ALKOR-Berichte

Multidisciplinary teaching cruise MNF-bioc-301
Plankton along the Baltic Sea salinity gradient

Cruise No. AL580

August 30th – September 9th 2022
Kiel (Germany) – Kiel (Germany)
MNF-bioc-301

Dr. Felix Mittermayer
GEOMAR Helmholtz Centre for Ocean Research Kiel

2022

Table of Contents

1 Cruise Summary

1.1 Summary in English

The multidisciplinary teaching cruise AL580 was part of the curriculum of the master “Biological Oceanography” at the Christian-Albrechts-University Kiel and the GEOMAR Helmholtz Centre for Ocean Research. During this mandatory part of the MNF-bioc-301 module the students were able to gain hands-on experience of the scientific operation on-board a modern multidisciplinary research vessel. Methods in physical, biological and chemical oceanography were taught based on biodiversity changes in several functional plankton groups along the Baltic Sea salinity gradient as a main subject. The students performed tasks such as deploying state-of-the-art measuring and sampling gear, data and sample collection as well as first on-board analyses and curation of data and samples for later use. The on-board analyses included taxonomic identification, measurements and counts of plankton organisms, determination of dissolved oxygen and chlorophyll A concentrations and recording of CTD profiles. Further samples were collected for later analyses during other practical courses in the master curriculum such as seawater samples for eDNA and viral plankton analyses. The work with the crew onboard ALKOR was outstanding.

1.2 Zusammenfassung

Die multidisziplinäre Lehrfahrt AL580 war Teil des Lehrplans für den Masterstudiengang "Biologische Ozeanographie" an der Christian-Albrechts-Universität zu Kiel und dem GEOMAR Helmholtz-Zentrum für Ozeanforschung. Während dieses obligatorischen Moduls (MNF-bioc-301) konnten die Studierenden praktische Erfahrungen zu dem wissenschaftlichen Betrieb an Bord eines modernen, multidisziplinären Forschungsschiffes sammeln. Methoden der physikalischen, biologischen und chemischen Ozeanographie wurden anhand von Biodiversitätsveränderungen verschiedener funktioneller Planktongruppen entlang des Salinitätsgradienten der Ostsee als Hauptthema vermittelt. Die Studierenden übernahmen Aufgaben wie z.B. die Bedienung modernster Mess- und Probenahmegeräte, die Daten- und Probensammlung sowie erste Analysen an Bord und die Aufbereitung von Daten und Proben für die spätere Verwendung. Zu den Analysen an Bord gehörten die taxonomische Identifizierung, Messungen und Zählungen von Planktonorganismen, die Bestimmung der Konzentrationen von gelöstem Sauerstoff und Chlorophyll A, sowie die Aufzeichnung von CTD-Profilen. Weitere Proben wurden für spätere Analysen während anderer Praktika im Rahmen des Masterstudiengangs entnommen, z.B. Meerwasserproben für eDNA- und Virusplanktonanalysen. Die Zusammenarbeit mit der Besatzung an Bord der ALKOR war hervorragend.

2 Participants

2.1 Principal Investigators

Name	Institution
Reusch, Thorsten BH, Prof.	GEOMAR
Mittermayer, Felix Hans, Dr.	GEOMAR

2.2 Scientific Party

Name	Discipline	Institution[1]
Dr. Felix Mittermayer	Chief Scientist	GEOMAR
Svend Olof Mees	Technician	GEOMAR
Katharina Csenteri	Student	GEOMAR
Jonas Blendle	Student	GEOMAR
Natasha Bryan	Student	GEOMAR
Samantha Chase	Student	GEOMAR
Sookyung Kim	Student	GEOMAR
Nele Weigt	Student	GEOMAR
Theo Krüger	Student	GEOMAR
Nora Theurich	Student	GEOMAR
Alexandra Hahn	Student	GEOMAR
Josefin Karnatz	Student	GEOMAR

2.3 Participating Institutions

Abbreviation	Full name
GEOMAR	Helmholtz-Centre for Ocean Research Kiel, Germany

3 Research Program

3.1 Description of the Work Area

The Baltic Sea has been chosen as a working area for a number of reasons. The Baltic Sea being the larges brackish body of water in the world allows us to study the hydrography and ecology along an environmental gradient. This characterizing salinity gradient, both vertically and horizontally, created by surface run off and irregular saltwater inflows has created a unique environment with vertically and horizontally structured saltwater, brackish and freshwater habitats. In addition, the Baltic Sea is under heavy anthropogenic impact due to over 85 million people living in is catchment area and has been the object of many studies and time series sampling.

3.2 Aims of the Cruise

The aim of this practical course and cruise is to introduce and familiarize the students with modern methods in biological oceanography on board a state-of-the-art research vessel. As part of the curriculum of the "Biological Oceanography" master program (GEOMAR & CAU, module MNF-bioc-301) it is obligatory for the students to participate in cruises and field work. Our aim is to convey a number of "hard" and "soft" skills to the participating students during this multidisciplinary research cruise as well as spark their interest for the Baltic Sea ecosystem in general and for participating in research cruises in particular. During this cruise the students learned about mechanisms, methods and current topics in, but not limited to, biological oceanography, marine ecology, hydrography, fisheries ecology, global change ecology, invasion biology, environmental genomics and biogeochemistry. In addition, we aimed to collect as many samples as possible to be analyzed by the students during the cruise or in the subsequent practical modules. Thus, in comparison to other teaching cruises, we try to integrate many previously independent topics into a more cohesive work where students are given the chance to follow up on their own samples. The long-term goal is to create a student time-series over several consecutive years and assess annual differences and shifts in species distribution and abundance along the salinity gradient. Allowing for analysis during practical cruises as well es in master theses.

General topics included personal safety during work on deck and in the laboratories, independent work in a shift roster as well as continuous, high standard data and sample curation. Specific topics covered during the cruise were operating procedures with scientific equipment on board such as deploying CTDs, rosette water samplers, horizontally and vertically towed plankton nets of different models, as well as handling and conserving various samples types including filtrations for Chl A measurements, eDNA and viral plankton. Further, the students were taught to identify the most common planktonic organisms found in the Baltic Sea including phytoplankton, ichthyoplankton and meso- and macro-zooplankton species.

Further we aimed to sample the ichthyoplankton survey "Bornholm Grid", a time series reaching back to 1986 and part of the eastern Baltic cod stock assessment process. The students had gained enough experience by this point during the cruise to conduct the operations more independently and be able to work in a shift system under supervision. Particular emphasis was put on sample and data curation during this part of the cruise.

3.3 Agenda of the Cruise

The overall agenda for the cruise is to first follow the surface salinity gradient from Kiel Bight via Mecklenburg Bight, Arkona Basin, and Bornholm Basin to the Gotland Basin (Fig 3.1) and spend 1 to 1.5 days sampling each area. Samples of the various functional plankton groups will be taken in coordination with hydrography measurements to connect the ecology to the hydrography along the salinity gradient.

The research during this cruise has been performed in accordance with the declarations on responsible marine research stated in the cruise proposal.

Fig 3.1 Cruise track of AL580 (Map produced in OSIS).

4 Narrative of the Cruise

RV ALKOR was loaded on the GEOMAR East shore campus on August 29th. On August 30th, the scientific crew came on board ALKOR. After the safety briefing by crew, ALKOR departed for the first station in the Kiel Fjord at 8:00 am (all times ship time). The first two initial stations in the Kiel Fjord were used to test and calibrate equipment as well as to give first instructions and familiarization to the students on how to operate the various plankton nets, CTD and rosette water sample correctly and safely. Then ALKOR set course for the North Western Kiel Bight under ideal conditions: a light northerly breeze and no swell. As in previous years The students were divided into groups and each group was given the task to operate one of the main works stations: zooplankton, phytoplankton, eDNA/viral plankton and hydrography which rotate every day. After additional instructions to the students, work at the Kiel Bight main station started at 12:15 am. The deployed gear included CTD, rosette water sampler, Bongo and Multinet Maxi horizontally towed plankton nets and vertically deployed plankton nets such as WP2 in 100 and 200 µm mesh size, WP3 and Apstein nets. From the rosette water sampler samples for eDNA, viral plankton, chlorophyll A and dissolved oxygen determination through Winkler titration were collection. Some of the plankton samples were fixed immediately for later analyses while others were analyzed subsequently on board through identification, counting and measuring of selected taxonomic groups. While six students continued analyzing plankton samples from the Kiel Bight main station, ALKOR moved eastward, and the remaining four students covered additional plankton stations. This pattern with work on a main station starting in the morning (8:00 am) and additional plankton stations in the afternoon and evening (ending deck operation between 17:00

and 20:00 an following with lab analyses, tutorials and lectures) was continued for the next 4 days in each of the visited Basins (Mecklenburg Bight, Arkona Basin, Bornholm Basin, Gotland Basin). Each day, the student pairs rotated to a different task so that by the 3rd of September all pairs had covered all work stations.

On the 4th of September the students were assigned to shifts and the 24h-sampling in the Central Bornholm Basin startet with a CTD profile at 5:00 am. Every six hours a double haul with the multinet maxi was performed to follow the diurnal vertical migration of zooplankton and to collect additional fish larvae.

Next the ichthyoplankton "Bornholm Grid" was sampled, starting on the Morning of the 5th of September with the first of 45 stations, the main objective being to familiarize the students with repeatet shift work and operation gear from the lab and on deck. The samples from this part are further used for stock assessment of the Eastern Baltic cod stock. This portion of the cruise was concluded on the evening of the 7th before transiting to the Mecklenburg Bight to start the ichthyoplankton "West Gird" on the morning of the 8th. Due to increasing easterly winds as swell the station work was suspended and ALKOR sheltered west of Fehmarn before heading back to Kiel.

The cruise ended on the 9th of September at 11:00 am in Kiel.

