NORAD-FAO PROGRAMME
GCP/GLO/690/NOR

CRUISE REPORTS *DR FRIDTJOF NANSEN*
EAF-Nansen/CR/2018/4

SURVEY OF REGIONAL RESOURCES AND ECOSYSTEM OFF SOUTHEAST AFRICA

Tanzania

6 – 18 April 2018

Tanzania Fisheries Research Institute
Dar es Salaam, Tanzania

Institute of Marine Research
Bergen, Norway

The EAF-Nansen Programme

The EAF-Nansen Programme "Supporting the application of the Ecosystem Approach to Fisheries Management considering climate and pollution impacts" (GCP/GLO/690/NOR) aims to further strengthen the knowledge base and the overall institutional capacity for the implementation of the Ecosystem Approach to Fisheries (EAF) in developing countries, with additional attention to the impact of climate variability and change, pollution and other anthropogenic stressors.

The programme, that started implementation in May 2017, builds on earlier phases, and is governed by an agreement between the Food and Agriculture Organization of the United Nations (FAO), the Institute of Marine Research (IMR), Norway and the Norwegian Agency for Development Cooperation (Norad). The three pillars of the new programme are: Science, Fisheries management, and Capacity development. A new state of the art research vessel, *Dr Fridtjof Nansen* is an integral part of the programme. A science plan, covering 11 research themes, guides the programme 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

Le Programme EAF-Nansen "Appuyer la mise en œuvre de l'approche écosystémique de la gestion des pêches en tenant compte des impacts du climat et de la pollution" (GCP/GLO/690/NOR), vise à renforcer la base de connaissances et la capacité institutionnelle pour la mise en œuvre de l'approche écosystémique des pêches (AEP) dans les pays en développement, en accordant une attention particulière aux effets de la variabilité et du changement climatique, de la pollution et d'autres facteurs de stress anthropiques.

Le programme, qui a débuté en mai 2017, s'appuie sur les phases précédentes et est régi par un protocole d'accord entre l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO), l'Institut de recherche marine (IMR) de Norvège et l'Agence norvégienne de Coopération au développement (Norad). Les trois piliers du nouveau programme sont : la science, l'aménagement de la pêche et le développement des capacités. Un navire de recherche à la pointe de la technologie, le nouveau *Dr Fridtjof Nansen*, fait partie intégrante du programme. Un plan scientifique, couvrant 11 thèmes de recherche, guide les travaux scientifiques du programme.

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

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CRUISE REPORTS *DR FRIDTJOF NANSEN*

SURVEY OF REGIONAL RESOURCES AND ECOSYSTEM OFF SOUTHEAST AFRICA

Tanzania

6 – 18 April 2018

by

Tore Johannessen[1], Shigalla Mahongo[2], Lucilla Giulietti[1], Helene Lødemel[1], Lars Johan Naustvoll[1], Diana Zaera[1]

[1] Institute of Marine Research, P.O. Box 1870 Nordnes, N-5817 Bergen, Norway

[2] Tanzania Fisheries Research Institute, P.O. Box 9750, Dar es Salaam, Tanzania

Institute of Marine Research
Bergen, 2020

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EXECUTIVE SUMMARY

This survey was part of a regional coverage of the eastern coast of Africa (South Africa to Tanzania), aimed at collecting a wide range of data and samples on marine ecosystems from about 20 to 1000 meters depth. Unfortunately, and due to the bottom topography and unavailability of detailed sea charts for Tanzania waters, the survey could not cover areas shallower that about 50 meters depth.

Data collection covered hydrography, meteorology, microplastics, phytoplankton, zooplankton, jellyfish, fishery biology including eggs and larvae, genetics, food safety and fish abundance. Much of the data and samples will be processed in the context of the EAF-Science Plan and related research themes. Hence, this survey report only provides an overview of what has been done during the survey and presents some preliminary results.

The hydrographic conditions were quite similar along the coast of Tanzania showing strong stratification of water masses and low primary productivity. Highest numbers of plastic particles were observed outside Dar es Salaam and northwards between Zanzibar and the main land up to the northern part of Zanzibar. The highest numbers of fish larvae and eggs were observed from Dar es Salaam, through the Zanzibar Channel, and up to Pemba.

Acoustic measurements of pelagic fish showed low abundances, with the shorthead ancovy (*E. heteroloba*) as the most abundant species. It should be noted that the survey did not cover more shallow areas where there is indication of substantially higher densities of Pelagic 1 species than over deeper waters. Furthermore, lager fish, tuna and tuna-like fish in offshore waters cannot be covered through surveys of this type.

Pelagic 2 species were found in a narrow belt in the Southern area in relatively low concentrations, in two smaller areas in near Mafia island and the highest abundances in the Zanzibar Channel. Total biomass was estimated to ~25 000 tonnes.

A total of 335 different species/groups were caught in 30 bottom trawl hauls, mostly fish but also some invertebrates, which reflects the high diversity found in these waters.

CHAPTER 1. INTRODUCTION

1.1 The survey area

The R/V *Dr Fridtjof Nansen* undertook a survey of regional resources and ecosystem in the Indian Ocean off Southeast Africa in 2018. The areas surveyed included the continental shelf and upper slope of coastal East Africa (Leg 1), the Mascarene Bank (Leg 2) and parts of the Bay of Bengal region (Leg 3). Leg 1 covered the continental shelf and upper slope of eastern Africa, with oceanographic transects in the Agulhas Current region and off Tanzania to the Seychelles (Figure 1). This report describes the ecosystem survey along the coast of Tanzania (Leg 1.4).

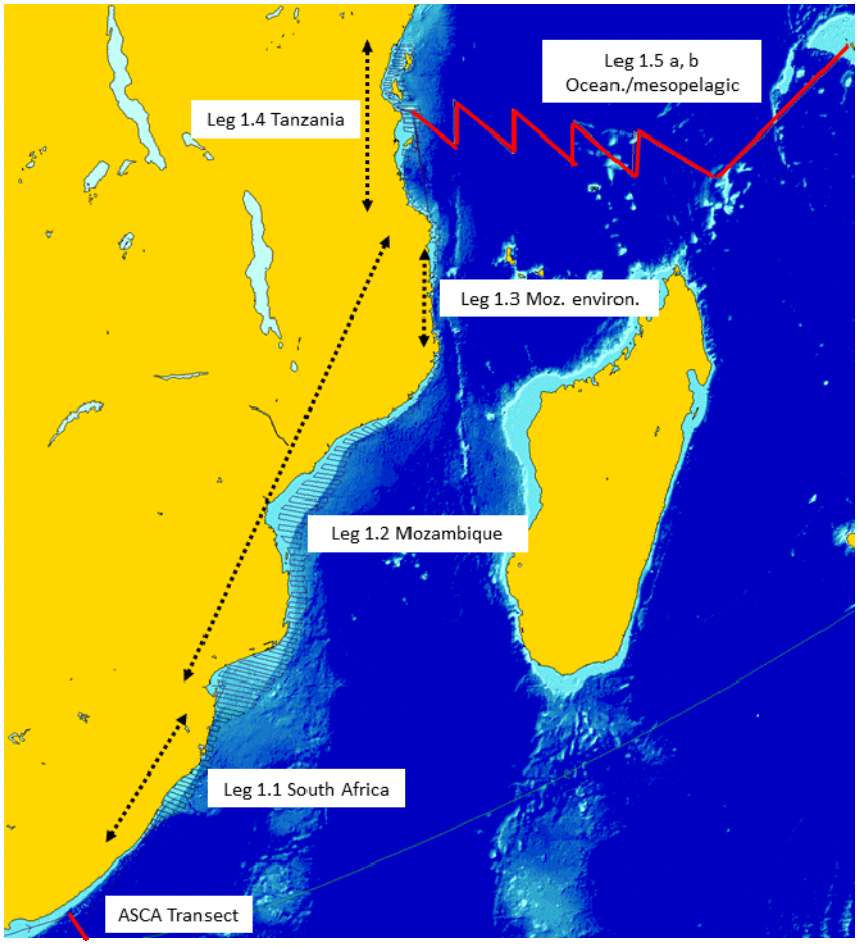

Figure 1. RV *DR Frdtjof Nansen* survey programme 2018, Leg 1.

1.2 Survey objectives

Hydrography:

- Mapping the hydrographic and environmental conditions in the survey area, viz. temperature, salinity, oxygen, chlorophyll, nutrients, pH and total alkalinity.

Phytoplankton, zooplankton, ichthyoplankton and jellyfish:

- Mapping the distribution, abundance and composition of phytoplankton, zooplankton (including jellyfish), and species composition of fish eggs and larvae.

Pelagic and demersal stocks:

- Obtaining information on abundance, size composition and distribution of the main pelagic fish species, and of the pelagic sub-groups *PEL 1* (*clupeids, engraulids) and PEL2 (carangids, scombrids, barracudas, hairtail),* using acoustical methods in a systematic grid survey strategy and targeted trawling.
- Obtaining information on abundance, size composition and distribution of the main demersal fish species, crustaceans and squids, using a swept area method with bottom trawls
- Collecting information on maturity stages for the main species of pelagic fish, demersal fish, crustaceans and squids
- Collecting samples for genetic analysis for stock identification of selected species
- Collecting stomach samples for analysis of contents (diet), including microplastics.

Mesopelagic fish:

- Identifying the main species and collect samples for identification and isotope analysis.

Marine debris and pollution:

- Recording occurrence of marine debris (surface);
- Collecting samples for levels of nutrients and contaminants including microplastics;
- Mapping occurrence of microplastics and describe associated neuston communities.

Contaminants and parasites:

- Collecting samples of fish species consumed locally, and other indicator species such as soles, for analysis of contaminant levels and nutrient values, and identifying and quantifying selected parasites in commercially important fish.

1.3 Participation

Pwani University, Kenya:

Jackline Adhiambo.

State Department of Fisheries and Blue Economy, Kenya:

John Kiarie Njuguna.

Kenya Marine and Fisheries Research Institute, Kenya:

Charles Mitto Kosore.

Instituto Nacional de Investigacao Pesqueira, Mozambique:

Celso Billy Isac Montanha.

Institute of Marine Research, Norway (IMR), Norway:

Vidar Fauskanger, Lucilla Giulietti, Tore Johannessen (Cruise leader), Helene Lødemel, Lars Johan Naustvoll, Hege Rognaldsen, Silje Elisabeth Seim, Olaf Johan Sørås, Jan Frode Wilhelmsen, Diana Zaera.

Ministry of Fisheries and Marine Resources, Somalia:

Abdi Ali Yare.

The University of the Western Cape, South Africa:

Yasmeen Parker.

Tanzania Fisheries Research Institute, Tanzania:

Charles Nyarongo Ezekiel, Valeli Joseph, Benedicto Boniphace Kashindye, Mary Alphonce Kishe-Machumu, Shigalla Mahongo (Co-cruise leader), Patroba Patrick Matiku, Hakim Davis Matola, Catherine Adam Mwakosya, Salome Daniel Shayo.

University of Dar es Salaam, Tanzania:

Margareth Kyewalyanga, Pooja Solanki, Omar Juma Suleiman.

State University of Zanzibar, Tanzania

Mohammed Suleiman Mohammed.

Tanzania Navy, Tanzania

Mussa Ally Yege.

1.4 Narrative

R/V *Dr Fridtjof Nansen* departed from Dar es Salaam on 6 April 2018 at 14 00 UCT. The first transect, just north of the border between Mozambique and Tanzania, was reached on 7 April 2018 at 1500 UCT. From the southern border, the Tanzanian coast was surveyed northwards, but only to 5°S due to maritime security regulations. *Dr Fridtjof Nansen* anchored in Menai Bay on the south-west side of Unguja Island in Zanzibar from the evening of 13 April 2018 to noon the following day, for calibration of echo-sounders. Due fish schools interfering with the calibration, and later on strong tidal currents bringing the calibration spheres out of position, the attempt was aborted as it was unsuccessful. *Dr Fridtjof Nansen* returned to Dar es Salaam on 18 April 2018 at 0600 UCT (9 am local time).

The wind conditions were generally good during the survey and did not limit sampling. Except for a few instances where strong currents prevented operating nets (plankton and fish

eggs and larvae) close to the shore, all hydrographical stations were carried out as planned. The shelf along the coast of Tanzania is generally very narrow (Figure 2), sloping steeply from shallow waters (20-30 m) to 300-400 m depth (Figure 2). The slope is characterized by uneven topography which does not allow bottom trawling in most places. Hence, the bottom trawling programme of four hauls per transect had to be substantially reduced. The topography in shallower waters along the coast of Tanzania is also generally "hilly". Furthermore, the maps describing depths and bottom topography are relatively coarse with many shallow bottom structures missing. Therefore, except for the Zanzibar Channel and the delta area north of Mafia where the bottom is relatively smooth, surveying bottom depth <50 m was considered unsafe and was generally avoided. Due to reduced bottom trawl sampling, it proved impossible to carry out the planned programme to estimate abundance of fish stocks. Instead, more focus was put on describing species composition and diversity of demersal fishes and invertebrates.

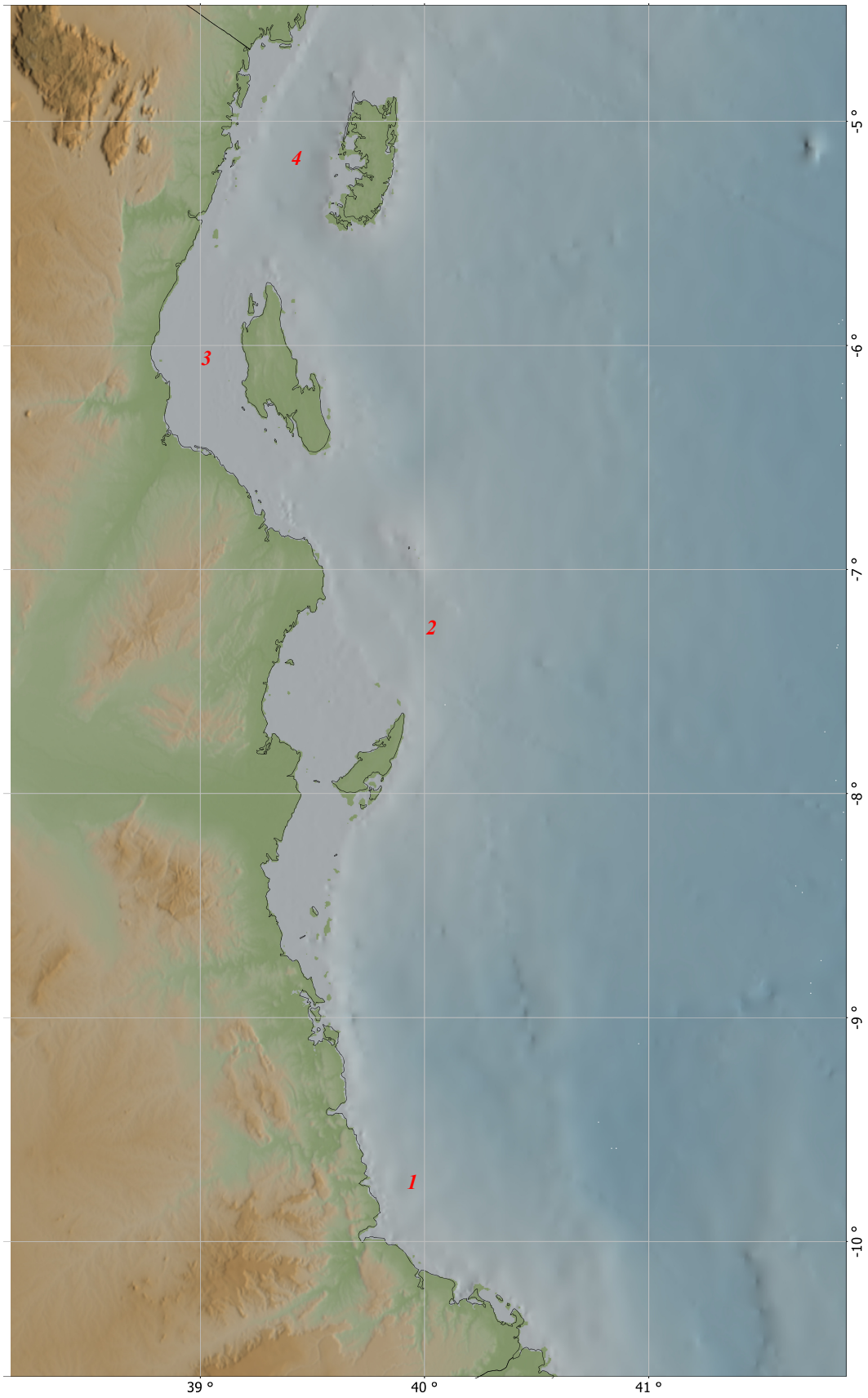

Figure 2. Depth contours along the coast of Tanzania: 0-20 m is indicated in blue along the shore, and survey depths (20-1000 m) are indicated in light blue, where lines indicate 50, 100, 200, 500 and 1000 m isobaths. 1-4 (in red) indicate sub-areas used during surveys with the first *Dr Fridtjof Nansen* in 1982-83: 1 – the southern area (south of 9°S), 2 – Mafia, 3 – Zanzibar, 4 – Pemba.

1.5 Survey effort

The survey was run along pseudo-parallel acoustic transects, perpendicular to the coastline, approximately 15 nautical miles apart, and from about 50 m to 1000 m depth (Figure 3a). In the Zanzibar Channel (between Zanzibar and the mainland), which is an important fishing area, the distance between two transects was reduced to 10 nautical miles. Both sides of the islands of Zanzibar (Unguja and Pemba), but not north of 5°S for security reasons (piracy).

Pelagic trawling was done irregularly, either to identify echo registrations or to check 'blindly' if fish were mixed with plankton in the upper layers of the water column. Pelagic trawl with floats was occasionally used to catch fish close to the surface. Bottom trawling was carried out where the bottom was sufficiently smooth, generally deeper than 200 m, or <50 m in the Rufiji delta area north of Mafia and the Zanzibar Channel (Table 2). Figure 3a shows the course track and trawl stations.

In addition to continuous acoustic recording for pelagic and mesopelagic for fish biomass estimates, continuous recordings of data from the multibeam bottom mapping echo sounder EM710, thermosalinograph and weather station was carried out.

At every second transect, hydrographic observations were carried out to a depth of 1000 m. These transects included CTD casts and sampling of phytoplankton, zooplankton, fish eggs and larvae, and microplastics. Figure 2b shows the position of hydrographical stations, and Table 1 effort during the survey in terms of number of trawl stations, CTD casts and samples of microplastics (Manta net), phytoplankton, zooplankton (WP2) and fish eggs and larvae (Multi net).

Fish were also sampled for analyses of food safety and parasites. The number of samples for food safety are given in Table 3, and number of samples and preliminary results from the parasite studies are represented in Table 4.

All collected data are the property of the United Republic of Tanzania.

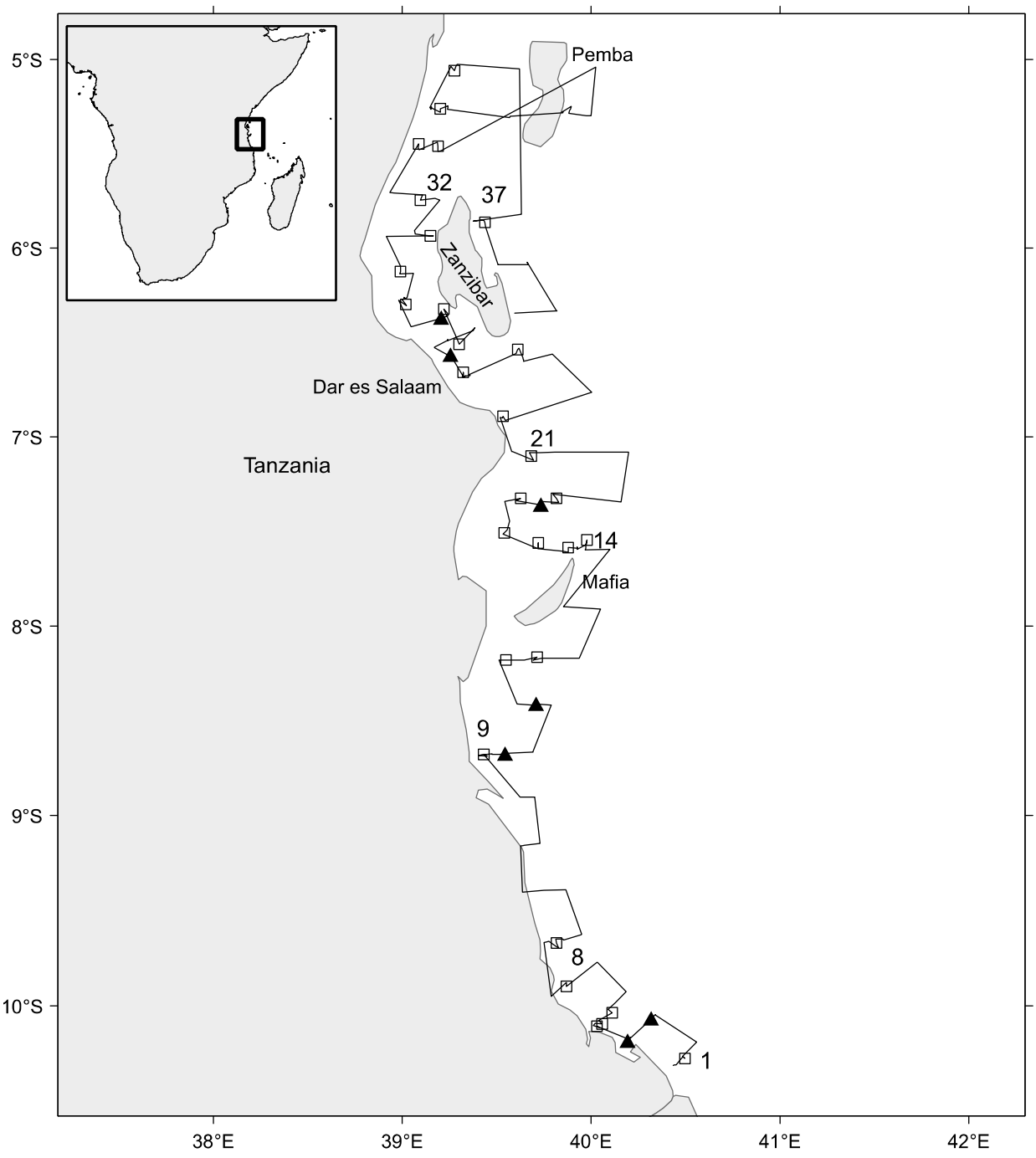

Figure 3a. Course tracks with trawl stations along Tanzania.

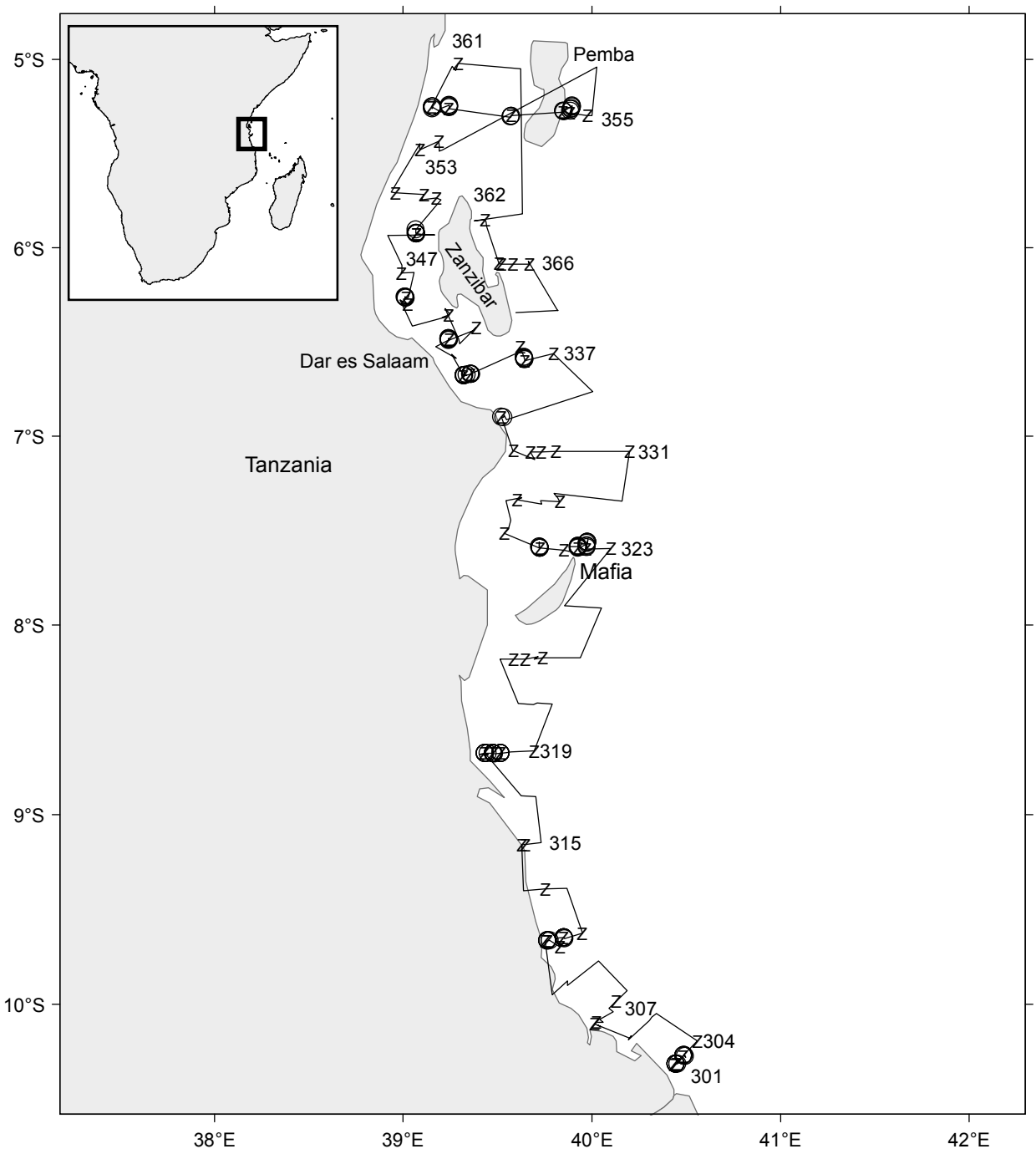

Figure 3b. Course track with hydrographic and plankton stations: Z indicates CTD and O CTD, plankton, Multi net for eggs and larvae, Manta net for microplastics and chemical seawater analyses.

Table 1. Survey effort: Phyto -phytoplankton net, WP-2 – zooplankton net, Multi – net for eggs and larvae, Manta – net for microplastic particles in the surface, BT-bottom trawl, PT- pelagic trawl.

	NM sailed	CTD	Phyto	WP-2	Multi	Manta	BT	PT
The southern area	224	15	4	8	4	4	6	2
Mafia	545	25	9	18	9	9	13	3
Zanzibar	304	15	3	4	3	3	7	2
Pemba	289	15	3	6	5	4	4	0
Total	1 362	65	19	36	21	19	30	7

Table 2. Bottom trawl hauls per depth stratum in the various areas.

Area	20-50 m	50-100 m	100-200 m	200-1000 m	Sum
The Southern area	0	1	0	5	6
Mafia	5	2	0	6	13
Zanzibar	4	2	0	1	7
Pemba	0	1	0	3	4
Total	9	6	0	15	30

Table 3. Number of fish samples collected for food safety analyses per species.

LARGE FISH

DATE	SPECIES	NO. OF FISH	TISSUE	FREECE-DRIED	STATION
08/04/2018	*Trichiurus lepturus*	5	Fillet and liver	6	5
09/04/2018	*Trichiurus lepturus*	5	Fillet and liver	6	7
10/04/2018	*Saurida undosquamis*	25	Fillet and liver	30	13
12/04/2018	*Trichiurus lepturus*	25	Fillet and liver	30	21
12/04/2018	*Saurida undosquamis*	15	Fillet and liver	18	21
15/04/2018	*Scomberomorus commerson*	8	Fillet and liver	7	33
	Total	83		97	

SMALL FISH

DATE	SPECIES	NO. OF FISH	TISSUE	FREECE-DRIED	STATION
08/04/2018	*Decapterus kuroides*	150	Whole fish	6	3
09/04/2018	*Stolephorus heterolobus*	300	Whole fish	3	9
10/04/2018	*Spratelloides gracilis*	450	Whole fish	3	12
11/04/2018	*Upeneus taeniopterus*	150	Whole fish	6	16
13/04/2018	*Encrasicholina punctifer*	900	Whole fish	3	25
14/04/2018	*Spratelloides gracilis*	450	Whole fish	3	28
14/04/2018	*Stolephorus heterolobus*	300	Whole fish	3	28
15/04/2018	*Carangoides malabaricus*	150	Whole fish	6	31
15/04/2018	*Upeneus taeniopterus*	150	Whole fish	6	31
15/04/2018	*Decapterus macrosoma*	150	Whole fish	6	32
	Total	3 150		45	

Table 4. Number of fish investigated for parasites.

