

ALKOR -Berichte

Bachelor-MARSYS education cruise in the Baltic Sea

Cruise No. AL524

19.07. – 01.08.2019,
Kiel (Germany) – Kiel (Germany)
BALTEACH - 1

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2019

Table of Contents

1	Cruise Summary.....	3
1.1	Summary in English	3
1.2	Zusammenfassung.....	3
2	Participants.....	4
2.1	Scientific Party	4
2.2	Participating Institutions	4
2.3	Crew.....	5
3	Research Program	5
3.1	Aims of the Cruise	5
3.2	Agenda of the Cruise	6
3.3	Description of the Working Area	7
4	Narrative of the Cruise.....	8
5	Preliminary Results.....	9
5.1	Phytoplankton sampling	9
5.2	Ichthyo– and zooplankton sampling	12
5.3	Fishery.....	13
5.3.1.	Stomach samplings.....	15
5.3.2.	Single fish cod sampling.....	16
5.4	Hydrography	20
5.4.1.	From Kiel Bight to Bornholm Basin.....	20
5.4.2.	Bornholm Basin.....	21
6	Station List AL524.....	23
6.1	Overall Station List	23
7	Data and Sample Storage and Availability	27
7.1	Data availability.....	27
7.2	Sample availability and storage	27
7.3	Data storage	27
8	Acknowledgements.....	28
9	References.....	28
10	Abbreviations	28

1 Cruise Summary

1.1 Summary in English

On this teaching cruise, six bachelor and five master (including an international Erasmus) students of the Institute of Marine Ecosystem and Fishery Science (IMF) were given the opportunity to learn about the most commonly used scientific methods, gears and working procedures on board of a research vessel for fisheries science as well as biological oceanography. The main objective of the cruise was the investigation of distribution patterns of certain spawning fish species, such as cod, whiting, sprat, plaice, flounder and dab in the Kiel Bight, Mecklenburg Bight, Arkona Basin and in the Bornholm Basin.

In addition to fisheries, a comprehensive grid of plankton net stations was sampled in order to gain insights into the spatial distribution of fish eggs, planktivorous prey (larval to adult life stages) cod larvae and plankton distribution (most important for sprat) within the Bornholm Basin.

Of special interest were picoplankton community's short term responses (on board) to temperature and salinity along the respective gradient in the Baltic Sea with an additional sampling scheme to later isolate *Ostreococcus* sp. and its associated viruses for future laboratory studies at the Institute for Marine Ecosystem and Fishery Science.

1.2 Zusammenfassung

Auf dieser Lehrausfahrt hatten sechs Bachelor- und fünf Master- (inklusive einer internationalen Erasmus-) Studenten des Institute für Marine Ökosystem- und Fischereiwissenschaften (IMF) die Möglichkeit, die am häufigsten verwendeten wissenschaftlichen Methoden, Geräte und Arbeitsverfahren der Fischereiwissenschaft sowie der biologische Ozeanographie an Bord eines Forschungsschiffes kennenzulernen.

Hauptziel dieser Reise war die Untersuchung der Verteilungsmuster bestimmter laichender Fischarten wie dem Dorsch, Wittling, Sprotte, Scholle, Flunder und Kliesche in der Kieler Bucht, der Mecklenburger Bucht, sowie im Arkona und Bornholm Becken.

Neben der Fischerei wurde ein umfassendes Grid aus Planktonstationen beprobt, um Einblicke in die räumliche Verteilung von planktischen Beutearten (Larven bis zu adult Stadien), Fischeiern, Dorsch-Larven und Planktonverteilungen im Bornholm Becken gewinnen.

Von besonderem Interesse waren die Kurzzeitreaktionen von Picoplankton-Gemeinschaften (an Bord) auf Temperatur und Salzgehalt entlang des jeweiligen Gradienten in der Ostsee mit einem zusätzlichen Probenahmenschema zur späteren Isolierung von *Ostreococcus* sp. und den damit verbundenen Viren, für zukünftige Laboruntersuchungen am Institut für Marine Ökosystem- und Fischereiwissenschaften.

2 Participants

2.1 Scientific Party

Name	Discipline	Institution
Klinger, Richard	Chief scientist	IMF
Schaum, Elisa	PostDoc	IMF
Plonus, Rene-Marcel	PhD student	IMF
Spich, Katarzyna	Observer of polish waters	MIR
Sguotti, Camilla	PhD student	IMF
Hornetz, Peter	MSc student	IMF
Kurbjuweit, Steffanie	MSc student	UHH
Zur Mühlen, Pauline	MSc student	UHH
Hirschmann, Sophia Carolin	MSc student	UHH
Ehlers, Jannick	BSc student	UHH
Gerull, Nadja-Katharina	BSc student	UHH
Schottes, Jaqueline	BSc student	UHH
Kurbjewweit Garcia, Elija	BSc student	UHH
Reßing, Tobias	BSc student	UHH
Gruse, Luka	BSc student	UHH
Rychwalski, Alexander Nicolas	BSc student	UHH
Mikhno, Marta	MSc student (Erasmus)	UNIC

2.2 Participating Institutions

IMF	Institute of Marine Ecosystem and Fishery Science, University of Hamburg
UHH	University of Hamburg
MIR	Morski Instytut Rybacki
UNIC	University of Cagliari

2.3 Crew

Name	Rank
Lass, Jan Peter	Master
Gräber, Christian	1st Officer
Maaß, Björn	2nd Officer
Kasten, Sefan	Chief Engineer
Stöck, Torsten	Electrician
Schweiger, Hardy	Boatswain
Delachaux, Lucian	A.B.
Brüdigam, Benjamin	A.B.
Ledwig, Christian	A.B.
Pottberg, Hauke	A.B.
Ennenga, Johann	Cook

3 Research Program

3.1 Aims of the Cruise

This cruise was a teaching cruise for MARSYS Bachelor and Master students from the Institute of Marine Ecosystems and Fisheries Science (IMF, University of Hamburg), aiming to train students in different sampling methods of marine ecology and fishery science.

The key characteristic is the integration of oceanographic and biological information to enhance understanding of the spatial distribution of pelagic fish eggs and larvae, phytoplankton and zooplankton abundance patterns as well as fish abundances in dependence of climate change and anthropogenic stressors.

This cruise is designed to train students in sampling methods targeting the different compartments of a marine ecosystem. The methods cover CTD profiles, phyto- and zooplankton samples as well as fishing operations. All students are trained in all technical procedures including work on deck, sample preparation, conservation, labelling documentation and storage. Students also receive training in pre-analyzing samples and species identification on nearest taxonomic level to get an overview of the biodiversity of the system.

3.2 Agenda of the Cruise

The cruises have three main general objectives with regard to the scientific training of our students:

1. Provide knowledge and practical skills with regard to the operation of a broad range of different gears needed to sample and investigate the different ecological compartments of a marine ecosystem covering ocean physics, chemistry, particularly plankton, and fish.
2. Provide insights and experiences regarding cruise organization and sampling strategies, producing meaningful estimates of abundance, biomass and rates of selected species or species groups in relation to a stratified marine ecosystem.
3. Provide opportunities to gather relevant data and specimens for bachelor, master and PhD theses.

These cruise programs are designed to introduce students of the institute to a scientifically sound practice of standard working procedures on board. As a basis of the teaching procedure, the daily work plan includes a concept of rotation through a range of different subjects. Four different fields of responsibility are determined, in which each student receives individual training, or in a group of 2, to establish a practical knowledge of work on a research vessel. Individual training entails that the student will be introduced to each individual job with the goal to handle everything at a certain point by themselves. Therefore, experienced staff members of the institute lead the teaching process and give guidance throughout the entire process, resulting in gapless mentoring.

These fields of responsibility are defined as:

- I. Gear:
Deploying gears, including the handling of the: voice intercom system, gear software, data documentation and station work coordination. During fishing, for example advanced students are on the bridge to get some insights on how hydroacoustic methods are used for fishery science.
- II. Working deck:
Practical work on deck, including: preparing the variety of gears for their use; supporting the crew to manoeuvre the gear in and out of the water.
- III. Sampling:
Handle the plankton samples correct until they are labelled, fixed and stored properly. Processing of fish hauls with the trawls, including: coordination of the working procedures as taking adequate subsamples, fish sorting and species identification, length-frequency measurements and determination of sex, maturity as well as otolith preparation, for age determination. These steps add up to apply basic and advanced methods needed for assessment of fish populations.
- IV. Lab. coordination:
Including: on one hand the in situ measurement of, for example phytoplankton samples as well as sorting and determination of fish larvae. On the other hand, the students learn the organization of all work procedures in the laboratory, as preparing laboratory utilities, protocol management, cleanliness and accomplish general jobs that keep the work flow organized and efficient.

3.3 Description of the Working Area

The spatial focus during this cruise has been the Arkona and Bornholm Basin but a variety of investigations was also conducted within the Kiel and Mecklenburg Bight, see Figure 3.1. The training includes collecting samples from all major compartments of the ecosystem, from coastal to open waters in a 3-dimensional distribution. To get a holistic understanding, students learn how to take, prepare and pre-analyze samples on board as well as post-cruise-processing of collected data or samples in the laboratory.

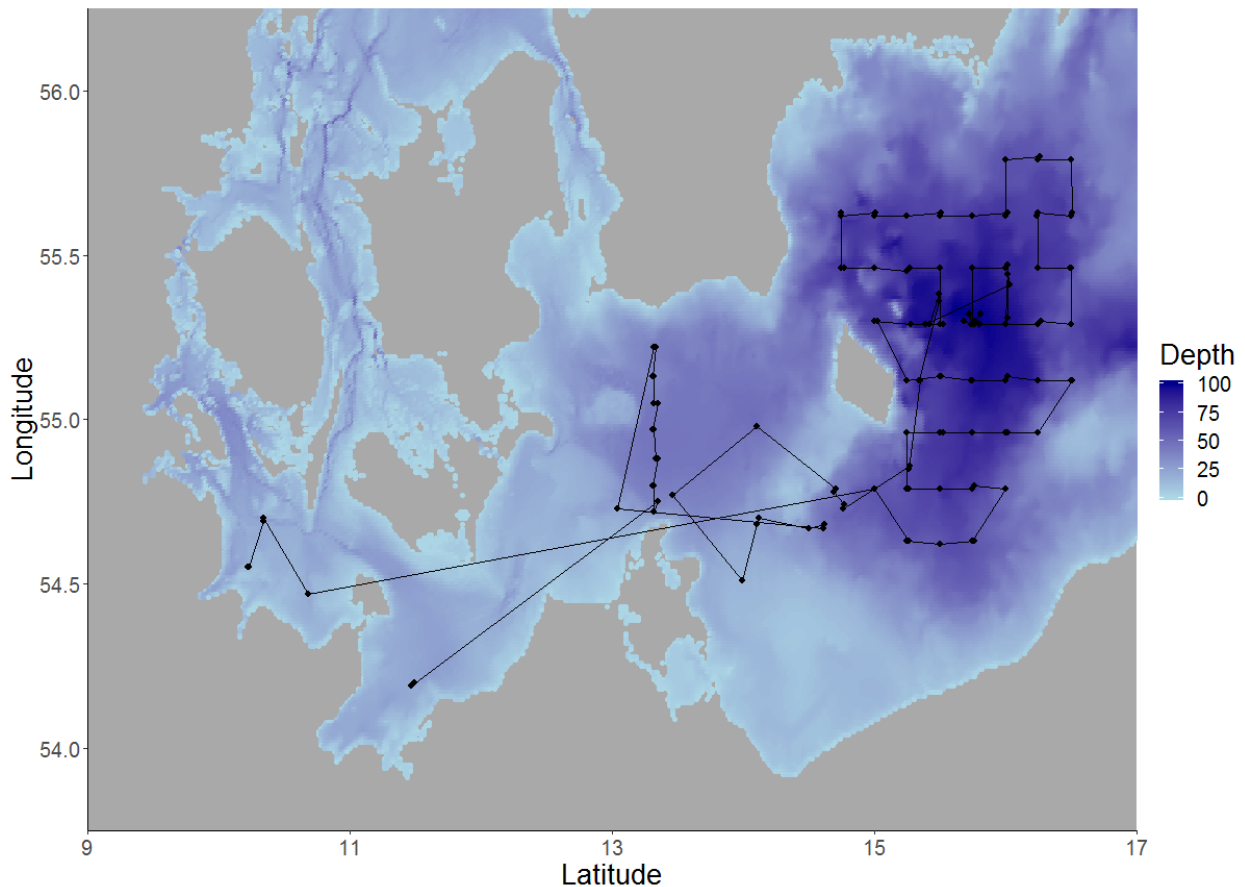


Figure 3.1: Cruise track of AL524. All realized sample stations are depicted by black dots. Positions per Gear are given in Table 6.1.

