear cond.: 0
BDEPTH: 241 244 Validity : 0
Towing dir: 0° Wire out : 540 m Speed : 2.9 kn
Sorted : 273 Total catch: 1400.00 Catch/hour: 2786.07

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1430.60	68778	51.35	299
Helicolenus dactylopterus	526.34	12531	18.89	301
Dentex macrophthalmus	518.99	3276	18.63	300
Chlorophthalmus agassizi	101.43	5073	3.64	
Pterothrissus belloci	92.90	796	3.33	
Dicologoglossa cuneata	27.15	509	0.97	
Synagrops microlepis	25.67	1879	0.92	
Trigla lyra	18.47	111	0.66	
Macropipus australis	16.13	1093	0.58	
Parapenaeus longirostris	9.80	1729	0.35	302
SOFT SPONGES	7.96	0	0.29	
Coelorinchus polli	5.10	122	0.18	
Galeus polli	3.88	52	0.14	
Malacocephalus laevis	1.63	82	0.06	
Total	2786.07		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 83
DATE :24/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°16.45
start stop duration Lon E 11°25.55
TIME :19:17:41 19:48:06 30.4 (min) Purpose : 3
LOG : 3334.85 3336.40 1.6 Region : 5010
FDEPTH: 433 441 Gear cond.: 0
BDEPTH: 433 441 Validity : 0
Towing dir: 0° Wire out : 995 m Speed : 3.1 kn
Sorted : 105 Total catch: 760.00 Catch/hour: 1499.51

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	503.37	1334	33.57	303
Helicolenus dactylopterus	207.20	2095	13.82	304
Nezumia micronychodon	126.56	5294	8.44	
Chaceon maritae	124.55	444	8.31	
Coelorinchus polli	111.92	2210	7.46	
Lophius vomerinus	81.79	30	5.45	306
Malacocephalus laevis	60.84	819	4.06	
Laemonema laureysi	45.34	760	3.02	
Galeus polli	43.91	373	2.93	
Lophius vaillanti	39.03	43	2.60	305
SOFT SPONGES	35.59	0	2.37	
Chlorophthalmus agassizi	33.00	904	2.20	
Cruriraja parcomaculata	19.23	14	1.28	
Deepwater fish mixture	15.78	0	1.05	
Todarodes sagittatus	14.64	57	0.98	
Epigonus telescopus	12.91	316	0.86	
Macropipus australis	4.88	329	0.33	
Nematocarcinus africanus	4.02	1334	0.27	
Bathynectes piperitus	4.02	71	0.27	
Bassanago albescens	3.73	71	0.25	
Trachyrincus scabrus	3.16	172	0.21	
Tetragonurus atlanticus	1.43	14	0.10	
Aristeus varidens	0.57	30	0.04	
Hoplostethus cadenati	0.57	30	0.04	
G A S T R O P O D S	0.57	57	0.04	
Ebinania costaecanarie	0.29	14	0.02	
MYCTOPHIDAE	0.29	43	0.02	
Stomias boa boa	0.29	14	0.02	
Metal waste	0.00	2	0.00	
Total	1499.50		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 84
DATE :24/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 18°17.45
start stop duration Lon E 11°23.22
TIME :23:25:11 23:55:04 29.9 (min) Purpose : 3
LOG : 3348.09 3349.47 1.4 Region : 5010
FDEPTH: 564 607 Gear cond.: 0
BDEPTH: 564 607 Validity : 0
Towing dir: 0° Wire out : 1200 m Speed : 2.8 kn
Sorted : 111 Total catch: 820.00 Catch/hour: 1645.48

