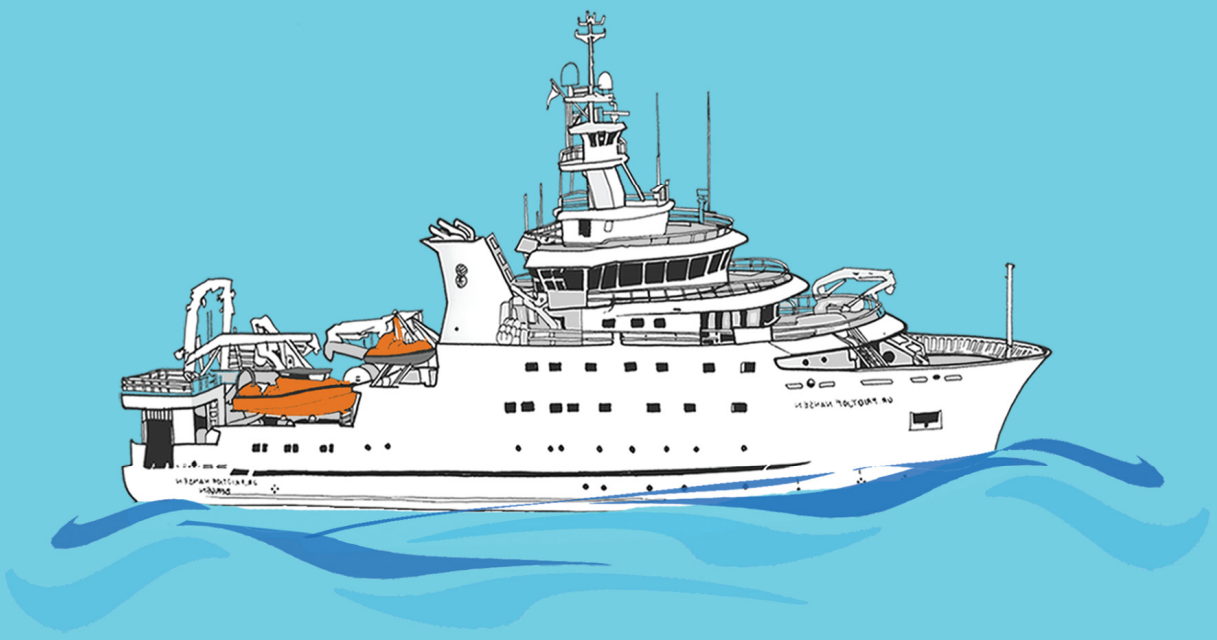
NORAD-FAO PROGRAMME
GCP/GLO/690/NOR

CRUISE REPORTS *DR FRIDTJOF NANSEN*
EAF-Nansen CR/2018/12



THAILAND, ANDAMAN SEA
ECOSYSTEM SURVEY

1 – 15 October 2018

Department of Fisheries, Thailand
Chulalongkorn University, Thailand
Kasetsart University, Thailand
Ramkhamhaeng University, Thailand
Burapha University, Thailand
Southeast Asian Fisheries Development Center, Thailand
Department of marine and coastal resources, Thailand
Royal Thai Navy, Thailand

Institute of Marine Research
Bergen, Norway

The EAF-Nansen Programme

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

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

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

Le Programme EAF-Nansen

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

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

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

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CRUISE REPORTS *DR FRIDTJOF NANSEN*

THAILAND, ANDAMAN SEA

ECOSYSTEM SURVEY

1 – 15 October 2018

by

Sarah Bruck, David Cervantes, Knut Korsbrekke, Marek Ostrowski, Diana Perez, Alina Rey[1],
Praulai Nootmorn, Tanut Srikum, Sakda Arbsuwan, Nirucha Udomwongyont, Tasawan Khawsejan, Sichon Hoimuk, Nirun Choosuan, Issarapon Jithlang, Chalerm Pusririt[2],
Penjai Sompongchaiyakul, Supranee Wattanapongsakul[3],
Jitraporn Phaksopa, Tanuspong Pokvanich[4],
Sitiporn Pengsakun[5], Sujitra Boonjun[6], Isara Chanrachkij[7],
Sitakarn Tawisuwan[8], Warongrit Hongprasith[9]

[1] Institute of Marine Research, P.O. Box 1870 Nordnes, N-5817 Bergen, Norway
[2] Department of Fisheries, Thailand
[3] Chulalongkorn University, Thailand
[4] Kasetsart University, Thailand
[5] Ramkhamhaeng University, Thailand
[6] Burapha University, Thailand
[7] Southeast Asian Fisheries Development Center, Thailand
[8] Department of marine and coastal resources, Thailand
[9] Royal Thai Navy, Thailand

Institute of Marine Research
Bergen, 2020

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EXECUTIVE SUMMARY

This survey was planned as part of a synoptic coverage of the Bay of Bengal marine resources and ecosystems to be conducted by the research vessel (R/V) *Dr Fridtjof Nansen* in 2018 as part of the EAF-Nansen Programme (2017–2021). This report documents the area covered and methods used, as well as preliminary results. Further scientific work using data and samples collected during this survey is envisaged as part of the EAF-Nansen Science Plan.

Overall the water characteristics were typical for the season, coinciding with the onset of the North East monsoon. Water masses identified during the survey can be divided into three water masses: near-surface layer (high temperature (around 29 °C) and low salinity (around 31–32) due to river runoff), sub-surface layer (Australian Mediterranean Water Mass - AAMW), and Intermediate Water Layer (Antarctic Intermediate Water -AAIW).

Surface temperatures along all transects were high, typically about 29 °C above the thermocline. The thermocline was around 150 m depth in the east and increasing slightly towards the west to around 200 m depth with increasing water depth.

Oxygen concentrations were high in the surface layers (typically ~ 4-5 ml/l), decreasing with depth. Hypoxia (>0 - <1.5 ml/l) were found between 100–400 m depth and increased slightly to 1.8 ml/l at 2000 m depth (sta 876).

Fluorescence increased with depth to the maximum level about 50 m depth. Below the thermocline there were typically no fluorescence maximum.

Above the thermocline, the inshore currents moved northwards while the offshore currents, moved in southward direction. Therefore, a cyclonic gyre may be present in this area. In the deeper layers, currents moved northwards and with lower speed.

Overall abundance of bottom fauna was higher (about twice) in deeper waters than in shallow waters. Average catch rates, after exclusion of mesopelagics, that represented the most abundant group of teleosts, were about 28 kg /h. Some species of sharks, e.g. *Bythaelurus* sp., were found in large number with the mean total length as 28.54 cm. This possibly indicates that the survey area may hold nursery grounds for this group. Generally, the size of demersal fish was quite small and placed in “non commercial species” group, except for some species of shrimps. Several species of rays, sharks and chimeras, may represent new records in Thai waters.

As regards pelagic species, only a few Carangidae occurred in both bottom and pelagic trawl with 0.03 and 0.35 kg/hr respectively. The most abudant specie belonged to the genus *Decapterus* and *Selar*, mainly represented by juveniles. Mesopelagic fish was the most abundant group.

CHAPTER 1. INTRODUCTION

1.1 Background

This survey was planned as part of a synoptic coverage of the Bay of Bengal marine resources and ecosystems to be conducted by the R/V *Dr Fridtjof Nansen* in 2018 as part of the EAF-Nansen Programme (2017–2021). In connection with this phase of the Programme, a Science Plan has been developed that addresses 11 different topics within three main lines of research related to resources, impacts of oil/mining activities and pollution on resources and ecosystems and climate change. Therefore, in addition to providing key information on abundance and distribution of main fish resources, the survey programme was designed to also support the research projects under the science plan. Within this framework, the survey scope and objectives for the Bay of Bengal were discussed and agreed to during a regional meeting held in Colombo (Sri Lanka) in August 2017. Detailed objectives for the survey within Thailand EEZ were discussed at a pre-survey meeting that took place in Yangon, Myanmar on 24 and 25 May 2018 and by correspondence with Thailand's Department of Fisheries.

1.2 The survey area

The Andaman Sea is west of Thailand and the EEZ stretches between the borders of Myanmar in the north and Malaysia in the south. The coastal areas shallower than 200 meters are considered as highly productive. The survey focused on the deep-water part of the EEZ, ranging from 200 meters to more than 1 000 meters with most of the survey area having depths ranging from 400 to 600 meters. The survey area was approximately fourteen thousand square nautical miles corresponding to fifty thousand square kilometers. The northernmost east-west transect was at 9° 30' N and the southernmost transect at 6° 50' N.

The main inflow of freshwater into the Andaman Sea comes from the three major rivers Trang, Palian and Krabi, influencing mostly the shallower parts of the shelf that was outside the survey coverage. The survey area is considered (and this was confirmed during survey) as a low productivity area, with low oxygen levels below the thermocline (typically at 150 meters depth).

The Andaman Sea is an area with profound and distinct internal waves. These are linked to tidal forcing and have an impact as deep as 250 meters. Such waves contain large amounts of energy and as they break, they cause water mixing beneficial to overall productivity. This process occurs in shallower waters not covered by this survey.

1.3 Aims and objectives

The area surveyed in 2018 by the R/V *Dr Fridtjof Nansen* includes the continental shelf and upper slope of East Africa (continental) (Leg 1), the Mascarene Bank (Leg 2) and parts of the Bay of Bengal region (Leg 3). Transfer of the vessel between the different legs was used as an opportunity to carry out studies of specific oceanographic features and of the mesopelagic communities. Although standard sampling was carried out throughout, the survey objectives

have been somewhat different for the different legs and these are therefore described separately. Sampling protocols are standardized to the extent possible to allow comparability across larger geographic scales. Figure 1 provides an overview of the surveys undertaken as part of Leg 3 (Bay of Bengal).

Leg 3 had a broad ecosystem approach and aimed at gaining understanding of ecosystem status in general and of specific ecosystem components and attributes. Sampling was undertaken in relation to hydrographic conditions (physical and chemical), plankton, egg and larvae, jellyfish, demersal, pelagic and mesopelagic resources, and bottom sediment. Opportunistic sampling for pollution (microplastics and food safety) was undertaken throughout the survey. In addition to providing data for ecosystem monitoring, specific priorities are addressed in the different countries based on suggestions provided at a meeting with represenatives from the involved countries, in Colombo in 2017.

Leg 3.5 started in Phuket (Thailand) on 1 October 2018 and covered the deeper part of the Andaman sea from 200–400 meters down to app. 2 000 meters.

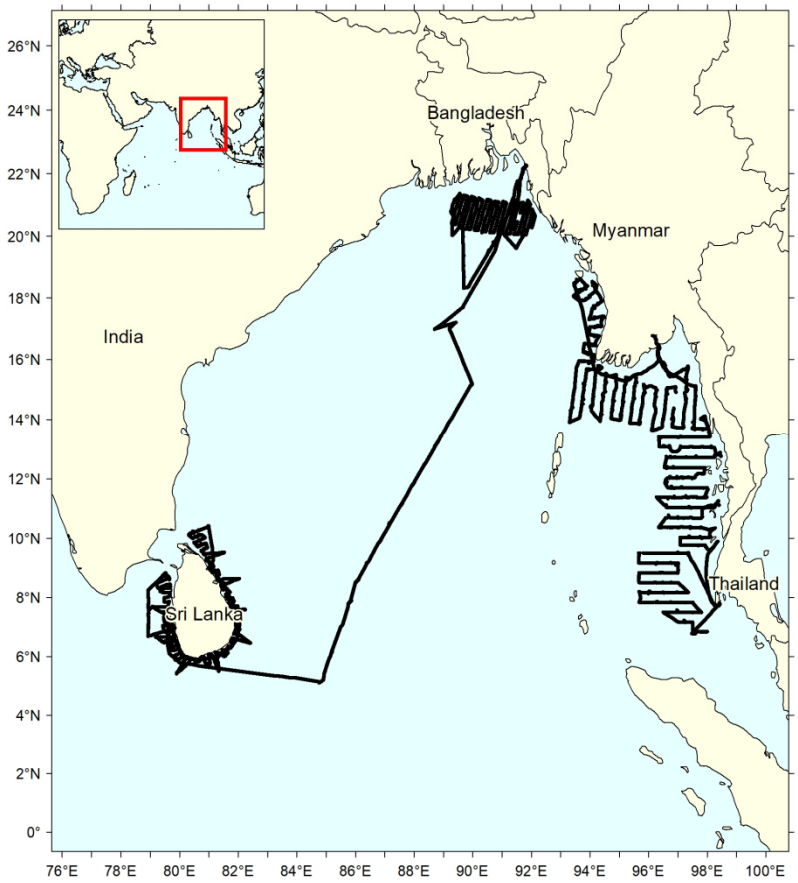


Figure 1. Survey programme for the R/V *Dr Fridtjof Nansen* in the Indian Ocean in 2018, Leg 3

The main objectives for Leg 3.5 were to cover demersal and mesopelagic resources and habitats at depths greater than 200 meters. More specific objectives included:

Hydrography

- To map the hydrographic/environmental conditions in the survey area (temperature, salinity, oxygen, chlorophyll, nutrients and pH values-acidity). Obtain information on the oxygen concentrations and ocean acidification state and calcium carbonate saturation horizon, relevant for calcifying organisms.

Phytoplankton, zooplankton, ichthyoplankton and jellyfish

- To establish as far as possible, the distribution, abundance and composition of phyto- and zooplankton, and species composition of fish eggs and larvae (data to be used, in part, to understand acoustic backscatter from zooplankton that can be used to refine TS for fish and jellyfish targets)
- Where possible, to carry out experiments on newly hatched larvae to describe developmental stages and improve their identification, to identify egg and larvae optimal environmental windows and to measure buoyancy in live fish eggs to get information on the vertical distributions in coastal water masses.
- To collect samples of jellyfish for a) morphological identification and taxonomic studies, b) genetic studies for the purposes of confirming identity, determining population structure and establishing regional and global connectivity.

Pelagic, mesopelagic and demersal resources:

- To obtain information on abundance, distribution (also by size) using acoustic and swept area methods, with a systematic grid survey strategy
- To collect biological samples of priority species
- To collect samples for levels of environmental contaminants, nutrients, parasites and microorganisms with regards to food safety and pollution.
- To collect information on the stage of maturity as support to identification of spawning time and spawning areas.

Record occurrence of marine debris (surface)

- To map occurrence of microplastics and describe associated neustonic communities

1.4 Participants

Name	Institution	Country
Knut Korsbrekke	IMR	Norway
Diana Zaera	IMR	Norway
Sarah Bruck	IMR	Norway
Alina Rey	IMR	Norway
Marek Ostrowski	IMR	Norway
Jan Frode Wilhelmsen	IMR	Norway
Hege Rognaldsen	IMR	Norway
David Cervantes	IMR	Norway
Tanut Srikum	DOF	Thailand
Sitiporn Pengsakun	RU	Thailand
Sakda Arbsuwan	DOF	Thailand
Nirucha Udomwongyont	DOF	Thailand
Tasawan Khawsejan	DOF	Thailand
Chalerm Pusririt	DOF	Thailand
Issarapon Jithlang	DOF	Thailand
Sichon Hoimuk	DOF	Thailand
Nirun Choosuan	DOF	Thailand
Supranee Wattanapongsakul	CU	Thailand
Penjai Sompongchaiyakul	CU	Thailand
Sujitra Boonjun	BU	Thailand
Jitraporn Phaksopa	KU	Thailand
Tanuspong Pokvanich	KU	Thailand
Isara Chanrachkij	SEAFDEC	Thailand
Warongrit Hongprasith	RTN	Thailand
Sitakarn Tawisuwan	DMCR	Thailand
Zayar Min	DOF	Myanmar
Saw Soe Moe Thu		Myanmar

1.5 Narrative and survey effort

The vessel left the port of Phuket on 1 October at 16:00 local time and arrived at the northernmost transect on 2 October 06:00. The initial station experienced several technical issues that were resolved in a few hours. The remaining part of the survey was conducted with no additional problems and the last station (super-station) was finished at 12:30 on October 13.

Quite early in the survey it became evident that sampling was more efficient than expected which gave more time for additional sampling. This resulted in adding 23 CTD stations to the design (including water samples).

1.6 Onboard training

All participants from Myanmar and Thailand demonstrated a high level of skill, competence and dedication early in the survey. This is the major factor behind the amount of high-quality results and samples produced during this survey.

The scientists working in the fish lab handled all the samples related to trawling and were trained in relevant sampling routines such as sub-sampling, correct sorting, and processing of the catch. The deck sampling procedure is described in detail by Strømme (1992). For correct identification of the catches they were trained in the use of taxonomic keys, including quality checking of identified species using both printed and electronic identification reference guides. Further, the training included the applied use of the electronic measuring board, as well as retrieval and post-processing of trawl data. Survey participants were also trained on how to perform the correct calculations using subsampled catches, and on how to routinely input data in the Nansis database. This training also included data processing and analysis using the Nansis software. Finally, all scientists had a major part in the daily running of the lab, which included cleaning routines, updating and maintaining spreadsheets for lab logistics, and handling and storing samples.

The aim of the on-board training in oceanographic methods was to develop the skills among the participants necessary for transforming the voluminous raw data collected during the survey into meaningful information. The training introduced quality-control, data reduction, reporting and analysis procedures to handle the daily streams of data from the running oceanographic instrumentation. The result of these daily efforts provided the basis for preparing the survey report so that the oceanographic section in this report is a joint effort of all participants participating in the training. The training relied strongly on the supporting specialized software. The software that was used on board was subsequently distributed to the participants for post-survey data analysis and data maintenance tasks at their respective institutes. The software packages used in the training included: ODV (Oceanographic data visualisation), OSSI (ADCP post-processing), Survey Mapper (geostatistics and horizontal property mapping), Quick Cast, (CTD, handling quality control and banking of the vertically profiled data) and XADCP (quality control and reporting of the ADCP-derived current data). The two former programs used in the training are courtesy of third-party institutions (AWI, and GEOMAR, respectively), while the other three have been developed at IMR.

The chemistry lab was responsible for collecting and analyzing the water samples from the CTD for high quality chemistry data. An introduction to the chemical lab was given and the survey plan was discussed within the group. A decision was taken to collect extra water samples for additional analyses. To ensure proficiency, the participants were trained individually on the lab instruments, with both theoretical and hands-on training in addition to protocol documentation. After the first two CTD casts, the facilitator allowed the participants to perform independently while monitoring closely to respond to any question or any needed help. Although the facilitator's role in the lab decreased over time, he continuously quality checked the data and discussed the data with the participants throughout the survey.

The plankton team was introduced to the equipment used on-board in addition to the routines used to handle the samples. This did not take very long since the team had good experience in plankton work and worked independently after a few days. The cruise leader conducted two seminars for each watch/shift. The first seminar was an introduction to swept area or swept volume estimation and focused on classical estimation assuming random sampling and compared this with probability-based estimators. The seminar covered both estimation of point estimates and variance and the participants were introduced to basic principles behind stratified sampling.

The second seminar was an introduction to fisheries acoustics, including the basic properties of sound and working principles of an echosounder and how knowledge of single object target strength can be used to convert estimates of reflected energy into estimated numbers of fish and how this conversion is depending on the size of the fish.

CHAPTER 2. EQUIPMENT AND METHODS

2.1 CTD and RapidCast CTD

Designated stations on the cruise track were selected for CTD deployments and water sampling. A Seabird 911plus CTD containing a SBE 3plus temperature sensor, SBE 4C conductivity sensor, Digiquarts pressure sensor, SBE 43 dissolved oxygen sensor and a Chelsea AquaTracka III fluorometer was mounted to a 12-bottle rosette for every CTD deployment. All sensor logging and profiling were performed using Seabird's Seasave software (see Annex VI for information on sensor validation).

RapidCast is a newly fitted instrument on board, enabling to preform CTD cast at the vessel's transit speed (10–12 knots). During this survey, the first seven trials to operate this instrument were undertaken. The six of these trials were carried out using a dummy probe with the aim to exercise the instrument's operating protocols and test the winch system. The team tested various operational setups as to the deployment of the probe, the launch and recovery process, as well as to test the software controlling the winch and data logging operations. The tests were successful in the end. However, the operation of the RapidCast CTD was found to be demanding instrument, requiring a constant vigilance on the side of the operators to protect against a winch damage or the probe loss. The manuals that came with the probe were found insufficient in providing all necessary information to operate the instrument with confidence. An email contact with the manufacturer's support (Oceanscience) was undertaken to obtain additional operational information and that worked very well. The first and, so far, the only cast with the real probe was undertaken during the last survey day. The test was successful. The probe deployed at 10 knots, and set to max. depth of 150 m, descended to 100 meters recording temperature and conductivity data, on average 2–3 data cycles per one meter of the descent.

2.2 Water samples

During each CTD deployment along the cruise track, the 12-bottle rosette collected water during the upcast to obtain vertical profiles of pH, total alkalinity, nutrients, and chlorophyll a. Predefined depths were chosen based on resolution and water budget requirements (Annex V). The instrument operator stopped the CTD at each predetermined depth for at least 20 seconds to allow the bottles to rinse well with the surrounding water as it reached equilibrium. Although sensor data was continuously logged during deployment, sensor readings were also logged separately to correspond with the depths at which the bottles were triggered to close. Water samples were collected throughout the survey to validate the salinity and dissolved oxygen measurements obtained by the sensors.

Water samples for pH and total alkalinity analyses were collected in the same 250 ml borosilicate glass bottle using silicone tubing. Since no preservative was used, it was necessary to keep the samples in the dark while waiting to be brought to 25 °C (with a water bath) for analysis. pH was determined using an Agilent Cary 8454 UV-Vis Diode Array spectrophotometer and a 2-mM stock solution of *m*-cresol purple sodium salt dissolved in

seawatera. The indicator dye was measured every 24 hours to determine the correction factor necessary for sample measurements (Clayton and Byrne, 1993; Chierici *et al.*, 1999). All pH spectrophotometric measurements were performed in duplicates on board. Total alkalinity was measured via potentiometric titration using a 0.05M HCl solution with a sodium chloride background as the titrant. A Metrohm 888 Titrando equipped with an Aquatrode plus pH electrode with Pt1000 temperature sensor was used in combination with the Metrohm tiamo software to measure the change in pH and perform the total alkalinity titrations. Certified Reference Material of known total alkalinity from the Andrew Dickson Lab at Scripps Institution of Oceanography was measured every 24 hours to determine the correction factor appropriate for sample measurements. All total alkalinity titrations were performed in triplicates or duplicates on board.

Chlorophyll a water samples were collected in 1 000 ml plastic bottles and divided into 263 ml volume samples so chlorophyll could be measured in triplicates or duplicates. These water samples were only collected from 200 m to the surface and were filtered using a 0.7µm filtration system (Munktell glass-fibre filters Grade: MGF, vacuum 200 mm Hg). Filters were stored at -20 °C until they were transferred to centrifuge tubes and 10 ml of 90% acetone were added. After being stored in the dark at 4 °C for at least 15 hours for extraction, the samples were centrifuged and immediately transferred to cuvettes for measurement on a 10AU Fluorometer. First without acid for chlorophyll a determination and then a second time with two drops of 5% HCl for pheopigment determination. The 10AU is calibrated approximately every three months with standards created from a chlorophyll a (from spinach) solid.

Water samples for nutrient analyses of nitrate, nitrite, silicate and phosphate were collected in 20 ml polyethylene vials. Samples were frozen for preservation and will remain frozen until they are thawed for analysis at the Institute of Marine Research. The analyses will be performed using a Skalar San++ Continuous Flow Analyser while following standard procedures (Grasshoff *et al.*, 1999). Storage and sample transport may introduce a loss in accuracy of results.

Water samples for TOC/TON and N-isotope were collected in 50 ml polypropylene centrifuge tubes with screw caps, and for TP were collected in 150 ml polyethylene bottles. Samples were frozen for preservation and will remain frozen until they are thawed for analysis. The analyses will be performed at the Department of Marine Science, Chulalongkorn University. TOC and TON will be analysed by catalytic high temperature oxidation, using a multi N/C 3100 TOC/TNb Analyzer (Analytik-Jena, Germany). TP will be analysed by oxidation and thereafter by spectrophotometry (Grasshoff *et al.*, 1999).

Water samples for analysis of petroleum oil dissolved and/or finely dispersed in seawater (DDPHs) were collected from the Niskin bottle that collected water from 5 m depth. Two liters of seawater were extracted twice using hexane. The extraction was performed on board. The extracts were collected in glass amber bottles and kept in the dark and chilled until they are further analysed at the Department of Marine Science, Chulalongkorn University. The

concentration of DDPHs will be determined by UV fluorimetry (UNESCO, 1984; Grasshoff *et al.*, 1999).

2.3 ADCP

The ocean current data were collected with Teledyne RDI Ocean Surveyor ADCPs, OS75 and OS150, operating at the frequency of 75 and 150 kHz, respectively. The two instruments run continuously underway throughout the survey. The RDI's VmDAS data logging software was used for the instrument configuration and data acquisition. The narrowband pinging mode was used. The pings were triggered externally, time-gated with other acoustic instruments to avoid interference between various sources of the backscattered sound. The pinging rate was not constant, varying between 2 and 4 seconds. The manufacturer's recommended bin sizes of 16 and 8 m for the OS75 and and OS150 ADCP unit, respectively, were used throughout the survey. Heading, pitch, roll and positional data were acquired by Kongsberg Marine SEAPATH unit. The VmDAS software used these data to convert the ADCP's along beam velocities into earth coordinates.

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

Table 1. The transducer misalignment with the ship centreline estimated from the ADCP data collected during the 2018-412 survey. The mean misalign angle data are in the rightmost column.

ADCP unit	Bin size	Reference layer	Amplitude	Angle
OS 75 kHz	16 m	200 - 300 m	1.0045	0.072147°
OS 150 kHz	8 m	100 – 200 m	1.0049	-0.24638°

According to the result in Table 1, the misalignment of the OS75 unit was below 0.1°, suggesting a good quality of the uncorrected data in contrast to the OS150 where the misalignment exceeding 0.2° demanded the correction. However, results for the 8 meter bin size obtained from other surveys through 2017 and 2018 campaigns indicates that the misalignment of ~ -0.22° is the stable value estimated for the OS150.

The density of the time-averaged current estimates varied per distance unit because of the varying speed of the vessel. The density was highest at fixed stations and at locations of trawl hauls in reverse direction, in contrast to the ship's transit sections where the distance between the two current samples could be as large as 50 m. To compare the flow patterns between the sections occupied with a varying number of fixed stations and trawl hauls, it was necessary to further average the 2-minute ensembles into larger, statistically significant, equal-distance

blocks. For each section, the 5 NM distance blocks were allocated along a straight line estimated by the least-squares fit using the true ship's track coordinates. The transect line fitting and distance binning was carried out using the XADCP software designed at IMR.

2.4 Thermosalinograph

The SBE 21 Seacat thermosalinograph (TSG) operated continuously underway during the survey collecting data at the intake of the water located at 4 m depth. The standard TSG unit measured temperature, conductivity. An add-on C3 Turner Design Submersible Fluorometer unit recorded turbidity and chlorophyll-*a* levels. Salinity and potential density were computationally derived from the TSG-collected data.

2.5 Weather station

Meteorological data including air temperature, solar radiation, relative humidity, air pressure and wind speed and direction were logged continuously with the AANDERAA Smartguard meteorological station. All data were logged to the Nansis tracklog system averaged every 60 seconds. Sadly, an instrument error introduced numerous spurious wind data into the tracklog record. The instrument manufacturer has been notified of the problem, but the vessel is still waiting for its resolution. Because the spurious data are unflagged, removing them involves a time-consuming process of cleaning large data files manually. In the absence of the available time and suitable tools, we were unable to undertake the data cleaning task during this survey. For this reason, the meteorological observations are not reported. However, the unedited raw data (with the embedded spurious records) have been preserved for the future quality control.

2.6 Sediments

For sediment sampling, a metal cylinder (inner diameter 65 mm x 400 mm) was attached to either side of the bottom trawl allowing sediments to be collected during demersal trawl hauls. Upon retrieval, the sediments were frozen at -20°C.

2.7 Phytoplankton

At each super-station, qualitative phytoplankton samples were collected with a net (35 cm diameter) with mesh-size 10 µm (Figure 2), hauled vertically at a speed of 0.1 ms^{-1}. One haul from the depth of 30 m to the surface, and one haul from below the thermocline (variation from 140 m to 240 m) to the surface. The samples were preserved in 100 ml brown glass bottles with a final solution of 2% hexamine-buffered formaldehyde. These samples will be used to establish the taxonomic composition of the phytoplankton community.

2.8 Mesozooplankton

At each super-station, mesozooplankton was collected with a WP2-net (56 cm diameter) with mesh size 180 µm (Figure 2), hauled vertically at a speed of ~0.5 ms^{-1} from the depth of 200 m to the surface. The counts of a manual flowmeter attached in the net opening were recorded at the start and end of each haul.

These zooplankton samples were divided into two equal parts using a Motoda plankton splitter (Motoda 1959). The first part of the sample was size-fractioned by using a series of sieves with the decreasing mesh-sizes of 2000 µm, 1000 µm and 180 µm, and the zooplankton retained on each sieve were dried on aluminium trays at ~60 ºC for 24 h (Figure 3). The trays were then packed in aluminium foil and frozen at -18 ºC until transport to the laboratory of IMR. These samples will be dried once more and weighed on shore after the cruise for estimation of biomasses for the different size-groups. The second part of the sample was preserved in a 100 mL plastic bottle with seawater and a final solution of 4% formaldehyde buffered with borax (Figure 3) for subsequent species identification and quantification.

Furthermore, a second sample with the WP2 net was collected from the upper 30 m. These zooplankton samples were preserved in 100 ml plastic bottles with seawater and a final solution of 4% formaldehyde buffered with borax for subsequent species identification and quantification. The purpose of these additional samples was to enable a direct comparison of the zooplankton composition and concentrations in the uppermost layer of the water-column along the bottom-depth gradient.

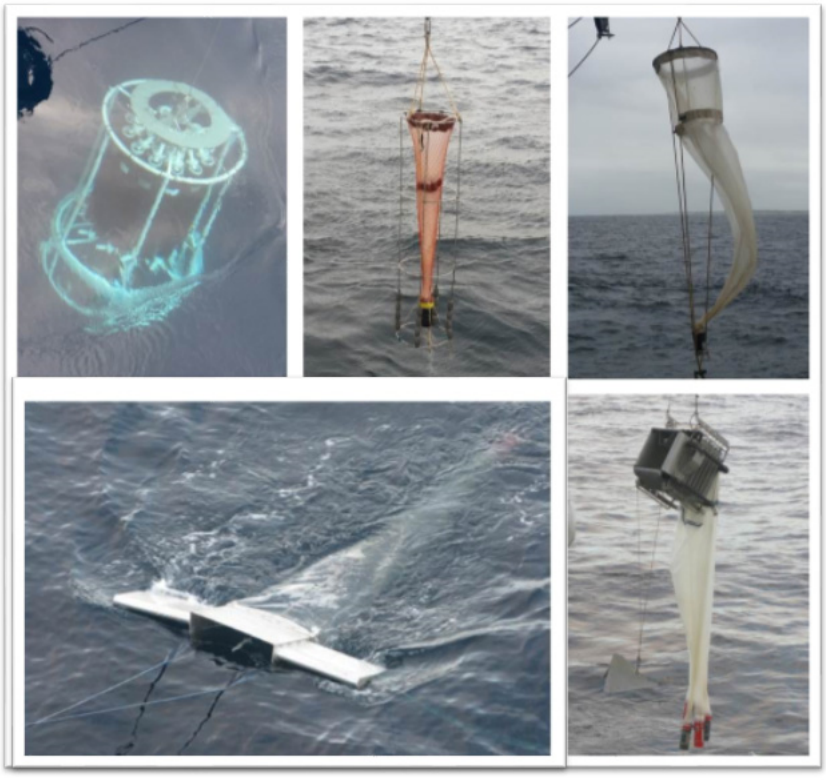


Figure 2. Plankton sampling equipment. Top: CTD with Niskin bottles, Phytoplankton net, WP2 net. Bottom: Manta trawl, Multinet rigged for oblique tow. Image credits: Jenny Huggett

Figure 3. Preserving samples. Top: Aluminium trays with dried biomasse from WP2. Bottom: 100 mL plastic bottles for preserving zooplankton samples in ethanol and formaldehyde, Vial for preserving fish eggs and larvae in ethanol. Image credits: Alina Rey

2.9 Ichtyoplankton

Ichthyoplankton sampling (fish eggs and larvae) was conducted at the super-stations using Hydrobios Midi Multinet (0.25 m^2 opening), fitted with one net of 405 µm mesh size. The net was towed obliquely from the depth of 200 m to the surface with a towing speed of 1.5 m/sec. All samples were examined under the stereo-microscope on board, and fish eggs and larvae were sorted out and counted. The meticulous plankton examination was done in small portions, and representative photos were taken under the microscope for each fish egg and larvae (Figure 4), before they were preserved in 96% ethanol in eppendorf vials (Figure 3). After sorting out fish eggs and larvae, the sample was divided in two parts by use of a Motoda plankton splitter. One half of the sample was sieved on a 180 µm mesh, transferred to a 100 ml plastic bottle and preserved in 96% ethanol. The other half was preserved in a 100 ml plastic bottle with seawater and a final solution of 4% formaldehyde buffered with borax (Figure 3).

Samples collected by the Manta trawl were also examined for isolating fish eggs and larvae distributed in the surface layer of the water column. The process followed was the same as in the Multinet samples.

Figure 4. Sorting and photographing fish eggs and larvae. Image credits: Alina Rey

2.10 Microplastics and debris

Microplastics are small pieces of plastic marine debris normally less than 5 mm long. Microplastics were collected along the hydrographic transects at all super-stations. At each station, the surface layer was sampled with a Manta-trawl, with a rectangular opening of 19 cm × 61 cm (HxW), mesh-size 335 µm and two wings to keep it balanced and at the surface during the tow (Figure 2). Trawls were hauled horizontally at a speed of ~1.5 ms^{-1} for 15 minutes. The counts of a manual flowmeter attached in the lower part of the trawl opening were recorded at the start and end of each trawl. Trawling was performed some meters away from of the starboard side, about mid-ship, attempting to avoid the wake of the vessel.

Once the Manta-trawl was back on the ship, the samples were washed in filtered sea-water over a sieve with a mesh-size 180 µm. The samples were then examined under the stereo-microscope on board, and microplastic particles, fish eggs and larvae were sorted out. All assumed plastic items were then placed on a gridded petri dish for examination, photographed and, to the extent possible, also measured and described (e.g. length, shape, type and colour). The sorted microplastics were dried in pre-weighed aluminium-trays in a drying cabinet at ~60 ºC for 24 h. The trays were then packed in aluminium foil and frozen at -18 ºC until transport to the laboratory of IMR, where they will be studied in more detail. Fish eggs and larvae distributed in the surface layer of the water column were also isolated from the sample following the same process as in the Multinet samples, where representative photos were taken under the microscope for each fish egg and larvae (Figure 4), before they were preserved in 96% ethanol in eppendorf vials (Figure 3).

After sorting out microplastic particles, fish eggs and larvae, the remaining part of the samples - mainly biological material - was sieved on a 180 µm mesh, transferred to a 100 ml plastic bottle and preserved in 96% ethanol.

2.11 Water pumps

Two continuous water pumps sampling from 2 m depth were running through two filters with different mesh sizes, for zooplankton sampling. The filters were emptied every 6 hours and the position of the vessel was recorded every time the filters were emptied. The small pump also had a flowmeter and the count was recorded when the filter was emptied. These samples are not representative of the transects, since they include time periods when the vessel kept the same position for hours during a super-station. Taking this issue into account the results will still represent useful quantitative values.

“Small water pump”

The water was continuously filtered through a cod end with mesh size of 180 µm (Figure 5). Every 6 hours the flowmeter count was recorded, and the sample was transferred to a 100 ml plastic bottle and preserved in 96% ethanol.

“Big water pump – CUVES”

The water was continuously filtered through a cod end with mesh size of 405 µm. Every 6 hours the sample was transferred to a 250 ml plastic bottle and preserved in seawater with a final solution of 4% formaldehyde buffered with borax.

Figure 5. "Small water pump” and “Big water pump – CUVES”. Image credits: Alina Rey

2.12 Demersal and pelagic trawl sampling

Biological sampling of the fish was carried out both pelagically and on the bottom. Pelagic trawl hauls were conducted using the MultPelt trawl, whilst a bottom trawl was used for the demersal hauls. A more detailed description of instruments and fishing gear is given in Annex I. Trawling was done either at predefined stations, or on acoustic registrations. A few 'blind hauls' were also conducted at night to survey the resources at the surface. All catches were sampled for composition by weight and numbers of each of the species caught. Length measurements (total length to the nearest cm below) were taken for some species. An Electronic Fish Meter (SCANTROL) connected to a customized data acquisition system (Nansis) running on a Windows PC was used for length measurements.

Species identification was made to the lowest taxonomic level possible following FAO species identification guides for Fishery purposes, Smith's Sea Fishes (Smith *et al.*, 2003), and several online databases especially the catalog of fishes (Eschmeyer *et al.*, 2018), WoRMS database (WoRMS Ed. Board, 2018) and FishBase (Froese and Pauly, 2018). In addition, high resolution pictures were taken of uncommon species of both fish and invertebrates for the photo database on board R/V *Dr Fridtjof Nansen*, and to assist in identification validation by specialists.

The biomass calculation of demersal fish in the survey area was based on the swept area method. All valid stations were treated as representative. All biomass calculations were done in Excel. All equations for the calculations are given in Annex XIV. The effective fishing width of the trawl gear used by R/V *Dr Fridtjof Nansen* is considered to be 18.5 m. The effective fishing area is the product of the fishing width multiplied by the towing distance measured by the GPS. It is assumed that all fish within the trawling path are caught which gives a catchability coefficient (q), i.e. the fraction of the fish encountered by the trawl that was caught, equal to 1.

2.13 Acoustic observations

2.13.1 Echosounder and settings

Acoustic data were recorded using a Simrad EK80 Scientific Split Beam Echo Sounder equipped with keel-mounted transducers at nominal operating frequencies of 18, 38, 70, 120, 200 and 333 kHz. The last calibration was conducted outside Walvis Bay at the last part of the previous survey, although the sounders were calibrated in Bergen on 23 January 2017.

2.13.2 Allocation of acoustic energy to species group

Acoustic data were logged and post-processed on board using the latest acoustic data post-processing software, the Large-Scale Survey System (LSSS) Version 2.0. Scatters were displayed at 38 kHz. The mean 5 nautical miles (nm) area backscattering coefficient sA (m^2/nm^2) was allocated to a predefined set of species groups as given in Table 2.

Table 2. Allocation of acoustic densities to species groups. Note only main genera/species are listed

Group	Taxon	Genera/Species
Pelagic species 1	Clupeidae	*Dussumieria* spp.
		Ilisha spp.
		Sardinella spp.
		Anodontostoma chacunda
	Engraulidae	*Coilia* spp.
		Stolephorus spp.
		Setipinna spp.
		Thryssa spp.
Pelagic species 2	Carangidae	*Alectis* spp.
		Atule mate
		Atropus atropos
		Caranx spp.
		Carangoides spp.
		Decapterus spp.
		Scomberoides spp.
		Megalaspis cordyla
		Parastromateus niger
		Uraspis spp.
	Scombridae	*Rastrelliger* spp.
		Scomberomorus spp.
	Sphyraenidae	*Sphyraena* spp.
	Trichiuridae	*Lepturacanthus savala*
		Tentoriceps cristatus
		Trichiurus lepturus
Other demersal species[1]	Demersal families	
Mesopelagic species	Myctophidae	
	Other mesopelagic fish	
Plankton	Calanoida	
	Euphausiidae	
	Other plankton	

The acoustic backscatter was scrutinized daily and allocated to the various target groups. The standard procedure uses s_V threshold at different levels in combination with observed visual patterns on the echogram to separate species groups. During this survey, hardly any echo energy above a -50 dB threshold was recorded and only a single school was classified as Pelagic 2. None of the acoustic recording was classified as Pelagic 1. The occasional single fish or shoal of single fish standing out from the background levels was classified as 'Other demersal species', but not in any amount defending any attempt to estimate biomass. The dominant species group in the trawl samples (pelagic trawl) was Myctophidae. They also dominated our few "blind" surface tows at nighttime. Most ecosystems have Myctophidae distributed considerably deeper. This close to surface occurrence coupled with strong vertical diurnal migrations introduced major depth dependent variations in target strength. The observed target strength distributions did not show any results useful to separate mesopelagic

[1] The group "Other demersal species" contains all acoustic targets of typical demersal character. No attempt is made to separate these into different families.

species from plankton and consequently it has not been possible to produce any biomass estimates based on acoustics.

A brief description on how to estimate number and biomass indices based on trawl information and acoustic records is given in the following section. The acoustic observations made on this survey did not contain any information that can be used to estimate abundance for any of the species or species groups given above. The overall very low acoustic observations were dominated by acoustic backscatter from plankton. It is, based on trawl samples, natural to assume that myctophids were the second biggest source of acoustic backscatter. The myctophids showed strong vertical diurnal migrations with a corresponding effect on single fish target strength making it even more difficult to define a threshold level separating them from the plankton.

2.14 Acoustic Estimation of abundance

There are no acoustic abundance estimates presented in this report. Explanation of how acoustic estimation is conducted is presented below.

Total or average reflected echo energy is calculated for each of the transects with transects being the primary sampling unit. The collection of transects represents the samples to be used to estimate the total echo energy (echo abundance or s_A) in the survey are (possibly stratum by stratum) and the corresponding level of uncertainty.

The estimated size composition is used to transform the estimated total reflected echo energy into numbers of fish. Please note that the estimated size composition (length distribution) is also given with a considerable level of uncertainty. Length to weight relationships can then be used to further transform estimated abundance in numbers into biomass.

2.15 Cetaceans, sea turtles and sea birds

The survey route corresponds to 1 620 kilometers. The observations of cetaceans, sea turtles and sea birds were limited to 10 days due to the weather conditions. Marine mammals, sea turtle and sea birds were recorded while the vessel was moving 9.8–10 knots along predetermined track lines (line-transect methodology).

Photographs were taken using Nikon D7000 with 80–400 mm telephoto zoom lens. The visual continuously watches for cetaceans used 25×1000 binoculars, scanning 180° of the view (forward of starting at 90° to port and 90° to starboard). All observations were made from a designated tower above the bridge at 30 meters above sea level.

The characters used for whale and dolphin identification was the lateral view of their dorsal fins, showing different markings and shapes of fin and shapes of head. Other distinctive marks were also useful, such as color pattern on the tip of the head, or scar/color patterns inside the mouth. Scars or any irregular appearances on their bodies were also useful for sea turtle and sea birds identification.

When an observer spots whales or dolphins, the species is identified while independent estimates the number of animals in the group are carried out. Observers measure the distance to the group, using markings on the lenses of the binocular, and the angle of the group from the vessel heading. The combination of distance and angle, together with geometric calculations, provide the perpendicular distance from the group to the track line. At the end of the survey, it is the collection of these track line distances that allows estimation of the detectability of cetacean groups. The length of the survey track lines, as well as species detectability and average group size, are some of the data used to estimate abundance. In this survey, only one observer was available.

Cetaceans and sea turtles must come to the surface to breathe and visual observation is the primary mode for cetacean and sea turtle abundance estimation. Visual observers can estimate the number of animals in a group, identify the presence of young animals, and describe the behavior of the group characteristics of the sighting that are difficult to measure or observe in other ways.

CHAPTER 3. RESULTS: HYDROGRAPHY AND WEATHER

3.1 CTD and rapid CTD

The physical and chemical properties of the water column were measured to a maximum depth of 2 000 m using SEABIRD conductivity- temperature-depth probe (CTD) and General Oceanic rosette sampler. 43 CTD stations in total were carried out.

3.1.1 Cross shelf vertical profiles of hydrography, oxygen and fluorescence

Cross shelf CTD profiles were made for all transects (7 horizontal transects, 2 diagonal transects). Stations were taken at predefined depths to a maximum of 2 500 m. Figure 6 shows the vertical distributions of temperature, salinity, oxygen, and fluorescence along the hydrographic transects to 600 m depth. The vertical profiles of hydrography, oxygen and fluorescence is best represented by Transect-T1 and -T7. T1 it is almost perpendicular to the isobaths and close to Myanmar. It can represent the connecting water masses between Andaman Sea and Myanmar. Also Transect-T7, it is located close to Sumatra Strait, so it will help to characterize the circular pattern from the southward.

3.1.2 Transect 1

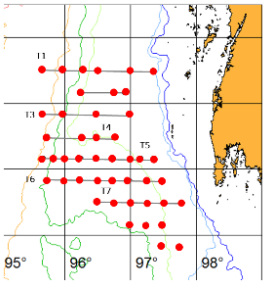
Figure 6 shows the position of the hydrographic transects and CTD stations (upper right), the cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T1 to 600 m depth. Surface temperatures along this transect were high, typically about 29 °C above the thermocline. The thermocline was around 150 m depth in the east and deepening slightly towards the west to around 200 m depth. The surface water was relatively stable with little variations between transects at 100 m depth, the temperatures were typically still >10°C. Temperatures decreased gradually to around 9°C at 500 m depth and ~ 4.8°C at 2 000 (CTD max depth).

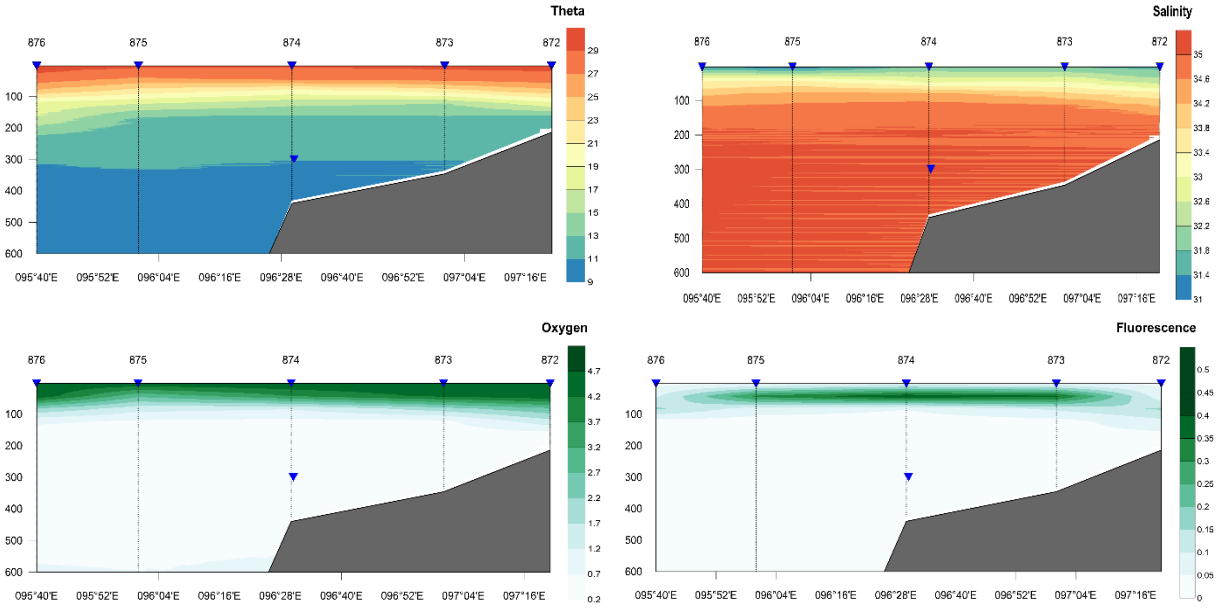
The profiles generally showed low salinity above the thermocline with values increasing from east towards the west. Intermediate salinities were found just above the thermocline while highest salinity waters (around 35.0) was found below the thermocline to 1 000 m depth. Below 1 000 m depth, salinity slightly decreasing to ~34.8 at 2 000 m.

Oxygen concentrations were high in the surface layers (typically ~ 4-5 ml/l), decreasing with depth. Water masses are hypoxia (>0-2 ml/l) between 100–400 m depth before the oxygen increases slightly to 1.8 ml/l at 2 000 m depth (sta 876).

Fluorescence increased with depth to the maximum level about 50 m depth. Below the thermocline there were typically no fluorescence maximum.

Figure 6. Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T1 to 600 m depth





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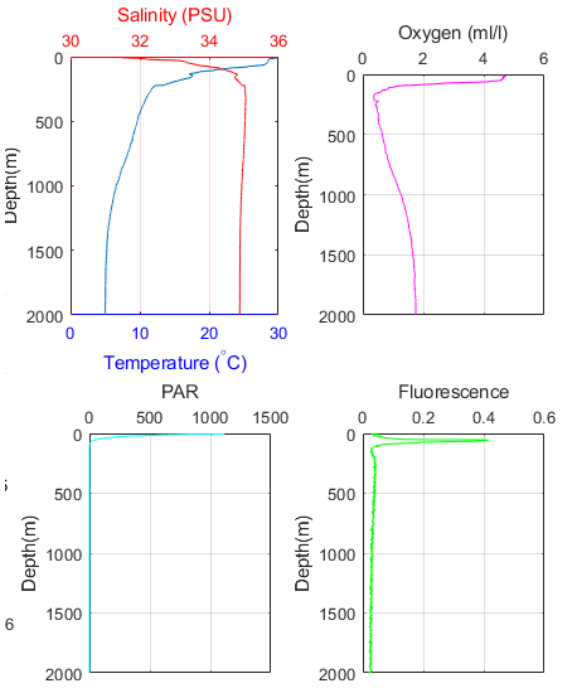

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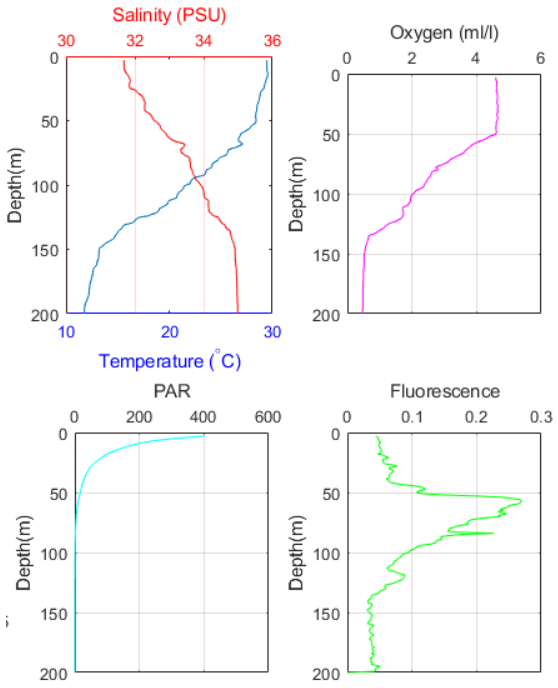


3.1.3 Water masses

Water masses characteristics are shown in the TS-diagram in Figure 7. It can be divided into three water masses: near-surface layer, sub-surface layer, and Intermediate Water Layer.

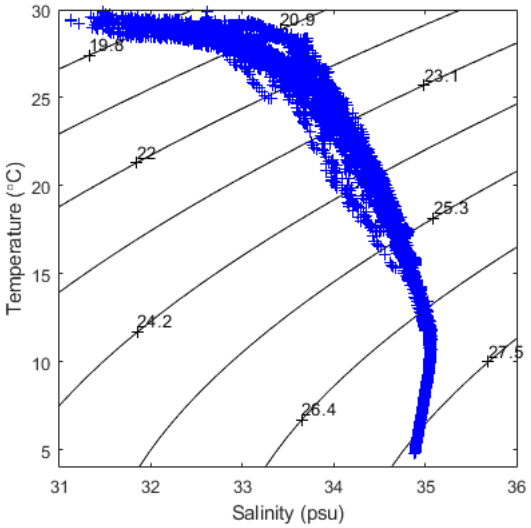


Figure 7. TS diagram for all stations. Curves show density anomaly in kilograms per cubic meter

3.1.4 Near-surface layer

The high temperature (around 29 °C) and low salinity (around 31–32) on the surface were observed. These low salinities derive from three main rivers including of Irrawaddy River and Salween River in Myanmar and Ganges river (northern Andaman Sea water). Those form the less dense water stratification in the surface layer of this area.

3.1.5 Subsurface Layer

Subsurface layer and thermocline represent the Australian Mediterranean Water Mass (AAMW) characteristic. AAMW is a tropical water mass derived from Pacific Ocean Central Water and formed during transit through the Australasian Mediterranean Sea. It enters the Indian Ocean between Timor and the Northwest Shelf and through the various route between the islands east of Bali.

3.1.6 Intermediate Water Layer

CTD stations 875, 876, 882, 883, 884, 898 and 899 made to more than 1 000 m depth (maximum 2 500 m), show traces of the Antarctic Intermediate Water (AAIW) salinity minimum (also seen in Figure 7). In fact, the AAIW in Indian Ocean is similar properties in the other oceans. However, the temperature and salinity of these waters increase when accessing the subtropical gyres (3–4°C in Temperature and 34.94 in salinity).

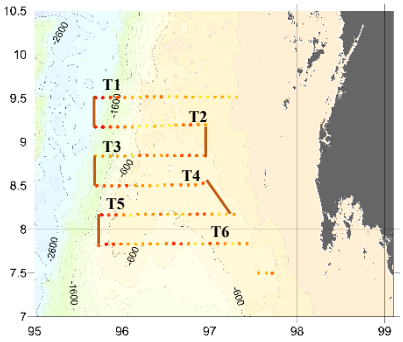
3.2 Water samples and chemistry

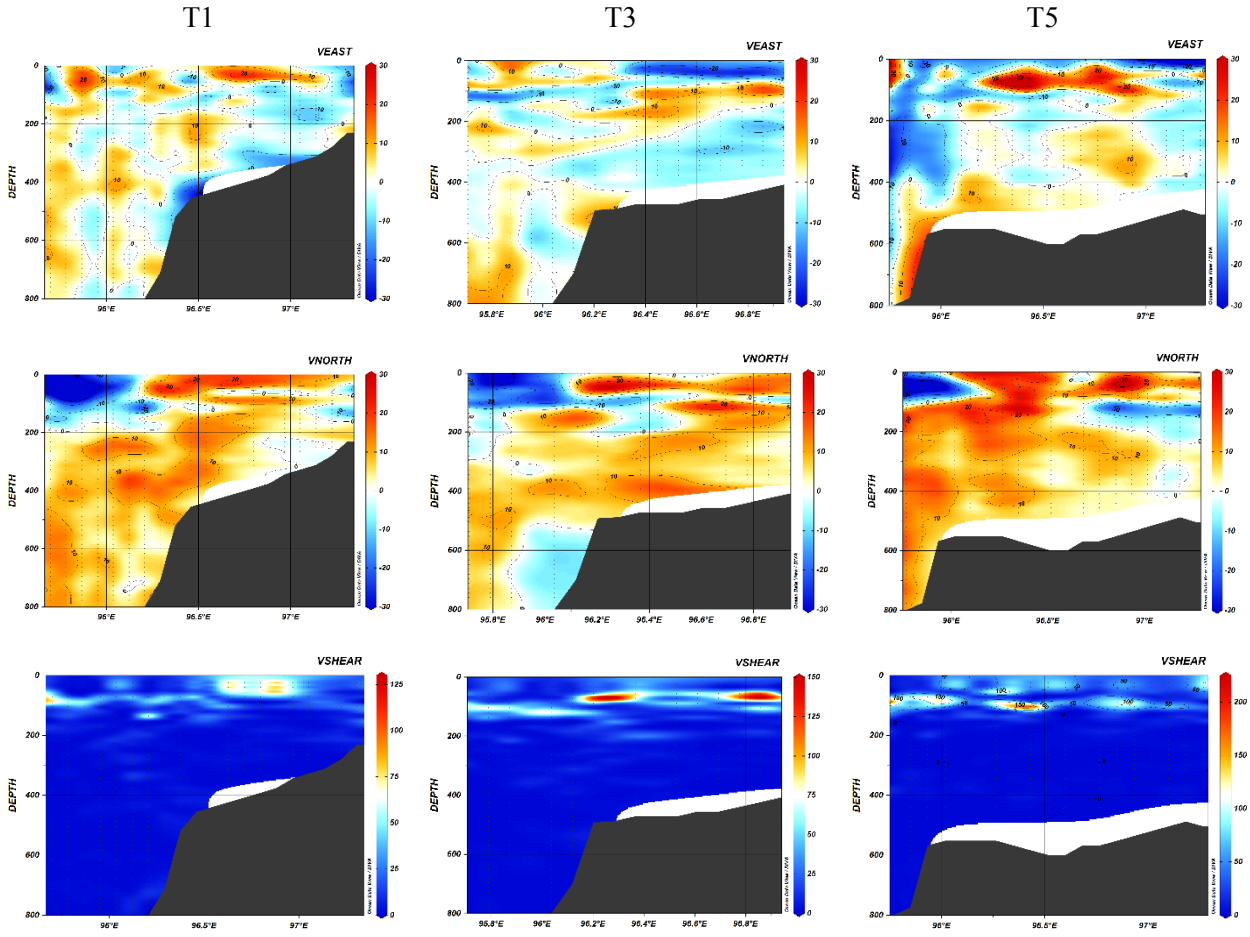
Water samples will be analysed and/or results validated after the survey and resulting datasets published separately.

3.3 ADCP

ADCP run along the ship track with two frequency – 75 and 150 KHz. All data were divided into 7 sections as shown in Figure 8.

Figure 8. ADCP 75 KHz data of section T1, T3, T5 shown in eastward current, northward current and vertical shear





The observations showed distinctive current profile between above and below the thermocline due to stable stratified layer. Above the thermocline, the inshore currents moved northwards. The offshore currents, on the other hand, moved in southward direction. Therefore, this pattern may result into a cyclonic gyre in this area.