Specific investigations included a detailed hydrographic survey (oxygen, salinity, temperature, light intensity, fluorescence), plankton surveys (phyto-, zoo- and ichthyoplankton, with the goal to determine the composition, abundance, vertical and horizontal distribution) and fishery hauls.

The latter served to determine size distributions, maturity status, and length – weight relationships of the three dominant fish species within the ecosystem Baltic Sea, cod (*Gadus morhua*), herring (*Clupea harengus*) and sprat (*Sprattus sprattus*), as well as the flatfish flounder (*Plathichthys flesus*). Secondly, various different samples were obtained for more detailed analyses, stomachs of cod, herring and sprat; otoliths of cod and whiting for the determination of the individual age. In addition, along the cruise track, hydroacoustic (echosounder) data were collected continuously for later analysis of fish abundance and distribution.

Concerning the teaching concept we involve the students in a rotating scheme which covers all relevant aspects:

1. gear operation
2. work on deck by handling the variety of used gears
3. sample preparation and processing,
4. storing as well as documenting and labelling of samples.

Since most of the samples are “dual use” in the sense that they are also either used for thesis work or in national (Senckenberg Research Institute, German Center for Marine Biodiversity Research) and international teaching cooperations (DTU Aqua), the students are also highly encouraged to work carefully and responsibly.

Further, the grid stations provide an opportunity to study variability and patchiness but also allow us to investigate the effects of influencing factors such as depth and hydrography. Our Phyto-Plankton group uses these cruises also to conduct on board incubation experiments with phytoplankton.

4 Narrative of the Cruise

RV ALKOR departed from GEOMAR pier on July 20th 2019 at 08:00 am and headed to the first research area in the Kiel Bight. 3 stations have been realized, including a test of each individual gear.

Throughout the next 3 days (September 21st – 23rd) a comprehensive grid of zooplankton samples has been conducted within the Bornholm Basin. A total amount of 48 stations have been sampled with the Bongo net (3 different mesh sizes) and CTD hauls. Additionally 6 stations within the sample area have been investigated regarding the phytoplankton distribution using a water sampler (Niskin bottle) and focusing on the vertical zooplankton distribution via a WP2. Subsequently the station within the central Bornholm Basin with the highest number of found cod larvae (BB23, see map below) was picked to conduct a “24h station” by 4 repetitions every 6 hours of each 2x Multinet-Maxi (horizontal) and 4x Multinet-Midi (vertical) to detect the differences in distribution patterns daytime wise.

During September 25th -27th the distribution patterns of fish along a depth gradient between the deep central Bornholm Basin and shallow coastal areas off of the island Rugia (Rügen) have been investigated by fishery hauls und corresponding hydrographic measurements via CTD. To exchange scientific cruise members (students) a one day stop at the harbor of Sassnitz (island Rugia) has been planned, which was reached in the morning of September 27th. Unfortunately poor weather conditions didn't allow to continue the cruise as planned on September 28th, thus the harbor was left one day later within the morning of September 29th.

The monitoring of fish distribution along the mentioned depth gradient was finished that day, followed by a setup of gears deployed along a north-south transect trough the bordering Arkona Basin during the next day. During the last day of the cruise (September 31st) the final station within the Mecklenburg Bight has been sampled, resulting in 13 stations which have been planned to be investigated with the WP2 and Niskin bottle.

A detail on gear deployments (Table 4.1), the station list (Table 6.1), and an overview of first scientific results are provided below.

Table 4.1: Overview of gear deployment. Mesh sizes are given in brackets.

Gear	Total
ADM-CTD vertical	74
Water sampler (Niskin Bottle)	13
Bongo (150µm,335µm, 500µm)	46
Bongo (335µm, 500µm)	7
Multinet MIDI vertical (50µ)	16
Multinet Maxi horizontal	8
WP-2 (150µ)	13
Pelagic fishery trawl	17
Water sampler (CTD-rosette)	1
Total	195

5 Preliminary Results

5.1 Phytoplankton sampling

(Luisa Listmann (PostDoc), Marilisa Santelia (PhD), Elisa Schaum (Junior Prof.),
Hamburg University)

Marine microbes and viruses of the Baltic Sea under climate change

As part of this project on the ecological and evolutionary effects of different temperatures and salinities in the Baltic Sea on phytoplankton, we aim to answer the following questions:

- a) Does the acute physiological response of picoplankton to temperature and salinity differ between samples from different regions of the Baltic Sea?
- b) From which regions of the Baltic Sea can we isolate *Ostreococcus* sp. and its associated viruses?
- c) How do the immediate responses change in space and time (comparing data of different cruises of the last two years)?

To answer these questions, we took surface water samples at 13 stations along the cruise track of AL524. On board, we measured metabolism (photosynthesis and respiration) of two different size fractions of phytoplankton (0.2-2 μm and 0.2-37.5 μm) immediately after sampling, and assessed these responses over a gradient of salinity and temperature. Furthermore, water samples of the smaller size fractions were set aside to isolate viruses and picoplankton back in the laboratory at the institute in Hamburg. The 11 stations were divided into Kiel Bay, Mecklenburg Bay (considered together as Kiel Area), the Arkona Basin and the Bornholm Basin.

Preliminary analyses of the temperature curves (see Figures 5.1 A and B) show that the size fractions and the interaction with different geographic locations, shape metabolic activity. In-depth analyses are ongoing, and point toward regional environmental forcing (e.g. comparisons between Bornholm Basin and Kiel Bight) having an impact on par with that of seasonal forcing (e.g. comparisons between different years and seasons). Our results suggest that while populations from either region can swiftly adjust their metabolic profiles along gradients of environmental change, the underlying mechanisms differ. For samples from the Bornholm Basin, rapid species sorting seems to explain most of the responses, whereas samples from Kiel Area tend to respond to environmental change through sorting within the same species and phenotypic plasticity. In-depth analyses are ongoing, and first results from our growth rate analyses show that samples from the Kiel and Bornholm region (Arkona data not included for clarity) are able to withstand temperatures far exceeding the temperatures at the sampling location, including temperatures above the decadal maxima. On-going researches involve also testing directly the evolutionary potential.

Further, we have had first lysis successes between 18S-confirmed *Ostreococcus* samples and ultra-filtrated seawater, pointing toward the presence of lytic host-virus pairs across the Baltic Sea Basins.

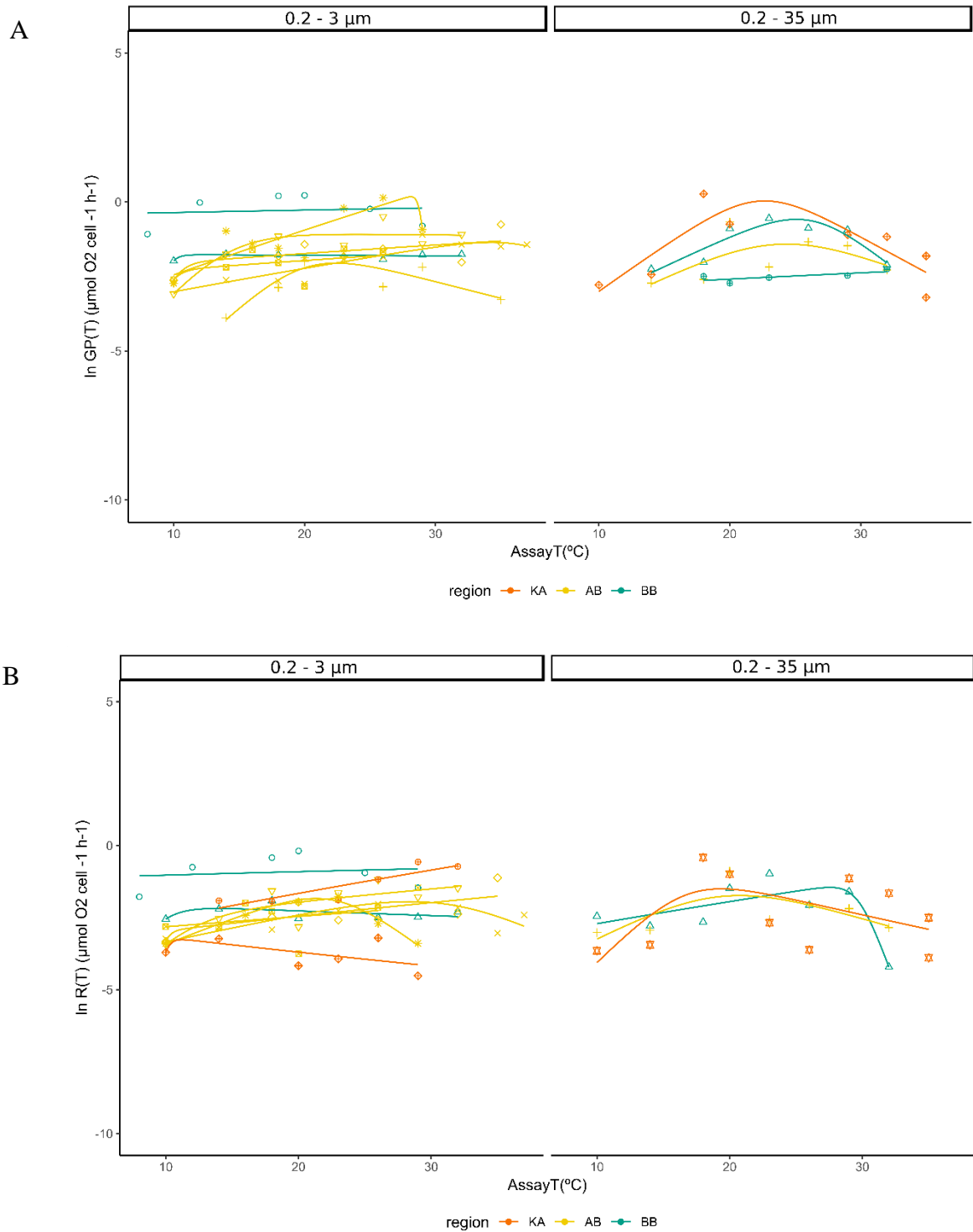


Figure 5.1: Temperature reaction norms per cell from size fractionated on-board incubations of Kiel Bight, Arkona, and Bornholm samples across a temperature gradient (10° C up to 40° C). **A** is for photosynthesis rates in $\mu\text{mol O}_2 \text{ h}^{-1} \text{ cell}^{-1}$, and **B**, for respiration rates in $\mu\text{mol O}_2 \text{ h}^{-1} \text{ cell}^{-1}$. Symbols denote different station, and the colours, as shown in the legend, characterize the different areas (KA: Kiel Area; AB: Arkona Basin; BB: Bornholm Basin). Metabolic data were normalized by cell count upon arrival to Hamburg.

