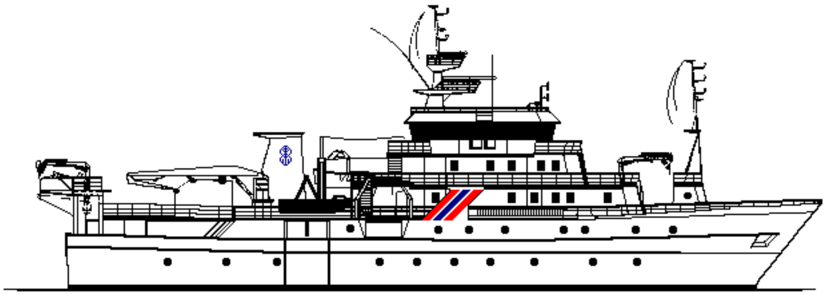


2008 ASCLME SURVEY NO. 3

Cruise report No 7/2008

8 October – 27 November 2008

by

**Tore Strømme [1], Isabelle Ansorge [2], Thomas Bornman[3], Sven Kaehler[4], Marek Ostrowski [1]
Denis Tweddle[5] and Oddgeir Alvheim [1]**

**[1] Institute of Marine Research
Bergen, Norway**

**[2] University of Cape Town
Cape Town, South Africa**

**[3] ASCLME
Grahamstown, South Africa**

**[4] Rhodes University
Grahamstown, South Africa**

**[5] South African Institute for Aquatic Biodiversity,
Grahamstown, South Africa**

Bergen April 2009

Table of contents

1. INTRODUCTION

Despite the success of the Shoals of Capricorn Marine Programme (New et al., 2007) surprisingly little is known of the ecology of the Mascarene Plateau. A key aim of the five-year ASCLME project is to develop a series of well coordinated research cruises aimed at gathering baseline information on the oceanography and ecology of the main marine ecosystems of the western Indian Ocean region. Although the ASCLME focuses on the Agulhas and Somalia Current ecosystems it was decided that a detailed survey of the Mascarene Plateau would be required to study the complex nature of the SEC upstream of both LMES. Through cooperation with the EAF-Nansen programme of FAO a pelagic fish component has been included in the surveys, thus covering the wider ecosystem. Due to resources limitations and time constrains it was not possible to include benthos and demersal resources into the investigations.

This survey is the third survey of the GEF funded “Agulhas and Somali Current Large Marine Ecosystem” (ASCLME) project.

The previous “Dr. Fridtjof Nansen” visited the Seychelles in 1978 and did a combined acoustic and demersal survey with some oceanography and plankton sampling. For 30 years this has been the baseline study as regards the fish resources of the Seychelles. The present survey thus represents an update of this baseline with increased effort on physical and biological oceanography, using modern methods.

The main objective of fisheries surveys in the 1980s was to find new resources. Today, when most of the world’s fish resources are located, and in many instances overexploited, the main focus is not on finding new resources, but to monitor the ecosystem and ensure that resource exploitation does not exceed the carrying capacity of the system. Hence an ecosystem approach - a holistic approach encompassing not only the targeted fishery species but the entire physical, chemical and biological environment - to the management of marine resources, is advocated.

This new baseline will enable Mauritus and the Seychelles within the region to monitor subsequent changes in the resources and in the environment. This is especially important today as we are in a crucial period of global warming with likely heavy impact on the coastal areas over time. The new EAF-Nansen (Ecosystem Approach to Fisheries) project with the full backup from the FAO and other UN agencies such as UNEP and the IOC will assist the coastal states in the SW Indian Ocean in following up on this important task in the years to come. This report presents an overview of work undertaken during the Mascarene survey (Leg 3 of the ASCLME cruises), which comprises of 2 parts – Part 1 Port Louis, Mauritius to Victoria, Seychelles (8.10.2008–15.11.2008) and part 2 Victoria, Seychelles to Pemba, Mozambique (18.11.2008–27.11.2008).

1.1 Aims and Objectives

Following discussion between the ASCLME and EAF-Nansen projects, the following aims and objectives were decided for the survey.

Aims

- To establish a baseline for the ecosystem of the Mascarene Plateau during Leg 1 and its ocean basins during Leg 2.
- To establish for the very first time the physical, chemical and biological characteristics of the East Madagascar Current system as a whole, its bifurcation and with special regard to its influence on the ecosystem of the adjacent continental shelf. This current system (including shelf) is one of the least known systems of the world ocean; physically, chemically and biologically (Lutjehams, 2006). The cruise has been planned to establish a baseline for all three of these disciplines, albeit a once off. It is planned to deploy current meters for long-term monitoring at a later stage to overcome this shortcoming. The ecosystem baseline assessment is expected to be completed with a special survey on the demersal fauna, (fish and benthos) in 2010.

Objectives

1. To carry out the first multi-disciplinary cruise that encompasses the whole of the Mascarene Plateau and the adjacent basin.
2. To establish the distribution of organisms on a number of trophic levels and how these are affected by the reigning current system.
3. To establish, as far as possible, the productivity, biodiversity and biomass of the pelagic ecosystem.
4. To establish the interaction of the local currents and the ecosystem over the Mascarene Plateau.
5. To determine the nature of the South Equatorial Current as a driving force for the marine ecosystem of the Mascarene Plateau.
6. To investigate demersal fish species diversity.
7. To fulfil the data management agreement contained in Appendix A.
8. To deploy two ATLAS (Autonomous Temperature Line Acquisition System) moorings at 8°S; 55°E and 12°S; 55°E.
9. To deploy four ARGO profiling floats along 55°E.

Key Questions

1. What is the influence of the South Equatorial Current on the waters and ecosystem over the Mascarene Plateau?
2. In what way is the flow of the South Equatorial Current affected by the gaps in the Mascarene Plateau?
3. Is the Mascarene Plateau characterised by an increased diversity in habitats and biota?
4. What are the main components in the Mascarene Plateau pelagic ecosystem, its distribution and abundance?
5. What are the biodiversity of the pelagic ecosystem, and the main fauna of the demersal fish community?
6. Can the Mascarene Plateau be considered a Large Marine Ecosystem on its own?
7. In what way is the flow of the South Equatorial Current affected by the Mascarene Plateau between Seychelles and Madagascar?
8. How does the Mascarene Plateau between Seychelles and Madagascar differ from the section between Mauritius and Seychelles and what are the linkages?

1.2 Participation

A total of 19 scientists and technicians participated in the survey. The full list of the participants and their affiliations is given in Table 1.

Table 1: List of cruise participants and their affiliations for Parts1 and 2 of the Mascarene Survey (Mauritius – Seychelles and Seychelles – Pemba, Mozambique).

Field	Names	Affiliation & nationalit	Gender	Portion	
				Part1	Part 2
Cruise Leader	Tore Strømme	IMR, Norwegian	Male		
Cruise Leader	Åsmund Bjordal	IMR, Norwegian	Male		
Cruise Leader (Local)	Isabelle Ansorge	UCT, South African	Female		
Oceanography	Emlyn Balarin	MA-RE, South African	Male		
Oceanography	Marek Ostrowski	IMR, Norway	Male		
Oceanography	Helena Francourt	SCMRT, Seychellois	Female		
Nutrients & phytoplankton	Thomas Bornman	ACEP, South African	Male		
Nutrients & phytoplankton	Andrea Plos	UCT, South African	Female		
Zooplankton	Mark Gibbons	UWC, South African	Male		
Zooplankton	Riaan Cedras	UWC, South African	Male		
Zooplankton	Kim Bernard	SAEON, South African	Female		
Isotopes & genetics	Sven Kaehler	RU, German	Male		
Isotopes & genetics	Jackie Hill	RU, Canadian	Female		
Fish	Sharon du Plessis	MCM, South African	Female		
Data & information	Lucy Scott	ASCLME, South Africar	Female		
Fish	Dennis Tweddle	SAIAB, British	Male		
Fish	Ryan Palmer	SAEON, South African	Male		
Fish	Rodney Govinden	SFA, Seychellois	Male		
Fish	Vincent Lucas	SFA, Seychellois	Male		
Fish/Scientific watch	Michelle Etienne	SCMRT, Seychellois	Male		
Moorings & instrumentation	Michael McPhaden	NOAA, USA	Male		
Moorings: electronics	Steven Kunze	NOAA, USA	Male		
Media (TV) / Scientific watch	Kyle O'Donaghue	50/50, South African	Male		
Technician, quality control	Oddgeir Alvheim	IMR, Norwegian	Male		
Technician, quality control	Diana Zaera	IMR, Norwegian	Female		
Instrument Chief	Tore Mørk	IMR, Norwegian	Male		
Technician, acoustic system	Ole Sverre Fossheim	IMR, Norwegian	Male		
Total				**17**	**17**

List of abbreviations

ASCLME: Agulhas Somali Current Large Marine Ecosyster
SCMRT: Seychelles Centre for Marine Research & Technology
SFA: Seychelles Fishing Authority
UM: University of Mauritius

RU: Rhodes University
SAIAB: South African Institute for Aquatic Biodiversity
OMI: Mauritius Oceanographic Institute

ACEP: African Coelacanth Ecosystem Programme
NOAA: National Oceanic and Atmospheric Administration
UCT: University of Cape Town
SAEON: South African Environmental Observation Network
MA-RE: Marine Research Institute, UCT.
UWC: University of the Western Cape
IMR: Institute of Marine Research, Norway
ISAM: Iziko-South African Museum

1.3 Narrative – Part 1

The complete survey track with environment and biological stations occupied during part 1 of the Mascarene Survey (Mauritius – Seychelles) are shown in Figure 1. The "Dr Fridtjof Nansen" left Port Louis in the evening of 8 October. Work started with completing 2 hydrographic transects remaining of the previous survey coverage around the island Mauritius,Figure 2. Work proceeded northwards with acoustic transects covering the shoals on the channel between Mauritius and Nazareth Bank.

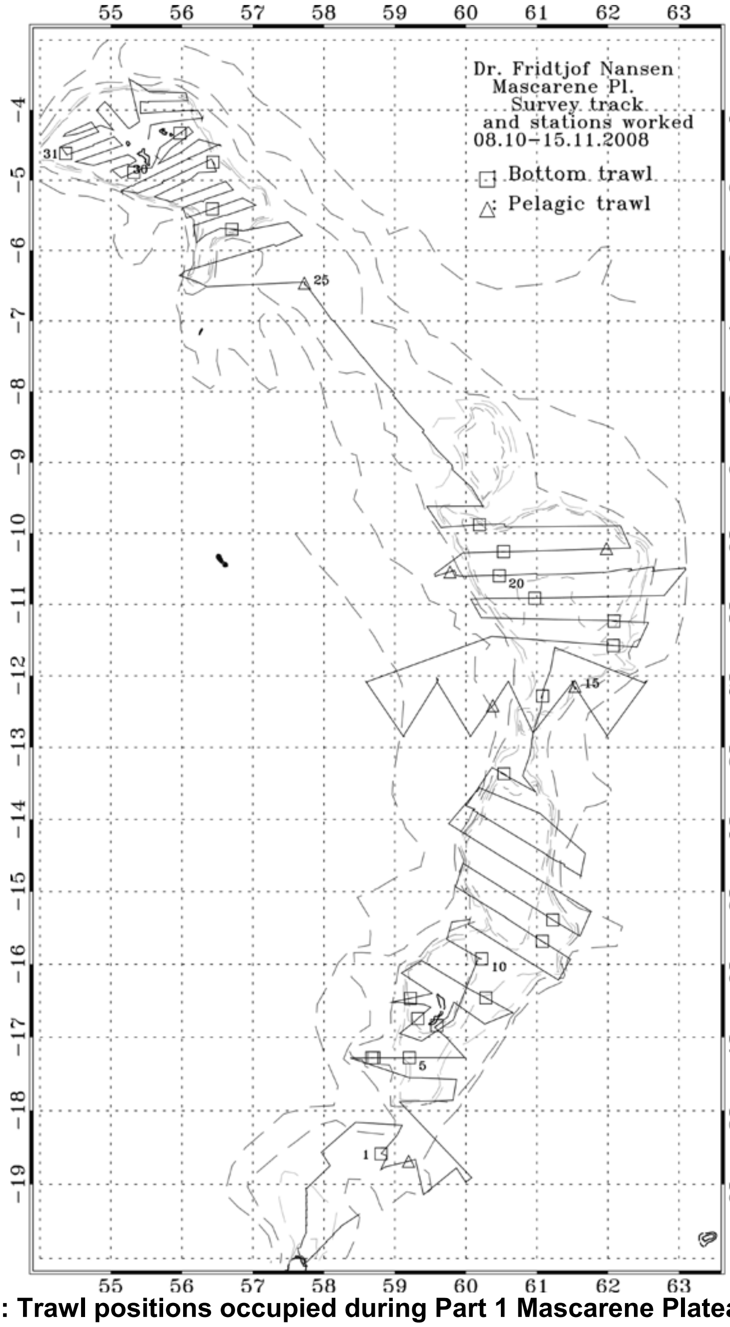


Figure 1: Trawl positions occupied during Part 1 Mascarene Plateau survey.

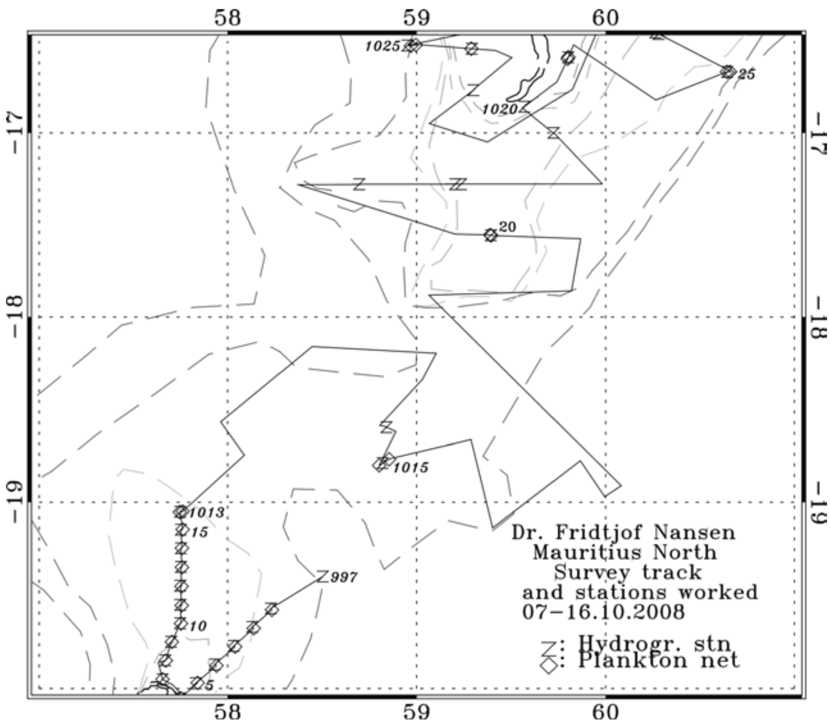


Figure 2: Cruise track with hydrographic and biological stations between the Mauritius and Nazareth Banks.

The Nazareth Bank was covered in the period 12 – 23 October (Figure 3). Acoustic transects were laid out perpendicular to the main axis of the plateau, with a transect distance of 20nm. Predetermined environment stations were sampled along the axis of the plateau. In a meeting between the scientists it was decided to lay out one reference transect with CTD, Bongo and Multinet on each of the main banks of the Mascarene (Nazareth, Saya del Malha and Seychelles Bank) in order to better analyse east-west gradients, the influence of the banks as a barrier and possible lifting of nutrients into the photosynthetic zone on the plateau or at the fringes. Bottom trawls for sampling of fish diversity were carried out when suitable bottom for trawling was located. CTD-casts were taken on each of these locations.

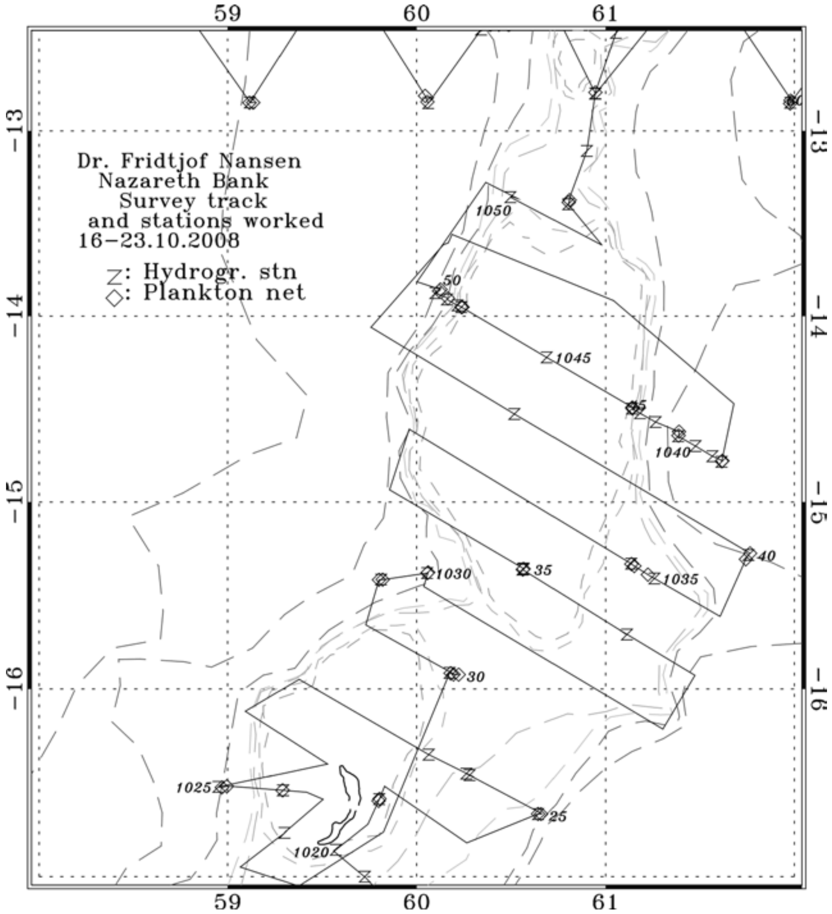


Figure 3: Cruise track with hydrographic and biological stations occupied during the Nazareth Bank section of Leg 3.

A special survey of the channel area between the Nazareth and Saya de Malha Banks and eastwards into the Mascarene Basin was carried out in the period 24-27 October (Figure 4). Recent investigations suggest that approximately 50% of the South Equatorial Current, blocked by the shallow bathymetry of the Mascarene Plateau, is channeled through this narrow gap. The aim of the special survey was to obtain a more detailed picture of the influence this region has on the throughflow of the SEC and the affect this gap could have on productivity downstream into the surface waters in the basin (Figure 18), possibly also holding previous undetected pelagic resources.

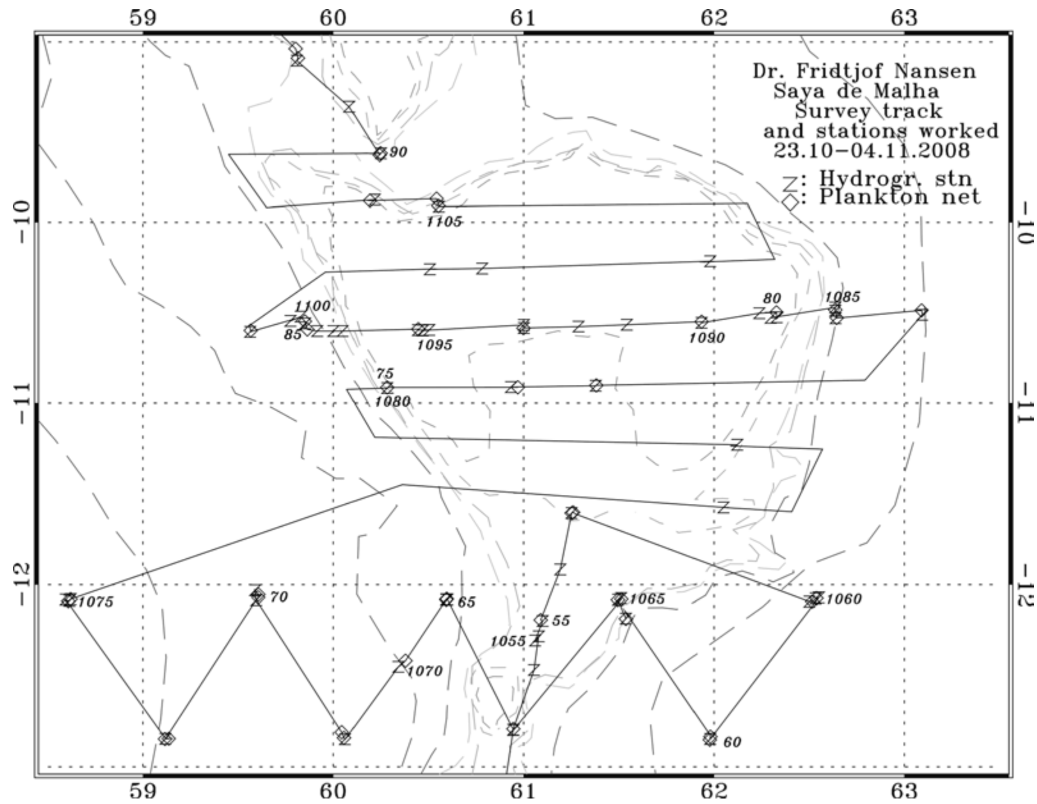


Figure 4: Detailed cruise track with hydrographic and biological stations in the deep (~1000 m) channel between the Nazareth Bank in the south and across the broad Saya de Malha Bank in the north.

The Saya de Malha Bank was covered in the period 28 October – 4 November with the same survey design as for the Nazareth Bank. Recent studies (New et al., 2007) have indicated that the SEC may act as a boundary separating nutrient rich subtropical waters from nutrient poor tropical water masses. Continued acoustic and environmental stations aimed at assessing whether there was indeed a change in the biogeochemical characteristic of this bank from the Nazareth to the south of the SEC. The east-west reference transect for interbank comparative analysis were placed close to 10°30’S (Figure 4).

The wide channel between the Saya de Malha and Seychelles Bank is also the deepest of the three channels of the Mascarene with depths ranging between 375 and 1763 and was surveyed between 4-7 November, Figure 4. Recent investigations have shown that approximately 25% of the known volume transport associated with the SEC flows through this channel (New et al., 2007). However, geostrophic velocities (Figure 18) suggests that this channel is one of higher variability then the channels to the south – suggesting that flow through may be represented through mesoscale eddies and/or meanders.

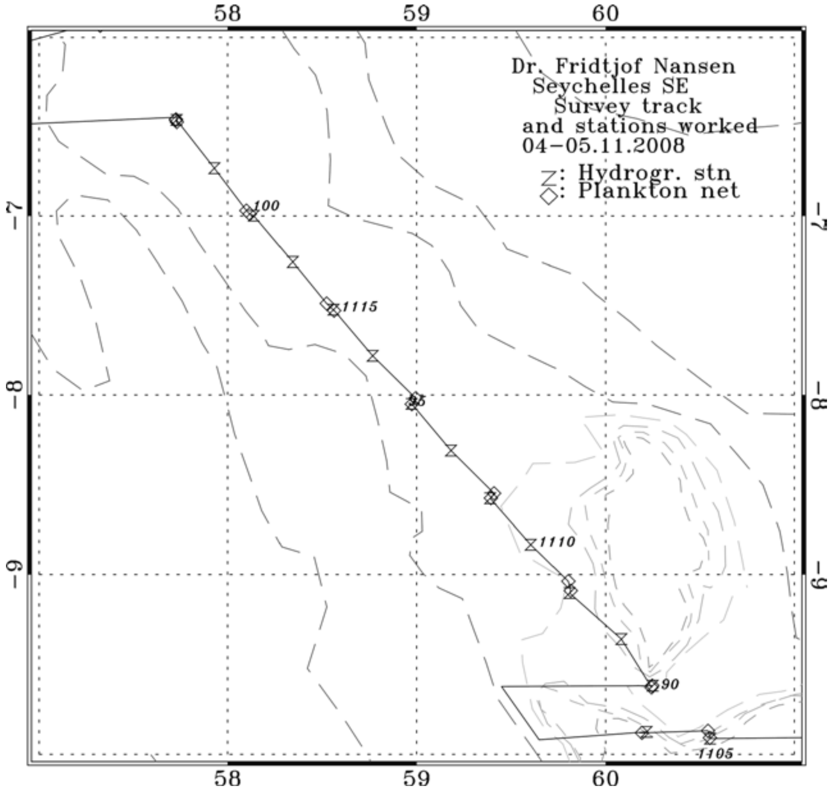


Figure 5: Detailed map with cruise track and hydrographic and biological stations occupied in the deep (~1000 m) channel between the Seychelles and the broad Saya de Malha Bank in the south.

The Seychelles Bank was surveyed in the period 7 - 15 November. Due to many shallow banks and the central islands it was not possible to survey with the same regular grid as for Nazareth and Saya de Malha. However since there were signs of higher productivity and more abundant fish resources it was decided to increase the sampling density by using an average transect distance of 10nm. The reference transect for inter bank comparative analysis was placed between stations 1130 and 1144 (05°08S, 055°08E and 04°29S, 056°31E - Figure 6). The chain of environment stations running along the axis of the Mascarene was extended into deep waters north of the bank. The survey of the Seychelles Bank was completed with a fixed station north east of the bank to record vertical migration of plankton and fish in connection with the diurnal cycle. The vessel then surveyed towards Port Victoria with the last acoustic transect and arrived in port on the late afternoon of 15 November.

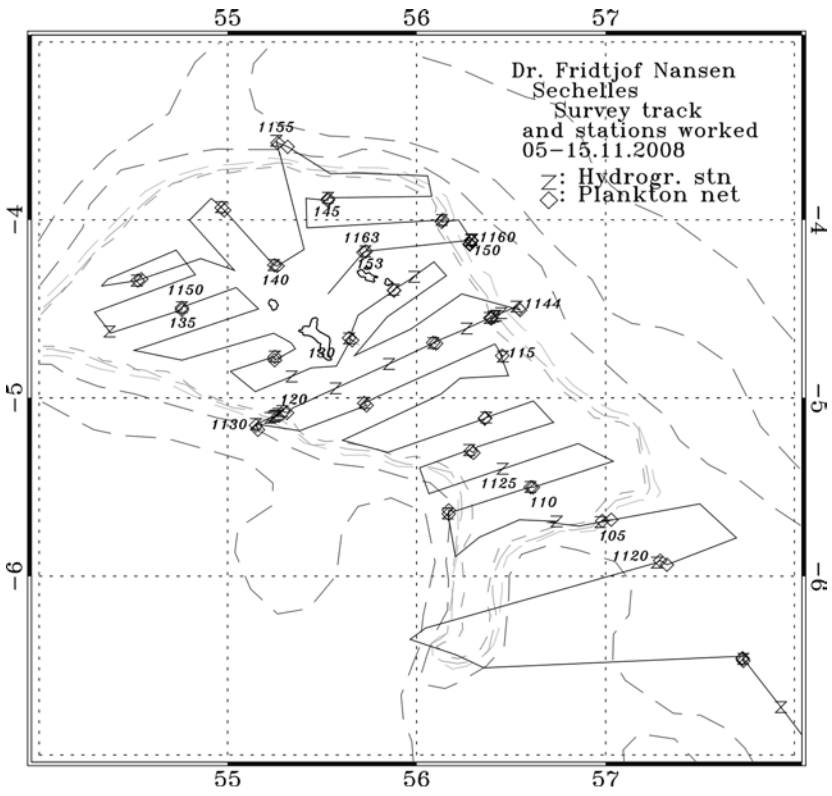


Figure 6: Cruise track with hydrographic and biological stations worked over the broad Seychelles Bank.

The weather conditions during part 1 of the Mascarene survey were mostly favourable and did not interfere with the work except for a tropical cyclone "ASMA" in the period 18-21 October that forced an interruption of the survey for two days.

Following departure from Seychelles at 08:00 on 18 November the RV Dr Fridtjof Nansen continued with the survey of the north-western extent of the Mascarene Plateau and the surrounding Mascarene Basin and the deployment of a number of ATLAS moorings and ARGO floats.

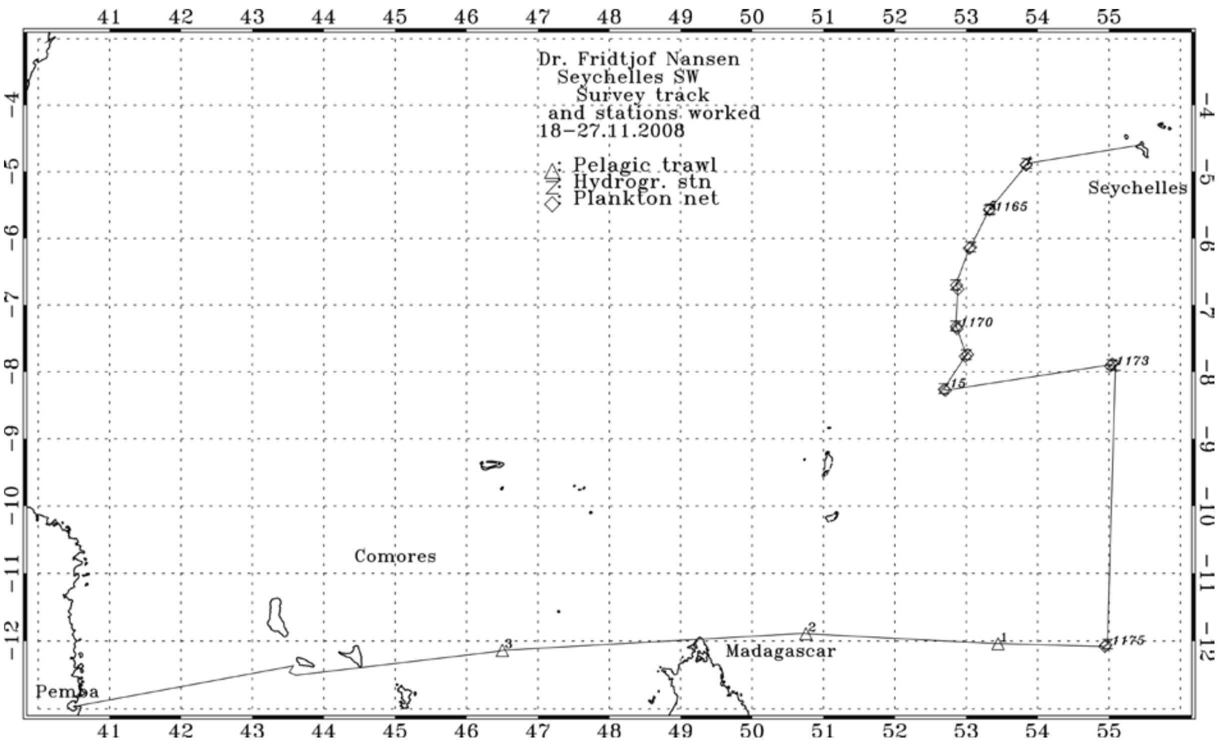


Figure 7: Cruise track with hydrographic and biological stations worked during part 2 of the Mascarene survey. The positions of the 2 ATLAS moorings are denoted by stations 1173 and 1176.

2. METHODS

2.1 Hydrographic Sampling

CTD profiles

A total of 167 CTD stations were conducted along selected hydrographical transects during part 1 (Figure 8) with an additional 12 CTD stations occupied during part 2 of the survey.

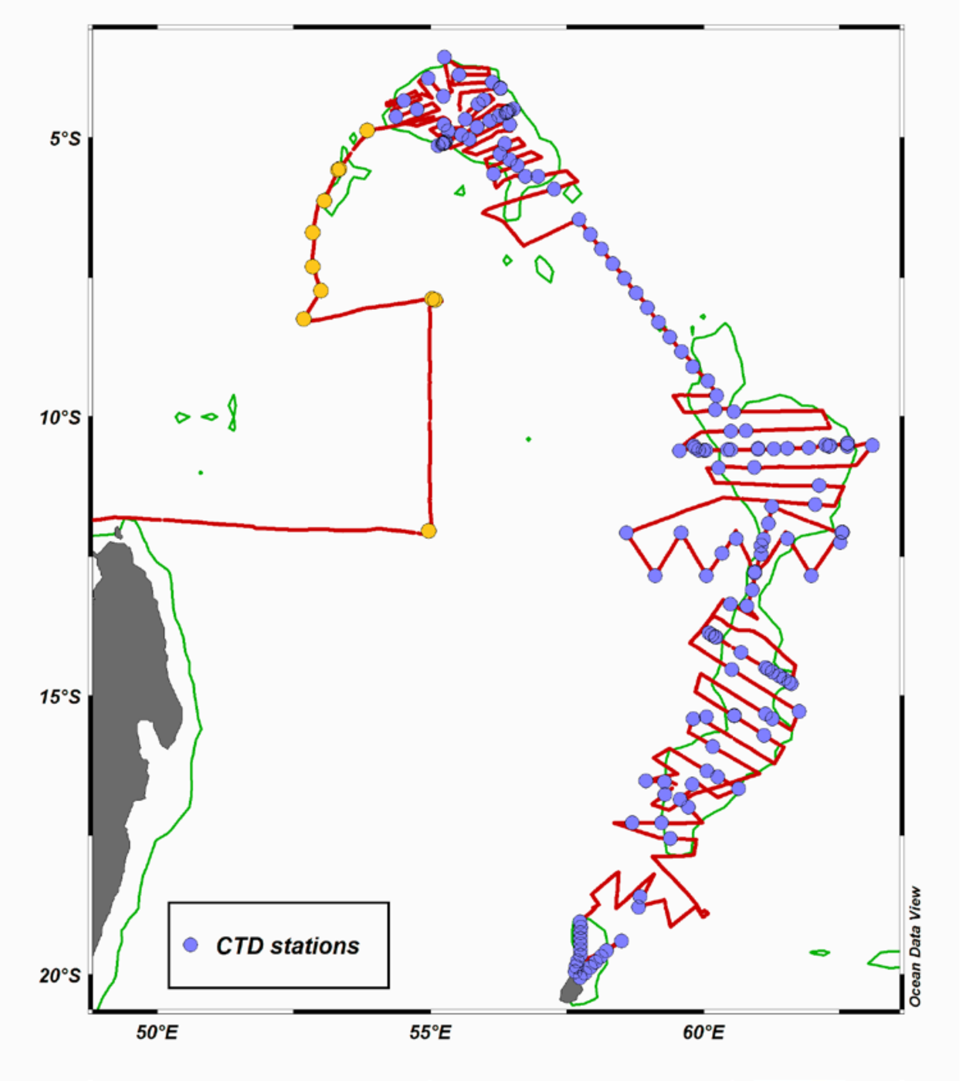


Figure 8: Map showing all CTD stations occupied during both parts (part 1 = blue dots) and (part 2 - yellow dots) of the Mascarene survey. The green line represents the 1000 m isobath.

A Seabird 911 plus CTD plus was used to obtain vertical profiles of temperature, salinity, pressure and oxygen. Real time plotting and logging was carried out using the Seabird Seasave software . The profiles along the Mascarene Plateau and surrounding shelf and slope regions were usually taken down to a few metres above the bottom, whilst offshore, due to instrument restrictions, the maximum sampling depth was 3000 m. Water samples were normally taken at 12 standard depths; 3000, 1500, 1000, 750, 500, 250, 150, f-max, 50, 20, surface (4-5 m) for nutrient analysis as well sensor calibrations of oxygen and salinity. Duplicates were collected only on F-max. Nutrient samples were frozen onboard for later analysis on land.

Duplicate oxygen samples were collected from a total of 48 stations (Figure 9). Discrepancies between the titrated oxygen concentration to the oxygen sensor averaged -0.0101

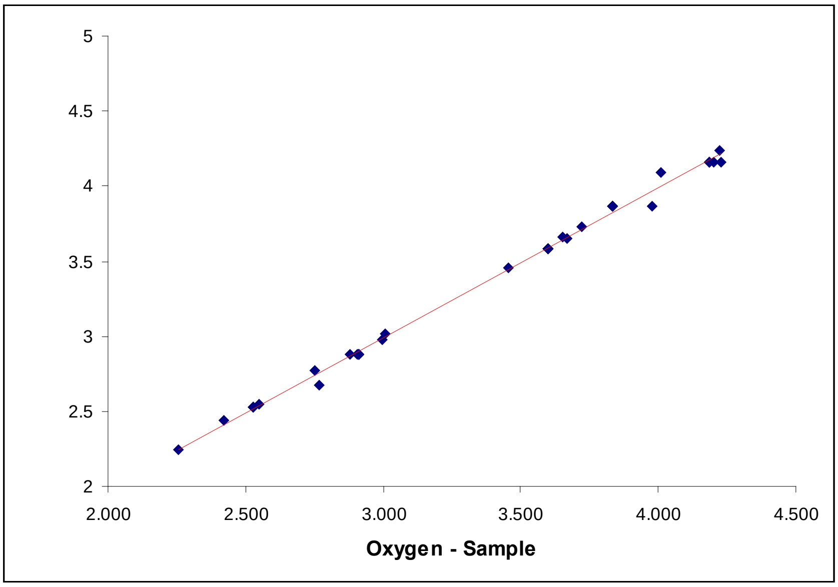


Figure 9: Graph showing differences in oxygen concentrations (ml/l) between the CTD sensor (y-axis) and water sample (x-axis) at 1500 m.

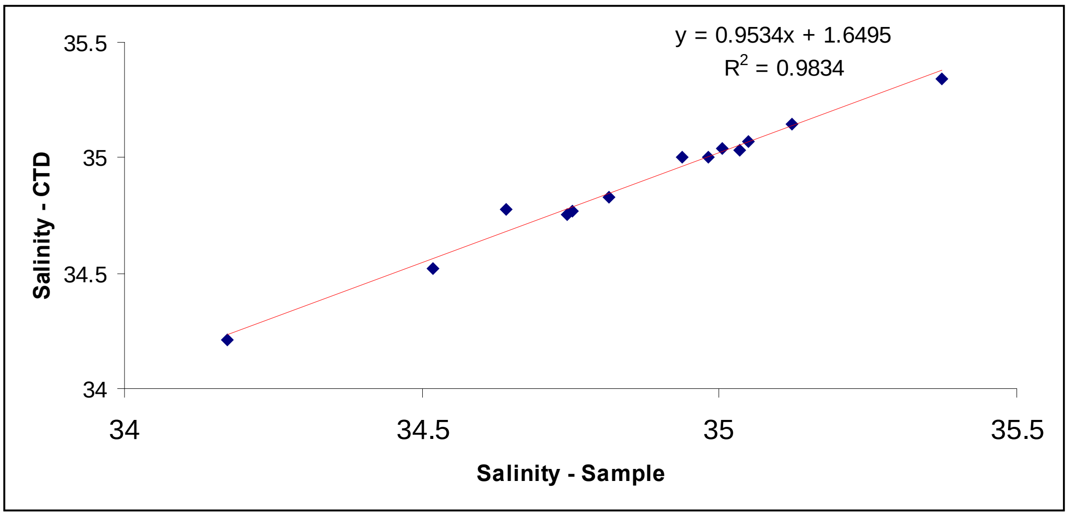


Figure 10: Graph showing differences in salinity between the CTD sensor (y-axis) and water sample (x-axis) at the 2 deepest sample depths.

Salinity samples collected at the 2 deepest depths were analysed using a 8410A Gildline portasal. Salinity calibration with the Portasal salinometer showed a regression factor of 0.9834 (**Figure 10**).

Also attached to the CTD was a Chelsea Mk III Aquatracka fluorometer. It measures chlorophyll a concentration in microgrammes per litre with an uncertainty of 3%. Factory slope and offset remained consistent at 0.921 and -0.02.

XBT

A total of 25 XBT (Expendable Bathythermograph - Table 2, Figure 11) were deployed in the narrow channel separating the Nazareth and Saya de Malha Banks.

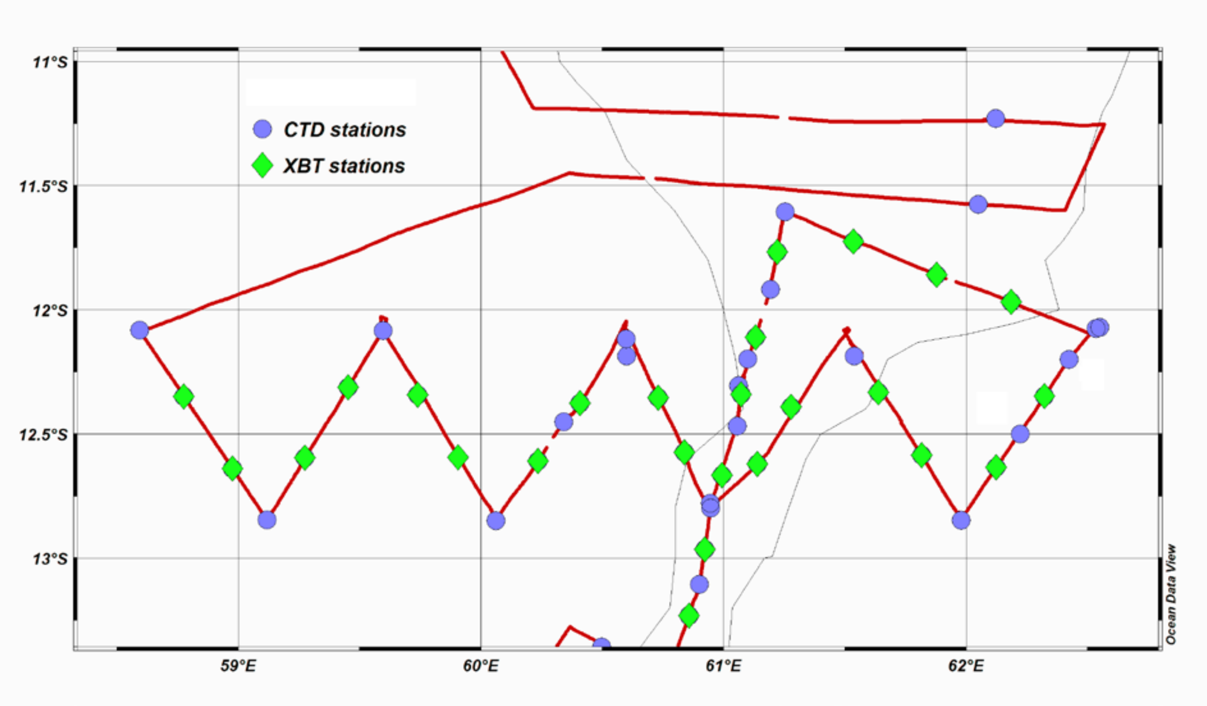


Figure 11: Map showing the distribution of XBT and CTD stations occupied in the narrow channel between the Nazareth and Saya de Malha banks.

Sippican Deep Blue XBTs were used and temperature collected to a maximum depth of 760 m. Only a single XBT failed (station 9020) and had to be repeated.

Table 2: Table showing the deployment position for each XBT. Only 9 out of the 25 stations (36%) were shallower than the maximum sampling cast for a Deep Blue XBT.

