ALKOR-Berichte

Bachelor MARSYS education cruise in the Baltic Sea

Cruise No. AL608

1st of March 2024 to 10th of March 2024,
Kiel (Germany)
MARSYS

Dr. Luisa Listmann

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IMF Institute for Marine Ecosystem and Fishery Science

2024

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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.

One objective was to investigate the distribution patterns of certain fish species such as cod, whiting, sprat and herring in the Kiel Bight, Mecklenburg Bight with a focus on juvenile gadeid species.

Another objective were zooplankton and hydrological surveys for which plankton stations were sampled along the cruise track to gain insights into the spatial distribution of zoo- and ichthyoplankton.

All necessary educational content could be taught. The rest of the analysis was partly done in the form of Bachelor or Master theses as well as in the courses taught at IMF.

1.2 Zusammenfassung

Diese Fahrt war als Lehrfahrt für Bachelor-Studenten des Instituts für Marine Ökosystem- und Fischereiwissenschaften (IMF) geplant, um an Bord eines Forschungsschiffes die gebräuchlichsten wissenschaftlichen Methoden, Fanggeräte und Arbeitsverfahren der Fischereiwissenschaft und der biologischen Ozeanographie kennenzulernen.

Ein Ziel war es, die Verteilungsmuster bestimmter Fischarten wie Dorsch, Wittling, Sprotte und Hering in der Kieler- und Mecklenburger Bucht zu untersuchen, wobei der Schwerpunkt in dieser Reise auf juvenilen Gadeidenarten lag.

Ein weiteres Ziel waren Zooplankton- und hydrologische Untersuchungen, für die Planktonstationen entlang der Fahrtroute beprobt wurden, um Erkenntnisse über die räumliche Verteilung von Zoo- und Ichthyoplankton zu gewinnen.

Alle notwendigen Lehrinhalte konnten an Bord vermittelt werden. Der Rest der Analyse wurde teilweise in Form von Bachelor- oder Masterarbeiten sowie im Rahmen von Kursen am IMF durchgeführt.

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
Dahlke, Flemming, Dr.	Jun. Prof.	IMF
Ressing, Tobias	PhD student	IMF
Estcourt, Tyrone	PhD student	IMF
13 Students from the Master Program 2nd semester		IMF

1 Student from Bachelor Program 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

Two work areas were part of the cruise and are the following going from the West to the East: Kiel Bight, Mecklenburg Bight (Fig. 3.1.1). This cruise included collecting samples from all major compartments of the ecosystem, from coastal to open waters in a 3-dimensional distribution.

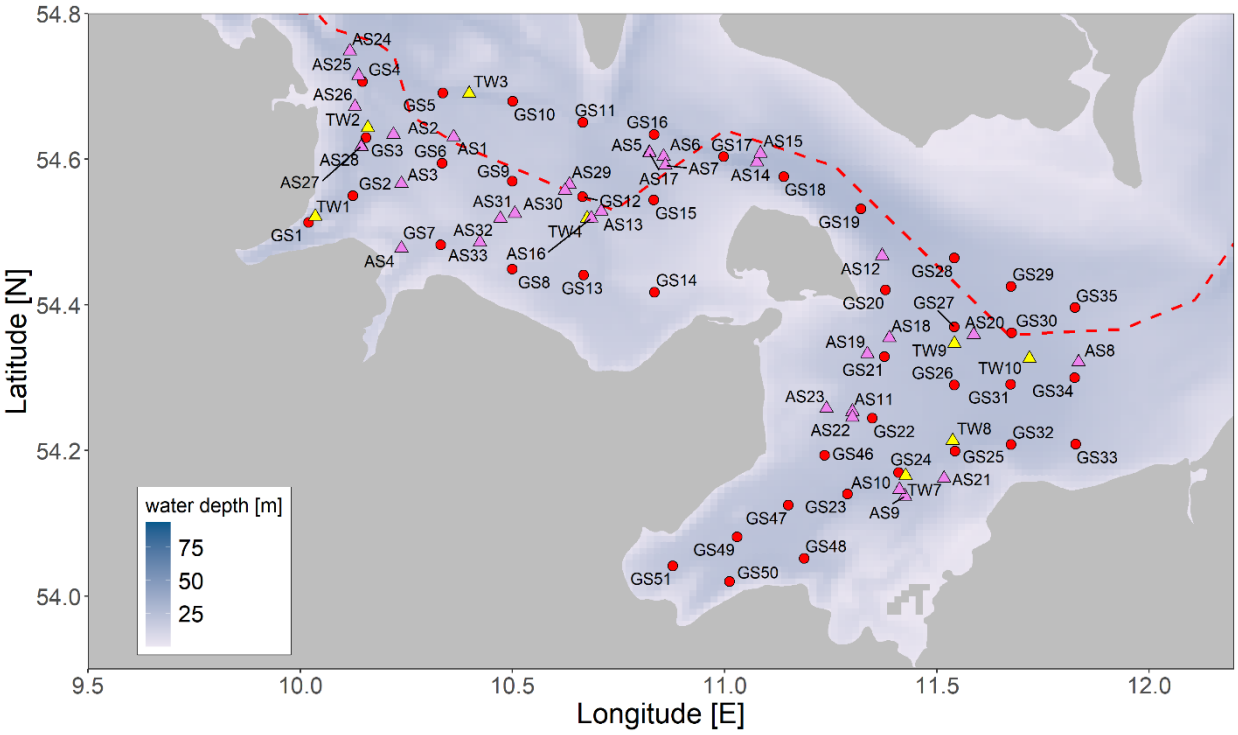

Fig. 3.1.1 Overview map indicating sampling stations of the cruise AL 608. Red dots indicate plankton grid stations (GS). Yellow triangles indicate trawl stations (TW). Violet triangles indicate Angling stations (AS). Dashed red line indicates EEZ borders. Positions per Gear that were realized during the cruise are given in Table 6.1

3.2 Aims 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.

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 two dominant fish species in the system of the Baltic, cod (Gadus morhua) and whiting (Merlangius merlangius) and the length distribution of additional species such as herring (Clupea harengus), sprat (Sprattus sprattus) and pleuronectiformes. Various different samples were obtained for more detailed analyses: stomachs of cod and 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).