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachyrincus scabrus	645.75	3474	39.24	
Merluccius paradoxus	338.53	526	20.57	307
Nezumia micronychodon	181.59	98151	11.04	
Chaceon maritae	93.27	153	5.67	310
Helicolenus dactylopterus	77.78	94	4.73	312
Todarodes sagittatus	58.68	207	3.57	311
Metal waste	55.38	0	3.37	
Lophius vomerinus	40.25	10	2.45	309
Selachophidium guentheri	35.98	319	2.19	
Deepwater fish mixture	18.00	0	1.09	
Lophius vaillanti	17.38	10	1.06	308
Notacanthus sexspinis	17.16	110	1.04	
PORIFERA (Sponges)	16.33	207	0.99	
Ebinania costaecanarie	13.57	28	0.82	
Eggs of ray	10.80	817	0.66	
Cruriraja parcomaculata	9.13	42	0.55	
Chlorophthalmus agassizi	6.08	138	0.37	
Anemones, pink	2.77	14	0.17	
Rajella barnardi	2.77	14	0.17	
Octopus sp.	2.21	42	0.13	
Hoplostethus cadenati	0.82	42	0.05	
Bathylagus antarcticus	0.28	28	0.02	
Starfish	0.28	42	0.02	
Stomias boa boa	0.28	28	0.02	
Lithodes ferox	0.14	14	0.01	
Melanocetus johnsoni	0.14	14	0.01	
Symbolophorus boops	0.14	28	0.01	
Total	1645.48		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 85
DATE :25/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°57.37
start stop duration Lon E 11°22.24
TIME :03:12:31 03:43:41 31.2 (min) Purpose : 3
LOG : 3368.65 3370.27 1.6 Region : 5010
FDEPTH: 433 439 Gear cond.: 0
BDEPTH: 433 439 Validity : 0
Towing dir: 0° Wire out : 1010 m Speed : 3.1 kn
Sorted : 102 Total catch: 690.00 Catch/hour: 1327.77

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	545.09	5498	41.05	316
Merluccius paradoxus	342.21	885	25.77	313
Chaceon maritae	115.90	187	8.73	
Malacocephalus laevis	88.98	674	6.70	
Nezumia micronychodon	63.81	2455	4.81	
Laemonema laureysi	49.10	735	3.70	
Lophius vomerinus	24.55	4	1.85	315
Coelorinchus polli	24.18	412	1.82	
Lophius vaillanti	16.97	10	1.28	314
Chlorophthalmus agassizi	12.71	312	0.96	
Deepwater fish mixture	8.22	0	0.62	
Galeus polli	7.98	75	0.60	
Schedophilus huttoni	5.85	2	0.44	
Lithodes ferox	5.43	6	0.41	
Epigonus telescopus	4.49	298	0.34	
Guentherus altivela	2.27	2	0.17	
Aristeus varidens	1.99	398	0.15	
Neoharriotta pinnata	1.58	2	0.12	
Bathynectes piperitus	1.50	25	0.11	
Tetragonurus atlanticus	1.50	12	0.11	
Ebinania costaecanarie	1.25	12	0.09	
Hoplostethus cadenati	0.50	25	0.04	
Dicologoglossa cuneata	0.50	12	0.04	
Synagrops microlepis	0.50	12	0.04	
Stomias boa boa	0.25	12	0.02	
Symbolophorus boops	0.25	62	0.02	
Triplophos hemingi	0.13	12	0.01	
Yarrella blackfordi	0.13	12	0.01	
Total	1327.78		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 86
DATE :25/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°59.09
start stop duration Lon E 11°27.28
TIME :05:36:30 06:06:29 30.0 (min) Purpose : 3
LOG : 3377.92 3379.46 1.5 Region : 5010
FDEPTH: 265 266 Gear cond.: 0
BDEPTH: 265 266 Validity : 0
Towing dir: 0° Wire out : 650 m Speed : 3.1 kn
Sorted : 111 Total catch: 1020.00 Catch/hour: 2042.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	958.39	2549	46.93	317
Helicolenus dactylopterus	668.68	23546	32.75	318
Pterothrissus belloci	152.54	1353	7.47	
Chlorophthalmus agassizi	111.93	3658	5.48	
Trachurus capensis	69.87	364	3.42	321
Dentex macrophthalmus	36.94	146	1.81	319
Synagrops microlepis	15.36	951	0.75	
Lophius vaillanti	8.57	4	0.42	320
Trigla lyra	4.75	18	0.23	
Todarodes sagittatus	3.66	18	0.18	
Laemonema laureysi	2.19	74	0.11	
SOFT SPONGES	1.83	0	0.09	
Coelorinchus polli	1.83	36	0.09	
Bathynectes piperitus	1.83	54	0.09	
Malacocephalus laevis	1.83	54	0.09	
Parapenaeus longirostris	1.46	220	0.07	
Myctophidae sp. small/mix	0.37	146	0.02	
Total	2042.05		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 87
DATE :25/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°59.46
start stop duration Lon E 11°36.37
TIME :07:45:51 07:49:54 4.1 (min) Purpose : 3
LOG : 3389.33 3389.55 0.2 Region : 5010
FDEPTH: 155 157 Gear cond.: 0
BDEPTH: 155 157 Validity : 0
Towing dir: 0° Wire out : 400 m Speed : 3.2 kn
Sorted : 166 Total catch: 2500.00 Catch/hour: 36855.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	27007.67	789700	73.28	323
Chrysaora sp.	7736.21	0	20.99	
Merluccius capensis	1509.83	5794	4.10	322
Dentex macrophthalmus	320.67	5572	0.87	324
Todarodes sagittatus	142.53	442	0.39	
Trigla lyra	62.36	442	0.17	
Pterothrissus belloci	57.89	1342	0.16	
Zenopsis conchifer	13.36	221	0.04	
Dicologoglossa cuneata	4.45	221	0.01	
Fishing gears	0.00	15	0.00	
Total	36854.96		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 88
DATE :25/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°39.33
start stop duration Lon E 11°29.80
TIME :13:28:37 13:33:41 5.1 (min) Purpose : 3
LOG : 3427.17 3427.41 0.2 Region : 5010
FDEPTH: 177 179 Gear cond.: 0
BDEPTH: 177 179 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 2.9 kn
Sorted : 97 Total catch: 640.00 Catch/hour: 7588.93