SPECIES	DATE	NO. OF FISH	TISSUE EXAMINED	PARASITE INVESTIGATED	INFECTED (Y= yes N= no)	FREEZED SAMPLES (Y= yes N= no)	TRAWL STATION
Scomberomorus commerson	09/04/2018	12	Fillet	*Kudoa* spp.	N	N	9
Scomberomorus commerson	15/04/2018	8	Fillet	*Kudoa* spp.	N	N	33
Lophoides mutilus	08/04/2018	5	Fillet, Viscera	Anisakids	Y	Y	6
Trichiurus lepturus	08/04/2018	9	Fillet, Viscera	Anisakids	y	y	6
Trichiurus lepturus	08/04/2018	19	Fillet	*Kudoa* spp.	y	y	7
Trichiurus lepturus	12/04/2018	50	Fillet	*Kudoa* spp.	y	y	21
Trichiurus lepturus	12/04/2018	20	Fillet, Viscera	Anisakids	y	y	22
Polysteganus coeruleopunctatus	08/04/2018	5	Fillet, Viscera	Anisakids	y	y	5
Polysteganus coeruleopunctatus	10/04/2018	6	Fillet, Viscera	Anisakids	y	y	13
Polysteganus coeruleopunctatus	12/04/2018	5	Fillet, Viscera	Anisakids	y	y	22
Decapterus macrosoma	08/04/2018	2	Fillet, Viscera	Anisakids	y	y	5
Saurida undosquamis	08/04/2018	5	Fillet, Viscera	Anisakids	y	y	6
Saurida undosquamis	09/04/2018	6	Fillet, Viscera	Anisakids	y	y	8
Saurida undosquamis	10/04/2018	11	Fillet, Viscera	Anisakids	y	y	13
Saurida undosquamis	10/04/2018	9	Fillet, Viscera	Anisakids	y	y	14
Saurida undosquamis	11/04/2018	17	Fillet, Viscera	Anisakids	y	y	17
Saurida undosquamis	14/04/2018	16	Fillet, Viscera	Anisakids	y	y	27
Saurida undosquamis	15/04/2018	7	Fillet, Viscera	Anisakids	y	y	30
Ephinephelus areolatus	11/04/2018	4	Fillet, Viscera	DIGENEAN	y	y	17
Octopus sp.	12/04/2018	2	Fillet, Viscera	Anisakids	N	N	21

CHAPTER 2. METHODS

2.1 Meteorological data

Meteorological data was logged continuously from the AANDERAA Smartguard meteorological station and included wind direction and speed, air pressure, relative humidity, air temperature and shortwave solar radiation. All data were logged to the Nansis tracklog system averaged every 60 seconds. A problem with the sensor systems may have had impact on the quality of the data. Hence, these data will not be presented until the sensors have been calibrated.

2.2 Oceanography

2.2.1 Thermosalinograph

The SBE 21 thermosalinograph ran continuously during the survey, obtaining samples of sea surface (at 4 m depth) salinity and relative temperature every 10 seconds. An attached in-line C3 Turner Design Submersible Fluorometer measured turbidity and chlorophyll-*a* levels.

2.2.2 Current speed and direction measurements (ADCP)

Two hull-mounted Acoustic Doppler Current Profiler (VMADCP) from RD Instruments ran during the survey. The frequency of the VMADCP are 75 and 150 kHz. The system was run in narrow band mode and data was averaged in 16 and 4 m vertical bins at 75 and 150 kHz respectively and stored on files for post survey processing. The 150 kHz was run continuously while the 75 kHz was turned off during the last part of the survey due to interference with the ping rate of the EK80 echosounder.

2.2.3 Temperature, salinity, oxygen, fluorescence and sampling of water

Vertical profiles of temperature and salinity were obtained by a Seabird 911 CTD, while *in situ* concentrations of dissolved oxygen were measured using a CTD-mounted SBE 43 oxygen sensor. Real time logging and plotting was performed using the Seabird Seasave software installed on a PC. Attached to the CTD was also an uncalibrated Chelsea Mk III Aquatracka fluorometer, which measures *in situ* fluorescence on relative scale (measure of chlorophyll-*a*). 12 Niskin water-bottles (10 l), attached to a CTD-mounted rosette, were used to collect water at standard sampling depths: 5, 25, 50, 75, 100, 150, 200, 250, 300, 400, and 500 m.

2.2.4 Hydrographical transects

The sailing order suggested CTD casts at bottom depths of 30 m, 75 m, 100 m, 200 m and 500 m, at transects 30 nautical miles apart. However, as the bottom generally sloped steeply from shallow water to 200-300 m, the distance between station <200 m was often negligible. Hence, at most transects the 75 and 200 m stations were cancelled, and in some instances also the 30 m station was not sampled. Additional CTD casts were carried out at 1000 m depth, and in relation to bottom trawl sampling.

At every second hydrographical transect (60 NM apart), a more extensive sampling programme was carried out at depths of 30 m (sometimes cancelled), 100 m and 500 m. The samples collected at these so-called "super-stations" are shown in Figure 4. The most northerly of these transects (~5°S) was carried out on both sides of the Pemba Channel and on the eastern side of Pemba as well (Figure 3). Three additional super-stations (30 m stations) were carried out along the middle of the Zanzibar Channel.

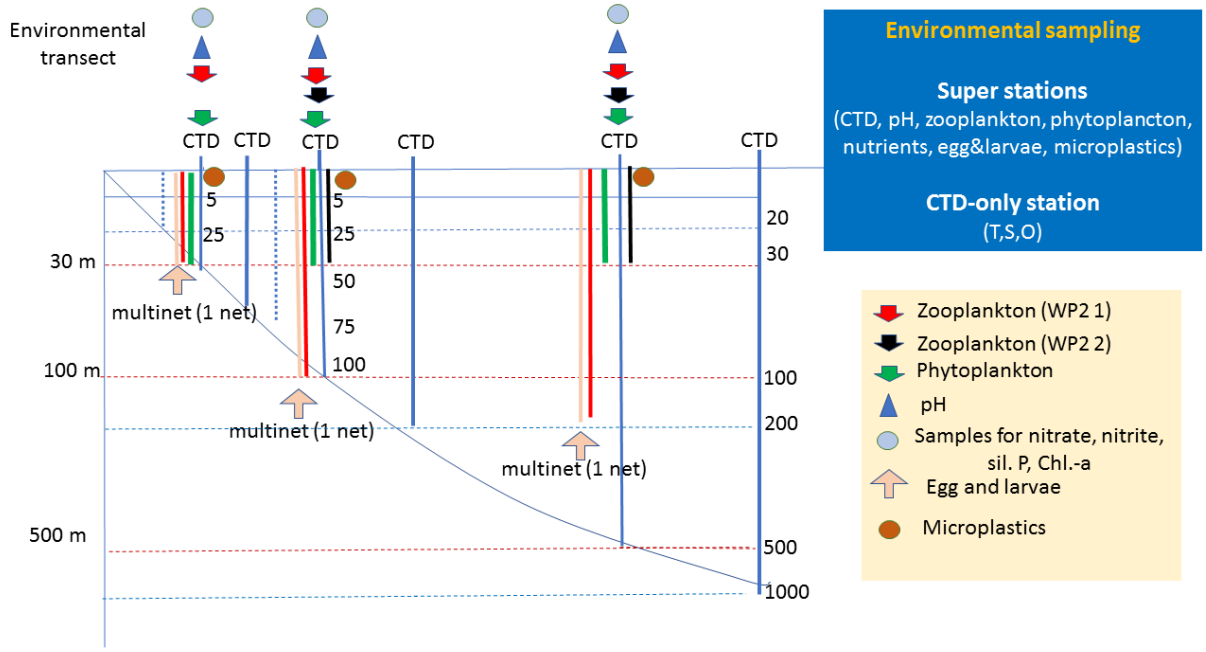

Figure 4. Sampling diagram showing the depth and the sampling at the hydrographical transect with the super-stations transects, from the inshore (left) towards the deep 500 m station (right).

The oxygen sensor on the CTD was validated using the Winkler titration (Grasshoff *et al.* 1983).

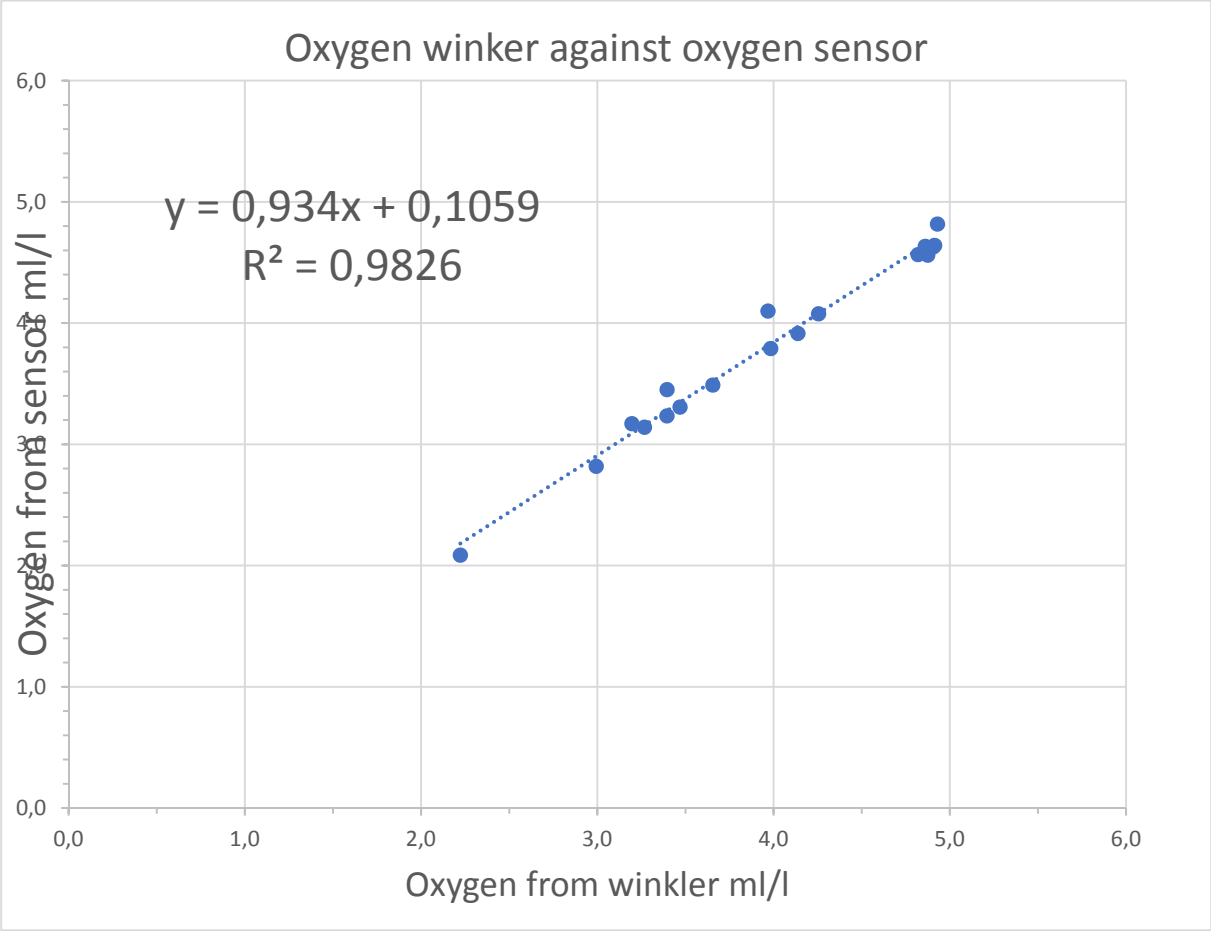

Figure 5. Oxygen sensor measurements on the CTD plotted against oxygen measurements performed on board.

2.2.5 Ocean acidification parameters (pH and alkalinity)

Seawater samples (250 ml) obtained at standard depths from the CTD-mounted Niskin-bottles were collected in borosilicate glass bottles using silicone tubing to reduce air exchange. Both pH and alkalinity were analysed on board the vessel. pH was determined spectrophotometrically using a diode array spectrophotometer and a pH sensitive indicator, m-cresol purple in 2 mM solution, as described by Clayton and Byrne (1993) and Chierici *et al*. (1999). Alkalinity was measured by titration with acid (0.05M HCl) and changes in pH were measured with an electrode (potential in mV) using tiamo software. Further processing of the data will be done on land by IMR and will provide more information on the marine carbonate system and parameters for ocean acidification.

2.2.6 Nutrients

Seawater samples (20 ml) for nutrient analyses (nitrate, silicate and phosphate) were collected from the Niskin water bottles (standard depths). The samples were stored in 20 ml

polyethylene vials, conserved with 0.2 ml chloroform, and kept cool and dark in a refrigerator The analyses will be made on shore by IMR, using a modified Alpkem AutoAnalyzer C (O I Analytical, USA) and following standard procedures (Grasshoff, 1965). Storage may introduce loss of accuracy of the results, especially when the concentrations of nitrate, silicate and phosphate are low, such as in surface samples from the productive season. Samples from deep water are more stable, because most of the nutrients in the deep water occur in their inorganic form.

2.3 Plankton

2.3.1 Phytoplankton biomass

Chlorophyll-*a* was sampled as an indicator of phytoplankton biomass. For chlorophyll-*a* and phaeopigment measurements, seawater was collected from the Nisken-bottles at the standard depths (not below 200 meters). The water was filtered using a 0.7µm filtration system (Munktell glassfiber filters Grade: MGF, vacuum 400 mm Hg) and stored at 20°C until analysis on shore by IMR. The assay was performed by extraction with 90% acetone followed by centrifugation, and the measurements were taken with a fluorometer (model 10 AU, Turner Designs Inc., Sunnyvale, Ca., USA), according to Welshmeyer (1994) and Jeffrey and Humphrey (1975).

2.3.2 Phytoplankton identification

Phytoplankton was collected along the hydrographic transects at stations positioned at bottom-depths of approximately 30 m, 100 m and 500 m. At each plankton-station, qualitative phytoplankton samples were collected with a net (35 cm in diameter and mesh-size of 10 µm), hauled vertically at a speed of 0.1 ms^{-1} from the depth of 30 m to the surface (from ca. 5 m above bottom at the 30 m stations). The samples were preserved with 2 ml of 20 % formalin buffered with hexamine in 100 ml bottles (i.e. a final solution of ca. 0.4% formaldehyde). These samples are not quantitative but used to establish the taxonomic composition of the phytoplankton community.

2.3.3 Zooplankton sampling

Mesozooplankton was collected with a WP2-net along the hydrographic transects at stations positioned at bottom-depths of approximately 30 m, 100 m and 500 m. The WP2-net (56 cm diameter, mesh size 180 µm) (Fraser 1966, Anonymous 1968) was hauled vertically at a speed of ~0.5 ms^{-1} at each station. At the shallowest and intermediately deep stations (bottom-depths of 30 m and 100 m, respectively), the sampling-strata were from near-bottom to the surface (lower sampling-depths of ~25 and 90 m, respectively). At the deepest stations with bottom-depth of ~500 m, the sampling-stratum was from the depth of 200 m to the surface.

Furthermore, a second collection with the WP2 net was performed for the depth-stratum of 30- 0 m at the stations with bottom-depths of 100 m and 500 m. The purpose of these additional samplings was to enable a direct comparison of the zooplankton composition and concentrations in the uppermost layer of the water-column along the bottom-depth gradient. Each zooplankton-sample was divided into two equally large parts using a Motoda plankton

splitter (Motoda 1959). The first part of the sample was size-fractioned by using a series of sieves with the decreasing mesh-sizes of 2000 µm, 1000 µm and 180 µm, and the zooplankton retained on each sieve were thereafter dried on aluminium-trays at ~60 ºC for 24 h. These samples will be dried once more and weighed on land for estimation of biomasses for the different size-groups. The second part of the sample was preserved in seawater with a final solution of 4% formaldehyde buffered with borax for subsequent species identification and quantification on land.

2.3.4 Fish eggs and larvae

Fish eggs and larvae were collected using a Hydro-Bios Multinet with 405 µm meshes. Samples were obtained along the hydrographical transects at approximately 30, 100 and 500 m depth. The net was towed obliquely from the bottom or a maximum depth of 100 m to the surface with a towing speed of 1.5 ms^{-1}. All fish larvae visible to "the naked eye" were removed from the total sample, transferred to vials and preserved in 4% borax buffered formaldehyde. After removing visible fish larvae, the Multinet sample was fractionated using a Motoda plankton splitter for enumeration of eggs under a stereomicroscope (Motoda 1959). The principle of this procedure is to split a homogenised sample into two "equal" parts, which again can be split further depending on the sample size. Small fish larvae overlooked by the "naked eye" scan were collected under the stereomicroscope and preserved in a separate vial noting the splitting factor. The remaining fish eggs were preserved in 4% borax buffered formaldehyde in vials noting the splitting factor. The rest of the sample was fixed for reference purpose and for possible later checks of overlooked egg and larvae. The fish-eggs will be sorted, and the larvae identified by regional laboratories (contact person: Margareth Kyewalyanga, University of Dar es Salaam, Tanzania).

2.4 Microplastics and debris

Microplastics are small pieces of plastic marine debris normally less than 5 mm long. Microplastics were collected at all hydrographical super-stations. At each station, the surface layer was sampled with a Manta-trawl having a rectangular opening of 19 cm × 61 cm (HxW), mesh-size 335 µm and two wings to keep it in balance and at the surface during the tow. Trawls were hauled horizontally at a speed of ~1.5 ms^{-1} for 15 minutes. Trawling was performed on the right-hand side about mid-ship, a few meters away from the ship attempting to avoid the wake of the vessel. Geographical start and stop positions were recorded in the bridge-log. In addition, the counts of a flowmeter attached below the trawl opening were recorded at start and stop of each trawl event.

The Manta-trawl samples were washed in filtered sea-water over a sieve with mesh-size 180 µm. Microplastic particles were picked from the sample under a stereomicroscope.This was repeated twice to ensure detection of the microplastic particles. All assumed microplastic items were then placed on a gridded petri dish for examination under the stereo-microscope, photographed and, to the extent possible, also measured and described (e.g. length, shape, type and colour). The sorted microplastics were washed with distilled water and dried in pre-weighed aluminium-trays in a drying cabinet at 30 ºC. The trays were packed in aluminium

foil, stored in room-temperature and shipped to the laboratory at IMR, where they will be studied in more detail. After removing the microplastics, the remaining part of the samples - mainly biological material - was preserved for studies of neuston.

2.5 Sediment sampling

Sediment samples were obtained at all bottom trawl stations. Stainless steel cylinders were mounted on the footrope of the trawl to collect bottom sediment samples at every trawl station. The samples were collected from the cylinder when the trawl was on deck and stored in plastic bags and preserved for further analyses of sedimentological and chemical composition.

2.6 Bottom mapping echo sounder

The EM 710 and EM 302 multibeam echo sounders are both belonging to a high to very high-resolution seabed mapping system. Data acquisition depth starts approximately 3 m below the transducers and the maximum acquisition depth is limited in practice to 1000–1500 m on *Dr Fridtjof Nansen*. Across track coverage (swath width) is up to 5.5 times water depth and may be limited by the operator either in angle or in swath width without reducing the number of beams. The operating frequencies are between 70 to 100 kHz. There are 128 beams with dynamic focusing employed in the near field. The transmitting fan is divided into three sectors to maximize range capability and to suppress interference from multiples of strong bottom echoes. The sectors are transmitted sequentially within each ping and use distinct frequencies or waveforms. The along track beam width is 1 degree. Ping rate is set according to depth. The receiving beam width is 2 degrees. Sound profiles were set manually in the system according to the area of operation. The data was logged to the on-board Olex plotting system.

2.7 Food safety and parasites

2.7.1 Food safety

Whole fish, fillet and different organs from various fish and octopus were sampled during this survey. At IMR, all the samples will be analysed for a wide variety of nutrients and contaminants. Some of the samples will also be analysed for correspondence between the microbiota and the metal content of the gut. One pelagic fish sample will be analysed for the content of microplastic particles.

2.7.2 Parasites

Whole fish, fillet and different organs from various fish that are regularly and irregularly consumed in the Tanzanian coast were sampled during this survey to detect the presence of parasites. All fish were measured (total body length, TL, 5 mm accuracy) and weighed (total body weight, TW, in g) before further parasitological analysis. Other host biometric parameters that were recorded on a routine basis included fish gender, state of maturity, as well as gross identification of stomach contents (empty/fish/crustaceans/mollusks/mud). All the samples were analysed for a wide variety of parasites, with a focus on those which are of concern to human health and seafood industry/fisheries (i.e. Anisakid nematodes and *Kudoa*

myxozoan). Members of both these groups include human pathogenic and/or impact fish quality reducing species. To date, "*Anisakis*" is the major biological hazard in seafood products (EFSA, 2010), since larval stages of Anisakis are etiological agents of human anisakiasis. On the other hand, *Kudoa* species may generate visible macroscopic cysts in the fish host's muscle and cause *postmortem* tissue myoliquefaction, commonly referred to as 'soft flesh' of the fish host's somatic musculature. Due to its repellent appearance and the spoilage of fish fillets, when it occurs in fish intended for human consumption, it can drastically reduce the marketability of the products.

The inspection procedure of nematode larvae applied in the present survey was based on the UV-press method. In brief, both flesh sides, i.e. fillets including belly flaps, and the visceral organs of each fish, were placed in separate clear plastic bags and then pressed in a hydraulic pressing device to a 1–2 mm thin layer. The bags were then deep-frozen for several hours to ensure proper core freezing, and, after thawing, examined under UV-light (366 nm). Any larvae present emerge as more or less brightly fluorescent spots or coils under UV-light. The larvae present in viscera and in the muscles were separately counted and stored in Eppendorf tubes at −20 °C until their further genetic identification to be achieved at IMR, Bergen.

Tissue samples from fish of the species *Thrichiurus lepturus* and *Scomberomorus commerson* were analysed also for the parasite *Kudoa.* Muscle samples from fresh fish were taken within 2 h after catch and stored in at −20 °C. After 48 hours, the musculature of the fish was examined for *post mortem* myoliquefaction, based on manual muscle texture testing and/or visual inspection of the muscle appearance. From every specimen showing light to clear signs of "soft flesh" at gross examination, one muscle tissue sample was taken and analysed with microscope of 100X magnification. When kudoid spores were detected, the entire mucle of fish was stored and preserved at −20 °C for further genetic identification at IMR. Tissue samples from mackerel samples will be analysed for the parasite *Kudoa*.

2.8 Top predators

There was no dedicated top predator observer on board during this cruise.

2.9 Trawl sampling

Biological sampling of fish was carried out using both pelagic and bottom trawls. Annex I gives a description of the instruments and the fishing gear used. In shallow waters (<30 m) or at night when pelagic fish was close to the surface, a small pelagic trawl with floats or a bottom trawl with floats were used for sampling. All catches were sorted, and subsamples taken to measure the number and weight by species. Species identification was based on the FAO Species Identification Guides. Individual fish were measured by total length (nearest cm below) and weight. For target species, 30 individuals were investigated with respect to sex, maturity stages and stomach fullness. In addition, for target species, the following biological samples were collected for later use: otoliths for aging, fin clipping for genetic analyses, stomachs for diet studies and liver for condition studies. Based on obtained measurements, length-weight relationships were established for acoustic estimates of the biomass of target species.

The list of species priority can be found in Annex II, and the complete records of fishing stations and catches are shown in Annex III. A full list of biological samples per species is given in Annex IV.

Jellyfish were caught as part of the trawl haul and identified to the lowest taxonomical level possible, and were counted and weighed. Jellyfish specimens that were in a good condition were photographed (top and bottom sections), before being processed and preserved for future analysis. A small piece of the oral arm tissue as well as one gonad was removed and preserved in 96% ethanol (EtOH) and stored at -20°C. Tissue samples stored in EtOH were collected for genetic studies, aimed at determining species and population structure, as well as establishing regional and global connectivity. The rest of the specimen was preserved in 10% formalin. These samples formed part of a greater morphological identification and taxonomic study.

2.10 Acoustic sampling

2.10.1 Sonar data

A Simrad SH90 Sonar was recording data continuously during the survey and stored for post processing after the survey. The sonar was set to a frequency of 26 kHz, in FM Normal mode. The sonar was operated using bow up/180 deg operation mode with the bearing of the vertical beams perpendicular to the vessel direction, and a horizontal range of 450 m and tilt angle of 3 deg. The filters built in the sonar software to improve the school representation (i.e. AGC, RCG) and ping to ping was set to default values, except for the Noise filter, which was turned off. The settings, including range and tilt, were kept the same throughout the survey, except during trawling operations when the sonar in some instances was used to target fish schools.

2.10.2 Acoustic estimates of fish biomass

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. Annex I gives the details of the acoustic settings used during the survey.

Acoustic data were logged and post-processed using the latest acoustic data post-processing software, the Large-Scale Survey System (LSSS) Version 2.0. In cases where the target category of fish contains more than one species, the mean s_A-value allocated to the category is divided between the species in the same ratio as their contribution to the mean back scattering strength in the catches (relative amount by number at length in the catches).

The following target strength (TS) function was applied to convert s_A-values (mean integrator value for a given species or group of species in a specified area) to number of fish:

$$TS = 20 \log L - 72 \text{ dB},$$

which can be converted (see Toresen *et al*. 1998 for details) to the area form (scattering cross sections of acoustic targets):

$$C_{Fi} = 1.26\ 10^{6}\ L^{-2},$$

where L is total length in 1 cm length group *i* and C_{Fi} (m^{-2}) is the reciprocal back scattering strength, or so-called fish conversion function. In order to split and convert the allocated s_A- values (m^2/NM^2) to fish densities (numbers per length group per NM^2), the following formula was used:

$$\rho_i = s_A \cdot \frac{p_i}{\sum_{i=1}^{n} \frac{p_i}{C_{F_i}}}$$

where

ρ_i = density of fish in length group *i*

s_A = mean integrator value

p_i = proportion of fish in length group *i*

$\sum_{i=1}^{n} \frac{p_i}{C_{Fi}}$ = the relative back scattering cross section (m^2) of the length frequency sample of the target species, and

C_{fi} = reciprocal back scattering cross section (σ_{bs}^{-1}) of a fish in length group *i.*

The integrator outputs were split in fish groups using a combination of behaviour pattern as deduced from echo diagrams, the LSSS analysis and catch composition as described below.

Table 5 shows the target species/groups that were used.

Table 5. Allocation of acoustic densities to species groups. Note that only examples are listed for the various groups.

Group	Taxon	Species
Pelagic species group 1 (PEL1)	Clupeidae	
		Dussumieria acuta
	Engraulididae	
		Stolephorus spp.
		Encrasicholina heteroloba
		Thryssa spp.
Pelagic species group 2 (PEL2)	Carangidae	
		Carangoides spp.
		Decapterus spp.
	Scombridae	
		Rastrelliger kanagurta
		Scomber japonicus
		Scomberomorus commerson
	Sphyraenidae	
		Sphyraena spp.
	Trichiuridae	
		Lepidopus caudatus
		Trichiurus lepturus
Other demersal species	Demersal families	
Mesopelagic species	Myctophidae	
	Other mesopelagic fish	
Plankton	Calanoidae	*Calanus* sp.
	Euphausiidae	*Meganyctiphanes* sp.
	Other plankton	

The equations above show that the conversion from s_A-values to number of fish is dependent on the length composition of the fish. It is therefore important to get representative length distributions from the stock in the whole distribution area.

When the size classes (of e.g. young fish and older fish) are well mixed, the various length distributions can be pooled together with equal importance. Otherwise, when the size classes are segregated, the total distribution area is post-stratified, according to the length distributions, and separate estimates are made for the regions containing fish with equal size.

For a region representing a distribution of a target-species, the following basic data are needed for the estimation of abundance:

1) The average s_A-value for the region,
2) The surface (usually square nautical miles, NM^2), and
3) A representative length distribution of the fish in the region.

If the targeted fish consists of more than one species, a representative length distribution of each species within the region, as obtained from the trawl catches, are used. A length distribution representing the number of the various species for each catch must be calculated.

Thereafter, these distributions must be normalized to a unit number (usually 100) so they are equally weighted (independent of sample size).

A systematic approach to a) divide the s_A-value between species in a category of fish and b) produce pooled length distributions of a target species for use in the above equation and c) calculate the biomass estimates for a region, is obtained through the following procedure:

- The samples of the species in the category are respectively pooled together with equal importance (normalized).
- The mean back scattering strength (ρ/s_A) of each length frequency distribution of the target species is calculated and summed. This is automatically done in the Excel spread-sheet made available for acoustic abundance estimation on board R/V *Dr Fridtjof Nansen*, provided the data are punched in this sheet.
- The mean s_A-value allocated to the category of fish in the region is divided between the species in the same ratio as their relative contribution to the mean back scattering strength of the length groups in the sample representing the region
- The pooled length distribution is used, together with the mean s_A-value, to calculate the density (numbers per square NM) by length groups and species, using the above formula. The total number by length group in the area is obtained by multiplying each number by the area.
- The numbers are then converted to biomass using the estimated weight at length.

The combination of low s_A value recorded and few PEL1 and PEL2 in the bottom trawl catch and few pelagic trawls made the splitting by length groups unreliable. For PEL1 an overall average of 9 cm was applied in the estimates of biomass, and for carangids and associated species (PEL2) an overall average of 23 cm was used.

2.11 Bottom trawl estimates of abundance

In the bottom trawl survey, stock biomasses were estimated by the swept-area method with catch per haul as the index of abundance (see Strømme 1992). In most hauls the trawling time (with the gear at the bottom) was around 30 min. The area swept by the trawl net within 30 minutes trawl time was 0.015 NM² and it corresponds to an average horizontal trawl opening of 18.5 m efficient net width, towing at 3.0 knots. Diagrams of the bottom trawl used are shown in Annex VI. The general formula to estimate biomass B, using this method is:

$$B=\frac{A}{a}.\frac{\overline{X}}{q} \qquad (6)$$

A is the total area surveyed, a is the swept area of the net per haul, $\overline{X}$ is the average catch per haul (the index of abundance) and q (trawl catchability) is the proportion of fish in the path of

the net that are actually caught. The density of the resource is estimated as biomass per unit area. In a stratified survey of k non-overlapping strata, if the mean catch per haul in stratum *i* and its variance are denoted by $\overline{X}_i$ and s_i^2 respectively, then an unbiased estimate of the population mean $\overline{X}$ is the stratified mean $\overline{X}_{st}$, which is given by:

$$\overline{X}_{st} = \frac{1}{N}\sum_{i=1}^{k} N_i \overline{X_i} = \sum_{i=1}^{k} W_i \overline{X_i} \qquad (7)$$

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

$$\text{var}\,(\overline{X}_{st}) = \sum_{i=1}^{k} W_i^2 \,\text{var}\,\overline{X}_i = \sum_{i=1}^{k} W_i^2 \frac{s_i^2}{n_i} \qquad (8)$$

where n_i is number of hauls in the i^{th} stratum and n is the total number of hauls in the survey. Table 6 shows the areas used in the swept-area method to estimate biomass for the different regions. A stratified semi-random design was used with depth and area as stratification factors. Estimated total biomass by species/group was obtained by summing estimates for each depth stratum.

