ALKOR -Berichte

Bachelor-MARSYS education cruise in the Baltic Sea

Cruise No. AL551

06.03 – 13.03.2021,
Kiel (Germany) – Kiel (Germany)
BALTEACH - 1

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2021

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1 Cruise Summary

1.1 Summary in English

This cruise was originally planned as a teaching cruise for bachelor students of the Institute of Marine Ecosystem and Fisheries Sciences (IMF) to learn the most commonly used scientific methods, gears and working procedures of fisheries science and biological oceanography on board of a research vessel.
Due to the current Covid-19 regulations and the resulting restrictions, only 7 scientists were allowed to attend, so the cruise was used to make more instructional videos and collect sample material for student project work and module theses.
The main scientific objective was to investigate the distribution patterns of certain fish species such as cod, whiting, sprat and herring in the Kiel Bight and Mecklenburg Bight.
Besides fisheries and hydrological surveys, plankton stations were sampled along the cruise track to gain insights into the spatial distribution of zoo- and ichthyoplankton, as well as fish eggs.
Furthermore, various experiments were conducted and recorded as educational videos.
Due to bad weather conditions, the cruise had to end earlier than planned, but it was still possible to fully implement the planned program in the shortened time.

1.2 Zusammenfassung

Diese Ausfahrt wurde ursprünglich als Lehrausfahrt für Bachelor-Studenten des Instituts für Marine Ökoystem- und Fischereiwissenschaften (IMF) geplant, um die am häufigsten verwendeten wissenschaftlichen Methoden, Geräte und Arbeitsverfahren der Fischereiwissenschaft sowie der biologischen Ozeanographie an Bord eines Forschungsschiffes kennenzulernen.
Aufgrund der geltenden Covid-19 Bestimmungen und der sich daraus ergebenden Einschränkungen durfte die Ausfahrt nur mit 7 Wissenschaftlern angetreten werden und wurde dazu genutzt, um weitere Lehrvideos zu erstellen, sowie Probenmaterial für Projektarbeiten und Modulabschlussarbeiten zu sammeln. Hauptziel dabei war die Untersuchung der Verteilungsmuster bestimmter Fischarten wie dem Dorsch, Wittling, Sprotten und Heringen in der Kieler Bucht und Mecklenburger Bucht.
Neben der Fischerei und hydrologischen Untersuchungen wurden entlang der Reiseroute Planktonstationen beprobt, um Einblicke in die räumliche Verteilung von Zoo- und Ichthyoplankton und Fischeiern zu gewinnen.
Weiterhin wurden verschiedene Experimente durchgeführt und als Lehrvideos aufgezeichnet.
Aufgrund der schlechten Wetterlage musste die Reise früher als geplant beendet werden, dennoch war es möglich das geplante Programm in der verkürzten Zeit vollständig umzusetzen.

2 Participants

2.1 Scientific Party

Name	Discipline	Institution
Nowicki, Margarethe	Chief scientist	IMF
Listmann, Luisa, Dr.	PostDoc	IMF
Funk, Steffen, Dr.	PostDoc	IMF
Klinger, Richard	PhD student	IMF
Plonus, René-Marcel	PhD student	IMF
Kurbjuweit, Stefanie	Scientific Assistant, MSc 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.
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.
Theoretically, all students should be trained in all technical procedures including work on deck, sample preparation, conservation, labelling documentation and storage. Students also receive training in pre-analysing samples and species identification on nearest taxonomic level to get an overview of the biodiversity of the system.
Due to the binding hygiene regulations caused by the Covid-19 Pandemic by the shipping company (Briese), only 7 scientific crew members were allowed to attend the cruise. In addition, due to the effective regulations of the University of Hamburg, no students were able to attend the cruise, as excursions were prohibited.
In order to meet the teaching obligations and the original goals of this cruise, an online field method course was designed under the direction of Dr. Luisa Listmann and in cooperation with Richard Klinger. The contents of this course were to reflect the originally planned teaching cruise in a digital version, aiming to include all steps regarding preparation, conduction and post processing of a scientific cruise.

3.2 Agenda of the Cruise

The cruise had 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.

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 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 students would 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.
With regard to the teaching goals, the online teaching module was created using digital methods such as videotaping and audio recording on board.

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 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.

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 lies on the Western Baltic Sea, in particular Kiel Bight and Mecklenburg Bight. This cruise included collecting samples from all major compartments of the ecosystem, from coastal to open waters in a 3-dimensional distribution.