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	3797.17	107265	50.04	327
Chrysaora sp.	1495.55	0	19.71	
Synagrops microlepis	640.51	106719	8.44	
Dentex macrophthalmus	590.75	7150	7.78	326
Helicolenus dactylopterus	373.11	6688	4.92	328
Merluccius capensis	329.58	1399	4.34	325
Myliobatis aquila	273.62	83	3.61	
Chelidonichthys capensis	18.26	24	0.24	329
Perulibatrachus elminensis	16.33	83	0.22	
Dicologoglossa cuneata	13.99	2087	0.18	
Sea pens	7.78	534	0.10	
Raja miraletus	7.35	24	0.10	
PORIFERA (Sponges)	6.21	154	0.08	
Trigla lyra	6.21	83	0.08	
Zenopsis conchifer	4.74	12	0.06	
Pterothrissus belloci	4.66	83	0.06	
Squilla acuelata calmani	1.55	83	0.02	
Aequorea sp.	1.55	83	0.02	
Total	7588.94		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 89
DATE :25/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°38.97
start stop duration Lon E 11°25.07
TIME :14:46:49 15:16:37 29.8 (min) Purpose : 3
LOG : 3433.53 3435.02 1.5 Region : 5010
FDEPTH: 236 237 Gear cond.: 0
BDEPTH: 236 237 Validity : 0
Towing dir: 0° Wire out : 600 m Speed : 3.0 kn
Sorted : 110 Total catch: 15000.00 Catch/hour: 30201.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	12529.23	258797	41.49	331
Chlorophthalmus agassizi	9144.74	275609	30.28	
Chrysaora sp.	5451.56	0	18.05	
Merluccius capensis	1278.83	7442	4.23	330
Dentex macrophthalmus	440.98	2756	1.46	332
Trachurus capensis	385.85	2481	1.28	333
SOFT SPONGES	248.05	0	0.82	
Dicologoglossa cuneata	192.93	3032	0.64	
Pterothrissus belloci	104.73	1377	0.35	
Synagrops microlepis	99.22	7442	0.33	
Todarodes sagittatus	71.66	552	0.24	
Centrolophus niger	71.66	276	0.24	
Parapenaeus longirostris	60.63	11299	0.20	334
G A S T R O P O D S	60.63	2756	0.20	
Myctophidae sp. small/mix	38.59	18465	0.13	
Macropipus australis	16.54	828	0.05	
Lophius vaillanti	5.51	276	0.02	335
Total	30201.34		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 90
DATE :25/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°38.58
start stop duration Lon E 11°22.88
TIME :16:26:25 16:54:40 28.3 (min) Purpose : 3
LOG : 3439.13 3440.39 1.3 Region : 5010
FDEPTH: 315 311 Gear cond.: 0
BDEPTH: 315 311 Validity : 0
Towing dir: 0° Wire out : 690 m Speed : 2.7 kn
Sorted : 133 Total catch: 2000.00 Catch/hour: 4246.28