Stati	Date	GM	Latitude (°	Longitude (°	Depth (
9001	2008/10/	21:	13 13.931	060 51.436	760
9002	2008/10/	23:	12 57.887	060 55.383	412
9003	2008/10/	00:	12 40.010	060 59.550	450
9004	2008/10/	04:	12 20.413	061 04.323	271
9005	2008/10/	10:	12 06.627	061 07.880	299
9006	2008/10/	12:	11 46.004	061 13.268	283
9007	2008/10/	17:	11 43.436	061 32.058	245
9008	2008/10/	19:	11 51.513	061 52.702	248
9009	2008/10/	21:	11 58.083	062 11.088	2300
9010	2008/10/	06:	12 20.862	062 19.388	3936
9011	2008/10/	08:	12 38.089	062 07.425	3582
9012	2008/10/	15:	12 35.160	061 48.952	3454
9013	2008/10/	17:	12 19.920	061 38.220	760
9014	2008/10/	03:	12 23.476	061 16.701	289
9015	2008/10/	04:	12 37.248	061 08.370	1303
9016	2008/10/	08:	12 34.462	060 50.295	399
9017	2008/10/	09:	12 21.190	060 43.810	1785

9018	2008/10/	17:	12 22.562	060 24.521	2427
9019	2008/10/	20:	12 36.541	060 14.121	3476
9020	2008/10/	03:	12 37.359	059 55.475	3572
9021	2008/10/	05:	12 20.487	059 44.358	3599
9022	2008/10/	13:	12 18.747	059 27.190	3821
9023	2008/10/	15:	12 35.787	059 16.476	3895
9024	2008/10/	22:	12 38.356	058 58.540	4040
9025	2008/10/	00:	12 20.906	055 46.524	4143

Surface Thermosalinograph

The SBE 21 Seacat thermosalinograph was running routinely during the survey, obtaining samples of sea surface salinity and relative temperature and fluorescence (5 m depth) every 10 seconds. An attached in-line Turner Design SCUFA Fluorometer continuously measured Chlorophyll A levels [RFU] at 5 m below the sea surface while underway during the entire cruise. TSG data is extremely high resolution and given the length of the survey it was decided to prevent overloading ODV with excessive data points to reduce the data into a 1:10 resolution i.e. a reading every 100 seconds. This was achieved using the Nantherm software designed by Marek Ostrowski from IMR.

Current speed and direction measurements (ADCP)

The currents along the track were measured by using vessel mounted Acoustic Doppler Current Profiler, (VMADCP), Ocean Surveyor from Teledyne RD Instruments. The unit mounted of R/V Dr. F. Nansen consists of a single transducer using electronic beam forming to produce four beams required to measure current velocity. The units operates at frequency is 150 kHz and is triggered synchronously with the onboard EK60 echo sounder. The navigation data are provided by the Seapath Differential Global Positioning System (DGPS). The instrument was run continuously in broadband mode shallower than about 150 meter and in narrow band mode in deeper waters. The practical range of detected currents varied between 200-300 meters, depending on density of scattering layers in the water column. The ping data were averaged in 4 and 8 m vertical bins for the shallow and deep water data, respectively. Spurious data (near bottom, wire interference, etc) were edited using custom designed, prototype software (Marek Ostrowski). The currents were estimated over 5 nautical mile horizontal bins using ping-based data. Only the regions where the vessel speed was more than 6 knots was included in the computations. The raw data, computed currents and quality flags from data editing were stored using the hierarchical data format (HDF5, see www.hdfgroup.org). The quality control of these data is still an ongoing process. In this report we present preliminary results of the horizontal currents at 30 m depth (Figure 20).

Meteorological observations

Wind direction and speed, air temperature, air pressure, relative humidity, and sea surface temperature (5 m depth) were logged automatically every 1 min. on an WIMDA meteorological station.

Satellite drifters

Ten satellite drifters were deployed at select positions along the Mascarene Plateau (Part 1- Leg 3) (Figure 12).

ID	Date	GMT	Lat	Lon
70852	10.10.2008	16.31	18 09.664	58 26.850
70848	11.10.2008	04.59	18 20.220	59 01.780
63894	19.10.2008	14.21	17 17.050	61 45.260
63925	21.10.2008	22.10	14 46.604	61 36.437
70851	25.10.2008	07.51	12 04.438	62 32.703
63896	25.10.2008	17.38	12 48.900	61 57.974
63895	25.10.2008	16.25	12 11.164	61 32.265
63897	01.11.2008	00.34	10 34.541	61 17.159
63893	05.11.2008	08.45	07 18.872	58 22.826
63892	05.11.2008	11.45	07 03.062	58 10.816

These surface drifters are drogued at a depth of 18 m and are able to measure surface temperature, velocity and geographic position, which are relayed to ARGOS ground stations. SVP drifters are designed to have a drag area ratio of ~40 (i.e. the ratio of the drag area of the drogue to that of the tether and surface float), which yields a wind slippage of <1 cms^{-1} (Niiler et al., 1995). Satellite tracked drifters have become invaluable tools for studying ocean circulation and provide mixed layer velocity and temperature observations over 5 year periods in all major ocean basins. Data can be obtained from the Drifting Buoy Data Assembly Centre at http://www.aoml.noaa.gov/phod/dac/ for the SVP drifters.

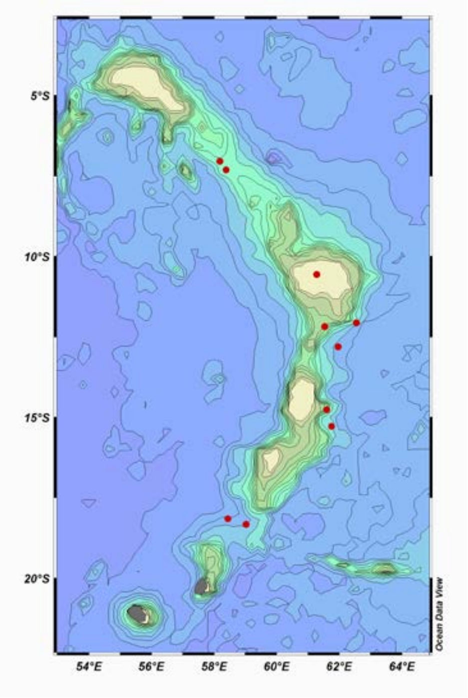


Figure 12: Position of all SVP drifter deployments during the Mascarene survey.

Fluorescence: Chl-a

Water samples were taken from up to 5 depths from Niskin bottles on the CTD rosette, dependant on other hydrographic sampling priorities. An ideal sampling regime was to have a sample from below fMax, one at fMax (maximum fluorescence noted during the CTD downcast), two between fMax and the surface, and one at the surface. Due to the shallow nature of the Mascarene Plateau often (~30 m deep) only 3 or 4 of these depths were available.

500 ml of water from each depth was filtered through a 2.5 cm diameter Whatman GF/F filter. This paper was then placed in a labelled plastic tube and 10 ml of 90% acetone was added; this sample was then stored in a refrigerator for approximately 24 hours. After this 24 hour extraction period, the samples were allowed to warm to room temperature in a dark place and the acetone solution was decanted into a borosilicate glass tube and its fluorescence measured on a Turner Designs Fluorometer, both before and after the addition of one drop of 10% HCl acid. A one minute period was allowed to elapse between the addition of the acid and the subsequent reading being taken. The sensitivity of the machine was adjusted to ensure a mid-scale reading. If the reading was off the scale at minimum sensitivity, the sample was diluted, the dilution factor noted, and a reading taken. 90% acetone blanks at all sensitivities were taken at least once every time the machine was turned on, and the machine was left on for at least 30 min prior to taking any readings. All procedures were performed in subdued light.

Fluorescence readings were converted with the following formula:

Chlorophyll a $(mg.m^{-3}/\mu g.l^{-1}) = F_D * (T/T-1)*(R_B-R_A)*(v/V)$

Where:

v = volume of acetone used for extraction (10ml)
V = volume of seawater filtered (500ml)
R_B = fluorescence reading prior to adding acid
R_A = fluorescence reading after adding acid
Acid ratio $T = R_B/R_A$
T = 2.19
T/T-1 = 1.84

F_D was a calibration factor determined prior to the cruise, dependent on the sensitivity of the fluorometer:

1x sensitivity on Min and 3.16 settings: 25.792
1x sensitivity on 20 and 31.6 settings: 2.7948
100x sensitivity on Min and 3.16 settings: 0.2876
100x sensitivity on 10 and 31.6 settings: could not be determined.

2.2 Multibeam echo sounder for bottom mapping

The EM 710 multibeam echo sounder is a high to very high-resolution seabed mapping system. Acquisition depth is approximately 3 m below the transducers, and the maximum acquisition depth is in practice limited to 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 (manually) according to depth. The receiving beam width is 2 degrees.

2.3 Phytoplankton and microzooplankton sampling

At each CTD station, water samples from fMax (maximum fluorescence noted during the CTD downcast) and the surface were taken. An attempt was made to assess flagellate abundance using a Leitz phase contrast microscope by placing one drop of seawater on a slide and placing a cover-slip over it and examining. If flagellates were found, an attempt to categorise them into taxa and an estimate of abundance was made (noting the dominant taxa), along with sketches. If no flagellates were apparent in the first drop, a second drop was examined in the same manner.

500ml of water from each of fMax and the Surface Niskin bottles was placed in separate Ütermohl settling chambers with 10 ml of prepared formalin solution (equal volume of 40% formaldehyde solution to distilled water with 100 g/l hexamine added). After settling for 24 hours in a fume cupboard, the supernatant layer was drained by slowly separating the baseplate, and the settled plankton remaining in the well were transferred using a glass micropipette into a labelled 50ml dark amber plastic bottle and stored in a plastic bin.

The samples will be analysed on shore for species composition.

Microzooplankton Community Structure

Microzooplankton are defined as phagotrophic organisms that are <200 µm in length. For the sake of operational convenience, the microzooplankton include the pico- and nanozooplankton (0.2-2 and 2-20 µm, respectively) although due to time constraints, we have only focused on the micro- and nanozooplankton (20-200 µm and 2-20 µm, respectively). Microzooplankton are abundant in the surface mixed layer of the oceans, forming a significant stock of organic carbon. Furthermore, microzooplankton have been shown to form a major trophic pathway linking phytoplankton to the higher trophic levels. The study of microzooplankton thus provides important information on the flux of organic carbon in the surface waters.

The methods described in the JGOFS Protocols (JGOFS, 1994) for microzooplankton biomass have been used. Microzooplankton biomass (mg C L^{-1}) is defined as the quantity of microzooplankton organic carbon per unit volume of sea-water. In addition to biomass, the microzooplankton samples will be identified to the finest taxonomic level possible and counted to give abundance (ind. L^{-1}).

Samples were collected at near surface and at F_{max} using a Niskin bottle rosette. Microzooplankton samples will be counted and analysed using inverted microscopy. Microzooplankton biomass will be estimated based on appropriate volume to organic carbon ratios obtained from the literature. Heterotrophic nanoplankton will be examined using epifluorescence microscopy.

In addition to the analysis of microzooplankton community structure, trial grazing studies were conducted in order to ascertain the relative importance of microzooplankton as grazers of phytoplankton in the region. Unfortunately, due to time constraints, only 2 dilution and 3 trophic cascading studies were conducted. The dilution experiments were conducted according to (Landry and Hassett, 1982), while the trophic cascading experiments were adapted from (Calbet and Landry, 1999).

Frozen samples from leg 1 were also worked up and prepared/ stored as above

2.4 Zooplankton sampling

Zooplankton samples were collected with Hydrobios MultiNet MiDi zooplankton sampler that takes up to five discrete samples at predefined depths while measuring the water flow through the net. The aim was to collect depth-stratified information on the abundance and distribution of zooplankton and to collect zooplankton for genetic analysis. The obliquely-hauled multi-net configuration was 5 nets, fitted with 180 µm mesh. The net was towed obliquely at a speed of 2 - 2.5 knots at five depth strata, from just above the bottom of the surface where deemed possible, and was retrieved at a speed of 0.5 - 1.0 $m.s^{-1}$. Nets were triggered at either 100 m intervals during deep casts (to a maximum depth of 500 m) or at intervals <20 m during shallow casts (<100 m). The ship's personnel deployed the net at each environmental station except when severe wind prevented deployment. No adjustments to the sampling protocols were made for day or night.

The samples collected were rinsed into the cod end and thoroughly washed into a sieve with a 100 micron mesh. The contents of the sieve were then washed into a sample jar using a water bottle filled with ambient seawater. Labels showing full station details, net number and sampling depth range were placed into the sample jars, which were topped up with 40 ml of 40% formalin. The lids of all sample jars were labelled with station details – including net and station number. The main types of zooplankton observed in each sample were identified and recorded in the log. Any medusa or other obstructions found in plankton samples were fixed and preserved separately (with full labels). Large specimens of other interesting taxa were removed, fixed and preserved separately, with full labels.

Jars were placed in the plastic fish box provided for 24 hours. At the end of each haul, after the samples had been processed, the cod ends were inspected for damage, repaired if necessary, and replaced on the nets. After 24 hours, the approximate volume of zooplankton in each sample was recorded and entered into the logbook. Thereafter, the samples were stored for further analysis on land.

Every 10th zooplankton haul were stored in sample jars filled with 96% ETOH. Samples were labelled and stored in the freezer. After 24 hours, the ETOH was replaced; and then again after a further 48 hours.

Bongos

A bongo net with 180 µm and 375 µm mesh nets was deployed at most environmental stations. The bongo was deployed to 200 m (where possible) and retrieved over 20 min. A flow meter was mounted inside the mouth of one net and the meter readings before and after each tow, along with the time down, was recorded. Tows generally lasted 45 minutes.

The 180 µm sample was immediately drained into a 180 µm sieve and wet weight was determined. Thereafter, the sample was preserved with formaldehyde in 250/500 ml jars (made up to 10% formaline). Jars were labelled and stored for later analysis in Grahamstown.

The 375 µm sample, intended for stable isotope analysis, was serially size-fractioned through 4 mm, 2 mm, 1mm, 500 µm and 280 µm sieves and representative taxa from each size-fraction were collected. In order to quantify the effect of gut clearance on isotope signatures, in some cases, the remaining animals from select size classes were placed into floating cages in filtered seawater (0.7 µm) bounded by 180 µm mesh, Isotope samples were then collected over a number of time series events. All isotope samples were transferred without water into separate labelled Eppendorf vials, pressed against the side of the vials, and then left open in an oven at 50˚C for 48 hours before being capped and stored. Labelling was restricted to the outside of the bottle only.

Frozen samples from leg 1 were also worked up and prepared/ stored as above

2.5 Biological fish sampling

The trawl catches were sampled for species composition by weight and number. The deck sampling procedure is described in more detail by Strømme (1992). Length measurements (TL/FL (depending on tail form) and SL, to 0.5 cm below) were taken for the more common species of fisheries interest on stations where caught in reasonable abundance. Few prawns and squid were caught and thus only numbers and weights were recorded, plus basic biological information for those samples kept for study. Basic information recorded at each fishing station, i.e. trawl hauls, is presented in Annex I. Pooled length frequency distributions, raised to catch per hour, of selected species by area are shown in Annex II.

As the Mascarene Plateau is an area that has been subjected to only limited fish surveys in the past, emphasis was placed on ensuring that all fish species caught during the survey were identified as far as possible and good representative samples of all species (particularly those that could not be identified with certainty using the literature available on board) were preserved. Whenever possible, a series of specimens over the size range sampled for each species was pinned out and fins fixed with formalin before storage in 10-15% formalin to ensure that the specimens were in good condition for morphometric measurements for taxonomic study. All fish species were photographed while very fresh to get perfect colour detail to use in the illustrations for the forthcoming book on the fishes of the Western Indian Ocean. The samples were placed in drums of formalin for storage, either separated by trawl number in large perforated ziplock bags or by reference number tied by string to the gills or caudal peduncle, until they are delivered to SAIAB, where they will be transferred to 70% ethanol. Smaller specimens have been stored by trawl number in 2L plastic jars in many cases. Large fish specimens too big to preserve on board were stored in the vessel's freezer until they can be delivered to SAIAB.

At least three individuals of all species taken during the survey were sampled for DNA. Tissues were also taken from three specimens of representative species for isotope analysis. These sampled specimens were measured and pictures taken with labels.

DNA: Muscle tissue was taken from the right side of the fish, or from the ventral in the case of flatfish. This was done in order to keep the left side in good condition for a reference picture (with sample tag). The tissue was removed from below the lateral line on the caudal peduncle after cleaning away skin and scales. Muscle tissue was cut and placed into 1.5 ml Eppendorf tubes containing 95% ethanol and a unique number for identification (e.g. ACEP 08-001). A label with the same identification number used for the DNA tube was attached to the specimens through the mouth and gills for future reference. Fin clips were taken from elasmobranchs for DNA analysis.

Stable Isotope sampling: Muscle tissue was taken from below the lateral line on the tail fin peduncle after cleaning away skin and scales. The tissue sample was placed in a 1.5 ml Eppendorf tube, placed in a 50^{o} C oven and dried with the lid open at this temperature for 48 hours. Permanent markers were used to label the outside of the tube, in addition to a sticky label on the lid. When possible, 3 individuals of the same species from each trawl were sampled. Once dried, Eppendorf tubes were closed and stored in a "cryobox". Full cryoboxes were wrapped in clingfilm for moisture protection and stored in a bin for subsequent analysis on shore.

For both DNA and stable isotope tissue samples, all equipment used was cleaned between specimens. The working surface used was also wiped clean and dried every time before a new individual was sampled in order to avoid contamination. Only one spreadsheet was used to record DNA, stable isotope sample and voucher specimen data.

Voucher specimens were kept for every species from which DNA and isotopes samples were collected. All specimens were fixed as for the taxonomic collection.

All DNA tissue samples were store in plastic containers by trawl number. All trawl containers with DNA were put in a plastic bucket labelled ASCMLE-LEG3 and kept in the freezer. The name of the person that collected the samples were included in the bucket labels in case questions arise at a later stage.

2.6 Productivity Stations

Primary production stations were conducted along two transects, one through a gap in the plateaux and one across the Saya de Malha bank. Productivity was estimated by the ^{13}C incorporation technique.

Before incubations were initiated, all containers, bottles, filter-funnels etc were acid washed. Water for the experiments was collected by CTD from predefined light-depths that were determined from a light-cast before sampling commenced. The five sampling depths corresponded to 100%, 50%, 25%, 12.5% and 1.25% of surface PAR (at 2m depth). At each sampling depths 10 l of water was collected (i.e. 2x Niskin Bottles). Whenever possible, 24 hr incubation experiments were started and ended during dark hours. Where this was not possible, bottles were kept in the dark (wrapped in black plastic) until the incubation was started and after the incubation (i.e. before filtering). In all cases, incubations were initiated within 30 min of water collection and filtration occurred within 10 min of termination of the experiment.

Exactly 2 l of water was siphoned into each of three Schott bottles from each depth (i.e. three replicates per depth). Bottles were kept in the dark until spiking with 4ml of prediluted $NaH^{13}CO_3$ (99 atom% ^{13}C; 240 µmol per bottle). The concentration of bicarbonate was chosen to represent approx 4-8% of total DIC. Spiking occurred at the incubation chambers. The chambers were covered with Lee neutral density filters that transmitted the above light percentages. Bottles in the incubation chambers were flushed and cooled with surface water from the scientific water supply. Incubations were conducted for 24 hrs.

From the remaining water sample at each light depth, salinity, temperature, pH and alkalinity were determined. These are used to derive the concentration of dissolved inorganic Carbon (DIC) at the start of the incubation (Strickland and Parsons 1968).

After 24 hrs, bottles were removed from the incubation chambers, kept in the dark and immediately filtered in triplicate onto pre-combusted (5 hrs at 480˚C) 47 mm GFF filters. GFF filters were then dried at 50˚C for 24 hrs and stored in an airtight container for carbon stable isotope analysis back in South Africa.

Nitrate isotopes

1 l water samples were collected in acid cleaned bottles for nitrogen isotope analysis in nitrates. Samples were collected at the surface (2 m), Fmax, 250m and 750m) at pre-selected stations. Samples were frozen after collection for analysis in South Africa.

Isotopes in Particular Organic Matter (POM)

Particulate organic matter collected from the water column reflects primarily phytoplankton (i.e. sources of production). POM was collected from Fmax (5 l) by CTD and the surface (2 m by bucket, 10 l sample size). After collection, water was filtered through precombusted (5 hrs at 480˚C) 47 mm GFF filters. Filters were then dried at 50˚C for 24 hrs and stored in an airtight container for carbon and nitrogen stable isotope analysis back in South Africa.

Sponge Collection for Pharmaceutical Bioprospecting

Sponges and soft corals were collected from demersal trawls (Table 3) and frozen for subsequent analysis by the marine natural products research group at Rhodes University, South Africa. The samples were photographed and individually bagged before being stored in the blast freezer as -18°C. The photographs will aid the identification of the frozen specimens. A total of 54 samples were collected at 7 stations.

The sponge specimens will be transported frozen to Grahamstown where they will be stored at -20°C in the Chemistry Department at Rhodes University. Small portions of each sponge will be taken as voucher specimens for identification (Dr Toufiek Samaai, Marine and Coastal Management). Another small portion will be lyophilized (freeze dried) and extracted with methanol. The methanol extract will be screened using nuclear magnetic resonance spectroscopy to identify potentially interesting biomolecules (natural products). The extracts will also initially be screened in a number of bioassays in South Africa including anti-malarial assays (Professor Pete Smith, University of Cape Town), anti-cancer assays (Dr Denver Hendricks, University of Cape Town) and at Rhodes for activity against trypanosomiasis (sleeping sickness) and leishmania (a tropical disease common in west and east Africa). The latter two screens are being sent from Rutgers University in the USA as part of the GIBEX (Global Initiative for Bioexploration) "screens to nature" programme. Further screening in other pharmaceutical screens will be contemplated at a later stage. Extracts that show good activity in the primary screens will be subjected to bioassay guided isolation of the natural products responsible for the activity. The chemical structures of the bioactive natural products will be determined using the facilities already in place in the Department of Chemistry, Rhodes University.

Table 3: Positions and Trawl numbers of where sponge samples were collected.

Trawl #	Longitude	Longitude	Deptł	Date	GMT	Duration	Samples Collected
6	16 50.4	59 35.4	60	2008/10/13	22:31	14.9	KB001-2; 4-5; 7-8; 010
8	16 28.0	59 13.1	47	2008/10/15	04:28	15.7	KB011-020
13	13 21.9	60 32.1	240	2008/10/23	12:25	30.3	KB021-024
17	11 34.6	62 04.6	47	2008/10/29	05:03	31.5	KB025-036
20	10 35.9	60 28.2	39	2008/11/01	06:41	25.9	KB037-052
24	9 52.8	60 11.5	31	2008/11/03	12:08	27	KB053-055
31	4 37.0	60 11.5	59	2008/11/12	14:28	23.5	KB056-057

2.7 Biomass estimates

Acoustic abundance estimation

A SIMRAD ER 60 Echo sounder was used to survey the water column and the echograms were stored on files. The acoustic biomass estimates were based on the integration technique. The Large Scale Survey System (LSSS) from MAREC was used for integration and allocation of the integrated s_A-values (average area back scattering coefficient in m^2/NM^2) The splitting and allocation of the integrator outputs (s_A-values) was based on a combination of a visual scrutiny of the behaviour pattern as deduced from echo diagrams, LSSS analysis and the catch composition. The mean integrator value in each sampling unit (s_A-values) was divided between the following standard categories/groups of fish: Pel 1 (Clupeoid species), Pel 2 (Carangids, Scombrids, Leiognathids and associated pelagic like barracudas and hairtails), Dem (Demersal species), Meso (Meseopelagic species), Plank (Plankton).

The following target strength (TS) function was applied to convert s_A-values (mean integrator value for a given area) to number of fish by category:

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

or in the form

$$C_F = 1.26 \cdot 10^6 \cdot L^{-2} \qquad (2)$$

where L is the total length and C_F is the reciprocal back scattering strength, or the so-called fish conversion factor. Generally, in order to split and convert the allocated s_A-values (m^2/NM^2) to fish densities (number per length group per NM^2) the following formula was used.

$$N_i = A \cdot s_A \cdot \frac{p_i}{\sum_{i=1}^{n} \frac{p_i}{C_{Fi}}} \qquad (3)$$

where: N_i = number of fish in length group i
A = area (NM^2) of fish concentration
s_A = mean integrator value (echo density) in area A (m^2/NM^2)
p_i = proportion of fish in length group i in samples from the area
C_{Fi} = fish conversion factor for length group i

$$N = \sum_{i=1}^{n} N_i \qquad (4)$$

Further, the traditional method is to sum the number per length group (N_i) to obtain the total number of fish:

The length distribution of a given species within an area is computed by simple addition of the length frequencies obtained in the pelagic trawl samples within the area. In the case of co-occurrence of target species, the s_A value is split in accordance with length distribution and catch rate in numbers in the trawl catches. Biomass per length group (B_i) is estimated by applying measured weights by length (W_i) when available or theoretical weights (calculated by using condition factors), multiplied with number of fish in the same length group (N_i). The total biomass in each area is obtained by summing the biomass of each length group:

$$B = \sum_{i=1}^{n} N_i \overline{W}_i \qquad (5)$$

The number and biomass per length group in each concentration are then added up to obtain totals for each region.

However, the combination of low s_A value recorded, few PEL1 and PEL2 in the bottom trawl catch and few pelagic trawls made the splitting by length groups unreliable. Therefore, a theoretic mean length of 23 cm was used to convert the s_A values by stratum (Equation 3) to number of fish. Equation 5 was used to convert the number of fish in the defined average length class (23 cm) to total estimated biomasses of PEL1 and PEL2.

A description of the fishing gears used, acoustic instruments and their standard settings is given in Annex III.

2.8 Cetacean Observations

Observations were done between 8h30 and 17h30, with observation periods of 1h30, followed by a 30min break. A 360° survey was done when the weather conditions permitted.

Every 1h30 the following were recorded: GPS position, sea state (Beaufort's scale), cloud cover, wind speed (in knots) and depth. All this data were recorded again for each sighting.

Table 4: Positions of cetacean observations.

N° observation	Date	Specie	GPS position	Number	Depth
G1	13/10/20	Humpback whales (*Megaptera Novaeangliae*)	17° 16' 46''S 58° 33' 38'' E	10-15	60 m
G2	25/10/20	Unindentified large baleen whales	12° 51' 17'' S 61° 58' 47'' E	2 (perhaps 3)	More than 30 m
G3	26/10/20	Bottlenose dolphins (*Tursiops truncatus*)	12° 47' 53'' S 60° 56' 45''E	Around 3	1000 m
G4	03/11/20	Like Bryde's whale (*Balaenoptera edeni*)	09° 51' 11'' S 60° 32' 25'' E	2 (mother and calf)	1300 m
G5	05/11/20	Like Bryde's whale (*Balaenoptera edeni*)	06° 59' 55'' S 58° 00' 50'' E	1	1600 m
G6	06/11/20	Dolphins	06° 12' 23'' S 56° 16' 58'' E	Only 2 sa (by breach	1000 m
G7	07/11/20	Common dolphin OR Striped dolphi (*Delphinus delphis* or *Stenella coeruleoalba*)	05° 42' 47'' S 56° 48' 45'' E	Only 1 sa (by breach	40 m
G8	10/11/20	Bottlenose dolphins (*Tursiops truncatus*)	04° 32' 19'' S 56° 25' 16'' E	5	60m
G9	11/11/20	Bottlenose dolphins (*Tursiops truncatus*)	04° 34' 39'' S 55° 40' 28'' E	3	45 m

2.9 Mooring Deployments during Part 2

Logistics and Personnel

PMEL mooring equipment and Argo floats were shipped to Seychelles and loaded on board the day before the ship departed for Leg 2 of Cruise 3. On the day of arrival in Pemba, all remaining PMEL mooring equipment was offloaded and shipped back to the U.S. PMEL personnel on board were Mooring Technician Steven Kunze and RAMA Director Michael McPhaden.

Mooring Operations

Prior to each mooring deployment, a bathymetric survey (Figure 13, Figure 14) was conducted to identify a relatively flat spot in which to anchor the mooring. The survey was done with the single beam 18 kHz echo sounder and took about 3-4 hours to complete. These surveys need to be done only once for each mooring site since subsequent deployments with replacement moorings will aim for the same target depths and locations.

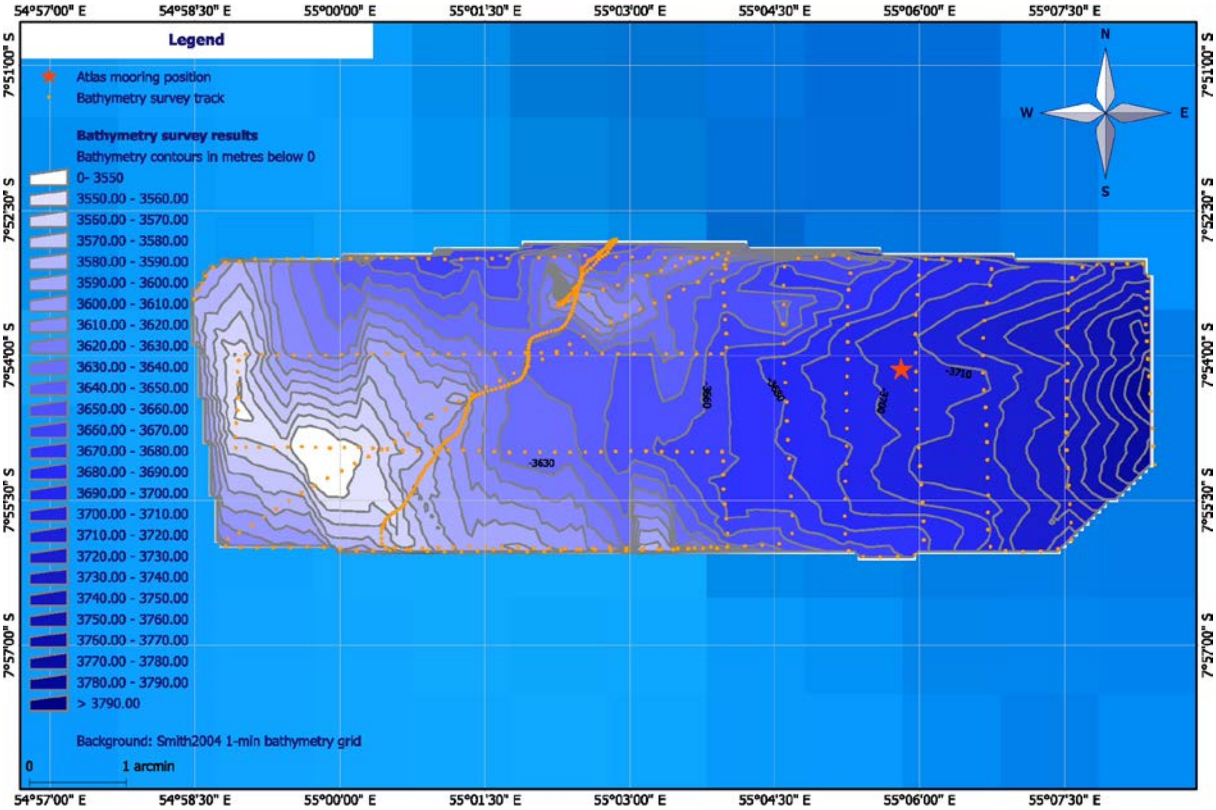


Figure 13: Bathymetric survey showing the position of ATLAS mooring 1 (red star) and the surrounding sea floor area.

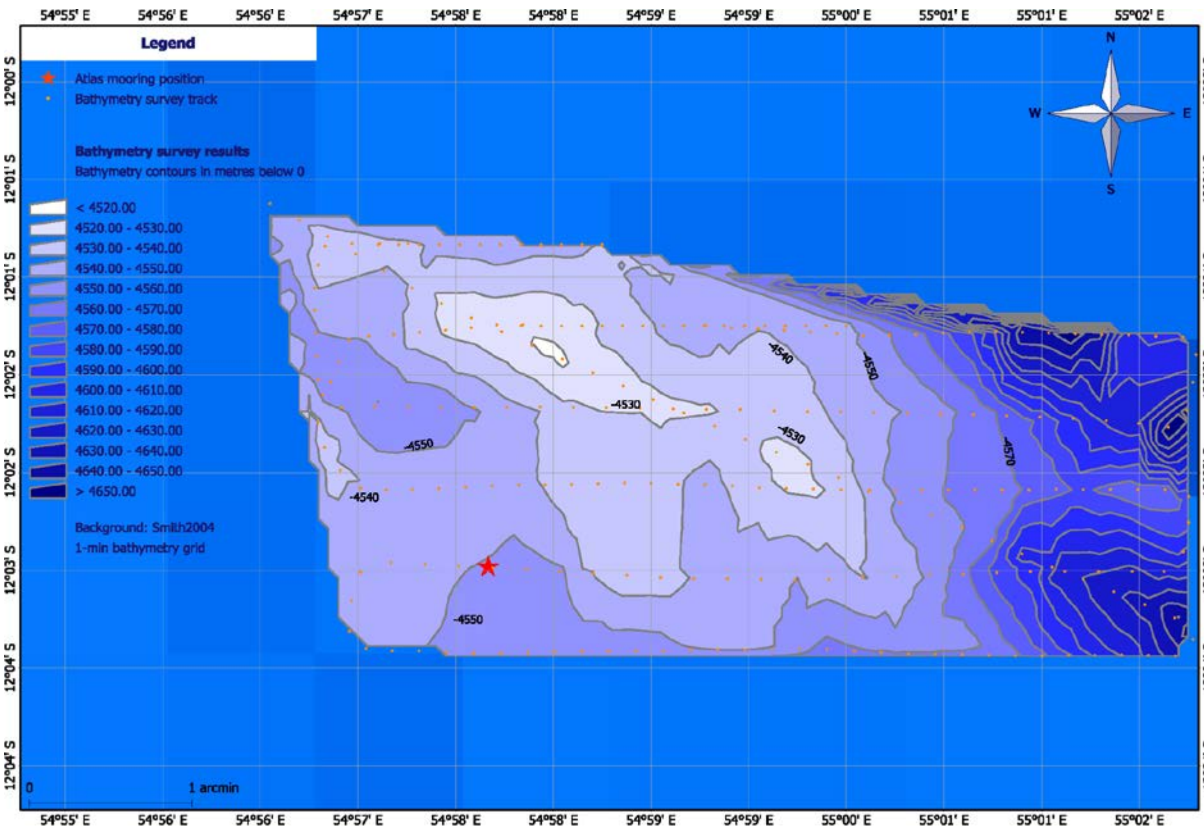


Figure 14: Bathymetric survey showing the position of ATLAS mooring 2 (red star) and the surrounding sea floor area.

Both mooring deployments proceeded flawlessly, and in each case it took less than 5 hours from the time the buoy was placed in the water until the time the anchor was dropped. After anchor drop and while waiting for the mooring to settle into place (which usually takes about 30 min to 1 hr depending on depth), a CTD cast was conducted to provide in situ calibration data for the mooring sensors. A final fly by the surface float was made by the ship after the CTD cast to ensure that the buoy was riding well and that the meteorological measurements from the buoy compare well with those from the ship.

OVERVIEW OF STATIONS

Table 5: Number of hydrographic (CTD and XBT), plankton (M and B), pelagic trawl (PT), bottom trawl (BT) stations and drifters occupied during both parts of the Mascarene Survey. BT numbers represent both bank and gap region.

Region	CTD	XBT	M	B	PT	BT	Drifter	ARGO Float
Mauritius Bank	17		14	14				
Mauritius – Nazareth Channel	2		1	1		11	2	
Nazareth Bank	35		18	18			2	
Nazareth – Saya de Malha Channel	25	25	10	10			3	
Saya de Malha Bank	30		7	7		7	1	
Saya de Malha – Seychelles Channel	12		7	7			2	
Seychelles Bank	42					6		
Seychelles – Pemba (Part 2)	12		9	9				4

3. OCEANOGRAPHIC CONDITIONS

3.1 Background

The Mascarene Plateau, in the South-western Indian Ocean, is a submerged volcanic plateau extending over 2200 km between the Seychelles Bank at 4°S to the island of Mauritius at 20°S (Figure 15).

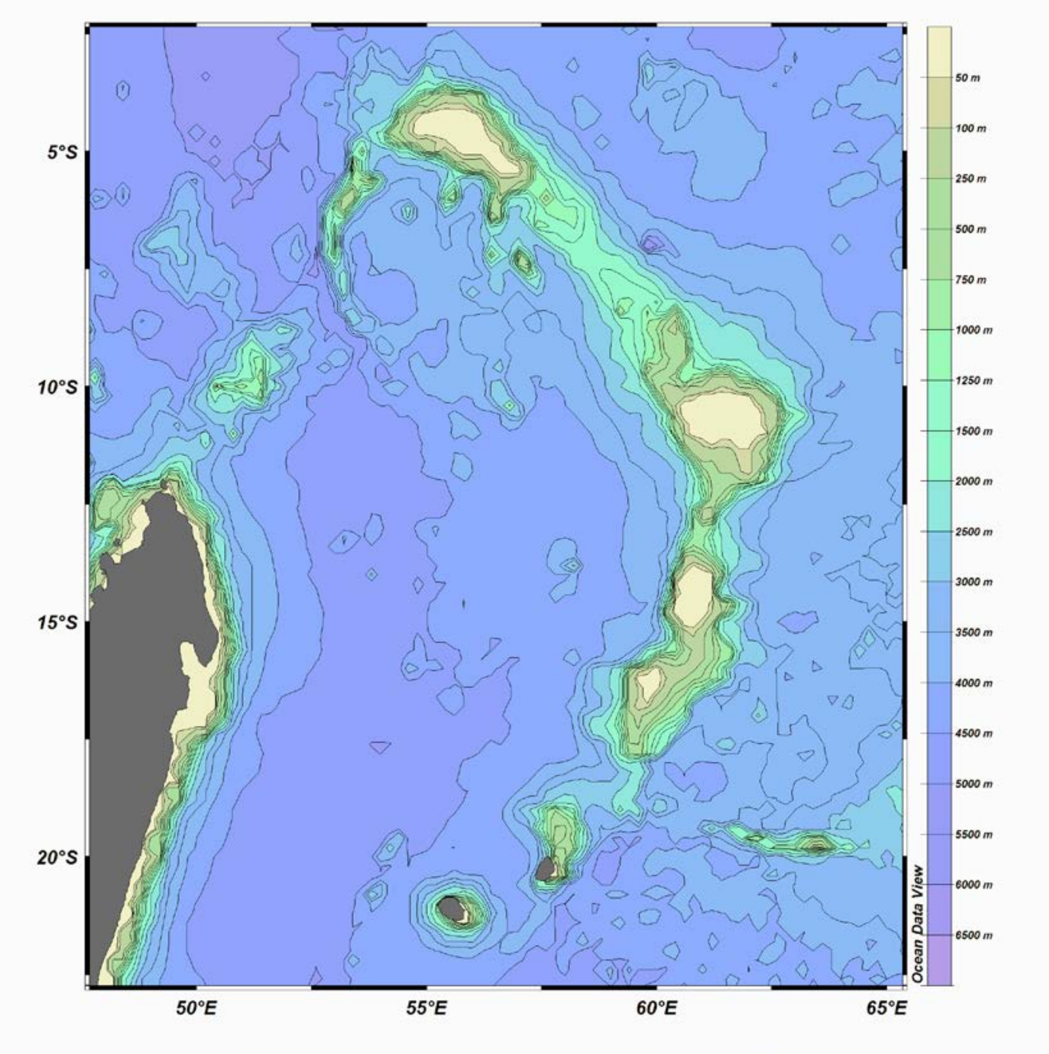


Figure 15: Map showing the location of the Mascarene Plateau. A colour bar highlights isobath readings.

It is a complex bathymetric feature oriented roughly north–south similar to a crescent, covering an area of over 115,000 km^2 and characterised by a series of islands, banks and shoals which are separated by deep channels (New et al., 2007). The main banks are known as the Seychelles Plateau, the Saya de Malha Bank, the Nazareth Bank and the Cargados-Carajos Bank (Figure 16). These are typically 20-100 m deep coral topped and sometimes break the surface to form small islands..

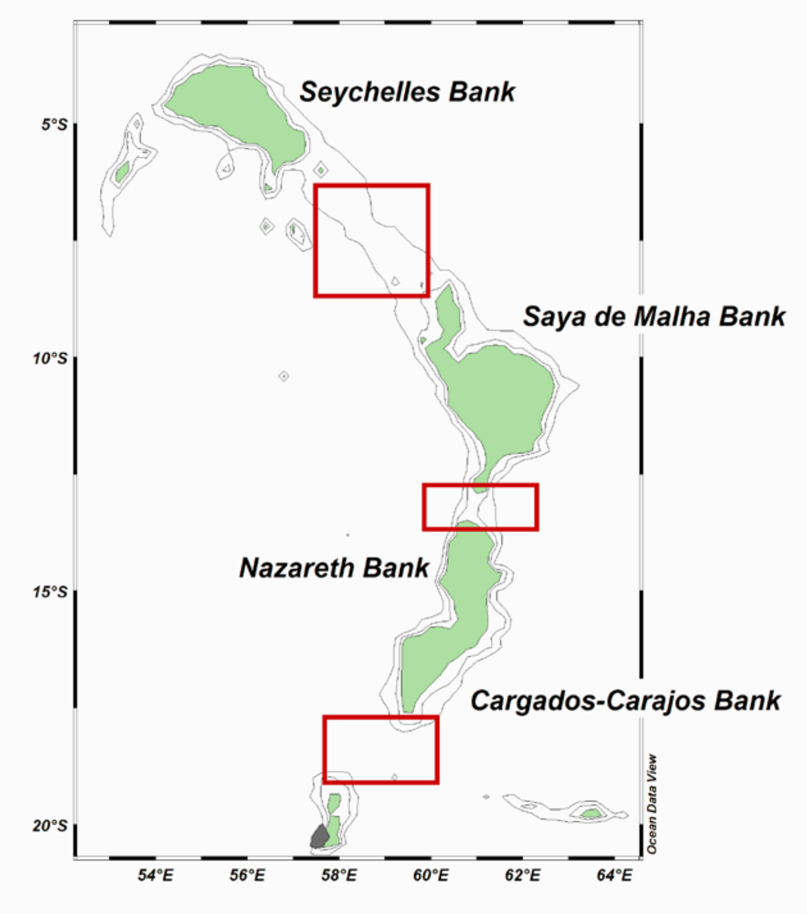


Figure 16: Location of each bank along the Mascarene Plateau. The deep channels separating banks have been highlighted by red rectangles.

On either side of the plateau steep slopes plunge to abyssal depths of 4000m.

The general circulation in this region is dominated by the South Equatorial Current (SEC), a broad current between 10 and 16°S and carrying approximately 50–55 Sv westwards at velocities rarely exceeding 0.3 m s^{-1} . The South Equatorial Current is directly driven by the trade wind belt and forms the westward limb of the large-scale subtropical Indian ocean gyre feeding into both the Agulhas Current system and the East African coastal current (Figure 17). To the north of the SEC lies the eastward flowing counter current known as the South Equatorial Counter Current (SECC).

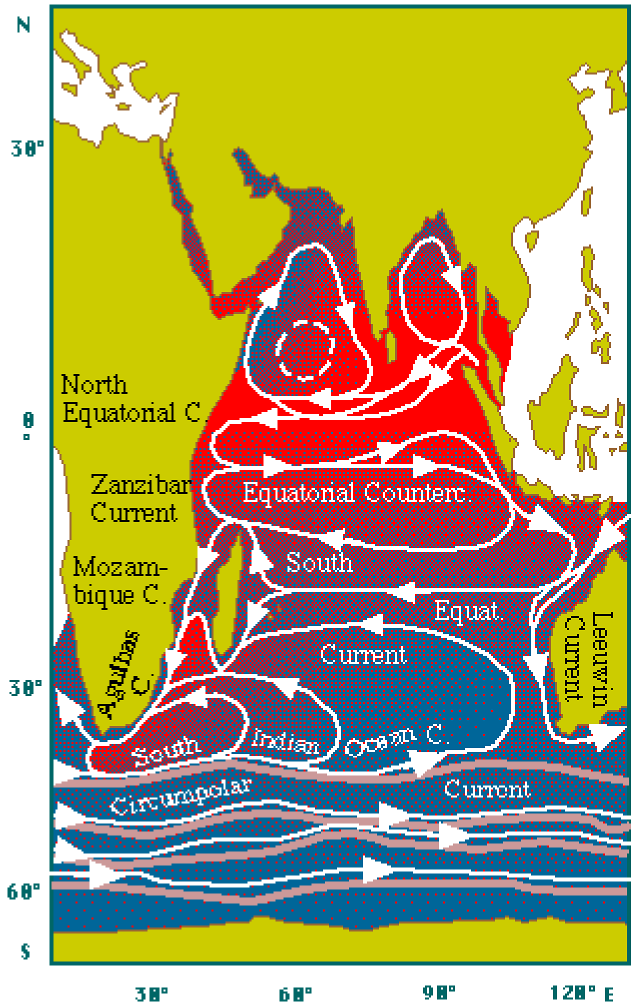


Figure 17: A map showing the general circulation of the Indian Ocean. Note the split in the South Equatorial Current at approx. 60E.