5.2 Ichthyo– and zooplankton sampling

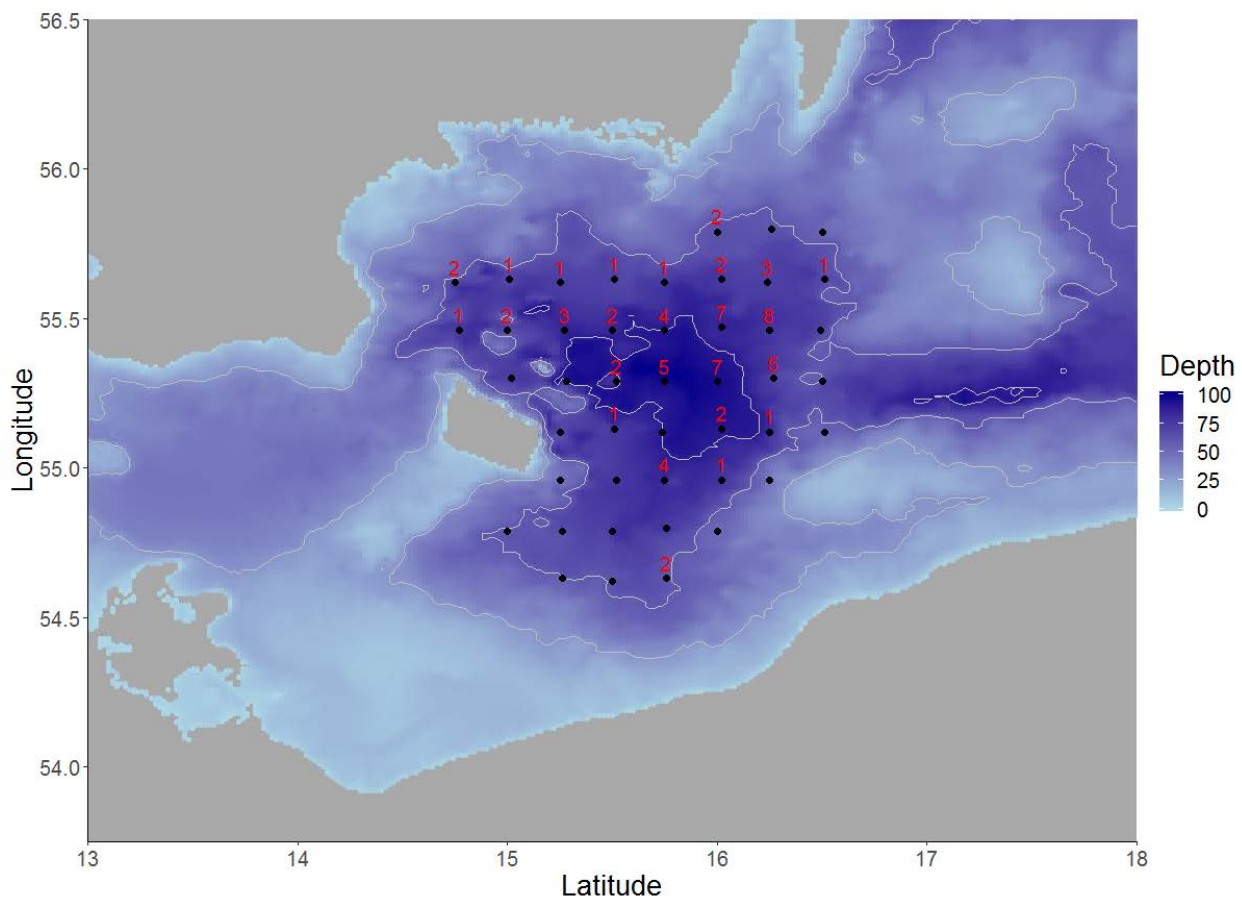


Figure 5.2: Overview of all processed bongo stations within the Bornholm-Basin during AL524. Black dots represent bongo stations with the red number indicating the amount of found cod larvae. On stations without a number no cod larvae was found.

Bongo hauls covering the Bornholm Basin. Larvae of cod (*Gadus morhua*; $n = 71$ in total) were picked from the 500 μm bongo-samples and conserved at -80°C for subsequent RNA/DNA analyses (collaboration with Dr. Bastian Huwer, DTU Aqua). The spatial distribution of the cod larvae is presented in Figure 5.2. Highest density was found in the central part of the Bornholm Basin.

During our last summer cruise in September 2018 (AL513) only 18 cod larvae were to be found within the same sample area, investigated the exact same stations by the same gear.

All of the 335 μm Bongo und the 300 μm Multinet samples were also checked for the presence of fish eggs. Following these initial on board steps, all Bongo samples were conserved in 4% buffered formal solution, and will be used for the determination of species composition and abundance of zooplankton and ichthyoplankton.

In addition, WP-2 (100 μm) hauls were conducted to obtain additional samples in the context of plankton species identification (collaboration with Dr. Janna Peters, DZMB).

5.3 Fishery

Fishery hauls were conducted in the Kiel Bight (1 haul), Mecklenburg Bight (1 haul), Arkona Basin (3 hauls) as well as Bornholm Basin including coastal waters of Rugia (12 hauls).

In parallel to the fishery hauls, hydroacoustic measurements of fish distribution patterns were recorded continuously.

The overall catch composition is shown in Table 5.1.

Table 5.1: Fish catch composition AL524.

Latin name	Common name	n	mass (kg)
<i>Sprattus sprattus</i>	Sprat	58315	786.51
<i>Clupea harengus</i>	Herring	15612	299.63
<i>Gadus morhua</i>	Cod	440	159.58
<i>Merlangius merlangus</i>	Whiting	34	2.77
<i>Ammodytes marinus</i>	Lesser sand-eel	1759	19,16
<i>Hyperoplus lanceolatus</i>	Great sand-eel	1381	14,45
<i>Limanda limanda</i>	Common Dab	21	3.04
<i>Platichthys flesus</i>	Flounder	2	0.44
<i>Myoxocephalus scorpius</i>	Northern sculpin	2	0.41
<i>Hippoglossoides platessoides</i>	American Plaice	4	1.67
<i>Gasterosteus aculeatus</i>	Three-spined Stickelback	2	0,01
<i>Scomber scombrus</i>	Atlantic Mackerel	2	0.71
<i>Cyclopterus lumpus</i>	Lumpfish	1	0.35
<i>Scophthalmus maximus</i>	Turbot	1	0.29
Total		77576	1255.4

For each haul and the entire catch, catch weight and length frequencies of all species were determined. Stomach samples were taken from sprat (30 per 1 cm length class) and herring (30 per 2 cm length class).

For cod, single fish data (length, weight, liver weight, liver worm infestation, sex and maturity stage) as well as samples (otoliths and stomach) were obtained for 273 individuals, whereas length, weight, liver weight, liver worm infestation, sex and maturity stage (without samples taken) were measured for 123 individuals. Length, weight and sex were determined for the remaining 44 individuals (juveniles are not included).

For whiting, single fish data (length, weight, liver weight, sex and maturity stage) and otoliths samples were obtained for 26 individuals, whereas length and weight were measured for the remaining 8 individuals (juveniles are not included).

Relative length frequency distribution of individual sampled cod and whiting is shown in Figure 5.3. Cod representing the main predator in the ecosystem Baltic Sea also displays the biggest fish species in the ecosystem, with a wider length distribution compared to whiting.

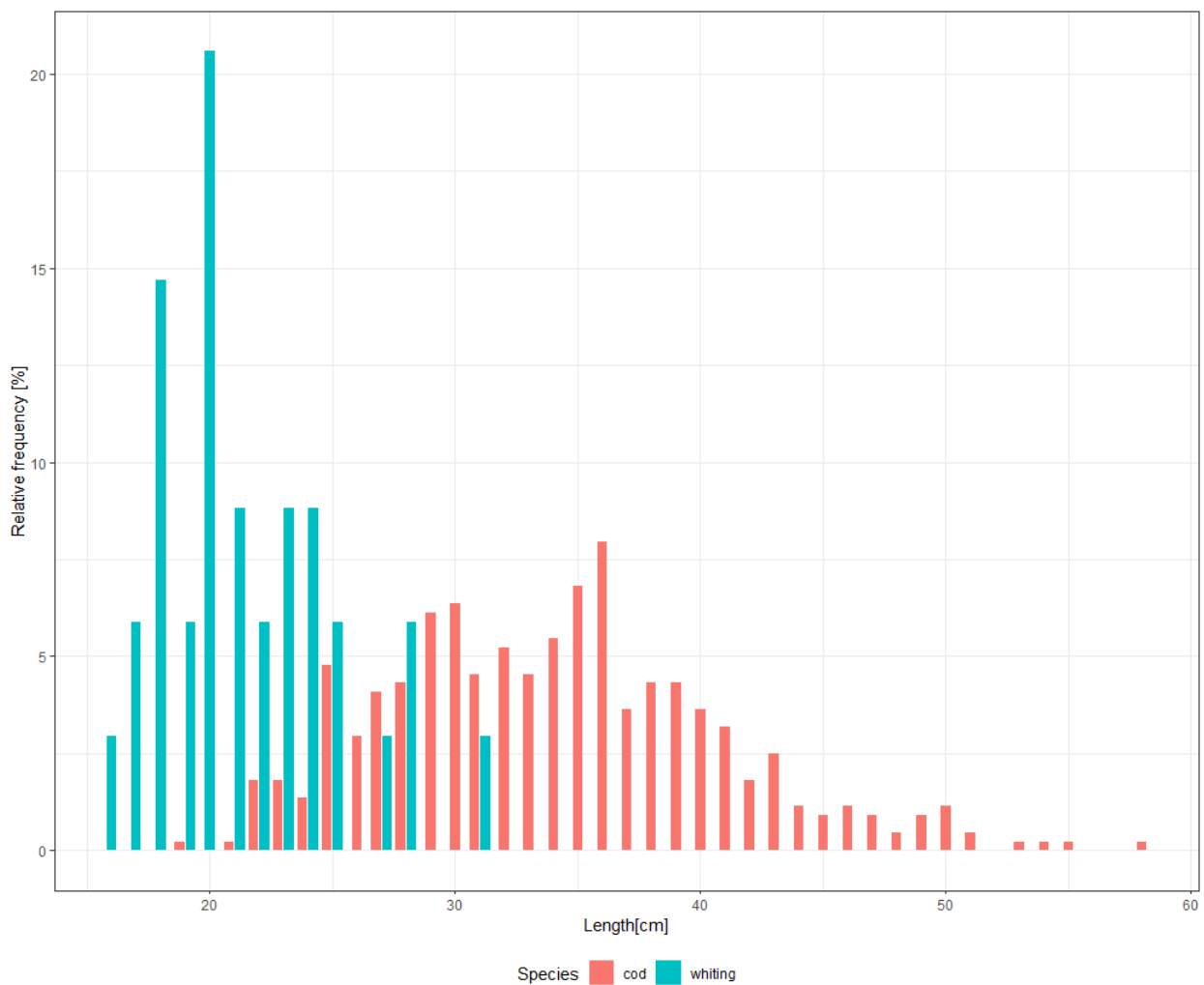


Figure 5.3: Relative length frequency distribution of individual sampled cod (n = 440) and whiting (n= 34) during AL524. Frequency is given in percent and length in cm (measurement cm below).