Table 4.1 Overview of gear deployments during AL563. Mesh sizes of all nets are given in brackets. Abbreviations: CTD = probe measuring salinity, temperature, oxygen concentration and depth. WS-CTD = Rosette water sampler coupled with CTD probe. MN Maxi = large multinet.

Gear	# of deployments
CTD	76
WS-CTD	14
Bongo (150, 335, 500 µm)	71
MN Maxi (335 µm)	13
Apstein (50 µm)	5
WP2 (200 µm)	21
WP2 (100 µm)	6
WP3 (1000 µm)	12
Thermosalinography	continuous
Total	**219**

5 Preliminary Results

5.1 Ichthyoplankton

Bongo net hauls (mesh sizes 150, 335 and 500 µm) of the first part of the course (August 30th to September 3rd) covered the Kiel Bight, Mecklenburg Bight, Arkona Basin, Bornholm Basin and Gotland Basin. All fish larvae from the 500 µm nets were identified to the closest possible taxa, counted (Table 5.1.1) and measured immediately on board. Fish larvae were conserved at -80 °C for subsequent RNA/DNA, stable isotope and genetic analyses. Clearly apparent is the change of

fish diversity between the basins. Many species in the western towards (maximum of 8 taxa in Kiel Bight) fewer species in the East (minimum 0 species in Gotland Basin), following the salinity gradient.

Table 5.1.1 Catches of fish larvae in Bongo net hauls (500 µm mesh size) in Kiel Bight (KB), Mecklenburg Bight (MB), Arkona Basin (AB), Bornholm Basin (BB) and Gotland Basin (GB).

Area	Flatfish	Gobies	Cod	Clupeidae	Sea scorpion	Rockling	Sandeel	Pipefish
KB	0	0	0	2	0	0	0	0
MB	0	1	0	1	0	2	0	1
AB	0	15	0	0	0	2	1	0
BB	0	2	4	0	0	1	0	0
GB	0	0	0	0	0	0	1	0
Total	0	18	2	3	o	5	2	1

At the 24h Station all ichthyoplankton was immediately sampled from the catch and frozen at -80C. A large number of cod larva were caught but no clear vertical migration pattern was discernible (Fig. 5.1.1).

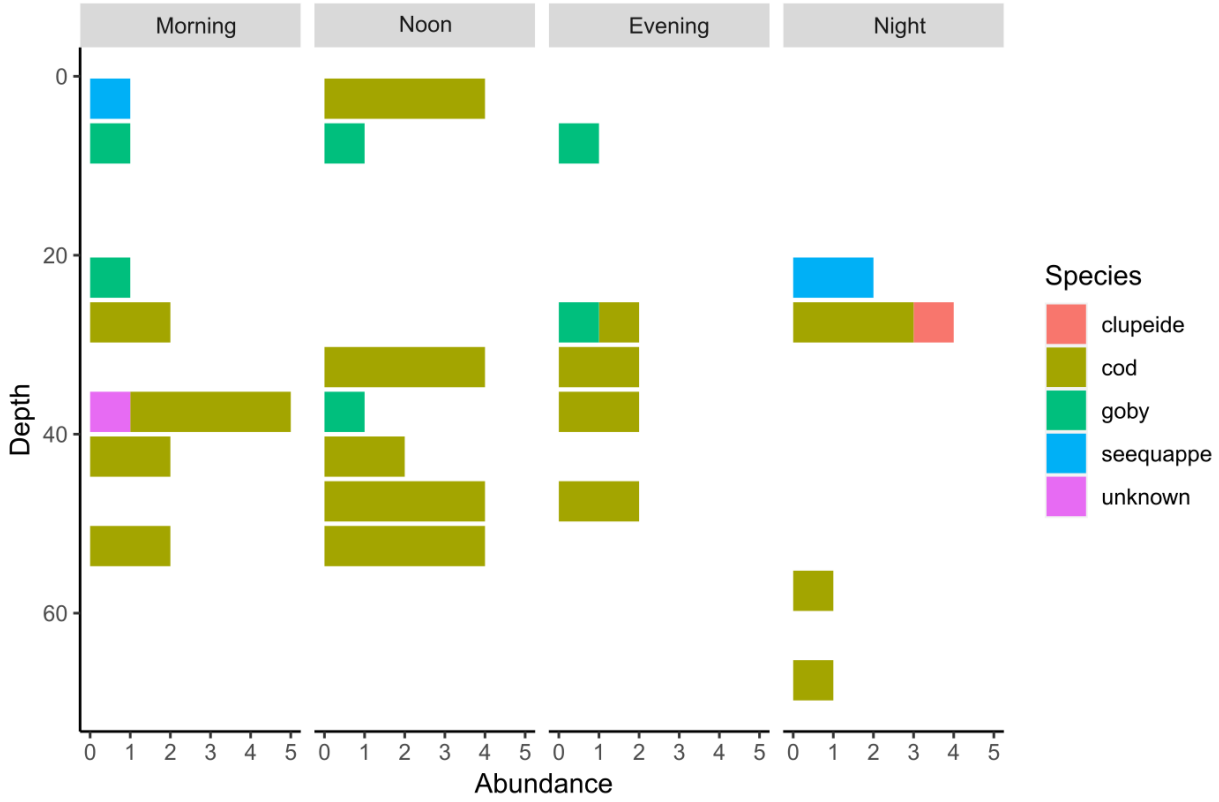


Fig. 5.1 Abundances of fish larva in 5m depth intervals caught during the 24h station multinet sampling.

45 Bongo net hauls (mesh sizes 150, 335 and 500 µm) were sampled to cover the Bornholm grid that is part of the Integrated Baltic Sea Time Series covering this area since 1987. Particular focus lies on the abundance of cod larvae and eggs in the Bongo catches. This cruise fills an important gap in the sampling efforts covering the end of the cod spawning and larvae season. Larvae from the 500 µm were identified to the closest possible taxa and measured immediately on board before being conserved in -80°C for later analysis. Further, the contents 335 µm net was conserved in 4% buffered formaldehyde. These samples were later analyzed in the lab, larvae were identified, measured and counted (Tables 5.1.2).

Table 5.1.2 Catches of fish larvae and eggs in Bongo net hauls (335 µm mesh size) during AL580 in the Bornholm Basin (45 hauls)

	Cod	**Gobies**	**Flounder**	**Sandeel**	**Rockling**	**Clupeidae**
Larva	28	24	0	12	12	4
Eggs	209	/	0	/	6	3

5.2 Gelatinous Plankton Sampling

Jellyfish (Ctnetophores and Scyphozoa) were identified, counted (Fig 5.3.1) and measured from the 500 µm Bongo nets. The invasive comb jelly *Mnemiopsis leidyi* was dominantly found in the Kiel well as the Arkona Basin but missing farther east. No gelatinous plankton was caught in the Mecklenburg Bight The scyphozoan jellyfish *Aurelia aurita* was present in lower abundances in all Basins except the Kiel Bight.

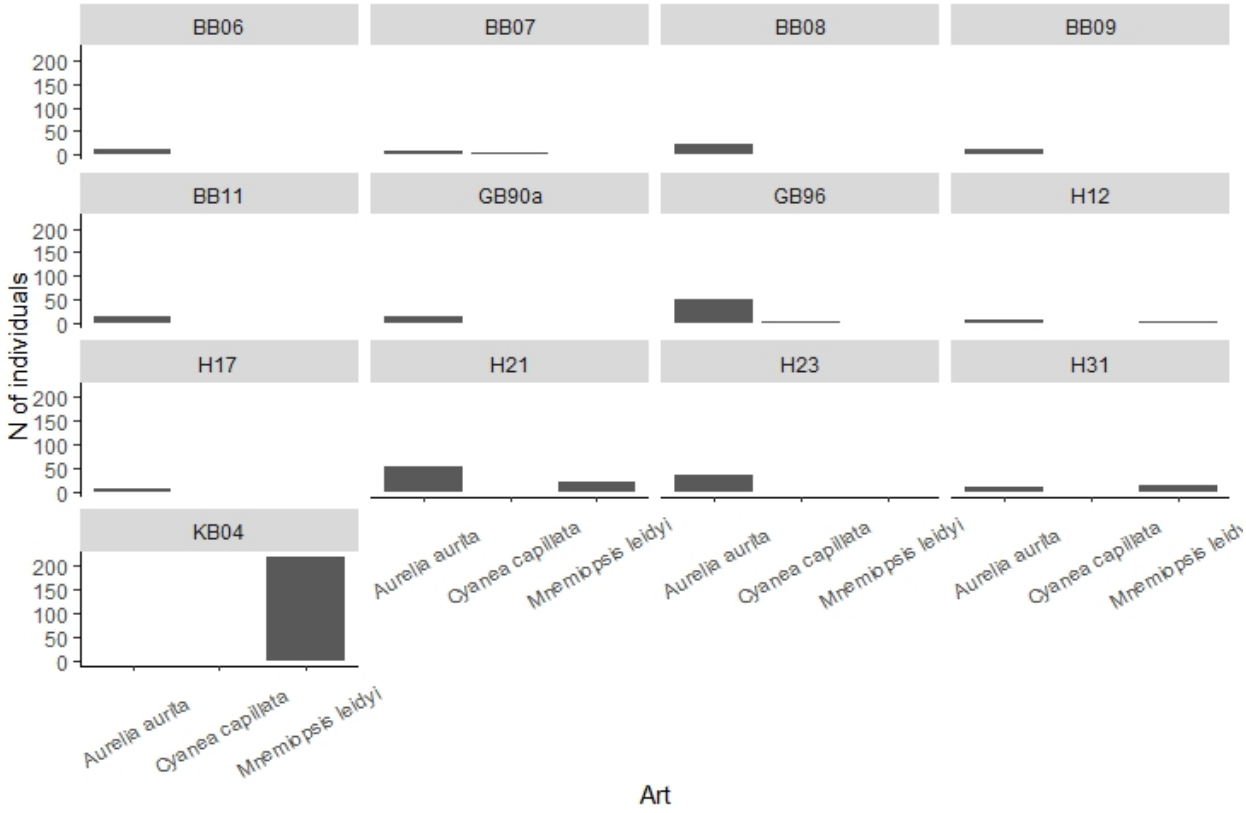


Fig 5.2.1 Catches of Ctnetophores and Scyphozoa jellyfish in Bongo net hauls (500 µm mesh size) in Kiel Bight (KB), Arkona Basin (H), Bornholm Basin (BB) and Gotland Basin (GB).