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

As a basis of the teaching procedure, the daily work plan included a concept of rotation through a range of different subjects. Four different fields of responsibility were determined, in which each student received individual training, or in a group of two, to establish a practical knowledge of work on a research vessel. Therefore, experienced staff members of the institute lead the teaching process and give guidance throughout the entire process, resulting in gapless mentoring.

The students were 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.
II. Working on deck: Practical work on deck, including preparation of gears for their use; supporting the crew to manoeuvre the gear in and out of the water.
III. Sampling: Handle the plankton samples correctly until they are labelled, fixed and stored properly. Processing of fish hauls with the trawls, including the coordination of the working procedures. These included 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: On board measurements of, for example phytoplankton samples as well as sorting and determination of fish larvae. Additionally, the students learn the organization of all work procedures in the laboratory.

4 Narrative of the Cruise

The RV ALKOR could be fully loaded on the set-up days prior to the voyage. The voyage began as planned on the Friday 1st of March at 7:30 am. The first CTD hauls and plankton sampling

(Bongo) as well as a first fishing haul were carried out in the Kiel Bight near Eckernförde. The working conditions were fine, so that almost all planned plankton grid stations in the Kiel Bight as well as two more fishery hauls and wreck angling could be carried out until Monday 4th of March. The order of the plankton station deviated from the original planning, since due to shooting operations an entry into the shooting area Todendorf was only possible from 5 p.m. on weekdays and due to the training obligation the station processing partly took longer.

In the night to Tuesday, the RV ALKOR stayed in Warnemünde after an exchange of the scientific crew late on Monday 4th of March. RV left Warnemünde again in the morning of 5th of March to continue the grid station and program in Mecklenburg Bight.

During the following days we continued with the grid station program and fisheries and angling stations according to our program and steamed back to the Kiel harbor late on Saturday 9th of March. The scientific crew left RV ALKOR on Sunday the 10th of March.

5 Preliminary Results

5.1 Underway Hydroacoustics

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

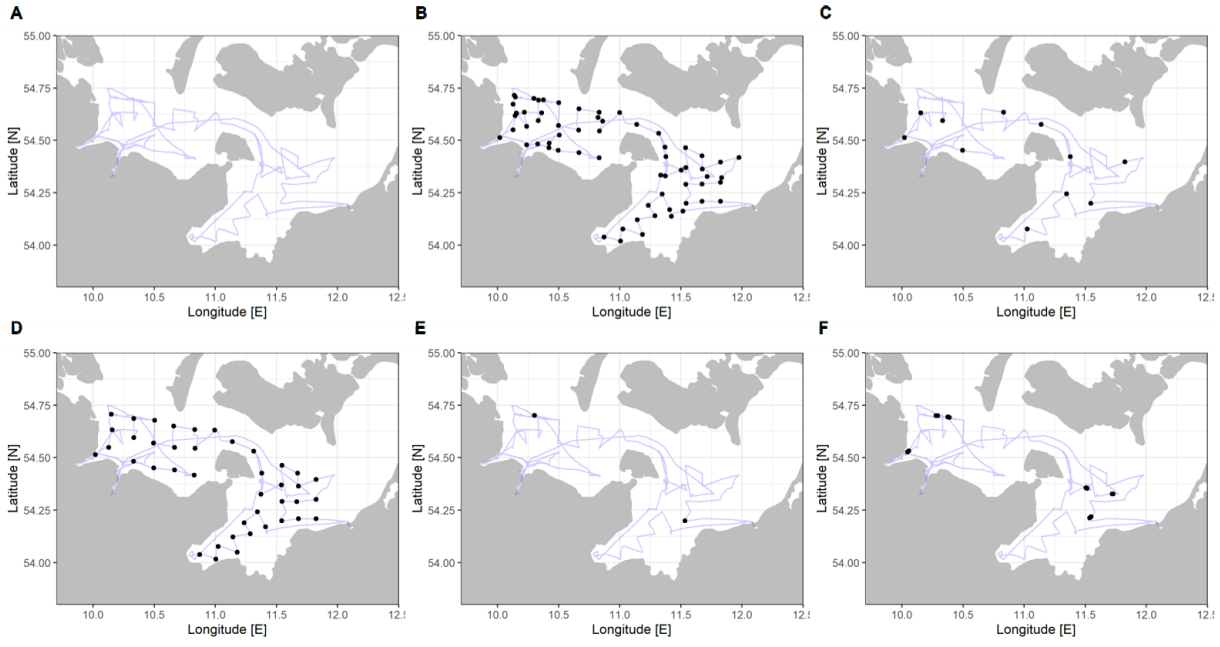

Fig. 5.1.1 Cruise track maps with station overview of the different deployed equipment.

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	65
Watersampler (Niskin Bottle)	11
Bongo (150µm ,335µm, 500µm)	41

TV/520 Bottom Trawl	6
Fishing at wrecks	27
Total	150

5.2 Water and Plankton Sampling With CTD/Rosette

5.2.1 CTD Measurements

From East to West we found a surface gradient in salinity (Fig. 5.2.1 B and C): in the Western Kiel Bight there were the highest salinities measured at ca. 20 PSU whereas towards the Eastern Mecklenburg Bight we measured lower salinities at around 10 PSU. We clearly found a less saline water body in the Mecklenburg Bight that was pushed in from the East due to strong winds. The temperature varied only slightly and ranged between 4 and 6 °C (Fig. 5.2.1. D)

Due to the strong winds from the East shortly before the cruise and during the cruise, we could detect high chlorophyll a contents in the Mecklenburg Bight (Fig. 5.2.1. A). The water masses were pushed towards the West and the phytoplankton was condensed.