3.3.1 Horizontal Distribution of currents

As seen in the Figure 9, the currents move northward with about 10–30 cm/s around nearshore and move southward with higher velocity (20–50 cm/s) further offshore at 20 m depth. What appears to be part of a similar oscillation was evident at 50 m (above thermocline). For below thermocline layer (150–300 m depth), the current patterns were different from the above layers. At 150 m depth, the currents had a larger variance due to strong stratification in this layer. In the deeper layer, the currents moved northwards with lower speed, less than 30 cm/s.

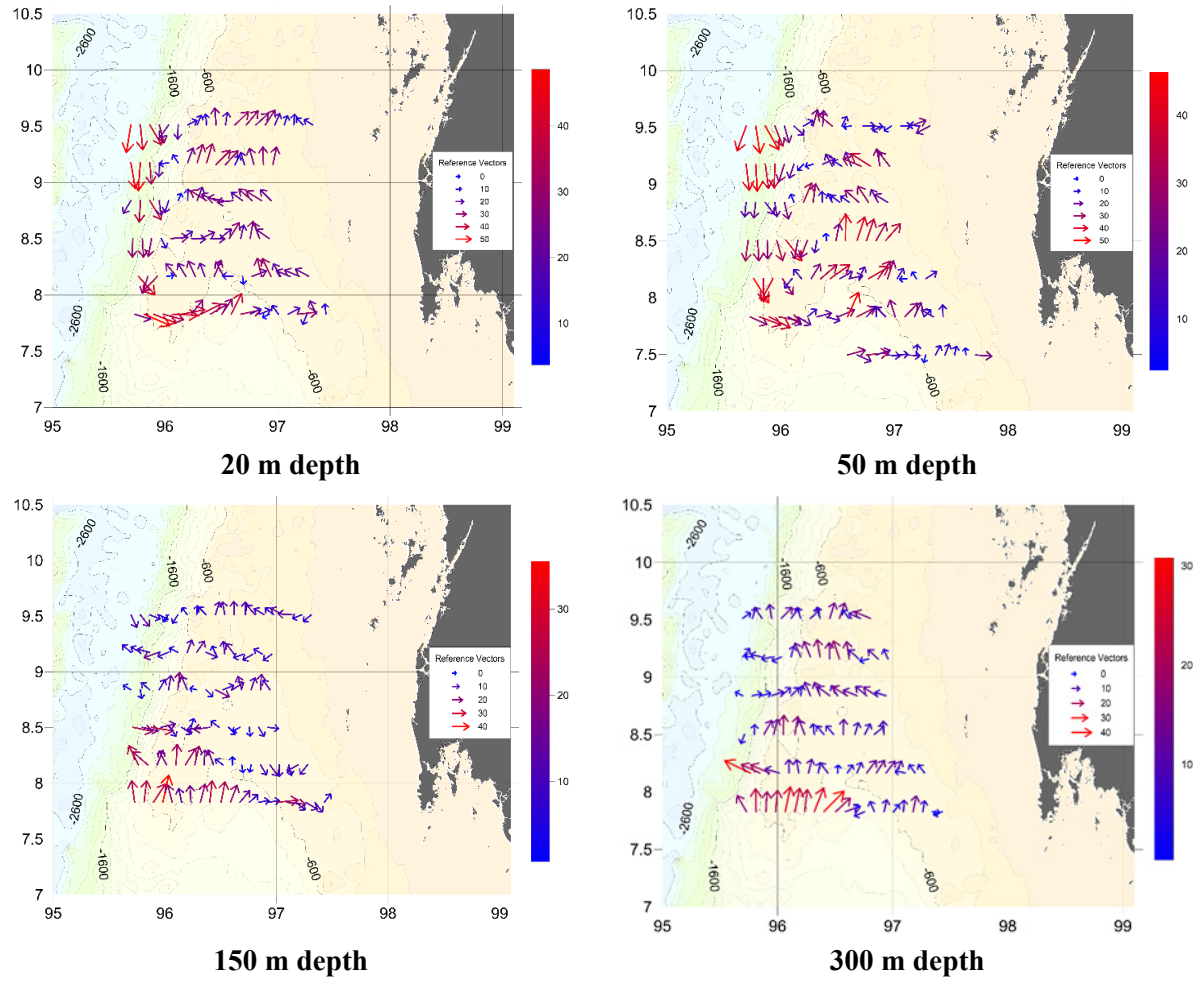


Figure 9. Horizontal distribution of the acoustic Doppler current profile (75 KHz) at four different layers (20, 50, 150 and 300 m depth)

3.4 Thermosalinograph

Derived from data from the Thermosalinograph are shown in Figure 10. The horizontal distribution of water temperature during the survey ranged roughly between 29 to 31 °C. The higher water temperature zones can be found in the shallow regions and in the offshore area in a north-west direction. Recorded salinity values range between 30 to 33.4 PSU. Lower salinity values can be found along the shallower regions and the lowest salinity zone was observed in the area northwest of Phuket at the beginning of the survey. Using the salinity and water temperature, water density in terms of Sigma-T were calculated. Sigma-T ranges

from between 18 to 20.6 kg/m3. Distribution of water density and salinity mimic well showing that the salinity governed water density during this survey. Low salinity distributed near the shallow region can be attributed to the low salinity water from the rivers surrounding the Andaman Sea.

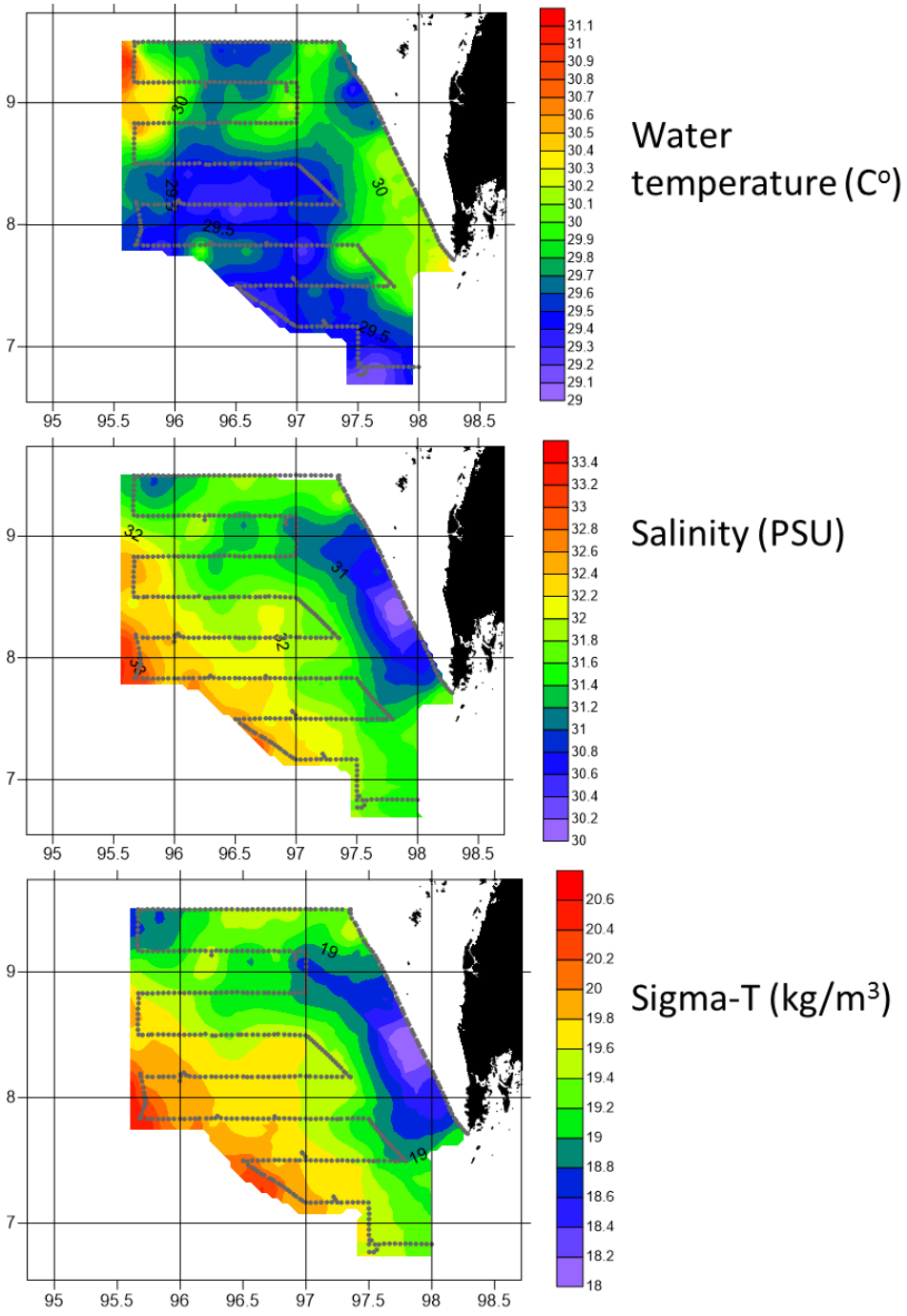


Figure 10. Near-surface distribution of water temperature, salinity and calculated seawater density (in terms of Sigma-T) recorded by the thermosalinograph

Figure 11 shows the horizontal distribution of the measured fluorescence and turbidity. The fluorescence values range between 0.09 and 0.15 RFU and the turbidity values range between 0.1 and 0.4 NTU. The distribution shows that there are two major groups of values, i.e., the

area of high fluorescence and low turbidity in the north and the area of low fluorescence and high turbidity in the south. The two zones were separated at the latitude of 8-8.5 degree. High turbidity and fluorescence values in the southern part of the survey area might be attributed to sediment stirred up from strong currents (Figure 12) in the Malacca Strait. Nutrient supplied from the suspended sediment is likely to support higher productivity in the area.

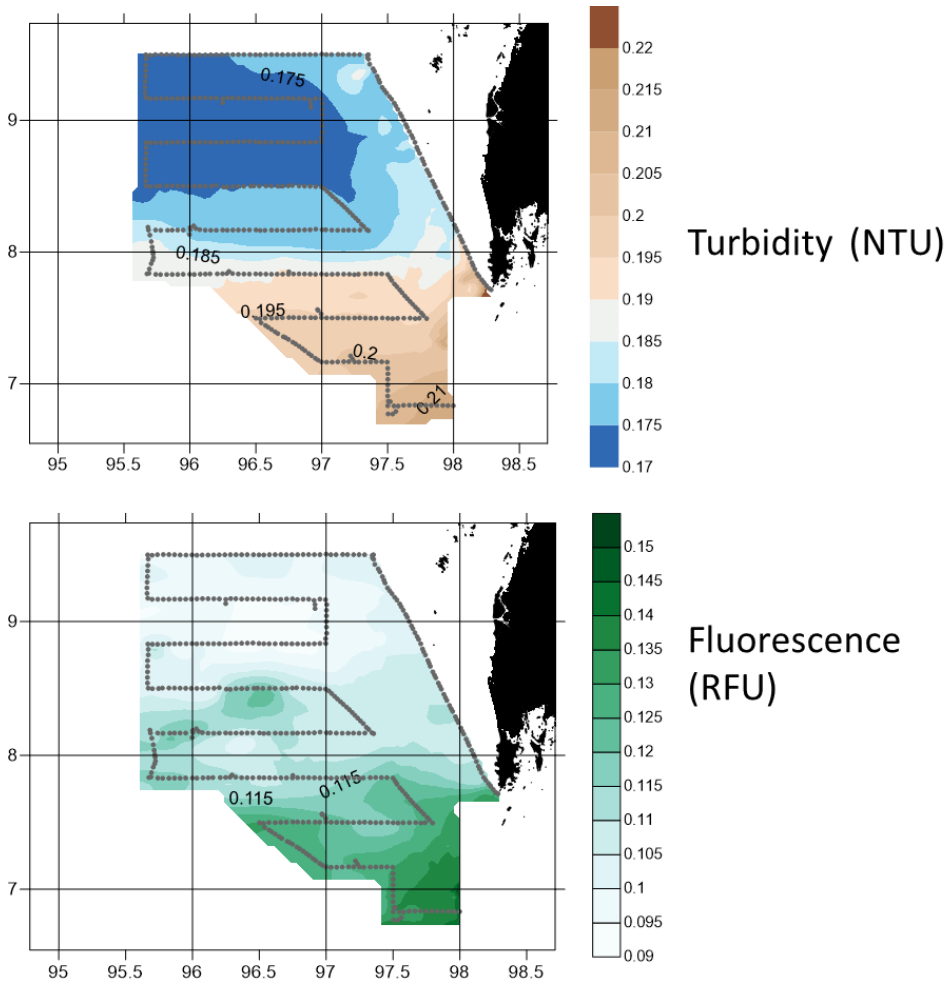


Figure 11. Near-surface distribution of turbidity and fluorescence recorded by the thermosalinograph

CHAPTER 4. RESULTS: PLANKTON

4.1 Phytoplankton

Phytoplankton samples for taxonomic analysis were collected from all 30 superstations of Leg 3.5, in total 60 samples. Taxonomic identification of phytoplankton samples will be done after the survey under the responsibility of the Southern Andaman Sea Fisheries Research and Development Center (Satun), Department of Fisheries of Thailand.

4.2 Mezozooplankton

Mesozooplankton samples were collected from all 30 superstations of Leg 3.5, in total 60 samples. 30 samples were preserved whole for taxonomic identification, and 30 samples were halved for the estimation of size-fractioned zooplankton biomass. Biomass measurements of in total 90 aluminum trays produced will be completed at the IMR laboratory facilities. The preserved WP2 samples will be managed by the Marine Fisheries Research and Development Bureau, Department of Fisheries, for further distribution and analysis.

4.3 Ichthyoplankton

During the Leg 3.5, fish egg and larvae were sorted out from 29 Multinet and 25 manta trawl samples. A total of 1 497 fish larvae were sorted out; 902 larvae from Multinet and 595 larvae from Manta trawl. Egg presence in the plankton samples collected by both multinet and manta trawl were only limited. A total of 44 fish eggs were sorted out; 8 eggs from Multinet and 36 eggs from manta trawl.

The sorted fish egg and larvae from the manta trawl will be sent to IMR for further analysis. From the multinet, the preserved samples (half the sample in ethanol and other half in formaldehyde) and the sorted fish egg and larvae will be managed by Nirucha Udomwongyont for further distribution and analysis.

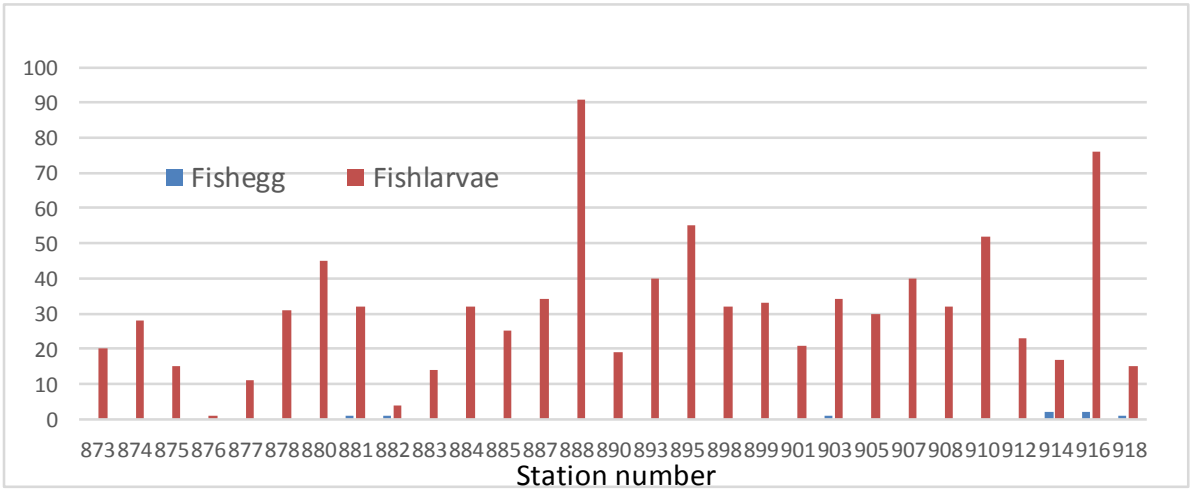


Figure 12. Fish-egg and -larvae sorted out from multinet at superstations

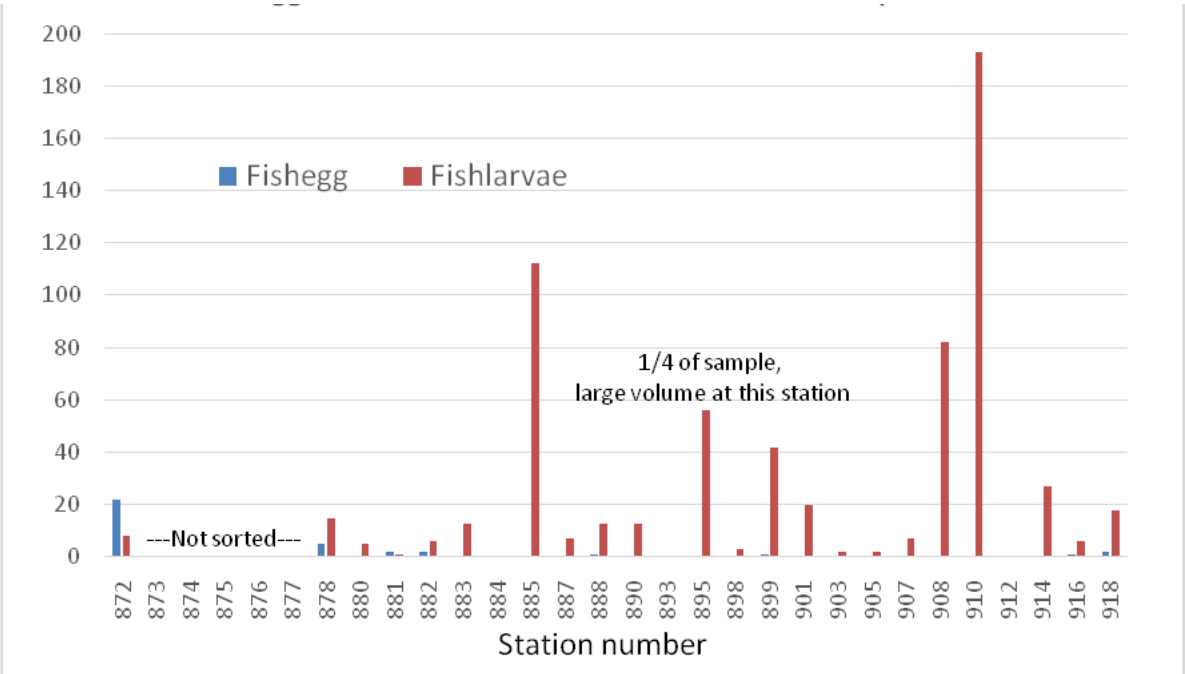


Figure 13. Fish-egg and -larvae sorted out from manta trawl at superstations

4.4 Microplastics and debris

Microplastics were found in 23 out of the 30 manta trawls of Leg 3.5. A total of 226 microplastic particles were sorted out. The microplastic samples will be sent to IMR for further analysis.

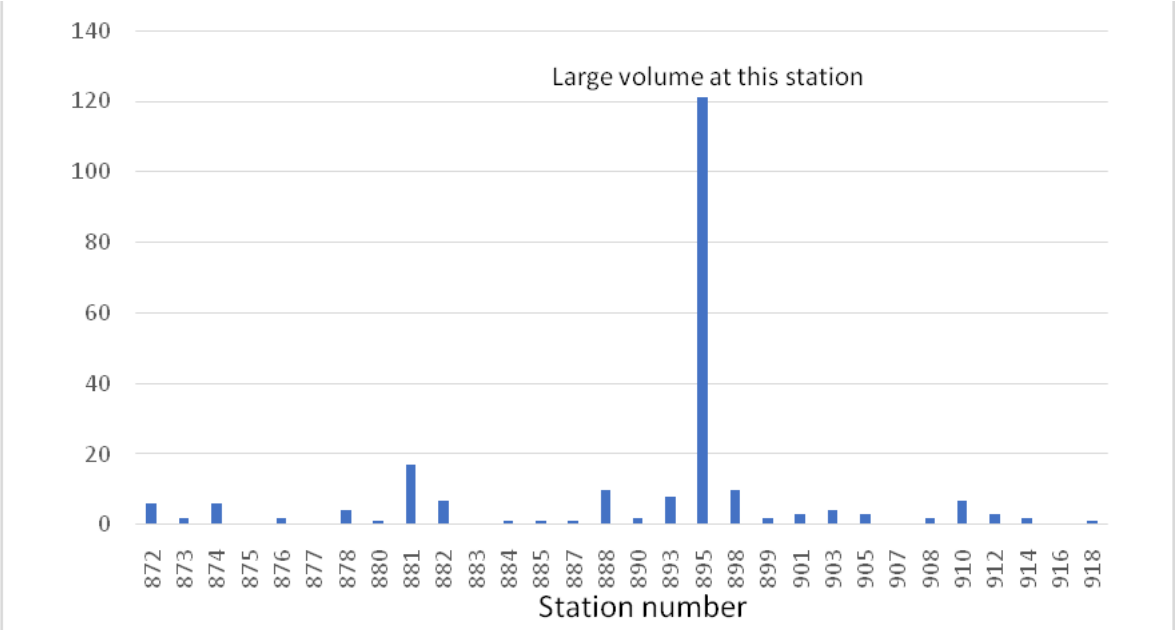


Figure 14. Microplastic sorted from manta trawl at superstations

4.5 Water pumps

A total of 90 samples were collected from the water pumps during Leg 3.5, i.e. 45 samples from the small water pump and 45 samples from the big water pump – CUVES. The position of the ship at the time of sampling was recorded. All the water pump samples will be managed by Nirucha Udomwongyont for further distribution and analysis.

CHAPTER 5. RESULTS: SEDIMENT PIPE

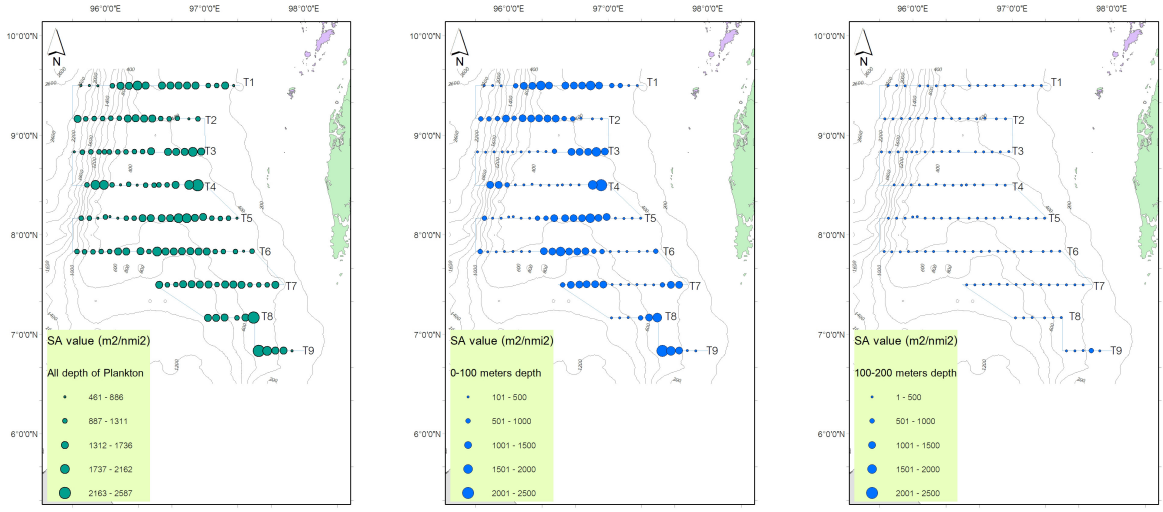
33 samples of sediments were collected from 17 demersal trawl stations. The sediments will be analysed for macro and meiofauna by the participating institutions in Thailand.

CHAPTER 6. RESULTS: ACOUSTIC ABUNDANCE AND DISTRIBUTION

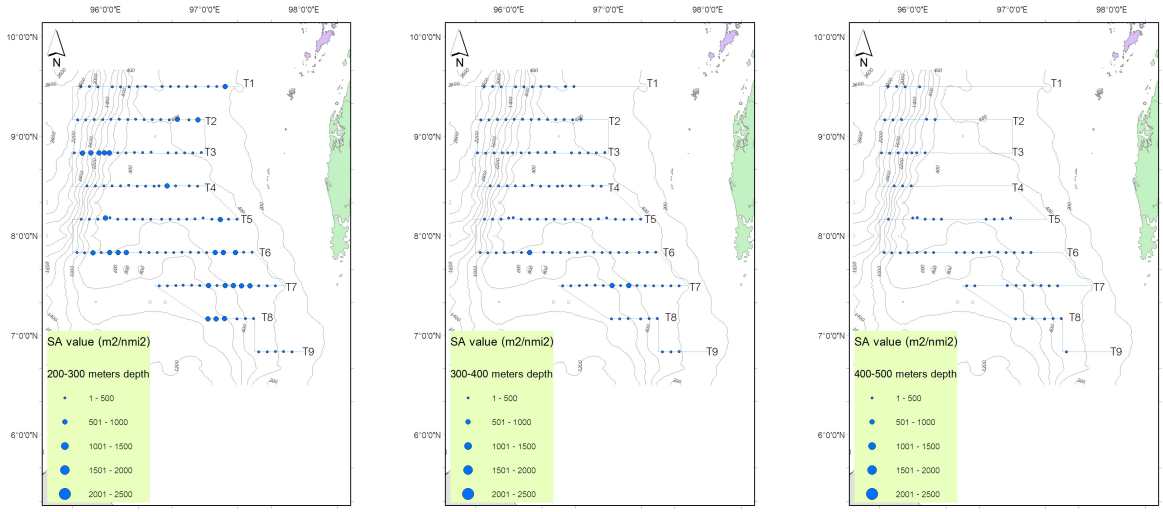
During the survey, hardly any echo energy could be associated to the presence of fish. Most of the reflected echo was identified as plankton and some as mesopelagic fish, mostly Myctophidae, and it was difficult to separate these groups. Allocation of eco energy (s_A) to either group was however attempted.

Depth stratified distribution of SA values along the cruise track is presented in Figures 15 and 16 for plankton and mesopelagic fish, respectively.

Mesopelagics represented a minor percentage of total SA values reflecting low abundance in this area.

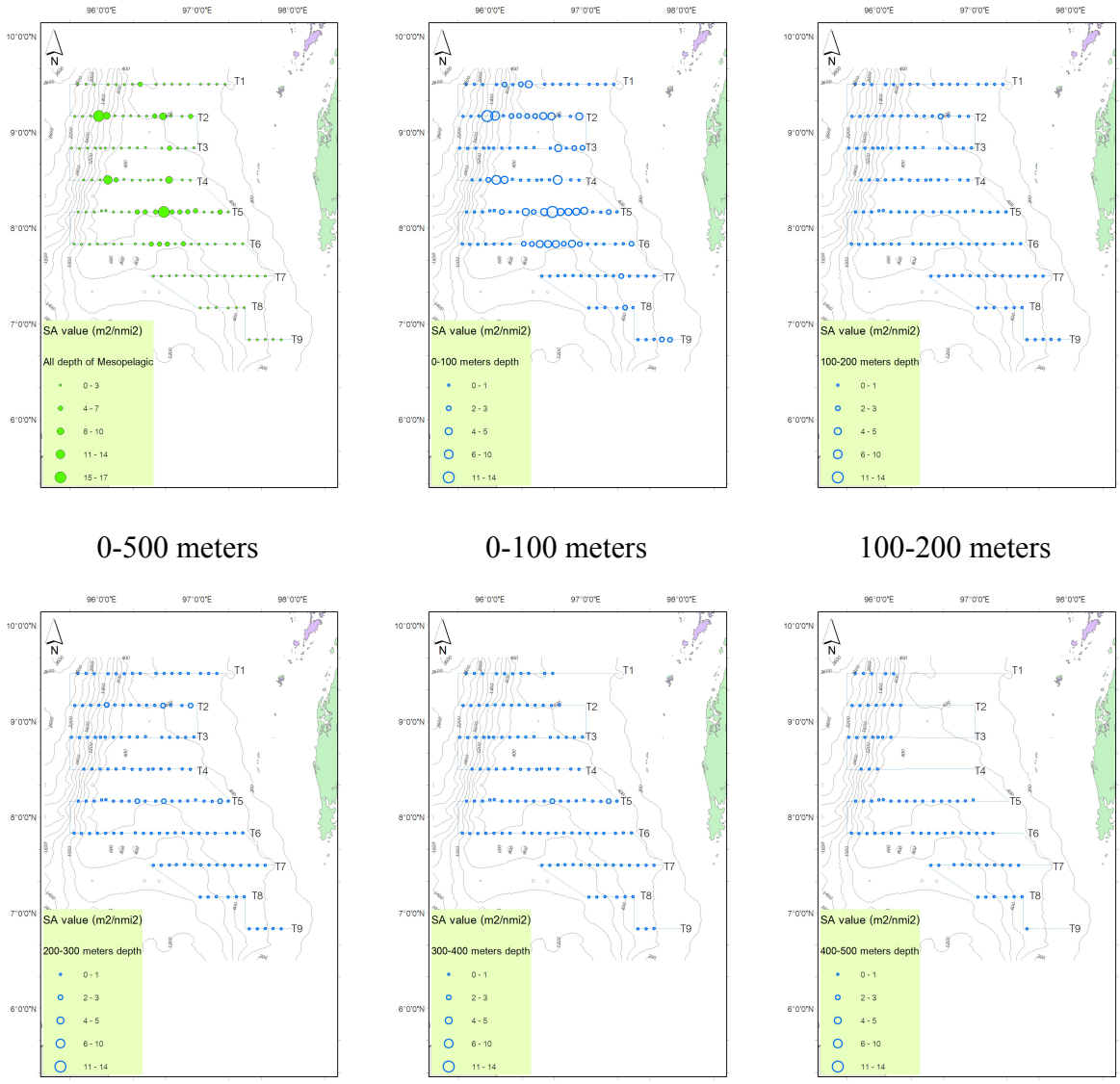


0-500 meters 0-100 meters 100-200 meters



200-300 meters 300-400 meters 400-500 meters

Figure 15. S_A value distribution of plankton in the survey area



0-500 meters | 0-100 meters | 100-200 meters

200-300 meters | 300-400 meters | 400-500 meters

Figure 16. S_A value distribution of mesopelagics in the survey area

CHAPTER 7. RESULTS: SWEPT AREA/SWEPT VOLUME ABUNDANCE AND DISTRIBUTION

7.1 Biological parameters

Length measurement data from a range of species were collected at 29 stations. The length frequencies are shown for the most frequently measured species in Annex XI, as well as the length-weight relationship for the most common shark (*Bythaelurus cf. hispidus*).

7.2 Abundance and distribution based on trawl

A total of 53 trawl hauls were completed, of these 19 were performed with the bottom trawl while the remaining 34 were done with the MultPelt (pelagic trawl). Catch rates were generally low, with average per hour rates (CPUE) of 126.754 ±77.36 kg/hr for bottom trawls and 51.275±27.18 kg/hr for pelagic trawls.

Myctophidae comprised the largest group caught, being recorded at 46 stations (86.79%) with a total of 414.78 kg across all trawls. When standardized to catch rate per hour, the average was 9.43 kg. It was more frequently caught in the pelagic trawl (41.25% of the catches) than in the bottom trawl (21.64%).

Cubiceps sp, a teleost in the Nomeidae family, was the second most abundant fish caught in the pelagic trawls (8.89%).

Within the group 'shrimps' the most abundant family was Aristeidae (10.68% of all bottom trawls). In station 31, the catch was particularly large (151.37 kg/h) and high abundance of this family was recorded at other stations with catches between 14.26 and 16.91 kg/h. At station 53 there was a big catch of shrimps belonging to the Pandalidae family, the catch per hour rate was of 34.55 kg/h.

Squids were caught in all stations but one. The most often caught families were Histioteuthidae (54.71% of trawls) and Enoploteuthidae (49.06% of all trawls), however they were not the most numerous families. Ommastrephidae were caught at 37.74% of all trawls and were the most abundant both in numbers and weight with catches up to 26.81 kg/h (1 737 individuals).

Sharks were relatively abundant, caught in all bottom trawls except one. The most abundant species was the bristly catshark (*Bythaelurus cf. hispidus)* with several catches of around 12.00 kg/h, followed by the gulper shark (*Centrophorus granulosus*) caught in two stations with catches of 43.13 and 71.46 kg/h. We found *B. cf. hispidus* to be sex segregated with almost exclusively mature females in deeper waters. In one of the shallowest stations we observed what was most probably a nursery area where juveniles of small size were congregated.

Overall composition of trawl catches are shown in Figure 17.

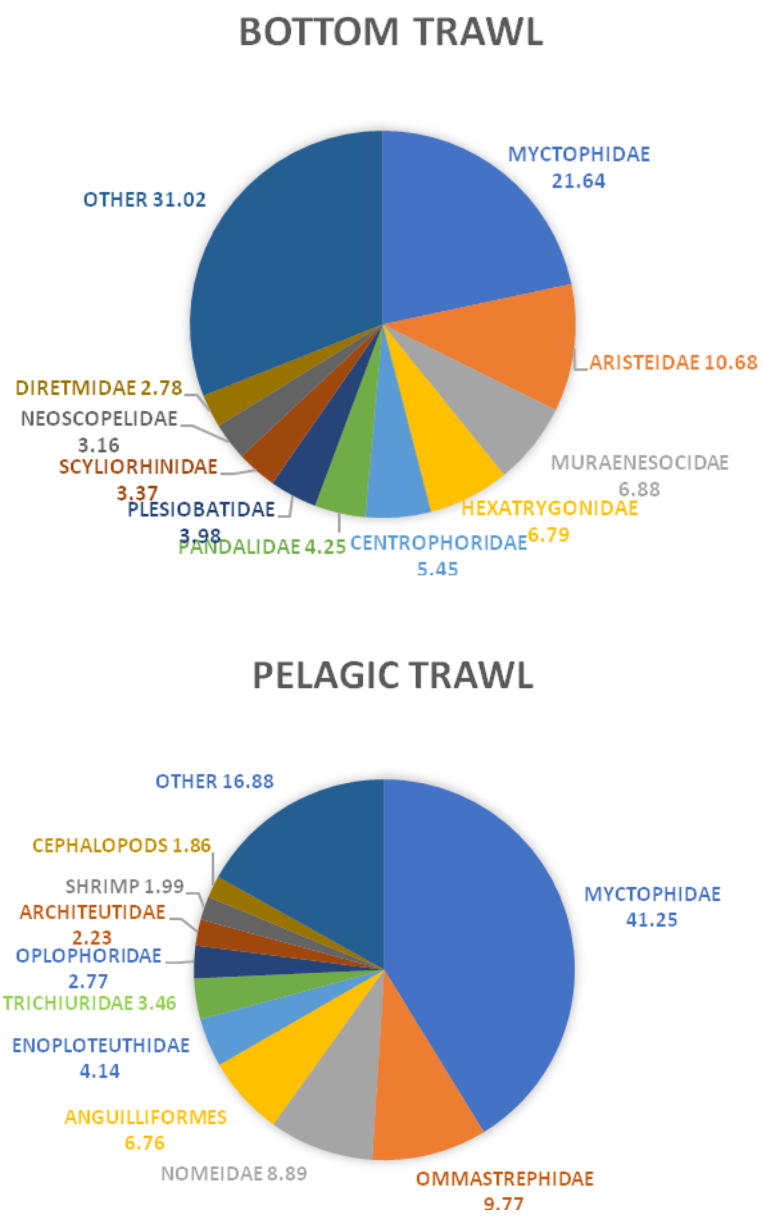


Figure 17. Species composition of main species groups by trawl type, in percentage of total catch.

Demersal juvenile fish were regularly caught in the pelagic trawl with one station in the northernmost part of the survey area containing exclusively juvenile individuals. It is also worth mention that the eel larva (*Leptocephalus*) were caught in almost all stations, often in large quantities.

7.3 Taxonomy and genetics

A total of 133 families were identified during the survey. These are presented in Table 3 where they have been grouped in 7 higher taxa. In almost all the stations eel larva (*Leptocephalus*) were caught but are not included in any of the mentioned groups.

As no taxonomic expert participated in this survey, we were not able to determine all the specimens caught to species level (see Table 3, for details). We can therefore not make any

conclusion regarding the area's true biodiversity, nor are we able to suggest the likelihood of new species records, whether to the area or to science. However, a total of 266 samples were collected and preserved for identification, and in addition a large photographic catalogue was made of the specimens caught. These .will be handed over to taxonomic experts for identification confirmation

Table 3. Number of families, genera and species for the different groups caught in the trawls. The group of other invertebrates includes jellyfish, lobsters, crabs, krill and gastropods.

Groups	Families	Genera	Species
Teleost	91	139	52
Squids	20	9	13
Shrimps	10	13	12
Chimaeras	1	2	1
Sharks	6	7	5
Rays	5	6	4
Other invetebrates	10	6	3

7.4 Biomass

The total swept area biomass was 55 193 tonnes, with mesopelagic fish (see Annex II for families included) being the group with the highest biomass (18 691 tonnes). Due to difficulties in separating all myctophids from other mesopelagic fish, this family has been included in the mesopelagic group. Consequently, we don't present biomass calculations separately for this family despite it being the most abundant. The biomass was also relatively high for the group of other teleosts and shrimps with 13 074 and 9 601 tonnes respectively. The biomass estimates for the various groups is presented in Annex XIII. Note that due to the nature of this survey these estimates must be considered indices (or relative). It is not a true reflection of the absolute biomass of all species in the survey area.

The distribution of the groups recorded in the bottom trawl is shown in Figure 18. Based on the analysis done thus far, we are not able to report any distinct trend in distribution for any of the groups.

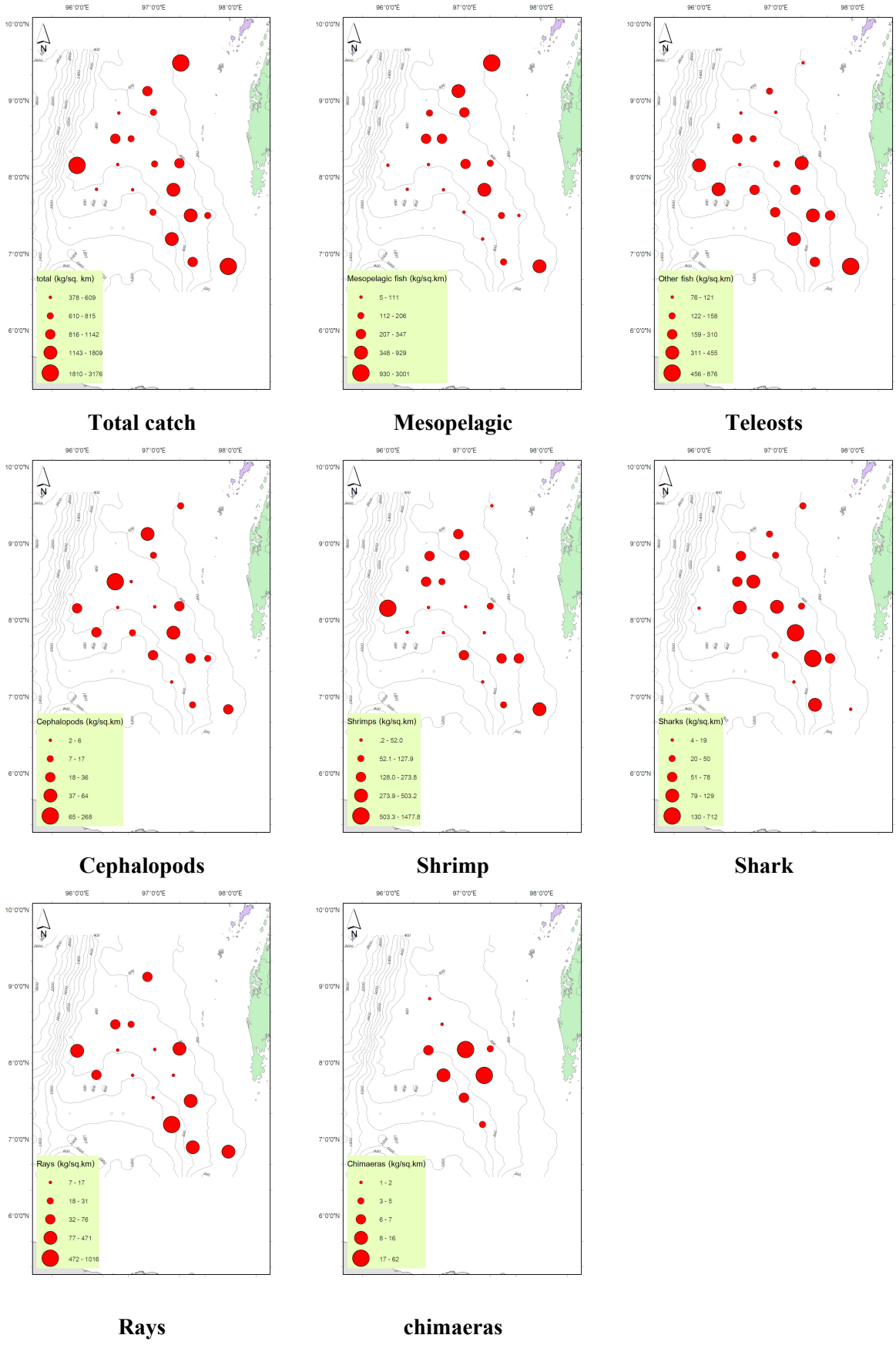


Figure 18. The distribution of the major taxonomic groups recorded in the bottom trawl

CHAPTER 8. RESULTS: CETACEANS, SEA TURTLES AND SEA BIRDS

8.1 Conditions

Transect observations are limited by light and weather conditions. Such conditions effect the probability of detection along the transects. The following table summarizes the weather conditions during this survey (Table 4 and Figure 19).

Table 4. The weather condition (Beaufort scale) 2-13 October 2018

Day	Date	Time	Weather	Wave	Survey
1	2 October 2018	Morning	1	1	Yes
		Afternoon	1	1	Yes
2	3 October 2018	Morning	1	1	Yes
		Afternoon	1	1	Yes
3	4 October 2018	Morning	5	1	Yes
		Afternoon	1	1	Yes
4	5 October 2018	Morning	5	2	Yes
		Afternoon	3	2	Yes
5	6 October 2018	Morning	1	2	Yes
		Afternoon	3	2	Yes
6	7 October 2018	Morning	3	2	Yes
		Afternoon	3	2	Yes
6	8 October 2018	Morning	5	2	Yes
		Afternoon	3	2	Yes
7	9 October 2018	Morning	1	2	Yes
		Afternoon	1	2	Yes
8	10 October 2018	Morning	1	1	Yes
		Afternoon	1	1	Yes
9	11 October 2018	Morning	1	2	Yes
		Afternoon	1	2	Yes
10	12 October 2018	Morning	1	2	Yes
		Afternoon	5	2	Yes
11	13 October 2018	Morning	3	2	No
		Afternoon	3	2	No
12	14 October 2018	Morning	3	2	No
		Afternoon	3	2	No
13	15 October 2018	Morning	3	2	No
		Afternoon	3	2	No

8.2 Survey observations and Data Collection.

Figure 19 shows the survey track with the sightings while Figures 21 to 27 show examples of sightings. Figure 21 shows 8 individuals of the spinner dolphin during night time (10.46 pm) on 13 October 2018. Spinner dolphin is usually characterized by rapid breathing while seeking food. Observations were made for 5 minutes and results suggested that the dolphins breathed every 7–9 seconds. This breathing rate can usually be observed during hunting activity. Figure 22 shows dolphins hunting squids, as it could be deducted by the presence of ink. Dolphins swim swiftly, and the body parts on the surface is quite small. One hawksbill sea turtle and one green turtle were observed between station 1 and station 2 when sea turtles were breathing at the sea surface. On the last track, an additional green turtle was observed on 13 October 2018 at night time (11.00 pm). The sea turtle was characterized by lethargy, scale erosion, general white spots on scale and external parasites (Figure 22).

In this survey, six seabirds were observed, i.e., one alcedine, one kestrel, twelve water birds, two swifts, three gulls and a group of nineteen egrets. Most of the birds observed were white in colour (Figure 23 and 24). The Andaman Sea is characterized by small islands with rocks, cliffs and caves at the sea. This environment is suitable for many sea birds such as seagulls. Table 6 shows the distance from the vessel to the shore for the different sightings.

It should be noted that this survey only covers daytime and the weather on some days has also limited the observations.

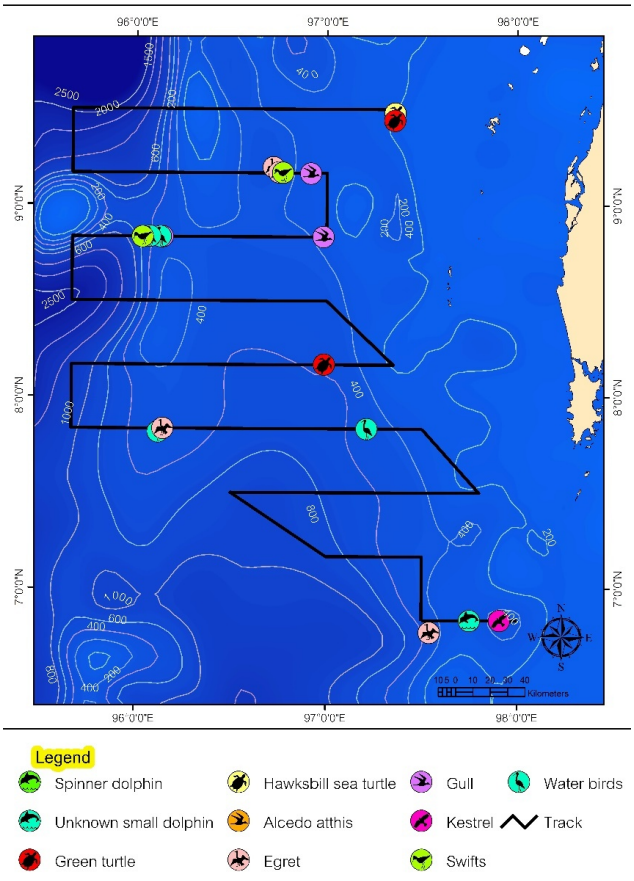


Figure 19. Survey tracks and sightings

Table 5. Count of cetaceans, sea turtles and sea birds during the survey

Date	Cetacean		Sea turtle			Sea birds					
	Spinner dolphin	Unknown small dolphin	Hawksbill sea turtle	Green turtle	Alcedines	Egret	Gull	Kestrel	Swifts	Water birds	Sum
2/10/2018			1	1							2
4/10/2018						13	1		1		15
5/10/2018							2		1	3	6
8/10/2018				1							1
9/10/2018						3				1	4
10/10/2018										8	8
13/10/2018[2]	8	2		1	1	3		1			16
Sum	8	2	1	3	1	19	3	1	2	12	52

Table 6. The distance from the shore at the spot of Sea birds

Group of sea animals	**Distance (km)**
Spinner dolphin	255.62
Unknown small dolphin	226.06
Hawksbill sea turtle	118.02
Green turtle	249.22
Alcedines	255.62
Egret	236.33
Gull	233.83
Kestrel	204.36
Swifts	250.78
Water birds	118.62

[2]Marine mammals at 13 October 2018 sighted at night time

Figure 20. Spinner Dolphin came beside the vessel on 13 October 2018 at night time (10.46 pm)

Figure 21. Dolphin hunting squids which is observed by the ink (13 October 2018 at night time 10.46 pm)

Figure 22. Sea turtle was found lethargy, scale erosion, general white spots on scale and external parasite (13 October 2018 at night time 11.00 pm)

Figure 23. Sea birds “Egret group” while flying, the head and neck are attached to the body. Stretch back legs

Figure 24. Sea birds “Alcedines group”

CHAPTER 9. ADDITIONAL EXPERIMENTS

9.1 Trawl performance (Multpelt)

9.1.1 Equipment and methods

The large pelagic trawl Multpelt 624 m is the main equipment for catching fish, squid and larger plankton in the pelagic zone. The stability of the overall performance of this trawl is the basis for assumptions used when estimating swept volume estimates in this survey. The construction of a sampling trawl is a compromise between several required properties related to these assumptions. The trawl operations are closely monitored during operation using sensors describing the geometry and performance close to the opening of the trawl. Far less is known about the performance closer to the cod-end.

The transition areas where mesh size is changed is of particular interest (reduced mesh size in steps towards the end of the trawl) and if the change in mesh size and size of panels has an influence on overall geometry, geometry of the meshes (the degree of stretching) and if this is likely to influence the catching efficiency of small fish and large plankton which of course defines the selectivity of the trawl.

The equipment used in this experiment (in addition to the standard Multpelt trawl with sensors) included two cameras that can be operated as deep as 300 meters in combination with light sources. These cameras were used to trace the overall geometry towards the cod-end and the resulting videos area a part of the data reported from this survey.

Video camera	GoPro Hero3+	HD 1080, 50 fps
Underwater housing	iqSub	Depth range 300 meters
Light source	Brinyte Divo1V	Depth range 200 meters

The experiment to verify trawl performance consisted of two hauls. Both to 120 meters and keeping that depth for 5 minutes before starting the slow retrieving corresponding to the standard hauls used in this survey. Closed cod-end was used in both hauls since an open end would have influenced the overall drag and most likely the performance.

The camera positions are shown in Figures 25 and 26. Please note that camera 2 in haul 2 was mounted on the outside of the trawl pointed forwards towards the “kite”.

9.1.2 Results

The resulting videos has not been edited and consists of files containing 10-minute-long sequences throughout the experiment. A snapshot is shown in Figure 27. The cameras and light sources operated as intended resulting in high resolution videos with very good quality for our purpose. There was no indication of reduced trawl performance detected in any of the videos. The camera monitoring the “kite” showed a stable performance thus confirming that the instrumentation and sensors mounted on the kite was not in any way influenced by the potential issues related to the use of “a kite”.

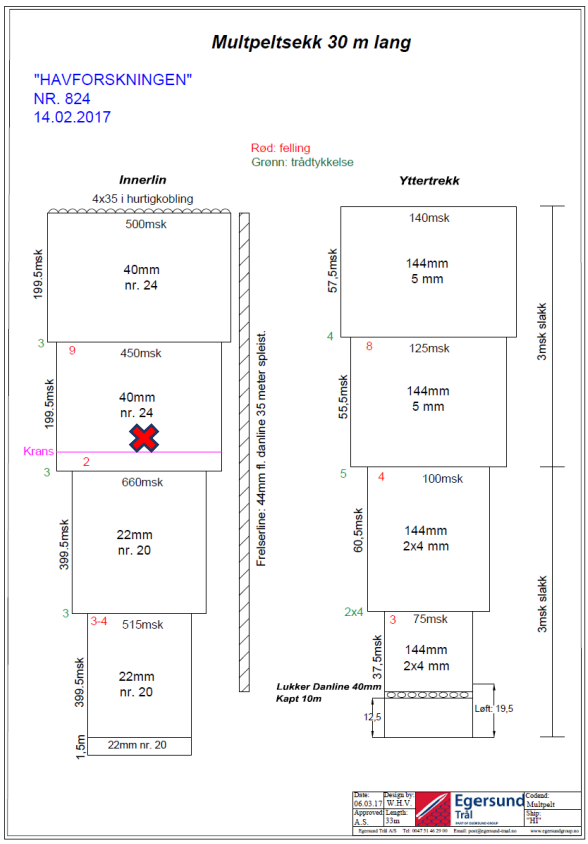


Figure 25. Position of video cameras. Camera 1 in haul 1

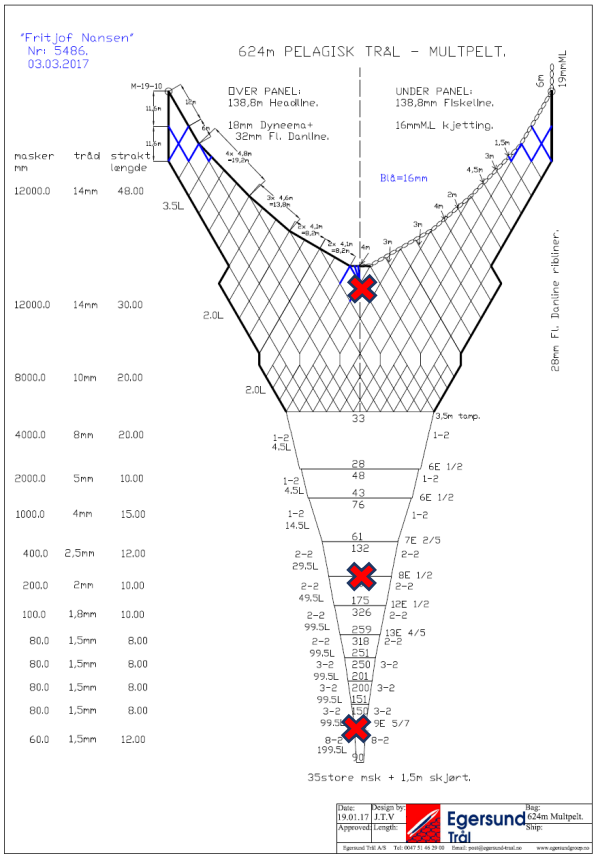


Figure 26. Position of video cameras. Camera 2 in haul 1 shown as the lower X with camera 1 in haul 2 as the middle X and camera 2 in haul 2 as the upper X monitoring the "kite".

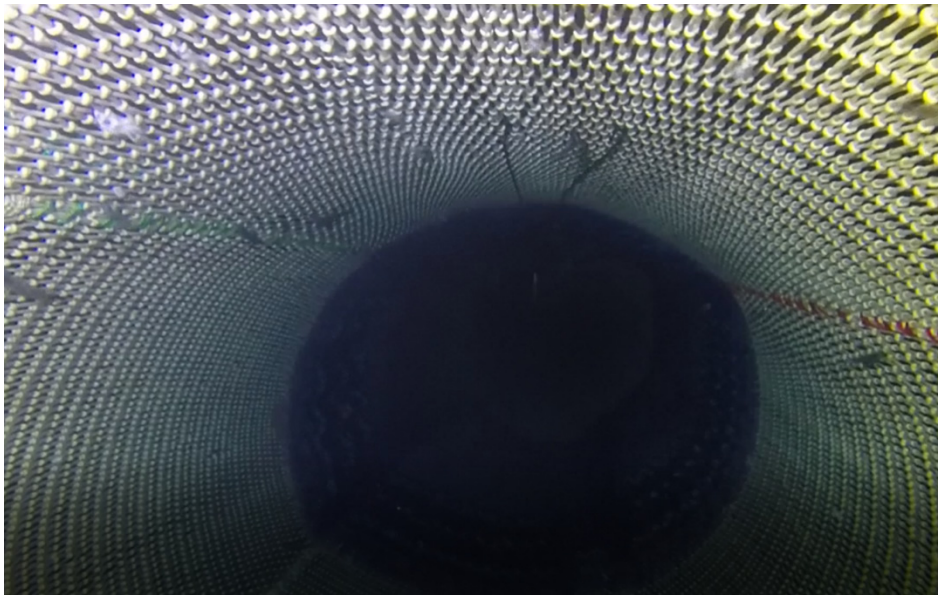


Figure 27. Example snapshot from one of the videos. Camera is pointing towards a distant cod-end.

9.2 Diurnal variation of plankton

9.2.1 Equipment and methods

The observed diurnal variation (and the internal waves in the Andaman Sea) are a fundamental property of this ecosystem. The survey used single bag multinet towed from 200 m depth. This is a valid sample regarding abundance and species composition conditional of choice of depth.

The diurnal pattern shows vertical variation that stretches well below 200 meters (down to 500–550 meters). A 24-hour station using a 5 bag-end approach was started at October 13. At 19:30 local time corresponding to 12:30 UTC. All six stations started with a CTD cast with water samples taken at specific depths. The design of the experiment is given in the following table.Diurnal variation: **Experimental design** Start position: Tow direction: Tow speed as a resultant of vessel speed and retrieving: CTD depth:	6°46.1' N 97°32.6 E 270°1.5 m/s 500 meters

Depth range night stations (19:30, 23:30, 03:30)	Water samples: 2 bottles at each depth	Depth range day stations (07:30, 11:30, 15:30)	Water samples: 2 bottles at each depth
200–100 m	175 m	500–350 m	
100–75 m	90 m	350–200 m	
75–50 m	60 m	200–150 m	175 m
50–25 m	40 m	150–50 m	100 m
25–0 m	15 m	50–0 m	25 m

There was no multinet station during dawn and sunset since those (short) periods represents vertical movements which cannot be mapped using equipment that can only observe at a single depth at the time. The use of echo sounder at several frequencies reveals the vertical patterns in time while the multinet samples will contribute the compositional data linking species/species groups to such change. The acoustic information with support of CTD information will give insight in the prevailing conditions relative to the "internal waves" so distinct for the Andaman Sea.

The Hydrobios Midi Multinet (0.25 m^2 opening) is fitted with one net of 405 μm mesh size. Each depth range sample (5 per station) was handled in the exact same way as multinet samples during the regular part of the main survey. All samples were examined under the stereo-microscope on board, and fish eggs and larvae were sorted, counted and representative photos were taken under the microscope for each fish egg and larvae, before they were preserved in 96% ethanol in eppendorf vials. After sorting out fish eggs and larvae, the sample was divided in two parts by use of a Motoda plankton splitter. One half of the sample was sieved on a 180 μm mesh, transferred to a 100 ml plastic bottle and preserved in 96%

ethanol. The other half was preserved in a 100 ml plastic bottle with seawater and a final solution of 4% formaldehyde buffered with borax.

9.2.2 Results

No results will be presented in this report. The analyses of this material will include detailed scrutiny of the collected plankton samples. These results should be compared with available acoustic information (multi frequency), CTD information and analyzes of the water samples taken. The acoustic information will be available as raw data and other approaches than the standard scrutinizing process will be beneficial.

9.3 Recommended follow up work

See Annex XV for scientific work that will be carried out based on the data and samples collected during this survey.