During the 24h station in the central Bornholm Basin gelatinous plankton, *Aurelia aurita* in particular showed the expected diurnal vertical migration. Migrating towards the surface during the dark hours and retreating into deeper layers at night.

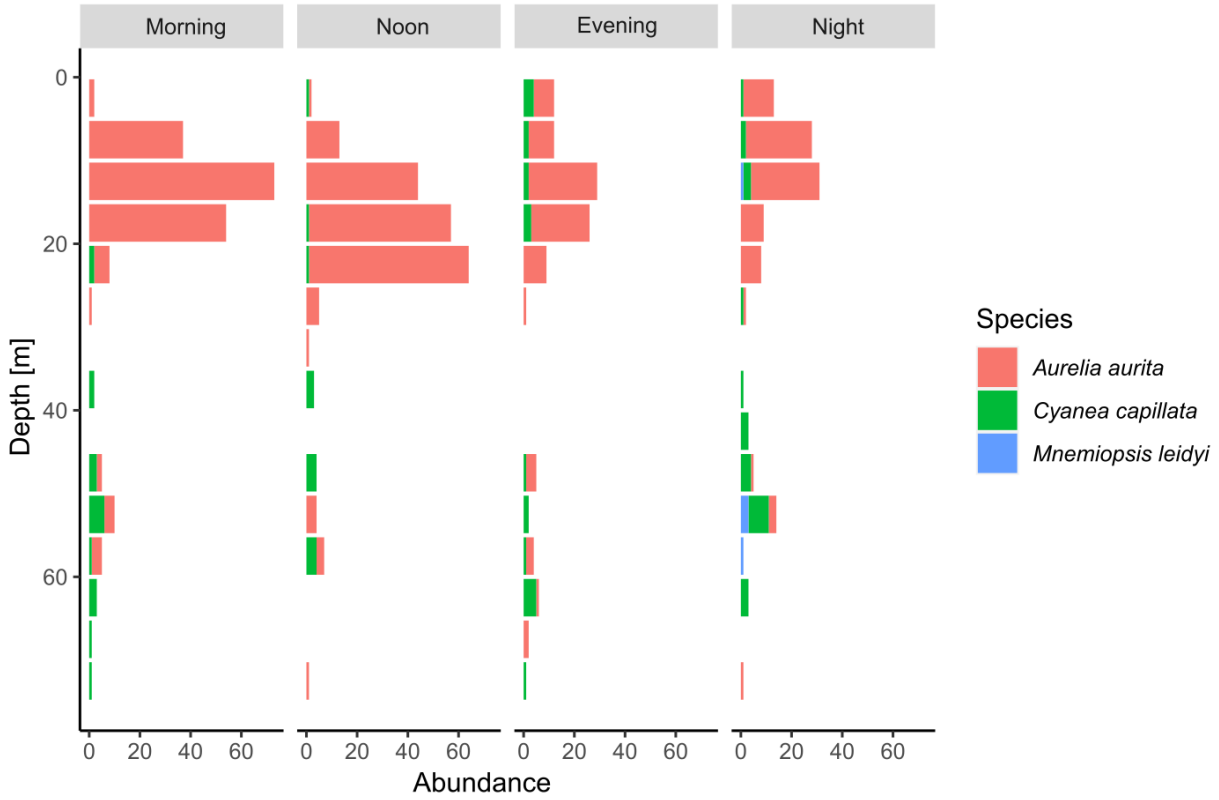


Fig 5.2.2 Catches of Ctnetophores and Scyphozoa jellyfish in 5m depth intervals caught during the 24h station multinet sampling.

Following the initial sorting steps on board, all remaining Bongo samples were conserved in formalin, and are available for the determination of species composition and abundance of zoo- and ichthyoplankton.

5.3 Phytoplankton

Phytoplankton was samples using Apstein plankton nets and the rosette water sampler (from east to west Kiel Bight, Mecklenburg Bight, Arkona Basin, Bornholm Basin and Gotland Basin. Part of each sample was examined under the microscope immediately as well as fixed in acid lugol for later analysis. The onside examination yielded qualitative results on the relative abundance of the many taxa along the salinity gradient (Tab. 5.1).

Table 5.3 Relative abundance of phytoplankton taxa in Kiel Bight (KB), Mecklenburg Bight (MB), Arkona Basin (AB), Bornholm Basin (BB) and Gotland Basin (GB). Dominant >50%, Abundant >25%, Common >15%, Rare = <15%

Taxa	Kiel Bight	Mecklenburg	Arkona Basin	Bornholm	Gotland

		Bight		Basin	Basin
Dinoflagellates	Dominant	Abundant	Rare	Abundant	Dominant
Diatomes	Common	Dominant	Abundant	Abundant	Abundant
Chiliates	Common	Rare	Rare	Rare	Rare
Other	Rare	Common	Rare	Rare	Rare

During a follow-up practical course (MNF-BiOc 102), the lugol fixed samples were further analyzed under the supervision of Dr. Birte Matthiesen and Dr. Annegret Stuhr.

5.4 Zooplankton

The zooplankton community was investigated from WP-2 samples directly after sampling. Using a stereo microscope, the most common taxa were identified in the five basins (Fig 5.2.1). Copepods of various genus (Fig. 5.2.2) where the most common taxa in all areas expect the Gotland Basin where cladocerans were the most common taxa. While some species, such as *Acartia clausi,* were abundant at all locations others, such as *Appendicularia*, were only found at higher salinities. The general trend of decreasing diversity along the salinity gradient was clearly observed in this functional group as well as represented in the category "other" (Fig. 5.2.1).

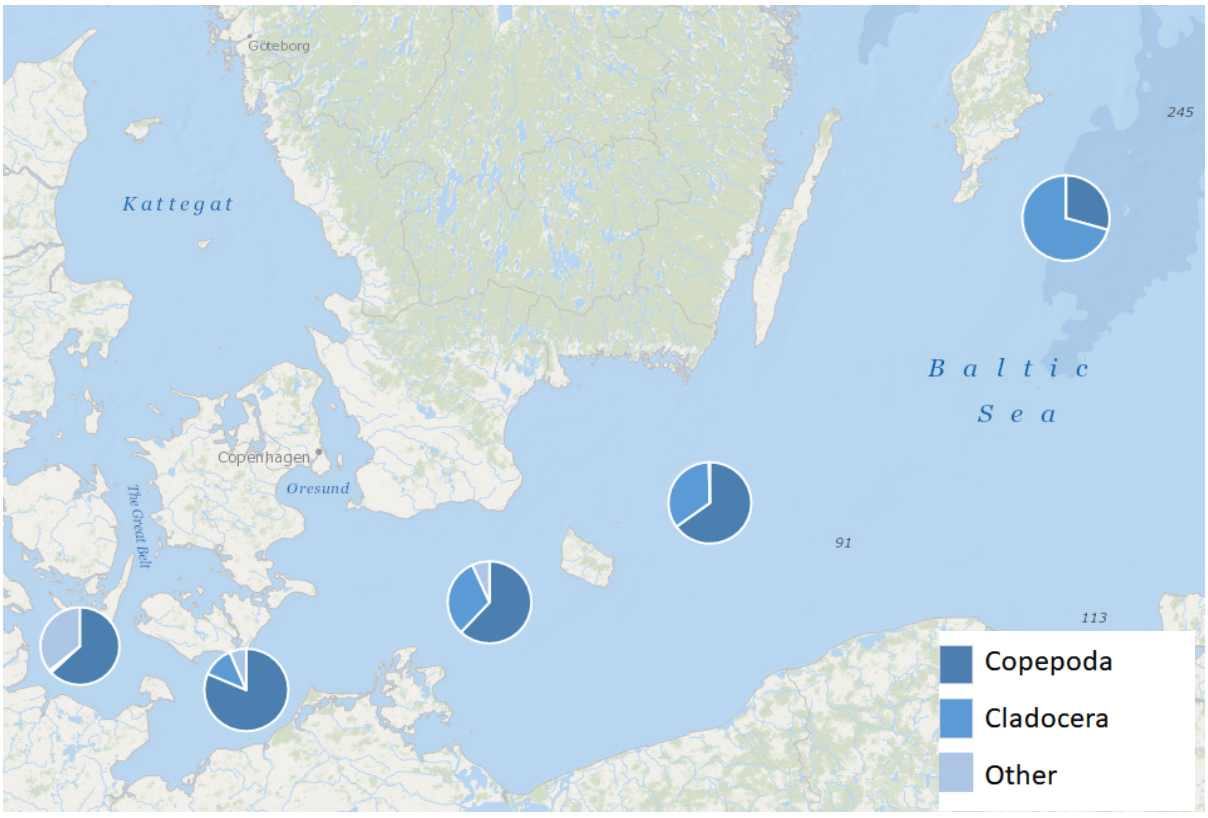


Fig 5.4.1 Diversity of zooplankton along the Baltic Sea salinity gradient from the Kiel Bight (KB), Mecklenburg Bight (MB), Arkona Basin (AB), Bornholm Basin (BB) to the Gotland Basin (GB). Identification was done on live WP-2 sample.

