ALKOR -Berichte

Bachelor-MARSYS education cruise in the Baltic Sea

Cruise No. AL560

19.07. – 27.07.2021,
Kiel (Germany) – Kiel (Germany)
BALTEACH - 1

Richard Klinger
Institute for Marine Ecosystem and Fishery Science

2021

Table of Contents

1 Cruise Summary

1.1 Summary in English

During this teaching cruise, bachelor students of the Institute of Marine Ecosystem and Fishery Science (IMF) were supposed to get 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.
Due to regulations which were applied to the ongoing corona pandemic, students were unfortunately not allowed to attend, resulting in a reduction of scientific crew participations to 7 IMF employees.
Therefore, a teaching module has been created during 2020 in order to reach the educational goals of the cruise, which conveys knowledge to the students in a digital format, during lectures, explanatory video material and by working with collected data from the present and past cruises.
The scientific 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, Arkona and with special focus within 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 communities´ short term responses (on board) to temperature 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 sollte Bachelor- und Master-Studierenden des Instituts für Marine Ökosystem- und Fischereiwissenschaften (IMF) die Möglichkeit gegeben werden, die am häufigsten verwendeten wissenschaftlichen Methoden, Geräte und Arbeitsverfahren der Fischereiwissenschaft sowie der biologischen Ozeanographie an Bord eines Forschungsschiffes kennenzulernen.
Aufgrund der andauernden Corona-Pandemie mussten Regeln eingehalten werden, welche es den Studierenden leider nicht erlaubte an der Reise teilzunehmen. Außerdem musste die wissenschaftliche Besatzung auf 7 Mitarbeiter des IMF reduziert werden.
Um jedoch trotzdem die Ausbildungsziele der Studierenden zu erreichen, wurde bereits 2020 ein Lehrmodul kreiert, welches das Vermitteln von Lehrinhalten auf digitalen Wegen beinhaltete, bestehend aus Vorlesungen, Lehrvideos und wissenschaftlicher Arbeit mit gewonnen Daten der aktuellen und vergangener Seereisen.
Wissenschaftliches Ziel dieser Reise war die Untersuchung der Verteilungsmuster bestimmter laichender Fischarten wie dem Dorsch, Wittling, Sprotte, Scholle, Flunder und Kliesche in der Kieler Bucht, im Arkona und mit besonderem Fokus innerhalb des Bornholm Beckens.
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 entlang des jeweiligen Gradienten in der Ostsee mit einem zusätzlichen Probenahmeschema zur späteren Isolierung von *Ostreococcus* sp. und den assoziierten Viren, für zukünftige Laboruntersuchungen am Institut für Marine Ökosystem- und Fischereiwissenschaften.

2 Participants

2.1 Scientific Party

Name	Discipline	Institution
Klinger, Richard	Chief scientist; PhD student	IMF
Schnell, Stefanie	Technical Assistant	IMF
Kurbjuweit, Stefanie	Scientific Assistant; MSc student	IMF
Dr. Funk, Steffen	PostDoc	IMF
Plonus, Rene	PhD student	IMF
Heimann, Tim	Scientific Assistant; MSc student	IMF
Ehlers, Jannick	Scientific Assistant; BSc student	IMF

2.2 Participating Institutions

IMF Institute of Marine Ecosystem and Fishery Science, University of Hamburg

3 Research Program

3.1 Aims of the Cruise

This cruise was planned as a teaching cruise for MARSYS Bachelor 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.
The 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 were supposed to be trained in all technical procedures including work on deck, sample preparation and conservation, labelling documentation and storage. Students should have also received training in pre-analyzing samples and species identification on species based taxonomic level to get an overview of the biodiversity of the system.

Due to the ongoing process of Covid-19 infections, a variety of rules had to be followed. This led to the following: One, the scientific cruise members allowed to attend the cruise was reduced to 7 people, in order to maintain a usage of the accommodation chambers by a single person. Two, students were not allowed to attend the cruise, due to regulations by the University of Hamburg, which prohibited the participation during excursions and field work.
In order to reach the attended goal, an online teaching module was brought to life, aiming at a widely diverse education regarding preparation, conduction and post processing of a scientific cruise.

3.2 Agenda of the Cruise

The cruise had three main 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, plankton, and fish.
2. Provide insights and experiences regarding cruise organization and sampling strategies, producing meaningful estimates of abundance, biomass in relation to a stratified marine ecosystem.
3. Provide opportunities to gather relevant data and specimens for bachelor, master and PhD theses.

This cruise program is 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 defined, in which each student receives individual training, or in a group of 2, to theoretically establish practical knowledge of work on a research vessel. Individual training would have entailed the introduction of each student each individual topic 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. This year, the online teaching module was created using digital methods such as videotaping and audio recording on board in order to achieve the aforementioned teaching goals.

Theoretically, the students are lead through the following fields of responsibilities:

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 would have been 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 maneuver 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.

This scheme was digitally implemented into the module, by the creation of explanatory videos, aiming at the different topics.

3.3 Description of the Working Area

The spatial focus during this cruise has been the Kiel Bight, Mecklenburg Bight, Arkona Basin and especially the Bornholm Basin, 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 should have learned how to take, prepare and pre-analyze samples on board as well as post-cruise-processing of collected data or samples in the laboratory. Mentioned aspects were realized by a variety of explanatory videos, as part of the created cruise module, listed within 5.1 Cruise Module.