REFERENCES

Chierici, M., Fransson, A. and Anderson, L.G. (1999) Influence of m-cresol purple indicator additions on the pH of seawater samples: correction factors evaluated from a chemical speciation model. Marine Chemistry 65: 281-290.

Clayton, T.D. and Byrne, R.H. (1993) Spectrophotometric seawater pH measurements: total hydrogen ion concentration scale calibration of m-cresol purple and at-sea results. Deep-Sea Research I 40(10): 2115-2129.

Grasshoff, K., Kremling, K. and Ehrhardt, M. (1999) Method of Seawater Analysis (3rd ed.), Wiley-VCH, 6p.

UNESCO (1984), Manual for Monitoring Oil and Dissolved/Dispersed Petroleum Hydrocarbons in MarineWaters and on Beaches. UNEP/IOC/IAEA Manuals and Guides No. 13.

ANNEX I. DESCRIPTION OF ACOUSTIC INSTRUMENTS AND FISHING GEAR

Acoustic instruments

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

Transceiver2 menu (38 kHz)	
Transducer depth	5 8 m
Absorption coeff.	8.3 dB/km
Pulse duration	medium (1,024ms)
Bandwidth	2.43 kHz
Max power	2000 Watt
2way beam angle	20,6dB
gain	26,95 dB
SA correction	0.03 dB
Angle sensitivity	21.9
3 dB beamwidth	6.22º along ship
	6.28 athwart ship
Alongship offset	0.10º
Athwardship offset	0.06º

Bottom detection menuMinimum level 50 Db

Fishing gear

The vessel has one small four-panel Åkrahamn pelagic trawl, one MultPelt 624 trawl (Figure II.1, new in 2017) and one 'Gisund super bottom trawl'. The smallest pelagic trawl has 8 to 12 m vertical opening under normal operation, whereas the MultPelt 624 trawl has 25 to 35 m opening.

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

The SCANMAR system was used during all trawl hauls. This equipment consists of sensors, a hydrophone, a receiver, a display unit and a battery charger. Communication between

sensors and ship is based on acoustic transmission. The doors are fitted with sensors to provide information on their interdistance and angle, while a height sensor is fitted on the bottom trawl to measure the trawl opening and provide information on clearance and bottom contact.

The all trawls are equipped with a trawl eye that provides information about the trawl opening and the distance of the footrope to the bottom. A pressure sensor is used to show the depth on the headline.

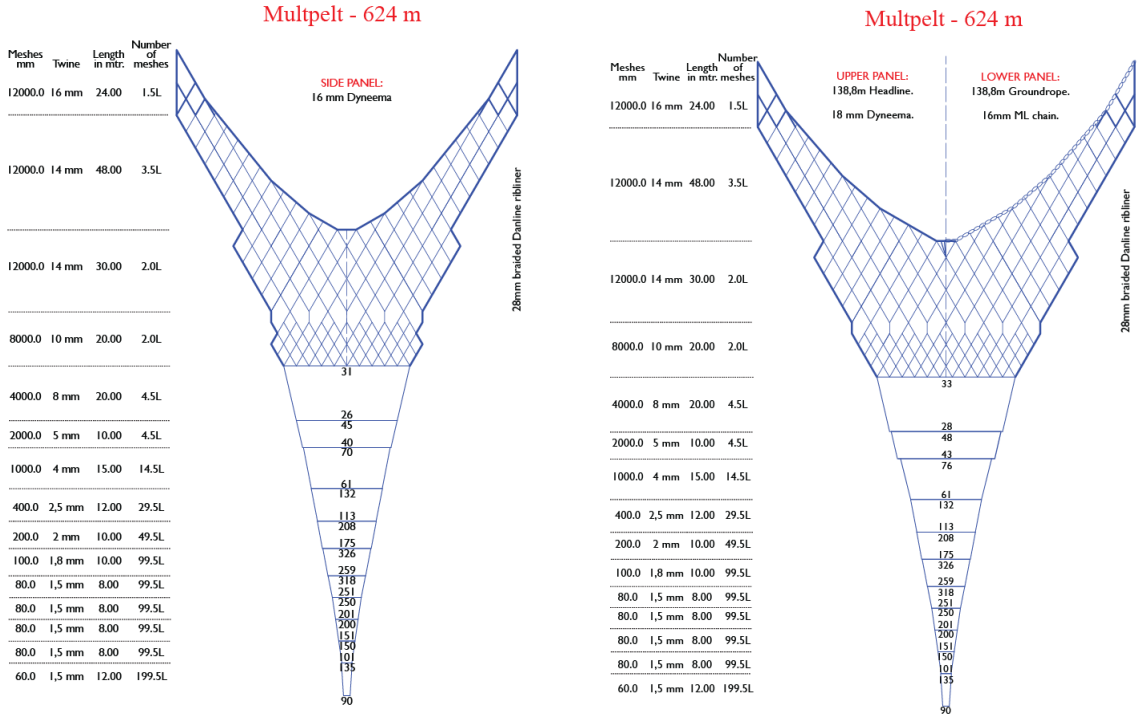


Figure I.1. Schematic drawing of the MultPelt 624.

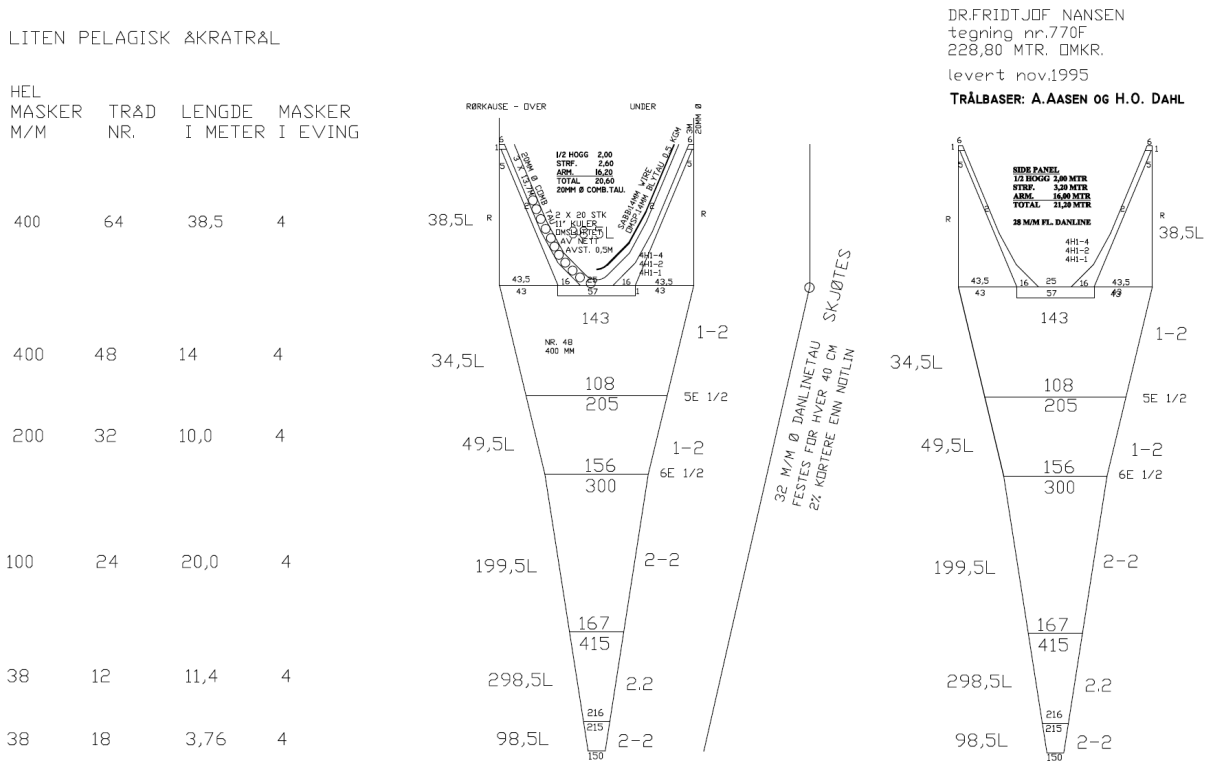


Figure I.2. Schematic drawing of the small pelagic Åkratrawl.

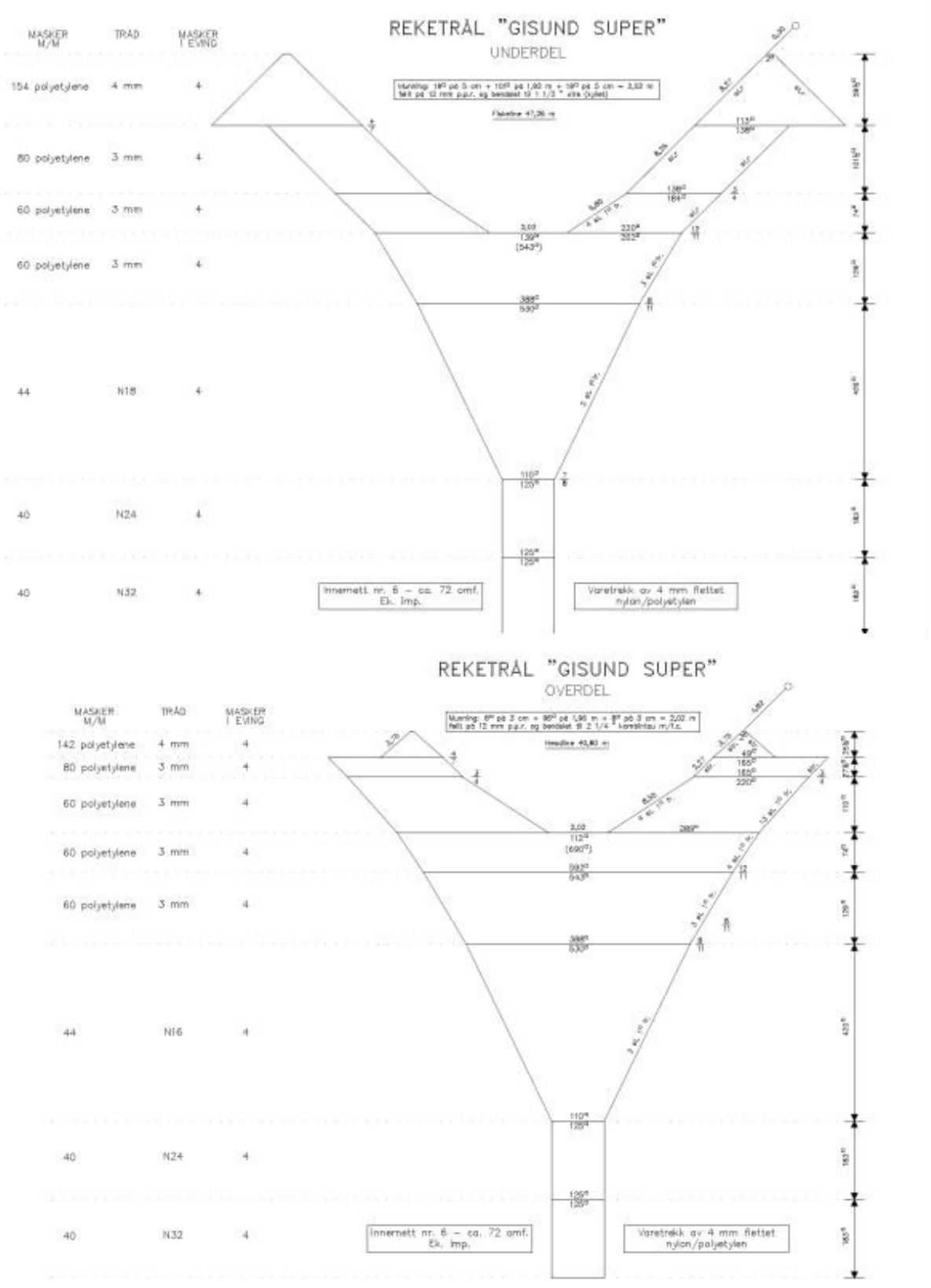
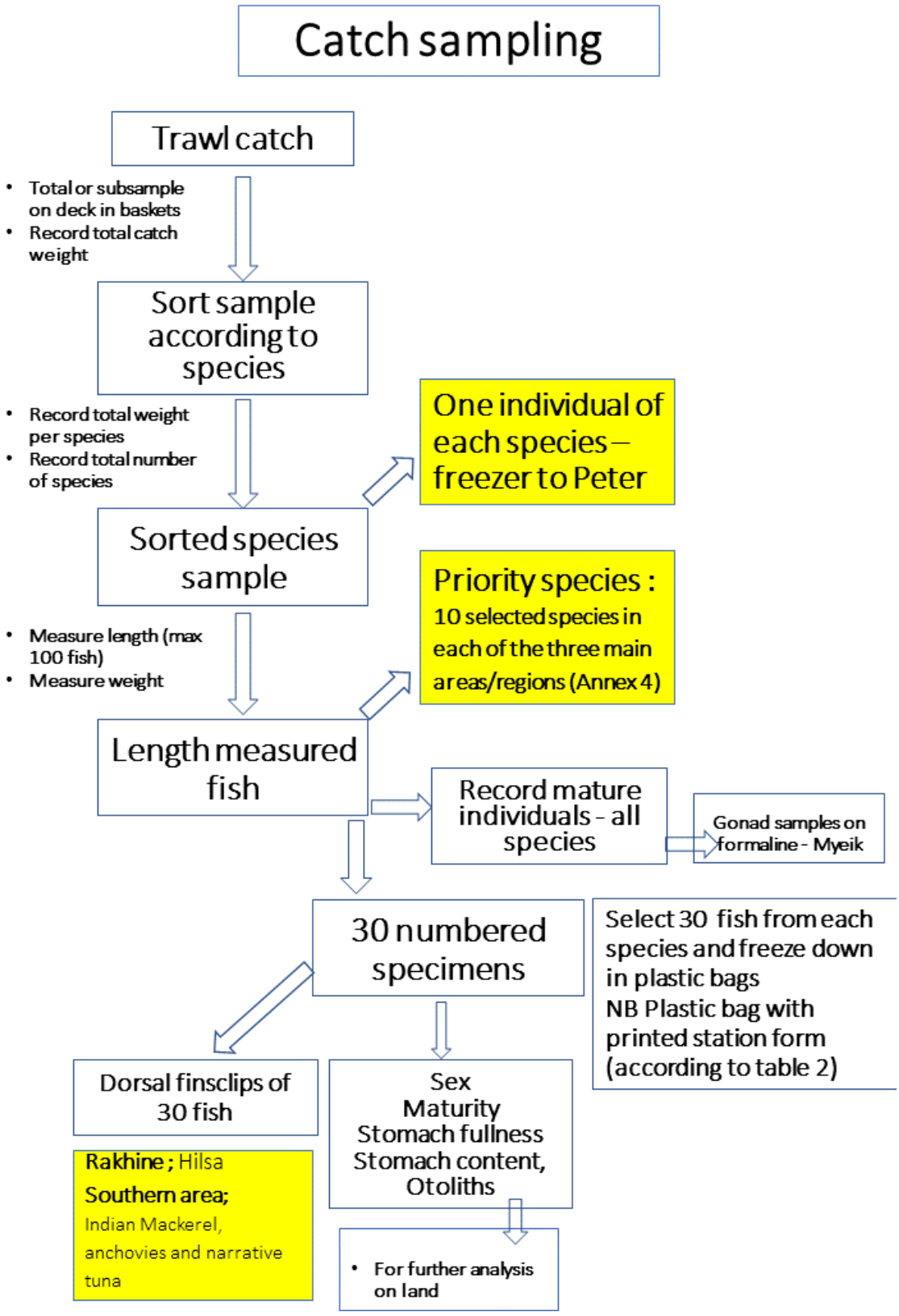


Figure I.3. Schematic drawing of the Super Gisund bottom trawl.

ANNEX II. LIST OF FAMILIES INCLUDED IN THE MESOPELAGIC FISH GROUP

Alepisauridae
Alepocephalidae
Anoplogastridae
Anotopteridae
Argentinidae
Barbourisiidae
Bathylagidae
Bramidae
Bregmacerotidae
Caristiidae
Caulophrynidae
Centrolophidae
Centrophrynidae
Ceratiidae
Cetomimidae
Chiasmodontidae
Cyematidae
Derichthydae
Diceratiidae
Diretmidae
Epigonidae
Eurypharyngidae
Evermannellidae
Gempylidae
Gigantactinidae
Giganturidae
Gonostomatidae
Himantolophidae
Howellidae
Leptochilichthyidae
Linophrynidae
Lophotidae
Melamphaidae
Melanocetidae
Melanonidae
Microstomatidae
Monognathidae
Myctophidae
Nemichthyidae
Neoceratiidae
Neoscopelidae
Nomeidae
Notosudidae
Omosudidae
Oneirodidae
Opisthoproctidae
Parabrotulidae
Paralepididae
Phosichthyidae
Platytroctidae
Radiicephalidae
Regalecidae
Rondeletiidae
Saccopharynigidae
Scombridae
Scombrolabracidae
Scopelarchidae
Serrivomeridae
Sternoptychidae
Stomiidae
Stylephoridae
Teragonuridae
Thaumatichthyidae
Trachipteridae
Trichiuridae
Xiphiidae

ANNEX III. SCHEMATIC PRESENTATION OF THE SAMPLING PROCEDURE



ANNEX IV. MATURITY STAGE

Stage	State	Description
I	Immature	Ovary and testis about 1/3rd length of body cavity. Ovaries pinkish, translucent, testis whitish. Ova not visible to naked eye.
II	Maturing virgin and recovering spent	Ovary and testis about ½ length of body cavity. Ovary pinkish, translucent, testis whitish, symmetrical. Ova not visible to naked eye.
III	Ripening	Ovary and testis is about 2/3rds length of body cavity. Ovary pinkish yellow colour with granular appearance, testis whitish to creamy. No transparent or translucent ova visible.
IV	Ripe	Ovary and testis from 2/3rds to full length of body cavity. Ovary orange-pink in colour with conspicuous superficial blood vessels. Large transparent, ripe ova visible. Testis whitish-creamy, soft.
V	Spent	Ovary and testis shrunken to about ½ length of body cavity. Walls loose. Ovary may contain remnants of disintegrating opaque and ripe Ova, darkened or translucent. Testis bloodshot and flabby

ANNEX V. CTD SAMPLING DEPTHS

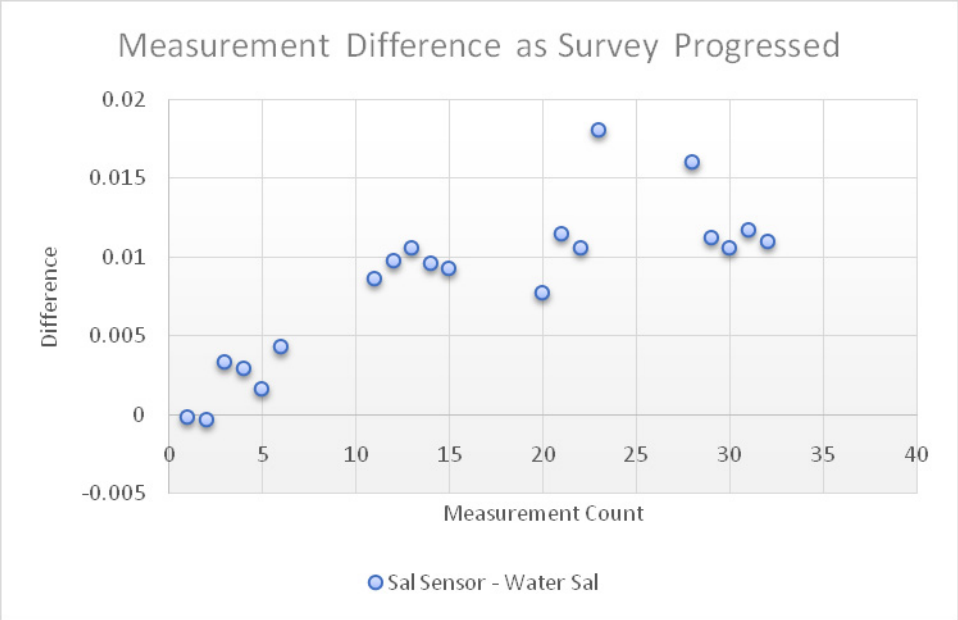
Dr Fridtjof Nansen is equipped with a 12 Niskin bottle (10 L) rosette to collect water samples from pre-defined depths. The decided water sampling depths were set to: bottom (if deeper than 500 m), 500 m, 400 m, 300 m, 200 m, 100 m 50 m, 25 m, 5 m and the depth of the fluorescence maximum. Two bottles were collected for the 5 m depth and towards the end of the survey, two bottles were dedicated for the deepest depth.

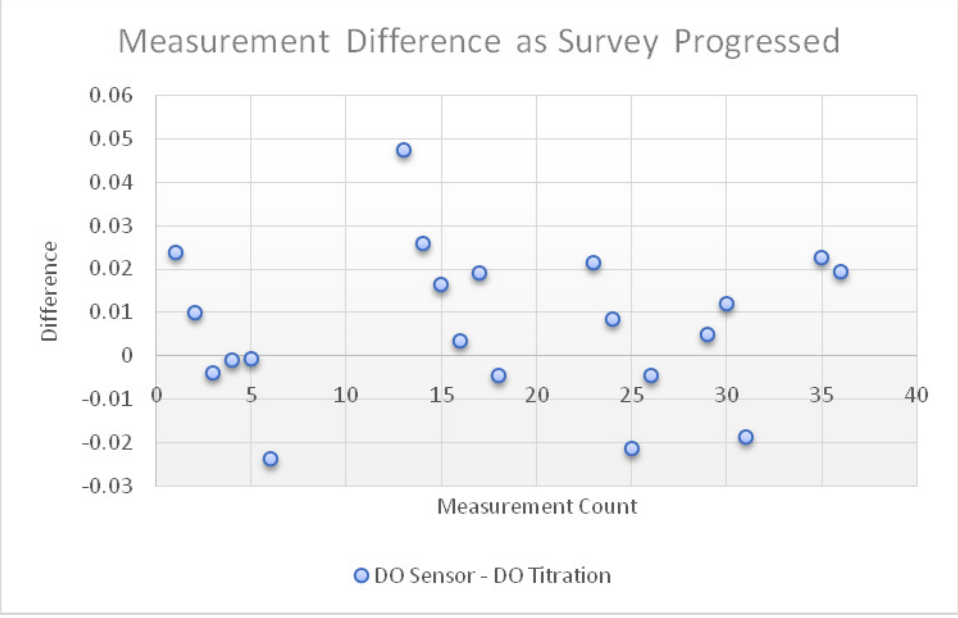
ANNEX VI. CTD SENSORS

Type	Seriel Number	Model	Calibration Date
Deck unit	11-1082	SBE 11plus	
Fluorometer	088-252	Chelsea aqua 3	13.08.2013
Pressure sensor	127957	DigiQuartz	22.07.2013
Underwater unit	09P75372-1160	SBE 9plus 6800m	
Water sampler	32-0972	SBE 32 6800m	
Conductivity sensor	42037	SBE 4C 6800m	25.10.2016
Conductivity sensor	43080	SBE 4C 6800m	14.04.2018
Oxygen sensor	43-3525	SBE 43 7000m	08.04.2017
Submersible pump	52147	SBE 5T	2014
Submersible pump	054196	SBE 5T	
Temperature sensor	31602	SBE 3plus 6800m	27.10.2016
Temperature sensor	03P4537	SBE 3plus 6800m	28.10.2016
Sonar Altimeter	1186	Benthos PSA-916	27.06.1905
Par sensor	1039	Satlantic	11.04.2015

ANNEX VII. SENSOR CHECKS

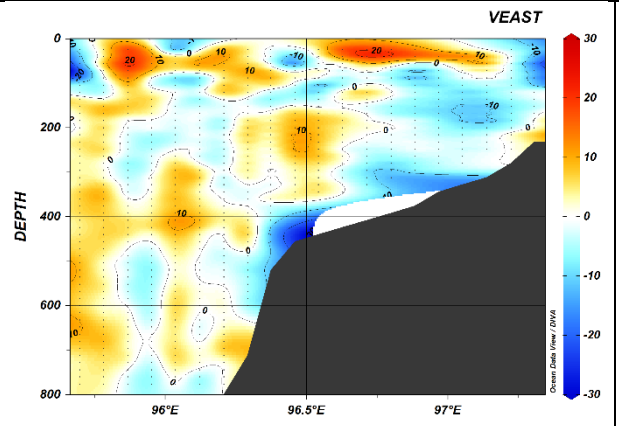
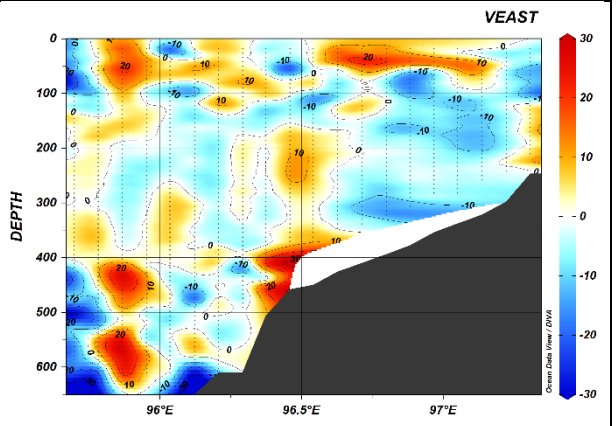
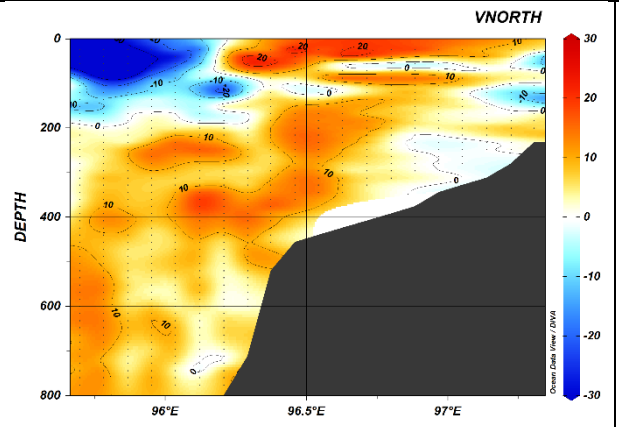
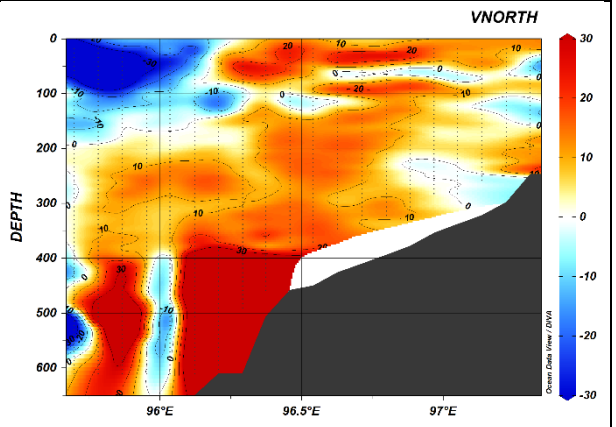
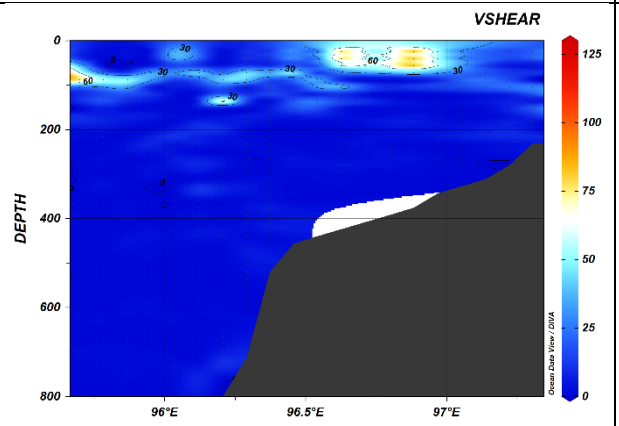
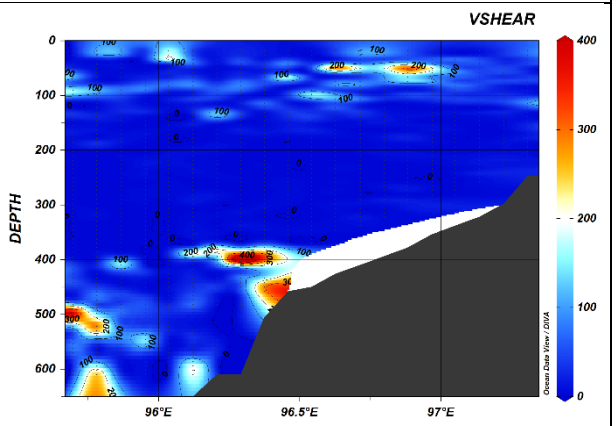
To check the salinity values from the CTD conductivity sensor, water samples were collected and measured on board with a Guildline Portasal Salinometer 8410A throughout the survey. The dissolved oxygen sensor values were also checked via onboard Winkler titrations (Grasshoff *et al*., 1999). Value comparisons show a slight drift increase in the conductivity sensor values, whereas the dissolved oxygen sensor remains relatively stable. IAPSO salinity standard seawater was used to standardize the salinometer to ensure reliable measurements.



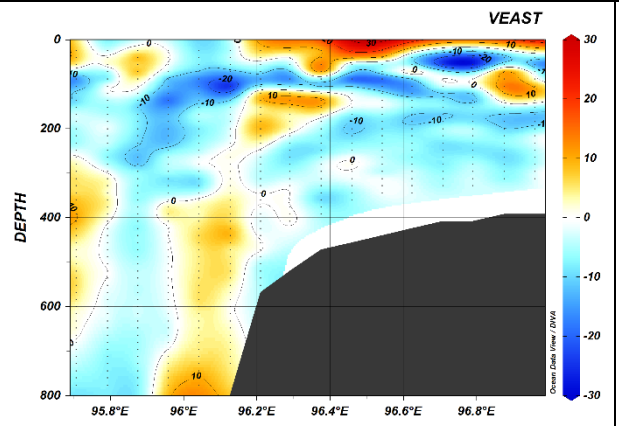
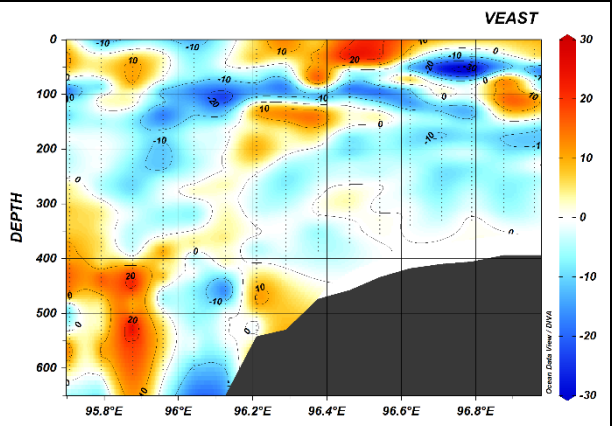
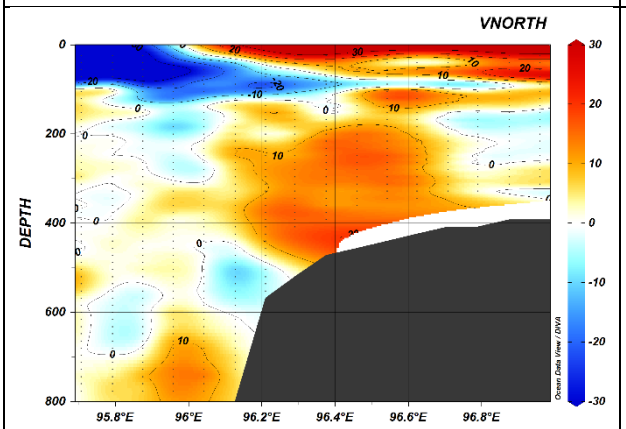
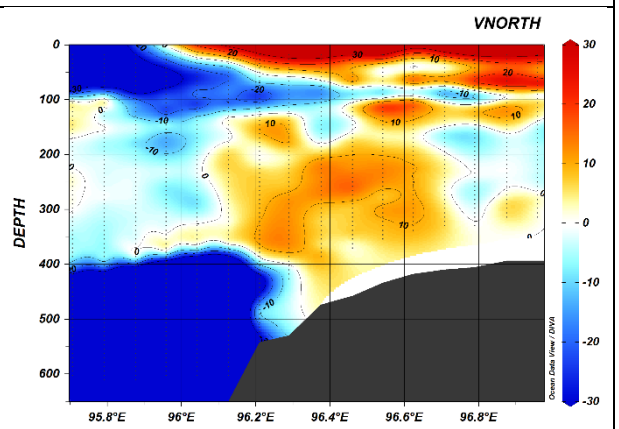
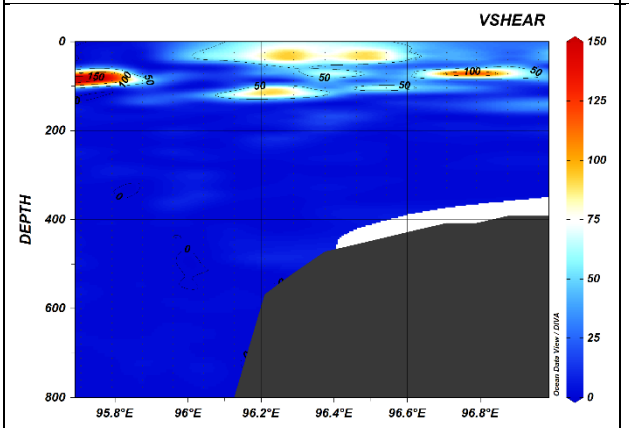
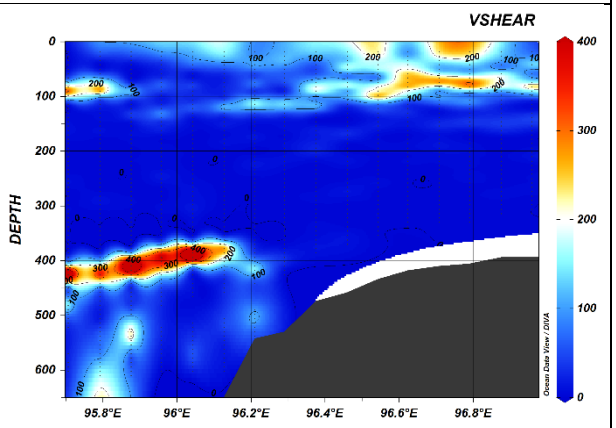


ANNEX VIII. HYDROGRAPHY (FIGURES)

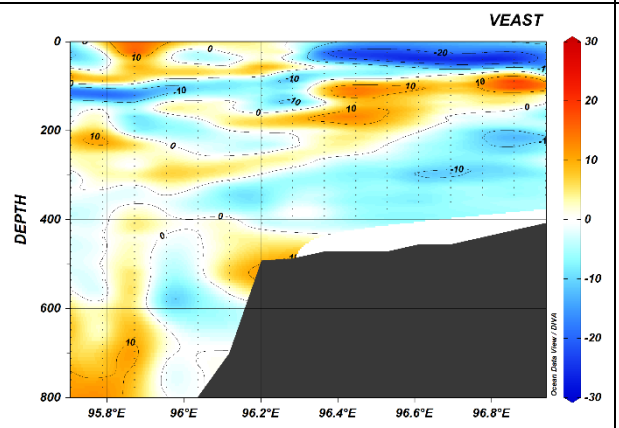
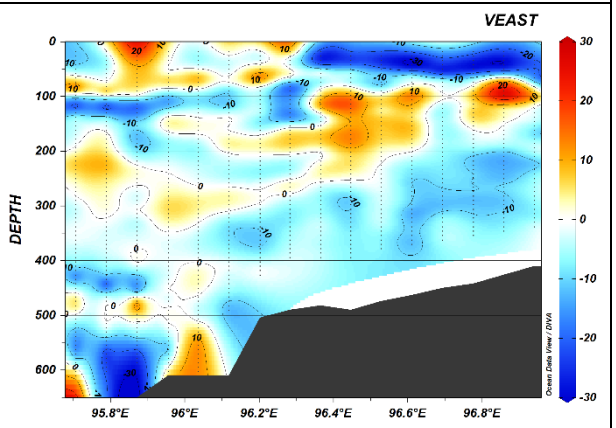
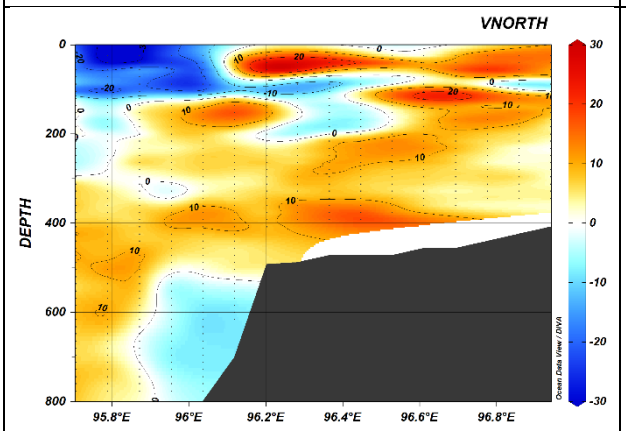
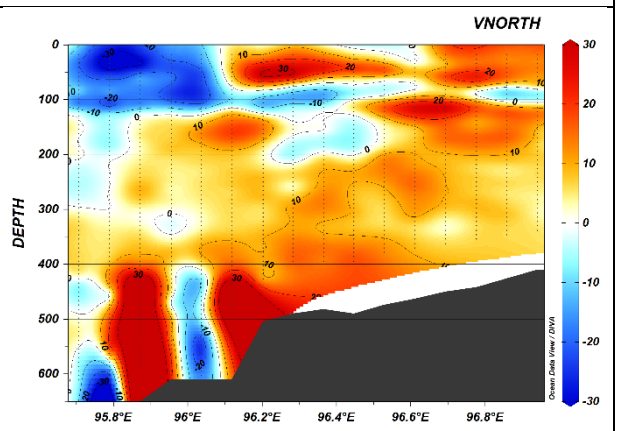
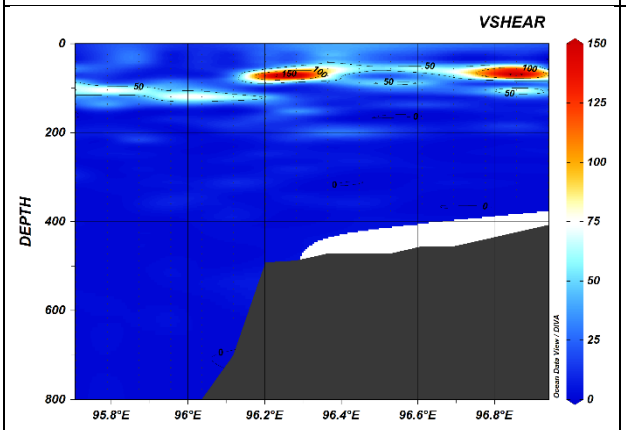
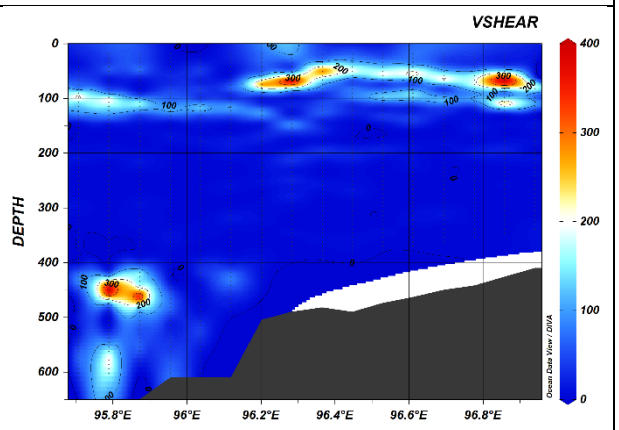
ADCP

T1 : 75 KHz	T1 : 150 KHz
	
	
	

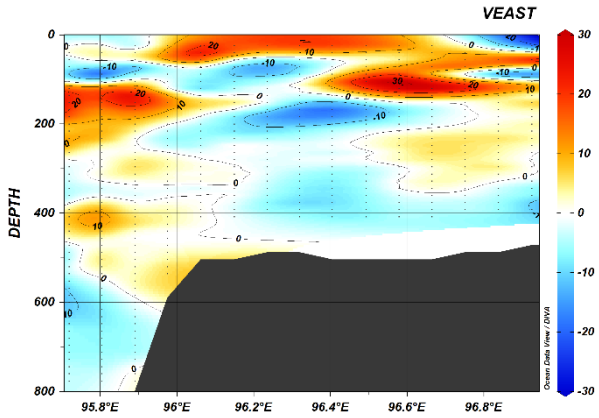
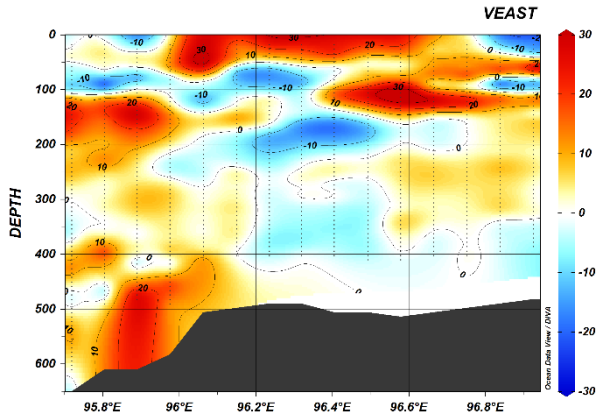
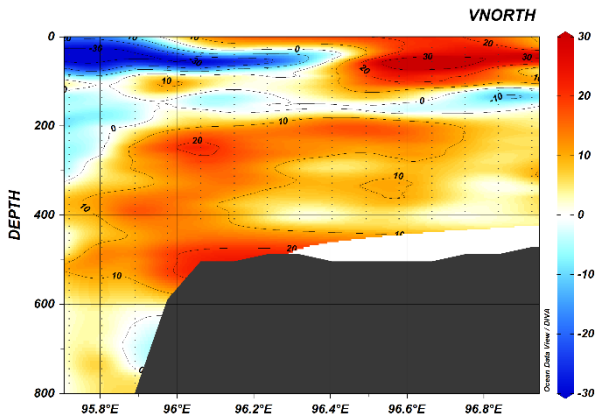
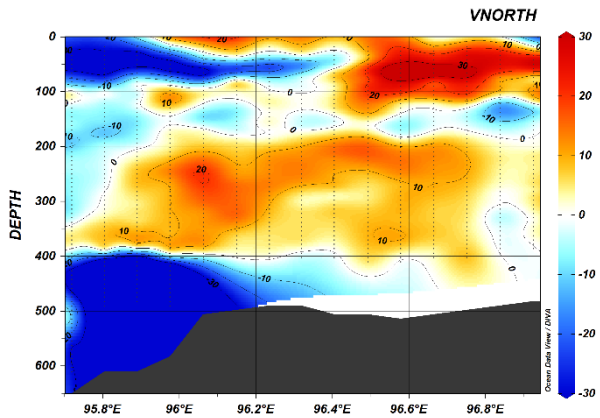
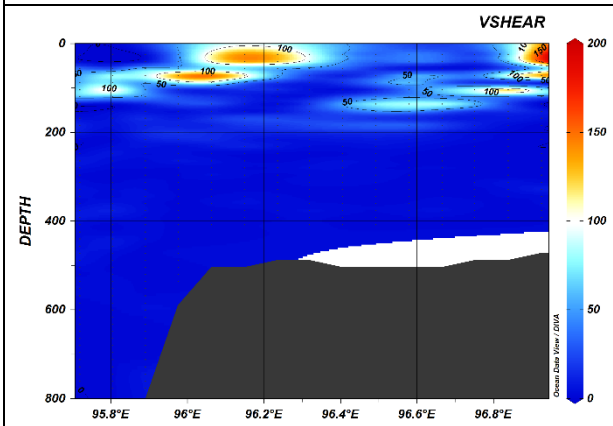
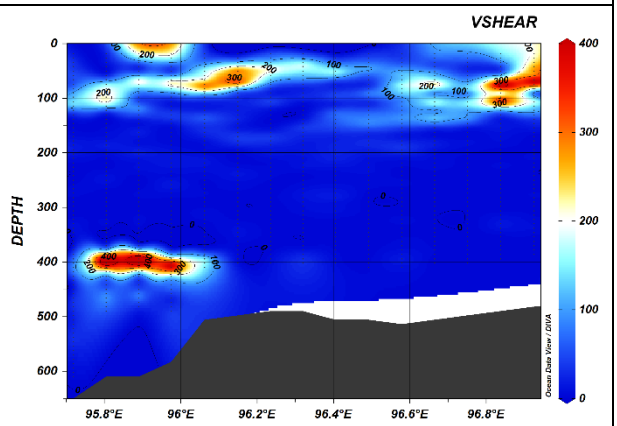
ADCP 75 and 150 KHz data of section T2 in eastward current, northward current and vertical shear

T2 : 75 KHz	T2 : 150 KHz
	
	
	

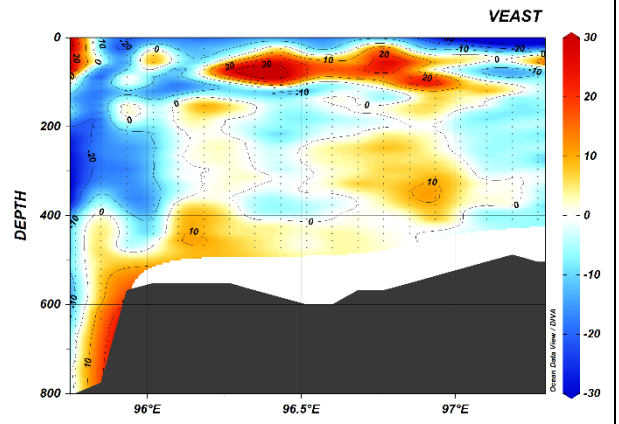
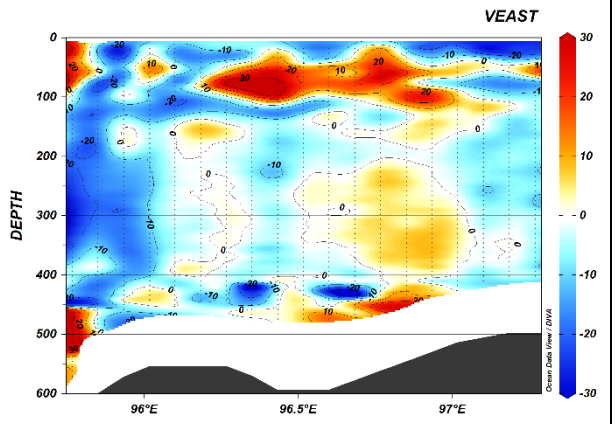
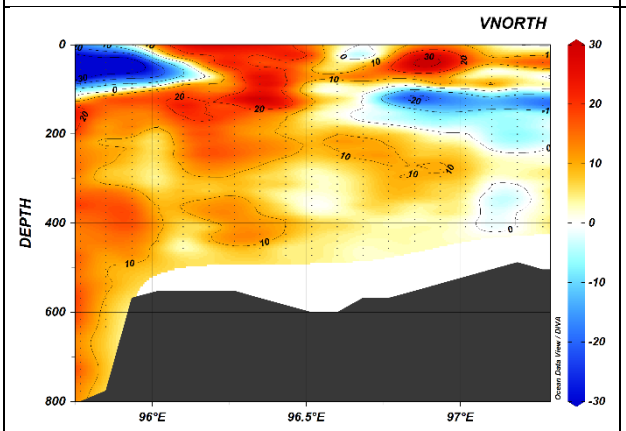
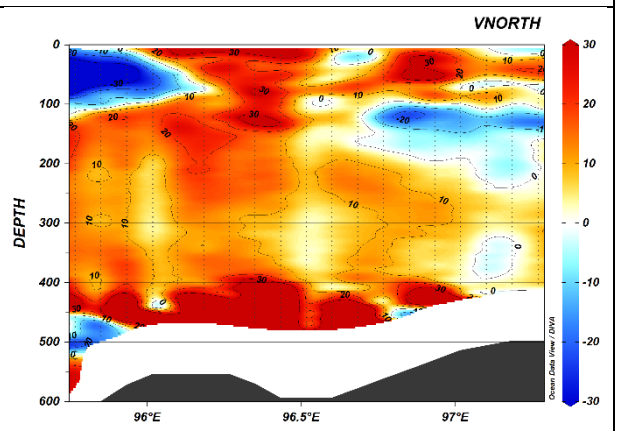
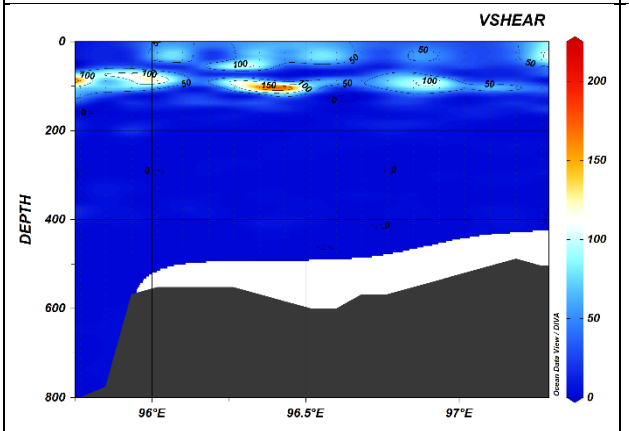
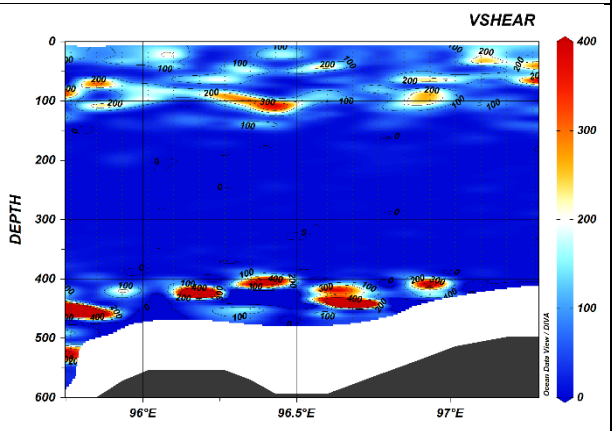
ADCP 75 and 150 KHz data of section T3 in eastward current, northward current and vertical shear

T3 : 75 KHz	T3 : 150 KHz
	
	
	

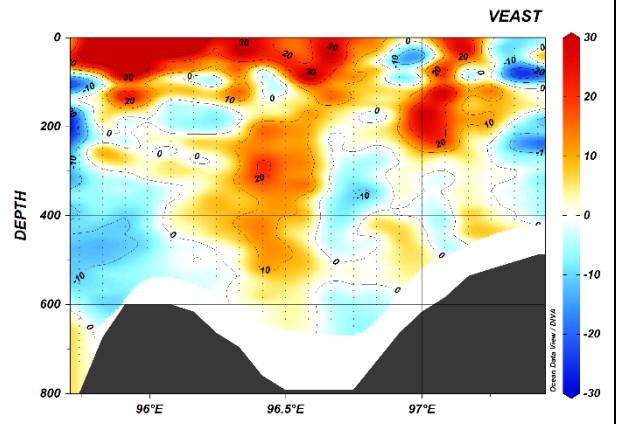
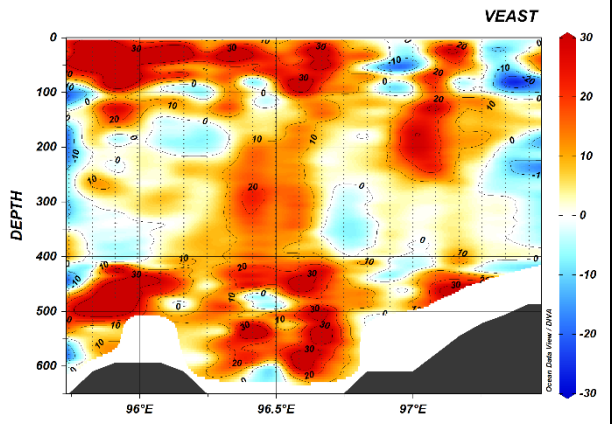
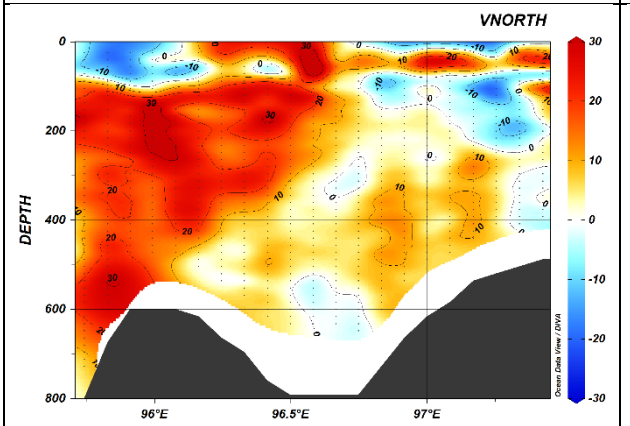
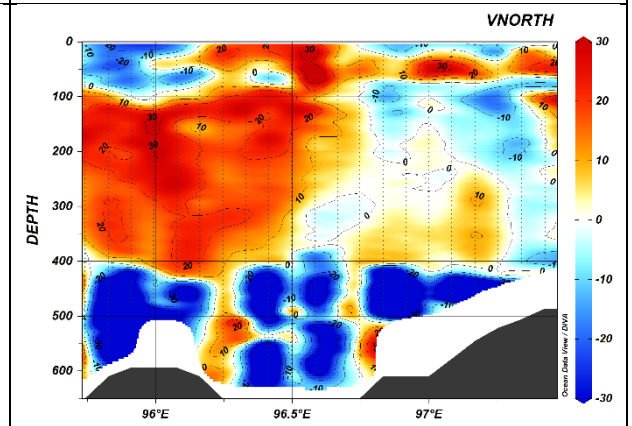
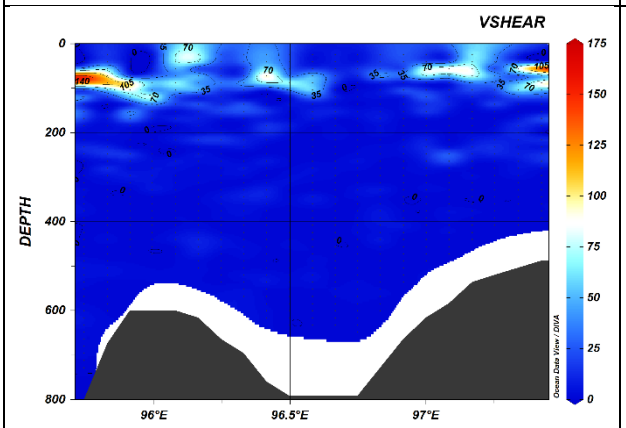
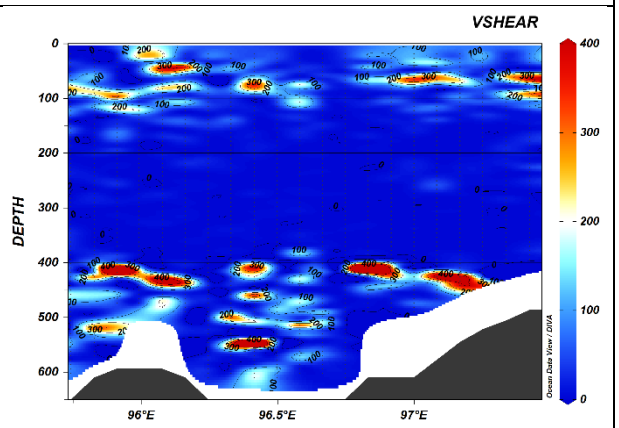
ADCP 75 and 150 KHz data of section T4 in eastward current, northward current and vertical shear

T4: 75 KHz	T4: 150 KHz
	
	
	

