ALKOR-Berichte

Bachelor MARSYS education cruise in the Baltic Sea

Cruise No. AL569

2nd of March 2022-6th of March 2022,
Kiel (Germany)
MARSYS

Dr. Luisa Listmann, Dr. Steffen Funk, Richard Klinger

Dr. Luisa Listmann
IMF Institute for Marine Ecosystem and Fishery Science

2022

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1 Cruise Summary

1.1 Summary in English

This cruise was 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.

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, Mecklenburg Bight, Arkona and Bornholm Basin.

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.

All necessary educational content could be taught and despite unforeseen Covid 19 conditions and the resulting changes in the cruise program, some sample and data material could be col-lected. The analysis of the data will be partly done in the form of module theses as well as in the context of doctoral theses.

1.2 Zusammenfassung

Diese Ausfahrt wurde 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.

Hauptziel dabei war die Untersuchung der Verteilungsmuster bestimmter Fischarten wie dem Dorsch, Wittling, Sprotten und Heringen in der Kieler Bucht, der Mecklenburger Bucht, des Arkona und des Bornholm Beckens.

Neben der Fischerei und hydrologischen Untersuchungen wurden entlang der Reiseroute Planktonstationen beprobt, um Einblicke in die räumliche Verteilung, Zoo- und Ichthyoplankton und Fischeiern, sowie der Primärproduktion von Phytoplankton zu gewinnen.

Es konnten alle benötigten Lehrinhalte vermittelt werden und trotz widrigen Covid-19 Bedingungen und der dadurch bedingten Änderung des Fahrprogrammes konnte Proben- und Datenmaterial gesammelt werden. Die Auswertung der Daten erfolgt zum Teil in Form von Modulabschlussarbeiten, wie auch in Rahmen von Doktorarbeiten.

2 Participants

2.1 Principal Investigators

Name	Institution
Luisa Listmann, Dr.	IMF

2.2 Scientific Party

Name	Discipline	Institution
Listmann, Luisa, Dr.	Chief scientist	IMF
Klinger, Richard	PhD student	IMF
Plonus, René-Marcel	PhD student	IMF
Funk, Steffen, Dr.	PostDoc	IMF
Janssen, Tobias	Technical Assistant	IMF

6 Students from Bachelor Program 1st and 3rd semester	IMF

2.3 Participating Institutions

IMF Institute for Marine Ecosystem and Fishery Science, Hamburg

3 Research Program

3.1 Description of the Work Area

The spatial focus lies on the Western Baltic Sea. This cruise included collecting samples from all major compartments of the ecosystem, from coastal to open waters in a 3-dimensional distribution.

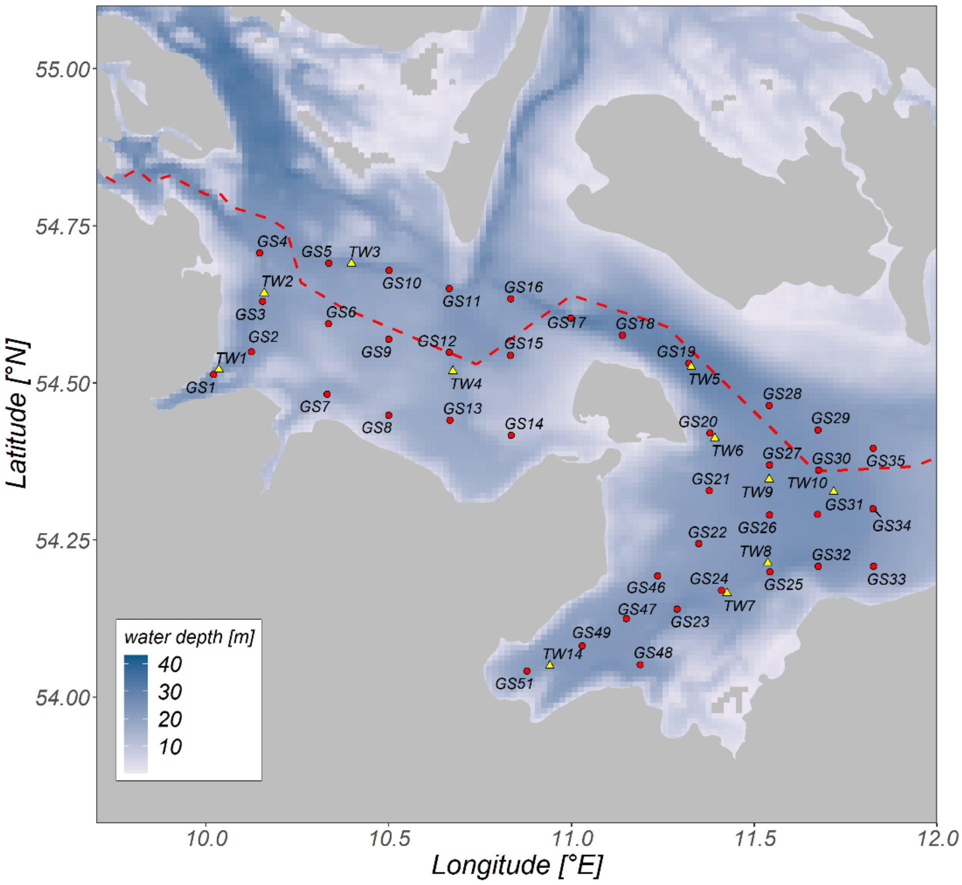

Fig. 3.1.1 Overview map indicating sampling stations of the cruise AL 569. Red dots indicate plankton grid stations (GS). Yellow triangles indicate trawl and multinet stations (TW). Dashed red line indicates EEZ borders. Positions per Gear that were realized during the cruise are given in Table 6.1

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 in the system of the Baltic, cod (Gadus morhua), herring (Clupea harengus) and sprat (Sprattus sprattus). 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.

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).

3.2 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 relation to environmental conditions.

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.

Above all we teach the scientific work following the "Declaration of Responsible Research" as well as to the "Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas of the OSPAR Maritime Area" issued by OSPAR, the Commission protecting and conserving the North-East Atlantic and its resources.

3.3 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 is 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.

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.

4 Narrative of the Cruise

The FS ALKOR departed on schedule on Wednesday 2nd of March 2022 at 8 am. First CTD hauls and plankton samples (bongo and multi-net samples) as well as two first fishery hauls were conducted in the Bay of Kiel near Eckernförde. Due to a damaged fishing net, no fishing could be conducted during the rest of the week. In order to collect data on the condition, length and maturity distribution of the western Baltic cod, it was decided to carry out fishing samples at selected positions until the repaired net came back on board on Saturday. The calm weather until Saturday resulted in good working conditions, so that all planned plankton grid stations in the Mecklenburg and Kiel Bight (Figure 3.3.1, GS red dots) could already be carried out (Tab. 4.1). The order of the plankton station deviated from the original planning, because shooting operations made it possible to enter the Todendorf shooting area only until 8 a.m. on weekdays and the fishing net was brought to Warnemünde for repair. It was therefore decided to steam into the Mecklenburg Bight after the first bongo stations in the Kiel Bight. The work in the Mecklenburg Bay could already be completed on Thursday evening. First fishing stations were made at the Black Ground and on wrecks in the northern Mecklenburg Bight close to the Fehmarn Belt. On Thursday evening, the ALKOR then steamed towards Howachter Bucht, where station work was then resumed on Friday morning. During Friday, the ALKOR worked its way north from Howachter Bucht and then toward the Fehmarn Belt. In the northern Howachter Buchtt fishing stations at wrecks were approached. At night the ALKOR steamed into the south-western Mecklenburg Bay.