Table 6. Areas in nm^2 for the various regions and depth strata.

DEPTH STRATA (NM^2)	The southern area	Mafia	Zanzibar	Pemba
20 – 50	312	2 271	3 315	429
50 – 100	328	906	1 116	228
100 – 200	525	866	564	355
200 – 500	1 916	5 160	1 478	3 221
200 – 1 000	5 538	12 038	4 065	7 745

For conversion of catch rates (kg/hour) to fish densities (t/NM²), the effective fishing area was considered as the product of the wing spread and the haul length, or distance over the bottom, as measured by means of the SCANMAR® equipment based on GPS readings. The area swept for each haul was thus 18.5 m (traditionally applied wing spread for the "Nansen" bottom trawl) times the distance trawled, raised to NM²/hour. The catchability coefficient (q), i.e. the fraction of the fish encountered by the 18.5 m horizontal opening of the trawl that was actually caught, was assumed equal to 1, which leads to an estimation of the minimum biomass for comparison with previous surveys. Catchability may vary depending on the type of gear used and the type of species (e.g. gears with bobbins are apparently less efficient for species such as flat fishes and octopus, while gears without bobbins and with footrope touching the bottom are more efficient for benthic species). Departures of q from 1 can introduce biases in biomass estimates leading to wrong fisheries management advices (David Somerton, 1996).

CHAPTER 3. SURVEY RESULTS

3.1 Hydrographical conditions

Hydrographical data were collected at fixed CTD stations to 1 000 m depth, and from the Aanderaa weather station that continuously collect sea surface temperature, wind speed and direction, solar radiation etc. during the survey (not presented).

3.1.1 Data from the CTD sensor

The CTD has sensors for measuring salinity, temperature, fluorescence and oxygen at approximately every meter, thus giving a vertical profile. Measurements were performed at 65 CTD stations, and seven "super transects" were carried out (Figure 6).

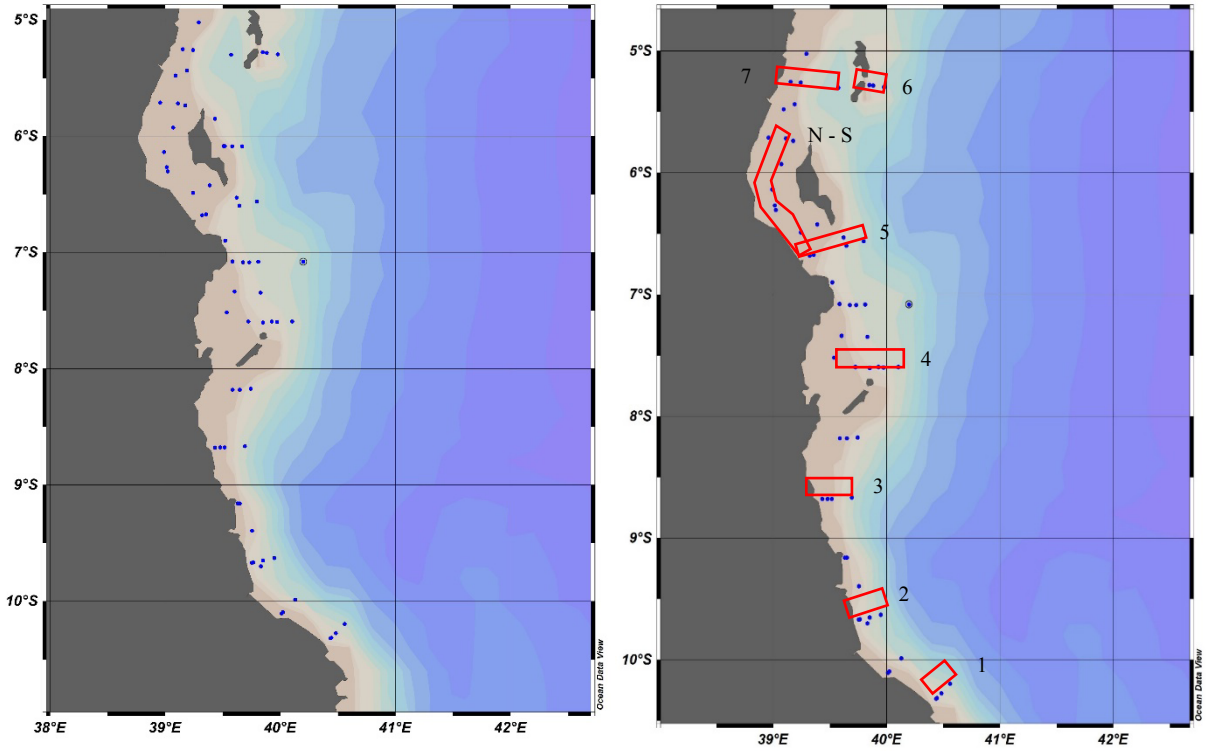

Figure 6. Map showing the position of the 65 CTD stations (left side) and the 7 selected "super transects" during survey 2018404, Tanzania.

In Figures 7 and 8 we present the different sensor parameters for "super transect 4". Figures from all transects are given in Annex VII. Transect 4 is situated outside the Rufiji River just north of Mafia. In this area the continental shelf is substantially wider than typical for the coast of Tanzania. At the shallow stations on the shelf, both temperature and salinity were more or less identical from surface to the bottom (Figure 7). Above deeper waters, high temperatures were measured from the surface to ~65 m (>25°C) at the edge of the shelf. With increasing distance offshore, this warm surface layer became gradually shallower and extended down to a depth of 30 m at the outmost station. The salinity showed much the same pattern, with mixing from surface to bottom at the shelf. At the deeper stations the salinity was <35 PSU down to 50-60 m, whereas at the outmost station of transect 4, the salinity was

~35 PSU at the surface. Outside the shelf there was an intermediate layer with high salinity water (>35.1 PSU), from ~60 m to 300 m, with lower salinity above and below. This pattern was observed at all transects, excepted for at the southern transect (transect 1) where the whole water column was mixed. The salinity differences may be influenced by the four different water masses in the Tanzanian offshore waters, having different levels of salinity (and oxygen): Tropical surface water, Arabian sea water, Antarctic intermediate water, and North Indian deep water.

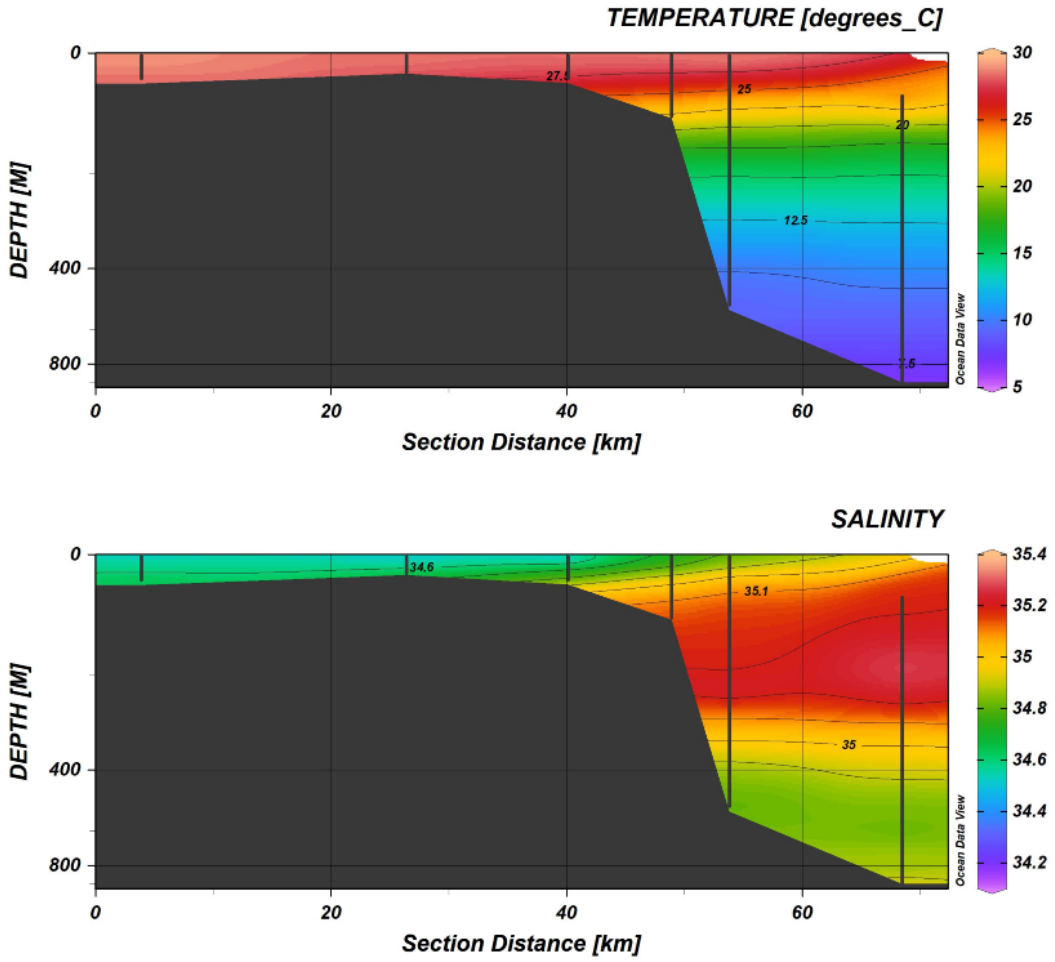

Figure 7. Sensor data (CTD) for salinity (PSU) and temperature (°C) along "super transect 4".

The vertical profiles along the transect for oxygen and fluorescence are given in Figure 7. In the upper well mixed waters the oxygen concentration was >4 ml/l (0 to ~65 m). In the intermediate water (60 m to 560 m) the oxygen concentration was between 3 and 4 ml/l. In the deep water (> 650 m) there were measured low oxygen concentrations (2.5 – 1.5 ml/l). Similar to salinity concentrations above, the four water masses off the coast of Tanzania also influence the levels of oxygen concentration along the coast.

Fluorescence gives a proxy for phytoplankton biomass. At all transects, higher fluorescence was measured above the shelf (Figure 8), whereas for most of the stations in deeper waters

(outside the shelf) the fluorescence values indicate low biomass of phytoplankton. At most stations the fluorescence data indicates that most of the phytoplankton biomass are located from 0 to 60 m.

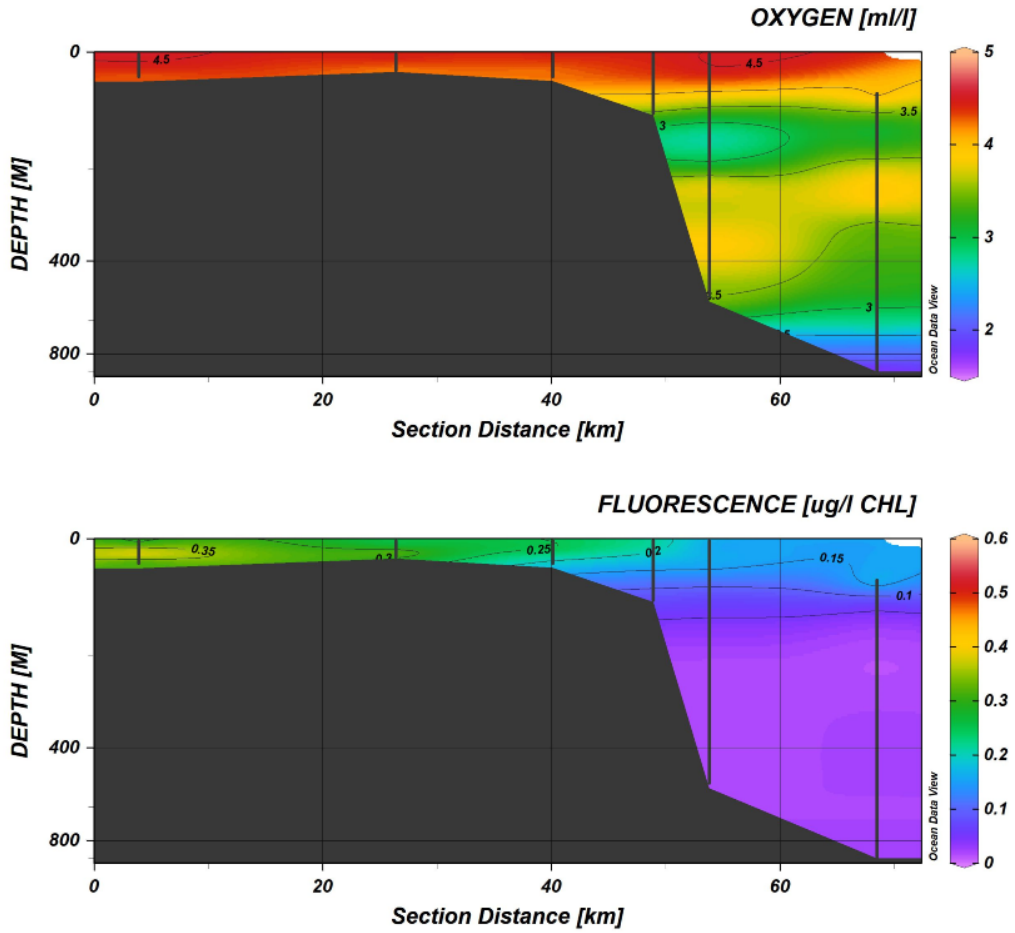

Figure 8. Sensor data (CTD) for oxygen (ml/l) and fluorescence (ug/l Chl) along "super transect 4".

Based on all CTD stations shown in the map (Figure 6, left), surface plots are given in Figure 9 for temperature, salinity, and fluorescence, and the concentration of oxygen in the deepest sampling depth.

The salinity data shows two areas with lower salinity in the surface water, one at the southern part (transect 1) and one area north of Mafia (transect 4). Both areas are situated close to the mouths of large rivers (Ruvuma in the south and Rufiji near Mafia). For the other stations, there were only minor differences. At the outmost station outside Mafia, the measured salinity was higher, indicating transport from oceanic water to the coast.

Based on surface temperature, the Tanzanian coast could be divided into three areas. South of Dar es Salaam, close to the coast, the surface temperatures measured were highest. North of Dara es Salaam the temperatures were lower in the surface with a small area west of Pemba that had even much lower surface temperature. East of Mafia lower temperatures were measured at the outmost stations, in the same area where higher salinity was measured.

The surface plot of fluorescence shows highest biomass of phytoplankton inside the island of Mafia and north of Dar es Salaam between Zanzibar and the main land. In addition, there was higher fluorescence at station in transect 1 (southern part of Tanzania).

The surface plot of oxygen in the bottom water shows concentrations >3 ml/l along the coast. However, at the deeper station in open waters the concentration of oxygen was <2.5 ml/l. The extend of this low oxygen water should be followed up to monitor the changes over time as well as the horizontal and vertical distribution of these water masses.

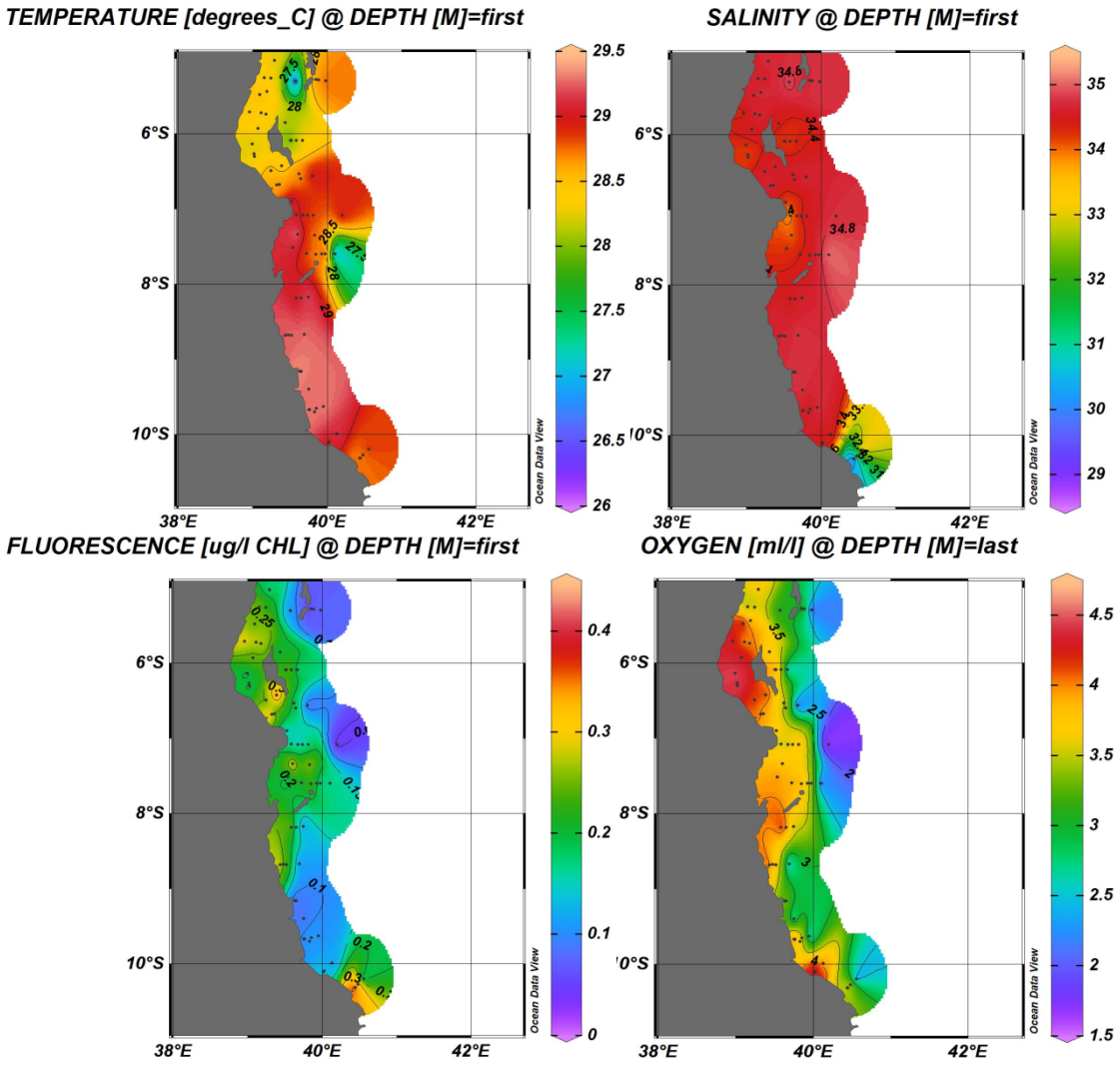

Figure 9. Surface plots of temperature, salinity, fluorescence and bottom concertation and oxygen using all CTD stations in the survey.

3.1.2 pH cross shelf distribution

Cross shelf distribution of pH is shown in Figure 10. In general, the pH was highest in the surface and decreased gradually with depth. In the south (Transect 1-3), high pH values (7.9 - 8.1) were recorded down to approximately 100 m depths. Further north (Transect 4-7),

high pH values were only recorded down to approximately 50-75 m depths, indicating a shallower mixed layer. In the deep-water masses between 500-1000 m depth, very low pH (7.5 - 7.6) values were measured.

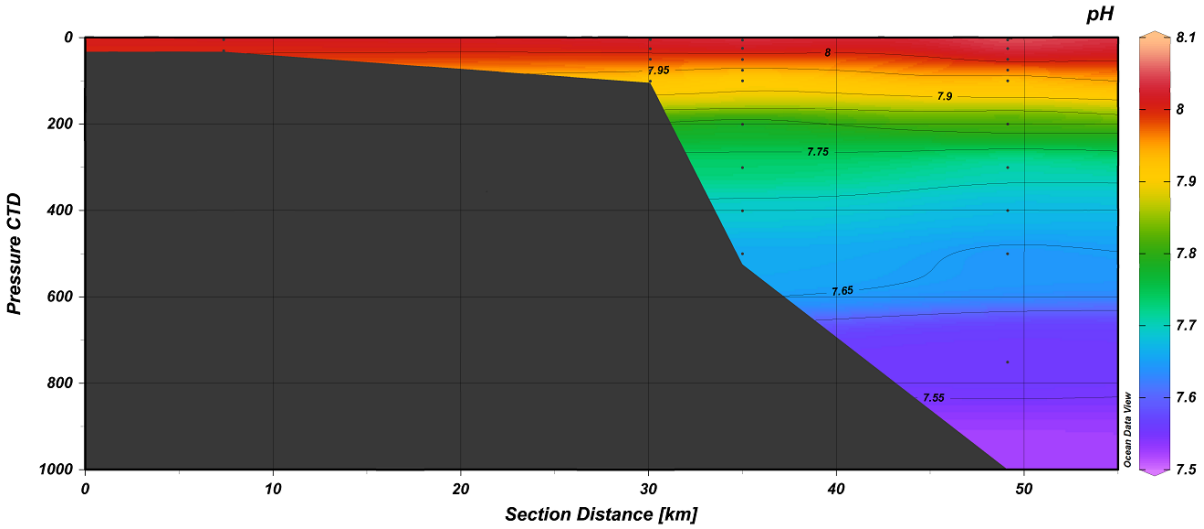

Figure 10. Cross shelf distribution of pH from Transect 4 (7.6 °S).

3.2 Microplastics

Samples for microplastics were collected at the surface using a Manta trawl retaining particles >335 µm. Microplastic particles were enumerated using a stereo microscope. Highest numbers of particles were observed outside Dar es Salaam and northwards between Zanzibar and the main land up to the northern part of Zanzibar (Figure 11). Intermediate numbers of particles were observed between Mafia and Zanzibar. Lower number of particles were recorded south of Mafia.

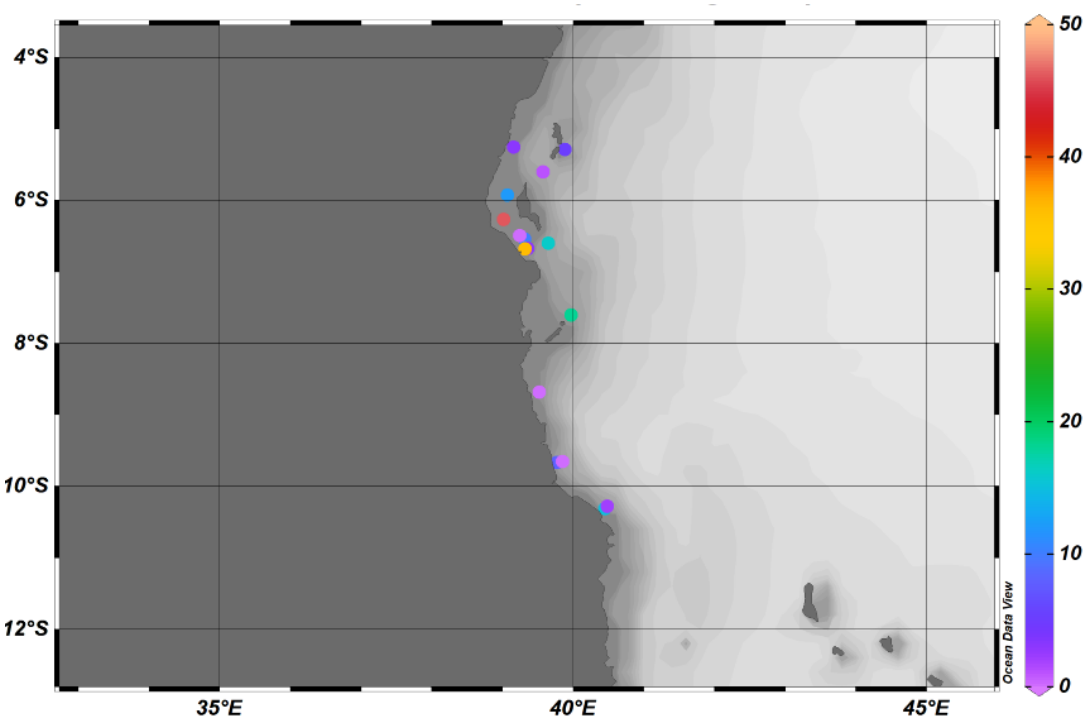

Figure 11. Microplastics collected at "super stations". The figure gives number of observed microplastic particles in the samples.

3.3 Fish larvae and eggs

Samples for fish eggs and larvae were collected from 100 m, or bottom depth if shallower, to 0 m using a multinet with a mesh size of 305 µm. The highest numbers of fish larvae and eggs were observed from Dar es Salaam, though the Zanzibar Channel, and all the way up to Pemba (Figure 12). In addition, relatively high number of fish larvae were observed at one station on "super transect 3", south of Mafia. In the southern part and at stations in open waters there were few observations of fish larvae and eggs.

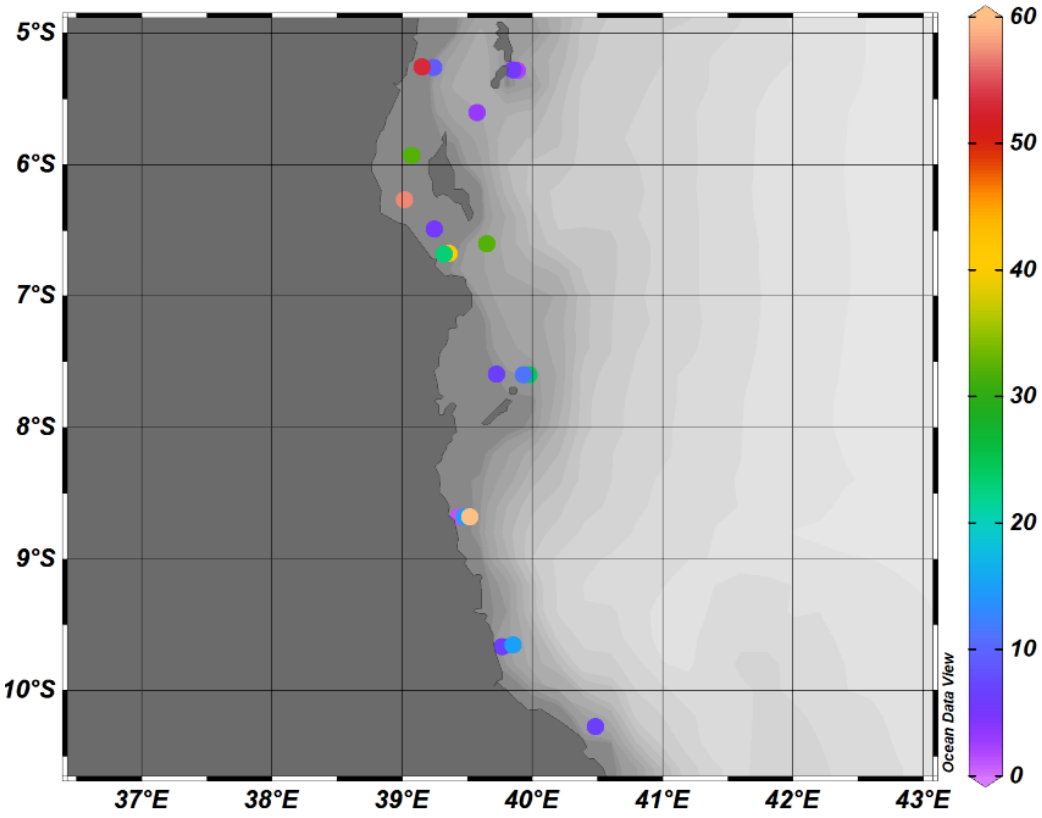

Figure 12. Numbers of fish larvae observed in the up part of the water column (<100 m).

3.3.1 Nutrients

Nutrient samples are undergoing analysis in the IMR laboratory in Norway, and data distributed once these analyses have been completed.

3.4 Plankton

3.4.1 Phytoplankton

Phytoplankton samples have not yet been analysed.

3.4.2 Chl *a*

This parameter is undergoing analysis at IMR in Norway, and the data distributed once these analyses have been completed.

3.4.3 Zooplankton

Zooplankton samples are undergoing analysis at IMR in Norway, and the data will be shared once these analyses have been completed.

3.4.4 Food safety and parasites

Samples for food safety and parasites are undergoing analysis at IMR in Norway and the data distributed once these analyses have been completed. Preliminary results of the parasite studies are presented in Table 4.

3.5 Acoustic abundance estimates and distribution

The acoustic survey covered the shelf and slope from roughly 20 m (but see 1.4 Narrative) to 1 000 m bottom depth. Acoustic distribution and abundance were estimated for two groups of species, Pelagic 1 and Pelagic 2. Pelagic 1 consists of pelagic fish of the families Clupeidae and Engraulididae, while the Pelagic 2 species consist of the families Carangidae, Scombridae, barracuda and hairtails. Table 5 gives an overview of the most common species belonging to each of these groups. The Pelagic 1 species are typically separated from the Pelagic 2 species based on the presence of the two groups in the trawl catches, and on the acoustic signal as seen during the scrutinizing process, e.g. the fact that the Clupeidae and Engraulididae have a much stronger backscattering signal than the Carangidae and other Pelagic 2 species.

Pelagic 1 species were observed in the Mafia area and the Zanzibar Channel (Figure 13), with estimated abundances of 516 and 6532 metric tons, respectively (Table 7). Both bottom and pelagic trawl samples suggested that the shorthead anchovy (*Enchrasicholina heteroloba*) was the most abundant species (Table 9 and 10). It should be noted that the survey did not cover more shallow areas where there is indication of substantially higher densities of Pelagic 1 species than over deeper waters.

Table 7. Abundance estimates (tons) of Pelagic 1 species in various areas.