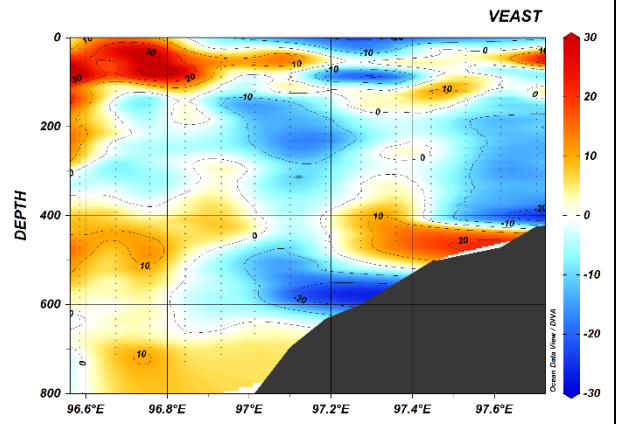
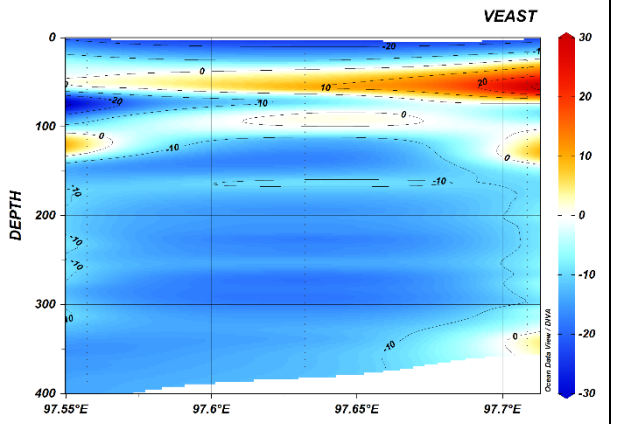
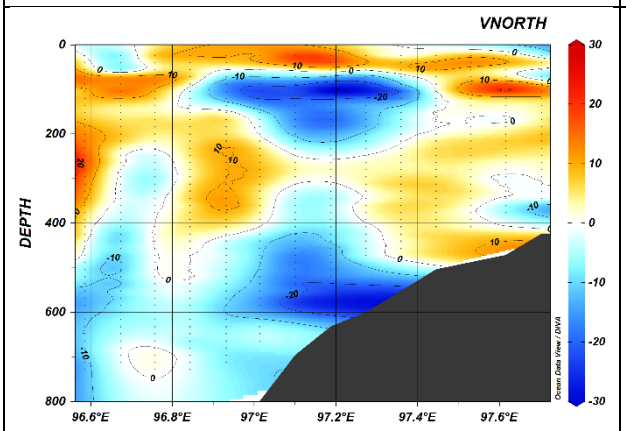
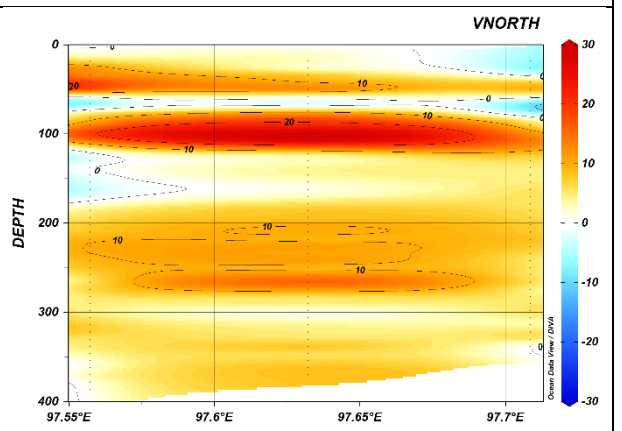
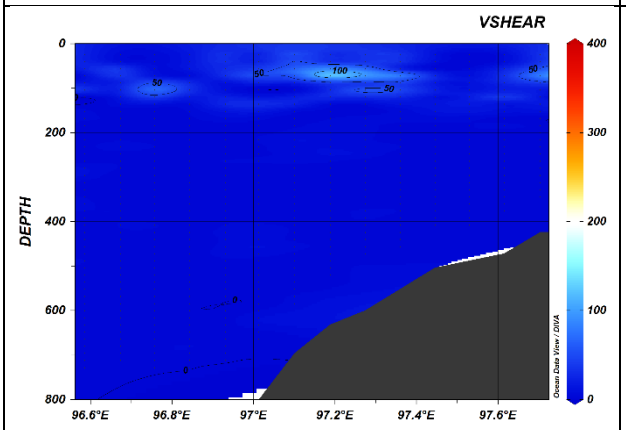
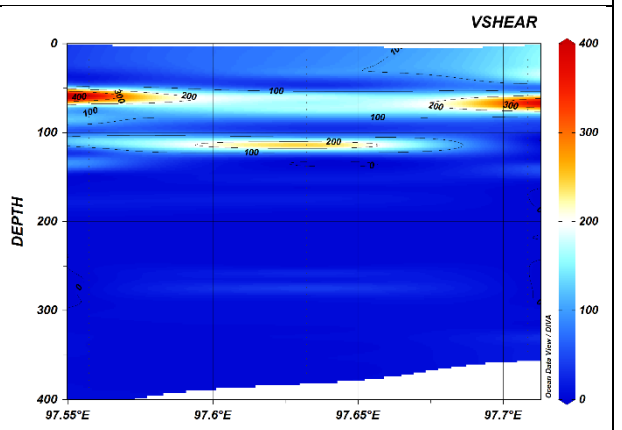
ADCP 75 and 150 KHz data of section T5 in eastward current, northward current and vertical shear

T5 : 75 KHz	T5 : 150 KHz
	
	
	

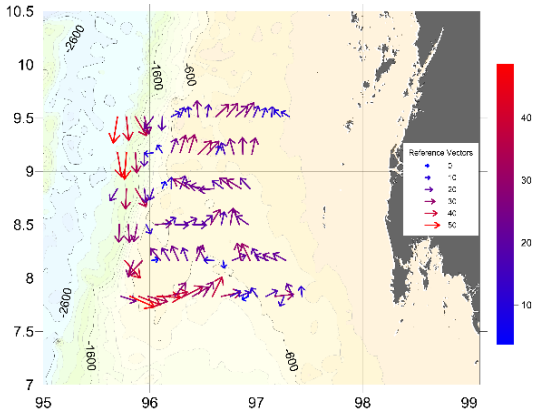
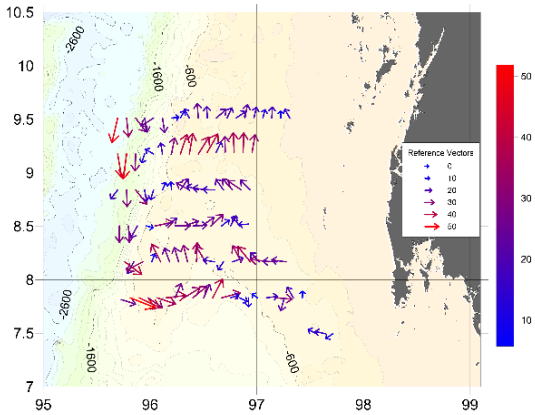
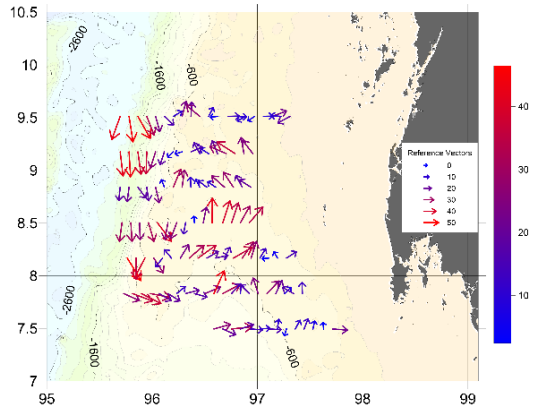
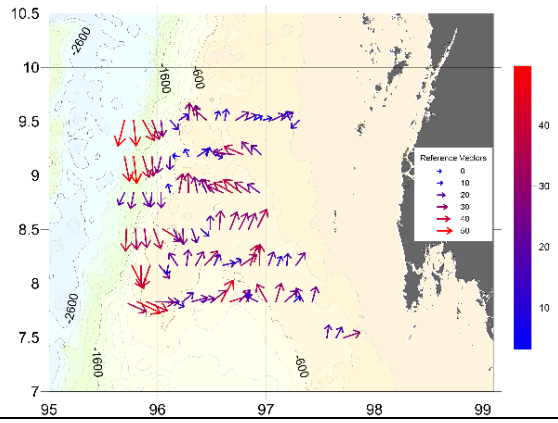
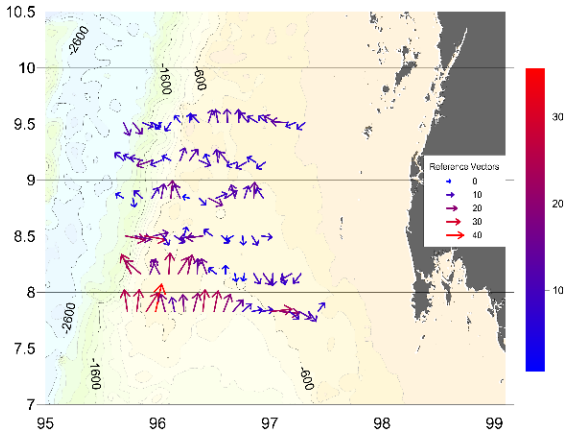
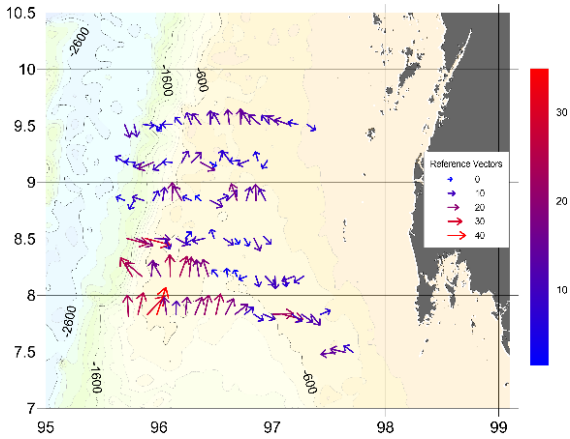
ADCP 75 and 150 KHz data of section T6 in eastward current, northward current and vertical shear

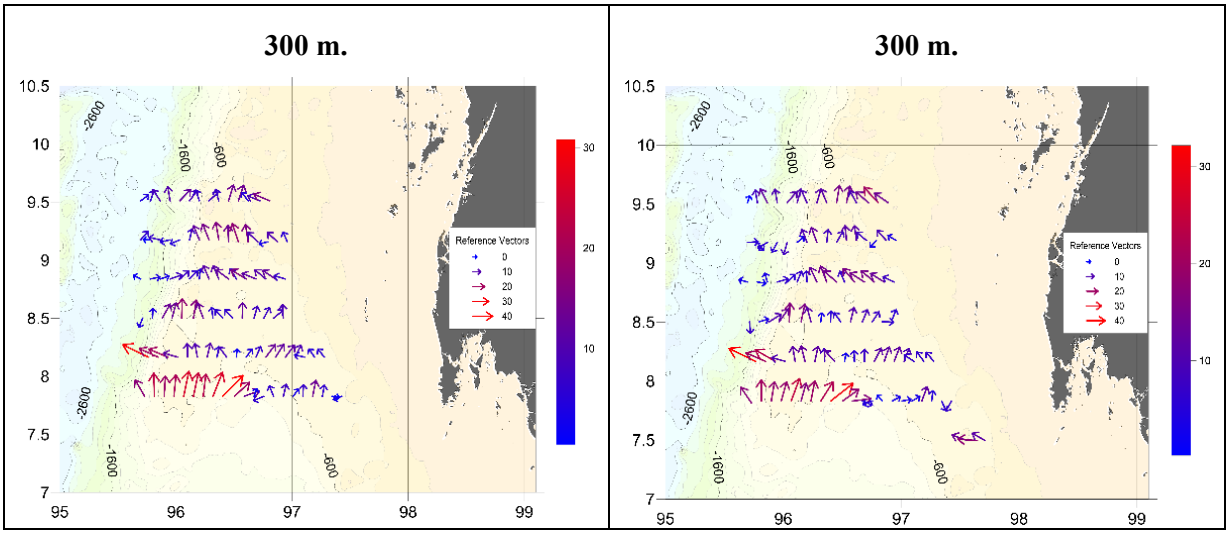
T6 : 75 KHz	T6 : 150 KHz
	
	
	

ADCP 75 and 150 KHz data of section T7 in eastward current, northward current and vertical shear

T7: 75 KHz	T7: 150 KHz
	
	
	

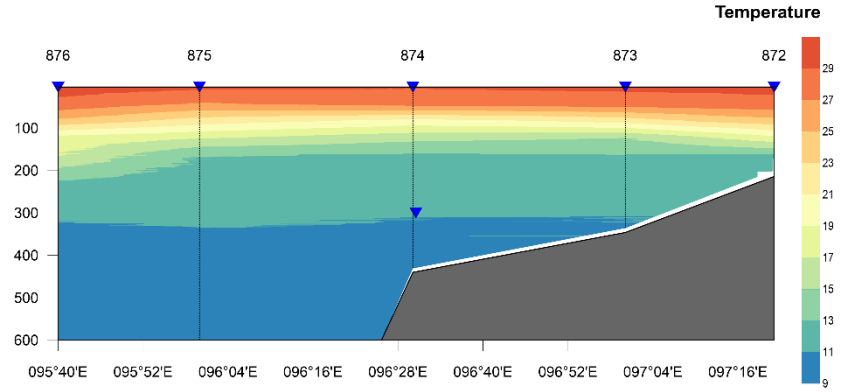
Horizontal distribution of the acoustic Doppler current profile (75 and 150 KHz) at four different layers (20, 50, 150 and 300 m depth)

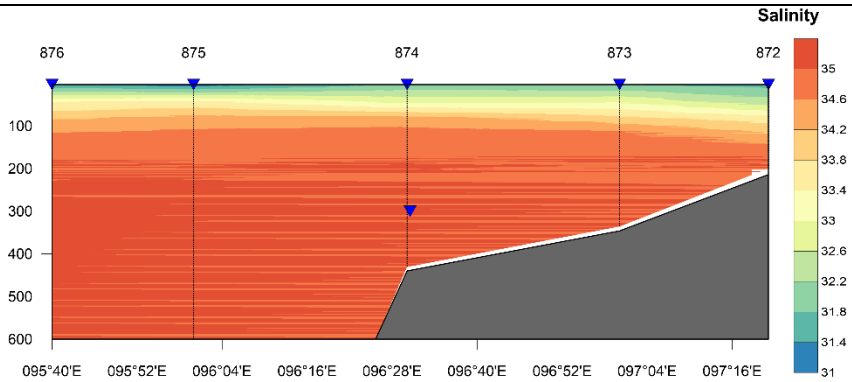
75 KHz	150 KHz
20 m	**20 m**
	
50 m	**50 m**
	
150 m	**150 m**
	

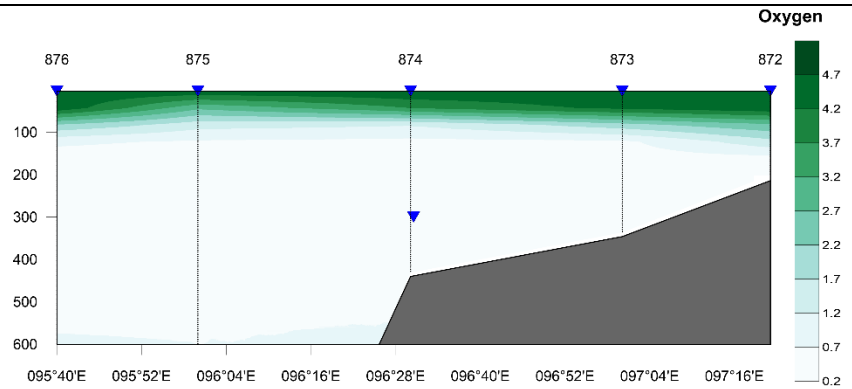

300 m.
300 m.
Reference Vectors
0
10
20
30
40
10.5
10
9.5
9
8.5
8
7.5
7
95
96
97
98
99
-2600
-1600
-600

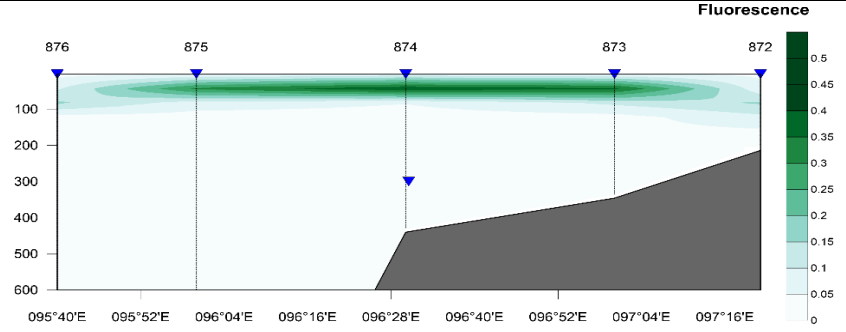
CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T1 to 600 m depth.

T1

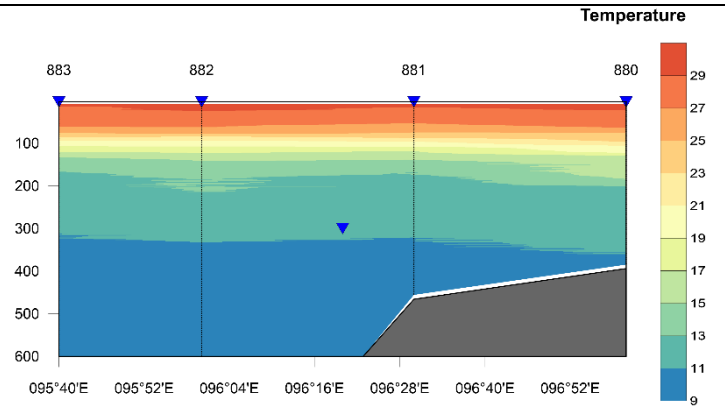


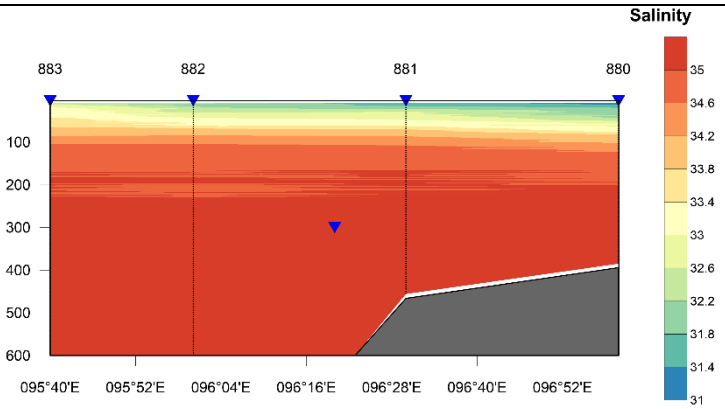


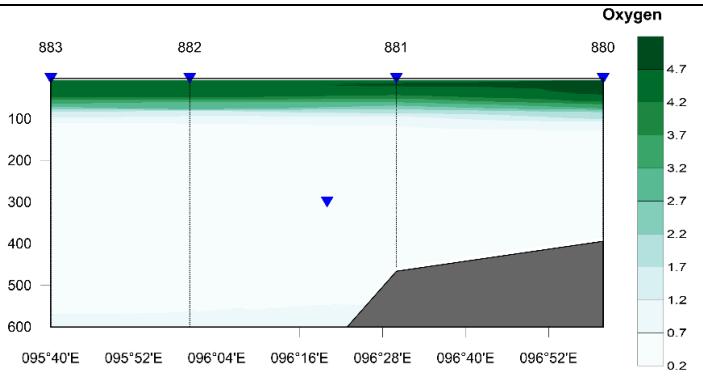


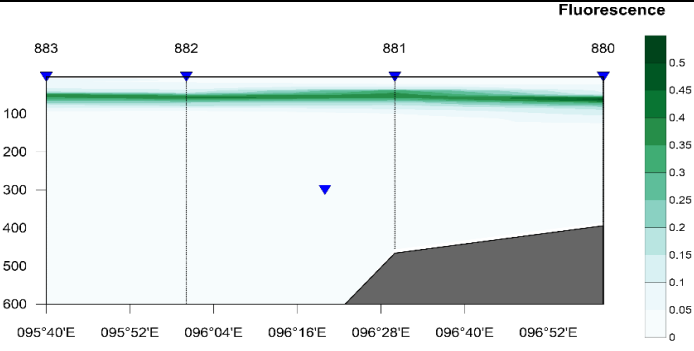


CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T3 to 600 m depth.

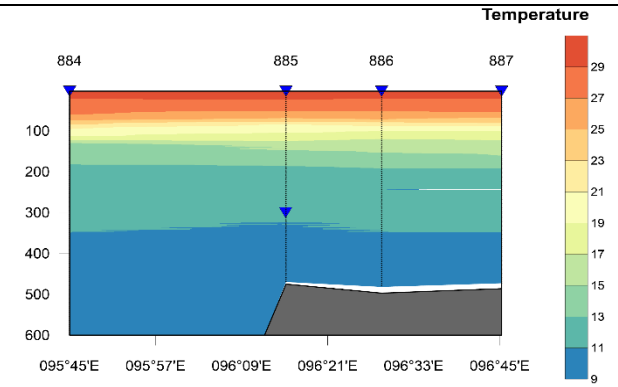


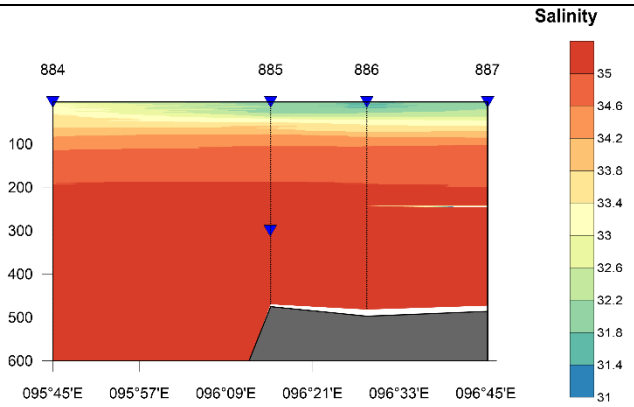


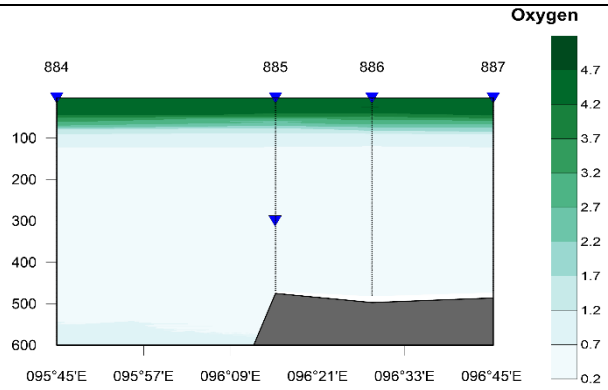


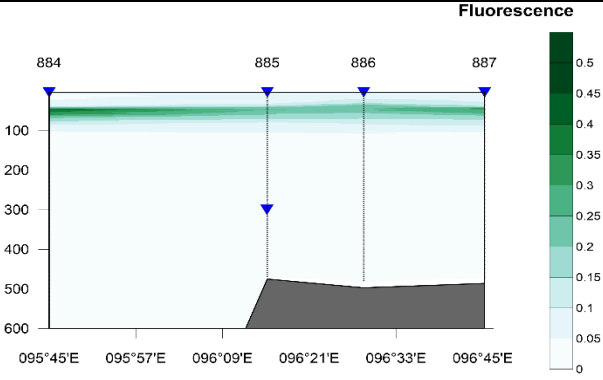


CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T4 to 600 m depth.

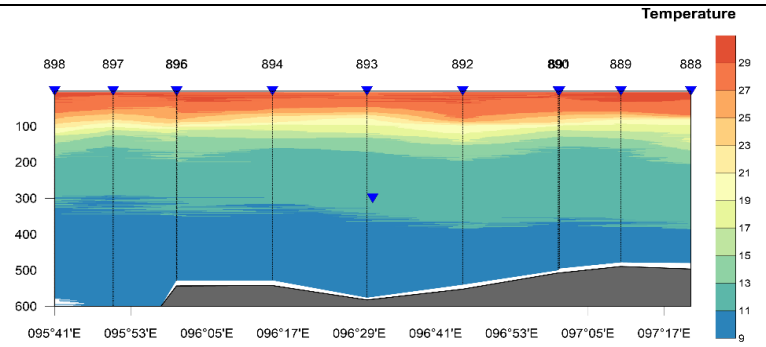


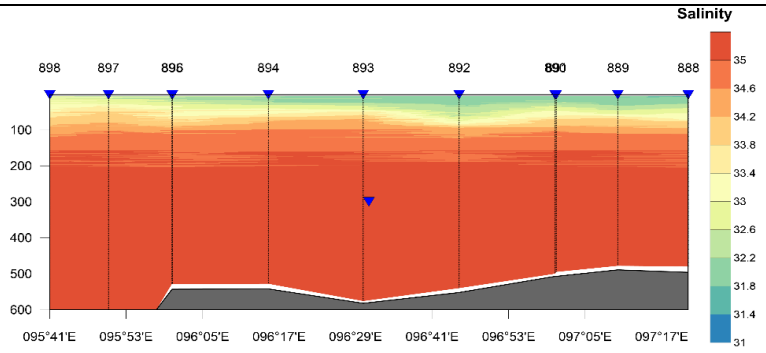


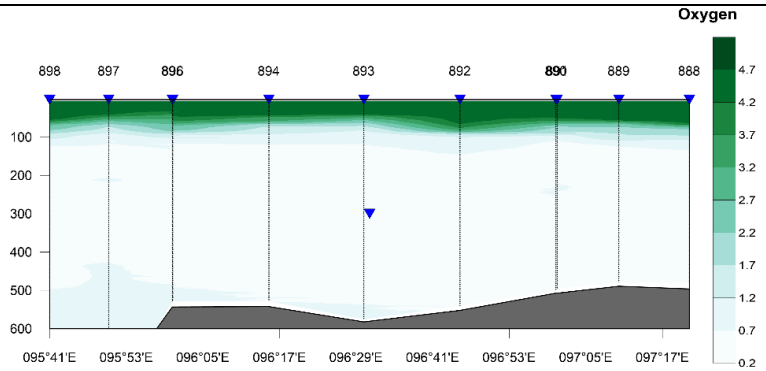


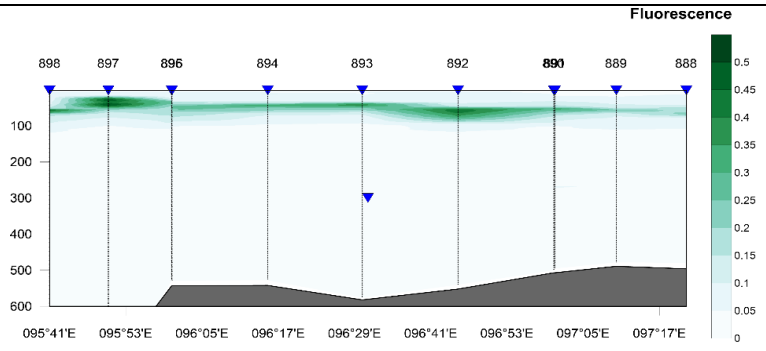


CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T5 to 600 m depth.

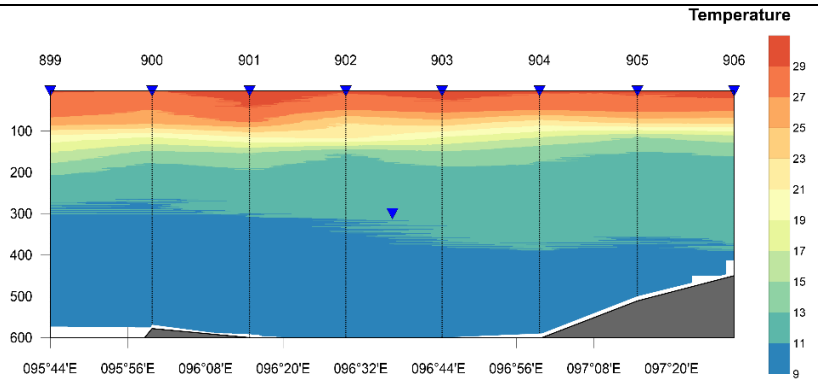


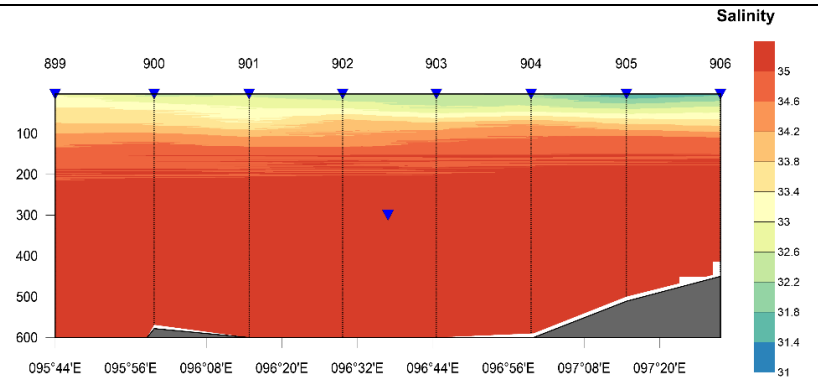


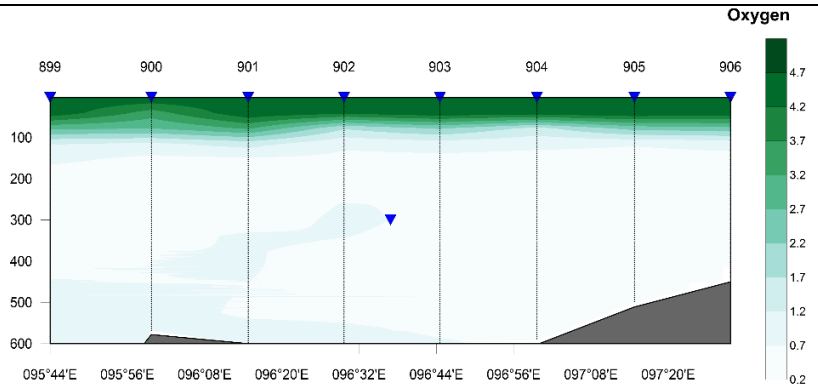


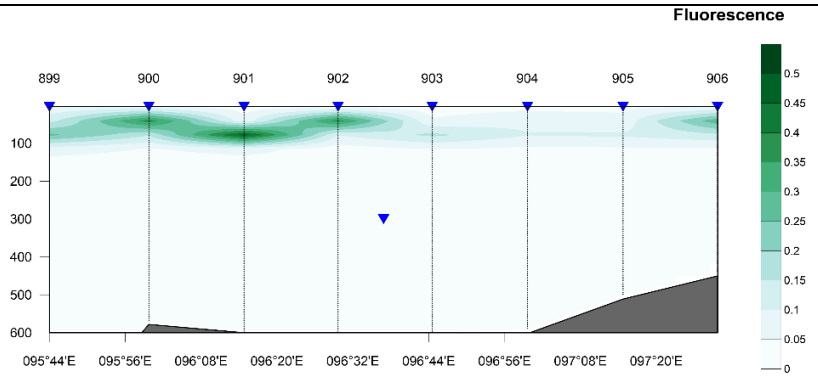


CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T6 to 600 m depth.

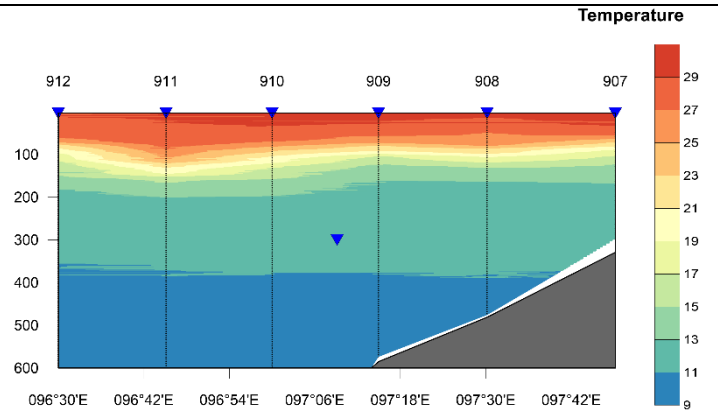


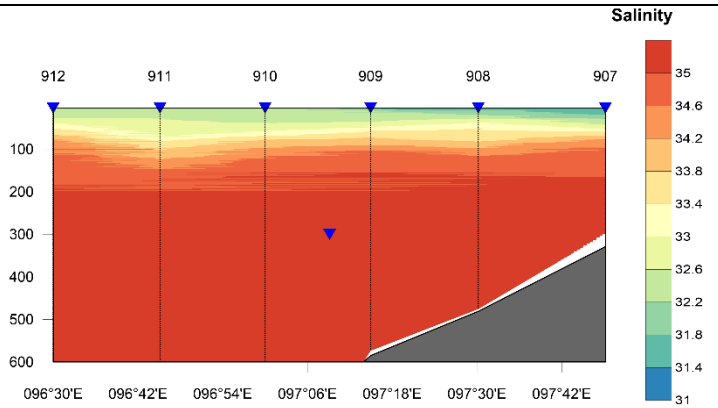


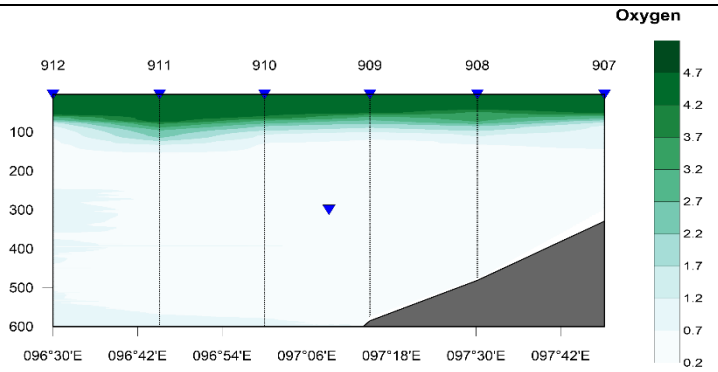


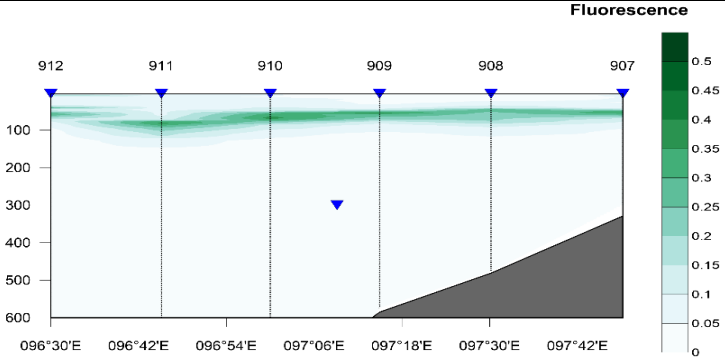


CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects T7 to 600 m depth.

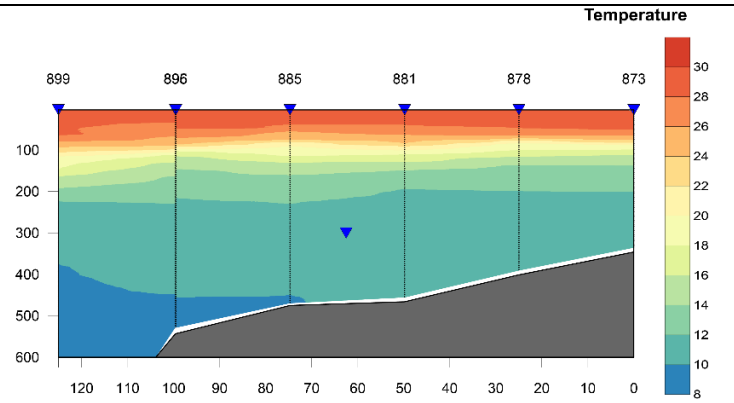


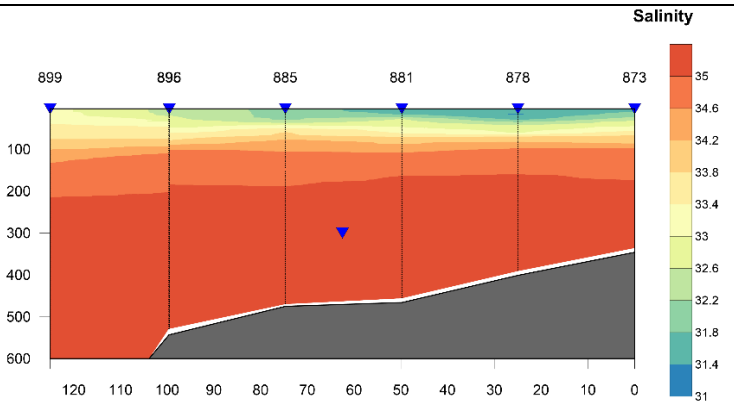


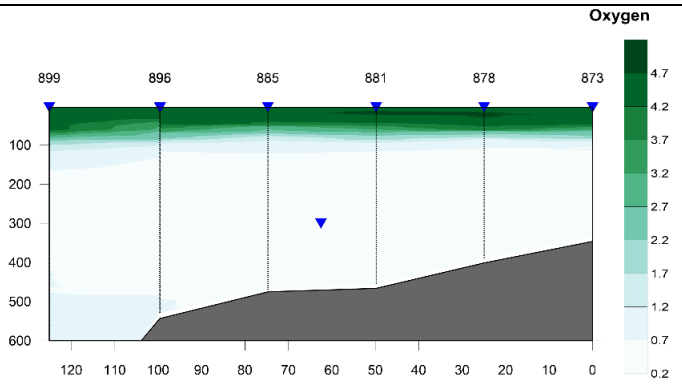


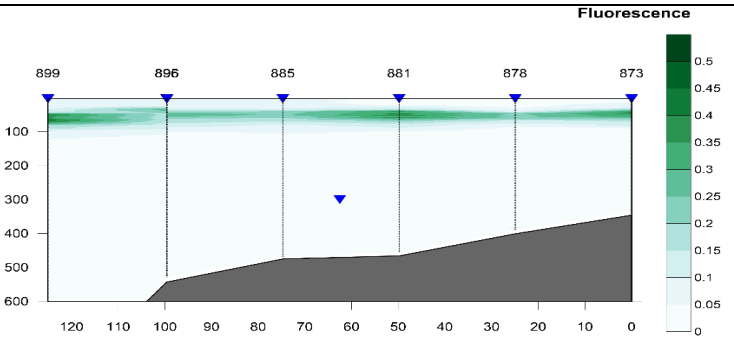


CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects D1 to 600 m depth.

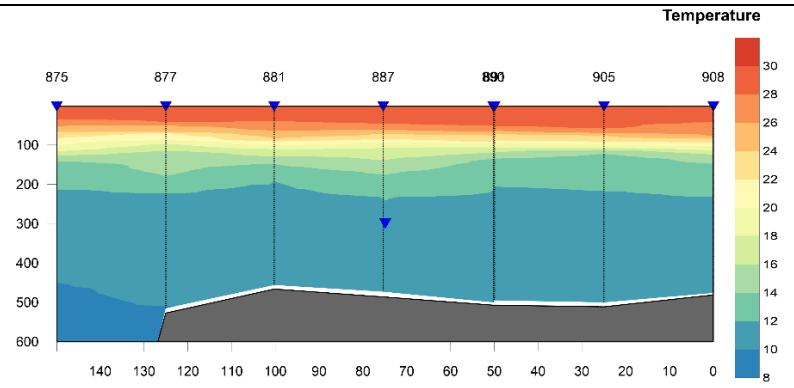


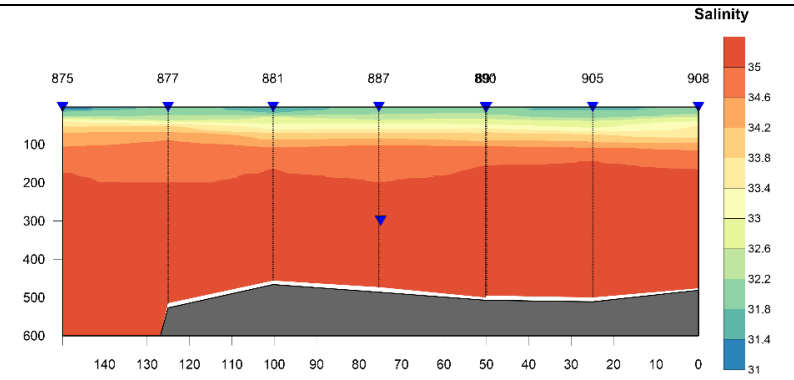


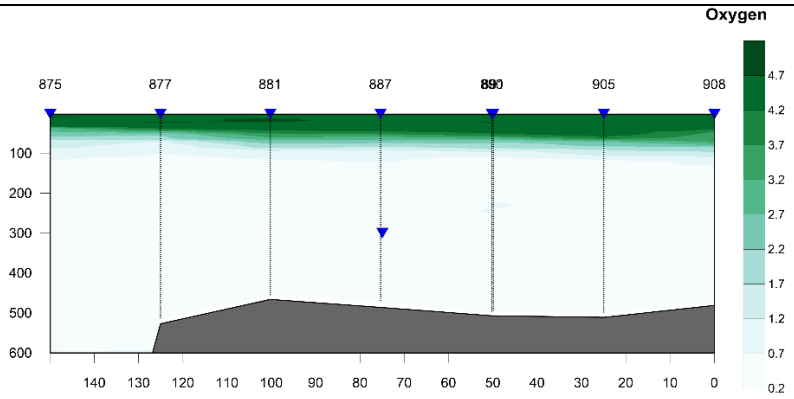


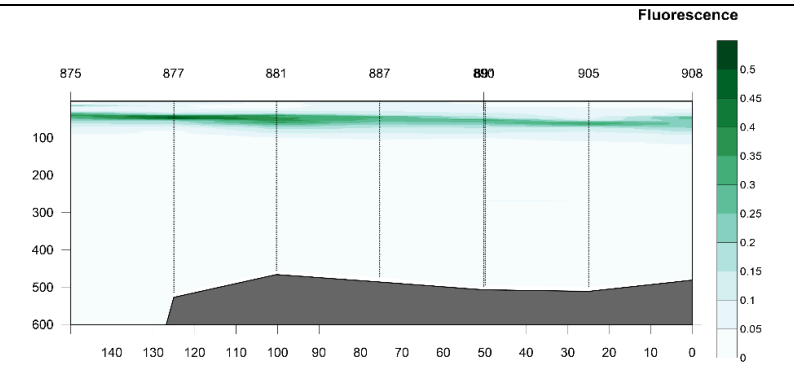


CTD DATA: Cross section of temperature, salinity, oxygen, and fluorescence along the hydrographic transects D2 to 600 m depth.

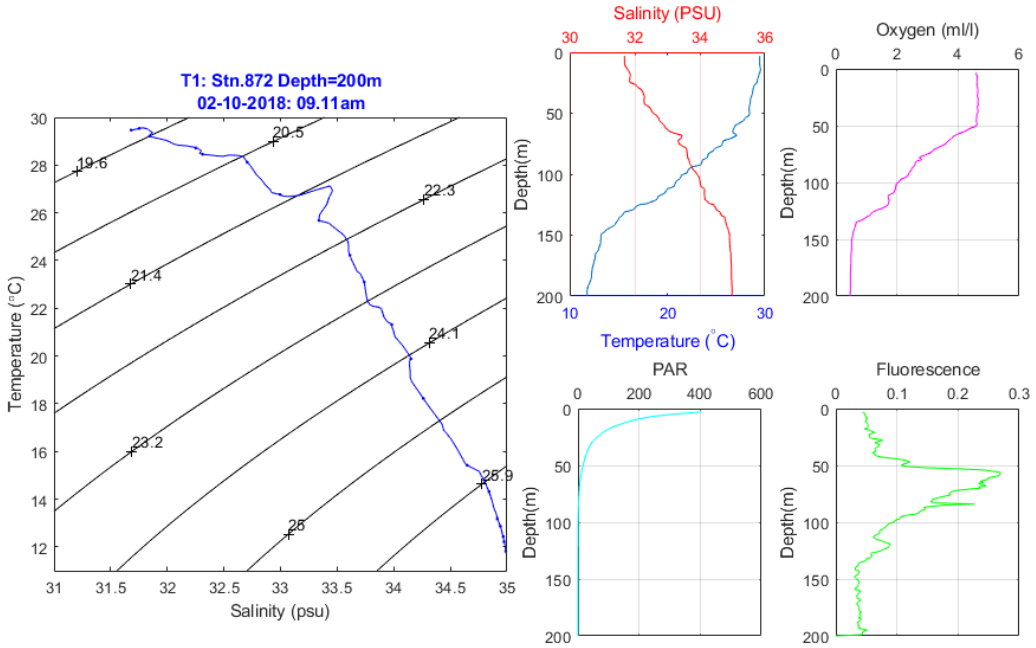


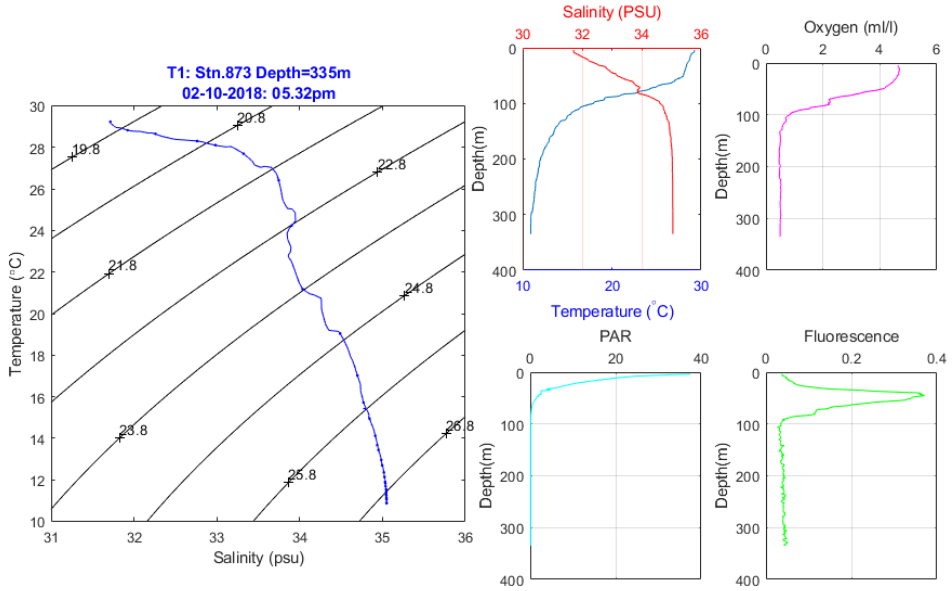


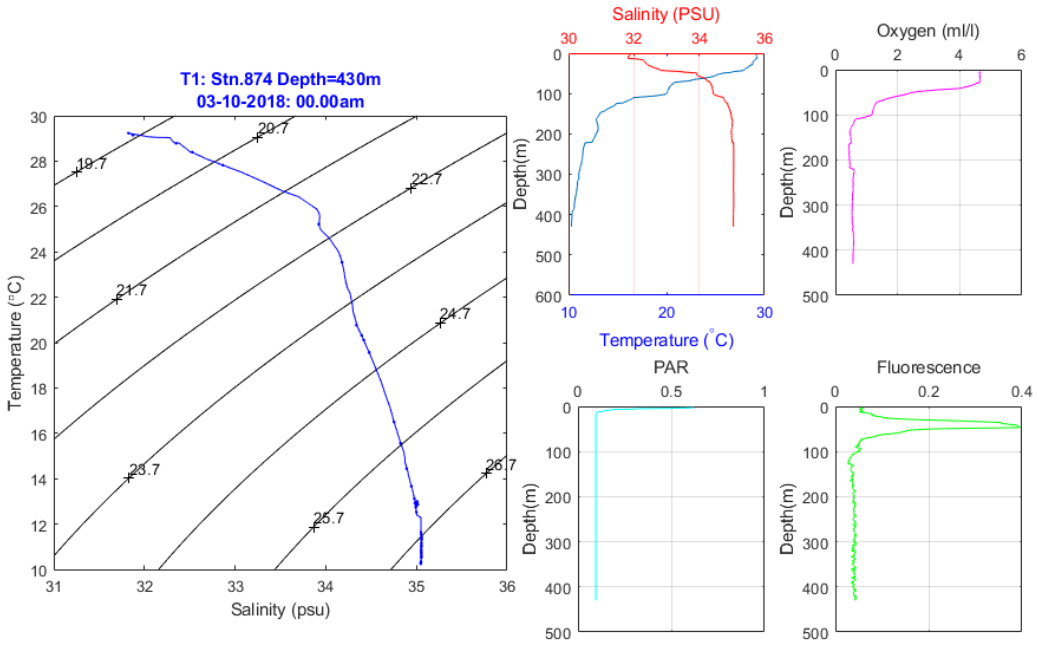


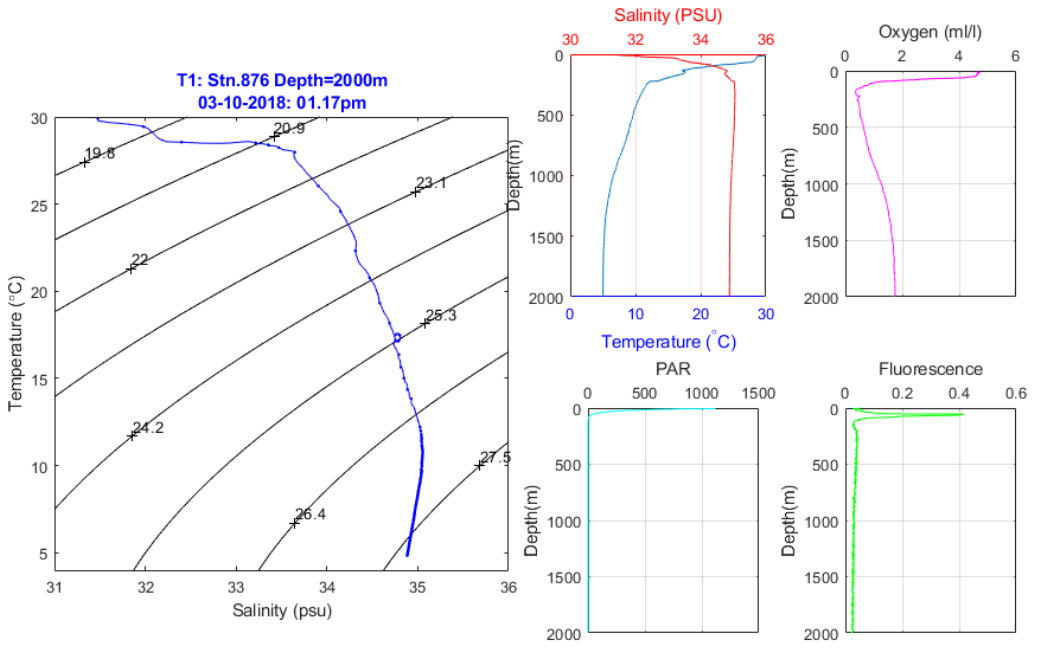


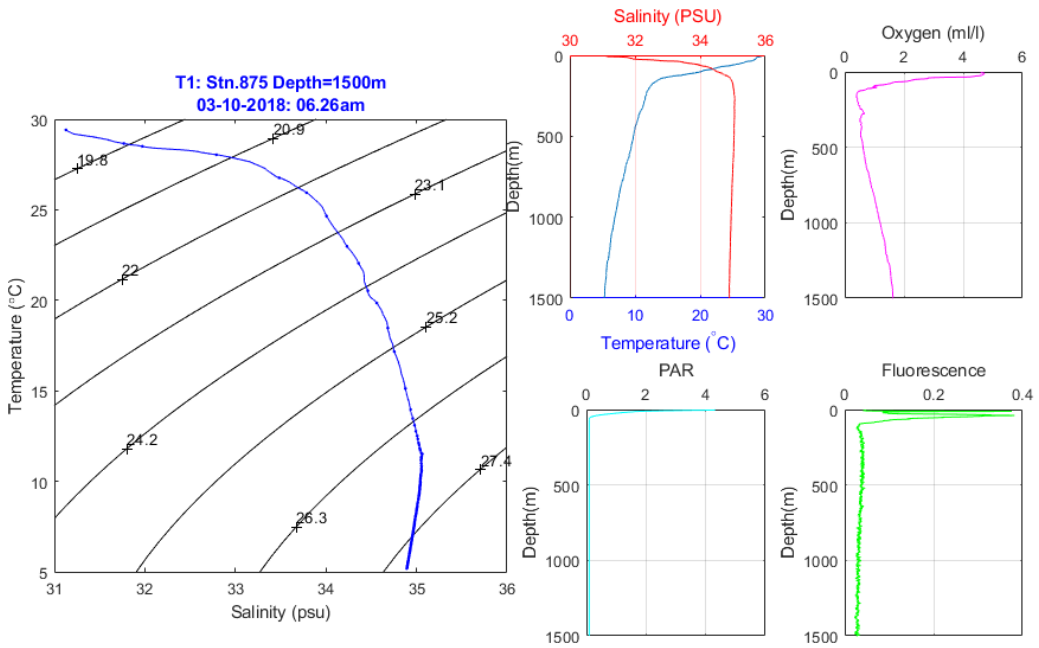
Vertical profile of temperature, salinity, oxygen, and fluorescence for all stations

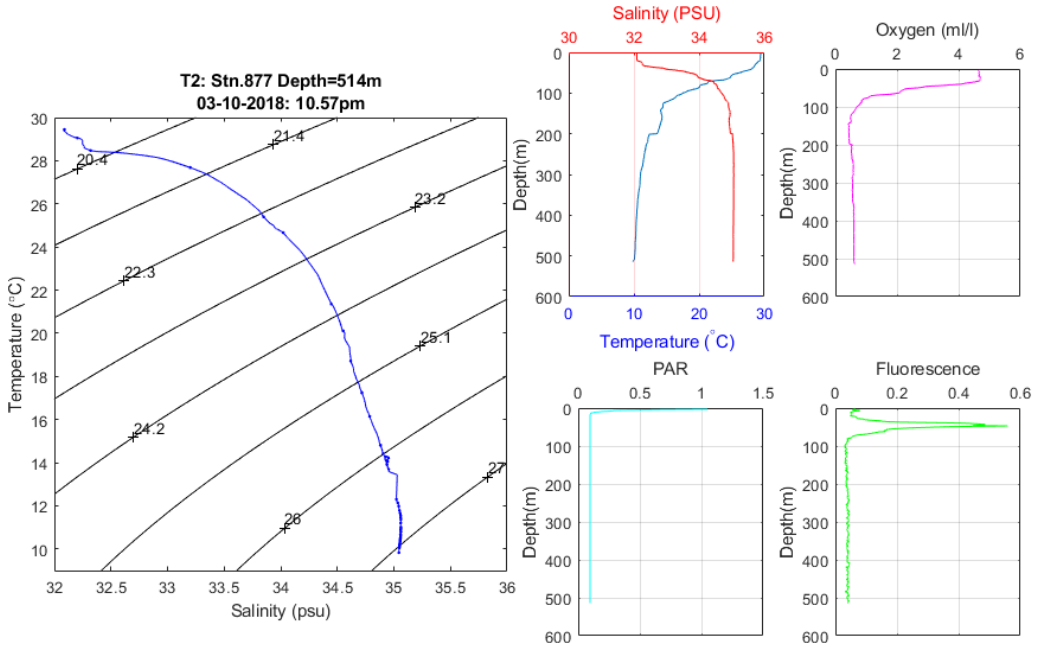


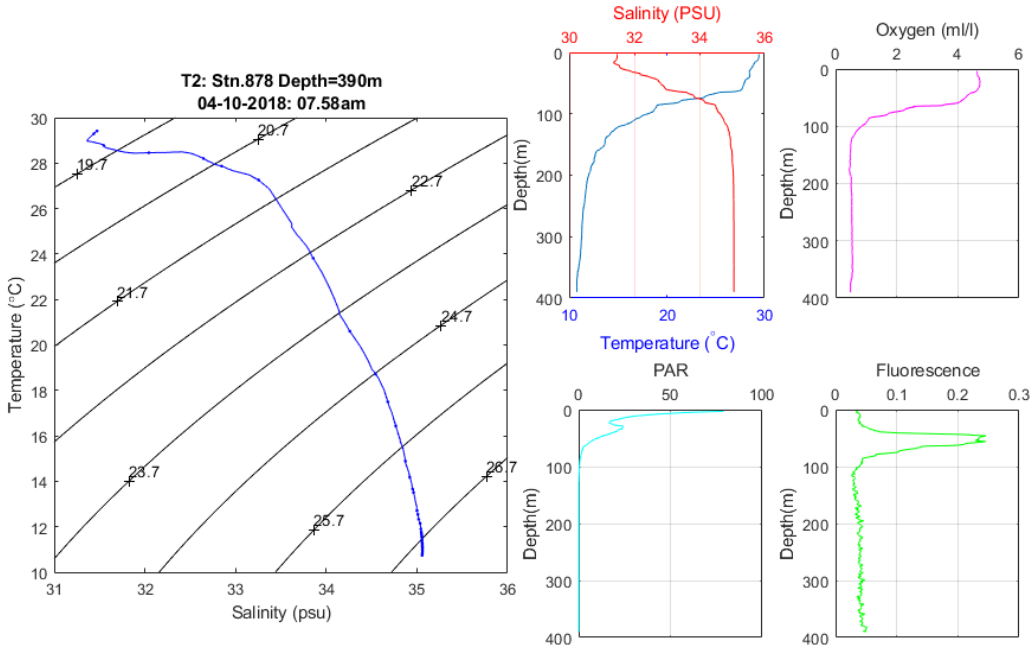


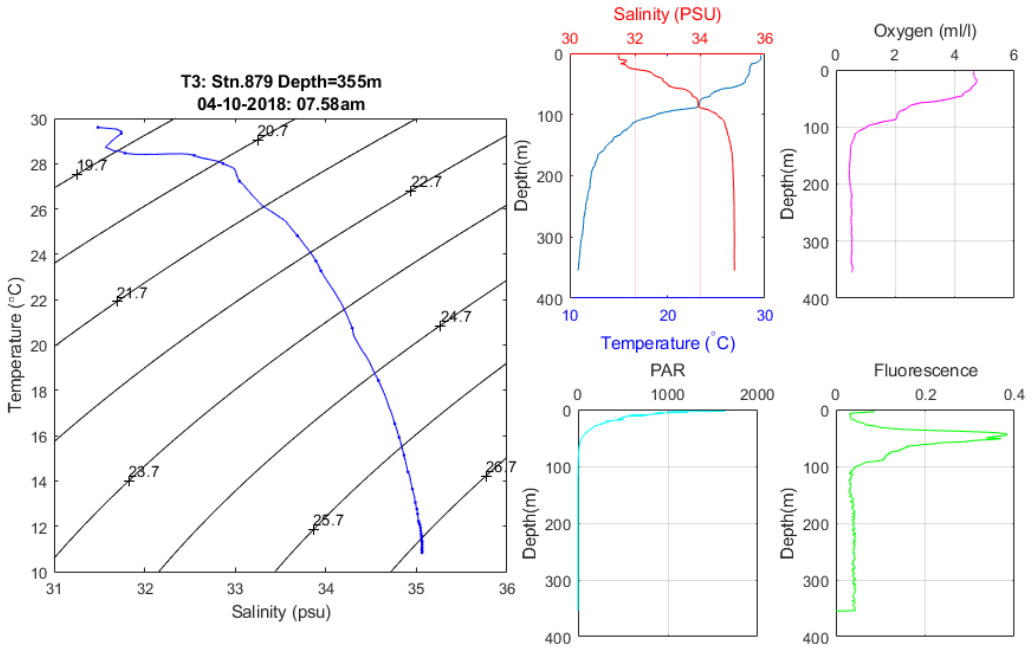

T1: Stn.874 Depth=430m
03-10-2018: 00.00am
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