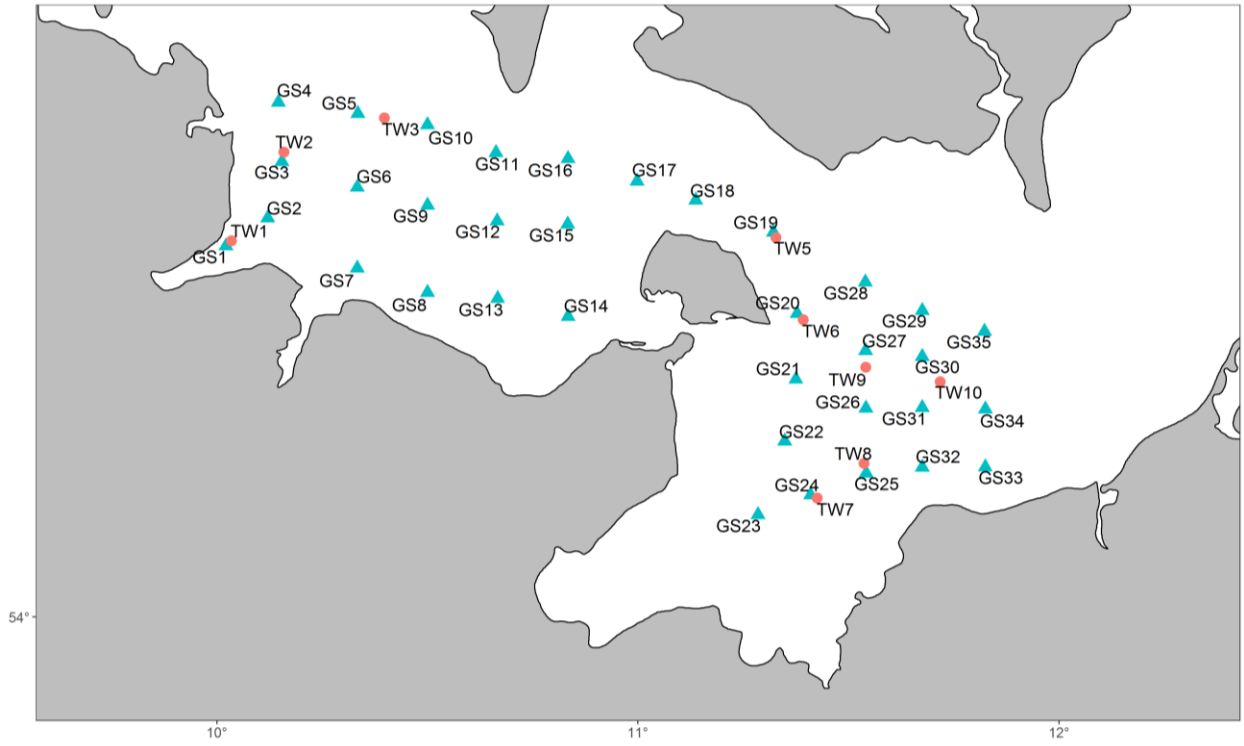

Figure 3.1: Station overview AL551. All plankton stations are depicted by turquoise triangles. All fishing stations are depicted by red dots. Positions per Gear are given in Table 6.1.

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 four dominant fish species in the system of the western Baltic Sea, cod (*Gadus morhua*), whiting (*Merlangius merlangus*), herring (*Clupea harengus*) and sprat (*Sprattus sprattus*). Various different samples were obtained for more detailed analyses, stomachs of cod, whiting, 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.

Most of the samples are of “dual use” in the sense that they are also either used for thesis work or in international cooperation (DTU Aqua).

4 Narrative of the Cruise

RV ALKOR departed from Kiel port on 6st of March 2021 at 07:54 am and headed to the first station in the Bight of Eckernförde (GS 1).
Over the course of the cruise, fishery hauls, zooplankton hauls with Bongo and Multinet MIDI, water sampler as well as CTD hauls were carried out following a large-scale spatial sampling design covering the Kiel Bight on 6-7st of March, the Mecklenburg Bight on 8-9th of March and parts of the Mecklenburg Bight and the Fehmarn Belt on 10th of March.
In addition, hydroacoustic data obtained with four different echosounder frequencies (38, 70, 120 and 200 kHz) were continuously recorded.
All trawl stations were predefined, based on the trawl stations of the AL549. Additional Multinet sampling (towed, in horizontal layers) was carried out on each of this trawl station, where the selection of the individual depths was made dependent on the results of the previous CTD profile.

All planned stations of the AL551 could be sampled, unfortunately the further station work had to be terminated early, due to the bad weather conditions, by the entry into Kiel. On the last day (12th of March) of the cruise a short instrument calibration (Bongo flowmeters) was done in the fjord.

A detailed list of 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 during AL551. Mesh sizes are given in brackets.

Gear	Total
ADM-CTD vertical	46
Watersampler (Niskin Bottle)	9
Bongo (150µm, 335µm, 500µm)	37
Multinet MIDI horizontal (300µm)	9
Pelagic fishery trawl	9

5 Preliminary Results

5.1 Cruise Module

(Dr. Luisa Listmann, Richard Klinger, Margarethe Nowicki,
Institute for Marine Ecosystem and Fishery Science, Hamburg University)

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 (here we improved or extended existing video material from 2020), covering all subject areas mentioned 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.

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

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 had to include hydrographic aspects into their thematic considerations. The following topics were assigned:

   a. Investigations on the winterly feeding ecology of two gadoid species (*Gadus morhua* and *Merlangius merlangus*) from the Belt Sea.
   b. Analysis of the fish catch compositions observed during the IMF winter cruises 2021.

5.2 Marine microbes and viruses of the Baltic Sea under climate change

(Dr. Luisa Listmann, Dr. Jana Hinners
Institute for Marine Ecosystem and Fishery Science, Hamburg University)

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 9 stations along the cruise track of AL551. On board, we measured metabolism (photosynthesis and respiration) of two different size fractions of phytoplankton (<0.45µm, 0.2-2 µm and 0.2-37.5 µm) of 6 of the 9 stations immediately after sampling, and assessed these responses over a gradient of salinity and temperature. Furthermore, water samples of all stations and thereof the two smaller size fractions were set aside to isolate viruses and picoplankton back in the laboratory at the institute in Hamburg. The 9 stations were divided into Kiel Bight and Mecklenburg Bight (considered together as Kiel Area).

Preliminary analyses of the temperature curves (see Figures 5.1) show that the size fractions shape metabolic activity. In-depth analyses are ongoing, and point toward regional environmental forcing (e.g. comparisons between Bornholm Basin and Kiel Bight from previous years and cruises) 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.