On Saturday morning the last Bongo-Grid stations in Mecklenburg Bay were done. Unfortunately, thereafter positive Covid cases were detected on Board and the trip had to be cancelled early.

5 Preliminary Results

5.1 Underway Hydroacoustics and Gear Deployment

During the whole cruise the EK60 was running and in Fig. 5.1.1A the cruise track over the whole cruise is shown.

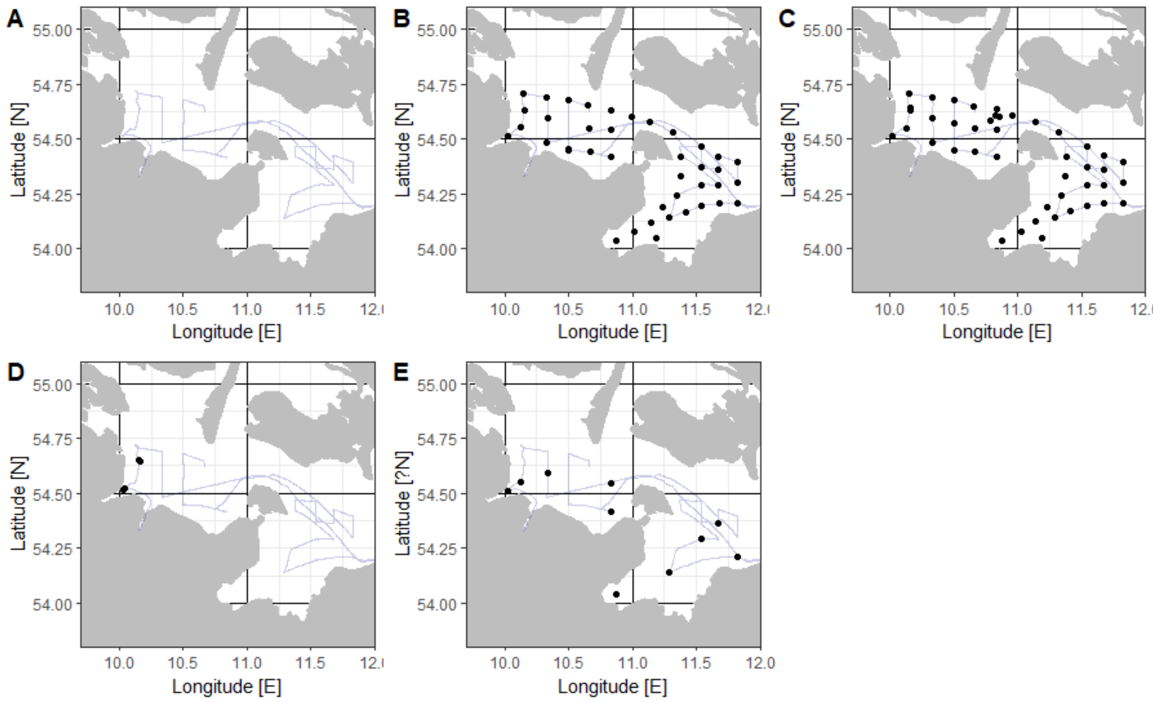

Fig. 5.1.1 Cruise track maps with station overview of the different deployed equipment. Panel a shows the cruise track, panel b Bongo stations, panel c CTD stations, panel D fisheries stations and panel e the shipwreck angling stations.

A detailed list of gear deployments (Table 5.1), the station list (Table 6.1), and an overview of first scientific results are provided below.

Table 5.1 Overview of gear deployment. Mesh sizes are given in brackets.

Gear	**Total**
ADM-CTD vertical	46
Watersampler (Niskin Bottle)	10
Bongo (150µm ,335µm, 500µm)	40
Pelagic fishery trawl	2
Fishing at wrecks	5
Total	103

5.2 Water and Plankton Sampling with CTD/Rosette

5.2.1 CTD Measurements

From East to West we found a gradient in salinity (Fig. 5.2.1 top panel): in the Western Kiel Bight there were the highest salinities measured at ca. 20 PSU whereas towards the Eastern Mecklenburg Bight we measured the lowest salinities at around 10 PSU. Due to strong storms in the weeks before the cruise we find that the water body was well mixed. This could be seen via the temperature and oxygen profiles that were fairly even throughout (Fig. 5.2.1. bottom middle and right panel).