5.3.1. Stomach samplings

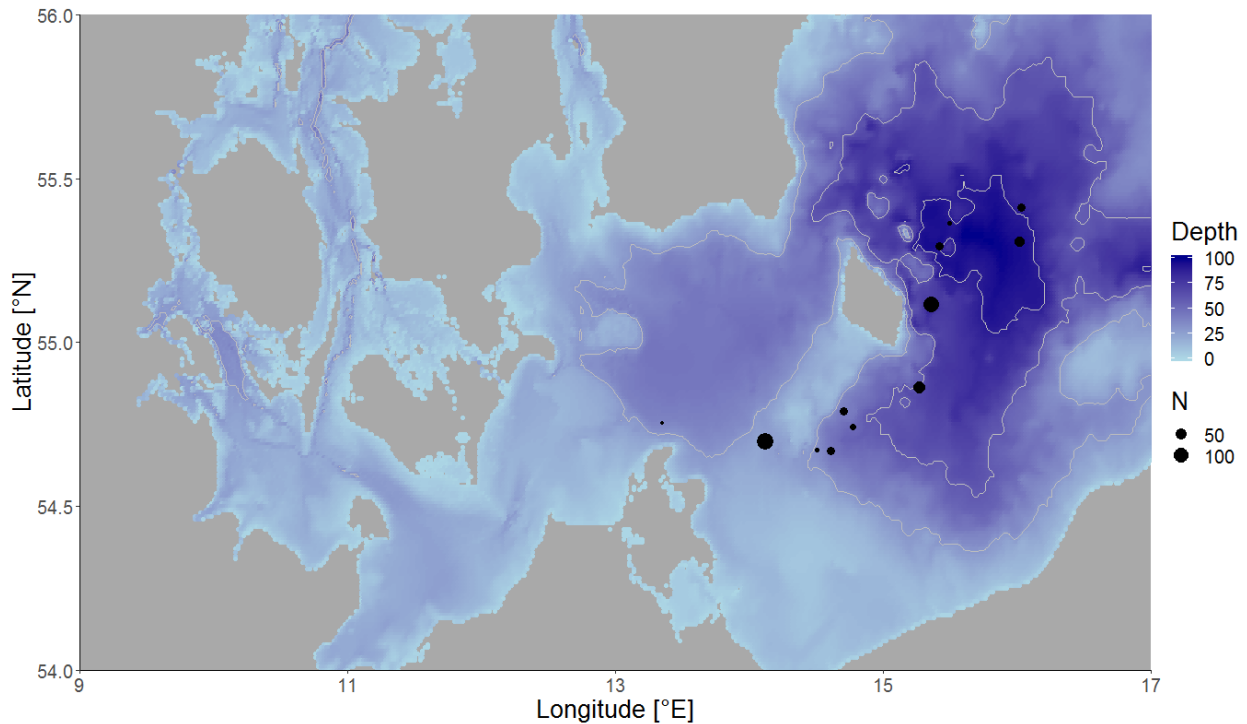


Figure 5.4: Spatial distribution of biomass in kg of sampled cod during AL524.

Routine stomach samplings are conducted during the research surveys in cooperation with the Thünen Institute of Baltic Sea Fisheries which focus on cod (*Gadus morhua*), whiting (*Merlangius merlangus*), flounder (*Platichthys flesus*) and plaice (*Pleuronectes platessa*). Figure 5.4 shows the spatial distribution of caught cod during AL524. Aim of the stomach sampling projects starting in 2016 is the investigation of feeding ecology of key predators in the Baltic Sea, whereby the sampling especially focuses on depth and habitat related patterns in the diet compositions. A year round depth stratified sampling in 2016 revealed depth specific, seasonal and ontogenetic effects in the diet composition of cod in the Western Baltic Sea and provided as a pilot study the basis for the still ongoing depth stratified sampling in the eastern Baltic Sea. Currently one bachelor thesis (Jacqueline Schottes), two master theses (Peter Hornetz, Tobias Reßing) and one PhD thesis (Steffen Funk) are involved in the stomach sampling project.

5.3.2. Single fish cod sampling

For a better comparability of the results, only the individual cod measurements from all Bornholm Basin stations (ICES Subdivision 25) of AL513 (July 2018) and AL524 (July 2019) were included in the calculations.

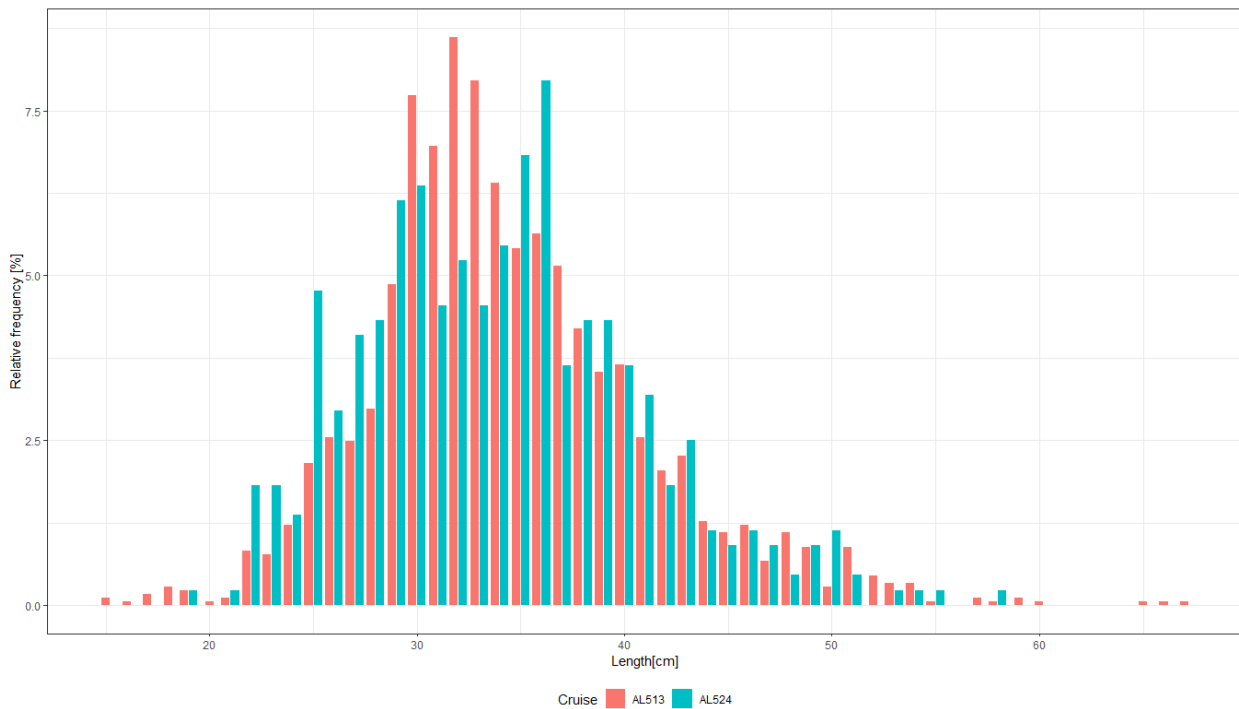


Figure 5.5: Comparison of the relative length frequency distribution of individual sampled cod in ICES Subdivision 25 during AL505 (July 2018) in red and AL524 (July 2019) in blue. Frequency is given in percent and length in cm (measurement cm below).

The fish length distribution of 2019 caught individuals almost confirms observations from 2018 (Figure 5.5), the mean size differs only 0,2cm. During 2018 a small fraction of cod larger then 60cm were caught, in comparison the largest individual during 2019 was 58cm. The most frequent length (median) between both cruises differs notable with 5cm.

The results of the length-weight relationship (Figure 5.6) show no significant difference between 2018 and 2019.

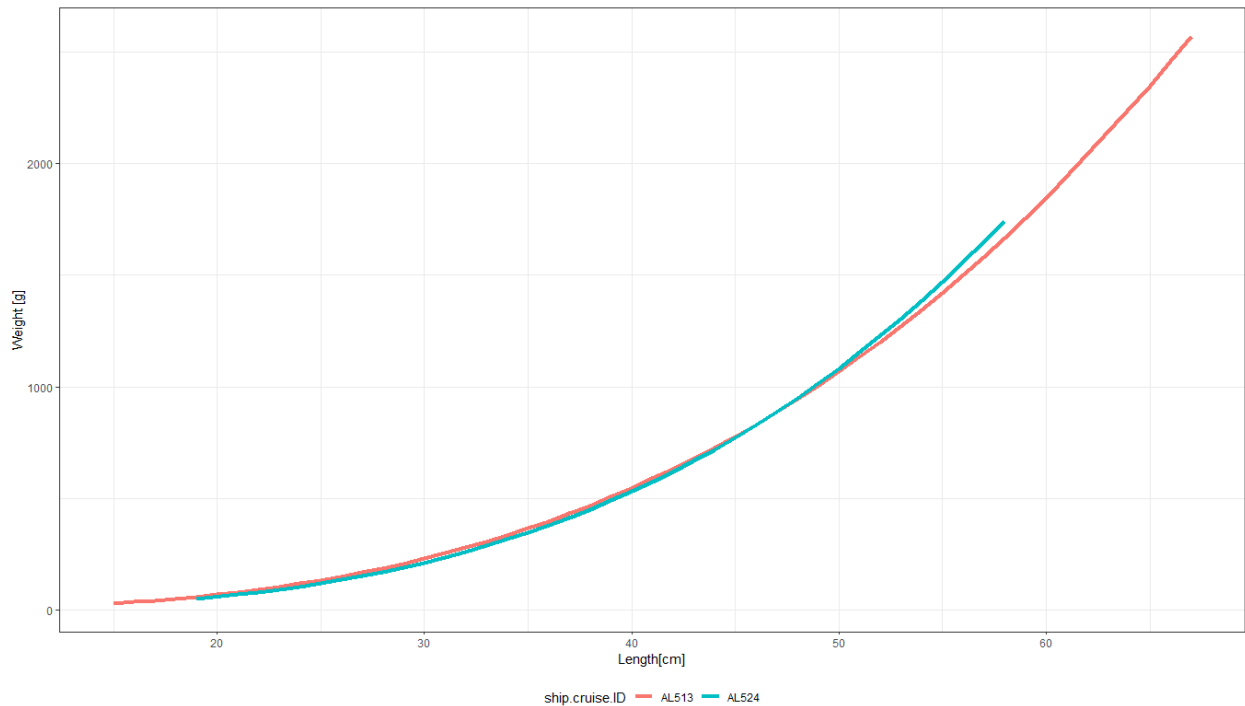


Figure 5.6: Comparison of the length-weight relationship of individual sampled cod during AL513 (July 2018) in red and AL524 (July 2019) in blue. Weight is given in g and length in cm (measurement cm below).

Figure 5.7 shows the condition factor Fulton's K for all sampled cod per 10cm length classes (LC) (11-20cm; 21-30cm; also) for all three ICES Subdivisions (SD) that have been investigated (22, 24 and 25). The Fulton's K Index is calculated as the somatic weight in g (gutted weight) and the total length in cm (Lambert and Dutil, 1996). There are no significant differences in the condition of individual cod between the Subdivisions, only within LC 41-50cm of SD 25 caught cod of 2019 show a significant decreased condition. These results are consistent with previous observations.

Another PhD thesis (Richard Klinger) focuses on the combination of single fish data gained from various research cruises with results of experimental studies regarding Baltic cod feeding on natural diets in recirculating water systems. This represents a basis of physiological data which will be completed with the stomach content data of the mentioned studies to create a bio-energetic growth model of eastern Baltic cod.

