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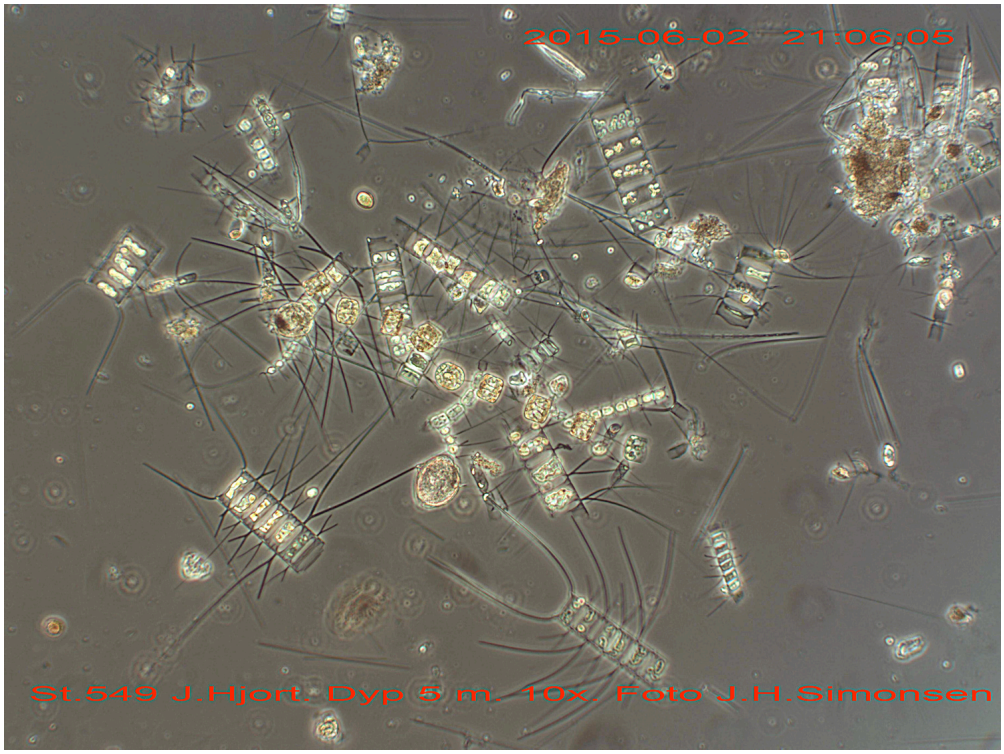
Survey report: Johan Hjort (survey nr: 2015 206)

Trophic interactions in the Barents Sea –

steps towards an Integrated Ecosystem Assessment

Summer TIBIA survey 2015

27 Mai – 6 June 2015



Phytoplankton. Photo taken by Jan Henrik Simonsen, IMR

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Summary

The summer TIBIA survey is part of an ongoing activity aiming at improve our understanding of the trophic interactions, food web structure and function, and energy flow in the Barents Sea ecosystem. TIBIA (Trophic interactions in the Barents Sea-steps towards an Integrated Ecosystem Assessment) is a strategic institute program.

The aim of the survey has been to examine how the benthic and pelagic systems are coupled by analyzing stable isotopes (carbon and nitrogen) and fatty acid signatures compare with traditional stomach analyses of major fauna components. Expand the resolution of the food web by adding data on occurrence of parasites. The survey was conducted in the period 27.05 - 06.06.2015 with the research vessel ”Johan Hjort” (survey number: 2015 206), starting in Tromsø and ending in Tromsø. The survey covered the area between 72 and 75˚30’N and between 20˚ and 30˚E. During the survey were taken environmental (water temperature and salinity), biological (parasites, plankton, fish and benthos) and isotopes of plankton, fish and benthos.

Contents

1 Introduction

This survey is part of an ongoing activity aiming at improve our understanding of the trophic interactions, food web structure and function, and energy flow in the Barents Sea ecosystem.

The specific objectives of the survey were:

Examine how the benthic and pelagic systems are coupled by analyzing stable isotopes (carbon and nitrogen) and fatty acid signatures compare with traditional stomach analyses of major fauna components. Expand the resolution of the food web by adding data on occurrence of parasites. In addition, explore the possibilities of using environmental DNA to assess the presence of species

- DNA environment
- Examine the spring bloom
    - Phytoplankton
    - Zooplankton
    - Macro plankton
- Examine parasitological fauna
    - Zooplankton
    - Fish
    - Benthos
- Trials with experimental pelagic trawls

2 Execution and methodology

The survey was conducted in the period 27.05.-06.06.2015 with the research vessel ”Johan Hjort” (survey number: 2015 206), starting in Tromsø and ending in Tromsø. The survey covered the area between 72 and 75˚30’N and between 20˚ and 30˚E (Figure 1 and Table1). Research vessel tracks during the survey are shown in Figure 1).

The vessel needs go to shore after the first station due to mechanical problems with CTD winch. After winch has been repaired the vessel continued the survey.

2.1 Survey design

Weather condition was bad during second part of the survey and survey design was changed: some stations deleted, and MOCNES hauls were replaced with WP2 hauls. Survey activities are shown figures 2 and 3, where trawls are shown in Figures 2 and hydrography and plankton stations are shown in Figures 3.

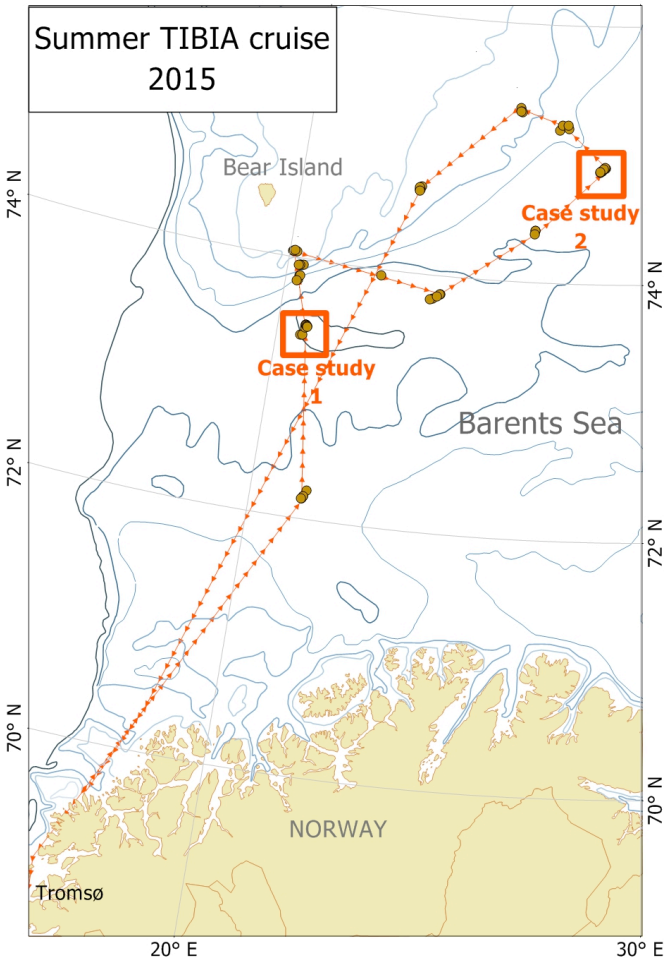


Figure 1. Course lines (red line) and case studies (red square) for the summer 2015 TIBIA survey.

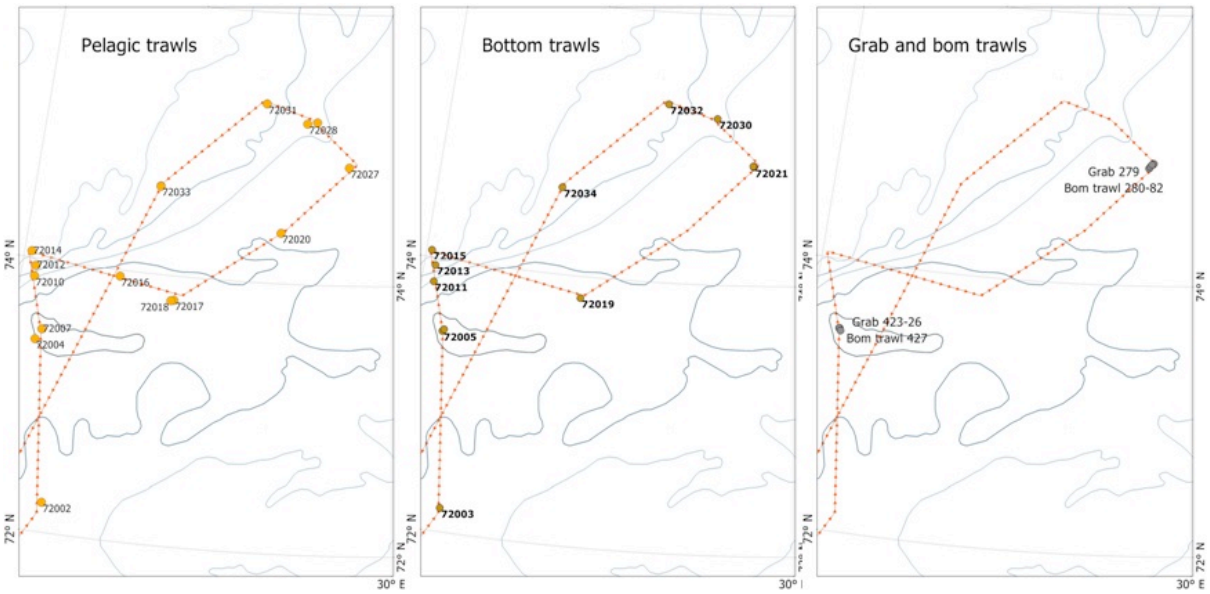


Figure 2. Course lines (red line) and pelagic (left), bottom (med) and grab and bom trawls taken during the summer 2015 TIBIA survey.

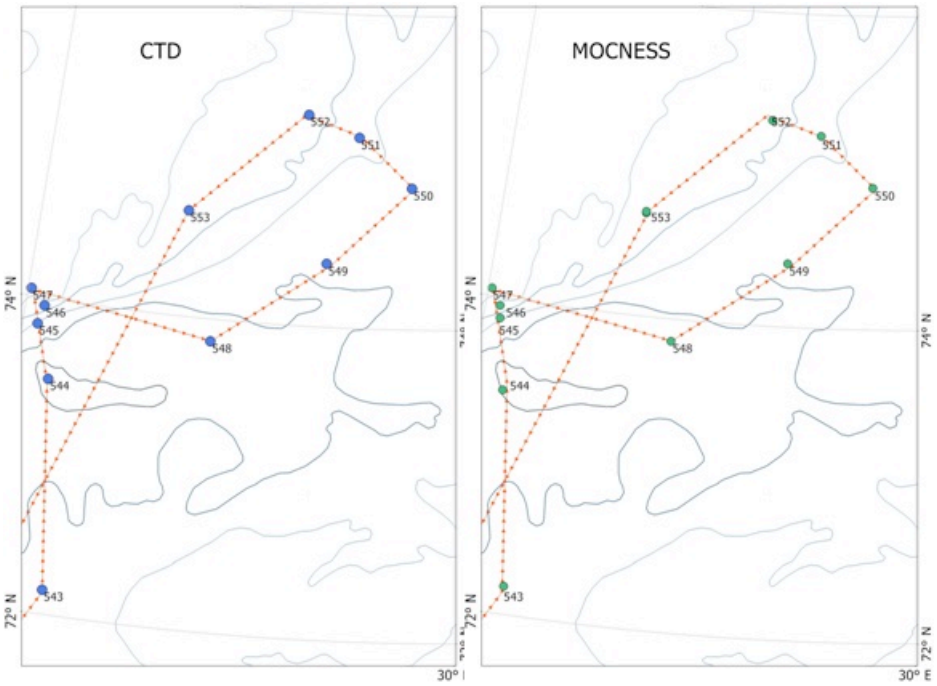


Figure 3. Course lines (red line) and CTD (left) and MOCNESS/WP2 hauls taken during the summer 2015 TIBIA survey.