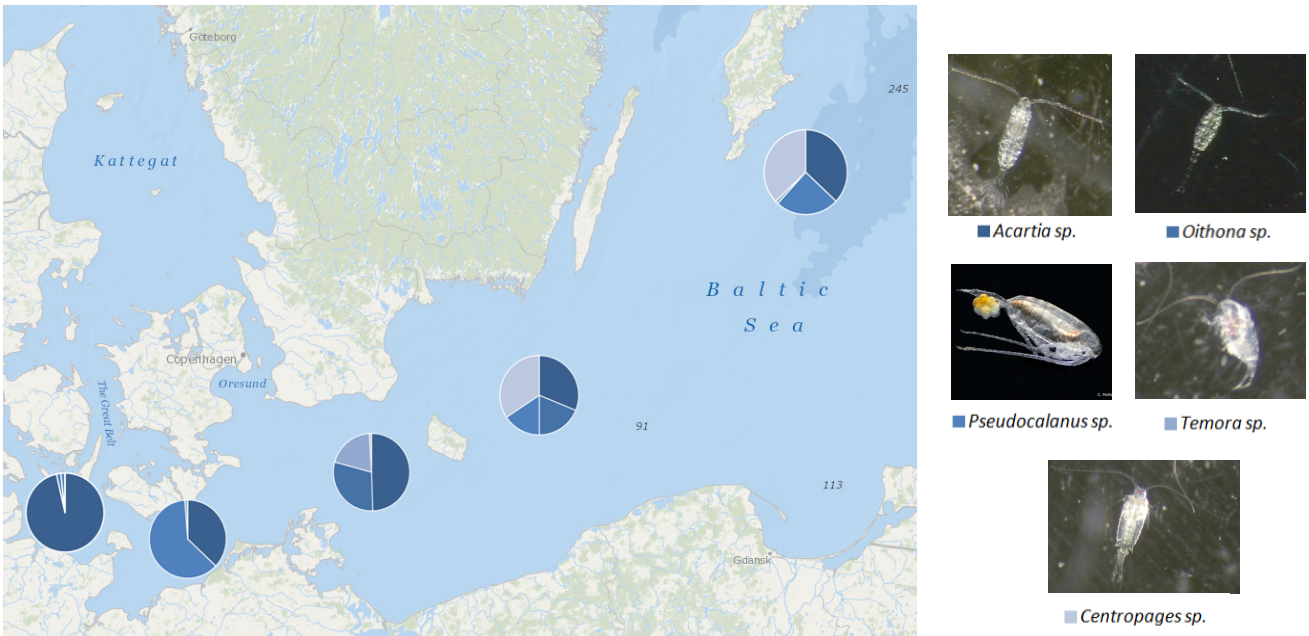


Fig 5.4.2 Diversity of copepods along the Baltic Sea salinity gradient from the Kiel Bight (KB), Mecklenburg Bight (MB), Arkona Basin (AB), Bornholm Basin (BB) to the Gotland Basin (GB). Identification was done on live WP-2 sample.

No Clear pattern of diurnal migration was identified in the zooplankton catches of the 24. Station in the central Bornholm Basin (Fig. 5.2.3).

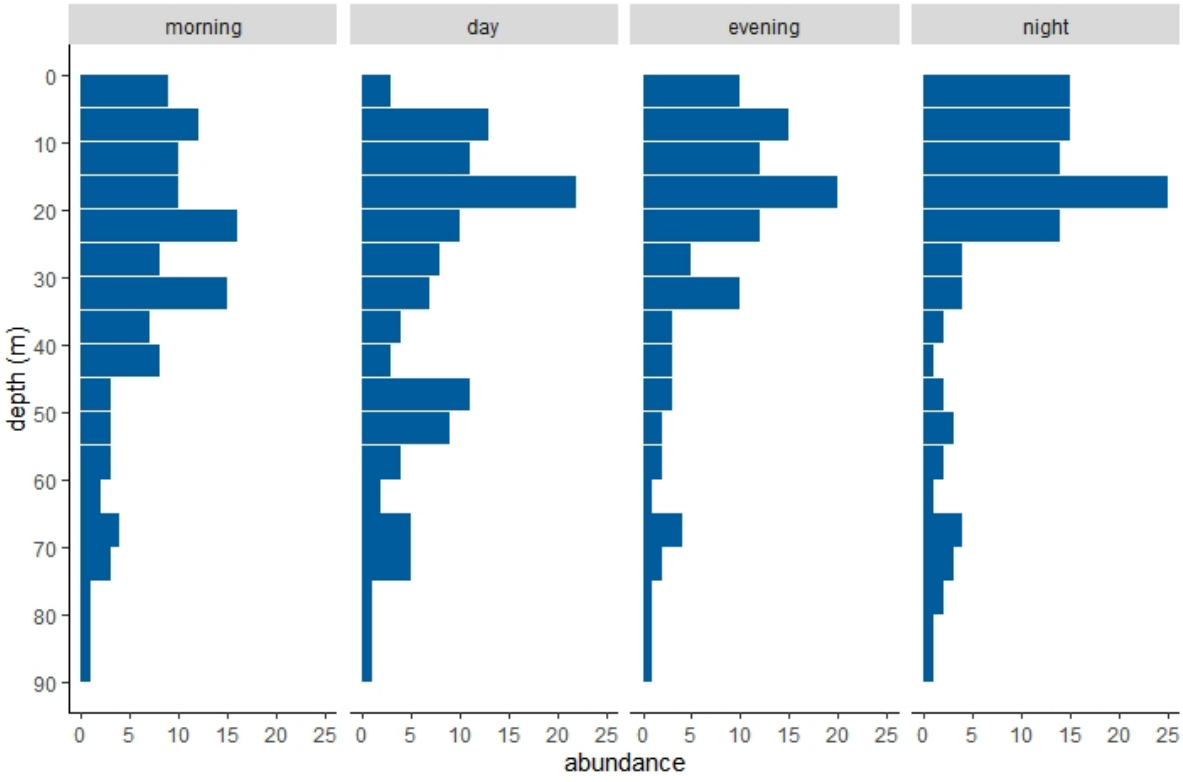


Fig 5.4.3 Catches (biomass by volume) of zooplankton in 5m depth intervals caught during the 24h station multinet sampling.

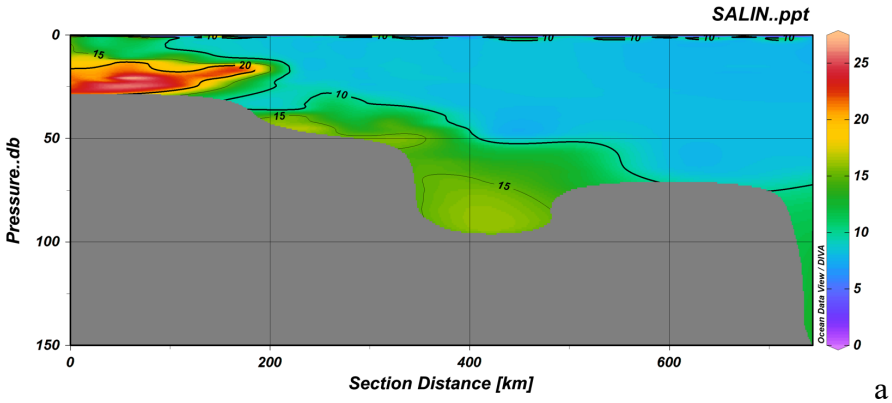
5.5 eDNA Sampling

eDNA samples were obtained at the from the deployment of the rosette water sampler and CTD at each of the five visited basins at various depths depending on the salinity of the waterbodies. Three replicates of three liters from each sampled depth were filtered through 0.45 and 0.22 µm encapsulated filters using a peristaltic pump. The filters were sealed and immediately frozen at -78ºC.

5.6 Hydrography

CTD profiles were obtained with the ADM-CTD (76 stations) and the HYDROBIOS water sampler with attached CTD (14 stations) to reconstruct temperature and salinity profiles. In addition, oxygen profiles were created for teaching and calibration purposes in each of the five basins. For this, depth-resolved water samples were taken with the rosette water sampler and oxygen concentrations of determined using the Winkler method.

The Baltic Sea surface salinity gradient was reconstructed as expected with approximately 15 PSU in the Kiel Bight to 7 PSU in the Gotland Basin. The bottom salinity was up to 26 PSU in the western Baltic and 14 PSU in the Gotland Basin (Fig 5.6a). Surface temperature was still high with up to 17°C (Fig 5.6b). The dissolved oxygen concentration (DO) varied between the basins but was generally what is to be expected at the season (Fig 5.6c). In the Western Baltic, the DO was less than 2 ml/l below 25 m. In the Bornholm Basin and Gotland Basin, the DO was less than 2 ml/l below 65 m.