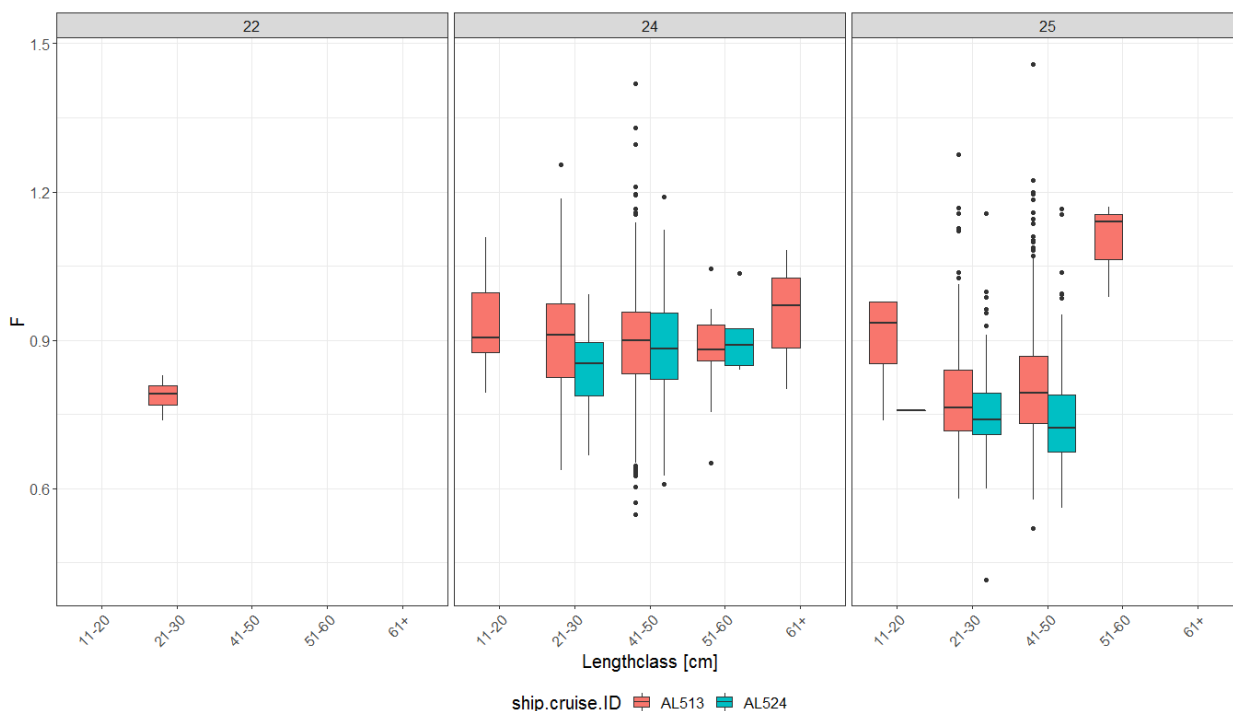


Figure 5.7: Fulton's K Index of individual sampled cod during AL513 (July 2018) in red and AL524 (July 2019) in blue, shown for all three investigated SDs.

As the cruise is conducted during the main spawning season of Eastern Baltic Cod (EBC) a special interest applies the distribution of the maturity stages of cod, as an important key species in the Western Baltic Sea.

Figure 5.8 shows the frequency of grouped maturity stages per 10 cm LC for females and males in SD 25 during the cruises AL513 (July 2018) and AL524 (July 2019). Comparing the results of both years, no major difference in the maturity distribution was found. The Bornholm Basin represents the main spawning area of EBC, which can be seen in the graph below, during both years maturity stages 5-7 representing spawning were most frequent in almost every LC.

During the past decade infestation rates of cod liver worms (nematodes) became more and more frequent. So far there is only little knowledge about the infestation effects on physiological aspects within Baltic cod. Some studies were able to show a correlation between infestation rates and reduced condition. Therefore it is mandatory to investigate the long-term changes of infestation and compare results between different cruises, seasons and years. Figure 5.9. shows the relative frequency distribution in percent of liver worm (Nematodes) infestation stages (visible on liver surface) per 10 cm length class shown for individual sampled female and male cod during AL513 (July 2018) bottom row and AL524 (July 2019) top row. Infestation is determined by visual determination of nematodes on the liver surface: stage 0 = no nematodes; stage 1 = 1-10 nematodes; stage 2 = 11-20 nematodes and stage 3 = >20 nematodes. Comparing both summer cruises (AL513 and AL524) regarding the mentioned infestation rates, no major change is notable, but the amount of found livers with more than 20 nematodes (stage 4) decreased within 2019. This represents a trend that has been observed throughout the last years, but the rather small sample size during AL524 might also be a reason for the mentioned observation from Figure 5.9.

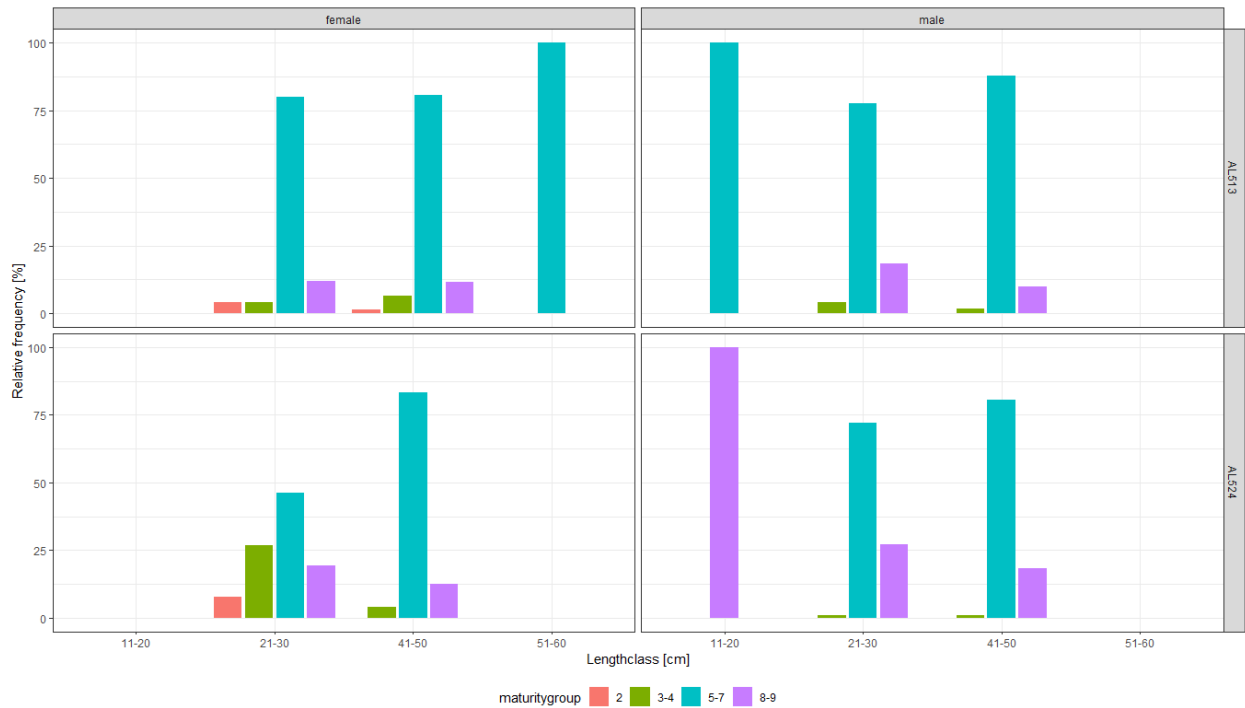


Figure 5.8: Relative frequency distribution in percent of the grouped maturity stages per 10 cm length class shown for individual sampled female and male cod during AL513 (July 2018) bottom row and AL524 (July 2019) top row. Maturity stages Red: 1-2 (juvenile and preparation); Green: Maturity stage 3-4 (maturation); Cyan: Maturity stage 5-7 (spawning); Purple: Maturity stage 8-9 (regeneration).

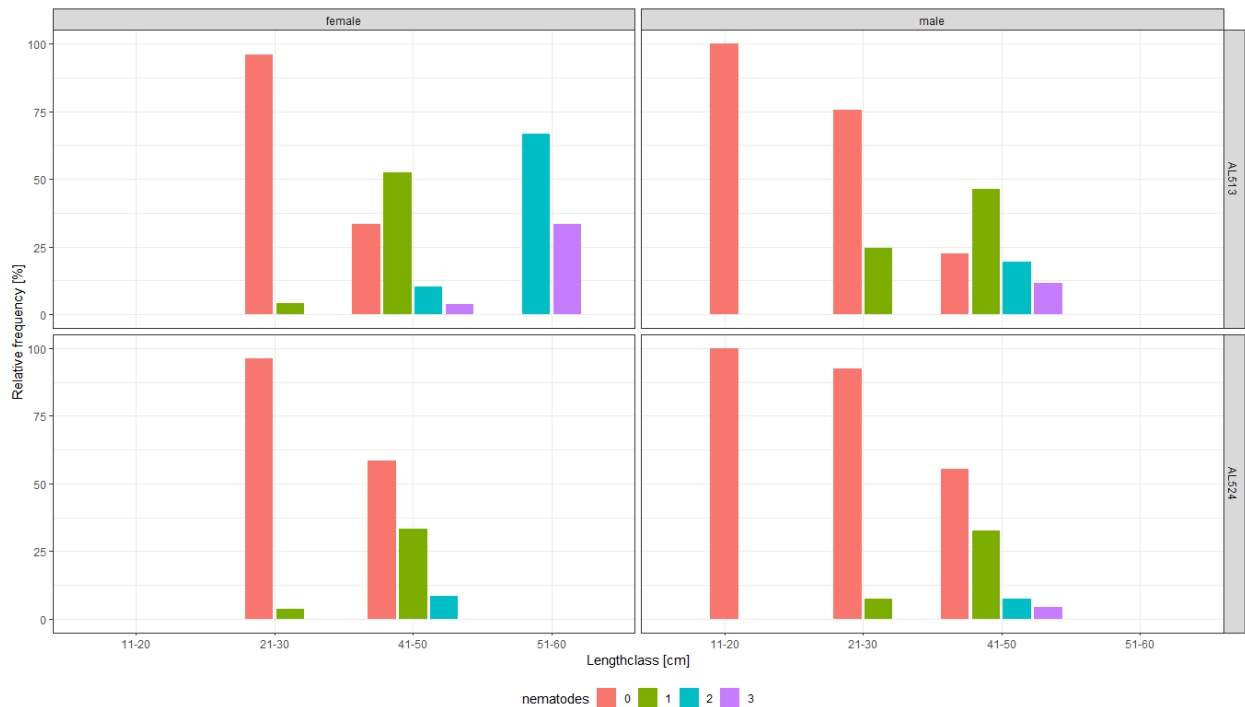


Figure 5.9: Relative frequency distribution in percent of liver worm (Nematodes) infestation stages (visible on liver surface) per 10 cm length class shown for individual sampled female and male cod during AL513 (July 2018) bottom row and AL524 (July 2019) top row. Infestation stages Red: 0 (0 nematodes); Green: stage 1 (1-10 nematodes); Cyan: stage 2 (11-20 nematodes); Purple: stage 3 (more than 20 nematodes).

5.4 Hydrography

5.4.1. From Kiel Bight to Bornholm Basin

As expected a strong salinity gradient from west (Kiel Bight) to east (Bornholm Basin) was detected (Figure 5.10 b). At the surface the salinity ranged from 16 PSU in the western part of the Kiel Bight to 7 PSU in the Bornholm Basin. Near the bottom the salinity was higher with 20 PSU in the west and 16 to 17 PSU in the east indicating a stratified water column. The temperature distribution (Figure 5.10. a) showed a uniform warmer layer from the surface to ca. 20m depth over the whole area. With its 16°C to 18°C the summer surface temperature was lower in comparison to former years. The pattern of Chlorophyll A (ChlA) (Figure 5.10 c) showed always a maximum at the thermocline with highest values in the western part. The oxygen distribution ((Figure 5.10 d) resulted in nearly saturated surface water masses along the transect. Near bottom the oxygen saturation was slightly depleted where stronger salinity stratifications were observed in the deeper parts of Kiel Bight with lowest values around 40% and 50% in the Arkona Basin. Indicating that the water masses in these areas are of certain age. In the Bornholm Basin below 70m depth no oxygen occurred.