The Southern area	Mafia	Zanzibar	Pemba	Total
0	516	6 532	0	7 048

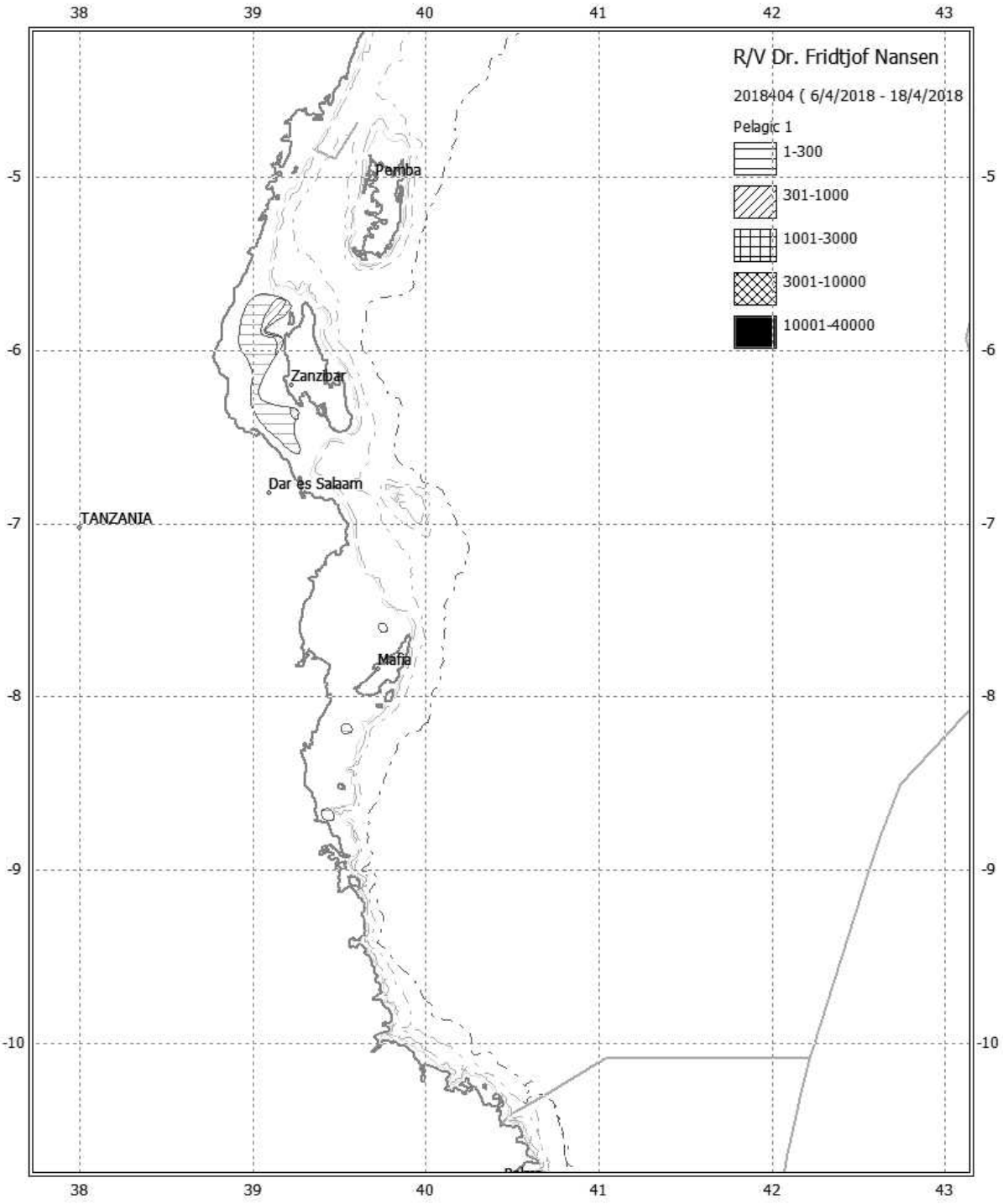

Figure 13. Distribution and density of Pelagic 1 species. Depth contours.

Pelagic 2 species were found in a narrow belt in the Southern area in relatively low concentrations, in two smaller areas in near the Mafia island and the highest abundances in the Zanzibar Channel (Figure 14 and Table 8). In the bottom trawl, the largehead hairtail (*T. lepturus*) was the most abundant Pelagic 2 species (Table 9).

Table 8. Abundance estimates (tons) of Pelagic 2 species in various areas.

The Southern area	Mafia	Zanzibar	Pemba	Total
4 112	2 197	18 816	0	25 125

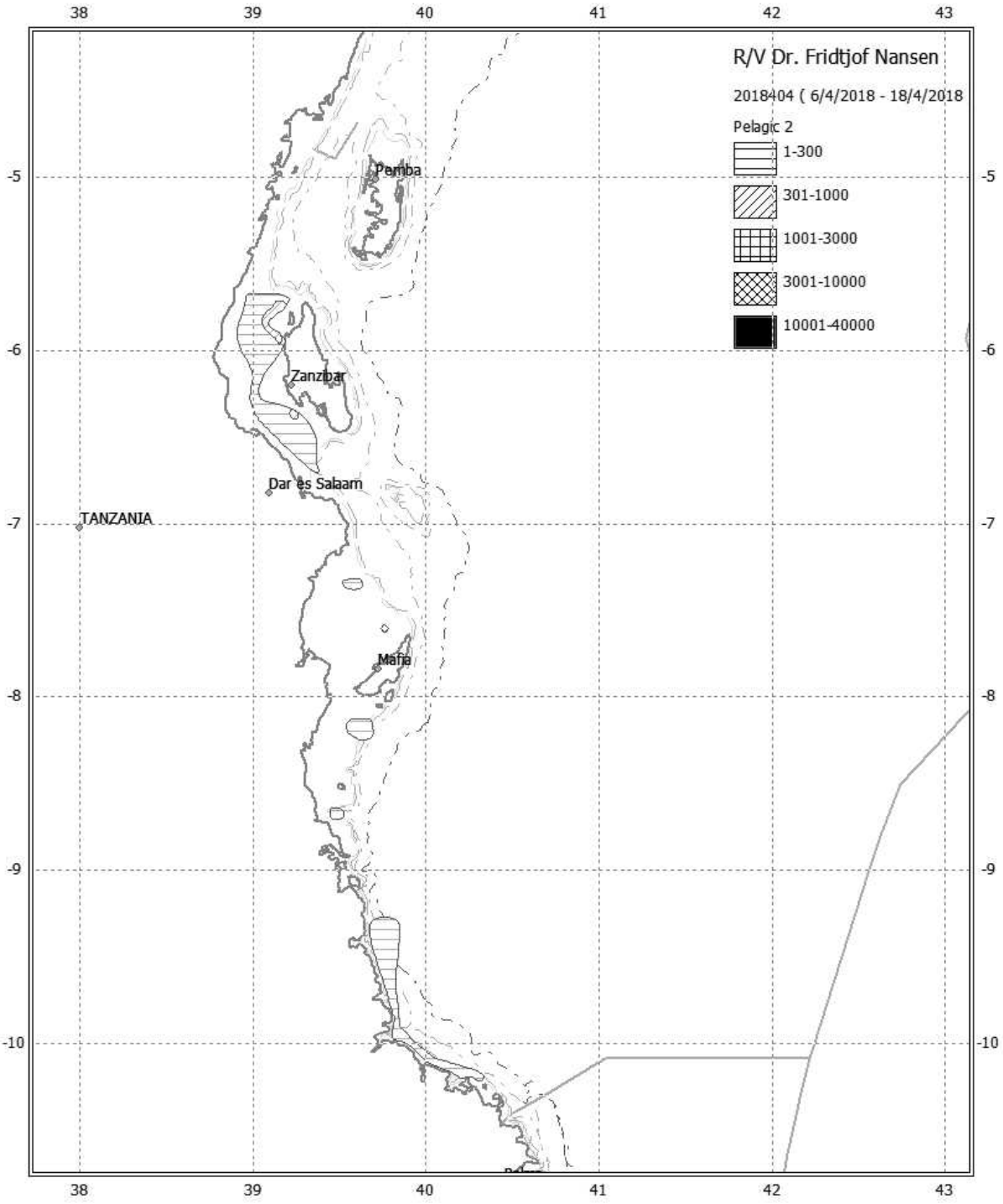

Figure 14. Distribution and density of Pelagic 2 species.

3.6 Swept area abundance and distributions

Because of the narrow shelf and "hilly" bottom along the Tanzanian coast, we were not able to carry out the planned swept area survey and have therefore not given estimates of bottom fish biomass. Instead we focused on aspects of fish diversity.

3.6.1 Bottom trawl catches

Table 9 shows the summarised catches in terms of weight and numbers, and no. of hauls with catch of the 25 most abundant species (in terms of weight) in 30 bottom trawl hauls along the coast of Tanzania. The abundance of all species caught in the bottom trawl is presented in Annex V. All hauls were standardised to one hour of trawling (actual time was ~30 minutes) Mean catch per hour can thus be estimated by dividing the catch by 30 hours.

The catch varied between 79 and 1 539 kg/h, with an average of 335 kg/h. There was no clear pattern between catch and depth (Figure 15a, the highest value in shallow waters was from a haul where a school of *E. heteroloba* was targeted). Number of species per haul varied between 13 and 45, with an average of 27.2. There was no relationship between number of species and depth (Figure 15b).

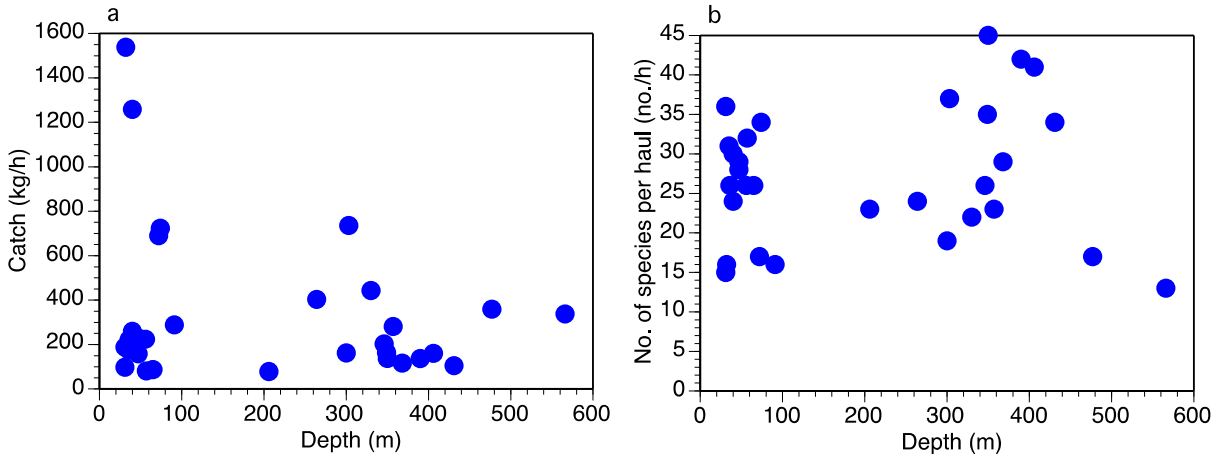

Figure 15. a) Catch vs. depth and b) no. of species per haul vs. depth.

Table 9. Summarized weight, number of fish and number of fish with catch of the most abundant species (in terms of weight) in 30 bottom trawl hauls.

Species	Catch (kg)	No. of fish	No. of hauls
Encrasicholina heteroloba	1 397.02	49 9078	2
Trichiurus lepturus	697.1	1 227	4
Upeneus taeniopterus	620.3	24 584	6
Decapterus macrosoma	559.4	18 840	8
Saurida undosquamis	374.08	3 036	25
Rexea prometheoides	353.37	4 583	8
Secutor insidiator	307.58	19 823	3
Carangoides malabaricus	278.95	6 178	8
Argentina euchus	231.72	4 025	8
Leiognathus elongatus	192.99	16 418	7
MYCTOPHIDAE	173.76	29 088	8
Nettastoma parviceps	165.59	1 957	2
Polymixia berndti	153.42	6 497	11
Centrophorus granulosus	136.42	67	3
Zenion sp.	124.4	1 232	1
Aluterus monoceros	115.41	46	2
Upeneus moluccensis	113.28	3 530	5
Gazza minuta	105.32	5 570	3
Decapterus russelli	103.31	1 462	8
Polysteganus coeruleopunctatus	102.53	97	4
Abalistes stellatus	93.09	148	9
Himantura jenkinsii	89.86	8	2
Scomberomorus commerson	85.44	54	4
Leiognathus berbis	84.48	41 814	5

A total of 335 species/groups were caught in bottom trawl during the survey, mainly fish but also some invertebrates (Annex V). Shorthead anchovy (*E. heteroloba,* Pelagic 1 species) contributed to the highest catches (Table 9). However, this species was only caught in two hauls, of which one was targeting a school. From the high no. of fish (column "No. of fish" in Table 9) it is evident that Shorthead anchovy is very small species (mean length was ~9 cm). The second highest catches consisted of largeheaded hairtail (*T. lepturus,* Pealgic 2 species), but this species too was caught in only a few hauls (4). On the other hand, most of the catch was taken at station 21 and 22 (Fig 3a), just south of Dar es Salaam at 270-300 m depth, with 453 and 185 kg/h, respectively. Hence, even though the overall abundance of largeheaded hairtail appears to be relatively low (avg. 23.2 kg/h), there are potentially local concentrations that may sustain a profitable fishery. This may be the case with other species as well.

On average, the 335 species/groups appeared in 2.4 trawl hauls (mean of values in the column "No. of hauls" in Annex V), which corresponds to 8% of the hauls. Hence, the majority of species appear to be relatively rare and have low overall abundance. Brushtooth lizardfish (*S. undosquamis*), on the other hand, was widely distributed as it was present in 25 of 30 hauls, but abundance was relatively low (12.5 kg/h).

CHAPTER 4. OVERVIEW AND SUMMARY OF RESULTS

The survey was carried out with 29 scientific personnel, coming from eight different countries. Everybody spoke English, and neither linguistic nor cultural differences posed any limits on collaboration or friendship among the participants. All work was carried out enthusiastically and with emphasis for high quality output, and the collaboration with the crew on board *Dr Fridtjof Nansen* was excellent.

Data collection during this survey along the coast of Tanzania was extensive, covering a wide range of scientific fields related to marine biology and ecology: hydrography, meteorology, microplastics, phytoplankton, zooplankton, jellyfish, fishery biology including eggs and larvae, genetics and fish abundance. Much of the data has not yet been analysed. Hence, this survey report only provides an overview of what has been done during the survey and presents some preliminary results, without the discussion of the results.

The hydrographic conditions were quite similar along the coast of Tanzania with high temperature in the upper water column (0 to ~60 m) ranging between 25 and 30°C. Surface water salinity was quite uniform, except for lower salinities close to the mouth of River Ruvuma on the southern border of Tanzania and River Rufiji near Mafia. In the upper well mixed waters the oxygen concentration was >4 ml/l (0 to ~65 m), in intermediate waters (60 m to 560 m) between 3 and 4 ml/l, whereas in deep waters (> 650 m) low oxygen concentrations were measured (2.5 – 1.5 ml/l).

Fluorescence measurements indicated low algal concentrations throughout the area, but with slightly elevated values north of Dar es Salaam, in the Zanzibar Channel, inside Mafia and near the mouth of River Ruvuma in the south. pH values were highest in surface and decreased with depth.

Highest numbers of plastic particles were observed outside Dar es Salaam and northwards between Zanzibar and the main land up to the northern part of Zanzibar.

The highest numbers of fish larvae and eggs were observed from Dar es Salaam, through the Zanzibar Channel, and up to Pemba.

Acoustic measurements of pelagic fish abundances were recorded throughout the survey. In general, the abundances were low, in particular over deeper waters outside the continental shelf. Pelagic 1 species were observed in the Mafia area and the Zanzibar Channel, with estimated abundances of 516 and 6 532 metric tons, respectively. Both bottom and pelagic trawl samples suggested that the shorthead ancovy (*E. heteroloba*) was the most abundant species. It should be noted that the survey did not cover more shallow areas where there is indication of substantially higher densities of Pelagic 1 species than over deeper waters. Also, the survey did not include lager fish, tuna and tuna-like fish in offshore waters.

Pelagic 2 species were found in a narrow belt in the Southern area in relatively low concentrations, in two smaller areas in near Mafia island and the highest abundances in the

Zanzibar Channel. Total biomass was estimated to ~25 kt. In the bottom trawl catches, the largehead hairtail (*T. lepturus*) was the most abundant Pelagic 2 species.

Because of the narrow shelf and "hilly" bottom along the Tanzanian coast, we were not able to carry out the planned swept area survey. A total of 335 different species/groups were caught in 30 bottom trawl hauls, mostly fish but also some invertebrates. On average, the 335 species/groups appeared in 2.4 trawl hauls, which corresponds to 8% of the hauls. Hence, the majority of species appear to be relatively rare and have low overall abundance. However, relatively high catches of largeheaded hairtail (*T. lepturus,* Pelagic 2 species) were taken in two hauls south of Dar es Salaam (453 and 185 kg/h). Hence, even though the overall abundance of largeheaded hairtail appears to be relatively low (avg. 23.2 kg/h), there are potentially local concentrations which may sustain a profitable fishery. This may be the case with other species as well.

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ANNEX I. DESCRIPTION OF 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 was checked on the 23.01.2017 in Sandviksflaket, Bergen, Norway using Cu-64 for the 18 kHz, Cu-60 for the 38 kHz, WC-38.1 for the 70, 120 and 200 kHz, and the WC-22 for the 333 kHz. The details of the settings for the 38 kHz echo sounder were as follows:

Transceiver-2 menu (38 kHz)	
Transducer depth	5 - 8 m
Absorption coeff.	8.3 dB/km
Pulse duration	medium (1,024ms)
Bandwidth	2.43 kHz
Max power	2000 Watt
2-way beam angle	-20,6dB
gain	26,95 dB
SA correction	0.03 dB
Angle sensitivity	21.9
3 dB beamwidth	6.22º along ship
	6.28 athwart ship
Alongship offset	-0.10º
Athwardship offset	-0.06º

Bottom detection menu Minimum level -50 dB

Fishing gear

The vessel has one small four-panel 'Åkrahamn' pelagic trawl (Figure A1), one MultPelt 624 trawl (Figure A2) and one ‘Gisund super bottom trawl’ (Figure A3). All trawls were used during the survey. The smallest pelagic trawl has 10-12 m vertical opening under normal operation, whereas the MultPelt 624 trawl has 30-40 m opening.

The bottom trawl has a 31 m headline and a 47 m footrope fitted with a 12" rubber bobbins gear. The codend has 20 mm meshes and has an inner net with 10 mm mesh size. The vertical opening is about 5.5 m. The distance between the wing tips is about 18 m during towing. The sweeps are 40 m long. The trawl doors are 'Thyborøen' combi, 8 m^2 and weigh 2000 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 inter-distance 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 pelagic trawls are equipped with a trawl eye that provides information about the trawl opening and the distance of the footrope to the bottom. A pressure sensor is used to show the depth on the headline.

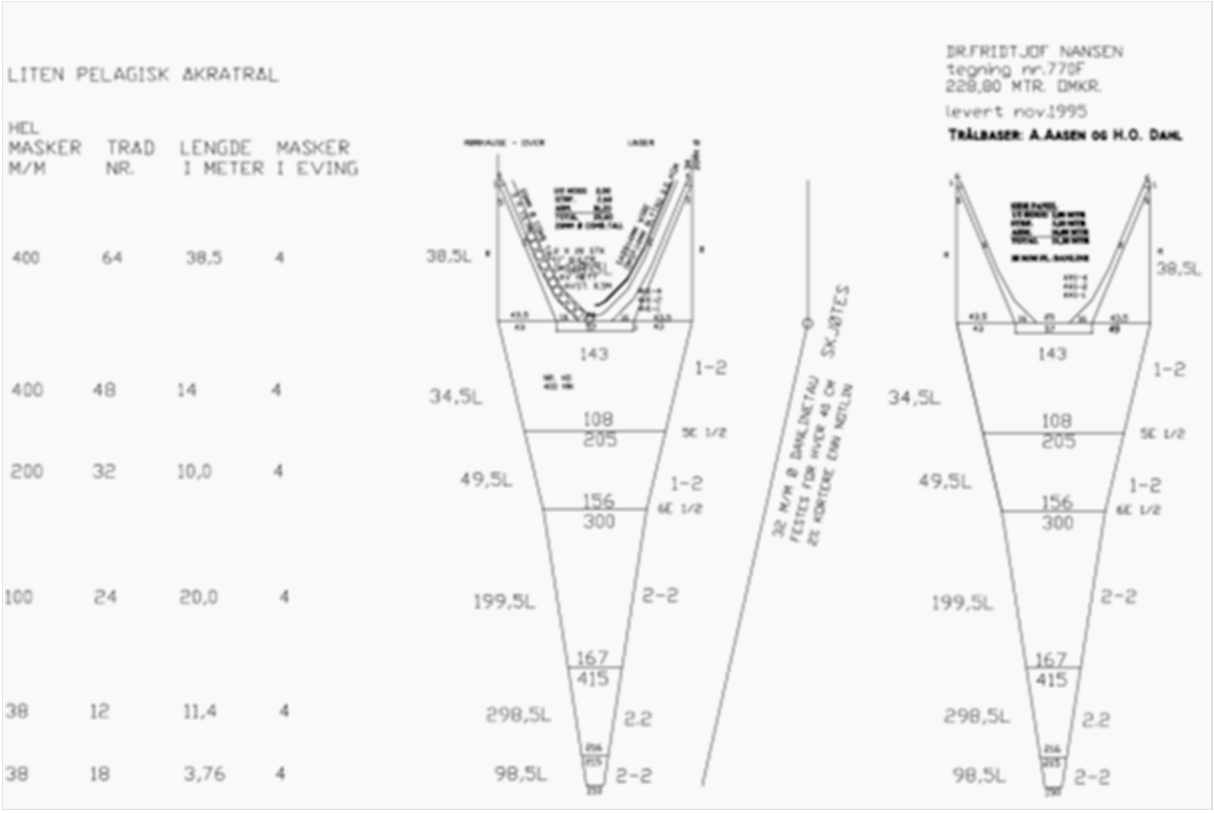


Figure A1. Schematic drawing of the small pelagic Åkratrawl.

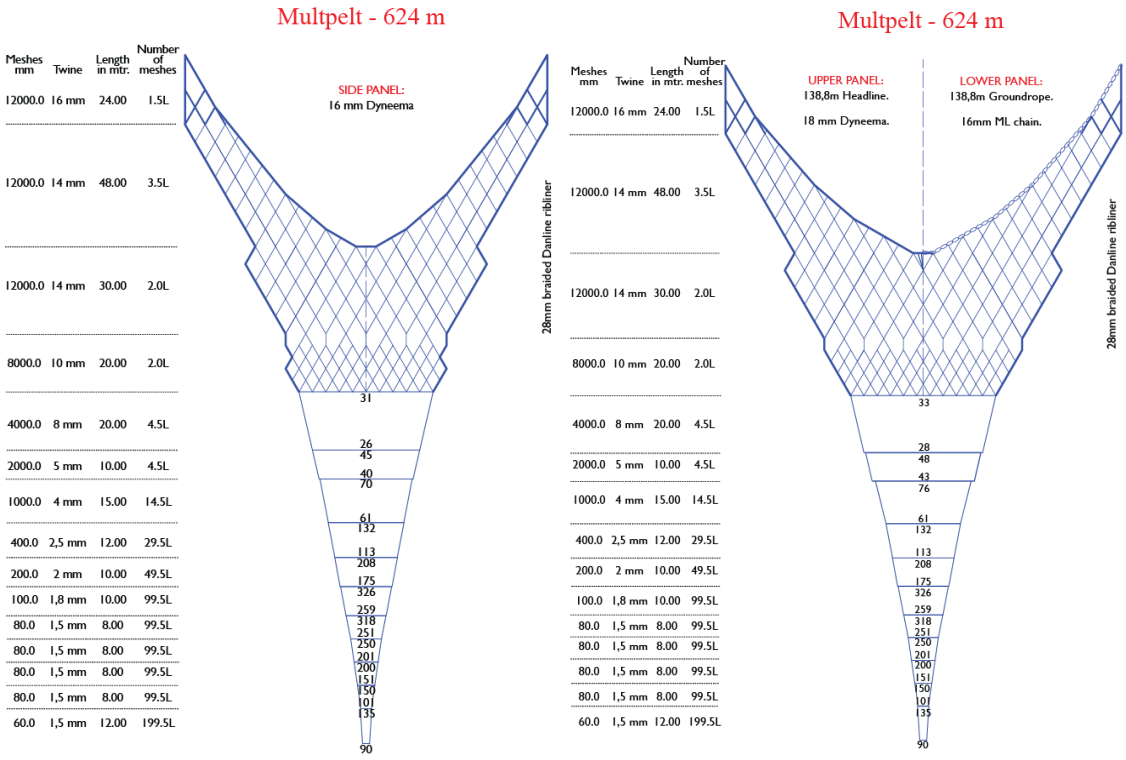


Figure A2. Schematic drawing of the MultPelt 624.

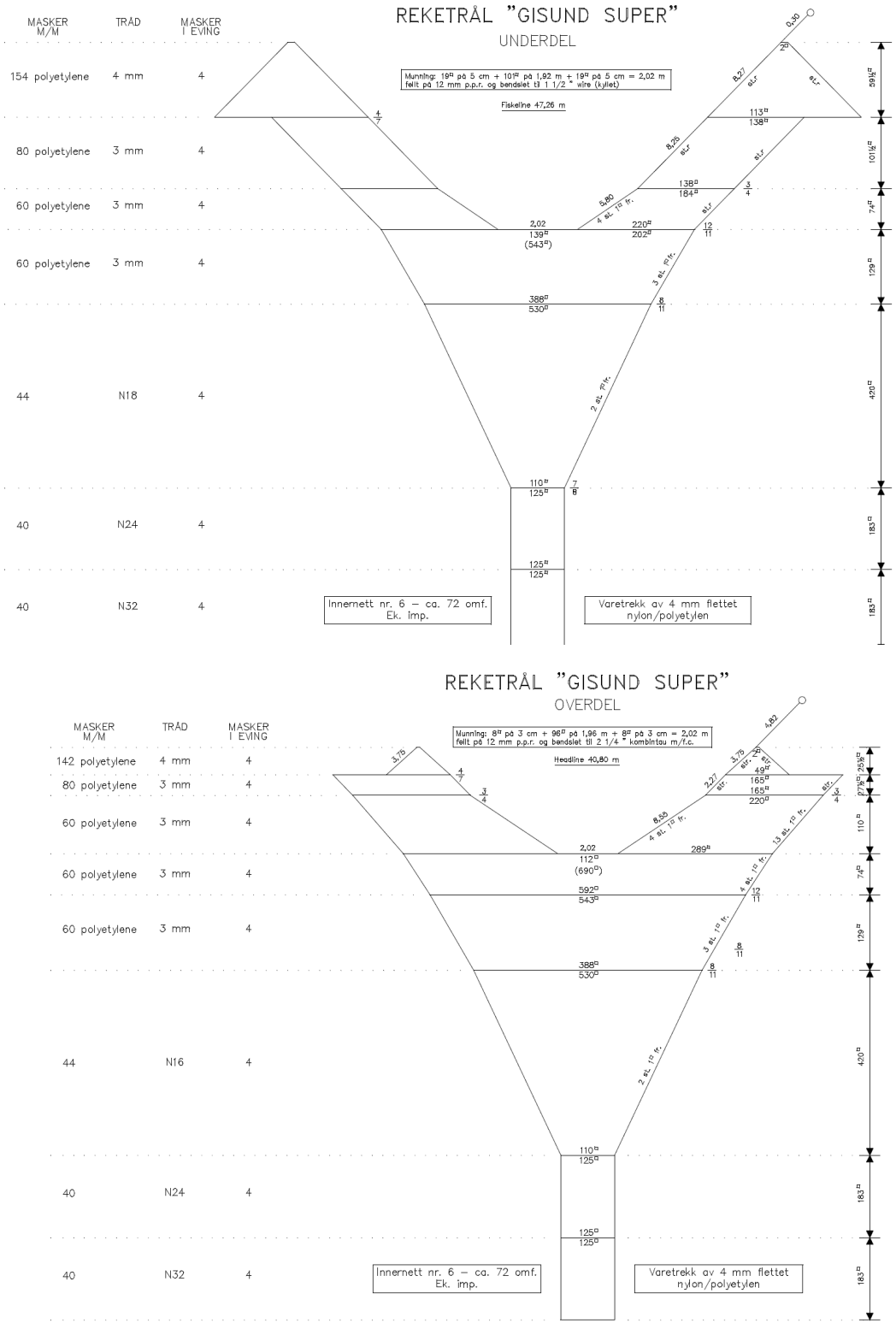


Figure A3. Schematic drawing of the Super Gisund bottom trawl.