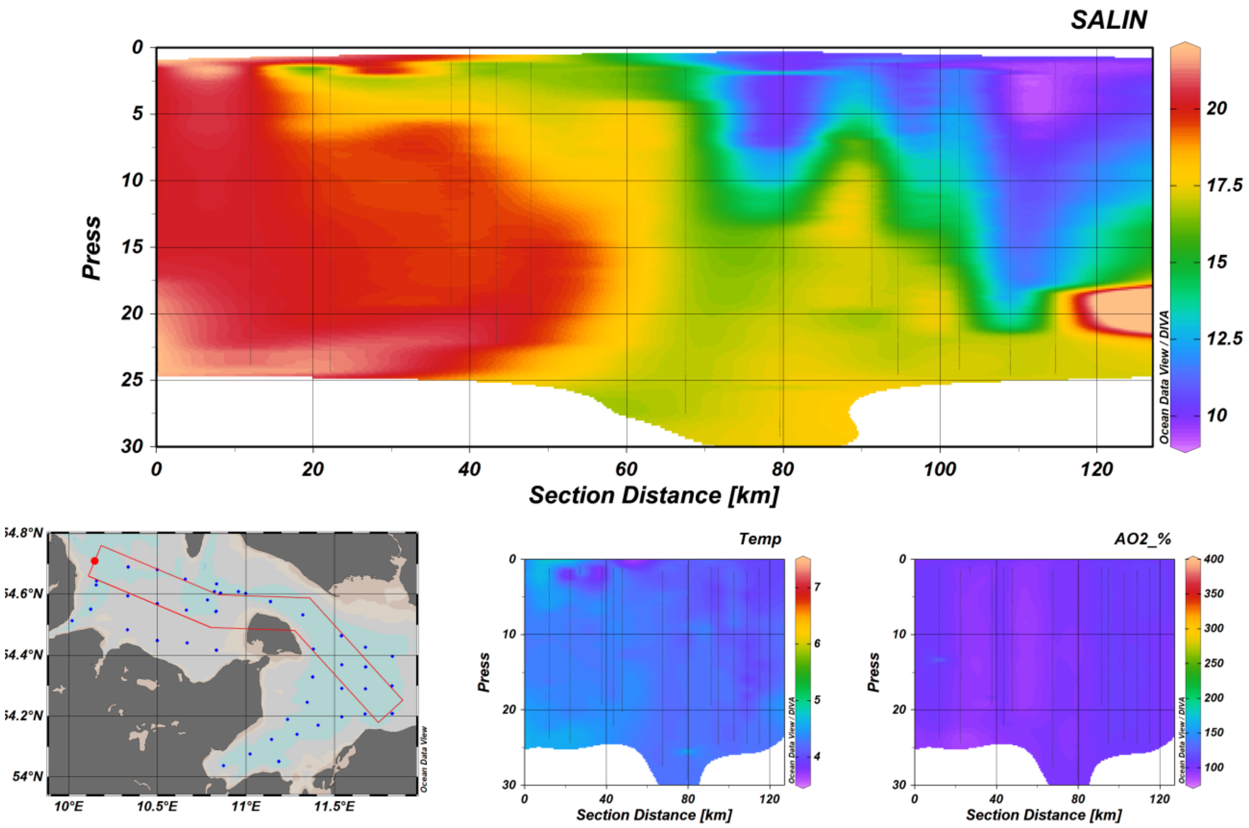

Fig. 5.2.1 Station map and hydrographic isoplots of the cruises AL5690 along a transect (bottom left panel) from Kiel Bight to Mecklenburg Bight. The top shows the salinity measurements. The bottom row shows the temperature and oxygen measurements (middle and right panel, respectively)

5.2.2 *Ostreococcus* and Virus Isolation From the Baltic Sea

As part of this ongoing project on the ecological and evolutionary effects of different temperatures and salinities in the Baltic Sea on host-virus dynamics of *Ostreococcus* and its viruses, we aim to answer the following questions: From which regions of the Baltic Sea can we isolate *Ostreococcus* sp. and its associated viruses° And, subsequently, how do the viral dynamics differ between the origins of the hosts and viruses.

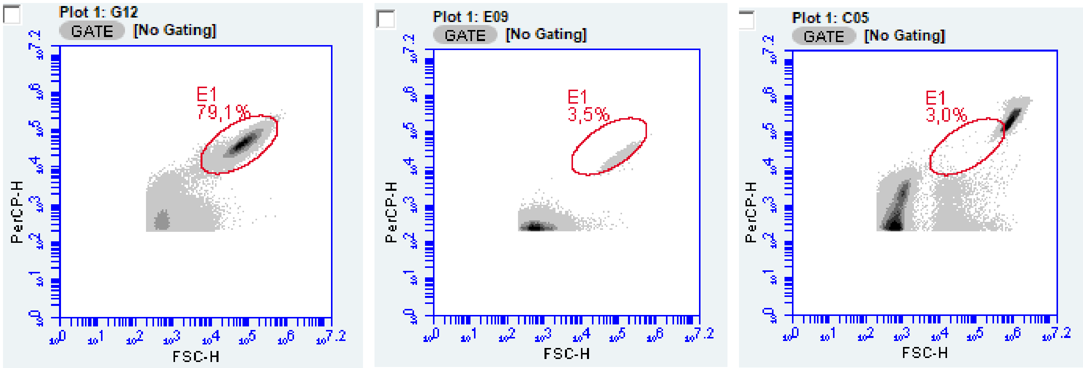

Fig. 5.2.2 Cytometric analysis of a potential Ostreococcus isolate after isolation by dilution. The left panel shows an identified Ostreococcus strain, the middle panel shows an isolate that may potentially be Ostreococcus and the right panel shows an isolate that is no Ostreococcus.

To answer these questions, we took surface water samples at 10 stations along the cruise track of AL569. On board, water samples of two size fractions (0.2-2µm and <0.45µm) were collected to isolate picoplankton and viruses, respectively, back in the laboratory at the IMF in Hamburg. The 10 stations were divided into Kiel Bight (6 stations) and Mecklenburg Bight (4 stations.

From water samples taken on previous cruises (2018 and 2019) we have already successfully isolated 24 new strains of Ostreococcus sp.. However, success was mainly restricted to water samples form Spring or Autumn cruises. First results on the isolations show potential Ostreococcus in 3 of the 10 stations (Fig. 5.2.2).

Previously, viral isolations of Ostreococcus viruses have also been highly successful yielding ca. 80 new viral strains from water samples ranging from the Kiel Bight up to the Bornholm Basin (water samples from cruises in 2018, 2019, 2020). Since virus isolations take months we have not yet isolated new virus strains from water samples taken on AL569. However, first results show, that viruses are present in the water samples collected on board AL569 (Fig. 5.2.3). With previous high success rates, we are confident, that also from water samples of the latest cruise, we will successfully isolate new virus strains.

Both virus and host strains from Ostreococcus will then be used for investigation of infection dynamics in relation to geographical distribution over the Baltic Sea and environmental change that include temperature and salinity changes.

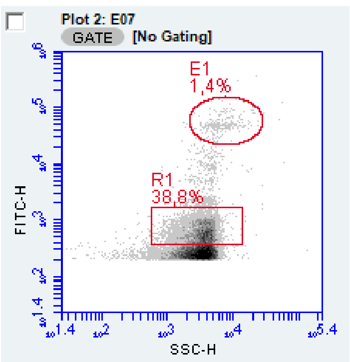

Fig. 5.2.3 Cytometric analysis of concentrated water sample from the cruise. It shows that in the water sample from the cruise a virus signal (R1) is present and isolation success is therefore likely. The population in E1 represents bacteria in the water sample.

5.2.3 Primary Productivity of Phytoplankton Communities

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 short-term physiological response of picoplankton to temperature and salinity differ between samples from different regions of the Baltic Sea°

To help answer these questions, we took surface water samples at 4 stations along the cruise track of AL569. On board, we measured photosynthesis and respiratory activity of two different size fractions (0.2-2 µm and 0.2-37.5 µm) immediately after sampling, and assessed these responses over a gradient of salinity and temperature. The 4 stations were divided into Kiel Bight (3 station), Mecklenburg Bay (1 station).

Preliminary analyses of the temperature curves (see Figure 5.2.4) show that the size fractions differ in their metabolic activity, but also point to differences between different regions along the salinity gradient of the Baltic Sea. In-depth analyses are ongoing, and point toward regional environmental forcing (e.g. comparisons between Mecklenburg and Kiel Bight) having an impact on par with that of seasonal forcing (e.g. comparisons between spring and summer). Our results suggest that while populations from either region can swiftly adjust their metabolic profiles along gradients of environmental change, the underlying mechanisms differ.