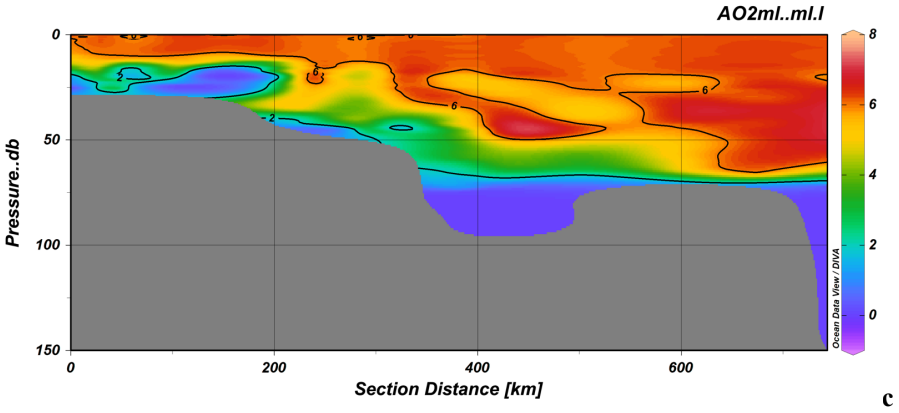


Fig 5.6.1 Hydrography West to East along the cruise track of the first part of the cruise (a) salinity (psu) (b) temperature(°C) and (c) dissolved oxygen (ml/l)

Dissolved oxygen determination by titration method (Winkler) confirmed sensor reading of the CTDs (Fig 5.6.2)

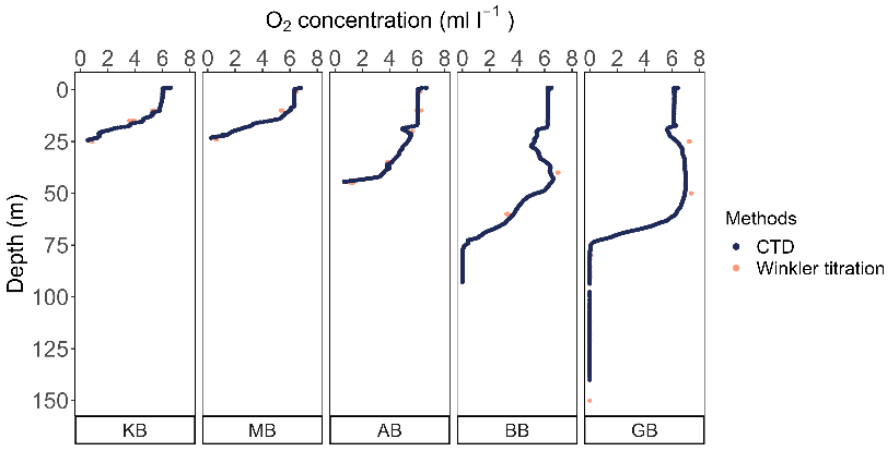


Fig 5.6.2 Comparison of dissolved oxygen (ml/l) values

5.7 Chlorophyll A Concentrations

Water samples were taken with the rosette water sampler at 5 stations along the salinity gradient, a 5 meters depth and at the Chl A maximum according to the CTD. The water was immediately filter onto a GF/F filter and frozen for later onboard analysis. The Analysis yielded results suggestion that the Chl A concentration at 5 m ist relatively stable whit the value of the Chl A maximum varies along the cruise gradient (Fig. 5.7)

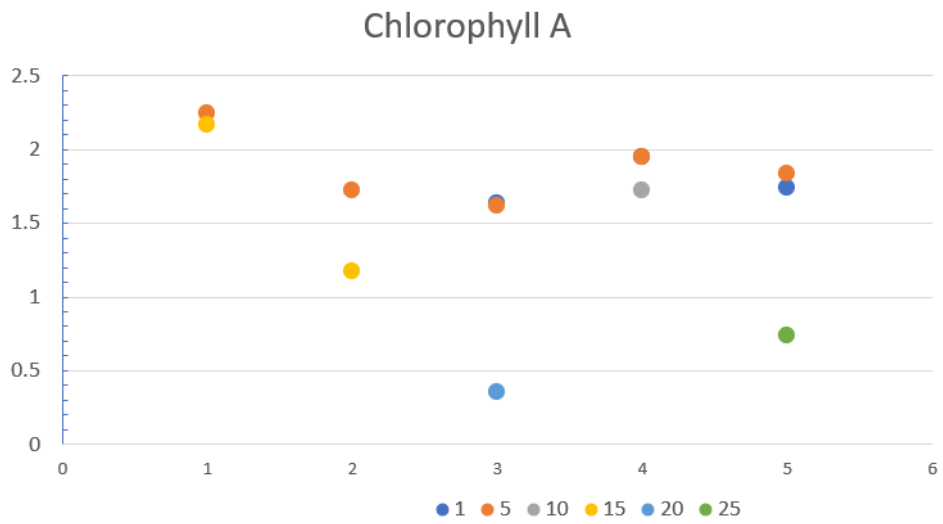


Fig. 5.7 Concentration of Chlorophyll A in Kiel Bight (KB), Mecklenburg Bight (MB), Arkona Basin (AB), Bornholm Basin (BB) and Gotland Basin (GB).

6 Station List AL580

In total, 219 gear deployments took place during this cruise (see Table 4.1 for an overview, and Table 6.1 for the full station list). The electronic version of the list and additional cruise data are also permanently available via the GEOMAR OSIS data portal under the link: https://osis.geomar.de/app/expeditions/359942

Table 6.1 Station list with all 219 gear deployments during of AL580. Gear abbreviations: CTD = probe measuring salinity, temperature, oxygen concentration and depth. CTD with water samploer = Rosette water sampler coupled with CTD probe. Multinet Maxi = large multinet. MN-Maxi, Bongo, Apstein and WP-2, WP-3 represent different plankton nets. TSG = Thermosalinograph. Times refer to "board time", representing Central European Time (CET). Latitude and longitude are given in degrees decimal minutes format. "100" and "200" in Device Comment referred to mesh size in microns.

Station Number	Event	Device	Device Comment	Event Time	Latitude N	Longitude E	Depth (m)
0	AL580_0_ Underway-1	TSG		2022/08/30 07:58:35	54° 19,928' N	010° 09,366' E	14
1	AL580_1-1	CTD		2022/08/30 08:13:34	54° 21,389' N	010° 09,690' E	12
1	AL580_1-2	WP-2 net	100	2022/08/30 08:22:25	54° 21,382' N	010° 09,668' E	12
1	AL580_1-3	WP-3 net		2022/08/30 08:33:31	54° 21,358' N	010° 09,664' E	12
1	AL580_1-4	Bongo net		2022/08/30 08:52:19	54° 21,309' N	010° 09,366' E	12
2	AL580_2-1	CTD		2022/08/30 11:15:02	54° 41,344' N	010° 09,102' E	26
2	AL580_2-2	CTD with water sampler		2022/08/30 11:31:42	54° 41,297' N	010° 09,187' E	27

2	AL580_2-3	Apstein net		2022/08/30 11:56:09	54° 41,309' N	010° 09,198' E	28
2	AL580_2-4	WP-2 net	100	2022/08/30 12:05:25	54° 41,309' N	010° 09,198' E	28
2	AL580_2-5	WP-2 net	200	2022/08/30 12:12:25	54° 41,302' N	010° 09,199' E	28
2	AL580_2-6	WP-2 net	200	2022/08/30 12:18:27	54° 41,324' N	010° 09,217' E	29
2	AL580_2-7	WP-3 net		2022/08/30 12:26:29	54° 41,309' N	010° 09,229' E	29
2	AL580_2-8	WP-3 net		2022/08/30 12:31:42	54° 41,302' N	010° 09,228' E	29
2	AL580_2-9	WP-3 net		2022/08/30 12:36:36	54° 41,309' N	010° 09,233' E	29
2	AL580_2-10	Bongo net		2022/08/30 12:44:48	54° 41,319' N	010° 09,301' E	31
2	AL580_2-11	Multinet Maxi		2022/08/30 13:37:23	54° 41,777' N	010° 10,766' E	24
3	AL580_3-1	CTD		2022/08/30 14:37:33	54° 41,297' N	010° 23,369' E	27
4	AL580_4-1	CTD		2022/08/30 15:04:58	54° 40,584' N	010° 29,508' E	23
4	AL580_4-2	WP-2 net	200	2022/08/30 15:43:03	54° 40,548' N	010° 29,547' E	23
5	AL580_5-1	CTD		2022/08/30 16:46:05	54° 39,225' N	010° 46,149' E	22
5	AL580_5-2	CTD with water sampler		2022/08/30 16:52:08	54° 39,216' N	010° 46,094' E	22
5	AL580_5-3	Bongo net		2022/08/30 17:00:07	54° 39,154' N	010° 46,183' E	22
6	AL580_6-1	CTD		2022/08/31 06:05:53	54° 24,478' N	011° 36,935' E	25
6	AL580_6-2	CTD with water sampler		2022/08/31 06:12:50	54° 24,482' N	011° 36,948' E	25
6	AL580_6-3	Apstein net		2022/08/31 06:30:01	54° 24,479' N	011° 36,971' E	25
6	AL580_6-4	WP-2 net	100	2022/08/31 06:39:57	54° 24,480' N	011° 36,968' E	25
6	AL580_6-5	WP-2 net	200	2022/08/31 06:46:29	54° 24,478' N	011° 36,968' E	25
6	AL580_6-6	WP-2 net	200	2022/08/31 06:51:27	54° 24,475' N	011° 36,967' E	25
6	AL580_6-7	WP-3 net		2022/08/31 06:58:44	54° 24,473' N	011° 36,969' E	25
6	AL580_6-8	Bongo net		2022/08/31 07:05:45	54° 24,461' N	011° 36,986' E	25
6	AL580_6-9	Multinet Maxi		2022/08/31 08:29:44	54° 24,478' N	011° 37,013' E	25
7	AL580_7-1	CTD		2022/08/31 10:54:17	54° 24,005' N	012° 10,046' E	21
7	AL580_7-2	WP-2 net	200	2022/08/31 10:57:45	54° 24,022' N	012° 10,054' E	21
7	AL580_7-3	Bongo net		2022/08/31 11:04:04	54° 24,083' N	012° 10,095' E	21

