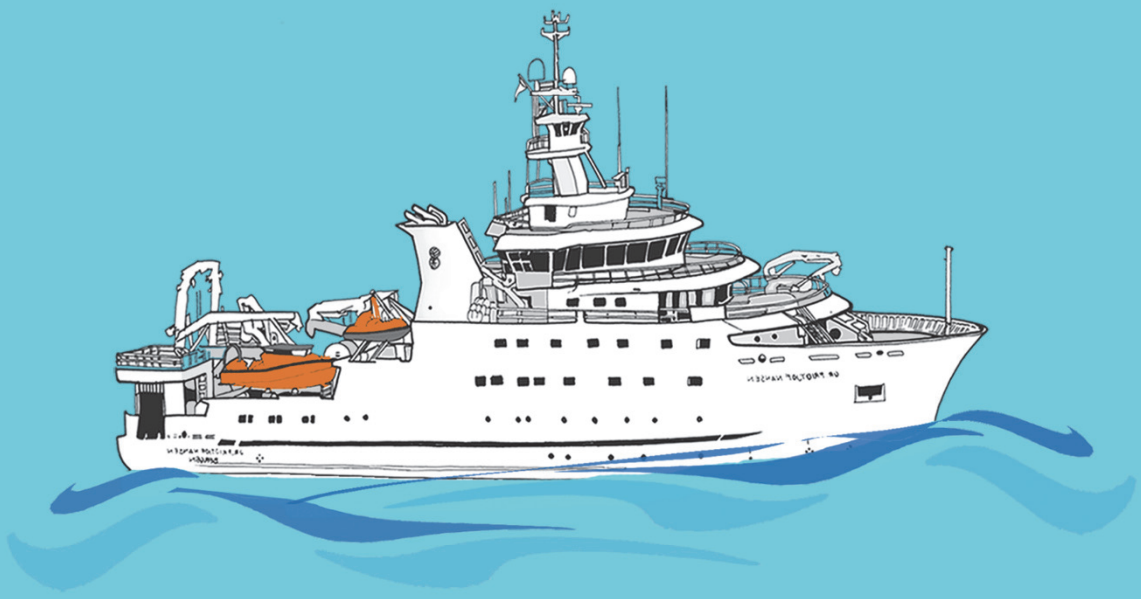
NORAD-FAO PROGRAMME
GCP/GLO/690/NOR

CRUISE REPORTS *DR FRIDTJOF NANSEN*
EAF-Nansen/CR/2019/7



OCEANOGRAPHIC SURVEY – GULF OF GUINEA HIGH SEAS

29 June–16 July 2019

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.

Korsbrekke, K., Zimmermann, F., Landa, G., Rognaldsen, H., Seim, S., Williams, T., Sanden, J., Dahl, L., Cervantes, D., Tsinga Keyi ep Langui, F.N., Bilombo Matondo, C.P., Mbakou, A.K., Itoba Okemba, A.G., Wamuini, L.S., Akenze, T.R., Monte Verde Gomes Cravid, M.G., Ongagna, S., Issanga Ngamissimi, M., Mbega, J.D., Kissiekiaoua, D.P.C.E., Lewembe, JDD., Kambale Mangaya, J.M., Mganga, S., Eyari Mfoumou, A.K.,Mengue Ayefegue, H., Ntse, R.B. 2019. Oceanographic survey – Gulf of Guinea, 29 June – 16 July 2019. NORAD-FAO PROGRAMME GCP/GLO/690/NOR, CRUISE REPORTS *DR FRIDTJOF NANSEN*, EAF-Nansen/CR/2019/7

CRUISE REPORTS *DR FRIDTJOF NANSEN*

OCEANOGRAPHIC SURVEY – GULF OF GUINEA HIGH SEAS

29 June–16 July 2019

by

K. Korsbrekke[1], F. Zimmermann[1], G. Landa[1], H. Rognaldsen[1], S. Seim[1], T. Williams[1], J. Sanden[1], L. Dahl[1], D. Cervantes[1], F.N. Tsinga Keyi ep Langui[2], C.P. Bilombo Matondo[3], A.K. Mbakou[3], A.G. Itoba Okemba[3], L.S. Wamuini[4], T.R. Akenze[3], M.G. Monte Verde Gomes Cravid[5], S. Ongagna[3], M. Issanga Ngamissimi[6], J.D. Mbega[2], D.P.C.E. Kissiekiaoua[3], JDD Lewembe[7], J.M. Kambale Mangaya[8], S. Mganga[7], A.K. Eyari Mfoumou[3], H. Mengue Ayefegue[7], R.B. Ntse[3]

[1] Institute of Marine Research (IMR), P.O. Box 1870 Nordnes, N-5817 Bergen, Norway
[2] Institut de Recherches Agronomique et Forèstieres (IRAF), Libreville, Gabon
[3] Ministère de l'Agriculture, de l'Élevage et de la Pêche (MAEP), Brazzaville, Republic Congo
[4] Enseignement Superieur et Universitaire (ESU), Mbanza-Mugungu, D.R. Congo
[5] Direction de la Peche Department de Recherches (STP), Sao Tome, Sao Tome and Principe
[6] Ministère du Tourisme et Environment (MTE), Pointe Noire, Republic Congo
[7] Direction Générale des Pêches et de l'Aquacultur (DGPA), Libreville, Gabon
[8] Ministère de l'Agriculture, Peche et Élevage (MAPE), Kinshasa, D.R. Congo

Institute of Marine Research
Bergen, 2020

CONTENTS

EXECUTIVE SUMMARY

The time this survey took place was originally allocated to a coverage of the demersal resources of the Democratic Republic of the Congo (RDC), the Republic of the Congo, and the Gabonese Republic, as the continuation of the transboundary demersal survey off southwestern Africa. Due to security issues in the area, the programme had to be changed and the time was used for an oceanographic survey as the vessel moved from Angola to Ghana to start Leg 3.

The survey consisted of two transects (see Figure 2) giving a "snapshot" of some of the major processes occurring in the offshore waters of the Gulf of Guinea.

The two long oceanic transects revealed the major trends east-west and south-north with more pronounced trends in the shallower parts of the upper 800 meters. From relatively cold water masses in the coastal waters of Angola to a thicker layer of warmer water further west. The south-north transect showed some variation in thickness of the warmer surface layer while the most remarkable observation were trends in observed dissolved oxygen, with extremely low concentrations especially along the longitudinal transect (east-west), at depths of 200 m to 600 m.

The direct observations of plankton using WP2, Manta trawl, Bongo nets and Multinet Mammoth produced samples to be processed after the survey. The Multinet Mammoth was used to map vertical distribution and diel variation.

Pelagic trawl observation revealed low densities of fish with the typical catch being around 30 kg. Species diversity was considerable and of the 172 taxa identified 78 observations could be identified to species level.

The acoustic observations of plankton showed overall trends in abundance and depth distribution along both transects with depth distribution also having a pronounced diel pattern. There was no (by visual inspection) obvious correlation between observed densities of plankton and the oceanographic conditions. Further analysis of plankton samples will facilitate more detailed analysis on this valuable material.

The data and samples collected during the survey will complement those collected in coastal waters for scientific work related to physical and chemical oceanography, biodiversity, microplastics, just to mention a few.

CHAPTER 1. INTRODUCTION

1.1 Survey area

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, a dedicated survey to the Discovery sea mounts in collaboration with SEAFO, and two mesopelagic transects off Walvis Bay and Morocco following the sampling strategy used in 2017. Figure 1 shows the overall survey programme for 2019 in southwest Africa.

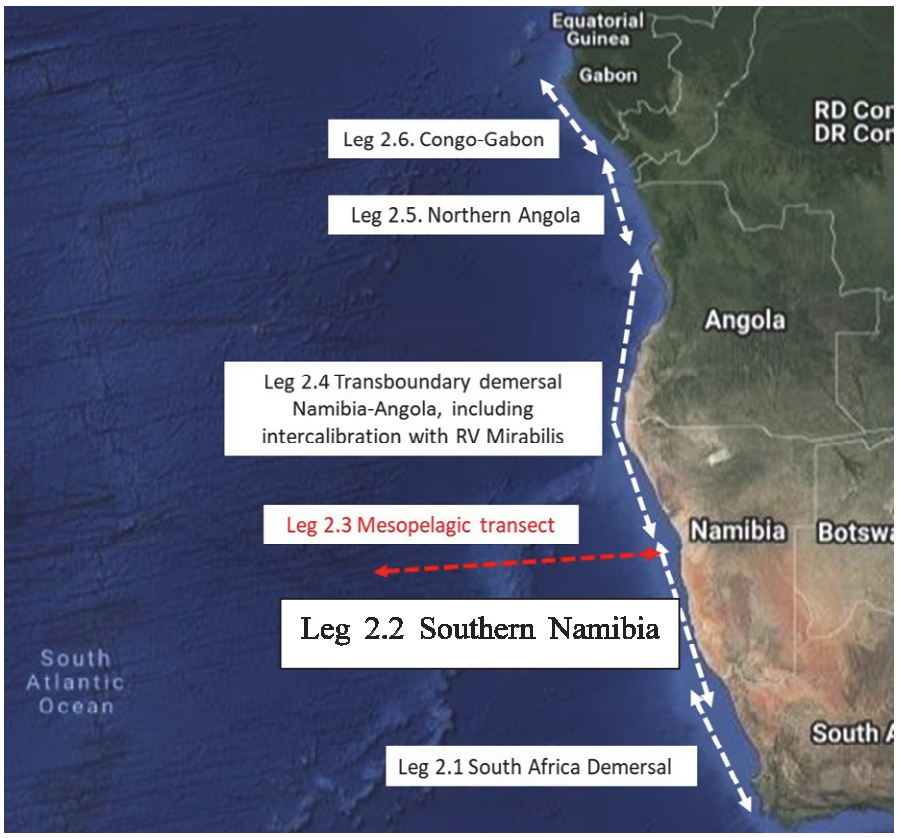


Figure 1. The survey plan for *Dr Fridtjof Nansen* during leg 2

Because of unforeseen constraints, Leg 2.6 (RDC, Congo and Gabon) had to be replaced by a deep ocean study starting in Luanda following 9°S westwards and turning north at 0°E. The survey objectives were adjusted accordingly, and the major objective became to better understand the dynamics of tropical upwelling systems in this region and the implications for the productivity in coastal areas.

Boreal summer is the period of large-scale seasonal changes in the equatorial Eastern Atlantic that affects upwelling conditions and, thus, productivity in the entire coastal areas of the Gulf of Guinea. A large pool of cold SST, referred to as the Equatorial Cold Tongue, develops just south of the Equator. Towards the end of June, it reaches its largest extent and includes coastal regions where it induces upwelling from Gabon to Congo. Driven by coastally trapped waves, this equator-induced upwelling propagates southward along the continental boundary to reach the Lobito - Benguela region off Angola. A northward branch of the coastally trapped

equatorial upwelling signal propagates in the thermocline along the northern Gulf of Guinea inducing the main upwelling season off Ghana and Côte d'Ivoire.

The upwelling seasons are strongly coupled to the seasonal conditions developing in the eastern equatorial Atlantic during the boreal summer correspond and shape critically the life history of coastal fishes from Guinea to Angola. Our understanding of this coupling, however, is solely derived from remote sensing observations and climatic models, and at present has a rather limited in situ validation.

This new survey Leg 2.6 with the R/V *Dr Fridtjof Nansen* crossed the equatorial Atlantic along the Prime Meridian during June-July, thus at the height of the Equatorial Cold Tongue season.

1.2 Survey objectives

1.2.1 Oceanography

- Investigate the transition from the Angolan upwelling to the open ocean and from the open ocean to coastal upwelling off Ghana-Ivory Coast.
- Investigate the northern perimeter of the Angola Dome and Angola Gyre.
- Determine physical, chemical and biological characteristics of the Equatorial Under Current (EUC) and equatorial upwelling.
- Investigate the northern transition between the Equatorial Cold Tongue and the westward current system in the central Gulf of Guinea.

1.2.2 Hydrography

- To map the hydrographic and environmental conditions (temperature, salinity, dissolved oxygen, chlorophyll-α, nutrients and pH).
- To obtain information on the dissolved oxygen concentrations, ocean acidification state and aragonite saturation state relevant for calcifying organisms.

1.2.3 Zooplankton, ichthyoplankton and jellyfish

- Describe principal groups of micronekton that form the Deep Scattering Layers (DSL).
- Link observed micronektonic groups to physical parameters to define their habitats.
- Investigate large-scale spatial changes in the composition and vertical migration pattern of micronekton observed along the survey path.
- Test the influence of oceanographic features of the equatorial Atlantic on acoustically determined distributions of micronekton.
- Detect a potential occurrence of pelagic fish stocks.

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

1.2.4 Fish resources

There was no specific objective in relation to fish resources. However, observations were made acoustically with sampling as appropriate, focusing on mesopelagic fish.

1.2.5 Microplastics and neuston communities

Map occurrence of microplastics and describe associated neustonic communities

1.2.6 Food safety

To collect samples for levels of environmental contaminants, nutrients, parasites and microorganisms with regards to food safety and pollution of selected species.

1.3 Participation

A total of 26 scientists and technicians from the Republic of the Congo, the Democratic Republic of the Congo, Gabon, Sao Tome and Principe, and Norway participated in the survey. The full list of the participants and their affiliations is given in Table 1.

Table 1. List of participants, their role, affiliation during survey leg 2.6

Name	**Role**	**Affiliation**
Knut Korsbrekke	Cruise leader	IMR
Fabian Zimmermann	Cruise leader trainee	IMR
Geir Landa	Acoustic engineer	IMR
Hege Rognaldsen	Acoustic engineer	IMR
Silje Seim	Fish sampling TL	IMR
Tom Williams	Fish sampling TL	IMR
Flore Nigerine Tsinga Keyi ep Langui	Fish biology	IRAF
Carmen Princia Bilombo Matondo	Fish biology	MAEP
Ange Kader Mbakou	Fish biology	MAEP
Arnaud Gildas Itoba Okemba	Fish biology	MAEP
Lunkayilakio Soleil Wamuini	Fish biology	ESU
Tite Romuald Akenze	Fish biology	MAEP

Name	Role	Affiliation
David Cervantes	Hydrography TL	IMR
Mirian Gorett Monte Verde Gomes Cravid	Water Chemistry	STP
Seraphin Ongagna	Water Chemistry	MAEP
Marius Issanga Ngamissimi	Water Chemistry	MTE
Jean Daniel Mbega	Water Chemistry	IRAF
Jorunn Sanden	Plankton TL	IMR
Dieudonne Pref Cety Emman Kissiekiaoua	Plankton biology	MAEP
Jean De Dieu Lewembe	Plankton biology	DGPA
Jean Marie Kambale Mangaya	Plankton biology	MAPE
Seboth Maganga	Plankton biology	DGPA
Lisbeth Dahl	Food safety TL	IMR
Ange Karelle Eyari Mfoumou	Food safety	MAEP
Hermine Mengue Ayefegue	Food safety	DGPA
Richard Blaise Ntse	Food safety	MAEP

List of institution abbreviations:

IMR – Institute of Marine Research, Bergen, Norway
IRAF – Institut de Recherches Agronomique et Forèstieres, Libreville, Gabon
MAEP – Ministère de l'Agriculture, de l'Élevage et de la Pêche, Brazzaville, Republic Congo
ESU – Enseignement Superieur et Universitaire, Mbanza-Mugungu, D.R. Congo
STP – Direction de la Peche Department de Recherches, Sao Tome, Sao Tome and Principe
MTE – Ministère du Tourisme et Environment, Pointe Noire, Republic Congo
DGPA – Direction Générale des Pêches et de l'Aquacultur, Libreville, Gabon
MAPE – Ministère de l'Agriculture, Peche et Élevage, Kinshasa, D.R. Congo

1.4 Narrative

The vessel departed from Luanda at 14:30 in the afternoon of 29th June 2019. The vessel started the survey at the first station in position 9° S and 13° E. The westward transect consisted of 27 stations with CTD observations on every station. 14 stations ("superstations") had additional observations using WP2, Bongo net and Manta trawl (see description in 2.2.5).

Based on acoustic registrations, fish samples were collected at 11 pelagic trawl stations along the westerward transect. With two exceptions, pelagic trawls were conducted between dusk and dawn to utilize the diel vertical migration of mesopelagic organisms that tend to aggregate close to the surface at night. The total catch weight at all trawl stations was relatively low, with the maximum catch collected at the first station close to the shore.

The first transect was completed on the 5th July 2019 at noon. At this point, the vessel turned in northern direction, following the 0° meridian in direction of Ghana and ending at the Ghanian EEZ. 34 fixed stations were placed on this transect, of which 12 were superstations. Furthermore, pelagic trawl samples were collected at 14 stations along the transect together with 6 multinet Mammoth stations. The sampling stopped at the border with Ghana's EEZ.

The vessel arrived in port at Tema at 10:30 local time on the 16th June.

1.5 Survey design and survey effort

The survey consisted of two transects:

- From the Angolan coastline along 9°S westwards to 9°S 0°E
- From 9°S 0°E straight north to Ghana's EEZ

The distance to be surveyed was planned to be 1700 nm with a total of 75 CTD stations and 29 of these with additional sampling (super stations), including work within Ghana's EEZ. However, work within Ghana's EEZ had to be cancelled because the fisheries licence was not obtained in time.

Occurrence of fish was observed using EK60 echosounder in combination with trawl stations. Figures 2 to 5 show the survey track, the position of CTD, plankton and trawl stations, respectively.