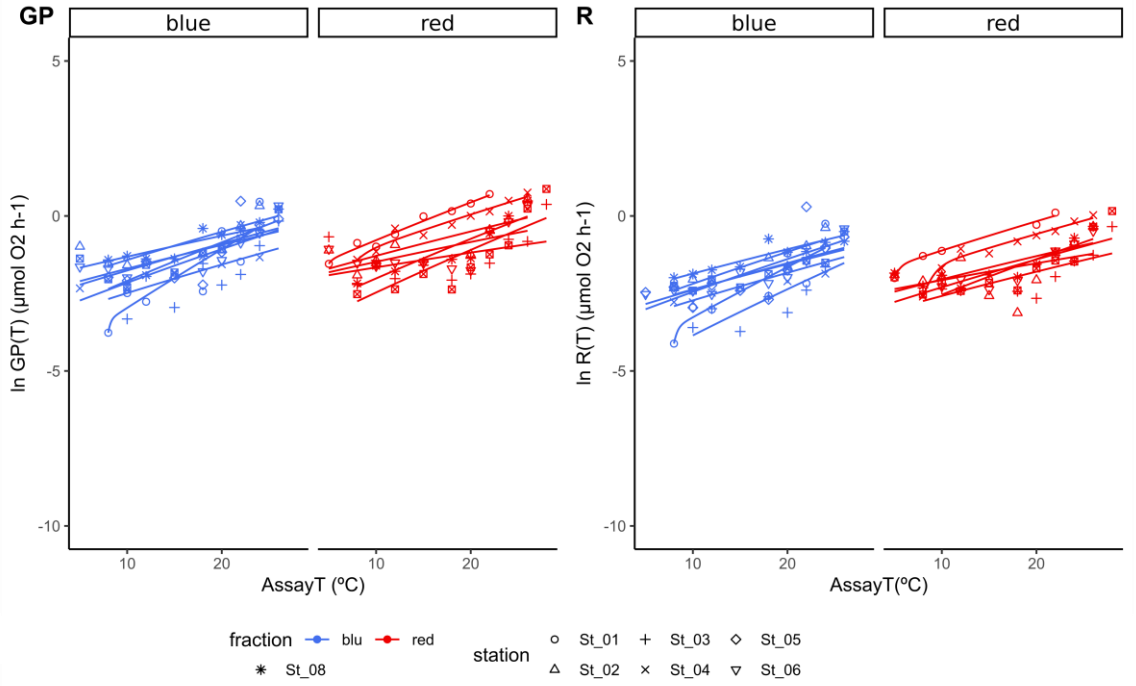

Figure 5.1: Temperature reaction norms from size fractioned on-board incubations of Kiel Bight across a temperature gradient (5° C up to 26° C). **Left panel** is for photosynthesis rates in µmol O_2 h^{-1}, and **right panel**, for respiration rates in µmol O_2 h^{-1}. Symbols denote different station, and the colours, as shown in the legend, characterize the different size fractions.

5.3 Ichthyo– and zooplankton sampling

(Margarethe Nowicki, Richard Klinger,
Institute for Marine Ecosystem and Fishery Science, Hamburg University)

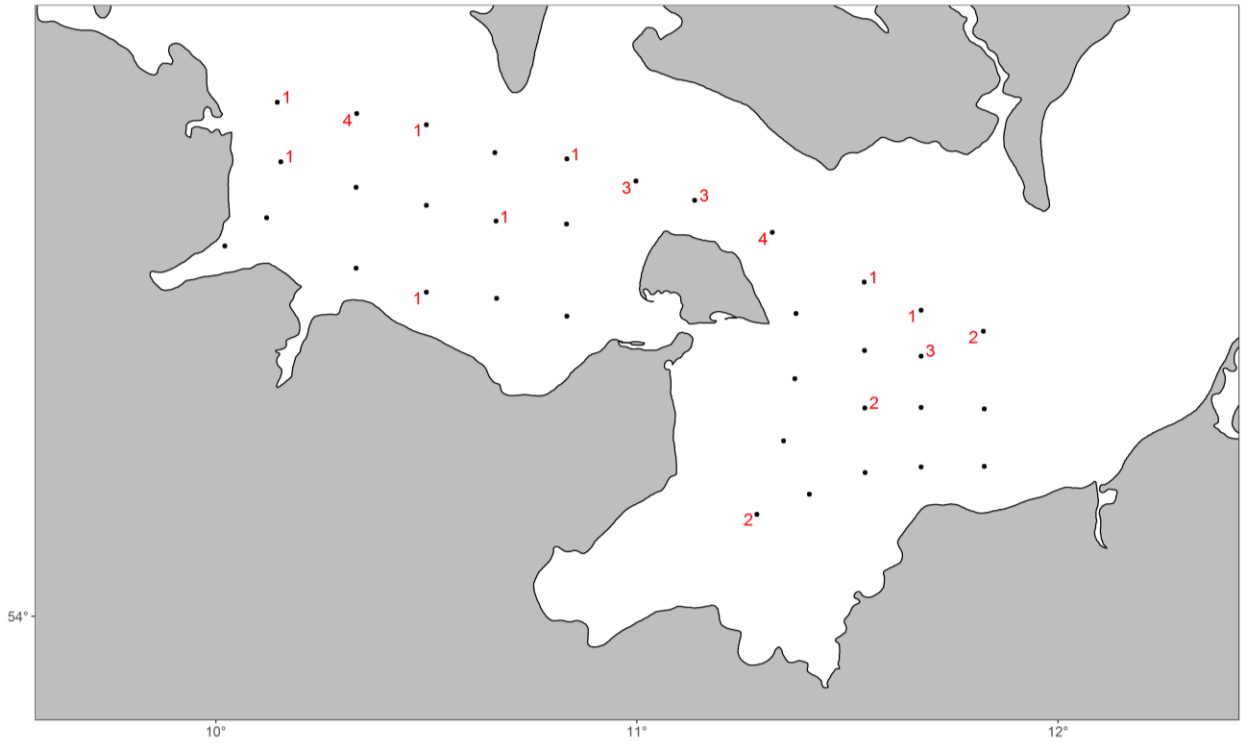

Figure 5.2: Overview of all processed bongo stations during AL551. Black dots represent bongo stations. Red numbers are the found cod larvae.