8	AL580_8-1	CTD		2022/08/31 13:22:08	54º 43,004' N	012º 29,478' E	18
9	AL580_9-1	CTD		2022/08/31 15:41:21	54º 53,531' N	013º 05,045' E	44
9	AL580_9-2	WP-2 net	200	2022/08/31 15:45:58	54º 53,564' N	013º 05,068' E	44
9	AL580_9-3	Bongo net		2022/08/31 15:52:23	54º 53,574' N	013º 05,138' E	44
10	AL580_10-1	CTD		2022/09/01 04:44:03	54º 56,505' N	013º 29,944' E	47
10	AL580_10-1	CTD		2022/09/01 04:48:04	54º 56,506' N	013º 29,946' E	47
10	AL580_10-2	Bongo net		2022/09/01 05:56:07	54º 56,500' N	013º 30,021' E	47
10	AL580_10-3	CTD with water sampler		2022/09/01 06:14:51	54º 56,402' N	013º 29,818' E	47
10	AL580_10-4	Apstein net		2022/09/01 06:41:19	54º 56,486' N	013º 29,969' E	47
10	AL580_10-5	WP-2 net	100	2022/09/01 06:50:25	54º 56,507' N	013º 29,959' E	47
10	AL580_10-6	WP-2 net	200	2022/09/01 06:56:44	54º 56,517' N	013º 29,954' E	47
10	AL580_10-7	WP-2 net	200	2022/09/01 07:02:43	54º 56,509' N	013º 29,974' E	47
10	AL580_10-8	WP-3 net		2022/09/01 07:10:11	54º 56,507' N	013º 29,977' E	47
10	AL580_10-9	WP-3 net		2022/09/01 07:15:45	54º 56,504' N	013º 29,983' E	47
10	AL580_10-10	Multinet Maxi		2022/09/01 08:09:22	54º 56,572' N	013º 30,163' E	47
11	AL580_11-1	CTD		2022/09/01 10:20:57	54º 58,586' N	014º 02,025' E	47
11	AL580_11-2	Bongo net		2022/09/01 10:27:02	54º 58,683' N	014º 02,104' E	47
12	AL580_12-1	CTD		2022/09/01 11:49:54	55º 04,472' N	014º 20,952' E	46
12	AL580_12-2	CTD with water sampler		2022/09/01 11:56:47	55º 04,491' N	014º 20,966' E	46
12	AL580_12-3	WP-2 net	200	2022/09/01 12:06:14	55º 04,521' N	014º 20,972' E	46
12	AL580_12-4	Bongo net		2022/09/01 12:12:48	55º 04,556' N	014º 20,994' E	46
13	AL580_13-1	CTD		2022/09/01 15:46:21	55º 17,524' N	015º 16,943' E	89
14	AL580_14-1	CTD		2022/09/02 04:41:03	55º 17,546' N	015º 44,993' E	96
14	AL580_14-2	Bongo net		2022/09/02 05:53:04	55º 17,465' N	015º 44,854' E	96
14	AL580_14-3	CTD with water sampler		2022/09/02 06:26:12	55º 17,519' N	015º 45,021' E	96
14	AL580_14-4	Apstein net		2022/09/02 06:43:05	55º 17,517' N	015º 45,037' E	96
14	AL580_14-5	WP-2 net	100	2022/09/02 06:50:45	55º 17,519' N	015º 45,023' E	96

14	AL580_14-6	WP-2 net	200	2022/09/02 07:00:48	55º 17,510' N	015º 45,012' E	96
14	AL580_14-7	WP-2 net	200	2022/09/02 07:11:05	55º 17,515' N	015º 44,999' E	96
14	AL580_14-8	WP-3 net		2022/09/02 07:22:23	55º 17,512' N	015º 45,017' E	96
14	AL580_14-9	WP-3 net		2022/09/02 07:31:57	55º 17,504' N	015º 45,003' E	96
14	AL580_14-10	Multinet Maxi		2022/09/02 07:48:28	55º 17,460' N	015º 45,104' E	96
15	AL580_15-1	CTD		2022/09/02 12:48:22	55º 20,982' N	017º 04,946' E	67
15	AL580_15-2	WP-2 net	200	2022/09/02 12:55:12	55º 20,989' N	017º 04,942' E	67
15	AL580_15-3	Bongo net		2022/09/02 13:02:37	55º 21,023' N	017º 04,951' E	67
16	AL580_16-1	CTD		2022/09/02 16:52:23	55º 50,018' N	017º 49,886' E	61
17	AL580_17-1	CTD		2022/09/02 18:12:12	55º 52,995' N	018º 11,932' E	66
17	AL580_17-2	CTD with water sampler		2022/09/02 18:19:20	55º 52,942' N	018º 12,035' E	67
17	AL580_17-3	WP-2 net	200	2022/09/02 18:31:42	55º 52,962' N	018º 11,981' E	67
17	AL580_17-4	Bongo net		2022/09/02 18:40:48	55º 53,048' N	018º 12,009' E	66
18	AL580_18-1	CTD		2022/09/03 04:42:36	56º 54,990' N	019º 34,978' E	156
18	AL580_18-2	Bongo net		2022/09/03 05:54:20	56º 54,999' N	019º 34,871' E	156
18	AL580_18-3	CTD with water sampler		2022/09/03 06:31:54	56º 54,905' N	019º 34,883' E	156
18	AL580_18-4	Apstein net		2022/09/03 06:55:05	56º 54,981' N	019º 34,974' E	156
18	AL580_18-5	WP-2 net	100	2022/09/03 07:02:41	56º 54,999' N	019º 34,959' E	156
18	AL580_18-6	WP-2 net	200	2022/09/03 07:12:13	56º 54,997' N	019º 34,966' E	156
18	AL580_18-7	WP-2 net	200	2022/09/03 07:21:06	56º 54,992' N	019º 34,971' E	156
18	AL580_18-8	WP-3 net		2022/09/03 07:31:01	56º 54,992' N	019º 34,993' E	156
18	AL580_18-9	WP-3 net		2022/09/03 07:41:06	56º 54,988' N	019º 35,000' E	156
18	AL580_18-10	WP-3 net		2022/09/03 07:50:10	56º 55,002' N	019º 35,023' E	156
18	AL580_18-11	Multinet Maxi		2022/09/03 08:13:11	56º 55,053' N	019º 35,048' E	156
19	AL580_19-1	CTD		2022/09/03 12:12:05	56º 31,995' N	018º 46,017' E	69
19	AL580_19-2	CTD with water sampler		2022/09/03 12:18:46	56º 32,027' N	018º 45,979' E	70
19	AL580_19-3	WP-2 net	200	2022/09/03 12:29:39	56º 32,034' N	018º 45,937' E	70

19	AL580_19-4	Bongo net		2022/09/03 12:37:31	56º 32,043' N	018º 45,868' E	69
20	AL580_20-1	CTD		2022/09/04 03:55:51	55º 17,501' N	015º 45,036' E	96
20	AL580_20-2	Multinet Maxi		2022/09/04 04:06:48	55º 17,496' N	015º 45,072' E	96
20	AL580_20-3	Multinet Maxi		2022/09/04 05:11:08	55º 17,522' N	015º 45,075' E	96
20	AL580_20-4	Multinet Maxi		2022/09/04 09:58:31	55º 17,524' N	015º 44,970' E	96
20	AL580_20-5	Multinet Maxi		2022/09/04 11:02:49	55º 17,540' N	015º 44,749' E	96
20	AL580_20-6	Multinet Maxi		2022/09/04 15:57:16	55º 17,484' N	015º 44,817' E	96
20	AL580_20-7	Multinet Maxi		2022/09/04 16:55:10	55º 17,510' N	015º 44,536' E	96
20	AL580_20-8	Multinet Maxi		2022/09/04 22:02:38	55º 17,466' N	015º 45,088' E	96
20	AL580_20-9	Multinet Maxi		2022/09/04 23:04:22	55º 17,572' N	015º 44,727' E	96
21	AL580_21-1	CTD		2022/09/05 04:00:00	55º 37,495' N	016º 14,978' E	75
21	AL580_21-2	Bongo net		2022/09/05 04:07:33	55º 37,501' N	016º 15,007' E	75
22	AL580_22-1	Bongo net		2022/09/05 05:00:40	55º 37,481' N	016º 29,145' E	63
22	AL580_22-2	CTD		2022/09/05 05:12:13	55º 37,541' N	016º 29,954' E	63
22	AL580_22-3	CTD with water sampler		2022/09/05 05:18:14	55º 37,570' N	016º 29,951' E	63
22	AL580_22-4	WP-2 net	200	2022/09/05 05:28:31	55º 37,553' N	016º 29,951' E	63
23	AL580_23-1	CTD		2022/09/05 06:31:32	55º 47,494' N	016º 29,947' E	57
23	AL580_23-2	Bongo net		2022/09/05 06:38:52	55º 47,485' N	016º 29,951' E	57
24	AL580_24-1	Bongo net		2022/09/05 07:30:55	55º 47,371' N	016º 16,095' E	60
24	AL580_24-2	CTD		2022/09/05 07:43:34	55º 47,479' N	016º 14,996' E	60
25	AL580_25-1	CTD		2022/09/05 08:37:26	55º 47,472' N	015º 59,993' E	62
25	AL580_25-2	Bongo net		2022/09/05 08:43:33	55º 47,489' N	016º 00,012' E	62
26	AL580_26-1	Bongo net		2022/09/05 09:48:04	55º 37,735' N	016º 01,334' E	74
26	AL580_26-2	CTD		2022/09/05 10:04:09	55º 37,482' N	016º 00,063' E	75
27	AL580_27-1	Bongo net		2022/09/05 11:02:08	55º 37,515' N	015º 44,964' E	69
27	AL580_27-2	Bongo net		2022/09/05 11:09:25	55º 37,575' N	015º 45,100' E	69
28	AL580_28-1	Bongo net		2022/09/05 12:12:20	55º 37,414' N	015º 29,050' E	67