ANNEX II. LIST OF PRIORITY SPECIES

			70 spp		16 spp	10 spp	15 spp
Main Groups	**Main Families**	**Typical Species**	**Length and weight**	**Sex and maturation**	**Stomach**	**Genetics**	**Contaminants**
Demersal fish	Mullidae	Upeneus taenopterus	x	x	x	x	x
		Upeneus baiassi	x	x			
		Upeneus sulfureus	x	x	x	x	x
		Upeneus vittatus	x	x			
	Nemipteridae	Nemipterus japonicus	x	x			
		Nemipterus bipunctatus	x	x			
	Leiognathidae	Leiognathus equulus	x	x			
	Synodontidae	Saurida undosquamis	x	x	x		x
	Merlucciidae	Merluccius paradoxus	x	x	x		
	Scianidae	*Johnius dussumieri*	x	x	x		
		Johnius amblycephalus	x	x			
		Otolithes ruber	x	x	x		x
	Sparidae	*Pagellus natalenses*	x	x			
		Polysteganus coeruleopunctatus	x	x			
	*Ariidae (catfish)	*Arius dussumieri*	x	x			
	Polynemidae (Threadfins)	*Polydactylus sextarius*	x	x			
		Polynemus sextarius	x	x			
	Haemulidae	*Pomadasys maculatus*	x	x	x		x
		Pomadasys kaakan	x	x	x		
Pelagic fish	Clupeidae	*Amblygaster sirm*	x	x			
		Dussumieria acuta	x	x			
		Herklotsichthys quadrimaculat.	x	x			
		Hilsa kelee	x	x	x	x	x
		Pellona ditchela	x	x	x		
		Sardinella gibbosa	x	x			
		Sardinella albella	x	x	x	x	x
		Sardinops ocellatus	x	x			
	Engraulidae	*Encrasicholina punctifer*	x	x			
		Thryssa vitrirostris	x	x			
		Thryssa setirostris	x	x	x		x
	Carangidae	*Alectis indicus*	x	x			
		Alepes djedaba	x	x			
		Carangoides malabaricus	x	x			
		Decapterus tabl	x	x			
		Decapterus macarellus	x	x			
		Decapterus macrosoma	x	x			
		Decapterus kurroides	x	x			
		Decapterus russelli	x	x	x	x	x
		Selar crumenophthalmus	x	x	x	x	x
	Scombridae	*Rastrelliger kanagurta*	x	x			
		Scomber japonicus	x	x			
		Scomberomorus commerson	x	x			
		Scomberomorus plurilineatus	x	x			
	Trichiuridae	Trichiurus lepturus	x	x	x		x
	Sphyraenidae (baracuda)	Sphyraena forsteri	x	x			
		Sphyraena jello	x	x			
		Sphyraena putnamie	x	x			
		Sphyraena qenie	x	x			
		Sphyraena barracuda	x	x	x		x
Shrimps	Penaeidae	*Penaeus monodon*	x	x			
		Penaeus indicus	x	x			x
		Penaeus japonicus	x	x			
		Penaeus semisulcatus	x	x			
		Penaeus latisulcatus	x	x			
		Penaeopsis balssi	x	x			
		Metapenaeus monoceros	x	x			
		Metapenaeus stebbingi	x	x			
	Aristeidae	*Aristeus antennatus*	x	x			
		Aristaeomorpha foliacea	x	x			
		Plesiopenaeus edwardsianus	x	x			
	Pandalidae	*Plesionika martia*	x	x			
	Solenoceridae	*Haliporoides triarthrus*	x	x			x
Lobsters	Palurinidae	*Palurinus delagoae*	x	x		x	x
Crayfish	Nephropidae	*Metanophropsis mozambicus*	x	x			
		Nephropsis stewarti	x	x			
Slipper lobster	Scyllaridae	*Ibacus novemdentatus*	x	x			
		Scyllarides elisabethae	x	x			
Crabs	Portunidae	*Portunus sanguinolentus*	x	x		x	
	Portunidae	*Portunus pelagicus*	x	x		x	
	Geryonidae	*Chaceon macpherson*	x	x		x	

ANNEX III. RECORDS OF FISHING STATIONS

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 1
DATE :07/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 10°16.71
start stop duration Lon E 40°29.90
TIME :19:52:05 20:12:56 20.9 (min) Purpose : 3
LOG : 1537.08 1538.12 1.0 Region : 7300
FDEPTH: 561 573 Gear cond.: 0
BDEPTH: 561 573 Validity : 0
Towing dir: 0° Wire out : 1345 m Speed : 3.0 kn
Sorted : 24 Total catch: 117.44 Catch/hour: 337.95

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Nettastoma parviceps	164.09	1940	48.55	8
Centrophorus granulosus	107.57	58	31.83	1
S H R I M P S	14.71	331	4.35	6
Chlorophthalmus agassizi	12.85	83	3.80	10
Ventrifossa mystax	9.95	299	2.94	9
Torpedo sp.	9.78	3	2.90	
Malacocephalus laevis	5.29	63	1.57	2
DIODONTIDAE	4.03	3	1.19	7
Haliporoides triarthrus	3.91	92	1.16	11
Aristeus antennatus	2.10	135	0.62	12
Rostroraja alba	1.55	3	0.46	4
Polymetme corythaeola	1.41	63	0.42	3
Cruriraja parcomaculata	0.72	3	0.21	5
Total	337.95		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 2
DATE :08/04/18 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°4.12
start stop duration Lon E 40°19.08
TIME :00:09:30 00:39:22 29.9 (min) Purpose : 3
LOG : 1562.37 1563.76 1.4 Region : 7300
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 851 771 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 2.8 kn
Sorted : 12 Total catch: 49.70 Catch/hour: 99.83

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Rastrelliger kanagurta	52.43	6	52.52	
Cubiceps pauciradiatus	37.50	0	37.57	
MYCTOPHIDAE	6.41	1270	6.42	
Onychoteuthis sp.	3.50	123	3.50	
Total	99.83		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 3
DATE :08/04/18 GEAR TYPE: PT NO: 4 POSITION:Lat S 10°11.25
start stop duration Lon E 40°11.65
TIME :02:13:26 02:44:08 30.7 (min) Purpose : 3
LOG : 1574.47 1575.97 1.5 Region : 7300
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 393 279 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 2.9 kn
Sorted : 0 Total catch: 18.04 Catch/hour: 35.27

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Leiognathus berbis	28.11	0	79.71	14
Decapterus kurroides	4.81	280	13.64	15
Polymetme corythaeola	1.72	477	4.88	17
Cheilopogon nigricans	0.27	6	0.78	13
Uroteuthis duvaucelii	0.20	16	0.55	16
Lestrolepis intermedia	0.16	2	0.44	18
Total	35.27		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 4
DATE :08/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 10°6.58
start stop duration Lon E 40°1.97
TIME :05:18:02 05:32:25 14.4 (min) Purpose : 3
LOG : 1590.20 1591.03 0.8 Region : 7300
FDEPTH: 88 100 Gear cond.: 0
BDEPTH: 88 100 Validity : 0
Towing dir: 0° Wire out : 280 m Speed : 3.4 kn
Sorted : 66 Total catch: 69.17 Catch/hour: 288.43

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aluterus monoceros	108.49	42	37.62	19
Leiognathus elongatus**	100.57	0	34.87	23
Gnathanodon speciosus	25.85	4	8.96	25
Carangoides dinema	12.93	4	4.48	32
Carangoides sp.	11.51	4	3.99	22
Carangoides chrysophrys	9.67	25	3.35	21
Decapterus macrosoma	9.55	1539	3.31	31
Seriola rivoliana	3.84	0	1.33	20
Uroteuthis duvaucelii	2.59	271	0.90	27
Nettastoma parviceps	1.50	17	0.52	26
Carangoides sp.	1.25	142	0.43	33
Malacocephalus laevis	0.42	17	0.14	30
Nemipterus sp.	0.18	0	0.06	24
Coelorinchus denticulatus	0.04	4	0.02	28
Cynoglossus lida	0.04	4	0.01	29
Waste General	0.00	4	0.00	
Total	288.42		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 5
DATE :08/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 10°5.77
start stop duration Lon E 40°3.56
TIME :07:28:48 07:58:12 29.4 (min) Purpose : 3
LOG : 1600.61 1602.09 1.5 Region : 7300
FDEPTH: 204 209 Gear cond.: 0
BDEPTH: 204 209 Validity : 0
Towing dir: 0° Wire out : 530 m Speed : 3.0 kn
Sorted : 38 Total catch: 38.47 Catch/hour: 78.51

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Polysteganus coeruleopunctatus	23.88	29	30.41	36
Rhinobatos holcorhynchus	19.51	16	24.85	43
Heterodontus ramalheira	11.43	2	14.56	34
Satyrichthys adeni	3.82	8	4.86	40
Uranoscopus archionema	3.01	10	3.83	44
Uroteuthis duvaucelii	2.71	51	3.46	55
Tylerius spinosissimus	2.63	8	3.35	38
Etelis carbunculus	2.41	2	3.07	37
Saurida undosquamis	2.12	12	2.70	35
Fistularia petimba	1.61	2	2.05	42
Ibacus novemdentatus	1.49	8	1.89	50
Harpiosquilla harpax	1.22	2	1.56	48
Champsodon sp.	0.73	118	0.94	53
Monocentris japonica	0.53	4	0.68	54
Decapterus russelli	0.42	4	0.54	47
Rexea prometheoides	0.33	16	0.42	39
SALPS	0.27	12	0.34	
Penaeus marginatus	0.14	2	0.18	49
Lepidotrigla alcocki	0.10	8	0.13	45
Citharichthys sp.	0.06	4	0.08	56
Sepia hieronis	0.03	8	0.04	52
Pontinus nigerimum	0.03	2	0.04	46
Antigonia capros	0.02	2	0.02	41
Total	78.51		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 6
DATE :08/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 10°2.36
start stop duration Lon E 40°6.70
TIME :09:29:46 09:59:46 30.0 (min) Purpose : 3
LOG : 1611.40 1613.03 1.6 Region : 7300
FDEPTH: 366 348 Gear cond.: 0
BDEPTH: 366 348 Validity : 0
Towing dir: 0° Wire out : 970 m Speed : 3.3 kn
Sorted : 13 Total catch: 140.66 Catch/hour: 281.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	48.32	60	17.18	61
Saurida undosquamis	44.08	0	15.67	60
Lepidotrigla faueri	32.16	90	11.43	
Narcine rierai	24.30	34	8.64	
Peristedion weberi	20.82	70	7.40	
Etmopterus sentosus	17.70	286	6.29	59
Priacanthus hamrur	13.70	130	4.87	
Polymetme corythaeola	13.02	894	4.63	64
RAJIDAE	12.72	60	4.52	
Lophiodes mutilus	12.20	10	4.34	68
Rexea prometheoides	7.28	122	2.59	
Cubiceps sp.	6.76	86	2.40	
Polymixia berndti	6.24	70	2.22	
ARGENTINIDAE	3.28	26	1.17	
Tydemania navigatoris	2.76	70	0.98	
OPHIDIIDAE	2.76	52	0.98	
Lestrolepis intermedia	2.24	52	0.80	
Uroteuthis duvaucelii	2.24	8	0.80	
Leucoraja wallacei	2.16	20	0.77	58
Atrobucca nibe	2.08	8	0.74	62
Sepia hieronis	1.90	26	0.68	63
PENAEIDAE	1.56	130	0.55	
Scorpaena sp.	1.04	18	0.37	57
Total	281.32		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 7
DATE :08/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 9°54.04
start stop duration Lon E 39°52.23
TIME :14:40:33 15:07:45 27.2 (min) Purpose : 3
LOG : 1650.54 1651.89 1.4 Region : 7300
FDEPTH: 274 423 Gear cond.: 0
BDEPTH: 274 423 Validity : 0
Towing dir: 0° Wire out : 700 m Speed : 3.0 kn
Sorted : 37 Total catch: 74.11 Catch/hour: 163.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Polysteganus coeruleopunctatus	26.04	29	15.92	72
Squatina sp.	18.32	2	11.20	104
Argentina euchus	17.39	24	10.63	89
Polymixia berndti	11.43	53	6.99	103
Saurida undosquamis	10.59	33	6.48	69
Trichiurus lepturus	9.97	44	6.10	71
Polymixia sp.	9.75	88	5.96	70
Atrobucca nibe	8.47	24	5.18	73
Satyrichthys adeni	6.66	24	4.07	81
Zeus faber	6.52	7	3.99	93
Lepidotrigla faueri	6.24	40	3.82	87
Carcharhinus sp.	5.47	9	3.35	96
Thyrsitoides marleyi	4.82	115	2.95	74
Chaunax sp.	4.26	7	2.60	100
Diaphus knappi	2.90	0	1.78	75
RAJIDAE	2.72	7	1.66	83
Callionymus marleyi	2.35	0	1.44	84
Narcine rierai	1.92	15	1.17	82
Sepia sp	1.24	38	0.76	90
Branchiostegus doliatus	1.24	7	0.76	79
Etmopterus sp.	1.17	24	0.72	80
Champsodon capensis	0.74	18	0.45	101
Lophiodes mutilus	0.68	2	0.42	
Antigonia capros	0.64	7	0.39	98
Citharoides macrolepis	0.43	7	0.26	
Pontinus nigerimum	0.38	7	0.23	99
Poecilopsetta zanzibarensis	0.31	9	0.19	
Uroteuthis duvaucelii	0.29	2	0.18	
Physiculus natalensis	0.19	2	0.11	86
Gobius sp.	0.16	49	0.10	102
Cynoglossus lida	0.12	2	0.08	
Polyipnus indicus	0.06	29	0.03	
Tydemania navigatoris	0.05	2	0.03	97
Neobythites kenyaensis	0.03	2	0.02	94
Beryx splendens	0.00	2	0.00	92
Total	163.55		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 8
DATE :08/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 9°40.38
start stop duration Lon E 39°49.14
TIME :21:12:30 21:39:18 26.8 (min) Purpose : 3
LOG : 1686.69 1687.99 1.3 Region : 7300
FDEPTH: 358 378 Gear cond.: 0
BDEPTH: 358 378 Validity : 0
Towing dir: 0° Wire out : 850 m Speed : 2.9 kn
Sorted : 12 Total catch: 52.02 Catch/hour: 116.46

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Centrophorus moluccensis	17.51	4	15.03	118
Polymetme corythaeola	14.40	513	12.36	106
Saurida undosquamis	9.40	40	8.07	105
Polyipnus indicus	8.57	0	7.36	
Bythalaelurus lutarius	8.26	83	7.09	133
Chaunax sp.	7.50	22	6.44	132
Malacocephalus laevis	6.27	67	5.38	111
Chlorophthalmus agassizi	5.66	99	4.86	126
Himantura sp.	5.17	22	4.44	115
Neobythites kenyaensis	5.13	22	4.40	116
Aristeus antennatus	4.75	237	4.08	125
Argentina euchus	3.83	83	3.29	119
Polymixia berndti	3.09	11	2.65	129
Rexea prometheoides	2.91	29	2.50	113
Etmopterus sentosus	2.69	25	2.31	117
Linuparus somniosus	2.15	7	1.85	
Uroteuthis duvaucelii	1.99	13	1.71	130
PENAEIDAE	1.23	11	1.06	127
Polymixia sp.	1.12	11	0.96	128
Neobythites cf somaliaensis	0.92	13	0.79	121
Coelorinchus trunovi	0.90	38	0.77	112
Zenion hololepis	0.76	83	0.65	122
Physiculus natalensis	0.76	7	0.65	120
Atrobucca nibe	0.54	7	0.46	131
Beryx splendens	0.31	7	0.27	124
Tydemania navigatoris	0.31	7	0.27	110
Lestrolepis intermedia	0.16	7	0.13	123
Antigonia rubescens	0.11	7	0.10	108
Rastrelliger kanagurta	0.07	13	0.06	109
Total	116.46		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 9
DATE :09/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 8°40.72
start stop duration Lon E 39°25.93
TIME :12:18:12 12:47:27 29.3 (min) Purpose : 3
LOG : 1791.63 1793.34 1.7 Region : 7300
FDEPTH: 22 41 Gear cond.: 0
BDEPTH: 22 41 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.5 kn
Sorted : 0 Total catch: 750.28 Catch/hour: 1538.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Encrasicholina heteroloba	1396.75	498845	90.79	147
Scomberomorus commerson	36.71	21	2.39	134
Himantura jenkinsii	30.64	4	1.99	149
Balistes capriscus	29.20	23	1.90	
Uroteuthis duvaucelii	16.67	416	1.08	146
Leiognathus berbis	12.24	504	0.80	135
OSTRACIIDAE	5.58	12	0.36	144
Arothron stellatus	5.09	2	0.33	143
Carangoides malabaricus	1.90	4	0.12	136
Cruriraja parcomaculata	1.49	23	0.10	145
Fistularia petimba	0.88	23	0.06	141
Sardinella gibbosa	0.44	66	0.03	140
Leiognathus elongatus**	0.44	66	0.03	139
Decapterus kurroides	0.29	23	0.02	138
Canthigaster sp.	0.17	23	0.01	148
Torquigener hypselogenion	0.04	2	0.00	142
Total	1538.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 10
DATE :09/04/18 GEAR TYPE: PT NO: 1 POSITION:Lat S 8°40.48
start stop duration Lon E 39°32.70
TIME :17:37:21 18:08:20 31.0 (min) Purpose : 3
LOG : 1805.65 1807.19 1.5 Region : 7300
FDEPTH: 65 55 Gear cond.: 0
BDEPTH: 526 397 Validity : 0
Towing dir: 0° Wire out : 155 m Speed : 3.0 kn
Sorted : 2 Total catch: 12.58 Catch/hour: 24.35

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	23.14	1936	95.02	
Muraenesox bagio	0.70	12	2.87	
Leptocephalus	0.40	35	1.65	
Lestrolepis intermedia	0.11	23	0.47	
Total	24.35		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 11
DATE :09/04/18 GEAR TYPE: PT NO: 4 POSITION:Lat S 8°24.71
start stop duration Lon E 39°42.60
TIME :23:58:36 00:28:59 30.4 (min) Purpose : 3
LOG : 1847.69 1849.03 1.3 Region : 7300
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 779 663 Validity : 0
Towing dir: 0° Wire out : 145 m Speed : 2.7 kn
Sorted : 3 Total catch: 2.79 Catch/hour: 5.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	2.39	2393	43.45	
Uroteuthis duvaucelii	1.78	219	32.32	151
Leptocephalus	0.81	296	14.79	
Seriola rivoliana	0.43	2	7.79	152
Scomber japonicus	0.04	4	0.65	155
Lestrolepis intermedia	0.03	6	0.61	150
Decapterus tabl	0.01	2	0.22	154
Zanclus cornutus	0.01	2	0.11	153
Hemiramphus sp.	0.00	2	0.07	156
Total	5.50		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 12
DATE :10/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 8°10.88
start stop duration Lon E 39°33.10
TIME :05:51:05 06:17:30 26.4 (min) Purpose : 3
LOG : 1880.53 1882.20 1.7 Region : 7300
FDEPTH: 27 35 Gear cond.: 0
BDEPTH: 27 35 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.8 kn
Sorted : 0 Total catch: 43.04 Catch/hour: 97.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Upeneus sp.	21.00	1317	21.49	168
Abalistes stellatus	16.44	14	16.82	
Spratelloides gracilis	11.35	5115	11.62	157
Diodon hystrix	11.26	9	11.52	159
Lethrinus sp.	8.40	216	8.60	167
Arothron stellatus	8.17	2	8.36	158
Ostracion cubicus	4.63	5	4.74	
Lethrinus sp.	3.75	11	3.83	170
Seriolina nigrofasciata	3.59	2	3.67	164
Upeneus bensasi	3.29	227	3.37	
SPARIDAE	3.06	204	3.14	
Carangoides sp.	1.02	45	1.05	
Parupeneus heptacanthus	0.79	34	0.81	165
Thunnus orientalis	0.50	5	0.51	
Loligo duvauceli	0.45	23	0.46	162
Total	97.71		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 13
DATE :10/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 8°10.00
start stop duration Lon E 39°42.92
TIME :08:50:03 09:20:45 30.7 (min) Purpose : 3
LOG : 1896.58 1898.16 1.6 Region : 7300
FDEPTH: 349 310 Gear cond.: 0
BDEPTH: 349 310 Validity : 0
Towing dir: 0° Wire out : 850 m Speed : 3.1 kn
Sorted : 26 Total catch: 226.77 Catch/hour: 443.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Rexea prometheoides	216.21	2635	48.78	183
Polymixia berndti	78.14	1349	17.63	171
Argentina euchus	24.83	545	5.60	179
Saurida undosquamis	24.70	72	5.57	178
Abalistes stellatus	18.03	18	4.07	176
Polysteganus coeruleopunctatus	17.82	12	4.02	175
Centrophorus moluccensis	16.61	10	3.75	191
Narcine rierai	8.63	76	1.95	188
Xenolepidichthys dagleishi	8.02	303	1.81	186
Decapterus russelli	5.94	23	1.34	177
MYCTOPHIDAE	4.84	545	1.09	
Malacocephalus laevis	4.84	61	1.09	174
Heptranchias perlo	4.01	6	0.90	
Uroteuthis duvaucelii	2.57	45	0.58	172
Tydemania navigatoris	1.82	45	0.41	180
Chascanopsetta lugubris	1.67	16	0.38	185
Lophius sp.	1.67	16	0.38	187
Stolephorus indicus	1.06	61	0.24	182
Sepia hieronis	0.76	16	0.17	173
Etmopterus sentosus	0.76	16	0.17	181
Eridacnis radcliffei	0.23	4	0.05	189
Bythalaelurus lutarius	0.03	2	0.01	190
Total	443.20		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 14
DATE :10/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 7°32.72
start stop duration Lon E 39°58.67
TIME :22:16:12 22:46:58 30.8 (min) Purpose : 3
LOG : 1990.95 1992.41 1.5 Region : 7300
FDEPTH: 486 468 Gear cond.: 0
BDEPTH: 486 468 Validity : 0
Towing dir: 0° Wire out : 1150 m Speed : 2.8 kn
Sorted : 26 Total catch: 184.17 Catch/hour: 359.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Zenion sp.	124.40	1232	34.64	198
Argentina euchus	120.12	1806	33.45	
MYCTOPHIDAE	39.58	6909	11.02	
Malacocephalus laevis	33.25	372	9.26	202
Chascanopsetta lugubris	14.19	14	3.95	204
Rexea prometheoides	6.02	29	1.68	197
PENAEIDAE	4.73	236	1.32	
Saurida undosquamis	4.09	18	1.14	194
Peristedion weberi	3.01	72	0.84	201
Ruvettus pretiosus	2.44	14	0.68	208
Chaunax sp.	2.44	29	0.68	200
Raja sp.	1.72	29	0.48	
Etmopterus sentosus	1.15	14	0.32	199
Tydemania navigatoris	0.86	29	0.24	195
Holohalaelurus regani	0.55	2	0.15	203
Polymetme corythaeola	0.29	14	0.08	207
Macrorhamphosus scolopax	0.29	14	0.08	196
Total	359.11		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 15
DATE :11/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 7°35.22
start stop duration Lon E 39°52.82
TIME :05:28:33 05:52:38 24.1 (min) Purpose : 3
LOG : 2010.11 2011.53 1.4 Region : 7300
FDEPTH: 42 38 Gear cond.: 0
BDEPTH: 42 38 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.5 kn
Sorted : 13 Total catch: 104.33 Catch/hour: 259.84

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sphyraena jello	55.29	102	21.28	232
Diagramma centurio	39.55	12	15.22	224
Decapterus macrosoma	36.86	6486	14.19	219
Abalistes stellatus	27.75	22	10.68	211
Leiognathus elongatus**	18.06	5014	6.95	215
Carangoides fulvoguttatus	17.68	2	6.81	
Pseudobalistes flavimarginatus	16.09	5	6.19	212
Lethrinus crocineus	11.86	2	4.56	221
Arothron stellatus	9.56	5	3.68	209
Ostracion cubicus	7.17	5	2.76	214
Pseudobalistes fuscus	4.41	2	1.70	233
Thenus orientalis	2.59	15	1.00	213
Lagocephalus sceleratus	2.29	2	0.88	
Decapterus kurroides	2.25	276	0.87	218
Seriolina nigrofasciata	2.24	5	0.86	
Upeneus bensasi	1.29	416	0.50	
Apogon sp.	1.11	396	0.43	226
Epigonus robustus**	1.11	17	0.43	220
Peristedion weberi	0.95	10	0.36	217
Velodona togata	0.65	2	0.25	
Bothus sp.	0.46	10	0.18	222
Uroteuthis duvaucelii	0.25	27	0.10	283
SERRANIDAE	0.15	10	0.06	
Nemipterus metopias	0.07	10	0.03	228
Echeneis naucrates	0.05	10	0.02	229
Saurida gracilis	0.05	10	0.02	231
Amblygaster leiogaster	0.04	10	0.01	227
LUTJANIDAE	0.01	10	0.00	234
Glass sponge	0.00	5	0.00	
Fishing gears	0.00	2	0.00	
Total	259.84		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 16
DATE :11/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 7°33.75
start stop duration Lon E 39°43.34
TIME :08:52:03 09:22:28 30.4 (min) Purpose : 3
LOG : 2025.56 2027.35 1.8 Region : 7300
FDEPTH: 46 33 Gear cond.: 0
BDEPTH: 46 33 Validity : 0
Towing dir: 0° Wire out : 145 m Speed : 3.5 kn
Sorted : 33 Total catch: 638.24 Catch/hour: 1258.86

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Upeneus taeniopterus	457.14	17862	36.31	247
Secutor insidiator	291.21	17862	23.13	248
Carangoides malabaricus	148.57	3258	11.80	239
Gazza minuta	99.47	5418	7.90	238
Dussumieria acuta	55.45	1525	4.40	240
Chirocentrus dorab	27.51	85	2.19	255
Leiognathus elongatus**	25.40	550	2.02	236
Leiognathus berbis	25.40	381	2.02	241
Gerres filamentosus	24.55	0	1.95	237
Thenus orientalis	17.78	85	1.41	
Decapterus russelli	14.39	126	1.14	252
Terapon theraps	11.85	254	0.94	243
Diagramma centurio	8.05	2	0.64	256
Saurida undosquamis	6.96	57	0.55	
Lagocephalus inermis	5.52	2	0.44	258
Nemipterus japonicus	5.37	85	0.43	242
Arius africanus	5.21	2	0.41	257
Leiognathus berbis	5.08	37968	0.40	
Rastrelliger kanagurta	5.08	211	0.40	251
Sphyraena flavicauda	5.08	126	0.40	244
Upeneus vittatus	4.87	41	0.39	245
Apogon sp.	4.23	170	0.34	253
Upeneus moluccensis	2.58	85	0.21	246
Loligo duvauceli	2.12	254	0.17	254
Total	1258.86		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 17
DATE :11/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 7°30.62
start stop duration Lon E 39°32.40
TIME :11:35:43 12:02:41 27.0 (min) Purpose : 3
LOG : 2043.08 2044.48 1.4 Region : 7300
FDEPTH: 49 46 Gear cond.: 0
BDEPTH: 49 46 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.1 kn
Sorted : 0 Total catch: 71.36 Catch/hour: 158.82

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Leiognathus berbis	22.72	1636	14.31	274
Upeneus taeniopterus	21.36	915	13.45	281
Carangoides malabaricus	18.56	839	11.69	271
Saurida undosquamis	16.78	263	10.57	
Epinephelus areolatus	11.82	4	7.44	260
Dussumieria acuta	11.42	501	7.19	270
Gerres filamentosus	7.92	118	4.99	261
Drepane sp.	7.37	67	4.64	
Scomberomorus commerson	5.54	9	3.49	265
Rastrelliger kanagurta	4.65	67	2.93	279
Loligo duvauceli	3.83	154	2.41	268
Penaeus semisulcatus	3.38	85	2.13	
Apogon sp.	3.20	610	2.02	277
Abalistes stellatus	2.96	2	1.86	269
Secutor insidiator	2.87	398	1.81	276
Lagocephalus inermis	2.54	51	1.60	267
Chirocentrus dorab	2.23	9	1.40	266
Fistularia petimba	1.74	67	1.10	264
Terapon theraps	1.57	51	0.99	275
Metapenaeus monoceros	1.19	118	0.75	
Leiognathus equulus	1.07	24	0.67	272
Pterois russelii	0.76	9	0.48	282
Upeneus vittatus	0.75	9	0.47	278
Sphyraena obtusata	0.73	18	0.46	263
Nemipterus japonicus	0.63	9	0.39	259
Mene maculata	0.53	9	0.34	
Sphyraena barracuda	0.39	9	0.25	262
Leiognathus splendens	0.31	9	0.20	273
Total	158.82		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 18
DATE :11/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 7°19.63
start stop duration Lon E 39°37.64
TIME :15:09:51 15:39:48 29.9 (min) Purpose : 3
LOG : 2061.90 2063.30 1.4 Region : 7300
FDEPTH: 76 72 Gear cond.: 0
BDEPTH: 76 72 Validity : 0
Towing dir: 0° Wire out : 210 m Speed : 2.8 kn
Sorted : 60 Total catch: 361.17 Catch/hour: 723.54

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Upeneus taeniopterus	103.49	4443	14.30	305
Decapterus macarellus	73.95	1434	10.22	294
Decapterus russelli	71.92	1125	9.94	292
Sphyraena obtusata	66.37	1406	9.17	290
Upeneus moluccensis	58.50	1659	8.08	295
Muraenesox bagio	45.04	14	6.22	
Rastrelliger kanagurta	42.19	843	5.83	297
Epinephelus malabaricus	38.26	10	5.29	
Decapterus macrosoma	36.28	843	5.01	291
Arius venosus	27.09	6	3.74	284
Nemipterus metopias	27.00	309	3.73	303
Saurida undosquamis	22.08	703	3.05	304
Pomadasys maculatus	21.94	168	3.03	296
Leiognathus equulus	19.69	252	2.72	289
Secutor insidiator	13.50	1563	1.87	293
Psettodes erumei	12.66	4	1.75	286
Pomadasys kaakan	7.57	2	1.05	285
Loligo duvauceli	6.01	589	0.83	310
Unidentified crustacean	5.06	591	0.70	
Dussumieria acuta	3.94	112	0.54	307
Apogon sp.	3.93	843	0.54	301
Leiognathus leuciscus**	3.37	168	0.47	299
Gazza minuta	2.75	112	0.38	300
Oxyurichthys petersii	2.25	168	0.31	315
Thryssa vitrirostris	2.25	112	0.31	306
Plastic	2.00	0	0.28	
Polynemus sextarius**	1.69	56	0.23	302
Sepia prashadi	1.12	28	0.16	311
Terapon theraps	0.56	28	0.08	298
Trypauchen microcephalus	0.33	56	0.05	316
Octopus cyaneus	0.25	28	0.03	
Citharoides macrolepis	0.20	28	0.03	313
Laeops natalensis	0.17	28	0.02	314
Citharichthys sp.	0.14	28	0.02	312
Total	723.54		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 19
DATE :11/04/18 GEAR TYPE: PT NO: 1 POSITION:Lat S 7°21.64
start stop duration Lon E 39°44.03
TIME :17:58:48 18:22:29 23.7 (min) Purpose : 3
LOG : 2076.38 2077.68 1.3 Region : 7300
FDEPTH: 55 65 Gear cond.: 0
BDEPTH: 193 233 Validity : 0
Towing dir: 0° Wire out : 155 m Speed : 3.3 kn
Sorted : 1 Total catch: 9.34 Catch/hour: 23.67