The Plateau's islands, banks and shoals (Figure 15) form a barrier modifying the predominantly westward passage of the South Equatorial Current. Recent studies have shown (ref) that this current, on approaching the Mascarene Plateau branches into a number of tributaries the largest occurring between 12-13°S between the Saya De Malha and Nazareth Banks. Here approximately 50% or 25 Sv of the SEC is forced to flow through the narrow channel separating the Saya De Malha and Nazareth Banks with the remainder of the flow passing in roughly equally volumes around the northern edge of the Saya De Malha Bank (8–9°S) and between Mauritius and the Cargados-Carajos Bank (18–20°S) (Figure 16). The modifying influence of this barrier to the background circulation provides a rare example of an extensive shallow-shelf sea completely detached from land boundaries, and remains an isolated and almost completely unexplored, marine ecosystem.

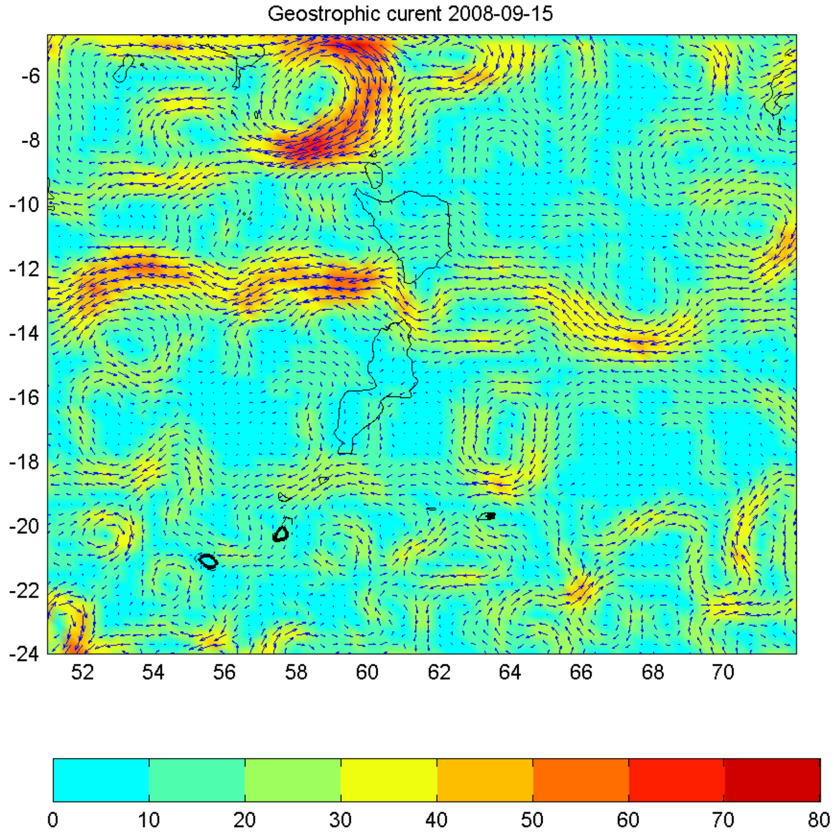


Figure 18: Geostrophic velocity form altimetry data highlighting the circulation in the region of the Mascarene Plateau.

3.2 Results

Past investigations (New et al., 2007) have shown that the overall effect of the Mascarene Plateau on the South Equatorial Current is fourfold:

1. It appears that the SEC is displaced southwards from its mean position of 10°-16°S by the obstruction caused by the shallow bathymetry of the Mascarene Plateau. Upstream of this Plateau the SEC exists as a broad (~650 km in width) shallow (~1000 m in depth) current with speeds averaging 0.30 ms^{-1}.
2. On approaching the Mascarene Plateau the complexity of the bathymetry results in the SEC, identified as a single core jet upstream of the region, to fragment into three distinct branches.
3. Deep channels separating individual banks (Figure 16) act as choke points funneling the flow of the SEC from east to west. Investigations during the Shoals of Capricorn project in 2002 show that downstream of the Plateau the SEC comprises of two cores suggesting that the flow reconstitutes itself, after passing over the Saya de Malha – Nazareth sill.
4. Ekman divergence resulting from the SE trade wind field results in a gradual uplifting of water masses between 15°-5°S as can be seen by the dynamic height for the region. Since nutrients increase with depth, it would be expected that levels would gradually increase with distance north and thus influencing the biological productivity of the surrounding region.
5. Finally, west of the Mascarene Plateau the SEC forms the westward limb of the large-scale subtropical Indian ocean gyre feeding into both the North Madagascar Current and the East African coastal current.

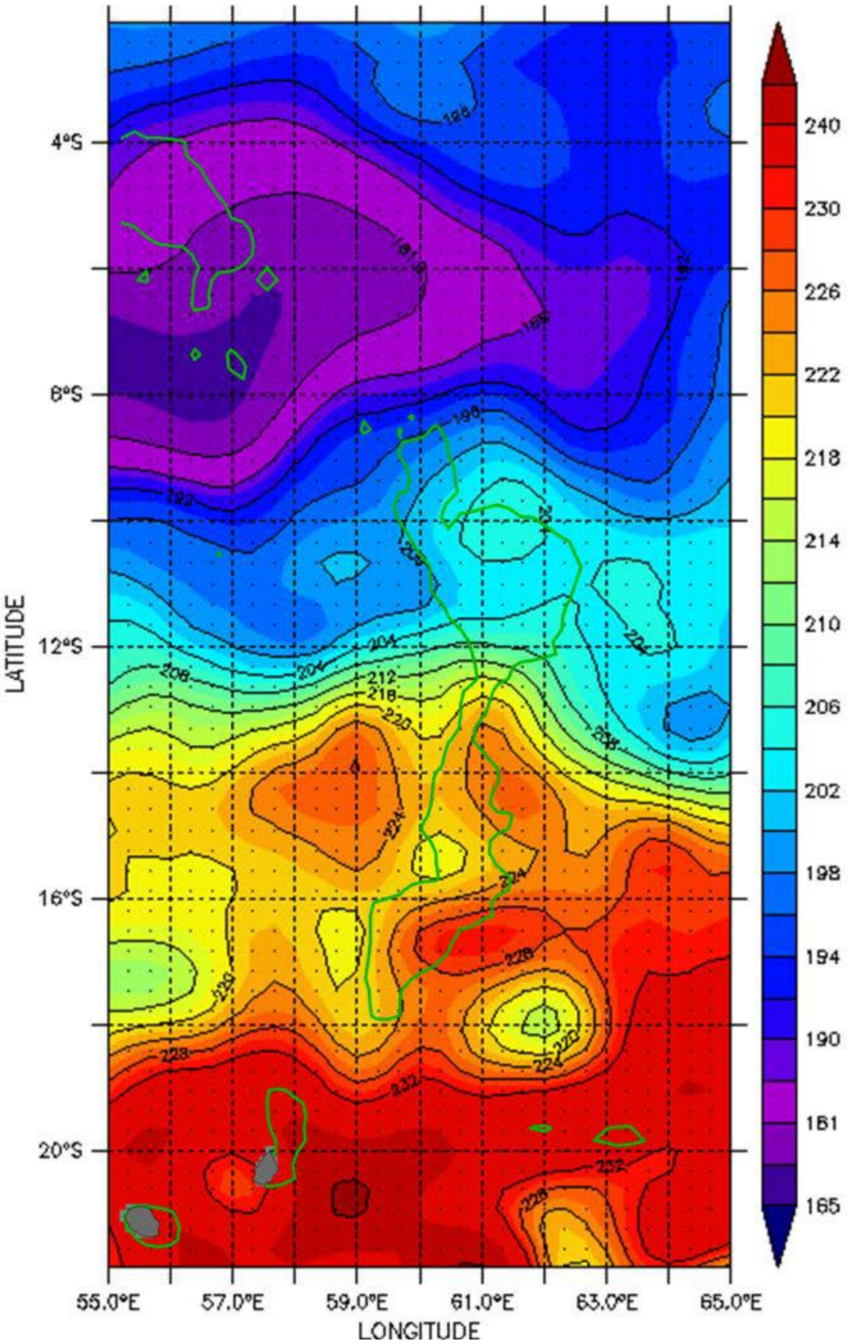


Figure 19: Map showing the change in dynamic height from north to south (165-240 cm). Of interest are the bunching of contours between the Mauritius – Carajos/Nazareth (~19°S) and Nazareth-Saya de Malha (~12°S) gaps as a result of the channeling of SEC. In addition, north of the Seychelles Bank at approx. 4°S dynamic height dips as a result of the eastward flowing SECC.

In agreement with past observations the SEC, during the survey period, existed as 3 separate branches channeled between the deep channels (Figure 16) at 9-8°S, 13°-12°S and 19°-18°S. Velocities exceeded 0.5 ms^{-1} in these channels as can be seen from Figure 20. The net westward geostrophic transport in the SEC on the eastern side of the Mascarene Plateau mirrors the velocity profiles in figure 14. From a total of 56 Sv (New et al., 2007), approx. 23 Sv is constricted between the Saya De Malha and Nazareth Banks near 12–13°S, 10 Sv is diverted around the northern side of the Saya De Malha Bank, and the remaining 25% (~10 Sv) flows southwestwards through the gap between the Cargados Carajos Bank and Mauritius. New et al., (2007) have suggested that the flow through the Saya de Malha and Nazareth sill forms the northern core of the SEC downstream of the Plateau between 10° -14° S, while the flow passing through the gap south of the Cargados Carajos Bank forms the southern core of the SEC between 16° - 20°S.

Finally, the presence of an eastward flow between 6° - 2°S can be related to the position of the eastward flowing South Equatorial Counter Current.

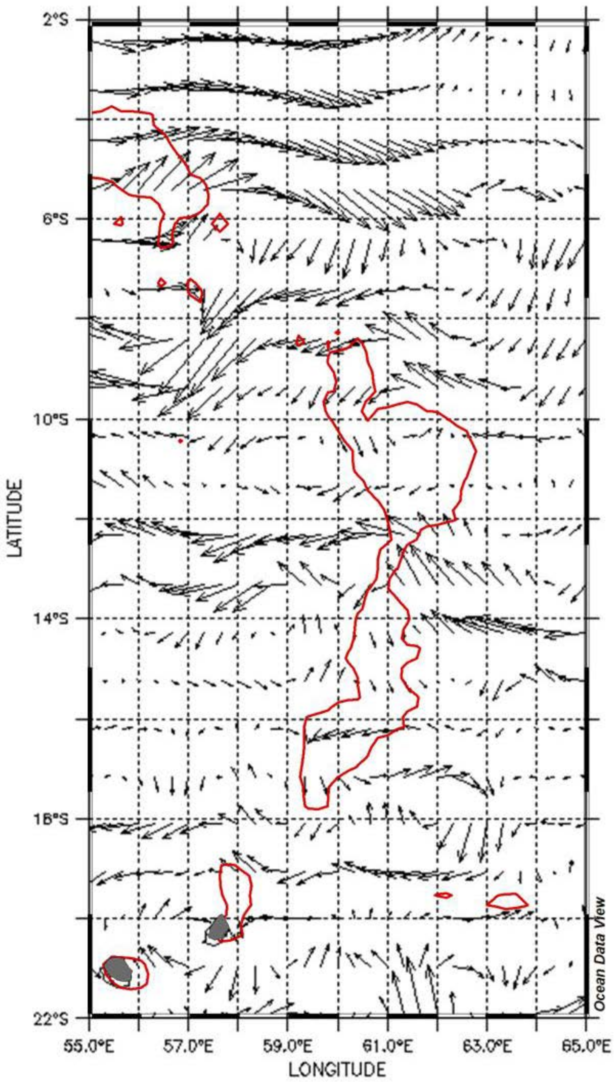


Figure 20: Map of absolute geostrophic velocities (1cm = 0.5 ms^{-1}) during the time of the survey. The 1000 m isobath depicting the location of the shallow shoals associated with the Mascarene Plateau is shown in red.

The preliminary ADCP results confirm the general current patterns derived from altimetry. The strongest flow was encountered in the gap between the Nazareth and Saya de Molha Banks with velocities exceeding 0.5 m s^{-1} at 30 m depth (**Figure 21**). The westward flow is also present across the northern gap, between Saya de Molha and Seychelles. The current reversal related to the SECC over the Seychelles bank is also clearly manifested (**Figure 22**). The results from southern gap, between Mauritius and Cardagos-Carajos are an exception. The ADCP-derived currents have variable magnitude and direction. A southeastwardly flow accelerates just off Mauritius, which is not resolved in the altimetry data (Figure 20). This suggests that this region may have experienced a period of an mesoscale variability, not well resolved by the survey sampling grid and not captured on the 1/3 degree altimetry-derived current maps.

Over the shallow banks of Saya de Molha and Nazareth, the currents were typically of the order of 0.1-0.2 m s^{-1}. A stronger current observed over the northern portion of the Nazareth Bank appears to be wind-driven, associated with the strong easterly wind event the survey encountered in this area.

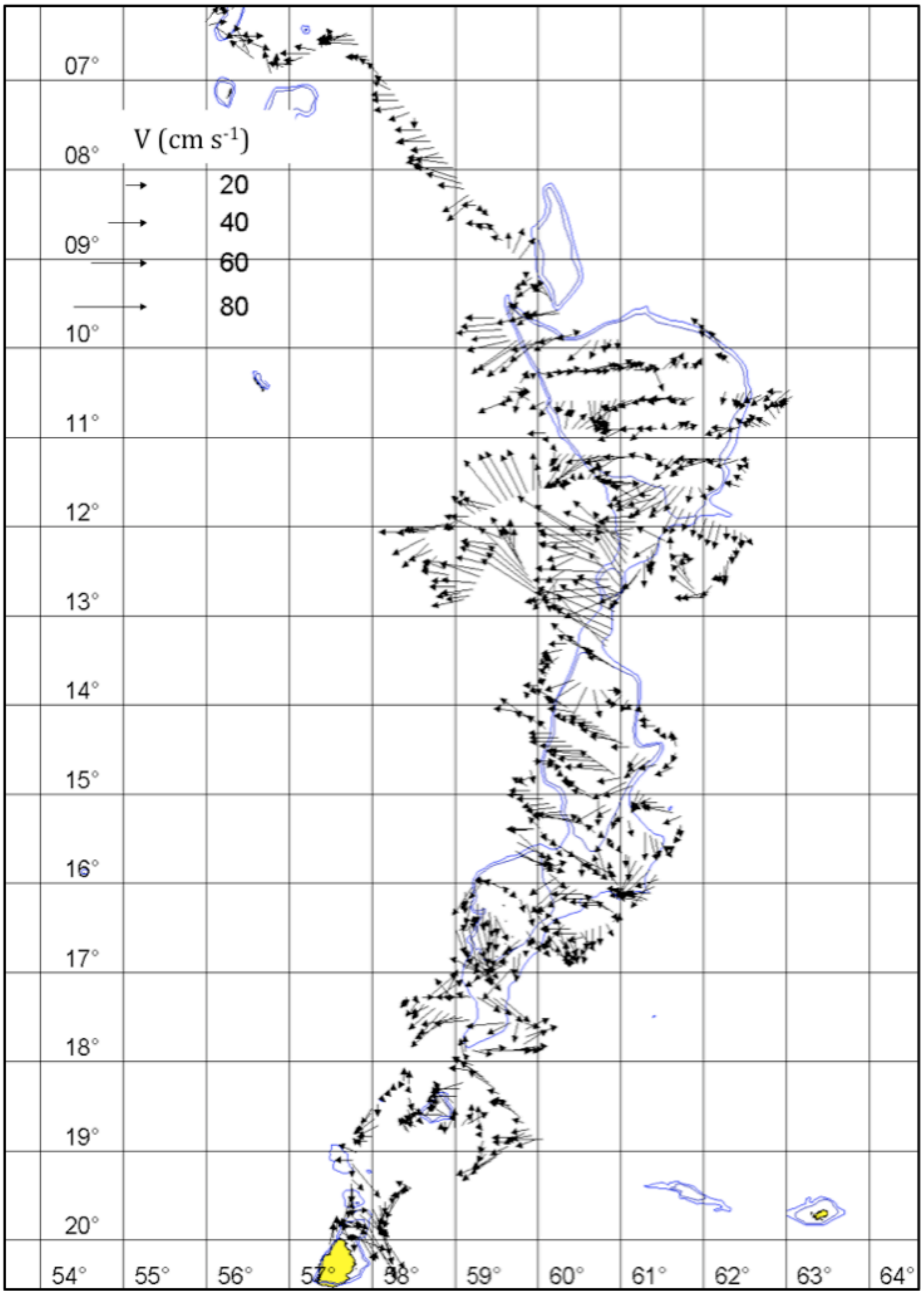


Figure 21: Map of ADCP-derived currents along the survey track at 30 m depth, excusive the Seychelles Bank. The vector scale shown in the top-left portion of figure.

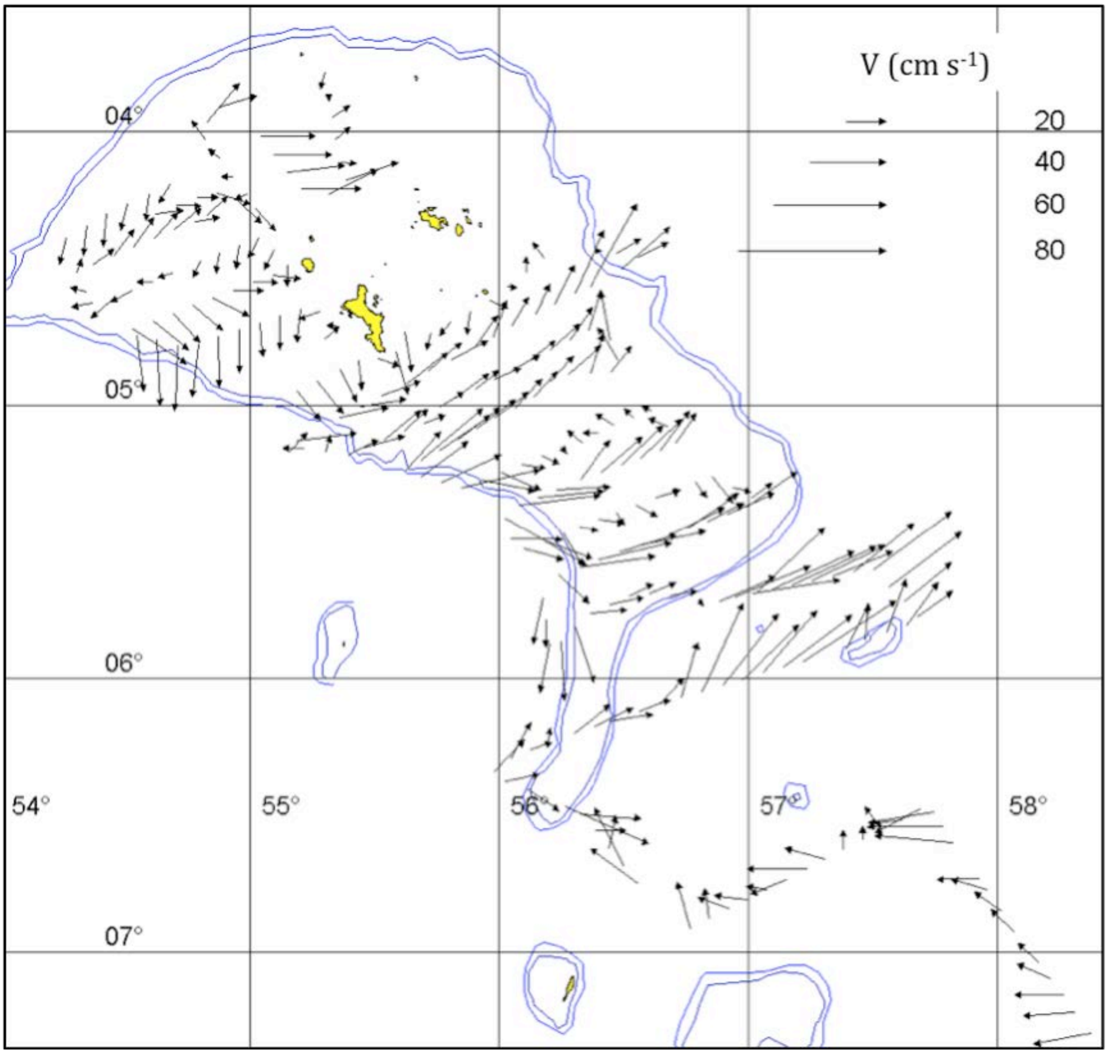


Figure 22: Detailed map of ADCP-derived currents at 30 m depth over the Seychelles Bank. Dataset until November 13, 2008. The vector scale shown in the top right portion of figure.

Defining the ocean environment of the Mascarene Plateau

New et al. (2007) carried out a detailed study of the water masses in the region of the Mascarene Plateau. From their data it can be seen that there are prominent differences between the northern and southern regions. In contrast there is relatively little difference between water masses found to the east and west of the plateau. Data collected during the Mascarene survey support past investigations and physical-chemical profiles (Figure 23) give further evidence that the SEC acts as a barrier between the north and southern regions. While the SEC dominates the general circulation in the vicinity of the Mascarene Plateau, highly saline surface waters over the Seychelles Bank bear resemblance to Arabian Sea High Salinity Water (ASHSW) and suggest the influence of the eastward flowing South Equatorial Counter Current (SECC) on local water masses. Further support to the close proximity of the SECC in the northern regions of the Mascarene Plateau is given from Figure 20 which highlights the eastward flow north of 4°S as well as the presence of Red Sea Water only in the northern sector of the survey. Furthermore, results collected during this survey provide evidence that the SEC acts as a major conduit for the transport of Indonesian Throughflow Water channeling its passage through the gaps across the Indian Ocean.

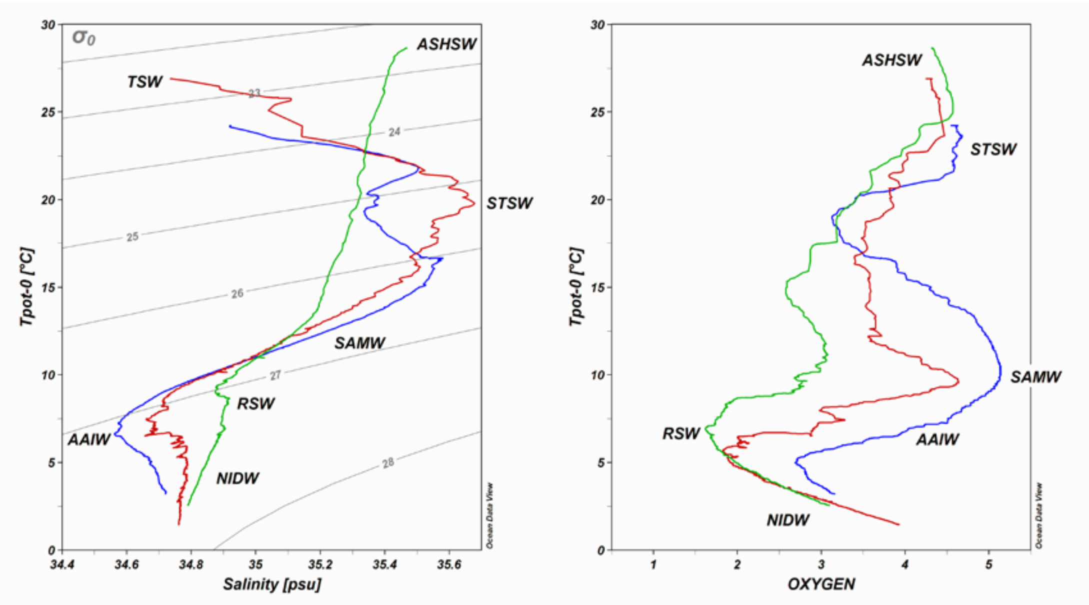


Figure 23: Temperature/Salinity (left panel) and Temperature/Oxygen (right panel) profiles for 3 CTD stations. The green line denotes CTD station 1130, which was occupied at 5°S, red line denotes CTD station 1059 at 12°S and the blue line represents CTD station 997 at ~19°20'S. Difference in their north-south physical/chemical properties is immediately clear.

The following water masses were observed during the cruise:

Tropical Surface Water (TSW) – this is a broad band of fresh water between 4 and 20°S. Salinities are low (34.7 – 34.9) due to the high levels of precipitation in the tropics. During the survey TSW was observed at all stations occupied south of the Seychelles-Saya de Malha gap, further supporting evidence that the SEC influences the distribution of surface water masses. Indeed Figure 25 shows the change in surface properties from CTD station 1109 (9°S) which is predominantly TSW and CTD station 1121 (5°30'S) which is typical of the high salinity characteristic of Arabian Sea High Salinity Water (ASHWS) to the north. ASHSW is highly saline (>35.5) as a result of excess evaporation over precipitation in the Arabian Sea and is swept eastwards across the Indian Ocean by the SECC. A north-south section (Figure 24) along the Mascarene Plateau clearly shows the meridional distribution of the fresher TSW in relation to other water masses. It is clear from the section that the channel separating the Seychelles and Saya de Malha bank acts as a barrier separating fresh TSW from saltier modified ASHSW to the north.

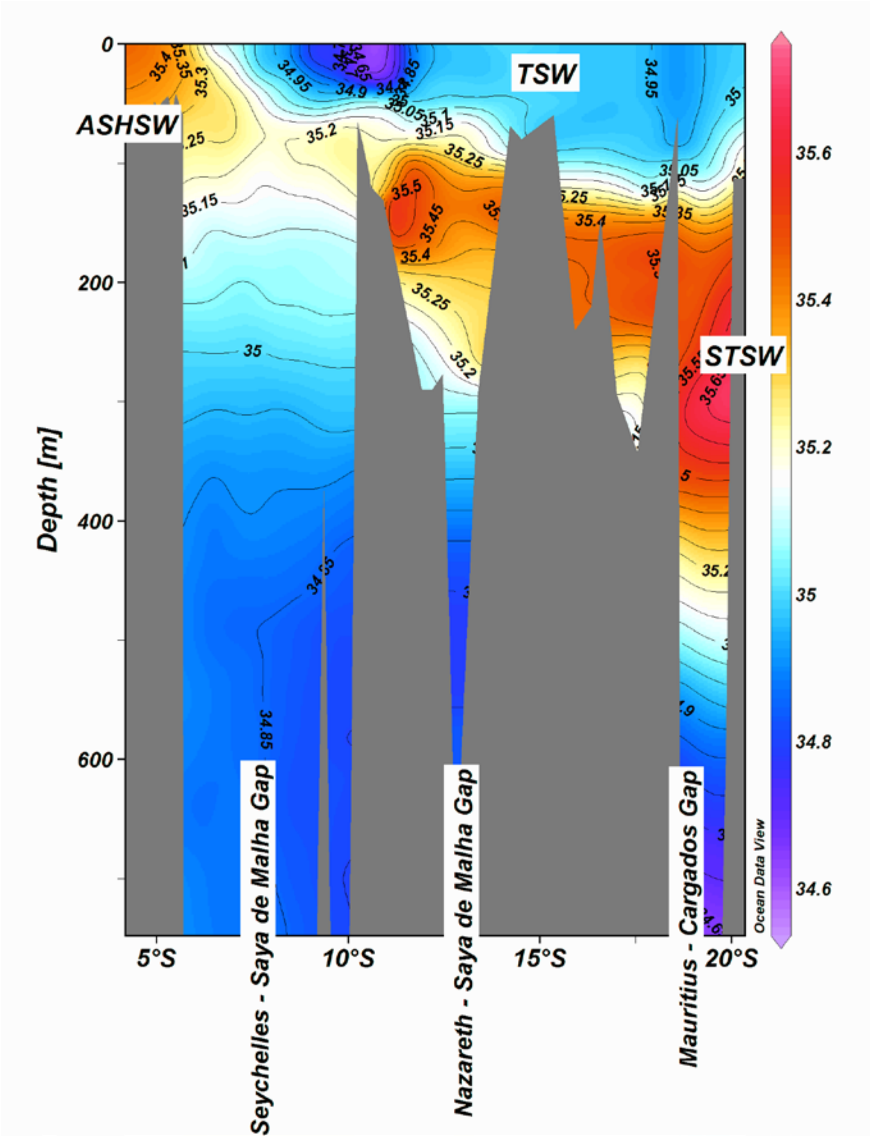


Figure 24: North - south salinity section across the Mascarene Plateau (upper 750 m). Core water masses ASHSW – Arabian Sea High Salinity Water, TSW – Tropical Surface Water, STSW – Subtropical Surface Water have been identified. It is clear that the channel separating the Seychelles-Saya de Malha Banks separates TSW from saltier surface waters in the north.

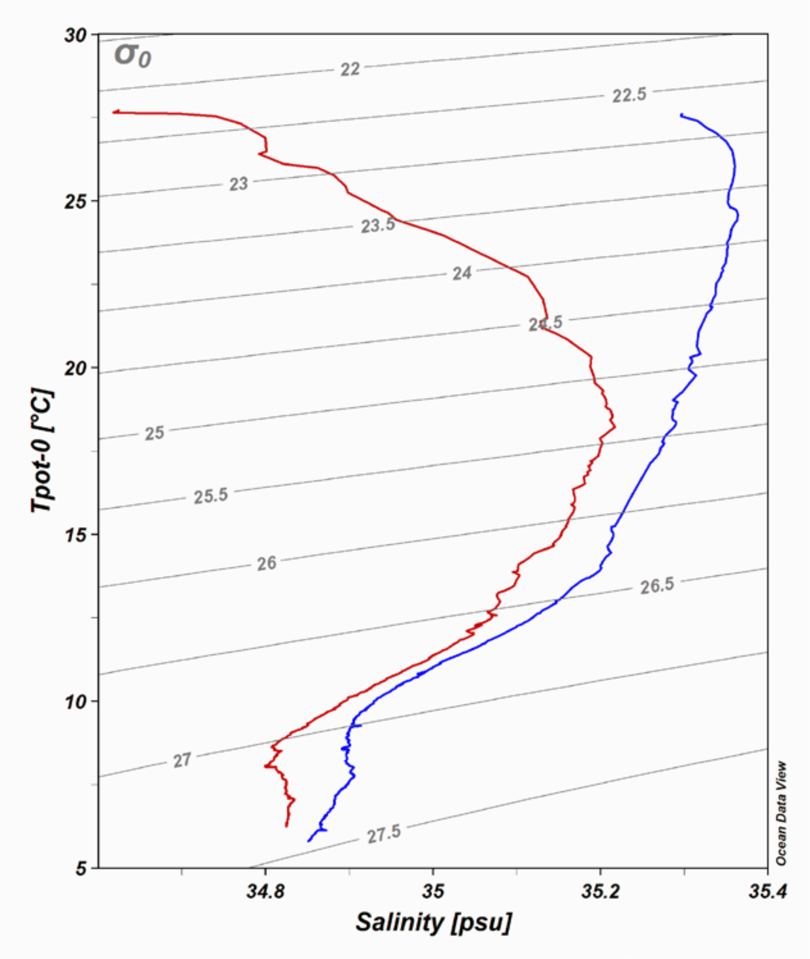


Figure 25: TS profiles for 2 stations occupied on the southern end (red) and northern end (blue) of the Seychelles – Saya de Malha channel

Subtropical Surface Water (STSW) can be found in the subtropical belt between 20°-35°S. STSW displays characteristically high salinity values (>35.4) due to the high levels of evaporation associated with the subtropics. Travelling northwards STSW subducts below the fresher TSW to form a subsurface salinity maximum, which at 18°S is centred at 300m depth (Figure 24). This salinity maximum extends as far north as 14°S, and may be partly carried westward by the SEC. Immediately below TSW between 100-300m, Song et al. (2004) have identified Indonesian Throughflow water (ITF). An important feature of the Indonesian Throughflow is that because the water in the western equatorial Pacific Ocean has a higher temperature and lower salinity than the water in the Indian Ocean, the Throughflow transports large amounts of relatively warm and fresh water to the Indian Ocean. When the Indonesian Throughflow through Lombok Strait and the Timor passage enters the Indian Ocean it is advected towards Africa within Indian South equatorial current. ITF is slightly more saline (>0.5-0.6 = 35.2) than TSW and in the region of the Mascarene Plateau can be found between 100–250m at 10°S. Carried within the core of the SEC (Figure 26), ITF has been shown to spread across the western boundary of the Indian Ocean, forming a subsurface oxygen minimum of ~2.5 ml/l (Figure 26).

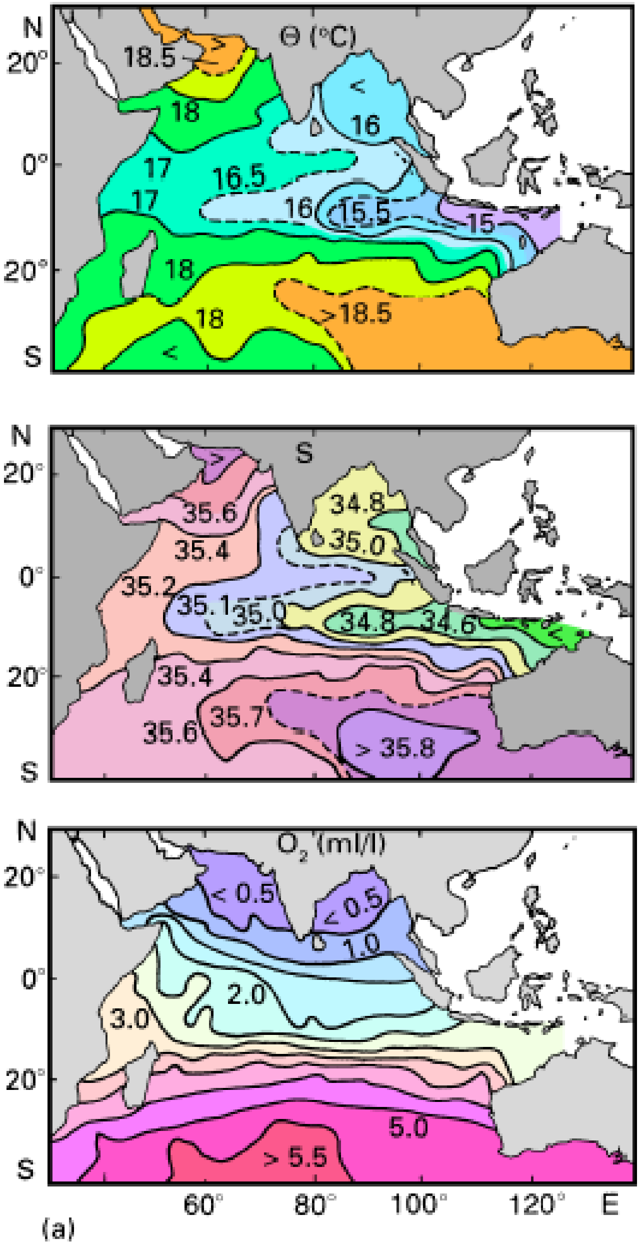


Figure 26: Map showing clearly the movement of Indonesian Throughflow water (ITF) across the Indian ocean between 100-150 m. Panels represent upper – temperature, middle – salinity and lower – dissolved oxygen.

During the survey evidence of ITF was identified by its subsurface oxygen minimum in each of the deep channels separating the shallow shoals of the Mascarene Plateau further supporting suggestions that SEC is the main conduit for ITF's advection across the Indian Ocean.

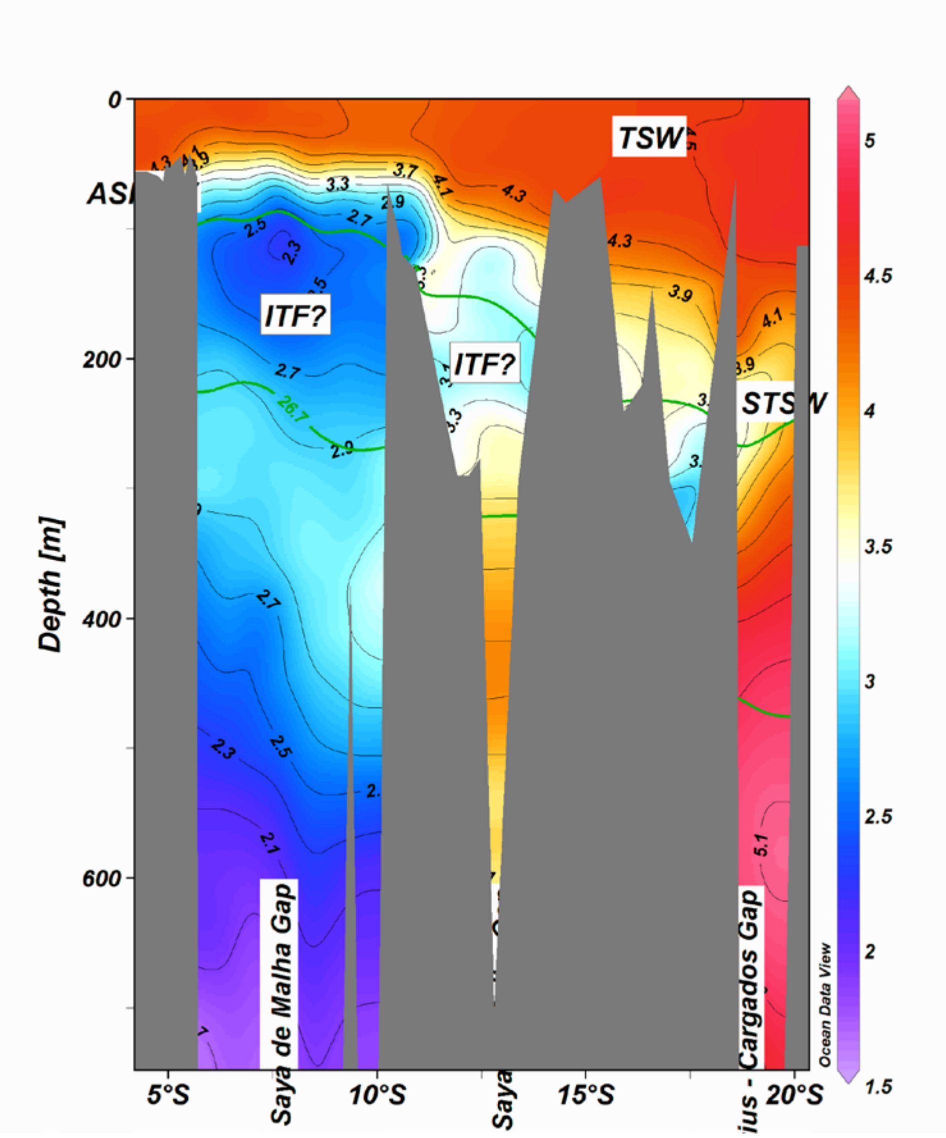


Figure 27: North - south oxygen section (upper 750 m) across the Mascarene Plateau. The location of core water masses have been highlighted. A tongue of subsurface oxygen minimum characteristic of ITF is seen to extend southwards. The density boundaries associated with ITF are shown in green.

Sub-Antarctic Mode Water (SAMW) – this water mass is formed between 35° and 45°S as a result of deep winter mixing, and subducted northwards in the subtropical gyre recirculation (McCartney, 1982). SAMW is characterized by a temperature range between 8°–15°C, salinities and an oxygen maximum >4.5 ml/l. High oxygen concentrations (>5 ml/l) characteristic of SAMW were only observed in the southern part of the survey between the Mauritius and Carajos Banks along centred at density 26.85 kg/m^3.

Antarctic Intermediate Water (AAIW) is characterised by a salinity minimum between 800–1500m (<34.6) and oxygen levels >3.5 ml/l. AAIW originates in the Southeast Pacific (McCartney, 1982) and in the South Atlantic (Piola and Gordon, 1989), and appears to enter the South Indian Ocean in its southeastern region (Fine, 1993). Higher salinity Red Sea Water (RSW) occupies approximately the same depth and density range as the AAIW (Figure 23), but in contrast to AAIW has a much lower oxygen content (<2 ml/l) and higher salinities >34.85. Beal et al. (2000) show that the primary spreading route for the RSW is, from its origins in the Red Sea, southwards along the western boundary of the Indian Ocean to at least 20°S, AAIW and RSW are easily identified in the TS profiles of the stations occupied during the survey with RSW found only in the northern section of the survey (10°S).

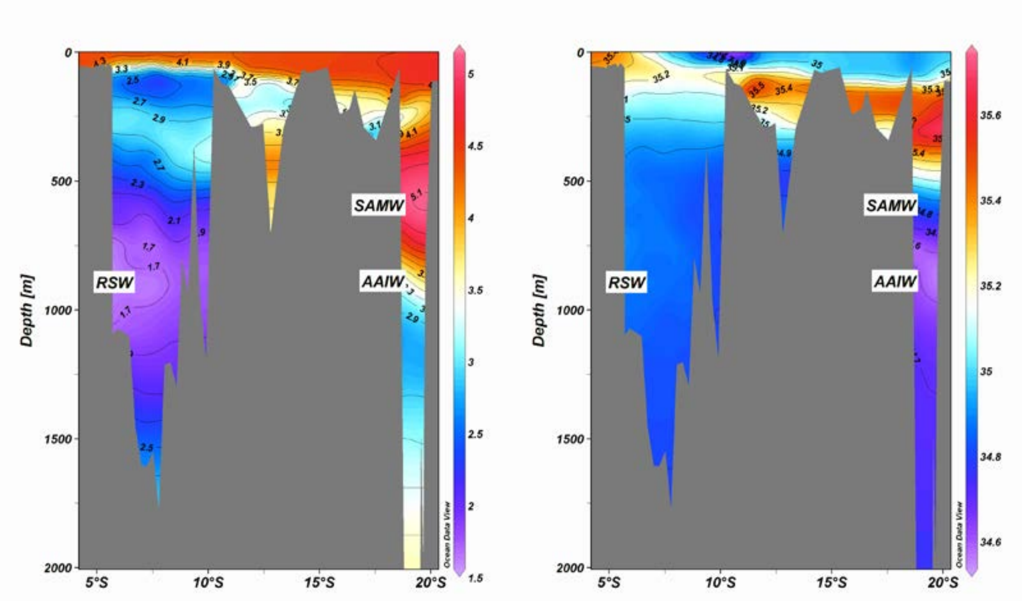


Figure 28: Full depth north - south oxygen (left panel) and salinity (right panel) section across the Mascarene Plateau. The separation of deeper water masses is clear with Red Sea Water restricted north of 10°S and Subantarctic Mode Water and Antarctic Intermediate Water observed in the south.

In contrast a number of stations () were occupied along an east-west transect in order to determine the influence the Mascarene Plateau may have as a barrier to the advection of water masses (Figure 29). Of interest is the degree of similarity within station pairs i.e. east and west, while distinct differences between station pairs i.e. north-south are observed, again suggesting the role the SEC plays in separating the northern tropical region from the south.