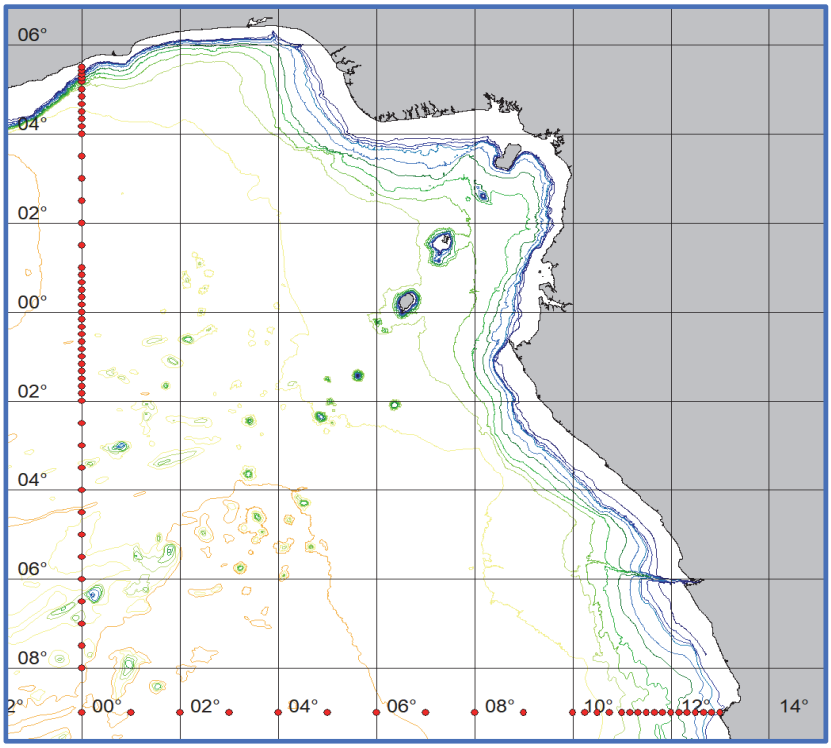


Figure 2. Survey track and planned oceanographic (CTD) stations

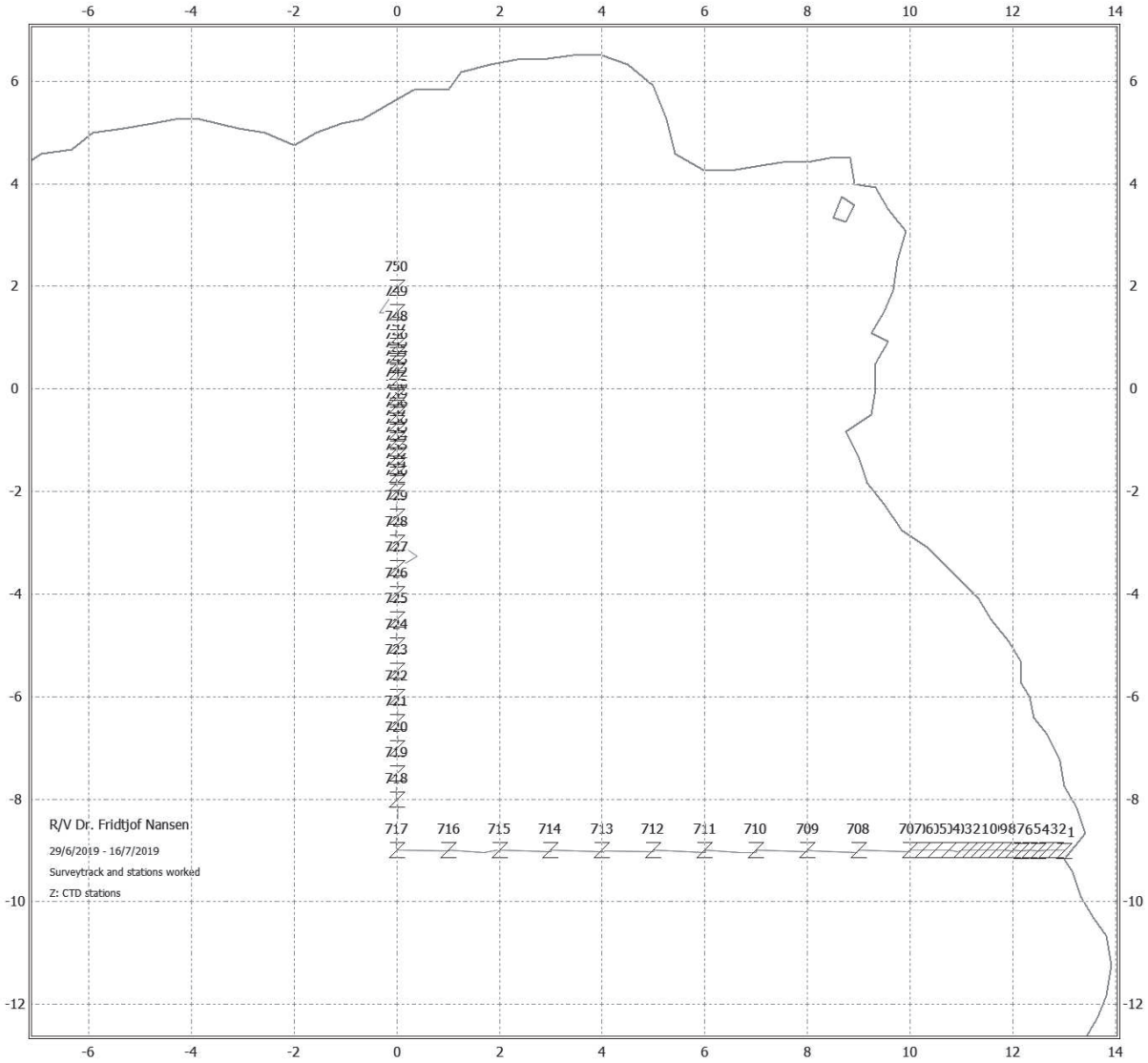


Figure 3. The 60 CTD stations sampled during the survey

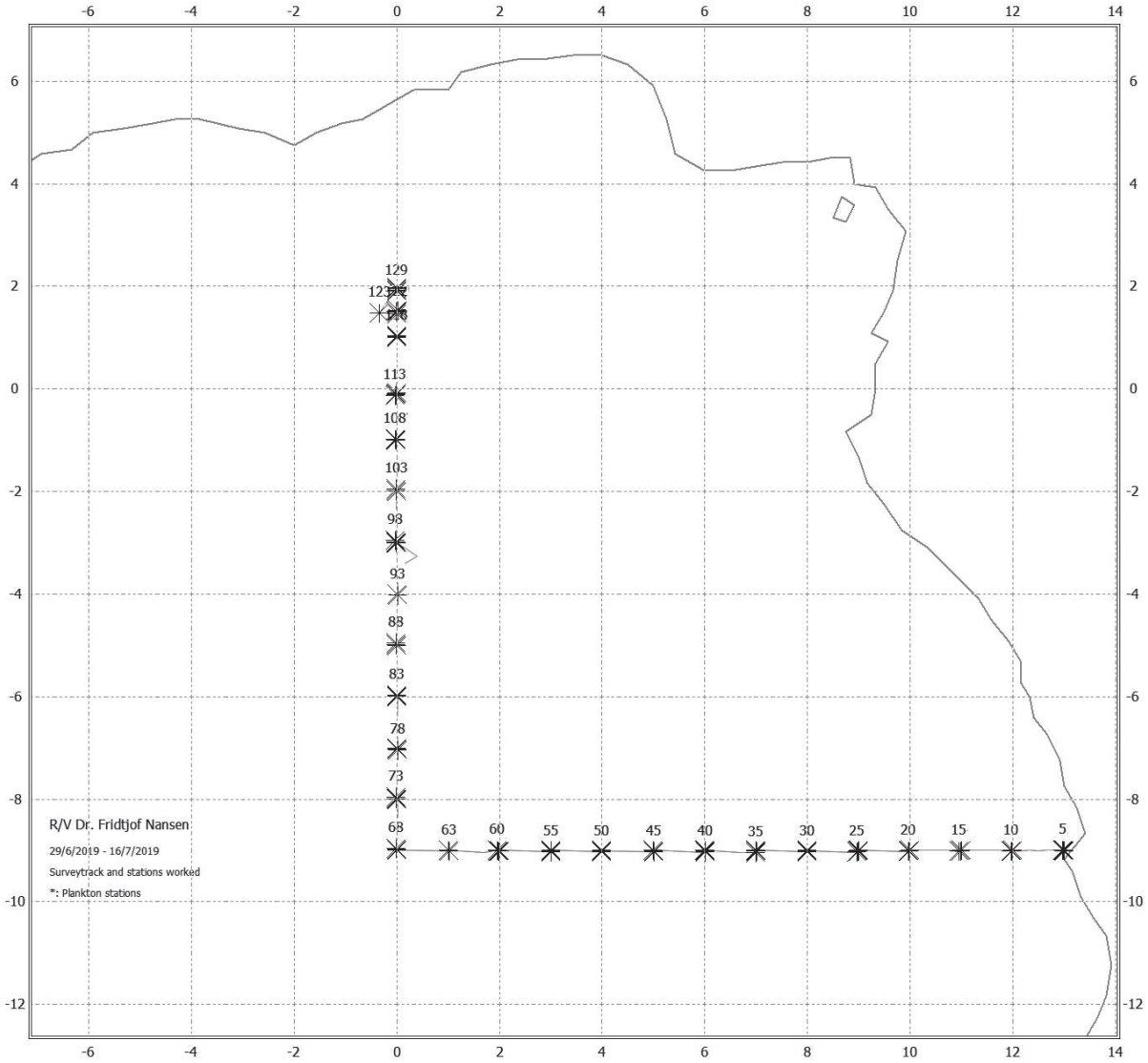


Figure 4. Position of 25 plankton stations

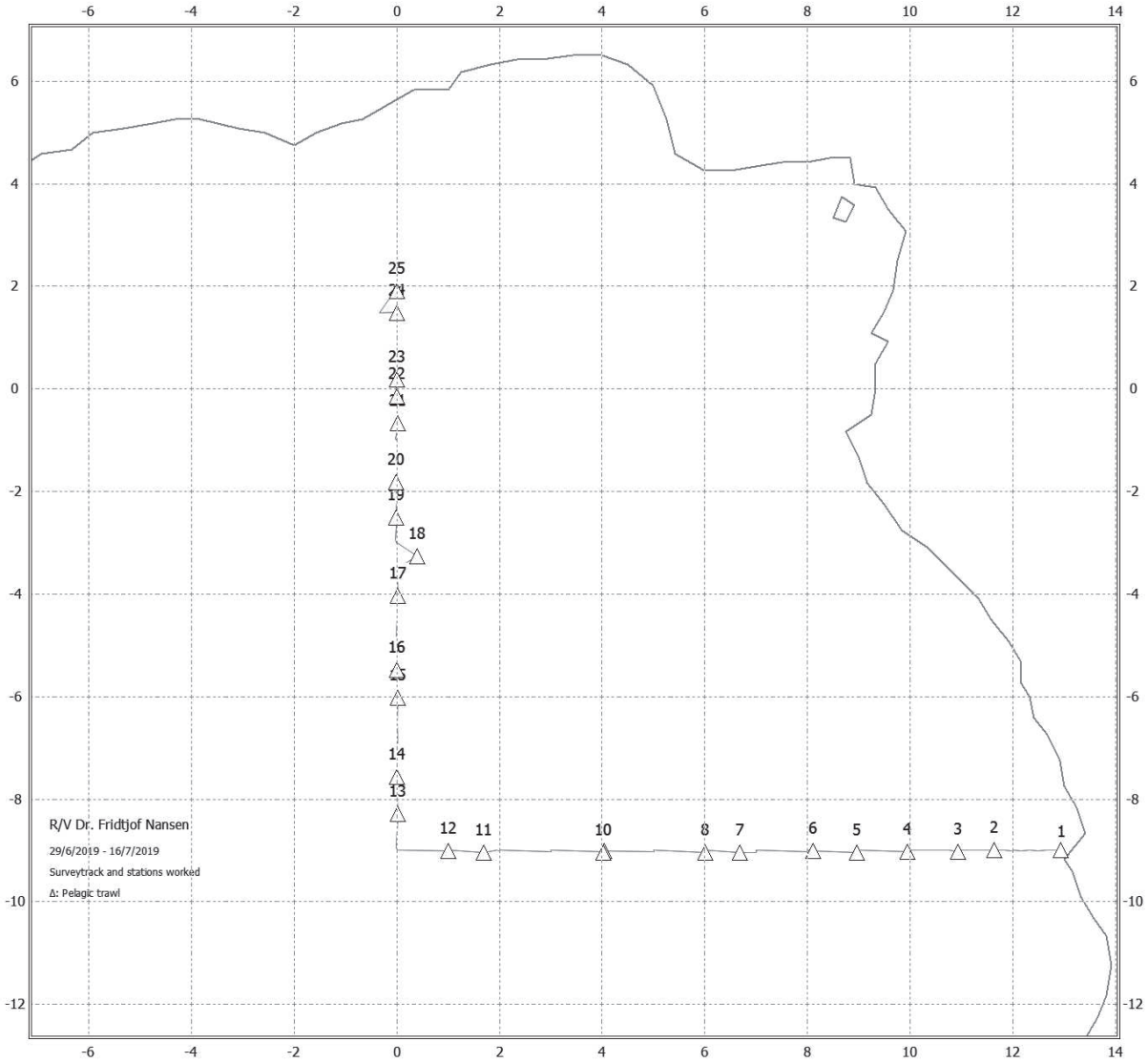


Figure 5. Map showing the 25 Pelagic Trawl stations

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.

2.1.2 Thermosalinograph

Two SBE 21 SeaCAT Thermosalinographs (TSG) ran continuously during the survey, obtaining samples at 4 meters depth and 6 meters depth to measure sea water salinity and temperature (internally and externally) every 10 seconds. The 4 meter TSG measured water from the intake of the engine cooling water, whereas the 6 meter TSG measured water from the intake at the drop keel holding the acoustic transducers. The 6 meter TSG was also equipped with a Sea-Bird WETStar Fluorometer for sub-surface fluorescence levels.

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. To account for this, the Lowered Acoustic Doppler Profiler (LADCP) was attached to the CTD frame to extend the current information to the maximum depth of the CTD casts. RDI's VmDAS data logging software was ran 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.

2.1.4 Bottom mapping echo sounder

The EM 302 multibeam echo sounder is a high-resolution seabed mapping systems. The EM 302 is mounted on the drop keel and the operational depths down to 5 000 m. The operating frequencies are 30 kHz. There are 402 beams. Sound profiles were set manually in the system according to the area of operation. Data from the EM 302 was logged to the on-board Olex plotting system and to raw data files.

2.2 Fixed station hydrographic sampling

75 hydrographic CTD deployments were planned from Luanda, Angola to Tema (Ghana), 29 of which (referred to as "super stations") involved extra hydrographic sampling for water chemistry and biological sampling for zooplankton, ichthyoplankton and jellyfish observations (Figure 6). During each super station CTD deployment, the 12-bottle rosette collected water at predefined depths (Annex I) during the up cast to obtain vertical profiles of pH, total alkalinity,

nutrients, and chlorophyll a. The CTD stopped at each depth for 20–30 seconds for water equilibration.

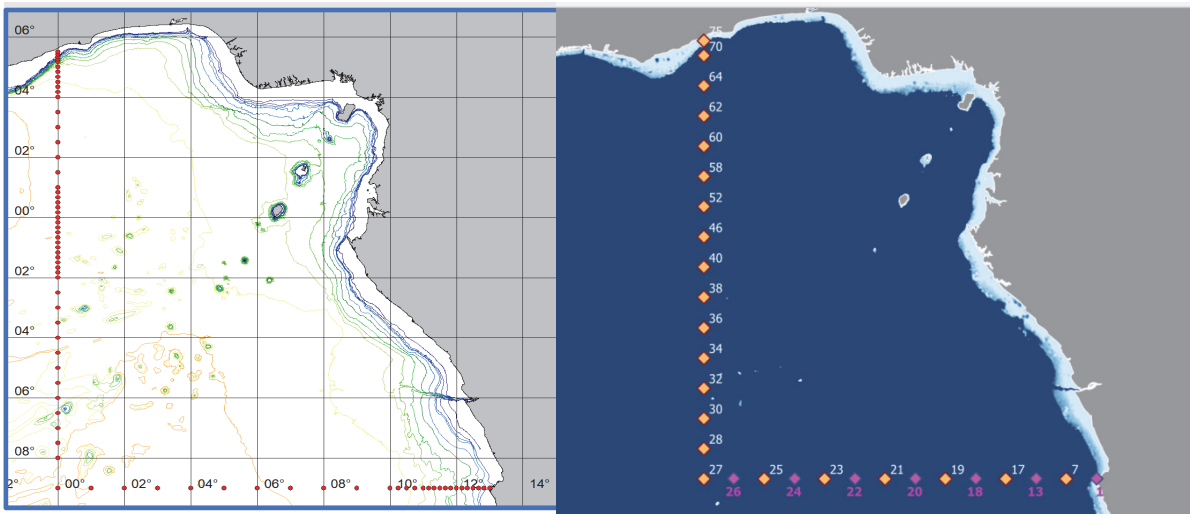


Figure 6. Survey track and oceanographic CTD stations (left) and super stations (right). Stations colored in purple represent the 7 super stations that were added to the original 22. No stations taken in Ghanaian waters (EEZ)

2.2.1 CTD sensors

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 Sea-Bird's Seasave software.

Water was collected from low-gradient depths of 300 m and below to perform on board validations of the dissolved oxygen sensor values. Measurements were performed using a Metrohm 916 Ti-Touch potentiometric titrator performing Winkler (Grasshoff *et al.*, 1983) and Karl Fischer titrations. The Guildline Portasal Salinometer 8410A was being repaired during the survey and therefore onboard validation of the CTD derived salinity values could not be validated. However, salinity values will be validated by the salinity samples collected from the previous and subsequent surveys when the salinometer returns to R/V *Dr Fridtjof Nansen*.

2.2.2 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.

2.2.3 Nutrient samples

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

2.2.4 Phytoplankton sampling

Chlorophyll a was measured to be used as an indicator for phytoplankton biomass. Water for chlorophyll samples were collected in 260 ml polyethylene bottles for filtration. These water samples were collected from depths ranging from 200 m to the surface and filtered using a 0.7µm filtration system (Munktell glass-fibre filters Grade: MGF, vacuum 200 mm Hg). The filters were stored in a freezer until they were transferred to centrifuge tubes with 10 ml of 90% acetone for 15 hours of extraction at 4°C. Samples were then centrifuged and transferred to cuvettes for measurement on a Turner Designs 10AU Fluorometer, according to Welshmeyer (1994) and Jeffrey and Humphrey (1975). First measured without acid for chlorophyll a determination and then a second time with two drops of 5% HCl for phaeopigment determination. The 10AU is calibrated approximately every three months with standards created from a chlorophyll a solid (from spinach).

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

2.2.5 Plankton and microplastic sampling

Zooplankton and ichtyoplankton samples were collected with WP2 vertical tows, Bongo hauls, Manta trawl and multinet Mammoth.

2.2.5.1 WP2

Zooplankton samples were collected with vertical tows of a WP2 net (180 µm). The net was towed within 5-10 m of the bottom to the surface on first station and for all other stations from 200 m depth to the surface. Each sample was halved 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 (60^{o}C) in pre-weighed aluminium trays. The second half was preserved in 4% borax buffered formaldehyde solution.

2.2.5.2 Manta trawl

The Manta trawl was deployed in parallel with the Bongo nets collecting microplastic and plankton in the surface layer. Total flow was registered. Samples from the Manta trawl were sorted on board for microplastics and ichthyoplankton.

2.2.5.3 Bongo net

Ichthyoplankton was collected with double oblique tows of a Bongo (405 µm). Samples were collected at all of the super-stations using double oblique tows from a depth of 200 m to the surface.

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. A total of 25 bulk Bongo V samples preserved in formaldhyde.

b) From the other net, the Bongo H, 8 was examined under the microscope and ichthyoplankton was sorted. The sorted larvae were photographed and preserved in 96% ethanol in small labelled scintillation vials. When sorting was finished, the bulk sample was preserved in 4% borax buffered formaldehyde (especially made for ichthyoplankton) in labelled bottles (as "sorted"). Samples not sorted were preserved directly in 96% ethanol.

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

2.2.5.4 Multinet Mammoth

The Mammoth plankton sampler consist of a Deck Command Unit and a steel frame with canvas part to which 9 net bags can be attached by means of zip fasteners. The net bags are opened and closed by means of an arrangement of levers which are triggered by a Motor unit.

Samples were taken from 500 m, 400 m, 300 m, 200 m, 125 m, 75 m, 50 m and 25 m depth. Samples devided with Motoda splitter in 2 samples from each depth. 50% of sample preserved in 4% formaldehyde and 50% preserved in 96% ethanol.

2.3 Pelagic-trawl fish sampling

2.3.1 Trawling strategy

The initial survey design was an *ad hoc* design with pelagic trawl stations based on acoustic registrations. The amount of fish visible on the echosounder was too poor to be informative. The strategy was replaced with a relaxed strategy with one pelagic trawl station after dusk and one more before dawn. The vertical migration of most organisms observed acoustically in the water column placed these at depths less than 60 m at night time. Each night time haul started at 60 m before slowly retrieving wire until the trawl was in the surface.

2.3.2 Biological sampling

Species identification, numbers and weight for each species was carried out as per standard procedure. Species identification followed the relevant *FAO Species Identification Sheets for Fisheries Purposes* (Carpenter *et al.*, 2016; Collette *et al.*, 1983; Jereb *et al.*, 2010), 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 *WoRMS* database (WoRMS Ed. Board, 2018) and *FishBase* (Froese and Pauly, 2018).

The biomass consisted mostly of the family Myctophidae of different sizes. When the biggest fish had been removed from the catch, the rest was subsampled due to the large amount of small-sized Myctophidae. The majority of Mictophidae was either too small or too damaged in the trawl to be identified to species or genus. These were registered as Myctophidae (MYCAA00) with catch weight and normally also catch number. No length measurements were taken for Myctophidae, but when possible, the Myctophidae catch was sorted by size and registered as Myctophidae (MYCAA00) with catch weight and number for large and small fish.

Larger specimens (>2.5cm) of Myctophidae that were not too damaged, were sorted as much as possible into different species. Some efforts were also made to sort smaller specimens (<2.5cm) into species if the photophores were intact and clearly visible. Numbers and weight for each species was carried out as per standard procedure. In most cases myctophids were not identified on board, instead samples were taken for future taxonomic identification. Due to difficulties however experienced in sorting the Myctophidae into different species, there is some uncertainty about how well the specimens collected and registered for taxonomic verification reflect the true species distribution of the catch.

Length measurements of commercial species were only taken at station 1 near the coast and of larger specimens of *Cubiceps pauciradiatus* along the transect. Samples were collected of "uncommon" and unidentified fish from all families. Each species was clearly coded in the catch data and the samples labelled accordingly. A sample included:

- a photo of the specimen
- a tissue sample for genetics
- a specimen preserved in a 90% sea water/10% formalin solution for future analyses

All photos taken were catalogued per trawl station and saved in survey folder.

A list of all samples taken can be found in Annex VII.

2.4 Acoustic sampling

2.4.1 Sonar data

Sonar was only used during the survey to detect possible schools of pelagic fish.

2.4.2 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. The transducers were last calibrated in Walvis bay on 11 and 12 May 2019.

2.4.3 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 2.6.0.

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 2.

The acoustic data were only used to observe the potential occurrence of pelagic and mesopelagic fish as well as the plankton distribution; no acoustic biomass estimations were attempted. The echograms were scrutinised during the survey to allocate the species groups and determine whether any relevant fish resources were present. Trawl catches were used to substantiate the allocations of acoustic data.

The acoustic data are available for subsequent analysis. The identifications recorded in the LSSS system were the best assessments of the scrutinisers and guided by the catches of the pelagic trawls in that area. Nevertheless, these identifications must be used with caution and we recommend limiting any analysis to echo values attributed to “Plankton” only.

Table 2. Allocation of acoustic densities to species groups

Group	**Taxon**
Mesopelagics	Myctophidae Sternoptychidae
Pelagic 1	Clupeiformes
Pelagic 2	Scombridae
Other pelagic species	Bramidae Cephalopoda Gempylidae Nomeidae
Plankton	Various

2.5 Top predator observations

No dedicated top predator observers were on board.

2.6 Jellyfish collection

The occasional occurrence of jellyfish did not constitute any basis for further analysis.

2.7 Nutriton and food safety

2.7.1 Background

Consumption of fish is acknowledged as an important component of a balanced diet by providing several essential nutrients. Further, fish plays a central role in nutrition and food security as a significant source of high-quality proteins, long chain n3 fatty acids, several vitamins and minerals. The concentration of these nutrients varies in different fish species. Presently there is little data on the content of nutrients in most fish species captured around the world. In addition to knowledge of the contents of nutrients, there is a lack of data on the contents of contaminants such as heavy metals and persistent organic pollutants that can be present in different types of fish. Knowledge on the concentration of contaminants is of significance both to assess seafood safety and possible effects of environmental pollution.

The priority species in this part of the EAF-Nansen project are *Sardinella maderensis* (Madeiran sardinella), *Sardinella aurita* (round sardinella) and *Engraulis encrasicolus* (anchovy). As Leg 2.6 was a deep-water oceanographic cruise these coastal species did not occur and could therefore not be sampled. However, selected fish were collected partly based on commonly eaten species or the idea that the fish could be relevant in the future. As mesopelagic fish may be a potential food resource , it is necessary to have documentation on nutrient and contaminant levels.

2.7.2 Sampling methods and sample preparation

Mesopelagic fish are generally small and will be analysed as composite samples of whole fish. The mesopelagic catch contains a mixture of many different species of fish and crustaceans. Since it has been difficult to verify species due to both high variety in the catch, lack of time and knowledge, most of the samples were identified at family or genus level. One or a few dominant species have been sampled in the catch and the goal was to sample at least three samples from each species.