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	17.03	14005	71.96	
Trichiurus lepturus	2.94	5	12.42	
Leiognathus elongatus**	0.86	109	3.64	
Lestrolepis intermedia	0.86	109	3.64	
Decapterus tabl	0.71	10	3.00	
Apogon sp.	0.22	23	0.92	
Dipterygonotus balteatus	0.22	8	0.92	
Bregmaceros sp.	0.22	13	0.92	
LOLIGINIDAE	0.22	218	0.92	
SEPIIDAE	0.22	23	0.92	
J E L L Y F I S H	0.17	23	0.73	
CARANGIDAE	0.00	66	0.00	
TETRAODONTIDAE	0.00	43	0.00	
Total	23.67		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 20
DATE :11/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 7°19.51
start stop duration Lon E 39°49.01
TIME :20:04:13 20:35:17 31.1 (min) Purpose : 3
LOG : 2086.36 2087.94 1.6 Region : 7300
FDEPTH: 347 345 Gear cond.: 0
BDEPTH: 347 345 Validity : 0
Towing dir: 0° Wire out : 810 m Speed : 3.1 kn
Sorted : 32 Total catch: 105.06 Catch/hour: 202.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	86.22	11755	42.50	332
Dalatias licha	20.12	2	9.92	
Peristedion weberi	17.67	282	8.71	326
Penaeopsis balssi	14.60	133	7.20	
Polymixia berndti	13.71	218	6.76	324
Argentina euchus	9.54	234	4.70	318
PROCESSIDAE	7.20	114	3.55	
Decapterus macrosoma	7.20	106	3.55	331
Saurida undosquamis	5.12	27	2.52	317
Cynoglossus capensis	4.31	42	2.12	335
Bembrops sp.	3.11	21	1.53	327
Lestrolepis intermedia	2.97	183	1.46	323
Bembrops platyrhynchus	1.81	35	0.89	341
Polymixia sp.	1.77	446	0.87	
Citharoides macrolepis	1.70	56	0.84	336
Tydemania navigatoris	0.99	35	0.49	328
Otolithes ruber	0.78	8	0.38	319
Macrorhamphosus sp.	0.71	8	0.35	338
Malacocephalus laevis	0.71	8	0.35	320
Chaunax sp.	0.67	14	0.33	
Coelorinchus sp.	0.57	35	0.28	321
Neobythites kenyaensis	0.49	56	0.24	337
Spratelloides sp.	0.35	21	0.17	329
Decapterus russelli	0.28	8	0.14	330
Arnoglossus sp.	0.14	29	0.07	334
Loligo duvauceli	0.14	8	0.07	333
Total	202.88		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 21
DATE :12/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 7°6.17
start stop duration Lon E 39°41.01
TIME :06:20:56 06:51:13 30.3 (min) Purpose : 3
LOG : 2162.97 2164.49 1.5 Region : 7300
FDEPTH: 302 304 Gear cond.: 0
BDEPTH: 302 304 Validity : 0
Towing dir: 0° Wire out : 700 m Speed : 3.0 kn
Sorted : 187 Total catch: 371.46 Catch/hour: 735.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	453.36	828	61.61	342
Polymixia berndti	35.85	4671	4.87	343
Saurida undosquamis	29.16	85	3.96	355
Uranoscopus archionema	19.12	101	2.60	357
Cynoglossus capensis	18.78	327	2.55	351
Loligo duvauceli	17.99	149	2.44	349
Peristedion sp.	17.79	36	2.42	363
Squalus megalops	17.71	24	2.41	364
Pteromylaeus bovinus	17.35	2	2.36	
Loligo duvauceli	16.26	168	2.21	373
Rexea prometheoides	14.28	164	1.94	366
Citharoides macrolepis	10.06	93	1.37	344
Scorpaena scrofa	8.74	16	1.19	345
Spratelloides sp.	8.08	277	1.10	350
Holohalaelurus punctatus	7.94	4	1.08	
Projasus parkeri	4.57	293	0.62	
Parabembras sp.	4.33	20	0.59	376
Unidentified fish	3.55	0	0.48	378
Tydemania navigatoris	3.17	145	0.43	348
Chaunax sp.	2.89	8	0.39	370
Sepia hieronis	2.73	52	0.37	353
Raja sp.	2.30	4	0.31	352
Neoepinnula orientalis	2.26	184	0.31	361
CREPIDULIDAE (=CALYPTRAEIDAE)	2.22	16	0.30	371
Ateleopus natalensis	2.15	4	0.29	374
Peristedion weberi	1.91	52	0.26	356
Narcine sp.	1.91	12	0.26	367
Halaelurus sp.	1.56	16	0.21	
Bythalaelurus lutarius	1.56	16	0.21	362
Neoscopelus sp.	1.31	8	0.18	377
Lepidoteuthis sp.	1.29	12	0.17	372
Pliotrema warreni	1.21	8	0.16	358
Branchiostegus doliatus	1.09	8	0.15	346
Antigonia capros	0.74	16	0.10	369
Poecilopsetta zanzibarensis**	0.43	8	0.06	354
Malacocephalus laevis	0.08	4	0.01	360
Macrorhamphosus gracilis	0.08	8	0.01	359
Total	735.80		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 22
DATE :12/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°53.43
start stop duration Lon E 39°32.03
TIME :10:51:01 11:21:45 30.7 (min) Purpose : 3
LOG : 2190.23 2191.86 1.6 Region : 7300
FDEPTH: 268 259 Gear cond.: 0
BDEPTH: 268 259 Validity : 0
Towing dir: 0° Wire out : 680 m Speed : 3.2 kn
Sorted : 44 Total catch: 206.72 Catch/hour: 403.62

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trichiurus lepturus	185.45	295	45.95	381
Polysteganus coeruleopunctatus	34.79	27	8.62	395
Saurida undosquamis	30.95	102	7.67	379
Apogon sp.	29.93	1287	7.42	
Uranoscopus archionema	18.18	84	4.50	
Satyrichthys adeni	17.34	33	4.30	392
Lophiodes mutilus	16.48	8	4.08	
Rexea prometheoides	14.70	135	3.64	382
Citharus sp.	14.70	178	3.64	387
Sepia hieronis	9.29	195	2.30	383
Squalus megalops	8.28	8	2.05	
Spratelloides sp.	5.66	271	1.40	384
Loligo duvauceli	4.55	43	1.13	398
Linuparus somniosus	3.38	8	0.84	
UNIDENTIFIED FISH	2.77	297	0.69	
Parabembras sp.	2.36	18	0.59	393
Cynoglossus lida	2.11	43	0.52	389
C R A B S	0.74	18	0.18	
Malacocephalus laevis	0.59	18	0.15	
Polymixia berndti	0.59	33	0.15	388
Lepidotrigla multispinosa	0.23	8	0.06	396
Tydemania navigatoris	0.23	18	0.06	
Uroconger sp.	0.23	8	0.06	391
Parapenaeus fissurus	0.08	8	0.02	
Total	403.62		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 23
DATE :12/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°32.26
start stop duration Lon E 39°36.83
TIME :22:17:28 22:48:21 30.9 (min) Purpose : 3
LOG : 2262.88 2264.30 1.4 Region : 7300
FDEPTH: 404 410 Gear cond.: 0
BDEPTH: 404 410 Validity : 0
Towing dir: 0° Wire out : 940 m Speed : 2.7 kn
Sorted : 27 Total catch: 82.66 Catch/hour: 160.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Argentina euchus	40.80	909	25.41	409
CARIDEA	15.93	1168	9.92	
Linuparus somniosus	13.35	27	8.31	0
MYCTOPHIDAE	10.78	2217	6.71	
Octopus sp.	9.85	16	6.13	434
Polyipnus indicus	9.69	1426	6.03	421
Otolithes ruber	8.23	21	5.13	425
Squalus megalops	5.75	6	3.58	399
Malacocephalus laevis	4.95	85	3.08	410
Peristedion weberi	4.95	155	3.08	426
Polymetme corythaeola	4.53	350	2.82	411
Tydemania navigatoris	4.04	97	2.51	415
Lepidopus caudatus	3.34	6	2.08	438
Cociella sp.	2.58	16	1.61	430
Raja sp.	2.53	12	1.57	405
Neoepinnula orientalis	2.31	6	1.44	428
Cynoglossus lida	1.72	37	1.07	418
Satyrichthys adeni	1.67	6	1.04	
Saurida undosquamis	1.35	12	0.84	424
Physiculus natalensis	1.26	12	0.79	404
Bathycongrus wallacei	1.18	16	0.74	
Uranoscopus archionema	1.13	6	0.70	437
Sepia sp	0.97	91	0.60	401
Uroteuthis duvaucelii	0.91	6	0.57	
Caelorinchus trunovi	0.91	6	0.57	412
Satyrichthys investigatoris	0.75	12	0.47	435
Sepia hieronis	0.65	12	0.40	419
Neobythites kenyaensis	0.51	21	0.32	408
Polymixia berndti	0.48	6	0.30	414
Bythalaelurus lutarius	0.48	6	0.30	429
Spratelloides sp.	0.48	323	0.30	427
Citharoides macrolepis	0.43	12	0.27	
Acropoma japonicum	0.43	6	0.27	422
Lepidotrigla sp.	0.38	6	0.23	431
Etmopterus sentosus	0.32	6	0.20	420
Apogon sp.	0.21	6	0.13	423
Xenolepidichthys dagleishi	0.17	12	0.11	403
Macrorhamphosus scolopax	0.16	12	0.10	413
Chaunax sp.	0.16	16	0.10	433
Unidentified fish	0.16	12	0.10	402
Stomias boa boa	0.11	12	0.07	436
Total	160.61		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 24
DATE :13/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°39.57
start stop duration Lon E 39°19.37
TIME :05:45:24 06:12:00 26.6 (min) Purpose : 3
LOG : 2294.40 2295.62 1.2 Region : 7300
FDEPTH: 67 60 Gear cond.: 0
BDEPTH: 67 60 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 2.8 kn
Sorted : 39 Total catch: 38.79 Catch/hour: 87.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sepia vermiculata	28.69	72	32.79	459
Acroteriobatus zanzibarensis	16.06	9	18.36	465
Uroteuthis duvaucelii	12.59	519	14.39	439
Tetrosomus concatenatus	5.41	14	6.19	450
Pterois miles	4.24	9	4.85	440
Gymnocranius griseus	3.92	29	4.49	456
Saurida undosquamis	3.38	52	3.87	441
Lactoria diaphana	3.29	14	3.76	449
Nemipterus zysron	3.20	59	3.66	442
Decapterus macrosoma	2.21	7	2.53	451
Paratriacanthodes retrospinis	0.86	29	0.98	454
Lagocephalus guentheri	0.63	18	0.72	447
Abalistes stellatus	0.54	2	0.62	446
Carangoides malabaricus	0.54	2	0.62	457
Upeneus guttatus	0.51	9	0.58	445
Parupeneus heptacanthus	0.34	2	0.39	443
Peristedion weberi	0.23	9	0.26	448
Nemipterus bipunctatus	0.22	2	0.25	444
Leiognathus elongatus**	0.18	108	0.21	453
Fistularia petimba	0.14	2	0.15	452
Polymetme corythaeola	0.09	9	0.10	462
Bothus pantherinus	0.09	2	0.10	460
Apogonidae - juvenile	0.05	23	0.05	458
Polyipnus indicus	0.05	7	0.05	461
UNIDENTIFIED FISH	0.03	5	0.03	
MYCTOPHIDAE	0.02	5	0.02	455
Total	87.50		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 25
DATE :13/04/18 GEAR TYPE: PT NO: 5 POSITION:Lat S 6°34.01
start stop duration Lon E 39°15.30
TIME :08:00:08 08:27:33 27.4 (min) Purpose : 3
LOG : 2308.18 2310.30 2.1 Region : 7300
FDEPTH: 0 30 Gear cond.: 0
BDEPTH: 58 64 Validity : 0
Towing dir: 0° Wire out : 200 m Speed : 4.7 kn
Sorted : 5 Total catch: 96.66 Catch/hour: 211.51

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Encrasicholina punctifer	211.51	88144	100.00	464
Total	211.51		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 26
DATE :14/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°30.61
start stop duration Lon E 39°18.05
TIME :12:28:40 12:56:25 27.8 (min) Purpose : 3
LOG : 2346.56 2348.08 1.5 Region : 7300
FDEPTH: 60 54 Gear cond.: 0
BDEPTH: 60 54 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.3 kn
Sorted : 38 Total catch: 37.70 Catch/hour: 81.52

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Saurida undosquamis	17.56	223	21.54	467
Gymnocranius griseus	12.50	28	15.33	475
Upeneus bensasi	9.38	763	11.51	472
Abalistes stellatus	7.87	11	9.65	474
Ostracion cubicus	5.77	6	7.08	482
Carcharhinus limbatus	4.71	2	5.78	489
Tetrosomus concatenatus	4.43	17	5.44	484
Sepia prashadi	3.59	2	4.40	487
Loligo duvauceli	3.16	50	3.87	471
Acroteriobatus zanzibarensis	2.85	2	3.50	466
Arothron hispidus	2.29	2	2.81	486
Nemipterus japonicus	1.66	24	2.04	468
Paramonacanthus sp.	0.99	108	1.22	493
Psettodes erumei	0.86	4	1.06	483
Lagocephalus guentheri	0.76	48	0.93	485
Fistularia petimba	0.56	19	0.69	469
Sphyraena forsteri	0.52	2	0.64	478
Choerodon gymnogenys	0.45	9	0.56	490
Sepia hieronis	0.26	4	0.32	488
Epinephelus areolatus	0.24	2	0.29	470
UNIDENTIFIED FISH	0.22	13	0.27	492
Lethrinus microdon	0.19	2	0.24	476
Leiognathus equulus	0.13	2	0.16	473
Upeneus moluccensis	0.13	4	0.16	477
Oxycheilinus bimaculatus	0.13	15	0.16	491
Thenus orientalis	0.09	4	0.11	
Carangoides malabaricus	0.09	2	0.11	481
Teixeirichthys jordani	0.06	4	0.08	
Apogon sp.	0.04	9	0.05	
Apogon quadrifasciatus**	0.01	6	0.01	494
Invertebrate	0.00	4	0.00	
SEA URCHINS	0.00	2	0.00	
Total	81.52		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 27
DATE :14/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°19.39
start stop duration Lon E 39°13.31
TIME :14:27:23 14:56:01 28.6 (min) Purpose : 3
LOG : 2359.86 2361.70 1.8 Region : 7300
FDEPTH: 33 37 Gear cond.: 0
BDEPTH: 33 37 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.9 kn
Sorted : 23 Total catch: 85.02 Catch/hour: 178.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Rachycentron canadum	69.76	31	39.17	
Carangoides malabaricus	26.19	505	14.70	515
Saurida undosquamis	18.12	247	10.17	506
Lagocephalus sceleratus	9.76	233	5.48	498
Sepia trigonina	5.89	63	3.31	516
Leiognathus leuciscus**	5.57	419	3.13	496
Upeneus bensasi	5.26	557	2.95	521
Thenus orientalis	4.94	23	2.78	507
Sepia vermiculata	4.48	8	2.52	505
Cyclichthys sp.	4.34	8	2.43	499
Carangoides ferdau	4.02	86	2.26	514
Nemipterus sp.	3.39	31	1.91	502
Gazza minuta	3.10	40	1.74	510
Pterois miles	2.16	8	1.21	508
Parupeneus sp.	2.16	31	1.21	522
Decapterus macrosoma	1.55	54	0.87	519
Caranx tille	1.24	23	0.69	523
Gerres filamentosus	1.24	40	0.69	497
Amanses scopas	0.78	69	0.44	512
Carangoides armatus	0.78	54	0.44	509
CARANGIDAE	0.61	15	0.34	
Decapterus russelli	0.61	8	0.34	525
Fistularia petimba	0.46	23	0.26	501
DACTYLOPTERIDAE	0.46	8	0.26	511
Uroteuthis duvaucelii	0.38	15	0.21	517
Encrasicholina heteroloba	0.27	233	0.15	520
Bothus myriaster	0.23	8	0.13	500
Teixeirichthys jordani	0.15	15	0.08	513
Plotosus lineatus	0.13	54	0.07	504
Apogon quadrifasciatus**	0.08	8	0.05	518
Citharichthys sp.	0.02	8	0.01	
Total	178.11		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 28
DATE :14/04/18 GEAR TYPE: PT NO: 1 POSITION:Lat S 6°22.26
start stop duration Lon E 39°12.44
TIME :16:00:23 16:20:48 20.4 (min) Purpose : 3
LOG : 2367.01 2368.23 1.2 Region : 7300
FDEPTH: 25 30 Gear cond.: 0
BDEPTH: 41 39 Validity : 0
Towing dir: 0° Wire out : 100 m Speed : 3.6 kn
Sorted : 15 Total catch: 16.62 Catch/hour: 48.87

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Spratelloides gracilis	17.37	10859	35.55	530
Encrasicholina heteroloba	13.58	7684	27.79	526
Decapterus macrosoma	10.85	1479	22.20	532
Amblygaster sirm	5.17	676	10.59	533
Rastrelliger kanagurta	0.72	68	1.47	528
UNIDENTIFIED FISH	0.53	185	1.08	534
Sphyraena obtusata	0.32	15	0.66	529
Loligo duvauceli	0.21	79	0.44	531
Samaris cristatus**	0.08	15	0.16	527
Apogon sp.	0.03	9	0.05	535
Total	48.87		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 29
DATE :14/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°17.87
start stop duration Lon E 39°1.25
TIME :20:40:12 21:10:37 30.4 (min) Purpose : 3
LOG : 2394.39 2396.26 1.9 Region : 7300
FDEPTH: 32 30 Gear cond.: 0
BDEPTH: 32 30 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.7 kn
Sorted : 22 Total catch: 95.54 Catch/hour: 188.38

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Stephanolepis auratus	36.34	6974	19.29	562
Saurida undosquamis	23.29	39	12.36	536
Upeneus bensasi	21.06	1782	11.18	539
Pseudorhombus elevatus ***	14.71	1530	7.81	548
SOFT SPONGES	11.22	0	5.96	
Lagocephalus sceleratus	10.61	244	5.63	
Paramonacanthus pusillus	10.45	300	5.55	561
Decapterus russelli	6.49	158	3.44	538
Thenus orientalis	5.70	87	3.02	
Paracallionymus costatus	4.93	244	2.62	570
Lutjanus fulvus	4.67	578	2.48	557
Lethrinus microdon	3.94	47	2.09	546
Apistus carinatus	3.81	237	2.02	560
Teixeirichthys jordani	3.73	260	1.98	545
Nemipterus bipunctatus	3.57	39	1.89	541
SYNODONTIDAE	3.17	32	1.69	565
Rastrelliger kanagurta	2.94	39	1.56	537
Unidentified crustacean	2.54	103	1.35	
Torquigener hypselogenion	2.44	79	1.30	552
Bothus myriaster	1.97	71	1.05	547
Lethrinus nebulosus	1.81	32	0.96	544
Upeneus taeniopterus	1.81	79	0.96	540
Sepia hieronis	1.34	16	0.71	554
Herklotsichthys quadrimaculat.	0.95	16	0.50	563
Gymnocranius griseus	0.79	16	0.42	558
Apogon sp.	0.63	71	0.33	556
Choerodon gymnogenys	0.63	16	0.33	559
Loligo duvauceli	0.55	16	0.29	555
Sphyraena guachancho	0.47	8	0.25	
Gerres oyena	0.47	8	0.25	566
Choerodon sp.	0.45	24	0.24	568
Plotosus lineatus	0.39	260	0.21	549
Samaris cristatus**	0.24	16	0.13	553
UNIDENTIFIED FISH	0.10	32	0.05	569
Hoplichthys acanthopleurus	0.08	8	0.04	564
Chaunax sp.	0.08	8	0.04	
Total	188.38		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 30
DATE :15/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 6°7.46
start stop duration Lon E 38°59.46
TIME :00:53:42 01:17:47 24.1 (min) Purpose : 3
LOG : 2415.69 2417.07 1.4 Region : 7300
FDEPTH: 35 37 Gear cond.: 0
BDEPTH: 35 37 Validity : 0
Towing dir: 0° Wire out : 140 m Speed : 3.4 kn
Sorted : 0 Total catch: 89.04 Catch/hour: 221.76

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Upeneus bensasi	42.14	3078	19.00	579
Lethrinus variegatus	36.01	598	16.24	571
Saurida undosquamis	23.91	224	10.78	586
Scolopsis bimaculata	20.47	1494	9.23	578
Teixeirichthys jordani	18.93	1494	8.54	
Parupeneus sp.	17.78	329	8.02	
Thenus orientalis	10.01	45	4.51	583
Lagocephalus sceleratus	9.71	164	4.38	575
Stephanolepis auratus	5.98	0	2.70	587
Pterois miles	5.23	30	2.36	585
Bothus sp.	4.87	45	2.20	590
Paramonacanthus pusillus	4.78	269	2.16	588
Apistus carinatus	4.48	254	2.02	580
Abalistes stellatus	3.74	15	1.68	573
Parupeneus macronemus	2.99	60	1.35	572
Plotosus lineatus	2.39	194	1.08	581
Sepia latimanus	1.94	75	0.88	582
Siganus sutor	1.79	45	0.81	584
Nemipterus bipunctatus	1.34	15	0.61	593
Rastrelliger kanagurta	0.90	15	0.40	589
Gymnocranius griseus	0.45	60	0.20	574
Dussumieria acuta	0.45	15	0.20	595
Choerodon gymnogenys	0.45	15	0.20	577
Synodus sp.	0.45	30	0.20	576
Lethrinus sp.	0.38	15	0.17	592
BOTHIDAE	0.17	30	0.08	591
Total	221.76		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 31
DATE :15/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 5°56.01
start stop duration Lon E 39°8.95
TIME :05:37:48 06:08:57 31.1 (min) Purpose : 3
LOG : 2444.31 2445.92 1.6 Region : 7300
FDEPTH: 45 50 Gear cond.: 0
BDEPTH: 45 50 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.1 kn
Sorted : 15 Total catch: 119.04 Catch/hour: 229.29

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Himantura jenkinsii	59.22	4	25.83	617
Upeneus taeniopterus	27.83	1285	12.14	613
Ariopsis sp.	23.58	10	10.28	624
Arius africanus	23.46	6	10.23	625
Leiognathus leuciscus**	14.99	917	6.54	612
Upeneus sulphureus	14.68	466	6.40	603
Saurida undosquamis	13.16	299	5.74	597
Carangoides malabaricus	10.56	206	4.60	610
Stolephorus waitei	10.40	4956	4.54	623
Arothron stellatus	5.82	2	2.54	621
Scomberomorus commerson	3.74	8	1.63	616
Psettodes erumei	3.66	2	1.60	620
Abalistes stellatus	3.22	15	1.40	600
Upeneus moluccensis	2.29	214	1.00	601
Fistularia petimba	1.83	46	0.80	598
Thenus orientalis	1.27	8	0.55	604
Penaeus semisulcatus	1.23	31	0.54	
Dussumieria acuta ***	1.23	62	0.54	619
Gerres filamentosus	1.23	15	0.54	607
Nemipterus metopias	1.08	8	0.47	618
Epinephelus malabaricus	1.08	15	0.47	608
Sepia vermiculata	1.07	8	0.47	599
Paramonacanthus pusillus	0.77	100	0.34	615
Apogon quadrifasciatus**	0.46	15	0.20	605
Mene maculata	0.46	15	0.20	611
Terapon theraps	0.44	8	0.19	622
Sphyraena putnamae	0.31	8	0.13	609
Rastrelliger kanagurta	0.15	39	0.07	614
Plotosus lineatus	0.08	23	0.03	606
Total	229.29		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 32
DATE :15/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 5°44.79
start stop duration Lon E 39°5.89
TIME :10:24:15 10:53:43 29.5 (min) Purpose : 3
LOG : 2474.63 2476.06 1.4 Region : 7300
FDEPTH: 71 74 Gear cond.: 0
BDEPTH: 71 74 Validity : 0
Towing dir: 0° Wire out : 200 m Speed : 2.9 kn
Sorted : 57 Total catch: 338.98 Catch/hour: 690.15

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus macrosoma	465.48	9799	67.45	629
Carangoides malabaricus	72.54	1362	10.51	635
Upeneus moluccensis	49.78	1568	7.21	636
Rastrelliger kanagurta	21.19	43	3.07	643
Leiognathus berbis	19.04	1325	2.76	633
Abalistes stellatus	12.54	49	1.82	630
Upeneus taeniopterus	8.67	0	1.26	642
Nemipterus japonicus	8.43	120	1.22	627
Saurida undosquamis	7.72	240	1.12	628
CARCHARHINIDAE	7.57	2	1.10	641
Apogon sp.	7.47	12	1.08	638
Loligo duvauceli	3.14	96	0.45	639
Stolephorus indicus	3.01	96	0.44	634
Sphyraena putnamae	1.57	12	0.23	
Dussumieria acuta	1.26	24	0.18	632
Paramonacanthus sp.	0.49	71	0.07	
Fistularia petimba	0.24	12	0.04	631
Total	690.15		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 33
DATE :15/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 5°26.80
start stop duration Lon E 39°5.28
TIME :15:15:09 15:45:40 30.5 (min) Purpose : 3
LOG : 2511.29 2512.84 1.6 Region : 7300
FDEPTH: 65 51 Gear cond.: 0
BDEPTH: 65 51 Validity : 0
Towing dir: 0° Wire out : 189 m Speed : 3.1 kn
Sorted : 5 Total catch: 113.97 Catch/hour: 224.12

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Leiognathus elongatus**	48.14	10637	21.48	661
Epinephelus coioides	40.55	2	18.09	648
Scomberomorus commerson	39.45	16	17.60	645
Lutjanus sanguineus	19.19	4	8.56	662
Lutjanus rivulatus	17.64	2	7.87	668
Gymnocranius griseus	9.99	65	4.46	660
Sphyraena putnamae	7.87	2	3.51	669
Loligo duvauceli	7.83	865	3.49	664
Aluterus monoceros	6.92	4	3.09	665
Nemipterus zysron	6.06	104	2.70	655
Decapterus kurroides	2.44	47	1.09	663
Stolephorus indicus	2.37	94	1.06	647
Saurida tumbil	2.16	6	0.97	
Thenus orientalis	2.01	8	0.90	651
Lagocephalus sceleratus	1.85	2	0.82	658
Diodon hystrix	1.85	2	0.82	659
Parupeneus heptacanthus	1.61	12	0.72	657
Trachinocephalus myops	1.53	47	0.68	667
Lactoria cornuta	1.26	4	0.56	649
Saurida undosquamis	1.10	6	0.49	652
Tetrosomus concatenatus	1.06	2	0.47	644
Sepia vermiculata	0.55	2	0.25	646
Rogadius asper	0.37	12	0.17	650
Apogon quadrifasciatus**	0.24	12	0.11	666
Saurida gracilis	0.04	8	0.02	653
Fistularia petimba	0.04	2	0.02	656
Total	224.12		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 34
DATE :15/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 5°27.60
start stop duration Lon E 39°11.44
TIME :17:44:19 18:14:57 30.6 (min) Purpose : 3
LOG : 2523.17 2524.81 1.6 Region : 7300
FDEPTH: 356 340 Gear cond.: 0
BDEPTH: 356 340 Validity : 0
Towing dir: 0° Wire out : 845 m Speed : 3.2 kn
Sorted : 21 Total catch: 70.13 Catch/hour: 137.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Centrophorus granulosus	19.39	6	14.12	682
Pristiophorus nancyae	11.51	82	8.38	690
Lepidotrigla faueri	9.20	94	6.70	676
Saurida undosquamis	8.66	39	6.30	671
MYCTOPHIDAE	7.46	1261	5.43	697
Citharoides macrolepis	5.86	43	4.26	706
S H R I M P S	5.76	658	4.19	
Eridacnis radcliffei	5.70	110	4.15	685
Atlantoraja cyclophora	5.15	16	3.75	
Dipturus stenorhynchus	4.99	6	3.64	713
Etmopterus sentosus	4.39	49	3.19	688
Cociella sp.**	4.33	16	3.15	711
Sepia hieronis	4.17	55	3.04	703
Palinurus sp.	3.51	27	2.55	714
Loligo duvauceli	3.41	27	2.48	704
Cubiceps whiteleggii	3.23	76	2.35	670
Dysomma anguillare	3.17	27	2.31	674
Polyipnus indicus	3.11	1073	2.27	677
Neobythites kenyaensis	2.36	16	1.72	683
Priacanthus hamrur	2.35	12	1.71	678
Physiculus natalensis	2.35	16	1.71	698
Bythalaelurus lutarius	2.25	49	1.64	689
Peristedion weberi	1.98	82	1.44	675
Lophiodes mutilus	1.80	6	1.31	680
Avocettina sp.	1.49	12	1.08	712
Lestrolepis intermedia	1.25	6	0.91	673
Unidentified fish	1.21	27	0.88	705
Arnoglossus sp.	1.10	27	0.80	707
Malacocephalus laevis	0.98	121	0.71	702
CHLOROPHTHALMIDAE	0.88	67	0.64	695
Chaunax sp.	0.82	39	0.60	699
Paratriacanthodes retrospinis	0.63	22	0.46	681
Cynoglossus lida	0.43	16	0.31	672
Linuparus sp.	0.37	12	0.27	708
Argentina euchus	0.33	131	0.24	696
Squalus megalops	0.29	2	0.21	684
Polymetme corythaeola	0.27	27	0.20	693
Decapterus macrosoma	0.27	6	0.20	709
Caelorinchus trunovi	0.22	6	0.16	701
Macrorhamphosus scolopax	0.22	22	0.16	679
Leiognathus elongatus**	0.20	43	0.15	691
Bembrops platyrhynchus	0.12	6	0.09	692
Stephanolepis auratus	0.10	16	0.07	694
Apogon sp.	0.06	6	0.04	710
Sepia hieronis	0.00	0	0.00	
Total	137.33		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 35
DATE :16/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 5°15.57
start stop duration Lon E 39°12.19
TIME :19:07:57 19:29:15 21.3 (min) Purpose : 3
LOG : 2701.19 2702.33 1.1 Region : 7300
FDEPTH: 390 390 Gear cond.: 0
BDEPTH: 390 390 Validity : 0
Towing dir: 0° Wire out : 970 m Speed : 3.2 kn
Sorted : 13 Total catch: 48.71 Catch/hour: 137.22