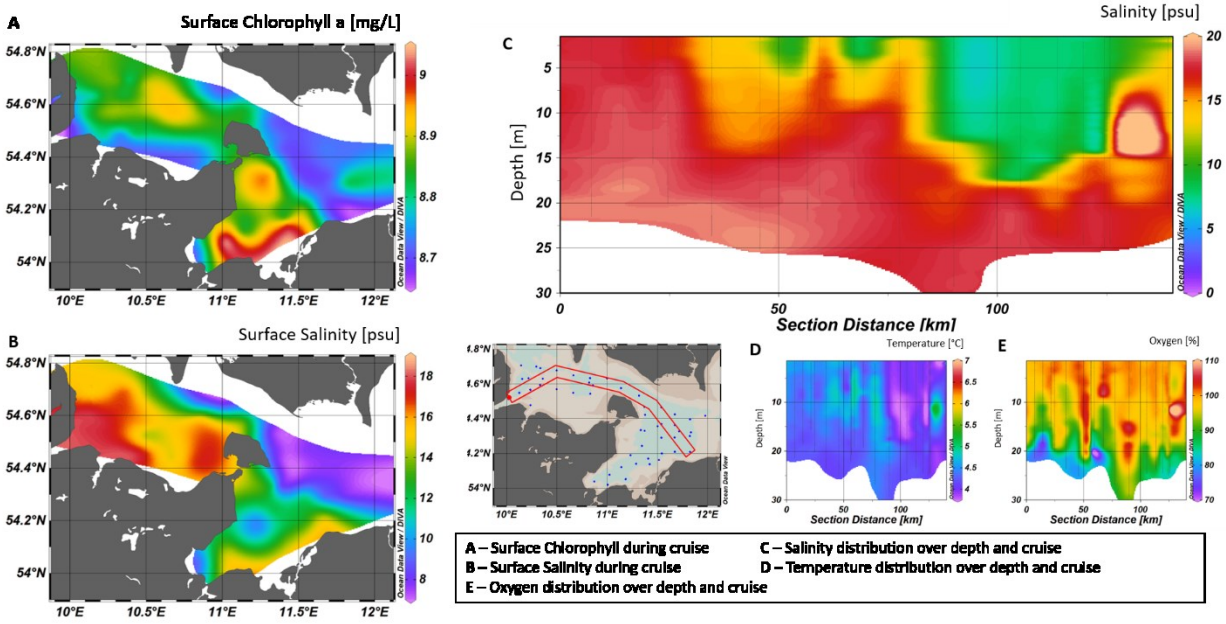

Fig. 5.2.1 Hydrographic data from CTD data during the cruise. Panels a and b show surface water conditions for chlorophyll a and salinity, respectively. Panels c to e show salinity, temperature and oxygen conditions along the cruise transect and the whole water column.

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.

We therefore took surface water samples at 11 stations along the cruise track of AL608. 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 11 stations were divided into Kiel Bight (6 stations) and Mecklenburg Bight (5 stations).

5.3 Fishery

A total of 6 trawl hauls and 27 rod and reel fishery hauls were conducted during cruise AL608 (Fig. 5.1.1). The main target of fishing operations during AL608 were spawning 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 to give insights on potential long- or short-term changes in biological parameters. This campaign aims to track potential changes in spawning phenology of the stock (see [1, 2]) and is conducted by the University of Hamburg in cooperation with the Danish Technical University (DTU Aqua), GEOMAR and the University of Aarhus.

Total Catches

In total a number of 184 cod individuals with a total weight of 169.627 kg were caught during AL608. During the six conducted trawl hauls a total of 26 different fish species were caught with a total weight of 2250.79 kg (see Tab. 5.1 and 5.2) including a total number of 45 cod with 50.023 kg. In general, it has to be noted, cod catches by trawl made in 2023 have been again 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 AL608 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). Spawning cod were mainly caught at wrecks.

Table 5.1 Total trawl catches during AL608 per species.

Species	Total weight [kg]	Total number
Cod (*Gadus morhua*)	46.072	31
Juvenile Cod (*Gadus morhua*)	0.83	240
Herring (*Clupea harengus*)	96.246	9026
Sprat (*Sprattus sprattus*)	120.428	14733
Common dab (*Limanda limanda*)	386.18	5915
Plaice (*Pleuronectes platessa*)	1320.77	20502
European Flounder (*Platichthys flesus*)	34.254	1223
American Plaice (*Hippoglossoides platessoides*)	10.126	137
Turbot (Pestta Maximus)	3.708	5
Common sole (*Solea Solea*)	3.341	24
Hooknose (*Agonus cataphratus)*	0.034	2
Great Sandeel *(Hyperolus lanceolatus)*	0.135	4
Snakeblenny (*Lumpenus lampretaeformis*)	3.459	431
Fourbeard Rockling (*Enchelyopus cimbrius*)	0.929	14
Butterfish (*Pholis gunnellus)*	0.012	1

Lemon sole (*Microstomus kitt*)	0	0
Sea Scorption (*Myoxocephalus Scorpius*)	3.117	59
Whiting (*Merlangius merlangus*)	8.823	212
Juvenile Whiting (*Merlangius merlangus*)	0	0
Eelpout (*Zoarces viviparous*)	1.364	24
Scaldfish (*Arnoglossus laterna*)	0.482	37
Common dragonet (*Callionymus lyra*)	0.051	1
Brill (*Scophthalmus rhombus*)	0.385	1
Black Goby (*Globus niger*)	0.029	1
Round Goby (*Neogobius melanostomus*)	0.127	10
Grey gurnard (*Eutrigla gurnardus*)	0.696	13
Haddock (*Melanogrammus aeglefinus*)	0.827	6
Stickleback (*Gasterosteus aculeatus*)	2.626	1446