Bongo hauls and the spatial distribution of cod larvae are presented in Figure 5.2 Bongo hauls covered the Kiel Bight (16 hauls), the Fehmarn Belt (3 hauls) and the Mecklenburg Bight (16 hauls).
From all of the 500 µm Bongo samples larvae of sprat/herring (Clupeidae; n =50) and cod (*Gadus morhua*; n = 33) were picked and conserved at -80°C for subsequent RNA/DNA analyses (collaboration with Dr. Bastian Huwer, DTU Aqua). After the larvae were picked out, the remaining sample were conserved in 4 % buffered formal solution.

Additionally, three trawled Multinet MIDI hauls (335µm) were performed in the Kiel Bight, one in the Fehmarn Belt and five in the Mecklenburg Bight.
All of the 300 µm Bongo samples and the Multinet samples (335 µm) were conserved in 4 % buffered formol solution for the determination of species composition and abundance of zooplankton and ichthyoplankton in the laboratory.

5.4 Fishery

(Margarethe Nowicki, Richard Klinger,
Institute for Marine Ecosystem and Fishery Science, Hamburg University)

Fishery hauls were conducted in the Kiel Bight (3 hauls), Mecklenburg Bight (5 hauls), and Fehmarn Belt (1 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 AL551.

Latin name	Common name	n	mass (kg)
Sprattus sprattus	Sprat	18736	155,67
Clupea harengus	Herring	1348	11,36
Limanda limanda	Dab	444	62,78
Pleuronectes platessa	Plaice	411	181,63
Merlangius merlangus	Whiting	46	4,68
Platichthys flesus	Flounder	35	11,19
Gadus morhua	Cod	27	45,71
Gasterosteus aculeatus	Three-spined stickleback	10	0,01
Scophthalmus maximus	Turbot	5	2,15
Ammodytes marinus	Sandlance	3	0,02
Cyclopterus lumpus	Lumpsucker	1	1,98
	Total	21066	477,18

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, sex, maturity stage and gonad weight) and samples (otoliths, fin clip and stomach) were obtained for 23 individuals (juveniles are not included).
For whiting, single fish data (length, weight, liver weight, sex, maturity stage and gonad weight) and samples (otoliths and fin clip) were obtained for 34 individuals (juveniles are not included).
Individuals from cod and whiting with a total length smaller than 21 cm were only measured in length and weighed. All of these individuals were deep frozen and taken as a whole sample for later analysis in the laboratory.

Abundance distribution of all sampled cod and whiting are presented in Figure 5.3 and Figure 5.4.

Figure 5.3: Abundance distribution of sampled cod (n = 27, juveniles included) during AL551. Numbers and size of points indicated individuals caught per haul (not standardized on haul duration).

Figure 5.4: Abundance distribution of sampled whiting (n = 46, juveniles included) during AL551. Numbers and size of points indicated individuals caught per haul (not standardized on haul duration).

Compared to the previous years the total number of caught cod and whiting were very low. However, comparable to the small numbers of caught cod on the AL549. But this is not true for the numbers of whiting in the catches, which were almost a tenfold less than on the AL549.

5.4.1. Stomach samplings

Stomach samples of cod, whiting and sprat were sampled during the cruise. Stomach of gadoids will be analysed as part of the teaching module. The obtained stomach data will complement the western Baltic cod and whiting stomach data bases of the IMF and Thuenen Institute of Baltic Sea Fisheries, which date back to 2016 and 2015, respectively.
Sprat stomachs were preserved in formalin and stored at the University of Hamburg to complement the long-term series of Baltic Sea sprat stomachs established by Jens-Peter Herrmann.

5.4.2. Preliminary results of single fish sampling

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

Figure 5.5 and Figure 5.6 show the frequency of grouped maturity stages per 10 cm length class for female and males in each investigated area.
The observations for cod (Fig. 5.5) indicates that during the sampling time in both areas spawning cod (maturity stage 5 – 7) occurred. But this outcomes are not representative, because only a few individuals were caught.
Therefore, a comparison to cruises on previous years is omitted here.