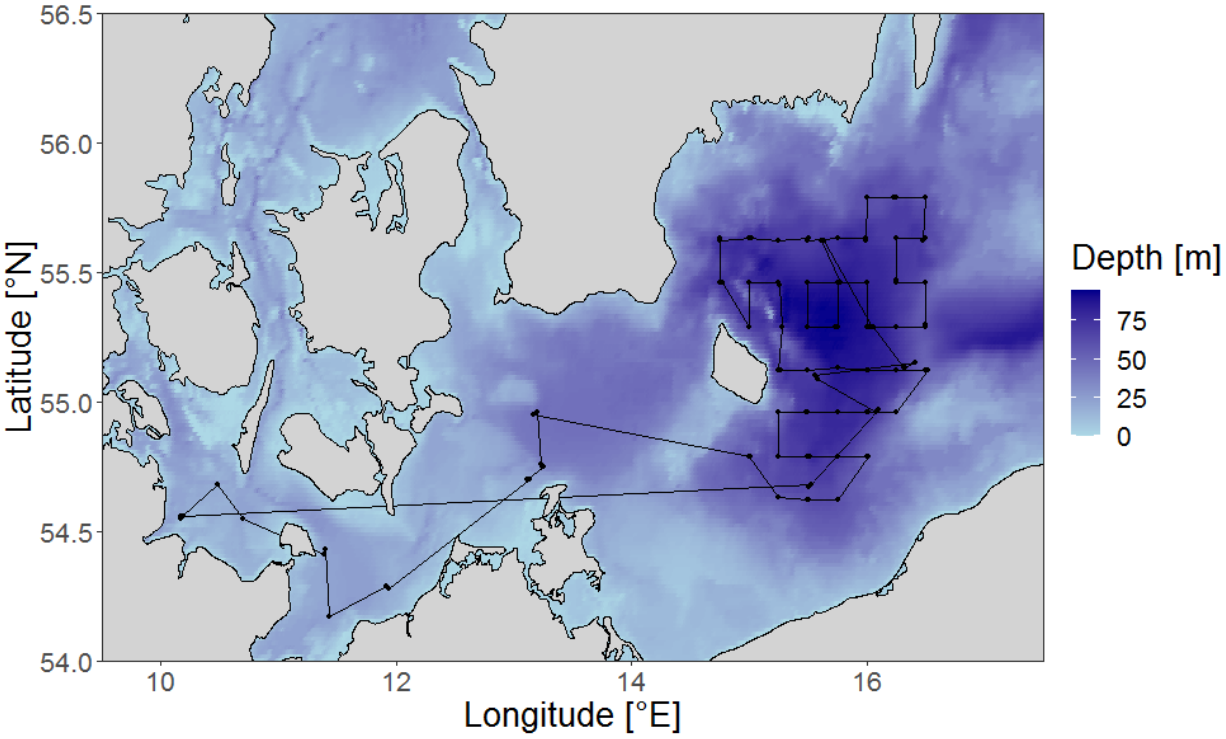

Figure 3.1: Cruise track of AL560. All realized sample stations are depicted by black dots. Positions per Gear are given in Table 6.1.

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, firstly, 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*). Secondly, various different samples were obtained for more detailed analyses, stomachs of cod, herring and sprat; otoliths of cod 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.

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 19th 2021 at 08:00 am and headed to the first research area in the Kiel Bight. 3 stations were realized, including a test of each individual gear, especially the usage and catchability of a new bottom trawl (TV3/520).
During July 20th the collection of water samples, as well as the gear testing regarding the new fisheries net has been continued within the Mecklenburg Bight. At the end of the day RV ALKOR entered harbor Warnemünde in order to load further scientific equipment for the upcoming days.
Unfortunately, we received a call during that day informing us that our lecturer, friend, mentor and former cruise leader Jens-Peter Herrmann had passed away. Most of the crew members knew him for many years and have spent a variety of days on board during multiple cruises with him. Jens-Peter has been way more than a teacher to all of us scientific cruise members, therefore the following days have been hard for all of us. Nevertheless, the rest of the cruise took place in remembrance of JP, since it couldn't have been a greater honor, paying respect to him that way.
On July 21st RV ALKOR left the harbor at 08:00 am steaming towards the Arkona Basin, followed by a set of 3 stations with hydrographic, zooplankton and fishery investigations.
Throughout the following 3 days (July 22nd – 24th) a comprehensive grid of zooplankton samples was conducted within the Bornholm Basin. A total amount of 45 stations were sampled with the Bongo net (3 different mesh sizes) and CTD hauls. Additionally, 6 stations within the sample area were investigated regarding the phytoplankton communities using a water sampler (Niskin bottle). Usually, the station within the central Bornholm Basin with the highest number of found cod larvae (AL560 → BB16, see figure 5.2) would have been sampled over a 24h period ("24h-station") by 4 repetitions every 6 hours of each 2x Multinet-Maxi (horizontally towed) and 4x Multinet-Midi (vertical hauls) to detect the differences in distribution patterns daytime wise. By that day, we have been informed about the scheduled funeral on July 29th, were most of the cruise participants planned to attend. Therefore, the further program has been adapted, in order to reach as many goals as possible during the remaining time. Instead of 4 full repetitions, only 2 hauls with the Multinet-Maxi were conducted at the end of the July 24th.
Between July 25th and July 26th, distribution patterns of fish (focusing on Eastern Baltic Cod) within the Bornholm Basin were investigated by 6 fishery hauls (Youngfishtrawl) and corresponding hydrographic measurements via CTD were conducted.
During the last day of the cruise (July 27th) a final station within the Kiel Bight was sampled by a fishery haul and a corresponding CTD measurement, as a comparison the first bottom trawl of the cruise, since both coordinates were equal.
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	62
Bongo (150µm, 335µm, 500µm)	52
Water sampler (Niskin Bottle)	13
Pelagic fishery trawl	7
Bottom Trawl	6
Multi Net Maxi	2
Total	142

5 Preliminary Results

5.1 Cruise Module

The module was structured in a specific way to impart knowledge as close as possible to the planned educational process during the cruise.
This resulted in a structured module, incorporating the following 4 objectives:

1 Creation of a variety of videos, covering the mentioned subjects under "3.2 Agenda of the Cruise" (defined responsibilities: I-IV), resulting in 12 topics (a-l, mentioned below) with a total of 14 videos (total length: 2,5h), which included added audio explanations.

   a. Tour around the ship; including all labs and important areas
   b. CTD; handling on deck and controls on the computer
   c. Water sampler; handling on deck and controls on the computer
   d. Plankton nets (Bongo, Multi net, WPS, Apstein); handling on deck and controls on the computer
   e. Bongo in detail, gear and sample handling
   f. Multi net in detail, gear and sample handling
   g. Phytoplankton primary production; sample handling and following measurements
   h. Jelly fish, handling jellies caught with plankton catching gears
   i. Fish larvae; sorting and recognizing different species of larvae from bongo samples
   j. Fisheries; usage of a trawl net; catch handling procedure
   k. Sprat and herring; species identification, length measurements and stomach sampling
   l. Cod; single fish analysis

2 A quiz for every video topic, which has to be passed by the students

3 3 recorded lectures (total length: 3h), serving background information with condensed information regarding:

   a. The ecosystem Baltic Sea
   b. Plankton sampling
   c. Fisheries
   d. Gears
   e. Work on a research vessel
   f. Introduction into handling CTD data using Ocean Data View

4 Working with data from recent cruises in groups of 3; resulting in an essay in the style of a scientific publication. Every group has to include hydrographic aspects into their thematic considerations. The following topics were assigned:

   a. Hydrography of the Baltic Sea
   b. Physiological response of phytoplankton communities to temperature changes
   c. Physiological response of phytoplankton communities to salinity changes
   d. Distribution and abundance changes of jelly fish
   e. Distribution and abundance changes of cod eggs
   f. Distribution and abundance changes of cod larvae
   g. Distribution and abundance changes of zooplankton communities
   h. Distribution and abundance changes of pelagic swarm fishes as sprat and herring
   i. Distribution and physiological aspects regarding cod