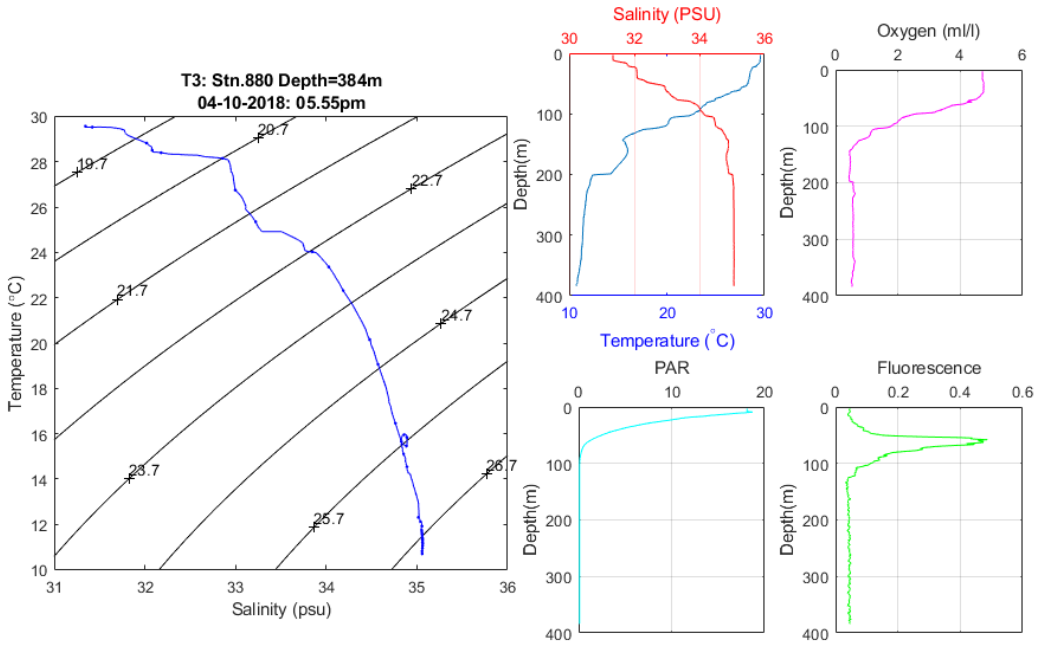

T1: Stn.876 Depth=2000m
03-10-2018: 01.17pm
Temperature (°C)
Salinity (psu)
19.8
20.9
22
23.1
24.2
25.3
26.4
27.5
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

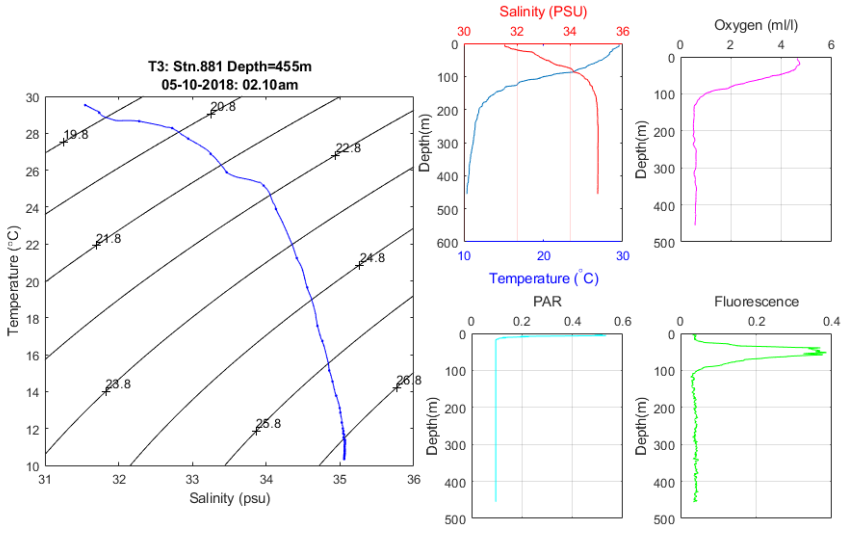

T1: Stn.875 Depth=1500m
03-10-2018: 06.26am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

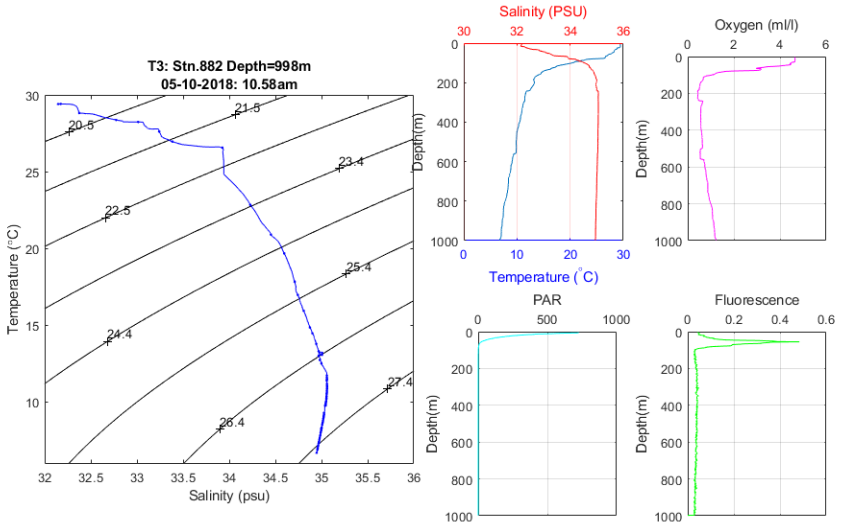

T2: Stn.877 Depth=514m
03-10-2018: 10.57pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

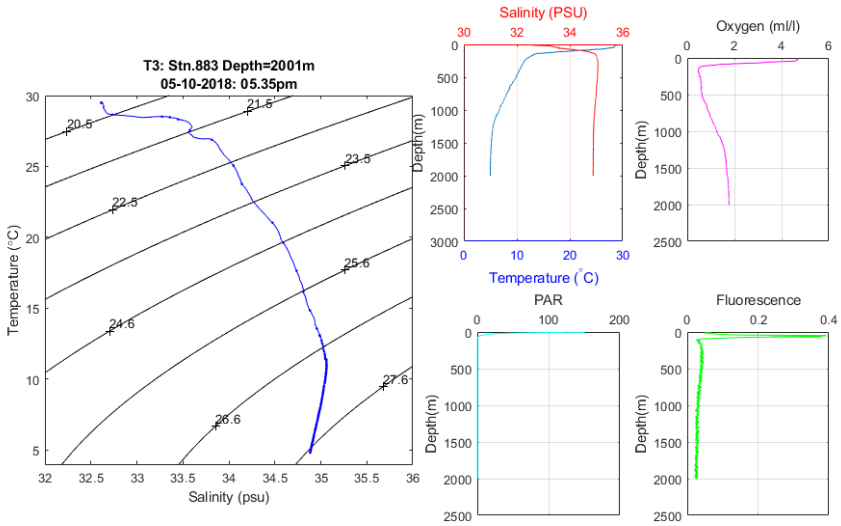

T2: Stn.878 Depth=390m
04-10-2018: 07.58am
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

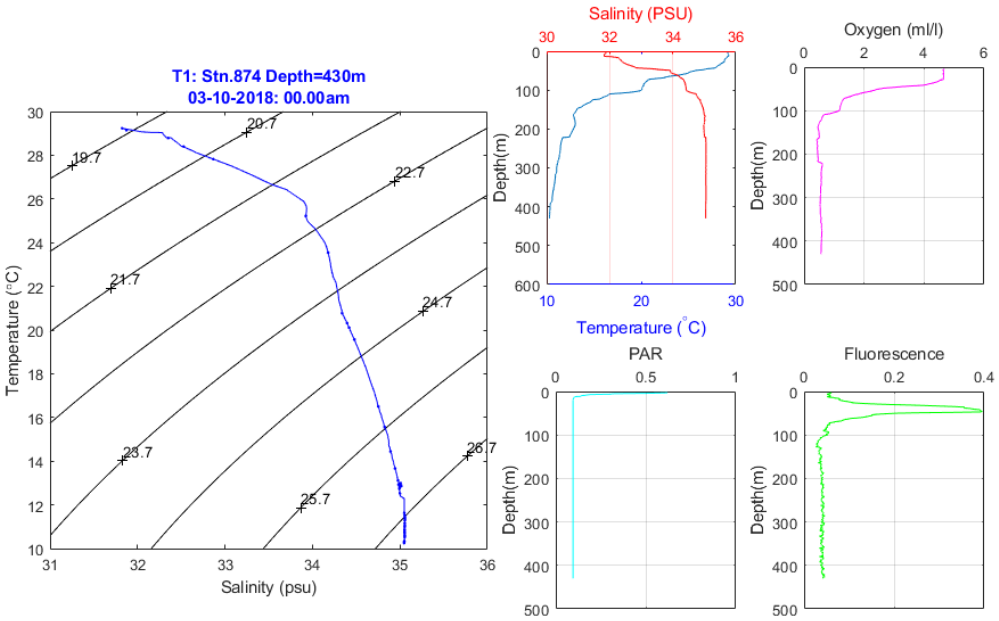

T3: Stn.879 Depth=355m
04-10-2018: 07.58am
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

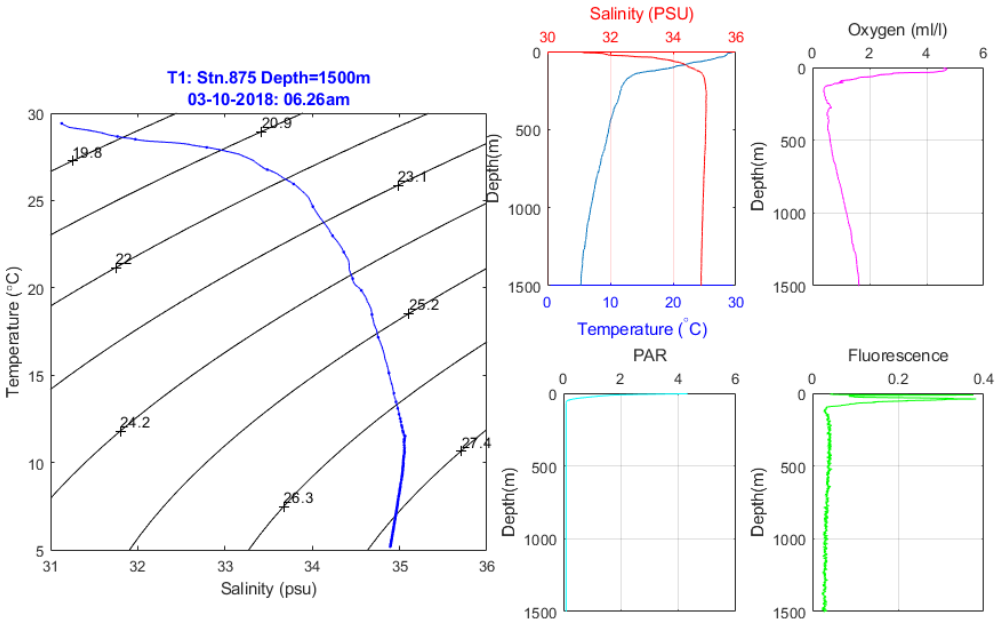

T3: Stn.880 Depth=384m
04-10-2018: 05.55pm
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Depth(m)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence

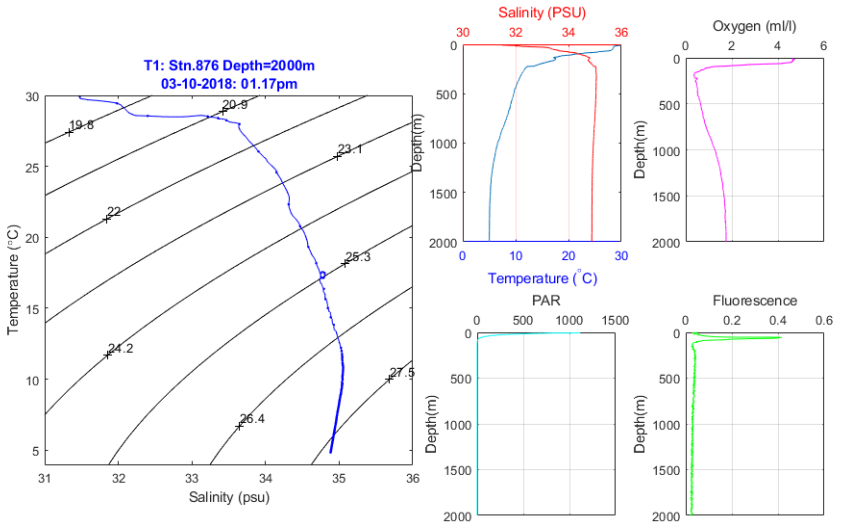

T3: Stn.881 Depth=455m
05-10-2018: 02.10am
Temperature (°C)
Salinity (psu)
19.8
20.8
21.8
22.8
23.8
24.8
25.8
26.8
Salinity (PSU)
Depth(m)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence

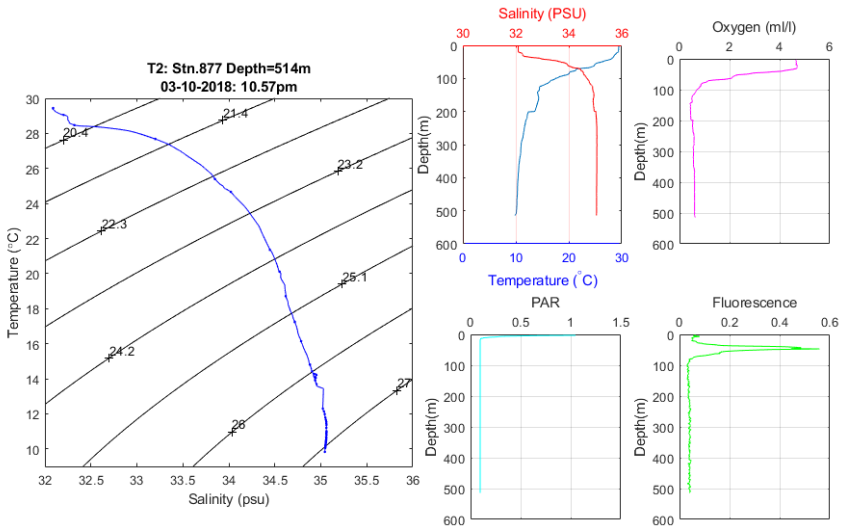

T3: Stn.882 Depth=998m
05-10-2018: 10.58am
Temperature (°C)
Salinity (psu)
20.5
21.5
22.5
23.4
24.4
25.4
26.4
27.4
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence

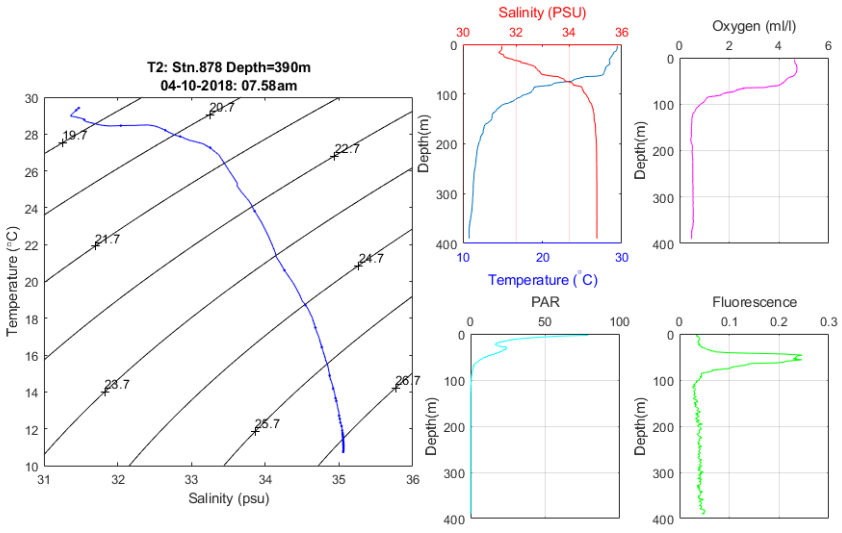

T3: Stn.883 Depth=2001m
05-10-2018: 05.35pm
Temperature (°C)
Salinity (psu)
20.5
21.5
22.5
23.5
24.6
25.6
26.6
27.6
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence

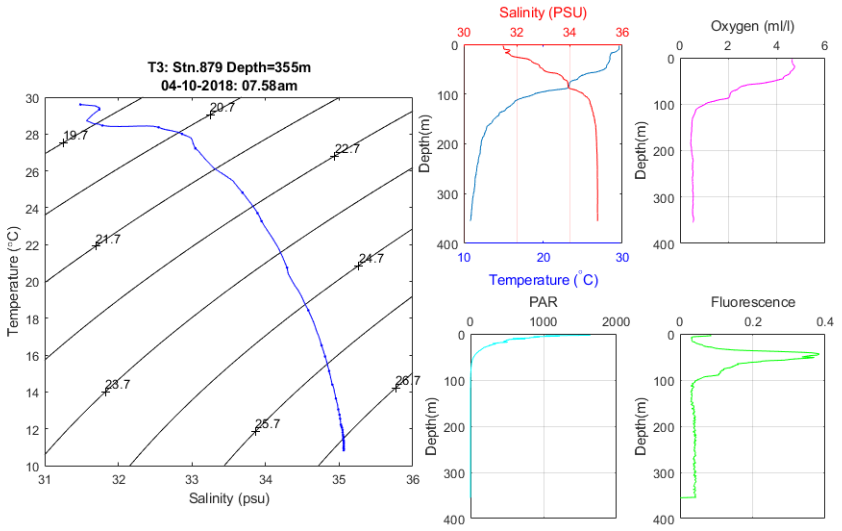

T1: Stn.874 Depth=430m
03-10-2018: 00.00am
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

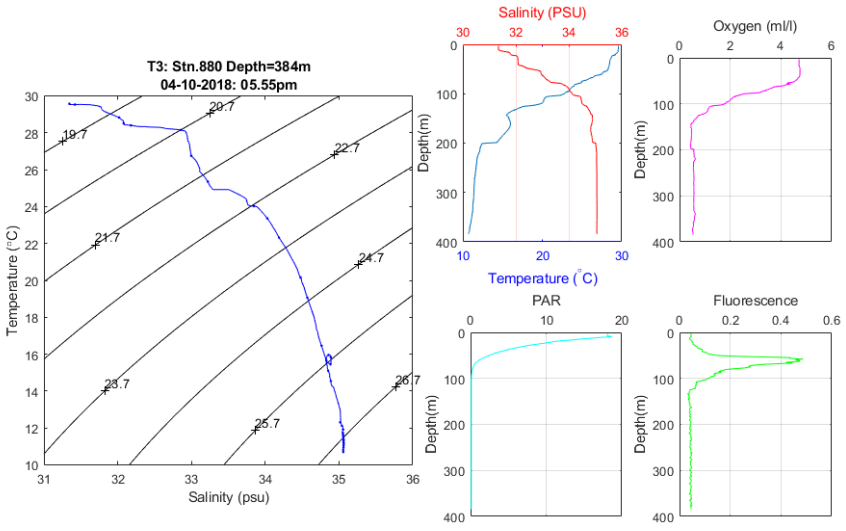

T1: Stn.875 Depth=1500m
03-10-2018: 06.26am
Temperature (°C)
Salinity (psu)
19.8
20.9
22
23.1
24.2
25.2
26.3
27.4
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

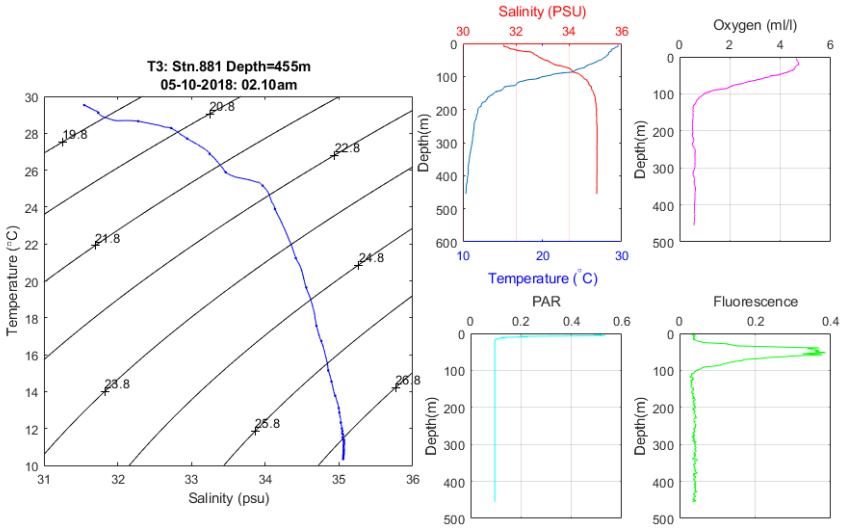

T1: Stn.876 Depth=2000m
03-10-2018: 01.17pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

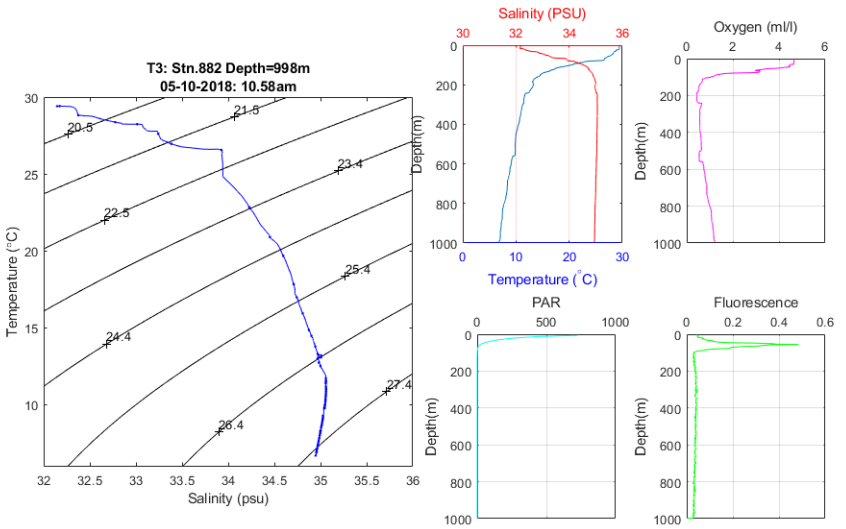

T2: Stn.877 Depth=514m
03-10-2018: 10.57pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

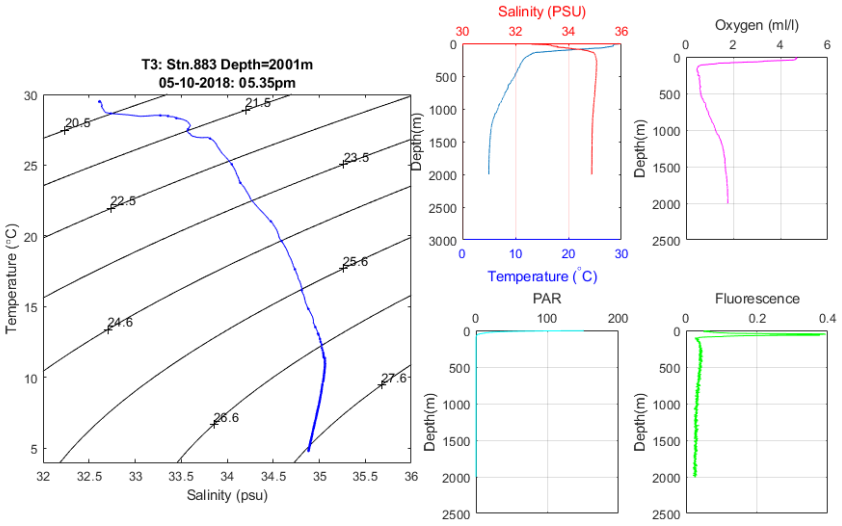

T2: Stn.878 Depth=390m
04-10-2018: 07.58am
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

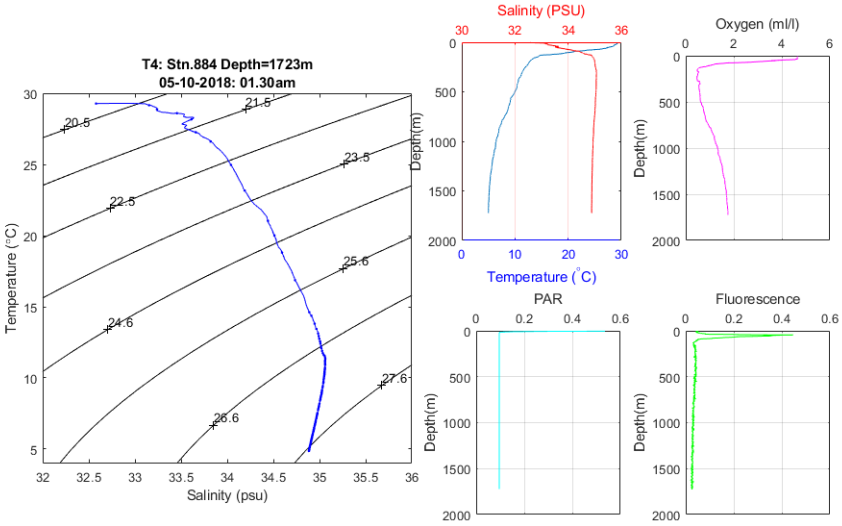

T3: Stn.879 Depth=355m
04-10-2018: 07.58am
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

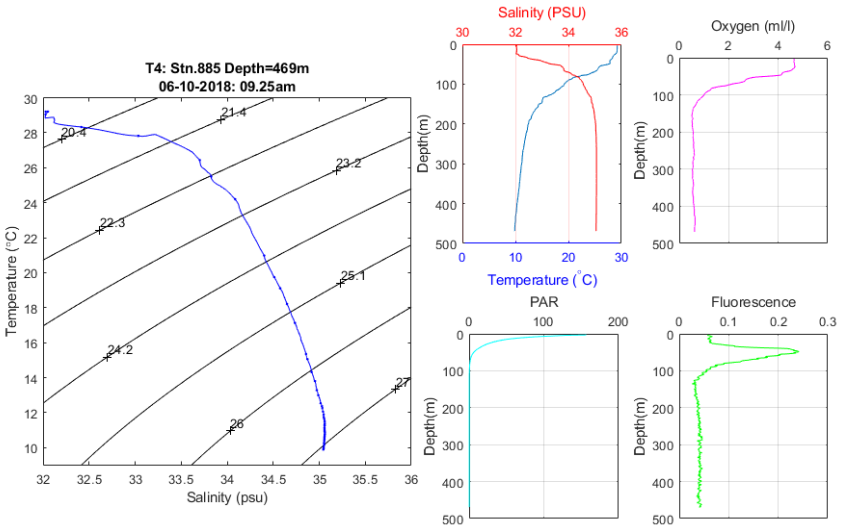

T3: Stn.880 Depth=384m
04-10-2018: 05.55pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

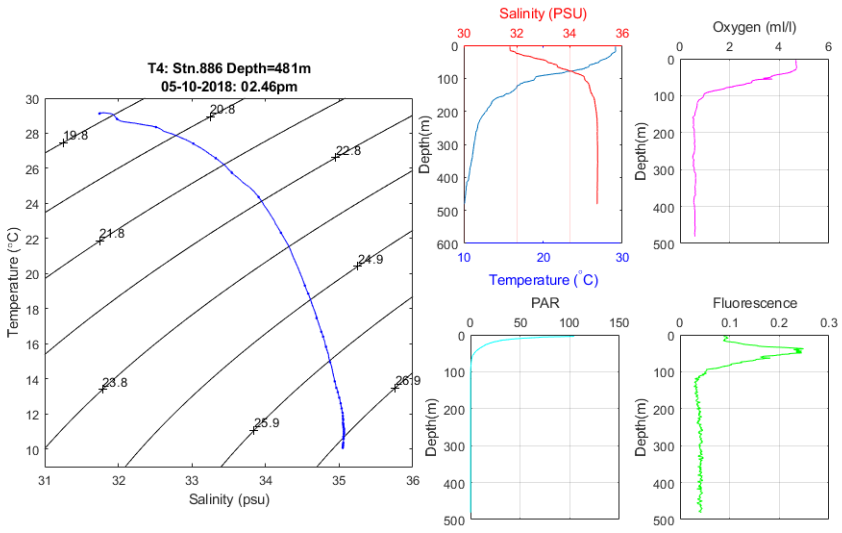

T3: Stn.881 Depth=455m
05-10-2018: 02.10am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

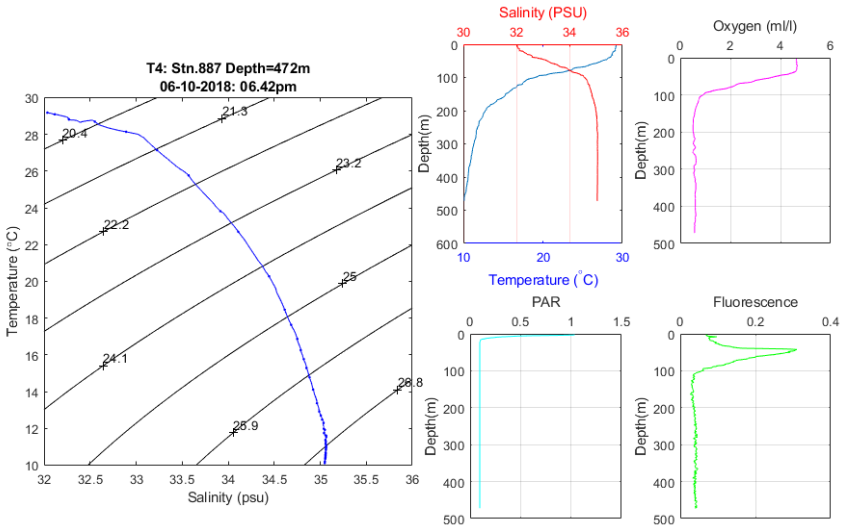

T3: Stn.882 Depth=998m
05-10-2018: 10.58am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

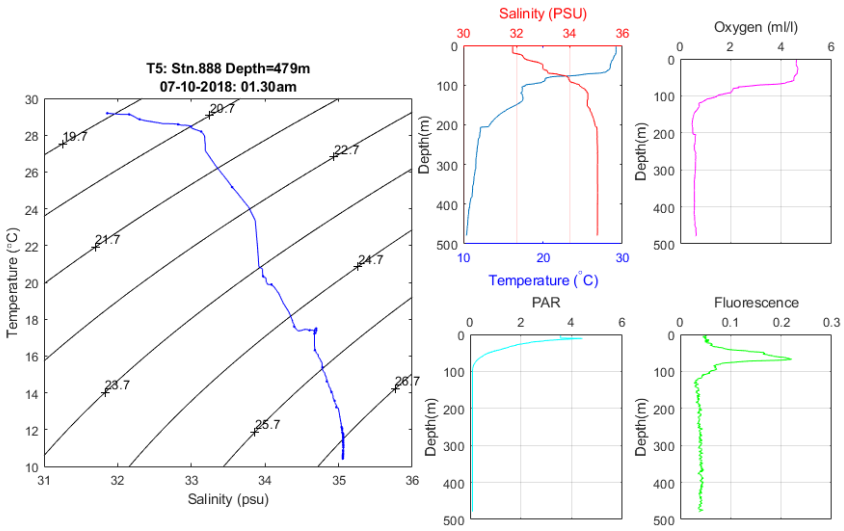

T3: Stn.883 Depth=2001m
05-10-2018: 05.35pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

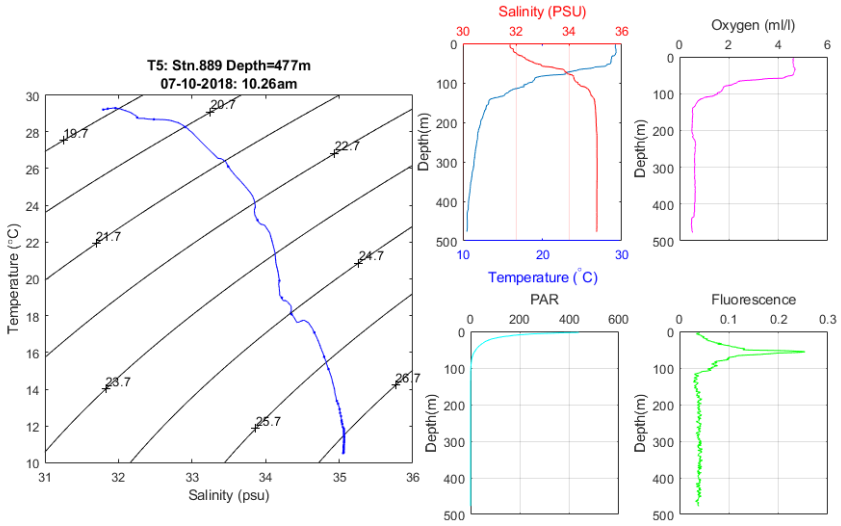

T4: Stn.884 Depth=1723m
05-10-2018: 01.30am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

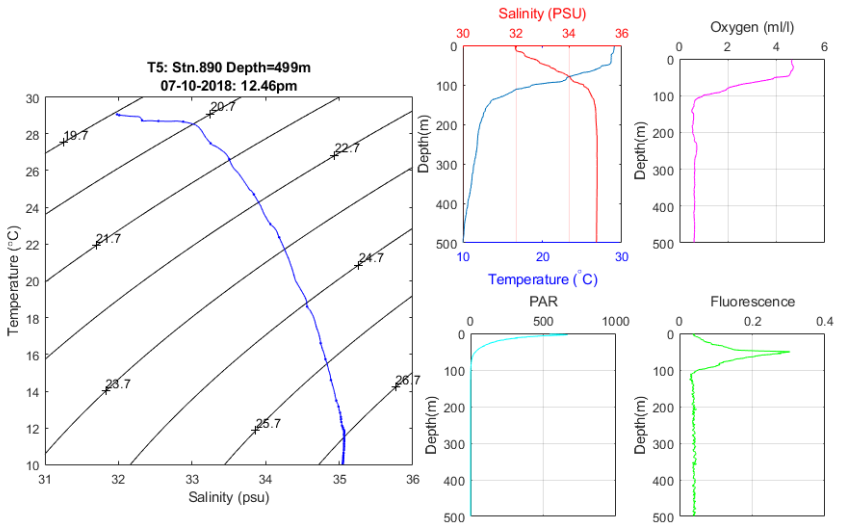

T4: Stn.885 Depth=469m
06-10-2018: 09.25am
Temperature (°C)
Salinity (psu)
20.4
21.4
22.3
23.2
24.2
25.1
26
27
Salinity (PSU)
Temperature (˚C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence

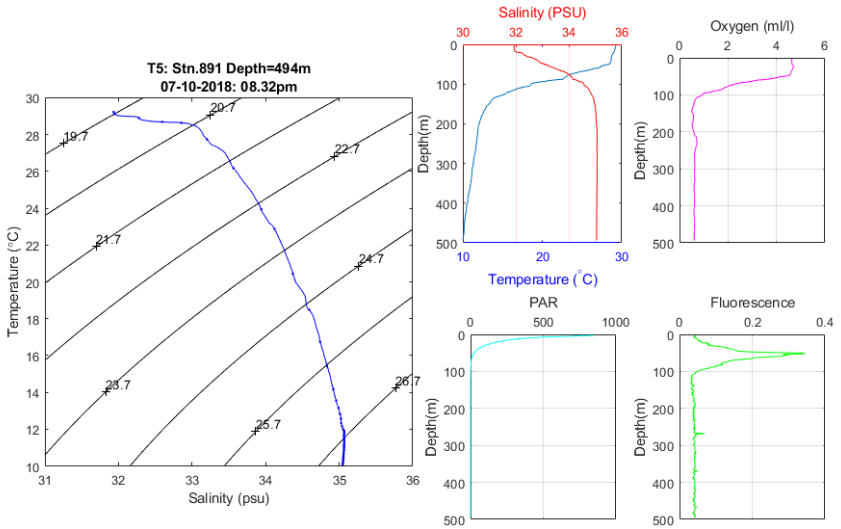

T4: Stn.886 Depth=481m
05-10-2018: 02.46pm
Temperature (°C)
Salinity (psu)
19.8
20.8
21.8
22.8
23.8
24.9
25.9
26.9
Salinity (PSU)
Temperature (˚C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence

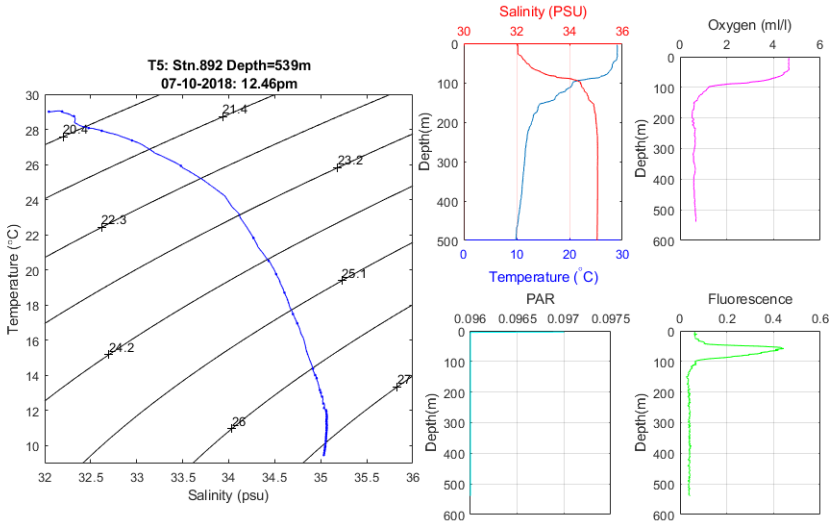

T4: Stn.887 Depth=472m
06-10-2018: 06.42pm
Temperature (°C)
Salinity (psu)
21.3
20.4
23.2
22.2
25
24.1
26.8
25.9
Salinity (PSU)
Depth(m)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence

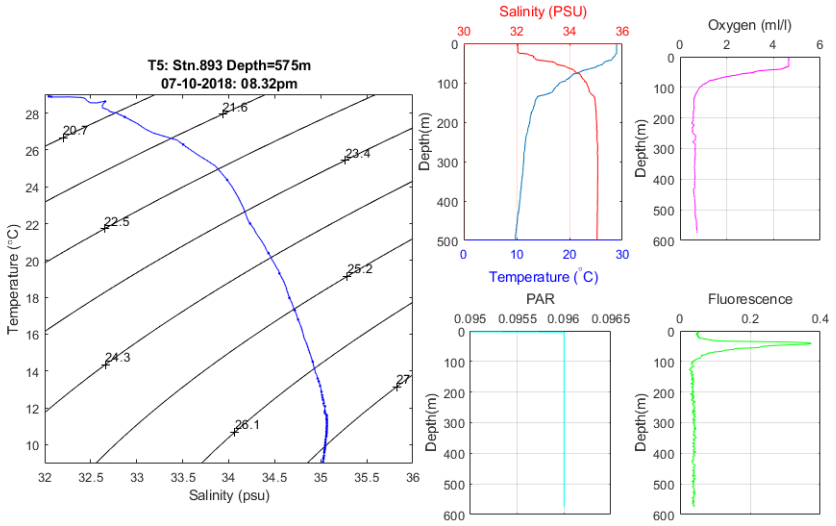

T5: Stn.888 Depth=479m
07-10-2018: 01.30am
Temperature (°C)
Salinity (psu)
20.7
19.7
22.7
21.7
24.7
23.7
26.7
25.7
Salinity (PSU)
Depth(m)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence

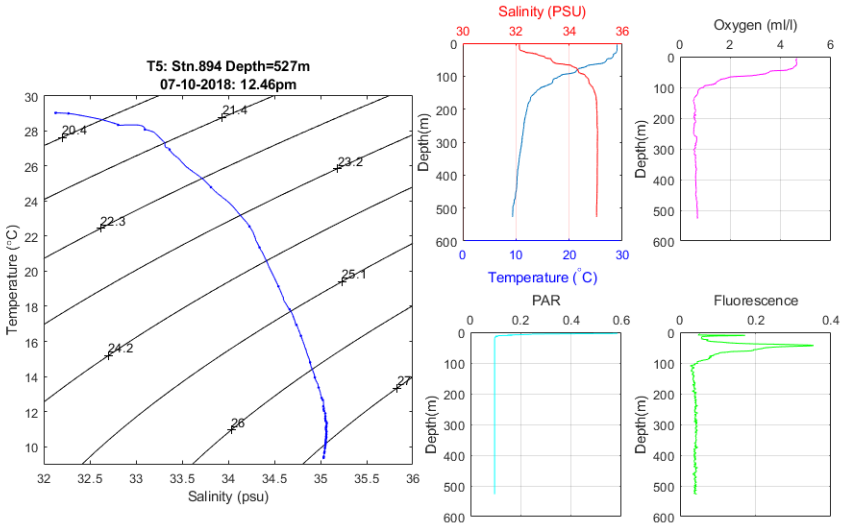

T5: Stn.889 Depth=477m
07-10-2018: 10.26am
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence

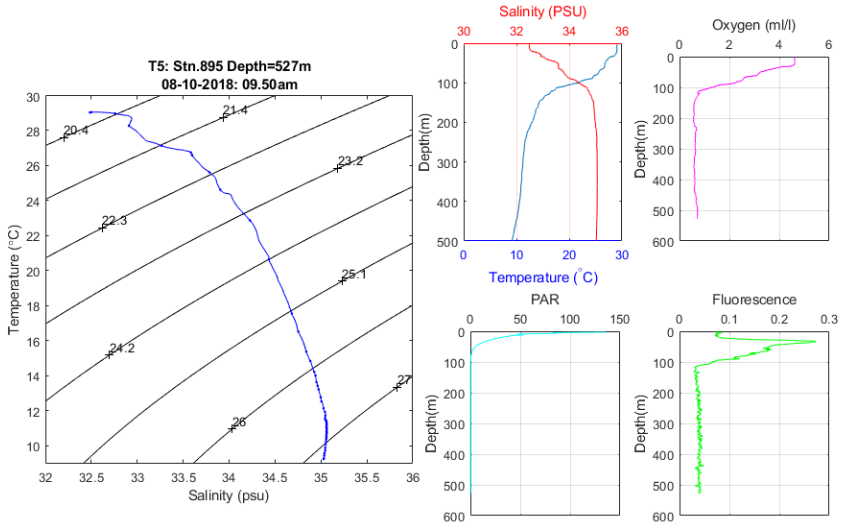

T5: Stn.890 Depth=499m
07-10-2018: 12.46pm
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence

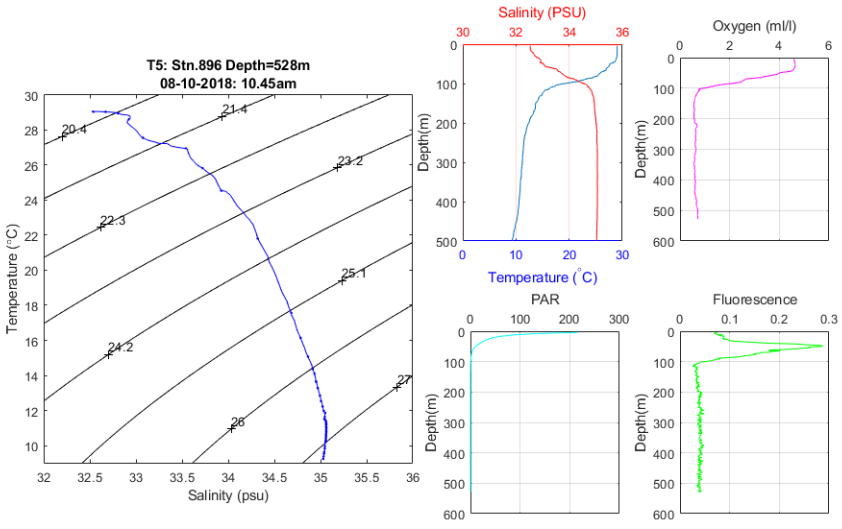

T5: Stn.891 Depth=494m
07-10-2018: 08.32pm
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence

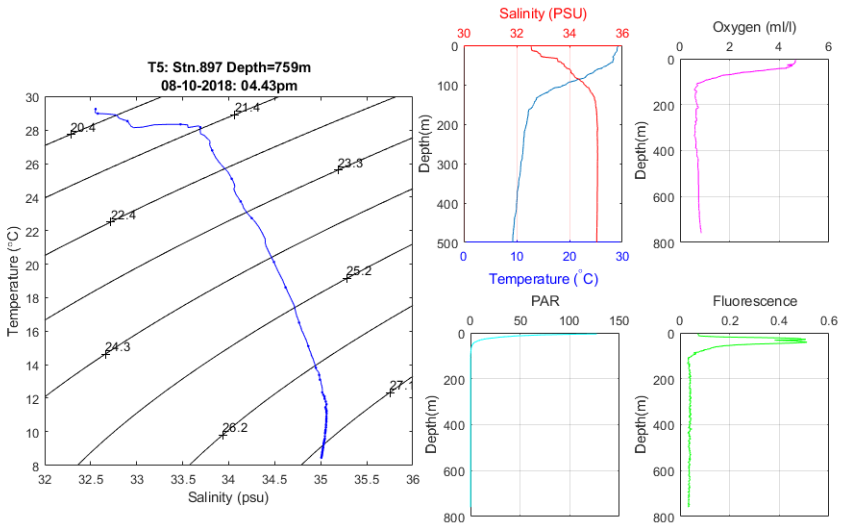

T5: Stn.892 Depth=539m
07-10-2018: 12.46pm
Temperature (°C)
Salinity (psu)
20.4
21.4
22.3
23.2
24.2
25.1
26
27
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

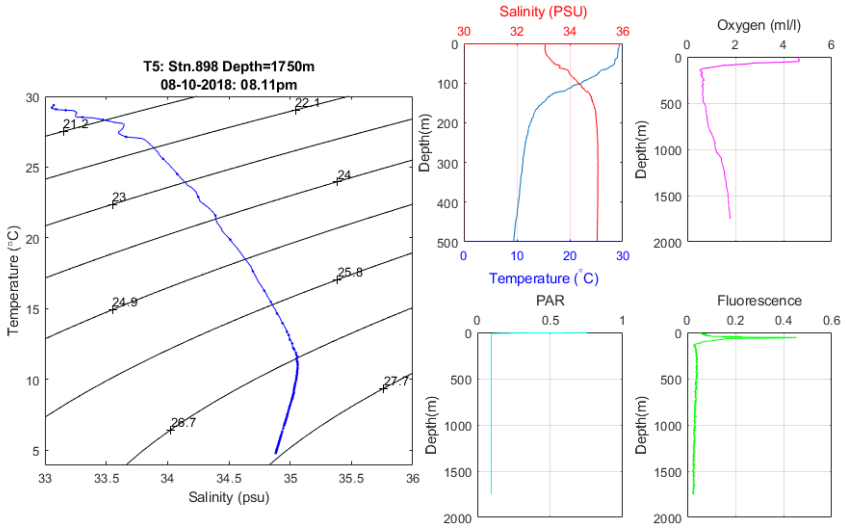

T5: Stn.893 Depth=575m
07-10-2018: 08.32pm
Temperature (°C)
Salinity (psu)
20.7
21.6
22.5
23.4
24.3
25.2
26.1
27
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

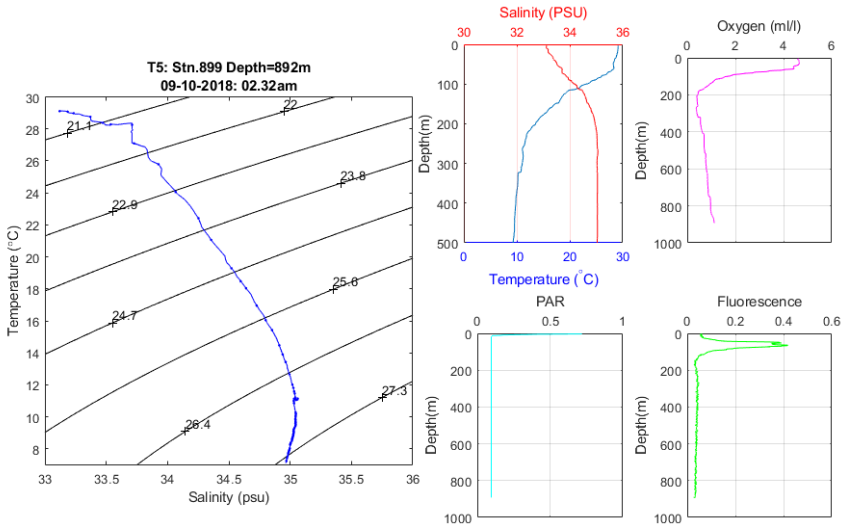

T5: Stn.894 Depth=527m
07-10-2018: 12.46pm
Temperature (°C)
Salinity (psu)
20.4
21.4
22.3
23.2
24.2
25.1
26
27
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

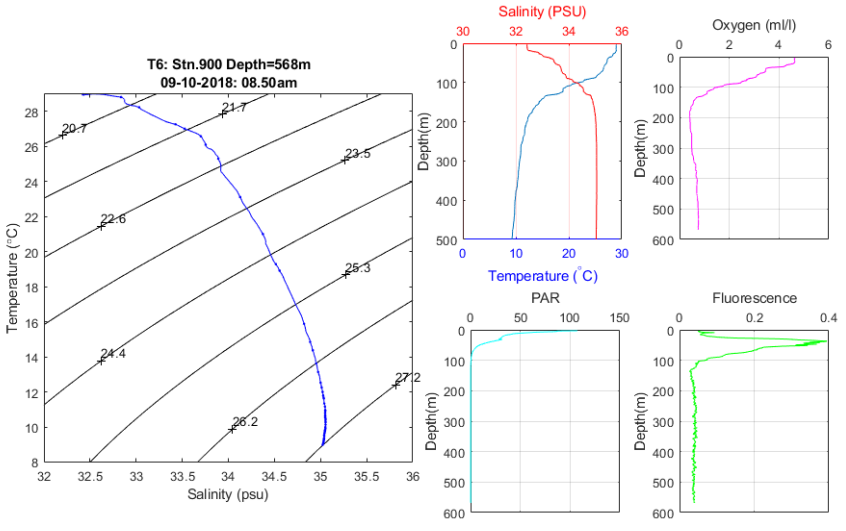

T5: Stn.895 Depth=527m
08-10-2018: 09.50am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Depth(m)
Temperature (°C)
PAR
Fluorescence

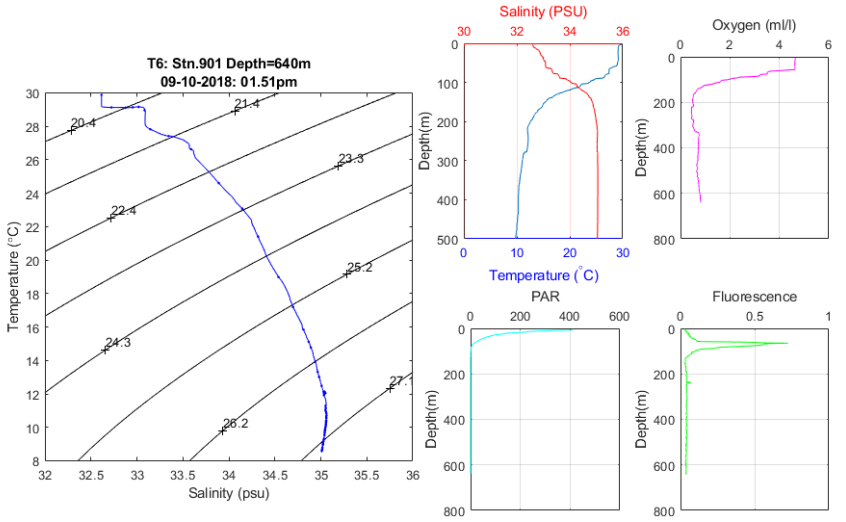

T5: Stn.896 Depth=528m
08-10-2018: 10.45am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Depth(m)
Temperature (°C)
PAR
Fluorescence

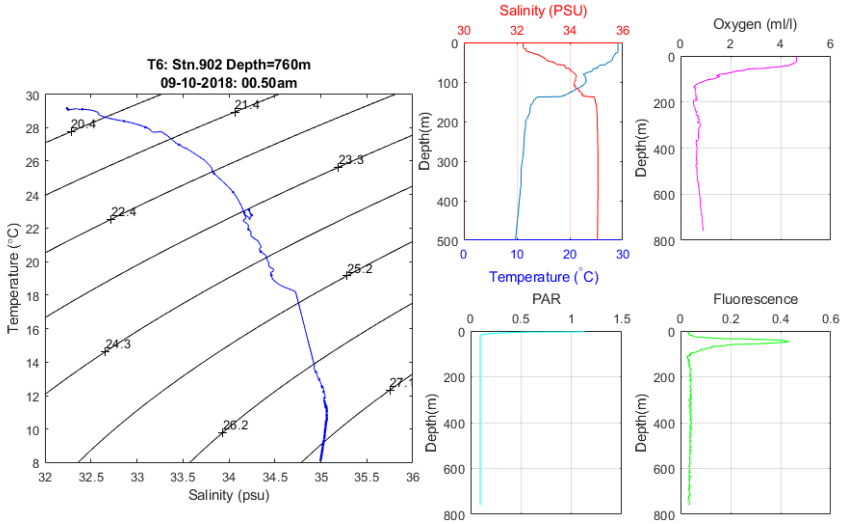

T5: Stn.897 Depth=759m
08-10-2018: 04.43pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Depth(m)
Temperature (°C)
PAR
Fluorescence

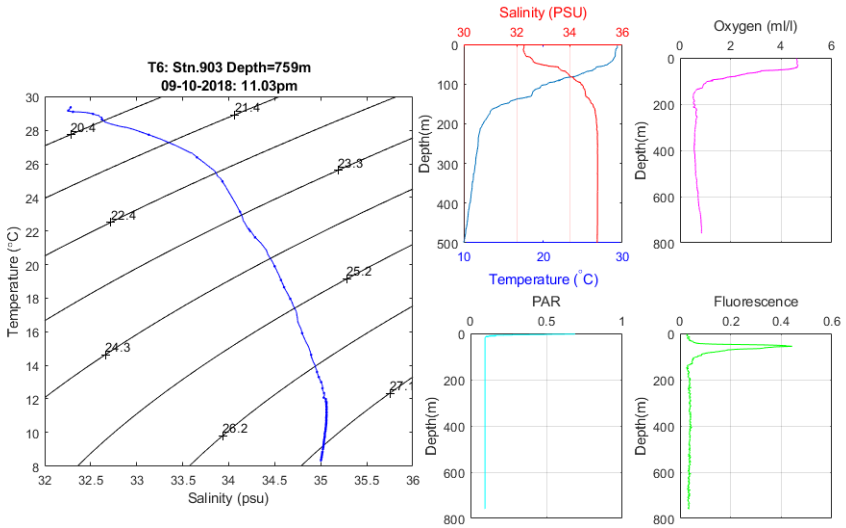

T5: Stn.898 Depth=1750m
08-10-2018: 08.11pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

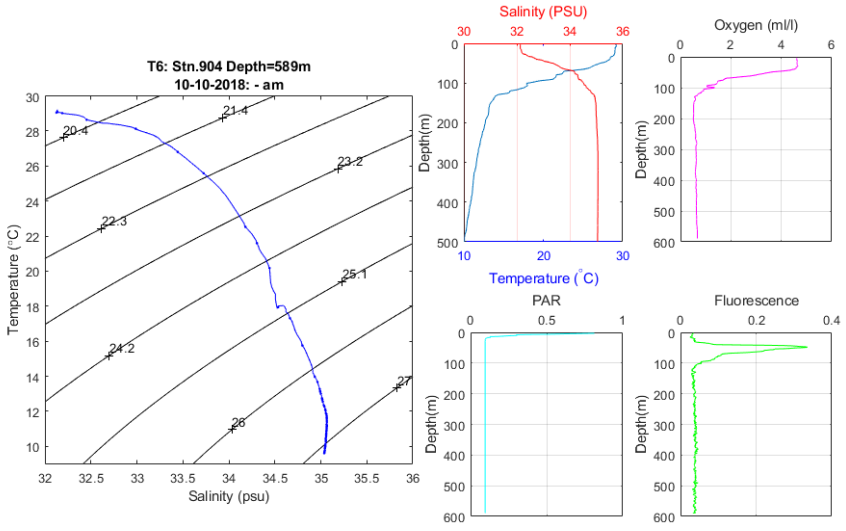

T5: Stn.899 Depth=892m
09-10-2018: 02.32am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

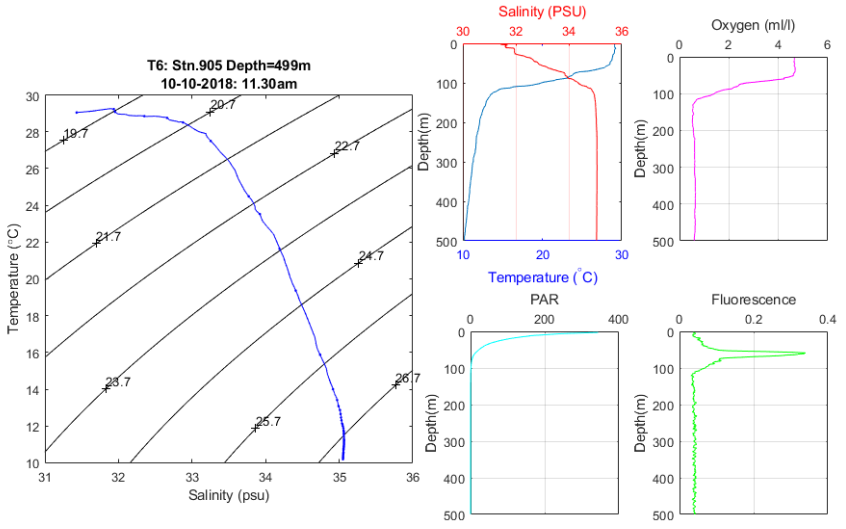

T6: Stn.900 Depth=568m
09-10-2018: 08.50am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