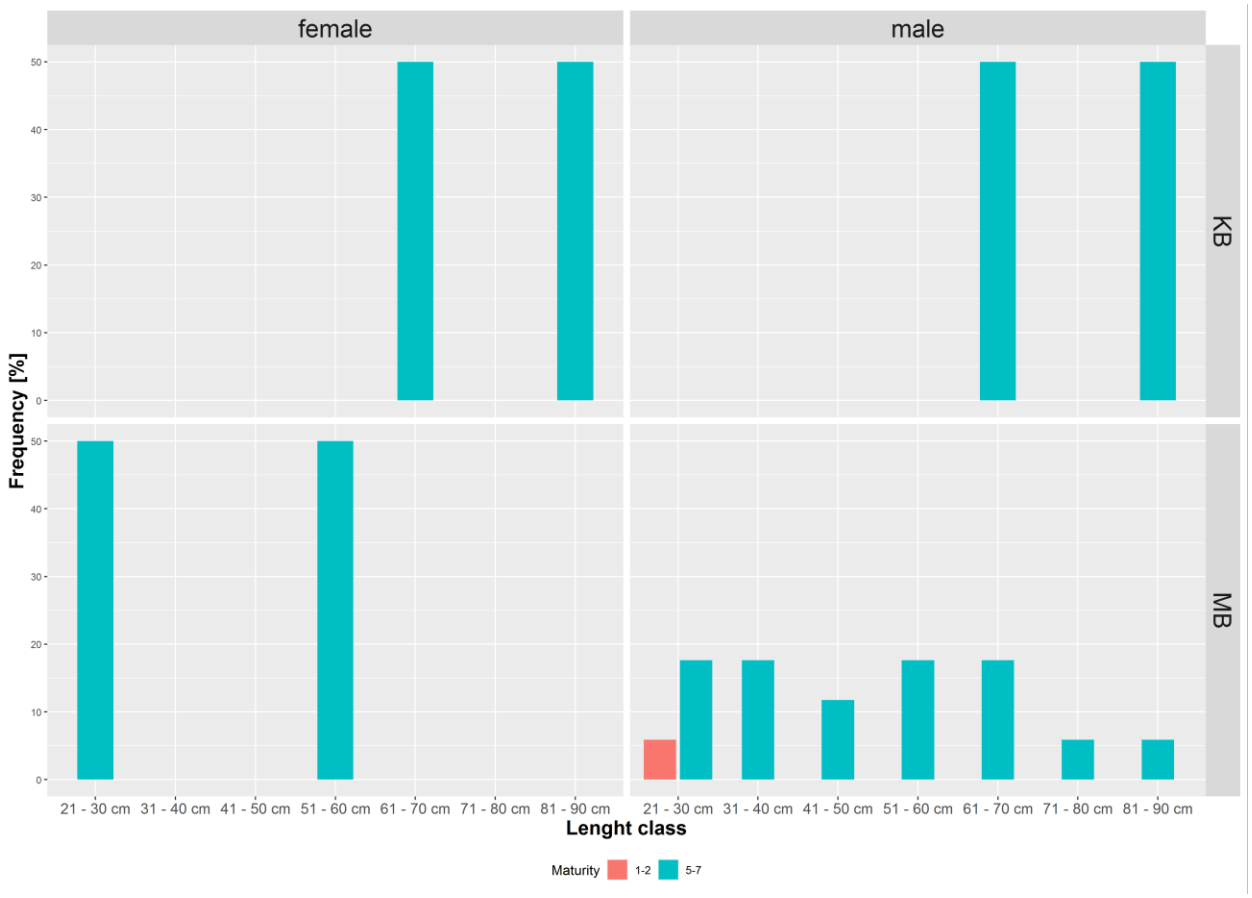

Figure 5.5: Relative frequency distribution in percent of the grouped maturity stages per 10 cm length class of individual sampled cod during AL551. Female and male cod in two different areas; KB = Kiel Bight, MB = Mecklenburg Bight. Red: Maturity stage 1-2 (juvenile and preparation); Green: Maturity stage 3-4 (maturation); Cyan: Maturity stage 5-7 (spawning); Purple: Maturity stage 8-9 (regeneration).

As show in Figure 5.6 mature whiting cod (maturity stage 5 – 7) individuals occurred in both research areas, in contrast to cod, whiting males and females occur in three different maturity stages. But this outcomes are likewise not representative, because only a few individuals were caught.

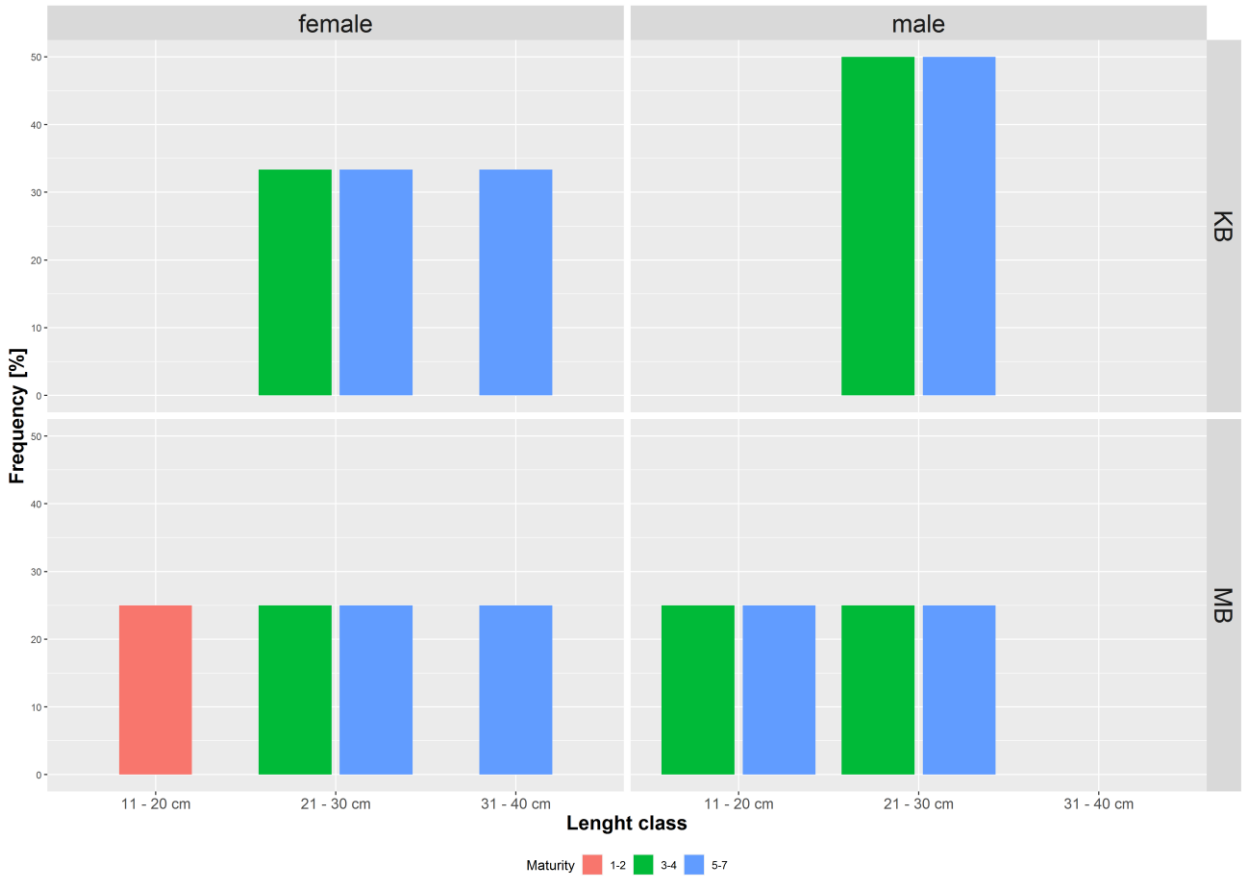

Figure 5.6: Relative frequency distribution in percent of the grouped maturity stages per 10 cm length class of individual sampled whiting during AL551. Female and male whiting in two different areas; KB = Kiel Bight, MB = Mecklenburg Bight. Red: Maturity stage 1-2 (juvenile and preparation); Green: Maturity stage 3-4 (maturation); Blue: Maturity stage 5-7 (spawning); Purple: Maturity stage 8-9 (regeneration).