5.1 Ichthyo– and zooplankton sampling

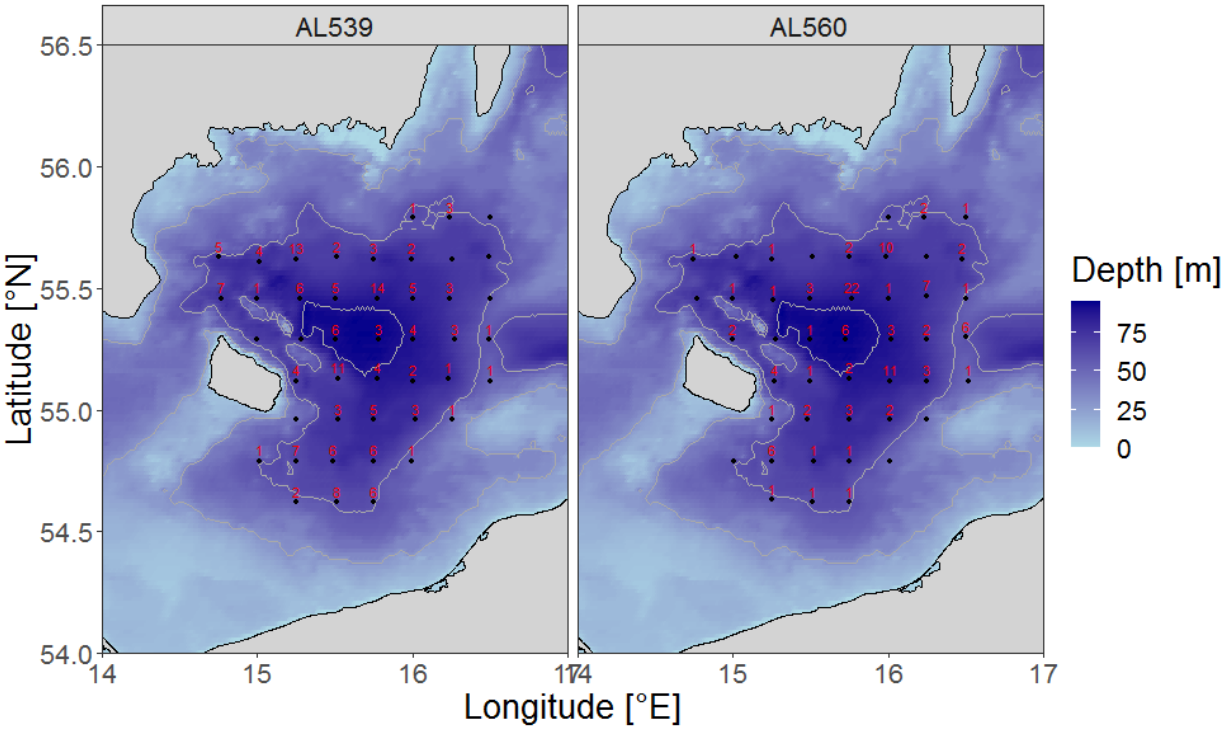

Figure 5.2: Overview of all processed bongo stations within the Bornholm-Basin during AL539 (July 2019) and AL560 (July 2020). Black dots represent bongo stations, red numbers are indicating the amount of cod larvae found within the corresponding 500µm Bongo samples. On stations without a number no cod larvae were found.

Within Bongo hauls covering the Bornholm Basin, cod larvae (*Gadus morhua*; n = 116 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 cod larvae during July 2020 (AL539) and July 2021 (AL560) is presented in Figure 5.2. Highest density was found within the central part of the Bornholm Basin.
During our last summer cruises, the total number of found cod larvae increased significantly from 18 individuals in 2018, to 71 during 2019, up to 163 in 2020.

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 formol solution, and will be used for the determination of species composition and abundance of zooplankton and ichthyoplankton.

5.3 Fishery

Fishery hauls were conducted in the Kiel Bight (2 haul), Mecklenburg Bight (2 hauls), Arkona Basin (3 hauls) as well as Bornholm Basin including 6 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 AL560.

Latin name	Common name	n	mass (kg)
Clupea harengus	Herring	7242	204.4
Sprattus sprattus	Sprat	7210	108.9
Pleuronectes platessa	Plaice	5664	471.5
Limanda limanda	Dab	4706	390.0
Gadus morhua	Cod	1974	371.3
Platichthys flesus	Flounder	515	108.0
Juvenil Gadus morhua	Juvenile Cod	183	0.3
Hyperoplus lanceolatus	Great Sandeel	137	2.1
Merlangius merlangus	Whiting	115	16.6
Juvenil Merlangius merlangus	Juvenile Whiting	77	0.4
Scophthalmus maximus	Turbot	43	15.8
Gasterosteus aculeatus	Three-spined Stickleback	39	0.1
Myoxocephalus scorpius	Shorthorn sculpin	34	3.7
Zoarces viviparus	European eelpout	12	0.5
Solea solea	Common Sole	10	1.6
Lumpenus Lampretaeformis		8	0.1
Scomber scombrus	Mackerel	3	0.9
Microstomus kitt	Lemon sole	2	0.7
Agonus cataphractus	Armed bullhead	2	0.2
Scophthalmus rhombus	Brill	1	0.3
Melanogrammus aeglefinus	Haddock	1	0.1
Eutrigla gurnardus	Grey gurnard	1	0.1
	Total	27979	1697

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 388 individuals, whereas length, weight, liver weight, liver worm infestation, sex and maturity stage (without samples taken) were measured for 156 individuals. Length, weight and sex were determined for another 1431 individuals (juveniles are not included).