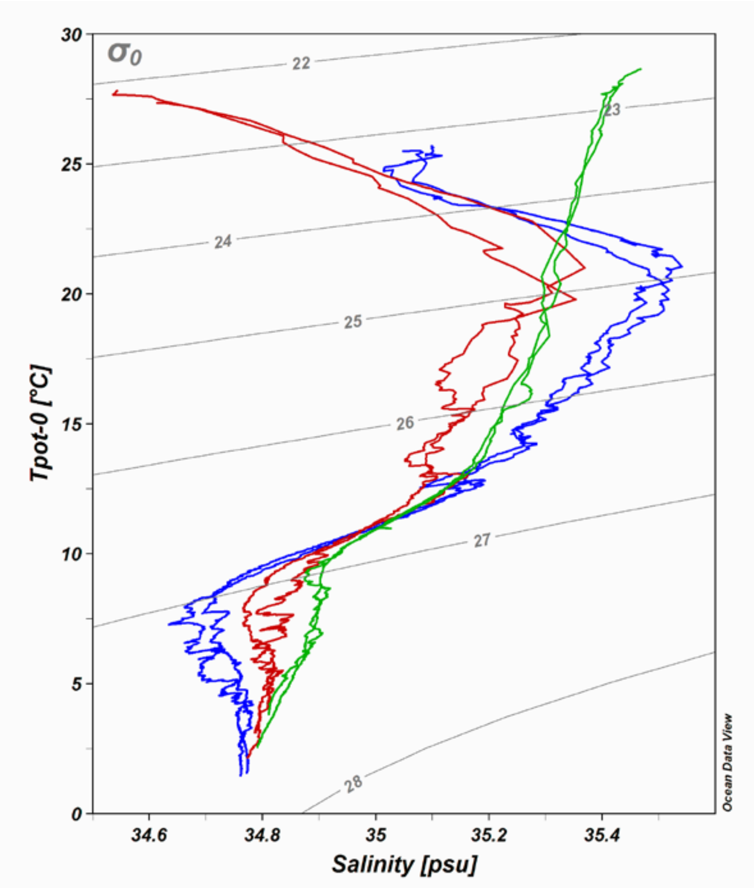


Figure 29: TS profiles of station pairs occupied along east-west transects during the survey. Blue denotes CTD stations 1038 and 1049 o ccupied across the Nazareth Bank, Red denotes CTD stations 1084 and 1099 occupied across the Saya de Malha Bank and green represents CTD stations 1130 and 1144 occupied across the Seychelles Bank.

The overall effect of the Mascarene Plateau is to split the SEC into separate cores centered near 12 and 18°S. Once passed the Plateau it seems likely that these 2 cores continue westwards towards the Madagascar coast at 50°E and there form the North East and South East Madagascar Currents.The SEC has been shown to divide the southern water masses (STSW and AAIW) from the northern water masses (ASHSW and RSW), at the same time as sweeping these water masses across the Mascarene Plateau (New et al., 2007). In addition, the SEC acts as a main conduit for the westward advection of ITF water across the Indian Ocean bringing with it it's subsurface oxygen and salinity characteristics. An interesting circulation exists over the Seychelles Bank, its character influenced by both the SEC flowing westwards to the south and the eastward flowing SECC. The influence the SECC has in bringing eastwards highly saline surface waters originating from the Arabian Gulf as well as RSW intermediate water needs to be further investigated.

4. RESULTS

4.1 Field results from atlas mooring deployment

Overview

Leg 2 of ASCLME Cruise 3 aboard the *R/V Fridtjof Nansen* gave NOAA's Pacific Marine Environmental Laboratory (PMEL) in Seattle, Washington the opportunity to deploy two ATLAS moorings in the western Indian Ocean. The first mooring was installed at a nominal location of 8°S, 55°E on 21 November 2008 and the second at 12°S, 55°E on 22 November 2008. These moorings are part of the Research Moored Array of African-Asian-Australian Monsoon Analysis and Prediction (RAMA), which is a multi-national effort to provide key oceanographic and marine meteorological data sets for monsoon research and forecasting. The RAMA plan (Figure 30) calls for spanning the Indian Ocean with an array of 46 moorings between 15°N to 25°S. Thanks to ASCLME and the *R/V Fridtjof Nansen*, RAMA has increased from 20 to 22 moorings and the array is now nearly 50% complete.

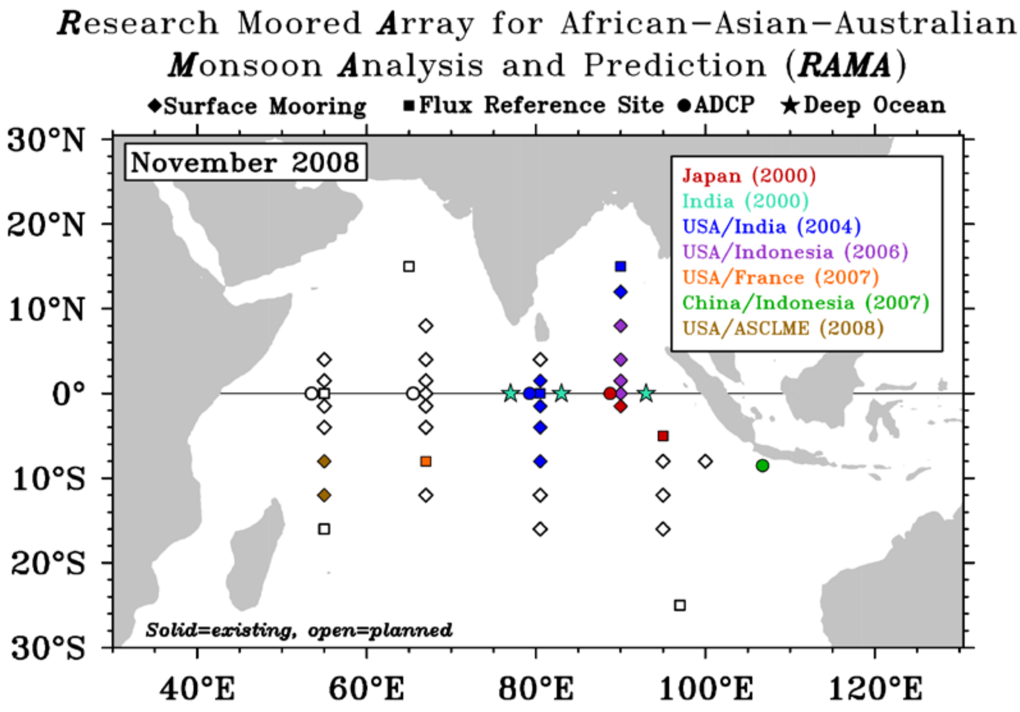


Figure 30:Schematic of RAMA as of November 2008. Solid symbols indicate those sites occupied so far, including 8°S and 12°S, 55°E. Colour coding indicates national support, with year of first involvement shown in the upper right box. Open symbols indicate sites that are not yet instrumented.

PMEL also successfully deployed four Argo floats between the ATLAS moorings. These are the first PMEL floats in the Indian Ocean and they fill a significant hole in Argo coverage. Details of mooring and float deployments are contained in the tables below:

Argo Float #	Date	Deploy Time (UTC)	Latitude	Longitude
4004	21-Nov-08	0834	07° 54.1' S	55° 04.0' E
4003	21-Nov-08	1611	09° 19.9' S	54° 59.6' E
4006	21-Nov-08	2248	10° 39.8' S	54° 59.9' E
4008	22-Nov-08	1905	12° 05.9' S	54° 53.9' E

Mooring ID	Latitude	Longitude	Date	Anchor Drop (UTC	Depth
PM791a	07° 54.15'S	55° 05.81'E	21-Nov-08	754	3700 m
PM792a	12° 02.98'S	54° 57.80'E	22-Nov-08	1509	4562 m

Table 6: Deployment positions for ARGO floats (upper panel) and the 2 ATLAS moorings (lower panel)

Data

ATLAS moorings measure surface wind speed and direction, air temperature, relative humidity, solar radiation, rain rate, sea surface temperature and conductivity, temperature and conductivity at several depths in the upper 500 m, and ocean velocity at 10 m depth in the surface mixed layer. Data are transmitted to shore in real-time via NOAA's polar weather satellites and are available to researchers and operational centers world wide. The data can be viewed and downloaded from http://www.pmel.noaa.gov/tao/disdel/disdel.html .

4.2 Field results from phytoplankton sampling

Introduction

The main hypothesis tested was that increases in phytoplankton biomass in the oligotrophic waters of the WIO would be restricted to areas of upwelling created by 1) the three main gaps in the Plateau through which the SEC is funnelled and 2) along the eastern edge as the SEC is forced over the Plateau. Water was collected from the 122 stations in Niskin bottles from five depths within the photic zone and analysed for size fractionated chl-*a*.

Hypotheses:

1. Divergence of the SEC on the leeward side result in upwelling & nutrient enrichment
2. Results in enhanced primary production along the leeward edge & in the three main gaps through the plateau
3. Phytoplankton levels, although higher than background levels, remain low due to zooplankton grazing

Results:
The mean chl-*a* biomass across the Plateau was 0.476 ± 1.562 µg/l. Microplankton (> 20 µm) formed the largest component of the phytoplankton with nano (20 µm - 2 µm) and picoplankton (2 µm - 0.7 µm) biomass rarely exceeding 1 µg/l. Surface biomass was generally < 0.5 µg/l (Figure 1) and the fluorescence maximum varied in depth between 30 m and 100 m depending on the depth of the seafloor. No indication of upwelling was discovered.

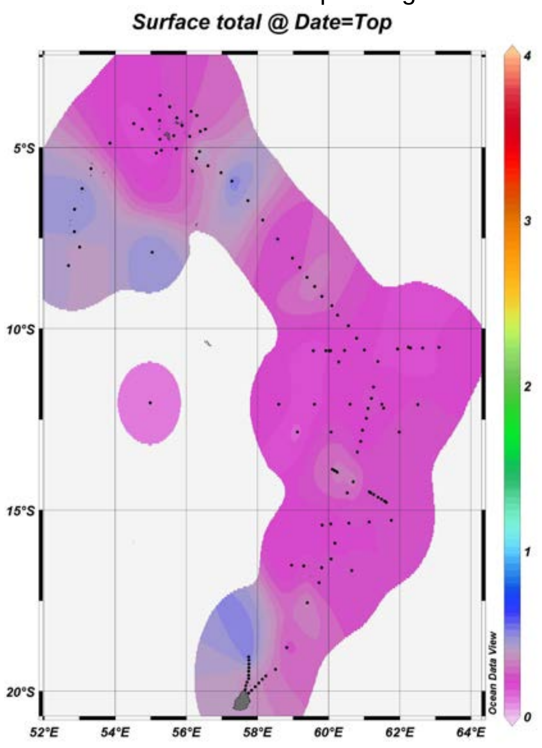


Figure 31. *Total chl-a of the near surface water*

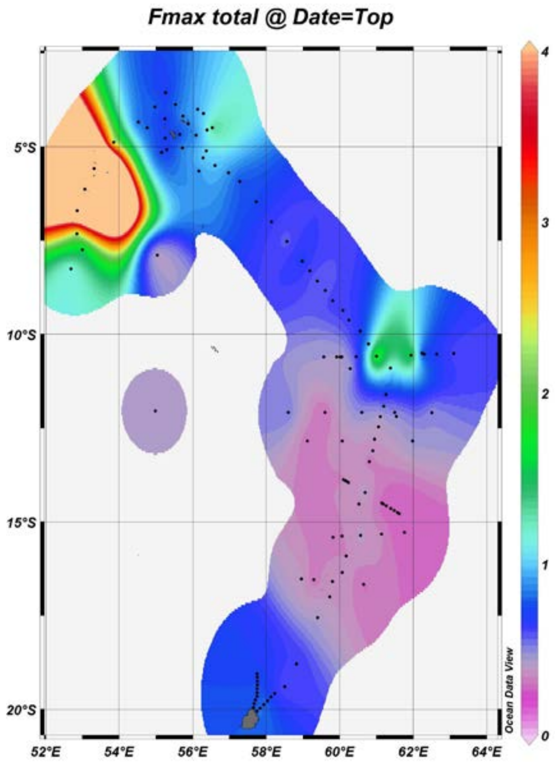


Figure32. *Total chl-a of the fluorescence maximum region.*

Total Surf Chl-*a* = 0.26 ± 0.01 µg/l whereas the total chl-a for the fluorescence maximum (Fmax) were significantly higher at 0.96 ± 0.26 µg/l (Figure 32). Low chl-*a* biomass was associated with the low salinity Tropical Surface Water situated between 4° and 20°S (Figure 31 & 32). While the SEC dominates the general circulation in the vicinity of the Mascarene Plateau, the higher chl-*a* biomass over the Seychelles Bank and Amirante Shelf was associated with Arabian Sea High Salinity Water under the influence of the warmer eastward flowing South Equatorial Counter Current (Figure 31 & 32).

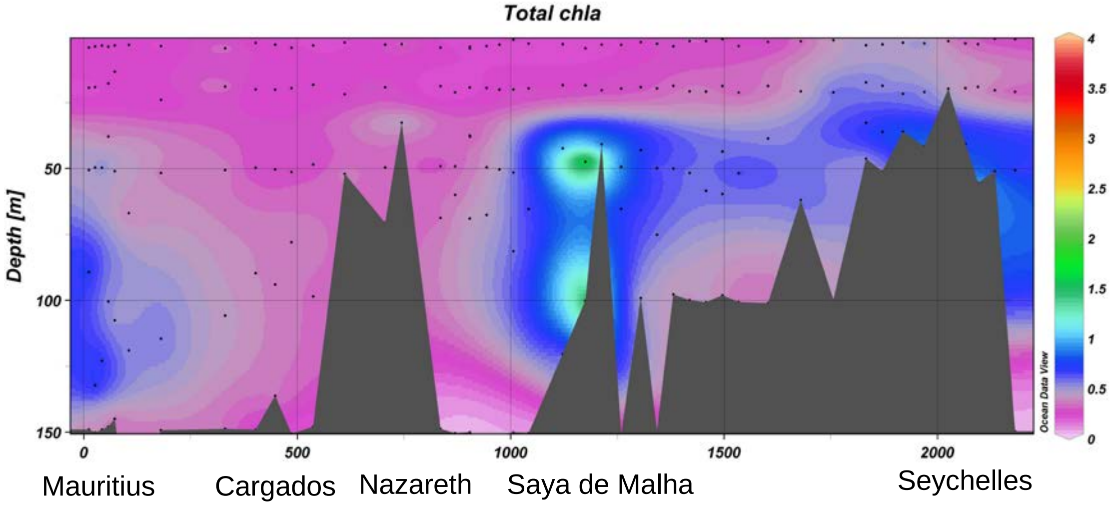


Figure 33. *Cross section from Mauritius to Seychelles showing the phytoplankton biomass distribution down to 150 m.*

Except for the Amirante basin where chl-a biomass exceeded 30 µg/l (Figure 32), the highest phytoplankton biomass between Mauritius and Seychelles were recorded on the Saya da Malha Bank (Figure 33 and Figure 34). Figure 34 and 35 indicates that the phytoplankton was characterized by microplankton, probably diatoms. The majority of stations contained mostly smaller flagellates in low numbers (Figure 35). The phytoplankton bloom along the Amirante Basin (Figure 32) consisted of chain forming diatoms (species still to be identified).

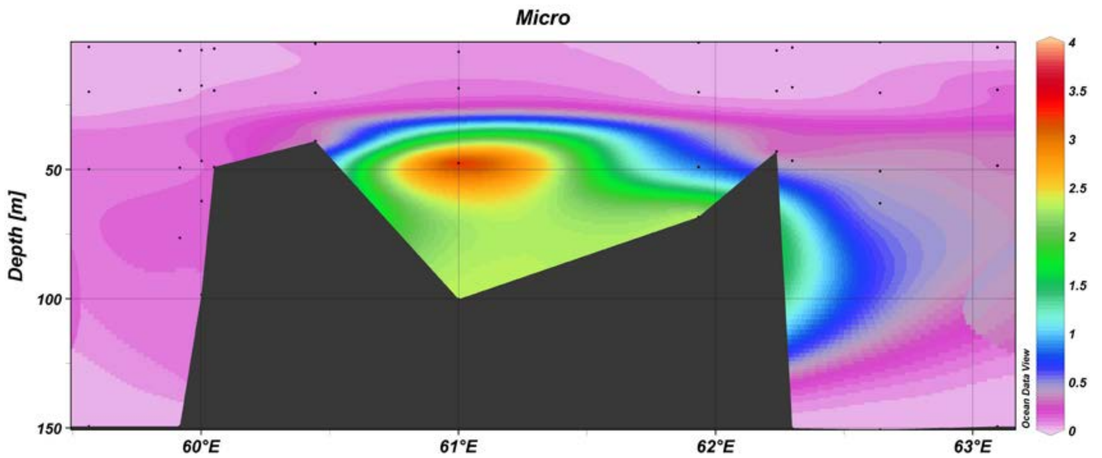
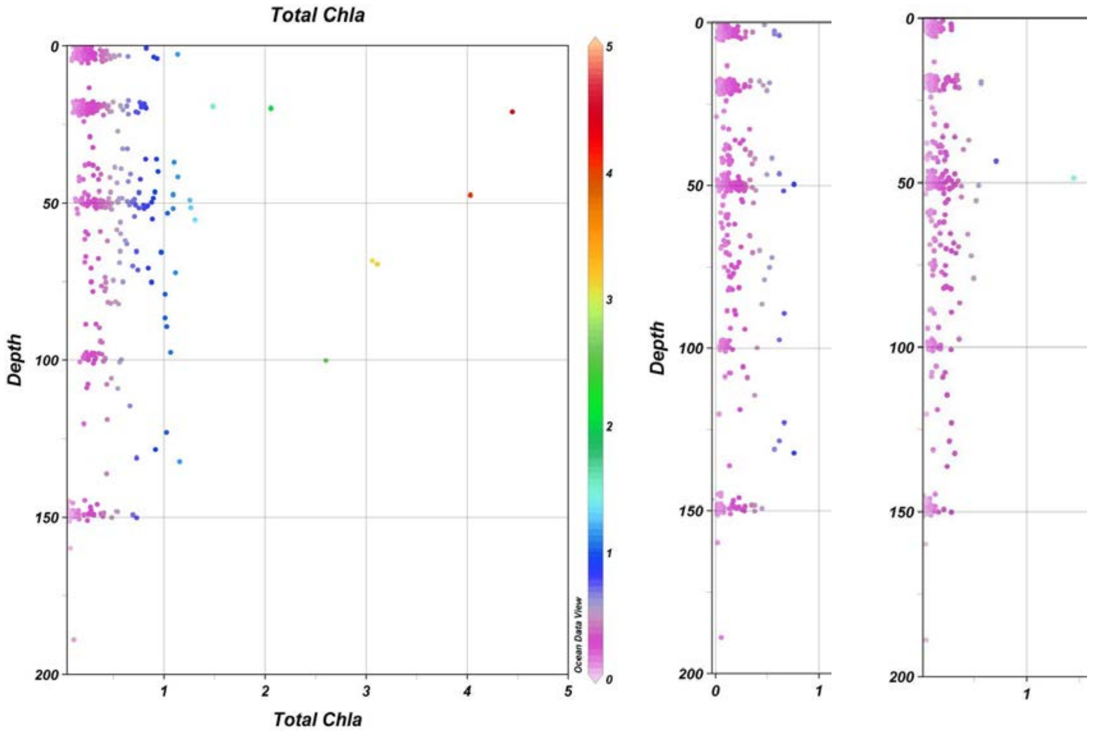


Figure 34. *Cross section across the Say da Malha Bank showing the microphytoplankton biomass.*



Total chl-a	Nano	Pico

Figure 35. Scatter plot of total chl-a, nano and pico-plankton.

Conclusions:

1. No evidence of upwelling.
2. Phytoplankton biomass increase from Mauritius towards Seychelles.
3. Phytoplankton distribution influenced by E-W flowing South Equatorial Current (splits water masses on the Plateau) and the W-E flowing South Equatorial Counter Current.
4. Microplankton (diatoms) associated with elevated levels of phytoplankton biomass.
5. Highest biomass recorded at depths varying from 30 to 150 m depending on bottom topography. An important result from this is that surface satellite imagery would not be able to pick up the chl-a peaks associated with bottom topography and currents.
6. Nutrient data will be important to further explain sources, processes & distributions.
7. The gaps through the Mascarene Plateau are not characterized by elevated phytoplankton biomass.

4.3 Field results from zooplankton sampling

A total of 93 multi-net stations were sampled on cruises 2008407 (84 stations) and 2008408 (9 stations), from 60 m - 5000 m in depth. Eighty-two of these stations comprised three or more depth strata, and a total of 365 nets (322 and 43 respectively) were cast altogether. In the first 44 stations, nets were hauled vertically, whilst the latter 49 were oblique. The total volume of water filtered by oblique tows was greater, and the flow rate higher, than that obtained with vertical hauls (Table 7).

A summary of the multi-net stations is provided in **Error! Reference source not found.**, from which it can be seen that there were “problems” with 14 of them. These “problems” were caused either by tears to the nets (subsequently patched) or to the catches on the cod-ends coming loose (it is recommended that these be replaced), and effectively reduce the total number of samples available for analysis.

Table 7: The average volume of water sampled by each net in the four surveys, by haul type. Average flow rate data also shown.

Survey	Tow Type	N	Mean Rate	STDEV Rate	Mean Vol	STDEV VOL

2008405	VERTICAL	290	0.15	0.04	40.30	12.56
2008406	VERTICAL	51	0.11	0.03	29.55	18.13
2008407	VERTICAL	168	0.15	0.03	48.76	29.22
2008407	OBLIQUE	154	0.32	0.07	129.45	75.94
2008408	OBLIQUE	86	0.34	0.11	130.51	76.61

Table 8: Summary details of the stations sampled by multi-net during surveys 2008407 and 2008408

Survey	Station	Time	Haul	Lat	Long	Sounding	No Nets	Max Depth	TOT Vol	Problem
2008407	PL01	05:07:26 AM	Vertical	19.58	58.23	2562	4	301.6	177.0	NO
2008407	PL02	07:34:35 AM	Vertical	19.68	58.14	2092	4	302.7	184.0	NO
2008407	PL03	09:32:57 AM	Vertical	19.78	58.04	814	4	305.4	162.0	NO
2008407	PL04	11:21:19 AM	Vertical	19.88	57.94	592	4	299.9	184.0	NO
2008407	PL07	03:40:36 PM	Vertical	19.95	57.66	45	1	40.6	16.0	NO
2008407	PL08	04:52:10 PM	Vertical	19.85	57.67	58	1	51.2	24.0	NO
2008407	PL09	06:22:15 PM	Vertical	19.75	57.70	536	4	298.9	189.0	NO
2008407	PL10	08:05:01 PM	Vertical	19.65	57.75	379	4	300.5	181.0	NO
2008407	PL11	09:44:57 PM	Vertical	19.55	57.76	507	4	303.6	113.0	NO
2008407	PL12	11:24:13 PM	Vertical	19.45	57.76	678	4	302.4	157.0	NO
2008407	PL13	12:59:01 AM	Vertical	19.35	57.76	650	4	304.1	112.0	NO
2008407	PL14	02:37:52 AM	Vertical	19.25	57.76	584	4	302.6	188.0	YES
2008407	PL15	05:17:50 AM	Vertical	19.15	57.76	616	4	301.3	186.0	NO
2008407	PL16	07:17:55 AM	Vertical	19.05	57.75	865	4	305.7	216.0	NO
2008407	PL19	02:08:35 PM	Vertical	18.77	58.85	1916	5	501.9	301.0	NO
2008407	PL20	08:56:19 PM	Vertical	17.56	59.40	344	4	301.6	135.0	NO
2008407	PL23	02:15:43 AM	Vertical	16.59	59.80	145	3	134.5	69.0	NO
2008407	PL24	09:07:55 AM	Vertical	16.67	60.64	1124	5	504.9	203.0	NO
2008407	PL27	09:02:41 AM	Vertical	16.52	59.00	1930	5	500.4	267.0	NO
2008407	PL28	11:14:33 AM	Vertical	16.54	59.29	53	1	42.1	25.0	NO
2008407	PL29	04:12:12 AM	Vertical	15.92	60.18	237	4	229.9	112.0	NO
2008407	PL32	01:24:44 PM	Vertical	15.42	59.82	2080	5	500.4	208.0	NO
2008407	PL33	03:35:07 PM	Vertical	15.38	60.06	60	1	50	25.0	NO
2008407	PL36	12:13:12 PM	Vertical	15.36	60.57	62	1	49.9	28.0	NO
2008407	PL37	05:03:01 AM	Vertical	15.33	61.14	305	4	291.5	204.0	NO
2008407	PL40	04:27:32 PM	Vertical	15.27	61.77	3301	4	300.2	198.0	YES
2008407	PL41	02:57:40 AM	Vertical	14.81	61.62	3219	4	299.2	214.0	NO
2008407	PL44	09:37:27 AM	Vertical	14.62	61.39	2921	5	505.1	217.0	NO
2008407	PL45	03:17:17 PM	Vertical	14.50	61.14	60	1	49.8	24.0	YES
2008407	PL47	10:07:32 PM	Vertical	13.95	60.24	53	1	41.5	19.0	NO
2008407	PL49	01:13:21 AM	Vertical	13.90	60.17	2656	5	499.7	196.0	YES
2008407	PL50	04:29:34 AM	Vertical	13.86	60.12	3232	5	498.9	256.0	NO
2008407	PL53	08:22:48 PM	Vertical	13.37	60.81	290	4	272	174.0	NO
2008407	PL54	01:10:03 AM	Vertical	12.79	60.95	550	5	506.1	301.0	NO
2008407	PL55	08:19:09 AM	Vertical	12.19	61.09	296	4	281	214.0	NO
2008407	PL56	01:38:08 PM	Vertical	11.61	61.25	220	3	205	187.0	NO
2008407	PL59	02:49:06 AM	Vertical	12.07	62.54	3680	5	500.4	353.0	YES
2008407	PL60	11:47:21 AM	Vertical	12.85	61.98	3612	5	503.7	429.0	NO
2008407	PL64	12:00:56 AM	Vertical	12.08	61.51	280	4	262.3	282.0	NO
2008407	PL65	12:33:46 PM	Vertical	12.08	60.59	2199	5	503.1	381.0	NO
2008407	PL68	12:08:55 AM	Vertical	12.81	60.04	3693	5	501.4	220.0	NO
2008407	PL69	07:48:59 AM	Vertical	12.07	59.61	3313	5	502.8	234.0	NO
2008407	PL72	06:37:38 PM	Vertical	12.85	59.14	3964	5	501.2	309.0	YES
2008407	PL73	03:14:51 AM	Vertical	12.09	58.61	4157	5	503.1	317.0	YES
2008407	PL76	02:15:45 PM	Oblique	10.90	61.38	124	2	115.2	215.0	NO
2008407	PL77	04:34:07 AM	Oblique	10.49	63.09	2313	5	455.8	997.0	NO
2008407	PL78	09:37:31 AM	Oblique	10.53	62.64	2191	5	439.6	1184.0	NO
2008407	PL85	03:03:14 PM	Oblique	10.56	59.85	2338	5	433.8	900.0	YES
2008407	PL86	09:24:02 PM	Oblique	10.60	59.57	2769	5	457.6	791.0	NO
2008407	PL87	07:27:58 AM	Oblique	9.91	60.55	1226	5	485.8	771.0	NO
2008407	PL90	12:33:27 AM	Oblique	9.63	60.24	978	5	465.1	997.0	NO
2008407	PL91	06:44:28 AM	Oblique	9.09	59.81	921	5	497.5	777.0	NO
2008407	PL94	02:19:03 PM	Oblique	8.55	59.41	1200	5	466.9	768.0	NO
2008407	PL95	08:52:47 PM	Oblique	8.05	58.97	1212	5	501.7	832.0	NO
2008407	PL97	05:34:54 AM	Oblique	7.53	58.56	1552	5	502.3	805.0	NO
2008407	PL99	12:38:40 PM	Oblique	6.99	58.12	1589	5	499.8	774.0	NO
2008407	PL102	09:27:48 PM	Oblique	6.47	57.73	1110	5	502.9	570.0	NO
2008407	PL103	07:30:54 PM	Oblique	5.91	57.29	1047	5	447.1	875.0	YES
2008407	PL106	06:20:21 AM	Oblique	5.68	57.03	1157	5	453.9	752.0	NO
2008407	PL107	05:50:32 PM	Oblique	5.63	56.17	2663	5	500.8	614.0	NO
2008407	PL110	10:18:58 PM	Oblique	5.50	56.62	42	1	29.8	60.0	NO
2008407	PL111	12:56:43 PM	Oblique	5.30	56.29	59	1	36.2	185.0	NO
2008407	PL114	08:05:30 PM	Oblique	5.12	56.36	38	3	25.2	150.0	NO
2008407	PL115	08:58:56 AM	Oblique	4.76	56.45	61	3	49.3	221.0	NO
2008407	PL116	02:44:36 PM	Oblique	5.03	55.72	56	3	52.5	255.0	NO
2008407	PL119	09:32:59 PM	Oblique	5.18	55.16	2247	5	499.9	742.0	NO
2008407	PL120	01:14:14 AM	Oblique	5.08	55.29	43	4	40.8	213.0	YES
2008407	PL123	07:50:57 AM	Oblique	4.69	56.09	45	3	35.2	190.0	NO
2008407	PL124	10:37:28 AM	Oblique	4.55	56.39	35	1	15.9	72.0	NO
2008407	PL127	03:44:30 PM	Oblique	4.51	56.55	1569	5	453.5	734.0	NO
2008407	PL128	06:27:46 AM	Oblique	4.40	55.88	49	3	44.6	212.0	NO
2008407	PL130	10:10:14 AM	Oblique	4.67	55.64	35	3	24	130.0	NO
2008407	PL133	08:01:24 PM	Oblique	4.79	55.25	67	3	47.6	156.0	NO
2008407	PL134	09:42:27 AM	Oblique	4.49	54.76	59	3	49.6	241.0	NO
2008407	PL137	05:41:36 AM	Oblique	4.33	54.54	59	3	50.3	332.0	NO
2008407	PL138	12:36:05 PM	Oblique	3.93	54.97	69	3	50.9	251.0	NO
2008407	PL141	04:16:50 PM	Oblique	4.26	55.26	44	3	40.4	232.0	NO
2008407	PL142	10:56:26 PM	Oblique	3.57	55.26	2585	5	501.1	825.0	NO
2008407	PL144	08:58:56 AM	Oblique	3.88	55.53	64	3	49.7	227.0	NO
2008407	PL147	04:08:20 PM	Oblique	4.01	56.13	174	3	51.6	246.0	NO
2008407	PL149	11:09:55 PM	Oblique	4.12	56.29	1482	4	250.8	467.0	NO
2008407	PL150	12:27:39 AM	Oblique	4.12	56.29	1493	4	250.3	297.0	NO
2008407	PL151	01:53:03 AM	Oblique	4.12	56.29	1443	5	415.8	691.0	NO
2008407	PL152	06:29:53 AM	Oblique	4.18	55.73	60	3	51.5	185.0	NO
2008408	PL02	03:51:17 PM	Oblique	4.90	53.84	3111	5	499.4	606.0	YES
2008408	PL04	09:21:48 PM	Oblique	5.57	53.32	59	4	49.9	231.0	YES
2008408	PL07	02:53:19 AM	Oblique	6.15	53.04	53	4	44.2	266.0	YES
2008408	PL08	07:54:46 AM	Oblique	6.70	52.86	1682	5	438.2	827.0	NO
2008408	PL11	03:14:04 PM	Oblique	7.36	52.87	3422	5	499.7	821.0	NO
2008408	PL12	07:23:23 PM	Oblique	7.74	53.02	2369	5	495.4	812.0	NO
2008408	PL15	02:49:15 AM	Oblique	8.28	52.71	5103	5	482.8	626.0	YES
2008408	PL16	08:12:27 PM	Oblique	7.88	55.05	3647	5	454.9	722.0	NO
2008408	PL19	06:23:40 PM	Oblique	12.08	54.94	4554	5	499.4	701.0	NO

Preliminary Bongo biomass results

Bongo nets were deployed at a total of 74 environmental stations, with a total of 482 samples collected for isotope analysis (280-500µm, n = 72; 500µm-1mm, n = 66; 1-2mm, n = 112; 2-4mm, n = 134; >4mm, n = 98).

Along the Mascarene Plateau, zooplankton biomass (mg wet-mass m^{-3}) increases northward by almost an order of magnitude (Figure 36). With only few exceptions, the highest consistent biomass was observed north of –7 degrees South. (Figure 37). On the Seychelles Bank, zooplankton biomass seemed to be concentrated over the shallow central shelf region of the plateau. In contrast, in deeper waters, biomass was greatly reduced. In most cases, shelf zooplankton was restricted to smaller size classes (primarily copepods and chaetognaths < 1 to 2 mm). Biomass did not vary much between day and night stations, however, larger species such as euphausids, decapods and ichthyoplankton seemed to be absent from most daytime samples.

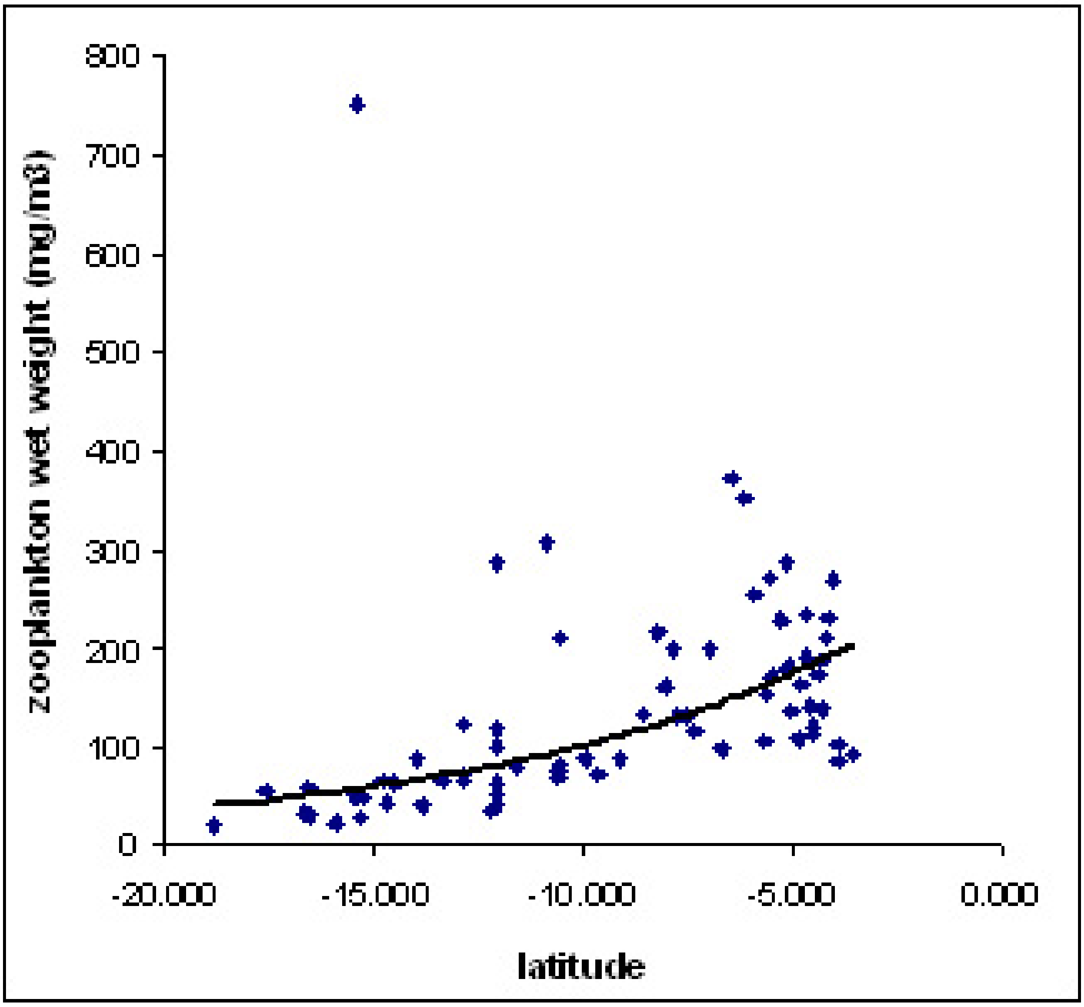


Figure 36: *Zooplankton biomass on the Mascarene Plateau along a latitudinal gradient (180 µm Bongo mesh size)*

Preliminary results suggest that south of the Seychelles Bank, zooplankton biomass was generally low both on and off the shelf and during both day and night stations. Enhanced biomass was observed only at isolated stations, was often due to the predominance of one species and with one exception was located downstream of the plateau (west). Additional analysis in relation to physical, chemical and biological data as well as bathymetry is required to better understand these patterns.

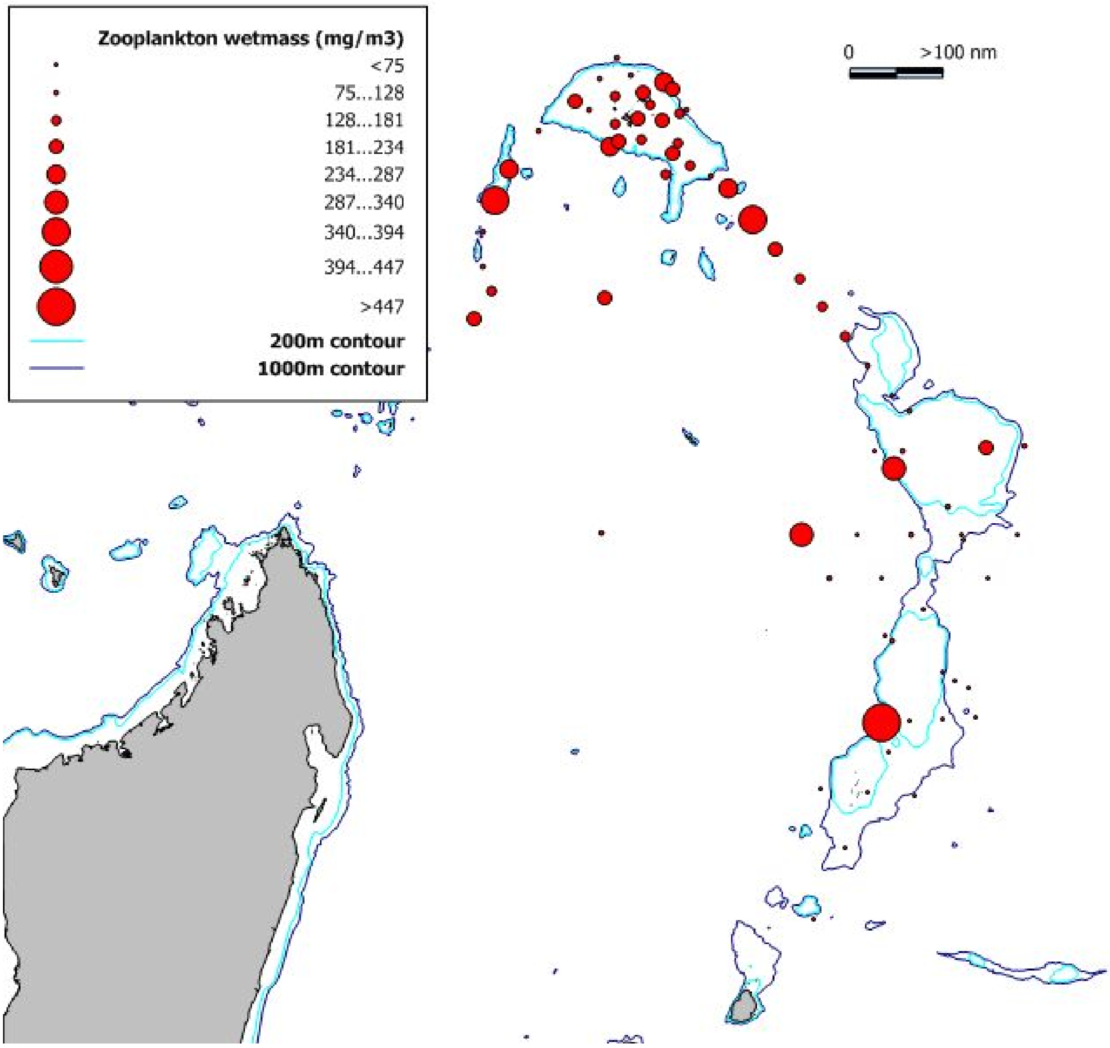


Figure 37: *Zooplankton biomass distribution along the Mascarene Plateau.*

5. RESULTS OF THE ACOUSTIC SURVEY AND FISHING OPERATIONS

5.1 Plankton registrations by the acoustic system

Figure 38 shows the distribution of plankton as recorded by the acoustic system and classified by its characteristic traces. The registrations does not necessary reflect biomass abundance as other factors

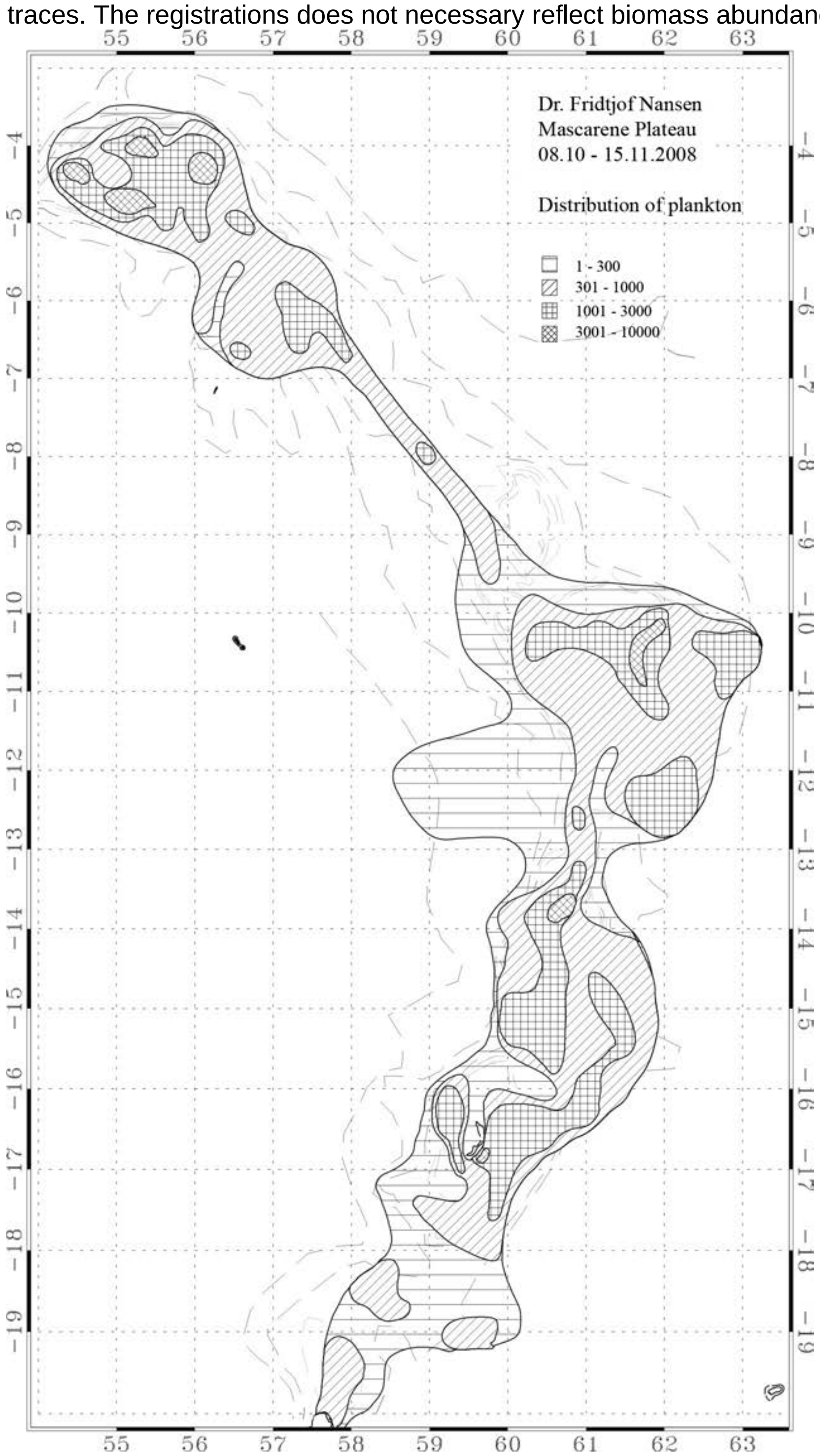


Figure 38. Distribution of plankton from acoustic registrations.

such as resonance effects and micro bubbles may also play a part. No south-north trend can be read from the figure while there is a tendency that densities tend to be higher at the margin of the banks than at the center

5.2 Mesopelagic fish

Figure 39 Shows the distribution of mesopelagic fish in the whole survey area. The outer hatched lines shows the geographical limits of the survey and the actual fish distribution will go beyond these lines. The abundance is low in the southern regions i.e north of Mauritius and around Nazareth Bank. Higher densities are recorded around Saya de Malha Bank and Seychelles Bank and in the wide channel between. The highest recordings are associated with the margins of the banks while the central parts in general have absence of mesopelagic fish.