The composite sample of small fish (<25 cm) should contain at least 25 fish or 120 g wet sample material. Because of the small size of mesopelagic fish, some samples contain more than 25 fish in order to get 120 g. The weight and length of each fish was recorded.

The compostite sample of large fish (>25 cm) should contain five fish. The weight and length of each fish were recorded before head, internal organs and tail were removed. Then the skin was removed, and the weight of the fillets was recorded.

One to three parallel composite samples were collected of the same fish in one trawl. Then the fish was homogenised using a food processor and the wet sample of approximately 120 g was

transferred into a salat tray and the weight was recorded. All samples were then stored in the freezer (-20°C and -80°C) pending freeze drying.

Several technical problems were experienced with the freeze-dryer machine and had to use several days involving many people before we managed to get the freeze-dryer starting again.

After freeze drying all samples in 24 hours, the samples were weighted again for calculation of dry matter percentage, ground and transferred to 50 ml tubes. The next step was vacumation of 10-12 tubes in a bag and storage in the large freezer pending transportation to Norway and analysis of nutrients and contaminants at IMR.

Analysis of nutrients includes: Energy, water content, total fat, protein, ash, fatty acids, cholesterol, vitamins (D, A, B12), iodine, selenium and other minerals. Samples will be stored pending budget for analysis of amino acids and other vitamins.

Analysis of contaminants: Analyses of heavy metals will be carried out. Samples will be stored pending budget for analysis of inorganic arsenic, methyl mercury, PCB, dioxins, furans, PBDE, pesticides, and PAH.

CHAPTER 3. RESULTS

3.1 Oceanography

3.1.1 Wind speed and dircetions

Data from the AANDERAA Smartguard Meteorological station can be used to calculate wind speed and directions during the survey.

3.1.2 Near sea surface temperature, salinity and fluorescence

The coastal region of Angola recorded the lowest sub-surface temperatures (19.8°C) and highest values of fluorescence (4.6 mg/m3) during the survey, indicating coastal upwelling (Figure 7). Fluorescence remained relatively low except for a drop right before a sudden increase again near the equator. This drop and sudden increase also showed up on the temperature and salinity readouts causing suspicion related to the functioning of the thermosalinograph, but the trends were confirmed by the CTD sensors. For most of the survey, the sub-surface temperature remained near 24°C and 25°C. When the vessel reached the equator however, values spiked up above 26°C. Salinity experienced a decrease at the equator to 34.218 PSU and averaged near 35.000 PSU for the remainder of the survey after recording an average just below 36.000 PSU for most of the survey. The 6 m drop keel TSG was chosen for analyses because the 4 m TSG proved to give inconsistent data when compared to the drop keel TSG and CTD.

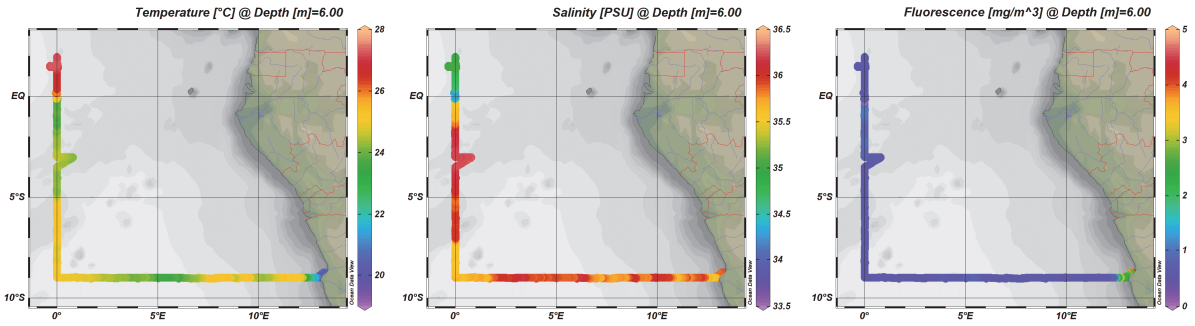


Figure 7. Near sea surface measurements of temperature salinity and fluorescence, recorded at 6 m depth by the drop keel thermosalinograph

3.1.3 Hydrographic sections

Dr Fridtjof Nansen left Angola due west along the 9°S latitude line until it reached the prime meridian, at which point, the vessel turned and headed north to Ghana, providing two hydrographic sections (Table 3, Figure 8).

Table 3. Survey effort for CTD stations, super stations, and hydrographic samples by main transct. Data from station 717 used for both transects

	Total	Westward	Northward
Total CTD stations	60	27	34
Super stations	25	14	12
pH	264	141	135
Total alkalinity	264	141	135
Chlorophyll a	133	75	64
Nutrients	264	141	135

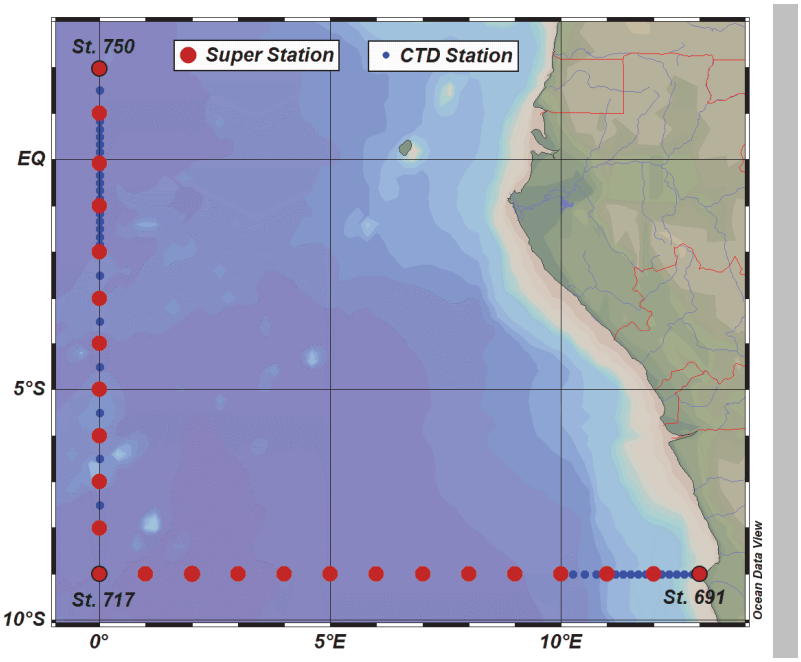


Figure 8. Completed CTD and Super Station positions for Leg 2.6

Westward Transect

Immediately as the survey began, the vessel experienced relatively cooler sea surface temperatures (~20°C) and increased fluorescence readings (~4.5 mg/m3) against the Angolan coast. Both indications of upwelling, which also brought along lower dissolved oxygen surface levels (~2.5 ml/l) from the 200 m to 600 m range. Dissolved oxygen levels below 1 ml/l in that depth range remained low as we approached the prime meridian but did have some signs of increased concentrations. In addition, dissolved oxygen levels began to increase again below 600 m. 26 of the 27 hydrographic stations along this horizontal transect lowered

the CTD to 1 000 m. However, station 713 at 4°E was lowered to 2 000 m and recorded dissolved oxygen levels increasing above 5 ml/l (Figure 9).

The pH also shows low values consistent with the low dissolved oxygen between 200 m and 600 m in the mesopelagic layer. These findings in addition to the noticeably dense concentrations of plankton on the echosounder between 200 m and 500 m provide indication of microbial plankton respiration (Robinson, 2019) in which oxygen is consumed to convert sinking organic matter into CO_2, which then lowers the pH at those depths. In addition, the 2 000 m station (station 713) also showed an increase in pH to above 7.7. Although this is higher than the observed lows of 7.4 between 200 m and 600 m, it is still much lower than the surface water and is a value more commonly seen with sinking CO_2 accumulation when microbial plankton respiration is not taking place.

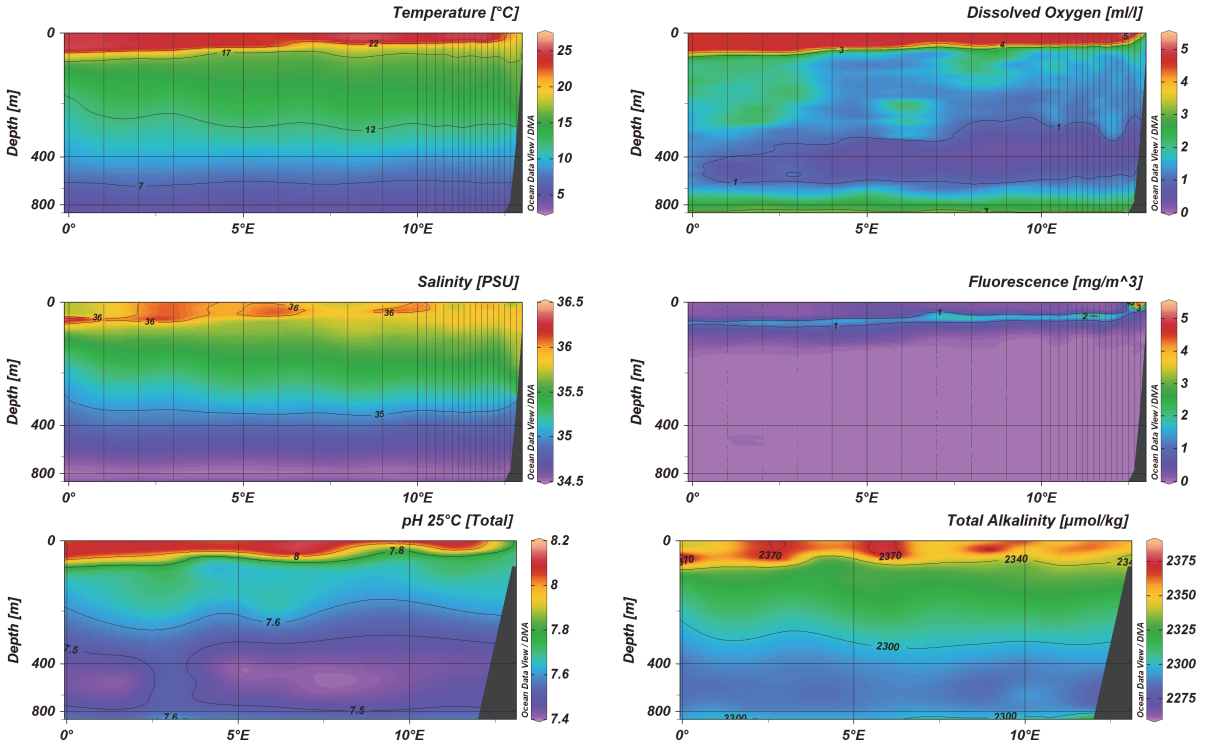


Figure 9. Cross sections along the Westward transect for temperature, salinity, dissolved oxygen, fluorescence, pH and total alkalinity as recorded from the CTD stations and super stations

Northward Transect

Stations that only included a CTD deployment were chosen for 2 000 m observations to observe the suspected increased levels of dissolved oxygen in the bathypelagic zone. Indeed, dissolved oxygen levels began to increase above 5.5 ml/l as a result of little to no microbial plankton respiration at these depths (Figure 10). Although still experiencing low dissolved oxygen as *Dr Fridtjof Nansen* travelled northward, average low concentrations began to increase above 1 ml/l near 4°S and continued this trend as the vessel approached 2°N where observations had to conclude. pH levels followed the same trend as dissolved oxygen, indicating a slow drop off in microbial plankton respiration. Sub-surface temperature began to increase above 26°C and pH approached 8.2 as the vessel passed the equator. Salinity and

total alkalinity however began to decrease, which could indicate the beginning of influence from the Guinea Current. Fluorescence remained relatively low with a high of 2.19 mg/m3 near 2°S that began to decrease in both concentration and depth as the vessel travelled northward. Future surveys are encouraged to observe the water south of Ghana.

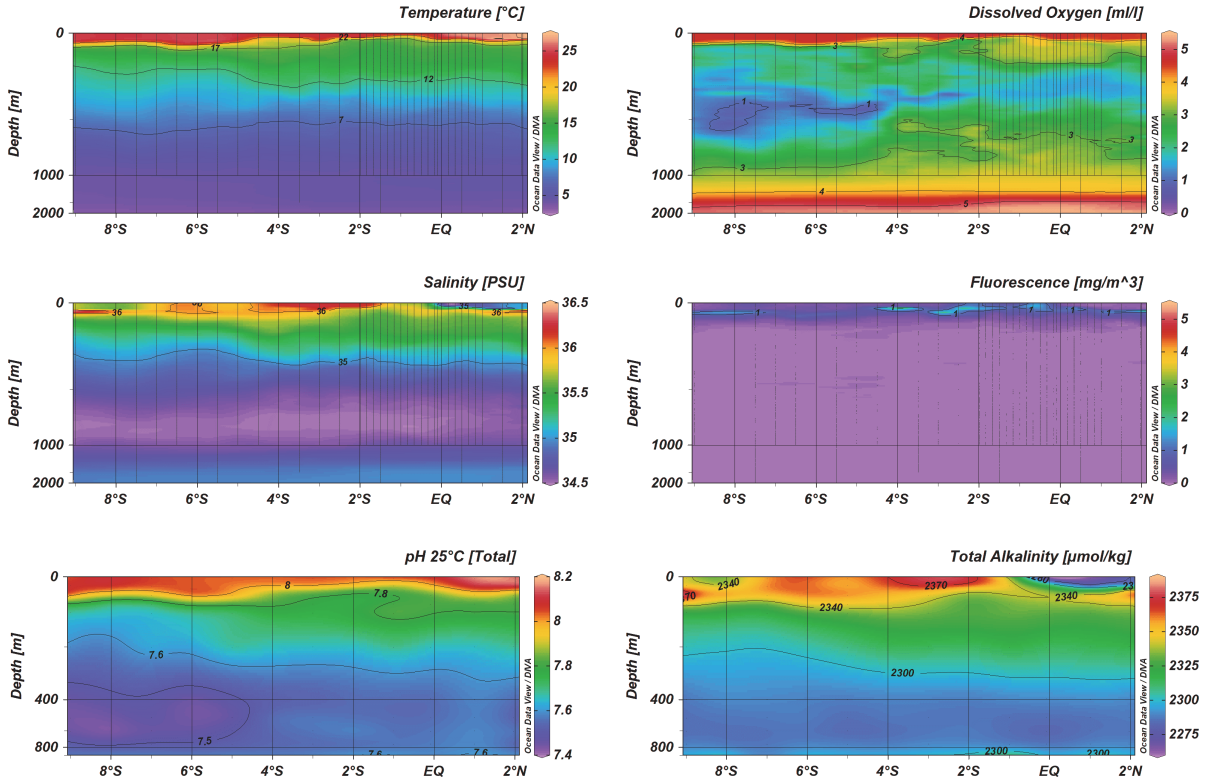


Figure 10. Cross sections along the Northward transect for temperature, salinity, dissolved oxygen, fluorescence, pH and total alkalinity as recorded from the CTD stations (2 000 m) and super stations (1 000 m). Water was only collected to 1 000 m for pH and total alkalinity for resolution purposes

Once nutrient samples are analysed at IMR, the pH and total alkalinity data can be combined with phosphate and silicate concentrations to calculate the area's inorganic carbon components along with aragonite saturation levels to update the ocean acidification status of the region. The nutrient data can also be used to describe the nutrient distribution throughout both transects.

3.1.4 Ocean Currents

The Teledyne RDI Ocean Surveyor Acoustic Doppler Profiler (ADCP) OS150 operated at 150 kHz for the duration of the survey without any issues and collected heading, pitch, roll and positional data. The 75 kHz ADCP was in need of repair and was not operational. The Lowered Acoustic Doppler Profiler (LADCP) was attached to the CTD frame to account for the unusable 75 kHz ADCP but experienced misconfiguration issues and only successfully collected data on the final CTD station. Results are presented in Figures 11 and 12.

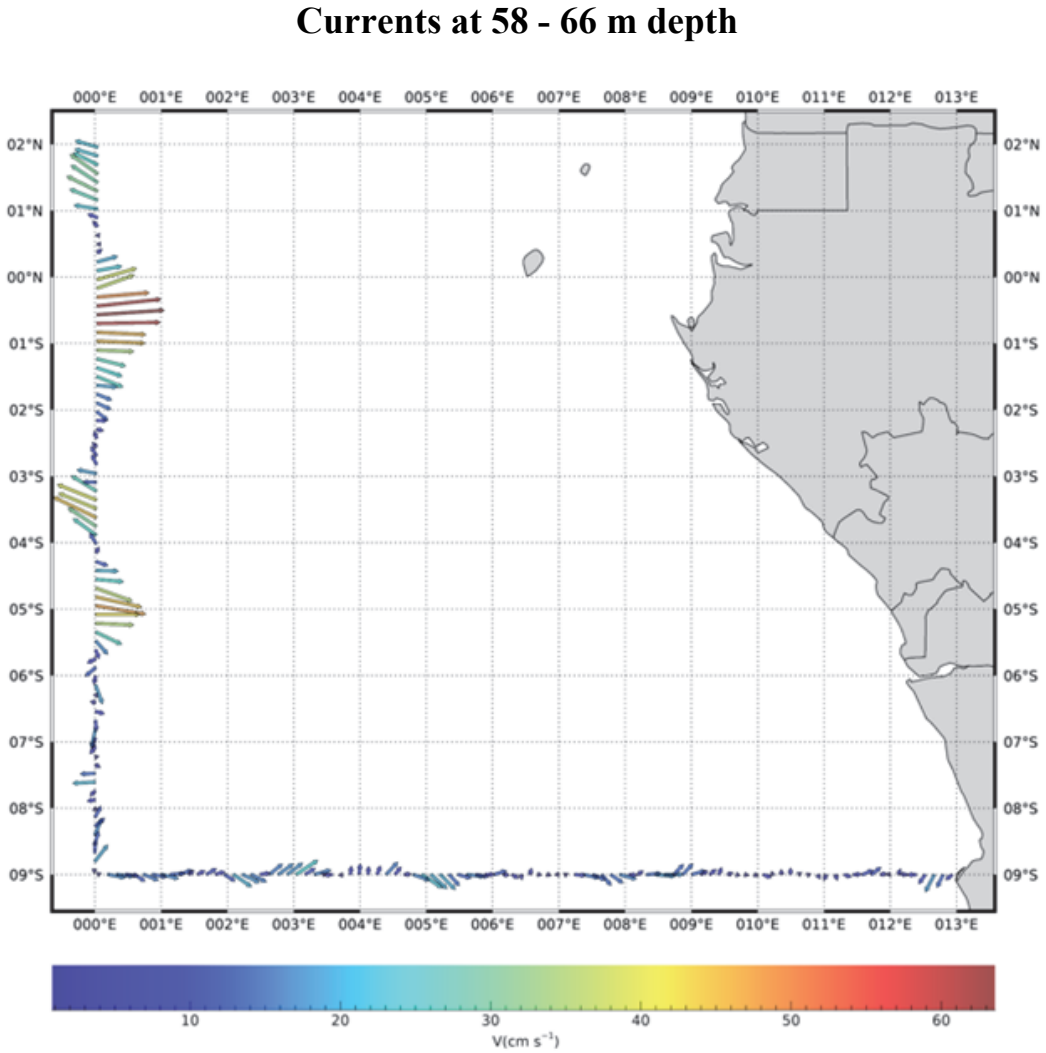


Figure 11. Preliminarily processed average currents from the 58-66 m depth layer. The two cores of the eastward flowing current represent the Equatorial Undercurrent (0-1°S) and the South Equatorial Countercurrent (5°S), respectively

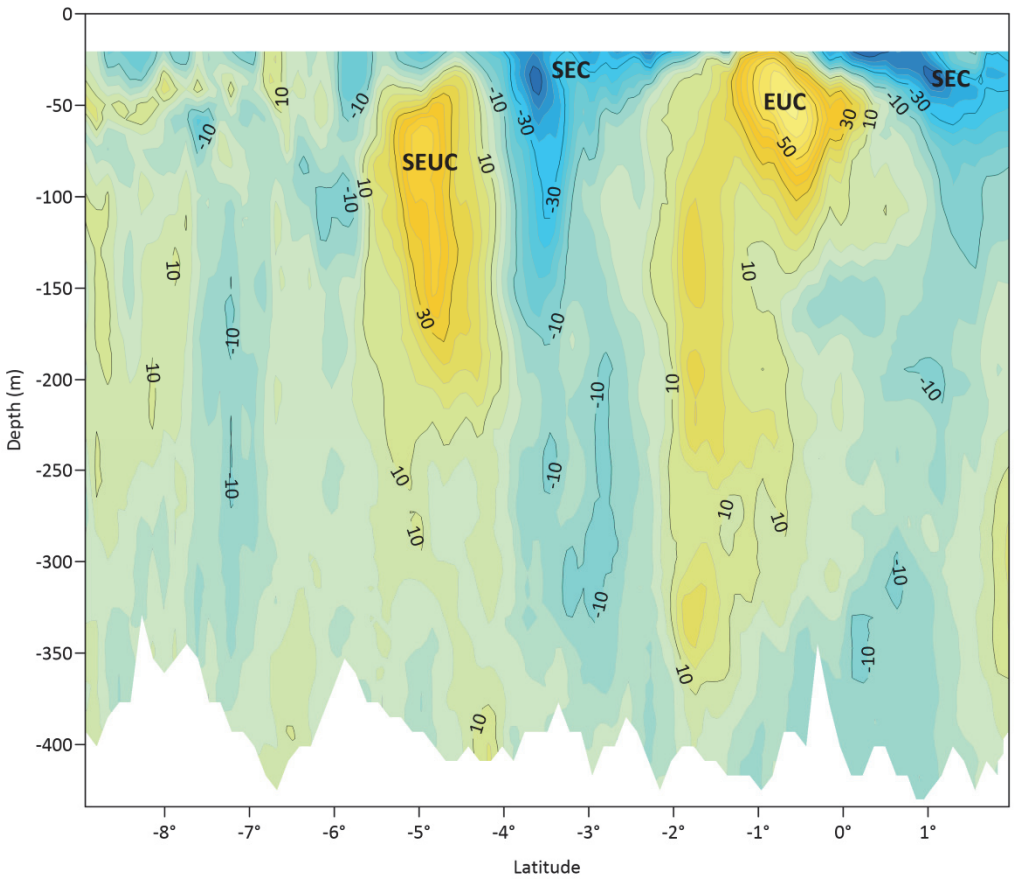


Figure 12. Vertical cross-section of the northward transect depicting the depth range of the South Equatorial Undercurrent (SEUC), Equatorial Undercurrent (EUC) and South Equatorial Current (SEC)

3.2 Plankton and microplastic sampling

3.2.1 Phytoplankton

Chlorophyll a is the pigment responsible for photosynthesis and is therefore found in photosynthetic organisms such as phytoplankton. Chlorophyll a concentrations can then be used as an indicator for phytoplankton biomass estimations if the phytoplankton species in the area are known. Chlorophyll a concentrations reached a high just below 2 µg/l against the coast of Angola, which combined with the low temperatures against the coast (Near sea surface temperature, salinity and fluorescence) provide further evidence of upwelling (Figure 13). One can expect increased nutrient levels here as well. For the rest of the survey in the open ocean, chlorophyll a concentrations remained relatively low below 0.4 µg/l.