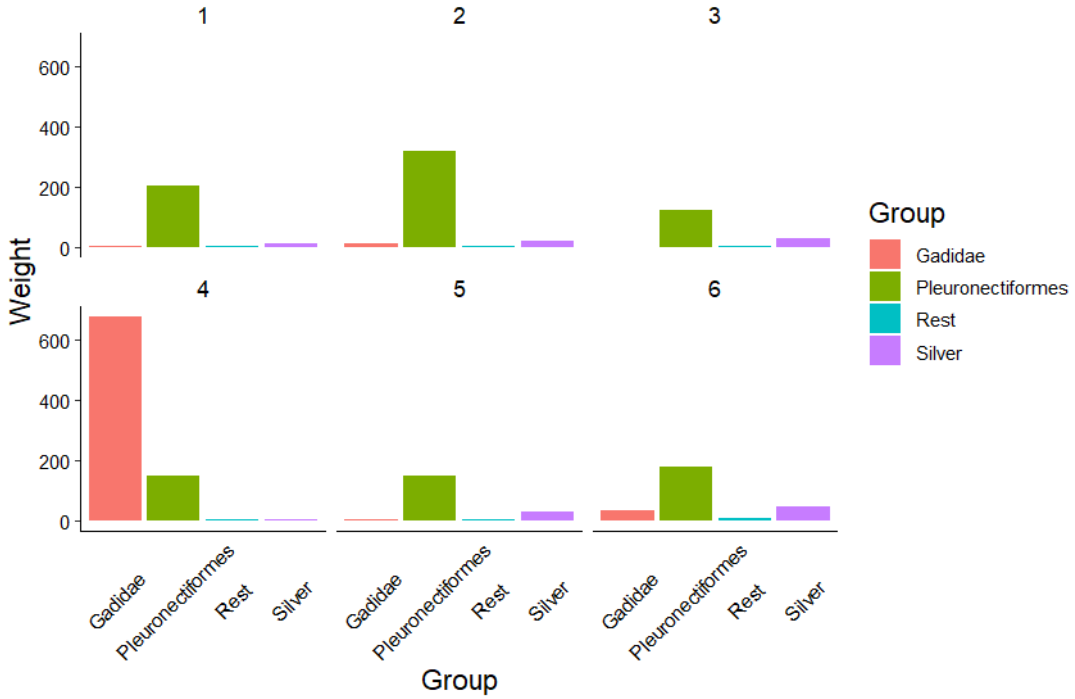

Fig. 5.3.1 Fish catches of AL608. Panel shows the weight distribution between all groups of fish species over the whole cruise.

Size distributions of Clupeids and *Pleuronectiformes*

For clupeid fish species as well as flatfish species we measured the length distributions on board both on whole catches but also on subsamples of the whole catches. The size range of the herring varied between 6 to 20 cm whereas the size range of the sprat varied between 5 and 15cm. Overall more sprat than herring was caught (Fig. 5.3.2).

Within the group of flatfish the most abundant species was plaice followed by common dab and a flounders. The size distribution of plaice and common dab were similar ranging from ca. 7 to

over 30cm whereas the flounders were much larger between 20 to 40cm. The size distribution indicates the presence of many juvenile flat fish in the fishery hauls (Fig. 5.3.3.).

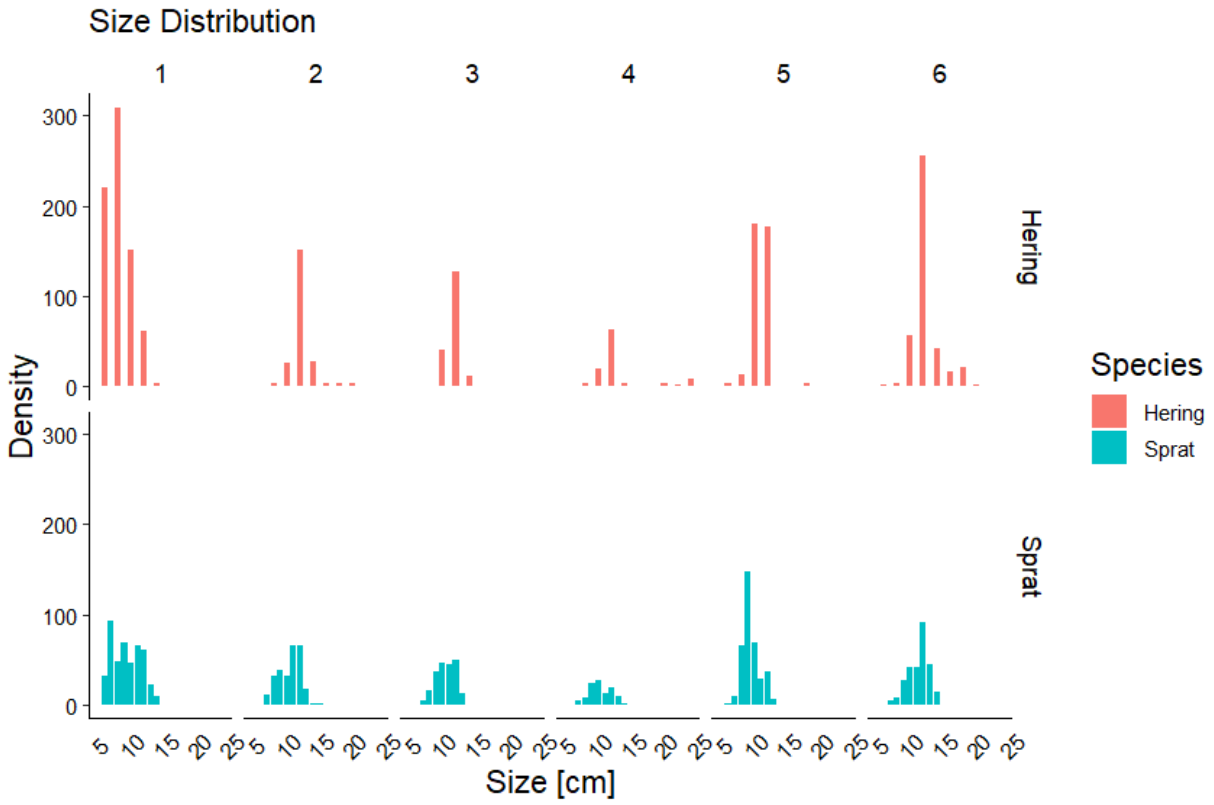

Fig. 5.3.2 Size distribution of herring (red) and sprat (blue) in the four fishery hauls.