Table 1. Coverage of the summer 2015 TIBIA survey. Number of CTD; MOCNESS, trawl and grabs taken during the survey. Reference log numbers represents sailed nautical miles, and are given for future reference.

Covered area	MOCNESS	WP2	CTD	Pelagic trawl	Bottom trawl	Grab	Bom trawls	Reference log
Barents Sea (72 °N - 74° 30'N and 20°E - 28 °E)	8 (543-553)	3 (548-550)	11 (543-553)	16 72002-72033)	13 (70003-72034)	5 (423-427)	4 (279-282)	5714-6529

2.2 Physical oceanography

Salinity (‰) and temperature (ºC) was measured with a CTD rosette with 24 bottles. The CTD was lowered and heaved with a mechanical winch and the interval for data registration was set to 1 per 2 sec. Data from the upcast was used, as the probe seemed to need some time in the water to stabilize. Samples were taken at regular intervals, and in combination with biological samples.

2.3 Biogeochemistry and biological samples

2.3.1 Dissolved inorganic nutrients and chlorophyll a

Nutrients and chlorophyll *a* samples were collected at all stations visited, using a CTD water bottle rosette sampler. Nutrients samples were collected from standard depths throughout the entire water column, while samples for chlorophyll *a* (Chl-a), particulate organic carbon and nitrogen (POC, PN), particulate organic phosphorus (POP) and particulate biological silicate (BSi) were collected at standard depths between surface and 100 m. Sampling and handling of samples was carried out in accordance with the existing manuals (Anonymous, 2012) and a field collection guide that can be found onboard all IMR research vessels (both in Norwegian). An outline of applied methods and principles of nutrient and pigment analysis (only in Norwegian but with literature references) as performed by the Inorganic Chemistry Laboratory at IMR can be found at;
http://www.imr.no/om_havforskningsinstituttet/fasiliteter/kjemilaboratoriet_1/kjemilaboratoriet/uorganisk_kjemi/analytiske_tjenester/nb-no

2.4 Phytoplankton

Phytoplankton sampling from water bottles were carried out on every station along the fixed transects during the ecosystem survey. From each of the depths 5, 10, 20 and 30 m, a **quantitative** 25 ml water sample from the respective water bottles was obtained by a custom made measurement cylinder. Each sample was poured into the same glass bottle (brown with a screw cap), thus obtaining a joint integrated 100 ml water sample that was fixated using 2 ml lugol.

Vertical net hauls (30–0 m) using an algae-net with a 0,1 m^2 opening and 10 µm mesh size were abandoned due to rough sea. Instead experimental net hauls were produced by placing the algae-net upright on the rear deck and letting water from the sea-water hose (intake 5m depth) run through the net for 7 minutes (see picture below). This seemed to be samples of good quality of the species present on the station from 5 m depth. Of course species from the rest of the 30-0 m column will be missing, but in rough sea there will be a vertical mixing, partly compensating for this. Such samples were taken on stations 549 to 553. Net-hauls are regarded **qualitative** samples. They should be concentrated in the cod-end bucket, and then poured gently into a glass bottle (brown with a screw cap) and fixated using 2 ml of 20% formalin.

Experimental net haul: running sea-water through the algae-net upright on the rear deck.

The SECCI depth should be registered at all stations during daylight hours, using a rope mounted white SECCI disk available on all research vessels, and operated from the side of the vessel at station.

2.5 Zooplankton

Zooplankton sampling carries out with the MOCNESS in order to obtain information on the vertical stratification of abundance and biomass profiles. The MOCNESS is towed obliquely generally from 300-200, 200-150, 150-100, 100- 50, 50-25, and 25-0 m.

Samples are normally split in two, one part was fixated in 4% borax neutralized formalin for species analysis and the other one was size-fractioned as follows; >2000 µm, 2000-1000 µm and 1000-180 µm size categories. These size-fractionated samples are weighed after drying at 60°C for ca. 24 hours. From the >2000 µm size fraction, krill, shrimps, amphipods, fish and fish larvae are species identified, counted, and their lengths measured separately before drying. *Chaetognatha*, *Pareuchaeta* sp. and *Calanus hyperboreus* from the >2000µm size fraction are counted and dried separately, but individual sizes are not measured. All dry weights are determined after additional drying at the IMR laboratory when the samples are returned to Bergen. Details on the sampling procedures, forms to be filled, and instructions on input to plankton data base are found in the official Plankton Manual (Hassel et al., 2013-updated version), which is always located in the plankton laboratory on board the research vessels.

2.5.1 Zooplankton for isotope analyses at the two "Case-study" stations

The samples were spitted into the copepods (*C. finmarchicus and C. glacilais* (herbivore) and *Pareuchaeta* (carnivore)) and the other Copepods. At least 30–50 individuals of individuals per species/taxon/group were collected for further processing. The samples were frozen (-20°C).

2.5.2 Macrozooplankton sampling from trawl

Macroplankton sampling is undertaken by the experimental pelagic trawl plankton net (mouth of 20*20, mesh size varied from 200mm in the first section to 120 millimeter in last section before ruffled small-meshed inner nets (mesh size of 8mm).

The samples were completely worked up on board according to traditional pelagic trawl sampling procedures. This includes species identification and wet weights of krill, amphipods. 100 speciements were length measuared. Macroplankton samples of krill (100gr) and amphipods (100 gr) were frozen for further processing at lab.

2.6 Fish

Biological samples were taken with a pelagic trawl with opening 20*20m with ruffled fine-meshed inner nets in the back part of the Harstad trawl (Engås et al. 2014, available on http://www.imr.no/tokt/okosystemtokt_i_barentshavet/survey_reports/survey_report_2014/nb-no). Demersal organisms were captured with the Campelen 1800 trawl with 15 m horisontal and 4 m vertical trawl opening. A total of 16 pelagic and 13 bottom trawls hauls were taken during the survey (Table 1).

Length (down to nearest ½ cm), weight (down to nearest 1 g) and sex were recorded for maximum 30 individuals of all fish species from each trawl sample. In addition individual measures of age, special maturation stadium, stomach was taken from 10 selected individuals. Stomach content of fish larger than 10 cm were analyzed onboard, smaller fish was frozen for diet analyses, which will take place at the institute later.

2.7 Benthos

Biological samples were taken with a bottom trawl (Campelen 1800 trawl with 15 m horisontal and 4 m vertical trawl opening). A total of 14 bottom trawls hauls were taken during the survey (Table 1).

All species was named to closest possible taxon, the individuals counted (when possible) and the biomass measured for each taxon. On the two case studies, up to 10 individuals from each benthic taxon were collected.

2.8 Echo sounder registrations

Acoustic data was recorded continuously by both vessels acoustic systems. Data was recorded at 5 frequencies (18, 38, 70, 120 and 200 kHz) with SIMRAD split-beam transducers. The range of the echosounder was set to 500 m, and pulse length was 1024 µs. Calibration of all frequencies was done in February. Acoustic abundance of fish was recorded as nautical area scattering coefficient (s_A) (m^2/n.mi.^{2}), and stored as ER60 raw files (*.raw). The acoustic data recorded at 38 kHz was scrutinised in the Large Scale Survey System[1]. The following acoustic categories were used (priority in parentheses): capelin (1), herring (1), blue whiting (1), redfishes (1), cod (1) and haddock (1), other fish (2), and plankton (3). The results were stored for each nautical mile with a vertical resolution of 10 m. Echo integration stopped at 0.5 m above the acoustic bottom registration, threshold for volume backscattering strength (S_v) was set to -82 dB. Acoustic recordings from the other frequencies were stored for multi-frequency analysis of capelin and herring.

2.9 Examine parasitological fauna

Specimens were collected from the sampling of fish, zooplankton and benthos described above. The aim was to examine the parasitological fauna of fish, zooplankton and benthos species that are abundant in the area and/or have been identified with many feeding links. The following were identified as species to be prioritized for examinations:

2.9.1 Zooplankton

Copepods

1. *Calanus finmarcichus*
2. *Calanus glacialis*
3. *Calanus hyperboreus*
4. *Metridia longa*
5. *Pareuchaeta norvegica*

Amphipods

6. *Themisto abyssorum*
7. *Themisto libellula*

Chaetognaths

8. *Sagitta elegans*

Euphasiids

9. *Thysanoessa inermis*
10. *Thysanoessa raschii*
11. *Meganyctiphanes norvegica*

2.9.2 Fish

1. *Gadus morhua* (Cod, torsk) **6**
2. *Sebastes mentella* (Deepwater redfish, snabeluer)
3. *Trisopterus esmarkii* (Norway pout, øyepål)
4. *Anarhichas lupus* (Atlantic wolfish, gråsteinbit) **2**
5. *Amblyraja radiata* (Thorny skate, kloskate) **5**
6. *Artediellus atlanticus* (Atlantic hookear sculpin, krokulke) **5**
7. *Lycodes gracilis* (Vahl's eelpout, vanlig ålebrosme) **6**
8. *Triglops murrayi* (Moustache sculpin, nordlig knurrulke)
9. *Lumpenus lampretaeformis* (Snakeblenny, langhalet langebarn) **3**
10. *Sebastes marinus* (deepsea redfish, vanlig uer)
11. *Leptoclinus maculates* (Daubed shanny, tverrhalet langebarn)

2.9.3 Benthos

Mud/basket/brittle stars

1. *Ctenodiscus crispatus*
2. *Gorgonocephalus arcticus*
3. *Ophiacantha bidentata*
4. *Ophiopholis aculeata*
5. *Ophiopleura borealis*
6. *Ophioscolex glacialis*
7. *Ophiura sarsi*

Sea lily

8. *Heliometra glacialis*

Sea urchin

9. *Strongylocentrotus pallidus*

Polychaetes

10. *Spiochaetopterus typicus*
11. *Lumbrieris sp.*
12. *Heteromastus filiformis*
13. *Maldane sarsii*

Crustaceans

14. *Chionocetes opilio*
15. *Pandalus borealis*
16. *Paralithodes camtschaticus*
17. *Sabinea septemcarinata*

Bivalves

18. *Macoma calcera*
19. *Mendicula ferruginosa*

Sponges

20. *Geodia macandrewii*
21. *Geodia barrette*

Gastropods: Species to be determined during the cruise.

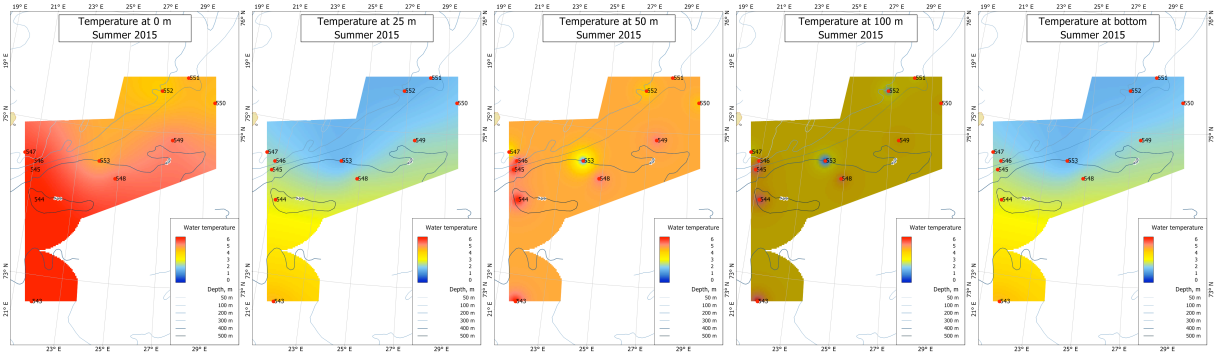
Standard parasitological examination techniques were used. They were adjusted according to species. For example, smaller zooplankton were squeezed between glass plates and examined under a dissection microscope while larger specimens were dissected and the various organs examined separately. Species identifications were mainly made during the cruise. Specimens to be examined after the cruise were stored in 4% formaldehyde or 96% ethanol.