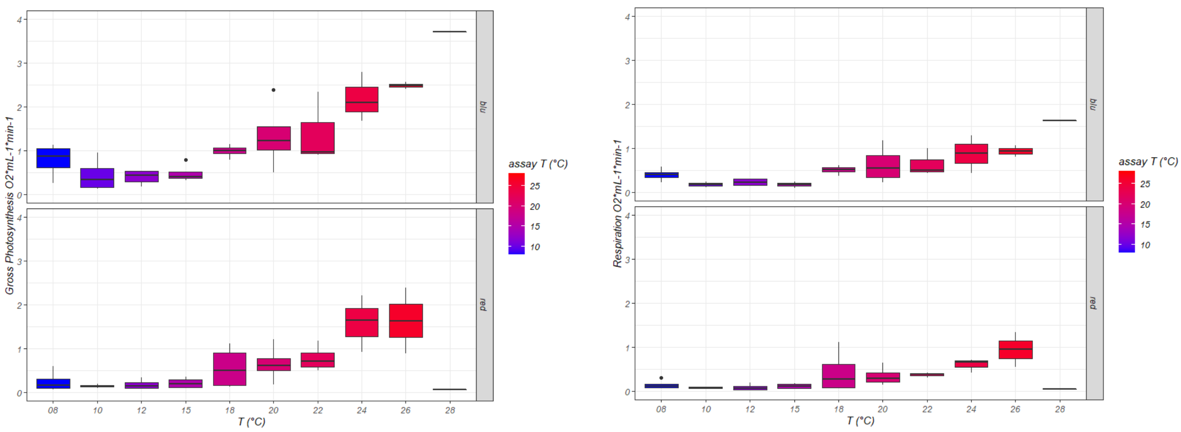

Fig. 5.2.4 Gross photosynthesis (left panel) and Respiration (right panel) rates of the two size fractions (blu <2µm, red <35.7µm) measured at different temperatures (colors indicate assay temperature). Respiration rates are generally lower than Photosynthesis indicating net primary production in the communities analysed.

5.3 Fishery

(Steffen Funk and Richard Klinger, IMF)

A total of 2 trawl hauls and 5 rod and reel fishery hauls were conducted during cruise AL569 (Fig. 5.4.1). The main target of fishing operations during AL569 were adult cod for subsequent staging of individuals as well as to collect biological parameters length, weight and condition. This data should be used for subsequent comparison with data from previous cruises (e.g., see Nowicki et al., 2021) to give insights on potential long- or short-term changes in biological parameters. They will be analyzed as a part of the newly established program for the monitoring of the winter-spawning activity of western Baltic cod. This monitoring campaign aims to track potential changes in spawning phenology of the stock (see Funk and Möllmann, 2021, 2022) and is conducted by the University of Hamburg in cooperation with the Danish Technical University (DTU Aqua), GEOMAR and the University of Aarhus.

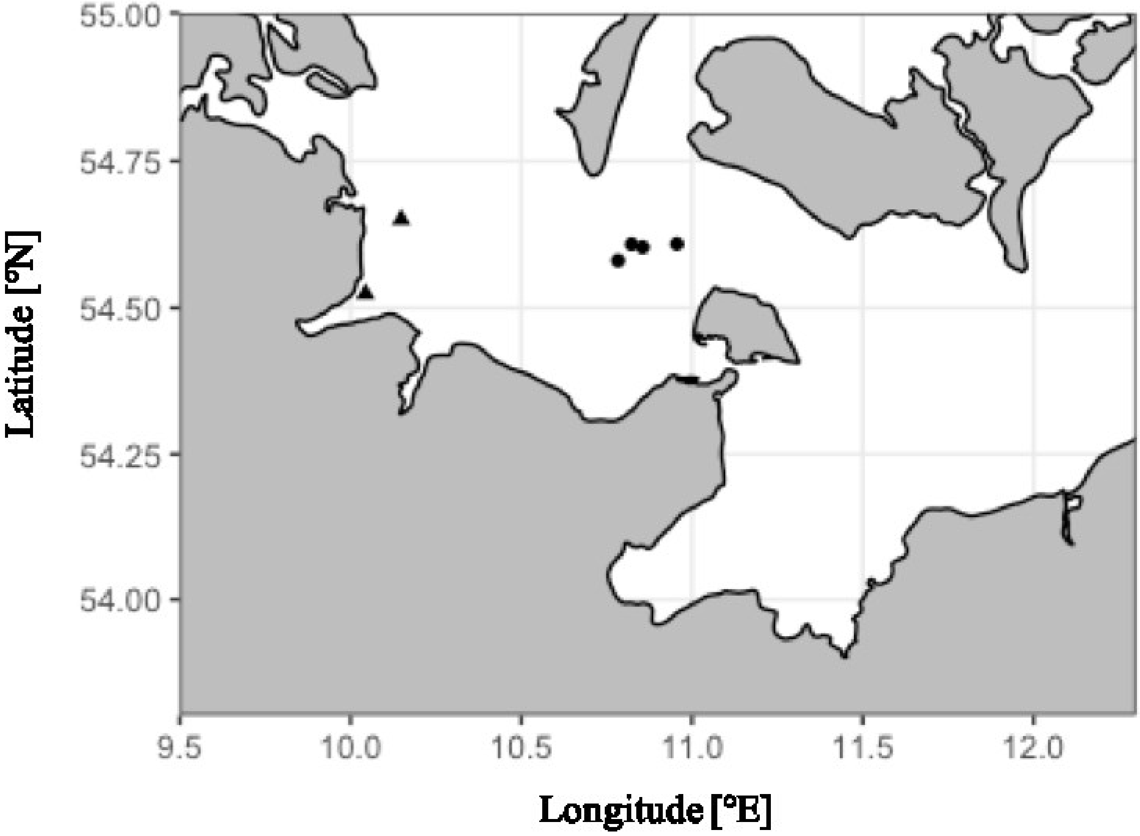

Fig. 5.3.1 Map of the study area indicating fishing positions of AL569 where cod were caught (triangles = bottom trawl hauls, and dots = rod and reel fishery hauls).

Initially, it was planned to use mainly trawl gear for fishing during AL569. It was intended to fish at least trawl at 10 different stations within the Belt Sea, which have been already sampled during previous cruises (e.g., in 2021 [see Funk and Möllmann, 2021]) and which are known spawning grounds of western Baltic cod. However, during the second trawl, the trawl was accidentally damaged by the capture of military gear (i.e., an old parachute), so we were unable to continue trawling. Instead, it was decided to conduct rod and reel fishery hauls, which have been already proven as a relatively successful and selective sampling method for cod during previous cruises in January and February 2022 (e.g., AL568b and AL568c [see Funk and Möllmann, 2022; Funk, 2022]).

Cod catches

In total a number of 36 cod individuals with a total weight of 32.716 kg were caught during AL569. During the two conducted trawl hauls a total of 12 different fish species were caught with a total weight of 164.167kg (see Tab. 5.2 and 5.3) including a total number of 9 cod with 11.909

kg. During rod and reel fishery only cod were caught (see Tab. 5.3) with a total number of 27 individuals with a total weight of 20.807 kg.

In general, it has to be noted, cod catches made in 2022 have been considerably low compared to catches in previous years (with exception of 2021 when cod catches have been ever lower than in 2021). However, the small number of cod caught during AL569 fits well to the poor stock status of the western Baltic cod, which is at present considered to be at a historic low level (ICES, 2021).