5.3.1. Stomach samplings

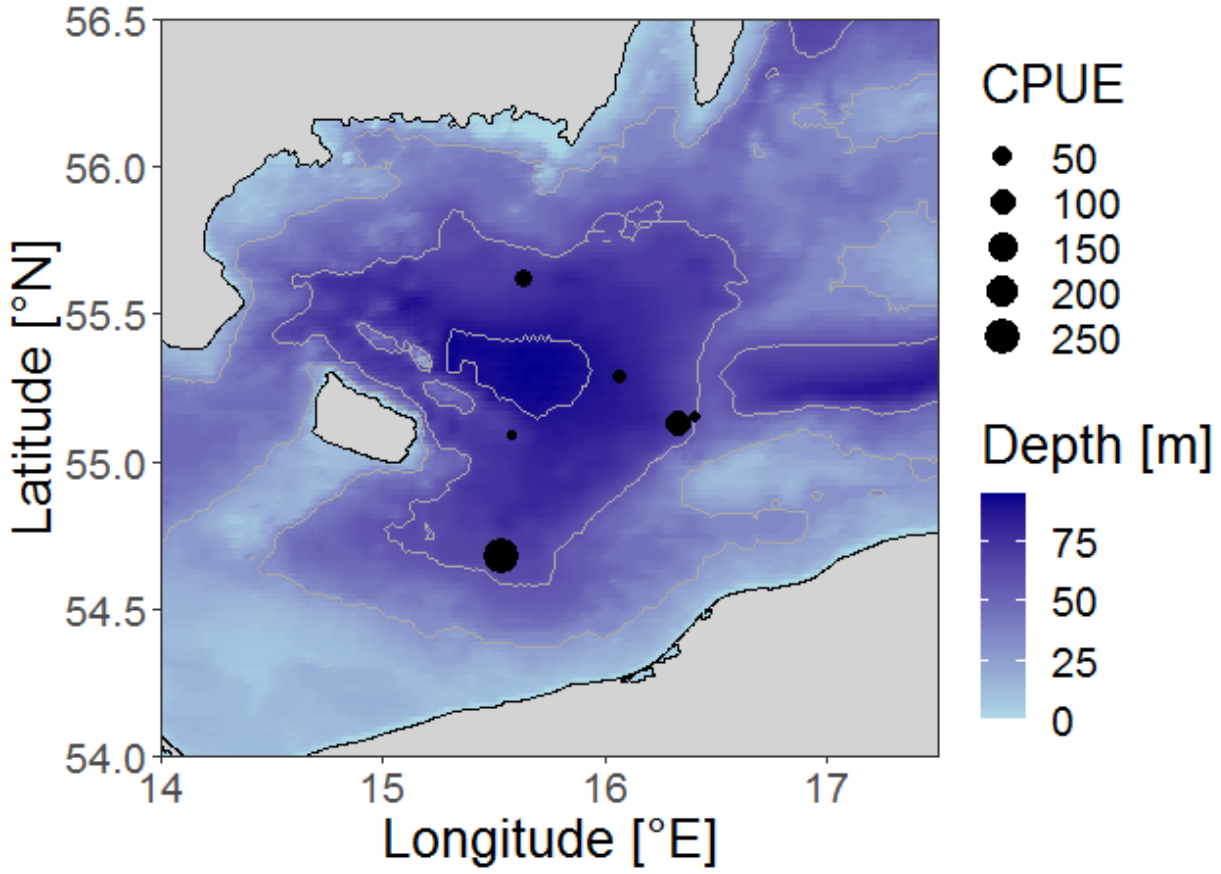

Figure 5.3: Spatial distribution of sampled cod, catch per hour in kg (CPUE = Catch per unit effort) during AL560 within the Bornholm Basin.

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*), plaice (Pleuronectes platessa) and turbot (*Scophthalmus maximus*). Figure 5.3 shows the spatial distribution of sampled cod during AL560. 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. Two master theses (Peter Hornetz, Tobias Reßing) and one PhD thesis (Steffen Funk) were conducted, beeing involved in the stomach sampling project.

5.3.2. Single fish cod sampling

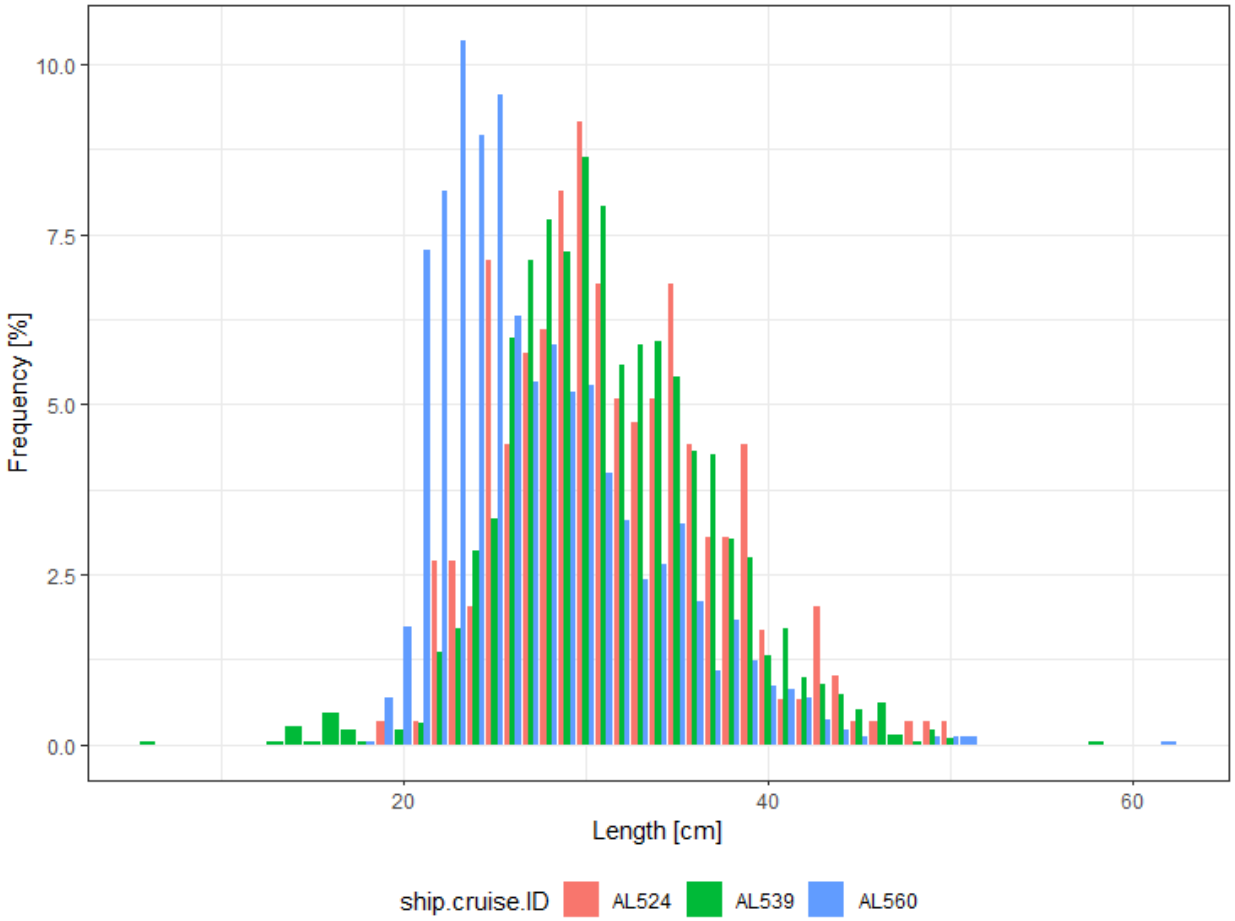

Figure 5.4: Relative length frequency distribution of individual sampled cod in 2019 (AL524; n = 440) in red, 2020 (AL539; n= 1922) in green and during 2021 (AL560; n = 1974) in blue columns. Frequency is given in percent and length in cm (measurement cm below).

Relative length frequency distribution of individual sampled cod within the Bornholm Basin during 2019 (AL524), 2020 (AL539) and 2021 (AL560) is shown in Figure 5.4.

Comparing the length frequency distribution between the July cruises in 2019 and 2021 reveal a shift towards smaller fish within the present cruises. Differences in spatial sampling might explain this shift, but nevertheless only a single fish bigger than 60cm was caught within those 3 cruises.