2.10 Diversity of bacteria, virus and assessment of environmental DNA (eDNA)

To assess the diversity of bacteria and virus as well as DNA from other species in the water, water samples were taken and filtered at most of the sampling stations. Waters was collected at three depths at each station: Surface, around 50 m and bottom. Water was collected in Niskin bottles mounted on the CTD sampler. On the ship, the water was filtered through filter with 0.22 micron pore size. A total of 400 water were filtered across sampling stations. Later, the DNA captured in these filters will be extracted and sequenced with next generation sequencing. This will yield data on a large proportion of the molecular operational taxonomical units in these samples. This can later be used to assess the diversity of virus and bacteria in the water column as well as other species present that have left detectable traces of DNA in the water.

3 Results and discussion

3.1 Physical oceanography



Spatial distribution of temperature at 0 m, 25 m, 50 m, 100 m and bottom during the survey are shown above. Other results will be available in 2015-2016.

3.2 Biogeochemistry and biological samples

3.2.1 Dissolved inorganic nutrients and chlorophyll a

Samples for dissolved inorganic nutrients (0-50 m average) were collected at all CTD stations visited (Figure 3 and 4). Concentrations of nitrate, phosphate and silicate appeared to follow each other and all were higher at the southern stations. While the ratio between dissolved inorganic nitrogen (DIN) and phosphate was near the N:P Redfield relationship of 16 (Figure 5), the DIN:Si relationship suggested that there was a lack of available silicate at almost all stations visited in the Barents Sea. Pigment concentrations per volume seawater (Figure 6) was higher at the northernmost stations for both Chl-a and Phaeo. The higher concentrations of biomass at the northern stations may be the cause of the lower dissolved nutrient concentrations found at these stations (Figures 4 and 6). The Chl-a:Phaeo ratios were all above one (Figure 6), an indication of a still healthy community of phytoplankton, yet potentially limited of dissolved silicate (Figure 4).

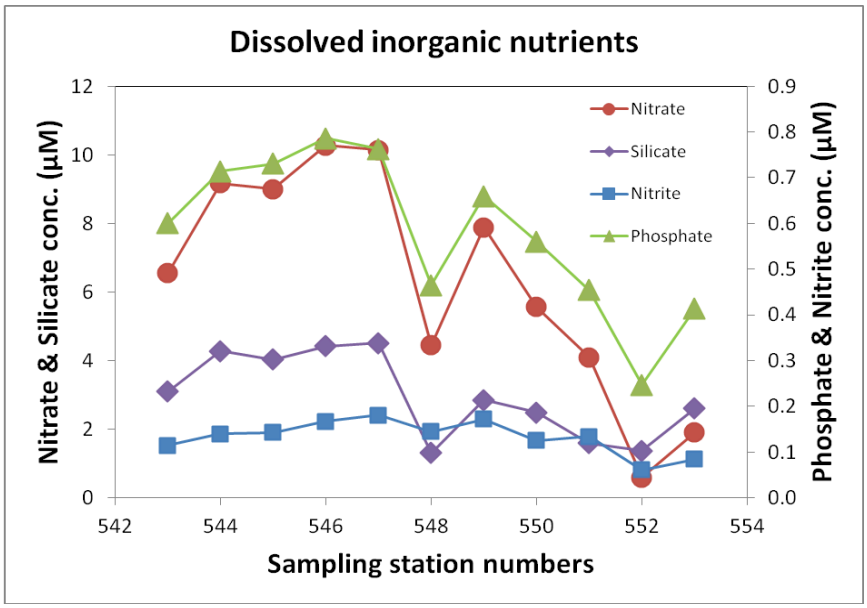


Figure 4. Concentrations of dissolved inorganic nutrients (0-50 m average) measured at stations 543-553 in the Barents Sea during the TIBIA survey cruise, 25 May–6 June 2015.

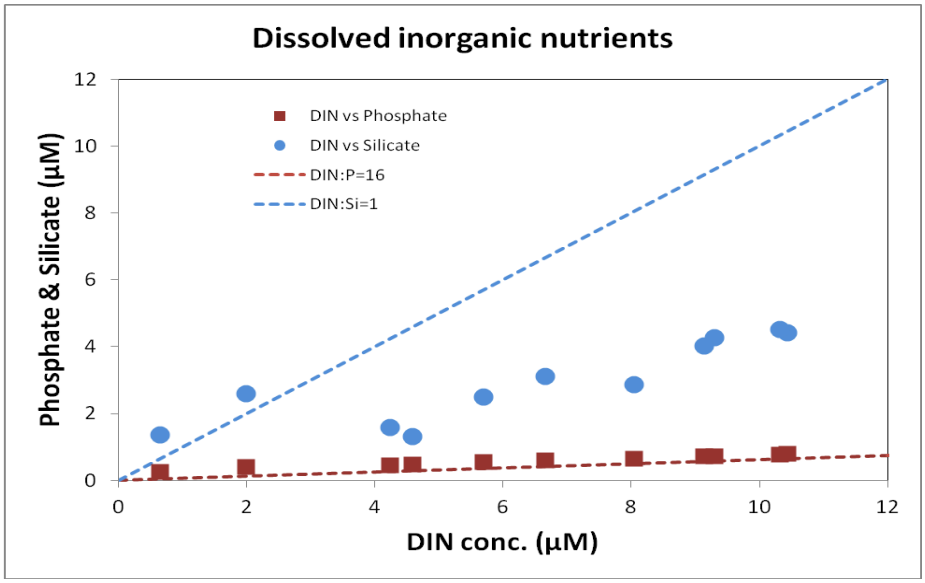


Figure 5. Concentrations of phosphate and silicate plotted as a function of total dissolved inorganic nitrogen (DIN). The lines shows the Redfield N:P-relationship of 16 (red dotted line) and the assumed N:Si of 1 requirement of a diatom cell (blue dotted line).

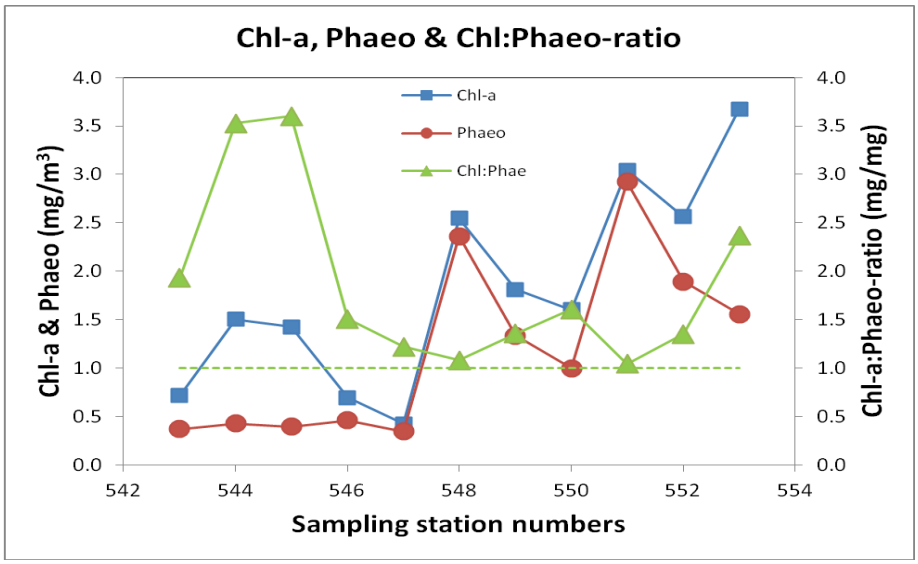


Figure 6. The distribution of Chl-a and Phaeopigments (Phaeo) concentrations from stations 543-553 (0-50m averages) during the TIBIA survey cruise, 25 May–6 June 2015. The Chl:Phaeo-ratio was also calculated (green symbols) and the line where Chl:Phaeo=1 is also shown (green dotted line).

3.3 Phytoplankton species distribution

Phytoplankton in this report includes algae, small flagellates and ciliates, organisms collected with the phytoplankton sampling procedures.

Concerning phytoplankton, there were obviously two types of water involved in this survey. The division was between stations 543-547 and stations 548-553, probably between Atlantic and Arctic waters. The number of taxa on the "Atlantic" stations varied between 8 to 15, on the "Arctic" stations between 21 to 27.

The Atlantic water phytoplankton society consisted mainly of small flagellates and cryptophyta. Station 546 and 547 also had 200.000-300.000 cells/l of the haptophyte *Emiliania huxleyi*. This species also occurred in the Arctic waters, but not in this concentrations. There were only traces of other taxa.

The Arctic water also had many small flagellates and cryptophyta, especially stations 552 and 553. The main difference from the Atlantic water was the presence of diatoms that dominated the algal biomass. Especially the genera *Chaetoceros* with at least 8 species, and *Pseudo-nitzschia* were important. In the three northern stations (551 to 553) the haptophyte *Phaeocystis* sp. were common. There were also higher abundance of ciliates in the Arctic water, especially *Strombidium* (?) sp. and *Myrionecta* sp.

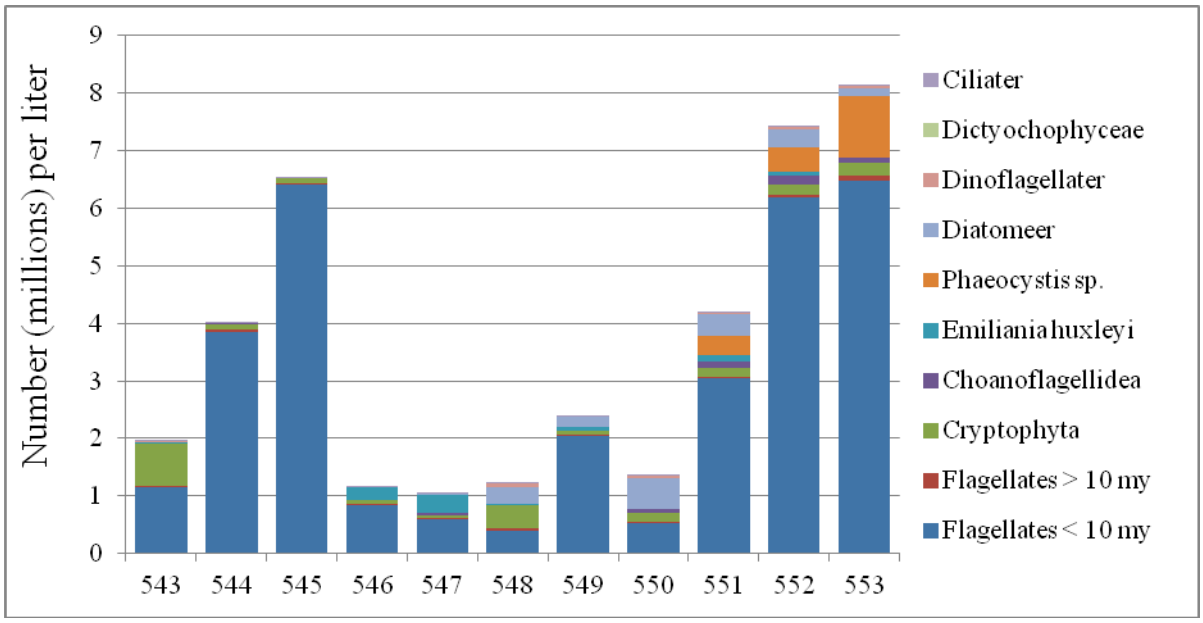


Figure 7. Phytoplankton species composition for each station during the summer TIBIA survey 2015.