Table 5.2 Total trawl catches during AL569 per species.

Species	Total weight [kg]	Total number
Cod (*Gadus morhua*)	11.909	9
Herring (*Clupea harengus*)	12.550	274
Sprat (*Sprattus sprattus*)	2.480	156
Common dab (*Limanda limanda*)	30.02	478
Plaice (*Pleuronectes platessa*)	101.28	1040
European Flounder (*Platichthys flesus*)	4.666	15
American Plaice (*Hippoglossoides platessoides*)	0.109	1
Lemon sole (*Microstomus kitt*)	0.328	1
Snakeblenny (*Lumpenus lampretaeformis*)	0.006	1
Sand goby (*Pomatoschistus* spp.)	0.006	3
Whiting (*Merlangius merlangus*)	0.765	36

Table 5.3 Total cod catches during AL569 per gear (TW = Bottom trawl TV3/520, and RF = rod and reel fishery) and station and area (FB = Fehmarn Belt, KB = Kiel Bight, and MB = Mecklenburg Bight).

Station	Haul	Area	Gear	Total number	Weight [kg]
1	1	KB	TW	8	11.810
4	2	KB	TW	1	0.099
	1	MB	RF	0	0.000
35	2	KB	RF	10	6.717
36	3	KB	RF	12	10.754
37	4	KB	RF	1	0.390
38	5	FB	RF	4	2.946

Cod lengths varied between 9 and 102 cm. Catches of cod < 10 cm, were relatively surprising since these small cod had been absent in previous winter cruises conducted by the University of Hamburg in the study area (smallest cod individuals caught during previous winter cruises (i.e., back to 2016) had been 12 cm). Otolith analyses should provide information on whether these individuals are extremely slow-growing individuals from 2021 or extremely late spawned specimens. Highest number of cod individuals were observed in length classes 31-40 cm and 41-50 cm (Fig. 5.3.2a).

For a first analysis of the cod catch composition data, we decided to estimate the age of the cod in order to obtain first estimates of age-specific biological parameters. For age assignment, we used the recently published VGBF parameters of McQueen et al. (2019) and calculated age-specific lengths. Age assignment was then made as follows: < 25 cm = age 1; 26-38 = age 2; 39-49 cm = age 3; 50-60 cm = age 4; 61-70 cm = age 5; 71-79 cm = age 6; 80-87 cm = age 7; 88-94 cm = age 8; 95-100 cm = age 9; and 101-106 cm = age 10.

According to this approach the ages of cod caught during AL569 varied between 1 and 10, with most of the cod belonging to age class 3 (N = 11), followed by age class 2 (N = 10) and 1 (N = 9) (Fig. 5.3.2b). Most of the cod were observed to be in spawning stage (N = 20). However, a surprisingly high number of cod were observed in preparation, resting and skip-spawning stage (i.e., cod in maturity stages II and IX following the maturity staging manual by Tomkiewicz et al., 2002) (N = 8). Furthermore, the observation of these cod which will not spawn in winter and spring 2022 was not limited to the younger age classes. Even in estimated age class 10 we observed gonads in resting or skip-spawning stage (i.e., stage IX).

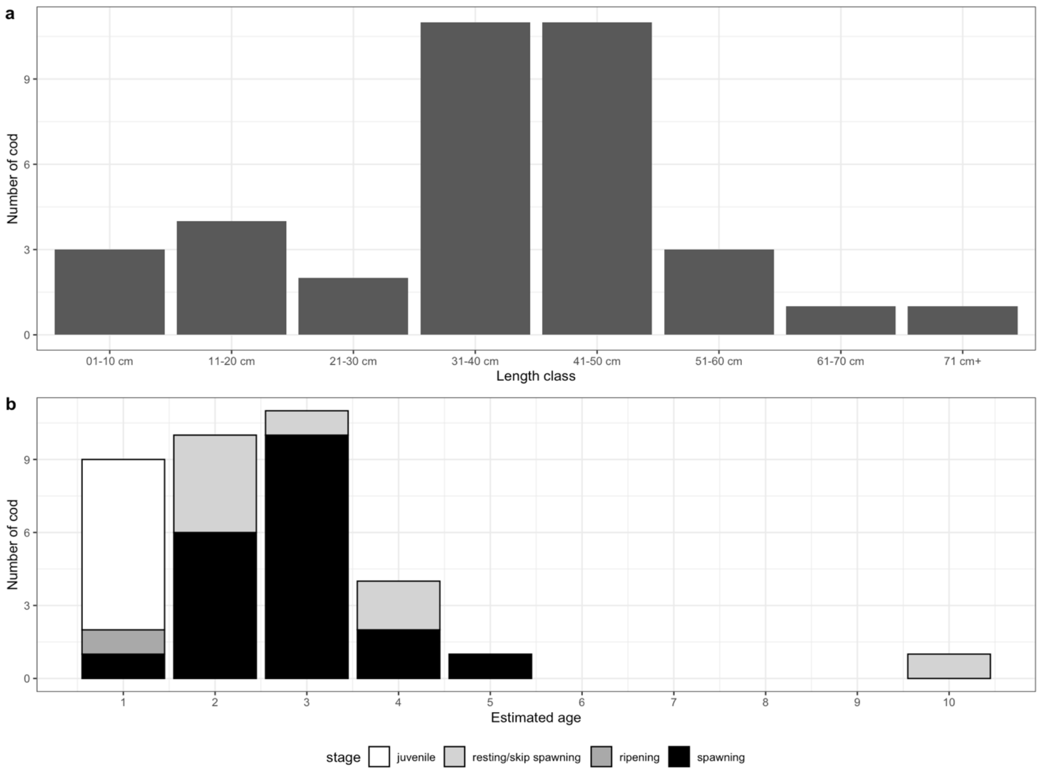

Fig. 5.3.2 Catch composition of cod caught during rod and reel and trawl fishery during AL569. In a: catch composition by 10 cm length class. In b: cod maturity stages per estimated age class.

This observation during AL569 of a considerable high proportion of individuals in resting and/or skip spawning stage, is consistent with observations made during earlier trips this year (i.e., in January and February [see Funk and Möllmann, 2022; Funk, 2022]). During these two previous trips, cod were also caught during rod and reel fishery and mostly on wreck sites. Funk and Möllmann (2022) hypothesized that the comparatively high proportions of non-spawning individuals (see Fig. 5.3.3 & Fig. 5.3.4) could be attributed to the different area coverages of the classical trawl fishery during previous year and the rod and reel fishery in 2022 (See Funk and Möllmann, 2022).