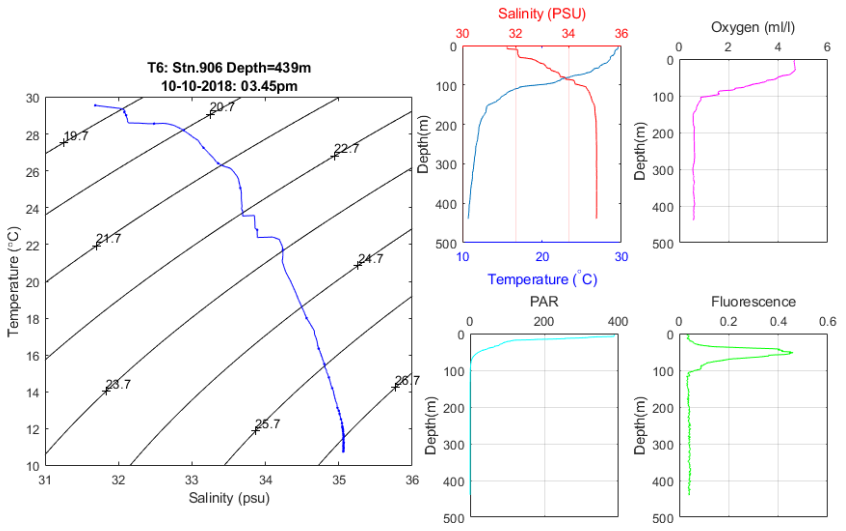

T6: Stn.901 Depth=640m
09-10-2018: 01.51pm
Temperature (°C)
Salinity (psu)
20.4
21.4
22.4
23.3
24.3
25.2
26.2
27
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

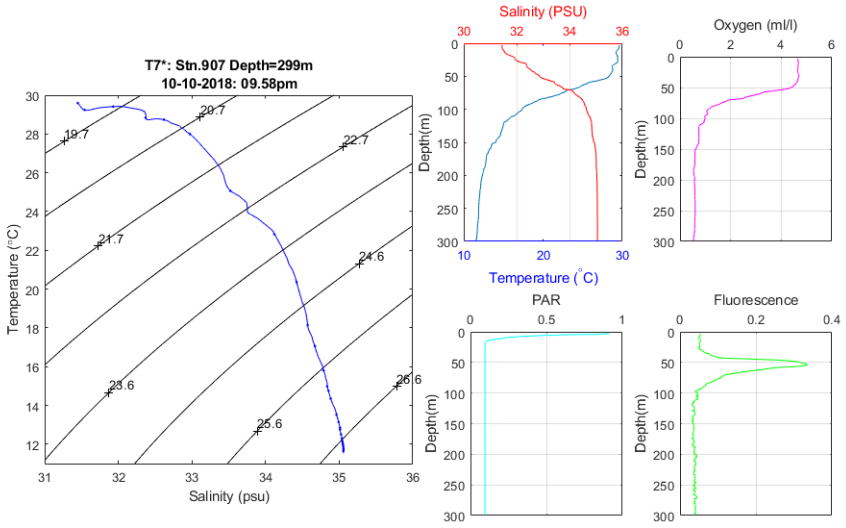

T6: Stn.902 Depth=760m
09-10-2018: 00.50am
Temperature (°C)
Salinity (psu)
20.4
21.4
22.4
23.3
24.3
25.2
26.2
27
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

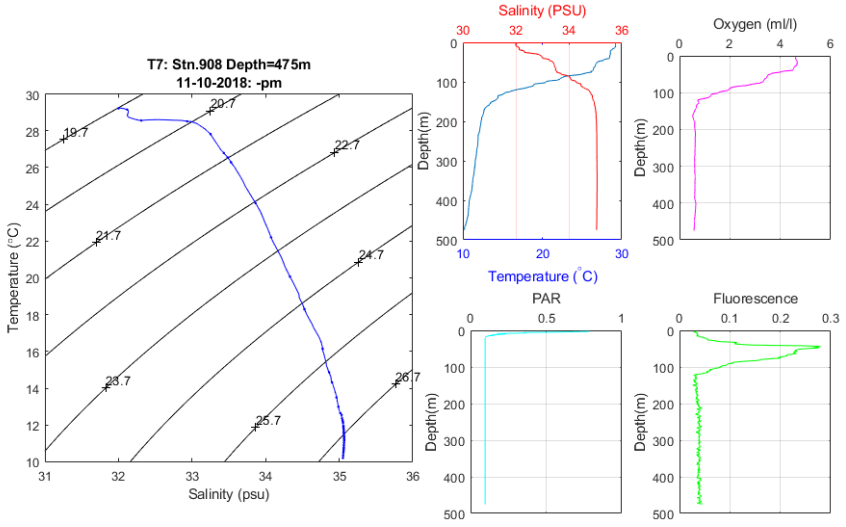

T6: Stn.903 Depth=759m
09-10-2018: 11.03pm
Temperature (°C)
Salinity (psu)
20.4
21.4
22.4
23.3
24.3
25.2
26.2
27
Salinity (PSU)
Depth(m)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence

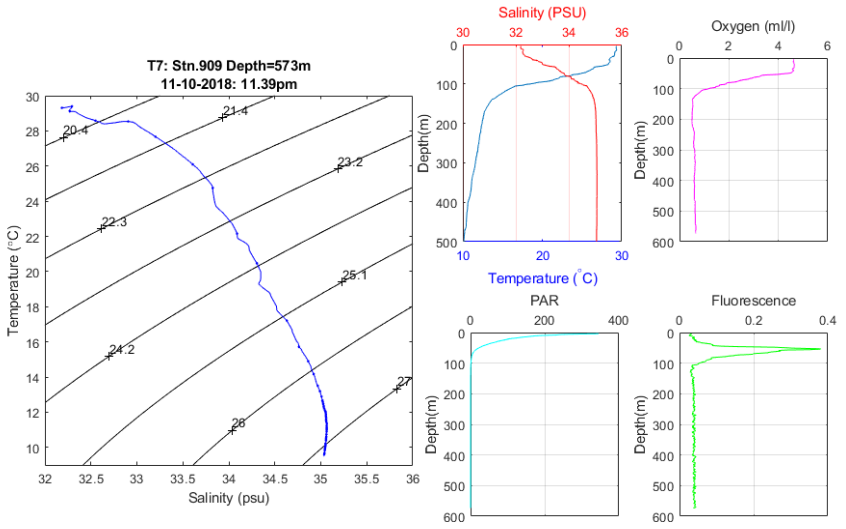

T6: Stn.904 Depth=589m
10-10-2018: - am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

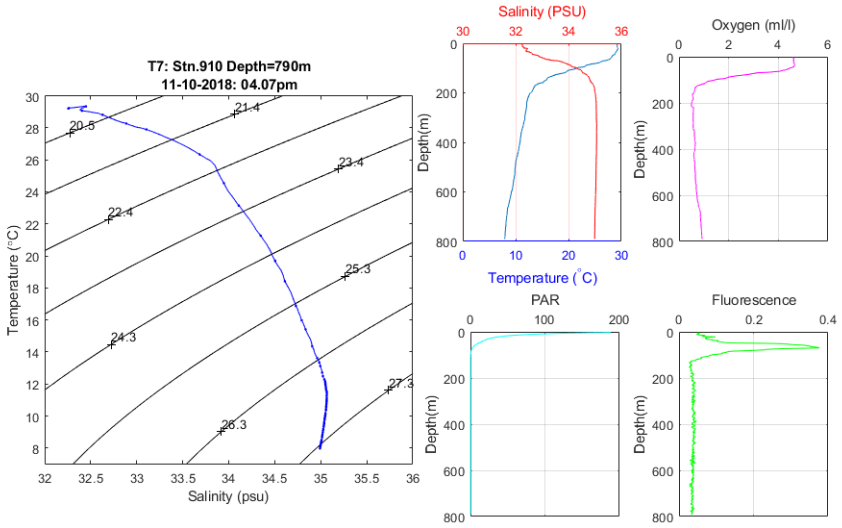

T6: Stn.905 Depth=499m
10-10-2018: 11.30am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

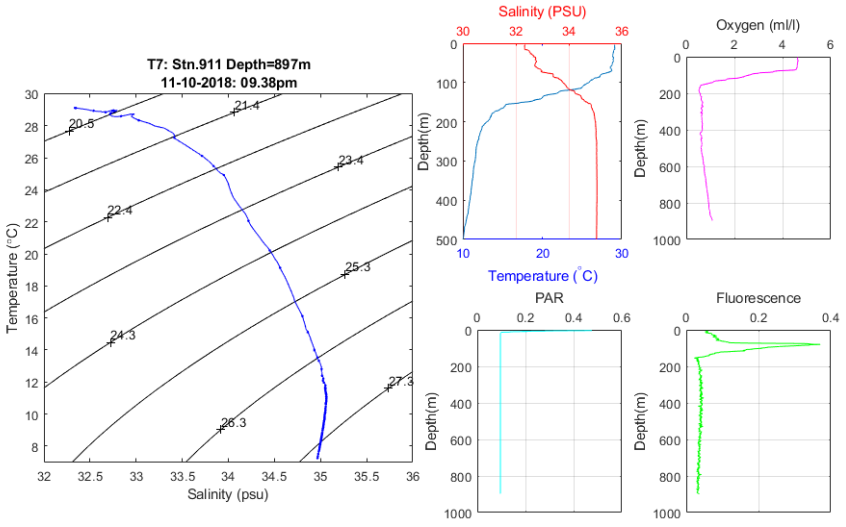

T6: Stn.906 Depth=439m
10-10-2018: 03.45pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Temperature (°C)
Oxygen (ml/l)
PAR
Fluorescence
Depth(m)

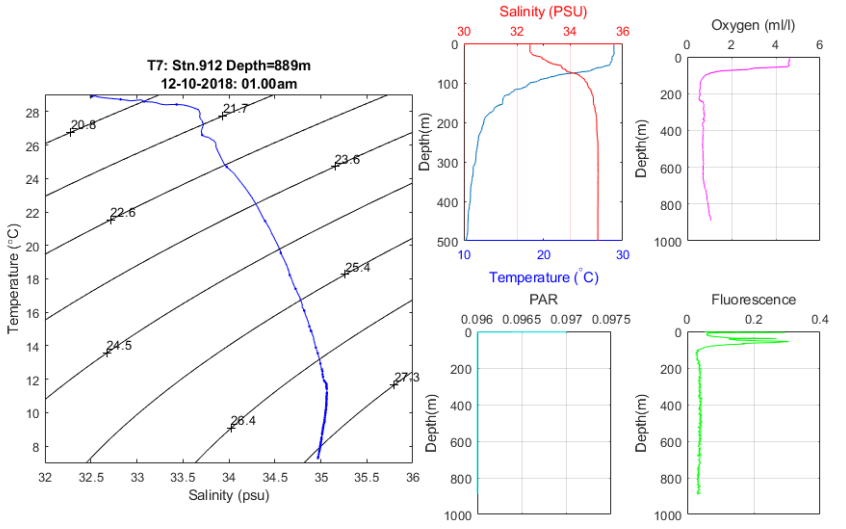

T7*: Stn.907 Depth=299m
10-10-2018: 09.58pm
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.6
24.6
25.6
26.6
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence


T7: Stn.908 Depth=475m
11-10-2018: -pm
Temperature (°C)
Salinity (psu)
19.7
20.7
21.7
22.7
23.7
24.7
25.7
26.7
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence


T7: Stn.909 Depth=573m
11-10-2018: 11.39pm
Temperature (°C)
Salinity (psu)
20.4
21.4
22.3
23.2
24.2
25.1
26
27
Salinity (PSU)
Temperature (°C)
Depth(m)
Oxygen (ml/l)
PAR
Fluorescence


T7: Stn.910 Depth=790m
11-10-2018: 04.07pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)


T7: Stn.911 Depth=897m
11-10-2018: 09.38pm
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)


T7: Stn.912 Depth=889m
12-10-2018: 01.00am
Temperature (°C)
Salinity (psu)
Salinity (PSU)
Oxygen (ml/l)
Temperature (°C)
PAR
Fluorescence
Depth(m)

ANNEX IX. OVERVIEW OF PLANKTON SAMPLES

Table IX1. Number of phytoplankton and zooplankton samples from superstations

				Phytoplankton net	Zooplankton WP2	
St. nr.	Year	Month	Day	Bottles (formol)	Bottles (formol)	Biomass Alu-trays
872	2018	10	2	2	2	3
873	2018	10	2	2	2	3
874	2018	10	2	2	2	3
875	2018	10	3	2	2	3
876	2018	10	3	2	2	3
877	2018	10	3	2	2	3
878	2018	10	4	2	2	3
880	2018	10	4	2	2	3
881	2018	10	4	2	2	3
882	2018	10	5	2	2	3
883	2018	10	5	2	2	3
884	2018	10	5	2	2	3
885	2018	10	6	2	2	3
887	2018	10	6	2	2	3
888	2018	10	7	2	2	3
890	2018	10	7	2	2	3
893	2018	10	7	2	2	3
895	2018	10	8	2	2	3
898	2018	10	8	2	2	3
899	2018	10	8	2	2	3
901	2018	10	9	2	2	3
903	2018	10	9	2	2	3
905	2018	10	10	2	2	3
907	2018	10	10	2	2	3
908	2018	10	11	2	2	3
910	2018	10	11	2	2	3
912	2018	10	11	2	2	3
914	2018	10	12	2	2	3
916	2018	10	12	2	2	3
918	2018	10	13	2	2	3
Total number				**60**	**60**	**90**

Table IX2. Number of ichtyoplankton samples from Multinet at superstations

						Fishegg	Fishlarvae
St. nr.	Year	Month	Day	Bottles (formol)	Bottles (ethanol)	Small tubes (ethanol)	Small tubes (ethanol)
872	2018	10	2				
873	2018	10	2	1	1	0	1
874	2018	10	2	1	1	0	2
875	2018	10	3	1	1	0	2
876	2018	10	3	1	1	0	1
877	2018	10	3	1	1	0	1
878	2018	10	4	1	1	0	1
880	2018	10	4	1	1	0	1
881	2018	10	4	1	1	1	1
882	2018	10	5	1	1	1	1
883	2018	10	5	1	1	0	1
884	2018	10	5	1	1	0	3
885	2018	10	6	1	1	0	2
887	2018	10	6	1	1	0	1
888	2018	10	7	1	1	0	1
890	2018	10	7	1	1	0	1
893	2018	10	7	1	1	0	1*
895	2018	10	8	1	1	0	1
898	2018	10	8	1	1	0	1
899	2018	10	8	1	1	0	1
901	2018	10	9	1	1	0	1**
903	2018	10	9	1	1	1	2
905	2018	10	10	1	1	0	1
907	2018	10	10	1	1	0	2
908	2018	10	11	1	1	0	1
910	2018	10	11	1	1	0	2
912	2018	10	11	1	1	0	2
914	2018	10	12	1	1	1	1
916	2018	10	12	1	1	1	4
918	2018	10	13	1	1	1	1
Total number				**29**	**29**	**6**	**41 (+2)**

*(+1 with 1 squid larvae)
**(+1with 2 squid larvae)

Table IX3. Number of microplastic and ichtyoplankton samples from Manta trawl at superstations

				Microplastic		Fishegg	Fishlarvae
St. nr.	Year	Month	Day	Alu-trays	Bottles (ethanol)	Small tubes (ethanol)	Small tubes (ethanol)
872	2018	10	2	1	1	1	1
873	2018	10	2	1	1	Not sorted	Not sorted
874	2018	10	2	1	1	Not sorted	Not sorted
875	2018	10	3	0	1	Not sorted	Not sorted
876	2018	10	3	1	1	Not sorted	Not sorted
877	2018	10	3	0	1	Not sorted	Not sorted
878	2018	10	4	1	1	1	1
880	2018	10	4	0	1	0	1
881	2018	10	4	1	1	1	1
882	2018	10	5	1	1	1	1
883	2018	10	5	0	1	0	3
884	2018	10	5	1	1	0	0
885	2018	10	6	0	1	0	4
887	2018	10	6	1	1	0	2
888	2018	10	7	1	1	1	1
890	2018	10	7	1	1	0	1
893	2018	10	7	1	1	0	0
895	2018	10	8	1	1	0	2
898	2018	10	8	1	1	0	1
899	2018	10	8	1	1	1	1
901	2018	10	9	1	1	0	1
903	2018	10	9	1	1	0	1
905	2018	10	10	1	1	0	1
907	2018	10	10	0	1	0	1
908	2018	10	11	1	1	0	1
910	2018	10	11	1	1	0	17
912	2018	10	11	1	1	0	0
914	2018	10	12	1	1	0	2
916	2018	10	12	0	1	1	3
918	2018	10	13	1	1	1	1
Total number				**23**	**30**	**8**	**48**
				Big volume		1/4 of sample	1/4 of sample

Table IX4. Small water pump sampling

Sample number	Date	Time start (local)	Flowmeter start	Date	Time end (local)	Flowmeter end
48	02.10.18	08:57	909218	02.10.18	14:56	913581
49	02.10.18	14:57	913593	02.10.18	20:56	917879
50	02.10.18	20:57	917879	03.10.18	02:56	921922
51	03.10.18	02:57	921930	03.10.18	08:55	926971
52	03.10.18	08:56	926979	03.10.18	14:56	930070
53	03.10.18	14:56	930090	03.10.18	20:56	933941
54	03.10.18	20:57	933945	04.10.18	02:56	937804
55	04.10.18	02:57	937812	04.10.18	08:57	941794
56	04.10.18	08:58	941798	04.10.18	14:56	945611
57	04.10.18	14:57	945616	04.10.18	20:56	949661
58	04.10.18	20:57	949688	05.10.18	02:58	953523
59	05.10.18	02:59	953538	05.10.18	08:57	957459
60	05.10.18	08:58	957463	05.10.18	14:57	961133
61	05.10.18	14:58	961149	05.10.18	20:57	964913
62	05.10.18	20:58	964920	06.10.18	02:57	968605
63	06.10.18	02:58	968611	06.10.18	08:56	972215
64	06.10.18	08:57	972226	06.10.18	14:58	975850
65	06.10.18	14:59	975855	06.10.18	20:52	979576
66	06.10.18	20:53	979653	07.10.18	02:58	983128
67	07.10.18	02:59	983132	07.10.18	08:55	986896
68	07.10.18	08:56	986909	07.10.18	14:57	990589
69	07.10.18	14:58	990685	07.10.18	20:55	994343
70	07.10.18	20:56	994466	08.10.18	05:01	999484
71	08.10.18	05:02	999498	08.10.18	08:56	1007883
72	08.10.18	08:57	1001998	08.10.18	14:57	1005422
73	08.10.18	14:58	1005430	08.10.18	20:56	1008944
74	08.10.18	20:57	1008958	09.10.18	02:57	1012324
75	09.10.18	02:58	1012328	09.10.18	08:55	1015538
76	09.10.18	08:56	1016932	09.10.18	14:57	1019426
77	09.10.18	14:58	1019429	09.10.18	21:06	1023071
78	09.10.18	21:07	1023085	10.10.18	02:58	1026497
79	10.10.18	02:59	1026501	10.10.18	08:56	1030053
80	10.10.18	08:57	1030166	10.10.18	14:57	1033644
81	10.10.18	14:58	1033647	10.10.18	20:58	1037236
82	10.10.18	20:59	1037240	11.10.18	02:58	1040819
83	11.10.18	02:59	1040824	11.10.18	08:56	1044345
84	11.10.18	08:57	1044448	11.10.18	14:54	1047968
85	11.10.18	14:58	1047973	11.10.18	20:58	1051698
86	11.10.18	20:59	1051704	12.10.18	03:00	1055451
87	12.10.18	03:00	1055458	12.10.18	08:56	1058863
88	12.10.18	08:57	1058857	12.10.18	14:57	1062415
89	12.10.18	14:58	1062428	12.10.18	20:56	1065918
90	12.10.18	20:59	1065924	13.10.18	02:57	1069472
91	13.10.18	02:58	1069488	13.10.18	08:58	1072712
92	13.10.18	08:59	1072719	13.10.18	14:57	1075935

Table IX5. Big water pump, CUVES, sampling

Sample number	Date	Time start (local)	Date	Time end (local)
48	02.10.18	08:59	02.10.18	14:58
49	02.10.18	14:59	02.10.18	20:58
50	02.10.18	20:59	03.10.18	02:57
51	03.10.18	02:58	03.10.18	08:57
52	03.10.18	08:58	03.10.18	14:57
53	03.10.18	14:58	03.10.18	20:57
54	03.10.18	20:59	04.10.18	02:59
55	04.10.18	03:00	04.10.18	08:57
56	04.10.18	08:59	04.10.18	14:58
57	04.10.18	14:59	04.10.18	20:57
58	04.10.18	20:58	05.10.18	02:59
59	05.10.18	03:00	05.10.18	08:59
60	05.10.18	09:00	05.10.18	14:59
61	05.10.18	15:00	05.10.18	20:59
62	05.10.18	21:01	06.10.18	03:02
63	06.10.18	03:04	06.10.18	08:58
64	06.10.18	08:59	06.10.18	15:00
65	06.10.18	15:01	06.10.18	20:53
66	06.10.18	20:54	07.10.18	02:59
67	07.10.18	03:00	07.10.18	08:57
68	07.10.18	08:58	07.10.18	14:59
69	07.10.18	15:00	07.10.18	20:56
70	07.10.18	20:57	08.10.18	05:02
71	08.10.18	05:03	08.10.18	08:58
72	08.10.18	08:59	08.10.18	14:59
73	08.10.18	15:00	08.10.18	20:57
74	08.10.18	20:59	09.10.18	02:59
75	09.10.18	03:00	09.10.18	08:57
76	09.10.18	08:58	09.10.18	14:58
77	09.10.18	14:59	09.10.18	21:07
78	09.10.18	21:08	10.10.18	02:59
79	10.10.18	03:00	10.10.18	08:56
80	10.10.18	08:58	10.10.18	14:59
81	10.10.18	15:00	10.10.18	20:56
82	10.10.18	20:57	11.10.18	02:59
83	11.10.18	03:00	11.10.18	08:57
84	11.10.18	08:58	11.10.18	14:59
85	11.10.18	15:00	11.10.18	20:59
86	11.10.18	21:01	12.10.18	03:01
87	12.10.18	03:02	12.10.18	08:57
88	12.10.18	08:58	12.10.18	14:59
89	12.10.18	15:00	12.10.18	20:58
90	12.10.18	21:00	13.10.18	02:58
91	13.10.18	02:59	13.10.18	08:59
92	13.10.18	09:00	13.10.18	14:58

Table IX6. Water pumps sampling – Position of ship

Date	Time UTC	Time (local)	Lat (N)	Lon (E)
02.10.18	02:00	09:00	9.29.26	97.21.24
02.10.18	08:04	15:04	9.30.00	97.10.05
02.10.18	14:01	21:01	9.30.02	96.49.86
02.10.18	20:00	03:00	9.29.96	96.22.32
03.10.18	01:58	08:58	9.29.88	95.59.92
03.10.18	08:10	15:10	9.30.07	95.39.88
03.10.18	14:01	21:01	9.10.24	96.5.05
03.10.18	20:21	03:21	9.10.26	96.17.52
04.10.18	02:00	09:00	9.10.06	96.44.89
04.10.18	08:00	15:00	9.6.56	97.0.21
04.10.18	13:50	20:50	8.50.55	96.59.84
04.10.18	20:01	03:01	8.50.17	96.29.90
05.10.18	02:03	09:03	8.50.00	96.2.91
05.10.18	08:00	15:00	8.49.98	95.50.83
05.10.18	14:02	21:02	8.48.76	95.39.93
05.10.18	20:05	03:05	8.29.95	95.44.87
06.10.18	02:01	09:01	8.29.95	96.15.05
06.10.18	08:01	15:01	8.30.10	96.28.46
06.10.18	13:56	20:56	8.30.11	96.44.49
06.10.18	20:02	03:02	8.13.34	97.17.54
07.10.18	01:59	08:59	8.10.03	97.19.98
07.10.18	08:00	15:00	8.10.12	97.0.24
07.10.18	13:59	20:59	8.9.93	96.45.07
07.10.18	22:04	05:04	8.10.03	96.21.44
08.10.18	02:03	09:03	8.12.43	96.1.86
08.10.18	08:02	15:02	8.10.74	96.0.05
08.10.18	14:00	21:00	8.9.99	95.40.90
08.10.18	20:01	03:01	7.50.92	95.41.09
09.10.18	01:59	08:59	7.49.89	96.0.14
09.10.18	07:59	14:59	7.50.08	96.15.28
09.10.18	14:11	21:11	7.49.94	96.35.12
09.10.18	20:26	03:26	7.49.98	96.44.71
10.10.18	02:10	09:10	7.49.97	97.14.95
10.10.18	08:00	15:00	7.50.09	97.24.08
10.10.18	14:00	21:00	7.29.68	97.48.02
10.10.18	20:00	03:00	7.29.87	97.40.50
11.10.18	02:17	09:17	7.29.86	97.30.41
11.10.18	08:20	15:20	7.31.19	97.0.23
11.10.18	14:03	21:03	7.30.08	96.49.90
11.10.18	20:04	03:04	7.29.73	96.30.05
12.10.18	02:22	09:22	7.9.84	97.3.41
12.10.18	08:00	15:00	7.10.39	97.14.55
12.10.18	14:02	21:02	6.58.96	97.30.03
12.10.18	20:01	03:01	6.54.80	97.29.75
13.10.18	02:02	09:02	6.50.09	97.59.90
13.10.18	08:00	15:00	6.50.21	97.49.01

ANNEX X. RECORDS OF FISHING STATIONS

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 1
DATE :01/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°27.88
start stop duration Lon E 97°21.45
TIME :23:22:22 23:54:19 31.9 (min) Purpose : 3
LOG : 4250.41 4252.48 2.1 Region : 10500
FDEPTH: 98 40 Gear cond.: 0
BDEPTH: 210 213 Validity : 3
Towing dir: 0° Wire out : 400 m Speed : 3.9 kn
Sorted : 0 Total catch: 0.18 Catch/hour: 0.35

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Squid unidentified	0.15 124	43.48	
Unidentified crustacean larvae	0.06 15	16.30	
Leptocephalus	0.04 36	10.87	
Decapterus sp.	0.04 2	10.87	
SALPS	0.03 4	9.78	
JUVENILE FISHES	0.01 30	3.26	
Arothron stellatus, juvenile	0.01 2	2.72	
Naso brevirostris, juvenile	0.01 6	1.63	
Priacanthus sp., juvenile	0.00 2	1.09	
Plastic	0.00 2	0.00	
Total	0.35	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 2
DATE :02/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°29.07
start stop duration Lon E 97°21.34
TIME :00:39:05 01:18:31 39.4 (min) Purpose : 3
LOG : 4254.87 4257.36 2.5 Region : 10500
FDEPTH: 110 40 Gear cond.: 0
BDEPTH: 211 211 Validity : 0
Towing dir: 0° Wire out : 400 m Speed : 3.8 kn
Sorted : 1 Total catch: 5.84 Catch/hour: 8.89

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Squid unidentified, juvenile	7.88 6009	88.63	
THYSANOTEUTHIDAE	0.49 6	5.48	
Leptocephalus	0.36 358	4.02	
JUVENILE FISHES	0.07 164	0.80	
PERISTEDIIDAE	0.04 8	0.41	
Naso brevirostris, juvenile	0.02 21	0.24	
MENIDAE, juvenile	0.01 8	0.15	
MONACANTHIDAE, juvenile	0.01 8	0.09	
SCORPAENIDAE, juvenile	0.01 8	0.09	
Unidentified crustacean larvae	0.01 29	0.09	
Total	8.89	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 3
DATE :02/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 9°29.35
start stop duration Lon E 97°21.23
TIME :05:46:43 05:59:31 12.8 (min) Purpose : 3
LOG : 4267.53 4268.14 0.6 Region : 10500
FDEPTH: 212 212 Gear cond.: 0
BDEPTH: 212 212 Validity : 0
Towing dir: 0° Wire out : 600 m Speed : 2.8 kn
Sorted : 66 Total catch: 66.39 Catch/hour: 311.42

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Benthosema sp.	293.48 90708	94.24	
Grammatonotus sp.	9.90 896	3.18	
Squalus cf. hemipinnis	2.02 5	0.65	
Proscyllium magnificum	1.88 5	0.60	
OMMASTREPHIDAE	1.41 19	0.45	5
Priacanthus macracanthus	1.17 5	0.38	1
Rexea bengalensis	0.47 19	0.15	2
Ostichthys acanthorhinus	0.28 5	0.09	
Antigonia sp.	0.28 5	0.09	
Argentina sp.	0.19 5	0.06	4
Paralepidae	0.14 66	0.05	
Selar crumenophthalmus	0.09 5	0.03	3
Bembrops sp.	0.09 9	0.03	
Aristeidae	0.01 9	0.00	
Metapenaeopsis spp.	0.01 5	0.00	
Unidentified invertebrate	0.00 5	0.00	
Sea cucumber	0.00 5	0.00	
G A S T R O P O D S	0.00 5	0.00	
SOFT SPONGES	0.00 14	0.00	
Total	311.42	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 4
DATE :02/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°29.97
start stop duration Lon E 97°2.96
TIME :09:34:31 10:06:10 31.6 (min) Purpose : 3
LOG : 4289.11 4290.97 1.9 Region : 10500
FDEPTH: 110 23 Gear cond.: 0
BDEPTH: 331 338 Validity : 0
Towing dir: 0° Wire out : 400 m Speed : 3.5 kn
Sorted : 0 Total catch: 0.49 Catch/hour: 0.92

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Squid unidentified	0.38 207	41.07	
Krill	0.17 6315	18.48	
Rastrelliger sp.	0.17 180	18.48	
J E L L Y F I S H	0.06 2	6.16	
Lagocephalus sp.	0.06 8	6.16	
Leptocephalus	0.04 36	4.11	
UNIDENTIFIED FISH	0.04 89	4.11	
Naso brevirostris	0.00 6	0.21	
Brama sp.	0.00 2	0.21	
Fistularia sp.	0.00 2	0.21	
Rexea bengalensis	0.00 2	0.21	
OSTRACIIDAE	0.00 2	0.21	
PRIACANTHIDAE	0.00 2	0.21	
TETRAODONTIDAE	0.00 2	0.21	
HOLOCENTRIDAE	0.00 2	0.00	
Plastic	0.00 2	0.00	
Total	0.92	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 5
DATE :02/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°29.85
start stop duration Lon E 96°32.11
TIME :16:03:45 16:33:48 30.1 (min) Purpose : 3
LOG : 4321.88 4323.46 1.6 Region : 10500
FDEPTH: 100 20 Gear cond.: 0
BDEPTH: 436 444 Validity : 0
Towing dir: 0° Wire out : 300 m Speed : 3.2 kn
Sorted : 5 Total catch: 19.52 Catch/hour: 38.98

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	15.86 17974	40.69	
Trachipterus sp.	5.27 4	13.52	
Leptocephalus	3.36 1298	8.63	
Symbolophorus sp.	2.88 721	7.40	
Myctophum sp.	2.88 1058	7.40	0
Neoepinnula orientalis	1.24 18	3.18	
Squid unidentified, juvenile	1.01 1106	2.59	
Diaphus sp.	0.96 960	2.46	
Diaphus sp.	0.96 192	2.46	0
Astronesthes sp.	0.96 192	2.46	0
Chauliodus sp.	0.96 144	2.46	
Bregmaceros sp.	0.48 673	1.23	
BATHYTEUTHIDAE	0.38 14	0.97	
Iago sp.	0.24 2	0.61	
Naso brevirostris, juvenile	0.19 144	0.49	
Synagrops sp.	0.16 6	0.41	
Cubiceps sp.	0.16 12	0.41	
Lestrolepis intermedia	0.16 12	0.41	
S H R I M P S, juvenile	0.14 1058	0.37	
Malacosteus sp.	0.14 2	0.36	
OPHIDIIDAE	0.12 2	0.31	
Psenes sp.	0.10 4	0.26	
Rexea bengalensis	0.08 10	0.20	
Unid. juvenile fishes	0.05 240	0.12	
Fistularia sp., juvenile	0.05 48	0.12	
UNIDENTIFIED FISH	0.05 48	0.12	
Setarches sp.	0.04 2	0.10	
Pterycombus sp.	0.04 2	0.10	
Decapterus sp.	0.02 6	0.05	
Astronesthes sp.	0.02 4	0.05	
STERNOPTYCHIDAE	0.00 2	0.01	
Total	38.97	99.98	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 6
DATE :02/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°29.74
start stop duration Lon E 96°2.16
TIME :22:21:52 22:55:16 33.4 (min) Purpose : 3
LOG : 4351.84 4353.73 1.9 Region : 10500
FDEPTH: 105 18 Gear cond.: 0
BDEPTH: 1402 1545 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 3.4 kn
Sorted : 2 Total catch: 40.02 Catch/hour: 71.88

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	34.59 259553	48.12	
OMMASTREPHIDAE	24.64 1196	34.29	
Leptocephalus	4.09 3082	5.69	
Small squid, juvenile	2.20 2107	3.06	
Cubiceps sp.	1.51 95	2.10	
Oplophoris sp.	1.23 849	1.71	
Funchalia sp	1.07 1352	1.49	
Ancistrocheirus sp.	1.02 4	1.42	
Maurolicus sp.	0.38 1383	0.52	
Unknown fish	0.38 95	0.52	
Naso brevirostris	0.28 221	0.39	
Cranchia scabra	0.13 63	0.17	
Centroberyx sp.	0.13 32	0.17	
PARALEPIDIDAE	0.10 126	0.13	
J E L L Y F I S H	0.08 4	0.11	
Unidentified juv fish	0.06 221	0.09	
Total	71.88	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 7
DATE :03/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°30.01
start stop duration Lon E 95°48.80
TIME :04:35:05 05:43:25 68.3 (min) Purpose : 3
LOG : 4366.42 4375.03 8.6 Region : 10500
FDEPTH: 440 50 Gear cond.: 0
BDEPTH: 334 0 Validity : 0
Towing dir: 0° Wire out : 1000 m Speed : 7.6 kn
Sorted : 6 Total catch: 13.24 Catch/hour: 11.63

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	3.33 3556	28.63	
LOLIGINIDAE	2.25 118	19.34	
Pteroplatytrygon violacea	2.06 1	17.75	6
PANDALIDAE	0.63 594	5.44	
Chauliodus sp.	0.55 55	4.76	10
Leptocephalus	0.47 190	4.08	
Argyropelecus sp.	0.47 142	4.08	7
Small squids	0.47 530	4.08	
J E L L Y F I S H	0.40 18	3.40	
HISTIOTEUTHIDAE	0.23 1	1.96	
Mene maculata	0.17 16	1.44	
Lestrolepis sp.	0.16 16	1.36	
Waste General	0.13 0	1.14	
Diplophos sp.	0.08 166	0.68	11
Squid unidentified	0.07 1	0.60	
Cubiceps pauciradiatus	0.05 3	0.45	9
Decapterus sp.	0.02 1	0.15	8
ENOPLOTEUTHIDAE	0.02 2	0.15	
Unidentified	0.02 1	0.15	
Shrimps, small, non comm.	0.02 150	0.15	
CRANCHIIDAE	0.01 8	0.08	
Vinciguerria sp.	0.01 79	0.08	
Unidentified	0.01 1	0.08	
Fish larvae	0.00 1	0.00	
TETRAODONTIDAE	0.00 1	0.00	
Total	11.63	100.01	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 8
DATE :03/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°10.14
start stop duration Lon E 96°11.85
TIME :14:57:32 15:26:26 28.9 (min) Purpose : 3
LOG : 4428.53 4429.91 1.4 Region : 10500
FDEPTH: 130 25 Gear cond.: 0
BDEPTH: 725 610 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 2.9 kn
Sorted : 2 Total catch: 24.22 Catch/hour: 50.31

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

MYCTOPHIDAE	26.58	39871	52.84	
Oplophoris sp.	4.25	3350	8.45	
Cubiceps pauciradiatus	4.13	264	8.21	12
Taaningichthys sp	2.66	4785	5.28	
HISTIOTEUTHIDAE	2.37	8	4.71	
CRANCHIIDAE	2.18	79	4.33	
Small squid	2.15	1782	4.28	
BATHYTEUTHIDAE	1.86	54	3.70	
Leptocephalus	0.80	212	1.59	
Chauliodus sp.	0.74	106	1.48	
Elagatis bipinnulata	0.66	2	1.32	13
Synagrops sp.	0.53	187	1.06	
Funchalia sp	0.53	453	1.06	
LOLIGINIDAE	0.39	21	0.78	
Pollichthys	0.13	79	0.26	
Synagrops japonicus	0.08	2	0.17	
Naso brevirostris	0.05	79	0.11	
REGALECIDAE	0.04	2	0.08	
Nemichthys sp.	0.04	2	0.08	
Unid. juvenile fishes	0.03	27	0.05	
MONACANTHIDAE	0.03	27	0.05	
Vinciguerria sp.	0.03	27	0.05	
TETRAODONTIDAE	0.03	54	0.05	
Poecilopsetta sp.	0.02	2	0.04	
Total	50.33		100.05	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 9
DATE :03/10/18 GEAR TYPE: PT NO: 5 POSITION:Lat N 9°8.79
start stop duration Lon E 96°14.99
TIME :19:34:38 20:20:20 45.7 (min) Purpose : 3
LOG : 4436.02 4439.29 3.3 Region : 10500
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 543 501 Validity : 0
Towing dir: 0° Wire out : 230 m Speed : 4.3 kn
Sorted : 2 Total catch: 57.36 Catch/hour: 75.33

SPECIES weight numbers	CATCH/HOUR		% OF TOT. C	SAMP
Shrimps, small, non comm.	16.90	118330	22.44	
MYCTOPHIDAE	15.21	53249	20.20	
Symbolophorus sp.	13.19	3043	17.51	
LOLIGINIDAE	10.14	1623	13.46	
Leptocephalus	7.78	8554	10.32	
Cubiceps sp.	6.09	337	8.08	
Myctophum sp.	5.41	1454	7.18	
Oplophoris sp.	0.34	202	0.45	
Brama sp.	0.13	1	0.17	
Gempylus serpens	0.11	1	0.14	
Mene maculata	0.03	67	0.05	
Total	75.32		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 10
DATE :03/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 9°10.20
start stop duration Lon E 96°43.34
TIME :23:49:05 00:19:24 30.3 (min) Purpose : 3
LOG : 4464.94 4466.32 1.4 Region : 10500
FDEPTH: 248 210 Gear cond.: 0
BDEPTH: 403 403 Validity : 0
Towing dir: 0° Wire out : 650 m Speed : 2.7 kn
Sorted : 1 Total catch: 2.67 Catch/hour: 5.28

SPECIES weight numbers	CATCH/HOUR		% OF TOT. C	SAMP
MYCTOPHIDAE	1.29	129	24.42	
Histioteuthis sp.	1.16	26	21.98	
Cubiceps sp.	1.16	65	21.98	
Leptocephalus	0.51	168	9.75	
Krill	0.39	0	7.31	
Small squid	0.26	451	4.88	
Brama sp.	0.26	14	4.88	
Lestrolepis intermedia	0.12	6	2.25	
Decapterus macarellus	0.08	2	1.50	
HOLOCENTRIDAE	0.02	2	0.38	
Rexea bengalensis	0.02	2	0.38	
Rexea sp.	0.01	65	0.26	
Unidentified juv fish	0.01	26	0.11	
J E L L Y F I S H	0.00	8	0.00	
Total	5.28		100.08	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 11
DATE :04/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 9°7.22
start stop duration Lon E 96°54.97
TIME :05:35:25 06:05:35 30.2 (min) Purpose : 3
LOG : 4486.07 4487.62 1.6 Region : 10500
FDEPTH: 382 382 Gear cond.: 0
BDEPTH: 382 382 Validity : 0
Towing dir: 0° Wire out : 1005 m Speed : 3.1 kn
Sorted : 6 Total catch: 58.81 Catch/hour: 116.93

SPECIES weight numbers	CATCH/HOUR		% OF TOT. C	SAMP
MYCTOPHIDAE	27.97	5992	23.92	
ARISTEIDAE	15.60	8616	13.35	
Neoepinnula orientalis	11.65	193	9.96	
Neoscopelus sp.	11.16	698	9.55	
Astronesthes sp	10.22	1825	8.74	
Plesiobatis daviesi	5.45	2	4.66	17
Heterocarpus chani	4.12	223	3.52	
Benthodesmus sp.	3.77	181	3.22	
Puerulus sp.	3.76	56	3.21	
Cubiceps sp.	3.70	70	3.16	
Setarches sp.	2.96	237	2.53	
Bythaelurus hispidus	2.39	42	2.04	15
LOLIGINIDAE	2.02	586	1.73	
Ancistrocheirus sp.	1.99	2	1.70	
STERNOPTYCHIDAE	1.75	755	1.49	
Priacanthus macracanthus	1.53	16	1.31	
Histioteuthis sp.	1.51	28	1.29	
OMMASTREPHIDAE	0.83	24	0.71	
Psenopsis obscura	0.58	8	0.49	
Chascanopsetta lugubris	0.38	4	0.32	
Ruvettus pretiosus	0.38	2	0.32	
Bolitaena sp.	0.32	2	0.27	
Champsodon sp.	0.27	80	0.23	
Iago sp.	0.26	4	0.22	16
Squalus cf. hemipinnis	0.25	4	0.21	14
Waste General	0.22	0	0.19	
Chiroteuthis sp.	0.16	4	0.14	
Aristaeomorpha sp.	0.16	12	0.14	
Halimochirurgus centriscoides	0.16	12	0.14	
Chlorophthalmus sp.	0.14	2	0.12	
Leptocephalus	0.14	34	0.12	
Hymenocephalus heterolepis	0.14	22	0.12	
Synagrops sp.	0.14	12	0.12	
Chlorophthalmus corniger	0.12	6	0.10	
Ariosoma sp.	0.12	2	0.10	
Ostracoberyx dorygenys	0.10	8	0.09	
Cyttopsis rosea	0.10	4	0.09	
Bembrops sp.	0.08	2	0.07	
Funchalia sp	0.06	4	0.05	
Satyrichthys sp.	0.06	4	0.05	
Bembradium sp.	0.06	2	0.05	
Tydemania navigatoris	0.06	6	0.05	
Pyramodon sp	0.05	12	0.05	
Rexea bengalensis	0.04	2	0.03	
Lestrolepis intermedia	0.04	2	0.03	
Bregmaceros sp.	0.01	12	0.01	
Total	116.93		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 12
DATE :04/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°52.73
start stop duration Lon E 96°59.84
TIME :09:46:20 10:17:11 30.9 (min) Purpose : 3
LOG : 4511.64 4513.22 1.6 Region : 10500
FDEPTH: 200 294 Gear cond.: 0
BDEPTH: 390 393 Validity : 0
Towing dir: 0° Wire out : 750 m Speed : 3.1 kn
Sorted : 2 Total catch: 3.86 Catch/hour: 7.50

SPECIES weight numbers	CATCH/HOUR		% OF TOT. C	SAMP
MYCTOPHIDAE	4.92	8001	65.66	
Small squids unident.	1.14	438	15.20	
STERNOPTYCHIDAE	0.73	342	9.73	
Leptocephalus	0.32	146	4.25	
Lestrolepis intermedia	0.19	10	2.59	
Krill	0.09	455	1.22	
Histioteuthis sp.	0.04	4	0.60	
Neoepinnula orientalis	0.02	4	0.26	
Astronesthes sp.	0.02	4	0.23	
UNIDENTIFIED FISH, juvenile	0.00	4	0.05	
Gonostoma sp.	0.00	4	0.05	
TETRAODONTIDAE	0.00	4	0.05	
Fistularia sp.	0.00	4	0.05	
Psenopsis sp.	0.00	4	0.05	
Tunicata	0.00	123	0.00	
Jelly	0.00	210	0.00	
Total	7.50		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 13
DATE :04/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°50.55
start stop duration Lon E 96°59.84
TIME :13:50:59 14:21:29 30.5 (min) Purpose : 3
LOG : 4518.10 4519.65 1.6 Region : 10500
FDEPTH: 393 392 Gear cond.: 0
BDEPTH: 393 392 Validity : 0
Towing dir: 0° Wire out : 970 m Speed : 3.0 kn
Sorted : 4 Total catch: 37.82 Catch/hour: 74.38

SPECIES weight numbers	CATCH/HOUR		% OF TOT. C	SAMP
Myctophid sp. A	16.81	1070	22.60	
Aristaeomorpha sp.	14.26	8912	19.18	
MYCTOPHIDAE	11.97	5424	16.09	
Setarches guentheri	7.24	295	9.73	22
Bythaelurus sp.	4.33	159	5.82	
STERNOPTYCHIDAE	3.50	1571	4.71	
Heterocarpus sp.	2.46	151	3.31	19
Neoscopelus sp.	2.28	122	3.07	20
Heterocarpus sp.	1.53	535	2.05	0
Benthodesmus sp.	1.49	59	2.01	
Small squid	1.02	356	1.37	0
Puerulus sewelli	0.94	22	1.27	
Aristaeomorpha foliacea	0.94	47	1.27	18
Chascanopsetta lugubris	0.85	10	1.14	21
Chlorophthalmus sp.	0.67	12	0.90	
Histioteuthis sp.	0.61	4	0.82	
TUNICATA	0.51	29	0.69	
Chlorophthalmus sp.	0.51	26	0.68	0
Satyrichthys sp.	0.43	22	0.58	
Tydemania navigatoris	0.43	53	0.58	
Ariosoma sp.	0.31	6	0.42	
Neobythites sp.	0.24	4	0.32	
Halimochirurgus centriscoides	0.22	26	0.29	
Ostracoberyx dorygenys	0.15	8	0.20	
Neoepinnula orientalis	0.12	2	0.16	
Cubiceps sp.	0.12	2	0.16	
Squalus cf. hemipinnis	0.12	4	0.16	
Ophichthus sp.	0.08	4	0.11	
Cyttopsis rosea	0.06	2	0.09	
EPIALTIDAE	0.06	2	0.08	
Coelorinchus sp.	0.03	2	0.04	
Chaunax sp.	0.02	2	0.03	
Pterygotrigla sp.	0.02	2	0.03	
HOMOLIDAE	0.02	2	0.03	
Leptocephalus	0.02	2	0.03	
Bembradium sp.	0.02	2	0.02	
Poecilopsetta sp.	0.01	2	0.02	
Small squid	0.01	2	0.01	
Total	74.41		100.05	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 14
DATE :04/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°50.02
start stop duration Lon E 96°32.46
TIME :18:10:59 18:41:04 30.1 (min) Purpose : 3
LOG : 4550.11 4551.70 1.6 Region : 10500
FDEPTH: 460 464 Gear cond.: 0
BDEPTH: 460 464 Validity : 0
Towing dir: 0° Wire out : 1190 m Speed : 3.2 kn
Sorted : 18 Total catch: 28.10 Catch/hour: 56.03

SPECIES weight numbers	CATCH/HOUR		% OF TOT. C	SAMP
MYCTOPHIDAE	10.78	3234	19.24	
Aristaeomorpha foliacea	10.37	642	18.51	
Bythaelurus sp.	6.51	86	11.62	
Neoscopelus sp.	5.36	130	9.57	
Heterocarpus chani	4.89	313	8.73	
STERNOPTYCHIDAE	4.74	742	8.47	
Small shrimps	2.36	1107	4.21	
Talismania sp.	1.89	32	3.37	
Hypopleuron caninum	1.77	2	3.15	
TRICHIURIDAE	1.44	26	2.58	
Coelorinchus sp.	1.18	72	2.10	
Neobythites sp.	0.91	14	1.63	
Puerulus sewelli	0.83	6	1.47	
Malacocephalus sp.	0.65	6	1.16	
Tydemania navigatoris	0.62	80	1.10	
Nettastoma sp.	0.47	12	0.84	

CONGRIDAE	0.44	12	0.79
Polycheles sp.	0.38	36	0.68
Setarches sp.	0.18	2	0.32
Ostracoberyx dorygenys	0.12	2	0.21
Hydrolagus sp.	0.12	2	0.21
GALATHEIDAE	0.03	2	0.05
Total	56.03		100.00

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 15
DATE :04/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°50.31
start stop duration Lon E 96°26.07
TIME :22:40:59 23:12:24 31.4 (min) Purpose : 3
LOG : 4556.30 4557.92 1.6 Region : 10500
FDEPTH: 100 40 Gear cond.: 0
BDEPTH: 479 482 Validity : 0
Towing dir: 0° Wire out : 350 m Speed : 3.1 kn
Sorted : 1 Total catch: 12.63 Catch/hour: 24.13

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	11.64 11641	48.25	
Benthosema sp.	3.37 766	13.97	
Small squid	2.76 1929	11.43	
OMMASTREPHIDAE	1.13 4	4.67	
Diaphus sp.	1.10 122	4.57	
Olophoris gracilirostris	0.92 1072	3.81	
ENOPLOTEUTHIDAE	0.82 19	3.40	23
LOLIGINIDAE	0.52 27	2.14	24
Krill	0.31 1712	1.27	
Astronesthes sp.	0.28 31	1.14	
Funchalia sp	0.21 92	0.89	
Synagrops sp.	0.19 6	0.79	
Vinciguerria sp.	0.18 888	0.76	
Decapterus sp., juvenile	0.18 583	0.76	
Decapterus tabl	0.13 4	0.55	
Leptocephalus	0.09 61	0.38	
Cubiceps pauciradiatus	0.08 4	0.32	
UNIDENTIFIED FISH, juvenile	0.06 214	0.25	
Diplophos sp.	0.06 31	0.25	
Chauliodus sp.	0.06 61	0.25	
Priacanthus sp., juvenile	0.03 92	0.13	
J E L L Y F I S H	0.00 2	0.00	
Total	24.12	99.98	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 16
DATE :05/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°50.00
start stop duration Lon E 96°2.91
TIME :01:57:49 03:21:35 83.8 (min) Purpose : 3
LOG : 4579.34 4583.28 4.0 Region : 10500
FDEPTH: 580 50 Gear cond.: 0
BDEPTH: 829 1115 Validity : 0
Towing dir: 0° Wire out : 1200 m Speed : 2.8 kn
Sorted : 3 Total catch: 3.06 Catch/hour: 2.19

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
J E L L Y F I S H	1.35 63	61.70	
Histioteuthis sp.	0.22 1	10.15	
Sthenoteuthis oualaniensis	0.16 1	7.20	
Brama sp.	0.13 1	5.89	25
PARALEPIDIDAE	0.09 4	4.26	
ENOPLOTEUTHIDAE	0.08 2	3.60	
Cryptopsaras couesii	0.06 1	2.95	
Gavialiceps taeniola	0.03 1	1.31	
LOLIGINIDAE	0.02 1	0.98	
CRANCHIIDAE	0.01 1	0.65	
Coccorella sp	0.01 1	0.65	
Lestrolepis sp.	0.01 1	0.33	
Ostracoberyx dorygenys	0.01 1	0.33	
Total	2.19	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 17
DATE :05/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°49.80
start stop duration Lon E 95°44.97
TIME :08:59:51 10:00:26 60.6 (min) Purpose : 3
LOG : 4601.03 4604.02 3.0 Region : 10500
FDEPTH: 570 259 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 1500 m Speed : 3.0 kn
Sorted : 3 Total catch: 10.49 Catch/hour: 10.39

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Myctophum sp.	2.44 2537	23.47	
Waste General	1.27 0	12.26	
Olophoris gracilirostris	1.13 597	10.86	
Chauliodus sp.	0.80 102	7.71	
Ancistrocheirus sp.	0.78 5	7.53	
STERNOPTYCHIDAE	0.66 219	6.31	
Coccorella sp	0.36 87	3.51	
Cryptopsaras couesii	0.32 1	3.05	
Diaphus sp.	0.29 22	2.80	
EVERMANNELLIDAE	0.25 4	2.45	
Electrona sp.	0.18 40	1.75	
Gavialiceps taeniola	0.18 15	1.75	
GONOSTOMATIDAE	0.18 15	1.75	
NETTASTOMATIDAE	0.18 4	1.75	
J E L L Y F I S H	0.15 7	1.43	
Small squid	0.15 87	1.40	
SCOMBROLABRACIDAE	0.14 11	1.36	
Histioteuthis sp.	0.14 1	1.33	
Symbolophorus sp.	0.11 48	1.05	
Leptocephalus	0.11 13	1.05	
ENOPLOTEUTHIDAE	0.09 3	0.86	
PARALEPIDIDAE	0.07 4	0.71	
CRANCHIIDAE	0.07 11	0.71	
LOLIGINIDAE	0.07 4	0.71	
MELAMPHAIDAE	0.07 15	0.67	
MYCTOPHIDAE	0.06 18	0.56	
ASTRONESTHIDAE	0.04 11	0.35	
Poecilopsetta sp.	0.04 4	0.35	
HOWELLIDAE	0.03 4	0.31	
Lestrolepis sp.	0.01 4	0.10	
Mephisto sp.	0.01 4	0.10	
SALPS	0.00 81	0.00	
Fishing gears	0.00 3	0.00	
Total	10.39	100.03	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 18
DATE :05/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°47.88
start stop duration Lon E 95°40.08
TIME :14:17:24 14:53:10 35.8 (min) Purpose : 3
LOG : 4608.07 4610.58 2.5 Region : 10500
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 240 m Speed : 4.2 kn
Sorted : 3 Total catch: 49.20 Catch/hour: 82.53

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Leptocephalus	33.51 20107	40.61	
Hygophum sp.	28.32 9055	34.32	28
OMMASTREPHIDAE	17.14 403	20.77	26
Cubiceps sp.	2.28 109	2.76	27
Electrona sp.	1.00 40	1.21	
Gempylus sp.	0.20 2	0.24	
Exocoetus sp.	0.07 2	0.08	
Total	82.53	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 19
DATE :05/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°29.90
start stop duration Lon E 95°41.13
TIME :17:22:19 17:53:59 31.7 (min) Purpose : 3
LOG : 4627.15 4628.90 1.8 Region : 10500
FDEPTH: 150 20 Gear cond.: 0
BDEPTH: 0 0 Validity : 0
Towing dir: 0° Wire out : 460 m Speed : 3.3 kn
Sorted : 3 Total catch: 18.68 Catch/hour: 35.40

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	18.12 45305	51.19	
Neoepinnula orientalis	4.70 66	13.27	
OMMASTREPHIDAE	3.13 97	8.83	
Cubiceps sp.	2.69 135	7.59	
BATHYTEUTHIDAE	1.42 9	4.01	
LOLIGINIDAE	1.34 2013	3.79	
Ophichthus sp.	0.67 66	1.90	
Leptocephalus	0.67 536	1.90	
Small shrimps	0.67 1207	1.90	
UNIDENTIFIED FISH	0.66 402	1.87	
Brama sp.	0.66 4	1.87	
Pollichthys	0.34 201	0.95	
PLATYTROCTIDAE	0.13 2	0.37	
Gempylus serpens	0.09 2	0.27	
Tetragonurus pacificus	0.06 2	0.16	0
CRANCHIIDAE, juvenile	0.04 2	0.11	
Total	35.39	99.97	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 20
DATE :06/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°30.18
start stop duration Lon E 96°10.85
TIME :00:42:01 01:12:21 30.3 (min) Purpose : 3
LOG : 4656.86 4658.36 1.5 Region : 10500
FDEPTH: 370 270 Gear cond.: 0
BDEPTH: 481 479 Validity : 0
Towing dir: 0° Wire out : 800 m Speed : 3.0 kn
Sorted : 1 Total catch: 7.22 Catch/hour: 14.28

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Waste General	10.48 0	73.38	
MYCTOPHIDAE	0.95 773	6.68	
SALPS	0.95 275	6.68	
ENOPLOTEUTHIDAE	0.60 291	4.21	
Argyropelecus sp.	0.53 190	3.71	
Chauliodus sp.	0.32 42	2.23	
Olophoris gracilirostris	0.21 95	1.48	
HISTIOTEUTHIDAE	0.10 2	0.69	
Funchalia sp	0.05 22	0.37	
Krill	0.03 221	0.22	
Lestrolepis sp.	0.02 2	0.14	
Priacanthus sp.	0.01 10	0.07	
UNIDENTIFIED FISH, juvenile	0.01 10	0.07	
EVERMANNELLIDAE	0.01 10	0.07	
Total	14.28	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 21
DATE :06/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°30.02
start stop duration Lon E 96°29.89
TIME :06:41:07 07:11:13 30.1 (min) Purpose : 3
LOG : 4678.33 4679.83 1.5 Region : 10500
FDEPTH: 497 497 Gear cond.: 0
BDEPTH: 497 497 Validity : 0
Towing dir: 0° Wire out : 1065 m Speed : 3.0 kn
Sorted : 2 Total catch: 59.52 Catch/hour: 118.68