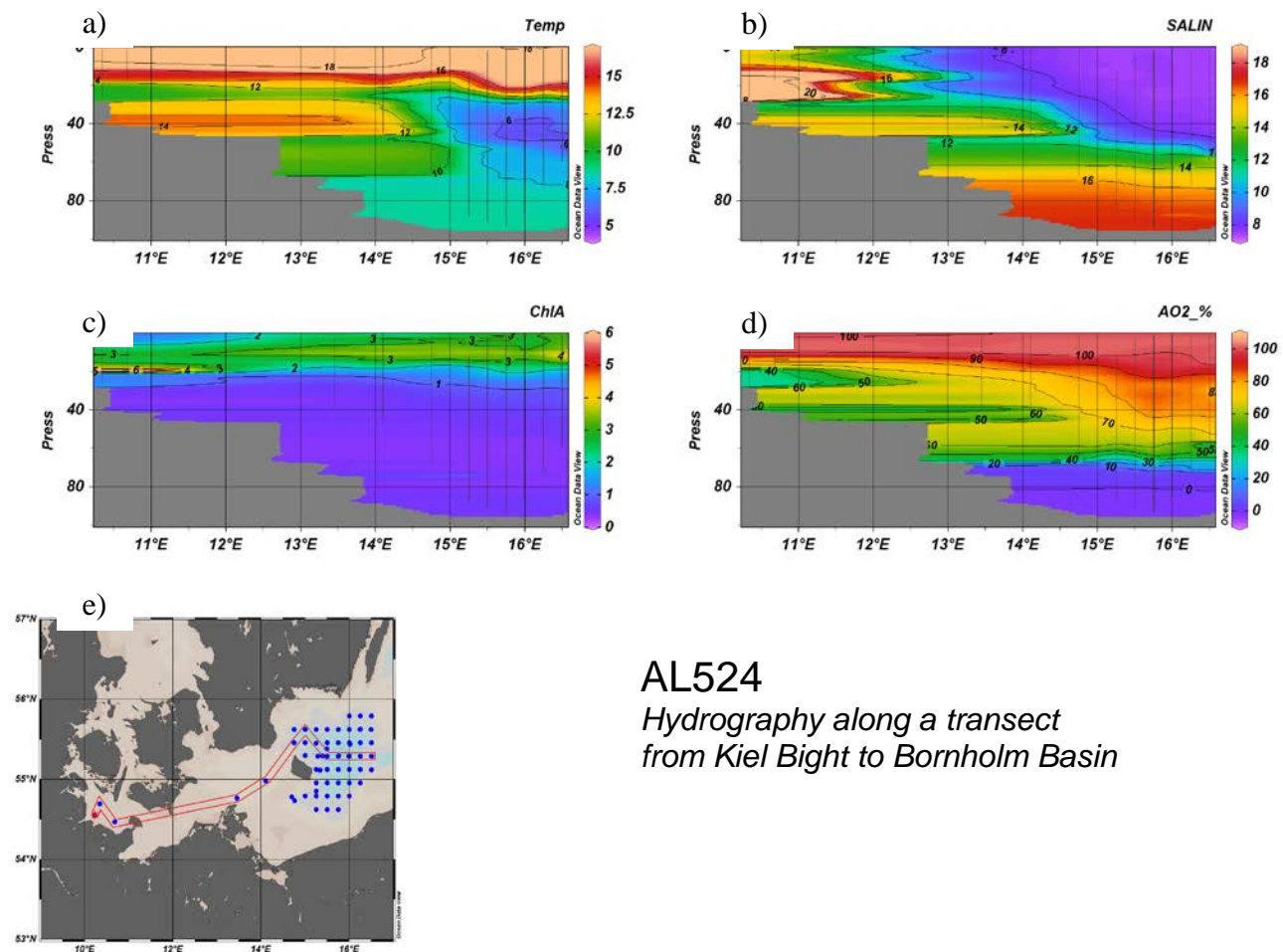


Figure 5.10: Station map and hydrographic isoplots of the cruise AL524 along a transect from Kiel Bight to Bornholm Basin.

5.4.2. Bornholm Basin

Within the Bornholm Basin the hydrography was relative uniform with only slightly higher surface temperatures in the southern most part (Figure 5.11 a, Figure 5.12 a). The salinity ranged from 7 to 9 PSU in the upper 30 m of the water column and values between 11 and 15 PSU in the deeper parts (Figure 5.11 b, Figure 5.12 b). The halocline was deeper in the east (60m) than in the west (40m) (Figure 5.12 b). The distribution oxygen saturation showed a very similar pattern with nearly 100% saturation in the upper water column and decreasing values down to 0% below the halocline (70m) where salinity was highest (Figure 5.11 d, Figure 5.12 d). Only in the southern part the temperature was slightly increased in the upper water column when compared to the rest (Figure 5.11 b). The chlorophyll data revealed relatively low values indicating that the summer minimum nutrient in this area was established (Figure 5.11 c, Figure 5.12 c).

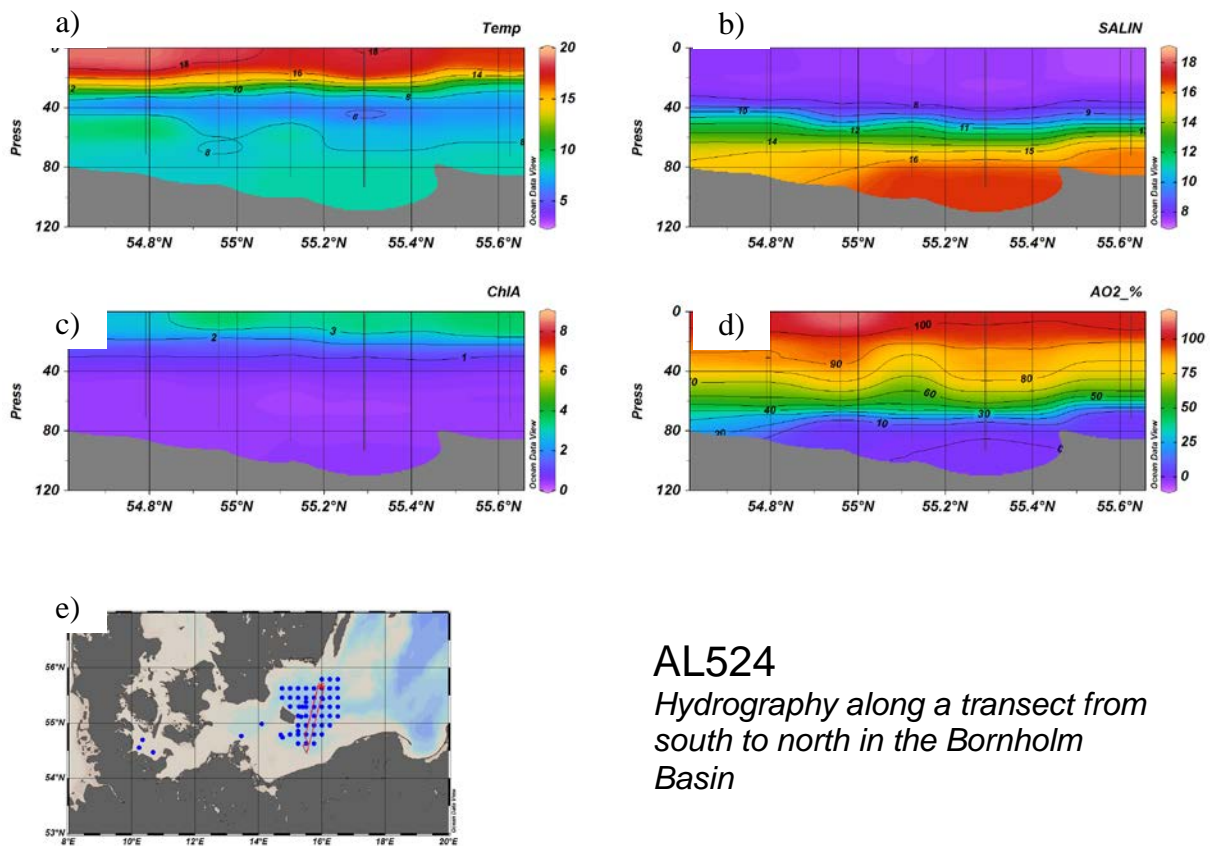
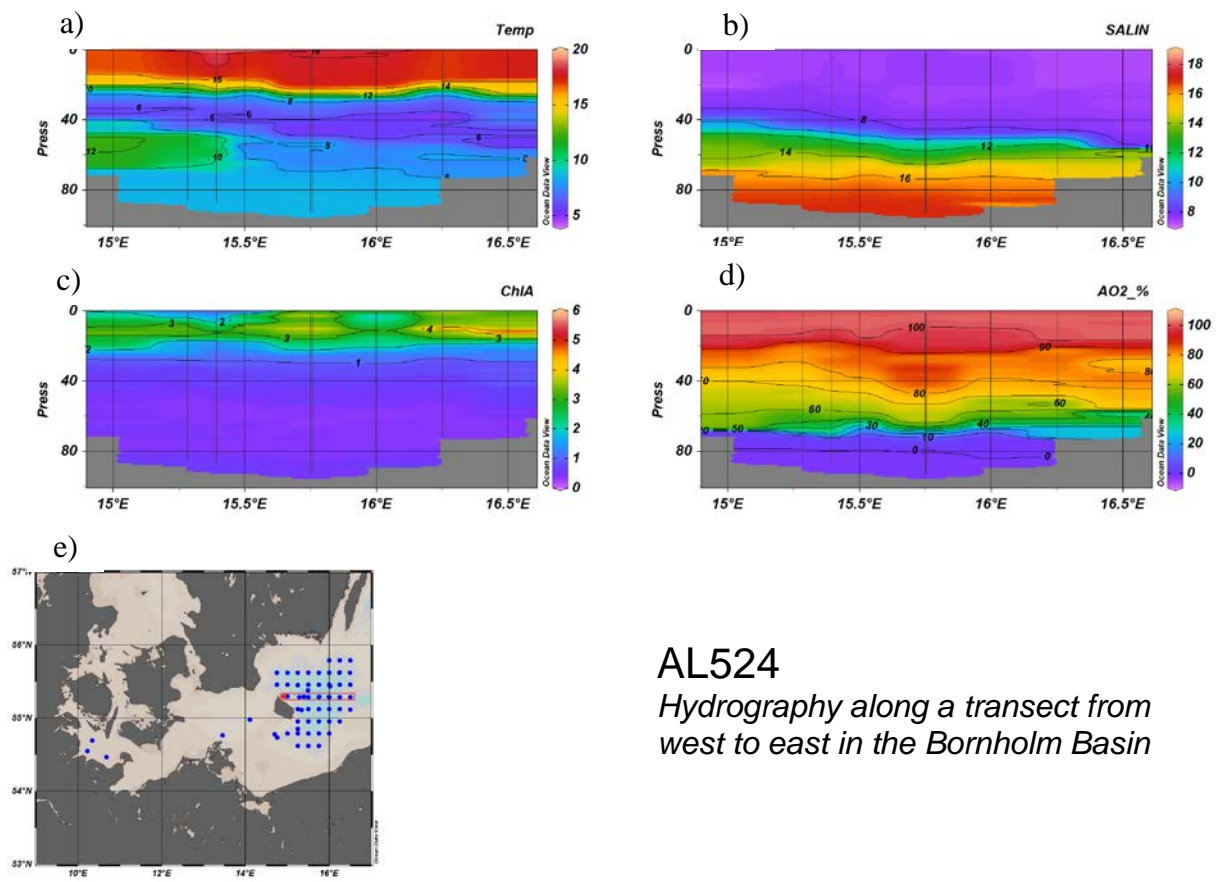


Figure 5.11: Station map and hydrographic isoplots of the cruise AL524 along a transect from south to north in the Bornholm Basin.