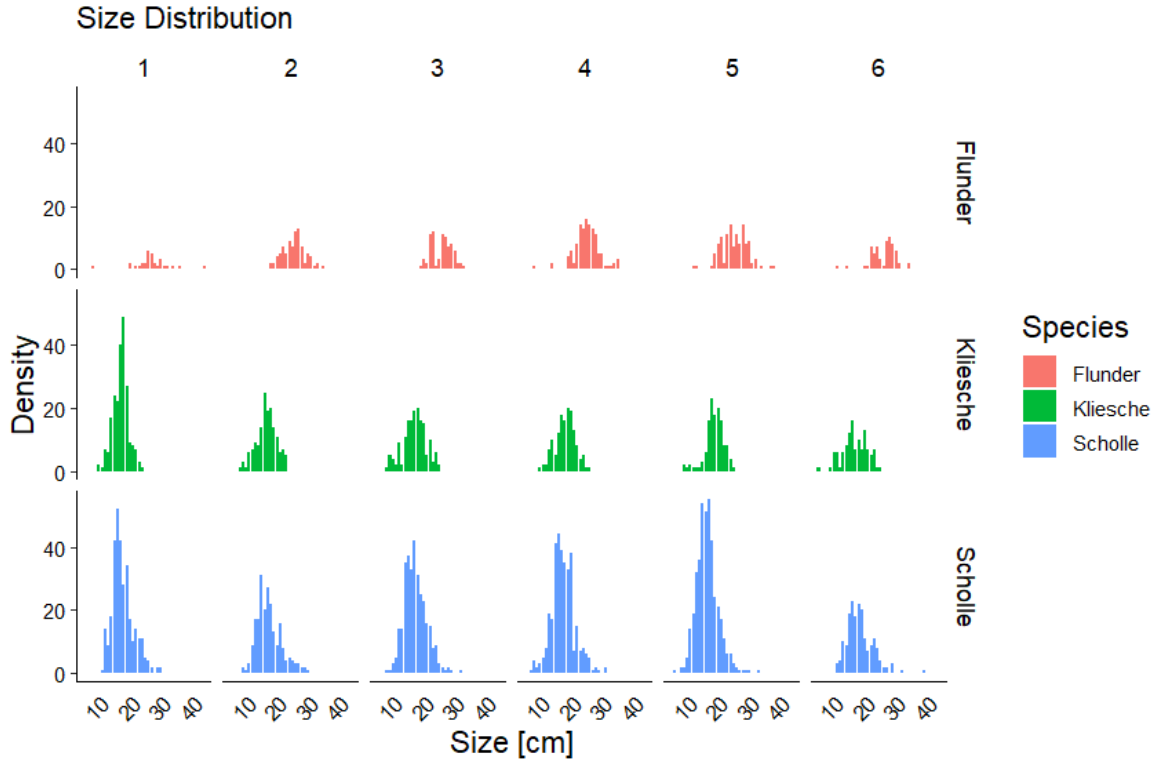

Fig. 5.3.3 Size distribution of flounder (red), common dab (green) and plaice (blue) in the six fishery hauls.

5.3.2 Additional Work With Fishery´s Samples

(Luisa Listmann, Flemming Dahlke, IMF)

As part of the teaching topic of fish fecundity and fertilization, spawning plaice and flounder were used for fertilization experiments on board with Prof. Dr. Flemming Dahlke. Egg and sperm from spawning fish were collected directly after the haul was on deck and the fertilization took place on board. To check for mortality in different temperatures eggs were kept for ca. 48h in a temperature controlled table and monitored. Female stage 4 cod gonads were also collected for histological analysis of the gonads. These analyses allow for a better understanding of fecundity of the fish in relation to their size and weight.

The collected samples and data were used in Bachelor and Master thesis at the IMF.

6 Station List AL608

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.