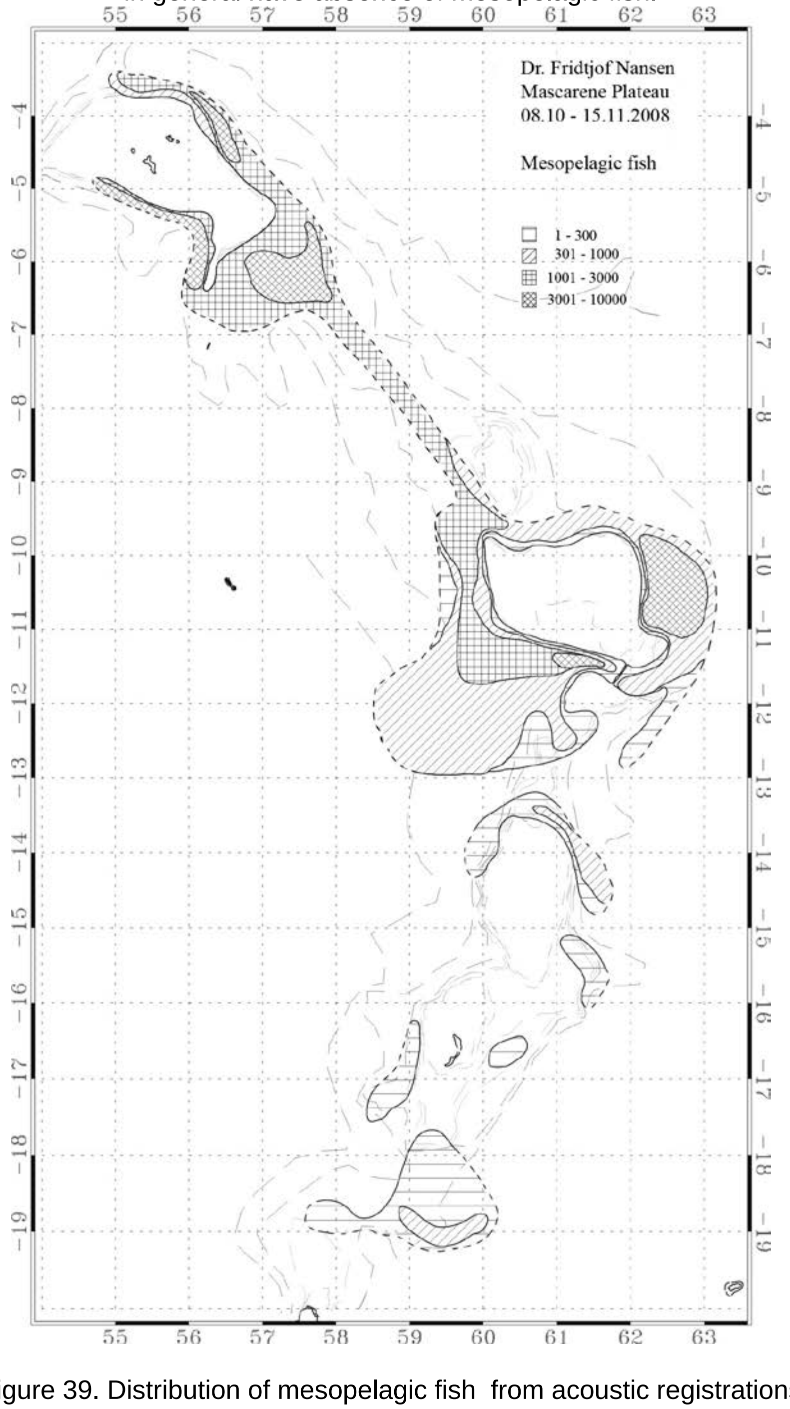


Figure 39. Distribution of mesopelagic fish from acoustic registrations

5.3 Pelagic fish distribution and abundance

Clupeoid fishes like anchovies and sardinellas are usually fairly easy to distinguish from other types of small pelagic fish such as carangids and scombroids from the type of registrations they form and are therefore in the daily scrutinising of the records roughly classified as Pelagic 1 and Pelagic 2 respectively.

No registrations of the Pelagic 1 category were recorded during the survey. Figure 40 shows the distribution of Pelagic 2 type of fish. Most of the survey area is absent from pelagic fish apart from a few single occurrences around the Nazareth Bank, a low-density aggregation on the northern part of the Saya de Malha Bank and at the south-western edges of the Seychelles Bank.

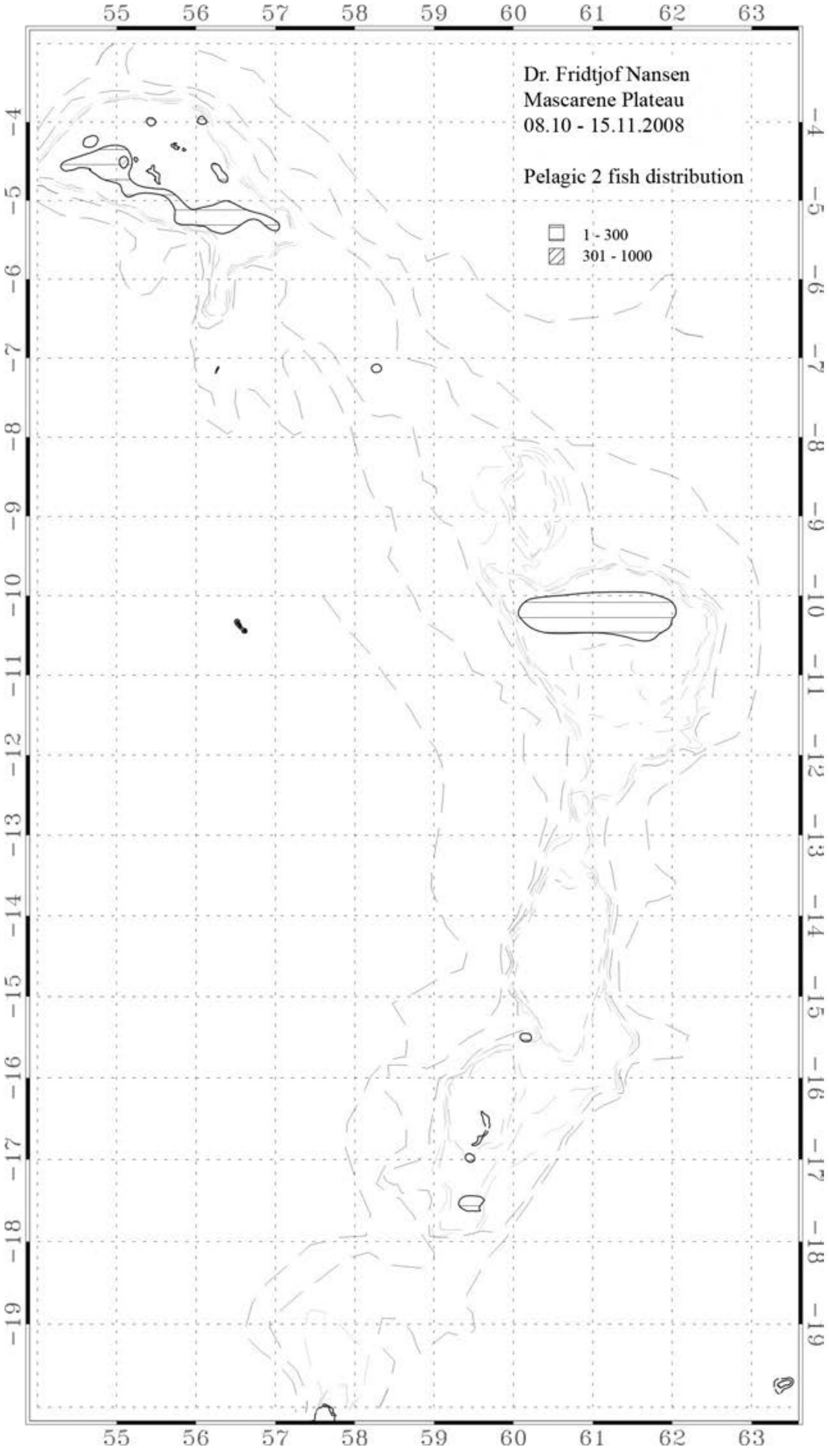


Figure 40 Distribution of pelagic fish, type 2 from acoustic observations.

5.4 Demersal fish distribution from acoustic registrations

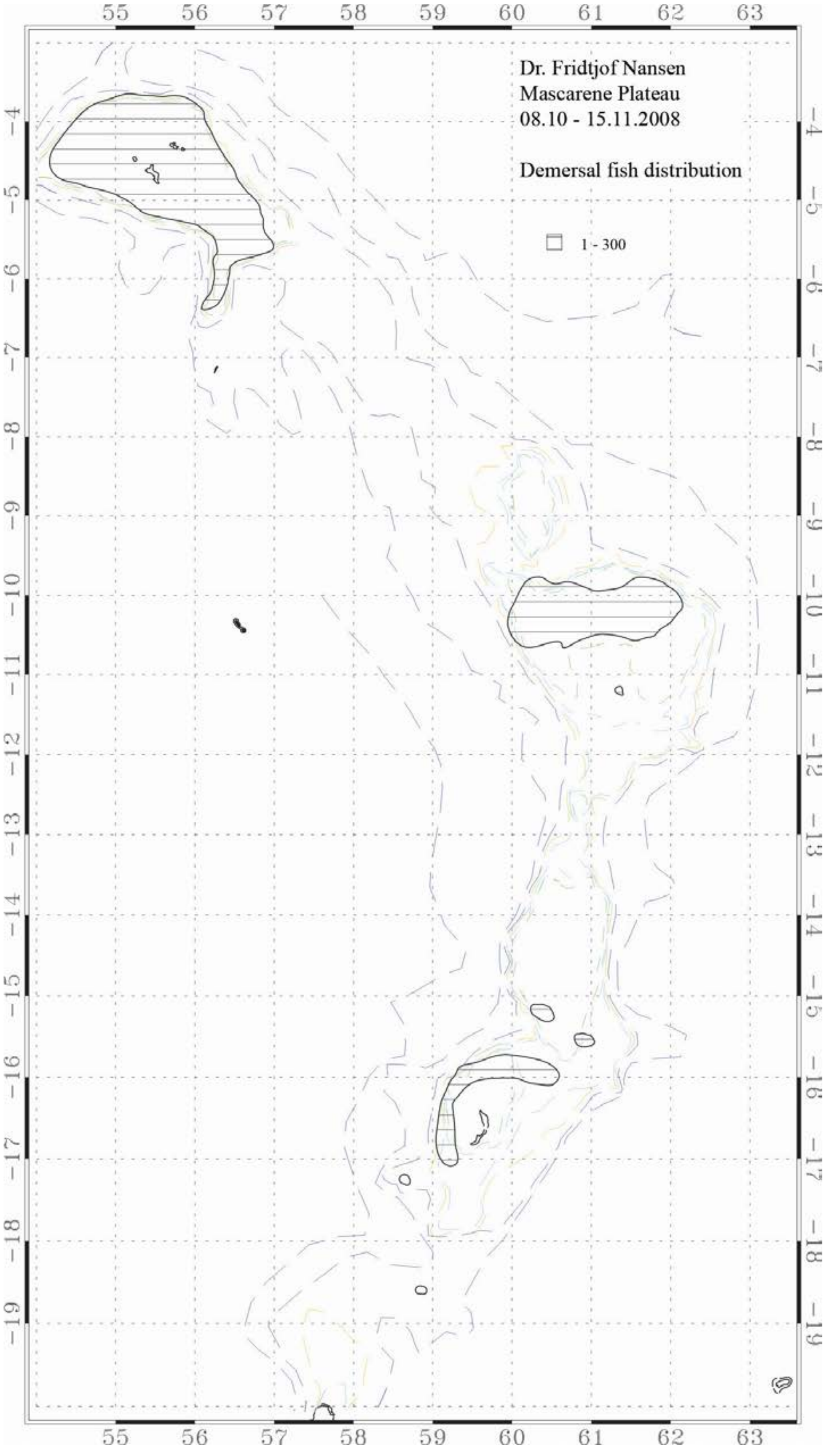


Figure 41. Distribution of demersal fish from acoustic recordings, in 5 nautical mile resolution.

Demersal fish are usually assessed, where bottom conditions permit, with demersal trawl sampling. Time constraints did not allow for a trawl survey on the Mascarene Plateau and the Seychelles Bank. The acoustic system do not record well fish that stays close to the bottom due to the so called bottom shadow effect. Although not quantitatively precise the method can still provide figures of relative density. At night when the fish often lift from bottom for feeding, better recordings of fish densities are obtained.

Figure 41 shows the distribution of demersal fish from the whole survey area as registered by the acoustic system. Low density aggregations are recorded at the north-western part of the Nazareth Bank, on the northern part of the Saya de Malha Bank and most of the Seychelles Bank. Figure 42 shows a detailed picture of the distribution on the Seychelles Bank, with one nautical mile resolution. It shows that the highest relative densities are associated with the margins of the bank, probably due to higher productivity in these areas as compared to the central parts of the bank.

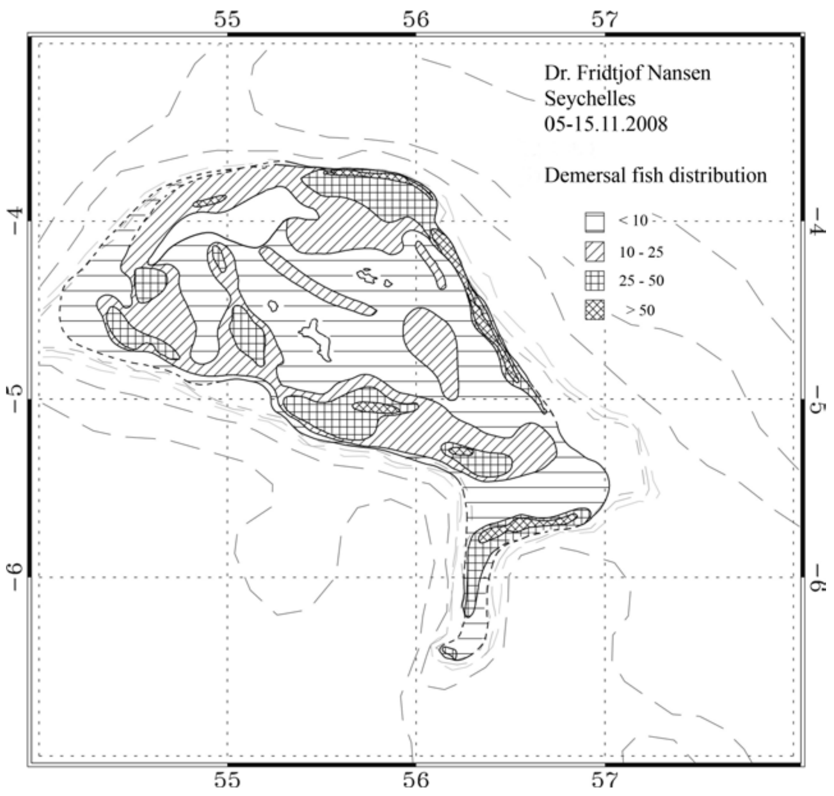


Figure 42 Distribution of demersal fish on the Seychelles Bank with 1nm resolution of acoustic registrations

5.5 Species diversity and DNA analysis from trawl sampling

DNA

A total of 654 tissue samples were collected for DNA analysis, from a provisional total of 20 fish species Annex V. Once the tissue samples are back in SAIAB in Grahamstown their identities will be confirmed by cross-referencing specimens, photos and labeled tissues. Tissue samples will be analysed through the Barcode of Life programme (FISHBOL) in addition to other genetic studies as and when these are conducted in association with taxonomic revisions.

Isotopes

A total of 842 tissue samples were collected for isotope analysis, from a provisional total of 379 fish and invertebrate species. Once the tissue samples are back in SAIAB in Grahamstown their identities will be confirmed by cross-referencing specimens, photos and labeled tissues.

Taxonomy and photography

The collection of reference specimens for all species collected during the survey, and type series for species believed to be undescribed or poorly represented in earlier collections, has resulted in a provisional total of 271 fish species (estimating for duplication of temporary names for the same species in the database) in over 80 families Annex IV. Most species have been positively identified on board using available reference materials (FishBase on-line, Smith's Sea Fishes, Heemstra & Heemstra's Coastal Fishes of Southern Africa, FAO identification guides for the Western Indian Ocean, FAO species catalogues for various important families, Compagno et al.'s Field Guide to the sharks of the world and the South African guide to sharks and rays, and also various field guides to coral reef fishes in the Indian Ocean). Up-to-date taxonomic names are in the process of being verified using Eschmeyer's on-line 'Catalog of Fishes'.

Photographs have been taken by Oddgeir Alvheim for every species collected; the majority after the fish were pinned out to display the fins properly. These photographs will be used in the preparation of paintings of each species for inclusion in the forthcoming book on the Fishes of the Western Indian Ocean. Examples of these photos shown here include (Plate 1) a selection of photos of species that are either undescribed or are poorly represented in the literature of the fishes of this area. Plate 2 is an example of the photos of all species of one family, in this case the Mullidae, presented together to facilitate identification in future. Plate 3 includes photos of a fairly random selection of species that indicate the quality of photos available for use in the preparation of the new WIO fishes book illustrations.

Biodiversity assessment

While every effort has been made to explore all depths down to 300 m, this proved difficult to achieve in many areas (Table 9). In the southern area near Mauritius and on the Nazareth Bank, shallow water stations were impossible to find because of extensive corals, and even in 60 m depth corals were present in most areas, limiting trawling opportunities. The first attempt at 60 m had to be abandoned when corals were encountered shortly after the net was set. In this area it did prove possible to trawl at greater depths and six trawls were made from 214 to 313 m in depth.

In the central part of the Mascarene Plateau, i.e. the Saya de Malha banks, shallower trawls were possible as a result of less extensive corals, and four trawls were made in water less than 50 m deep. Trawls were possible over a wide depth range.

The greatest difficulty in finding suitable trawling ground was on the Seychelles Islands banks, where all trawls were carried out at similar depths in the region of 60 m. In shallower water the bottom was untrawlable as a result of uneven topography and/or coral outcrops. At the edge of the banks, the slopes to deep water are too steep to permit trawling along the depth contours.

The data collected are thus inadequate for any statistical meaningful analysis, the only possible comparison being the four hauls on the Mauritius/Nazareth banks and six on the Seychelles banks between 50 and 70 m depth. Catches were, however, extremely variable, as shown by the very large SDs for the catch data by weight (Table 10). Most noteworthy catches came from the last three hauls of the survey, which yielded catch rates between 484 and 819 kg h^{-1}, and it appears that the northern part of the survey area is more productive than the areas to the south.

The trawl station data with preliminary species lists are included as Appendix I to this report. The highest diversity was recorded in the last two trawls of the survey, with 60 and 64 fish species listed. This was remarkable given that the first four trawls on the Seychelles bank at similar depths yielded only 13 to 28 species, while no other trawls during the survey yielded 40 species or more.

Table 9. Distribution of demersal trawl stations by depth in the three parts of the Mascarene Plateau.

Depth (	Number of ½ hr trawls		
	Nazare	Saya de Mal	Seychell
30-50	1	3	
50-70	*4	0	6
70-100	0	1	
100-20(	0	2	
200-30(	6	1	

* The 3rd (5 min) and 4th (22 min) trawls are combined as one in this analysis.

Table 10. Mean catch rates, with standard deviation, for the trawl hauls shown in Table 9.

Depth (m)	Nazareth		Saya de Malha		Seychelles	
	Mean kg h^{-1}	SD	Mean kg h^{-1}	SD	Mean kg h^{-1}	SD
30-50	62		123	45		
50-70	142	155			338	314
70-100			73			
100-200			51	15		
200-300+	41	23	22			

* The 3rd (5 min) and 4th (22 min) trawls are combined as one in this analysis.

These biodiversity data indicate that, although some idea has been obtained of the distribution and abundance of commoner species in the Mascarene area, the survey must be regarded as only providing a preliminary impression of the diversity and abundance of the fishes in the area. The data will be compared with the species list provided in the report on the 1978 survey by the previous RV Dr Fridtjof Nansen, but this will require some research into the literature to take account of taxonomic progress since that survey

In addition to the demersal trawls, six pelagic trawls were conducted at night to investigate the composition of concentrations of organisms revealed in the acoustic survey. Four trawls were in midwater at various depths, while two trawls were carried out in the surface layer. The pelagic trawl catches were investigated and samples collected of the various species in the catch.

Crustaceans and squid in the catches were also recorded. Table 3, sorted by family in alphabetical order). The final species list is uncertain because of a number of informal names used in early trawls that may result in duplication, while close study of the pelagic fauna will undoubtedly increase the number of species, particularly the difficult to distinguish Myctophidae, in the catch.

6. OTHER OBSERVATIONS

6.1. Marine Mammals

Very few observations were done during the length of the cruise, only 9 (Table 4). For each sighting the following were also recorded if possible: species, number of individuals (lowest, highest and best estimation), type (calf, juvenile or adult), activity (travelling, resting, socializing, hunting or milling), specific behaviors (e.g.: breaching, bow riding), boat reaction of animal and the sighting cue.
Binoculars were use to help during the research.
Mauritius- Nazareth channel: 0 sighting
Nazareth bank: 1 sighting
Nazareth – Saya de Malha channel: 2 sightings
Saya de Malha bank: 0 sighting
Saya de Malha- Seychelles: 3 sightings
Seychelles bank: 3 sightings

These results could potentially be explained by:

- It was the end of reproductive season for the migratory species (e.g.: Humpback whales), and the area observed was done on the northern limit of the reproductive area.
- Preliminary results of the measurements (i.e. biomass of phytoplankton, zooplankton, fishes/ macrofauna and birds) also show very low productivity in the Mascarene plateau. These preliminary results could explain the "absence" of sedentary species.

These results need to be put in perspective regarding observation conditions:

- Only one whale-watcher during the entire cruise. The effects of fatigue and the difficulty of covering the entire observation area may have resulted in missed sightings.
- The boat did not change its course to follow a sighted cetacean and consequently species determination was impossible.
- The weather conditions were not ideal for the season, especially at the beginning of the cruise. For example, there was no sea-state under 3 before the 5th of November.

6.2. Observations from Part II: Seychelles- Pemba

6.2.1. Acoustic recordings Seychelles- Pemba

No registrations of commercial pelagic fish were recorded while, at average, medium high concentrations of mesopelagic fish were found continuously along the survey track (1000 >s_A>3000). Table 11 shows maximum, minimum and average values of s_A for the three main acoustic categories (demersal, plankton and mesopelagic).

The highest s_A values for mesopelagic were recorded close to the Seychelles (3000 > s_A > 10000).

Demersal recordings belong to the area west of the Seychelles where depths ranged between 24 and 215m.

	Depth	Demersal	Plankton	Mesopelag
Max	3 697.0	762.0	7 122.0	7 351.0
Min	24.0	2.0	97.0	122.0
Average	1 368.1	54.7	870.0	1 408.8

Table 11: Depth (m) and s_A (m^2/NM^2) values for the three acoustic categories of fish as acoustically recorded.

The main mesopelagic layer was found between 200 and 500m depth, but at dusk it separated, and part of it moved close to the surface, where it mixed with the plankton, to migrate back to deeper waters at dawn.

6.2.2. Species diversity from trawl catches (Seychelles-Pemba)

Three pelagic hauls were taken on the open sea to check for species composition and abundance. The trawl catches were sampled for species composition by weight and number. Basic information, recorded at each station, together with catch information is shown in Annex I. The catches were small (the biggest being no more than 4k) but with a high diversity (an average of 26 species per haul) and consisted mainly of mesopelagic species. Most of the other species collected were in juvenile or larval stages, (possibly drifting with the currents.

The most commonly caught species belonged to the Myctophidae family with the genus Diaphus being the most common and diverse .

6.2.3. Other observations Seychelles - Pemba

Whales and birds Seychelles Pemba

A few sights of shortfin pilot whales (*Globicephala macrorhynchus*) and bottle nose dolphins (*Tursiops truncatus*) were made during the survey. As no whale observers were onboard no counting was carried out.

At 8°10.8'S, 53°22'E a large group of dolphins together with a school of tuna was observed, and then at 12°01.47S, 53°09.4E a group of around 10 to 15 shortfin pilot whales and 25 to 30 bottle nose dolphins followed the boat.

Very few seabirds were observed during the survey. The species observed were the common noddy tern (*Anous stolidus*), an unidentified tern (Sternidae family), shearwaters (*Puffinus sp*) and frigates (*Fregate sp*),

DNA and isotope collections Seychelles - Pemba

At least three individuals of all species taken during the survey were sampled for DNA. Tissues were also taken from three specimens of representative species for isotope analysis. These sampled specimens were measured and pictures taken with labels.

DNA: Muscle tissue was taken from the right side of the fish. This was done in order to keep the left side in good condition for a reference picture (with sample tag). The tissue was removed from below the lateral line on the caudal peduncle after cleaning away skin and scales. Muscle tissue was cut and placed into 1.5 ml Eppendorf tubes containing 95% ethanol and a unique number for identification (e.g. ACEP 08-001). A label with the same identification number used for the DNA tube was attached to the specimens through the mouth and gills for future reference.

Stable Isotope sampling: Muscle tissue was taken from below the lateral line on the tail fin peduncle after cleaning away skin and scales. The tissue sample was placed in a 1.5 ml Eppendorf tube, placed in a 50^{o} C oven and dried with the lid open at this temperature for 48 hours. Permanent markers were used to label the outside of the tube, in addition to a sticky label on the lid. When possible, 3 individuals of the same species from each trawl were sampled. Once dried, Eppendorf tubes were closed and stored in a "cryobox". Full cryoboxes were wrapped in clingfilm for moisture protection and stored in a bin for subsequent analysis on shore.

For both DNA and stable isotope tissue samples, all equipment used was cleaned between specimens. The working surface used was also wiped clean and dried every time before a new individual was sampled in order to avoid contamination. Only one spreadsheet was used to record DNA, stable isotope sample and voucher specimen data.

Voucher specimens were kept for every species from which DNA and isotopes samples were collected. All specimens were fixed as for the taxonomic collection.

All DNA tissue samples were stored in plastic containers by trawl number. All trawl containers with DNA were put in a plastic bucket labelled ASCMLE-LEG3 (part I or II) and kept in the freezer. The name of the person that collected the samples were included in the bucket labels in case questions arise at a later stage.

7. REFERENCES

Calbet, A., and Landry, M. R. (1999). Mesozooplankton influences on the microbial food web: Direct and indirect trophic interactions in the oligotrophic open ocean. *Limnology and Oceanography* **44,** 1370-1380.

JGOFS. (1994). Protocols for the Joint Global Ocean Flux Study (JGOFS). Core Measurements, Manual and Guides., pp. 210. UNESCO, Scientific Committee on Oceanic Research, Intergovernmental Oceanographic Commission.

Landry, M. R., and Hassett, R. P. (1982). Estimating the grazing impact of marine micro-zooplankton. *Marine Biology* **67,** 283-288.

Annex I Records of fishing station

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 1
DATE :11.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 18°35.13
start stop duration Lon E 58°48.28
TIME :07:36:34 08:05:20 28.8 (min) Purpose : 1
LOG : 8103.29 8104.88 1.6 Region : 7600
FDEPTH: 60 61 Gear cond.: 0
BDEPTH: 60 61 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.3 kn
Sorted : 36 Total catch: 35.55 Catch/hour: 74.17

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Balistoides viridescens	12.02	4	16.20	3
Acanthurus dussumieri	10.74	6	14.49	4
Pomacanthus imperator	10.03	6	13.53	5
Pseudobalistes fuscus	9.95	4	13.42	7
Acanthurus blochii	9.28	6	12.52	6
Sargocentron spiniferum	3.92	2	5.29	1
Parupeneus pleurostigma	2.82	67	3.80	
Balistoides conspicillum	2.52	2	3.40	2
Diodon hystrix	1.98	2	2.67	
Gymnothorax cf. nudivomer	1.88	2	2.53	
Bodianus bilunulatus bilunula.	1.79	6	2.42	
Lactoria diaphana	1.73	2	2.33	
Pterocaesio tile	1.13	25	1.52	
Gymnothorax undulatus	0.88	2	1.18	
Parupeneus macronema	0.69	23	0.93	
Gymnocranius griseus	0.58	2	0.79	
Apolemichthys trimaculatus	0.35	2	0.48	
Chaetodon auriga	0.31	2	0.42	
Canthigaster valentini	0.27	8	0.37	
Paracirrhites arcatus	0.27	15	0.37	
Epinephelus fasciatus	0.17	4	0.23	
Parupeneus cf. cinnabaricus	0.13	8	0.17	
Parupeneus sp.	0.10	4	0.14	
Dascyllus carneus	0.08	8	0.11	
Lactoria fornasini	0.08	2	0.11	
Anthias cooperi	0.06	2	0.08	
Scolopsis frenatus	0.06	2	0.08	
Sufflamen chrysopterum	0.06	2	0.08	
Cirrhitichthys sp.	0.06	6	0.08	
Syngnathidae sp.	0.04	2	0.06	
Cheatodon guttatissimus	0.02	2	0.03	
Anthias sp.	0.02	2	0.03	
Apogon cf. taeniatus	0.02	2	0.03	
Apogon sp. 'dark'	0.02	2	0.03	
Sargocentron diadema	0.02	2	0.03	
Synodus dermatogenys	0.02	2	0.03	
Labroides dimidiatus	0.02	2	0.03	
Total	74.17		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 2
DATE :11.10.2008 GEAR TYPE: PT NO: 2 POSITION:Lat S 18°41.18
start stop duration Lon E 59°11.46
TIME :17:31:34 18:04:48 33.2 (min) Purpose : 1
LOG : 8148.37 8150.12 1.8 Region : 7600
FDEPTH: 100 95 Gear cond.: 0
BDEPTH: 1723 1541 Validity : 0
Towing dir: 0° Wire out : 270 m Speed : 3.2 kn
Sorted : 1 Total catch: 1.41 Catch/hour: 2.55

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Loligo duvauceli	1.95	2	76.60	
Ommastrephes sp.	0.36	11	14.18	
Diaphus sp.	0.18	0	7.09	
Diplophos cf. taenia	0.04	11	1.42	
Abraliopsis sp.	0.02	9	0.71	
Total	2.55		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 3
DATE :13.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 17°16.84
start stop duration Lon E 58°42.23
TIME :06:48:51 06:54:36 5.8 (min) Purpose : 1
LOG : 8505.01 8505.30 0.3 Region : 7600
FDEPTH: 60 60 Gear cond.: 9
BDEPTH: 60 60 Validity : 4
Towing dir: 0° Wire out : 150 m Speed : 3.0 kn
Sorted : 10 Total catch: 9.95 Catch/hour: 103.83

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Pterocaesio tile	30.78	543	29.65	
Gymnocranius grandoculis	30.78	21	29.65	8
Pseudobalistes fuscus	27.34	10	26.33	10
Balistoides conspicillum	10.85	10	10.45	11
Pterocaesio capricornis	1.67	31	1.61	
Parupeneus 'yellowstripe'	0.63	21	0.60	
Gnathodentex aurolineatus	0.63	21	0.60	9
Labrid cf. Xyrichthys	0.42	21	0.40	
Chaetodon kleinii	0.21	10	0.20	
Canthigaster coronata	0.21	10	0.20	
Canthigaster smithae	0.21	10	0.20	
Parupeneus 'roundhead-yellow l	0.10	10	0.10	
Total	103.83		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 4
DATE :13.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 17°16.81
start stop duration Lon E 58°40.47
TIME :07:32:23 07:54:08 21.7 (min) Purpose : 1
LOG : 8508.04 8509.19 1.1 Region : 7600
FDEPTH: 59 58 Gear cond.: 0
BDEPTH: 59 58 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.2 kn
Sorted : 19 Total catch: 18.55 Catch/hour: 51.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aprion virescens	20.34	8	39.74	10
Balistoides viridescens	7.37	6	14.40	
Pseudobalistes fuscus	6.73	3	13.16	
Pomacanthus imperator	4.08	3	7.98	
Arothron hispidus	4.08	3	7.98	12
Ostracion cubicus	2.37	3	4.64	
Lethrinus rubrioperculatus	1.30	3	2.53	11
Parupeneus pleurostigma	1.19	44	2.32	
Pterocaesio capricornis	1.05	17	2.05	
Pterocaesio tile	0.72	14	1.40	
Anthias cooperi	0.66	36	1.29	
Parupeneus macronema	0.61	25	1.19	
Parupeneus 'brown stripe'	0.22	14	0.43	
Parupeneus 'longsnout'	0.14	6	0.27	
Paracirrhites arcatus	0.08	6	0.16	
Lutjanus cf. bengalensis	0.06	3	0.11	13
Parupeneus 'roundhead-yellow l	0.03	3	0.05	
Chaetodon kleinii	0.03	3	0.05	
Cheilinus bimaculatus	0.03	3	0.05	
Labrid cf. Xyrichthys sp2	0.03	3	0.05	
Synodus dermatogenys	0.03	3	0.05	
Labroides dimidiatus	0.03	6	0.05	
Cirrhitichthys cf. oxycephalus	0.01	3	0.03	
Total	51.18		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 5
DATE :13.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 17°16.74
start stop duration Lon E 59°12.28
TIME :12:40:20 12:55:21 15.0 (min) Purpose : 1
LOG : 8545.77 8546.56 0.8 Region : 7600
FDEPTH: 313 311 Gear cond.: 0
BDEPTH: 313 311 Validity : 0
Towing dir: 0° Wire out : 800 m Speed : 3.2 kn
Sorted : 17 Total catch: 17.37 Catch/hour: 69.43

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Thyrsitoides marleyi	49.97	4	71.96	
Antigonia cf rubescens	5.76	60	8.29	
Squalus megalops	3.20	4	4.61	
Rexea prometheoides	2.92	196	4.20	
Pristipomoides argyrogrammicus	2.48	8	3.57	
Puerulus angulatus	2.44	24	3.51	
Peristedion weberi	1.00	20	1.44	
Synagrops japonicus	0.80	160	1.15	
Sepia sp. 'slender'	0.52	8	0.75	
Champsodon capensis	0.08	8	0.12	
Sepia sp.	0.08	4	0.12	
Chlorophthalmus sp.	0.08	24	0.12	
Zenion sp.	0.04	4	0.06	
Luzonichthys sp.	0.02	4	0.03	
Chlorophthalmus sp.	0.00	4	0.01	
Chaunax cf. pictus	0.00	4	0.01	
Total	69.38		99.93	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 6
DATE :13.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 16°50.36
start stop duration Lon E 59°35.36
TIME :22:31:54 22:46:48 14.9 (min) Purpose : 1
LOG : 8633.94 8634.84 0.9 Region : 7600
FDEPTH: 60 58 Gear cond.: 0
BDEPTH: 60 58 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.6 kn
Sorted : 94 Total catch: 93.64 Catch/hour: 377.31

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Taeniura meyeni	120.89	4	32.04	
Pterocaesio capricornis	100.34	318	26.59	
Lutjanus bohar	41.91	4	11.11	14
Scarus cf. ghobban	27.20	4	7.21	15
Lethrinus sp. 'elongate'	17.53	222	4.65	
Plotosus lineatus	15.35	693	4.07	
Abalistes stellatus	8.46	8	2.24	
Lethrinus rubrioperculatus	5.27	4	1.40	18
Apogon 'barred'	4.71	520	1.25	
Gymnocranius grandoculis	4.35	4	1.15	20
Arothron hispidus	4.05	4	1.07	17
Small unid blue fish	3.67	169	0.97	
Lutjanus kasmira	3.22	16	0.85	16
Parupeneus 'yellowstripe'	3.02	12	0.80	
Priacanthus hamrur	2.62	36	0.69	
Gymnocranius griseus	2.58	4	0.68	19
Scolopsis frenatus	1.69	40	0.45	
Parupeneus 'longsnout'	1.53	93	0.41	
Parupeneus 'brown stripe'	1.13	40	0.30	
Parupeneus macronema	1.13	44	0.30	
Parupeneus 'roundhead-yellow l	0.81	40	0.22	
Sargocentron ittodai	0.73	32	0.19	
Lagocephalus sceleratus	0.41	4	0.11	
Pterocaesio tile	0.32	8	0.09	
Sargocentron diadema	0.28	12	0.07	
Apogon sp. 'spot'	0.24	12	0.06	
Fistularia commersonii	0.19	4	0.05	
Dascyllus trimaculatus	0.18	4	0.05	
Parapriacanthus ransonneti	0.16	36	0.04	
Chaetodon dolosus	0.13	4	0.03	
Synodus dermatogenys	0.12	24	0.03	
Canthigaster coronata	0.10	8	0.03	
Cantherhines cf. fronticinctus	0.08	8	0.02	

Apogon nitidus	0.08	8	0.02	
Synodus sp.	0.07	4	0.02	
Myripristis hexagona	0.04	4	0.01	
Apogon apogonides	0.04	4	0.01	
Anthias cooperi	0.02	4	0.01	
Malthopsis cf. tiarella	0.01	4	0.00	
Total	374.66		99.30	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 7
DATE :14.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 16°27.62
start stop duration Lon E 60°16.84
TIME :14:01:12 14:28:28 27.3 (min) Purpose : 1
LOG : 8747.94 8749.32 1.4 Region : 7600
FDEPTH: 214 219 Gear cond.: 0
BDEPTH: 214 219 Validity : 0
Towing dir: 0° Wire out : 550 m Speed : 3.0 kn
Sorted : 24 Total catch: 23.96 Catch/hour: 52.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Fistularia petimba	19.74	18	37.44	
Pliotrema warreni	6.34	2	12.02	
Centroberyx lineatus	4.49	55	8.52	
Pterocaesio capricornis	3.81	11	7.22	
Rhinobatos sp.	3.76	4	7.14	
Polysteganus coeruleopunctatus	3.34	9	6.34	
Emmelichthys nitidus	2.53	88	4.80	
Nemipterid 'yellow lobe'	2.51	37	4.76	
Pomacentridae sp.	1.43	26	2.71	
Thamnaconus fajardoi	1.10	9	2.09	
Anthias sp.	1.06	7	2.00	
Thamnaconus modestoides	0.53	2	1.00	
Parupeneus 'roundhead-yellow l	0.51	11	0.96	
Sepia sp. 'slender'	0.33	22	0.63	
Sepia sp.	0.20	2	0.38	
OPHICHTHIDAE	0.20	2	0.38	
Ariomma sp.	0.09	2	0.17	
Scorpaenid sp.	0.04	2	0.08	
Champsodon capensis	0.04	7	0.08	
Synodonthidae 'pale yellow'	0.02	7	0.04	
Tetradonthidae	0.01	7	0.01	
Total	52.06		98.78	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 8
DATE :15.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 16°28.03
start stop duration Lon E 59°13.10
TIME :04:28:55 04:44:38 15.7 (min) Purpose : 1
LOG : 8882.49 8883.41 0.9 Region : 7600
FDEPTH: 47 47 Gear cond.: 0
BDEPTH: 47 47 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 3.5 kn
Sorted : 16 Total catch: 16.34 Catch/hour: 62.37

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Balistoides viridescens	27.02	11	43.33	
Diagramma centurio	11.87	4	19.03	21
Pseudobalistes fuscus	9.50	4	15.24	
Gymnocranius grandoculis	7.37	4	11.81	26
Pomacanthus semicirculatus	3.40	4	5.45	22
Sufflamen fraenatus	1.68	4	2.69	23
Gymnocranius griseus	0.31	4	0.49	24
Parupeneus pleurostigma	0.27	4	0.43	
Thamnaconus fajardoi	0.23	4	0.37	25
Cantherhines fronticinctus	0.19	8	0.31	
Sufflamen chrysopterum	0.19	8	0.31	
Dascyllus trimaculatus	0.11	8	0.18	
Synodus CF dermatogenys	0.08	4	0.12	
Pomacentrus caeruleus	0.04	4	0.06	
Odontodactylus scyllarus	0.04	4	0.06	
Apogon nitidus	0.02	4	0.03	
Pomacanthus imperator	0.02	4	0.03	
Total	62.33		99.94	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 9
DATE :16.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 16°44.67
start stop duration Lon E 59°19.40
TIME :06:34:24 07:03:35 29.2 (min) Purpose : 1
LOG : 8963.23 8964.83 1.6 Region : 7600
FDEPTH: 52 53 Gear cond.: 0
BDEPTH: 52 53 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.3 kn
Sorted : 28 Total catch: 27.94 Catch/hour: 57.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Small unid blue fish	15.13	818	26.34	
Abalistes stellatus	12.75	8	22.19	
Diagramma centurio	12.40	4	21.58	
Lutjanus sebae	11.14	2	19.40	26
Parapriacanthus ransonneti	1.81	905	3.15	
Teixeirichthys jordani	1.81	90	3.15	
Canthigaster coronata	0.39	21	0.68	
Lethrinus 'narrow'	0.35	10	0.61	
Gymnothorax undulatus	0.33	2	0.57	29
Emmelichthys nitidus	0.31	193	0.54	
Parupeneus 'roundhead-yellow l	0.16	8	0.29	
Synodus CF dermatogenys	0.12	6	0.21	
Cantherhines fronticinctus	0.10	12	0.18	
Amblyrhynchotes honkenii	0.10	10	0.18	
Apogon spilurus	0.10	2	0.18	
Sepia sp.	0.10	2	0.18	
Labrid cf. Xyrichthys sp2	0.08	8	0.14	
Pristotis cf. cyanostigma	0.08	43	0.14	
Pseudobalistes fuscus	0.06	2	0.11	27
Amphiprion chrysogaster	0.06	2	0.11	28
Anthias cooperi	0.02	2	0.04	
Labrid cf. Xyrichthys	0.02	2	0.04	
Total	57.45		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 10
DATE :17.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 15°55.43
start stop duration Lon E 60°13.36
TIME :05:57:40 06:26:29 28.8 (min) Purpose : 1
LOG : 9168.17 9169.46 1.3 Region : 7600
FDEPTH: 236 232 Gear cond.: 0
BDEPTH: 236 232 Validity : 0
Towing dir: 0° Wire out : 550 m Speed : 2.7 kn
Sorted : 8 Total catch: 7.65 Catch/hour: 15.93

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Hexanchus nakamurai	9.27	2	58.17	
Polysteganus coeruleopunctatus	4.06	8	25.49	
Gymnothorax zonipectis	0.71	2	4.44	30
Parupeneus 'roundhead-yellow l	0.58	10	3.66	
OMMASTREPHIDAE	0.37	17	2.35	
Thamnaconus modestoides	0.27	2	1.70	
Fistularia petimba	0.23	2	1.44	
Antigonia cf rubescens	0.21	15	1.31	
Sepia sp. 'slender'	0.12	2	0.78	
Ariomma cf. melanum	0.10	6	0.65	
Total	15.93		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 11
DATE :18.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 15°41.11
start stop duration Lon E 61°4.54
TIME :06:35:23 07:09:41 34.3 (min) Purpose : 1
LOG : 9374.92 9377.16 2.2 Region : 7600
FDEPTH: 302 305 Gear cond.: 0
BDEPTH: 302 305 Validity : 0
Towing dir: 0° Wire out : 320 m Speed : 3.9 kn
Sorted : 20 Total catch: 19.90 Catch/hour: 34.81