As described in the Crusie Report from the AL549 the findings of spawning whiting in the Baltic Sea are known.

5.5 Hydrography

5.5.1. From the Bight of Eckernförde to Kadetrinne

As expected the water column was stratified (Fig. 5.7). At the surface the salinity (SALIN) ranged from 15 to 16 PSU. Near the bottom the salinity was higher 18 PSU to 24.5 PSU in the deeper parts of the transect. The temperature distribution (Temp) followed mostly that of the salinity. However in the more eastern part a first small temperature increase at the surface was observed as a result of intensifying radiation in spring time.
The oxygen distribution (AO2%) resulted in nearly saturated surface water masses along the transect. Near bottom the oxygen saturation was slightly depleted with lowest values around 60% where stronger salinity stratifications were observed in the deeper parts of Kiel Bight. Indicating that the water masses in these areas are of certain age.

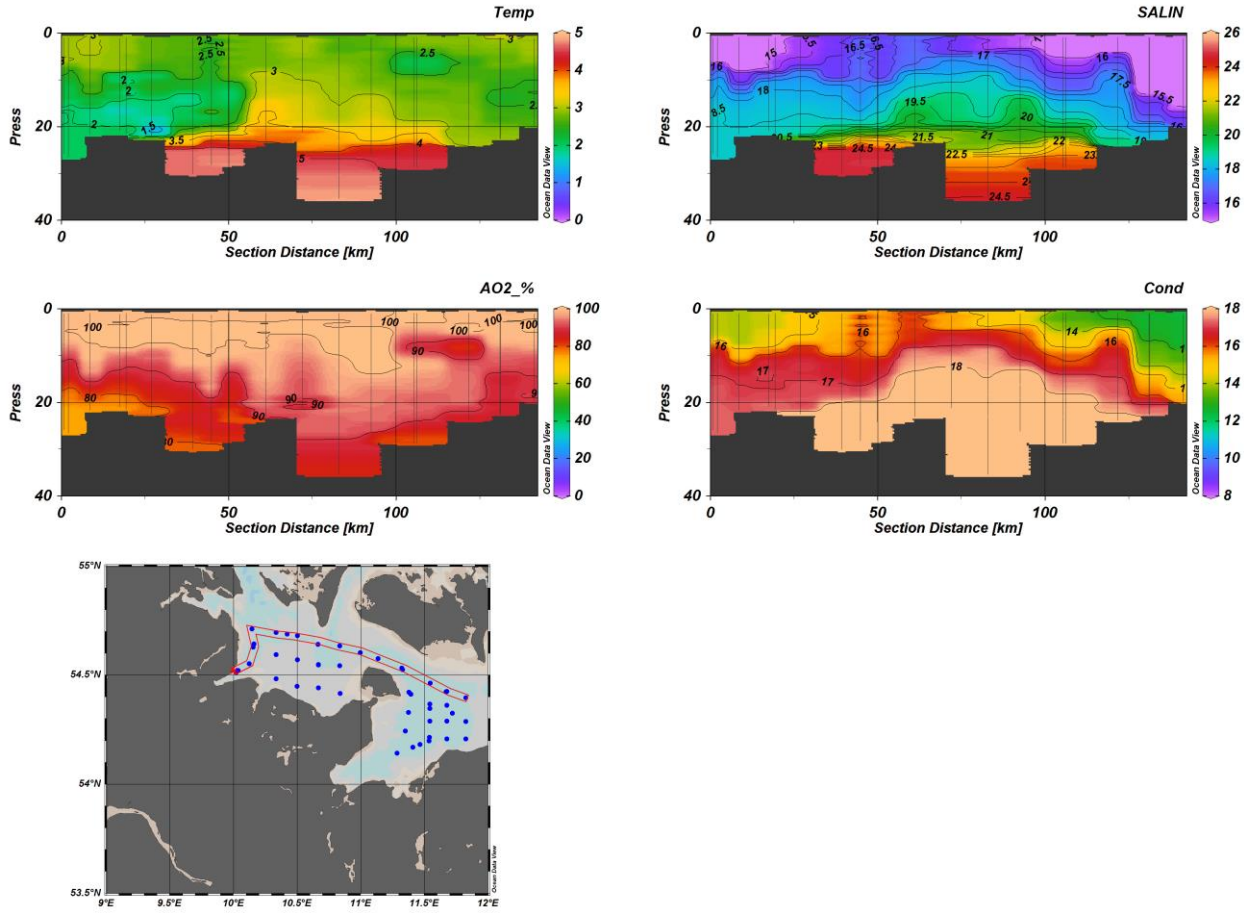

Figure 5.7: Station map and hydrographic isoplots of the AL551 along a transect from Bight of Eckernförde to Kadetrinne (Mecklenburg Bight).