Date and time [UTC]	Gear	Latitude	Longitude	Depth (m)	DSHIP
ALKOR			[°N]	[°E]	Events
2024-03-01 08:00:23	TSG	54° 30,304' N	010° 08,300' E	12	AL608_0_Underway-1
2024-03-01 08:28:26	CTD	54° 30,797' N	010° 01,172' E	28	AL608_1-1
2024-03-01 08:31:24	BUCKET	54° 30,800' N	010° 01,194' E	28	AL608_1-2
2024-03-01 08:44:56	BONGO	54° 30,843' N	010° 01,145' E	29	AL608_1-3
2024-03-01 09:04:03	BT	54° 31,947' N	010° 03,363' E	28	AL608_2-1
2024-03-01 09:14:34	BT	54° 31,593' N	010° 02,632' E	29	AL608_2-1
2024-03-01 12:50:02	CTD	54° 32,954' N	010° 07,578' E	23	AL608_3-1
2024-03-01 12:54:54	BONGO	54° 32,942' N	010° 07,602' E	23	AL608_3-2
2024-03-01 13:35:49	BONGO	54° 37,982' N	010° 09,404' E	23	AL608_4-1
2024-03-01 13:41:36	CTD	54° 37,730' N	010° 09,356' E	23	AL608_4-2
2024-03-01 14:18:06	FR	54° 33,994' N	010° 14,291' E	19	AL608_5-1
2024-03-01 14:52:38	CTD	54° 33,983' N	010° 14,298' E	20	AL608_5-2
2024-03-01 15:25:41	FR	54° 38,038' N	010° 13,171' E	21	AL608_6-1
2024-03-01 15:53:13	CTD	54° 38,021' N	010° 13,150' E	22	AL608_6-2
2024-03-01 16:27:55	FR	54° 37,826' N	010° 21,631' E	21	AL608_7-1
2024-03-01 16:56:19	CTD	54° 37,839' N	010° 21,670' E	21	AL608_7-2
2024-03-01 17:19:47	CTD	54° 35,622' N	010° 20,034' E	17	AL608_8-1
2024-03-01 17:21:46	BUCKET	54° 35,622' N	010° 20,053' E	17	AL608_8-2
2024-03-01 17:29:59	BONGO	54° 35,732' N	010° 20,027' E	18	AL608_8-3
2024-03-01 18:05:06	BONGO	54° 41,174' N	010° 19,941' E	24	AL608_9-1
2024-03-01 18:11:59	CTD	54° 41,464' N	010° 20,183' E	26	AL608_9-2
2024-03-01 18:55:58	CTD	54° 42,387' N	010° 08,723' E	26	AL608_10-1
2024-03-01 19:01:29	BONGO	54° 42,391' N	010° 08,878' E	26	AL608_10-2
2024-03-02 06:27:02	CTD	54° 42,016' N	010° 17,849' E	31	AL608_11-1
2024-03-02 06:34:11	MN_S5	54° 42,056' N	010° 18,169' E	30	AL608_11-2
2024-03-02 07:15:21	BT	54° 42,026' N	010° 16,694' E	27	AL608_11-3
2024-03-02 07:23:46	BT	54° 41,987' N	010° 17,637' E	30	AL608_11-3
2024-03-02 11:00:43	CTD	54° 40,729' N	010° 30,005' E	25	AL608_12-1

2024-03-02 11:06:05	BONGO	54° 40,691' N	010° 30,134' E	25	AL608_12-2
2024-03-02 11:51:25	BONGO	54° 34,171' N	010° 29,614' E	19	AL608_13-1
2024-03-02 11:56:28	CTD	54° 34,201' N	010° 29,922' E	19	AL608_13-2
2024-03-02 12:38:11	CTD	54° 32,924' N	010° 39,860' E	21	AL608_14-1
2024-03-02 12:41:52	BONGO	54° 32,930' N	010° 39,973' E	21	AL608_14-2
2024-03-02 13:24:57	BONGO	54° 39,004' N	010° 39,549' E	32	AL608_15-1
2024-03-02 13:31:03	CTD	54° 39,004' N	010° 39,919' E	27	AL608_15-2
2024-03-02 14:14:02	CTD	54° 38,046' N	010° 49,897' E	23	AL608_16-1
2024-03-02 14:17:26	BUCKET	54° 38,054' N	010° 49,893' E	23	AL608_16-2
2024-03-02 14:23:09	BONGO	54° 38,050' N	010° 49,921' E	23	AL608_16-3
2024-03-02 14:39:33	FR	54° 36,506' N	010° 49,355' E	23	AL608_17-1
2024-03-02 15:01:46	CTD	54° 36,506' N	010° 49,364' E	23	AL608_17-2
2024-03-02 15:14:32	FR	54° 36,220' N	010° 51,319' E	20	AL608_18-1
2024-03-02 15:47:33	FR	54° 35,503' N	010° 51,582' E	21	AL608_19-1
2024-03-02 16:15:34	CTD	54° 35,501' N	010° 51,594' E	21	AL608_19-2
2024-03-02 17:01:31	CTD	54° 32,632' N	010° 50,006' E	22	AL608_20-1
2024-03-02 17:05:29	BONGO	54° 32,661' N	010° 50,038' E	22	AL608_20-2
2024-03-02 17:56:22	BONGO	54° 37,851' N	010° 59,666' E	22	AL608_21-1
2024-03-02 18:03:19	CTD	54° 37,942' N	011° 00,019' E	21	AL608_21-2
2024-03-02 18:54:00	CTD	54° 34,552' N	011° 08,323' E	28	AL608_22-1
2024-03-02 18:57:13	BUCKET	54° 34,547' N	011° 08,326' E	28	AL608_22-2
2024-03-02 19:03:08	BONGO	54° 34,551' N	011° 08,409' E	29	AL608_22-3
2024-03-03 06:26:01	CTD	54° 21,404' N	011° 30,186' E	25	AL608_23-1
2024-03-03 06:35:21	BT	54° 21,357' N	011° 30,288' E	25	AL608_23-2
2024-03-03 06:42:57	BT	54° 21,189' N	011° 30,915' E	25	AL608_23-2
2024-03-03 09:44:33	CTD	54° 22,178' N	011° 32,437' E	26	AL608_24-1
2024-03-03 09:48:08	BONGO	54° 22,171' N	011° 32,486' E	26	AL608_24-2
2024-03-03 10:38:58	BONGO	54° 19,517' N	011° 22,447' E	22	AL608_25-1
2024-03-03 10:45:23	CTD	54° 19,763' N	011° 22,399' E	22	AL608_25-2
2024-03-03 11:22:28	CTD	54° 25,304' N	011° 22,680' E	22	AL608_26-1
2024-03-03 11:24:42	BUCKET	54° 25,339' N	011° 22,676' E	23	AL608_26-2
2024-03-03 11:32:06	BONGO	54° 25,530' N	011° 22,839' E	22	AL608_26-3
2024-03-03 12:13:17	BONGO	54° 31,850' N	011° 18,868' E	31	AL608_27-1
2024-03-03 12:18:56	CTD	54° 31,961' N	011° 19,134' E	31	AL608_27-2
2024-03-03 13:01:24	FR	54° 28,049' N	011° 22,240' E	23	AL608_28-1
2024-03-03 13:31:06	CTD	54° 28,047' N	011° 22,255' E	25	AL608_28-2
2024-03-03 14:21:24	FR	54° 21,281' N	011° 23,503' E	22	AL608_29-1
2024-03-03 14:58:04	FR	54° 20,005' N	011° 20,117' E	21	AL608_30-1
2024-03-03 15:34:07	CTD	54° 20,011' N	011° 20,136' E	22	AL608_30-2
2024-03-03 16:10:58	FR	54° 15,216' N	011° 18,021' E	22	AL608_31-1
2024-03-03 16:48:49	FR	54° 15,411' N	011° 14,204' E	17	AL608_32-1
2024-03-04 05:30:28	CTD	54° 02,280' N	010° 52,373' E	22	AL608_33-1
2024-03-04 05:34:38	BONGO	54° 02,299' N	010° 52,391' E	22	AL608_33-2
2024-03-04 06:08:58	BONGO	54° 00,941' N	011° 00,231' E	24	AL608_34-1
2024-03-04 06:15:02	CTD	54° 01,139' N	011° 00,417' E	24	AL608_34-2
2024-03-04 06:45:03	CTD	54° 04,562' N	011° 01,474' E	24	AL608_35-1
2024-03-04 06:47:21	BUCKET	54° 04,575' N	011° 01,491' E	24	AL608_35-2
2024-03-04 06:53:34	BONGO	54° 04,628' N	011° 01,469' E	24	AL608_35-3
2024-03-04 07:33:10	BONGO	54° 02,970' N	011° 10,822' E	23	AL608_36-1