28	AL580_28-2	CTD		2022/09/05 12:22:31	55º 37,494' N	015º 29,864' E	67
29	AL580_29-1	CTD		2022/09/05 13:16:43	55º 37,520' N	015º 15,018' E	73
29	AL580_29-2	CTD with water sampler		2022/09/05 13:24:07	55º 37,514' N	015º 15,019' E	73
29	AL580_29-3	WP-2 net	200	2022/09/05 13:33:13	55º 37,524' N	015º 15,019' E	73
29	AL580_29-4	Bongo net		2022/09/05 13:40:54	55º 37,528' N	015º 15,035' E	73
30	AL580_30-1	Bongo net		2022/09/05 14:41:50	55º 37,593' N	014º 58,956' E	76
30	AL580_30-2	CTD		2022/09/05 14:53:36	55º 37,553' N	014º 59,829' E	76
31	AL580_31-1	CTD		2022/09/05 15:49:36	55º 37,518' N	014º 44,904' E	68
31	AL580_31-2	Bongo net		2022/09/05 15:55:56	55º 37,555' N	014º 44,910' E	68
32	AL580_32-1	Bongo net		2022/09/05 17:06:39	55º 27,501' N	014º 43,697' E	69
32	AL580_32-2	CTD		2022/09/05 17:19:29	55º 27,471' N	014º 44,757' E	69
33	AL580_33-1	CTD		2022/09/05 18:19:26	55º 27,546' N	014º 59,977' E	79
33	AL580_33-2	Bongo net		2022/09/05 18:26:02	55º 27,578' N	015º 00,028' E	79
34	AL580_34-1	Bongo net		2022/09/05 19:23:27	55º 27,380' N	015º 14,005' E	92
34	AL580_34-2	CTD		2022/09/05 19:40:33	55º 27,497' N	015º 15,153' E	91
35	AL580_35-1	CTD		2022/09/05 20:40:04	55º 27,511' N	015º 29,911' E	85
35	AL580_35-2	Bongo net		2022/09/05 20:48:13	55º 27,546' N	015º 30,096' E	85
36	AL580_36-1	Bongo net		2022/09/05 21:45:51	55º 27,387' N	015º 43,904' E	85
36	AL580_36-2	CTD		2022/09/05 22:02:27	55º 27,555' N	015º 45,125' E	86
37	AL580_37-1	CTD		2022/09/06 03:59:16	55º 27,488' N	016º 00,015' E	83
37	AL580_37-2	Bongo net		2022/09/06 04:07:15	55º 27,531' N	016º 00,127' E	83
38	AL580_38-1	Bongo net		2022/09/06 04:59:07	55º 27,414' N	016º 13,873' E	75
38	AL580_38-2	CTD		2022/09/06 05:10:34	55º 27,476' N	016º 14,861' E	75
39	AL580_39-1	CTD		2022/09/06 06:06:15	55º 27,502' N	016º 29,968' E	58
39	AL580_39-2	Bongo net		2022/09/06 06:12:44	55º 27,485' N	016º 30,110' E	58
40	AL580_40-1	Bongo net		2022/09/06 07:21:59	55º 17,705' N	016º 28,999' E	60
40	AL580_40-2	CTD		2022/09/06 07:34:15	55º 17,550' N	016º 29,930' E	61

41	AL580_41-1	CTD		2022/09/06 08:29:30	55º 17,487' N	016º 14,965' E	74
41	AL580_41-2	Bongo net		2022/09/06 08:36:44	55º 17,507' N	016º 15,001' E	74
42	AL580_42-1	Bongo net		2022/09/06 09:41:01	55º 18,144' N	015º 59,400' E	90
42	AL580_42-2	CTD		2022/09/06 09:57:31	55º 17,530' N	015º 59,937' E	89
43	AL580_43-1	CTD		2022/09/06 10:54:31	55º 17,523' N	015º 44,909' E	96
43	AL580_43-2	CTD with water sampler		2022/09/06 11:10:57	55º 17,529' N	015º 44,992' E	96
43	AL580_43-3	Bongo net		2022/09/06 11:25:48	55º 17,472' N	015º 45,230' E	96
44	AL580_44-1	Bongo net		2022/09/06 12:36:58	55º 17,709' N	015º 28,897' E	93
44	AL580_44-2	CTD		2022/09/06 12:51:03	55º 17,533' N	015º 29,934' E	94
45	AL580_45-1	CTD		2022/09/06 13:41:15	55º 17,504' N	015º 16,992' E	89
45	AL580_45-2	Bongo net		2022/09/06 13:49:06	55º 17,527' N	015º 17,052' E	90
46	AL580_46-1	Bongo net		2022/09/06 15:00:15	55º 17,586' N	014º 59,012' E	71
46	AL580_46-2	CTD		2022/09/06 15:11:49	55º 17,499' N	014º 59,933' E	72
47	AL580_47-1	CTD		2022/09/06 16:35:59	55º 07,480' N	015º 15,018' E	62
47	AL580_47-2	Bongo net		2022/09/06 16:42:20	55º 07,509' N	015º 15,113' E	62
48	AL580_48-1	Bongo net		2022/09/06 17:38:08	55º 07,396' N	015º 28,932' E	68
48	AL580_48-2	CTD		2022/09/06 17:49:28	55º 07,482' N	015º 29,753' E	68
49	AL580_49-1	CTD		2022/09/06 18:49:21	55º 07,520' N	015º 44,895' E	90
49	AL580_49-2	Bongo net		2022/09/06 18:58:00	55º 07,552' N	015º 45,102' E	90
50	AL580_50-1	Bongo net		2022/09/06 19:57:52	55º 07,379' N	015º 58,969' E	87
50	AL580_50-2	CTD		2022/09/06 20:11:19	55º 07,416' N	015º 59,741' E	87
51	AL580_51-1	CTD		2022/09/06 21:14:24	55º 07,518' N	016º 14,951' E	80
51	AL580_51-2	Bongo net		2022/09/06 21:21:34	55º 07,511' N	016º 15,059' E	80
52	AL580_52-1	Bongo net		2022/09/06 22:22:11	55º 07,757' N	016º 29,204' E	51
52	AL580_52-2	CTD		2022/09/06 22:32:02	55º 07,585' N	016º 29,803' E	51
53	AL580_53-1	CTD		2022/09/06 23:52:12	54º 57,485' N	016º 14,770' E	50
53	AL580_53-2	Bongo net		2022/09/06 23:59:11	54º 57,458' N	016º 14,943' E	49

54	AL580_54-1	Bongo net		2022/09/07 01:02:40	54° 57,592' N	015° 58,850' E	76
54	AL580_54-2	WP-2 net	200	2022/09/07 01:17:47	54° 57,535' N	015° 59,885' E	74
54	AL580_54-3	CTD		2022/09/07 01:26:16	54° 57,537' N	015° 59,922' E	74
54	AL580_54-4	CTD with water sampler		2022/09/07 01:34:46	54° 57,534' N	016° 00,000' E	74
55	AL580_55-1	CTD		2022/09/07 02:38:27	54° 57,506' N	015° 44,958' E	81
55	AL580_55-2	Bongo net		2022/09/07 02:46:54	54° 57,454' N	015° 45,133' E	81
56	AL580_56-1	Bongo net		2022/09/07 03:53:49	54° 57,726' N	015° 29,164' E	77
56	AL580_56-2	CTD		2022/09/07 04:06:02	54° 57,524' N	015° 29,969' E	77
57	AL580_57-1	CTD		2022/09/07 05:03:00	54° 57,477' N	015° 15,024' E	43
57	AL580_57-2	Bongo net		2022/09/07 05:07:17	54° 57,479' N	015° 15,072' E	43
58	AL580_58-1	Bongo net		2022/09/07 06:11:52	54° 47,819' N	015° 14,243' E	67
58	AL580_58-2	CTD		2022/09/07 06:24:00	54° 47,533' N	015° 15,003' E	68
59	AL580_59-1	CTD		2022/09/07 07:23:48	54° 47,503' N	015° 29,967' E	74
59	AL580_59-2	Bongo net		2022/09/07 07:31:10	54° 47,472' N	015° 30,140' E	74
60	AL580_60-1	Bongo net		2022/09/07 08:27:34	54° 47,458' N	015° 43,945' E	73
60	AL580_60-2	CTD		2022/09/07 08:39:56	54° 47,498' N	015° 44,911' E	72
61	AL580_61-1	CTD		2022/09/07 09:39:38	54° 47,511' N	015° 59,961' E	52
61	AL580_61-2	Bongo net		2022/09/07 09:46:14	54° 47,521' N	016° 00,113' E	51
62	AL580_62-1	Bongo net		2022/09/07 11:12:01	54° 37,419' N	015° 44,141' E	60
62	AL580_62-2	CTD		2022/09/07 11:22:54	54° 37,506' N	015° 44,898' E	60
63	AL580_63-1	CTD		2022/09/07 12:18:11	54° 37,499' N	015° 29,976' E	63
63	AL580_63-2	Bongo net		2022/09/07 12:24:20	54° 37,518' N	015° 30,016' E	63
64	AL580_64-1	Bongo net		2022/09/07 13:24:53	54° 37,448' N	015° 14,165' E	58
64	AL580_64-2	WP-2 net	200	2022/09/07 13:35:20	54° 37,506' N	015° 14,922' E	59
64	AL580_64-3	CTD		2022/09/07 13:42:30	54° 37,530' N	015° 14,917' E	59
64	AL580_64-4	CTD with water sampler		2022/09/07 13:54:16	54° 37,562' N	015° 14,906' E	59
65	AL580_65-1	CTD		2022/09/07 15:14:17	54° 47,526' N	015° 00,000' E	60