6 Station List AL551

6.1 Overall Station List

Table 6.1: Start positions for all used gears are given (in actionlog 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]	
AL551_1-1	06.03	CTD	08:39	54° 30,828' N	010° 01,250' E	28	
AL551_1-2	06.03	WS	08:47	54° 30,819' N	010° 01,222' E	28	
AL551_1-3	06.03	Bongo	09:02	54° 30,738' N	010° 01,073' E	28	
AL551_1-4	06.03	MSN_5	09:18	54° 30,718' N	010° 01,177' E	28	
AL551_3-1	06.03	CTD	10:30	54° 31,319' N	010° 02,174' E	29	
AL551_3-2	06.03	Fish Net	10:45	54° 31,358' N	010° 02,329' E	28	
AL551_4-1	06.03	CTD	12:20	54° 33,187' N	010° 07,279' E	23	
AL551_4-2	06.03	WS	12:25	54° 33,149' N	010° 07,260' E	23	
AL551_4-3	06.03	Bongo	12:32	54° 33,158' N	010° 07,287' E	23	
AL551_5-1	06.03	Bongo	13:12	54° 37,804' N	010° 09,620' E	22	
AL551_5-2	06.03	CTD	13:20	54° 37,787' N	010° 09,284' E	23	
AL551_6-1	06.03	CTD	13:32	54° 38,595' N	010° 09,538' E	23	
AL551_6-2	06.03	Fish Net	13:44	54° 38,274' N	010° 10,606' E	23	
AL551_6-4	06.03	MSN_5	14:54	54° 38,550' N	010° 10,320' E	23	
AL551_7-1	06.03	Bongo	15:41	54° 42,733' N	010° 09,035' E	24	
AL551_7-2	06.03	CTD	15:51	54° 42,734' N	010° 08,730' E	24	
AL551_8-1	07.03	CTD	06:53	54° 41,743' N	010° 20,097' E	32	
AL551_8-2	07.03	WS	07:00	54° 41,745' N	010° 20,084' E	32	
AL551_8-3	07.03	Bongo	07:06	54° 41,731' N	010° 19,947' E	31	
AL551_9-1	07.03	CTD	07:35	54° 41,305' N	010° 25,245' E	30	
AL551_9-2	07.03	MSN_5	07:45	54° 41,260' N	010° 24,922' E	31	
AL551_9-3	07.03	Fish Net	08:32	54° 40,964' N	010° 28,282' E	32	
AL551_10-1	07.03	Bongo	10:06	54° 35,683' N	010° 20,206' E	17	
AL551_10-2	07.03	CTD	10:13	54° 35,716' N	010° 19,991' E	17	
AL551_11-1	07.03	CTD	11:00	54° 29,022' N	010° 19,999' E	20	
AL551_11-2	07.03	WS	11:07	54° 29,013' N	010° 20,003' E	20	
AL551_11-3	07.03	Bongo	11:14	54° 28,988' N	010° 19,962' E	20	
AL551_12-1	07.03	Bongo	12:00	54° 26,975' N	010° 30,104' E	17	
AL551_12-2	07.03	CTD	12:05	54° 26,987' N	010° 29,875' E	17	
AL551_13-1	07.03	CTD	12:55	54° 34,245' N	010° 30,012' E	19	
AL551_13-2	07.03	Bongo	12:59	54° 34,226' N	010° 29,956' E	19	
AL551_14-1	07.03	Bongo	13:42	54° 40,876' N	010° 30,389' E	26	
AL551_14-2	07.03	CTD	13:49	54° 40,866' N	010° 30,026' E	26	
AL551_15-1	07.03	CTD	14:30	54° 38,556' N	010° 39,797' E	25	
AL551_15-2	07.03	WS	14:34	54° 38,534' N	010° 39,811' E	24	
AL551_15-3	07.03	Bongo	14:39	54° 38,528' N	010° 39,794' E	24	
AL551_16-1	07.03	Bongo	15:18	54° 32,895' N	010° 40,212' E	21	
AL551_16-2	07.03	CTD	15:25	54° 32,900' N	010° 39,927' E	21	
AL551_17-1	07.03	CTD	16:07	54° 26,487' N	010° 40,052' E	19	
AL551_17-2	07.03	Bongo	16:13	54° 26,486' N	010° 39,972' E	19	