While cod fishing using rod and reel fisheries were conducted on hard grounds, which can be considered the typical feeding grounds of cod in the area, trawl fishing is limited to trawlable grounds (i.e., soft bottom areas) which are mostly located in the deeper channels of the Belt Sea in depth deeper than 20 m. These deeper channels are known spawning grounds of cod but can be considered relatively food-poor areas (Funk et al., 2021b). Thus, for cod outside spawning these deeper areas can be considered unfavorable areas, and it is assumed that skip-spawning or generally cod outside spawning stages are tending to stay on their feeding grounds (hard grounds such as cobble and boulder fields, rocky reef structures or wreck sites) rather than entering spawning habitats (Funk et al., 2020). Following this hypothesis classical sampling with trawl gear on spawning grounds likely underestimate the proportion of skip-spawners or immature individuals (Funk et al., 2021a). Observations made during rod and reel samplings on hard structured grounds during AL569 where we also observed relatively high proportions of cod in preparation, resting and spawning omission stage at the wreck sites (Fig. 5.3.2b and Fig. 5.3.3) emphasize this hypothesis.

To elaborate more on this potential sampling bias, it is planned to conduct rod and reel fishery also during upcoming winter cruises of the University of Hamburg as a complementation to traditional bottom trawling activities.

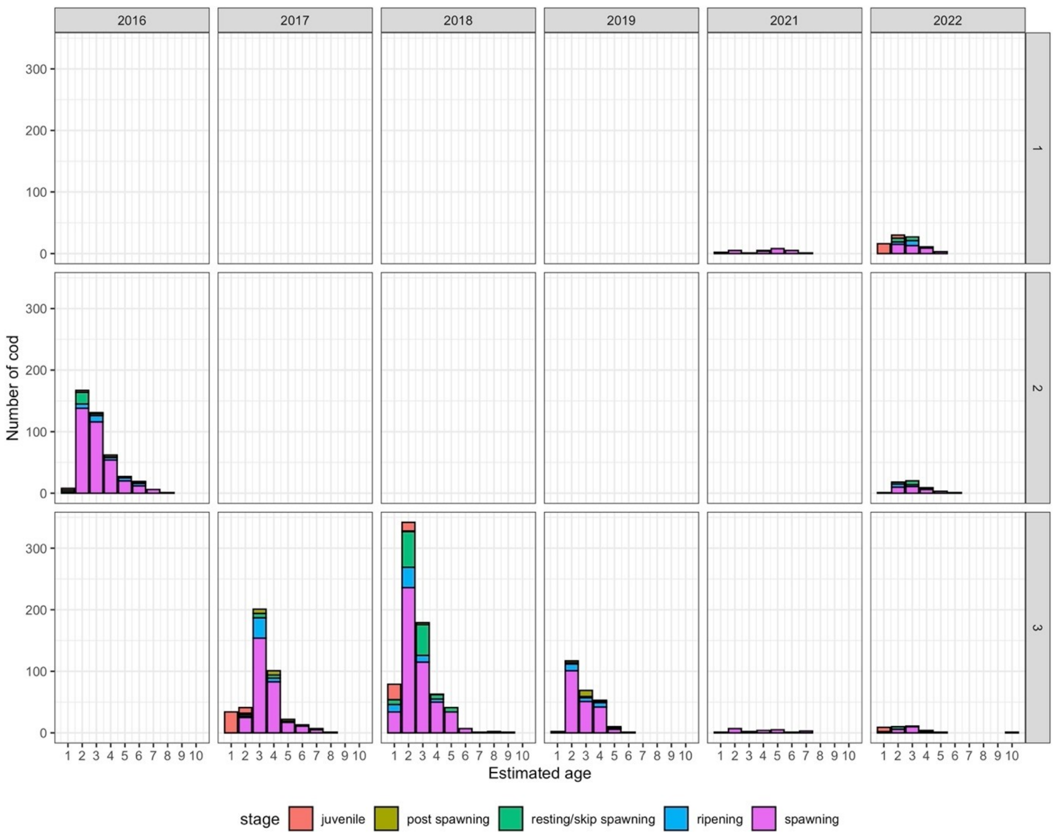

Fig. 5.3.3 Total number of observed cod maturity stages per year (from left to right) and month (from top to bottom) during University of Hamburg winter surveys from 2016 to 2022. Cod in 2022 were mainly caught during rod and reel fishery on wreck sites (with exception of 9 cod caught during trawling during AL569 in March 2022), while fish during previous surveys were caught exclusively during trawling. Note that the number of cod in estimated age class 1 are not representative for years 2016 to 2018, as individuals < 20 cm were not staged.

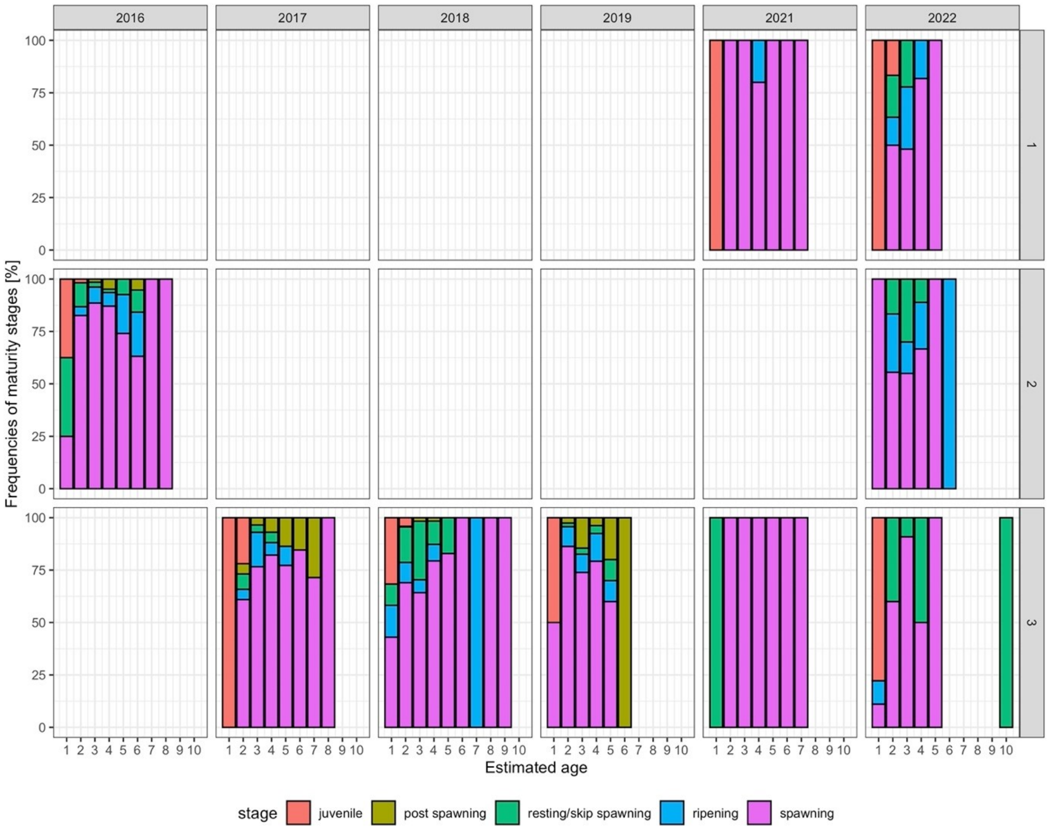

Fig. 5.3.4 Frequencies of cod maturity stages observed per year (from left to right) and month (from top to bottom) during University of Hamburg winter surveys from 2016 to 2022. Cod in 2022 were mainly caught during rod and reel fishery on wreck sites (with exception of 9 cod caught during trawling during AL569 in March 2022), while fish during previous surveys were caught exclusively during trawling. Note that the number of cod in estimated age class 1 are not representative for years 2016 to 2018, as individuals < 20 cm were not staged.