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Saurida undosquamis	36.37	189	26.51	716
MYCTOPHIDAE	20.42	5104	14.88	
Chlorophthalmus agassizi	9.60	242	7.00	
Centrophorus granulosus	9.46	3	6.90	
Parapenaeus sp.	8.11	1245	5.91	
Peristedion weberi	6.76	39	4.93	
Chaunax sp.	5.81	39	4.24	738
Ornithoteuthis volatilis	4.29	54	3.13	748
Tydemania navigatoris	4.26	6	3.10	740
Metanephrops mozambicus	4.12	48	3.01	
Atrobucca nibe	2.59	3	1.89	735
Solenocera agoensis	2.57	54	1.87	
Malacocephalus laevis	2.37	20	1.72	742
Polymixia berndti	2.37	28	1.72	741
Aristeus antennatus	2.16	68	1.58	
Polyipnus indicus	1.76	527	1.28	
Ruvettus pretiosus	1.69	14	1.23	
Velodona togata	1.57	6	1.15	753
Phosichthys argenteus	1.49	101	1.08	
Spratelloides sp.	1.15	39	0.84	
Pristiophorus nancyae	1.13	11	0.82	
Satyrichthys investigatoris	1.08	48	0.79	732
Thyrsitoides marleyi	1.01	14	0.74	718
Stomias boa boa	0.81	155	0.59	752
Lestrolepis intermedia	0.64	34	0.47	725
Cynoglossus marleyi	0.44	6	0.32	726
Gymnoscopelus sp.	0.41	130	0.30	751
Bathycongrus wallacei	0.41	3	0.30	
Macrorhamphosus scolopax	0.41	54	0.30	717
Malacocephalus laevis	0.27	87	0.20	
Poecilopsetta zanzibarensis	0.21	20	0.15	727
Coelorinchus denticulatus	0.20	6	0.15	730
Etmopterus sentosus	0.17	3	0.12	
Cynoglossus lida	0.17	6	0.12	728
Eridacnis radcliffei	0.14	3	0.10	
Bythalaelurus lutarius	0.14	3	0.10	
Bembrops platyrhynchus	0.14	6	0.10	755
Physiculus natalensis	0.14	6	0.10	739
Lepidotrigla faueri	0.14	6	0.10	747
Paratriacanthodes retrospinis	0.11	0	0.08	754
Parabathynomus natalensis	0.10	6	0.07	749
Laeops nigromaculatus	0.03	6	0.02	734
Total	137.22		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 36
DATE :16/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 5°3.46
start stop duration Lon E 39°16.74
TIME :23:53:25 00:27:14 33.8 (min) Purpose : 3
LOG : 2730.63 2732.37 1.7 Region : 7300
FDEPTH: 442 420 Gear cond.: 0
BDEPTH: 442 420 Validity : 0
Towing dir: 0° Wire out : 1050 m Speed : 3.1 kn
Sorted : 24 Total catch: 59.26 Catch/hour: 105.13

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Argentina euchus	14.88	293	14.15	769
Polymetme corythaeola	9.77	319	9.29	
Parapenaeus investigatoris	9.24	800	8.79	
Parascolopsis sp.	8.30	266	7.90	
Peristedion weberi	7.28	115	6.93	770
Saurida undosquamis	5.95	27	5.66	759
Neobythites cf somaliaensis	4.97	5	4.73	
Gymnoscopelus sp.	4.88	1017	4.65	787
MYCTOPHIDAE	4.44	1292	4.22	766
Sepia sp	3.86	5	3.68	
Malacocephalus laevis	3.73	124	3.55	771
Lestrolepis intermedia	3.64	160	3.46	768
Neoepinnula orientalis	3.20	41	3.04	767
Scombrops boops	2.84	41	2.70	788
Chaunax sp.	2.80	27	2.66	
Polyipnus indicus	2.71	848	2.58	786
Squalus megalops	2.45	4	2.33	
RAJIDAE	2.04	41	1.94	
Uroconger lepturus	1.60	9	1.52	762
Sepia hieronis	1.15	14	1.10	
Spratelloides sp.	0.76	32	0.72	
Tydemania navigatoris	0.72	27	0.69	
Rhinochimaera atlantica	0.71	18	0.68	
Lophiodes sp.	0.49	9	0.46	
Stomias boa boa	0.49	98	0.46	763
Cynoglossus lida	0.40	14	0.38	
Polymixia berndti	0.31	5	0.30	773
Avocettina sp.	0.31	14	0.30	765
Neobythites analis	0.31	18	0.30	764
Plastic	0.30	14	0.28	
Unidentified demersal fish	0.18	14	0.17	
Unidentified demersal fish	0.15	14	0.14	789
Macrorhamphosus scolopax	0.13	14	0.13	
Dussumieria acuta	0.13	5	0.13	761
Total	105.13		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018404 STATION: 37
DATE :17/04/18 GEAR TYPE: BT NO: 1 POSITION:Lat S 5°51.88
start stop duration Lon E 39°26.30
TIME :12:29:30 12:58:47 29.3 (min) Purpose : 3
LOG : 2829.03 2830.48 1.4 Region : 7300
FDEPTH: 295 303 Gear cond.: 0
BDEPTH: 295 303 Validity : 0
Towing dir: 0° Wire out : 780 m Speed : 3.0 kn
Sorted : 28 Total catch: 79.11 Catch/hour: 162.10

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Rexea prometheoides	91.64	1453	56.53	790
Zeus capensis	15.69	6	9.68	801
Peristedion weberi	15.17	57	9.36	800
Squalus megalops	8.69	4	5.36	
Plastic	7.58	10	4.68	
Saurida undosquamis	7.48	27	4.61	793
Decapterus russelli	3.26	10	2.01	792
Loligo duvauceli	2.69	20	1.66	798
Apogon sp.	2.11	191	1.30	794
Lepidotrigla sp.	1.47	31	0.91	803
Antigonia rubescens	1.42	64	0.88	797
Citharoides macrolepis	1.26	10	0.78	796
Polymixia berndti	1.21	53	0.75	795
Spratelloides sp.	1.00	53	0.62	791
Ateleopus sp.	0.42	6	0.26	805
Sepia hieronis	0.32	6	0.19	799
Synagrops sp.	0.26	6	0.16	804
Eridacnis radcliffei	0.21	6	0.13	
Bembrops sp.	0.21	6	0.13	802
Total	162.10		100.00	

ANNEX IV. OVERVIEW OF BIOLOGICAL SAMPLES PER SPECIES

Length – length measurements only, Length/weight – both and length and weight, Biology – sex, maturity and stomach fullness, Stomach – frozen stomach samples, Otoliths – no. of fish where otoliths were collected, Fin clips – no. of individuals sampled for genetical analysis, Frozen – no. of individuals frozen, Preserved – no. of individuals preserved in formalin.

Species/groups	Length	Length/ Weight	Biology	Liver	Stomach	Otoliths	Fin clips	Frozen	Preserved
Chaunax sp.	32								
Abalistes stellatus	27	11					12		
Acropoma japonicum	1								
Acroteriobatus zanzibarensis	1	4							
Aluterus monoceros	5								
Aluterus monoceros		2							
Amanses scopas		9							
Amblygaster leiogaster	1								
Amblygaster sirm	50								
Antigonia capros	8								
Antigonia rubescens	13								
Apistus carinatus	31								
Apogon quadrifasciatus	10	10							
Apogon sp.	201	10							
Argentina euchus	427	24							
Aristaeus antennatus	70		13						
Arius africanus		3							
Arius venosus	2								
Arnoglossus sp.	9								
Arothron hispidus	1								
Arothron stellatus	1	4							
Ateleopus natalensis	1								
Ateleopus sp.	1								
Atlantoraja cyclophora	1								
Atrobucca nibe	1	1							
Atrobucca nibe	11								
Avocettina sp.	6								
Bathycongrus wallacei		1							
Bembrops platyrhynchus	5	1							
Bembrops sp	10								
Beryx splendes	2								
Bothidae		2							
Bothus myriaster	9	1							
Bothus pantherinus	1								
Bothus sp.	1	3							
Branchiostegus doliatus	2	2							
Bythalaelurus lutarius	1	21							
Carcharhinus limbatus	1								
Coelorhincus trunovi	1								
Caelorinchus trunovi	1								
Callionymus marleyi	4								
Canthigaster sp.		1							
Carangoides armatus		7							
Carangoides chrysophyrs	6								
Carangoides dinema	1								
Carangoides ferdau		11							
Carangoides malabaricus	121	132	31						
Carangoides sp.	39								
Caranx tille	1								
Carcharhinus sp.	1								
Carcharinidae	1								
Caridea sp.	30								
Centrophorus granulosus		1							
Centrophorus moluccensis	2								

Species/groups	Length	Length/ Weight	Biology	Liver	Stomach	Otoliths	Fin clips	Frozen	Preserved
Centrophorus sp.		20							
Champsodon sp.	64								
Chascanopsetta lugubris	2								
Cheilopogon nigricans		3							
Chirocentrus dorab	3								
CHLOROPHTHALMIDAE	1								
Chlorophthalmus agassizi	12	44							
Choerodon gymnogenys	7								
Choerodon sp.	3								3
Citharichthys sp.	6								
Citharoides macrolepis	47								
Citharus	35								
Cociella	8								
Coelorhincus denticulatus	1								
Coelorhincus turnovi	5								
Coelorinchus denticulatus		1							
Crepidulidae	4								
Cruriraja parcomaculata		1							
Cubiceps whiteleggii		14							
Cyclichthys sp.		1							
Cynoglossus capensis	90								
Cynoglossus lida	17	4							
Cynoglossus marleyi		1							
Dactylopteridae		1							
Decapterus kurroides	5	133					30		
Decapterus macarellus	19								
Decapterus macrosoma	174	247	37		30		120		
Decapterus russelli	25	57	54		13		58		
Decapterus tabl	1								
Diagramma centurio		5	5						
Diaphus knappi		100							
Diodon hystrix	5								
Diodontidae sp		1							
Dipturus stenorhynchus	1								
Dussumeria acuta	139	1							
Dussumieria acuta		8							
Dysomma anguillare		5							
Echeneis naucrates	1								
Encrasicholina punctifer		100							
Encrasicholina heteroloba		100							
Epigonus robustus	2								
Epinephelus aerolatus	3								
Epinephelus coioides		1							
Epinephelus malabaricus		2							
Eridacnis radcliffei	3	20							
Etelis carbunculus	1								
Etmopterus molleri		8							
Etmopterus sentosus	36	10							
Fistularia petimba	1								
Fistularia petimba	14	11							
Gazza minuta	132	5							
Gerres filamentosus	20	7							
Gerres oyena	4								
Gnathanodon speciosus	1								
Gobius spp.	16								
Gymnocranius griseus	6	61	15				15		
Gymnoscopelus sp.	50								
Halaelurus lutarius	5								
Halaelurus sp.	5								
Haliporoides triarthrus			9						
Harpiosquilla harpax	1								
Hemiramphus sp.	1								
Heptranchias perlo	5								
Herklotsichthys quadrimaculat	2								

Species/groups	Length	Length/ Weight	Biology	Liver	Stomach	Otoliths	Fin clips	Frozen	Preserved
Heterodontus ramalheria	1								
Himantura gerradi	4								
Himantura jenkinsii		4							
Holohalaelurus regani	1								
Holohalaelurus punctatus	1								
Hoplichthys acanthopleurus	1								
Ibacus novemdentatus	4								
Lactoria cornuta		2							
Lactoria sp.	6								
Laeops nataliensis	1								
Laeops nigromaculatus		1							
Laeops pectoralis		15							
Lagocephalus guentheri	30								
Lagocephalus inermis	7								
Lagocephalus sceleratus	44	10							
Leiognathus berbis	211	23							
Leiognathus elongatus	254	109							
Leiognathus equulus	4	18	18						
Leiognathus leuciscus	55	56							
Lepidopus caudatus	1								
Lepidoteuthis sp.	3								
Lepidotrigla alcocki	4								
Lepidotrigla faueri	14	17							
Lepidotrigla multispinosa	1								
Lepidotrigla sp.	7								
Lestrolepis intermedia	67	6							
Lethrinus crocineus	1								
Lethrinus mahsena	1								
Lethrinus nebulosus	6								
Lethrinus sp.	25								
Lethrinus variegatus	40								
Linuparus somniosus	5								
Linuparus sp.	2								
Loligo duvaceli	320	8							
Lophiodes mutilus	6	1							
Lophius sp.	1								
Lutjanidae	1								
Lutjanus fulvus	73								
Lutjanus rivulatus	1								
Lutjanus sanguineus		2					2		
Macrorhamphosidae	7								
Macrorhamphosus gracilis	2								
Macrorhamphosus scolopax	6	12							
Malacocephalus	1								
Malacocephalus laevis	91	21							
Mene maculata		2							
Metanephrops mozambicus									
Monocentris japonica	2								
Myctophidae	132								
Narcine rierai	11								
Narcine sp.	3								
Nemipterus bipunctatus	1								
Nemipterus bleekevi	10	4							
Nemipterus japonicus	15								
Nemipterus metopias	12	1							
Nemipterus zysron	26	53							
Neobythites analis	4								
Neobythites kenyaensis	16	3							
Neobythites somaliaensis	3								
Neoepinnula orientalis	10								
Neoepinnula orientalis	47								
Neoscopelus sp.	2								
Nettastoma parviceps	101								
Nettostoma parviceps	6								

Species/groups	Length	Length/ Weight	Biology	Liver	Stomach	Otoliths	Fin clips	Frozen	Preserved
Octopus sp	3								
Octupus cyaneus	1								
Ornithoteuthis volatilis	8								
Ostraciidae	6								
Ostracion cubicus	5	2							
Otolithes ruber	5	1	1		1		1		
Oxycheilinus bimaculatus	6								
Palinurus sp.	5								
Parabathynomus	1								
Parabembras sp.	7								
Paracallionymus costatus	31								
Paramonacanthus pusillus	38	31							
Paramonacanthus sp.	6	51							
Parapenaeus sp.									
Paratriacanthodes retrospinis	1	4							
Parupeneus heptacanthus	10								
Parupeneus macronemus	4								
Parupeneus sp.	3	4							
Penaeidae	5								
Penaeus marginatus	1								
Penaeus semisulcatus		4							
Peristedion sp.	9								
Peristedion weberi	128	25							
Physiculus natalensis	7								
Physiculus nateliensis	1								
Pliotrema warreni	2								
Plotosus lineatus	78	9							
Poecilopsetta zanzibarensis	5	3							
Polyipnus indicus	51	227							
Polymetme corythaeola	296	30							
Polymixia berndti	191								
Polymixia sp.	5	40							
Polynemus sextarius	2								
Polysteganus caeruleopunctatus	23	13	13		13		13		
Pomadasys kaakan	1								
Pomadasys maculatus	6								
Pontinus nigerimum	3								
Priacanthus hamrur		3							
Pristiophorus nancyae	15								
Projasus parkeri	9								
Psettodes erumei	3	1							
Pseudobalistes flavimarginatus		2							
Pseudobalistes fuscus	1								
Pseudorhombus elevatus	104								
Pterios miles	4								
Pterois miles	2	1							
Pterois russelii	1								
Pteromylaeus bovinus	1								
Raja sp.	5			1					
Rajidae	11								1
Rastrelliger kanagurta	6	65	19				5		
Rastroraja alba		1							
Rexea prometheoides	291								
Rhinobatos	8								
Rhinochimaera atlantica	4								
Rogadius asper	1								
Ruvettus pretiosus	3								
Samaris cristatus	3								
Sardinella gibbosa		3	3				3		
Satyrichthys adeni	20								
Satyrichthys investigatoris		7							
Satyrinchus investigatoris	2								
Saurida gracilis	5								
Saurida tumbil	3								

Species/groups	Length	Length/ Weight	Biology	Liver	Stomach	Otoliths	Fin clips	Frozen	Preserved
Saurida undosquamis	102	300	31				12		
Sauridia undosquamis		106	36		42		57		
Scolopsis bimaculata	40								
Scomber japonicus	2								
Scomberomorus commerson	1	16	20				20		
Scombrops boops		9							
Scorpaena scorfa	6								
Scorpaenopsis sp	1								
Secutor insidiator	47								
Sepia hieronis	57								
Sepia latimanus	5								
Sepia prashadi	5								
Sepia sp.	19								
Sepia trygonina		9							
Sepia vermiculata		35							
Seriola rivoliana	2								
Seriolina nigrofasciata	1								
Shrimps		20							
Siganus sutor	3								
Sinodus sp	2								
Solenocera agoensis	8								
Sparidae	18							15	
Sphyraena barracuda	1								
Sphyraena flavicauda	3								
Sphyraena forsteri	1								
Sphyraena jello	10								
Sphyraena obtusa	2	50							
Sphyraena obtusta	2	1							
Sphyraena putnamae	2	22							
Spratelloides	122								
Sprattelloides gracilis		200			15		63		
Squalus megalops	8	1							
Squatina sp.									
Stephanolepis auratus	103	3							
Stolephorus heterolobus	29	100					30		
Stolephorus indicus	13	8							
Stomias boa boa	47								
SYNODONTIDAE	4								
Teixeirichthys jordani	2	102							
Terapon theraps	13	1							
Tetraodontidae	4								
Tetrosomus concatentus	14								
Thenus orientalis	15	14							
Thryssa vitrirostris	4								
Thunus orientalis	2								
Thyrsitoides marleyi		39							
Torquigener hypselogenion	10	1							
Trachinocephalus myops	4								
Trichiurus lepturus	14	115	60		60		30		
Tydemania navigatoris	74								
Tylerius spinosissimus	4								
Unidentified fish	20	10							4
Upeneus bensasi	220	32							
Upeneus guttatus	4								
Upeneus moluccensis	163	28							
Upeneus sp.	116								
Upeneus sulphureus		61			30		30		
Upeneus taeniopterus	40	192	30		30		30		
Upeneus vittatus	2								
Uranoscopus archionema	32								
Uroconger lepturus	2								
Uroconger sp.	1								
Uroteuthis duvacelli	100	32							
Uroteuthis sp	132								

Species/groups	Length	Length/ Weight	Biology	Liver	Stomach	Otoliths	Fin clips	Frozen	Preserved
Velodona togata	1								
Ventrifossa mystax		29							
Xenolepidichthys dagleishi	22								
Zanclus cornutus	1								
Zenion sp.	97								
Zeus capensis	1								
Zeus faber	2								
Total	**7 083**	**3 664**	**395**	**1**	**234**		**531**	**15**	**8**

ANNEX V. SPECIES/GROUPS CAUGHT IN 30 BOTTOM TRAWL HAULS ALONG THE COAST OF TANZANIA

Each haul was standardised to 60 minutes of towing. Weight -summarised catch in all hauls, No. of fish – summarised no of fish, No. of hauls – no. of hauls with catch.

Species/groups	Weight (kg)	No. of fish	No. of hauls
Encrasicholina heteroloba	1 397.0	499 078	2
Trichiurus lepturus	697.1	1 227	4
Upeneus taeniopterus	620.3	24 584	6
Decapterus macrosoma	559.4	18 840	8
Saurida undosquamis	374.1	3 036	25
Rexea prometheoides	353.4	4 583	8
Secutor insidiator	307.6	19 823	3
Carangoides malabaricus	279.0	6 178	8
Argentina euchus	231.7	4 025	8
Leiognathus elongatus	193.0	16 418	7
MYCTOPHIDAE	173.8	29 088	8
Nettastoma parviceps	165.6	1 957	2
Polymixia berndti	153.4	6 497	11
Centrophorus granulosus	136.4	67	3
Zenion sp.	124.4	1 232	1
Aluterus monoceros	115.4	46	2
Upeneus moluccensis	113.3	3 530	5
Gazza minuta	105.3	5 570	3
Decapterus russelli	103.3	1 462	8
Polysteganus coeruleopunctatus	102.5	97	4
Abalistes stellatus	93.1	148	9
Himantura jenkinsii	89.9	8	2
Scomberomorus commerson	85.4	54	4
Leiognathus berbis	84.5	41 814	5
Upeneus bensasi	82.4	6 823	6
Peristedion weberi	80.7	943	11
Rastrelliger kanagurta	77.2	1 270	8
Decapterus macarellus	74.0	1 434	1
Dussumieria acuta	72.7	2 182	6
Loligo duvauceli	72.1	2 462	14
Rachycentron canadum	69.8	31	1
Sphyraena obtusata	67.1	1 424	2
Malacocephalus laevis	63.8	1 047	13
Sphyraena jello	55.3	102	1
Apogon sp.	52.9	3 601	11
Lepidotrigla faueri	47.7	230	4
Diagramma centurio	47.6	14	2
Muraenesox bagio	45.0	14	1
Thenus orientalis	44.4	275	8
Polymetme corythaeola	43.8	2 189	8
Uroteuthis duvaucelii	43.2	1 373	11
Squalus megalops	43.2	48	6
Stephanolepis auratus	42.4	6 990	3
Uranoscopus archionema	41.4	201	4
Epinephelus coioides	40.6	2	1
Epinephelus malabaricus	39.3	25	2
Lethrinus variegatus	36.0	598	1
Gerres filamentosus	34.9	173	4
Narcine rierai	34.9	125	3
Sepia vermiculata	34.8	90	4
Lagocephalus sceleratus	34.2	645	5
Centrophorus moluccensis	34.1	14	2
Lophiodes mutilus	31.2	26	4
Chirocentrus dorab	29.7	94	2
Satyrichthys adeni	29.5	71	4
Balistes capriscus	29.2	23	1
Arius africanus	28.7	8	2

Species/groups	Weight (kg)	No. of fish	No. of hauls
Arothron stellatus	28.6	11	4
Nemipterus metopias	28.2	327	3
Chlorophthalmus agassizi	28.1	424	3
Gymnocranius griseus	27.7	198	5
Chaunax sp.	27.4	209	10
Etmopterus sentosus	27.2	399	7
Arius venosus	27.1	6	1
Polyipnus indicus	26.0	3 910	7
Gnathanodon speciosus	25.9	4	1
Leiognathus leuciscus	23.9	1 504	3
Ariopsis sp.	23.6	10	1
Cynoglossus capensis	23.1	369	2
Teixeirichthys jordani	22.9	1 773	4
Sepia hieronis	22.6	404	12
Pomadasys maculatus	21.9	168	1
Upeneus sp.	21.0	1 317	1
Leiognathus equulus	20.9	278	3
SHRIMPS	20.5	989	2
Scolopsis bimaculata	20.5	1 494	1
Dalatias licha	20.1	2	1
Citharoides macrolepis	19.9	249	7
Parupeneus sp.	19.9	360	2
Rhinobatos holcorhynchus	19.5	16	1
Tydemania navigatoris	19.2	481	11
Lutjanus sanguineus	19.2	4	1
Acroteriobatus zanzibarensis	18.9	11	2
Linuparus somniosus	18.9	42	3
Squatina sp.	18.3	2	1
Peristedion sp.	17.8	36	1
Carangoides fulvoguttatus	17.7	2	1
Lutjanus rivulatus	17.6	2	1
Ostracion cubicus	17.6	16	3
RAJIDAE	17.5	108	3
Spratelloides sp.	17.5	1 016	7
Pteromylaeus bovinus	17.4	2	1
Psettodes erumei	17.2	10	3
Nemipterus japonicus	16.1	238	4
Pseudobalistes flavimarginatus	16.1	5	1
Priacanthus hamrur	16.1	142	2
Paramonacanthus pusillus	16.0	669	3
CARIDAE	15.9	1 168	1
Chascanopsetta lugubris	15.9	30	2
Zeus capensis	15.7	6	1
Pseudorhombus elevatus	14.7	1 530	1
Citharus sp.	14.7	178	1
Upeneus sulphureus	14.7	466	1
Penaeopsis balssi	14.6	133	1
Terapon theraps	14.4	341	4
Carangoides sp.	13.8	191	3
Atrobucca nibe	13.7	42	4
Diodon hystrix	13.1	11	2
Carangoides dinema	12.9	4	1
Bythalaelurus lutarius	12.7	159	6
Polymixia sp.	12.6	545	3
Pristiophorus nancyae	12.6	93	2
Lethrinus sp.	12.5	242	3
Epinephelus areolatus	12.1	6	2
Lethrinus crocineus	11.9	2	1
Pterois miles	11.6	47	3
Heterodontus ramalheira	11.4	2	1
Spratelloides gracilis	11.4	5 115	1
SOFT SPONGES	11.2	0	1
Lestrolepis intermedia	10.9	442	6
Tetrosomus concatenatus	10.9	33	3
Stolephorus waitei	10.4	4 956	1

Species/groups	Weight (kg)	No. of fish	No. of hauls
Ventrifossa mystax	10.0	299	1
Octopus sp.	9.9	16	1
Torpedo sp.	9.8	3	1
Sphyraena putnamae	9.8	22	3
Carangoides chrysophrys	9.7	25	1
Nemipterus zysron	9.3	163	2
Parapenaeus investigatoris	9.2	800	1
Aristeus antennatus	9.0	440	3
Otolithes ruber	9.0	29	2
Scorpaena scrofa	8.7	16	1
Neobythites kenyaensis	8.5	117	5
Parascolopsis sp.	8.3	266	1
Apistus carinatus	8.3	491	2
Xenolepidichthys dagleishi	8.2	315	2
Parapenaeus sp.	8.1	1 245	1
Lagocephalus inermis	8.1	53	2
Unidentified fish	8.0	386	7
Holohalaelurus punctatus	7.9	4	1
Neoepinnula orientalis	7.8	231	3
Unidentified crustacean	7.6	694	2
CARCHARHINIDAE	7.6	2	1
Pomadasys kaakan	7.6	2	1
PENAEIDAE	7.5	377	3
Fistularia petimba	7.5	196	9
Drepane sp.	7.4	67	1
PROCESSIDAE	7.2	114	1
Cubiceps sp.	6.8	86	1
Parabembras sp.	6.7	38	2
Raja sp.	6.6	45	3
Zeus faber	6.5	7	1
Stolephorus indicus	6.4	251	3
Eridacnis radcliffei	6.3	123	4
Sepia sp.	6.1	134	3
Neobythites cf somaliaensis	5.9	18	2
Sepia trigonina	5.9	63	1
Seriolina nigrofasciata	5.8	7	2
Thyrsitoides marleyi	5.8	129	2
Upeneus vittatus	5.6	50	2
OSTRACIIDAE	5.6	12	1
Carcharhinus sp.	5.5	9	1
Bothus sp.	5.3	55	2
Gymnoscopelus sp.	5.3	1 147	2
Himantura sp.	5.2	22	1
Atlantoraja cyclophora	5.2	16	1
Nemipterus bipunctatus	5.1	56	3
Sphyraena flavicauda	5.1	126	1
Cynoglossus lida	5.0	122	7
Dipturus stenorhynchus	5.0	6	1
Decapterus kurroides	5.0	346	3
Paracallionymus costatus	4.9	244	1
Carcharhinus limbatus	4.7	2	1
Sepia prashadi	4.7	30	2
Physiculus natalensis	4.7	43	5
Lutjanus fulvus	4.7	578	1
Penaeus semisulcatus	4.6	116	2
Projasus parkeri	4.6	293	1
Pseudobalistes fuscus	4.4	2	1
Cyclichthys sp.	4.3	8	1
Cociella sp.	4.3	16	1
Ornithoteuthis volatilis	4.3	54	1
Lethrinus microdon	4.1	49	2
Ruvettus pretiosus	4.1	28	2
Metanephrops mozambicus	4.1	48	1
DIODONTIDAE	4.0	3	1
Carangoides ferdau	4.0	86	1

Species/groups	Weight (kg)	No. of fish	No. of hauls
Heptranchias perlo	4.0	6	1
Haliporoides triarthrus	3.9	92	1
Seriola rivoliana	3.8	0	1
Nemipterus sp.	3.6	31	2
Palinurus sp.	3.5	27	1
Lepidopus caudatus	3.3	6	1
Bembrops sp.	3.3	27	2
Lactoria diaphana	3.3	14	1
ARGENTINIDAE	3.3	26	1
Cubiceps whiteleggii	3.2	76	1
Dysomma anguillare	3.2	27	1
SYNODONTIDAE	3.2	32	1
SPARIDAE	3.1	204	1
Parupeneus macronemus	3.0	60	1
Plotosus lineatus	3.0	531	4
Diaphus knappi	2.9	0	1
Scombrops boops	2.8	41	1
OPHIDIIDAE	2.8	52	1
Parupeneus heptacanthus	2.7	48	3
Tylerius spinosissimus	2.6	8	1
Cociella sp.	2.6	16	1
Solenocera agoensis	2.6	54	1
Torquigener hypselogenion	2.5	81	2
Etelis carbunculus	2.4	2	1
Callionymus marleyi	2.4	0	1
Branchiostegus doliatus	2.3	15	2
Arothron hispidus	2.3	2	1
Oxyurichthys petersii	2.3	168	1
Thryssa vitrirostris	2.3	112	1
CREPIDULIDAE	2.2	16	1
Velodona togata	2.2	8	2
Cruriraja parcomaculata	2.2	26	2
Bothus myriaster	2.2	79	2
Leucoraja wallacei	2.2	20	1
Saurida tumbil	2.2	6	1
Ateleopus natalensis	2.2	4	1
Bembrops platyrhynchus	2.1	47	3
Sepia latimanus	1.9	75	1
Narcine sp.	1.9	12	1
Lepidotrigla sp.	1.9	37	2
Satyrichthys investigatoris	1.8	60	2
Lethrinus nebulosus	1.8	32	1
Avocettina sp.	1.8	26	2
Siganus sutor	1.8	45	1
Polynemus sextarius	1.7	56	1
Lophius sp.	1.7	16	1
Paratriacanthodes retrospinis	1.6	51	3
Uroconger lepturus	1.6	9	1
Bathycongrus wallacei	1.6	19	2
Halaelurus sp.	1.6	16	1
Rostroraja alba	1.6	3	1
Antigonia rubescens	1.5	71	2
Choerodon gymnogenys	1.5	40	3
Trachinocephalus myops	1.5	47	1
Ibacus novemdentatus	1.5	8	1
Phosichthys argenteus	1.5	101	1
Paramonacanthus sp.	1.5	179	2
Stomias boa boa	1.4	265	3
Antigonia capros	1.4	25	3
Lagocephalus guentheri	1.4	66	2
Neoscopelus sp.	1.3	8	1
Lepidoteuthis sp.	1.3	12	1
Lactoria cornuta	1.3	4	1
Arnoglossus sp.	1.2	56	2
Caranx tille	1.2	23	1