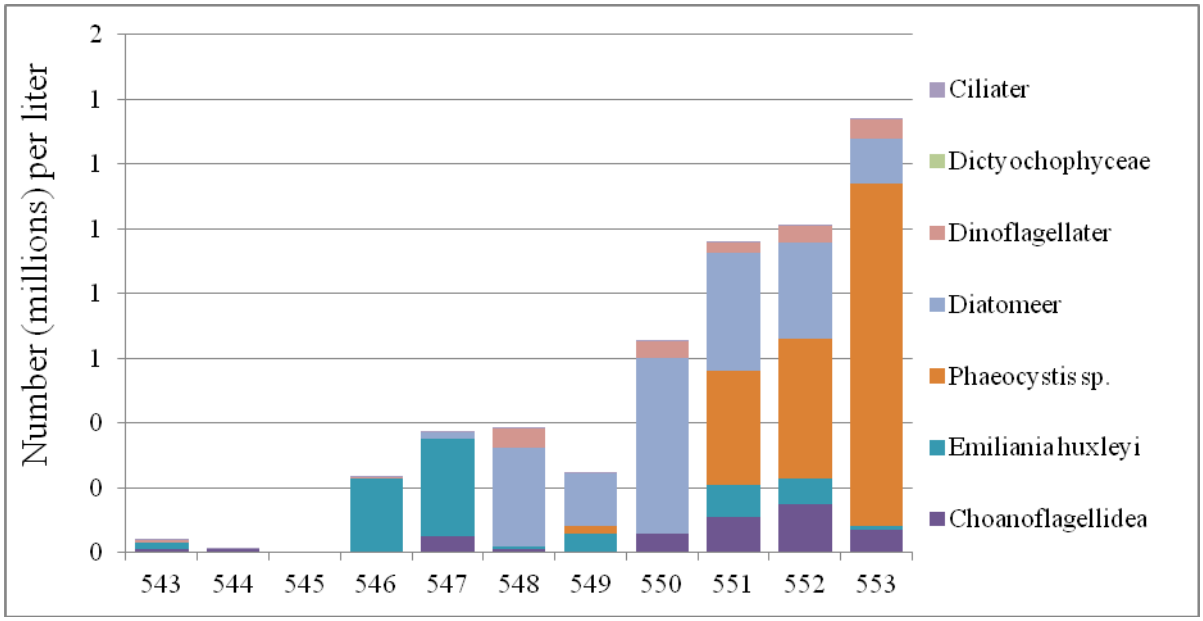


Figure 8.Total number of phytoplankton taxa, except small flagellates and cryptophyta, for each station. The difference between Atlantic- and Arctic water is easier to see. Division is between station 547 and 548.

3.4 Zooplankton

3.4.1 Mesozooplankton biomass

The mesozooplankton biomass was investigated based on 8 MOCNESS and 3 WP2 stations (Fig 9). In general, low mesozooplankton biomass (average 3.3 g dw m^{-2}) was observed in most stations except for st. 547 (12 g dw. m^{-2}) (Fig. 10 & 11). In the more southern stations (st. 543-547), the largest (>2000 µm) and the medium size (2000-1000 µm) fraction dominated indicating that the production of mesozooplankton (likely dominated by *Calanus* copepods) has come far. In contrast, the smallest size (1000-180µm) fraction (likely dominated by younger copepodite stages) contributed significantly to the biomass in the northern most stations (st. 548-553). The high Chl concentrations (spring/early summer bloom) observed at these northern stations correspond well with the initiation of mesozooplankton production observed at these locations.

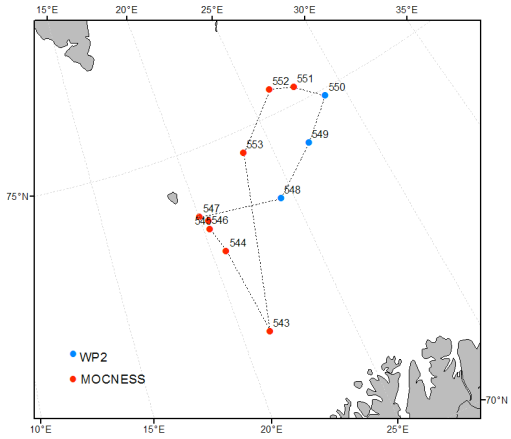


Figure 9. Location of MOCNESS and WP2 stations. TIBIA cruise 27 May to 6 June.

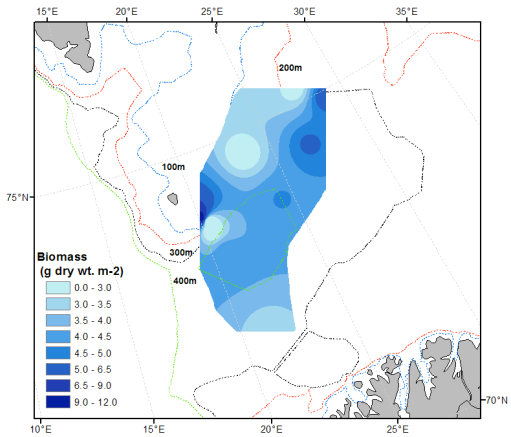


Figure 10. Spatial distribution of mesozooplankton biomass based on MOCNESS and WP2.

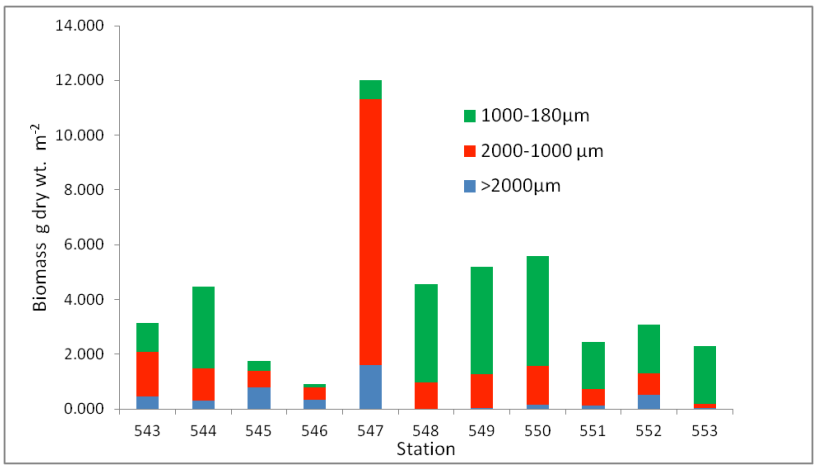


Figure 11. Size fractionated biomass based on MOCNESS and WP2.

3.5 Euphausiid abundance and biomass

3.5.1 MOCNESS

Euphausiid (krill) abundance and biomass was explored using 8 MOCNESS stations. The abundance and biomass were generally highest in the northern stations (st. 547, 551 and 552) with *Thysanoessa inermis* and *T. longicaudata* dominating (Figure 12). Though the abundance of *T. longicaudata* was higher than *T. inermis*, contribution to biomass is most likely from the latter species as it is comparatively a much larger species. The largest of the krill species, *Meganyctiphanes norvegica* was present only in 3 stations with very low abundance (< 1.5 no. m^{-2}). The abundance of *Meganyctiphanes norvegica* is most likely underestimated in the MOCNESS catches due to avoidance. Another reason for the low abundance could be that this species is mostly restricted to warmer Atlantic waters in the south e.g. Norwegian Sea. In the recent years this species is more commonly observed in the Barents Sea due to warming conditions.

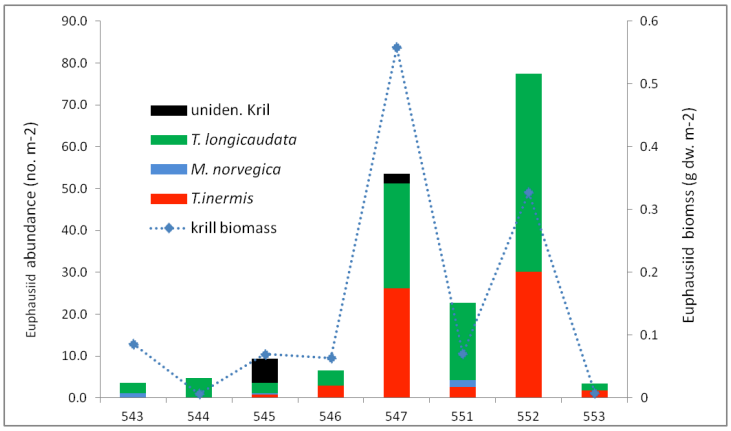


Figure 12. Euphausiid abundance and biomass based on MOCNESS catches.

3.5.2 Pelagic trawl

Euphausiids taken by pelagic trawl (V-towing: from surface down to the bottom and up to surface again) were identified and 100 specimens length measured. All three krill species of abundance were found in the southwestern area (serie. nr 70002 and 70012, Figure 2). The largest krill abundance were found in shallow area and dominated by *T.inermis* (Figure 13). In this area highest abundance of phytoplankton was also observed.

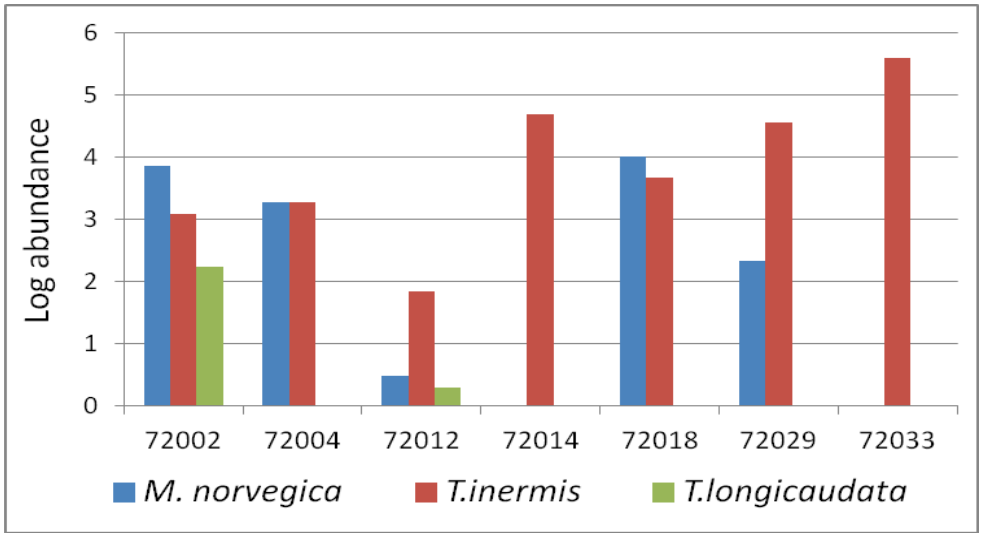


Figure 13. Log transformed abundance of euphausiids.

Length of *M. norvegica* varied between 18 and 38 mm and length distribution was widest at the deepest station (serie. nr 70004, Figure 2) showed most likely several generations of krill (Figure 14).

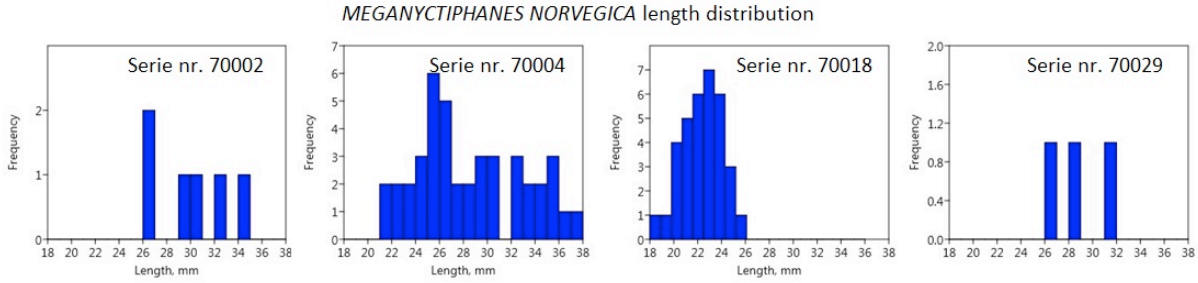


Figure 14. Length distribution of *Meganyctiphanes norvegica.*

Length of *T.inermis* varied between 16 and 44 mm and length distribution was widest in the Hopen trench (serie. nr 70018, Figure 2) showed most likely several generations of krill (Figure 15).