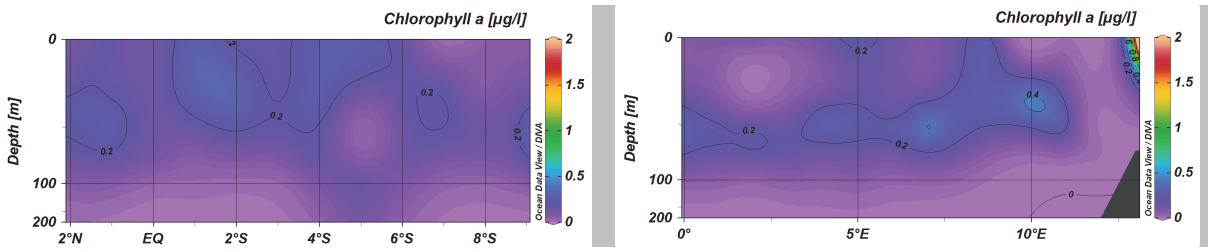


Figure 13. Cross sections of chlorophyll a along the Northward and Westward transects

3.2.2 Ichthyoplankton

3.2.2.1 WP2

Based on WP2 samples, a total of 71 aluminium trays produced during the survey will be transferred to IMR for zooplankton identification. A total of 25 WP2 samples (4% borax buffered formaldehyde) were prepared.

3.2.2.2 Manta trawl

A total of 35 scintillation vials and 100 ml bottles with sorted larvae and eggs preserved in 96% ethanol and were transferred to IMR for taxonomic identification. A total of 23 bulk Manta trawl samples (13 x 100 ml and 5 x 250 ml bottles) preserved in 96% ethanol will be transferred to University of Western Cape, South Africa, for future analysis.

3.2.2.3 Bongo nets

A total of 25 bulk Bongo V samples preserved in formaldhyde. 8 of the Bongo H samples was sorted and ichtyoplankton was sorted out and preserved in n 4% borax buffered formaldehyde (especially made for ichthyoplankton) in labelled bottles (as “sorted”). Remaining plankton and samples not sorted were preserved directly in 96% ethanol.

3.2.2.4 Multinet Mammoth

There was a total of 6 stations with the Mammoth multinet. The first station was discarded since too few nets were released. The 5 valid tows are labelled PL120, PL121, PL122, PL123 and PL129. Net 3 (N3) was not functional in any of the tows.

Station PL120: N7, N8 and N9 did not release

Station PL121: all OK

Station PL122: N9 did not release

Station PL123: N9 lost

Station PL129: All OK (without N9) First depth range changed to 500-300 meters

Every sample was split in half and saved in 4% formaldehyde and ethanols respectively. A total of 38 samples of each.

3.2.2.5 Overview of ichthyoplankton samples

Table 4. Ichthyoplankton samples collected and their corresponding conversation method

WP2-net	25 x 100ml bottle. Formaldehyde 71 Aluminium trays
Manta-net	23 x 100ml bottle. 39 scintillation vials. 20ml, 96% ethanol 6 Aluminium trays with microplastics
Bongo-nets	25 x 250ml bottles. -4% formaldehyde 25 250ml bottles. -96% ethanol 8 x 20ml scintillation vials
Mammoth nets	38 x 100ml bottle. 4% formaldehyde 38 x 100ml bottle. 96% ethanol bottle

3.2.3 Microplastics and Debris

A total of six aluminium trays with microplastics will be transferred to IMR for further processing.

3.3 FISH SAMPLING AND ACOUSTIC OBSERVATIONS

3.3.1 Trawl sampling

Trawl samples were collected at a total of 25 stations. Following acoustic observations, trawl samples were only collected during darkness after station 4 to utilize the diel vertical migration of mesopelagic organisms and their accumulation near the surface. Before, two trawl hauls during daytime revealed very low fish densities both in deeper and shallower depth. The catches were generally small, ranging from 6–200 kg, the median catch being 30 kg. Overall there were few large fish (>100g) or commercial fish species.

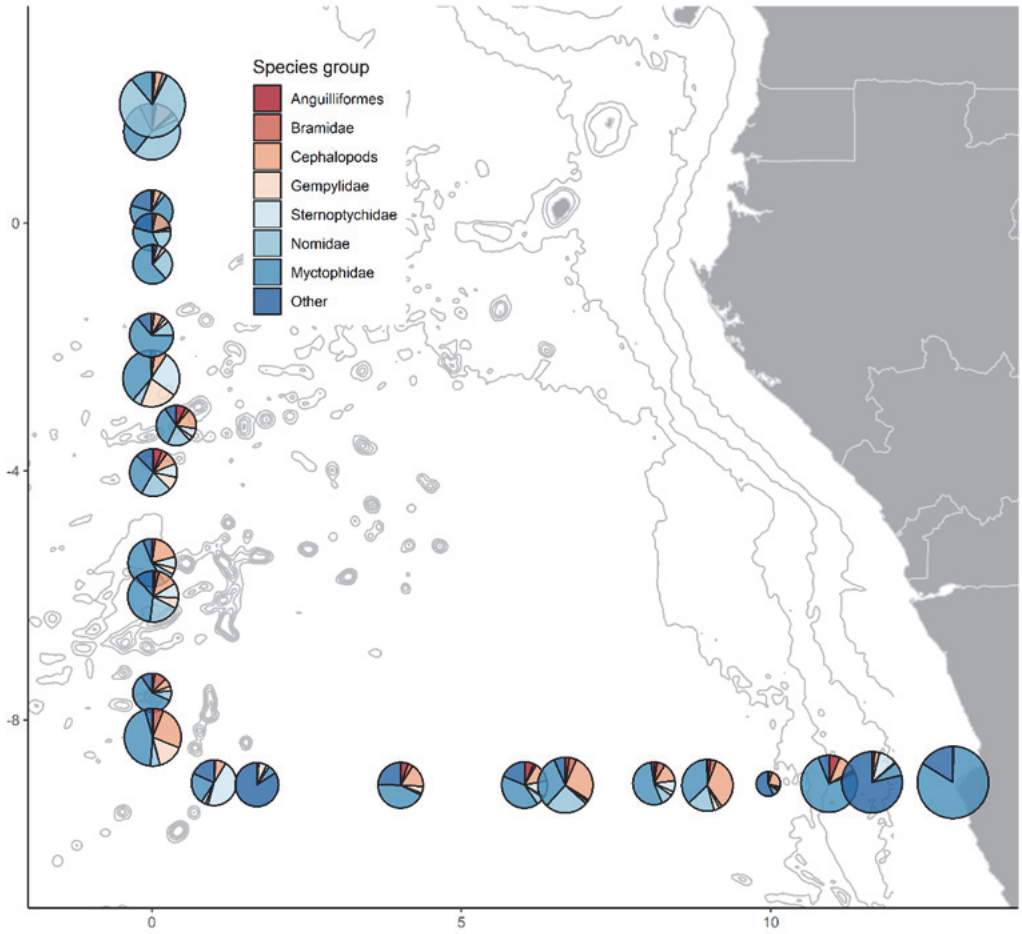


Figure 14. Location of all trawl station and their catch composition. The pie charts are scaled to the log-transformed total catch weight at each station. Shown are major taxonomic groups, remaining catch was aggregated as other

Catches at most stations were dominated by mesopelagic fish primarily Myctophidae and to a lesser degree Sternoptychidae. Other relevant components of trawl samples were *Cubiceps pauciradiatus* (Nomeidae), *Gempylus serpens* and *Nesiarchus nasutus* (Gempylidae), Bramidae, cephalopods, notably *Todarodes* sp., and Anguilliformes larvae (Figure 14). The proportion of the different taxonomic groups remained relatively constant along the offshore areas of the westward and northward transects (Figure 15). The largest variation was found for *C. pauciradiatus* (Nomeidae) which was a main catch component at some stations but largely absent at others (Figure 16). *C. pauciradiatus* showed also the largest variation in mean catch in weight (Figure 17) whereas the four other species that occurred most consistently along the transects and could be taxonomically determined, *B. dussumieri*, *G. serpens*, *N. nasutus* and *T. sagittatus*, had a very even distribution of mean weights. Because mean weight was derived from catch weight and number, the weight distribution within each sample remained unknown.

Besides cephalopods, krill was the only invertebrate that was caught commonly along the transects and partially in substantial quantities (Figure 18). Additionally, various tunicate species were found, however in very low numbers. The only exceptions were stations 2 and 3

where the trawl depth was significantly deeper than at all the other stations (400 m, during the day; 112 m, during the night) and tunicates contributed the largest share of the catches.

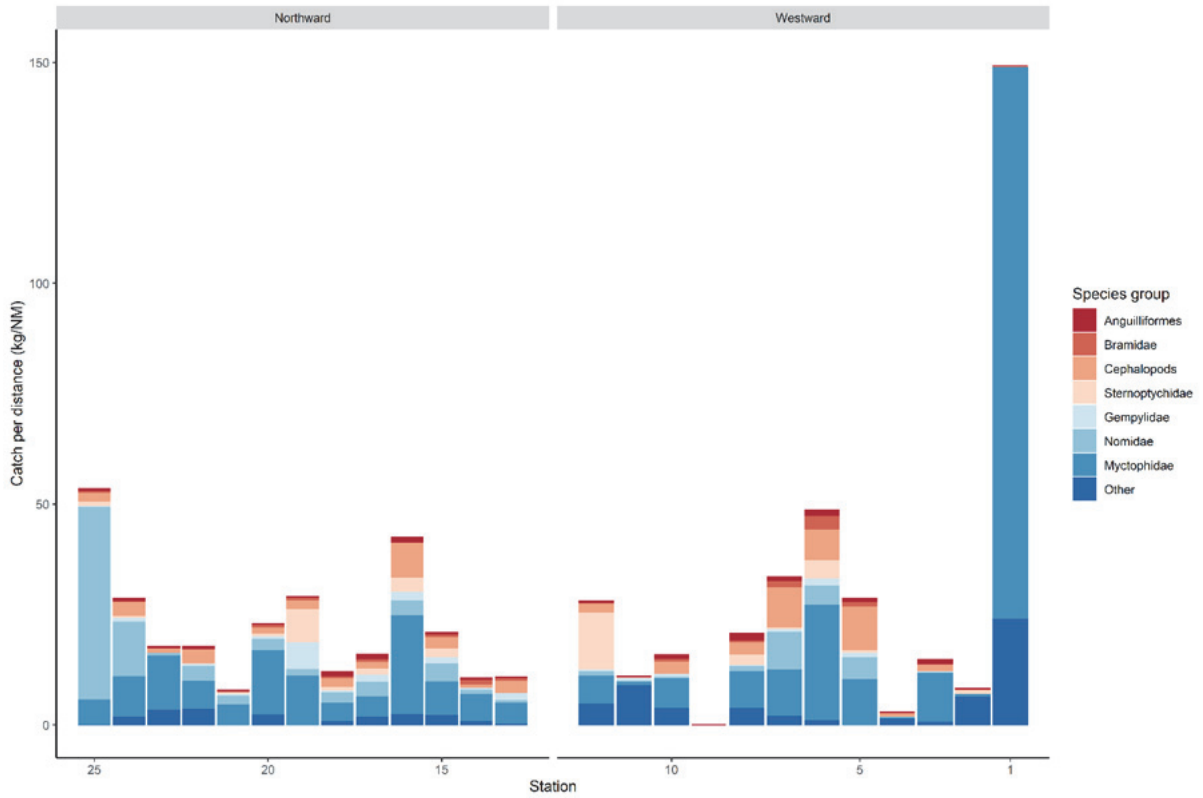


Figure 15. Catch per trawl distance (kg/NM) of fish (including cephalopods) at each trawl station along the westward and northward transects. Major taxonomic groups are shown, remaining catch was aggregated as other

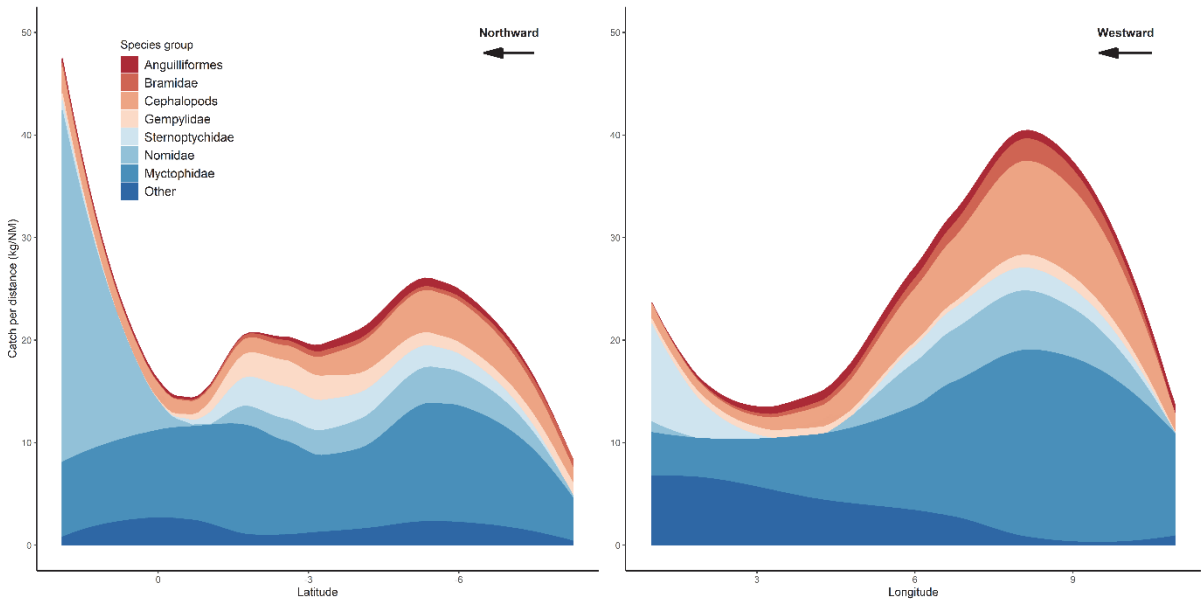


Figure 16. Catch per trawl distance (kg/NM) of fish (including cephalopods) along the northward (latitude) and westward (longitude) transects. Shown are major taxonomic groups, remaining catch was aggregated as other. The data used are the smoothed version of the data presented in Figure 14 with the first 4 coastal stations removed

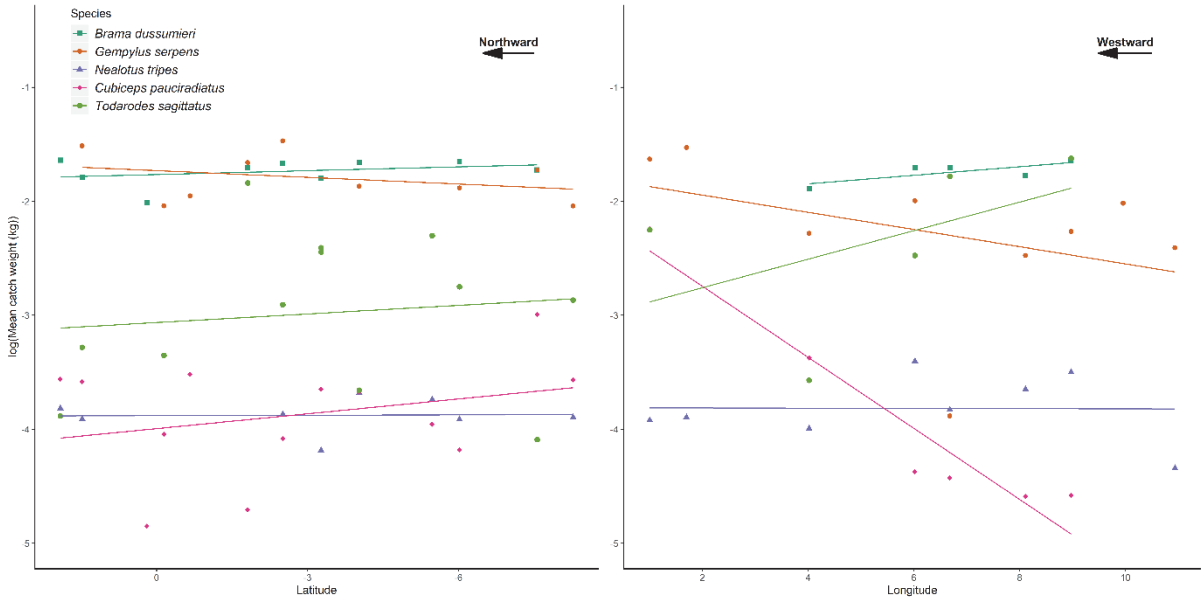


Figure 17. Log-transformed mean catch weights (dots) of five species that were consistently caught along the northward (latitude) and westward (longitude) transects with a linear trend line

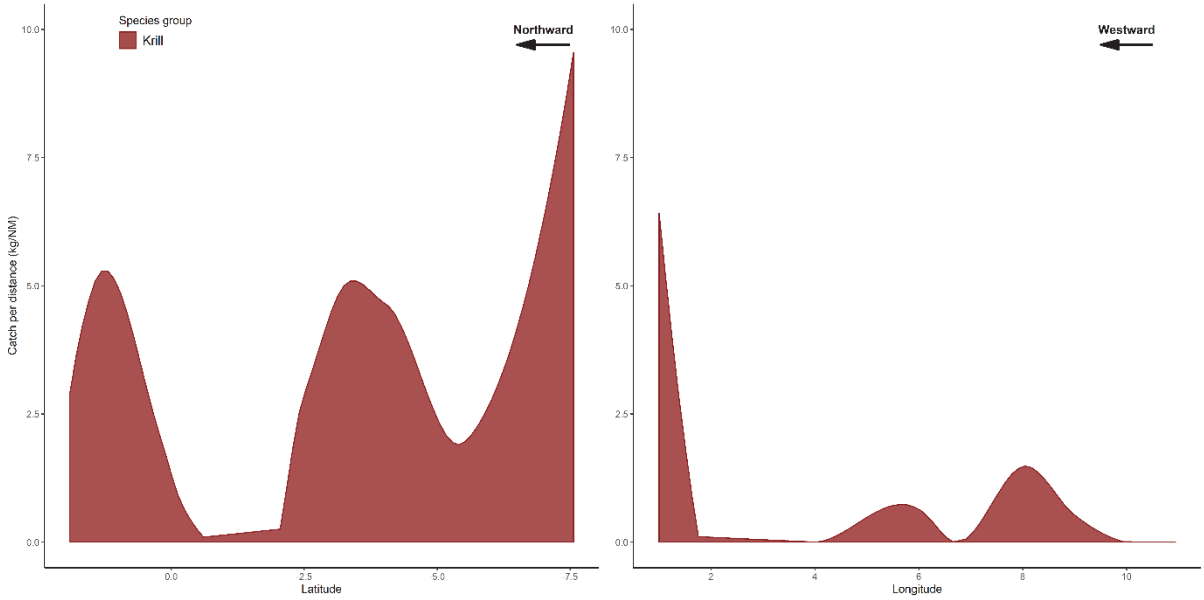


Figure 18. Catch per trawl distance (kg/NM) of krill along the northward (latitude) and westward (longitude) transects

3.3.2 Other observations/Biodiversity

All trawl catches were taken using the same pelagic trawl and − with the exception of station 2 (max. depth 400 m) and station 3 (max. depth 112 m) − at maximum fishing depths between 17–70 m. Occurrence of coastal species (*Trachurus trecae, Sarda sarda, Saurida brasiliensis, Merluccius polli and Synagrops microlepis*) was only observed in station 1. Mesopelagic and offshore pelagic species and families dominated in all other catches. Two species of Molidae were found in station 11 and 12. The first was an adult specimen (19 kg)

of *Masturus lanceolatus* (Figure 19) and the second a juvenile specimen of *Mola mola* (Figure 20). These two occurrences coincided with observations of three specimens of *Mola mola* larvae in the plankton trawl stations taken in the same area.