Species/groups	Weight (kg)	No. of fish	No. of hauls
Dussumieria acuta	1.2	62	1
Harpiosquilla harpax	1.2	2	1
Macrorhamphosus scolopax	1.2	116	5
Pliotrema warreni	1.2	8	1
Metapenaeus monoceros	1.2	118	1
Etmopterus sp.	1.2	24	1
Caelorinchus trunovi	1.1	12	2
Epigonus robustus	1.1	17	1
Scorpaena sp.	1.0	18	1
Mene maculata	1.0	24	2
Herklotsichthys quadrimaculat.	1.0	16	1
Coelorinchus trunovi	0.9	38	1
CHLOROPHTHALMIDAE	0.9	67	1
*Apogon quadrifasciatus***	0.8	41	4
Amanses scopas	0.8	69	1
Carangoides armatus	0.8	54	1
Pterois russelii	0.8	9	1
Zenion hololepis	0.8	83	1
CRABS	0.7	18	1
Champsodon capensis	0.7	18	1
Champsodon sp.	0.7	118	1
Macrorhamphosus sp.	0.7	8	1
Rhinochimaera atlantica	0.7	18	1
CARANGIDAE	0.6	15	1
Coelorinchus sp.	0.6	35	1
Holohalaelurus regani	0.6	2	1
Monocentris japonica	0.5	4	1
Poecilopsetta zanzibarensis	0.5	29	2
Sphyraena forsteri	0.5	2	1
Upeneus guttatus	0.5	9	1
Thunnus orientalis	0.5	5	1
Lophiodes sp.	0.5	9	1
Gerres oyena	0.5	8	1
Sphyraena guachancho	0.5	8	1
DACTYLOPTERIDAE	0.5	8	1
Choerodon sp.	0.5	24	1
Synodus sp.	0.5	30	1
Cynoglossus marleyi	0.4	6	1
Sardinella gibbosa	0.4	66	1
Acropoma japonicum	0.4	6	1
Poecilopsetta zanzibarensis	0.4	8	1
Ateleopus sp.	0.4	6	1
Pontinus nigerimum	0.4	9	2
Sphyraena barracuda	0.4	9	1
Linuparus sp.	0.4	12	1
Rogadius asper	0.4	12	1
Trypauchen microcephalus	0.3	56	1
Unidentified demersal fish	0.3	28	2
Beryx splendens	0.3	9	2
Leiognathus splendens	0.3	9	1
Neobythites analis	0.3	18	1
SALPS	0.3	12	1
Synagrops sp.	0.3	6	1
Octopus cyaneus	0.3	28	1
Coelorinchus denticulatus	0.2	10	2
Samaris cristatus	0.2	16	1
Lepidotrigla multispinosa	0.2	8	1
Uroconger sp.	0.2	8	1
Citharichthys sp.	0.2	40	3
BOTHIDAE	0.2	30	1
Canthigaster sp.	0.2	23	1
Laeops natalensis	0.2	28	1
Gobius sp.	0.2	49	1
SERRANIDAE	0.2	10	1
Penaeus marginatus	0.1	2	1

Species/groups	Weight (kg)	No. of fish	No. of hauls
Oxycheilinus bimaculatus	0.1	15	1
Lepidotrigla alcocki	0.1	8	1
Parabathynomus natalensis	0.1	6	1
Bothus pantherinus	0.1	2	1
Saurida gracilis	0.1	18	2
Hoplichthys acanthopleurus	0.1	8	1
Macrorhamphosus gracilis	0.1	8	1
Parapenaeus fissurus	0.1	8	1
Apogonidae - juvenile	0.1	23	1
Echeneis naucrates	0.1	10	1
Amblygaster leiogaster	0.0	10	1
Laeops nigromaculatus	0.0	6	1
LUTJANIDAE	0.0	10	1
Fishing gears	0.0	2	1
Glass sponge	0.0	5	1
Invertebrate	0.0	4	1
SEA URCHINS	0.0	2	1

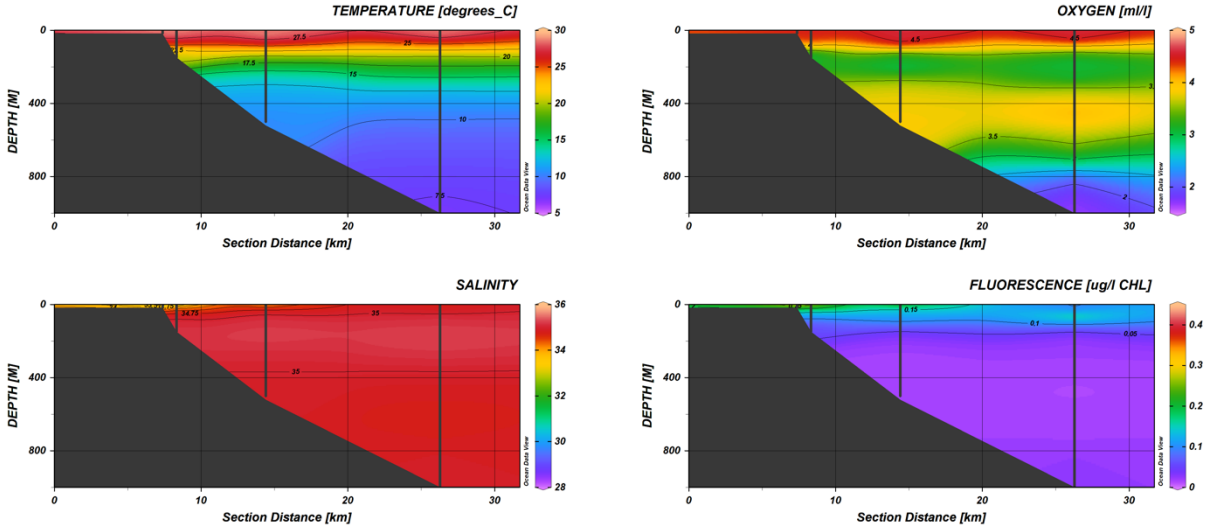
ANNEX VI. SPECIES/GROUPS CAUGHT IN 7 PELAGIC TRAWL HAULS ALONG THE COAST OF TANZANIA

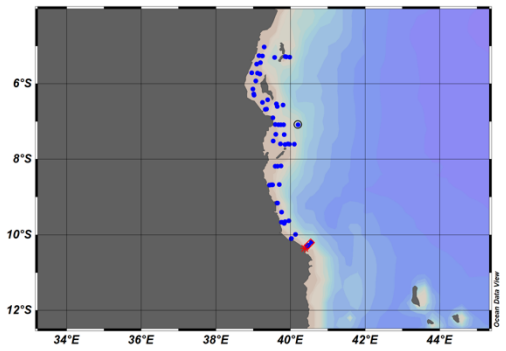
Each haul was standardised to 60 minutes of towing. Weight -summarised catch in all hauls, No. of fish – summarised no of fish, No. of hauls – no. of hauls with catch.

Species/groups	Weight (kg)	No. of fish	No. of hauls
Encrasicholina punctifer	211.5	88144	1
Rastrelliger kanagurta	53.2	74	2
MYCTOPHIDAE	49.0	19604	4
Cubiceps pauciradiatus	37.5	-	1
Leiognathus berbis	28.1	-	1
Spratelloides gracilis	17.4	10859	1
Encrasicholina heteroloba	13.6	7684	1
Decapterus macrosoma	10.9	1479	1
Amblygaster sirm	5.2	676	1
Decapterus kurroides	4.8	280	1
Onychoteuthis sp.	3.5	123	1
Trichiurus lepturus	2.9	5	1
Uroteuthis duvaucelii	2.0	235	2
Polymetme corythaeola	1.7	477	1
Leptocephalus	1.2	331	2
Lestrolepis intermedia	1.2	140	4
Leiognathus elongatus	0.9	109	1
Decapterus tabl	0.7	12	2
Muraenesox bagio	0.7	12	1
UNIDENTIFIED FISH	0.5	185	1
Seriola rivoliana	0.4	2	1
Sphyraena obtusata	0.3	15	1
Cheilopogon nigricans	0.3	6	1
Apogon sp.	0.3	32	2
Bregmaceros sp.	0.2	13	1
Dipterygonotus balteatus	0.2	8	1
LOLIGINIDAE	0.2	218	1
SEPIIDAE	0.2	23	1
Loligo duvauceli	0.2	79	1
JELLY FISH	0.2	23	1
Samaris cristatus	0.1	15	1
Scomber japonicus	0.0	4	1
Zanclus cornutus	0.0	2	1
Carangidae	0.0	66	1
Hemiramphus sp.	0.0	2	1
TETRAODONTIDAE	0.0	43	1

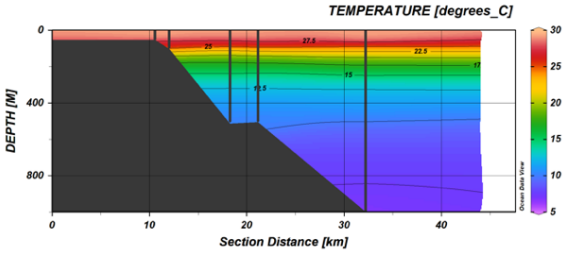
ANNEX VII. HYDROGRAPHICAL TRANSECTS

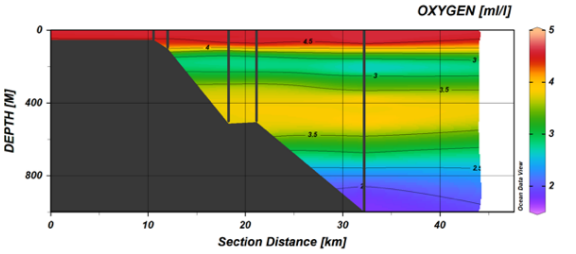
In this Annex, data obtained at super transects are presented. These transects were carried out perpendicular to the coast line, except for the transect along the Zanzibar Channel. Geographical position of the various transects are indicated in the attached maps. The transects are organised from south to north.

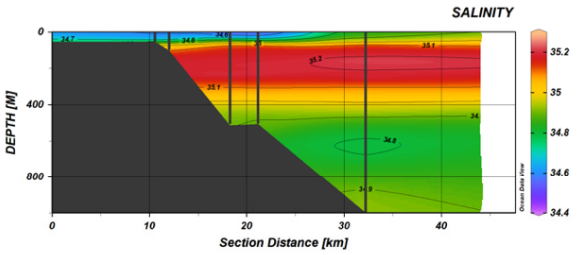


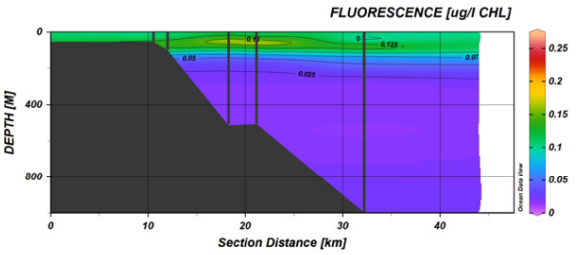


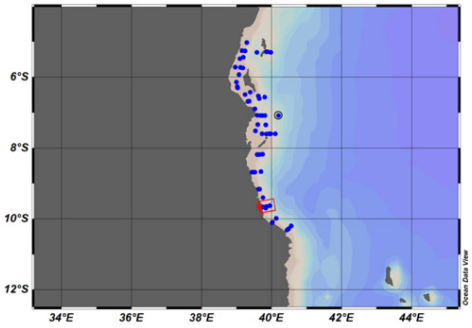
Transect 1, ~10.5°S











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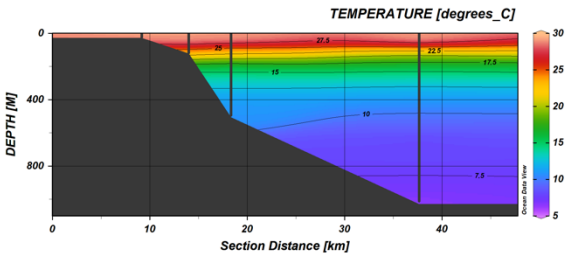
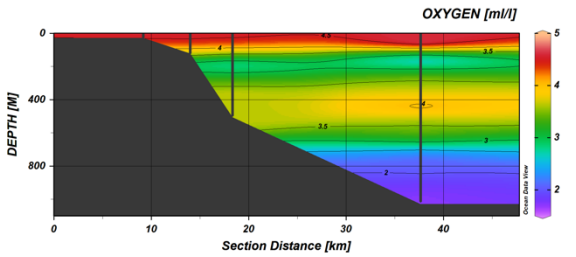
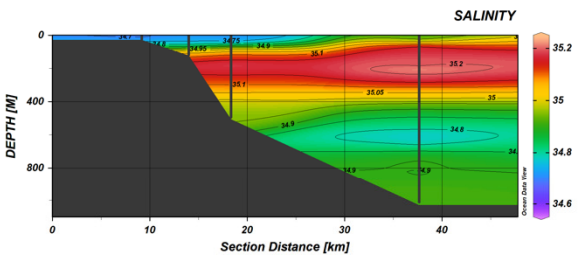
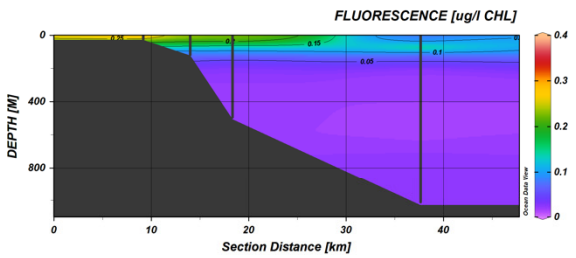
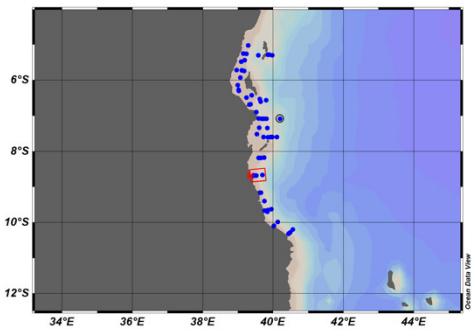


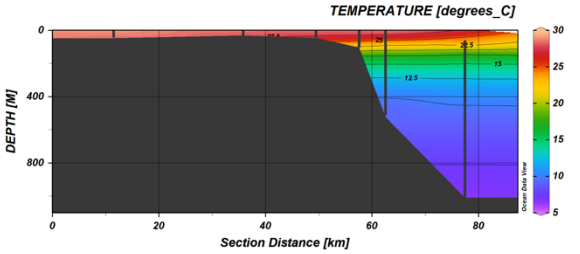


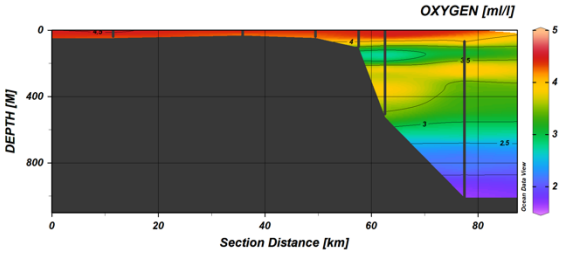


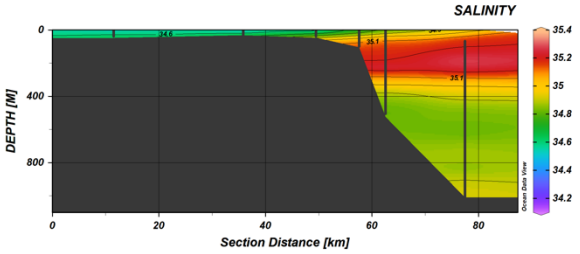


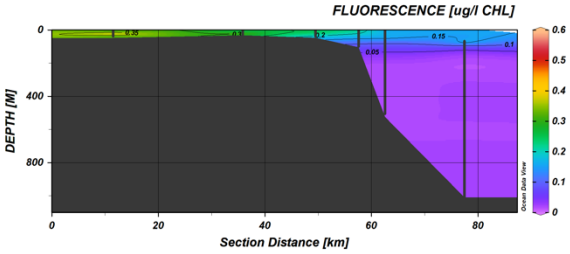


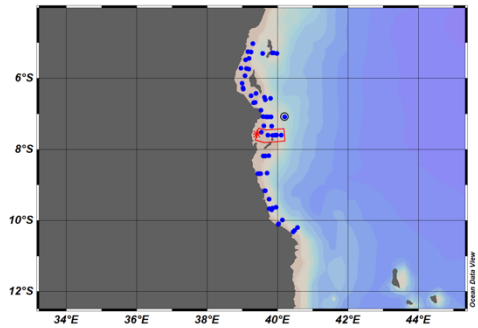
Transect 3, ~10.5°S



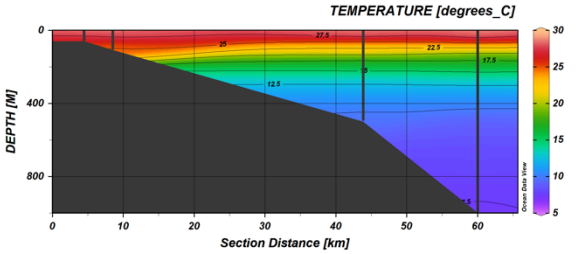


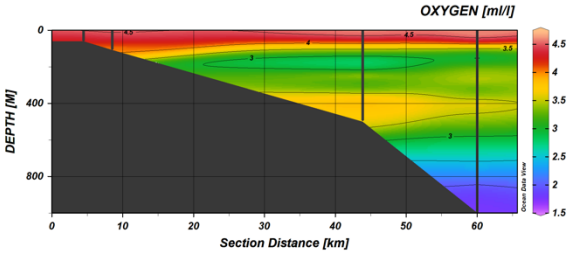


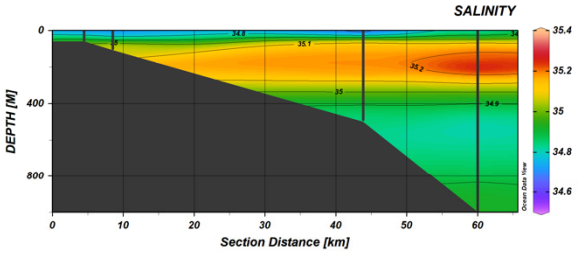


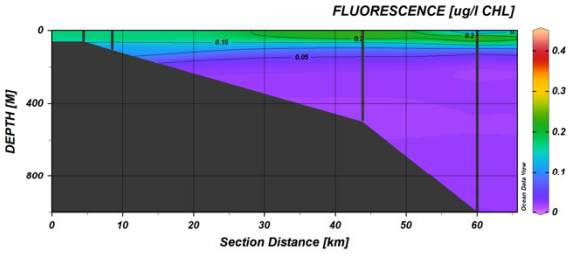


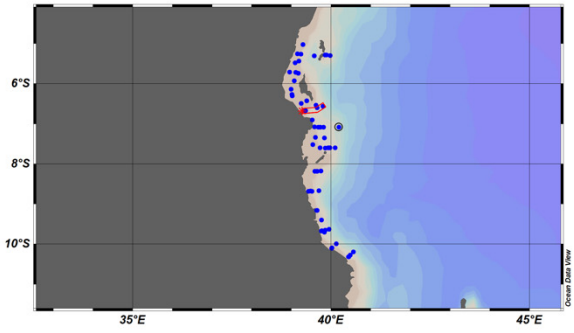
Transect 4, ~7.5°S



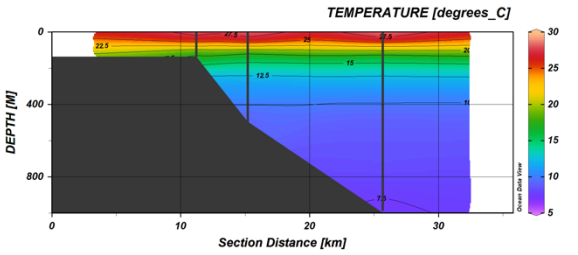


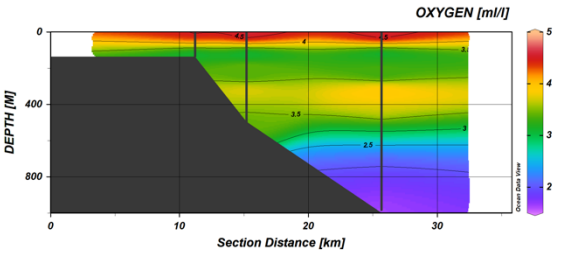


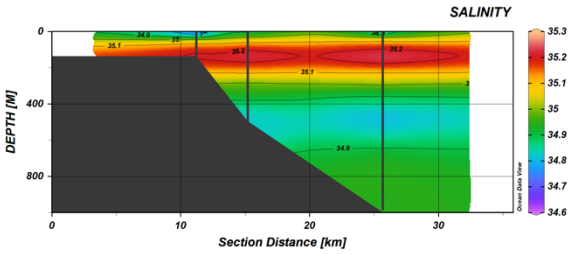


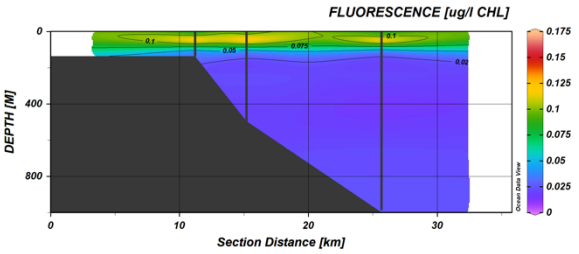


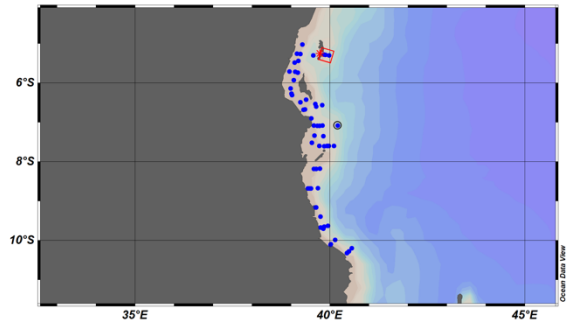
Transect 5, ~6.5°S



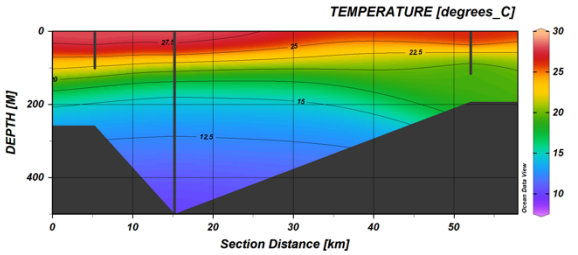


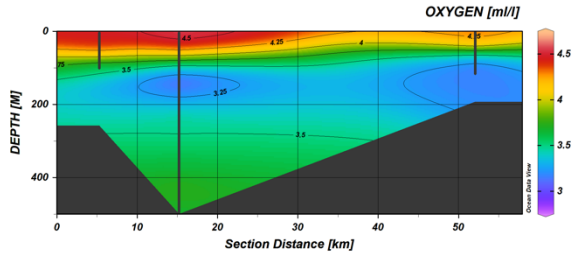


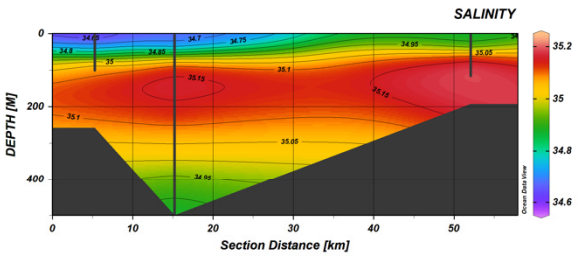


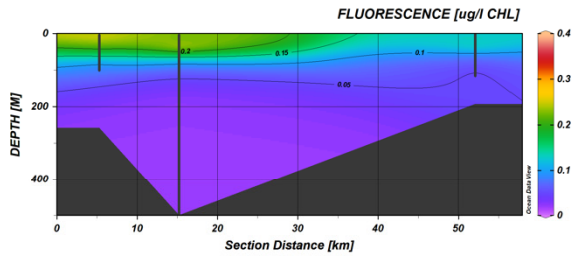


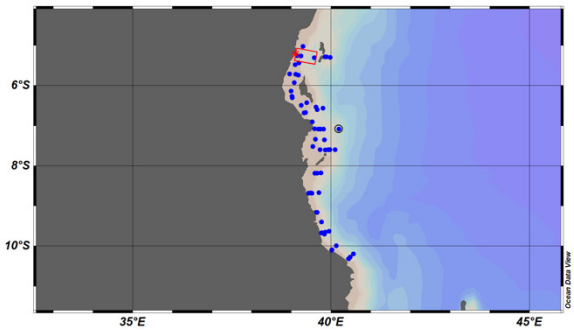
Transect 6, ~5.5°S outside Pemba



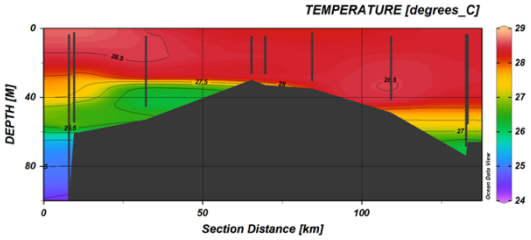


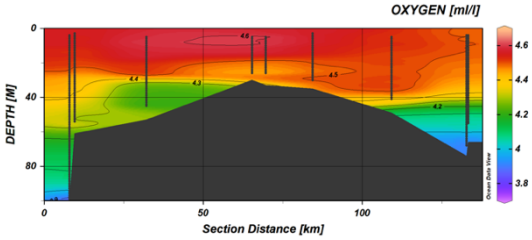


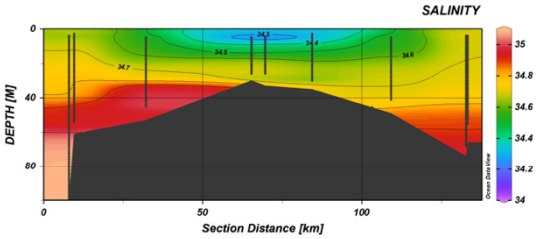


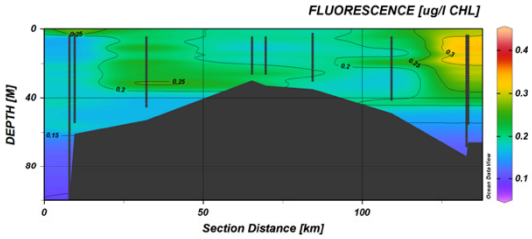


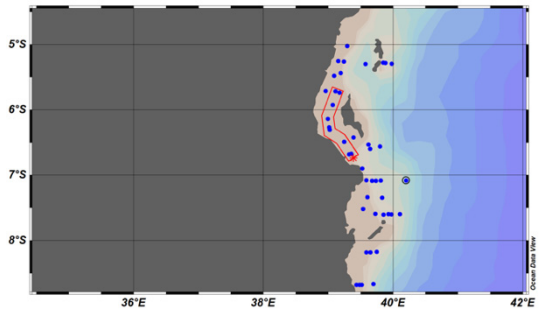
Transect 7, ~5.5°S in the Pemba channel











Transect 8, along the Zanzibar channel

ANNEX VIII. OVERVIEW OF COLLECTED SAMPLES

Gear/equipment	Samples	Preservation	Port of off Loading	Transport	Institution address	Contact person	Number	Status
Niskin bottles	Nutrients	Chloroform	Norway	Air freight	IMR	Lars Naustvoll		processed
Niskin bottles	Chlorophyll a	Frozen	Norway	Air freight	IMR	Lars Naustvoll		Processed
Algae net	Phytoplankton	Formaldehyde	Dar-es-Salam	To Zanzibar	IMS	M.s. Kyewalyanga	19	Unprocessed
Niskin bottles	DIC/TA	N/A	N/A	N/A	N/A	N/A	N/A	Processed on board
WP2 (180 µm): (1) vertical haul from max 200 m) – ½ sample, (2) vertical haul from 30 m – ½ sample	Zooplankton (biomass)	Dried	IMR	Air freight	IMR	Stamatina Isari	36	Processed
(1) vertical haul from max 200 m)- ½ sample (2) vertical haul from 30 m – ½ sample	Zooplankton identification	Formaldehyde	Dar-es-Salam	Boat	IMS	M.s. Kyewalyanga	36	Unprocessed
MultiNet (Midi, 1 x 180 µm): oblique tow from max 200 m	Fish eggs and larvae	Formaldehyde	Dar-es-Salam	Boat	IMS	M.s. Kyewalyanga	21	Unprocessed
Manta trawl (375 µm): surface tow for 15 mins	Jelly fish	Formaldehyde	South Africa	Air freight	South Africa	Mark Gibbons	Unknown	Unprocessed
Manta trawl (375 µm): surface tow for 15 mins	Microplastics	Photographed and frozen	Norway	Air freight	IMR	Bjørn Einar Grøsvik	21	Initial analysis done on board
Trawl	Unidentified fish samples	Formaldehyde	Norway	Air freight	IMR	Peter Pomasakis	Unknown	Unprocessed
Trawl	Finclips of priority species for genetic analysis	Ethanol	Norway	Air freight	IMR	Erling Kåre Stenvik	531	Unprocessed
Trawl	Standard Nansen food safety sampling	Freece-dried	Norway	Air freight	IMR	Vidar Fauskanger	142	Unprocessed
Trawl	Parasites in fish	UV-press method; frozen at -80°C (?)	Norway	Air freight	IMR	Lucilla Giulietti	Unknown	Unprocessed
Trawl - cylinder	Sediments grain size/Composition	Frozen	Norway	Air freight	IMR	Bjørn Einar Grøsvik	2x30	Unprocessed