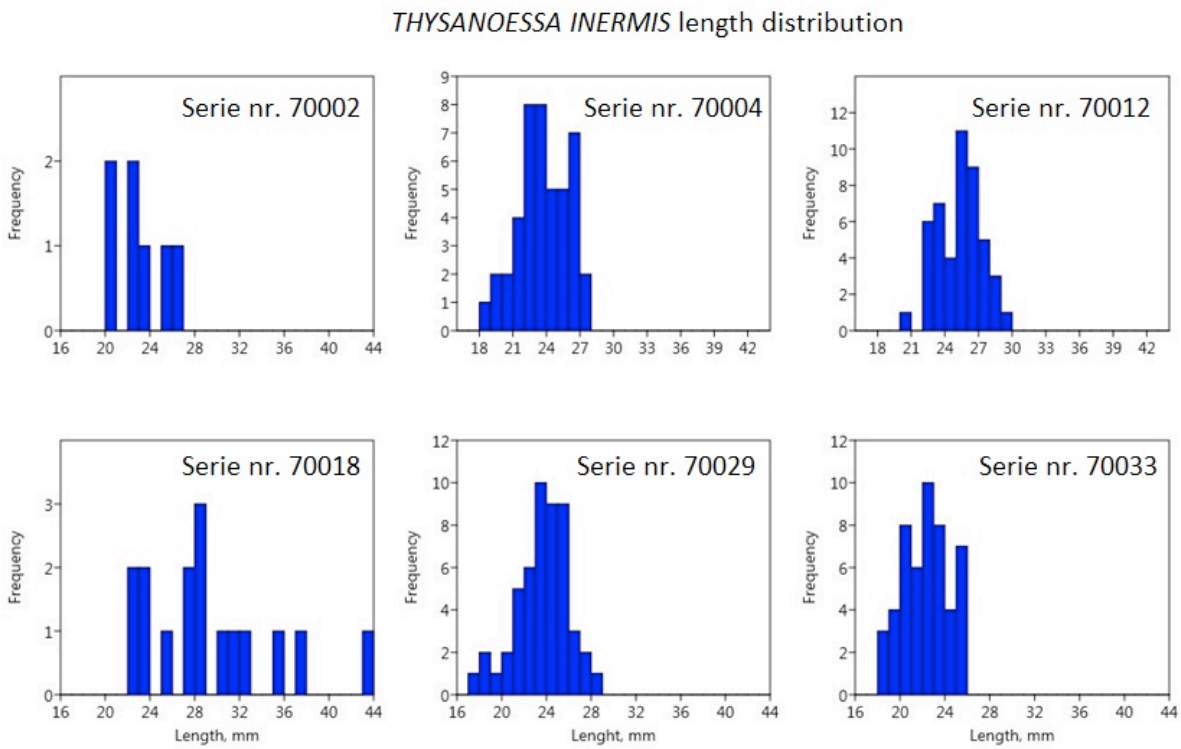


Figure 15. Length distribution of *Thysanoessa inermis.*

Thysanoessa longicaudata were observed only at two stations (serie. nr 70002 and 72012), and was of 23 and 15 mm respectively.

3.6 Fish

41 fish species from 19 families were taken by pelagic and bottom trawl and registered during the survey (Table 2).

Table 2. Fish species recorded during the summer TIBIA survey 2015.

English name	Norwegian name	Order	Family	Scientific name	Author
Greenland halibut	BLÅKVEITE	Pleuronectiformes	Pleuronectidae	*Reinhardtius hippoglossoides*	(Walbaum, 1792)
Northern wolfish	BLÅSTEINBIT	Perciformes	Anarhichadidae	*Anarhichas denticulatus*	Kröyer, 1845
Doubleline eelpout	BÅNDÅLEBROSME	Perciformes	Zoarcidae	*Lycodes eudipleurostictus*	Jensen, 1901
Spotted wolffish	FLEKKSTEINBIT	Perciformes	Anarhichadidae	*Anarhichas minor*	Olafsen, 1772
Long rough dab	GAPEFLYNDRE	Pleuronectiformes	Pleuronectidae	*Hippoglossoides platessoides*	(Fabricius, 1780)
Atlantic wolfish	GRÅSTEINBIT	Perciformes	Anarhichadidae	*Anarhichas lupus*	Linnaeus, 1758
Whiting	HVITTING	Gadiformes	Gadidae	*Merlangius merlangus*	(Linnaeus, 1758)
Haddock	HYSE	Gadiformes	Gadidae	*Melanogrammus aeglefinus*	(Linnaeus, 1758)
Rough-head grenadier (ICES), onion-eye grenadier (Fish-base)	ISGALT	Gadiformes	Macrouridae	*Macrourus berglax*	
Thorny skate	KLOSKATE	Rajiformes	Rajidae	*Amblyraja radiata*	(Donovan, 1808)
Blue whiting	KOLMULE	Gadiformes	Gadidae	*Micromesistius poutassou*	(Risso, 1826)
Atlantic hookear sculpin	KROKULKE	Scorpaeniformes	Cottidae	*Artediellus atlanticus*	Jordan & Evermann, 1898
Pearlsides	LAKSESILD	Stomiiformes	Sternoptychidae	*Maurolicus muelleri*	(Gmelin, 1789)
Snakeblenny	LANGHALET LAGEBARN	Perciformes	Stichaeidae	*Lumpenus lampretaeformis*	(Walbaum, 1792)
White barracudina	LITEN LAKSETOBIS	Aulopiformes	Paralepididae	*Arctozenus risso*	(Bonaparte, 1840)
Capelin	LODDE	Osmeriformes	Osmeridae	*Mallotus villosus*	(Müller, 1776)
Moustache sculpin	NORDLIG KNUR	Scorpaeniformes	Cottidae	*Triglops murrayi*	Günther, 1888
Glacier lanternfish	NORDLIG LYSPIKFISK	Myctophiformes	Myctophidae	*Benthosema glaciale*	(Reinhardt, 1837)
Threespot eelpout	NORDLIG ÅLEBRÅSME	Perciformes	Zoarcidae	*Lycodes rossi*	Malmgren, 1864
Polar sculpin	PADDEULKE	Scorpaeniformes	Psychrolutidae	*Cottunculus microps*	Collett, 1875
Gelantinous snailfish	POLARRINGBUK	Scorpaeniformes	Liparidae	*Liparis fabricii*	Kröyer, 1847
Polar cod	POLARTORSK	Gadiformes	Gadidae	*Boreogadus saida*	
Lumpsucker	ROGNKJEKS	Scorpaeniformes	Cyclopteridae	*Cyclopterus lumpus*	Linnaeus, 1758
Stout eelblenny	RUNDHALET LANGEBARN	Perciformes	Stichaeidae	*Anisarchus medius*	
Saithe	SEI	Gadiformes	Gadidae	*Pollachius virens*	(Linnaeus, 1758)
Herring	SILD'G03	Clupeiformes	Clupeidae	*Clupea harengus*	Lumpsucker
Deepwater redfish	SNABELUER	Scorpaeniformes	Sebastidae	*Sebastes mentella*	Travin 1951
Snailfish	SNOTTFISH	Scorpaeniformes	Liparidae	*The genus under revisions*	
Silvery pout	SØLVTORSK	Gadiformes	Gadidae	*Gadiculus argenteus*	Guichenot, 1850
Atlantic poacher	TISKJEGG	Scorpaeniformes	Agonidae	*Leptagonus decagonus*	(Bloch & Schneider, 1801)
Twohorn sculpin	TORNULKE	Scorpaeniformes	Cottidae	*Icelus bicornis*	(Reinhardt, 1840)
Atlantic cod	TORSK	Gadiformes	Gadidae	*Gadus morhua*	Linnaeus, 1758
Daubed shanny	TVERRHALET LANGEBARN	Perciformes	Stichaeidae	*Leptoclinus maculatus*	(Fries, 1838)
Greater eelpout	ULVEFISK	Perciformes	Zoarcidae	*Lycodes esmarkii*	Collett, 1875
Golden Redfish	VANLIG UER	Scorpaeniformes	Sebastidae	*Sebastes marinus*	(Linnaeus, 1758)
Shorthorn sculpin	VANLIG ULKE	Scorpaeniformes	Cottidae	*Myoxocephalus scorpius*	(Linnaeus, 1758)
	VANLIG ÅLEBRÅSME	Perciformes	Zoarcidae	*Lycodes gracilis*	Sars, 1867
Greater argentine	VASSILD	Osmeriformes	Argentinidae	*Argentina silus*	(Ascanius, 1775)
Norway pout	ØYEPÅL	Gadiformes	Gadidae	*Trisopterus esmarkii*	(Nilsson, 1855)

Atlantic cod, haddock, long rough dab, capelin, spotted wolfish and Atlantic hookear sculpin were most abundant during the survey (Table 3). Large cod were observed in the southern area

with depth of 360-370m (serer nr. 72021-23), while smaller cod (and small haddock) in the northern area with 140-170 m depth (serie nr. 720032 and 72034).

Table 3. Fish (age 1+) observed during the survey. Number of station fish were observed, total catch weight (kg) and numbers is given.

Species/groups	Number of station species observed	Catch weight, kg	Catch number, ind.
Northern wolfish	8	140.89	16
Doubleline eelpout	4	0.408	21
Spotted wolffish	6	26.924	10
Long rough dab	20	157.5635	727
Atlantic wolfish	1	9.379	11
Whiting	2	1.776	5
Haddock	18	141.991	194
Rough-head grenadier (ICES) Onion-eye grenadier (Fisb-base)	2	1.426	2
Thorny skate	9	22.049	17
Blue whiting	8	61.389	416
Atlantic hookear sculpin	10	0.456	109
Pearlsides	9	0.0795	55
Snakeblenny	7	0.4885	54
White barracudina	6	0.539	10
Capelin	26	287.702	33953
Moustache sculpin	4	0.204	35
Glacier lanternfish	4	0.018	19
Threespot eelpout	1	0.029	1
Polar sculpin	4	0.538	5
Gelantinous snailfish	1	0.004	1
Polar cod	1	0.0225	1
Lumpsucker	5	17.213	13
Stout eelblenny	2	0.018	9
Saithe	1	1.61	
Herring	3	0.254	3
Deepwater redfish	24	66.5629	631
Snailfish	3	0.022	4
Silvery pout	1	0.005	1
Atlantic poacher	3	0.203	12
Twohorn sculpin	1	0.001	1
Atlantic cod	39	1638.334	1446
Daubed shanny	2	0.008	7
Greater eelpout	2	2.508	2
Golden Redfish	3	2.017	6
Shorthorn sculpin	9	1.403	38
Lycodes gracilis	2	0.9254	4
Greater argentine	1	0.04	1
Moustache sculpin	4	0.028	10
Shorthorn sculpin, age 0+	1	0.004	4

Juvenile fish (age 0) of wolffishes (Photo 1), long rough dab, capelin and other fishes were observed in the south-western area during the survey (Table 4). Small meshed panels inside the trawl make us able to catch small individuals of 1.0 (redfish) to 5.0-5.4 cm (saithe, Atlantic and spotted wolfish, snakeblenny and stout eelblenny). Capelin larvae were observed in upper water layer in the deeper area of 360 m (serie nr. 70001) and shallower area of 150 m (serie nr. 7004 and 70010).

Photo 1. 0-group wolffishes. Northern (above), spotted (mid) and Atlantic (below) wolffish.

Table 4. Fish (age 0) observed during the survey. Number of station fish were observed, total catch weight (g), catch numbers and fish length (cm) is given.

Species/groups	Number of station species observed	Catch number, ind.	Catch weight, gram	Fish length, cm
Northern wolffish	2	14	7	3.7
Spotted wolffish	9	153	73.2	3.3
Long rough dab	2	2	1.03	1.4
Atlantic wolffish	10	169	52.2	3.1
Snakeblenny	5	98	11.7	4.1
Capelin	3	69	26	3.0
Stout eelblenny	1	1	0.2	4.4
Saithe	3	22	2.7	2.9
Herring	2	417	35.5	2.9
Cod family	2	3	1.1	2.8
Redfish family	1	2	0.1	1.2

3.7 Benthos

Invertebrate animals connected to the seabed (benthos) were recorded with a Campelen trawl on 14 stations. A total of 126 taxons (Table 5), and 60313 kg of biomass was recorded. The highest biomass belonged to the "Dyphavsreke" (*Pandalus borealis*), followed by "Muddekamstjerne", *Bathyarca glacialis* (bivalve), *Brada inhabilis* (Polychaeta) (Figure 16).