Figure 5.5 shows the condition factor Fulton`s *K* for all sampled cod per 10cm length classes (LC) (11-20cm; 21-30cm; aso). 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, only within LC 51-60cm caught cod show a greater variety in condition, this might be explained with the very low sample size. 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.

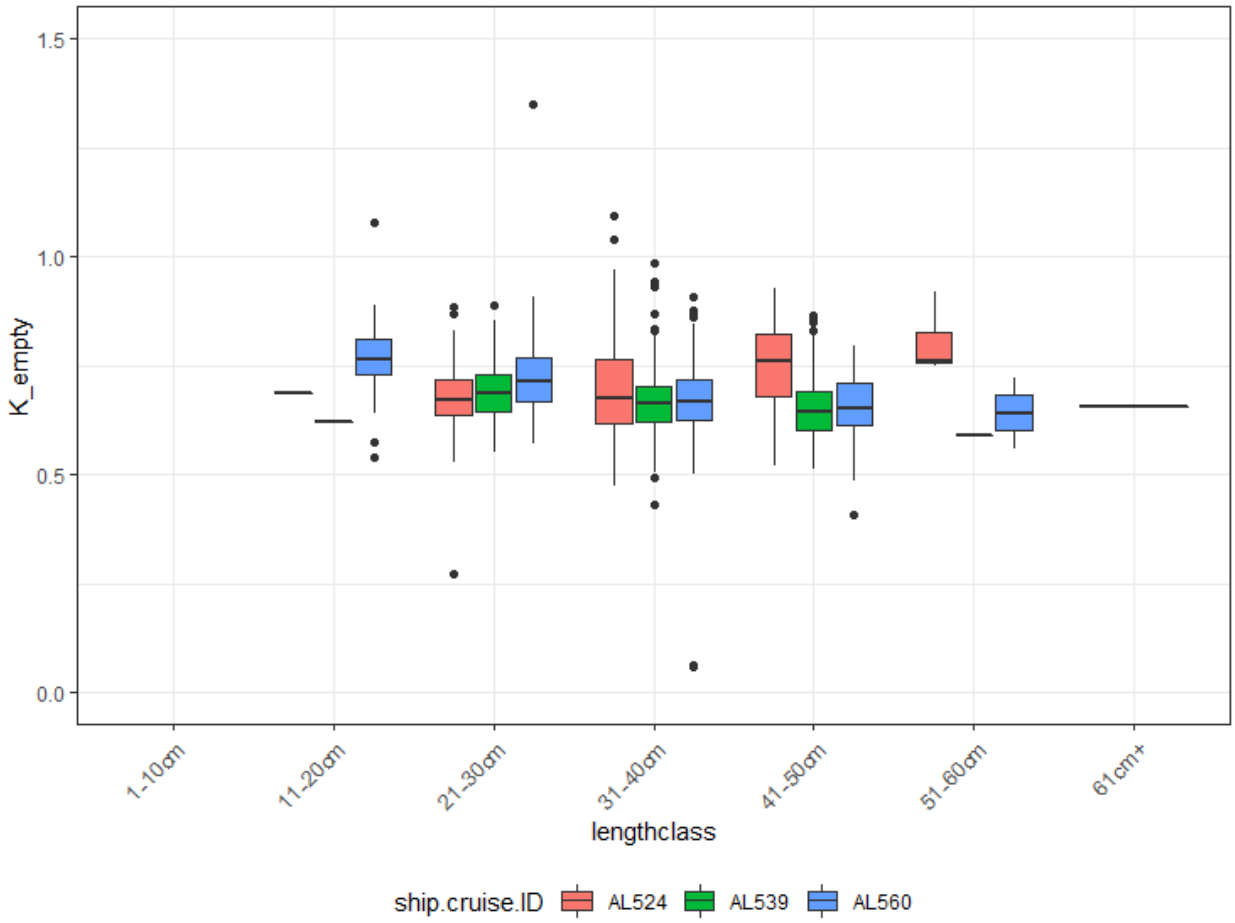

Figure 5.5: Fulton´s K Index of individual sampled cod during AL524 (July 2019) in red, AL539 (July 2020) in green and AL560 (July 2021) in red of all caught cod within the Bornholm Basin.

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 Baltic Sea.

Figure 5.6 shows the frequency of grouped maturity stages per 10 cm LC for females and males within the Bornholm Basin during the cruises AL524 (July 2019), AL539 (July 2020) and AL560 (July 2021). Comparing the results of mentioned 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.