Figure 19. Masturus lanceolatus station 11

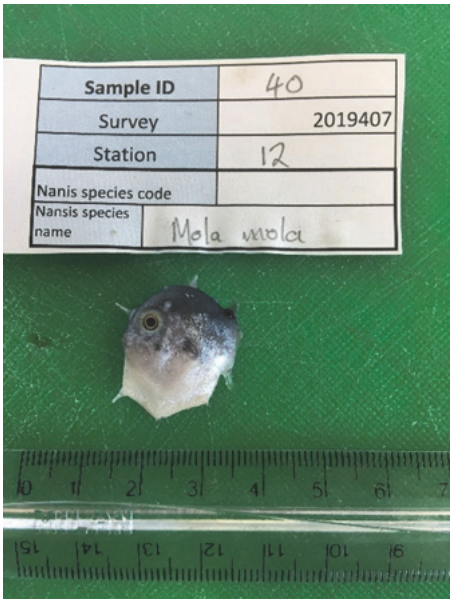


Figure 20. Mola mola station 12

Sharks and other species of Elasmobranch were absent in all catches except 3 specimens of *Isistus brasiliensis* in stations 7, 8 and 16, and one specimen from the family Pseudocarchariidae in station 7 (Figure 21).

Figure 21. Sharks of the family Pseudocarchariidae (left) and a specimen of Isistus brasiliensis (right) caught in the trawl samples.

Regular observations of various species of Lampriformes were made throughout the survey, with occurrences of both adult and juvenile specimens from each family. These observations are presented in Table 5 and pictures shown below (Figures 22, 23 and 24).

Table 5. Observations of Lampriforms registered in trawl catches

Station	Species	Catch weight (kg)	Catch number	Transect
7	*Desmodema polystictum*	3.095	2	Westward
8	*Desmodema polystictum*	1.86	1	Westward
8	*Trachipterus trachypterus*	0.27	1	Westward
10	*Desmodema polystictum*	3.22	3	Westward
17	*Lampris guttatus*	0.002	1	Northward
17	*Desmodema polystictum*	0.005	1	Northward
17	*Desmodema polystictum*	3.5	2	Northward
18	*Trachipterus trachypterus*	0.005	1	Northward
20	*Desmodema polystictum*	0.027	1	Northward
20	*Zu cristatus*	0.42	1	Northward
22	*Desmodema polystictum*	2.12	1	Northward
22	*Desmodema polystictum*	0.041	1	Northward
22	*Trachipterus* sp.	0.007	1	Northward

Samples of both *Desmodema polystictum*, *Trachipterus* sp. and *Zu cristatus* were taken for taxanomic analysis and museum samples.

Figure 22. *Desmodema polystictum* station 22

Figure 23. *Zu cristatus* station 20

Figure 24. *Trachipterus* sp. station 22

3.3.3 Taxonomy

During the survey identification of fish and invertebrate species was made to the lowest taxonomic level possible by taxonomists as described in the methods section. None of the taxonomists on board had extensive experience in identifying the species found in this area. Availability of taxonomic literature in English only also caused some difficulties for some local scientists having limited knowledge of English. Samples were taken for later identification.

In total, 172 different taxa were identified, of which only 78 were observations made to species level. Bony fishes constituted greatest proportion of the biodiversity in the catches with 70 species recorded, further 77 genera or higher catches.

Table 6. Number of different taxa recorded

Category	Phylum	Order	Family	Genus	Species	Grand Total
Bony fishes		1	35	40	70	147
Shark			1		1	2
Cephalopods		1	2	4	6	13
Crustacea		4	2			6
Tunicates		1				2
Jellyfish	1					1
Other molluscs					1	1
Grand Total	1	7	40	44	78	172

In total, 125 samples were taken with specimens for taxonomy preserved in formaldehyde. Of these, a genetic sample was collected in 86 cases for further taxonomic analysis. Sampling of Myctophidae was prioritized and in total 86 samples taken. 60 of these included a genetic sample. Pictures of the specimens were also taken to accompany the majority of samples. A complete overview of all the samples taken can be found in Annex VII.

3.3.4 Acoustic observations of plankton and mesopelagic fish

Acoustic observations showed very low concentration and a near negligible occurrence of larger fish or schools of pelagic fish, which was substantiated by the trawl catches (Annex VI). Acoustic values were almost exclusively allocated to the categories of mesopelagic and other fish, with mostly very low proportions around 1% of the total s_A values. The large majority of acoustic backscattering was, subsequently, allocated to plankton.

Over the entire cruise distance, substantial acoustic values of plankton were registered with a mean s_A of 1908 m^2/NM^2 and a maximum of 6976 m^2/NM^2 in the layers down to a depth of

500 m. Plankton registrations showed large variation but no clear trend over the cruise distance (Figure 25). A generalized additive model with distance as well as time of day as explanatory variables were tested but explained only 28% of total s_A. The time of the day as a variable had very little effect on the registered total s_A (Figure 26) and we attributed this to depth independent target strength. This is not conclusive since the diurnal variation in the surface dead zone could not be observed.

However, there were very clear diel vertical migration patterns of plankton both visible directly in the acoustic data (Figure 27) and when calculating mean depth of the plankton distribution using the registered s_A values (Figure 28). The weighted mean depth of plankton during daylight time was ca. 200 m deeper than during the dark period when most of the plankton aggregated near the surface. This diel vertical migration is evident in the data and was consistently observed during the entire cruise (Figure 29). A GAM modelling weighted mean depth as a function of time of the day was found to explain 85% of the variation in mean depth. Additionally, a statistically significant negative linear trend in weighted mean depth was found, resulting in a deepening toward the end over the cruise distance both for daylight and darkness periods (Figure 28). The weighted mean depth had, in the other hand, no detectable relationship with the total registered s_A values.

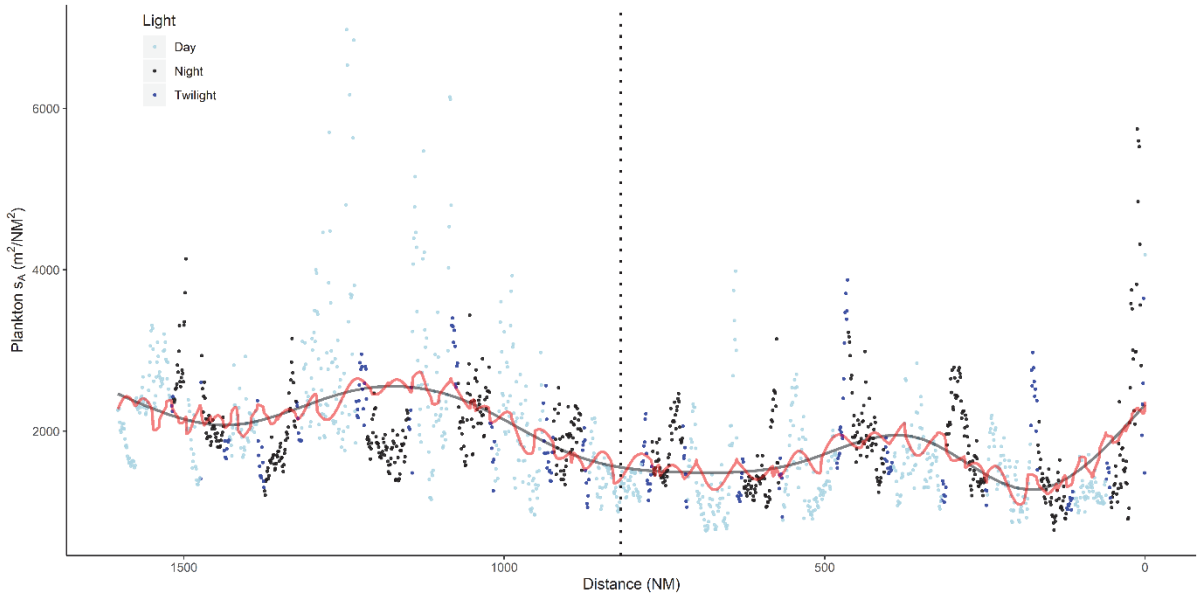


Figure 25. Total backscattering coefficients s_A (m^2/NM^2) of plankton (dots) over the entire cruise distance, differentiated by the light conditions (day=lightblue, twilight=blue, night=black). The black solid curve shows a GAM smoother fitted to the data, whereas the red solid curve represents the predictions of a GAM that incorporate time of day in addition to cruise time. The dotted line indicates the turning point from the westward to the northward transect

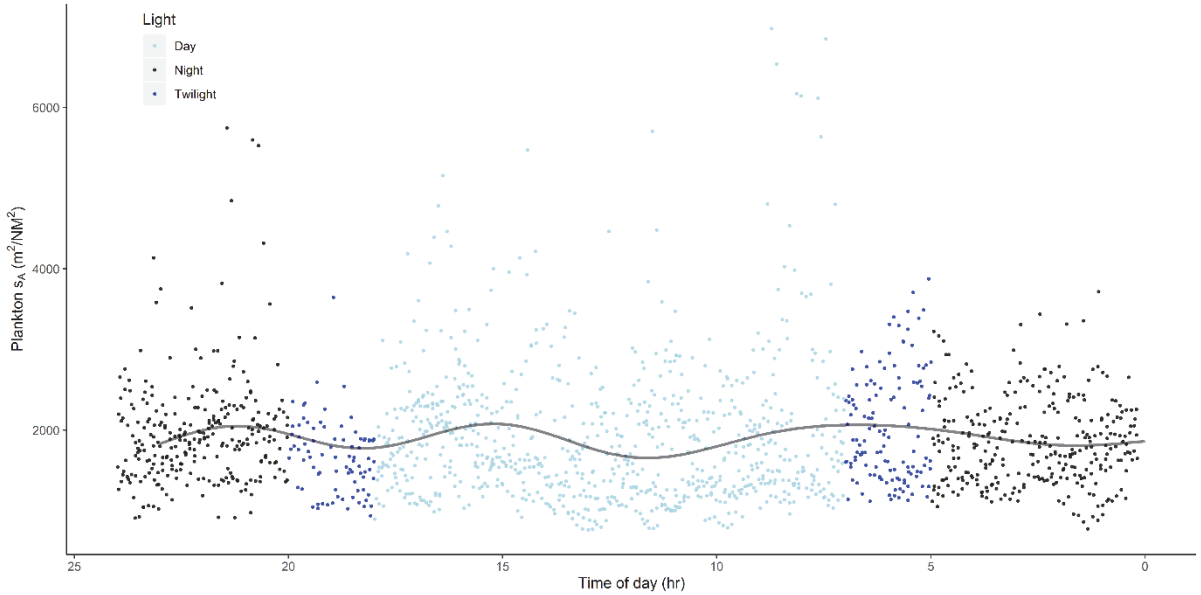


Figure 26. Total backscattering coefficients s_A (m^2/NM^2) of plankton (dots) over the time of day during the entire cruise period, differentiated by the light conditions (day=lightblue, twilight=blue, night=black). The black solid curve shows a GAM smoother fitted to the data

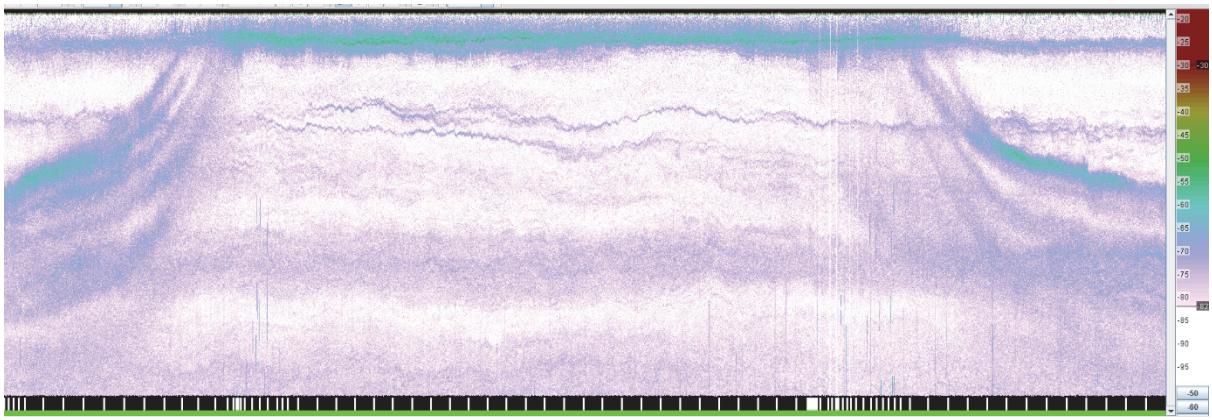


Figure 27. Example of acoustic observations in LSSS of the period between dusk on the 04.07.2019 and dawn on the 05.07.2019

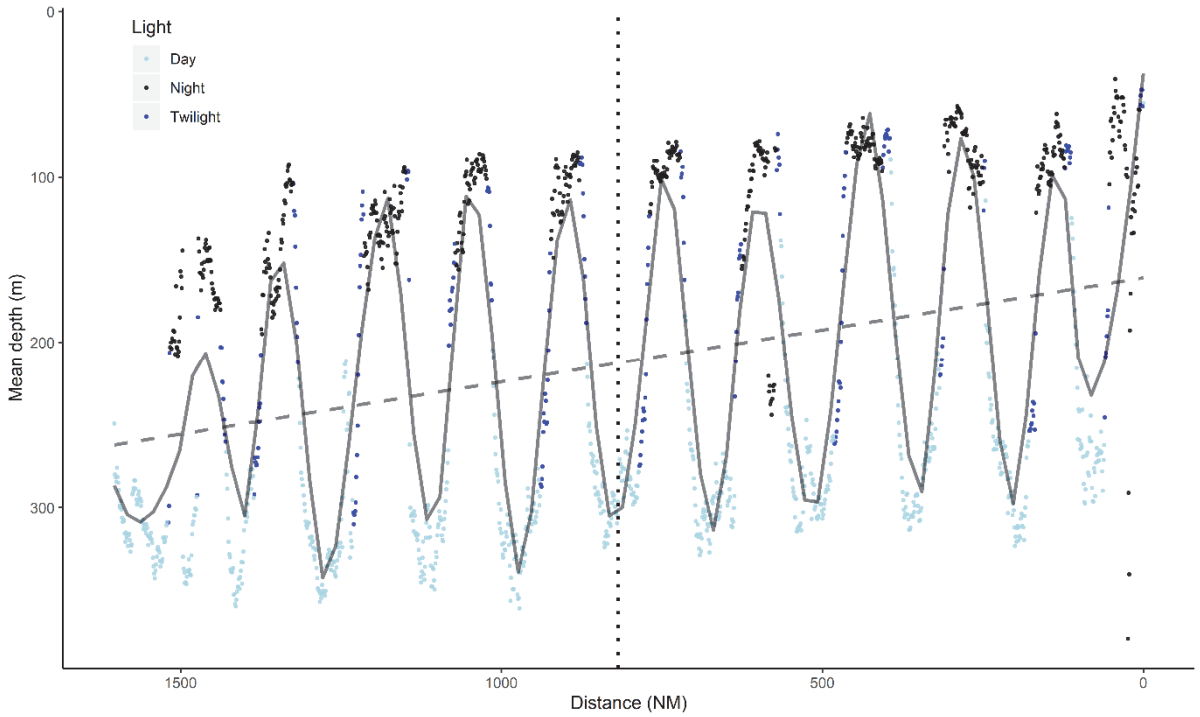


Figure 28. Mean depth of the plankton distribution weighted by the s_A (m^2/NM^2) in every 5 m depth interval over the entire cruise distance. All data points were differentiated by the light conditions (day=lightblue, twilight=blue, night=black). The black solid line represents a locally estimated scatterplot smoothing regression and the black dashed line a linear regression. The dotted line indicates the turning point from the westward to the northward transect

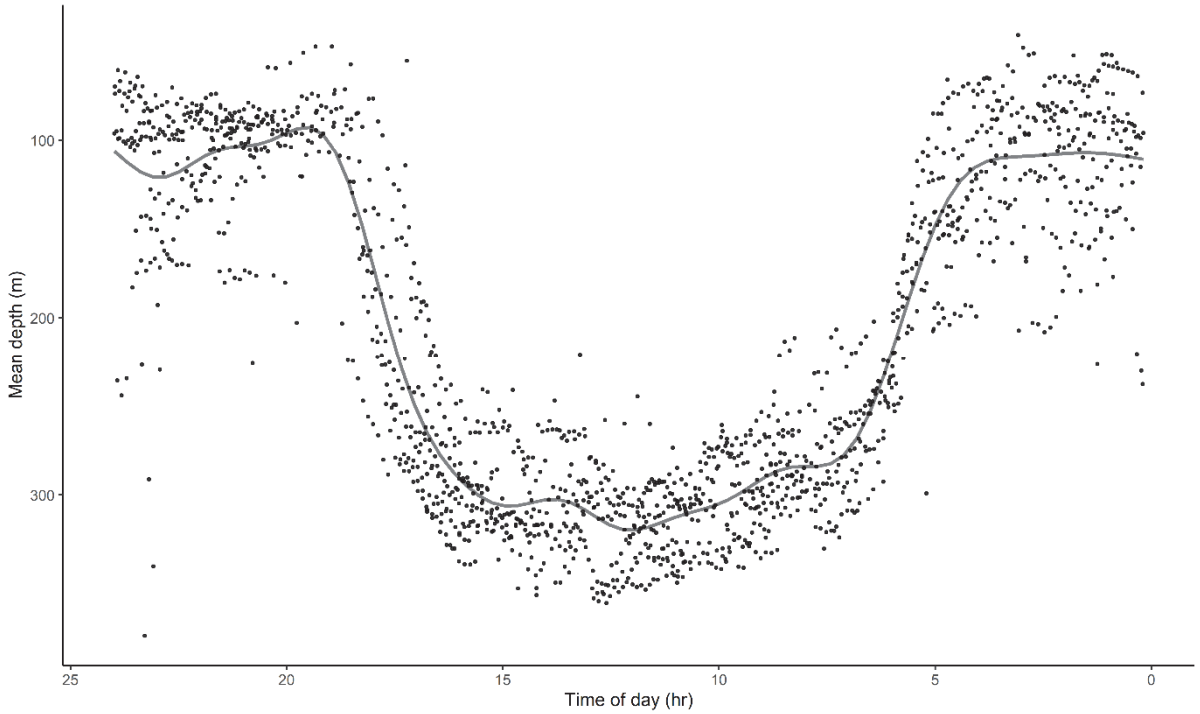


Figure 29. Mean depth of the plankton distribution weighted by the s_A (m^2/NM^2) in every 5 m depth interval over the time of day during the entire cruise period. The black solid curve shows a GAM smoother fitted to the data

3.4 TOP PREDATOR OBSERVATIONS

A large dolphin pod, several sharks and a sea turtle were observed from the bridge, however there was no systematic assessments and observations were therefore not quantified.

3.5 JELLYFISH

The occasional occurrence of jellyfish did not constitute any basis for collection of samples.

3.6 NUTRITON AND FOOD SAFETY

3.6.1 Results of sampling

Totally 36 samples were prepared for analysis of nutrients and contaminants and Table 7 gives an overview of the small and large fish samples collected during Leg 2.6.

Table 7. Overview of trawl number, species, total number of fish, length, weight and LIMS number of the collected samples

Trawl number	Fish	Size of fish	Total number of fish	Lenght, cm	Weight, g	LIMS number
1	Sarda Sarda	Large	2	44.5	812.5	2019-748
1	Myctophidae	Small	75	9 -13.5	6.1	2019-778
3	Myctophidae	Small	25	10.8	8.6	2019-779
5	Cubiceps gracilis	Large	10	28	231	2019-749
5	Brama dussumieri	Large	5	25.2	189.3	2019-750
5	Myctophidae	Small	75	9-13.5	5.5	2019-780
5	Cubiceps pauciradiatus	Small	50	10.6	10.5	2019-781
6	Brama dussumieri	Large	5	24.4	175.8	2019-751
7	Brama dussumieri	Large	10	24	177	2019-752
7	Gubiceps gracilis	Large	10	29.2	250.7	2019-753
10	Nealotus tripes	Small	50	18	19.3	2019-782
11	Myctophidae	Small	80	7	3.4	2019-783
13	Myctophidae	Small	75	7 - 9	7.9	2019-785
13	Nealotus tripes	Small	75	19.1	25.1	2019-786
13	Brama dussumieri	Large	10	24.8	192.2	2019-787
16	Asteronesthidae spp	Small	25	5.1	5.1	2019-788
17	Brama dussumieri	Large	5	24.7	188.4	2019-754
17	Desmodema	Large	1	138	1725	2019-756
22	Desmodema	Large	1	120	2000	2019-755
24	Auxis thazard	Small	75	15.3	31.9	2019-789

CHAPTER 4. DISCUSSIONS

The survey area and objectives were different from the original plan due to unforeseen reasons related to possible security issues.

The survey consisted of two transects giving a "snapshot" of some of the major processes occurring in the deep waters of the Gulf of Guinea.

The data and samples collected will be used in the context of the science plan, especially in Theme 1 (early life stages and plankton), Theme 3 (mesopelagic fish), Theme 8 (Food safety and nutrition), Theme 9 (physical oceanography) and Theme 10 (chemical oceanography).

REFERENCES

Carpenter, K.E. & De Angelis, N., (eds.) 2016.The living marine resources of the Eastern Central Atlantic. Vol:1-5. FAO Species Identification Guide for Fishery Purposes, Rome, FAO.

Collette, B.B. & Naunen, C.E., (eds.) 1983. FAO Species Catalogue. Vol: 2 Scombrids of the World. FAO Fisheries Synopsis. No. 125, Vol. 2.

Froese, R. & Pauly, D.. (eds.) 2018. FishBase. World Wide Web electronic publication.www.fishbase.org, version (06/2018)

Grasshoff K., Erhardt M. & Kremling K. (eds.) 1983. Methods for sea water analysis, Verlag Chemie, Weinheim, 63-97, 127-187.

Grasshoff, K., Kremling, K. & Ehrhardt, M. 1999. Method of Seawater Analysis (3rd ed.), Wiley-VCH, 660 p.