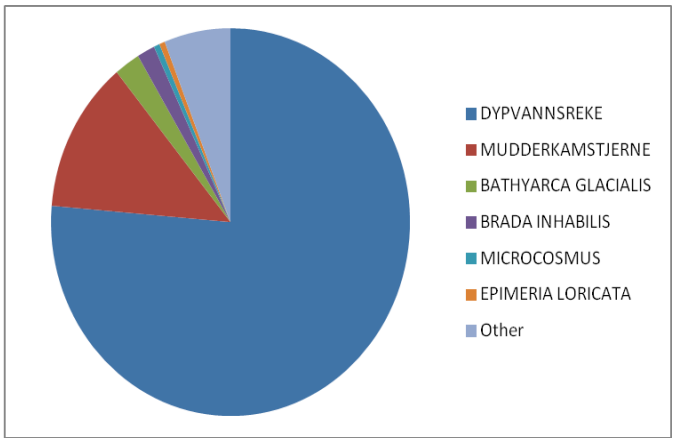


Figure 16. The biomass distribution of the 126 taxa recorded. All taxa contributing with less than 1 % of the total biomass was lumped into "others".

Trawl 72003 had the highest biomass recorded, while trawl 72030 the highest abundance (Figure 17).

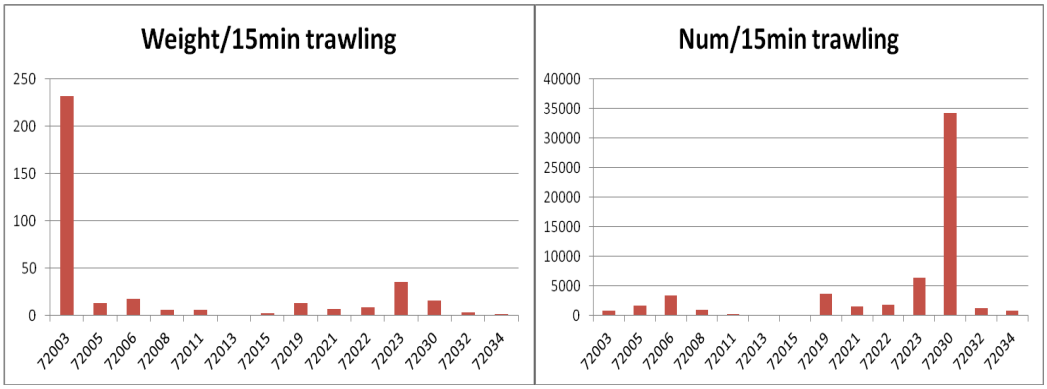
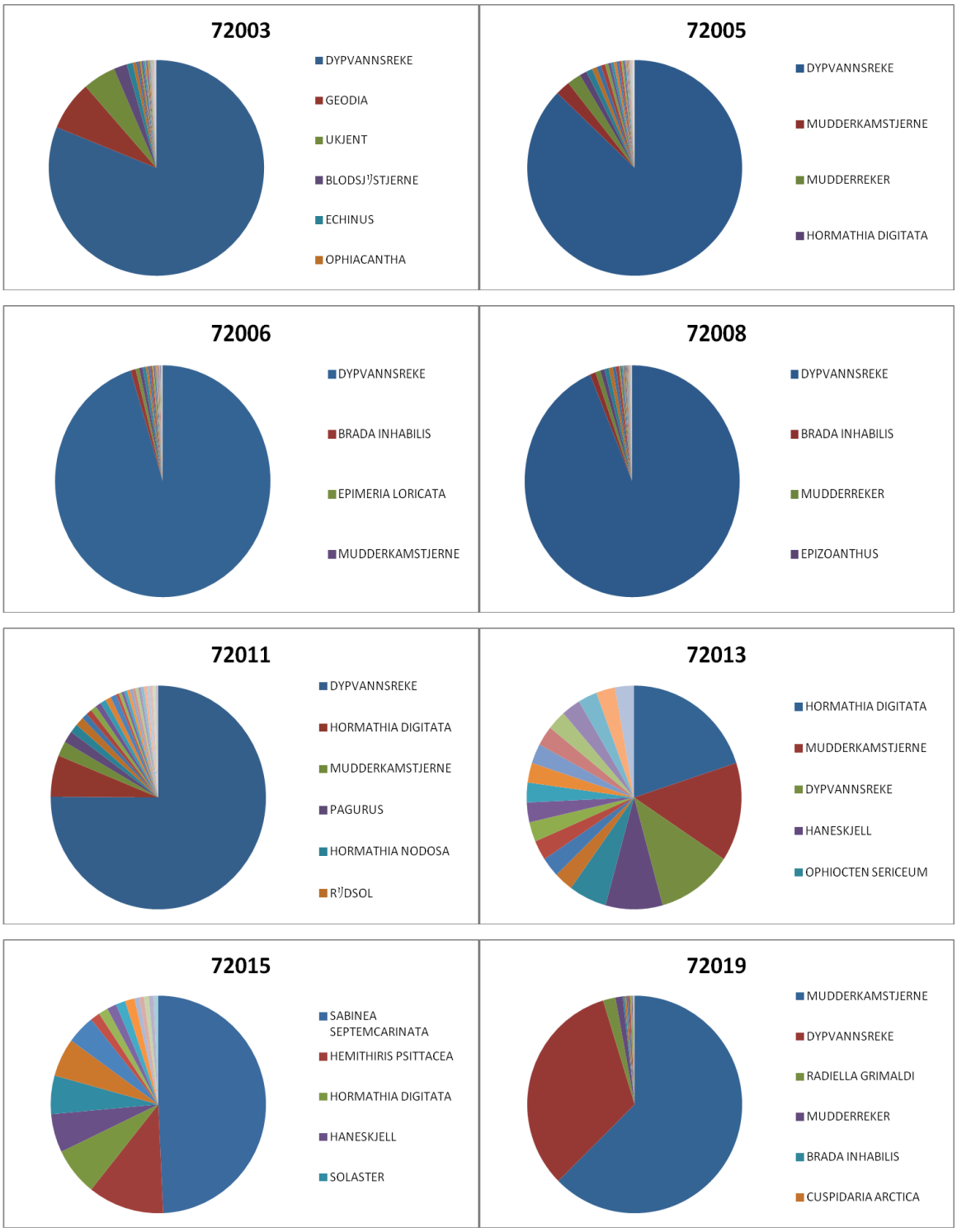


Figure 17. Biomass and abundance distribution among Campelen bottomtrawls after 15 minutes trawling.

A total of 7 Campelen trawls (7200-03, -05, -06, -08, -11, -23 and -30, see figure 18) was dominated by the "Dyphavsreke" (*Pandalus borealis*), five (720-19, -21, -22, -26, -32) was dominated by the "Mudderkamstjerne" (*Ctenodiscus crispatus*), while the Crangonidae crustacean *Sabinea septemcarinata* dominated 72013, and *Microcosmos* trawl 72032.


72003
DYPVANNSREKE
GEODIA
UKJENT
BLODSJ)STJERNE
ECHINUS
OPHIACANTHA
72005
DYPVANNSREKE
MUDDERKAMSTJERNE
MUDDERREKER
HORMATHIA DIGITATA
72006
DYPVANNSREKE
BRADA INHABILIS
EPIMERIA LORICATA
MUDDERKAMSTJERNE
72008
DYPVANNSREKE
BRADA INHABILIS
MUDDERREKER
EPIZOANTHUS
72011
DYPVANNSREKE
HORMATHIA DIGITATA
MUDDERKAMSTJERNE
PAGURUS
HORMATHIA NODOSA
R)DSOL
72013
HORMATHIA DIGITATA
MUDDERKAMSTJERNE
DYPVANNSREKE
HANESKJELL
OPHIOCTEN SERICEUM
72015
SABINEA SEPTEMCARINATA
HEMITHIRIS PSITTACEA
HORMATHIA DIGITATA
HANESKJELL
SOLASTER
72019
MUDDERKAMSTJERNE
DYPVANNSREKE
RADIELLA GRIMALDI
MUDDERREKER
BRADA INHABILIS
CUSPIDARIA ARCTICA

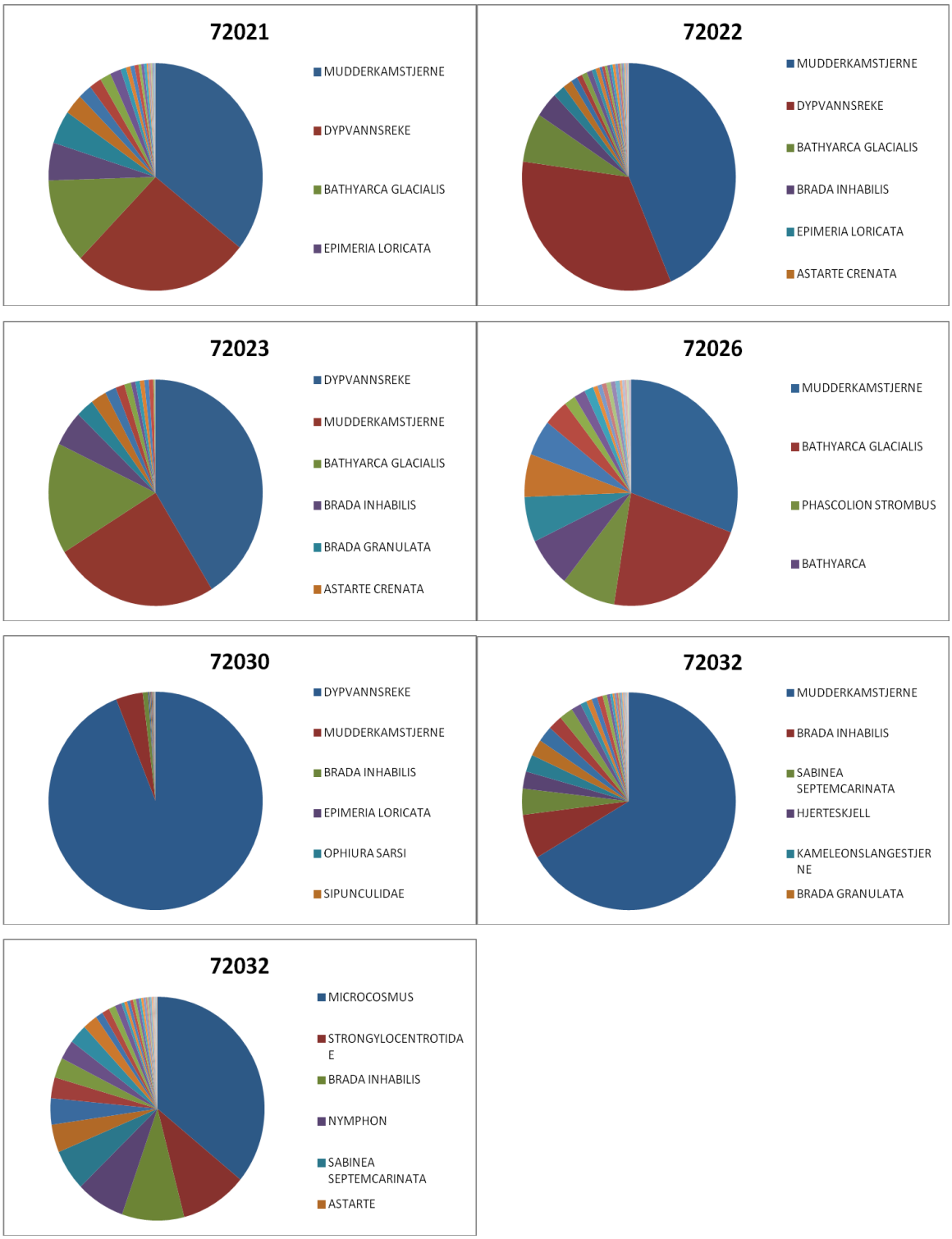


Figure 18. Each of the 14 bottomtrawl stations with the % distribution of taxons. Only the six most dominant taxons are given in each of the pie-plots. For information of kg wetweight per taxon per station see table 5.