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	1769.23	0	41.67	
Merluccius capensis	1224.51	1688	28.84	336
Helicolenus dactylopterus	676.60	11202	15.93	337
Todarodes sagittatus	168.83	828	3.98	
Chlorophthalmus agassizi	121.05	2548	2.85	
Pterothrissus belloci	117.23	860	2.76	
Laemonema laureysi	109.58	3089	2.58	
Malacocephalus laevis	37.59	478	0.89	
Coelorinchus polli	10.19	255	0.24	
Synagrops microlepis	5.10	446	0.12	
Bathynectes piperitus	2.55	64	0.06	
Galeus polli	1.91	32	0.04	
Squilla acuelata calmani	1.27	127	0.03	
G A S T R O P O D S	0.32	32	0.01	
Parapenaeus longirostris	0.32	64	0.01	
Total	4246.28		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 91
DATE :25/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°17.39
start stop duration Lon E 11°17.22
TIME :23:41:59 00:12:22 30.4 (min) Purpose : 3
LOG : 3471.31 3472.74 1.4 Region : 5010
FDEPTH: 460 477 Gear cond.: 0
BDEPTH: 460 477 Validity : 0
Towing dir: 0° Wire out : 1020 m Speed : 2.8 kn
Sorted : 70 Total catch: 680.00 Catch/hour: 1342.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachyrincus scabrus	581.01	3473	43.28	
Helicolenus dactylopterus	411.43	1850	30.65	340
Nezumia micronychodon	118.82	3208	8.85	
Merluccius paradoxus	68.31	103	5.09	338
Lophius vaillanti	46.12	38	3.44	339
Chaceon maritae	44.07	176	3.28	
Ebinania costaecanarie	19.74	18	1.47	
Deepwater fish mixture	19.03	0	1.42	
Galeus polli	12.34	107	0.92	
Todarodes sagittatus	8.11	18	0.60	341
PORIFERA (Sponges)	3.87	229	0.29	
Yarrella blackfordi	2.82	336	0.21	
Nematocarcinus africanus	1.76	582	0.13	
Hoplostethus cadenati	1.40	71	0.10	
Aristeus varidens	1.07	140	0.08	
Epigonus denticulatus	1.07	18	0.08	
Rajella barnardi	0.71	53	0.05	
Stomias boa boa	0.36	53	0.03	
Laemonema laureysi	0.36	36	0.03	
Plesionika martia	0.18	36	0.01	
Total	1342.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 92
DATE :26/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°18.93
start stop duration Lon E 11°23.27
TIME :05:47:34 06:17:43 30.1 (min) Purpose : 3
LOG : 3481.85 3483.40 1.6 Region : 5010
FDEPTH: 271 259 Gear cond.: 0
BDEPTH: 271 259 Validity : 0
Towing dir: 0° Wire out : 700 m Speed : 3.1 kn
Sorted : 166 Total catch: 7500.00 Catch/hour: 14930.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	4399.09	21671	29.46	342
Helicolenus dactylopterus	2766.47	40933	18.53	344
Chrysaora sp.	2673.19	0	17.90	
Chlorophthalmus agassizi	2330.50	68265	15.61	
Pterothrissus belloci	1422.70	14711	9.53	
Dentex macrophthalmus	461.08	2871	3.09	343
Todarodes sagittatus	138.14	627	0.93	
Pontinus accraensis	127.38	898	0.85	
Merluccius polli	122.00	537	0.82	345
Coelorinchus polli	109.44	1973	0.73	
Deepwater fish mixture	89.70	0	0.60	
Parapenaeus longirostris	87.91	11572	0.59	
Dicologoglossa cuneata	57.41	987	0.38	
Laemonema laureysi	44.85	1525	0.30	
Galeus polli	23.32	179	0.16	
SOFT SPONGES	21.53	179	0.14	
G A S T R O P O D S	17.94	1614	0.12	
Synagrops microlepis	8.97	808	0.06	
Starfish	8.97	269	0.06	
Octopus vulgaris	8.97	90	0.06	
Acanthocarpus brevipinnis	7.18	90	0.05	
Anemones, white	3.59	90	0.02	
Total	14930.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2019405 STATION: 93
DATE :26/05/19 GEAR TYPE: BT NO: 1 POSITION:Lat S 17°20.08
start stop duration Lon E 11°30.08
TIME :07:52:16 07:55:44 3.5 (min) Purpose : 3
LOG : 3490.52 3490.70 0.2 Region : 5010
FDEPTH: 154 154 Gear cond.: 0
BDEPTH: 154 154 Validity : 0
Towing dir: 0° Wire out : 420 m Speed : 3.1 kn
Sorted : 111 Total catch: 3000.00 Catch/hour: 52023.12