AL524

Hydrography along a transect from west to east in the Bornholm Basin

Figure 5.12: Station map and hydrographic isoplots of the cruise AL524 along a transect from west to east in the Bornholm Basin.

6 Station List AL524

6.1 Overall Station List

Table 6.1: Start positions for all used gears are given (in action log noted as “in water”).

For fishing the “Start Fishing” positions are listed.

Station No.	Date	Gear	Time	Latitude	Longitude	Water Depth	Remarks/ Recovery
ALKOR	2019		[UTC]	[°N]	[°W]	[m]	
AL524_1-1	20.07.	Bongo Net	07:54	54°33.082'N	10°13.073'E	18.90	
AL524_1-2	20.07.	CTD	08:02	54°33.128'N	10°13.384'E	18.90	
AL524_1-3	20.07.	Fish Net	08:25	54°33.273'N	10°13.933'E	18.80	
AL524_2-1	20.07.	CTD	10:11	54°41.559'N	10°20.379'E	26.90	
AL524_2-2	20.07.	WS	10:21	54°41.655'N	10°20.392'E	30.10	
AL524_2-3	20.07.	WP2	10:27	54°41.72'N	10°20.439'E	31.60	
AL524_3-1	20.07.	WP2	12:33	54°28.091'N	10°40.588'E	18.50	
AL524_3-2	20.07.	WS	12:39	54°28.088'N	10°40.588'E	18.50	
AL524_3-3	20.07.	CTD	12:45	54°28.088'N	10°40.581'E	18.50	
AL524_4-1	21.07.	CTD	05:57	54°47.505'N	14°59.913'E	59.70	
AL524_4-2	21.07.	Bongo Net	06:04	54°47.502'N	14°59.97'E	59.60	
AL524_5-1	21.07.	Bongo Net	07:22	54°37.763'N	15°15.641'E	59.00	
AL524_5-2	21.07.	CTD	07:33	54°37.509'N	15°15.026'E	58.40	
AL524_6-1	21.07.	CTD	08:30	54°37.488'N	15°29.974'E	62.80	
AL524_6-2	21.07.	Bongo Net	08:37	54°37.467'N	15°29.978'E	62.90	
AL524_7-1	21.07.	Bongo Net	09:34	54°37.828'N	15°45.738'E	58.90	
AL524_7-2	21.07.	CTD	09:46	54°37.507'N	15°45.097'E	59.30	
AL524_8-1	21.07.	CTD	11:09	54°47.484'N	15°59.948'E	51.40	
AL524_8-2	21.07.	Bongo Net	11:16	54°47.403'N	15°59.991'E	51.50	
AL524_9-1	21.07.	Bongo Net	12:09	54°47.889'N	15°45.744'E	71.10	
AL524_9-2	21.07.	CTD	12:23	54°47.581'N	15°45.044'E	71.30	
AL524_10-1	21.07.	CTD	13:22	54°47.483'N	15°30.063'E	73.00	
AL524_10-2	21.07.	Bongo Net	13:30	54°47.464'N	15°29.993'E	72.90	
AL524_11-1	21.07.	Bongo Net	14:27	54°47.579'N	15°15.78'E	67.10	
AL524_11-2	21.07.	CTD	14:42	54°47.485'N	15°15.013'E	67.10	
AL524_12-1	21.07.	CTD	15:48	54°57.483'N	15°15.035'E	43.20	
AL524_12-2	21.07.	Bongo Net	15:57	54°57.413'N	15°14.819'E	42.80	
AL524_13-1	21.07.	Bongo Net	16:58	54°57.62'N	15°31.183'E	76.60	
AL524_13-2	21.07.	CTD	17:13	54°57.497'N	15°30.134'E	75.70	
AL524_14-1	21.07.	CTD	18:07	54°57.51'N	15°44.977'E	80.70	
AL524_14-2	21.07.	Bongo Net	18:15	54°57.454'N	15°44.841'E	81.10	
AL524_15-1	21.07.	Bongo Net	19:20	54°57.642'N	16°1.031'E	72.40	
AL524_15-2	21.07.	CTD	19:33	54°57.502'N	16°0.076'E	73.60	
AL524_16-1	21.07.	CTD	20:28	54°57.488'N	16°14.989'E	49.00	
AL524_16-2	21.07.	Bongo Net	20:36	54°57.431'N	16°14.877'E	49.10	
AL524_17-1	21.07.	Bongo Net	22:02	55°7.48'N	16°30.684'E	51.40	
AL524_17-2	21.07.	WP2	22:12	55°7.42'N	16°30.073'E	50.20	
AL524_17-3	21.07.	CTD	22:21	55°7.386'N	16°30.057'E	49.50	
AL524_18-1	21.07.	CTD	23:26	55°7.466'N	16°15.002'E	78.50	
AL524_18-2	21.07.	Bongo Net	23:36	55°7.321'N	16°14.903'E	79.90	
AL524_19-1	22.07.	Bongo Net	00:36	55°7.562'N	16°1.306'E	85.80	

AL524_19-2	22.07.	CTD	00:53	55°7.483'N	16°0.169'E	86.40	
AL524_20-1	22.07.	CTD	02:01	55°7.441'N	15°44.948'E	88.30	
AL524_20-2	22.07.	Bongo Net	02:11	55°7.363'N	15°44.672'E	89.00	
AL524_21-1	22.07.	Bongo Net	03:11	55°7.553'N	15°30.825'E	68.40	
AL524_21-2	22.07.	CTD	03:25	55°7.528'N	15°30.027'E	66.70	
AL524_22-1	22.07.	CTD	04:22	55°7.498'N	15°15.014'E	61.00	
AL524_22-2	22.07.	WS	04:31	55°7.485'N	15°14.986'E	61.40	
AL524_22-3	22.07.	Bongo Net	04:36	55°7.493'N	15°14.871'E	61.10	
AL524_23-1	22.07.	Bongo Net	05:56	55°17.785'N	15°1.028'E	72.00	
AL524_23-2	22.07.	WP2	06:07	55°17.932'N	15°0.125'E	72.20	
AL524_23-3	22.07.	WS	06:17	55°17.897'N	15°0.072'E	72.10	
AL524_23-4	22.07.	CTD	06:22	55°17.882'N	15°0.068'E	72.20	
AL524_24-1	22.07.	CTD	07:25	55°17.487'N	15°16.995'E	87.90	
AL524_24-2	22.07.	Bongo Net	07:34	55°17.493'N	15°16.986'E	88.30	
AL524_25-1	22.07.	Bongo Net	08:32	55°17.542'N	15°31.326'E	93.50	
AL524_25-2	22.07.	CTD	08:48	55°17.496'N	15°30.081'E	92.80	
AL524_26-1	22.07.	CTD	09:53	55°27.498'N	15°30.004'E	84.50	
AL524_26-2	22.07.	WS	10:02	55°27.404'N	15°30.029'E	84.90	
AL524_26-3	22.07.	Bongo Net	10:07	55°27.317'N	15°29.843'E	84.70	
AL524_27-1	22.07.	Bongo Net	11:03	55°27.54'N	15°16.149'E	88.10	
AL524_27-2	22.07.	CTD	11:19	55°27.215'N	15°15.276'E	89.40	
AL524_28-1	22.07.	CTD	12:19	55°27.518'N	15°0.09'E	78.00	
AL524_28-2	22.07.	Bongo Net	12:27	55°27.468'N	15°0.066'E	77.80	
AL524_29-1	22.07.	Bongo Net	13:24	55°27.738'N	14°45.971'E	68.70	
AL524_29-2	22.07.	CTD	13:37	55°27.49'N	14°45.059'E	68.40	
AL524_30-1	22.07.	CTD	14:37	55°37.51'N	14°44.999'E	67.80	
AL524_30-2	22.07.	Bongo Net	14:46	55°37.427'N	14°44.884'E	68.60	
AL524_31-1	22.07.	Bongo Net	15:51	55°37.821'N	15°0.75'E	75.10	
AL524_31-2	22.07.	WP2	16:05	55°37.438'N	14°59.981'E	75.60	
AL524_31-3	22.07.	CTD	16:18	55°37.437'N	14°59.977'E	75.60	
AL524_32-1	22.07.	CTD	17:14	55°37.499'N	15°14.984'E	72.10	
AL524_32-2	22.07.	WS	17:23	55°37.459'N	15°15.03'E	72.20	
AL524_32-3	22.07.	Bongo Net	17:28	55°37.45'N	15°15.005'E	72.30	
AL524_33-1	22.07.	Bongo Net	18:28	55°37.756'N	15°30.666'E	66.70	
AL524_33-2	22.07.	CTD	18:41	55°37.496'N	15°30.001'E	66.80	
AL524_34-1	22.07.	CTD	19:33	55°37.493'N	15°45.016'E	68.70	
AL524_34-2	22.07.	Bongo Net	19:40	55°37.453'N	15°44.965'E	68.50	
AL524_35-1	22.07.	Bongo Net	20:39	55°37.575'N	16°1.09'E	73.60	
AL524_35-2	22.07.	CTD	20:53	55°37.494'N	16°0.146'E	74.30	
AL524_36-1	22.07.	CTD	22:02	55°47.494'N	16°0.087'E	61.90	
AL524_36-2	22.07.	Bongo Net	22:09	55°47.406'N	15°59.997'E	61.50	
AL524_37-1	22.07.	Bongo Net	23:14	55°47.841'N	16°15.742'E	59.00	
AL524_37-2	22.07.	CTD	23:27	55°47.566'N	16°15.008'E	59.90	
AL524_38-1	23.07.	CTD	00:24	55°47.492'N	16°30.056'E	56.50	
AL524_38-2	23.07.	WP2	00:33	55°47.49'N	16°30.042'E	56.70	
AL524_38-3	23.07.	Bongo Net	00:44	55°47.462'N	16°29.709'E	56.70	
AL524_39-1	23.07.	Bongo Net	01:53	55°37.546'N	16°30.525'E	62.10	
AL524_39-2	23.07.	CTD	02:07	55°37.448'N	16°29.759'E	62.50	
AL524_40-1	23.07.	CTD	03:06	55°37.551'N	16°15.02'E	57.70	
AL524_40-2	23.07.	Bongo Net	03:51	55°37.343'N	16°14.579'E	75.80	