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
GONATIDAE	20.23 16	17.04	
MYCTOPHIDAE	15.29 3815	12.89	
Aristaeomorpha foliacea	11.92 889	10.05	
Neoscopelus sp.	7.66 134	6.45	
Bythaelurus hispidus	7.66 88	6.45	
Talismania sp.	5.10 70	4.30	30
Long armed squid	4.77 16	4.02	
Aristaeopsis edwardsiana	4.47 209	3.76	
Hexatrygon brickelli	4.31 2	3.63	
Benthodesmus sp.	3.45 46	2.91	
Setarches guentheri	3.17 32	2.67	
Coelorinchus sp.	3.17 72	2.67	
Hypopleuron caninum	3.15 4	2.65	
Brama sp.	2.81 40	2.37	
Nesiarchus nasutus	2.53 8	2.13	
Waste General	2.47 0	2.08	
Jelly squid	2.14 82	1.80	
Gavialiceps taeniola	1.79 14	1.51	
Glyptophidium sp.	1.48 114	1.25	
Narcine sp.	1.40 2	1.18	
MACROURIDAE	1.31 32	1.11	
Heterocarpus chani	1.16 54	0.97	
Chauliodus sp.	1.15 132	0.97	
Satyrichthys sp.	0.93 36	0.78	
Cubiceps sp.	0.66 32	0.55	
Neoepinnula orientalis	0.60 10	0.50	29
Setarches sp.	0.52 12	0.44	
Dicrolene sp.	0.49 16	0.41	
Synagrops sp.	0.46 8	0.39	31
Heterocarpus chani	0.38 6	0.32	0
EVERMANNELLIDAE	0.33 16	0.28	
UNIDENTIFIED FISH	0.30 12	0.25	0
Tydemania navigatoris	0.26 14	0.22	
Olophoris gracilirostris	0.16 98	0.14	
Lestrolepis sp.	0.16 16	0.14	
J E L L Y F I S H	0.16 16	0.14	
LOLIGINIDAE	0.16 2	0.13	
Ariosoma sp.	0.12 2	0.10	
Nephropsis stewarti	0.10 2	0.08	
OPHICHTHIDAE	0.10 2	0.08	
Chaunax sp.	0.08 6	0.07	
UNIDENTIFIED FISH	0.06 2	0.05	
POLYCHAELIDAE	0.04 6	0.03	
Ostracoberyx dorygenys	0.02 2	0.02	
Total	118.68	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 22
DATE :06/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°30.06
start stop duration Lon E 96°42.57
TIME :09:59:24 11:02:54 63.5 (min) Purpose : 3
LOG : 4695.35 4698.33 3.0 Region : 10500
FDEPTH: 404 62 Gear cond.: 0
BDEPTH: 492 484 Validity : 0
Towing dir: 0° Wire out : 930 m Speed : 2.8 kn
Sorted : 2 Total catch: 9.00 Catch/hour: 8.50

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	2.68 2821	31.49	
Olophoris gracilirostris	1.43 878	16.80	
Ancistrocheirus sp.	0.73 2	8.56	
Chauliodus sp.	0.71 107	8.40	
Waste General	0.66 0	7.80	
SALPS	0.61 250	7.20	
Electrona sp.	0.51 189	6.00	
ENOPLOTEUTHIDAE	0.20 143	2.40	
Leptocephalus	0.20 61	2.40	
Argyropelecus sp.	0.20 117	2.40	
Coccorella sp	0.15 46	1.80	
Histioteuthis sp.	0.10 1	1.22	
Vinciguerria sp.	0.10 372	1.20	
Polyipnus sp.	0.10 10	1.20	
TETRAODONTIDAE	0.03 5	0.36	
Funchalia sp	0.03 10	0.30	
UNIDENTIFIED FISH, juvenile	0.02 26	0.24	
Diplophos sp.	0.01 5	0.12	
Unidentified lobster	0.00 5	0.06	
Synagrops sp.	0.00 5	0.06	
Total	8.50	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 23
DATE :06/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°30.03
start stop duration Lon E 96°42.24
TIME :15:02:56 15:33:26 30.5 (min) Purpose : 3
LOG : 4706.82 4708.37 1.5 Region : 10500
FDEPTH: 494 489 Gear cond.: 0
BDEPTH: 494 489 Validity : 0
Towing dir: 0° Wire out : 1150 m Speed : 3.0 kn
Sorted : 2 Total catch: 36.78 Catch/hour: 72.33

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	24.19 6598	33.44	
Bythaelurus hispidus	11.01 114	15.23	
Hypopleuron caninum	4.15 8	5.74	32
Heterocarpus chani	3.93 210	5.44	
Talismania sp.	3.74 63	5.17	35
Aristeus sp.	3.34 201	4.62	
Benthobatis sp.	3.19 6	4.40	
Neoscopelus sp.	2.67 47	3.70	34
Benthodesmus sp.	2.64 33	3.64	
Nephropsis sp.	2.44 118	3.37	
Gavialiceps taeniola	1.89 18	2.61	
Dicrolene nigricaudis	1.46 10	2.01	
Coelorinchus sp.	1.10 47	1.52	
Squalus sp.	0.98 2	1.36	
Satyrichthys sp.	0.98 8	1.36	
Glyptophidium sp.	0.71 31	0.98	
DIRETMIDAE	0.55 8	0.76	
Waste General	0.53 0	0.74	
Setarches guentheri	0.43 4	0.60	33
Aristaeopsis edwardsiana	0.43 6	0.60	
Decapterus macarellus	0.29 8	0.41	36
Tydemania navigatoris	0.26 12	0.35	
Glyphocrangon sp.	0.21 53	0.30	
OPHIDIIDAE	0.20 10	0.27	
Histioteuthis sp.	0.16 4	0.22	
Hydrolagus sp.	0.16 2	0.22	
Olophoris gracilirostris	0.12 71	0.17	
CONGRIDAE	0.10 2	0.14	
Lampadena sp.	0.08 4	0.12	
Peristedion sp.	0.08 2	0.11	
Cubiceps sp.	0.07 6	0.10	
Cyttopsis rosea	0.07 2	0.09	
Ostracoberyx dorygenys	0.06 2	0.08	
Chlorophthalmus cf. corniger	0.04 2	0.05	
Polyipnus sp.	0.02 2	0.02	
MYCTOPHIDAE	0.02 4	0.02	0
Nemichthys sp.	0.01 2	0.02	
Photonectes sp.	0.01 2	0.01	
Diplophos sp.	0.01 2	0.01	
Ophichthus sp.	0.01 2	0.01	
Total	72.33	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 24
DATE :06/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°10.80
start stop duration Lon E 97°20.06
TIME :21:07:05 21:37:26 30.4 (min) Purpose : 3
LOG : 4755.71 4757.21 1.5 Region : 10500
FDEPTH: 489 484 Gear cond.: 0
BDEPTH: 489 484 Validity : 0
Towing dir: 0° Wire out : 1120 m Speed : 3.0 kn
Sorted : 0 Total catch: 48.94 Catch/hour: 96.75

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Gavialiceps taeniola	25.03 1281	25.87	
Hexatrygon brickelli	19.93 2	20.60	
MYCTOPHIDAE	13.42 4794	13.87	
Talismania sp.	8.14 299	8.42	37
Heterocarpus chani	6.92 785	7.15	39
Bythaelurus sp.	5.02 105	5.19	38
Aristeus sp.	3.66 267	3.78	
Glyptophidium sp.	2.39 115	2.47	
Nephropsis stewarti	2.04 107	2.10	41
HISTIOTEUTHIDAE	1.72 12	1.78	
OPHIDIIDAE	1.19 59	1.23	
Benthobatis sp.	0.97 2	1.00	
Coelorinchus sp.	0.69 57	0.72	
Diretmoides sp.	0.65 10	0.67	
Benthodesmus sp.	0.55 12	0.57	
Hydrolagus sp.	0.53 4	0.55	
Chiroteuthis sp.	0.49 6	0.51	
Neoscopelus microchir	0.45 24	0.47	40
Glyphocrangon sp.	0.42 65	0.43	
Chascanopsetta sp.	0.36 4	0.37	
Malacocephalus sp.	0.28 2	0.29	
OPHICHTHIDAE	0.24 4	0.25	
OCTOPODIDAE	0.22 2	0.22	
Hymenocephalus heterolepis	0.16 22	0.16	
Satyrichthys sp.	0.16 2	0.16	
Cubiceps sp.	0.14 6	0.14	
Neoepinnula orientalis	0.14 2	0.14	
Decapterus sp.	0.14 4	0.14	
CRANCHIIDAE	0.12 2	0.12	
Chlorophthalmus corniger	0.12 4	0.12	
Aristaeopsis edwardsiana	0.12 2	0.12	
Coloconger raniceps	0.10 2	0.10	
Chaunax sp.	0.10 4	0.10	
Chauliodus sp.	0.08 16	0.08	
Bufoceratias sp	0.02 2	0.02	
Ostracoberyx dorygenys	0.02 2	0.02	
Bregmaceros sp.	0.02 8	0.02	
Brama sp.	0.00 2	0.00	
CARANGIDAE	0.00 2	0.00	
Plastic	0.00 2	0.00	
Total	96.73	99.98	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 25
DATE :06/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°12.07
start stop duration Lon E 97°18.63
TIME :22:30:27 23:01:54 31.4 (min) Purpose : 3
LOG : 4760.05 4761.62 1.6 Region : 10500
FDEPTH: 170 18 Gear cond.: 0
BDEPTH: 483 488 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 3.0 kn
Sorted : 1 Total catch: 12.66 Catch/hour: 24.15

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Aristeus sp.	6.12 612	25.32	
Benthosema sp.	4.98 1744	20.63	
Waste General	4.08 0	16.88	
MYCTOPHIDAE	2.95 3239	12.20	
OMMASTREPHIDAE	1.59 46	6.56	
Olophoris gracilirostris	1.36 1292	5.62	
Cubiceps sp.	0.99 48	4.11	42
ENOPLOTEUTHIDAE	0.68 475	2.81	
Krill	0.45 3012	1.87	
Vinciguerria sp.	0.27 1744	1.12	
Decapterus sp.	0.23 113	0.94	
Brama sp.	0.19 10	0.79	
Leptocephalus	0.16 113	0.66	
Chauliodus sp.	0.07 23	0.28	
UNIDENTIFIED FISH, juvenile	0.02 23	0.09	
TETRAODONTIDAE	0.02 23	0.09	
Total	24.15	99.99	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 26
DATE :07/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°10.02
start stop duration Lon E 97°2.67
TIME :04:50:35 05:21:44 31.1 (min) Purpose : 3
LOG : 4781.58 4783.12 1.5 Region : 10500
FDEPTH: 210 50 Gear cond.: 0
BDEPTH: 501 505 Validity : 0
Towing dir: 0° Wire out : 650 m Speed : 3.0 kn
Sorted : 4 Total catch: 4.48 Catch/hour: 8.63

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Arothron sp.	4.89 8	56.70	
Olophoris gracilirostris	1.67 0	19.40	
Waste General	1.08 0	12.50	
BATHYTEUTHIDAE	0.29 37	3.35	
Acanthephyra sp.	0.15 19	1.79	
J E L L Y F I S H	0.13 10	1.56	
Leptocephalus	0.12 67	1.34	
Small squid	0.10 37	1.12	
Brama sp.	0.06 15	0.67	
Decapterus sp.	0.04 17	0.45	
MYCTOPHIDAE	0.04 12	0.45	
Beryx splendens	0.02 4	0.22	
Naso brevirostris	0.02 6	0.22	
Unidentified juv fish	0.02 15	0.22	
UNIDENTIFIED FISH, juvenile	0.00 2	0.02	
Total	8.63	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 27
DATE :07/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°10.23
start stop duration Lon E 97°0.63
TIME :11:03:55 11:34:39 30.7 (min) Purpose : 3
LOG : 4788.09 4789.55 1.5 Region : 10500
FDEPTH: 506 510 Gear cond.: 0
BDEPTH: 506 510 Validity : 0
Towing dir: 0° Wire out : 1120 m Speed : 2.8 kn
Sorted : 27 Total catch: 35.84 Catch/hour: 69.98

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Diaphus sp.	15.61 3950	22.30	
Bythaelurus sp.	11.25 127	16.07	47
Diretmoides sp.	7.69 107	10.99	46
Neoharriotta pinnata	5.39 2	7.70	
Talismania sp.	4.84 68	6.92	43
Hypopleuron caninum	3.55 4	5.08	
ARISTEIDAE	2.75 385	3.93	
Neoscopelus sp.	2.67 57	3.82	45
CONGRIDAE	2.03 133	2.91	
Coelorinchus mycterismus	1.85 31	2.65	
Heterocarpus chani	1.56 84	2.23	
Hexatrygon brickelli	1.09 2	1.56	
Gempylus sp.	1.05 2	1.51	
OPHIDIIDAE	1.03 47	1.48	
Glyptophidium sp.	0.96 43	1.37	
Benthodesmus sp.	0.94 8	1.34	
Electrona sp.	0.80 223	1.14	
Hydrolagus sp.	0.66 4	0.95	
Nephropsis stewarti	0.64 23	0.92	44
MYCTOPHIDAE	0.64 80	0.91	
Lampadena sp.	0.55 27	0.78	
Polycheles sp.	0.55 96	0.78	
Coloconger raniceps	0.49 6	0.70	
Neoepinnula orientalis	0.23 4	0.33	
OCTOPOTEUTHIDAE	0.20 2	0.28	
Olophoris gracilirostris	0.16 111	0.23	
Argyropelecus sp.	0.14 31	0.20	
Bregmaceros sp.	0.14 80	0.20	
ALEPOCEPHALIDAE	0.14 4	0.20	
Fistularia sp.	0.08 31	0.11	
Cubiceps sp.	0.08 2	0.11	
Hymenocephalus heterolepis	0.08 10	0.11	
Setarches guentheri	0.07 2	0.11	
OGCOCEPHALIDAE	0.04 4	0.06	
Ostracoberyx dorygenys	0.02 2	0.03	
Metal waste	0.00 2	0.00	
Total	69.99	100.02	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 28
DATE :07/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°10.01
start stop duration Lon E 96°33.26
TIME :15:38:03 16:14:40 36.6 (min) Purpose : 3
LOG : 4815.65 4817.15 1.5 Region : 10500
FDEPTH: 200 20 Gear cond.: 0

BDEPTH: 582 583 Validity : 0
Towing dir: 0° Wire out : 550 m Speed : 2.5 kn
Sorted : 1 Total catch: 11.98 Catch/hour: 19.63

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	6.06 6567	30.89	
Ancistrocheirus sp.	4.23 41	21.54	
Cubiceps sp.	3.08 175	15.69	48
Small squid	1.14 778	5.83	
Krill	1.14 2289	5.83	
Olophoris gracilirostris	0.80 354	4.08	
UNIDENTIFIED FISH	0.57 80	2.91	
Diaphus sp.	0.37 46	1.86	
Leptocephalus	0.34 218	1.74	
J E L L Y F I S H	0.23 69	1.17	
Gempylus serpens	0.20 2	1.00	
Chauliodus sp.	0.13 34	0.64	
EVERMANNELLIDAE	0.13 34	0.64	
CRANCHIIDAE	0.12 18	0.59	
Howella brodiei	0.11 23	0.58	
Waste General	0.11 0	0.58	
Brama sp.	0.10 13	0.53	
Lampadena sp.	0.08 23	0.41	
Astronesthes sp	0.08 11	0.41	
PLATYTROCTIDAE	0.07 23	0.35	
Naso brevirostris	0.06 15	0.32	
Chiroteuthis sp.	0.06 11	0.29	
Argyropelecus sp.	0.06 34	0.29	
Myctophum sp.	0.05 23	0.23	
Diplophos sp.	0.05 23	0.23	
Chelidoperca sp.	0.05 11	0.23	
Chlorophthalmus corniger	0.05 11	0.23	
ENOPLOTEUTHIDAE	0.03 2	0.17	
Neoepinnula orientalis	0.03 2	0.17	
Cyclothone sp.	0.03 2	0.17	
TETRAODONTIDAE	0.02 5	0.11	
CONGRIDAE	0.02 2	0.08	
Bregmaceros sp.	0.01 23	0.06	
Benthodesmus sp.	0.01 11	0.06	
Vinciguerria sp.	0.01 57	0.06	
Total	19.63	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 29
DATE :07/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°9.76
start stop duration Lon E 96°31.68
TIME :20:07:15 20:37:18 30.1 (min) Purpose : 3
LOG : 4824.80 4826.39 1.6 Region : 10500
FDEPTH: 584 583 Gear cond.: 0
BDEPTH: 584 583 Validity : 0
Towing dir: 0° Wire out : 1350 m Speed : 3.2 kn
Sorted : 21 Total catch: 20.59 Catch/hour: 41.09

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Centrophorus sp.	12.10 4	29.44	
Gavialiceps taeniola	3.79 20	9.23	
Neoscopelus sp.	3.61 44	8.79	
CONGRIDAE	3.17 20	7.72	
Aristeidae	2.40 184	5.83	
Acanthephyra armata	2.12 465	5.15	
Talismania sp.	1.98 16	4.81	
Coelorinchus sp.	1.30 20	3.16	
Benthobatis sp.	1.30 2	3.16	
Glyptophidium sp.	0.94 48	2.28	
Cubiceps sp.	0.92 54	2.23	
Hydrolagus sp.	0.80 2	1.94	
MYCTOPHIDAE	0.72 206	1.75	
Lampadena sp.	0.60 24	1.46	
Cruriraja andamanica	0.52 2	1.26	
Diaphus sp.	0.50 50	1.21	
J E L L Y F I S H	0.44 132	1.07	
Nephropsis stewarti	0.30 10	0.73	
MELAMPHAIDAE	0.30 92	0.73	
Chauliodus sp.	0.28 32	0.68	
Dicrolene intronigra	0.26 8	0.63	
Diretmoides sp.	0.26 2	0.63	
MELANOSTOMIATIDAE	0.26 4	0.63	
Gonostoma sp.	0.24 12	0.58	
Ancistrocheirus sp.	0.22 4	0.53	
Polycheles sp.	0.22 58	0.53	
Coloconger raniceps	0.18 2	0.44	
Malacosteus sp.	0.18 12	0.44	
MASTIGOTEUTHIDAE	0.16 2	0.39	
Pasiphaea unispinosa	0.12 14	0.29	
EVERMANNELLIDAE	0.08 2	0.20	
Small squid	0.08 18	0.19	
Rhynchoconger sp.	0.08 2	0.19	
Hymenocephalus sp.	0.08 2	0.19	
NETTASTOMATIDAE	0.08 2	0.19	
Polyipnus sp.	0.06 24	0.15	
Chlorophthalmus corniger	0.06 4	0.15	
Shrimps unidentified	0.06 30	0.15	
Heterocarpus chani	0.06 4	0.15	
Leptocephalus	0.04 26	0.10	
LOLIGINIDAE	0.04 2	0.10	
Leptostomias sp.	0.04 4	0.10	
SERRIVOMERIDAE	0.02 4	0.06	
CRANCHIIDAE	0.02 2	0.05	
Bathypterois sp.	0.02 2	0.05	
OGCOCEPHALIDAE	0.02 6	0.05	
Olophoris gracilirostris	0.02 8	0.05	
Howella sp.	0.02 2	0.05	
OMMASTREPHIDAE	0.02 2	0.04	
Diplophos sp.	0.01 2	0.02	
Chiroteuthis sp.	0.01 2	0.02	
Unknown fish	0.00 2	0.01	
Total	41.09	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 30
DATE :08/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°10.66
start stop duration Lon E 96°2.80
TIME :01:18:23 01:51:43 33.3 (min) Purpose : 3
LOG : 4854.66 4856.31 1.7 Region : 10500
FDEPTH: 200 25 Gear cond.: 0
BDEPTH: 534 533 Validity : 0
Towing dir: 0° Wire out : 550 m Speed : 3.0 kn
Sorted : 0 Total catch: 0.24 Catch/hour: 0.44

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
SALPS	0.18 27	41.32	
LOLIGINIDAE	0.13 52	30.17	
CRANCHIIDAE	0.05 18	10.33	
TETRAODONTIDAE	0.03 9	6.61	
Brama sp.	0.02 14	4.55	
Leptocephalus	0.01 7	2.07	
CAESIONIDAE	0.01 5	2.07	
Synagrops sp.	0.00 2	0.83	
Naso sp.	0.00 2	0.41	
Decapterus sp.	0.00 4	0.41	
Lactoria sp.	0.00 2	0.41	
Setarches sp.	0.00 2	0.41	
UNIDENTIFIED FISH	0.00 9	0.41	
Fishing gears	0.00 2	0.00	
Total	0.44	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 31
DATE :08/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 8°9.19
start stop duration Lon E 95°59.89
TIME :07:27:13 07:57:05 29.9 (min) Purpose : 3
LOG : 4867.42 4868.92 1.5 Region : 10500
FDEPTH: 545 539 Gear cond.: 0
BDEPTH: 545 539 Validity : 0
Towing dir: 0° Wire out : 1320 m Speed : 3.0 kn
Sorted : 0 Total catch: 119.22 Catch/hour: 239.49

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Aristaeomorpha foliacea	151.38 6589	63.21	
Gavialiceps taeniola	23.30 185	9.73	
Hexatrygon brickelli	23.10 4	9.65	
Tausmania sp.	13.98 161	5.84	
Diretmoides sp.	5.38 40	2.25	
Neoscopelus sp.	2.57 48	1.07	
Iago sp.	1.97 4	0.82	
Neobythites sp.	1.89 16	0.79	
Waste General	1.77 0	0.74	
Coelorinchus mycterismus	1.61 48	0.67	
Synagrops sp.	1.61 48	0.67	
Coloconger sp.	1.45 16	0.60	
Sea cucumber	1.45 2	0.60	
Glyptophidium sp.	1.29 201	0.54	
Jelly squid	1.12 2	0.47	
Kondakovia sp.	0.88 2	0.37	
Ruvettus pretiosus	0.84 2	0.35	
Dicrolene sp.	0.64 24	0.27	
HISTIOTEUTHIDAE	0.48 2	0.20	
Beryx splendens	0.40 2	0.17	
Hymenocephalus sp.	0.32 16	0.13	
SOFT SPONGES	0.32 24	0.13	
SEA URCHINS	0.32 8	0.13	
ALEPOCEPHALIDAE	0.32 8	0.13	
Nephropsis stewarti	0.32 16	0.13	
Heterocarpus chani	0.16 32	0.07	
Gempylus serpens	0.16 8	0.07	
MYCTOPHIDAE	0.16 8	0.07	
Chlorophthalmus corniger	0.16 16	0.07	
E C H I N O D E R M A T A	0.07 8	0.03	
Bregmaceros sp.	0.06 8	0.02	
Total	239.49	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 32
DATE :08/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 8°10.07
start stop duration Lon E 95°43.91
TIME :11:31:39 12:31:10 59.5 (min) Purpose : 3
LOG : 4886.27 4889.19 2.9 Region : 10500
FDEPTH: 350 24 Gear cond.: 0
BDEPTH: 10 10 Validity : 0
Towing dir: 0° Wire out : 800 m Speed : 2.9 kn
Sorted : 0 Total catch: 38.24 Catch/hour: 38.55

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	21.52 9411	55.83	
Cubiceps sp.	5.11 273	13.25	49
OMMASTREPHIDAE	2.33 94	6.04	
Vinciguerria sp.	1.46 7898	3.78	
Brama sp.	1.37 27	3.55	50
Ancistrocheirus sp.	1.27 5	3.29	
Small squid	1.09 1095	2.84	
GONOSTOMATIDAE	0.73 638	1.89	
Diaphus sp.	0.73 128	1.89	
SERGESTIDAE	0.40 273	1.04	
Bregmaceros sp.	0.36 54	0.95	
Olophoris gracilirostris	0.29 383	0.76	
Lampadena sp.	0.24 36	0.61	
Polyipnus sp.	0.24 36	0.61	
Leptocephalus	0.22 219	0.57	
Lestidium sp.	0.18 36	0.47	
Electrona sp.	0.18 73	0.47	
SALPS	0.15 36	0.38	
Howella sp.	0.13 54	0.33	
Argyropelecus sp.	0.13 36	0.33	
Chauliodus sp.	0.11 18	0.29	
Lestrolepis intermedia	0.09 36	0.24	
Diplophos sp.	0.09 73	0.24	
Coccorella sp	0.05 36	0.14	
EVERMANNELLIDAE	0.04 18	0.09	
Decapterus sp.	0.02 18	0.05	
Naso sp.	0.02 36	0.05	
Total	38.55	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 33
DATE :08/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°53.79
start stop duration Lon E 95°42.01
TIME :18:55:55 19:59:25 63.5 (min) Purpose : 3
LOG : 4908.28 4911.18 2.9 Region : 10500
FDEPTH: 412 53 Gear cond.: 0
BDEPTH: 1241 1155 Validity : 0
Towing dir: 0° Wire out : 1100 m Speed : 2.7 kn
Sorted : 0 Total catch: 25.18 Catch/hour: 23.79

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	11.82 9668	49.67	
Waste General	3.76 0	15.81	
Ancistrocheirus sp.	1.98 14	8.34	
Small squid	1.07 590	4.52	
Olophoris gracilirostris	1.07 1342	4.52	
OMMASTREPHIDAE	0.59 18	2.46	
Argyropelecus sp.	0.54 108	2.26	
Glyphocrangon sp.	0.54 80	2.26	
J E L L Y F I S H	0.54 26	2.26	
Cubiceps sp.	0.38 21	1.59	51
Gempylus serpens	0.32 1	1.35	
Myctophum sp.	0.21 26	0.90	
PLATYTROCTIDAE	0.15 7	0.64	
Malacosteus sp.	0.10 26	0.43	
EVERMANNELLIDAE	0.10 54	0.42	
CRANCHIIDAE	0.09 2	0.40	
Bregmaceros sp.	0.09 26	0.37	
ASTRONESTHIDAE	0.08 3	0.32	0
SCOMBROLABRACIDAE	0.08 2	0.32	
Chauliodus sp.	0.08 54	0.32	
CONGRIDAE	0.06 26	0.26	
ASTRONESTHIDAE	0.04 26	0.17	
Howella sp.	0.03 26	0.14	
Chiroteuthis sp.	0.02 1	0.08	

HIMANTOLOPHIDAE	0.02	1	0.08
UNIDENTIFIED FISH	0.02	1	0.08
SPIRULIDAE	0.01	1	0.04
Neoepinnula orientalis	0.00	1	0.02
Cyttopsis rosea	0.00	1	0.01
Total	23.79		100.01

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 34
DATE :09/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°50.04
start stop duration Lon E 96°14.34
TIME :05:07:01 06:11:49 64.8 (min) Purpose : 3
LOG : 4946.88 4949.90 3.0 Region : 10500
FDEPTH: 500 30 Gear cond.: 0
BDEPTH: 644 672 Validity : 0
Towing dir: 0° Wire out : 1200 m Speed : 2.8 kn
Sorted : 0 Total catch: 11.48 Catch/hour: 10.63

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Waste General	3.56 0	33.54	
MYCTOPHIDAE	2.89 2313	27.20	
Jelly squid	0.93 1	8.71	
Oplophoris sp.	0.44 367	4.18	
Cubiceps sp.	0.44 33	4.18	
Argyropelecus sp.	0.44 161	4.18	
Bathyteuthis sp.	0.39 1	3.66	
HISTIOTEUTHIDAE	0.33 3	3.14	
Small squid	0.33 217	3.14	
Brama sp.	0.13 1	1.22	
Leptocephalus	0.11 89	1.05	
EVERMANNELLIDAE	0.11 28	1.05	
Cyclothone sp.	0.11 6	1.05	
Grammicolepis sp	0.09 1	0.87	
Histioteuthis celetaria	0.06 1	0.61	
Small shrimps	0.06 22	0.52	
Ostracoberyx dorygenys	0.06 11	0.52	
Unid. juvenile fishes	0.06 67	0.52	
J E L L Y F I S H	0.05 83	0.48	
Xenodermichthys sp.	0.02 1	0.17	
Total	10.63	99.98	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 35
DATE :09/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 7°50.34
start stop duration Lon E 96°14.97
TIME :10:25:44 10:56:56 31.2 (min) Purpose : 3
LOG : 4958.06 4959.64 1.6 Region : 10500
FDEPTH: 647 660 Gear cond.: 0
BDEPTH: 647 660 Validity : 0
Towing dir: 0° Wire out : 1390 m Speed : 3.0 kn
Sorted : 33 Total catch: 33.01 Catch/hour: 63.48

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Gavialiceps taeniola	30.66 156	48.30	
Plesiobatis daviesi	7.38 2	11.63	
Waste General	7.13 0	11.24	
CONGRIDAE	4.81 23	7.57	
Vitreledonella sp.	3.46 8	5.45	
Acanthephyra armata	2.12 296	3.33	54
Coloconger sp.	1.15 8	1.82	
Talismania sp.	1.08 8	1.70	52
Aristeus virilis	0.85 138	1.33	
Bathypterois sp.	0.69 29	1.09	
Dicrolene sp.	0.65 19	1.03	53
Coelorinchus mycterismus	0.58 8	0.91	
Benthobatis sp.	0.54 2	0.85	
Lamprogrammus sp.	0.46 17	0.73	
HISTIOTEUTHIDAE	0.31 2	0.48	
MACROURIDAE	0.27 10	0.42	
OPHIDIIDAE	0.23 2	0.36	
ALEPOCEPHALIDAE	0.23 2	0.36	
Glyphocrangon sp.	0.17 21	0.27	
SCOMBROLABRACIDAE	0.12 2	0.18	
OGCOCEPHALIDAE	0.12 15	0.18	
Cubiceps sp.	0.10 2	0.16	
Heterocarpus chani	0.10 6	0.15	
Nephropsis sp.	0.06 4	0.09	
Chaunax sp.	0.06 2	0.09	
Aristaeomorpha foliacea	0.05 2	0.08	
E C H I N O D E R M A T A	0.04 2	0.06	
J E L L Y F I S H	0.03 6	0.04	
MELAMPHAIDAE	0.02 6	0.04	
Bregmaceros sp.	0.01 4	0.01	
Olophoris gracilirostris	0.00 4	0.01	
Shrimps, small, non comm.	0.00 2	0.01	
TETRAODONTIDAE	0.00 2	0.00	
Aristeus sp.	0.00 2	0.00	
Fishing gears	0.00 2	0.00	
Plastic cans-jars etc	0.00 4	0.00	
Total	63.48	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 36
DATE :09/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°50.05
start stop duration Lon E 96°42.82
TIME :15:14:32 15:44:53 30.4 (min) Purpose : 3
LOG : 4986.59 4987.99 1.4 Region : 10500
FDEPTH: 195 25 Gear cond.: 0
BDEPTH: 778 775 Validity : 0
Towing dir: 0° Wire out : 550 m Speed : 2.8 kn
Sorted : 0 Total catch: 21.54 Catch/hour: 42.58

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	10.79 17535	25.34	
Cubiceps sp.	9.45 308	22.19	55
Elagatis bipinnulata	9.21 8	21.63	56
Ancistrocheirus lesueuri	3.16 18	7.43	
Small squid	2.10 1724	4.93	
Leptocephalus	1.50 900	3.52	
OMMASTREPHIDAE	1.34 71	3.16	
Olophoris gracilirostris	0.90 660	2.11	
Diaphus sp.	0.67 89	1.58	
Vinciguerria sp.	0.43 1799	1.02	
Brama sp.	0.43 2	1.02	
Chauliodus sp	0.36 45	0.84	
Krill	0.33 2054	0.78	
Dipterygonotus sp.	0.30 16	0.71	
ENOPLOTEUTHIDAE	0.28 12	0.65	
Electrona sp.	0.18 89	0.42	
Funchalia sp	0.18 75	0.42	
SERGESTIDAE	0.16 105	0.39	
Histioteuthis sp.	0.16 2	0.37	
EVERMANNELLIDAE	0.12 16	0.28	
SALPS	0.08 45	0.18	
Coccorella sp	0.08 16	0.18	
Diplophos sp.	0.05 45	0.11	
JUVENILE FISHES	0.05 285	0.11	
CRANCHIIDAE	0.05 30	0.11	
MACROURIDAE	0.04 2	0.09	
ALEPOCEPHALIDAE	0.04 2	0.09	
Lepidophanes guentheri	0.03 16	0.07	
Bregmaceros sp.	0.03 16	0.07	
Argyropelecus sp.	0.02 16	0.04	
Howella brodiei	0.02 2	0.04	
Brama sp.	0.02 16	0.04	0
Neoepinnula orientalis	0.02 16	0.04	
Myctophum sp.	0.02 16	0.04	
Naso brevirostris	0.02 16	0.04	
Total	42.59	100.01	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 37
DATE :09/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 7°49.90
start stop duration Lon E 96°43.26
TIME :19:56:51 20:26:12 29.4 (min) Purpose : 3
LOG : 4995.65 4997.08 1.4 Region : 10500
FDEPTH: 781 775 Gear cond.: 0
BDEPTH: 781 775 Validity : 0
Towing dir: 0° Wire out : 1750 m Speed : 2.9 kn
Sorted : 31 Total catch: 30.63 Catch/hour: 62.62

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Gavialiceps taeniola	22.49 59	35.91	
J E L L Y F I S H	16.64 2	26.58	
Talismania sp.	4.50 27	7.18	58
Acanthephyra armata	3.84 515	6.14	
Coelorinchus sp.	2.11 25	3.36	
Waste General	1.64 0	2.61	
Hydrolagus sp.	1.55 2	2.48	
Cruriraja andamanica	0.98 4	1.57	
Sea cucumber	0.94 2	1.50	
Gonostoma sp.	0.94 33	1.50	
ALEPOCEPHALIDAE	0.86 14	1.37	
Chiroteuthis sp.	0.78 4	1.24	
Coloconger raniceps	0.61 4	0.98	
NEMICHTHYIDAE	0.52 4	0.83	
Ancistrocheirus lesueuri	0.41 4	0.65	
Nephropsis sp.	0.37 161	0.59	
Leptocephalus	0.37 423	0.59	
Hymenocephalus sp.	0.29 8	0.46	
Dicrolene sp.	0.26 10	0.41	
Cubiceps sp.	0.25 14	0.39	57
Chauliodus sp.	0.25 25	0.39	
Histioteuthis sp.	0.25 2	0.39	
MYCTOPHIDAE	0.25 102	0.39	
Photonectes sp.	0.16 2	0.26	
OGCOCEPHALIDAE	0.14 12	0.23	
Coccorella sp	0.12 8	0.20	
Bathypterois	0.12 6	0.20	
SEPIOLIDAE	0.12 2	0.20	
Jelly squid	0.12 2	0.20	
POLYCHAELIDAE	0.10 6	0.16	
GONOSTOMATIDAE	0.08 6	0.13	
SCOMBROLABRACIDAE	0.08 2	0.13	
Lamprogrammus sp.	0.08 8	0.13	
Glyphocrangon sp.	0.08 49	0.13	
MELAMPHAIDAE	0.06 22	0.10	
Scopelogadus sp.	0.06 10	0.09	
OPHIDIIDAE	0.04 2	0.07	
Squid unidentified	0.04 4	0.07	
OMOSUDIDAE	0.04 8	0.07	
Howella sp.	0.02 2	0.03	
NEPHROPIDAE	0.02 2	0.03	
G A S T R O P O D S	0.02 2	0.03	
Idiacanthus sp.	0.02 4	0.03	
GLYPHOCRANGONIDAE	0.00 6	0.00	
Oplophoris sp.	0.00 10	0.00	
Diplophos sp.	0.00 2	0.00	
Bregmaceros sp.	0.00 6	0.00	
Malacosteus sp.	0.00 2	0.00	
PLATYTROCTIDAE	0.00 2	0.00	
Hoplostethus sp.	0.00 2	0.00	
Small squids	0.00 8	0.00	
Total	62.62	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 38
DATE :10/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°49.98
start stop duration Lon E 97°12.03
TIME :01:06:20 02:10:03 63.7 (min) Purpose : 3
LOG : 5025.86 5028.76 2.9 Region : 10500
FDEPTH: 400 30 Gear cond.: 0
BDEPTH: 524 511 Validity : 0
Towing dir: 0° Wire out : 850 m Speed : 2.7 kn
Sorted : 1 Total catch: 0.51 Catch/hour: 0.48

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Chauliodus sp.	0.13 18	27.29	
Olophoris gracilirostris	0.11 64	23.39	
Leptocephalus	0.09 8	19.49	
Coccorella sp	0.05 14	9.75	
Diaphus sp.	0.04 5	8.38	
J E L L Y F I S H	0.04 6	7.80	
TETRAODONTIDAE	0.01 3	1.95	
ENOPLOTEUTHIDAE	0.00 4	0.78	
Funchalia sp	0.00 2	0.62	
UNIDENTIFIED FISH, juvenile	0.00 3	0.19	
MONACANTHIDAE, juvenile	0.00 1	0.19	
Naso brevirostris	0.00 2	0.19	
Total	0.48	100.04	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 39
DATE :10/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 7°50.01
start stop duration Lon E 97°15.22
TIME :03:02:41 03:32:35 29.9 (min) Purpose : 3
LOG : 5032.14 5033.62 1.5 Region : 10500
FDEPTH: 510 516 Gear cond.: 0
BDEPTH: 510 516 Validity : 0
Towing dir: 0° Wire out : 1150 m Speed : 3.0 kn
Sorted : 0 Total catch: 92.55 Catch/hour: 185.65

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
DIRETMIDAE	50.83 694	27.38	
Centrophorus granulosus	43.13 14	23.23	59
MYCTOPHIDAE	15.83 3793	8.53	
Benthodesmus sp.	11.76 100	6.33	
Neoscopelus microchir	8.51 154	4.58	60
Halieutaea sp.	8.46 40	4.56	
Bythaelurus sp.	6.62 70	3.57	62
Hydrolagus sp.	4.65 12	2.51	
ALEPOCEPHALIDAE	3.55 164	1.91	
Talismania sp.	3.00 96	1.62	61
Gavialiceps taeniola	2.81 30	1.51	
BATHYTEUTHIDAE	2.73 82	1.47	
ARISTEIDAE	2.18 381	1.18	
Heterocarpus chani	2.18 136	1.18	

Holcomycteronus sp.	2.05	4	1.10	
Gempylus sp.	1.97	6	1.06	
Waste General	1.64	0	0.88	
Hymenocephalus heterolepis	1.50	40	0.81	
Coelorinchus sp.	1.32	28	0.71	
Histioteuthis sp.	0.96	8	0.52	
Nephropsis sp.	0.82	68	0.44	
Peristedion sp.	0.72	4	0.39	
Benthobatis sp.	0.72	2	0.39	
Chiroteuthis sp.	0.71	16	0.38	
Glyptophidium sp.	0.68	2	0.37	
Apristurus longicephalus	0.58	4	0.31	63
Chaunax sp.	0.56	2	0.30	
MYCTOPHIDAE	0.55	40	0.29	0
Synagrops sp.	0.55	14	0.29	
LOPHIIDAE	0.36	4	0.19	
Neoepinnula orientalis	0.36	6	0.19	
OMMASTREPHIDAE	0.32	10	0.17	
Dicrolene sp.	0.27	28	0.15	
Cubiceps sp.	0.27	28	0.15	
Chauliodus sp.	0.27	54	0.15	
Oplophoris sp.	0.27	273	0.15	
Setarches sp.	0.27	14	0.15	
MELANOSTOMIATIDAE	0.27	14	0.15	
CARIDEA	0.27	54	0.15	
Leptocephalus	0.27	14	0.15	
Ostracoberyx dorygenys	0.27	14	0.15	
Coloconger sp.	0.20	2	0.11	
EVERMANNELLIDAE	0.16	2	0.09	
Chlorophthalmus sp.	0.10	14	0.05	
Bregmaceros sp.	0.10	28	0.05	
Lestrolepis sp.	0.03	4	0.02	
Fishing gears	0.00	4	0.00	
Total	185.65		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 40
DATE :10/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°31.95
start stop duration Lon E 97°45.62
TIME :12:00:47 12:33:04 32.3 (min) Purpose : 3
LOG : 5075.30 5076.90 1.6 Region : 10500
FDEPTH: 194 26 Gear cond.: 0
BDEPTH: 420 436 Validity : 0
Towing dir: 0° Wire out : 480 m Speed : 3.0 kn
Sorted : 1 Total catch: 49.54 Catch/hour: 92.08

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
weight numbers				
MYCTOPHIDAE	42.31	47257	45.94	
Trichiurus lepturus	31.56	110	34.28	65
Small squid	5.92	2242	6.43	
Ancistrocheirus lesueuri	2.86	2	3.11	
Olophoris gracilirostris	2.54	3130	2.76	
Cubiceps sp.	1.15	32	1.25	64
Sthenoteuthis oualaniensis	1.00	2	1.09	
Polyipnus sp.	0.85	634	0.92	
Krill	0.85	931	0.92	
Electrona sp.	0.42	212	0.46	
Neoepinnula orientalis	0.30	65	0.32	
Leptocephalus	0.30	255	0.32	
Diaphus sp.	0.30	86	0.32	
Aristaeomorpha foliacea	0.26	30	0.28	
Lestrolepis intermedia	0.22	26	0.24	
Brama sp.	0.19	4	0.20	
Heterocarpus chani	0.19	19	0.20	
Chauliodus sp.	0.17	43	0.18	
Decapterus sp.	0.15	32	0.16	
Vinciguerria sp.	0.13	381	0.14	
Pasiphaea sp.	0.09	169	0.09	
Setarches guentheri	0.07	4	0.08	
Histioteuthis sp.	0.07	7	0.08	
TETRAODONTIDAE	0.05	2	0.05	
SYNGNATHIDAE	0.04	43	0.05	
CRANCHIIDAE	0.03	4	0.04	
Tunicata	0.01	4	0.02	
Synagrops sp.	0.01	2	0.02	
Funchalia sp	0.01	6	0.01	
Gavialiceps taeniola	0.01	4	0.01	
OPHICHTHIDAE	0.01	2	0.01	
Sargocentron sp.	0.00	2	0.00	
CARANGIDAE	0.00	2	0.00	
Total	92.08		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 41
DATE :10/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°29.91
start stop duration Lon E 97°45.78
TIME :16:34:53 17:08:50 34.0 (min) Purpose : 3
LOG : 5082.08 5084.48 2.4 Region : 10500
FDEPTH: 0 0 Gear cond.: 0
BDEPTH: 432 419 Validity : 0
Towing dir: 0° Wire out : 250 m Speed : 4.2 kn
Sorted : 0 Total catch: 41.36 Catch/hour: 73.10

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
weight numbers				
OMMASTREPHIDAE	26.81	1737	36.68	
Cubiceps sp.	19.16	486	26.21	66
MYCTOPHIDAE	13.90	17378	19.02	
Small squids unident.	3.97	993	5.44	
Krill	1.99	84908	2.72	
Coryphaena equiselis	1.17	7	1.60	
Leptocephalus	0.99	993	1.36	
Waste General	0.99	0	1.36	
Selar sp.	0.99	49	1.36	
SCOMBRIDAE	0.99	49	1.36	
Trichiurus sp.	0.92	7	1.26	
Cheilopogon sp.	0.32	4	0.44	
Synagrops sp.	0.25	7	0.34	
Myctophum sp.	0.20	497	0.27	
Rexea bengalensis	0.16	2	0.22	
Tentoriceps cristatus	0.14	2	0.19	
ARGONAUTIDAE	0.07	2	0.10	
UNIDENTIFIED FISH, juvenile	0.04	2	0.05	
Zanclus cornutus, juvenile	0.04	4	0.05	
Total	73.10		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 42
DATE :10/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 7°29.91
start stop duration Lon E 97°42.29
TIME :18:38:53 19:08:07 29.2 (min) Purpose : 3
LOG : 5091.38 5092.80 1.4 Region : 10500
FDEPTH: 421 418 Gear cond.: 0
BDEPTH: 421 418 Validity : 0
Towing dir: 0° Wire out : 1040 m Speed : 2.9 kn
Sorted : 0 Total catch: 37.59 Catch/hour: 77.16

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
weight numbers				
Heterocarpus sp.	20.44	1840	26.50	
Gavialiceps sp.	13.22	150	17.13	
Bythaelurus sp.	7.80	224	10.11	
ARISTEIDAE	6.24	291	8.09	
Hypopleuron caninum	4.89	21	6.33	
Waste General	4.19	0	5.43	
MYCTOPHIDAE	4.15	2309	5.37	
BOTHIDAE	3.28	31	4.26	
Polyipnus sp.	2.79	780	3.62	
Neoscopelus microchir	1.72	140	2.23	
Trichiurus lepturus	1.64	4	2.13	
Histioteuthis sp.	1.11	6	1.44	
Talismania sp.	0.70	25	0.90	
Small shrimps	0.66	480	0.85	
Coelorinchus sp.	0.66	66	0.85	
OPHICHTHIDAE	0.49	16	0.64	
Torquigener sp.	0.33	8	0.43	
CONGRIDAE	0.21	12	0.27	
Peristedion sp.	0.21	8	0.27	
Neoepinnula orientalis	0.21	4	0.27	
Cubiceps sp.	0.16	6	0.21	
L O B S T E R S	0.16	8	0.21	
Lestrolepis intermedia	0.16	2	0.21	
Cynoglossus sp.	0.16	2	0.21	
Platymaia sp	0.16	4	0.21	
Coloconger raniceps	0.16	4	0.21	
Chaunax sp.	0.12	4	0.16	
Puerulus sewelli	0.12	4	0.16	
Hymenocephalus sp.	0.12	10	0.16	
Setarches sp.	0.12	4	0.16	
Tydemania sp.	0.12	10	0.16	
Lampadena sp.	0.08	4	0.11	
Synagrops sp.	0.08	2	0.11	
Diaphus sp.	0.08	4	0.11	
Neobythites sp.	0.08	8	0.11	
NEMICHTHYIDAE	0.08	4	0.11	
MELANOSTOMIATIDAE	0.04	2	0.05	
Nephropsis sp.	0.04	4	0.05	
Glyptophidium sp.	0.04	2	0.05	
Chlorophthalmus sp.	0.04	2	0.05	
Decapterus sp.	0.02	2	0.03	
Total	77.12		99.95	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 43
DATE :10/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°29.76
start stop duration Lon E 97°32.53
TIME :21:14:30 21:47:57 33.5 (min) Purpose : 3
LOG : 5105.00 5106.58 1.6 Region : 10500
FDEPTH: 210 25 Gear cond.: 0
BDEPTH: 469 477 Validity : 0
Towing dir: 0° Wire out : 500 m Speed : 2.8 kn
Sorted : 0 Total catch: 23.18 Catch/hour: 41.57

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
weight numbers				
Hexatrygon brickelli	9.29	2	22.35	
MYCTOPHIDAE	6.97	8188	16.76	
Histioteuthis sp.	5.88	545	14.15	
Gavialiceps taeniola	4.36	240	10.48	
Ancistrocheirus sp.	3.69	4	8.89	
Cubiceps sp.	2.94	65	7.08	
Waste General	2.18	0	5.24	
Krill	1.74	113245	4.19	
Leptocephalus	1.31	828	3.14	
Small squid	1.31	567	3.14	
Olophoris gracilirostris	0.65	479	1.57	
Priacanthus sp.	0.39	5	0.95	
Brama sp.	0.18	5	0.43	
Lestrolepis sp.	0.15	22	0.37	
Neoepinnula orientalis	0.14	4	0.35	
Myctophum sp.	0.09	348	0.21	
Synagrops sp.	0.07	4	0.17	
EXOCOETIDAE	0.07	2	0.17	
Zanclus cornutus, juvenile	0.04	2	0.09	
Poecilopsetta sp.	0.04	2	0.09	
Acanthephyra armata	0.04	2	0.09	
Bregmaceros sp.	0.02	22	0.05	
Naso brevirostris	0.02	22	0.05	
Total	41.57		100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 44
DATE :11/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 7°29.90
start stop duration Lon E 97°28.79
TIME :01:46:23 02:17:25 31.1 (min) Purpose : 3
LOG : 5113.50 5115.12 1.6 Region : 10500
FDEPTH: 493 482 Gear cond.: 0
BDEPTH: 493 482 Validity : 0
Towing dir: 0° Wire out : 1100 m Speed : 3.1 kn
Sorted : 67 Total catch: 93.26 Catch/hour: 180.21

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
weight numbers				
Centrophorus granulosus	72.46	12	40.21	72
Gavialiceps taeniola	23.75	526	13.18	
Hexatrygon brickelli	16.39	4	9.09	
Neoscopelus microchir	14.58	400	8.09	69
Heterocarpus chani	8.50	657	4.71	
Benthobatis sp.	6.34	10	3.52	
Talismania sp.	6.08	193	3.38	67
Acanthephyra armata	3.86	242	2.14	
Bythaelurus sp.	3.48	58	1.93	68
Aristeus virilis	3.38	155	1.88	71
Cubiceps sp.	2.90	87	1.61	70
Hymenocephalus heterolepis	2.41	419	1.34	
OMMASTREPHIDAE	1.83	68	1.02	
Satyrichthys sp.	1.64	10	0.91	
Dicrolene sp.	1.35	43	0.75	
Neoepinnula orientalis	0.97	10	0.54	
SOLENOCERIDAE	0.87	43	0.48	
Brama sp.	0.87	10	0.48	
Benthodesmus sp.	0.77	14	0.43	
Coelorinchus sp.	0.77	48	0.43	
Chiroteuthis sp.	0.77	19	0.43	
Glyphocrangon sp.	0.68	87	0.38	
Halieutaea sp.	0.68	4	0.38	
Histioteuthis sp.	0.68	4	0.38	
CONGRIDAE	0.63	14	0.35	
OGCOCEPHALIDAE	0.48	77	0.27	
Synagrops sp.	0.48	19	0.27	
Setarches longimanus	0.39	19	0.21	
Aristaeopsis edwardsiana	0.39	10	0.21	
Setarches guentheri	0.19	10	0.11	
CRANCHIIDAE	0.19	10	0.11	
Ostracoberyx dorygenys	0.19	14	0.11	
Peristedion sp.	0.19	4	0.11	
Ariosoma sp.	0.19	4	0.11	
ARISTEIDAE	0.19	77	0.11	
Astronesthes sp	0.10	14	0.06	
Leptocephalus	0.10	10	0.05	
Tunicata	0.10	19	0.05	
MURAENIDAE	0.10	4	0.05	
ALEPOCEPHALIDAE	0.08	4	0.05	
Chauliodus sp	0.06	29	0.03	
ASTRONESTHIDAE	0.04	4	0.02	
PLATYTROCTIDAE	0.03	4	0.02	
Photonectes sp.	0.02	4	0.01	

Bregmaceros sp.	0.02	10	0.01
TETRAODONTIDAE	0.01	4	0.01
Chlorophthalmus sp.	0.01	4	0.01
OPHIDIIDAE	0.01	4	0.01
LINOPHRYNIDAE	0.00	4	0.00
Total	180.21		100.00

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 45
DATE :11/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 7°32.38
start stop duration Lon E 96°59.34
TIME :07:50:41 08:20:03 29.4 (min) Purpose : 3
LOG : 5153.58 5155.07 1.5 Region : 10500
FDEPTH: 775 772 Gear cond.: 0
BDEPTH: 775 772 Validity : 0
Towing dir: 0° Wire out : 1765 m Speed : 3.1 kn
Sorted : 22 Total catch: 51.70 Catch/hour: 105.65

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
J E L L Y F I S H	23.60 1263	22.34	
Gavialiceps taeniola	18.47 84	17.49	
Waste General	15.81 0	14.96	
Acanthephyra armata	10.39 407	9.83	
Aristeidae	4.97 317	4.70	
Benthobatis moresbyi	4.78 8	4.53	
Talismania sp.	4.05 33	3.83	
Iago sp.	2.90 2	2.75	
Small shrimps	1.81 701	1.71	
Cubiceps sp.	1.81 90	1.71	
ANOPLOGASTERIDAE	1.81 45	1.71	
Sea cucumber	1.63 4	1.55	
Hymenocephalus sp.	1.35 22	1.28	
Neobythites sp.	1.35 22	1.28	
Glyphocrangon sp.	1.35 362	1.28	
Coloconger sp.	1.06 4	1.01	
OCTOPOTEUTHIDAE	1.06 2	1.01	
Chauliodus sp	1.04 112	0.98	
ALEPOCEPHALIDAE	0.90 22	0.85	
Hydrolagus sp.	0.74 2	0.70	
OPISTHOTEUTHIDAE	0.69 2	0.66	
Cruriraja andamanica	0.69 2	0.66	
HISTIOTEUTHIDAE	0.61 2	0.58	
Gempylus sp.	0.57 2	0.54	
MYCTOPHIDAE	0.45 294	0.43	
Avocettina sp.	0.45 22	0.43	
Halosaurus sp.	0.45 112	0.43	
Puerulus sp.	0.25 4	0.23	
Halieutaea sp.	0.23 67	0.21	
Small squid	0.23 112	0.21	
Tydemania sp.	0.04 2	0.04	
Bregmaceros sp.	0.02 22	0.02	
Bathypterois sp.	0.02 22	0.02	
MELAMPHAIDAE	0.02 22	0.02	
Leptocephalus	0.02 22	0.02	
Total	105.65		100.00

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 46
DATE :11/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°30.07
start stop duration Lon E 96°57.23
TIME :12:37:03 13:09:42 32.6 (min) Purpose : 3
LOG : 5159.71 5161.22 1.5 Region : 10500
FDEPTH: 200 30 Gear cond.: 0
BDEPTH: 881 920 Validity : 0
Towing dir: 0° Wire out : 540 m Speed : 2.8 kn
Sorted : 10 Total catch: 37.00 Catch/hour: 67.99

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	21.23 36371	31.22	
Cubiceps sp.	18.73 1062	27.55	73
Ancistrocheirus lesueuri	11.72 72	17.24	
OMMASTREPHIDAE	2.50 1498	3.67	0
Sthenoteuthis oualaniensis	1.95 83	2.86	
Leptocephalus	1.87 781	2.75	
Olophoris gracilirostris	1.87 1187	2.75	
Funchalia sp	1.56 62	2.29	
Brama sp.	1.32 11	1.95	74
SERGESTIDAE	0.91 1529	1.33	
Krill	0.62 3622	0.92	
Diaphus sp.	0.62 94	0.92	
Electrona sp.	0.62 219	0.92	
Chauliodus sp.	0.62 94	0.92	
Astronesthes sp	0.62 62	0.92	
Bregmaceros sp.	0.22 94	0.32	
Howella sp.	0.22 62	0.32	
SCOMBROLABRACIDAE	0.16 31	0.23	
Coccorella sp	0.12 62	0.18	
Ectreposebastes imus	0.11 2	0.16	
Neoepinnula orientalis	0.07 2	0.11	
MELAMPHAIDAE	0.06 31	0.09	
GONOSTOMATIDAE	0.06 31	0.09	
Lestrolepis sp.	0.06 31	0.09	
Auxis sp.	0.04 2	0.05	
Unidentified fish	0.03 31	0.05	
EVERMANNELLIDAE	0.03 31	0.05	
Histioteuthis sp.	0.01 2	0.02	
EMMELICHTHYIDAE	0.01 2	0.01	
Total	67.99		100.00

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 47
DATE :11/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°29.90
start stop duration Lon E 96°33.53
TIME :16:47:13 17:27:58 40.8 (min) Purpose : 3
LOG : 5183.79 5185.54 1.8 Region : 10500
FDEPTH: 190 20 Gear cond.: 0
BDEPTH: 910 908 Validity : 0
Towing dir: 0° Wire out : 450 m Speed : 2.6 kn
Sorted : 0 Total catch: 20.46 Catch/hour: 30.12

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	8.28 8285	27.51	
Ancistrocheirus lesueuri	4.68 19	15.54	
Waste General	3.68 0	12.23	
Cubiceps sp.	2.77 171	9.19	75
Small squids	1.47 1151	4.89	
OPLOPHORIDAE	1.47 1474	4.89	
Leptocephalus	1.06 230	3.51	
Small shrimps	0.92 2071	3.05	
OMMASTREPHIDAE	0.74 12	2.44	
EVERMANNELLIDAE	0.46 46	1.53	
Idiacanthinae	0.46 46	1.53	
Astronesthes sp	0.46 46	1.53	
Neoepinnula orientalis	0.46 7	1.52	
Nesiarchus sp.	0.38 1	1.27	
GEMPYLIDAE	0.34 3	1.12	
Melanostomias sp.	0.32 46	1.07	
Funchalia sp	0.32 138	1.07	
Diaphus sp.	0.29 1	0.98	
Brama sp.	0.24 3	0.78	
Vinciguerria sp.	0.21 1197	0.69	
J E L L Y F I S H	0.18 93	0.61	
OCTOPODIDAE	0.14 46	0.46	
Bregmaceros sp.	0.14 46	0.46	
UNIDENTIFIED FISH	0.12 4	0.39	
Chauliodus sp.	0.09 93	0.31	
CRANCHIIDAE	0.09 46	0.31	
Diplophos sp.	0.09 93	0.31	
ANOPLOGASTERIDAE	0.09 9	0.29	
Lestrolepis sp.	0.05 9	0.17	
CAPROIDAE	0.05 46	0.15	
DERICHTHYDAE	0.02 1	0.07	
Ectreposebastes imus	0.01 1	0.04	
MELAMPHAIDAE	0.01 1	0.03	
Xiphasia sp.	0.01 1	0.02	
ALEPOCEPHALIDAE	0.01 1	0.02	
NEMICHTHYIDAE	0.00 1	0.00	
Total	30.12		100.01

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 48
DATE :12/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 7°10.05
start stop duration Lon E 97°12.18
TIME :03:37:19 04:43:51 66.5 (min) Purpose : 3
LOG : 5235.36 5238.59 3.2 Region : 10500
FDEPTH: 490 40 Gear cond.: 0
BDEPTH: 831 732 Validity : 0
Towing dir: 0° Wire out : 1100 m Speed : 2.9 kn
Sorted : 0 Total catch: 7.70 Catch/hour: 6.94