6 Station List AL569

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	Event Time	Latitude	Longitude	Depth (m)	Remarks
ALKOR	2022		[UTC]	[°N]	[°E]	[m]	
AL569_47-2	05.03.	BONGO	05.03.2022 14:02	54° 19.750' N	011° 22.625' E	22	
AL569_47-1	05.03.	CTD	05.03.2022 13:58	54° 19.708' N	011° 22.589' E	22	
AL569_46-2	05.03.	BONGO	05.03.2022 07:52	54° 11.343' N	011° 14.104' E	21	
AL569_46-1	05.03.	CTD	05.03.2022 07:48	54° 11.368' N	011° 14.037' E	21	
AL569_45-2	05.03.	CTD	05.03.2022 07:13	54° 07.333' N	011° 08.532' E	23	
AL569_45-1	05.03.	BONGO	05.03.2022 07:04	54° 07.149' N	011° 08.564' E	23	
AL569_44-2	05.03.	BONGO	05.03.2022 06:35	54° 03.093' N	011° 11.177' E	22	
AL569_44-1	05.03.	CTD	05.03.2022 06:30	54° 03.069' N	011° 11.156' E	23	
AL569_43-2	05.03.	CTD	05.03.2022 05:51	54° 04.519' N	011° 01.384' E	23	
AL569_43-1	05.03.	BONGO	05.03.2022 05:46	54° 04.560' N	011° 01.074' E	23	

AL569_42-3	05.03.	BONGO	05.03.2022 05:11	54° 02.312' N	010° 52.436' E	22
AL569_42-2	05.03.	BUCKET	05.03.2022 05:06	54° 02.293' N	010° 52.409' E	22
AL569_42-1	05.03.	CTD	05.03.2022 05:02	54° 02.294' N	010° 52.411' E	22
AL569_41-2	04.03.	BONGO	04.03.2022 18:50	54° 31.913' N	011° 19.319' E	30
AL569_41-1	04.03.	CTD	04.03.2022 18:46	54° 31.912' N	011° 19.312' E	30
AL569_40-2	04.03.	CTD	04.03.2022 17:52	54° 34.540' N	011° 08.348' E	28
AL569_40-1	04.03.	BONGO	04.03.2022 17:45	54° 34.656' N	011° 07.940' E	28
AL569_39-2	04.03.	BONGO	04.03.2022 17:08	54° 36.193' N	010° 59.923' E	36
AL569_39-1	04.03.	CTD	04.03.2022 16:06	54° 36.535' N	010° 57.422' E	28
AL569_38-2	04.03.	CTD	04.03.2022 16:04	54° 36.523' N	010° 57.409' E	28
AL569_38-1	04.03.	FR	04.03.2022 15:28	54° 36.535' N	010° 57.349' E	25
AL569_37-2	04.03.	CTD	04.03.2022 14:39	54° 34.861' N	010° 47.001' E	22
AL569_37-1	04.03.	FR	04.03.2022 14:18	54° 34.858' N	010° 46.990' E	21
AL569_36-2	04.03.	CTD	04.03.2022 13:53	54° 36.215' N	010° 51.392' E	21
AL569_36-1	04.03.	FR	04.03.2022 12:51	54° 36.225' N	010° 51.318' E	20
AL569_35-2	04.03.	CTD	04.03.2022 12:33	54° 36.529' N	010° 49.383' E	22
AL569_35-1	04.03.	FR	04.03.2022 12:02	54° 36.512' N	010° 49.358' E	21
AL569_34-2	04.03.	CTD	04.03.2022 11:25	54° 38.028' N	010° 50.057' E	23
AL569_34-1	04.03.	BONGO	04.03.2022 11:18	54° 37.974' N	010° 49.691' E	23
AL569_33-3	04.03.	BONGO	04.03.2022 10:42	54° 32.699' N	010° 49.834' E	22
AL569_33-2	04.03.	BUCKET	04.03.2022 10:37	54° 32.606' N	010° 49.847' E	21
AL569_33-1	04.03.	CTD	04.03.2022 10:33	54° 32.601' N	010° 49.892' E	21
AL569_32-2	04.03.	BONGO	04.03.2022 09:48	54° 32.925' N	010° 39.891' E	20
AL569_32-1	04.03.	CTD	04.03.2022 09:45	54° 32.900' N	010° 39.842' E	20
AL569_31-2	04.03.	CTD	04.03.2022 08:59	54° 38.991' N	010° 39.428' E	33
AL569_31-1	04.03.	BONGO	04.03.2022 08:52	54° 39.172' N	010° 39.050' E	31
AL569_30-2	04.03.	BONGO	04.03.2022 08:16	54° 40.804' N	010° 30.068' E	25
AL569_30-1	04.03.	CTD	04.03.2022 08:11	54° 40.801' N	010° 29.937' E	25
AL569_29-2	04.03.	CTD	04.03.2022 07:27	54° 34.191' N	010° 29.960' E	19
AL569_29-1	04.03.	BONGO	04.03.2022 06:42	54° 27.160' N	010° 29.952' E	17
AL569_28-2	04.03.	BONGO	04.03.2022 06:38	54° 26.921' N	010° 29.986' E	17
AL569_28-1	04.03.	CTD	04.03.2022 06:34	54° 26.871' N	010° 29.963' E	17
AL569_27-2	04.03.	CTD	04.03.2022 05:55	54° 26.407' N	010° 40.053' E	19
AL569_27-1	04.03.	BONGO	04.03.2022 05:50	54° 26.428' N	010° 40.309' E	19
AL569_26-3	04.03.	BONGO	04.03.2022 05:14	54° 25.001' N	010° 49.986' E	12
AL569_26-2	04.03.	BUCKET	04.03.2022 05:09	54° 25.010' N	010° 50.009' E	12
AL569_26-1	04.03.	CTD	04.03.2022 05:04	54° 25.012' N	010° 50.008' E	12
AL569_25-2	03.03.	CTD	03.03.2022 19:38	54° 17.956' N	011° 49.469' E	23
AL569_25-1	03.03.	BONGO	03.03.2022 19:32	54° 18.178' N	011° 49.547' E	23
AL569_24-2	03.03.	BONGO	03.03.2022 18:55	54° 23.737' N	011° 49.504' E	21
AL569_24-1	03.03.	CTD	03.03.2022 18:51	54° 23.768' N	011° 49.549' E	21
AL569_23-2	03.03.	CTD	03.03.2022 18:11	54° 25.527' N	011° 40.416' E	25
AL569_23-1	03.03.	BONGO	03.03.2022 18:05	54° 25.262' N	011° 40.368' E	25
AL569_22-3	03.03.	BONGO	03.03.2022 17:38	54° 21.687' N	011° 40.570' E	26