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Chrysaora sp.	42181.91	0	81.08	
Trachurus capensis	3921.50	72087	7.54	348
Merluccius capensis	3724.96	21052	7.16	346
Dentex macrophthalmus	1778.25	16838	3.42	347
Synagrops microlepis	215.25	25734	0.41	
Zenopsis conchifer	65.51	936	0.13	
Brotula barbata	56.15	468	0.11	
Helicolenus dactylopterus	37.44	936	0.07	
Pterothrissus belloci	37.44	468	0.07	
G A S T R O P O D S	4.68	468	0.01	
Total	52023.10		100.00	

ANNEX IX. TIME SPENT ON PRIMARY OBSERVATIONS FOR CETACEANS AND SEABIRDS

Table IX.1. Species, dates, time and locations of the cetaceans spotted along the Namibia coastline.

Species	Time	Dates	Latitude	Longitude
Dusky dolphins	16:10	15-May-19	22°1'33"S	13°11'18"E
Dusky dolphins	9:50	17-May-19	21°22'22"S	13°9'36"E
Dusky dolphins	15:30	20-May-19	19°53'55"S	12°53'9"E
Dusky dolphins	17:05	22-May-19	19°0'42"S	12°17'49"E
Dusky dolphins	13:49	24-May-19	18°19'25"S	11°52'44"E
Pilot whales	15:30	18-May-19	20°52'18"S	12°14'9"E
Pilot whales	16:10	20-May-19	19° 30' 21" S	12° 6' 49" E

Table IX.2. Dates and hours spend on observation of cetaceans and seabird species found along the northern coastline of Namibia.

Dates of observation	Hours spend on observation (Average)
5/14/2019	7.5
5/15/2019	7.5
5/16/2019	7.5
5/17/2019	7.5
5/18/2019	7.5
5/19/2019	7.5
5/20/2019	7.5
5/21/2019	7.5
5/22/2019	7.5
5/23/2019	7.5
5/24/2019	7.5
5/25/2019	7.5
5/26/2019	7.5
Total	97.5

ANNEX X. OVERVIEW OF DATA COLLECTED AND WHEN THEY ARE MADE AVAILABLE TO PARTNER COUNTRIES

2019405		**after the survey, to local cruise leader Ester Nangolo**	**at the post survey meeting, to local cruise leader**	**upon request**	**not collected/stored**	**analyzed by partner country**	**analyzed by Sci.Plan**
Data types	Data						
Track log	continous GPS data	x					
Diary	event information	x					
Acoustic data	EK 60 raw data	x		x			
Acoustic data	EK60 processed (report files like list com scatter)			x			
Acoustic data	EK80, raw data			x			
Acoustic data	MS70			x			
Acoustic data	ME70				x		
Acoustic data	SU90			x			
Acoustic data	SH90				x		
Acoustic data	SBP300				x		
Acoustic data	EM302				x		
Acoustic data	EM710				x		
Physics	CTD probe (C, t, d, O, fl, light)	x					
Physics	CTD Underway				x		
Physics	ADCP 75kHz	x					
Physics	ADCP 150kHz	x					
Physics	LADCP				x		
Physics	Thermosalinograph (c, t,	x					

2019405		**after the survey, to local cruise leader Ester Nangolo**	**at the post survey meeting, to local cruise leader**	**upon request**	**not collected/stored**	**analyzed by partner country**	**analyzed by Sci.Plan**
	fl, turb)						
Physics	Weather st (T, w dir, w speed, solar ir, humid)	x					
Chemistry	Nutrients		x				
Chemistry	pH			x			x
Chemistry	Total alkalinity			x			x
Chemistry	Chlorophyll		x				
Biology	Trawl catch data (Nansis data base)	x	x				
Biology	Zooplankton biomass		x				
Pollution	Microplastics						x
Pollution	Microplastics (pictures)						
Geology	Sediment (trawl)						x
Geology	Grab					x	
Observation platforms	VAMS				x		
Observation platforms	WBAT				x		
Observation platforms	Deep vision				x		