Hagebø, M. & Rey, F. 1984. Lagring av sjøvann til analyse av næringssalter. In Norwegian with English summary. Fisken Havet, No. 4, 12 pp.

Jeffrey, S.W. & Humphrey, G.F. 1975. New Spectrophotometric Equations for Determining Chlorophylls a, b c1 and c2 in Higher Plants, Algae and Natural Phytoplankton. Biochem. Physiol. Plantzen, 167: 191-194.

Jereb, P. & Roper, C.F.E. (eds.) 2010. Cephalapods of the World. Vol: 2. FAO Species Identification Guide for Fishery Purposes, Rome, FAO. No. 4, Vol. 2.

Robinson, C. 2019. Microbial Respiration, the Engine of Ocean Deoxygenation. Frontiers in Marine Science. 5. 10.3389/fmars.2018.00533.

Smith, M.M. & Heemstra, P. C. 1999. Smiths' Sea Fishes. Southern Book Publishers.

Welscmeyer, N.A. 1994. Fluorometric analysis of chlorophyll a in the presence of chlorophyll b and phaeopigments. Limnol.Oceanogr. 39: 1985-1992.

WoRMS Editorial Board. 2018. World Register of Marine Species. Available from http://www.marinespecies.org at VLIZ.

ANNEX I. CTD BOTTLE DEPTHS AT SUPER STATIONS

Shallow Stations with depth 30 m	Intermediate Stations with depth 100 m	Deep Stations with depth 500 m	Extra deep Stations with depth 1 000 m	Extra deep Stations with depth 2 000 m
25	100	500	1 000	2 000
5	75	400	750	1 500
*FLU max	50	300	600	1 000
	25	200	500	600
	5	150	400	400
	*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

*FLU max refers to the depth at which the fluorescence maximum is observed during the CTD deployment

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	43-3525	SBE 43 7000m	02.02.2019
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	2005
Par sensor	1123	PAR-LOG ICSW	12.10.2017

Thermosalinograph Sensors – 6 m drop keel

Type	Serial Number	Model	Calibration Date	Usage Start Date
Thermosalinograph	21-3418	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)	0878	SBE38	31.03.2016	04.04.2019
Fluorometer	257S	9702011 WETStar	20.04.2015	02.01.2019

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

Water Chemistry Quality Assurance

pH samples were measured in duplicates (or greater if a value appeared suspect). Total alkalinity samples were measured in triplicates.

Parameter	Sample count	Average Standard Deviation
pH	264	0.007
Total alkalinity	264	1.47

Fluorometric standard measurements were performed to quality control chlorophyll a and phaeopigment measurements

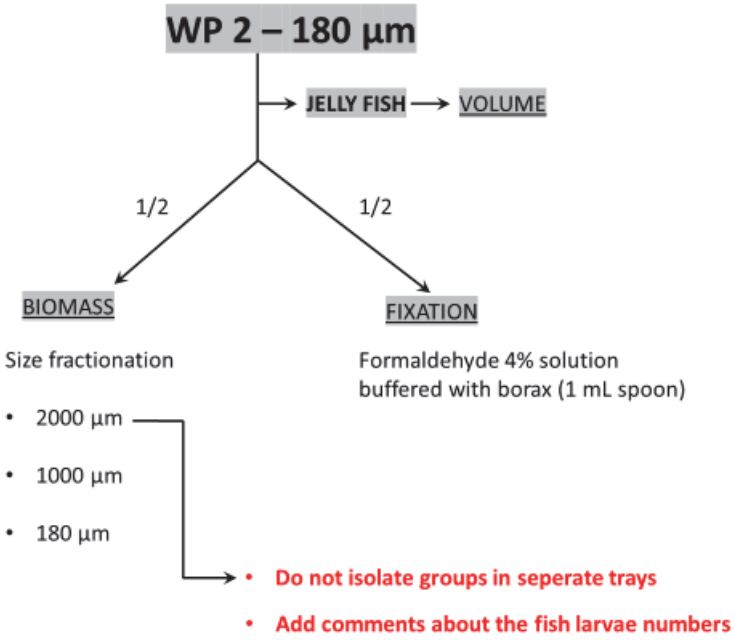
Parameter	Low Standard Coefficient of Variation	High Standard Coefficient of Variation	Calibration Date
Turner 10AU Fluorometer	6%	2%	13.06.2019

CTD dissolved oxygen and salinity value validity statistics

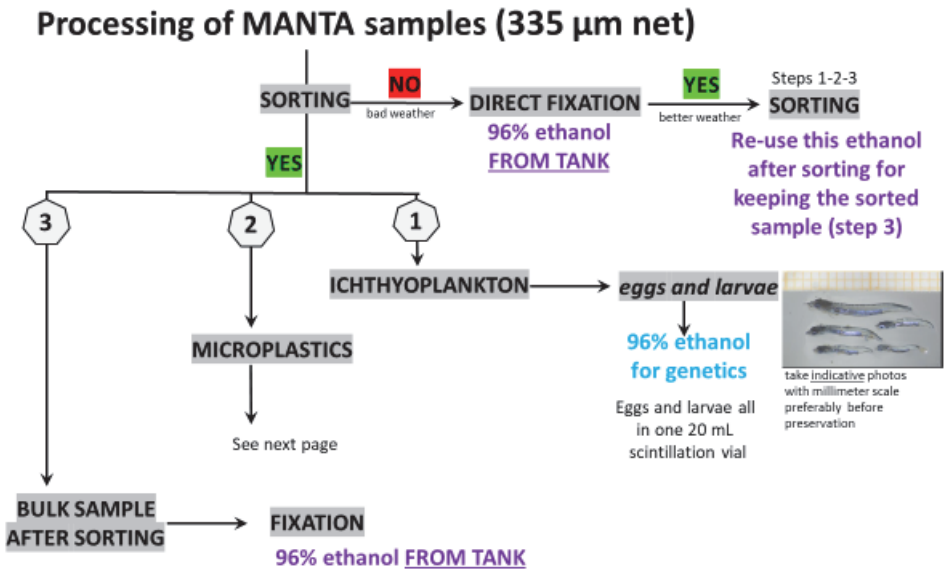
Parameter	Sample Count	Offset from factory calibration
Dissolved Oxygen	31	-1.6%
Salinity	0	N/A

The dissolved oxygen validation data is taken from Leg 2.5, which concluded three days before Leg 2.6. The planned station for dissolved oxygen sensor validation could not be performed because of licensing issues in Ghana. However, the last reported offset is well within the 15% range operational limit as suggested by Sea-Bird The Portasal salinometer was being repaired during the survey. Leg 2.6 salinity values will be validated by the salinity samples collected from the previous and subsequent surveys when the salinometer returns to R/V *Dr Fridtjof Nansen*.

ANNEX III. OVERVIEW OF SAMPLING PROCEDURES IN THE PLANKTON LAB

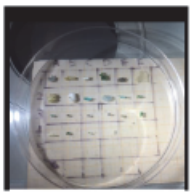


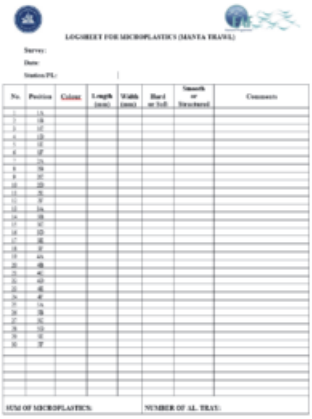
All manta samples should be sorted on board
Sorting of manta samples can be done even after preservation



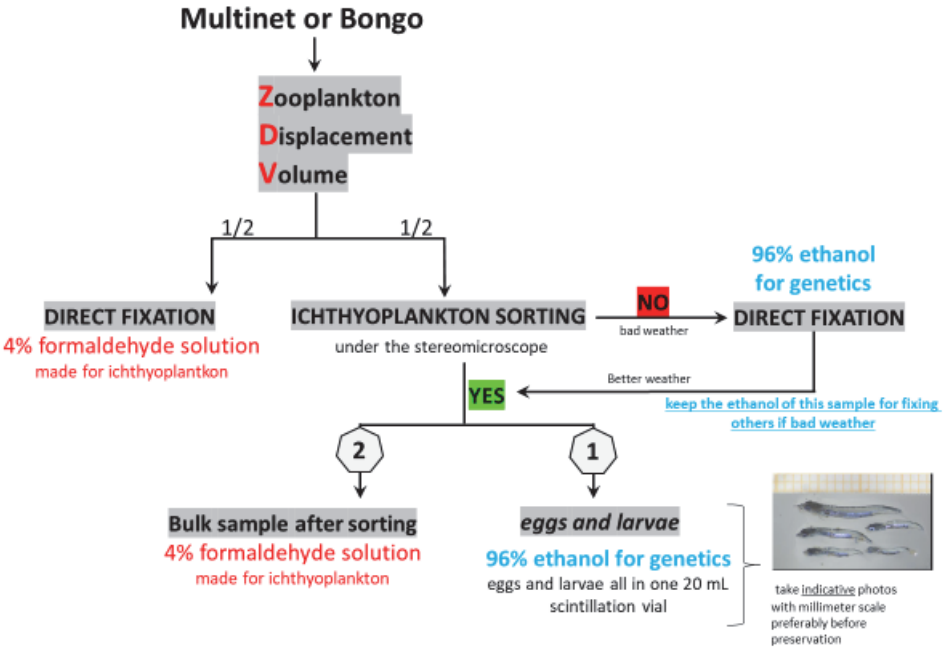
Microplastics

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 conducted 11'th and 12'th May in Walvis Bay at 20 m bottom depth 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 (1,024 ms)
Bandwidth	2.43 kHz
Max power	2 000 Watt
2way beam angle	20,6 dB
gain	26,62 dB
SA correction	0.03 dB
Angle sensitivity	21.9
3 dB beamwidth	6.25º along ship
	6.38 athwart ship
Alongship offset	0.01º
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.

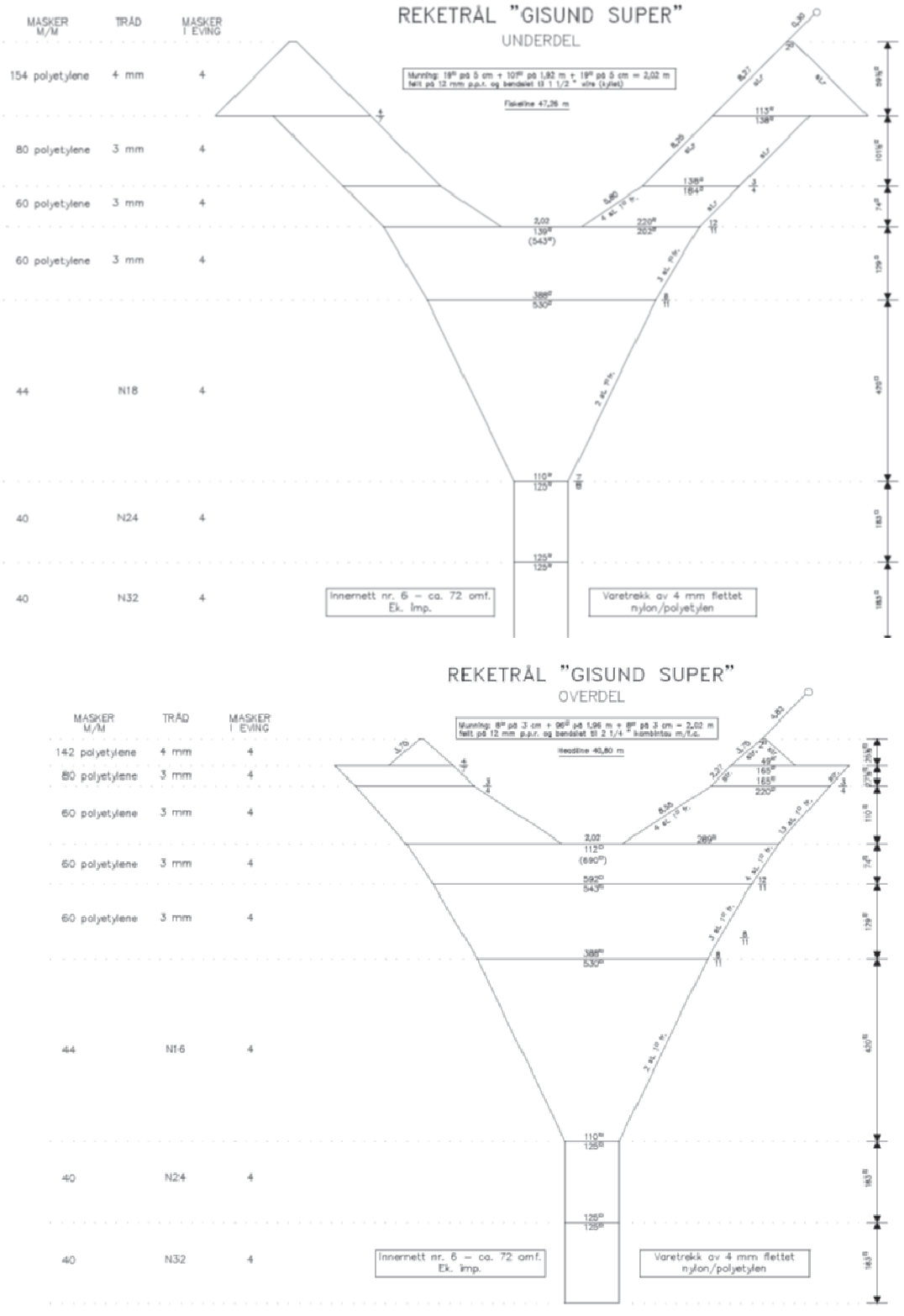


Figure IV.1 Schematic drawing of the Super Gisund bottom trawl

ANNEX V. OVERVIEW OF SAMPLES AND INSTITUTIONS

Row Labels	Species code	# specimens with picture	# specimens to museum	# specimens to taxonomi	# specimens preserved in formalin	# specimens with genetic
Argonauta argo	SQUAR01	1		1	1	
Astronesthes spp	STOAS00	1	1	1	1	
Bonapartia pedaliota	GONBO01	1		1	1	
CAPROIDAE	CAPAA00	1	1	1	1	
CARAPIDAE	CRPAA00			1	1	
Chauliodus sloani	CHOCH01	1		1	1	
Cryptopsaras couesii	CETCR01	1	1	1	1	1
Cubiceps baxteri	NOMCU07	1		1	1	1
Cubiceps capensis	NOMCU08	1		1	1	1
Cubiceps spp	NOMCU00	1		1	1	
Desmodema polystictum	TRCDE01	4	1	1	1	
Diplophos rebainsi/taenia	GONDI01	1		1	1	1
Enoploteuthis leptura	SQUEN82	1		1		
Enoploteuthis leptura leptura	SQUEN82	1		1	1	1
HEMIRAMPHIDAE	HEMAA00	1		1	1	1
Hoplunnis punctata	NETHO00	1				
Lampanytus spp	MYCLP00	1		1	1	1
Macroparalepis affinis	PARMA02	1				
Maurolicus sp	STEMA00			1	1	
Mola mola	MOLMO01	1	1	1	1	
MYCTOPHIDAE	MYCAA00	3		11	11	3
MYCTOPHIDAE	MYCAA01	1		2	2	1
MYCTOPHIDAE	MYCAA02			4	4	
MYCTOPHIDAE	MYCAA03			3	3	
MYCTOPHIDAE	MYCAA08	1		1	1	1
Myctophidae sp C	MYCAA11	8	2	10	10	8
Myctophidae sp D	MYCAA12	8	2	10	10	8
Myctophidae sp E	MYCAA13	8	2	10	10	8
Myctophidae sp F	MYCAA14	8	2	8	8	8
Myctophidae sp G	MYCAA15	8	2	8	8	8
Myctophidae sp H	MYCAA16	5	1	5	5	5
Myctophidae sp I	MYCAA17	3		3	3	3
Myctophidae sp J	MYCAA18	2		2	2	2
Myctophidae sp K	MYCAA19	1		1	1	1
Myctophidae sp L	MYCAA20	1		1	1	1
Myctophum spp	MYCMY00	1		1	1	1
Myctorphum punctata	MYCMY12	1		1	1	1
NOMEIDAE	NOMAA00	2		3	3	1
Octopoteithis spp	SQUOT10	1		1	1	1
Ommastrephinae	SQUOM00	1		1	1	

Row Labels	Species code	# specimens with picture	# specimens to museum	# specimens to taxonomi	# specimens preserved in formalin	# specimens with genetic
Onychoteothis banksii	SQUON11	1				
ORESOMATIDAE	OREAA00			1	1	
Ornithoteusis antillarum	SQUOM71	1				
Promethichthys prometheus	GEMPR01	1		1	1	1
Pterycombus brama	BRAPT03	1				
Scopelosaurus spp	NOSSC00	1		1	1	1
Scopelosaurus spp	NOSSC00	1		1	1	1
Symblophorus rufinus	MYCSY03	1		1	1	1
Symbolophorus boops	MYCSY01	1		1	1	1
Synagrops microlepsis	ACRSY01	1				
Thysanotheunis rhombus	SQUTH11	1				
Todarodes spp	SQUOM30	2		2	2	2
Trachipterus sp	TRCTR00	1	1	1	1	1
Unidentified	UNIDE01	3		2	3	1
Unidentified	UNIDE03	1		1	1	1
Unidentified	UNIDO00	1		1	1	
Unidentified	UNIDE02	1			1	
Unidentified fish	UNIDE01	1	1	1	1	
Vinciguerria spp	PHOVI00	1		1	1	
Zu cristatus	TRCZU01	1				
Myctophid sp. A	MYCAA02			1	1	
Myctophid sp. B	MYCAA03			1	1	
NEOSCOPELIDAE	NEOAA00	1	1	1	1	1
Symphysanodontidae	SYMAA00	1		1	1	1
Thunnus sp	SCMTH00	1		1	1	1
Grand Total		**109**	**19**	**124**	**125**	**81**

ANNEX VI. RECORDS OF FISHING STATIONS

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 1
DATE :29/06/19 GEAR TYPE: PT NO: 8 POSITION:Lat S
8°59.92
start stop duration Lon E
12°56.50
TIME :19:35:24 19:58:25 23.0 (min) Purpose : 3
LOG : 6863.78 6865.12 1.3 Region : 21000
FDEPTH: 70 0 Gear cond.: 0
BDEPTH: 187 227 Validity : 3
Towing dir: 0° Wire out : 340 m Speed : 3.5 kn
Sorted : 0 Total catch: 200.00 Catch/hour: 521.29

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
MYCTOPHIDAE	436.16	235626	83.67
Trichiurus lepturus	49.68	258	9.53
1			
Lagocephalus laevigatus	12.09	18	2.32
5			
Synagrops microlepis	11.19	1235	2.15
Sarda sarda	4.59	5	0.88
3			
Saurida brasiliensis	2.74	521	0.53
4			
Trachurus trecae	2.44	26	0.47
2			
Merluccius polli	1.01	26	0.19
Hoplunnis punctata	0.96	26	0.18
Illex coindetii	0.41	81	0.08
Total	521.29		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 2
DATE :30/06/19 GEAR TYPE: PT NO: 8 POSITION:Lat S
8°59.81
start stop duration Lon E
11°38.10
TIME :12:03:38 12:22:03 18.4 (min) Purpose : 3
LOG : 6942.51 6943.40 0.9 Region : 21000
FDEPTH: 400 260 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 890 m Speed : 2.9 kn
Sorted : 21 Total catch: 90.68 Catch/hour: 295.53

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Tunicata	271.30	33911	91.80
Jellyfish	17.96	0	6.08
STERNOPTYCHIDAE	2.15	1046	0.73
MYCTOPHIDAE	1.68	1571	0.57
CRANCHIIDAE	0.54	169	0.18
ANGUILLIFORMES	0.35	254	0.12
S H R I M P S	0.34	440	0.11
Chauliodus sloani	0.21	13	0.07
NOMEIDAE	0.16	85	0.05
Maurolicus sp.	0.14	13	0.05
Peristedion cataphractum	0.13	13	0.04
PSYCHROLUTIDAE	0.13	42	0.04
Tetragonurus atlanticus	0.07	13	0.02
Small squid	0.07	85	0.02
Schedophilus sp.	0.06	13	0.02
Unidentified	0.06	55	0.02
Miscellaneous	0.06	212	0.02
Bonapartia pedaliota	0.03	13	0.01
TRICHIURIDAE	0.03	29	0.01
Saurida brasiliensis	0.02	3	0.01
ATELEOPODIDAE	0.01	13	0.00
Unidentified	0.01	13	0.00
HYPERIIDAE	0.01	55	0.00
Brotula barbata	0.01	3	0.00
Total	295.53		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 3
DATE :30/06/19 GEAR TYPE: PT NO: 8 POSITION:Lat S
9°1.23
start stop duration Lon E
10°56.31
TIME :22:20:42 22:43:41 23.0 (min) Purpose : 3
LOG : 6986.86 6987.94 1.1 Region : 21000
FDEPTH: 112 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 340 m Speed : 2.8 kn
Sorted : 25 Total catch: 65.77 Catch/hour: 171.65