2024-03-04 07:40:01	CTD	54° 03,051' N	011° 11,165' E	23	AL608_36-2
2024-03-04 08:14:00	CTD	54° 07,260' N	011° 08,563' E	24	AL608_37-1
2024-03-04 08:17:45	BONGO	54° 07,290' N	011° 08,601' E	24	AL608_37-2
2024-03-04 08:55:02	BONGO	54° 08,213' N	011° 17,078' E	27	AL608_38-1
2024-03-04 09:01:06	CTD	54° 08,409' N	011° 17,304' E	27	AL608_38-2
2024-03-04 09:28:17	CTD	54° 11,349' N	011° 14,061' E	22	AL608_39-1
2024-03-04 09:32:00	BONGO	54° 11,372' N	011° 14,096' E	22	AL608_39-2
2024-03-04 10:12:26	BONGO	54° 14,478' N	011° 20,663' E	22	AL608_40-1
2024-03-04 10:17:43	CTD	54° 14,617' N	011° 20,777' E	21	AL608_40-2
2024-03-04 10:19:55	BUCKET	54° 14,630' N	011° 20,771' E	22	AL608_40-3
2024-03-04 10:58:19	CTD	54° 10,145' N	011° 24,575' E	25	AL608_41-1
2024-03-04 11:02:50	BONGO	54° 10,213' N	011° 24,672' E	25	AL608_41-2
2024-03-04 11:28:25	FR	54° 08,235' N	011° 25,454' E	21	AL608_42-1
2024-03-04 12:02:57	CTD	54° 08,250' N	011° 25,435' E	23	AL608_42-2
2024-03-04 12:22:43	FR	54° 08,785' N	011° 24,689' E	22	AL608_43-1
2024-03-04 13:22:41	FR	54° 09,717' N	011° 31,009' E	22	AL608_44-1
2024-03-04 13:58:49	CTD	54° 09,724' N	011° 31,008' E	22	AL608_44-2
2024-03-06 07:00:15	CTD	54° 12,538' N	011° 49,510' E	22	AL608_45-1
2024-03-06 07:05:05	BONGO	54° 12,487' N	011° 49,541' E	22	AL608_45-2
2024-03-06 07:39:42	BONGO	54° 12,529' N	011° 40,781' E	26	AL608_46-1
2024-03-06 07:45:58	CTD	54° 12,532' N	011° 40,421' E	26	AL608_46-2
2024-03-06 08:20:29	CTD	54° 11,952' N	011° 32,629' E	25	AL608_47-1
2024-03-06 08:23:31	BUCKET	54° 11,968' N	011° 32,708' E	25	AL608_47-2
2024-03-06 08:29:49	BONGO	54° 11,929' N	011° 32,620' E	25	AL608_47-3
2024-03-06 08:37:55	MN_S5	54° 11,947' N	011° 32,008' E	25	AL608_47-4
2024-03-06 09:03:06	BT	54° 12,736' N	011° 32,232' E	25	AL608_48-1
2024-03-06 09:12:38	BT	54° 13,133' N	011° 32,840' E	26	AL608_48-1
2024-03-06 12:16:24	CTD	54° 17,426' N	011° 32,427' E	25	AL608_49-1
2024-03-06 12:24:36	BONGO	54° 17,508' N	011° 32,696' E	25	AL608_49-2
2024-03-06 12:56:42	BONGO	54° 17,346' N	011° 40,008' E	26	AL608_50-1
2024-03-06 13:02:05	CTD	54° 17,453' N	011° 40,353' E	26	AL608_50-2
2024-03-06 13:42:54	CTD	54° 17,992' N	011° 49,445' E	24	AL608_51-1
2024-03-06 13:46:57	BONGO	54° 18,005' N	011° 49,438' E	24	AL608_51-2
2024-03-06 14:03:40	FR	54° 19,277' N	011° 49,973' E	22	AL608_52-1
2024-03-06 14:28:33	CTD	54° 19,283' N	011° 49,995' E	24	AL608_52-2
2024-03-06 15:27:52	FR	54° 25,014' N	011° 58,544' E	19	AL608_53-1
2024-03-06 16:02:50	CTD	54° 25,024' N	011° 58,542' E	20	AL608_53-2
2024-03-06 16:39:48	CTD	54° 23,775' N	011° 49,471' E	22	AL608_54-1
2024-03-06 16:42:00	BUCKET	54° 23,789' N	011° 49,461' E	22	AL608_54-2
2024-03-06 16:45:31	BONGO	54° 23,747' N	011° 49,496' E	22	AL608_54-3
2024-03-06 17:19:19	BONGO	54° 21,874' N	011° 40,832' E	26	AL608_55-1
2024-03-06 17:25:38	CTD	54° 21,727' N	011° 40,479' E	26	AL608_55-2
2024-03-06 17:55:43	CTD	54° 25,530' N	011° 40,467' E	25	AL608_56-1
2024-03-06 18:00:29	BONGO	54° 25,538' N	011° 40,407' E	25	AL608_56-2
2024-03-06 18:32:49	BONGO	54° 27,757' N	011° 32,681' E	26	AL608_57-1
2024-03-06 18:37:54	CTD	54° 27,883' N	011° 32,373' E	26	AL608_57-2
2024-03-07 06:30:09	CTD	54° 19,579' N	011° 43,027' E	26	AL608_58-1
2024-03-07 06:42:03	BT	54° 19,598' N	011° 43,178' E	26	AL608_58-2
2024-03-07 06:48:46	BT	54° 19,598' N	011° 43,725' E	26	AL608_58-2