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etelis coruscans	17.84	2	51.26	33
Dentex sp.	10.50	2	30.15	32
Pliotrema warreni	2.71	2	7.79	34
Champsodon capensis	0.93	264	2.66	
Synodontidae sp. 'dorsal spot'	0.52	10	1.51	
Chlorophthalmus sp.	0.16	66	0.45	
Polysteganus coeruleopunctatus	0.16	2	0.45	39
Sepia sp. 'slender'	0.14	10	0.40	
Antigonia sp. 'yellow dorsal/a	0.06	5	0.19	
Antigonia cf rubescens	0.06	2	0.16	37
Decapterus tabl	0.06	2	0.16	36
Gobidae sp. 'yellowfin'	0.05	0	0.15	
Lepidotrigla sp. 'orange spot	0.04	3	0.13	
Lepidotrigla sp. 'red dorsal'	0.04	2	0.12	38
Promethichthys prometheus	0.02	2	0.07	35
OPHICHTHIDAE	0.01	2	0.04	
Emmelichthys nitidus	0.01	0	0.04	
Bembrops cf. nematopterus	0.01	2	0.03	40
Hoplichthys cf. acanthopleurus	0.00	2	0.01	
Balistidae juvenile	0.00	2	0.01	
Brama orcini	0.00	2	0.01	
Total	33.34		95.78	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 12
DATE :19.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 15°23.32
start stop duration Lon E 61°13.41
TIME :07:23:27 07:55:46 32.3 (min) Purpose : 1
LOG : 9578.95 9580.87 1.9 Region : 7600
FDEPTH: 288 258 Gear cond.: 0
BDEPTH: 288 258 Validity : 0
Towing dir: 0° Wire out : 680 m Speed : 3.6 kn
Sorted : 32 Total catch: 32.20 Catch/hour: 59.79

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex sp.	22.84	4	38.20	41
Emmelichthys nitidus	20.06	364	33.54	
Cookeolus japonicus	7.71	2	12.89	42
Dasyatis sp.	4.27	2	7.14	
Centroberyx lineatus	2.79	39	4.66	
Monocentris japonicus	0.80	6	1.34	
Polysteganus coeruleopunctatus	0.61	2	1.02	43
Plectranthias morgansi	0.33	6	0.56	
Antigonia rubescens	0.26	6	0.43	
Synodontidae sp. 'dorsal spot'	0.06	2	0.09	
Anthias sp. 'red'	0.05	2	0.08	
Grammatonotus sp.	0.02	2	0.04	
Total	59.79		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 13
DATE :23.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 13°21.92
start stop duration Lon E 60°32.10
TIME :12:25:50 12:56:09 30.3 (min) Purpose : 1
LOG : 143.62 145.20 1.6 Region : 7600
FDEPTH: 237 240 Gear cond.: 0
BDEPTH: 237 240 Validity : 0
Towing dir: 0° Wire out : 700 m Speed : 3.1 kn
Sorted : 8 Total catch: 7.58 Catch/hour: 14.99

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Sphoeroides pachgaster	7.32	2	48.84	
Fistularia petimba	2.49	4	16.63	
PORTUNIDAE	1.66	10	11.09	
Chlorophthamus sp. juv	1.58	1583	10.56	
Antigonia rubescens	1.29	20	8.58	
Parabothus cf. coarctus	0.18	4	1.19	44
Synodontidae sp. 'dorsal spot'	0.14	4	0.92	
Halieutaea sp.	0.14	2	0.92	45
RANINIDAE	0.12	4	0.79	
Arnoglossus sp.	0.04	2	0.26	
Ammodytoides renniei	0.02	2	0.13	
Antigonia sp. 'yellow dorsal/a	0.01	2	0.07	
Ammodytoides 'shortjaw'	0.00	2	0.01	
Total	14.99		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 14
DATE :24.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 12°17.02
start stop duration Lon E 61°4.75
TIME :05:34:13 06:04:13 30.0 (min) Purpose : 1
LOG : 269.17 270.75 1.6 Region : 7600
FDEPTH: 276 275 Gear cond.: 0
BDEPTH: 276 275 Validity : 0
Towing dir: 0° Wire out : 700 m Speed : 3.2 kn

Sorted : 11 Total catch: 11.18 Catch/hour: 22.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Satyrichthys adeni	5.14	6	22.99	
Puerulus angulatus	4.24	44	18.96	
Synodus sp. 'pointy snout'	3.40	50	15.21	
Heptranchias perlo	2.42	2	10.82	46
Lophiodes mutilis	2.08	2	9.30	47
Antigonia sp. 'yellow dorsal/a	1.62	46	7.25	
Pontinus nigerimum	1.42	8	6.35	
Antigonia rubescens	0.78	24	3.49	
Thamnaconus fajardoi	0.46	2	2.06	
Grammatonotus sp. 'plaintail'	0.44	22	1.97	
Bembrops platyrhynchus	0.16	2	0.72	49
Synchiropus sp.	0.08	2	0.36	48
Lepidotrigla sp. 'black/orange	0.08	4	0.36	
Chlorophthalmus sp.	0.04	6	0.18	
Total	22.36		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 15
DATE :25.10.2008 GEAR TYPE: PT NO: 2 POSITION:Lat S 12°8.78
start stop duration Lon E 61°32.00
TIME :19:03:09 19:39:26 36.3 (min) Purpose : 1
LOG : 519.89 521.65 1.8 Region : 7600
FDEPTH: 185 185 Gear cond.: 0
BDEPTH: 287 1132 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 2.9 kn
Sorted : 355 Total catch: 355.10 Catch/hour: 587.27

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Mola mola	578.83	2	98.56	
MYCTOPHIDAE	8.27	0	1.41	
Maurolicus muelleri	0.17	0	0.03	
Triplophos sp.	0.00	0	0.00	
Eustomias 'long barbel'	0.00	2	0.00	
Margrethia sp.	0.00	0	0.00	
Chlorophthalmus sp.	0.00	0	0.00	
Diaphus cf. thiollieri	0.00	0	0.00	
Diaphus cf. brachycephalus	0.00	0	0.00	
Gymnoscopelus sp.	0.00	0	0.00	
Gymnoscopelus sp. B	0.00	0	0.00	
Antigonia 'deep'	0.00	2	0.00	
Black round head	0.00	0	0.00	
Zenion sp.	0.00	0	0.00	
Total	587.27		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 16
DATE :26.10.2008 GEAR TYPE: PT NO: 4 POSITION:Lat S 12°25.05
start stop duration Lon E 60°22.72
TIME :18:09:25 18:42:30 33.1 (min) Purpose : 1
LOG : 668.62 670.55 1.9 Region : 7600
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 2710 2942 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.5 kn
Sorted : 5 Total catch: 5.01 Catch/hour: 9.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Ommastrephes bartrami	4.53	0	49.90	
MYCTOPHIDAE	3.63	0	39.92	
Cubiceps sp.	0.36	18	3.99	
Coryphaena equiselis	0.36	4	3.99	
Myctiphid 'fully scaled'	0.18	36	2.00	
Oxyporhamphus m. micropterus	0.02	7	0.20	
Brama orcini	0.01	2	0.10	
Mullidae juvenile	0.00	2	0.00	
Diplophos taenia	0.00	2	0.00	
Myctophid sp. A	0.00	0	0.00	
Myctophid sp. B	0.00	0	0.00	
Neolates tripes	0.00	2	0.00	
Vinciguerria cf. nimbaria	0.00	0	0.00	
Juvenile flatfish	0.00	2	0.00	
Total	9.09		100.10	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 17
DATE :29.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 11°34.56
start stop duration Lon E 62°4.55
TIME :05:03:30 05:35:02 31.5 (min) Purpose : 1
LOG : 1093.56 1095.19 1.6 Region : 7600
FDEPTH: 47 46 Gear cond.: 0
BDEPTH: 47 46 Validity : 0
Towing dir: 0° Wire out : 130 m Speed : 3.1 kn
Sorted : 55 Total catch: 55.24 Catch/hour: 105.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aprion virescens	71.34	23	67.89	50
Pseudobalistes fuscus	13.32	6	12.67	
Naso tanganus	8.18	2	7.78	52
Variola louti	5.52	2	5.25	51
Naso cf. tuberosus	4.85	2	4.62	55
Ostracion cubicus	0.95	2	0.91	
Canthigaster coronata	0.53	23	0.51	53
Dascyllus trimaculatus	0.15	4	0.14	
Amphiprion chrysogaster	0.13	2	0.13	
Canthigaster smithae	0.05	2	0.05	54
Echeneis naucrates	0.04	2	0.04	
Cirrhitidae sp.	0.02	8	0.02	
ANTHIIDAE	0.00	8	0.00	
Squat lobster	0.00	2	0.00	
Cirrhitidae - juvenile	0.00	2	0.00	
Total	105.08		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 18
DATE :29.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 11°14.12
start stop duration Lon E 62°5.14
TIME :13:30:28 14:00:39 30.2 (min) Purpose : 1
LOG : 1170.14 1171.66 1.5 Region : 7600
FDEPTH: 189 210 Gear cond.: 0
BDEPTH: 189 210 Validity : 0
Towing dir: 0° Wire out : 480 m Speed : 3.0 kn
Sorted : 286 Total catch: 285.82 Catch/hour: 568.03

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
LOLIGINIDAE	528.65	13216	93.07	
Satyrichthys adeni	13.75	14	2.42	
Synodus 'shortsnout'	9.26	175	1.63	
Cookeolus japonicus	3.36	10	0.59	
Etelis carbunculus	2.19	34	0.38	
Fistularia petimba	2.19	6	0.38	
Mustelus manazo	1.69	2	0.30	55
Triglidae 'OrangeSpotYellowPec	1.55	54	0.27	
Triglidae 'RedDorsalFinSpot'	1.31	38	0.23	
PORTUNIDAE	0.79	6	0.14	
Ariomma sp.	0.66	6	0.12	
Plectranthias morgansi	0.58	22	0.10	
Dactyloptena peterseni	0.54	8	0.09	
Triglidae 'PinkPec-YellowStrip	0.46	12	0.08	
Antigonia sp. 'yellow dorsal/a	0.28	24	0.05	
Sphoeroides pachgaster	0.24	2	0.04	
Priacanthus cf. prolixus	0.22	2	0.04	
Antigonia cf rubescens	0.10	8	0.02	
Kentrocapros rosapinto	0.08	2	0.01	
Grammatonotus sp.	0.06	4	0.01	
TETRAROGIDAE	0.04	2	0.01	
Champsodon capensis	0.04	8	0.01	
Triglidae 'PectSemicircBlue'	0.01	2	0.00	
Total	568.03		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 19
DATE :30.10.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 10°54.75
start stop duration Lon E 60°58.17
TIME :10:31:40 11:01:39 30.0 (min) Purpose : 1
LOG : 1361.89 1363.49 1.6 Region : 7600
FDEPTH: 127 127 Gear cond.: 0
BDEPTH: 127 127 Validity : 0
Towing dir: 0° Wire out : 300 m Speed : 3.2 kn
Sorted : 31 Total catch: 30.58 Catch/hour: 61.23

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Saurida undosquamis	37.44	126	61.15	
Squatina africana	11.11	6	18.15	
Nemipterus 'yellow mandible'	3.00	22	4.90	
Zeus faber	1.70	4	2.78	
Mullidae 'RoundheadLateralspot	1.48	16	2.42	
Satyrichthys adeni	1.38	6	2.26	
C E P H A L O P O D A	1.20	0	1.96	
PRIACANTHIDAE	1.12	6	1.83	
Epinephelus poecilonotus	0.82	2	1.34	57
Synodus 'yellowpectoral'	0.50	14	0.82	
Scorpaenid 'smallspots'	0.34	2	0.56	
Kentrocapros rosapinto	0.30	2	0.49	56
Tylerius spinosissimus	0.28	4	0.46	
Carangoides cf. equula	0.26	4	0.43	
Polysteganus coeruleopunctatus	0.18	2	0.29	
Paracallionymus cf. costatus	0.06	4	0.10	
TRIGLIDAE	0.04	2	0.07	
Little brown blotch	0.00	2	0.01	
Little silvery thing	0.00	2	0.00	
Total	61.23		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 20
DATE :01.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 10°35.92
start stop duration Lon E 60°28.18
TIME :06:41:43 07:07:38 25.9 (min) Purpose : 1
LOG : 1681.33 1682.76 1.4 Region : 9800
FDEPTH: 40 39 Gear cond.: 8
BDEPTH: 40 39 Validity : 4
Towing dir: 0° Wire out : 120 m Speed : 3.3 kn
Sorted : 76 Total catch: 75.69 Catch/hour: 175.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aprion virescens	31.74	14	18.10	58
Diagramma centurio	25.48	12	14.53	60
Acanthurus xanthopterus	25.02	9	14.27	0
Naso cf. tuberosus	21.08	12	12.02	
Diodon hystrix	17.26	2	9.84	59
Lethrinus rubrioperculatus	11.58	60	6.61	
Lethrinus enigmaticus	10.54	5	6.01	
Myripristis seychellensis	3.82	32	2.18	
Gymnocranius griseus	3.82	5	2.18	
Lethrinus sp. 'elongate'	3.71	12	2.11	
Diodon holocanthus	3.71	5	2.11	
Acanthurus tennentii	2.90	12	1.65	
Pseudobalistes fuscus	2.43	2	1.39	
Gymnocranius grandoculis	2.43	5	1.39	
Acanthurus dussumieri	2.43	2	1.39	
Parupeneus macronema	2.29	53	1.31	
Parupeneus 'houndhead 2'	0.83	2	0.48	
Zanclus canescens *	0.69	5	0.40	
Sargocentron diadema	0.69	14	0.40	
Chaetodon auriga	0.60	2	0.34	
CAESIONIDAE	0.46	9	0.26	
Canthigaster valentini	0.32	23	0.18	
Canthigaster coronata	0.28	16	0.16	
Scorpaenid 'blackspot tail'	0.23	2	0.13	
Parupeneus 'yellowstripe'	0.14	2	0.08	
Fistularia commersonii	0.12	2	0.07	
Scolopsis frenatus	0.12	5	0.07	
Sargocentron seychellense	0.09	2	0.05	
Small unid blue fish	0.09	46	0.05	
Labroides dimidiatus	0.07	23	0.04	
Scorpaenid 'pale tail bar'	0.05	2	0.03	
Lethrinus 'spotback'	0.05	2	0.03	
Pomacanthus imperator	0.05	2	0.03	
Centropyge multispinis	0.02	2	0.01	
Chaetodon kleinii	0.02	2	0.01	
Chromis dimidiata	0.02	2	0.01	
Pomacentrus caeruleus	0.02	2	0.01	
Antennarius coccineus	0.02	2	0.01	
ACANTHURIDAE	0.02	2	0.01	
Scorpaenid 'eyespot tail'	0.01	2	0.01	
PORTUNIDAE	0.00	7	0.00	
Total	175.29		99.97	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 21
DATE :01.11.2008 GEAR TYPE: PT NO: 2 POSITION:Lat S 10°32.70

start stop duration Lon E 59°46.54
TIME :17:58:39 18:33:03 34.4 (min) Purpose : 1
LOG : 1739.36 1741.43 2.1 Region : 9800
FDEPTH: 95 102 Gear cond.: 0
BDEPTH: 2450 2456 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 3.6 kn
Sorted : 16 Total catch: 16.20 Catch/hour: 28.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
MYCTOPHIDAE	26.17	0	92.59	
Symplectoteuthys oualaniensis	1.40	2	4.94	
Psenes sp.	0.61	2	2.16	
Stomias boa boa	0.07	3	0.25	
Astronesthes 'long barbel'	0.02	2	0.06	
Total	28.26		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 22
DATE :02.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 10°15.49
start stop duration Lon E 60°31.88
TIME :06:02:48 06:32:32 29.7 (min) Purpose : 1
LOG : 1827.75 1829.21 1.5 Region : 9800
FDEPTH: 76 76 Gear cond.: 0
BDEPTH: 76 76 Validity : 0
Towing dir: 0° Wire out : 190 m Speed : 2.9 kn
Sorted : 36 Total catch: 36.31 Catch/hour: 73.30

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Nemipterus 'yellow mandible'	29.68	254	40.48	61
Saurida undosquamis	16.45	81	22.45	62
Rhizoprionodon acutus	12.31	4	16.80	
Lagocephalus sceleratus	8.22	2	11.21	
Xiphasia setifer	2.02	8	2.75	
Mullidae 'RoundheadLateralspot	1.82	2	2.48	
Abalistes stellatus	0.77	8	1.05	
MULLIDAE	0.61	32	0.83	
Sepia 'blue line'	0.52	4	0.72	
Teixeirichthys jordani	0.32	16	0.44	
Fistularia commersonii	0.22	10	0.30	
Priacanthus cruentatus	0.16	4	0.22	
Velifer africanus	0.10	2	0.14	
Amblyrhynchotes honkenii	0.06	2	0.08	
Carangoides armatus-hedlandens	0.02	2	0.03	
Canthigaster coronata	0.02	2	0.03	
Total	73.30		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 23
DATE :02.11.2008 GEAR TYPE: PT NO: 1 POSITION:Lat S 10°12.93
start stop duration Lon E 61°58.77
TIME :16:04:35 16:35:50 31.2 (min) Purpose : 1
LOG : 1918.26 1920.21 1.9 Region : 9800
FDEPTH: 33 40 Gear cond.: 0
BDEPTH: 72 75 Validity : 0
Towing dir: 0° Wire out : 85 m Speed : 3.7 kn
Sorted : 26 Total catch: 25.51 Catch/hour: 48.99

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus russelli	17.29	165	35.29	64
Decapterus macarellus	13.64	129	27.84	63
Saurida undosquamis	11.91	2151	24.31	
Leiognathus elongatus	3.46	2113	7.06	
C E P H A L O P O D A	2.69	1460	5.49	
Apogon 'barred'	0.01	2	0.02	
Total	48.99		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 24
DATE :03.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 9°52.83
start stop duration Lon E 60°11.52
TIME :12:08:50 12:35:50 27.0 (min) Purpose : 1
LOG : 2086.73 2087.91 1.2 Region : 9800
FDEPTH: 43 43 Gear cond.: 0
BDEPTH: 43 43 Validity : 0
Towing dir: 0° Wire out : 120 m Speed : 2.6 kn
Sorted : 41 Total catch: 40.73 Catch/hour: 90.48

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Aprion virescens	37.76	9	41.74	
Rhizoprionodon acutus	31.99	16	35.35	
Gymnocranius grandoculis	11.44	2	12.64	
Carangoides fulvoguttatus	9.11	2	10.07	
Canthigaster coronata	0.18	9	0.20	
Total	90.48		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 25
DATE :05.11.2008 GEAR TYPE: PT NO: 5 POSITION:Lat S 6°27.71
start stop duration Lon E 57°43.56
TIME :21:13:03 21:42:40 29.6 (min) Purpose : 1
LOG : 2459.76 2461.41 1.7 Region : 9800
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 1101 1142 Validity : 0
Towing dir: 0° Wire out : 125 m Speed : 3.3 kn
Sorted : 85 Total catch: 84.95 Catch/hour: 172.08

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Cubiceps sp.	141.80	0	82.40	
MYCTOPHIDAE	16.21	0	9.42	
OMMASTREPHIDAE	11.55	0	6.71	
Gempylus serpens	0.91	16	0.53	
Neolates tripes	0.81	59	0.47	
Carybdis sp.	0.81	28	0.47	
Carangoid 'bars' juvenile	0.00	0	0.00	
Carangoid 'deep' juvenile	0.00	0	0.00	
Cubiceps cf. pauciradiatus	0.00	0	0.00	
Cubiceps 'blackbelly'	0.00	0	0.00	
Cubiceps 'pale tophead'	0.00	0	0.00	
Vinciguerria cf. nimbaria	0.00	0	0.00	
Decapterus sp. juvenile	0.00	0	0.00	
Stomias boa boa	0.00	0	0.00	
Total	172.08		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 26
DATE :07.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 5°41.89
start stop duration Lon E 56°42.12
TIME :10:57:51 11:28:51 31.0 (min) Purpose : 1
LOG : 2782.09 2783.64 1.6 Region : 9800
FDEPTH: 59 59 Gear cond.: 0
BDEPTH: 59 59 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.0 kn
Sorted : 155 Total catch: 155.13 Catch/hour: 300.16

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus macarellus	125.38	5971	41.77	
Lutjanus sebae	83.01	10	27.65	65
Dipterygonotus balteatus	21.36	780	7.12	70
Epinephelus flavocaeruleus	13.93	2	4.64	66
Lutjanus madras	10.02	110	3.34	68
Tetrosomus concatenatus	6.97	12	2.32	
Abalistes stellatus	5.71	4	1.90	
Rhizoprionodon acutus	3.50	2	1.17	
Saurida undosquamis	3.02	50	1.01	
Parupeneus pleurostigma	2.24	6	0.75	71
Decapterus russelli	2.03	50	0.68	
Saurida undosquamis	1.41	23	0.47	73
Chaetodon dolosus	1.34	23	0.44	74
Ostracion cubicus	1.28	2	0.43	
Lutjanus cf. bengalensis	1.26	45	0.42	67
Sarda orientalis	1.08	2	0.36	
Cookeolus japonicus	0.87	2	0.29	
Nemipterus zysron	0.77	8	0.26	72
Dactyloptena orientalis	0.58	2	0.19	
Teixeirichthys jordani	0.39	43	0.13	
Gymnocranius griseus	0.37	2	0.12	
Lactoria fornasini	0.14	4	0.05	
Canthigaster coronata	0.06	2	0.02	
ENGRAULIDIDAE	0.06	12	0.02	
Apogon quadrifasciatus	0.03	12	0.01	
Paracirrhites arcatus	0.03	2	0.01	
Anthias cooperi	0.02	2	0.01	
Labroides dimidiatus	0.01	6	0.00	
Total	286.87		95.57	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 27
DATE :08.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 5°24.42
start stop duration Lon E 56°25.73
TIME :06:09:13 06:40:05 30.9 (min) Purpose : 1
LOG : 2935.44 2937.23 1.8 Region : 9800
FDEPTH: 60 60 Gear cond.: 0
BDEPTH: 60 60 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.5 kn
Sorted : 54 Total catch: 54.28 Catch/hour: 105.50

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Saurida undosquamis	42.95	533	40.71	76
Upeneus cf. guttatus	21.38	912	20.27	
Nemipterus 'yellow mandible'	16.91	148	16.03	75
Teixeirichthys jordani	8.16	398	7.74	
Plotosus lineatus	3.17	301	3.00	
Mullidae 'RoundheadLateralspot	2.16	49	2.04	
Amblyrhynchotes honkenii	1.03	60	0.98	
Abalistes stellatus	0.84	6	0.79	
Fistularia commersonii	0.56	17	0.53	
Torpedo cf. panthera	0.54	2	0.52	
Nemipterus zysron	0.25	2	0.24	
Upeneus moluccensis	0.16	4	0.15	
Synodus 'yellowpectoral'	0.08	2	0.07	
Decapterus macarellus	0.08	2	0.07	
Carangoides sp.	0.04	2	0.04	
Total	98.31		93.18	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 28
DATE :09.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 4°44.45
start stop duration Lon E 56°26.28
TIME :09:00:29 09:30:35 30.1 (min) Purpose : 1
LOG : 3176.29 3177.73 1.4 Region : 9800
FDEPTH: 59 61 Gear cond.: 0
BDEPTH: 59 61 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 2.9 kn
Sorted : 42 Total catch: 42.40 Catch/hour: 84.51

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Parupeneus 'houndhead 2'	23.32	118	27.60	78
Lutjanus sebae	17.44	2	20.64	79
Saurida undosquamis	12.76	361	15.10	81
Aprion virescens	12.76	2	15.10	80
Diodon hystrix	3.27	2	3.87	
Nemipterus 'yellow mandible'	2.99	58	3.54	77
Upeneus cf. guttatus	2.61	148	3.09	82
Ostracion cubicus	2.15	2	2.55	
Abalistes stellatus	2.03	2	2.41	
Caranx tille	1.79	6	2.12	
Tetrosomus concatenatus	0.88	4	1.04	
Scolopsis frenatus	0.52	4	0.61	
Teixeirichthys jordani	0.50	38	0.59	
Fistularia commersonii	0.32	12	0.38	
Nemipterus zysron	0.20	2	0.24	
Amblyrhynchotes honkenii	0.08	12	0.09	
Bothus pantherinus	0.06	2	0.07	
Crossorhombus valderostratus	0.04	6	0.05	
Synodus 'yellowpectoral'	0.04	6	0.05	
Carangoides oblongus	0.03	2	0.04	
Apogon cf. quadrifasciatus	0.00	2	0.00	
Total	83.79		99.15	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 29
DATE :11.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 4°19.70
start stop duration Lon E 55°58.34
TIME :05:40:53 06:02:04 21.2 (min) Purpose : 1
LOG : 3507.55 3508.73 1.2 Region : 9800
FDEPTH: 67 67 Gear cond.: 0
BDEPTH: 67 67 Validity : 0
Towing dir: 0° Wire out : 170 m Speed : 3.3 kn
Sorted : 289 Total catch: 289.37 Catch/hour: 819.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Leiognathus leuciscus	550.45	36527	67.18	83
Upeneus moluccensis	212.79	7557	25.97	84
Saurida undosquamis	34.40	459	4.20	85
Leiognathus 'dotline longfin'	9.34	45	1.14	
Sphyrna lewini	4.67	3	0.57	
Nemipterus 'yellow mandible'	2.27	31	0.28	
Pterois miles	2.24	3	0.27	
Abalistes stellatus	2.21	14	0.27	
Nemipterus zysron	0.57	3	0.07	
Sphyraena sp.	0.20	3	0.02	
Amblyrhynchotes honkenii	0.08	8	0.01	
Fistularia commersonii	0.08	3	0.01	
CARANGIDAE	0.06	3	0.01	
Total	819.36		100.00	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 30
DATE :11.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 4°53.19
start stop duration Lon E 55°19.36
TIME :15:43:17 16:13:48 30.5 (min) Purpose : 1
LOG : 3577.16 3578.80 1.6 Region : 9800
FDEPTH: 63 64 Gear cond.: 0
BDEPTH: 63 64 Validity : 0
Towing dir: 0° Wire out : 160 m Speed : 3.2 kn
Sorted : 45 Total catch: 246.04 Catch/hour: 483.69

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Saurida undosquamis	200.19	4710	41.39	
Nemipterus 'yellow mandible'	67.71	1522	14.00	
Upeneus moluccensis	45.41	1180	9.39	
Leiognathus leuciscus	44.86	1447	9.28	0
Upeneus cf. guttatus	21.47	914	4.44	
Rhizoprionodon acutus	14.74	8	3.05	
Parupeneus 'roundhead-yellow l	9.91	55	2.05	
Epinephelus chlorostigma	6.66	28	1.38	87
Decapterus sp.	6.61	83	1.37	
Lutjanus madras	6.55	26	1.35	90
Amblyrhynchotes honkenii	6.19	358	1.28	0
Lutjanus sebae	4.88	28	1.01	88
Aesopia cornuta	4.13	14	0.85	
Gymnocranius griseus	3.58	14	0.74	0
Diagramma centurio	3.46	20	0.72	86
Sphyraena flavicauda	3.44	28	0.71	0
Lutjanus cf. bengalensis	3.09	20	0.64	89
Fistularia petimba	2.48	69	0.51	
Abalistes stellatus	2.48	14	0.51	
Cociella sp.	2.32	63	0.48	
Decapterus macarellus	2.02	18	0.42	
Lethrinus lentjan	1.73	4	0.36	
Sphyraena qenie	1.63	2	0.34	
Mullidae 'RoundheadLateralspot	1.51	14	0.31	
Scolopsis frenatus	1.51	14	0.31	0
Sphyraena flavicauda	1.51	10	0.31	
Gymnocranius griseus	1.42	6	0.29	
Scolopsis frenatus	1.28	10	0.26	
Selar crumenophthalmus	1.22	6	0.25	
Leiognathus 'dotline longfin'	1.16	4	0.24	
Diagramma centurio	1.10	14	0.23	
Penaeus semisulcatus	1.02	26	0.21	
Crossorhombus valderostratus	0.96	110	0.20	
Priacanthus hamrur	0.88	2	0.18	
Canthigaster rivulata	0.69	138	0.14	0
Ophididae 'spot nose'	0.55	8	0.11	
Cheatodon guttatissimus	0.55	8	0.11	
Callionymus cf spiniceps	0.49	31	0.10	
Amblyrhynchotes honkenii	0.47	28	0.10	
Minous 'striped'	0.45	33	0.09	
Dactyloptena peterseni	0.41	2	0.09	
Scorpaenopsis venosa	0.39	4	0.08	
Cynoglossus 'dashed'	0.37	18	0.08	
Apogon spilurus	0.28	124	0.06	0
Torpedo cf. panthera	0.26	2	0.05	
Canthigaster smithae	0.24	2	0.05	
Pterois miles	0.18	2	0.04	
Penaeus latisulcatus	0.14	2	0.03	
Champsodon sp.	0.14	14	0.03	
Apogon cf. quadrifasciatus	0.14	41	0.03	0
Leiognathus leuciscus	0.14	2	0.03	
Lactoria fornasini	0.10	2	0.02	
Apogon 'big'	0.10	4	0.02	
Carybdis sp.	0.08	8	0.02	
Canthigaster rivulata	0.04	4	0.01	
Halieutaea sp. A	0.04	2	0.01	
Dipterygonotus balteatus	0.03	14	0.01	
Apogon spilurus	0.02	6	0.00	
LEIOGNATHIDAE	0.02	2	0.00	
Apogon cf. quadrifasciatus	0.00	2	0.00	
Total	485.42		100.36	

R/V "DR. FRIDTJOF NANSEN" SURVEY:2008407 STATION: 31
DATE :12.11.2008 GEAR TYPE: BT NO: 22 POSITION:Lat S 4°37.01
start stop duration Lon E 54°21.86
TIME :14:28:24 14:51:54 23.5 (min) Purpose : 1
LOG : 3785.38 3786.57 1.2 Region : 9800
FDEPTH: 59 57 Gear cond.: 0
BDEPTH: 59 57 Validity : 0
Towing dir: 0° Wire out : 150 m Speed : 3.0 kn
Sorted : 198 Total catch: 198.12 Catch/hour: 505.63

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Decapterus sp.	88.30	5518	17.46	
Lutjanus madras	80.26	2208	15.87	93
Saurida undosquamis	54.62	880	10.80	
Sphyraena qenie	48.49	71	9.59	92
Abalistes stellatus	44.66	38	8.83	
Lutjanus sebae	19.27	5	3.81	91
Scolopsis frenatus	17.10	230	3.38	
Gymnocranius griseus	14.42	89	2.85	
Pristipomoides filamentosus	13.78	166	2.73	
Lutjanus cf. bengalensis	12.89	306	2.55	94
Lagocephalus sceleratus	12.76	5	2.52	
Lethrinus rubrioperculatus	11.48	102	2.27	
Upeneus cf. guttatus	10.59	664	2.09	
Parupeneus 'roundhead-yellow l	9.95	179	1.97	
Parupeneus 'roundhead-yellow l	9.70	128	1.92	0
Echeneis naucrates	5.03	8	0.99	
Diagramma centurio	4.64	71	0.92	
Epinephelus chlorostigma	4.08	3	0.81	
LABRIDAE	3.83	166	0.76	
Thenus orientalis	3.83	5	0.76	
Atule mate	3.80	10	0.75	
Priacanthus hamrur	2.81	38	0.56	0
Teixeirichthys jordani	2.68	242	0.53	0
Mullidae 'RoundheadLateralspot	2.42	64	0.48	
Aprion virescens	2.30	26	0.45	
Myripristis seychellensis	2.25	10	0.44	
Charybdis natator	2.04	3	0.40	
Sarda orientalis	1.71	5	0.34	
Priacanthus hamrur	1.53	26	0.30	
Nemipterus 'yellow mandible'	1.40	51	0.28	
Epinephelus fasciatus	1.05	8	0.21	
Upeneus moluccensis	1.02	26	0.20	
Upeneus 'white barbel'	0.89	51	0.18	
Chaetodon kleinii	0.84	33	0.17	
Apogon spilurus	0.84	158	0.17	
Chaetodon dolosus	0.66	18	0.13	
Lutjanus gibbus	0.54	5	0.11	
Canthigaster coronata	0.51	13	0.10	
Lagocephalus sceleratus	0.51	13	0.10	0
Small unid blue fish	0.51	26	0.10	0
Apogon aureus	0.51	26	0.10	
Fistularia commersonii	0.48	5	0.10	
Canthigaster rivulata	0.38	64	0.08	0
Dascyllus trimaculatus	0.36	8	0.07	
Apogon apogonides	0.33	26	0.07	
Lactoria diaphana	0.31	5	0.06	
Carangoides sp.	0.31	5	0.06	
Small unid blue fish	0.28	10	0.06	
Cociella sp.	0.26	18	0.05	
Loligo sp.	0.20	5	0.04	
Apolemichthys trimaculatus	0.15	3	0.03	
Amblyrhynchotes honkenii	0.13	13	0.03	
Leiognathus sp.	0.13	13	0.03	
Callionymus cf spiniceps	0.13	13	0.03	
Bothus myriaster	0.13	13	0.03	
Leiognathus elongatus	0.13	26	0.03	0
Synodus sp.	0.13	13	0.03	
Choerodon robustus	0.13	3	0.03	
Apogon sp.	0.13	26	0.03	0
Apogon sp.	0.13	26	0.03	
Parupeneus macronema	0.10	3	0.02	
Apogon 'dorsal spot'	0.06	13	0.01	
Apogon cf. quadrifasciatus	0.04	26	0.01	
Pristotis cf. cyanostigma	0.03	5	0.01	
Canthigaster rivulata	0.03	5	0.01	
Cynoglossus 'dashed'	0.03	3	0.01	
Teixeirichthys jordani	0.03	3	0.01	
Leiognathus elongatus	0.03	3	0.01	
Canthigaster valentini	0.03	3	0.01	
Minous 'striped'	0.03	3	0.01	
Apogon nitidus	0.01	3	0.00	
Total	505.12		99.90	

Annex II Instruments and fishing gear used

Echo sounder

The SIMRAD ER60/38 kHz scientific sounder was used during the survey for fish abundance estimation. The lowering keel was not submerged during the survey. The LSSS Integrator system was used to scrutinise the acoustic records. System calibration experiment using a standard copper sphere was performed 23.06.2008. The settings of 38 kHz echo sounder were as follows:

Transceiver-1 menu (38 kHz lowering keel)

Transducer depth	5.50 m
Absorbtion coeff.	6.7 dB/km
Pulse length	1.024ms
Bandwidth	2.43 kHz
Max power	2000 Watt
2-way beam angle	-20.6 dB
Transducer gain	25.82 dB
Angle sensitivity	21.9
3 dB beamwidth	6.95º alongship
	6.99º athwardship
Alongship offset	0.11º
Athwardship offset	0.04º

Display menu

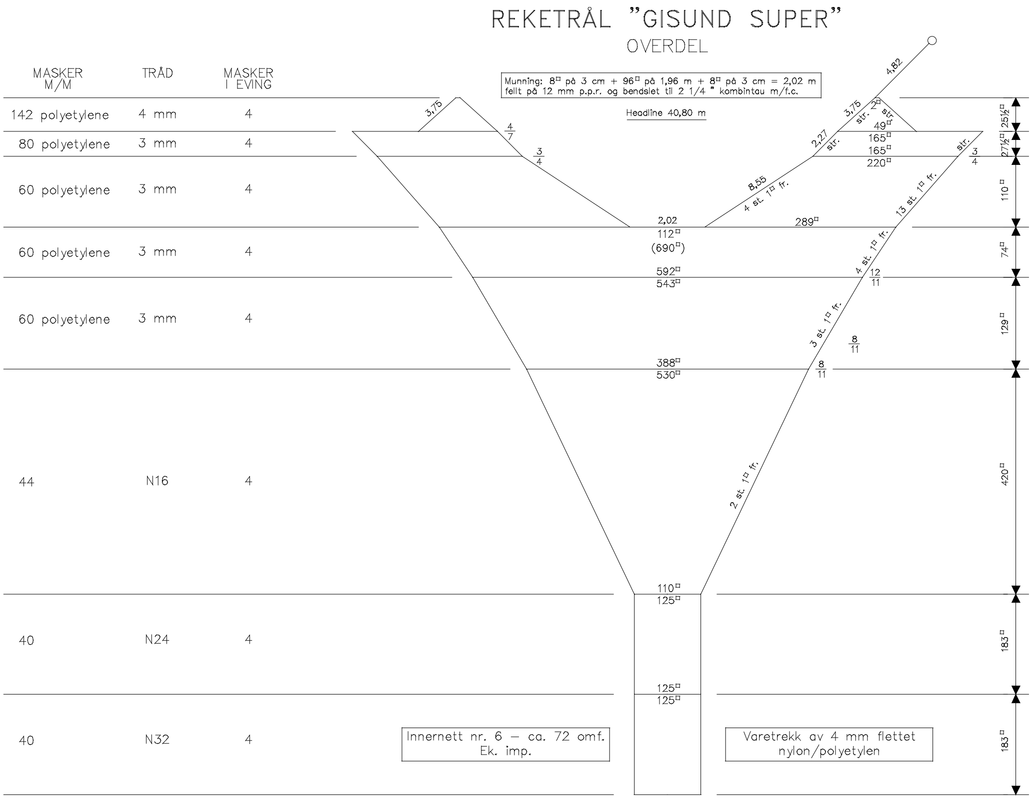
Echogram	1 (38 kHz)
Bottom range	15 m
Bottom range start	10 m

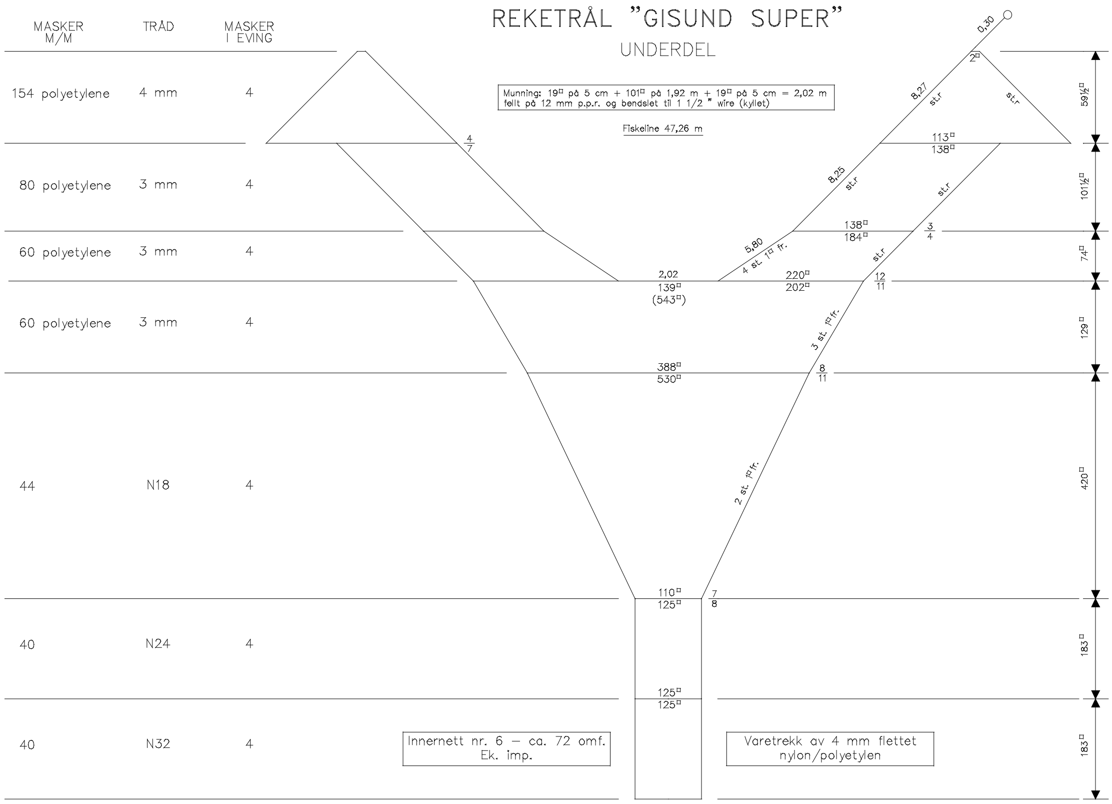
Fishing gear
The vessel has both small and medium sized "Åkrahamn" pelagic trawls and a "Gisund super bottom trawl".

The bottom trawl has a headline of 31 m, footrope 47 m and 20 mm mesh size in the cod end with an inner net of 10 mm mesh size (Figure A1). The estimated opening is 6 m (observed 5.7) and distance between wings during towing about 18 m. The sweeps are 40 m long. The trawl is equipped with a 12" rubber bobbins gear. The doors are of 'Thyborøn' combi type, 7.81 m^2, 1670 kg, their distance while trawling about 45 - 55 m on average, depending on the depth (least distance at low depths). This distance can be kept constant (about 50 m) at all depths by the use of a 9.5 m strap between the wires at 130 m distance from the doors, normally applied at depths greater than 80 m.

The SCANMAR system was used on all trawl hauls. This equipment consists of sensors, a hydrophone, a receiver, a display unit and a battery charger. Communication between sensors and ship is based on acoustic transmission. The doors are fitted with sensors to provide information on their distance and the trawl with a trawl eye that provides information on the trawl opening, the distance of the footrope to the bottom, bottom contact and fish entering the trawl.

The figure below presents the design of the bottom trawl used.





Design of the trawl used.