AL551_18-1	07.03	Bongo	16:56	54° 24,933' N	010° 50,573' E	12	
AL551_18-2	07.03	CTD	17:02	54° 24,966' N	010° 50,260' E	12	
AL551_19-1	08.03	CTD	06:57	54° 08,531' N	011° 17,130' E	26	
AL551_19-2	08.03	WS	07:04	54° 08,540' N	011° 17,121' E	26	
AL551_19-3	08.03	Bongo	07:10	54° 08,678' N	011° 17,231' E	26	
AL551_20-1	08.03	CTD	07:52	54° 10,943' N	011° 27,825' E	25	
AL551_20-2	08.03	MSN_5	07:59	54° 10,937' N	011° 27,630' E	24	
AL551_20-3	08.03	Fish Net	08:25	54° 10,393' N	011° 25,821' E	24	
AL551_21-1	08.03	Bongo	09:38	54° 10,264' N	011° 24,847' E	24	
AL551_21-2	08.03	CTD	09:46	54° 10,186' N	011° 24,576' E	24	
AL551_22-1	08.03	CTD	10:21	54° 11,992' N	011° 32,193' E	25	
AL551_22-2	08.03	Bongo	10:27	54° 12,060' N	011° 32,125' E	25	
AL551_23-1	08.03	CTD	10:41	54° 12,882' N	011° 32,266' E	25	
AL551_23-2	08.03	MSN_5	10:49	54° 12,791' N	011° 32,103' E	25	
AL551_23-3	08.03	Fish Net	11:27	54° 12,802' N	011° 31,797' E	25	
AL551_24-1	08.03	Bongo	13:06	54° 12,407' N	011° 40,111' E	26	
AL551_24-2	08.03	CTD	13:14	54° 12,483' N	011° 40,497' E	26	
AL551_25-1	08.03	CTD	13:50	54° 12,525' N	011° 49,475' E	21	
AL551_26-1	08.03	Bongo	13:52	54° 12,529' N	011° 49,464' E	21	
AL551_27-1	08.03	Bongo	14:24	54° 17,117' N	011° 49,620' E	24	
AL551_27-2	08.03	CTD	14:31	54° 17,325' N	011° 49,510' E	24	
AL551_28-1	08.03	CTD	15:10	54° 23,803' N	011° 49,434' E	22	
AL551_28-2	08.03	Bongo	15:16	54° 23,792' N	011° 49,326' E	22	
AL551_29-1	08.03	Bongo	15:48	54° 25,551' N	011° 40,878' E	25	
AL551_29-2	08.03	CTD	15:56	54° 25,526' N	011° 40,467' E	25	
AL551_30-1	08.03	CTD	16:31	54° 27,833' N	011° 32,634' E	26	
AL551_30-2	08.03	Bongo	16:38	54° 27,746' N	011° 32,626' E	26	
AL551_31-1	09.03	Bongo	06:59	54° 22,238' N	011° 32,044' E	25	
AL551_31-2	09.03	CTD	07:06	54° 22,111' N	011° 32,433' E	25	
AL551_32-1	09.03	CTD	07:21	54° 20,881' N	011° 32,491' E	25	
AL551_32-2	09.03	MSN_5	07:27	54° 20,761' N	011° 32,621' E	25	
AL551_32-3	09.03	Fish Net	08:04	54° 20,923' N	011° 32,536' E	25	
AL551_33-1	09.03	Bongo	09:40	54° 21,908' N	011° 40,284' E	26	
AL551_33-2	09.03	CTD	09:48	54° 21,696' N	011° 40,516' E	26	
AL551_34-1	09.03	CTD	10:40	54° 19,574' N	011° 43,088' E	26	
AL551_34-2	09.03	MSN_5	10:46	54° 19,573' N	011° 43,207' E	26	
AL551_34-3	09.03	Fish Net	11:29	54° 19,087' N	011° 42,572' E	26	
AL551_35-1	09.03	CTD	13:26	54° 17,420' N	011° 40,574' E	26	
AL551_35-2	09.03	WS	13:31	54° 17,426' N	011° 40,599' E	26	
AL551_35-3	09.03	Bongo	13:36	54° 17,417' N	011° 40,557' E	26	
AL551_36-1	09.03	Bongo	14:07	54° 17,423' N	011° 32,759' E	25	
AL551_36-2	09.03	CTD	14:14	54° 17,405' N	011° 32,426' E	25	
AL551_37-1	09.03	CTD	14:59	54° 14,694' N	011° 20,894' E	21	
AL551_37-2	09.03	Bongo	15:05	54° 14,751' N	011° 20,862' E	21	
AL551_38-1	09.03	Bongo	15:36	54° 19,640' N	011° 22,204' E	22	
AL551_38-2	09.03	CTD	15:42	54° 19,802' N	011° 22,426' E	22	
AL551_39-1	09.03	CTD	16:58	54° 25,425' N	011° 40,162' E	25	
AL551_39-2	09.03	Bongo	17:05	54° 25,466' N	011° 39,972' E	25	
AL551_40-1	10.03	CTD	06:54	54° 24,779' N	011° 23,587' E	23	
AL551_40-2	10.03	MSN_5	07:00	54° 24,876' N	011° 23,608' E	23	

AL551_40-3	10.03	Fish Net	07:43	54° 25,028' N	011° 23,735' E	23	
AL551_41-1	10.03	CTD	08:53	54° 25,324' N	011° 22,659' E	21	
AL551_41-2	10.03	WS	08:59	54° 25,327' N	011° 22,681' E	21	
AL551_41-3	10.03	Bongo	09:05	54° 25,331' N	011° 22,607' E	21	
AL551_42-1	10.03	Bongo	09:46	54° 31,996' N	011° 18,788' E	31	
AL551_42-2	10.03	CTD	09:56	54° 31,958' N	011° 19,292' E	31	
AL551_43-1	10.03	CTD	10:42	54° 31,575' N	011° 19,643' E	31	
AL551_43-2	10.03	MSN_5	10:49	54° 31,560' N	011° 19,838' E	31	
AL551_43-3	10.03	Fish Net	11:22	54° 31,577' N	011° 19,737' E	31	
AL551_44-1	10.03	Bongo	13:33	54° 34,665' N	011° 07,718' E	28	
AL551_44-2	10.03	CTD	13:41	54° 34,619' N	011° 08,180' E	28	
AL551_45-1	10.03	CTD	14:17	54° 36,236' N	010° 59,796' E	37	
AL551_45-2	10.03	WS	14:24	54° 36,250' N	010° 59,817' E	37	
AL551_45-3	10.03	Bongo	14:28	54° 36,246' N	010° 59,823' E	37	
AL551_46-1	10.03	Bongo	15:09	54° 38,236' N	010° 49,815' E	23	
AL551_46-2	10.03	CTD	15:16	54° 38,064' N	010° 50,030' E	23	
AL551_47-1	10.03	CTD	15:55	54° 32,659' N	010° 50,069' E	22	
AL551_47-2	10.03	Bongo	16:01	54° 32,638' N	010° 50,004' E	21	
AL551_48-1	10.03	Bongo	16:40	54° 33,075' N	010° 39,720' E	21	
AL551_48-2	10.03	CTD	16:47	54° 32,905' N	010° 39,909' E	21	
AL551_49-1	12.03	Bongo	08:11	54° 20,307' N	010° 09,923' E	14	Calibration
AL551_50-1	12.03	Bongo	08:37	54° 19,570' N	010° 08,970' E	13	Calibration

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 her 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 her 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).

8 Acknowledgements

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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