2024-03-07 15:00:09	FR	54° 28,649' N	010° 14,241' E	20	AL608_59-1
2024-03-07 15:33:36	CTD	54° 28,661' N	010° 14,274' E	20	AL608_59-2
2024-03-07 16:01:53	CTD	54° 28,918' N	010° 19,767' E	20	AL608_60-1
2024-03-07 16:05:33	BONGO	54° 28,935' N	010° 19,850' E	20	AL608_60-2
2024-03-07 16:47:54	BONGO	54° 27,005' N	010° 29,730' E	17	AL608_61-1
2024-03-07 16:52:33	CTD	54° 27,148' N	010° 29,793' E	17	AL608_61-2
2024-03-07 16:54:28	BUCKET	54° 27,132' N	010° 29,785' E	17	AL608_61-3
2024-03-07 17:40:12	CTD	54° 26,456' N	010° 39,941' E	19	AL608_62-1
2024-03-07 17:46:14	BONGO	54° 26,474' N	010° 39,974' E	19	AL608_62-2
2024-03-07 18:27:59	BONGO	54° 24,969' N	010° 49,584' E	13	AL608_63-1
2024-03-07 18:32:40	CTD	54° 24,995' N	010° 49,850' E	13	AL608_63-2
2024-03-08 06:58:25	CTD	54° 41,575' N	010° 22,571' E	31	AL608_64-1
2024-03-08 07:04:50	BT	54° 41,651' N	010° 22,596' E	30	AL608_64-2
2024-03-08 07:13:20	BT	54° 41,507' N	010° 23,302' E	31	AL608_64-2
2024-03-08 11:45:40	FR	54° 44,901' N	010° 06,997' E	24	AL608_65-1
2024-03-08 12:21:11	FR	54° 42,899' N	010° 08,220' E	25	AL608_66-1
2024-03-08 12:54:31	CTD	54° 42,917' N	010° 08,245' E	25	AL608_66-2
2024-03-08 13:19:28	FR	54° 40,331' N	010° 07,687' E	20	AL608_67-1
2024-03-08 13:53:00	CTD	54° 40,329' N	010° 07,708' E	20	AL608_67-2
2024-03-08 14:15:42	CTD	54° 37,806' N	010° 09,225' E	23	AL608_68-1
2024-03-08 14:18:15	BUCKET	54° 37,821' N	010° 09,245' E	23	AL608_68-2
2024-03-08 14:37:22	FR	54° 38,035' N	010° 13,136' E	21	AL608_69-1
2024-03-08 15:07:24	CTD	54° 38,030' N	010° 13,179' E	22	AL608_69-2
2024-03-08 15:30:05	FR	54° 37,052' N	010° 08,579' E	20	AL608_70-1
2024-03-08 16:02:09	CTD	54° 37,067' N	010° 08,597' E	24	AL608_70-2
2024-03-09 07:00:25	FR	54° 31,526' N	010° 30,278' E	18	AL608_71-1
2024-03-09 07:33:21	CTD	54° 31,538' N	010° 30,307' E	18	AL608_71-2
2024-03-09 08:02:04	FR	54° 31,116' N	010° 28,256' E	16	AL608_72-1
2024-03-09 08:38:41	FR	54° 29,153' N	010° 25,365' E	19	AL608_73-1
2024-03-09 08:57:59	CTD	54° 29,162' N	010° 25,356' E	19	AL608_73-2
2024-03-09 09:14:45	FR	54° 27,853' N	010° 25,185' E	17	AL608_74-1
2024-03-09 09:43:16	CTD	54° 27,858' N	010° 25,203' E	18	AL608_74-2
2024-03-09 09:58:44	FR	54° 28,372' N	010° 24,051' E	19	AL608_75-1

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 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
    b. Fisheries data
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).

Table 7.1 Overview of data availability

Type	Database	Available	Free Access	Contact
hydrography		Date	Date	E-Mail
CTD Fisheries	PANGAEA	Dec. 2024	Feb 2025	luisa.listmann@uni-hamburg.de

8 Acknowledgements

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9 References

Möllmann C, Cormon X, Funk S, et al (2021) Tipping point realized in cod fishery. Sci Reports 2021 111 11:1–12. https://doi.org/10.1038/s41598-021-93843-z

Receveur A, Bleil M, Funk S, et al (2022) Western Baltic cod in distress: decline in energy reserves since 1977. ICES J Mar Sci 79:1187–1201. https://doi.org/10.1093/ICESJMS/FSAC042

10 Abbreviations

CTD	Conductivity Temperature Depth probe
WS	Water Sampler (Niskin Bottle)
Bongo	Plankton Net
MSN	Multi opening/closing net (MultiNet)
Trawl	Bottom Trawl