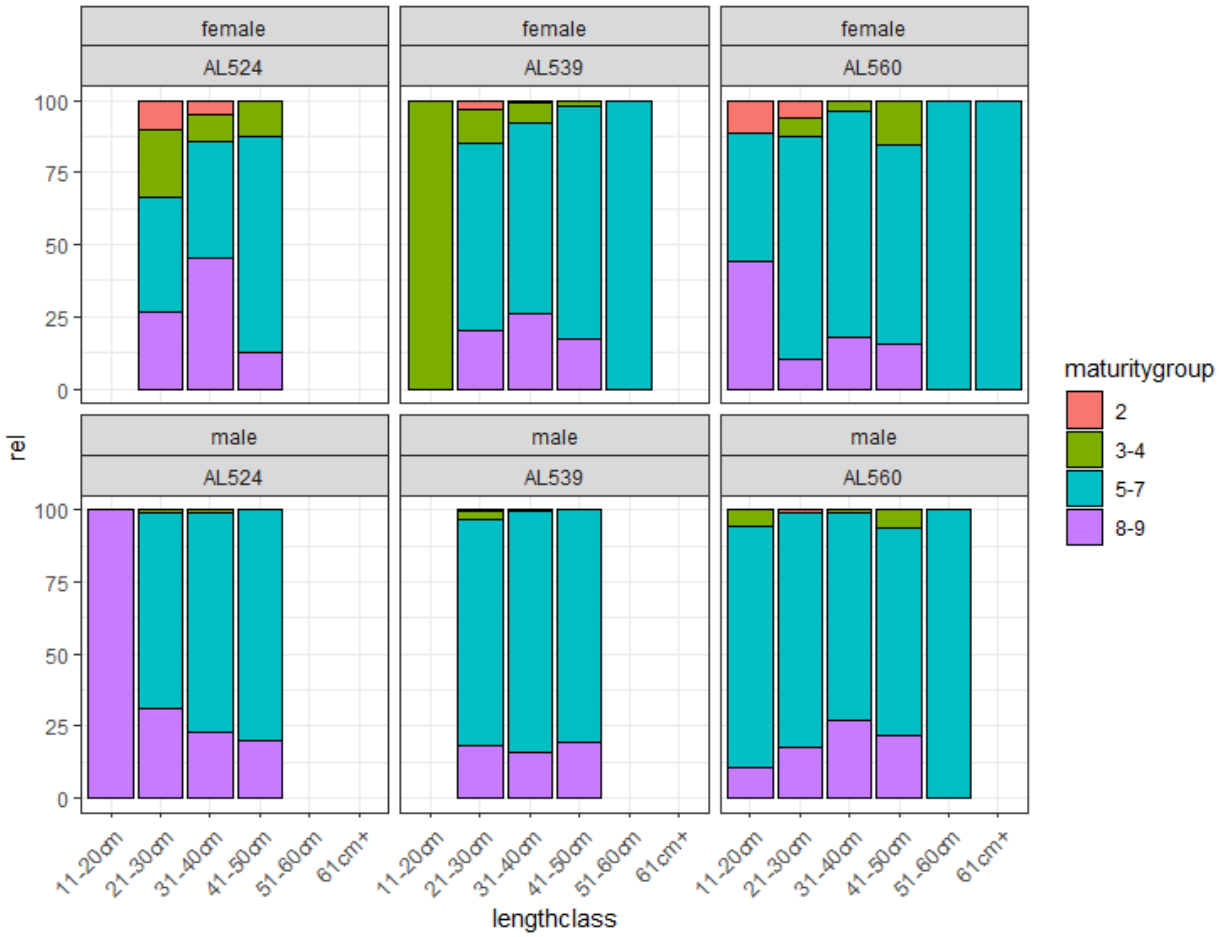

Figure 5.6: Relative frequency distribution in percent of the grouped maturity stages per 10 cm length class shown for individual sampled female and male cod during AL524 (July 2019) left hand column, AL539 (July 2020) middle column and AL560 (July 2021) right hand column. Maturity stages Red: 1-2 (juvenile and preparation); Green: Maturity stage 3-4 (maturation); Cyan: Maturity stage 5-7 (spawning); Purple: Maturity stage 8-9 (regeneration).

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 where 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 5.7. 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 AL524 (July 2019) left hand column, AL539 (July 2020) middle column and AL560 (July 2021) right hand column. Infestation is determined by visual determination of nematodes on the liver surface: stage 0 = nematodes; stage 1 = 1-10 nematodes; stage 2 = 11-20 nematodes and stage 3 = >20 nematodes. Comparing the mentioned summer cruises (AL524, AL539 and AL560) regarding the infestation rates, no major change is notable. 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 5.7.

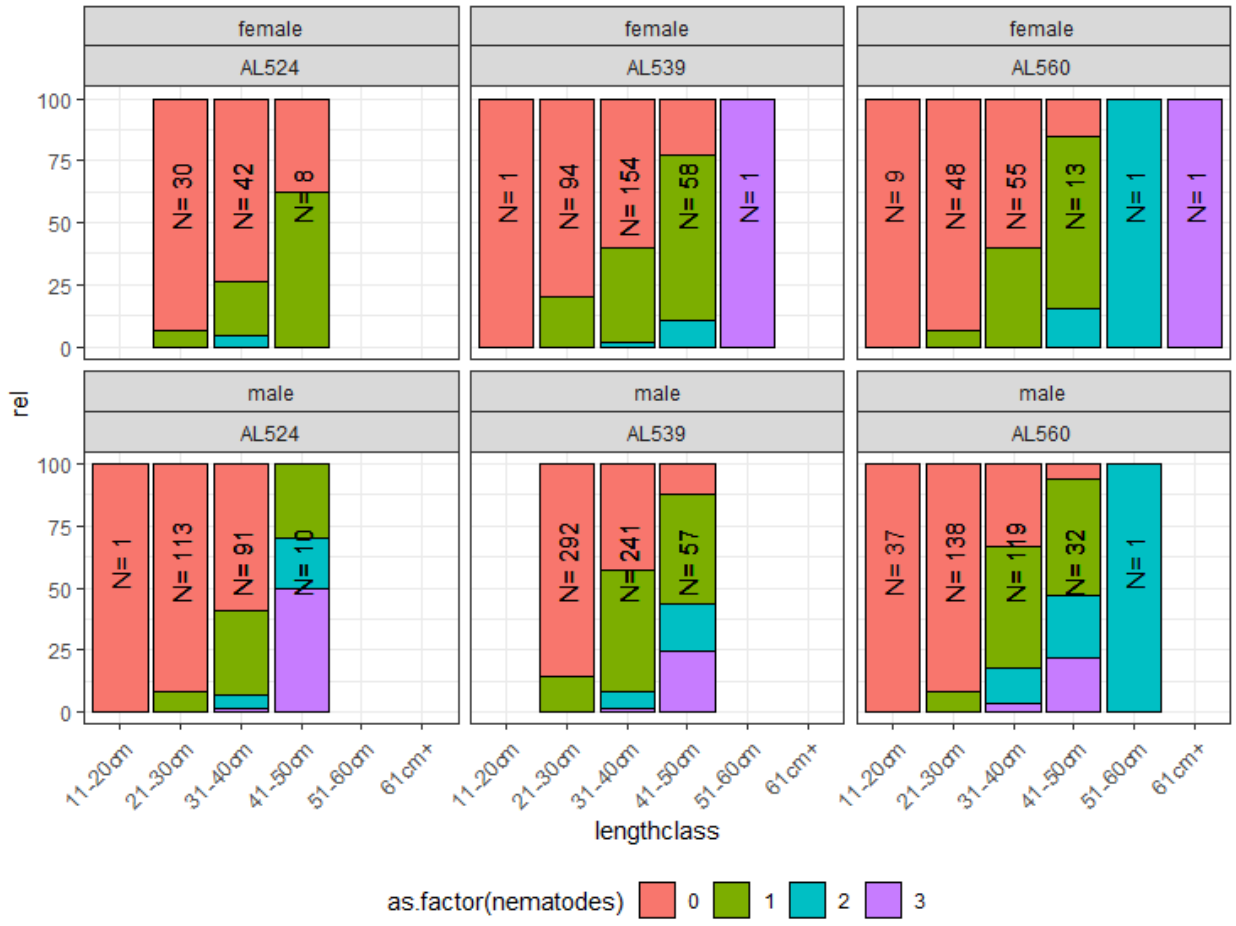

Figure 5.7: Relative frequency distribution in percent of liver worm (Nematodes) infestation stages (visible on liver surface) per 10 cm length class shown for individual sampled female and male cod during AL524 (July 2019) left hand column, AL539 (July 2020) middle column and AL560 (July 2021) right hand column. 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).