Annex IV Samples collected and storage location

Refer to sampling methods (pg XX)

	Species	DNA (#)	Isotopes (#)
1	*Acanthurus sp.*	1	0
2	*Allocyttus verrucosus*	3	3
3	*Amblygaster sirm*	1	1
4	*Ammodytoides sp.*	3	0
5	*Antegonia hulleyi*	1	0
6	*Anthias cooperi*	3	3
7	*Antigonia nulleyi*	3	3
8	*Apistus carinatus*	3	3
9	*Apogon apogonides*	3	3
10	*Apogon quadrifasciatus*	3	3
11	*Apogon sp.*	7	7
12	*Apogonidae*	5	0
13	*Aprion visceres*	1	1
14	*Argyops filamentosus*	4	4
15	*Argyropelecus aculecitus*	3	3
16	*Argyrosomus hololepidotus*	2	2
17	*Ariomma indica*	4	4
18	*Ariomma indicus*	3	3
19	*Astronesthes*	1	0
20	*Bambridae*	1	0
21	*Berycidae sp.*	4	4
22	*Beryx sp.*	6	6
23	*Beryx spenders*	6	6
24	*Bodianus perdito*	1	1
25	*Bothidae*	7	0
26	*Bothus sp.*	1	0
27	*Bregnacerus sp.*	6	3
28	*Caelorinchus sp.*	2	2
29	*Caesio sp.*	4	4
30	*Callionymus persieus*	1	0
31	*Canthigaster sp.*	1	0
32	*Carangidae*	3	0
33	*Caranx ignoblis*	1	1
34	*Carcharhinus brevipinna*	2	0
35	*Carcharhinus limbatus?*	1	0
36	*Centrobranchus sp.*	1	1
37	*Centrophorus granulosus*	8	0
38	*Centrophorus lusitanicus*	6	0
39	*Centrophorus sp.*	1	0
40	*Chaetodon blackburnii*	4	4
41	*Chaetodon dolosus*	5	4
42	*Chaetodon marleyi*	1	1
43	*Chaetodon sp. 3*	1	0
44	*Chaetodon sp.1*	1	0
45	*Chaetodon sp.2*	1	0
46	*Champsodon sp.*	7	6
47	*Champsodon capensis*	3	3
48	*Chauliodus sloani*	1	0
49	*Chaunax sp*	1	0
50	*Cheimerius nufar*	3	3

51	*Chlorophthalmus*	2	2
52	*Cholorphathalmus punctatus*	2	2
53	*Chromis dasygenys*	1	1
54	*Clupeidae*	2	0
55	*Coelorinchus*	1	1
56	*Coris caudimacula*	1	0
57	*Coris sp.*	1	0
58	*Cynoglossus*	1	0
59	*Cyprinocirrhites polyactis*	4	4
60	*Cypselurus naresii*	1	1
61	*Cyrophlaeonides sp*	3	3
62	*Cyttopsis rosea*	1	1
63	*Dactyloptena orientalis*	1	0
64	*Dascyllus trimaculatus*	6	6
65	*Deania profundorum*	3	3
66	*Deania quadrispinosus*	1	0
67	*Decapterus sp.*	3	3
68	*Decapterus macarellus*	3	3
69	*Decapterus macrosoma*	10	10
70	*Decapterus muruadsi*	3	3
71	*Decapterus russelli*	4	4
72	*Dinematichthys*	3	3
73	*Diodontidae*	1	0
74	*Diodon liturosus*	1	1
75	*Eel larva*	2	0
76	*Emmelichthys nitidus*	3	3
77	*Engraulis sp.*	7	7
78	*Engraulis japonicus*	2	0
79	*Epigonus robustus*	3	3
80	*Epinephelus malabaricus*	1	1
81	*Epinephelus multinotatus*	1	1
82	*Epinephelus rivulatus*	3	3
83	*Equalites elongatus*	3	3
84	*Etmopterus lucifer*	3	3
85	*Etrumeus teres*	7	7
86	*Fistularia commersonii*	1	0
87	*Fistularidae*	1	0
88	*Gazza sp.*	3	2
89	*Gazza minuta*	1	1
90	*Gempylidae*	1	0
91	*Gephyroberyx darwini*	1	1
92	*Gonostoma sp.*	1	0
93	*Gramma orcini*	2	2
94	*Grammicolepididae*	3	0
95	*Gymnothorax johnsoni?*	1	0
96	*Gymnothorax sp.2*	1	0
97	*Halichoeres lapillus*	3	3
98	*Halichoeres sp.*	1	0
99	*Heniochus dipherentes*	3	3
100	*Hygophum sp.*	3	3
101	*Labridae*	1	0
102	*Labroides dimidiatus*	3	3
103	*Lactoria fornasini*	2	0
104	*Laeops sp.*	1	0
105	*Lagocephalidae*	2	0

106	*Lagocephalus guentheri*	2	0
107	*Lagocephalus sp.*	1	0
108	*Leiognathidae*	5	3
109	*Leiognathus elongatus*	3	3
110	*Lepidopus caudatus*	1	1
111	*Lestidiops jayakari*	3	3
112	*Lestrolepis intermedia*	2	2
113	*Lethrinus crocineus*	3	3
114	*Lutjanidae*	1	0
115	*Lutjanus argentimaculatus*	4	4
116	*Lutjanus sanguineous*	5	5
117	*Macrouridae sp.*	3	3
118	*Malacocephalus sp.*	1	1
119	*Malthopsis mitrigera*	0	0
120	*Malthopsis tiarella*	1	0
121	*Monacanthidae*	3	3
122	*Morey*	1	0
123	*Morey1*	1	0
124	*Mullidae*	3	3
125	*Mustelus manazo*	1	0
126	*Mustelus sp.*	4	0
127	*Myctophidae*	3	3
128	*Nemipteridae*	3	0
129	*Nemipterus japonicus*	3	3
130	*Nemipterus sp.*	4	4
131	*Nemipterus zystron*	1	1
132	*Neobythites*	2	2
133	*Ophichthus unicolor*	2	3
134	*Oplegnathus robinsomi*	1	0
135	*Oreosoma atlanticum*	3	3
136	*Ostraciidae*	2	0
137	*Ostracion cubicus*	2	2
138	*Oxycirrhites typus*	1	1
139	*Pagellus bellotti natalensis*	3	3
140	*Paracallionymus cf. costatus*	3	0
141	*Paralichthyidae*	3	3
142	*Parapeneus diagonalis*	1	1
143	*Parapercis xanthozona*	3	3
144	*Parexocoetus mento*	1	1
145	*Parupeneus heptacanthus*	6	6
146	*Parupeneus indicus*	3	3
147	*Parupeneus macronemus*	3	3
148	*Parupeneus rubescens*	3	3
149	*Parupeneus sp.*	3	3
150	*Pentaceros capensis*	3	3
151	*Phosichthys*	3	3
152	*Plotosus lineatus*	3	3
153	*Polimixia sp.*	3	3
154	*Polydactylus sextarius*	1	1
155	*Pomacanthus imperator*	1	1
156	*Pomacanthus striatus*	1	1
157	*Priacanthidae hamrur*	1	1
158	*Priacanthus hambur*	8	7
159	*Priacanthus sp.*	5	5
160	*Psettina sp. (Bothidae)*	1	0

161	*Pseudanthias*	1	0
162	*Pseudohombus sp.*	1	1
163	*Pteragogus*	3	3
164	*Puffer 1*	1	0
165	*puffer 2*	1	0
166	*Pyramodon punctatus*	2	2
167	*Rhinobatus ocellatus*	2	0
168	*Sardinella sp.*	6	6
169	*Sardinella gibbosun*	1	1
170	*Satyrichthys investigatoris*	3	0
171	*Saurida undosquamis*	8	8
172	*Scalopis bimaculatus*	3	3
173	*Scomber*	3	3
174	*Scomber japonicus*	3	3
175	*Selar crumenophthalmus*	5	4
176	*Setarches guentheri*	6	6
177	*Siganus sutor*	3	3
178	*Sphyraena sp.*	7	7
179	*Sphyraena africana?*	4	4
180	*Sphyraena helleri*	3	3
181	*Squalus megalops*	3	3
182	*Squalus mitsukurii*	6	0
183	*Stegostoma fasciatum*	2	0
184	*Stephanolepus auratus*	3	3
185	*Stethojulis albovittata*	2	0
186	*Stolephoros sp.*	4	0
187	*Stolephorus indicus*	1	1
188	*Sufflamen fraenatus*	2	2
189	*Symphodon sp.*	3	3
190	*Synodus hoshinonis*	2	2
191	*Synodus indicus*	2	2
192	*Teiseirichthys jordani*	5	5
193	*Terapon theraps*	1	1
194	*Tetradontidae*	1	0
195	*Therapon sp.*	1	1
196	*Trachinocephalus myops*	1	1
197	*Trachurus*	3	0
198	*Trachurus cephalus myops*	1	0
199	*Trachurus delagoa*	9	10
200	*Upeneus bensasi*	4	4
201	*Upeneus guttatus*	3	3
202	*Upeneus moluccensis*	9	9
203	*Upeneus pori*	3	3
204	*Upeneus sp.*	1	1
205	*Upeneus taeniopterus*	3	3
206	*Upeneus trontis*	2	2
207	*Uramoscopus archionema*	1	0
208	*Uramoscopus sp.*	1	0
209	*Xenolepidichthys dalgleishi*	3	3
210	*Yarrella sp.*	3	3
211	*Zebrasoma gemmatum*	1	0
212	*Zenion sp*	3	3
213	*Zenopsis conchifer*	4	4

Annex V Samples collected for Isotope and Genetic analysis

Sample	DNA ?	Isotopes?	Station #	Tentative species id
GM8-103	Yes	Yes	3	Chaetodon kleinii
GM8-104	Yes	Yes	3	Labrid cf xyrichtys
GM8-105	Yes	Yes	3	Canthigaster smithae
GM8-106	Yes	Yes	3	Canthigaster coronata
GM8-107	Yes	Yes	3	Pterocaesio tile
GM8-107B	No	Yes	3	Pterocaesio tile
GM8-107C	No	Yes	3	Pterocaesio tile
GM8-108	Yes	Yes	5	Squalus megalops
GM8-109	Yes	Yes	5	Pristipomoides argyrogrammicus
GM8-109B	Yes	Yes	5	Pristipomoides argyrogrammicus
GM8-110	Yes	Yes	4	Cheilinus bimaculatus
GM8-111	Yes	Yes	4	Synodus dermatogenys
GM8-112	Yes	Yes	4	Parupeneus macronema
GM8-112B	No	Yes	4	Parupeneus macronema
GM8-112C	No	Yes	4	Parupeneus macronema
GM8-113	Yes	Yes	4	Parupeneus "roundhead"
GM8-114	Yes	Yes	4	Parupeneus "brownstripe"
GM8-115	Yes	Yes	4	Parupeneus "longsnout"
GM8-116	Yes	Yes	4	Anthias cooperi
GM8-116B	No	Yes	4	Anthias cooperi
GM8-116C	No	Yes	4	Anthias cooperi
GM8-117	No	No	5	Chaunax cf pictus
GM8-118	No	No	5	Champsodon capensis
GM8-119	Yes	Yes	5	Champsodon capensis
GM8-120	Yes	Yes	5	Zenion sp.
GM8-121	Yes	Yes	5	Peristedion weberi
GM8-122	Yes	Yes	5	cf Luzonichthys sp.
GM8-123	Yes	Yes	5	Antigonia rubescens
GM8-123B	Yes	Yes	5	Antigonia rubescens
GM8-123C	Yes	Yes	5	Antigonia rubescens
GM8-124	Yes	Yes	5	Rexea prometheoides
GM8-124B	Yes	Yes	5	Rexea prometheoides
GM8-124C	Yes	Yes	5	Rexea prometheoides
GM8-125	Yes	Yes	5	Synagrops japonicus
GM8-126	Yes	No	5	
GM8-127	Yes	Yes	5	
GM8-128	Yes	Yes	5	Thyrsitoides marleyi
GM8-129	Yes	Yes	6	Lutjanus bohar
GM8-130	Yes	Yes	6	Scarus cf ghobban
GM8-131	Yes	Yes	6	Squalus megalops
GM8-132	Yes	Yes	6	Squalus megalops
GM8-133	Yes	No	6	Lutjanus kasmira
GM8-134	Yes	No	6	Arothron hispidus
GM8-135	Yes	No	6	Lethrinus rubrioperculatus
GM8-136	Yes	Yes	6	Gymnocranius grandoculis
GM8-137	Yes	Yes	6	Abalistes stellatus
GM8-138	Yes	Yes	6	Lethrinus "elongate"
GM8-138B	No	Yes	6	Lethrinus "elongate"
GM8-138C	No	Yes	6	Lethrinus "elongate"
GM8-139	Yes	No	6	Gymnocranius griseus
GM8-140	Yes	No	6	Parupeneus "yellowstripe"

GM8-141	Yes	No	4	Cirrhitichthys cf oxycephalus
GM8-142	Yes	Yes	4	Osctracion cubicus
GM8-143	Yes	Yes	4	Arothron hispidus
GM8-144	Yes	Yes	4	Aprion virescens
GM8-144B	No	Yes	4	Aprion virescens
GM8-144C	No	Yes	4	Aprion virescens
GM8-145	Yes	Yes	4	Lethrinus rubrioperculatus
GM8-146	Yes	Yes	4	Lutjanus cf bengalensis
GM8-147	Yes	Yes	4	Chaetodon kleinii
GM8-148	Yes	Yes	4	Labrid cf xyrichtys
GM8-149	Yes	Yes	4	Paracirrhites arcatus
GM8-149B	No	Yes	4	Paracirrhites arcatus
GM8-150	Yes	Yes	4	Labroides dimidiatus
GM8-150B	No	Yes	4	Labroides dimidiatus
GM8-201	Yes	No	6	Scolopsis frenatus
GM8-202	Yes	No	6	Fistularia commersonnii
GM8-203	Yes	Yes	6	Priacanthus hamrur
GM8-204	Yes	Yes	6	Chrysiptera cf unimaculata
GM8-205	Yes	Yes	6	"Blue fish"
GM8-205B	No	Yes	6	"Blue fish"
GM8-205C	No	Yes	6	"Blue fish"
GM8-206	Yes	Yes	6	Chaetodon dolosus
GM8-207	Yes	No	6	
GM8-208	Yes	No	6	
GM8-209	Yes	No	6	
GM8-210	Yes	Yes	6	Cantherines cf frontinctus
GM8-211	Yes	No	6	Canthigaster coronata
GM8-212	Yes	No	6	Synodus dermatogenys
GM8-213	Yes	No	6	Synodus sp.
GM8-214	Yes	No	6	
GM8-215	Yes	No	6	
GM8-216	Yes	No	6	Parapriacanthus ransonneti
GM8-217	Yes	Yes	6	
GM8-217B	No	Yes	6	
GM8-217C	No	Yes	6	
GM8-218	Yes	Yes	6	Sargocentron ittoidai
GM8-219	Yes	Yes	6	Plotosus lineatus
GM8-219B	No	Yes	6	Plotosus lineatus
GM8-219C	No	Yes	6	Plotosus lineatus
GM8-220	Yes	No	6	Paraupeneus "roundhead"
GM8-221	Yes	Yes	6	Lagiocephalus scleratus
GM8-222	Yes	No	6	Sargocentron diadema
GM8-223	Yes	No	6	Parupeneus "brownstripe"
GM8-224	No	No	6	Malthopsis cf tiarella
GM8-225	Yes	No	6	Apogon nitidus
GM8-226	Yes	No	6	Apogon "spot"
GM8-227	Yes	No	6	Myripristis hexagona
GM8-228	Yes	No	6	Apogon apogonoides
GM8-229	Yes	Yes	7	Pilotrema warreni
GM8-230	Yes	Yes	7	Rhinobatus sp.
GM8-230B	Yes	Yes	7	Rhinobatus sp.
GM8-231	Yes	Yes	7	Polysteganus coeruleopunctatus
GM8-231B	No	Yes	7	Polysteganus coeruleopunctatus
GM8-232	Yes	No	7	Thamnaconus modestoides
GM8-233	Yes	No	7	Thamnaconus fajardoi
GM8-234	Yes	Yes	7	Nemipterid "yellow lobe"
GM8-234B	No	Yes	7	Nemipterid "yellow lobe"

GM8-234C	No	Yes	7	Nemipterid "yellow lobe"
GM8-235	Yes	Yes	7	Fistularia petimba
GM8-235B	No	Yes	7	Fistularia petimba
GM8-235C	No	Yes	7	Fistularia petimba
GM8-236	Yes	No	7	Scorpaenid sp.
GM8-237	Yes	Yes	7	Centroberyx lineatus
GM8-237B	No	Yes	7	Centroberyx lineatus
GM8-237C	No	Yes	7	Centroberyx lineatus
GM8-238	Yes	No	7	
GM8-239	Yes	Yes	7	Emmelichthys nitidus
GM8-239B	No	Yes	7	Emmelichthys nitidus
GM8-239C	No	Yes	7	Emmelichthys nitidus
GM8-240	Yes	No	7	Anthias sp.
GM8-241	Yes	No	7	Ariomma sp.
GM8-242	Yes	No	7	Champsodon capensis
GM8-243	Yes	No	7	
GM8-244	Yes	Yes	7	Chromis dasygenys
GM8-244B	No	Yes	7	Chromis dasygenys
GM8-244C	No	Yes	7	Chromis dasygenys
GM8-245	Yes	No	7	
GM8-246	Yes	No	7	Synodonthidae "pale yellow"
GM8-247	Yes	Yes	8	Diagramma centurio
GM8-248	Yes	Yes	8	Pomacanthus semicirculatus
GM8-249	Yes	No	8	Sufflamen fraenatus
GM8-250	Yes	No	8	Sufflamen chrysopterus
GM8-250B	Yes	No	8	Sufflamen chrysopterus
GM8-251	Yes	Yes	1	Sargocentron spiniferum
GM8-252	Yes	Yes	1	Balistoides conspicillum
GM8-253	Yes	Yes	1	Balistoides viridescens
GM8-254	Yes	Yes	1	Acanthurus cf dussumieri
GM8-255	Yes	Yes	1	Pomacanthus imperator
GM8-256	Yes	Yes	1	Ancanthurus sp.
GM8-257	Yes	Yes	1	Pseudobalistes fuscus
GM8-258	Yes	Yes	1	Lactoria diaphana
GM8-259	Yes	Yes	1	Bodianus bilunulatus
GM8-260	Yes	Yes	1	Didodon hystrix
GM8-261	Yes	Yes	1	Chaetodon auriga
GM8-262	Yes	Yes	1	Apolemichthys trimaculatus
GM8-263	Yes	Yes	1	Dascyllus carneus
GM8-264	Yes	Yes	1	Chaetodon guttatissimus
GM8-265	Yes	Yes	1	Siganus sp. ?
GM8-266	Yes	Yes	1	Lactoria fornasini
GM8-267	Yes	Yes	1	Gymnocranius griseus
GM8-268	Yes	Yes	1	Sufflamen cf chrysopterus
GM8-269	Yes	Yes	1	Parupeneus pleurostigma
GM8-269B	No	Yes	1	Parupeneus pleurostigma
GM8-269C	No	Yes	1	Parupeneus pleurostigma
GM8-270	Yes	Yes	1	Canthigaster cf valentini
GM8-271	Yes	Yes	1	Anthias cooperi
GM8-272	Yes	Yes	1	Paracirrhites arcatus
GM8-273	Yes	No	1	Anthias sp.
GM8-274	Yes	Yes	1	Labroides dimidiatus
GM8-275	Yes	No	1	Apogon cf taeniatus
GM8-276	Yes	Yes	1	Cirrhitichthys sp.
GM8-277	Yes	Yes	1	Sargocentron diadema
GM8-278	Yes	Yes	1	Pterocaesio tile
GM8-278B	No	Yes	1	Pterocaesio tile

GM8-278C	No	Yes	1	Pterocaesio tile
GM8-279	Yes	No	1	Syngnathidae sp.
GM8-280	Yes	No	1	Apogon sp.
GM8-281	Yes	No	1	Synodus dermatogenys
GM8-282	Yes	Yes	1	Epinephelus fasciatus
GM8-283	Yes	Yes	1	Parupeneus cf cinnabarinus
GM8-284	Yes	Yes	1	Parupeneus sp.
GM8-285	Yes	Yes	1	Parupeneus macronema
GM8-285B	No	Yes	1	Parupeneus macronema
GM8-285C	No	Yes	1	Parupeneus macronema
GM8-286	Yes	Yes	1	Gymnothorax undulatus
GM8-287	Yes	Yes	1	Gymnothorax cf nudivomer
GM8-289	Yes	Yes	2	Myctophid sp.
GM8-290	Yes	Yes	2	Myctophid sp.
GM8-291	Yes	Yes	2	Myctophid sp.
GM8-292	Yes	Yes	2	Myctophid sp.
GM8-293	Yes	Yes	2	Myctophid sp.
GM8-294	Yes	Yes	2	Myctophid sp.
GM8-295	Yes	Yes	3	Gymnocranius grandoculis
GM8-295B	No	Yes	3	Gymnocranius grandoculis
GM8-296	Yes	Yes	3	Parupeneus "yellowstripe"
GM8-296B	No	Yes	3	Parupeneus "yellowstripe"
GM8-297	Yes	Yes	3	Gnathodentex aurolineatus
GM8-297B	No	Yes	3	Gnathodentex aurolineatus
GM8-298	Yes	Yes	3	Pterocaesio capricornis
GM8-298B	No	Yes	3	Pterocaesio capricornis
GM8-298C	No	Yes	3	Pterocaesio capricornis
GM8-299	Yes	Yes	3	Parupeneus "roundhead"
GM8-300	Yes	Yes	4	Parupeneus pleurostigma
GM8-300B	No	Yes	4	Parupeneus pleurostigma
GM8-300C	No	Yes	4	Parupeneus pleurostigma
ACEP08-1401	Yes	Yes	31	Atule mate
ACEP08-1402	Yes	Yes	31	Labridae sp.
ACEP08-1403	Yes	Yes	31	Labridae sp.
ACEP08-1404	Yes	Yes	31	Labridae sp.
ACEP08-1405	No	Yes	31	Dascyllus trimaculatus
ACEP08-1405B	No	Yes	31	Dascyllus trimaculatus
ACEP08-1406	No	Yes	31	Parupeneus macronemus
ACEP08-1406B	No	Yes	31	Parupeneus macronemus
ACEP08-1407	No	Yes	31	Sargocentron seychellense
ACEP08-1407B	No	Yes	31	Sargocentron seychellense
ACEP08-1407C	No	Yes	31	Sargocentron seychellense
ACEP08-1408	No	Yes	31	Sarda orientalis
ACEP08-1408B	No	Yes	31	Sarda orientalis
ACEP08-1409	Yes	Yes	31	Pristipomoides filamentosus
ACEP08-1410	Yes	Yes	31	Pristipomoides filamentosus
ACEP08-1411	Yes	Yes	31	Pristipomoides filamentosus
ACEP08-1412	Yes	Yes	31	Bothus myriaster
ACEP08-1413	Yes	Yes	31	Bothus myriaster
ACEP08-1414	No	Yes	31	
ACEP08-1414B	No	Yes	31	
ACEP08-1415	No	Yes	31	"Blue fish"
ACEP08-1415B	No	Yes	31	"Blue fish"
ACEP08-1415C	No	Yes	31	"Blue fish"
ACEP08-1416	No	Yes	31	Lagocephalus sceleratus
ACEP08-1416B	No	Yes	31	Lagocephalus sceleratus
ACEP08-1417	Yes	No	31	Apogon apogonides

ACEP08-1418	Yes	No	31	Apogon apogonides
ACEP08-1419	Yes	No	31	Apogon spilurus
ACEP08-1420	Yes	No	31	Apogon spilurus
ACEP08-1421	Yes	Yes	31	Apogon aureus
ACEP08-1422	Yes	Yes	31	Apogon aureus
ACEP08-1501	Yes	No	8	Cantherhines frontinctus
ACEP08-1502	Yes	Yes	8	Dascyllus trimaculatus
ACEP08-1502B	Yes	Yes	8	Dascyllus trimaculatus
ACEP08-1503	Yes	Yes	8	Apogon nitidus
ACEP08-1504	Yes	No	8	Pomacentrus caeruleus
ACEP08-1505	Yes	No	8	Gymnocranius griseus
ACEP08-1506	Yes	No	8	Thamnaconus fajardoi
ACEP08-1507	Yes	Yes	9	Lutjanus sebae
ACEP08-1508	Yes	Yes	9	Pseudobalistes fuscus
ACEP08-1509	Yes	Yes	9	Amphiprion chrysogaster
ACEP08-1510	Yes	Yes	9	Lethrinus "narrow"
ACEP08-1510B	Yes	Yes	9	Lethrinus "narrow"
ACEP08-1511	Yes	Yes	9	Amblyrhynchotes honckenii
ACEP08-1512	Yes	Yes	9	Texeirichthys jordani
ACEP08-1512B	Yes	Yes	9	Texeirichthys jordani
ACEP08-1512C	Yes	Yes	9	Texeirichthys jordani
ACEP08-1513	Yes	Yes	9	"Blue fish"
ACEP08-1513B	Yes	Yes	9	"Blue fish"
ACEP08-1513C	Yes	Yes	9	"Blue fish"
ACEP08-1514	Yes	Yes	9	Emmelichthys nitidus
ACEP08-1514B	Yes	Yes	9	Emmelichthys nitidus
ACEP08-1514C	Yes	Yes	9	Emmelichthys nitidus
ACEP08-1515	Yes	Yes	9	Pristotis cf. cyanostigma
ACEP08-1515B	Yes	Yes	9	Pristotis cf. cyanostigma
ACEP08-1515C	Yes	Yes	9	Pristotis cf. cyanostigma
ACEP08-1516	Yes	Yes	9	Abalistes stellatus
ACEP08-1517	Yes	Yes	9	Gymnothorax undulatus
ACEP08-1518	Yes	Yes	9	
ACEP08-1519	Yes	Yes	9	Diagramma centurio
ACEP08-1520	Yes	Yes	9	Rhizoprionodon acutus
ACEP08-1521	Yes	Yes	9	Sphyraena forsteri
ACEP08-1522	Yes	Yes	9	Echeneis naucrates
ACEP08-1523	Yes	Yes	10	Ariomma cf melanum
ACEP08-1523B	Yes	Yes	10	Ariomma cf melanum
ACEP08-1524	Yes	Yes	10	Antigonia rubescens
ACEP08-1525	Yes	Yes	10	Polysteganus coeruleopunctatus
ACEP08-1525B	Yes	Yes	10	Polysteganus coeruleopunctatus
ACEP08-1526	Yes	Yes	10	Gymnothorax zonipectis
ACEP08-1527	Yes	Yes	10	Fistularia petimba
ACEP08-1528	Yes	Yes	10	Hexanchus nakamurai
ACEP08-1529	Yes	Yes	11	Champsodon capensis
ACEP08-1529B	Yes	Yes	11	Champsodon capensis
ACEP08-1529C	Yes	Yes	11	Champsodon capensis
ACEP08-1530	Yes	No	11	Eel?
ACEP08-1531	Yes	Yes	11	Polysteganus coeruleopunctatus
ACEP08-1532	Yes	Yes	11	Rexea prometheoides
ACEP08-1533	Yes	Yes	11	Antigonia "yellow dorsal"
ACEP08-1533B	Yes	Yes	11	Antigonia "yellow dorsal"
ACEP08-1533C	Yes	Yes	11	Antigonia "yellow dorsal"
ACEP08-1534	Yes	Yes	11	Lepidotrigla "orange spot"
ACEP08-1534B	Yes	Yes	11	Lepidotrigla "orange spot"
ACEP08-1534C	Yes	Yes	11	Lepidotrigla "orange spot"

ACEP08-1535	Yes	Yes	11	Lepidotrigla "red dorsal"
ACEP08-1536	Yes	Yes	11	Chlorophthalmus sp.
ACEP08-1536B	Yes	Yes	11	Chlorophthalmus sp.
ACEP08-1537	Yes	Yes	11	Etelis coruscens
ACEP08-1538	Yes	Yes	11	Dentex sp.
ACEP08-1539	Yes	Yes	11	Pilotrema warreni
ACEP08-1540	Yes	Yes	11	Emmelichthys nitidus
ACEP08-1540B	Yes	Yes	11	Emmelichthys nitidus
ACEP08-1541	Yes	Yes	11	Decapterus macarellus
ACEP08-1551	Yes	Yes	11	Antigonia rubescens
ACEP08-1551B	Yes	Yes	11	Antigonia rubescens
ACEP08-1552	Yes	Yes	11	Saurida sp.
ACEP08-1552B	Yes	Yes	11	Saurida sp.
ACEP08-1552C	Yes	Yes	11	Saurida sp.
ACEP08-1553	Yes	No	11	Bembrops cf nematopterus
ACEP08-1554	Yes	Yes	12	Dentex sp.
ACEP08-1554B	Yes	Yes	12	Dentex sp.
ACEP08-1555	Yes	Yes	12	Cookeolus japonicus
ACEP08-1556	Yes	Yes	12	Polysteganus coeruleopunctatus
ACEP08-1557	Yes	Yes	12	Centroberyx cf lineatus
ACEP08-1557B	No	Yes	12	Centroberyx cf lineatus
ACEP08-1557C	No	Yes	12	Centroberyx cf lineatus
ACEP08-1558	Yes	Yes	12	Grammatonotus sp
ACEP08-1558B	Yes	Yes	12	Grammatonotus sp
ACEP08-1558C	Yes	Yes	12	Grammatonotus sp
ACEP08-1559	Yes	Yes	12	Monocentris sp
ACEP08-1559B	Yes	Yes	12	Monocentris sp
ACEP08-1559C	Yes	Yes	12	Monocentris sp
ACEP08-1560	Yes	Yes	12	Anthias sp
ACEP08-1561	Yes	Yes	12	Dasyatis sp.
ACEP08-1562	Yes	Yes	CTD 1038	Hirundichthys speculiger
ACEP08-1563	Yes	Yes	13	Halieutaea sp.
ACEP08-1564	Yes	No	13	Sand lance sp.
ACEP08-1565	Yes	No	13	Bleekeria renniei
ACEP08-1566	Yes	Yes	13	Parabothus cf. coarctus
ACEP08-1566B	Yes	Yes	13	Parabothus cf. coarctus
ACEP08-1567	Yes	Yes	13	Arnoglossus sp.
ACEP08-1568	Yes	Yes	13	Antigonia rubescens
ACEP08-1568B	Yes	Yes	13	Antigonia rubescens
ACEP08-1568C	Yes	Yes	13	Antigonia rubescens
ACEP08-1569	Yes	Yes	13	Fistularia petimba
ACEP08-1569B	Yes	Yes	13	Fistularia petimba
ACEP08-1570	Yes	Yes	13	Sphoeroides pachygaster
ACEP08-1572	Yes	Yes	14	Heptranchias perlo
ACEP08-1573	Yes	Yes	14	Satyrichthys adeni
ACEP08-1573B	No	Yes	14	Satyrichthys adeni
ACEP08-1573C	No	Yes	14	Satyrichthys adeni
ACEP08-1574	Yes	Yes	14	Lophiodes mutilis
ACEP08-1575	Yes	Yes	14	Synchiropus cf monacanthus
ACEP08-1576	Yes	Yes	14	Bembrops platyrhynchus
ACEP08-1577	Yes	Yes	12	Plectranthias morgansi
ACEP08-1577B	Yes	Yes	12	Plectranthias morgansi
ACEP08-1577C	Yes	Yes	12	Plectranthias morgansi
ACEP08-1578	Yes	No	12	Emmelichthys nitidus
ACEP08-1579	Yes	Yes	12	Antigonia rubescens
ACEP08-1579B	No	Yes	12	Antigonia rubescens
ACEP08-1579C	No	Yes	12	Antigonia rubescens

ACEP08-1580	Yes	No	12	Saurida sp.
ACEP08-1601	Yes	No	27	Parupeneus "white barbel"
ACEP08-1602	Yes	No	27	Parupeneus "white barbel"
ACEP08-1603	Yes	No	27	Parupeneus "white barbel"
ACEP08-1604	Yes	No	27	Upeneus cf guttatus
ACEP08-1605	Yes	No	27	Upeneus cf guttatus
ACEP08-1606	Yes	No	28	Bothus pantherinus
ACEP08-1607	Yes	Yes	28	
ACEP08-1608	Yes	Yes	28	
ACEP08-1609	Yes	Yes	28	Caranx tille
ACEP08-1610	Yes	No	28	Carangoides oblongus
ACEP08-1611	Yes	No	28	Crossorhombus valderostratus
ACEP08-1612	Yes	No	28	Crossorhombus valderostratus
ACEP08-1613	Yes	Yes	28	
ACEP08-1614	Yes	No	28	Apogon quadrifasciatus
ACEP08-1615	Yes	No	28	Brown tipped fusilier
ACEP08-1616	Yes	No	28	Brown tipped fusilier
ACEP08-1617	Yes	Yes	28	Brown tipped fusilier
ACEP08-1618	Yes	Yes	29	Pterois miles
ACEP08-1619	Yes	Yes	29	Sphyraena lewini
ACEP08-1620	Yes	Yes	29	
ACEP08-1621	Yes	Yes	29	
ACEP08-1622	Yes	Yes	29	
ACEP08-1623	Yes	Yes	29	Upeneus moluccensis
ACEP08-1624	Yes	Yes	29	
ACEP08-1625	Yes	Yes	29	
ACEP08-1626	Yes	Yes	29	
ACEP08-1627	Yes	Yes	29	
ACEP08-1628	Yes	Yes	29	Upeneus moluccensis
ACEP08-1629	Yes	Yes	29	Upeneus moluccensis
ACEP08-1630	Yes	Yes	CTD 1147	
ACEP08-1630B	Yes	Yes	CTD 1147	
ACEP08-1630C	Yes	Yes	CTD 1147	
ACEP08-1631	Yes	No	CTD 1147	
ACEP08-1631B	Yes	No	CTD 1147	
ACEP08-1631C	Yes	No	CTD 1147	
ACEP08-1632	Yes	No	CTD 1147	
ACEP08-1632B	Yes	No	CTD 1147	
ACEP08-1632C	Yes	No	CTD 1147	
ACEP08-1633	Yes	Yes	CTD 1147	
ACEP08-1633B	Yes	Yes	CTD 1147	
ACEP08-1634	Yes	Yes	30	Scorpaenopsis venosa
ACEP08-1635	Yes	Yes	30	Scorpaenopsis venosa
ACEP08-1636	Yes	Yes	30	Priacanthus sp.
ACEP08-1637	Yes	Yes	30	Lethrinus lentjan
ACEP08-1638	Yes	Yes	30	Lethrinus lentjan
ACEP08-1639	Yes	No	30	Pterois miles
ACEP08-1640	Yes	Yes	30	Torpedo sp.
ACEP08-1647	Yes	Yes	30	Selar crumenophthalmus
ACEP08-1648	Yes	Yes	30	Selar crumenophthalmus
ACEP08-1649	Yes	Yes	30	Selar crumenophthalmus
ACEP08-1650	Yes	Yes	30	Apogon "large"
ACEP08-1651	Yes	Yes	14	Pontinus nigerimum
ACEP08-1651B	No	Yes	14	Pontinus nigerimum
ACEP08-1651C	No	Yes	14	Pontinus nigerimum
ACEP08-1652	Yes	Yes	14	Grammatonotus "plain tail"
ACEP08-1653	Yes	Yes	14	Synodus "pointy snout"

ACEP08-1654	Yes	Yes	14	Lepidotrigla "black/orange"
ACEP08-1655	Yes	Yes	15	Myctophid sp.
ACEP08-1655B	Yes	Yes	15	Myctophid sp.
ACEP08-1655C	Yes	Yes	15	Myctophid sp.
ACEP08-1656	Yes	Yes	15	
ACEP08-1656B	Yes	Yes	15	
ACEP08-1656C	Yes	Yes	15	
ACEP08-1657	Yes	Yes	15	Mola mola
ACEP08-1659	Yes	Yes	15	Myctophid sp.
ACEP08-1659B	Yes	Yes	15	Myctophid sp.
ACEP08-1659C	Yes	Yes	15	Myctophid sp.
ACEP08-1660	Yes	Yes	15	Remora remora
ACEP08-1661	Yes	Yes	15	Zenon sp.
ACEP08-1661B	Yes	Yes	15	Zenon sp.
ACEP08-1662	Yes	Yes	15	
ACEP08-1663	Yes	No	15	
ACEP08-1664	Yes	Yes	16	Coryphaena equiselis
ACEP08-1665	Yes	Yes	16	Rexea prometheoides
ACEP08-1666	Yes	Yes	16	Myctophid sp. A
ACEP08-1666B	Yes	Yes	16	Myctophid sp. A
ACEP08-1666C	Yes	Yes	16	Myctophid sp. A
ACEP08-1667	Yes	Yes	16	Myctophid sp. B
ACEP08-1667B	Yes	Yes	16	Myctophid sp. B
ACEP08-1667C	Yes	Yes	16	Myctophid sp. B
ACEP08-1668	Yes	Yes	16	Myctophid "fully scaled"
ACEP08-1668B	Yes	Yes	16	Myctophid "fully scaled"
ACEP08-1668C	Yes	Yes	16	Myctophid "fully scaled"
ACEP08-1669	Yes	Yes	16	Cubiceps sp.
ACEP08-1669B	Yes	Yes	16	Cubiceps sp.
ACEP08-1669C	Yes	Yes	16	Cubiceps sp.
ACEP08-1671	Yes	No	16	
ACEP08-1673	Yes	No	17	
ACEP08-1674	Yes	Yes	17	Dascyllus trimaculatus
ACEP08-1674B	Yes	Yes	17	Dascyllus trimaculatus
ACEP08-1675	Yes	Yes	17	Cirrhitichthys sp.
ACEP08-1676	Yes	Yes	17	
ACEP08-1676B	Yes	Yes	17	
ACEP08-1677	Yes	Yes	17	Canthigaster coronata
ACEP08-1677B	Yes	Yes	17	Canthigaster coronata
ACEP08-1678	Yes	Yes	17	Echeneis naucrates
ACEP08-1679	Yes	Yes	17	Amphiprion chrysogaster
ACEP08-1680	Yes	Yes	17	Ostracion cubicus
ACEP08-1681	Yes	Yes	17	Naso cf. tuberosus
ACEP08-1682	Yes	Yes	17	Naso tonganus
ACEP08-1683	Yes	Yes	17	Variola louti
ACEP08-1684	Yes	Yes	18	Synodus sp.
ACEP08-1684B	Yes	Yes	18	Synodus sp.
ACEP08-1684C	Yes	Yes	18	Synodus sp.
ACEP08-1685	No	Yes	18	
ACEP08-1685B	No	Yes	18	
ACEP08-1685C	No	Yes	18	
ACEP08-1686	Yes	No	18	Triglidae sp.
ACEP08-1686B	Yes	No	18	Triglidae sp.
ACEP08-1686C	Yes	No	18	Triglidae sp.
ACEP08-1687	Yes	No	18	Triglidae sp.
ACEP08-1687B	Yes	No	18	Triglidae sp.
ACEP08-1687C	Yes	No	18	Triglidae sp.

ACEP08-1688	Yes	No	18	Triglidae sp.
ACEP08-1688B	Yes	No	18	Triglidae sp.
ACEP08-1688C	Yes	No	18	Triglidae sp.
ACEP08-1689	Yes	Yes	18	Ariomma sp.
ACEP08-1689B	Yes	Yes	18	Ariomma sp.
ACEP08-1690	Yes	No	18	Priacanthus sp.
ACEP08-1691	Yes	No	18	Dactyloptene petersoni
ACEP08-1691B	Yes	No	18	Dactyloptene petersoni
ACEP08-1692	Yes	No	18	Etelis coruscens
ACEP08-1692B	Yes	No	18	Etelis coruscens
ACEP08-1692C	Yes	No	18	Etelis coruscens
ACEP08-1693	Yes	Yes	18	Mustelus manazo
ACEP08-1694	Yes	No	18	Plectranthias morgansi
ACEP08-1694B	Yes	No	18	Plectranthias morgansi
ACEP08-1694C	Yes	No	18	Plectranthias morgansi
ACEP08-1695	No	No	18	Triglidae sp.
ACEP08-1696	Yes	Yes	CTD 1080	Cypselurus poecilopterus
ACEP08-1697	Yes	Yes	19	Priacanthidae sp.
ACEP08-1697B	Yes	Yes	19	Priacanthidae sp.
ACEP08-1697C	Yes	Yes	19	Priacanthidae sp.
ACEP08-1698	Yes	Yes	19	Carangoides cf. equula
ACEP08-1698B	Yes	Yes	19	Carangoides cf. equula
ACEP08-1699	Yes	Yes	19	Scorpaenid sp.
ACEP08-1700	Yes	Yes	19	Epinephelus poecilonotus
ACEP08-1701	Yes	Yes	19	Parupeneus sp.
ACEP08-1701B	Yes	Yes	19	Parupeneus sp.
ACEP08-1701C	Yes	Yes	19	Parupeneus sp.
ACEP08-1702	Yes	No	19	Nemipterus sp.
ACEP08-1702B	Yes	No	19	Nemipterus sp.
ACEP08-1702C	Yes	No	19	Nemipterus sp.
ACEP08-1703	Yes	No	19	Zeus faber
ACEP08-1703B	Yes	No	19	Zeus faber
ACEP08-1704	Yes	No	19	Polysteganus coeruleopunctatus
ACEP08-1705	Yes	No	19	Paracallionymus cf. costatus
ACEP08-1706	Yes	No	19	Triglidae sp.
ACEP08-1707	Yes	No	19	Kentrocapros rosapinto
ACEP08-1708	Yes	No	19	Tylerius spinosissimus
ACEP08-1709	Yes	Yes	19	Squatina africana
ACEP08-1709B	Yes	Yes	19	Squatina africana
ACEP08-1709C	Yes	Yes	19	Squatina africana
ACEP08-1710	Yes	Yes	19	Saurida undosquamis
ACEP08-1710B	Yes	Yes	19	Saurida undosquamis
ACEP08-1710C	Yes	Yes	19	Saurida undosquamis
ACEP08-1711	Yes	No	19	Synodus sp.
ACEP08-1711B	Yes	No	19	Synodus sp.
ACEP08-1711C	Yes	No	19	Synodus sp.
ACEP08-1712	Yes	Yes	20	Pomacanthus imperator (juvenile)
ACEP08-1713	Yes	Yes	20	Aprion virescens
ACEP08-1713B	Yes	Yes	20	Aprion virescens
ACEP08-1713C	Yes	Yes	20	Aprion virescens
ACEP08-1714	Yes	Yes	20	Surgeon "yellowtail"
ACEP08-1715	Yes	Yes	20	Centropyge multispinis
ACEP08-1716	Yes	Yes	20	Chromis dimidiata
ACEP08-1717	Yes	Yes	20	Pomacentrus caeruleus
ACEP08-1718	Yes	Yes	20	Scolopsis cf. frenatus
ACEP08-1719	Yes	Yes	20	Antennarius coccineus
ACEP08-1720	Yes	Yes	20	"Flathead"

ACEP08-1721	Yes	Yes	20	Zanclus cornutus
ACEP08-1721B	Yes	Yes	20	Zanclus cornutus
ACEP08-1722	Yes	Yes	20	Parupeneus "yellowstripe"
ACEP08-1723	Yes	Yes	20	Sargocentron seychellense
ACEP08-1723B	Yes	Yes	20	Sargocentron seychellense
ACEP08-1723C	Yes	Yes	20	Sargocentron seychellense
ACEP08-1724	Yes	Yes	20	"Blue fish"
ACEP08-1724B	Yes	Yes	20	"Blue fish"
ACEP08-1724C	Yes	Yes	20	"Blue fish"
ACEP08-1725	Yes	Yes	20	Chaetodon kleini
ACEP08-1726	Yes	Yes	20	Chaetodon auriga
ACEP08-1727	Yes	Yes	20	Parupeneus "roundhead"
ACEP08-1728	Yes	Yes	20	Caesionidae sp.
ACEP08-1728B	Yes	Yes	20	Caesionidae sp.
ACEP08-1728C	Yes	Yes	20	Caesionidae sp.
ACEP08-1729	Yes	Yes	20	Diodon holocanthus
ACEP08-1729B	Yes	Yes	20	Diodon holocanthus
ACEP08-1730	Yes	Yes	20	Lethrinus enigmaticus
ACEP08-1730B	Yes	Yes	20	Lethrinus enigmaticus
ACEP08-1731	Yes	Yes	20	Lethrinus "elongate"
ACEP08-1731B	Yes	Yes	20	Lethrinus "elongate"
ACEP08-1731C	Yes	Yes	20	Lethrinus "elongate"
ACEP08-1732	Yes	Yes	20	Acanthurus tennenti
ACEP08-1733	Yes	Yes	20	Scorpaenid "blackspot tail"
ACEP08-1734	Yes	Yes	20	Scorpaenid "pale tail bar"
ACEP08-1735	Yes	Yes	20	Scorpaenid "eyespot tail"
ACEP08-1736	Yes	Yes	20	Acanthurus dussumieri
ACEP08-1737	Yes	Yes	20	Lethrinus rubrioperculatus
ACEP08-1738	Yes	Yes	20	Pseudobalistes fuscus
ACEP08-1739	Yes	Yes	20	Lethrinus "spotback"
ACEP08-1740	Yes	Yes	20	Gymnocranius grandoculis
ACEP08-1740B	Yes	Yes	20	Gymnocranius grandoculis
ACEP08-1741	Yes	Yes	20	Gymnocranius griseus
ACEP08-1741B	Yes	Yes	20	Gymnocranius griseus
ACEP08-1742	Yes	Yes	20	Sargocentron diadema
ACEP08-1742B	Yes	Yes	20	Sargocentron diadema
ACEP08-1742C	Yes	Yes	20	Sargocentron diadema
ACEP08-1743	Yes	Yes	20	Acanthurus xanthopterus
ACEP08-1743B	Yes	Yes	20	Acanthurus xanthopterus
ACEP08-1743C	Yes	Yes	20	Acanthurus xanthopterus
ACEP08-1743D	Yes	Yes	20	Acanthurus xanthopterus
ACEP08-1744	Yes	Yes	20	Myripristis seychellensis
ACEP08-1744B	Yes	Yes	20	Myripristis seychellensis
ACEP08-1744C	Yes	Yes	20	Myripristis seychellensis
ACEP08-1745	Yes	Yes	20	Parupeneus macronema
ACEP08-1745B	Yes	Yes	20	Parupeneus macronema
ACEP08-1745C	Yes	Yes	20	Parupeneus macronema
ACEP08-1746	Yes	Yes	20	Labroides dimidiatus
ACEP08-1746B	Yes	Yes	20	Labroides dimidiatus
ACEP08-1746C	Yes	Yes	20	Labroides dimidiatus
ACEP08-1747	Yes	Yes	20	Fistularia commersonii
ACEP08-1748	Yes	Yes	20	Canthigaster valentini
ACEP08-1748B	Yes	Yes	20	Canthigaster valentini
ACEP08-1748C	Yes	Yes	20	Canthigaster valentini
ACEP08-1749	Yes	Yes	20	Canthigaster coronata
ACEP08-1749B	Yes	Yes	20	Canthigaster coronata
ACEP08-1749C	Yes	Yes	20	Canthigaster coronata