Table 5. Invertebrate bottom associated animals (kg wet-weight per 15 minutes trawling per station) in alphabethic order.

Taxon	72003	72005	72006	72008	72011	72013	72015	72019	72021	72022	72023	72030	72032	72034
ACTINIA	0.01	0.15			0.03			0.14						
AMPELISCA												0.00		
APLACOPHORA			0.00								0.00			
ARCTINULA GREENLANDICA		0.00	0.00	0.00					0.00					
ASTARTE							0.01						0.11	0.08
ASTARTE CRENATA	0.00				0.00	0.00			0.07	0.10	0.66	0.03		
BATHYARCA									0.03			0.00		
BATHYARCA GLACIALIS		0.02	0.01	0.00	0.00			1.01	0.37	0.22	1.62			
BLODSJØSTJERNE	0.03	0.02	0.01	0.00		0.00							0.00	0.03
BLØSOL					0.01	0.00		0.21						0.00
BRADA GRANULATA									0.07	0.05	0.47	0.05	0.06	0.03
BRADA INHABILIS		0.03	0.05	0.02	0.00	0.00		0.02	0.15	0.17	0.91	0.10	0.16	0.12
BUCCINUM BELCHERI														0.01
BUCCINUM HYDROPHANUM					0.02									0.05
BJRSTEORMER											0.00			
COLUS		0.01	0.05	0.00	0.01									
COLUS ISLANDICUS						0.00								
COLUS PUBESCENS		0.01								0.02				
COLUS SABINII		0.01		0.00								0.39		
CROSSASTER		0.01												
CUSPIDARIA ARCTICA		0.00						0.01						
DIPLOSOLEN INTRICARIUS												0.01		
DYPVANNSREKE	5.99	8.11	15.95	5.34	0.86	0.02		7.23	2.43	6.22	13.30	12.86		
ECHINUS	0.02													
EPIMERIA LORICATA	0.00	0.00	0.01	0.00	0.00	0.00			0.03	0.02	0.04	0.02		
EPIZOANTHUS		0.00		0.00	0.00									
EUALUS GAIMARDII	0.00											0.00		
GEODIA	202.50	3.88			4.50									
GERSEMIA						0.00			0.02	0.01	0.01	0.01	0.00	
GOLFINGIA											0.00			
GONATUS														0.01
HAMINGIA ARCTICA			0.01	0.01					0.01			0.02	0.03	
HANESKJELL					0.01	0.01	0.03	0.01			0.01			
HARMOTHOE			0.00	0.00	0.00					0.01			0.02	0.01
HAVEDDERKOPPER		0.00												
HEMITHIRIS PSITTACEA							0.02							0.04
HJERNESVAMP	0.01													
HJERTESKJELL													0.65	0.07
HORMATHIA DIGITATA		0.03	0.02	0.01	0.04	0.03	0.04	0.00		0.03		0.04	0.05	0.12
HORMATHIA NODOSA			0.02		0.06									

ICASTERIAS PANOPLA							0.32			0.02		0.14	0.67	0.33
ISHAVSLUSA								0.01	0.01	0.01	0.00			
KAMELEONSLANGESTJERNE	0.00	0.00					0.00	0.00	0.00	0.01	0.03	0.00	0.03	0.03
KAPPEDYR					0.00									
KR†KEBOLLER													0.02	0.02
LABIDOPLAX									0.01				0.00	
LAETMONICE							0.01							
MARGARITES GROENLANDICUS										0.00				
MICROCOSMUS														0.29
MOLGULA	0.03	0.07	0.08	0.00				0.01						
MOLPADIA BOREALIS		0.24	1.18	0.09				0.80	1.23	0.94	6.98	0.20		
MUDDERKAMSTJERNE		0.10	0.06	0.02	0.01	0.01	0.00	1.79	1.45	1.22	10.28	1.45	1.38	0.01
MUDDERREKER	0.00	0.05	0.02	0.01				0.08		0.01		0.00		
MUNIDA TENUIMANA	0.00													
MUSLINGER														0.00
MYRIOTROCHUS											0.00	0.01		
NAKENSNEGLER										0.00		0.00		
NEPHTYIDAE		0.00												0.03
NEPTUNEA DENSELIRATA														0.05
NEPTUNSNEGL					0.02	0.07	0.02	0.03						
NOTHRIA														0.00
NOTHRIA CONCHYLEGA			0.00											
NYMPHON													0.00	0.03
NYMPHON GRACILE													0.00	0.00
NYMPHON HIRTUM								0.00		0.00	0.00	0.00	0.00	
NYMPHONIDAE						0.00								
ONCHIDIOPSIS				0.00										
OPHELINA	0.00													
OPHIACANTHA	0.00													
OPHIOCTEN SERICEUM				0.00		0.00								
OPHIOSCOLEX					0.00								0.01	
OPHIURA ALBIDA	0.00													
OPHIURA SARSI					0.00		0.00		0.01	0.03	0.19	0.04	0.02	0.01
OPHIURIDAE														0.00
PAGURUS					0.04									
PAGURUS PUBESCENS	0.00					0.00								
PARAMPHITHOE									0.00				0.00	
PECTEN	0.00									0.01			0.04	0.01
PELONAIA CORRUGATA				0.00										
PHAKELLIA		0.16			0.63	0.01			0.25	0.06	0.05			
PHASCOLION									0.00					
PHASCOLION STROMBUS				0.00									0.01	0.00
PHILINE										0.00	0.04	0.01		0.01
PHILINE FINMARCHICA		0.00	0.00		0.00				0.01					

PHYLLOPHORIDAE												0.02	0.01	
PONTASTER TENUISPINUS	0.00			0.02					0.03	0.03	0.09	0.04	0.01	
PORANIOMORPHA	0.01									0.00	0.06	0.00		
PTERASTER MILITARIS		0.00	0.01	0.00										0.00
PTERASTER PULVILLUS		0.00		0.00										
PYNTEKRABBER							0.00							
RADIELLA GRIMALDI	0.01	0.00		0.01				2.12	0.25	0.02				
RØD SKJELLPØLSE					0.02	0.00								
RØDSOL			0.02	0.00	0.02	0.00							0.00	
SABINEA SEPTEMCARINATA							0.13		0.06	0.04	0.11	0.08	0.13	0.09
SANDPYNTEKRABBE												0.01		
SANDSKJELL													0.02	
SERTELLA BEANIANA	0.00													
SIPUNCULIDAE												0.01		
SJØSTJERNER	0.00													
SKALLUS	0.01	0.00												
SKJELLRYGGER									0.00					
SLIMORMER				0.00										
SMÅPYNTEKRABBE	0.01	0.00			0.00					0.02			0.01	
SNEGLER		0.01					0.00					0.01		0.00
SNØKRABBE											1.12			
SOLASTER							1.70							
SPIOCHAETOPTERUS													0.01	0.01
SPIRONTOCARIS													0.01	0.00
STEINBORESKJELL		0.00												
STRONGYLOCENTROTIDAE					0.00	0.00	0.01			0.00		0.02		0.17
SVAMPER							0.00	0.18	0.16					
TANGLOPPER				0.00										
TARMSJØPUNG			0.02	0.01										
TEREBRATULINA	0.02													
TETILLA		0.03												
TROLLHUMMER		0.00												
TROPHON														0.00
TUBULARIA INDIVISA					0.00									
TURRISIPHO		0.00												
TURRISIPHO LACHESIS										0.01				
URASTERIAS LINCKI												0.17	0.06	
URTICINA			0.26											
VANLIG EREMITTKREPS													0.01	0.02
VOLUTOPSIUS								0.01						0.01

3.8 3.3 Diet investigation

During the survey 43 fish species were registered and stomach were taken from 27 fish species (Table 6). In total 734 fish stomach were collected, 220 stomachs were frozen for further analyzing on lab and 514 fish stomach were analysed on board (Table 7).

Table 6. Diet investigation of fish species during the survey. Stomach content were analysed on board and food items were identified and percentage given.

English name	Norwegian names	Order	Family	Scientific name	Author
Greenland halibut	BLÅKVEITE	Pleuronectiformes	Pleuronectidae	Reinhardtius hippoglossoides	(Walbaum, 1792)
Northern wolffish	BLÅSTEINBIT	Perciformes	Anarhichadidae	Anarhichas denticulatus	Kröyer, 1845
Doubleline eelpout	BÅNDÅLEBROSME	Perciformes	Zoarcidae	Lycodes eudipleurostictus	Jensen, 1901
Spotted wolffish	FLEKKSTEINBI	Perciformes	Anarhichadidae	Anarhichas minor	Olafsen, 1772
Long rough dab	GAPEFLYNDRE	Pleuronectiformes	Pleuronectidae	Hippoglossoides platessoides	(Fabricius, 1780)
Whiting	HVITTING	Gadiformes	Gadidae	Merlangius merlangus	(Linnaeus, 1758)
Haddock	HYSE	Gadiformes	Gadidae	Melanogrammus aeglefinus	(Linnaeus, 1758)
Thorny skate	KLOSKATE	Rajiformes	Rajidae	Amblyraja radiata	(Donovan, 1808)
Blue whiting	KOLMULE	Gadiformes	Gadidae	Micromesistius poutassou	(Risso, 1826)
Atlantic hookear sculpin	KROKULKE	Scorpaeniformes	Cottidae	Artediellus atlanticus	Jordan & Evermann, 1898
Pearlsides	LAKSESILD	Stomiiformes	Sternoptychidae	Maurolicus muelleri	(Gmelin, 1789)
Snakeblenny	LANGHALET LANGEBARN	Perciformes	Stichaeidae	Lumpenus lampretaeformis	(Walbaum, 1792)
White barracudina	LITEN LAKSETOBIS	Aulopiformes	Paralepididae	Arctozenus risso	(Bonaparte, 1840)
Capelin	LODDE	Osmeriformes	Osmeridae	Mallotus villosus	(Müller, 1776)
Moustache sculpin	NORDLIG KNURULKE	Scorpaeniformes	Cottidae	Triglops murrayi	Günther, 1888
Threespot eelpout	NORDLIG ÅLEBEBROSME	Perciformes	Zoarcidae	Lycodes rossi	Malmgren, 1864
Polar sculpin	PADDEULKE	Scorpaeniformes	Psychrolutidae	Cottunculus microps	Collett, 1875
Gelantinous snailfish	POLARRINGBUK	Scorpaeniformes	Liparidae	Liparis fabricii	Kröyer, 1847
Lumpsucker	ROGNKJEKS	Scorpaeniformes	Cyclopteridae	Cyclopterus lumpus	Linnaeus, 1758
Saithe	SEI	Gadiformes	Gadidae	Pollachius virens	(Linnaeus, 1758)
Deepwater redfish	SNABELUER	Scorpaeniformes	Sebastidae	Sebastes mentella	Travin 1951
Atlantic poacher	TISKJEGG	Scorpaeniformes	Agonidae	Leptagonus decagonus	(Bloch & Schneider, 1801)
Atlantic cod	TORSK	Gadiformes	Gadidae	Gadus morhua	Linnaeus, 1758
Daubed shanny	TVERRHALET LANGEBARN	Perciformes	Stichaeidae	Leptoclinus maculatus	(Fries, 1838)
Greater eelpout	ULVEFISK	Perciformes	Zoarcidae	Lycodes esmarkii	Collett, 1875
Golden Redfish	VANLIG UER	Scorpaeniformes	Sebastidae	Sebastes marinus	(Linnaeus, 1758)
	VANLIG ÅLEBR	Perciformes	Zoarcidae	Lycodes gracilis	Sars, 1867

Stomachs of most of fishes included one or more food items, while more than 60% of stomachs of Greenland halibut, Spotted wolfish, Atlantic hookear sculpin were empty (Table 7).