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
SALPS	126.73	16737	73.83
MYCTOPHIDAE	31.10	55140	18.12
SALPS	3.34	16	1.94
0			
CRANCHIIDAE	2.80	78	1.63
0			
ANGUILLIFORMES	2.62	420	1.53
Cephalopoda - juvenile	0.75	1002	0.44
Dolicholagus longirostris	0.56	47	0.32
AULOPIFORMES	0.52	1386	0.30
C E P H A L O P O D A	0.51	117	0.30
S H R I M P S	0.32	407	0.19
Regalecus sp.	0.29	8	0.17
CRANCHIIDAE	0.25	752	0.15
Gempylus serpens	0.23	3	0.14
Cubiceps sp.	0.23	8	0.13
Nealotus tripes	0.20	16	0.12
Flagellostomias sp	0.16	8	0.10
Scombrolabrax heterolepis	0.15	8	0.09
NOMEIDAE	0.14	384	0.08
Vinciguerria sp.	0.13	1503	0.07
Naucrates ductor	0.10	8	0.06
Bothidae - juvenile	0.08	251	0.04
Tetragonurus atlanticus	0.07	8	0.04
Lagocephalus lagocephalus	0.06	8	0.04
Stomias sp.	0.06	8	0.04
Small squid	0.06	63	0.03
Brotula barbata	0.05	8	0.03
Polyipnus sp.	0.05	8	0.03
Miscellaneous	0.04	10	0.02
OREOSOMATIDAE	0.03	5	0.02
Nemichthys curvirostris	0.02	8	0.01
Total	171.65		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 4
DATE :01/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S
9°1.41
start stop duration Lon E
9°57.50
TIME :10:09:43 10:36:21 26.6 (min) Purpose : 3
LOG : 7046.90 7048.47 1.6 Region : 21000
FDEPTH: 60 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.5 kn
Sorted : 1 Total catch: 6.06 Catch/hour: 13.64

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
UNIDENTIFIED FISH	2.59	0	19.02
SALPS	2.12	2	15.52
0			
Unid. juvenile fishes	1.44	72	10.57
0			
Small squid	1.44	1117	10.57
SALPS	1.30	0	9.51
MYCTOPHIDAE	0.86	144	6.34
BRAMIDAE	0.47	36	3.43
Unidentified	0.40	252	2.91
0			
Regalecus sp.	0.36	36	2.64
DIRETMIDAE	0.36	108	2.64
OMMASTREPHIDAE	0.32	92	2.31
CRANCHIIDAE	0.30	106	2.23
Gempylus serpens	0.30	2	2.20
NOMEIDAE	0.27	200	1.96
CRANCHIIDAE	0.25	396	1.85
0			
Amphipods	0.22	1369	1.58
Drepane africana	0.14	108	1.06
Amphipods	0.11	396	0.79
0			
Argonauta argo	0.07	25	0.54
STOMATOPODA	0.07	36	0.53
ANGUILLIFORMES	0.06	47	0.45
CEPOLIDAE	0.04	108	0.26
Lagocephalus lagocephalus	0.03	65	0.25
NOMEIDAE	0.03	108	0.21
0			
ANGUILLIFORMES	0.03	324	0.21
0			
TRICHIURIDAE	0.02	0	0.17
Jellyfish	0.02	2	0.13
S H R I M P S	0.01	9	0.07
Selene dorsalis	0.01	9	0.05
Total	13.64		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 5
DATE :01/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S
9°2.74
start stop duration Lon E
8°58.44
TIME :20:00:13 20:25:34 25.4 (min) Purpose : 3
LOG : 7109.73 7111.26 1.5 Region : 21000
FDEPTH: 0 17 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 150 m Speed : 3.6 kn
Sorted : 0 Total catch: 44.81 Catch/hour: 106.03

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
MYCTOPHIDAE	38.12	92591	35.95
0			
Small squids	32.20	0	30.36
Cubiceps gracilis	9.77	47	9.22
Cubiceps pauciradiatus	8.15	795	7.68
Todarodes sp.	3.74	19	3.53
Brama dussumieri	3.67	19	3.46
6			
Gempylus serpens	3.19	31	3.01
ANGUILLIFORMES	2.19	0	2.06
Maurolicus sp.	1.99	4770	1.87
Krill	1.99	15502	1.87
TUNICATA	0.40	2	0.38
Nealotus tripes	0.36	12	0.34
CARAPIDAE	0.28	795	0.26
Total	106.03		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 6
DATE :02/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S
9°0.88
start stop duration Lon E
8°6.69
TIME :03:04:37 03:14:57 10.3 (min) Purpose : 3
LOG : 7163.56 7163.94 0.4 Region : 21000
FDEPTH: 50 5 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 2.2 kn
Sorted : 1 Total catch: 23.06 Catch/hour: 133.79

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Myctophid sp. B	41.50	0	31.02
SALPS	17.18	0	12.84
0			
Myctophid sp. A	14.63	0	10.93
Small squids	11.92	6203	8.91
Maurolicus sp.	9.39	4132	7.02
Cubiceps gracilis	8.22	41	6.14
8			
Brama dussumieri	6.89	41	5.15
7			
Gempylus serpens	3.42	41	2.55
10			
Krill	3.34	453	2.50
SALPS	3.34	0	2.50
MYCTOPHIDAE	3.34	1114	2.49
CRANCHIIDAE	2.99	952	2.23
ANGUILLIFORMES	2.54	3818	1.90
Cubiceps pauciradiatus	1.59	157	1.19
S H R I M P S	0.76	0	0.57
Todaropsis sp.	0.70	17	0.52
ARGENTINIDAE	0.64	638	0.48
Unid. juvenile fishes	0.48	0	0.36
CARAPIDAE	0.32	157	0.24
STOMATOPODA	0.16	157	0.12
Amphipods	0.16	157	0.12
Nealotus tripes	0.15	6	0.11
9			
Argonauta argo	0.08	6	0.06
Stomias sp.	0.07	6	0.05
Total	133.79		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 7

DATE :02/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 9°2.53
start stop duration Lon E 6°40.80
TIME :18:34:30 19:00:39 26.1 (min) Purpose : 3
LOG : 7257.54 7259.34 1.8 Region : 21000
FDEPTH: 40 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 180 m Speed : 4.1 kn
Sorted : 0 Total catch: 60.31 Catch/hour: 138.39

SPECIES	CATCH/HOUR		% OF TOT.
	weight	numbers	
MYCTOPHIDAE	33.12	110391	23.93
Cubiceps gracilis	30.22	124	21.84
Todarodes sp.	23.95	142	17.31
Small squids	13.89	0	10.04
MYCTOPHIDAE	10.15	2850	7.33
Desmodema polystictum	7.10	5	5.13
Brama dussumieri	5.83	32	4.21
Cubiceps pauciradiatus	4.80	402	3.47
ANGUILLIFORMES	3.21	0	2.32
Nealotus tripes	1.74	80	1.26
Maurolicus sp.	1.60	2850	1.16
S H R I M P S	0.89	0	0.64
Isistius brasiliensis	0.65	2	0.47
PSEUDOCARCHARIIDAE	0.62	2	0.45
Gempylus serpens	0.42	21	0.31
Exocoetus obtusirostris	0.17	2	0.13
Nemichthys scolopaceus	0.02	2	0.02
Total	138.39		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 8
DATE :03/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 9°2.40
start stop duration Lon E 6°1.17
TIME :02:11:53 02:36:23 24.5 (min) Purpose : 3
LOG : 7302.38 7303.76 1.4 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 170 m Speed : 3.4 kn
Sorted : 0 Total catch: 30.05 Catch/hour: 73.60

SPECIES	CATCH/HOUR		% OF TOT.
	weight	numbers	
MYCTOPHIDAE	23.70	0	32.20
Maurolicus sp.	8.06	3632	10.95
Small squids unident.	7.11	0	9.66
Benthosema sp.	4.74	475	6.44
Desmodema polystictum	4.56	2	6.19
ANGUILLIFORMES	4.50	0	6.12
Cubiceps gracilis	3.54	15	4.81
Unid. juvenile fishes	2.37	0	3.22
Todarodes sp.	2.27	27	3.08
Krill	2.13	0	2.90
Bregmaceros sp.	2.13	713	2.90
SALPS	1.42	0	1.93
Brama dussumieri	1.33	7	1.81
Diplophos sp.	1.19	238	1.61
Isistius brasiliensis	0.78	2	1.06
Lagocephalus lagocephalus	0.71	238	0.96
S H R I M P S	0.71	0	0.96
Trachipterus trachypterus	0.66	2	0.90
Cubiceps pauciradiatus	0.56	44	0.76
Gempylus serpens	0.33	2	0.45
Nealotus tripes	0.33	10	0.44
ANGUILLIFORMES	0.15	22	0.20
SALPS	0.14	2	0.19
Exocoetus obtusirostris	0.08	2	0.11
Beryx splendens	0.04	2	0.05
Ornithoteuthis antillarum	0.04	2	0.05
Diretmus argenteus	0.01	2	0.02
S H R I M P S	0.01	2	0.02
Total	73.60		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 9
DATE :03/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 9°0.94
start stop duration Lon E 4°2.45
TIME :18:33:22 18:49:46 16.4 (min) Purpose : 3
LOG : 7427.65 7428.72 1.1 Region : 21000
FDEPTH: 60 30 Gear cond.: 7
BDEPTH: 0 0 Validity : 5
Towing dir: 0° Wire out : 180 m Speed : 3.9 kn
Sorted : 0 Total catch: 0.00 Catch/hour: 0.00

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

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 10
DATE :03/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 9°2.62
start stop duration Lon E 4°1.09
TIME :19:56:39 20:21:46 25.1 (min) Purpose : 3
LOG : 7431.34 7433.14 1.8 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 185 m Speed : 4.3 kn
Sorted : 0 Total catch: 28.93 Catch/hour: 69.14

SPECIES	CATCH/HOUR		% OF TOT.
	weight	numbers	
MYCTOPHIDAE	29.53	0	42.71
Desmodema polystictum	7.69	7	11.13
C E P H A L O P O D A	6.56	0	9.49
Todarodes sp.	4.30	153	6.22
ANGUILLIFORMES	3.69	0	5.34
NEOSCOPELIDAE	2.87	0	4.15
Krill	2.87	0	4.15
Nealotus tripes	2.55	139	3.69
Brama dussumieri	2.53	17	3.66
Auxis thazard	1.68	2	2.42
Diplophos taenia	1.21	820	1.75
Cubiceps pauciradiatus	0.98	29	1.42
SALPS	0.82	0	1.19
Gempylus serpens	0.73	7	1.06
Exocoetus obtusirostris	0.24	2	0.34
Onychoteuthis banksi	0.20	10	0.29
Ornithoteuthis antillarum	0.17	14	0.25
Scombrolabrax heterolepis	0.16	2	0.24
Thysanoteuthis rhombus	0.11	5	0.16
Enoploteuthis leptura leptura	0.09	10	0.12
Bregmaceros sp.	0.07	205	0.10
TRICHIURIDAE	0.06	205	0.09
Auxis thazard	0.02	2	0.02
Beryx splendens	0.01	2	0.01
Total	69.14		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 11
DATE :04/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 9°2.08
start stop duration Lon E 1°41.83
TIME :19:24:59 19:57:23 32.4 (min) Purpose : 3
LOG : 7579.55 7581.74 2.2 Region : 21000
FDEPTH: 60 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 200 m Speed : 4.1 kn
Sorted : 0 Total catch: 25.12 Catch/hour: 46.53

SPECIES	CATCH/HOUR		% OF TOT.
	weight	numbers	
Masturus lanceolatus	36.97	2	79.46
Krill	1.99	0	4.28
Nealotus tripes	1.81	89	3.88
MYCTOPHIDAE	1.08	632	2.32
MYCTOPHIDAE	1.00	0	2.15
Cubiceps sp.	0.99	33	2.13
Gempylus serpens	0.80	4	1.73
Myctophum sp.	0.72	213	1.55
Maurolicus sp.	0.28	0	0.60
Small squids unident.	0.26	0	0.57
Remora osteochir	0.19	2	0.40
SALPS	0.12	0	0.27
ANGUILLIFORMES	0.09	0	0.20
Bregmaceros sp.	0.08	31	0.17
Pterycombus brama	0.05	19	0.11
Diplophos sp.	0.05	124	0.10
Shrimps, small, non comm.	0.01	61	0.03
Brama dussumieri	0.01	2	0.02
Beryx splendens	0.01	4	0.02
Lestrolepis intermedia	0.01	4	0.01
HEMIRAMPHIDAE	0.01	4	0.01
Grammicolepis brachiusculus	0.00	2	0.00
JUVENILE FISHES	0.00	2	0.00
Total	46.53		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 12
DATE :05/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 9°0.29
start stop duration Lon E 1°0.21
TIME :04:42:39 05:13:18 30.6 (min) Purpose : 3
LOG : 7628.56 7629.37 0.8 Region : 21000
FDEPTH: 55 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 230 m Speed : 1.6 kn
Sorted : 0 Total catch: 28.44 Catch/hour: 55.68

SPECIES	CATCH/HOUR		% OF TOT.
	weight	numbers	
Maurolicus sp.	20.16	0	36.21
Krill	10.18	0	18.28
MYCTOPHIDAE	7.05	0	12.66
Macroparalepis affinis	6.07	12	10.90
Myctophum sp.	2.94	10	5.27
Small squids unident.	2.35	0	4.22
GONOSTOMATIDAE	1.96	392	3.52
Cubiceps pauciradiatus	1.46	14	2.62
SALPS	1.17	0	2.11
Todarodes sp.	0.82	8	1.48
ANGUILLIFORMES	0.41	0	0.74
Nealotus tripes	0.39	20	0.70
Gempylus serpens	0.38	2	0.69
Ornithoteuthis antillarum	0.18	8	0.33
Pterycombus brama	0.05	20	0.09
Onychoteuthis banksi	0.04	2	0.07
Brama sp.	0.02	6	0.04
Lagocephalus lagocephalus	0.01	2	0.02
Beryx splendens	0.01	6	0.02
Plastic	0.01	4	0.02
OREOSOMATIDAE	0.01	2	0.02
Mola mola	0.00	2	0.00
Total	55.68		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 13
DATE :05/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 8°16.73
start stop duration Lon E 0°0.84
TIME :19:03:05 19:45:18 42.2 (min) Purpose : 3
LOG : 7734.35 7737.43 3.1 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 200 m Speed : 4.4 kn
Sorted : 1 Total catch: 68.97 Catch/hour: 97.99

SPECIES	CATCH/HOUR		% OF TOT.
	weight	numbers	
Krill	50.66	0	51.70
MYCTOPHIDAE	19.02	0	19.41
Todarodes sp.	8.81	155	8.99
Nealotus tripes	5.68	280	5.80
Brama sp.	2.77	14	2.83
Cubiceps pauciradiatus	2.57	91	2.62
Myctophum sp.	1.35	388	1.38
Gempylus serpens	1.29	10	1.32
CRANCHIIDAE	1.12	448	1.14
Small squids	0.90	895	0.91
NEOSCOPELIDAE	0.78	1678	0.80
Coryphaena equiselis	0.59	6	0.61
Octopoteuthis sp.	0.57	24	0.58
Myctophidae sp. large	0.53	34	0.54
Diplophos sp.	0.22	224	0.23
Ornithoteuthis antillarum	0.19	18	0.20
ANGUILLIFORMES	0.16	45	0.16
Scopelosaurus sp.	0.10	6	0.10
Shrimps unidentified	0.10	24	0.10
Remora brachyptera	0.08	1	0.08
Diplophos taenia	0.07	48	0.08
Myctophidae sp. C	0.07	10	0.07
Enoploteuthis leptura leptura	0.06	3	0.06
Thysanoteuthis rhombus	0.06	4	0.06
Chauliodus sloani	0.05	3	0.05
Macroparalepis affinis	0.05	24	0.05
S H R I M P S	0.03	560	0.03

Onychoteuthis banksi	0.03	1	0.03
Nealotus tripes	0.01	4	0.01
0			
Howella atlantica	0.01	4	0.01
Pterycombus brama	0.01	6	0.01
0			
Gymnammodytes sp.	0.01	4	0.01
Promethichthys prometheus	0.01	7	0.01
Auxis thazard	0.01	1	0.01
Beryx splendens	0.00	3	0.00
Oxyporhamphus micropterus	0.00	3	0.00
Eustomias sp.	0.00	3	0.00
Unid. juvenile fishes	0.00	3	0.00
Total	97.99		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 14
DATE :06/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 7°33.89
start stop duration Lon E 0°0.24
TIME :02:59:19 03:19:35 20.3 (min) Purpose : 3
LOG : 7778.97 7779.83 0.9 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 200 m Speed : 2.6 kn
Sorted : 0 Total catch: 17.58 Catch/hour: 52.03

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Krill	25.16	0	48.35
MYCTOPHIDAE	13.02	151	25.03
Brama dussumieri	2.64	15	5.07
Cubiceps pauciradiatus	2.23	44	4.28
Myctophidae sp. C	1.33	249	2.55
Gempylus serpens	1.05	6	2.03
CRANCHIIDAE	0.99	92	1.91
NEOSCOPELIDAE	0.89	355	1.71
Todarodes sp.	0.69	41	1.33
ANGUILLIFORMES	0.66	0	1.27
Unid. juvenile fishes	0.59	296	1.14
Myctophidae sp. D	0.39	86	0.75
Symbolophorus rufinus	0.39	98	0.75
Diplophos sp.	0.30	296	0.57
Protomyctophum sp.	0.29	86	0.56
Shrimps unidentified	0.21	36	0.40
BATHYLAGIDAE	0.20	27	0.39
Myctophidae sp. E	0.17	21	0.32
Diplophos taenia	0.16	92	0.31
Ornithoteuthis antillarum	0.12	9	0.23
Lestidiops distans	0.12	89	0.23
Enoploteuthis leptura leptura	0.09	9	0.18
Symbolophorus boops	0.07	6	0.13
Lampanyctus sp.	0.07	15	0.13
Myctophum punctatum	0.06	12	0.11
Pterycombus brama	0.04	21	0.08
Astronesthes sp.	0.03	12	0.06
0			
Lagocephalus lagocephalus	0.02	3	0.05
Astronesthes sp.	0.01	3	0.02
Synagrops sp.	0.01	3	0.02
Stomias sp.	0.01	3	0.01
MELANOSTOMIATIDAE	0.01	3	0.01
Chauliodus sloani	0.01	6	0.01
Grammicolepis brachiusculus	0.01	3	0.01
Neoscopelus macrolepidotus	0.01	6	0.01
Beryx splendens	0.00	6	0.01
Total	52.03		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 15
DATE :06/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 6°1.25
start stop duration Lon E 0°1.23
TIME :18:45:58 19:14:30 28.5 (min) Purpose : 3
LOG : 7878.86 7880.87 2.0 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 200 m Speed : 4.2 kn
Sorted : 0 Total catch: 43.81 Catch/hour: 92.14

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Cubiceps pauciradiatus	16.99	1110	18.44
Myctophid sp. B	13.25	0	14.38
Krill	10.09	0	10.96
Maurolicus sp.	8.41	1682	9.13
Myctophum sp.	8.41	210	9.13
Myctophid sp. A	8.41	9674	9.13
Todarodes sp.	7.66	120	8.31
Nealotus tripes	4.28	215	4.65
TUNICATA	4.00	48	4.34
Small squids	3.15	2944	3.42
Brama dussumieri	2.02	11	2.19
MYCTOPHIDAE	1.89	841	2.05
Gempylus serpens	1.60	11	1.73
ANGUILLIFORMES	1.26	1262	1.37
Ornithoteuthis antillarum	0.23	13	0.25
Enoploteuthis leptura leptura	0.18	13	0.19
Lampadena sp.	0.16	13	0.18
Astronesthes sp	0.05	11	0.05
Lestrolepis japonica	0.04	23	0.05
Shrimps unidentified	0.02	4	0.03
Pterycombus brama	0.01	2	0.01
Diplophos taenia	0.01	2	0.01
Stomias sp.	0.00	2	0.00
Bregmaceros sp.	0.00	4	0.00
Serrivomer sp.	0.00	2	0.00
Total	92.14		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 16
DATE :07/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 5°28.78
start stop duration Lon E 0°0.08
TIME :02:35:45 02:54:32 18.8 (min) Purpose : 3
LOG : 7914.23 7914.94 0.7 Region : 21000
FDEPTH: 70 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 250 m Speed : 2.3 kn
Sorted : 1 Total catch: 34.84 Catch/hour: 111.19

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
MYCTOPHIDAE	33.18	21271	29.84
Krill	12.04	0	10.83
Small squids	10.33	4360	9.29
Maurolicus sp.	7.58	6635	6.82
Cubiceps pauciradiatus	7.02	367	6.31
CRANCHIIDAE	4.79	77	4.31
Myctophidae sp. C	4.74	2276	4.26
Myctophidae sp. I	4.08	1044	3.67
Nealotus tripes	3.64	153	3.27
Todarodes sp.	2.87	29	2.58
Myctophidae sp. D	2.56	96	2.30
ANGUILLIFORMES	2.28	2371	2.05
Myctophidae sp. H	1.99	760	1.79
Astronesthes sp	1.75	300	1.57
SALPS	1.71	948	1.54
Myctophidae sp. G	1.61	760	1.45
Myctophidae sp. J	1.42	96	1.28
Astronesthes sp	1.33	188	1.19
0			
Isistius brasiliensis	0.99	3	0.89
Myctophidae sp. F	0.95	852	0.85
NOMEIDAE	0.74	6	0.67
Gempylidae - juvenile**	0.48	96	0.43
Myctophidae sp. L	0.48	188	0.43
Diplophos taenia	0.48	476	0.43
S H R I M P S	0.48	1328	0.43
Myctophidae sp. K	0.38	188	0.34
Lestidiops distans	0.28	188	0.26
Myctophidae sp. E	0.26	284	0.23
CYNOGLOSSIDAE	0.19	188	0.17
Bregmaceros sp.	0.19	568	0.17
Pterycombus brama	0.11	16	0.10
Unid. juvenile fishes	0.10	188	0.09
Stomias boa	0.05	13	0.05
Scopelosaurus sp.	0.05	191	0.04
Lestrolepis sp.	0.03	6	0.02
Malacosteinae	0.02	3	0.02
Lagocephalus lagocephalus	0.02	6	0.02
Unidentified	0.02	3	0.01
Total	111.19		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 17
DATE :07/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 4°1.71
start stop duration Lon E 0°1.47
TIME :19:10:02 19:37:15 27.2 (min) Purpose : 3
LOG : 8005.92 8007.86 1.9 Region : 21000
FDEPTH: 55 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 180 m Speed : 4.3 kn
Sorted : 0 Total catch: 33.90 Catch/hour: 74.71