ACEP08-1750	Yes	Yes	20	Naso cf. tuberosus
ACEP08-1750B	Yes	Yes	20	Naso cf. tuberosus
ACEP08-1750C	Yes	Yes	20	Naso cf. tuberosus
ACEP08-1751	Yes	Yes	20	Diagramma pictum
ACEP08-1751B	Yes	Yes	20	Diagramma pictum
ACEP08-1751C	Yes	Yes	20	Diagramma pictum
ACEP08-1752	Yes	Yes	20	Diodon hystrix
ACEP08-1753	Yes	Yes	21	Psenes sp.
ACEP08-1754	No	No	21	Stomias boa boa
ACEP08-1755	No	No	21	
ACEP08-1756	No	No	21	
ACEP08-1757	No	No	21	Astronesthes "long barbel"
ACEP08-1758	No	No	21	
ACEP08-1759	Yes	Yes	21	
ACEP08-1760	Yes	Yes	21	Nemichthys curvirostris
ACEP08-1760B	Yes	Yes	21	Nemichthys curvirostris
ACEP08-1761	Yes	Yes	21	
ACEP08-1761B	Yes	Yes	21	
ACEP08-1762	No	No	23	
ACEP08-1763	No	No	23	
ACEP08-1764	No	No	23	
ACEP08-1765	No	No	23	
ACEP08-1766	No	No	23	
ACEP08-1768	No	No	23	
ACEP08-1769	Yes	Yes	21	
ACEP08-1770	Yes	Yes	21	Myctophid sp.
ACEP08-1770B	Yes	Yes	21	Myctophid sp.
ACEP08-1770C	Yes	Yes	21	Myctophid sp.
ACEP08-1771	Yes	Yes	21	Myctophid sp.
ACEP08-1771B	Yes	Yes	21	Myctophid sp.
ACEP08-1771C	Yes	Yes	21	Myctophid sp.
ACEP08-1772	Yes	Yes	21	
ACEP08-1772B	Yes	Yes	21	
ACEP08-1772C	Yes	Yes	21	
ACEP08-1773	Yes	Yes	21	
ACEP08-1773B	Yes	Yes	21	
ACEP08-1773C	Yes	Yes	21	
ACEP08-1774	Yes	Yes	21	Myctophid sp.
ACEP08-1774B	Yes	Yes	21	Myctophid sp.
ACEP08-1774C	Yes	Yes	21	Myctophid sp.
ACEP08-1775	No	No	21	
ACEP08-1776	Yes	No	22	Xiphasia setifer
ACEP08-1776B	Yes	No	22	Xiphasia setifer
ACEP08-1777	Yes	No	22	Velifer hypselopterus
ACEP08-1778	Yes	No	22	Carangoides armatus or hedlandensis
ACEP08-1779	Yes	No	22	Texeirichthys jordani
ACEP08-1779B	Yes	No	22	Texeirichthys jordani
ACEP08-1780	Yes	No	22	Lagocephalus scleratus
ACEP08-1781	Yes	No	22	Priacanthus cruentatus
ACEP08-1782	Yes	No	22	Parupeneus "redspot roundhead"
ACEP08-1782B	Yes	No	22	Parupeneus "redspot roundhead"
ACEP08-1782C	Yes	No	22	Parupeneus "redspot roundhead"
ACEP08-1783	Yes	Yes	22	
ACEP08-1784	Yes	Yes	22	
ACEP08-1785	Yes	Yes	23	Decapterus macarellus
ACEP08-1785B	Yes	Yes	23	Decapterus macarellus
ACEP08-1785C	Yes	Yes	23	Decapterus macarellus

ACEP08-1786	Yes	Yes	23	Leiognathus elongatus
ACEP08-1786B	Yes	Yes	23	Leiognathus elongatus
ACEP08-1786C	Yes	Yes	23	Leiognathus elongatus
ACEP08-1787	Yes	Yes	23	Saurida undosquamis
ACEP08-1787B	Yes	Yes	23	Saurida undosquamis
ACEP08-1787C	Yes	Yes	23	Saurida undosquamis
ACEP08-1788	Yes	Yes	23	Decapterus russelli
ACEP08-1788B	Yes	Yes	23	Decapterus russelli
ACEP08-1788C	Yes	Yes	23	Decapterus russelli
ACEP08-1789	Yes	Yes	24	Carangoides fulvoguttatus
ACEP08-1790	No	No	23	
ACEP08-1791	Yes	No	25	Cubiceps "blackbelly"
ACEP08-1792	Yes	Yes	25	Cubiceps "bluecheek"
ACEP08-1792B	Yes	Yes	25	Cubiceps "bluecheek"
ACEP08-1792C	Yes	Yes	25	Cubiceps "bluecheek"
ACEP08-1793	Yes	Yes	25	Cubiceps "pale top head"
ACEP08-1793B	Yes	Yes	25	Cubiceps "pale top head"
ACEP08-1793C	Yes	Yes	25	Cubiceps "pale top head"
ACEP08-1794	Yes	Yes	25	Myctophid sp.
ACEP08-1795	Yes	Yes	25	Nealotus tripes
ACEP08-1795B	Yes	Yes	25	Nealotus tripes
ACEP08-1795B	Yes	Yes	25	Nealotus tripes
ACEP08-1795C	Yes	Yes	25	Nealotus tripes
ACEP08-1796	Yes	Yes	25	Gempylus serpens
ACEP08-1796B	Yes	Yes	25	Gempylus serpens
ACEP08-1796C	Yes	Yes	25	Gempylus serpens
ACEP08-1797	Yes	Yes	25	Myctophid sp.
ACEP08-1798	Yes	Yes	25	Myctophid "fully scaled"
ACEP08-1798B	Yes	Yes	25	Myctophid "fully scaled"
ACEP08-1798C	Yes	Yes	25	Myctophid "fully scaled"
ACEP08-1799	Yes	Yes	26	Lutjanus sebae
ACEP08-1799B	Yes	Yes	26	Lutjanus sebae
ACEP08-1799C	Yes	Yes	26	Lutjanus sebae
ACEP08-1800	Yes	No	25	Myctophid sp.
ACEP08-1808	Yes	No	26	Pterocaesio sp.
ACEP08-1808B	Yes	No	26	Pterocaesio sp.
ACEP08-1808C	Yes	No	26	Pterocaesio sp.
ACEP08-1809	Yes	Yes	26	Texeirichthys jordani
ACEP08-1809B	Yes	Yes	26	Texeirichthys jordani
ACEP08-1809C	Yes	Yes	26	Texeirichthys jordani
ACEP08-1810	Yes	Yes	26	Anthias cooperi
ACEP08-1810B	Yes	Yes	26	Anthias cooperi
ACEP08-1810C	Yes	Yes	26	Anthias cooperi
ACEP08-1811	Yes	No	26	Parupeneus "yellowstripe"
ACEP08-1811B	Yes	No	26	Parupeneus "yellowstripe"
ACEP08-1811C	Yes	No	26	Parupeneus "yellowstripe"
ACEP08-1812	Yes	Yes	26	Mullidae "stripetail"
ACEP08-1812B	Yes	Yes	26	Mullidae "stripetail"
ACEP08-1812C	Yes	Yes	26	Mullidae "stripetail"
ACEP08-1813	Yes	Yes	26	Epinephelus flavocaeruleus
ACEP08-1814	Yes	No	26	Nemipterus zysron
ACEP08-1814B	Yes	No	26	Nemipterus zysron
ACEP08-1815	Yes	Yes	26	Parupeneus cf rubescens
ACEP08-1815B	Yes	Yes	26	Parupeneus cf rubescens
ACEP08-1815C	Yes	Yes	26	Parupeneus cf rubescens
ACEP08-1816	Yes	Yes	26	Rhizoprionodon acutus
ACEP08-1817	Yes	Yes	26	Priacanthus hamrur

ACEP08-1818	Yes	No	26	Dypterygonotus balteatus
ACEP08-1818B	Yes	No	26	Dypterygonotus balteatus
ACEP08-1818C	Yes	No	26	Dypterygonotus balteatus
ACEP08-1819	Yes	Yes	26	Mullidae "redspotroundhead"
ACEP08-1819B	Yes	Yes	26	Mullidae "redspotroundhead"
ACEP08-1819C	Yes	Yes	26	Mullidae "redspotroundhead"
ACEP08-1820	Yes	Yes	26	Chaetodon dolosus
ACEP08-1820B	Yes	Yes	26	Chaetodon dolosus
ACEP08-1820C	Yes	Yes	26	Chaetodon dolosus
ACEP08-1825	Yes	No	26	Chaetodon kleini
ACEP08-1826	Yes	No	26	Apogon "plain"
ACEP08-1826B	Yes	No	26	Apogon "plain"
ACEP08-1826C	Yes	No	26	Apogon "plain"
ACEP08-1827	Yes	No	26	Lutjanus cf bengalensis
ACEP08-1827B	Yes	No	26	Lutjanus cf bengalensis
ACEP08-1827C	Yes	No	26	Lutjanus cf bengalensis
ACEP08-1828	Yes	No	26	Gymnocranius griseus
ACEP08-1828B	Yes	No	26	Gymnocranius griseus
ACEP08-1829	Yes	No	26	Lutjanus madras
ACEP08-1829B	Yes	No	26	Lutjanus madras
ACEP08-1829C	Yes	No	26	Lutjanus madras
ACEP08-1830	Yes	No	26	Tetrasomus concatenatus
ACEP08-1830B	Yes	No	26	Tetrasomus concatenatus
ACEP08-1831	Yes	Yes	26	Sarda orientalis
ACEP08-1832	Yes	Yes	26	Synodus sp. ?
ACEP08-1832B	Yes	Yes	26	Synodus sp. ?
ACEP08-1833	Yes	Yes	26	
ACEP08-1833B	Yes	Yes	26	
ACEP08-1833C	Yes	Yes	26	
ACEP08-1834	Yes	Yes	26	
ACEP08-1834B	Yes	Yes	26	
ACEP08-1834C	Yes	Yes	26	
ACEP08-1835	Yes	No	27	Parupeneus "roundhead redspot"
ACEP08-1836	Yes	No	27	Parupeneus "roundhead redspot"
ACEP08-1837	Yes	Yes	27	Torpedo cf. panthera
ACEP08-1838	Yes	No	27	
ACEP08-1839	Yes	No	27	Carangoides sp
ACEP08-1840	Yes	No	27	Plotsus lineatus
ACEP08-1847	Yes	No	27	Plotsus lineatus
ACEP08-1848	Yes	No	27	Plotsus lineatus
ACEP08-1849	Yes	No	27	Synodus "yellow pectoral"
ACEP08-1850	Yes	No	27	Upeneus cf guttatus
ACEP08-1851	Yes	No	30	Cynoglossus "dashed"
ACEP08-1852	No	No	30	Calionymus cf. spiniceps
ACEP08-1853	Yes	No	30	Calionymus cf. spiniceps
ACEP08-1854	Yes	Yes	30	"Flathead"
ACEP08-1855	Yes	Yes	30	"Flathead"
ACEP08-1856	Yes	Yes	30	"Flathead"
ACEP08-1857	Yes	No	30	Canthigaster rivulata
ACEP08-1858	Yes	No	30	Canthigaster rivulata
ACEP08-1859	Yes	No	30	Halietaea sp
ACEP08-1860	Yes	No	30	Scorpaenid 'barred'
ACEP08-1861	Yes	No	30	Scorpaenid 'barred'
ACEP08-1862	Yes	No	30	Scorpaenid 'barred'
ACEP08-1863	Yes	No	30	Bothid sp.
ACEP08-1864	Yes	No	30	Bothid sp.
ACEP08-1865	Yes	No	30	Bothid sp.

ACEP08-1866	Yes	Yes	31	Lutjanus gibbus
ACEP08-1867	Yes	Yes	31	Atule mate
ACEP08-1868	Yes	Yes	31	Atule mate
ACEP08-1869	Yes	Yes	30	
ACEP08-1870	Yes	Yes	30	Diagramma centurio
ACEP08-1871	Yes	Yes	30	Diagramma centurio
ACEP08-1872	Yes	Yes	30	Diagramma centurio
ACEP08-1873	Yes	Yes	30	Lutjanus cf. bengalensis
ACEP08-1874	Yes	Yes	30	Lutjanus cf. bengalensis
ACEP08-1875	Yes	Yes	30	Lutjanus cf. bengalensis
ACEP08-1876	Yes	Yes	30	
ACEP08-1877	Yes	Yes	30	
ACEP08-1878	Yes	Yes	30	
ACEP08-1879	Yes	Yes	30	Leiognathus "longfin"
ACEP08-1880	Yes	Yes	30	Gymnocranius griseus
ACEP08-1881	Yes	Yes	30	Gymnocranius griseus
ACEP08-1882	Yes	Yes	30	Gymnocranius griseus
ACEP08-1883	Yes	Yes	30	Lutjanus sebae
ACEP08-1884	Yes	Yes	30	Lutjanus sebae
ACEP08-1885	Yes	Yes	30	Lutjanus sebae
ACEP08-1886	Yes	Yes	30	Scolopsis frenatus
ACEP08-1887	Yes	Yes	30	Scolopsis frenatus
ACEP08-1888	Yes	Yes	30	Scolopsis frenatus
ACEP08-1889	Yes	Yes	30	Sphyraena qenie
ACEP08-1890	Yes	Yes	30	Sphyraena flavicauda
ACEP08-1891	Yes	Yes	30	Sphyraena flavicauda
ACEP08-1892	Yes	Yes	30	Sphyraena flavicauda
ACEP08-1893	Yes	Yes	30	Decapterus spp
ACEP08-1894	Yes	Yes	30	Decapterus spp
ACEP08-1895	Yes	Yes	30	Decapterus spp
ACEP08-1897	Yes	Yes	30	Ophichthidae "spotnose"
ACEP08-1898	Yes	Yes	30	Ophichthidae "spotnose"
ACEP08-1899	Yes	Yes	30	Ophichthidae "spotnose"
ACEP08-1900	Yes	Yes	31	Choerodon robustus
NT3-01	No	Yes	3	Pseudobalistes fuscus
NT3-02	No	Yes	3	Balistoides conspicillum
NT4-01	No	Yes	4	Pomacanthus imperator
NT4-02	No	Yes	4	Pseudobalistes fuscus
NT4-03	No	Yes	4	Balistoides viridescens
NT4-04	No	Yes	4	Balistoides viridescens
NT6-01	No	Yes	6	Pterocaesio capricornis
NT6-01B	No	Yes	6	Pterocaesio capricornis
NT6-01C	No	Yes	6	Pterocaesio capricornis
NT6-02	No	Yes	6	Parupeneus macronema
NT6-02B	No	Yes	6	Parupeneus macronema
NT6-02C	No	Yes	6	Parupeneus macronema
NT8-01	No	Yes	8	Parupeneus pleurostigma
NT8-02	No	Yes	8	Epinephalus fasciatus
NT8-04	No	Yes	8	Pseudobalistes fuscus
NT8-05	No	Yes	8	Gymnocranius grandoculis
NT9-01	No	Yes	9	Parapriacanthus ransonneti
NT9-01B	No	Yes	9	Parapriacanthus ransonneti
NT9-02	No	Yes	9	Anthias cooperi
NT9-03	No	Yes	9	Synodus cf dermatogenys
NT9-04	No	Yes	9	Parupeneus "roundhead"
NT10-01	No	Yes	10	Parupeneus "roundhead"
NT10-01B	No	Yes	10	Parupeneus "roundhead"

NT10-02	No	Yes	10	Thamnaconus fajardoi
NT14-01	No	Yes	14	Antigonia rubescens
NT14-01B	No	Yes	14	Antigonia rubescens
NT14-02	No	Yes	14	Antigonia "yellow dorsal"
NT14-02B	No	Yes	14	Antigonia "yellow dorsal"
NT17-01	No	Yes	17	Aprion virescens
NT17-01B	No	Yes	17	Aprion virescens
NT17-01C	No	Yes	17	Aprion virescens
NT17-02	No	Yes	17	Pseudobalistes fuscus
NT17-02B	No	Yes	17	Pseudobalistes fuscus
NT18-01	No	Yes	18	Fistularia petimba
NT18-01B	No	Yes	18	Fistularia petimba
NT18-01C	No	Yes	18	Fistularia petimba
NT18-02	No	Yes	18	Cookeolus japonicus
NT18-02B	No	Yes	18	Cookeolus japonicus
NT18-02C	No	Yes	18	Cookeolus japonicus
NT18-04	No	Yes	18	Antigonia rubescens
NT18-04B	No	Yes	18	Antigonia rubescens
NT18-04C	No	Yes	18	Antigonia rubescens
NT24-01	No	Yes	24	Gymnocranius grandoculis
NT24-02	No	Yes	24	Rhizoprionodon acutus
NT24-02B	No	Yes	24	Rhizoprionodon acutus
NT24-03	No	Yes	24	Aprion virescens
NT24-03B	No	Yes	24	Aprion virescens
NT27-01	No	Yes	27	Fistularia commersonnii
NT27-01B	No	Yes	27	Fistularia commersonnii
NT28-01	No	Yes	28	Aprion virescens
NT29-01	No	Yes	29	
NT29-01B	No	Yes	29	
NT29-01C	No	Yes	29	
Sample	**DNA ?**	**Isotopes?**	**Station #**	**Tentative species id**

Annex VI Trawl stations of the Mascarene Plateau

Station	Gear Type	Date	GMT	Duration (min)	Depth (m)	LAT.	LON	Location
1	BT22	2008/11/10	7:36	28.8	60.0	-18.585	58.805	Nansen Fish Trawl # 1 Bottom
2	PT2	2008/11/10	17:31	33.2	100.0	-18.687	59.192	Nansen Fish Trawl # 2 Pelagic
3	BT22	13/10/2008	6:48	5.8	60.0	-17.280	58.703	Nansen Fish Trawl # 3 Bottom
4	BT22	13/10/2008	7:32	21.7	59.0	-17.280	58.675	Nansen Fish Trawl # 4 Bottom
5	BT22	13/10/2008	12:40	15.0	313.0	-17.278	59.205	Nansen Fish Trawl # 5 Bottom
6	BT22	13/10/2008	22:31	14.9	60.0	-16.840	59.590	Nansen Fish Trawl # 6 Bottom
7	BT22	14/10/2008	14:01	27.3	214.0	-16.460	60.302	Nansen Fish Trawl # 7 Bottom
8	BT22	15/10/2008	04:28	15.70	47.00	-16.467	59.218	Nansen Fish Trawl # 8 Bottom
9	BT22	16/10/2008	6:36	29.2	52.0	-16.745	59.323	Nansen Fish Trawl # 9 Bottom
10	BT22	17/10/2008	5:57	28.8	236.0	-15.923	60.223	Nansen Fish Trawl # 10 Bottom
11	BT22	18/10/2008	6:35	34.3	302.0	-15.685	61.075	Nansen Fish Trawl # 11 Bottom
12	BT22	19/10/2008	7:23	32.3	288.0	-15.388	61.219	Nansen Fish Trawl # 12 Bottom
13	BT22	23/10/2008	12:25	30.3	240.0	-13.365	60.535	Nansen Fish Trawl # 13 Bottom
14	BT22	24/10/2008	5:34	30.0	276.0	-12.283	61.080	Nansen Fish Trawl # 14 Bottom
15	PT2	25/10/2008	19:03	36.3	185.0	-12.147	61.533	Nansen Fish Trawl # 15 Pelagic
16	PT4	26/10/2008	18:09	33.1	0.0	-12.417	60.378	Nansen Fish Trawl # 16 Surface
17	BT22	29/10/2008	5:03	31.5	47.0	-11.577	62.077	Nansen Fish Trawl # 17 Bottom
18	BT22	29/10/2008	13:30	30.2	189.0	-11.235	62.085	Nansen Fish Trawl # 18 Bottom
19	BT22	30/10/2008	10:31	30.0	127.0	-10.912	60.970	Nansen Fish Trawl # 19 Bottom
20	BT22	2008/01/11	6:41	25.9	40.0	-10.598	60.470	Nansen Fish Trawl # 20 Bottom
21	PT2	2008/01/11	17:58	34.4	95.0	-10.545	59.775	Nansen Fish Trawl # 21 Pelagic
22	BT22	2008/02/11	6:02	29.7	76.0	-10.258	60.532	Nansen Fish Trawl # 22 Bottom
23	PT1	2008/02/11	16:04	31.2	33.0	-10.215	61.980	Nansen Fish Trawl # 23 Pelagic
24	PT2	2008/03/11	12:08	27.0	43.0	-9.880	60.192	Nansen Fish Trawl # 24 Pelagic
25	PT4	2008/05/11	21:13	29.6	0.0	-6.462	57.727	Nansen Fish Trawl # 25 Surface
26	BT22	2008/07/11	10:57	31.0	59.0	-5.698	56.702	Nansen Fish Trawl # 26 Bottom
27	BT22	2008/08/11	6:09	30.9	60.0	-5.407	56.428	Nansen Fish Trawl # 27 Bottom
28	BT22	2008/09/11	9:00	30.1	59.0	-4.740	56.105	Nansen Fish Trawl # 28 Bottom
29	PT1	2008/11/11	5:40	21.2	67.0	-4.395	55.878	Nansen Fish Trawl # 29 Pelagic
30	BT22	2008/11/11	15:43	30.5	60.0	-4.887	55.323	Nansen Fish Trawl # 30 Bottom
31	BT22	2008/12/11	14:28	23.5	59.0	-4.617	54.365	Nansen Fish Trawl # 31 Bottom

Annex VII CTD stations

Date and time	latitude	longitude	Station No.	Bottom Depth (m)
2008/10/09 00:13	19°23.910'S	058°30.200'E	997	3723
2008/10/09 03:46	19°34.320'S	058°13.820'E	998	2562
2008/10/09 06:24	19°40.250'S	058°07.860'E	999	2022
2008/10/09 08:53	19°46.300'S	058°01.970'E	1000	743
2008/10/09 10:46	19°52.310'S	057°55.880'E	1001	572
2008/10/09 12:37	19°58.300'S	057°49.920'E	1002	275
2008/10/09 14:08	20°03.060'S	057°44.880'E	1003	113
2008/10/09 15:32	19°57.030'S	057°39.280'E	1004	43
2008/10/09 16:43	19°51.000'S	057°40.280'E	1005	58
2008/10/09 17:47	19°44.990'S	057°42.060'E	1006	543
2008/10/09 19:32	19°39.030'S	057°44.960'E	1007	373
2008/10/09 21:08	19°33.140'S	057°44.990'E	1008	506
2008/10/09 22:50	19°26.920'S	057°44.960'E	1009	685
2008/10/10 00:25	19°20.880'S	057°45.210'E	1010	650
2008/10/10 01:58	19°14.860'S	057°45.190'E	1011	569
2008/10/10 04:37	19°08.790'S	057°45.480'E	1012	602
2008/10/10 06:28	19°03.090'S	057°44.880'E	1013	880
2008/10/11 08:29	18°35.700'S	058°50.370'E	1014	62
2008/10/11 11:06	18°47.360'S	058°49.210'E	1015	1997
2008/10/12 21:18	17°33.350'S	059°23.600'E	1016	343
2008/10/13 08:32	17°16.720'S	058°41.770'E	1017	58
2008/10/13 12:05	17°16.760'S	059°14.110'E	1018	318
2008/10/13 20:23	17°00.000'S	059°43.500'E	1019	294
2008/10/13 23:09	16°51.480'S	059°34.310'E	1020	59
2008/10/14 01:54	16°35.260'S	059°48.130'E	1021	146
2008/10/14 09:36	16°40.060'S	060°38.670'E	1022	1126
2008/10/14 13:35	16°27.130'S	060°15.850'E	1023	207
2008/10/14 16:30	16°21.030'S	060°03.880'E	1024	220
2008/10/15 06:35	16°31.390'S	058°57.110'E	1025	2271
2008/10/15 11:26	16°32.460'S	059°17.600'E	1026	53
2008/10/16 07:19	16°46.070'S	059°18.150'E	1027	53
2008/10/17 03:44	15°54.880'S	060°10.550'E	1028	241
2008/10/17 11:46	15°24.940'S	059°48.760'E	1029	2460
2008/10/17 15:27	15°22.860'S	060°03.380'E	1030	60
2008/10/18 07:35	15°42.590'S	061°06.820'E	1031	307
2008/10/18 11:58	15°21.560'S	060°34.000'E	1032	62
2008/10/18 12:25	15°21.350'S	060°33.920'E	1033	60
2008/10/19 04:35	15°19.840'S	061°08.160'E	1034	305
2008/10/19 08:18	15°24.600'S	061°15.550'E	1035	251
2008/10/19 14:25	15°17.030'S	061°45.440'E	1036	3301
2008/10/20 01:42	14°31.560'S	060°31.080'E	1037	80
2008/10/22 00:17	14°47.030'S	061°36.920'E	1038	3292
2008/10/22 04:55	14°45.210'S	061°33.980'E	1039	3240
2008/10/22 06:14	14°41.990'S	061°28.630'E	1040	3127
2008/10/22 07:41	14°38.780'S	061°23.190'E	1041	2880
2008/10/22 11:19	14°34.200'S	061°15.920'E	1042	2677
2008/10/22 13:17	14°31.380'S	061°10.980'E	1043	1072
2008/10/22 14:19	14°29.860'S	061°08.480'E	1044	55
2008/10/22 18:32	14°13.290'S	060°41.340'E	1045	69
2008/10/22 21:58	13°57.100'S	060°14.220'E	1046	50
2008/10/22 22:46	13°56.500'S	060°13.030'E	1047	1378
2008/10/23 00:05	13°54.590'S	060°09.610'E	1048	2666
2008/10/23 02:11	13°52.460'S	060°06.100'E	1049	3273

2008/10/23 13:21	13°21.480'S	060°29.850'E	1050	248
2008/10/23 19:05	13°23.720'S	060°48.100'E	1051	293
2008/10/23 22:25	13°06.410'S	060°54.010'E	1052	336
2008/10/24 00:32	12°47.690'S	060°56.730'E	1053	667
2008/10/24 03:50	12°28.080'S	061°03.330'E	1054	277
2008/10/24 06:31	12°18.290'S	061°03.710'E	1055	287
2008/10/24 07:55	12°11.900'S	061°05.980'E	1056	290
2008/10/24 11:07	11°55.040'S	061°11.580'E	1057	290
2008/10/24 13:18	11°36.340'S	061°15.170'E	1058	219
2008/10/24 23:44	12°05.560'S	062°30.070'E	1059	3652
2008/10/25 02:13	12°04.500'S	062°32.090'E	1060	3675
2008/10/25 03:40	12°04.190'S	062°33.080'E	1061	3703
2008/10/25 09:45	12°50.820'S	061°58.750'E	1062	3620
2008/10/25 20:17	12°11.210'S	061°32.280'E	1063	990
2008/10/25 22:39	12°04.950'S	061°29.740'E	1064	279
2008/10/25 23:36	12°04.500'S	061°30.760'E	1065	280
2008/10/26 06:01	12°47.890'S	060°56.770'E	1066	709
2008/10/26 11:13	12°04.930'S	060°35.970'E	1067	2406
2008/10/26 12:57	12°04.960'S	060°35.630'E	1068	2199
2008/10/26 14:35	12°04.830'S	060°35.630'E	1069	2363
2008/10/26 19:06	12°27.100'S	060°20.470'E	1070	3183
2008/10/26 22:11	12°50.950'S	060°03.700'E	1071	3666
2008/10/27 06:45	12°05.030'S	059°35.750'E	1072	3326
2008/10/27 10:56	12°01.810'S	059°35.360'E	1073	3278
2008/10/27 16:37	12°50.780'S	059°07.080'E	1074	3977
2008/10/28 02:06	12°04.920'S	058°35.620'E	1075	4158
2008/10/28 05:15	12°05.290'S	058°36.780'E	1076	4156
2008/10/28 06:17	12°04.780'S	058°37.140'E	1077	4157
2008/10/29 05:53	11°34.480'S	062°02.990'E	1078	46
2008/10/29 14:30	11°13.710'S	062°07.280'E	1079	211
2008/10/30 04:45	10°55.020'S	060°16.980'E	1080	82
2008/10/30 11:18	10°54.660'S	060°55.980'E	1081	131
2008/10/30 14:54	10°54.270'S	061°22.800'E	1082	124
2008/10/31 03:20	10°30.710'S	063°05.740'E	1083	1984
2008/10/31 08:57	10°31.830'S	062°38.370'E	1084	2195
2008/10/31 11:36	10°29.390'S	062°38.220'E	1085	2185
2008/10/31 12:33	10°28.270'S	062°38.200'E	1086	2191
2008/10/31 14:46	10°31.690'S	062°17.860'E	1087	224
2008/10/31 15:14	10°31.480'S	062°19.800'E	1088	1537
2008/10/31 18:08	10°30.230'S	062°14.260'E	1089	48
2008/10/31 20:05	10°33.360'S	061°56.020'E	1090	72
2008/10/31 22:52	10°34.040'S	061°32.550'E	1091	100
2008/11/01 00:34	10°34.590'S	061°17.310'E	1092	121
2008/11/01 02:27	10°35.130'S	061°00.040'E	1093	120
2008/11/01 03:10	10°34.080'S	061°00.090'E	1094	111
2008/11/01 07:27	10°35.720'S	060°30.270'E	1095	40
2008/11/01 07:56	10°35.770'S	060°26.630'E	1096	44
2008/11/01 11:02	10°36.080'S	060°03.030'E	1097	62
2008/11/01 11:33	10°36.100'S	060°00.090'E	1098	1118
2008/11/01 12:38	10°36.090'S	059°55.040'E	1099	1898
2008/11/01 15:20	10°33.550'S	059°51.200'E	1100	2313
2008/11/01 16:59	10°31.330'S	059°49.790'E	1101	2360
2008/11/01 20:25	10°36.370'S	059°33.800'E	1102	2772
2008/11/02 06:47	10°15.590'S	060°30.470'E	1103	75
2008/11/02 08:32	10°15.310'S	060°47.000'E	1104	66
2008/11/03 07:14	09°54.740'S	060°33.220'E	1105	1196
2008/11/03 12:50	09°52.490'S	060°13.030'E	1106	43

2008/11/03 23:35	09°37.100'S	060°14.950'E	1107	952
2008/11/04 04:05	09°21.530'S	060°05.030'E	1108	375
2008/11/04 06:35	09°06.160'S	059°48.560'E	1109	941
2008/11/04 10:44	08°50.010'S	059°36.300'E	1110	803
2008/11/04 13:13	08°34.560'S	059°23.430'E	1111	1298
2008/11/04 17:54	08°18.590'S	059°10.960'E	1112	1205
2008/11/04 20:39	08°02.950'S	058°58.410'E	1113	1212
2008/11/05 01:17	07°46.880'S	058°46.030'E	1114	1763
2008/11/05 04:22	07°31.390'S	058°33.570'E	1115	1549
2008/11/05 09:12	07°15.460'S	058°20.620'E	1116	1608
2008/11/05 12:12	06°59.880'S	058°08.320'E	1117	1605
2008/11/05 16:43	06°43.950'S	057°55.740'E	1118	1457
2008/11/05 19:42	06°27.730'S	057°43.720'E	1119	1103
2008/11/06 19:20	05°55.340'S	057°16.440'E	1120	1073
2008/11/07 05:13	05°41.730'S	056°58.320'E	1121	1100
2008/11/07 11:50	05°41.540'S	056°44.430'E	1122	60
2008/11/07 16:59	05°38.810'S	056°09.960'E	1123	2662
2008/11/07 22:51	05°29.930'S	056°36.160'E	1124	42
2008/11/08 06:58	05°23.770'S	056°27.300'E	1125	60
2008/11/08 13:43	05°17.520'S	056°16.830'E	1126	44
2008/11/08 20:09	05°06.560'S	056°22.090'E	1127	48
2008/11/09 09:46	04°46.100'S	056°27.380'E	1128	61
2008/11/09 15:36	05°01.710'S	055°43.230'E	1129	53
2008/11/09 20:19	05°08.730'S	055°08.930'E	1130	1891
2008/11/10 00:07	05°06.670'S	055°13.570'E	1131	1042
2008/11/10 00:56	05°06.230'S	055°14.680'E	1132	543
2008/11/10 01:25	05°05.920'S	055°15.330'E	1133	200
2008/11/10 01:46	05°05.370'S	055°16.120'E	1134	40
2008/11/10 02:05	05°04.450'S	055°17.430'E	1135	44
2008/11/10 04:42	04°56.810'S	055°34.320'E	1136	49
2008/11/10 06:35	04°48.610'S	055°51.440'E	1137	62
2008/11/10 08:07	04°41.580'S	056°05.380'E	1138	46
2008/11/10 10:12	04°36.620'S	056°15.960'E	1139	64
2008/11/10 11:25	04°33.110'S	056°23.250'E	1140	32
2008/11/10 12:18	04°32.620'S	056°24.470'E	1141	233
2008/11/10 12:43	04°32.310'S	056°25.310'E	1142	491
2008/11/10 13:18	04°31.490'S	056°26.850'E	1143	1004
2008/11/10 14:28	04°29.300'S	056°31.710'E	1144	1480
2008/11/11 06:22	04°19.210'S	055°59.200'E	1145	67
2008/11/11 07:18	04°23.680'S	055°52.650'E	1146	46
2008/11/11 10:29	04°40.050'S	055°38.560'E	1147	38
2008/11/11 16:36	04°52.820'S	055°20.190'E	1148	64
2008/11/11 20:20	04°46.150'S	055°14.910'E	1149	60
2008/11/12 10:32	04°29.530'S	054°45.420'E	1150	56
2008/11/12 15:13	04°37.570'S	054°22.480'E	1151	57
2008/11/13 05:58	04°20.470'S	054°31.180'E	1152	60
2008/11/13 13:24	03°55.830'S	054°57.910'E	1153	68
2008/11/13 16:43	04°15.320'S	055°14.690'E	1154	32
2008/11/13 22:02	03°33.350'S	055°15.440'E	1155	2551
2008/11/14 09:43	03°52.630'S	055°31.750'E	1156	64
2008/11/14 16:30	04°00.040'S	056°08.070'E	1157	60
2008/11/14 20:19	04°06.870'S	056°17.430'E	1158	1541
2008/11/14 23:42	04°06.720'S	056°17.340'E	1159	1547
2008/11/15 01:02	04°06.920'S	056°17.360'E	1160	1526
2008/11/15 02:01	04°06.870'S	056°17.350'E	1161	1530
2008/11/15 04:00	04°06.850'S	056°17.350'E	1162	1527
2008/11/15 07:20	04°10.670'S	055°43.730'E	1163	60

Annex VIII Data management agreement

Data Management Agreement for the FAO/ASCLME Cruises

The intention of this Data Management Agreement is to clarify and protect the interests of all scientists and countries. This Agreement is appended to the ToRs for all scientists that are working on the Nansen as part of the 2008 ASCLME Cruise Schedule.

Introduction

Participating countries in the ASCLME Project, and their designated representatives, have the mandate to develop a comprehensive document on principles and guidelines for ASCLME data and information management so that it facilitates the effective collection, use and dissemination of information in support of TDA/SAP development in the short term and the ecosystem approach in the long term. National Data and Information coordinators in particular, have a responsibility for developing mechanisms for reliable long-term storage and use of information collected under the ASCLME Project.

This Agreement is intended to govern the collection, storage and access to data on the ASCLME 2008 Cruises as an interim measure prior to agreement of a more detailed MoU on data access and management which is currently under development as part of the overall ASCLME Programme (particularly as a joint MoU between the ASCLME and SWIOFP projects and their respective countries). In this context, data collected will be shared freely between the ASCLME and the SWIOFP Project with due note being taken of SWIOFP's own MoU with each of its countries regarding Transboundary Marine Scientific Research in Support of the South West Indian Ocean Fisheries Project (SWIOFP). Nothing in this current agreement should jeopardise the ability of SWIOFP scientists on joint research cruises from abiding by their terms of agreement as specified in this SWIOFP MoU.

Bearing in mind that access to new data, associated metadata, information collection **activities and resulting products funded by the FAO/ASCLME Project** shall be free and unrestricted;

The primary owner of data sets shall be the UNDP GEF ASCLME Project, the FAO and the member-countries of the ASCLME Project, and the primary contact points and archive locations for ASCLME-generated data shall be at nationally appointed data centres as well as through the ASCLME Project Coordination Unit and the FAO.

The first right to publish findings from new data, associated metadata, information collection activities and resulting products funded by the ASCLME Project resides with the principal investigator and her/his associated team (in the case of a scientific investigation), the participating country and the ASCLME Project and FAO.

These guidelines for intellectual property assume that adequate opportunity has been given to regional scientists to collaborate on research projects (data collection, processing and paper-writing), particularly from countries in whose territorial waters the research cruises have taken place.

Interim data management guidelines with specific reference to 2008 ASCLME/EAF-Nansen cruises

Detailed documentation will be made of all measurements and samples collected during each cruise. Documentation will include the cruise track, timing, geo-referenced and time-referenced records of every sampling site and station. All specimens and samples collected will be described and documented electronically during each cruise.

Wherever possible, duplicate or triplicate voucher specimens of macrofauna will be preserved.

The IMR Cruise Leader and the ASCLME Chief Scientist will be jointly responsible for ensuring the accurate documentation of activities, preservation of samples and backup of electronic data.

The primary custodians of data sets shall be the Institute of Marine Research, Bergen (on behalf of the FAO EAF-Nansen project,) the UNDP/GEF ASCLME Project and the member-countries of the ASCLME Project. The primary contact points and archive locations for the survey data shall be at nationally appointed data centres as well as through the ASCLME Project Coordination Unit. The intellectual property of new data, associated metadata, information collection activities and resulting products resides with the principal investigator (in the case of a scientific investigation), the Institution to which the scientist belongs, the participating countries, the ASCLME Project and FAO.

Timing of cruise data reports and products

Specimens

Morphological specimens which are preserved as voucher specimens will be fixed in formalin during the cruises. These will be transferred to ethanol after fixing, also during the cruises. At least one voucher will be lodged at each of:

1) the South African Institute of Aquatic Biodiversity in South Africa (SAIAB). This is an African collection where specimens will be preserved for the use and study by scientists throughout the region.
2) The National collection or National focal point institution for the ASCLME Project of the country from which the collection was made. This will ensure that countries also keep voucher collections. Where feasible, appropriate support will be provided by the ASCLME Project to the countries that do not currently have good capacity for specimen curation.

Specimens will be lodged at institutions *within three months of the conclusion of the 2008 cruises (18 March 2009)*

Electronic data from the cruises

A provisional cruise report and completed data report (containing documentation of all measurements and samples collected during each cruise, include the cruise track, timing, geo-referenced and time-referenced records of every sampling site and station) will be provided to the ASCLME PCU *within 21 days of end of that particular cruise*. It is accepted that biological samples may not be identified and sorted before the end of the cruises, but those data that are captured must be included in the report.

Together with this, an electronic version (in Excel) of all activity/site/station records, and video & photographic inventories will be given to the PCU.

The provisional cruise reports and completed data reports will be made available to the ASCLME participating countries *within six weeks of the conclusion of the 2008 cruise schedule (21st February 2009).*

A final draft cruise report will be made within three months of the completion of the survey. The Cruise Leader and the Chief Scientist are responsible for finalising the report which will be distributed to ASCLME and FAO for final editing and approval. After approval this will be named the Final Cruise Report and will be printed and be available in electronic copies in pdf format.

Processed data from the cruises

A complete set of all processed data collected on the 2008 ASCLME cruises will be made available to the PCU *within three months of the conclusion of the cruise (18 March 2009).* Examples of these data will include CTD, ADCP, multibeam data sets, as well as inventories of identified specimens. It is recognized that some data sets may not be processed by this time. In that case, any raw electronic data must be provided to the PCU together with a report on the steps (and timing) that will be taken to process the data.

The provision of flagged (data to be published) data sets to the PCU will be safely retained offline until either

a) Chief scientists agree to the dissemination of data sets OR
b) Publications are submitted OR
c) Eighteen months has passed since the conclusion of the cruise, whichever is the soonest.

As soon as processed data sets are distributable, they will be lodged at nationally appointed data centres for the ASCLME.

Raw OR processed data collected by scientists under the ASCLME Project shall be immediately available to the Regional Information Working Group (made up of national D&I Coordinators) for the sole purpose of (*internally*, not for distribution) informing the TDA/SAP, should it be necessary.

Proposed time line for delivery of data products

During each cruise	All sampling activities are carefully documented, geo-and time-referenced.
	Voucher specimens are fixed.
Final day of the 2008 cruise schedule. 18 December	Provisional cruise reports, and final data report (containing a record of sampling activities) is delivered to the PCU. Electronic inventories are provided to the PCU.
After completion of the 2008 cruise schedule (ongoing)	Public domain data sets are reviewed, checked and made available to the PCU and National data centres.

Six weeks after that. 21st February	Provisional reports, and the final data reports are sent to ASCLME countries.
Three months from the conclusion of the 2008 cruise schedule. 18 March 2009	Voucher specimens are lodged at National Collections.
	All processed data (or raw data sets + report if not yet processed) provided to the PCU.
	Draft Final Cruise Report submitted to FAO and ASCLME
Eighteen months from the conclusion of the 2008 cruise schedule. 11th June 2010.	The last of the processed data sets are made available to National data centres.

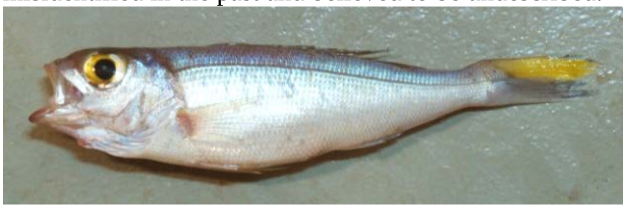
Bothidae, a beautiful pale blue species that has yet to be identified.

A waspfish, Tetrarogidae, photo sent to Dr S. Poss for identification.

Dentex sp., a large, apparently undescribed, deep water sparid taken in two trawls in 300 m depth.

Nemipterus sp., common in the area but apparently misidentified in the past and believed to be undescribed.

An unusual Synodontid with a very pointed snout, apparently undescribed.



A species caught early in the cruise that has not as yet been identified or even assigned to a family.

Four different species of Triglidae taken in one trawl haul, showing distinctive pectoral fin colouration and marked differences in head shape.

Plate 1. A selection of species that have yet to be positively identified, including some undoubtedly undescribed species.

Elongate brown stripe

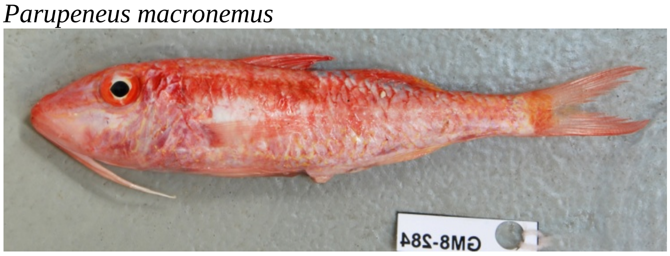
Elongate yellowfins

Upeneus guttatus

Long straight snout

Parupeneus macronemus

Roundhead red mark lateral



red

Parupeneus pleurostigma

Roundhead yellow stripe

Upeneus moluccensis

White barbel bartail

Parupeneus cf. *rubescens*

Plate 2. Different species of the family Mullidae caught during the survey. Similar plates will be prepared for each family or appropriate species group in due course.


GM8-270

Plate 3. Left to right, top to bottom: *Apolemichthys trimaculatus, Monocentris japonicus, Lutjanus gibbus, Lutjanus sebae, Scarus* cf. *ghobban, Epinephelus fasciatus, Aesopia cornuta, Sargocentron seychellense, Kentrocapros rosapinto, Canthigaster valentini*.