6 Station List AL560

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	2021		[UTC]	[°N]	[°W]	[m]	
AL560_1-1	19.7.	CTD	13:35	10°10.23	54°33.08	20	
AL560_1-2	19.7.	WS	13:39	10°10.23	54°33.05	20	
AL560_1-3	19.7.	BONGO	13:42	10°10.22	54°33.04	20	
AL560_1-4	19.7.	TV3/520	14:20	10°10.5	54°33.61	20	
AL560_2-1	19.7.	BONGO	16:34	10°29.09	54°41	32	
AL560_2-2	19.7.	WS	16:40	10°28.72	54°40.99	32	
AL560_2-3	19.7.	CTD	16:45	10°28.74	54°40.97	32	
AL560_3-1	19.7.	CTD	17:54	10°41.78	54°32.76	22	
AL560_3-2	19.7.	WS	17:59	10°41.78	54°32.76	22	
AL560_4-1	20.7.	CTD	7:57	11°23.63	54°24.78	22	
AL560_4-2	20.7.	WS	8:03	11°23.63	54°24.77	22	
AL560_4-3	20.7.	BONGO	8:08	11°23.59	54°24.78	21	
AL560_4-4	20.7.	TV3/520	8:32	11°23.72	54°25.61	21	
AL560_5-1	20.7.	CTD	11:05	11°25.57	54°9.94	23	
AL560_5-2	20.7.	WS	11:10	11°25.54	54°9.91	23	
AL560_6-1	20.7.	CTD	13:07	11°54.41	54°17.18	19	
AL560_6-2	20.7.	WS	13:12	11°54.39	54°17.15	19	
AL560_6-3	20.7.	BONGO	13:17	11°54.33	54°17.15	19	
AL560_6-4	20.7.	TV3/520	13:46	11°56.35	54°16.67	18	
AL560_7-1	21.7.	CTD	12:03	13°7.99	54°41.77	22	
AL560_7-2	21.7.	BONGO	12:09	13°7.93	54°41.78	22	
AL560_7-3	21.7.	TV3/520	12:25	13°6.83	54°42.05	22	
AL560_8-1	21.7.	BONGO	14:08	13°14.85	54°44.97	37	
AL560_8-2	21.7.	CTD	14:17	13°14.29	54°44.99	35	
AL560_8-3	21.7.	TV3/520	14:33	13°13.62	54°45.45	36	
AL560_9-1	21.7.	CTD	16:32	13°12.25	54°57.53	46	
AL560_9-2	21.7.	BONGO	16:38	13°12.12	54°57.49	46	
AL560_9-3	21.7.	TV3/520	17:40	13°10.12	54°57.09	45	
AL560_10-1	22.7.	BONGO	9:58	15°0.88	54°47.4	61	
AL560_10-2	22.7.	CTD	10:10	15°0.03	54°47.48	61	
AL560_11-1	22.7.	CTD	11:30	15°14.99	54°37.56	59	
AL560_11-2	22.7.	BONGO	11:37	15°14.95	54°37.51	58	
AL560_12-1	22.7.	BONGO	12:44	15°30.78	54°37.48	63	
AL560_12-2	22.7.	CTD	12:57	15°29.86	54°37.43	63	
AL560_13-1	22.7.	CTD	13:55	15°45.01	54°37.46	59	
AL560_13-2	22.7.	WS	14:02	15°45	54°37.46	59	
AL560_13-3	22.7.	BONGO	14:07	15°44.97	54°37.47	60	
AL560_14-1	22.7.	BONGO	15:28	16°0.78	54°47.47	50	
AL560_14-2	22.7.	CTD	15:38	16°0.07	54°47.49	51	
AL560_15-1	22.7.	CTD	16:36	15°45.03	54°47.49	72	
AL560_15-2	22.7.	BONGO	16:43	15°44.99	54°47.43	72	

AL560_16-1	22.7.	BONGO	17:39	15°31.01	54°47.68	74	
AL560_16-2	22.7.	CTD	17:52	15°30.1	54°47.54	74	
AL560_17-1	22.7.	CTD	18:48	15°15.1	54°47.48	68	
AL560_17-2	22.7.	BONGO	18:55	15°14.95	54°47.45	67	
AL560_18-1	22.7.	CTD	20:01	15°15.02	54°57.47	43	
AL560_18-2	22.7.	WS	20:08	15°15	54°57.47	43	
AL560_18-3	22.7.	BONGO	20:12	15°14.9	54°57.49	43	
AL560_19-1	22.7.	BONGO	21:02	15°28.78	54°57.51	77	
AL560_19-2	22.7.	CTD	21:17	15°30	54°57.4	77	
AL560_20-1	22.7.	CTD	22:10	15°44.95	54°57.48	81	
AL560_20-2	22.7.	BONGO	22:18	15°44.88	54°57.4	81	
AL560_21-1	22.7.	BONGO	23:21	16°0.8	54°57.75	74	
AL560_21-2	22.7.	CTD	23:34	15°59.98	54°57.54	74	
AL560_22-1	23.7.	CTD	0:32	16°15.09	54°57.5	49	
AL560_22-2	23.7.	BONGO	0:39	16°14.88	54°57.47	49	
AL560_23-1	23.7.	BONGO	2:05	16°30.91	55°7.48	51	
AL560_23-2	23.7.	CTD	2:17	16°29.95	55°7.48	51	
AL560_24-1	23.7.	CTD	3:19	16°14.97	55°7.5	79	
AL560_24-2	23.7.	BONGO	3:28	16°14.82	55°7.47	80	
AL560_25-1	23.7.	BONGO	4:25	16°0.89	55°7.49	87	
AL560_25-2	23.7.	CTD	4:41	16°0	55°7.48	87	
AL560_26-1	23.7.	CTD	5:42	15°45.01	55°7.54	89	
AL560_26-2	23.7.	BONGO	5:51	15°44.88	55°7.52	89	
AL560_27-1	23.7.	CTD	6:49	15°30	55°7.47	67	
AL560_27-2	23.7.	WS	6:56	15°29.93	55°7.39	67	
AL560_27-3	23.7.	BONGO	7:01	15°29.9	55°7.34	67	
AL560_28-1	23.7.	BONGO	7:53	15°15.93	55°7.49	62	
AL560_28-2	23.7.	CTD	8:05	15°15.09	55°7.48	62	
AL560_29-1	23.7.	CTD	9:10	15°16.98	55°17.43	88	
AL560_29-2	23.7.	BONGO	9:19	15°16.83	55°17.44	87	
AL560_30-1	23.7.	BONGO	10:26	15°15.88	55°27.04	89	
AL560_30-2	23.7.	CTD	10:41	15°15.02	55°27.48	91	
AL560_31-1	23.7.	CTD	11:38	14°60	55°27.53	78	
AL560_31-2	23.7.	BONGO	11:46	15°0.04	55°27.48	78	
AL560_32-1	23.7.	CTD	12:56	15°0.06	55°17.54	72	
AL560_32-2	23.7.	WS	13:04	15°0.01	55°17.54	72	
AL560_32-3	23.7.	BONGO	13:09	14°59.88	55°17.52	72	
AL560_33-1	23.7.	BONGO	14:28	14°45.99	55°27.59	69	
AL560_33-2	23.7.	CTD	14:41	14°45.03	55°27.5	69	
AL560_34-1	23.7.	CTD	15:43	14°44.99	55°37.52	68	
AL560_34-2	23.7.	BONGO	15:52	14°45.02	55°37.48	68	
AL560_35-1	23.7.	BONGO	16:50	15°1.04	55°37.86	75	
AL560_35-2	23.7.	CTD	17:03	15°0.1	55°37.52	76	
AL560_36-1	23.7.	CTD	17:58	15°14.99	55°37.5	73	
AL560_36-2	23.7.	WS	18:06	15°15.01	55°37.43	73	
AL560_36-3	23.7.	BONGO	18:10	15°14.89	55°37.36	73	
AL560_37-1	23.7.	BONGO	19:10	15°30.54	55°37.83	67	
AL560_37-2	23.7.	CTD	19:22	15°29.98	55°37.46	67	
AL560_38-1	23.7.	CTD	20:16	15°44.94	55°37.52	69	
AL560_38-2	23.7.	BONGO	20:29	15°45.15	55°37.61	69	