Euphausiids were mainly preyed by Atlantic cod, deepwater redfish, lumpsucker, capelin, white barracudina and blue whiting, and consisted more than 50 % of stomach content. Ctenophora (commonly known as comb jellies) were preyed on lumpsucker only. Northern

shrimp (*Pandalus borealis*) was a main food for Greenland halibut, thorny skate, blue whiting and deepwater redfish. Brittle stars or ophiuroids were mainly preyed by Northern wolfish, long rough dab, haddock and Greater eelpout. The annelids (Annelida, also known as the ringed worms or segmented worms) were dominated in diet of haddock, thorny skate, Moustache sculpin, Atlantic hookear sculpin, Atlantic cod and Lycodes gracilis. Fish (not identified to species level) were preyed by Atlantic cod, blue whiting and whiting. More detailed information about fish diet will be presented later after all samples have been analysed.

Table 7. Samples collected during the summer TIBIA survey 2015.

English name	Norwegian name	Total number stomachs	Frozen stomachs	Analysed stomach	Stomachs with food	Empty stomachs
Greenland halibut	BLÅKVEITE	29	4	25	24	76
Northern wolffish	BLÅSTEINBIT	27	0	27	78	22
Doubleline eelpout	BÅNDÅLEBROSM	11	10	1	100	0
Spotted wolffish	FLEKKSTEINBI	12	11	1	0	100
Long rough dab	GAPEFLYNDRE	65	32	33	76	24
Whiting	HVITTING	5	1	4	75	25
Haddock	HYSE	79	0	79	96	4
Thorny skate	KLOSKATE	29	0	29	100	0
Blue whiting	KOLMULE	35	0	35	97	3
Atlantic hookear sculpin	KROKULKE	33	24	9	33	67
Pearlsides	LAKSESILD	10	10	0	0	0
Snakeblenny	LANGHALET LA	17	0	17	59	41
White barracudina	LITEN LAKSET	5	0	5	80	20
Capelin	LODDE	27	0	27	89	11
Threespot eelpout	NORDLIG ÅLEB	1	1	0		
Moustache sculpin	NORDLIG KNUR	11	0	11	91	9
Polar sculpin	PADDEULKE	5	3	2	100	0
Gelantinous snailfish	POLARRINGBUK	1	0	1	100	0
Lumpsucker	ROGNKJEKS	10	0	10	60	40
Saithe	SEI	10	10	0	0	0
Deepwater redfish	SNABELUER	57	6	51	51	2
Atlantic poacher	TISKJEGG	2	2	0		
Atlantic cod	TORSK	238	99	139	76	24
Daubed shanny	TVERRHALET L	7	7	0		
Greater eelpout	ULVEFISK	3	0	3	67	33
Golden Redfish	VANLIG UER	1	0	1	0	100
	VANLIG ÅLEBR	4	0	4	75	25
Total		**734**	**220**	**514**		

3.9 Examine parasitological fauna

In total, 900 individuals from 70 host species were examined. The list of examined species deviates from the list of prioritized species due to limited availability of samples for the target species. The following host species were sampled:

Species	Type	Sample size
Ambleraja radiata	Large fish	5
Anarchichas lupus	Large fish	13
Anarhichas denticulatus	Large fish	1
Argentina salvelinus	Large fish	2
Artedillus atlanticus	Large fish	10
Astarte crenata	Bivalves	18
Bathyarca glacialis	Bivalves	31
Benthosoma glaciali	Juvenile fish / larvae	5
Beringius ossiani	Gastropods	1
Boreogadus saidi	Large fish	1
Brada granulata	Polychaets	15
Brada inhabilis	Polychaets	15
Buccinum finmarchianum	Gastropods	4
Buccinum hydrophanum	Gastropods	10
Calanus finmarchicus	Copepods	120
Calanus hyperboreus	Copepods	30
Chionoecetes opilio	Crabs	1
Chlamys islandica	Bivalves	12
Clinocardium ciliatum	Bivalves	17
Colus sp.	Gastropods	1
Cotonculus microps	Large fish	2
Crossaster papposus	Echinoderms	2
Cryptonatica affinis	Gastropods	1
Ctenodiscus crispatus	Echinoderms	18
Cyclopterus lumpus	Large fish	1
Epimeria loriata	Amphipods	10
Eukronhia hamata	Chaetognats	48
Gadiculus thori	Large fish	1
Gadus morhua	Large fish	9
Harmothoe sp.	Polychaets	6
Hemithyris psittacea	Bivalves	10
Hippoglossoides platessoides	Large fish	10
Hyas coarctatus	Crabs	2
Icasterias panopla	Echinoderms	1
Leptagonus decagonus	Large fish	4
Lumpenus lampretaeformis	Large fish	5
Lycodes eudipliurostictus	Large fish	3

Lycodes gracilis	Large fish	8
Mallotus villosus	Large fish	54
Maurolecus muilleri	Juvenile fish / larvae	6
Meganychtipanes norvegica	Euphasiids	78
Metridia longa	Copepods	42
Mya truncata	Bivalves	2
Neptunea denselirata	Gastropods	2
Neptunea despecta	Arthropoda	1
Neptunea sp.	Gastropods	1
Notolepus rassoi	Large fish	2
Nymphon hirtum	Arthropoda	1
Ophiopholis aculeata	Echinoderms	2
Ophiura sarsi	Echinoderms	12
Pagurus bernhardus	Arthropoda	3
Pagurus pubescens	Crabs	2
Pandalus borealis	Prawns	10
Pandalus borealis	Prawns	32
Pareuchaeta norvegica	Copepods	40
Pectinaria sp.	Polychaets	2
Phascolion strombus strombus	Sipuncula	7
Pontaster tenuispinus	Echinoderms	6
Pontophilus norvegicus	Prawns	15
Radiella grimaldi	*Sponges*	*2*
Sabinea septemcarinata	Prawns	14
Saduria sabini	Prawns	7
Sebastes mentella	Large fish	1
Solaster endeca	Echinoderms	5
Spiochaetopterus typicus	Polychaets	14
Strongylocentrotus pallidus	Echinoderms	8
Themisto abyssorum	Amphipods	5
Themisto abyssorum	Amphipods	43
Themisto compressa	Amphipods	2
Thysanoessa inermis	Euphasiids	18
Triglops murrai	Large fish	7
Volutopsis norvegicus	Gastropods	1

Infection levels varied among species but were in general low compared with for example findings from coastal regions. Most of the parasites were known from previous studies, but 6 of them are potentially new to science. Their identity will be determined using morphological and molecular methods.

3.10 Bacteria, virus and environmental DNA (eDNA)

Analyses of the samples are currently being done at the University of Alaska, Fairbanks. Results will start to appear in October 2015.

4 Appendix 1. Survey activity

St no	Longitude	Latitude	Type of activities	Comments
1 28.05	21.34092 21°20'27''	72.15325 72°09'12''	CTD, CTD MOCNESS (bottom-surface) Pelagic haul (surface-bottom-surface). Something wrong with instruments. New pelagic haul (surface-bottom-surface). Bottom hauls (Standard).	St nr **543** St nr **543** Serienr. **72001** Serienr. **72002** Serienr. **72003**
2	20.89112 20°53'28''	73.17037 73°10'13''	CTD, CTD (1. CTD med stasjons nr, ikke send st.nr ved neste) VPII (bunn –overflate) MOCNESS (bunn-overflate) Pelagisk trål (fra 200 m). Serienr. 72003 Bunntrål (standsrd). Serienr. 72004	Station was not taken
3 30.05	**Case study** 20.75484 20°45'17''	73.46259 73°27'45''	CTD, CTD Pelagic haul (surface-bottom-surface). MOCNESS (bottom-surface) 2* Bottom hauls (Standard). 3* Grab Eksperimental trawling Bottom hauls (Standard). 1* Bom trawl	St nr **544** Serienr. **72004** St nr **544** Serienr. **72005-6** Serienr **72007** Serienr **72008** Serienr **72009**
4 31.05	20°20'	73°50'	CTD, CTD MOCNESS Pelagic haul (surface-bottom-surface). Bottom hauls (Standard).	St nr **545** St nr **545** Serienr. **72010** Serienr. **72011**
5 31.05	20°15'	73°50'	CTD, CTD MOCNESS Pelagic haul (surface-bottom-surface). Bottom hauls (Standard).	St nr **546** St nr **546** Serienr. **72012** Serienr. **72013**
6 1.06	20°03'	74°42'	CTD, CTD MOCNESS (Pelagic haul (surface-bottom-surface Bottom hauls (Standard). Eksperimental trawling	St nr **547** St nr **547** Serienr. **72014** Serienr. **72015** Serienr. **72016**
7 1-2 .06	24.37024 24°22'13''	73.86085 73°51'39''	CTD, CTD MOCNESS or VPII Eksperimental trawling	St nr **548** St nr **548** Serienr. **72017**

			Pelagic haul (surface-bottom-surface) Bottom hauls (Standard).	Serienr. **72018** Serienr. **72019**
8 2-3 .06	26.97497 26°58'30''	74.411 74°24'40''	CTD, CTD MOCNESS or VPII) Pelagic haul (surface-200m-surface)	St nr **549** St nr **549** Serienr. **72020**
9 3.06	28.97816 28°58'41''	74.90552 74°54'20''	3* CTD MOCNESS or VPII 3* Bottom hauls (Standard). 1* Grab 3* Bom trawl 3* Pelagic haul (surface-bottom-surface) Bottom hauls (Standard).	St nr **550-551** St nr **551** Serienr. **72021-23** Serienr. **72024-26** Serienr **72027-29** Serienr **72030**
10. 4.06	27.57719 27°34'38''	75.22154 75°13'18''	CTD, CTD Pelagic haul (surface-bottom-surface) MOCNESS Bottom hauls (Standard).	St nr **552** Serienr **72031** St nr **552** Serienr **72032**
11. 9 4.06	26.13827 26°08'18''	75.50375 75°30'13''	CTD, CTD MOCNESS Pelagic haul (surface-bottom-surface) Bottom hauls (Standard).	St nr **553** St nr **553** Serienr **72033** Serienr **72034**

5 Appendix 2. Participants of the Summer TIBIA survey 2015.

Participants	Research group	Time	Responsibility
Elena Eriksen	439 Ecosystem processes	27/05–6/06	Cruise leader
Randi Ingvaldsen	431 Oceanography	27/05–6/06	Biological sampling
Per Arneberg	439 Ecosystem processes	27/05–6/06	Biological sampling
Egil Karlsbakk	428 Helse	27/05–6/06	Biological sampling
Arill Engås	431 Observation methodology	27/05–6/06	Equipment
Asbjørn Aasen	431 Observation methodology	27/05–6/06	Equipment
Ronald Pedersen	431 Oceanography	27/05–6/06	Equipment/data storage
Magner Mjanger	620 Electronic equipment	27/05–6/06	Equipment/data storage
Kirsti Børve Eriksen	439 Ecosystem processes	27/05–6/06	Biological sampling
Inger Marie Beck	439 Ecosystem processes	27/05–6/06	Biological sampling
Alina Rey	434 Plankton	27/05–6/06	Equipment/data storage
Jan Henrik Simonsen	434 Plankton	27/05–6/06	Plankton
Magnus Johannessen	434 Plankton	27/05–6/06	Plankton
Pavel Lubin	guest	27/05–6/06	Biological sampling
Tatiana Prokhorova	guest	27/05–6/06	Biological sampling
Alejandra jaramilo	guest	27/05–6/06	Biological sampling
Ken MacKenzie	guest	27/05–6/06	Biological sampling
Brian Ulaski	guest	27/05–6/06	Biological sampling
Ian MacKenzie Cook	guest	27/05–6/06	Biological sampling
Alex Andrew	guest	27/05–6/06	Equipment