AL569_22-2	03.03.	BUCKET	03.03.2022 17:33	54° 21.648' N	011° 40.508' E	26
AL569_22-1	03.03.	CTD	03.03.2022 17:30	54° 21.678' N	011° 40.546' E	26
AL569_21-2	03.03.	CTD	03.03.2022 16:53	54° 22.157' N	011° 32.493' E	25
AL569_21-1	03.03.	BONGO	03.03.2022 16:47	54° 22.404' N	011° 32.571' E	25
AL569_20-2	03.03.	BONGO	03.03.2022 16:10	54° 27.818' N	011° 32.332' E	26
AL569_20-1	03.03.	CTD	03.03.2022 16:06	54° 27.845' N	011° 32.350' E	26
AL569_19-1	03.03.	FR	03.03.2022 14:56	54° 28.061' N	011° 22.260' E	23
AL569_18-2	03.03.	BONGO	03.03.2022 14:34	54° 25.241' N	011° 22.839' E	21
AL569_18-1	03.03.	CTD	03.03.2022 14:31	54° 25.222' N	011° 22.843' E	20
AL569_17-2	03.03.	CTD	03.03.2022 13:14	54° 17.386' N	011° 40.400' E	26
AL569_17-1	03.03.	BONGO	03.03.2022 13:07	54° 17.350' N	011° 40.016' E	26
AL569_16-3	03.03.	BONGO	03.03.2022 12:32	54° 17.513' N	011° 32.577' E	24
AL569_16-2	03.03.	BUCKET	03.03.2022 12:26	54° 17.457' N	011° 32.414' E	24
AL569_16-1	03.03.	CTD	03.03.2022 12:22	54° 17.431' N	011° 32.401' E	24
AL569_15-1	03.03.	CTD	03.03.2022 11:30	54° 14.724' N	011° 20.703' E	21
AL569_14-1	03.03.	BONGO	03.03.2022 11:24	54° 14.486' N	011° 20.675' E	21
AL569_13-3	03.03.	BONGO	03.03.2022 10:42	54° 08.542' N	011° 17.330' E	26
AL569_13-2	03.03.	BUCKET	03.03.2022 10:37	54° 08.446' N	011° 17.271' E	26
AL569_13-1	03.03.	CTD	03.03.2022 10:33	54° 08.414' N	011° 17.287' E	26
AL569_12-2	03.03.	CTD	03.03.2022 10:02	54° 10.178' N	011° 24.503' E	24
AL569_12-1	03.03.	BONGO	03.03.2022 09:55	54° 10.078' N	011° 25.019' E	24
AL569_11-2	03.03.	BONGO	03.03.2022 09:26	54° 11.870' N	011° 32.511' E	25
AL569_11-1	03.03.	CTD	03.03.2022 09:22	54° 11.861' N	011° 32.480' E	24
AL569_10-2	03.03.	CTD	03.03.2022 08:53	54° 12.420' N	011° 40.378' E	25
AL569_10-1	03.03.	BONGO	03.03.2022 08:47	54° 12.417' N	011° 40.827' E	25
AL569_9-3	03.03.	BONGO	03.03.2022 08:15	54° 12.534' N	011° 49.438' E	21
AL569_9-2	03.03.	BUCKET	03.03.2022 08:09	54° 12.511' N	011° 49.510' E	21
AL569_9-1	03.03.	CTD	03.03.2022 08:05	54° 12.488' N	011° 49.547' E	21
AL569_8-2	02.03.	CTD	02.03.2022 16:29	54° 28.984' N	010° 19.877' E	19
AL569_8-1	02.03.	BONGO	02.03.2022 16:24	54° 29.161' N	010° 19.813' E	19
AL569_7-3	02.03.	BONGO	02.03.2022 15:44	54° 35.651' N	010° 20.144' E	16
AL569_7-2	02.03.	BUCKET	02.03.2022 15:39	54° 35.643' N	010° 20.103' E	16
AL569_7-1	02.03.	CTD	02.03.2022 15:33	54° 35.634' N	010° 20.055' E	16
AL569_6-2	02.03.	CTD	02.03.2022 14:56	54° 41.424' N	010° 20.107' E	25
AL569_6-1	02.03.	BONGO	02.03.2022 14:50	54° 41.379' N	010° 19.736' E	24
AL569_5-2	02.03.	BONGO	02.03.2022 14:11	54° 42.378' N	010° 08.831' E	25
AL569_5-1	02.03.	CTD	02.03.2022 14:08	54° 42.373' N	010° 08.809' E	25
AL569_4-2	02.03.	FN	02.03.2022 12:30	54° 39.045' N	010° 08.877' E	23
AL569_4-2	02.03.	FN	02.03.2022 12:21	54° 38.671' N	010° 09.435' E	23
AL569_4-1	02.03.	CTD	02.03.2022 12:16	54° 38.627' N	010° 09.424' E	23
AL569_3-2	02.03.	CTD	02.03.2022 12:00	54° 37.814' N	010° 09.334' E	23
AL569_3-1	02.03.	BONGO	02.03.2022 11:54	54° 37.662' N	010° 09.072' E	23
AL569_2-3	02.03.	BONGO	02.03.2022 11:20	54° 33.103' N	010° 07.429' E	22
AL569_2-2	02.03.	BUCKET	02.03.2022 11:13	54° 33.018' N	010° 07.436' E	22

AL569_2-1	02.03.	CTD	02.03.2022 11:09	54° 32.996' N	010° 07.457' E	22
AL569_1-5	02.03.	FN	02.03.2022 09:41	54° 31.453' N	010° 02.603' E	28
AL569_1-5	02.03.	FN	02.03.2022 09:31	54° 31.122' N	010° 01.862' E	28
AL569_1-4	02.03.	BONGO	02.03.2022 09:19	54° 30.822' N	010° 01.266' E	28
AL569_1-3	02.03.	CTD	02.03.2022 09:12	54° 30.765' N	010° 01.198' E	27
AL569_1-2	02.03.	BUCKET	02.03.2022 09:06	54° 30.755' N	010° 01.219' E	27
AL569_1-1	02.03.	CTD	02.03.2022 08:53	54° 30.757' N	010° 01.193' E	27

7 Data and Sample Storage and Availability

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 PANGEA.
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

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).

Data storage

a) Tentative scientific data from this cruise will be
    a. CTD data. light measurements. fluorescence data
    b. Hydroacoustic data (EK 60)
    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 ZENODO 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).

Table 7.1 Overview of data availability

Type	Database	Available	Free Access	Contact
hydrography		Date	Date	E-Mail
TRIMBLE Hydroaccoustic Plankton CTD Fisheries	PANGAEA	Dec. 2023	Jan 2023	luisa.listmann@uni-hamburg.de

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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