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	2.38 1856	34.26	
J E L L Y F I S H	1.11 317	15.99	
OPLOPHORIDAE	0.95 896	13.70	
Leptocephalus	0.63 142	9.14	
Waste General	0.45 0	6.49	
Small squid	0.41 222	5.94	
HISTIOTEUTHIDAE	0.18 1	2.60	
Chauliodus sp.	0.10 23	1.48	
Argyropelecus sp.	0.10 79	1.38	
Funchalia woodwardi	0.08 32	1.14	
TETRAGONURIDAE	0.07 3	1.04	
Brama sp.	0.07 1	1.04	
TETRAODONTIDAE	0.06 16	0.91	
Diaphus sp.	0.06 79	0.81	
Isistius brasiliensis	0.05 1	0.65	
Beryx splendens	0.04 48	0.57	
Coccorella sp	0.04 23	0.57	
Howella sp.	0.03 8	0.45	
EMMELICHTHYIDAE	0.03 40	0.45	
OMMASTREPHIDAE	0.03 2	0.38	
Krill	0.02 238	0.34	
Lestrolepis sp.	0.02 3	0.26	
SEPIOLIDAE	0.01 1	0.17	
Diplophos sp.	0.01 3	0.12	
Electrona sp.	0.01 8	0.12	
Total	6.94		99.99

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 49
DATE :12/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 7°11.41
start stop duration Lon E 97°13.96
TIME :09:21:55 09:52:55 31.0 (min) Purpose : 3
LOG : 5247.48 5248.98 1.5 Region : 10500
FDEPTH: 750 750 Gear cond.: 0
BDEPTH: 750 750 Validity : 0
Towing dir: 0° Wire out : 1700 m Speed : 2.9 kn
Sorted : 88 Total catch: 88.35 Catch/hour: 171.00

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Hexatrygon brickelli	95.34 15	55.76	
Gavialiceps taeniola	20.36 170	11.91	
J E L L Y F I S H	19.86 507	11.61	
Benthobatis sp.	4.68 10	2.74	
Waste General	4.57 0	2.67	
Halieutaea sp.	4.14 4	2.42	
Talismania sp.	3.45 23	2.01	76
Acanthephyra armata	2.63 232	1.54	
Coelorinchus sp.	1.82 25	1.06	
Sea cucumber	1.78 4	1.04	
Lamprogrammus sp.	1.55 37	0.91	
Dicrolene sp.	1.28 39	0.75	
Cruriraja andamanica	1.08 6	0.63	
Xenomystax sp.	1.05 6	0.61	
Aristeidae	0.58 186	0.34	
SOFT SPONGES	0.54 2	0.32	
Coloconger sp.	0.50 2	0.29	
Acanthephyra sp.	0.50 85	0.29	
SERGESTIDAE	0.43 29	0.25	
GONOSTOMATIDAE	0.43 17	0.25	
Hydrolagus sp.	0.39 2	0.23	
Apristurus longicephalus	0.38 4	0.22	
Bathypterois	0.35 15	0.20	
Aristeus virilis	0.35 39	0.20	
Glyphocrangon sp.	0.31 201	0.18	
Nemichthys scolopaceus	0.27 14	0.16	
Ancistrocheirus lesueuri	0.23 2	0.14	
Histioteuthis sp.	0.23 2	0.14	
Diceratias cf. bispinosus	0.19 8	0.11	
Diretmoides sp.	0.19 2	0.11	
Aristeus mabahissae	0.19 19	0.11	
ALEPOCEPHALIDAE	0.15 8	0.09	
Sthenoteuthis oualaniensis	0.15 4	0.09	
Leptocephalus	0.15 15	0.09	
Neobythites sp.	0.12 4	0.07	
OPHIDIIDAE	0.12 2	0.07	
POLYCHAELIDAE	0.08 2	0.05	
Coccorella sp	0.08 4	0.05	
Aristaeopsis edwardsiana	0.08 2	0.05	
Chauliodus sp.	0.08 8	0.05	
Hoplostethus sp.	0.07 4	0.04	
Olophoris gracilirostris	0.04 14	0.02	
Oplophoris sp.	0.04 27	0.02	
MELANOSTOMIATIDAE	0.04 2	0.02	
Priacanthus sp.	0.04 2	0.02	
MACROURIDAE	0.04 2	0.02	
OGCOCEPHALIDAE	0.03 4	0.02	
CARIDEA	0.03 6	0.01	
Electrona sp.	0.01 2	0.01	
TETRAODONTIDAE	0.01 2	0.00	
Gorgonians	0.01 2	0.00	
Total	171.00		100.00

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 50
DATE :12/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 6°53.10
start stop duration Lon E 97°29.99
TIME :14:56:22 15:28:19 31.9 (min) Purpose : 3

LOG : 5282.40 5283.76 1.4 Region : 10500
FDEPTH: 180 30 Gear cond.: 0
BDEPTH: 528 535 Validity : 0
Towing dir: 0° Wire out : 550 m Speed : 2.5 kn
Sorted : 8 Total catch: 23.32 Catch/hour: 43.79

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
MYCTOPHIDAE	23.96 398426	54.70	
OMMASTREPHIDAE	6.53 819	14.91	
Leptocephalus	2.58 255	5.90	
Olophoris gracilirostris	2.22 1264	5.06	
Funchalia sp	1.77 531	4.05	
Ancistroteuthis lesueurii	1.65 6	3.77	
Cubiceps sp.	1.24 94	2.83	77
Diaphus sp.	0.89 177	2.02	
Halieutaea sp.	0.49 2	1.11	
Electrona sp.	0.44 111	1.01	
Diplophos sp.	0.44 511	1.01	
Bregmaceros sp.	0.33 244	0.76	
Brama sp.	0.26 6	0.60	
Chauliodus sp.	0.15 17	0.34	
Histioteuthis sp.	0.15 2	0.34	
Naso sp.	0.11 45	0.25	
Parascombrops sp.	0.09 23	0.20	
Coccorella sp	0.08 11	0.17	
Gempylus sp.	0.08 6	0.17	
Lestrolepis sp.	0.08 11	0.17	
Xenodermichthys sp.	0.08 6	0.17	
CRANCHIIDAE	0.04 8	0.10	
Astronesthes sp	0.04 2	0.09	
Beryx splendens	0.02 45	0.05	
Rexea sp.	0.02 23	0.05	
Ostichthys sp.	0.02 23	0.05	
Tunicata	0.02 23	0.05	
Howella sp.	0.01 2	0.02	
Polymixia sp.	0.00 2	0.00	
Total	43.79	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 51
DATE :12/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 6°53.54
start stop duration Lon E 97°30.48
TIME :19:31:15 20:01:07 29.9 (min) Purpose : 3
LOG : 5290.00 5291.46 1.5 Region : 10500
FDEPTH: 520 524 Gear cond.: 0
BDEPTH: 520 524 Validity : 0
Towing dir: 0° Wire out : 1225 m Speed : 2.9 kn
Sorted : 0 Total catch: 53.19 Catch/hour: 106.89

SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Plesiobatis daviesi	30.14 2	28.20	
Talismania sp.	12.38 98	11.58	
Bythaelurus sp.	11.94 153	11.17	78
MYCTOPHIDAE	8.72 1744	8.16	
Aristeus sp.	8.56 442	8.01	
Gavialiceps taeniola	5.30 48	4.96	
Halieutaea sp.	5.02 2	4.70	
Neoscopelus microchir	4.86 96	4.55	
Waste General	2.09 0	1.96	
Coelorinchus sp.	2.01 28	1.88	
ARISTEIDAE	2.01 770	1.88	
Benthodesmus sp.	1.91 8	1.79	
CRANCHIIDAE	1.26 4	1.17	
Heterocarpus chani	1.21 62	1.13	
Malacocephalus laevis	1.21 4	1.13	
Glyphocrangon sp.	1.09 143	1.02	
CENTROLOPHIDAE	1.00 2	0.94	
Centrophorus sp.	1.00 2	0.94	
Lophius sp.	0.64 2	0.60	
Melanostomias sp.	0.53 2	0.50	
Nephropsis sp.	0.40 20	0.38	
OPHIDIIDAE	0.36 18	0.34	
Xenomystax sp.	0.36 4	0.34	
Glyptophidium sp.	0.36 18	0.34	
Chauliodus sp	0.32 50	0.30	
Hymenocephalus sp.	0.32 14	0.30	
Hoplostethus sp.	0.28 4	0.26	
Dicrolene sp.	0.20 4	0.19	
Sea cucumber	0.20 2	0.19	
Coloconger sp.	0.20 4	0.19	
Centroberyx druzhinini	0.20 2	0.19	
Leptocephalus	0.20 20	0.19	
ALEPOCEPHALIDAE	0.16 6	0.15	
LOLIGINIDAE	0.08 12	0.08	
Ariosoma sp.	0.08 2	0.08	
ATELEOPODIDAE	0.08 2	0.08	
Apristurus sp.	0.07 2	0.06	
Peristedion sp.	0.04 2	0.04	
Coccorella sp	0.02 4	0.02	
ASTRONESTHIDAE	0.02 4	0.02	
Bregmaceros sp.	0.01 10	0.01	
Diplophos sp.	0.01 2	0.01	
TETRAODONTIDAE	0.01 2	0.01	
J E L L Y F I S H	0.01 10	0.00	
Wood, paper, cardboard	0.00 2	0.00	
Plastic	0.00 2	0.00	
Fishing gears	0.00 2	0.00	
Total	106.89	100.00	

R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 52
DATE :13/10/18 GEAR TYPE: PT NO: 8 POSITION:Lat N 6°50.14
start stop duration Lon E 97°57.49
TIME :00:53:01 01:31:05 38.1 (min) Purpose : 3
LOG : 5324.98 5326.77 1.8 Region : 10500
FDEPTH: 270 30 Gear cond.: 0
BDEPTH: 332 323 Validity : 0
Towing dir: 0° Wire out : 630 m Speed : 2.8 kn
Sorted : 1 Total catch: 0.81 Catch/hour: 1.27

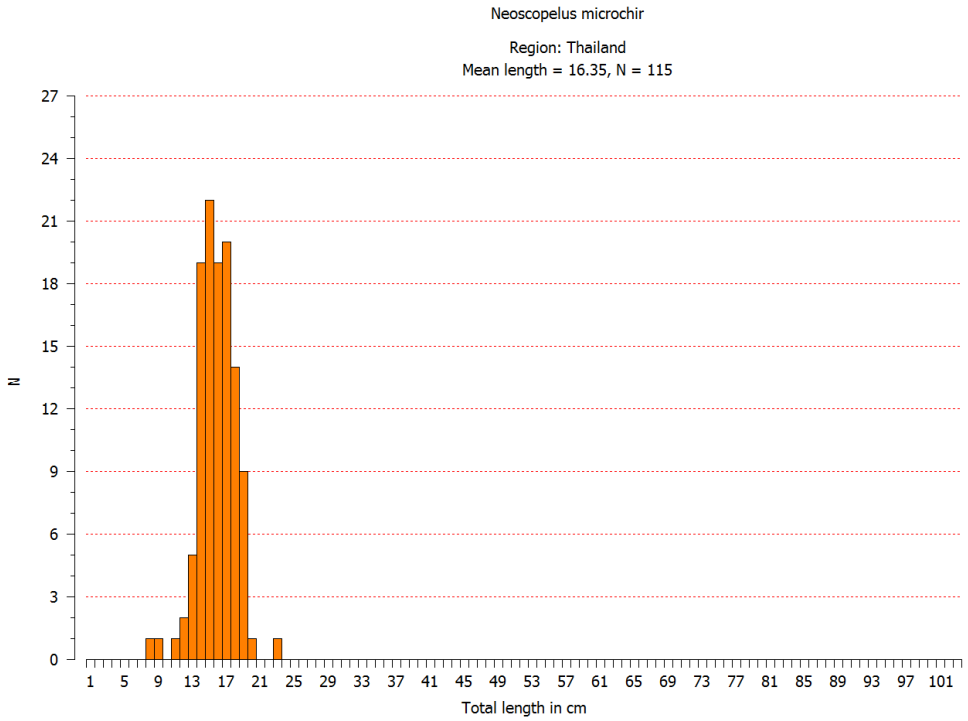
SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Krill	0.60 20157	47.20	
OMMASTREPHIDAE	0.44 183	34.78	
Diaphus sp.	0.16 19	12.42	
Leptocephalus	0.03 17	2.48	
SERGESTIDAE	0.03 60	2.48	
UNIDENTIFIED FISH, juvenile	0.00 3	0.25	
Psenopsis sp.	0.00 6	0.25	
Monacanthus sp.	0.00 2	0.12	
Total	1.27	100.00	

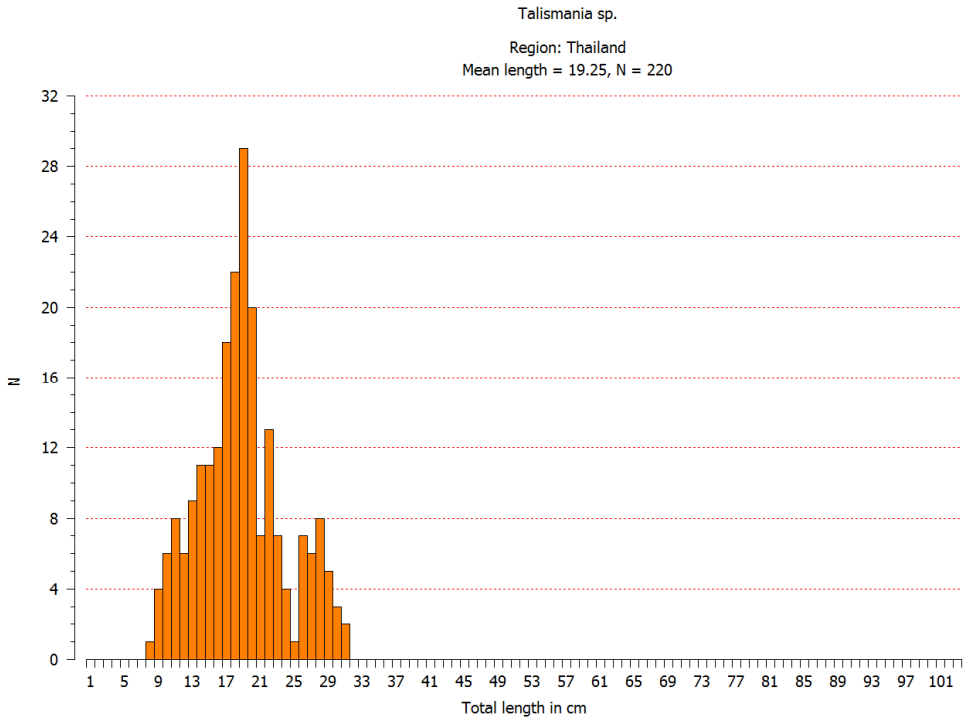
R/V Dr. Fridtjof Nansen SURVEY:2018412 STATION: 53
DATE :13/10/18 GEAR TYPE: BT NO: 1 POSITION:Lat N 6°50.04
start stop duration Lon E 97°58.39
TIME :02:26:32 02:59:02 32.5 (min) Purpose : 3
LOG : 5330.16 5331.76 1.6 Region : 10500
FDEPTH: 328 336 Gear cond.: 0
BDEPTH: 328 336 Validity : 0
Towing dir: 0° Wire out : 800 m Speed : 2.9 kn
Sorted : 49 Total catch: 142.70 Catch/hour: 263.37

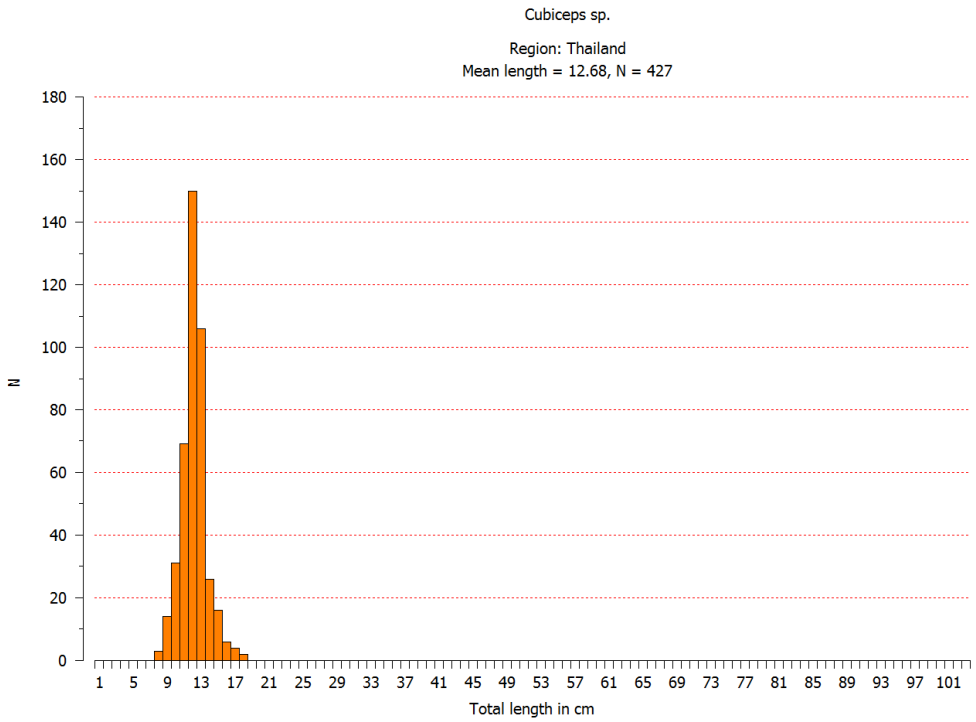
SPECIES	CATCH/HOUR	% OF TOT. C	SAMP
weight numbers			
Plesiobatis daviesi	47.38 13	17.99	
MYCTOPHIDAE	46.24 15612	17.56	
Plesionika quasigrandis	34.55 7406	13.12	
Synagrops sp.	21.09 3200	8.01	
Ariosoma sp.	10.16 229	3.86	
Ostracoberyx dorygenys	9.91 648	3.76	
Chlorophthalmus sp.	9.49 216	3.60	82
Olophoris gracilirostris	9.02 801	3.42	
Neobythites sp.	8.64 114	3.28	
Coelorinchus sp.	8.38 279	3.18	
Cubiceps sp.	8.38 255	3.18	81
Waste General	6.86 0	2.60	
Satyrichthys sp.	6.39 6	2.42	
Neoscopelus sp.	6.35 991	2.41	
Hypopleuron caninum	4.06 26	1.54	
Heterocarpus chani	3.56 229	1.35	83
Heterocarpus sibogae	2.54 279	0.96	
Priacanthus sp.	2.14 26	0.81	79
Tydemania sp.	2.03 419	0.77	
Ancistrocheirus lesueuri	1.66 7	0.63	
Rexea bengalensis	1.27 114	0.48	
Chascanopsetta lugubris	1.27 39	0.48	
OPHICHTHIDAE	1.27 13	0.48	
Halimochirurgus centriscoides	1.14 26	0.43	
Solenocera sp.	0.95 76	0.36	
Linuparus somniosus	0.81 4	0.31	
Neoepinnula orientalis	0.76 13	0.29	
Diaphus sp.	0.76 63	0.29	
ASTRONESTHIDAE	0.76 177	0.29	
Psenopsis obscura	0.76 13	0.29	
Setarches longimanus	0.53 26	0.20	
Malacocephalus laevis	0.51 13	0.19	
Bythaelurus sp.	0.44 13	0.17	80
OMMASTREPHIDAE	0.43 153	0.16	
Lophiodes sp.	0.37 2	0.14	
Cruriraja andamanica	0.30 2	0.11	
Puerulus sewelli	0.30 2	0.11	
Malthopsis sp.	0.28 13	0.11	
Sthenoteuthis oualaniensis	0.26 4	0.10	
Lamprogrammus sp.	0.25 13	0.10	
Histioteuthis sp.	0.22 9	0.08	
Leptocephalus	0.19 26	0.07	
Aristeidae	0.19 203	0.07	
Chiroteuthis sp.	0.11 2	0.04	
Platymaia sp	0.11 7	0.04	
Glyphocrangon sp.	0.10 13	0.04	
Halieutaea sp.	0.09 13	0.03	
Tydemania sp.	0.09 13	0.03	0
Total	263.36	100.00	

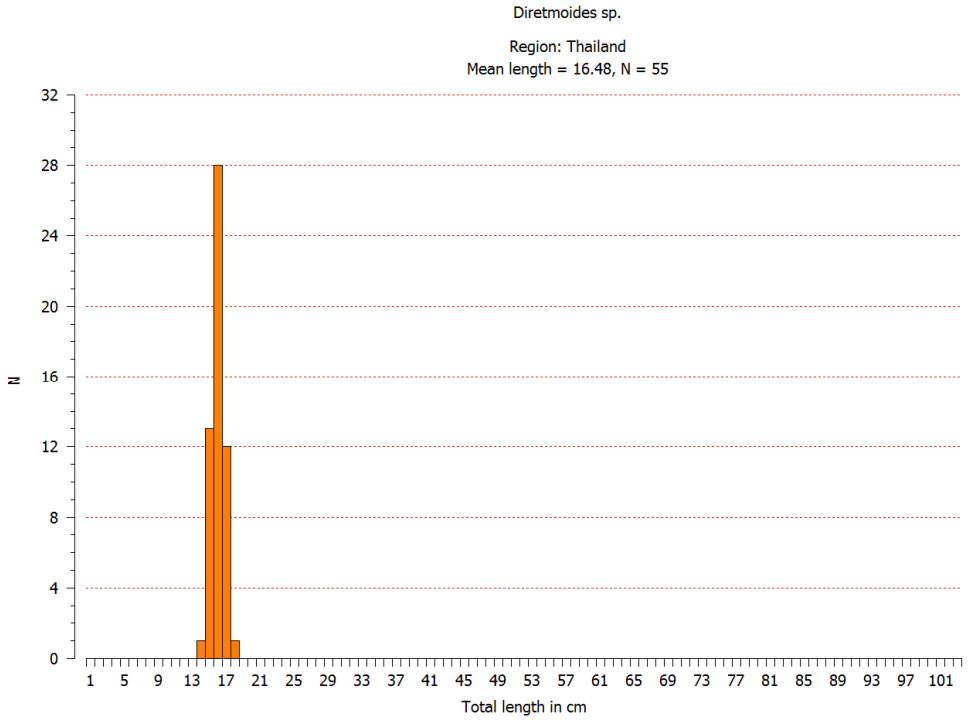
ANNEX XI. LENGTH DISTRIBUTION OF MAIN SPECIES

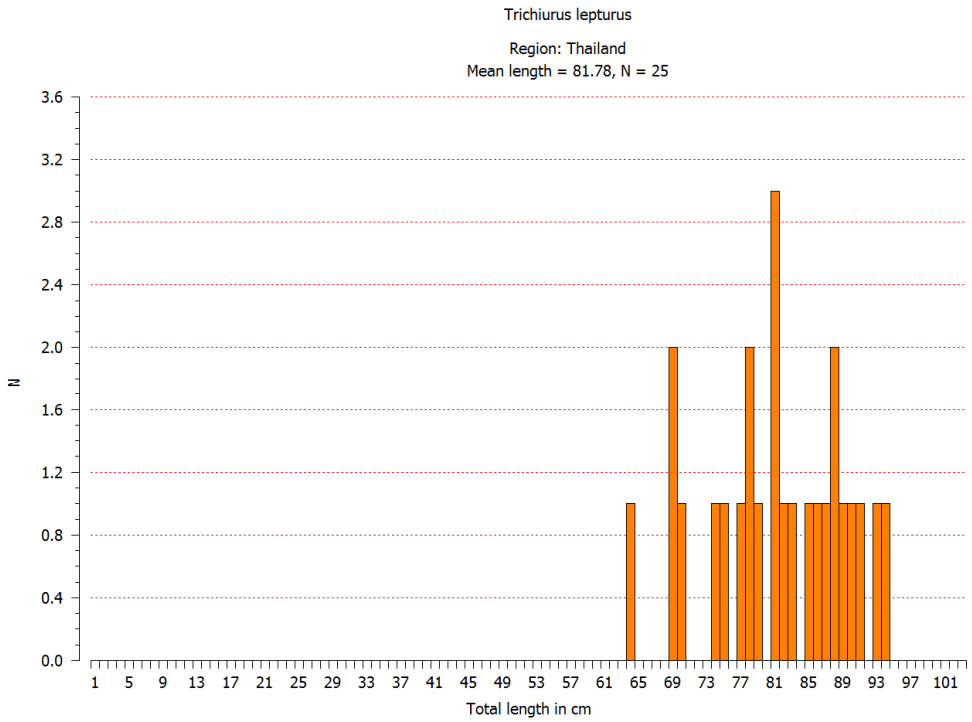
LFQ of selected teleosts

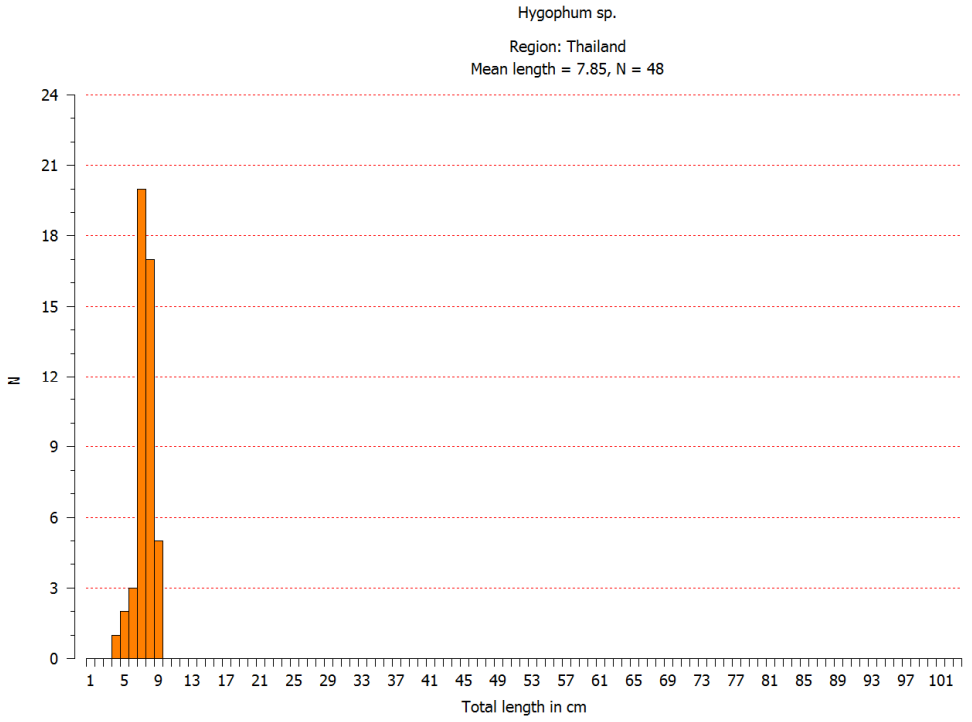


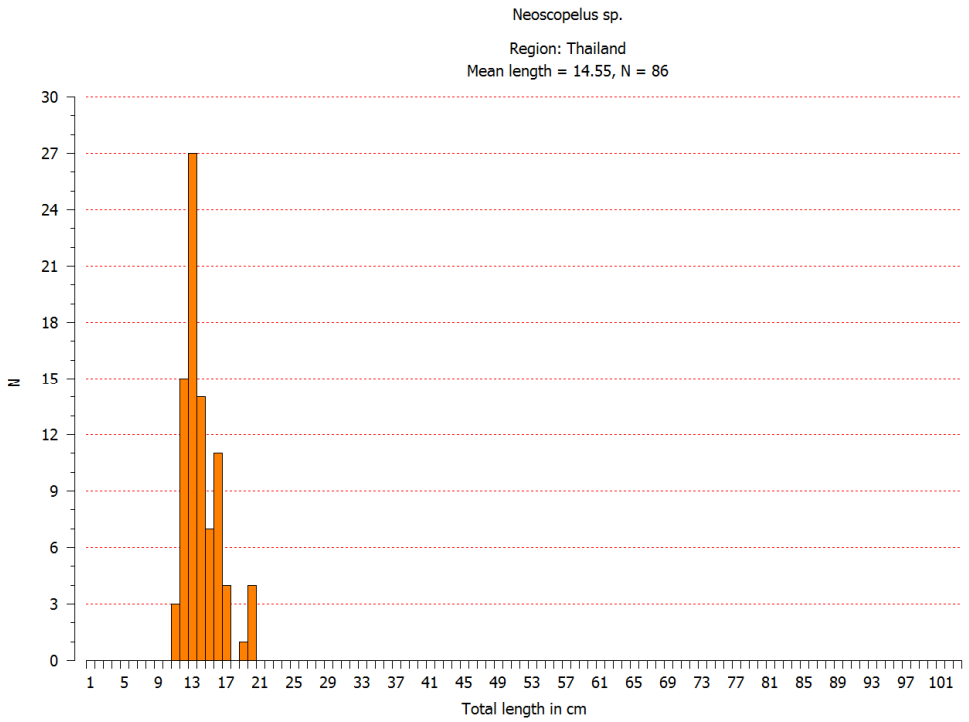



Cubiceps sp.
Region: Thailand
Mean length = 12.68, N = 427
N
Total length in cm

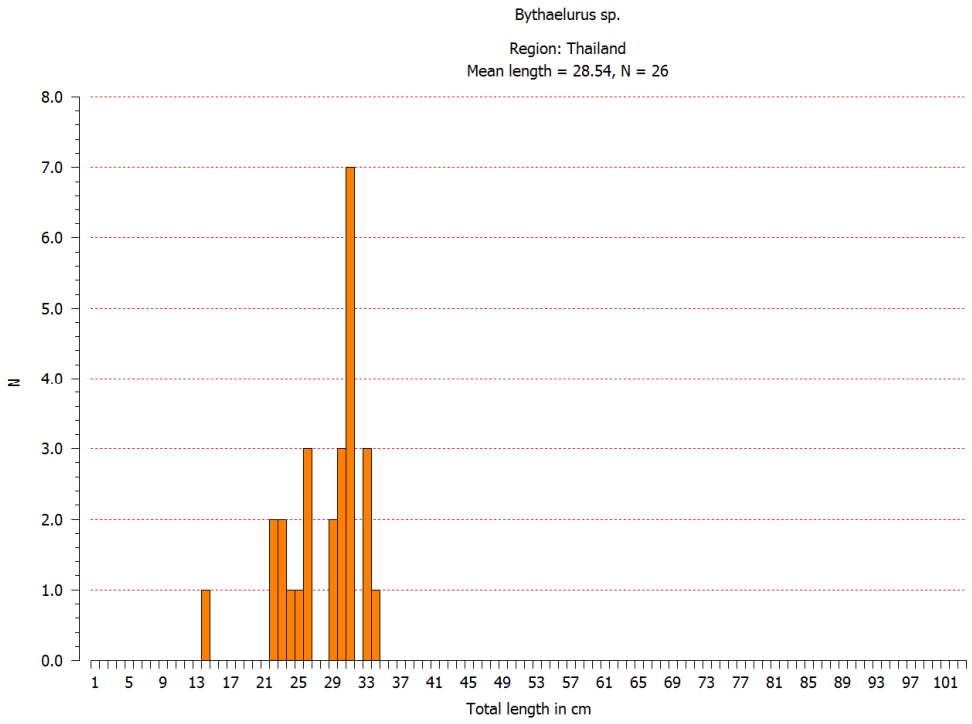

Diretmoides sp.
Region: Thailand
Mean length = 16.48, N = 55
N
Total length in cm


Trichiurus lepturus
Region: Thailand
Mean length = 81.78, N = 25
N
Total length in cm

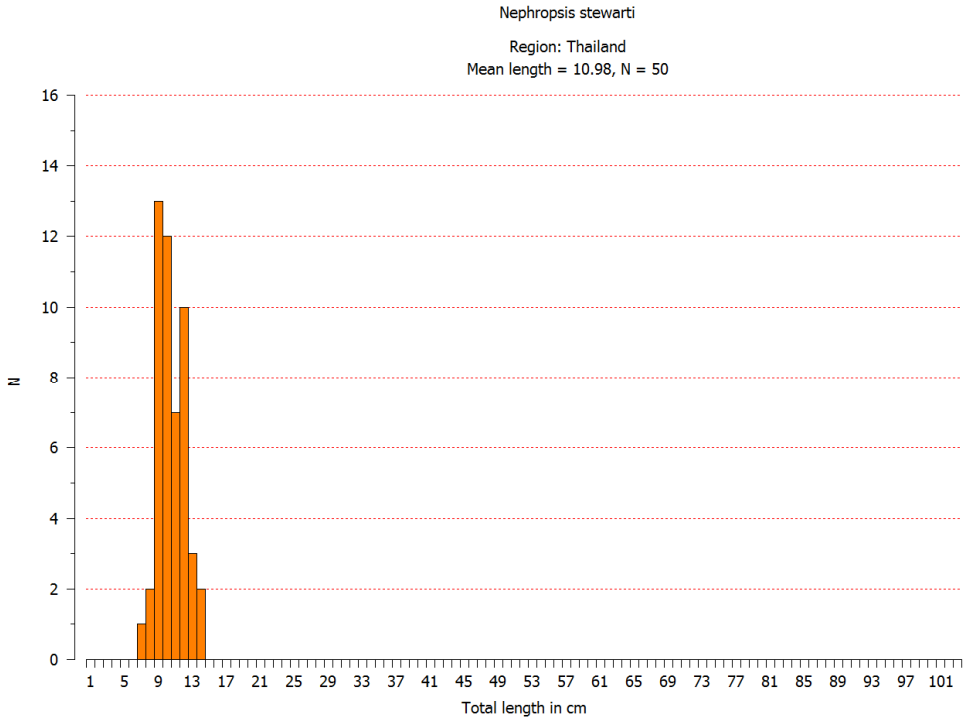

Hygophum sp.
Region: Thailand
Mean length = 7.85, N = 48
N
Total length in cm

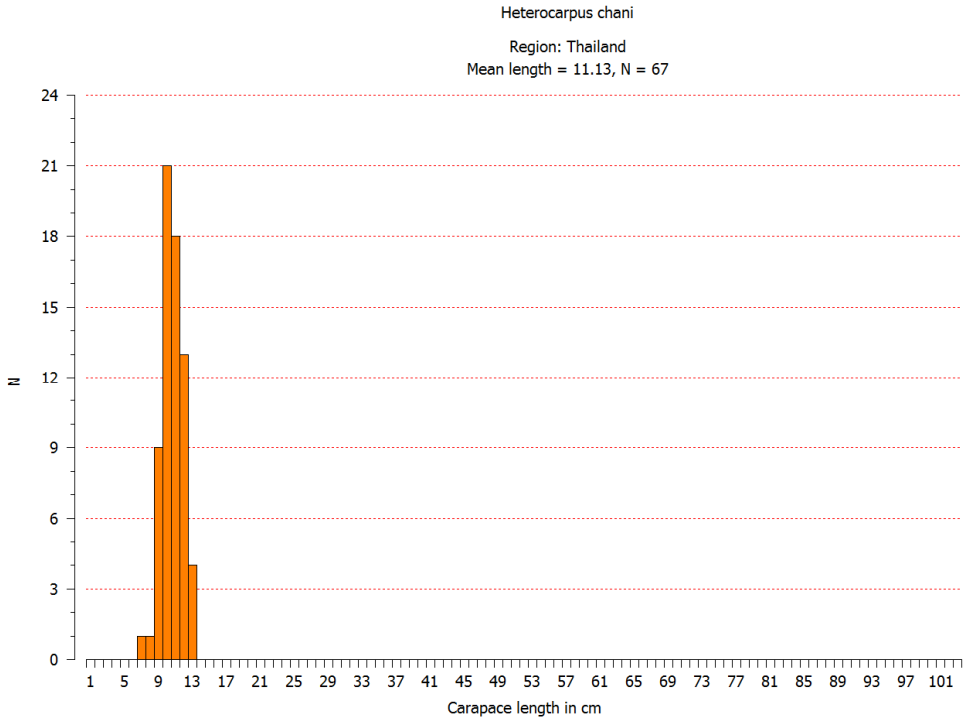


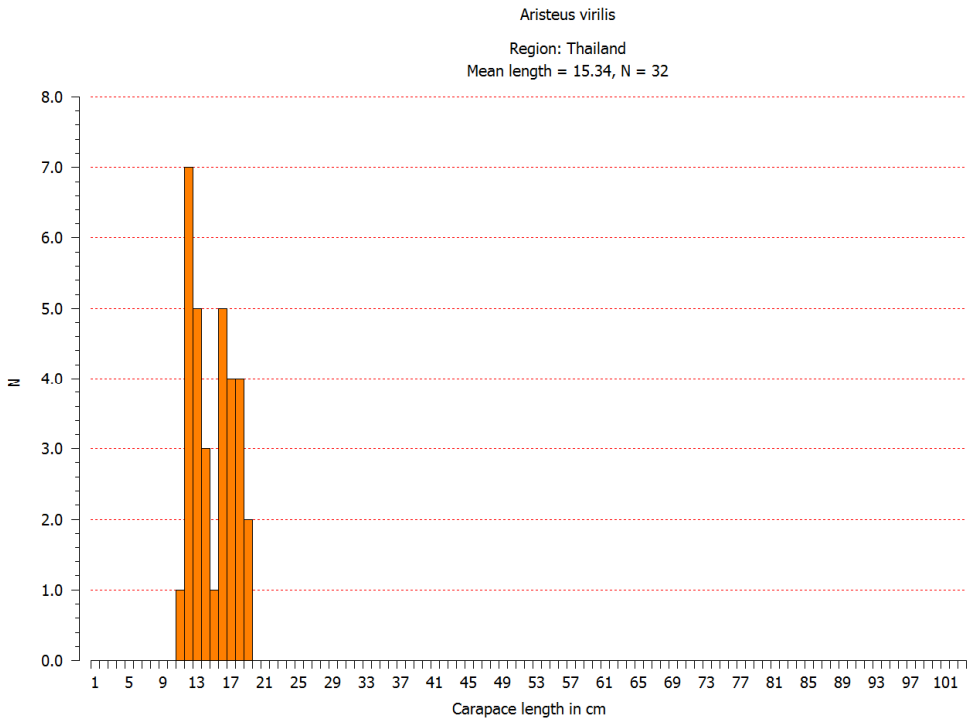
LFQ of sharks

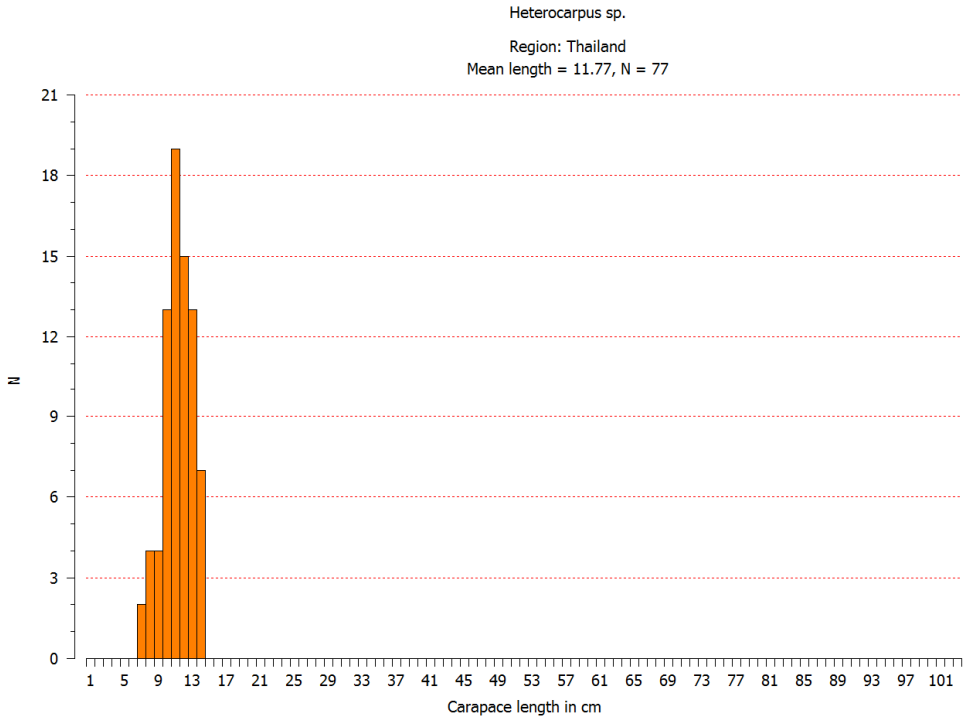


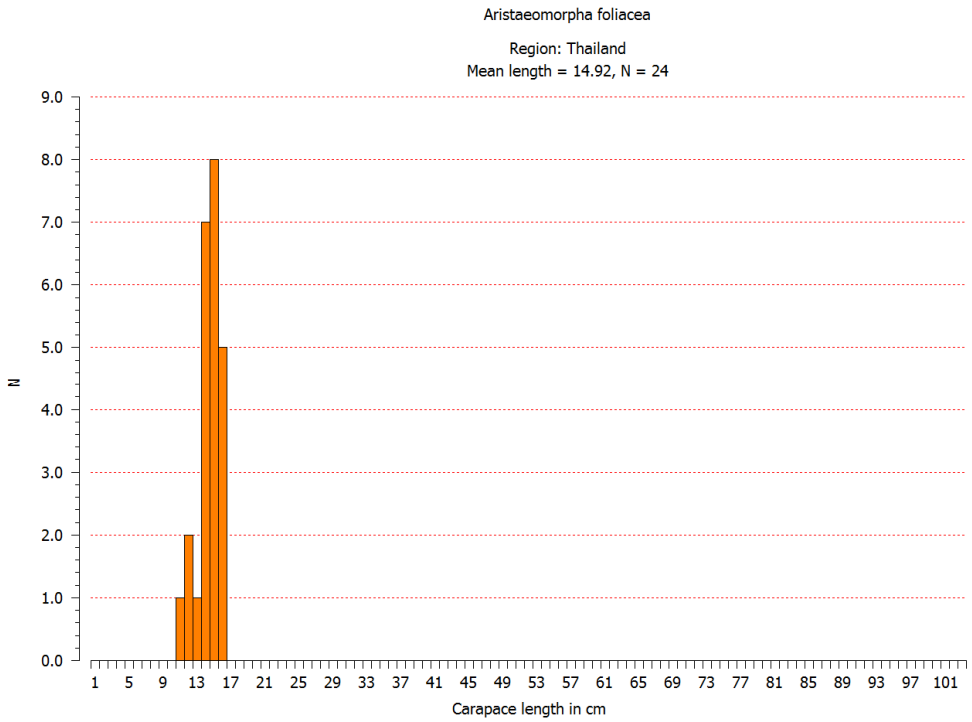
LFQ of shrimps



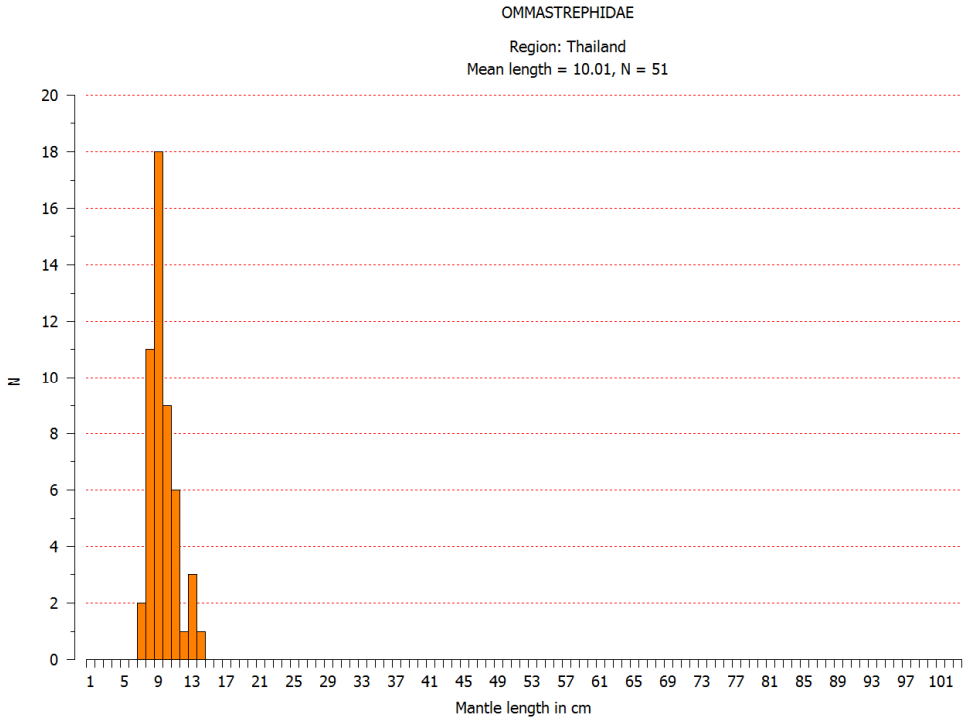



Aristeus virilis
Region: Thailand
Mean length = 15.34, N = 32
N
Carapace length in cm


Heterocarpus sp.
Region: Thailand
Mean length = 11.77, N = 77
N
Carapace length in cm



LFQ of squids



ANNEX XII. CATCH RATE (kg/h) BY GEAR, STATION AND TAXONOMIC GROUP

Bottom trawl

station	Mesopelagic	Teleosts	Cephalopods	Shrimps	Crabs	Mantisshimps	Lobsters	Invertebrate	Chimaeras	Sharks	Rays	Other sp.	Wast	Total
3	294.28	11.82	1.41	0.02	0.00	0.00	0.00	0.00	0.00	3.89	0.00	0.00		311.42
11	61.04	16.75	6.83	19.94	0.05	0.00	3.76	0.00	0.00	2.89	5.45	0.00	0.22	116.93
13	36.29	11.32	1.64	19.19	0.08	0.00	0.94	0.51	0.00	4.44	0.00	0.00		74.42
14	22.33	8.22		17.62	0.00	0.00	1.24	0.00	0.12	6.51	0.00	0.00		56.03
21	34.65	22.52	27.30	18.09	0.00	0.00	0.14	0.00	0.00	7.66	5.70	0.16	2.47	118.69
23	30.27	15.55	0.16	7.83	0.00	0.00	2.65	0.00	0.16	12.00	3.19	0.00	0.53	72.33
24	15.40	39.19	2.55	10.70	0.00	0.00	2.45	0.00	0.53	5.02	20.90	0.00	0.00	96.73
27	30.68	15.06	0.20	4.47	0.00	0.00	1.19	0.00	6.05	11.25	1.09	0.00	0.00	69.99
29	7.82	12.28	0.55	4.77	0.00	0.00	0.52	0.00	0.80	12.10	1.82	0.44		41.09
31	9.50	46.64	2.49	151.54	0.00	0.00	0.32	1.84	0.00	1.97	23.10	0.32	1.77	239.49
35	0.48	40.76	3.77	3.29	0.00	0.00	0.06	0.04	0.00	0.00	7.92	0.03	7.14	63.48
37	3.71	31.01	1.72	3.93	0.00	0.02	0.48	0.94	1.55	0.00	0.98	16.64	1.64	62.62
39	94.54	23.32	4.72	4.91	0.00	0.00	0.82	0.00	4.65	50.33	0.72	0.00	1.64	185.65
42	11.12	25.06	1.11	27.34	0.16	0.00	0.33	0.00	0.00	7.80	0.00	0.00	4.19	77.11
44	20.22	39.89	3.48	17.87	0.00	0.00	0.00	0.10	0.00	75.94	22.72	0.00		180.22
45	6.04	28.10	2.60	18.52	0.00	0.00	0.25	1.64	0.74	2.90	0.70	23.60	15.81	100.87
49	1.44	35.06	0.62	5.17	0.00	0.00	0.08	1.78	0.39	0.38	101.11	20.41	4.57	171.00
51	17.88	28.97	1.34	12.86	0.00	0.00	0.40	0.20	0.00	13.01	30.14	0.01	2.09	106.89
53	64.90	88.67	2.68	50.91	0.11	0.00	1.11	0.00	0.00	0.44	47.67	0.00	6.86	263.36
Total	762.58	540.19	65.14	398.97	0.41	0.02	16.73	7.04	14.99	218.52	273.21	61.61	48.91	2408.32
CPUE (kg/hr)	40.14	28.43	3.62	21.00	0.02	0.00	0.88	0.37	0.79	11.50	14.38	3.24	3.49	126.75
Std.Dev.	66.26	18.56	6.15	33.71	0.05	0.00	1.03	0.66	1.68	19.17	24.84	7.64	4.25	77.36
%	31.66	22.43	2.71	16.57	0.02	0.00	0.70	0.29	0.62	9.07	11.34	2.56	2.03	100.00

Pelagic trawl

station	Mesopelagic	Teleosts	Cephalopods	Shrimps	Lobsters	Crustaceans	Invertebrate	Sharks	Rays	Other sp.	Wast	Total
1	0.00	0.14	0.15	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.35
2	0.00	0.52	8.37	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	8.89
4	0.18	0.14	0.38	0.17	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.93
5	33.16	4.04	1.39	0.14	0.00	0.00	0.00	0.24	0.00	0.00	0.00	38.97
6	36.57	4.94	28.00	2.30	0.00	0.00	0.00	0.00	0.00	0.08	0.00	71.88
7	4.65	0.69	3.05	0.65	0.00	0.00	0.00	0.00	2.06	0.40	0.13	11.63
8	34.36	2.23	8.96	4.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50.34
9	40.13	7.81	10.14	17.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.32
10	2.86	0.62	1.42	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.28
12	5.89	0.33	1.19	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.50
15	16.77	0.69	5.22	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.12
16	0.31	0.04	0.49	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00	2.19
17	5.98	0.56	1.30	1.13	0.00	0.00	0.00	0.00	0.00	0.15	1.27	10.39
18	31.80	33.58	17.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	82.53
19	26.79	2.01	5.93	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.39
20	1.83	0.97	0.70	0.30	0.00	0.00	0.00	0.00	0.00	0.00	10.48	14.28
22	4.47	0.87	1.04	1.45	0.01	0.00	0.00	0.00	0.00	0.00	0.66	8.50
25	9.38	0.50	2.26	7.93	0.00	0.00	0.00	0.00	0.00	0.00	4.08	24.15
26	0.10	5.11	0.39	1.83	0.00	0.00	0.00	0.00	0.00	0.14	1.08	8.63
28	10.46	1.30	5.58	1.95	0.00	0.00	0.00	0.00	0.00	0.23	0.12	19.63
30	0.02	0.24	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44
32	32.65	0.51	4.70	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.55
33	13.84	0.27	3.77	1.61	0.00	0.00	0.00	0.00	0.00	0.54	3.76	23.79
34	4.13	0.34	2.05	0.50	0.00	0.00	0.00	0.00	0.00	0.05	3.57	10.63
36	22.37	11.56	7.09	1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	42.59
38	0.09	0.24	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.48
40	77.42	0.78	9.90	3.93	0.00	0.00	0.02	0.00	0.00	0.04	0.00	92.08
41	35.47	3.79	30.86	1.99	0.00	0.00	0.00	0.00	0.00	0.00	0.99	73.10
43	10.49	6.30	10.88	2.43	0.00	0.00	0.00	0.00	9.29	0.00	2.18	41.57
46	43.58	3.27	16.18	4.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	67.99
47	14.53	1.88	7.12	2.72	0.00	0.00	0.00	0.00	0.00	0.18	3.68	30.12
48	2.88	0.77	0.63	1.05	0.00	0.00	0.00	0.05	0.00	1.11	0.45	6.94
50	27.97	3.43	8.37	3.99	0.00	0.00	0.00	0.00	0.00	0.02	0.00	43.79
52	0.16	0.04	0.44	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27
Total	551.30	100.50	205.23	68.65	0.01	0.06	0.02	0.29	11.35	4.38	32.45	974.23
CPUE (kg/hr)	16.21	2.96	6.04	2.02	0.00	0.00	0.00	0.01	0.33	0.13	0.95	28.65
Std.Dev.	17.97	6.00	7.49	3.23	0.00	0.01	0.00	0.04	1.62	0.31	2.10	27.18
%	56.59	10.31	21.07	7.05	0.00	0.01	0.00	0.03	1.16	0.45	3.33	100.00

ANNEX XIII. CPUE (kg/km2) OF BOTTOM TRAWL BY STATION AND TAXONOMIC GROUP AND BIOMASS (tonnes)

station	Mesopelagic	Teleosts	Cephalopods	Shrimps	Crabs	Mantisshimps	Lopsters	Invertebrate	Chimaeras	Sharks	Rays	Other sp.	Total
3	3,001.46	120.58	14.35	0.24	-	-	-	-	-	39.71	-	-	3,176.34
11	574.42	157.67	64.27	187.64	0.51	-	35.36	-	-	27.22	51.26	-	1,062.48
13	347.47	108.35	15.67	183.76	0.79	-	9.04	4.90	-	42.56	-	-	697.81
14	205.57	75.67	-	162.16	-	-	11.40	-	1.08	59.93	-	-	504.42
21	340.33	221.25	268.13	177.71	-	-	1.37	-	-	75.22	56.02	1.61	1,138.66
23	291.66	149.88	1.52	75.49	-	-	25.57	-	1.52	115.61	30.70	-	666.37
24	152.59	388.26	25.27	105.97	-	-	24.29	-	5.29	49.75	207.05	-	934.19
27	314.12	154.23	2.00	45.78	-	-	12.19	-	61.97	115.15	11.19	-	704.44
29	71.92	112.95	5.03	43.87	-	-	4.77	-	7.34	111.24	16.70	4.04	369.06
31	92.61	454.84	24.29	1,477.76	-	-	3.13	17.94	-	19.20	225.27	3.13	2,293.97
35	4.62	391.55	36.21	31.59	-	-	0.57	0.37	-	-	76.11	0.26	540.07
37	37.07	309.56	17.17	39.23	-	0.16	4.82	9.39	15.51	-	9.80	166.14	428.33
39	929.42	229.20	46.38	48.28	-	-	8.05	-	45.75	494.80	7.10	-	1,800.93
42	111.40	250.97	11.10	273.78	1.64	-	3.29	-	-	78.11	-	-	725.35
44	189.70	374.24	32.61	167.60	-	-	-	0.91	-	712.43	213.19	-	1,689.77
45	57.86	269.30	24.90	177.49	-	-	2.35	15.67	7.05	27.82	6.66	226.25	571.08
49	14.50	352.44	6.23	52.01	-	-	0.78	17.90	3.89	3.77	1,016.48	205.14	1,449.32
51	177.88	288.19	13.29	127.94	-	-	4.00	2.00	-	129.40	299.86	0.05	1,036.57
53	641.45	876.44	26.52	503.22	1.09	-	10.95	-	-	4.38	471.19	-	2,523.20
ave.CPUE (kg/km^2)	397.69	278.19	35.27	204.29	1.01	0.08	9.52	7.67	16.60	123.90	179.91	67.40	1,174.34
Biomass (ton)	18,691	13,074	1,657	9,601	47	3	447	360	780	5,823	8,455	3,167	55,193

Remark: total area 47 000 km^2

The stratified estimator of mean density in the entire area can be calculated as (Cochran, 1977)

$$\bar{y}_{st} = \sum_{i=1}^{L} W_i \bar{y}_i \quad , \tag{1}$$

where

L is the number of strata,

$W_i = \frac{area_i}{total\ area}$ is the proportion of the i^{th} stratum of the total survey area,

$\bar{y}_i = \frac{\sum_{k=1}^{n_i} y_{i,k}}{n_i}$ is the average density in the i^{th} stratum

$y_{i,k}$ is the density [tonnes/NM^2] by the k^{th} tow in stratum i

$n_i$is the number of tows in the i^{th} stratum.

The total biomass in the area is calculated by

$$B = \bar{y}_{st} \cdot total\ area \tag{2}$$

The estimated variance of the biomass (var(biomass)) was calculated by:

$$\text{var}(biomass) = \left(\sum \frac{W_i^2 s_i^2}{n_i} \right) A^2 \tag{3}$$

where

$s_i^2 = \frac{\sum_{k=1}^{n_i} (y_{i,k} - \bar{y}_i)^2}{n_i - 1}$, and A is total area

The standard error (SE) of the stratified mean was calculated as (Cochran 1977):

$$SE = \sqrt{\text{var}(biomass)} \tag{4}$$

ANNEX XV. LIST OF FOLLOW-UP SCIENTIFIC WORK

No.	Theme	Title	Contact person
1	9	Water mass characteristics of Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Jitraporn Phaksopa, KU
2	9	Internal wave characteristics around the Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Jitraporn Phaksopa, KU
3	9	Distribution of CDOM and Phytoplankton Absorption in Surface Water of Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Jitraporn Phaksopa, KU
4	10	Nutrient distribution and carbonate chemistry of Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Penjai Sompongchaiyakul, CU
5	5	Dissolved and dispursed petroleum hydrocarbon in surface water of Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Penjai Sompongchaiyakul, CU
6	5	Chemical composition and potential source of aerosols in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Penjai Sompongchaiyakul, CU
7	8	Contamination of some heavy metals in marine organisms of Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Tasawan Khawsejan, DOF
8	6	Microplastics in zooplankton of Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Sittiporn Pengsakun, RU
9	9	Primary productivity of Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Nirucha Udomwongyont, DOF
10	1	Diversity of phytoplankton in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Atchaneey Boonprakob, RU
11	1	Density and diversity of zooplankton in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Issarapon Jithlang, DOF Nirucha Udomwongyont, DOF Sakda Arbsuwan, DOF
12	4	Demersal Marine Resources in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Nirun Choosuan, DOF
13	2	Marine resources abundance and distribution collected by mid-water trawl in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Sichon Hoimuk, DOF
14	8	Parasite survey in Deep-sea fish of Andaman Seafrom 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Sittiporn Pengsakun, RU
15	4	Species and Distribution of Deep-Sea Cephalopods in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Charauy Sukhsangchan, KU
16	3	Invertebrates Identification (Jelly Fish) from Mid - Water Trawl in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Sitakarn Tawissuwan, DMCR
17	Taxonomy	New record of Cartilaginous fishes found in Thai water and the adjacent areas and an updated species list in 2019	Tassapon Krajangdara, DOF
18		Oogenesis and ovarian health problems in economically important fishes from different habitats potentially affected by pollution in Thailand.	Sinlapachai Senarat, RUTS
19		Cetaceans, Sea turtle and Sea birds Watching in Andaman Sea from 2018 R/V *Dr Fridjof Nansen* surveys, Thailand	Sitakarn Tawissuwan, DMCR