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Myctophid sp. B	10.80	1344	14.45
Desmodema polystictum	7.71	4	10.32
0			
MYCTOPHIDAE	7.49	1542	10.03
Cubiceps pauciradiatus	7.10	280	9.50
Maurolicus sp.	6.39	0	8.55
Krill	6.17	0	8.26
Cubiceps capensis	5.91	161	7.90
Small squids unident.	4.41	0	5.90
ANGUILLIFORMES	4.19	3305	5.60
Nealotus tripes	3.88	154	5.19
Brama dussumieri	2.51	13	3.36
Gempylus serpens	2.38	15	3.19
Myctophid sp. A	1.76	1322	2.36
Todarodes sp.	0.80	31	1.06
CRANCHIIDAE	0.70	13	0.93
Cubiceps baxteri	0.67	4	0.90
NOMEIDAE	0.62	2	0.83
Bregmaceros sp.	0.44	220	0.59
Ornithoteuthis antillarum	0.30	22	0.40
Nemichthys curvirostris	0.22	220	0.29
TUNICATA	0.19	11	0.25
Juvenile flatfish	0.02	220	0.03
Antigonia capros	0.02	24	0.02
Antigonia capros	0.02	24	0.02
0			
Desmodema polystictum	0.01	2	0.01
Shrimps unidentified	0.01	2	0.01
Unid. juvenile fishes	0.00	4	0.01
0			
Lampris guttatus	0.00	2	0.01
Snyderidia canina	0.00	2	0.00
Grammicolepis brachiusculus	0.00	4	0.00
CHAETODONTIDAE	0.00	7	0.00
Total	74.71		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 18
DATE :08/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 3°16.21
start stop duration Lon E 0°23.63
TIME :03:49:05 04:07:24 18.3 (min) Purpose : 3
LOG : 8067.40 8068.30 0.9 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 200 m Speed : 3.0 kn
Sorted : 1 Total catch: 19.75 Catch/hour: 64.71

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Krill	28.52	0	44.08
Cubiceps pauciradiatus	5.46	210	8.44
Myctophidae sp. D	4.53	8490	7.00
ANGUILLIFORMES	2.74	1117	4.24
Maurolicus sp.	2.60	1697	4.02
Small squids	2.49	904	3.85
Myctophid sp. A	2.21	1019	3.41
Myctophidae sp. C	1.81	963	2.80
Myctophidae sp. E	1.70	1301	2.62
Myctophid sp. B	1.70	1697	2.62
Nealotus tripes	1.20	79	1.85
CRANCHIIDAE	1.16	39	1.79
0			
Brama dussumieri	1.09	7	1.68
Cubiceps capensis	1.03	7	1.59
Todarodes sp.	0.88	10	1.37
Todarodes sp.	0.85	10	1.32
0			
Bregmaceros sp.	0.68	452	1.05
Diplophos sp.	0.57	170	0.88
0			
CRANCHIIDAE	0.57	226	0.88
S H R I M P S	0.34	341	0.53
SALPS	0.28	115	0.44
Diplophos taenia	0.28	115	0.44
Cubiceps sp.	0.28	56	0.44
OPHIDIIDAE	0.28	170	0.44
Astronesthes sp	0.23	33	0.35
TUNICATA	0.23	115	0.35
MELANOSTOMIATIDAE	0.17	115	0.26
Nansenia sp	0.16	16	0.25
0			
Juvenile flatfish	0.11	115	0.18
Diplophos sp.	0.11	56	0.18
Lagocephalus lagocephalus	0.08	3	0.13
Nansenia sp	0.07	56	0.11
Unid. juvenile fishes	0.06	115	0.09

CAPROIDAE	0.06	170	0.09
Pterycombus brama	0.03	10	0.05
Diaphus brachycephalus	0.03	3	0.05
Malacosteus sp.	0.02	3	0.03
Polymetme thaeocoryla	0.02	3	0.03
BRAMIDAE	0.02	3	0.03
SCORPAENIDAE	0.02	56	0.03
Trachipterus trachypterus	0.02	3	0.03
Lestrolepis intermedia	0.01	7	0.02
Selene dorsalis	0.01	7	0.01
Bonapartia sp.	0.00	3	0.01
Antigonia sp.	0.00	10	0.01
Total	64.71		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 19
DATE :08/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 2°30.63
start stop duration Lon W 0°0.62
TIME :19:46:50 20:22:05 35.3 (min) Purpose : 3
LOG : 8183.37 8185.66 2.3 Region : 21000
FDEPTH: 45 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 200 m Speed : 3.9 kn
Sorted : 0 Total catch: 67.77 Catch/hour: 115.36

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Maurolicus sp.	29.45	0	25.53
MYCTOPHIDAE	28.26	84766	24.49
Lepidocybium flavobrunneum	18.96	2	16.44
Myctophidae sp. D	9.36	2043	8.12
Cubiceps pauciradiatus	5.73	340	4.97
Small squids	4.60	0	3.98
Gempylus serpens	3.13	14	2.71
Brama dussumieri	2.25	12	1.95
Myctophidae sp. C	1.70	170	1.48
Myctophidae sp. E	1.70	1362	1.48
Nealotus tripes	1.60	77	1.39
Todarodes sp.	1.30	24	1.13
Myctophidae sp. F	1.28	1021	1.11
Krill	1.19	0	1.03
CRANCHIIDAE	0.93	29	0.81
Myctophidae sp. I	0.51	340	0.44
Myctophidae sp. J	0.51	340	0.44
Enoploteuthis leptura leptura	0.44	5	0.38
ANGUILLIFORMES	0.41	63	0.36
Ornithoteuthis antillarum	0.37	26	0.32
TUNICATA	0.34	170	0.30
0			
SALPS	0.34	170	0.30
Myctophidae sp. H	0.26	340	0.22
Brotula barbata	0.17	170	0.15
Myctophidae sp. G	0.17	170	0.15
Psenes cyanophrys	0.17	3	0.14
TUNICATA	0.11	2	0.09
OPHIDIIDAE	0.09	170	0.07
Nemichthys scolopaceus	0.02	3	0.01
Lestrolepis intermedia	0.01	2	0.01
CAPROIDAE	0.01	14	0.00
Antigonia capros	0.00	3	0.00
Total	115.36		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 20
DATE :09/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 1°48.71
start stop duration Lon W 0°0.41
TIME :03:44:26 04:07:59 23.5 (min) Purpose : 3
LOG : 8226.38 8227.50 1.1 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 200 m Speed : 2.9 kn
Sorted : 3 Total catch: 25.82 Catch/hour: 65.80

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
MYCTOPHIDAE	16.57	0	25.18
0			
MYCTOPHIDAE	16.31	0	24.79
Cubiceps pauciradiatus	5.89	653	8.96
Myctophidae sp. C	3.49	754	5.30
Nansenia macrolepis	3.18	816	4.83
CRANCHIIDAE	2.43	224	3.69
Myctophidae sp. D	2.00	612	3.04
Gempylus serpens	1.94	10	2.94
Maurolicus sp.	1.63	1223	2.48
Brama dussumieri	1.39	8	2.11
Psenes cyanophrys	1.26	8	1.92
Small squids	1.22	632	1.86
Zu cristatus	1.07	3	1.63
Astronesthes sp.	0.82	163	1.24
Myctophidae sp. E	0.77	102	1.18
Myctophidae sp. G	0.71	754	1.08
Myctophidae sp. H	0.71	673	1.08
Lestrolepis intermedia	0.57	367	0.87
STOMIIDAE	0.55	245	0.84
Myctophidae sp. I	0.53	306	0.81
Krill	0.49	0	0.74
Myctophidae sp. F	0.45	204	0.68
Todarodes sp.	0.41	3	0.62
Idiacanthus sp.	0.14	20	0.22
ANGUILLIFORMES	0.12	102	0.19
Diplophos taenia	0.12	102	0.19
S H R I M P S	0.12	41	0.19
SALPIDAE	0.12	102	0.19
Desmodema polystictum	0.07	3	0.10
Lestidiops sp.	0.06	20	0.09
Eustomias lipochirus	0.06	20	0.09
Cryptopsaras couesii	0.05	3	0.08
Scopelosaurus sp.	0.04	41	0.06
0			
DIRETMIDAE	0.04	20	0.06
Antigonia sp. 'yellow dorsal/a	0.04	20	0.06
CAPROIDAE	0.04	61	0.06
Xenolepidichthys dagleishi	0.04	41	0.06
Stomias sp.	0.04	20	0.06
Nemichthys curvirostris	0.04	43	0.06
Scopelosaurus sp.	0.04	8	0.06
Nealotus tripes	0.03	102	0.05
Enoploteuthis leptura leptura	0.03	20	0.05
Promethichthys prometheus	0.03	61	0.05
ELOPIDAE	0.02	20	0.03
Bregmaceros sp.	0.02	20	0.03
Lagocephalus lagocephalus	0.02	20	0.03
Selene dorsalis	0.02	20	0.03
OPHIDIIDAE	0.02	20	0.03
Stomias sp.	0.01	3	0.02
0			
SCORPAENIDAE	0.01	20	0.01
Total	65.80		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 21
DATE :09/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 0°40.08
start stop duration Lon E 0°0.73
TIME :19:50:39 20:25:19 34.7 (min) Purpose : 3
LOG : 8297.14 8299.33 2.2 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 180 m Speed : 3.8 kn
Sorted : 0 Total catch: 18.45 Catch/hour: 31.92

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Cubiceps pauciradiatus	7.54	254	23.63
Myctophidae sp. E	6.40	2336	20.06
Myctophidae sp. C	4.58	692	14.36
MYCTOPHIDAE	4.33	12358	13.55
Myctophidae sp. G	1.62	3806	5.07
TUNICATA	1.42	36	4.43
Maurolicus sp.	1.38	433	4.34
Myctophidae sp. D	1.12	692	3.52
Gempylus serpens	0.98	7	3.07
Krill	0.87	0	2.71
ANGUILLIFORMES	0.43	382	1.36
Small squids	0.26	346	0.81
0			
Myctophidae sp. F	0.22	260	0.70
CRANCHIIDAE	0.22	62	0.69
Cubiceps sp.	0.19	211	0.61
Nealotus tripes	0.09	36	0.28
Small squids	0.09	47	0.28
Taractichthys longipinnis	0.04	2	0.14
Todarodes sp.	0.04	21	0.11
S H R I M P S	0.03	2	0.11
OPHIDIIDAE	0.01	9	0.03
Unid. juvenile fishes	0.01	14	0.03
Brama dussumieri	0.01	3	0.02
CAPROIDAE	0.01	9	0.02
Lestrolepis sp.	0.01	9	0.02
Lestrolepis intermedia	0.00	3	0.01
Auxis rochei	0.00	2	0.01
Astronesthes sp.	0.00	2	0.01
Unidentified	0.00	2	0.01
Psenes cyanophrys	0.00	2	0.01
Juvenile flatfish	0.00	3	0.01
Antigonia capros	0.00	2	0.01
Total	31.92		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 22
DATE :10/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat S 0°8.90
start stop duration Lon E 0°0.16
TIME :03:09:44 03:26:42 17.0 (min) Purpose : 3
LOG : 8328.68 8329.58 0.9 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 3
Towing dir: 0° Wire out : 160 m Speed : 3.2 kn
Sorted : 0 Total catch: 16.64 Catch/hour: 58.83

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP	weight	numbers	
Myctophidae sp. C	11.71	2037	19.91
Cubiceps pauciradiatus	10.39	594	17.67
Desmodema polystictum	7.50	4	12.74
MYCTOPHIDAE	7.16	0	12.16
CRANCHIIDAE	4.76	131	8.08
CRANCHIIDAE	2.18	368	3.70
0			
Small squids	2.04	1103	3.46
Nansenia sp.	1.47	1018	2.50
0			
Krill	1.10	0	1.88
Nansenia sp.	1.08	226	1.83
ANGUILLIFORMES	1.07	707	1.83
0			
Myctophidae sp. D	0.96	764	1.63
ANGUILLIFORMES	0.93	219	1.57
TUNICATA	0.92	11	1.57
Maurolicus sp.	0.68	1810	1.15
Todarodes sp.	0.62	18	1.05
Nealotus tripes	0.56	113	0.94
Astronesthes sp.	0.54	198	0.91
Gempylus serpens	0.46	4	0.78
Cubiceps sp.	0.31	1556	0.53
Gempylus serpens	0.31	198	0.53
0			
Myctophidae sp. F	0.28	28	0.48
Scopelosaurus sp.	0.23	7	0.38
Unid. juvenile fishes	0.17	339	0.29
0			
Desmodema polystictum	0.14	4	0.25
0			
Myctophidae sp. E	0.14	141	0.24
Nealotus tripes	0.14	113	0.24
0			
OPHIDIIDAE	0.14	0	0.24
0			
DIRETMIDAE	0.11	28	0.19
Nemichthys curvirostris	0.08	28	0.14
Stolephorus indicus	0.08	57	0.14
Bregmaceros sp.	0.08	0	0.14
OPHIDIIDAE	0.07	71	0.11
S H R I M P S	0.06	57	0.10
Nemichthys sp.	0.06	85	0.10
Diplophos taenia	0.06	57	0.10
Diplophos sp.	0.06	28	0.10
Myctophidae sp. G	0.03	28	0.05
TUNICATA	0.03	0	0.05
0			
CAPROIDAE	0.03	28	0.05
Myctophidae sp. H	0.03	28	0.05
Trachipterus sp.	0.02	4	0.04
Lestrolepis intermedia	0.01	7	0.02
Lagocephalus lagocephalus	0.01	4	0.02
Pterycombus brama	0.01	4	0.02
Lagocephalus lagocephalus	0.01	4	0.01
0			
Carinaria lamarcki	0.00	4	0.01
Total	58.83		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 23
DATE :11/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat N 0°11.43
start stop duration Lon W 0°0.17
TIME :01:17:38 01:42:55 25.3 (min) Purpose : 3
LOG : 8362.53 8363.64 1.1 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 2.7 kn
Sorted : 1 Total catch: 23.39 Catch/hour: 55.51

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP			
	weight	numbers	
MYCTOPHIDAE	25.92	64790	46.68
Krill	5.62	0	10.13
Lestrolepis intermedia	4.28	427	7.72
Myctophidae sp. C	3.75	589	6.75
Small squid	2.62	1875	4.72
SALPS	2.57	0	4.63
Malacosteus sp.	1.73	956	3.12
Myctophidae sp. E	1.66	1445	2.99
Cubiceps sp.	1.19	3112	2.14
Myctophidae sp. D	1.02	1125	1.83
Bathygadus sp.	1.02	1016	1.83
Shrimps unidentified	0.86	2784	1.54
ANGUILLIFORMES	0.64	0	1.16
Bregmaceros sp.	0.54	268	0.97
Cubiceps pauciradiatus	0.43	55	0.77
OPHIDIIDAE	0.32	427	0.58
Amphipods	0.32	695	0.58
Brama dussumieri	0.32	2	0.57
Chauliodus sp.	0.27	55	0.48
Bothidae - juvenile	0.16	536	0.29
Antigonia sp.	0.05	55	0.10
PORTUNIDAE	0.05	55	0.10
NOTOSUDIDAE	0.05	55	0.10
SCORPAENIDAE	0.05	55	0.10
Diplophos sp.	0.05	55	0.10
Argonauta sp.	0.01	2	0.02
Total	55.51		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 24
DATE :11/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat N 1°28.59
start stop duration Lon E 0°0.06
TIME :19:06:50 19:35:23 28.6 (min) Purpose : 3
LOG : 8443.19 8444.99 1.8 Region : 21000
FDEPTH: 50 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 200 m Speed : 3.8 kn
Sorted : 0 Total catch: 66.10 Catch/hour: 138.87

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP			
	weight	numbers	
Cubiceps pauciradiatus	45.97	1653	33.10
Krill	31.09	0	22.39
MYCTOPHIDAE	28.57	87605	20.57
Todarodes sp.	7.65	204	5.51
Auxis thazard	7.38	244	5.32
Small squids	2.94	4412	2.12
Nealotus tripes	2.94	147	2.12
Myctophidae sp. C	2.31	420	1.66
Maurolicus sp.	1.68	4412	1.21
ANGUILLIFORMES	1.68	1050	1.21
Myctophidae sp. F	1.47	1471	1.06
Brama dussumieri	1.05	6	0.76
Ornithoteuthis antillarum	0.79	29	0.57
Myctophidae sp. D	0.74	420	0.53
Gempylus serpens	0.46	2	0.33
Myctophidae sp. G	0.42	210	0.30
Myctophidae sp. E	0.42	210	0.30
Myctophidae sp. H	0.42	420	0.30
Cubiceps sp.	0.27	1050	0.20
Aulopus sp.	0.15	1261	0.11
Tunicata	0.14	6	0.10
Selene dorsalis	0.11	200	0.08
ACANTHURIDAE	0.09	36	0.06
Lestrolepis intermedia	0.06	21	0.04
Juvenile flatfish	0.02	420	0.02
Enoploteuthis leptura leptura	0.02	2	0.01
Nemichthys curvirostris	0.00	2	0.00
Cubiceps pauciradiatus	0.00	21	0.00
0			
BOTHIDAE	0.00	15	0.00
SYMPHYSANODONTIDAE	0.00	21	0.00
Dactylopterus volitans	0.00	2	0.00
Antigonia capros	0.00	6	0.00
HOLOCENTRIDAE	0.00	4	0.00
BALISTIDAE	0.00	2	0.00
PRIACANTHIDAE	0.00	2	0.00
CAPROIDAE	0.00	2	0.00
Total	138.87		100.00

R/V Dr. Fridtjof Nansen SURVEY:2019407 STATION: 25
DATE :13/07/19 GEAR TYPE: PT NO: 8 POSITION:Lat N 1°54.70
start stop duration Lon E 0°0.53
TIME :20:25:24 21:00:33 35.1 (min) Purpose : 3
LOG : 8592.72 8595.12 2.4 Region : 21000
FDEPTH: 60 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 230 m Speed : 4.1 kn
Sorted : 40 Total catch: 131.30 Catch/hour: 224.13

SPECIES	CATCH/HOUR		% OF TOT.
C SAMP			
	weight	numbers	
Cubiceps pauciradiatus	179.23	6307	79.97
MYCTOPHIDAE	14.68	40797	6.55
Todarodes sp.	7.72	376	3.44
Myctophidae sp. G	4.44	1024	1.98
Maurolicus sp.	3.93	0	1.75
Krill	3.76	0	1.68
Myctophidae sp. E	1.71	171	0.76
ANGUILLIFORMES	1.66	1195	0.74
Brama dussumieri	1.66	9	0.74
Myctophidae sp. D	1.02	512	0.46
Myctophidae sp. F	1.02	341	0.46
Nealotus tripes	0.94	43	0.42
Myctophidae sp. C	0.85	853	0.38
Small squids unident.	0.51	512	0.23
Tunicata	0.33	17	0.15
Thunnus sp.	0.28	9	0.13
Unid. juvenile fishes	0.09	512	0.04
Cubiceps sp.	0.09	512	0.04
SYMPHYSANODONTIDAE	0.06	51	0.03
Selene dorsalis	0.05	51	0.02
Acanthurus sp.	0.05	51	0.02
Enoploteuthis leptura leptura	0.03	9	0.01
Lestidiops distans	0.01	9	0.00
Bothidae - juvenile	0.01	34	0.00
Lestrolepis sp.	0.01	9	0.00
Total	224.13		100.00

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

Equipment Used	Analysis	Sample Type	Preservation	Quantity	Receiving country	Receiving institution	Responsible at Receiving Institution	Deadline for analysis
Niskin bottles on CTD Rosette	Nutrients	Water samples	0.2 ml chloroform; 4°C	264	Norway	IMR	David Cervantes	Complete
WP2 (180 µm) from max 200 m 1/2 Split	Zooplankton biomass estimation	Aluminium trays	Dried and then frozen	71	Norway	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	25	Norway	IMR	Stamatina Isari	
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	25	Norway	IMR	Stamatina Isari	
Bongo H (right net 405 µm), double oblique tow from max 200 m	Ichthyoplankton community identification	Bottles with the bulk sample after sorting ichthyoplankton (if not done on live sample)	96% ethanol	25	Norway	IMR	Stamatina Isari	
Bongo H (right net 405 µm), double oblique tow from max 200 m	Ichthyoplankton community identification	Scintillation vials with sorted larval fish and eggs from the bulk manta sample	96% ethanol	8	Norway	IMR	Stamatina Isari	

Mammoth	Ichthyoplankton community identification	Bottles with ½ of bulk multinet sample	4% formaldehyde	38	Norway	IMR	Stamatina Isari	
Mammoth	Ichthyoplankton community identification	Bottles with ½ of bulk multinet sample	96% ethanol	38	Norway	IMR	Stamatina Isari	
Manta trawl	Neuston community identification	Neuston community identification	96% ethanol	23	South Africa	UWC	Mark Gibbons	
Manta trawl	Species identification, Genetics	Scintillation vials with sorted ichthyoplankton from the bulk manta sample	96% ethanol	39	Norway	IMR	Stamatina Isari	
Manta trawl	Abundance and chemical composition of microplastics	Aluminium trays with sorted microplastics from the bulk manta sample	Photographed, dried and frozen	6	Norway	IMR	Bjørn Einar Grøsvik	
Trawl	Genetics (stock identity)	Tissue (vials)	96% Ethanol	81	Norway	IMR	Geir Dahle	
Trawl	Identification	Whole fish	4% formaldehyde	126 (19 for museum collection)	Norway	IMR	Gabriella	