AL560_39-1	23.7.	BONGO	21:19	15°59.18	55°37.95	74	
AL560_39-2	23.7.	CTD	21:31	15°59.42	55°37.47	75	
AL560_40-1	23.7.	CTD	22:35	15°59.95	55°47.44	62	
AL560_40-2	23.7.	BONGO	22:42	16°0.09	55°47.47	62	
AL560_41-1	23.7.	BONGO	23:34	16°13.93	55°47.19	61	
AL560_41-2	23.7.	CTD	23:48	16°14.95	55°47.48	60	
AL560_42-1	24.7.	CTD	0:46	16°29.96	55°47.46	57	
AL560_42-2	24.7.	BONGO	0:55	16°29.89	55°47.44	57	
AL560_43-1	24.7.	BONGO	2:07	16°28.94	55°37.29	63	
AL560_43-2	24.7.	CTD	2:20	16°30.08	55°37.55	63	
AL560_44-1	24.7.	CTD	3:20	16°15.04	55°37.54	74	
AL560_44-2	24.7.	BONGO	3:28	16°15.09	55°37.51	75	
AL560_45-1	24.7.	BONGO	4:37	16°15.13	55°28.21	74	
AL560_45-2	24.7.	CTD	4:52	16°15.14	55°27.59	74	
AL560_46-1	24.7.	CTD	5:46	16°29.97	55°27.55	59	
AL560_46-2	24.7.	BONGO	5:53	16°30	55°27.47	59	
AL560_47-1	24.7.	BONGO	6:53	16°29.71	55°17.89	61	
AL560_47-2	24.7.	CTD	7:03	16°29.95	55°17.53	62	
AL560_48-1	24.7.	CTD	7:57	16°15.2	55°17.49	74	
AL560_48-2	24.7.	BONGO	8:05	16°15.09	55°17.51	74	
AL560_49-1	24.7.	BONGO	8:57	16°1.39	55°17.45	88	
AL560_49-2	24.7.	CTD	9:13	16°0.11	55°17.48	89	
AL560_50-1	24.7.	CTD	10:17	15°59.94	55°27.48	83	
AL560_50-2	24.7.	WS	10:26	15°59.95	55°27.44	83	
AL560_50-3	24.7.	BONGO	10:31	16°0.03	55°27.35	83	
AL560_51-1	24.7.	BONGO	11:22	15°46.25	55°27.65	86	
AL560_51-2	24.7.	CTD	11:35	15°45.16	55°27.5	86	
AL560_52-1	24.7.	CTD	12:36	15°30.06	55°27.49	85	
AL560_52-2	24.7.	BONGO	12:44	15°30.03	55°27.54	85	
AL560_53-1	24.7.	CTD	13:51	15°29.92	55°17.54	93	
AL560_53-2	24.7.	WS	14:00	15°29.96	55°17.54	93	
AL560_53-3	24.7.	BONGO	14:04	15°29.98	55°17.54	93	
AL560_54-1	24.7.	BONGO	15:01	15°43.62	55°17.4	96	
AL560_54-2	24.7.	CTD	15:17	15°44.89	55°17.52	96	
AL560_55-1	24.7.	MAXI	17:56	15°45.23	55°27.5	86	
AL560_55-2	24.7.	MAXI	18:40	15°44.93	55°27.46	86	
AL560_55-3	24.7.	CTD	19:10	15°46.55	55°27.38	86	
AL560_56-1	25.7.	CTD	7:59	15°36.44	55°37.24	68	
AL560_56-2	25.7.	JFT	8:21	15°38.03	55°37.17	68	
AL560_57-1	25.7.	CTD	11:29	16°2.47	55°17.24	87	
AL560_57-2	25.7.	JFT	11:49	16°3.68	55°17.31	86	
AL560_58-1	25.7.	CTD	13:53	16°18.8	55°7.56	71	
AL560_58-2	25.7.	JFT	14:12	16°19.81	55°7.8	67	
AL560_59-1	25.7.	RF	18:12	16°24.34	55°9.02	70	
AL560_60-1	26.7.	CTD	8:00	15°33.74	55°5.77	71	
AL560_60-2	26.7.	JFT	8:17	15°34.83	55°5.44	74	
AL560_61-1	26.7.	CTD	11:30	16°4.84	54°57.85	71	
AL560_61-2	26.7.	JFT	11:51	16°6.08	54°58.28	70	
AL560_62-1	26.7.	CTD	15:22	15°30.52	54°40.27	66	
AL560_62-2	26.7.	JFT	15:42	15°31.64	54°40.69	67	

AL560_63-1	27.7.	CTD	10:10	10°11.21	54°33.63	20	
AL560_63-2	27.7.	JFT	10:28	10°10.03	54°33.5	20	

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 sent 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 PANGEA 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).

8 Acknowledgements

I want to thank captain Jan Lass and the entire crew of RV ALKOR for their outstanding support throughout this and many past cruises, Svend Mees and Hendrik Hampe (GEOMAR) for their support with technical equipment for the cruise, Margarethe Nowicki and Steffen Funk for the great collaboration on cruise preparations and follow-up work during the cruise. Finally, many thanks go to the scientific cruise participants on AL560 for their enthusiasm and motivation throughout this challenging cruise.

There is no way to express my thanks to Jens-Peter in words, he has been mentor and friend to me at the same time. I owe him most of my knowledge regarding practical field work and we would have never been able to conduct cruises and follow our scientific interests without his tireless support and sharing of experiences. You'll always be with us during future cruises.

9 References

Lambert, Yvan, and J-D. Dutil, 1997. Condition and energy reserves of Atlantic cod (Gadus morhua) during the collapse of the northern Gulf of St. Lawrence stock. In: Canadian journal of fisheries and aquatic sciences 54.10: 2388-2400.

10 Abbreviations

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