AL524_40-3	23.07.	CTD	04:05	55°37.524'N	16°14.695'E	77.50	
AL524_41-1	23.07.	CTD	05:19	55°27.537'N	16°15.047'E	74.00	
AL524_41-2	23.07.	Bongo Net	05:28	55°27.567'N	16°15.136'E	73.80	
AL524_42-1	23.07.	Bongo Net	06:20	55°27.365'N	16°29.127'E	58.60	
AL524_42-2	23.07.	WS	06:31	55°27.504'N	16°29.936'E	57.90	
AL524_42-3	23.07.	CTD	06:37	55°27.509'N	16°30.009'E	57.80	
AL524_43-1	23.07.	CTD	07:38	55°17.488'N	16°29.941'E	61.60	
AL524_43-2	23.07.	Bongo Net	07:45	55°17.439'N	16°29.943'E	62.00	
AL524_44-1	23.07.	Bongo Net	08:36	55°17.761'N	16°15.901'E	72.70	
AL524_44-2	23.07.	CTD	08:49	55°17.522'N	16°15.072'E	73.90	
AL524_45-1	23.07.	CTD	09:43	55°17.456'N	16°0'E	88.70	
AL524_45-2	23.07.	WS	09:52	55°17.35'N	15°59.955'E	88.60	
AL524_45-3	23.07.	Bongo Net	09:59	55°17.302'N	15°59.864'E	88.80	
AL524_46-1	23.07.	Bongo Net	11:16	55°27.957'N	16°0.948'E	81.90	
AL524_46-2	23.07.	CTD	11:31	55°27.488'N	16°0.106'E	82.70	
AL524_47-1	23.07.	CTD	12:29	55°27.505'N	15°45.035'E	85.10	
AL524_47-2	23.07.	Bongo Net	12:38	55°27.498'N	15°45.027'E	85.00	
AL524_48-1	23.07.	CTD	13:46	55°17.493'N	15°45.041'E	95.20	
AL524_48-2	23.07.	WP2	13:56	55°17.483'N	15°44.973'E	95.20	
AL524_48-3	23.07.	CTD + WS	14:16	55°17.487'N	15°44.974'E	95.10	
AL524_48-4	23.07.	Bongo Net	14:34	55°17.479'N	15°44.977'E	95.10	
AL524_49-1	23.07.	CTD	22:02	55°17.462'N	15°45.001'E	95.20	
AL524_49-2	23.07.	MSN 9 Nets	22:25	55°17.509'N	15°44.457'E	95.40	
AL524_49-3	23.07.	MSN 9 Nets	23:26	55°18.003'N	15°41.013'E	95.70	
AL524_49-4	24.07.	MSN 5 Nets	00:34	55°17.5'N	15°45.014'E	95.10	
AL524_49-5	24.07.	MSN 5 Nets	01:01	55°17.492'N	15°45.006'E	95.10	
AL524_49-6	24.07.	MSN 5 Nets	01:24	55°17.484'N	15°45.002'E	95.10	
AL524_49-7	24.07.	MSN 5 Nets	01:48	55°17.465'N	15°45.006'E	95.10	
AL524_49-8	24.07.	MSN 9 Nets	04:03	55°17.606'N	15°44.885'E	95.30	
AL524_49-9	24.07.	MSN 9 Nets	04:56	55°19.033'N	15°43.331'E	95.10	
AL524_49-10	24.07.	MSN 5 Nets	06:00	55°17.502'N	15°44.987'E	95.20	
AL524_49-11	24.07.	MSN 5 Nets	06:20	55°17.49'N	15°44.968'E	95.20	
AL524_49-12	24.07.	MSN 5 Nets	06:38	55°17.49'N	15°44.994'E	95.20	
AL524_49-13	24.07.	MSN 5 Nets	06:55	55°17.504'N	15°44.969'E	95.20	
AL524_49-14	24.07.	MSN 9 Nets	10:13	55°17.783'N	15°46.206'E	94.80	
AL524_49-15	24.07.	MSN 9 Nets	11:12	55°19.249'N	15°48.704'E	93.80	
AL524_49-16	24.07.	MSN 5 Nets	12:04	55°17.507'N	15°44.958'E	95.20	
AL524_49-17	24.07.	MSN 5 Nets	12:25	55°17.501'N	15°44.952'E	95.20	
AL524_49-18	24.07.	MSN 5 Nets	12:45	55°17.502'N	15°44.958'E	95.20	
AL524_49-19	24.07.	MSN 5 Nets	13:05	55°17.532'N	15°44.97'E	95.20	
AL524_49-20	24.07.	MSN 9 Nets	16:01	55°17.522'N	15°45.114'E	95.10	
AL524_49-21	24.07.	MSN 9 Nets	16:50	55°17.354'N	15°47.913'E	94.10	
AL524_49-22	24.07.	MSN 5 Nets	17:43	55°17.616'N	15°45.064'E	95.10	
AL524_49-23	24.07.	MSN 5 Nets	18:01	55°17.635'N	15°45.142'E	95.10	
AL524_49-24	24.07.	MSN 5 Nets	18:19	55°17.651'N	15°45.247'E	95.00	
AL524_49-25	24.07.	MSN 5 Nets	18:36	55°17.614'N	15°45.35'E	95.10	
AL524_49-26	24.07.	CTD	18:51	55°17.638'N	15°45.402'E	95.10	
AL524_50-1	25.07.	CTD	05:58	55°17.47'N	15°59.73'E	88.80	
AL524_50-2	25.07.	Fish Net	06:32	55°18.393'N	16°1.213'E	87.40	
AL524_51-1	25.07.	CTD	07:54	55°26.173'N	16°1.172'E	83.40	

AL524_51-2	25.07.	Fish Net	08:20	55°24.768'N	16°1.809'E	84.20	
AL524_52-1	25.07.	CTD	11:31	55°17.54'N	15°23.576'E	89.10	
AL524_52-2	25.07.	Fish Net	11:55	55°17.537'N	15°25.07'E	89.60	
AL524_53-1	25.07.	CTD	13:19	55°22.784'N	15°29.629'E	92.90	
AL524_53-2	25.07.	Fish Net	13:46	55°21.844'N	15°29.546'E	93.10	
AL524_54-1	26.07.	CTD	05:58	55°6.915'N	15°20.555'E	70.00	
AL524_54-2	26.07.	Fish Net	06:24	55°7.052'N	15°21.293'E	70.70	
AL524_55-1	26.07.	CTD	08:39	54°51.171'N	15°15.297'E	67.90	
AL524_55-2	26.07.	WP2	08:46	54°51.201'N	15°15.306'E	68.00	
AL524_55-3	26.07.	Fish Net	09:28	54°51.739'N	15°16.074'E	68.80	
AL524_56-1	26.07.	CTD	12:07	54°44.086'N	14°45.463'E	53.10	
AL524_56-2	26.07.	Fish Net	12:27	54°44.527'N	14°46.231'E	53.50	
AL524_57-1	26.07.	CTD	13:48	54°46.967'N	14°41.628'E	44.70	
AL524_57-2	26.07.	Fish Net	14:07	54°47.377'N	14°42.45'E	45.00	
AL524_58-1	26.07.	CTD	17:11	54°58.992'N	14°6.214'E	46.70	
AL524_58-2	26.07.	WS	17:19	54°58.995'N	14°6.231'E	46.70	
AL524_58-3	26.07.	WP2	17:23	54°58.995'N	14°6.24'E	46.80	
AL524_59-1	27.07.	WP2	03:59	54°45.972'N	13°27.316'E	41.80	
AL524_59-2	27.07.	WS	04:07	54°45.982'N	13°27.346'E	41.70	
AL524_59-3	27.07.	CTD	04:15	54°45.983'N	13°27.368'E	41.10	
AL524_60-2	29.07.	CTD	06:38	54°30.602'N	13°59.294'E	16.90	
AL524_60-2	29.07.	Fish Net	06:55	54°30.602'N	13°59.294'E	16.90	
AL524_61-1	29.07.	CTD	08:36	54°40.975'N	14°5.918'E	25.30	
AL524_61-2	29.07.	Fish Net	09:27	54°41.773'N	14°7.387'E	26.20	
AL524_62-1	29.07.	CTD	11:22	54°40.036'N	14°30.09'E	36.60	
AL524_62-2	29.07.	Fish Net	11:51	54°40.357'N	14°30.266'E	36.80	
AL524_63-1	29.07.	CTD	13:04	54°40.762'N	14°37.372'E	47.50	
AL524_63-2	29.07.	Fish Net	13:34	54°40.234'N	14°36.579'E	46.70	
AL524_64-1	29.07.	CTD	19:11	54°43.965'N	13°2.407'E	23.50	
AL524_64-2	29.07.	WP2	19:19	54°43.977'N	13°2.426'E	23.60	
AL524_64-3	29.07.	WS	19:25	54°43.992'N	13°2.425'E	23.60	
AL524_65-1	30.07.	CTD	06:03	55°13.002'N	13°19.5'E	41.10	
AL524_65-2	30.07.	Bongo Net	06:09	55°12.999'N	13°19.587'E	41.10	
AL524_66-1	30.07.	Bongo Net	06:44	55°8.049'N	13°18.858'E	37.60	
AL524_66-2	30.07.	CTD	06:53	55°8.09'N	13°19.4'E	37.70	
AL524_67-1	30.07.	CTD	07:26	55°3.023'N	13°19.376'E	43.60	
AL524_67-2	30.07.	WS	07:32	55°3.012'N	13°19.409'E	43.60	
AL524_67-3	30.07.	WP2	07:36	55°3.004'N	13°19.436'E	43.60	
AL524_67-4	30.07.	Bongo Net	07:44	55°3.01'N	13°19.488'E	43.50	
AL524_67-5	30.07.	Fish Net	08:06	55°3.111'N	13°21.153'E	42.90	
AL524_68-1	30.07.	Bongo Net	09:37	54°58.047'N	13°18.856'E	45.30	
AL524_68-2	30.07.	CTD	09:48	54°58.013'N	13°19.471'E	45.10	
AL524_69-1	30.07.	CTD	10:28	54°52.97'N	13°19.511'E	45.20	
AL524_69-2	30.07.	Bongo Net	10:34	54°53.039'N	13°19.596'E	45.20	
AL524_69-3	30.07.	Fish Net	10:56	54°52.992'N	13°20.955'E	45.20	
AL524_70-1	30.07.	Bongo Net	12:14	54°48.127'N	13°18.785'E	43.20	
AL524_70-2	30.07.	CTD	12:23	54°48.099'N	13°19.37'E	43.20	
AL524_71-1	30.07.	CTD	12:59	54°43.024'N	13°19.228'E	32.30	
AL524_71-2	30.07.	Bongo Net	13:05	54°43.052'N	13°19.309'E	32.20	
AL524_71-3	30.07.	Fish Net	13:39	54°45.284'N	13°21.232'E	39.30	

AL524_72-1	31.07.	CTD	04:03	54°11.228'N	11°28.379'E	23.30	
AL524_72-2	31.07.	Fish Net	04:19	54°11.772'N	11°29.451'E	23.60	
AL524_73-1	31.07.	WP2	05:50	54°11.211'N	11°28.44'E	23.60	
AL524_73-2	31.07.	WS	05:54	54°11.209'N	11°28.429'E	23.30	

7 Data and Sample Storage and Availability

7.1 Data availability

- a) The station list meta data (time, position, gear) will be transferred to the DOD.
- b) CTD data will be quality checked and transferred into PANGAEA.
- c) A cruise summary report (CSR) will be send by the cruise leader to the BSH.
- d) The cruise leader confirms the data transfer from a) and b) in his cruise report.
- e) The cruise leader will supply detailed information about the analysis of samples and long term storage of the data and samples in his cruise report. Diplomatic mandatory data transfers to visited states will be conducted by the cruise leader.

7.2 Sample availability and storage

- a) Samples will be analysed within the IMF teaching modules and student thesis's and stored within the IMF.
- b) IMF has its own cruise data base and a certified storage for formalin samples. Frozen samples will be stored in -20°C, -40°C, or -80°C containers at the IMF, which are equipped with an automatic, mobile phone based, alarm system.
- c) Samples will be labelled including a barcoding scheme, which is also used for professional archiving of all samples (long-term storage via an external company).

7.3 Data storage

- a) Tentative scientific data from this cruise will be
 - a. CTD data, light measurements, fluorescence data
 - b. Hydroacoustic data (EK 60 & EK 80; 38, 70, 120, 200, 333 kHz)
 - c. Fisheries data
 - d. Zooplankton data from net samples
- b) Paper protocols will be entered in a database continuously during the entire cruise (including daily back up) and conserved as hard copies as well.
- c) After quality checks and after their use in publications, data will be submitted to the PANGAEA database. The data transfer will be done within three years. Before transfer the data will be stored within the IMF data storage server system (RAID 5 & tape libraries).

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9 References

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10 Abbreviations

CTD	Conductivity Temperature Depth probe
WS	Water Sampler (Niskin Bottle)
WP-2	Plankton Net
Bongo	Plankton Net
MSN	Multi opening/closing net (MultiNet)
FishNet	Youngfishtrawl (for pelagic and bottom near use) with a trawl-eye