65	AL580_65-2	Bongo net		2022/09/07 15:19:59	54º 47,595' N	015º 00,023' E	60
66	AL580_66-1	CTD		2022/09/08 03:59:47	54º 18,019' N	011º 49,454' E	23
66	AL580_66-2	Bongo net		2022/09/08 04:04:10	54º 18,012' N	011º 49,498' E	23
67	AL580_67-1	Bongo net		2022/09/08 04:38:34	54º 12,634' N	011º 49,379' E	21
67	AL580_67-2	CTD		2022/09/08 04:43:41	54º 12,512' N	011º 49,618' E	21
68	AL580_68-1	CTD		2022/09/08 05:27:50	54º 12,498' N	011º 40,520' E	25
68	AL580_68-2	Bongo net		2022/09/08 05:31:34	54º 12,505' N	011º 40,547' E	25
69	AL580_69-1	Bongo net		2022/09/08 06:08:33	54º 17,400' N	011º 39,891' E	25
69	AL580_69-2	CTD		2022/09/08 06:15:41	54º 17,408' N	011º 40,240' E	25
70	AL580_70-1	CTD		2022/09/08 06:49:21	54º 21,657' N	011º 40,495' E	25
70	AL580_70-2	Bongo net		2022/09/08 06:52:53	54º 21,687' N	011º 40,525' E	25
71	AL580_71-1	Bongo net		2022/09/08 07:32:01	54º 22,174' N	011º 31,990' E	24
71	AL580_71-2	CTD		2022/09/08 07:39:20	54º 22,154' N	011º 32,419' E	24
72	AL580_72-1	CTD		2022/09/08 08:12:27	54º 17,420' N	011º 32,390' E	24
72	AL580_72-2	Bongo net		2022/09/08 08:16:10	54º 17,428' N	011º 32,430' E	24
73	AL580_73-1	Bongo net		2022/09/08 08:51:37	54º 11,989' N	011º 32,152' E	24
73	AL580_73-2	CTD		2022/09/08 08:57:19	54º 11,993' N	011º 32,484' E	24
74	AL580_74-1	CTD		2022/09/08 09:44:54	54º 14,676' N	011º 20,713' E	21
74	AL580_74-2	Bongo net		2022/09/08 09:48:44	54º 14,715' N	011º 20,804' E	21
75	AL580_75-1	Bongo net		2022/09/08 10:25:10	54º 19,682' N	011º 22,225' E	21
75	AL580_75-2	CTD		2022/09/08 10:30:32	54º 19,727' N	011º 22,535' E	21
76	AL580_76-1	CTD		2022/09/08 11:10:05	54º 25,252' N	011º 22,637' E	20
76	AL580_76-2	Bongo net		2022/09/08 11:14:02	54º 25,310' N	011º 22,717' E	21

7 Data and Sample Storage and Availability

All data are available immediately upon request if not otherwise stated.

7.1 Data Availability and Storage

All data obtained during the cruise have been backed up on a GEOMAR virtual drive that is backed up daily. In addition, data are stored on different hard drives in different locations. Paper protocols filled out during the cruise were entered electronically continuously throughout the cruise, and thus fall under the electronic back-up scheme, but have also been conserved as hard copies to resolve possible data entry errors later on if needed.

All cruise meta-data – including output of the on board DSHIP-System - have been entered in the GEOMAR Ocean Science Information System (OSIS), managed by the Data technologies Team at GEOMA's Ocean Reseach and Technology Center, and intended for permanent archiving of such data. The data are freely available via the link https://osis.geomar.de/app/expeditions/359942 (keyword "AL580").

We aim to ultimately make all data accumulated during the cruise publicly available.

All hydrographic (CTD) data will be submitted to the ICES database. Moreover, the DT team will assist with the publication of data in the public data repository PANGAEA to provide long-term archival and access. Some of the data are intended for specific publications, and will be published openly with the appearance of the underlying peer-review article. In these cases, please contact the person responsible for the data in case earlier access to the data is desired (Table 7.1).

Table 7.1 Overview of data and sample availability and persons responsible for specific data and sample sets.

Type	Database	Available	Free Access	Contact
Hydrography (CTD data)	ICES database	Submission pending. Available upon request (see contact e-mail).		fmittermayer@geomar.de
Plankton data Western Baltic Sea	PANGAEA	Publicly at time of acceptance of the underlying peer-reviewed publication; alternatively. via request (see contact e-mail).		fmittermayer @geomar.de
Plankton samples	BIS	Publicly at time of acceptance of the underlying peer-reviewed publication; alternatively. via request (see contact e-mail).		fmittermayer @geomar.de
Ichthyoplankton samples	BIS	Publicly at time of acceptance of the underlying peer-reviewed publication; alternatively. via request (see contact e-mail).		fmittermayer@geomar.de
Ichthyoplankton data Bornholm Basin	ICES	Publicly at time of acceptance of the underlying peer-reviewed publication; alternatively. via request (see contact e-mail).		bhu@dtu.aqua.dk
Viral plankton sampling	PANGAEA	Publicly at time of acceptance of the underlying peer-reviewed publication; alternatively. via request (see contact e-mail).		dneedham@geomar.de
eDNA sampling	BIS PANGAEA	Publicly at time of acceptance of the underlying peer-reviewed publication; alternatively. via request (see		hhoving@geomar.de

		contact e-mail).		

7.2 Sample Availability and Storage

All samples obtained during the cruise were labelled on board with a barcoding scheme, and all samples intended for longer-term storage at GEOMAR were professionally archived immediately after the cruise. This includes formalin conserved samples for long-term storage, and frozen samples (-20°C and -80°C) currently conserved in freezer rooms at GEOMAR. A selection of samples has been deposited together with their meta data in the developing BIS system and has been assigned persistent identifiers and are available here (https://biosamples.geomar.de/). Additional samples will be deposited during the ongoing development of the data base being set up under the umbrella of Helmholtz Mare/DataHub initiative to contain all sample metadata of all zooplankton, fin-clip and other preserved biological samples. Please send further inquiries to biosamples@geomar.de

8 Acknowledgements

I want to thank Captain Jan Lass and the entire crew of RV ALKOR for their outstanding support and for the excellent and constructive working atmosphere throughout the cruise. Further I would like to thank Hendrik Hampe for his technical support in planning. preparation and all the help during the cruise. I also thank Hendrik Hampe. Jan Dierking and Thorsten Reusch for their help with cruise preparations and planning. Further I would like to thank GEOMARs export and customs team and data technologies team as well as the ship coordination and logistics group. Last of all I would like to acknowledge the enthusiasm and motivation of the students' participation in AL580.

9 Appendices

9.1 Selected Pictures of Shipboard Operations

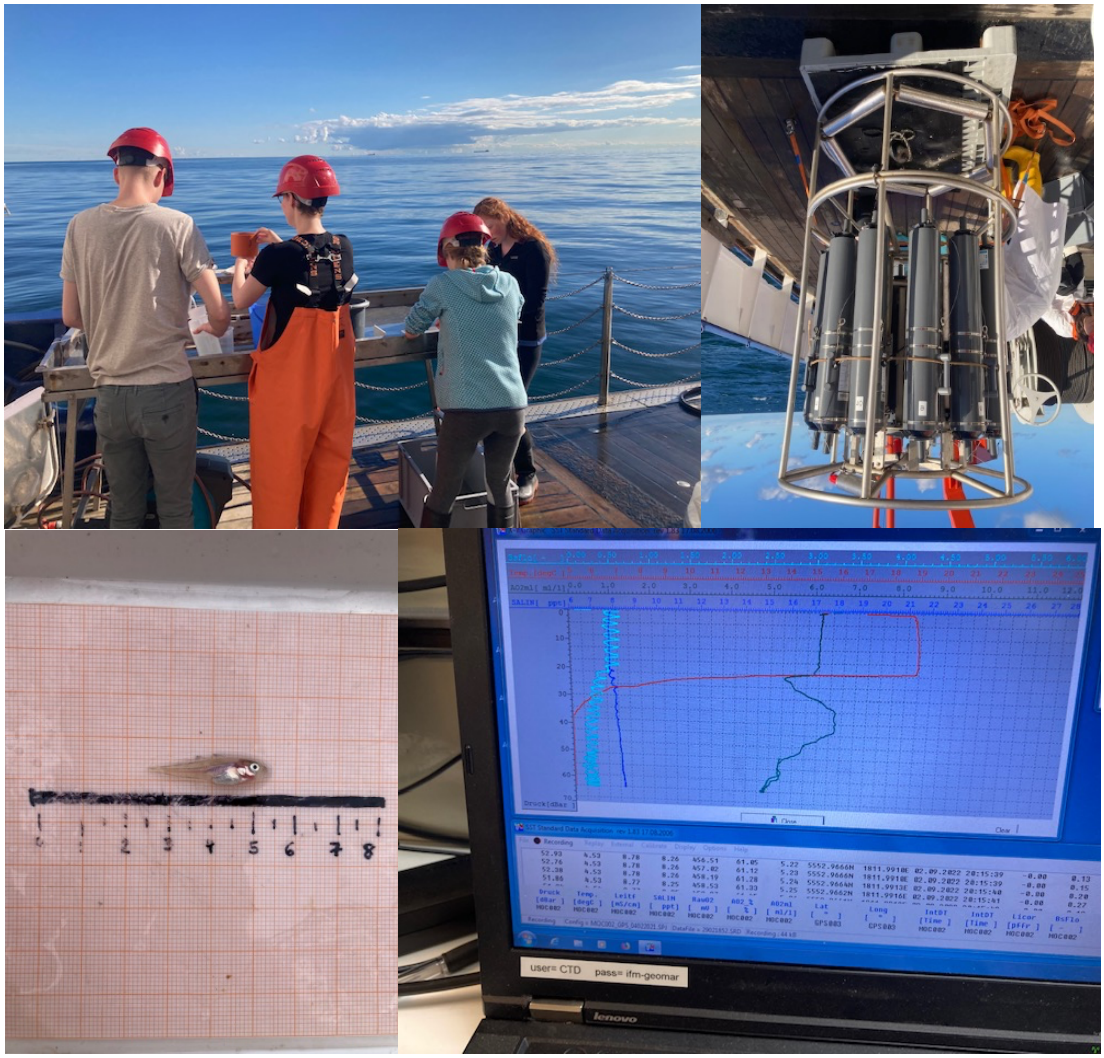


Fig 9.1 Impressions of cruise AL580. Top left to bottom right: Pictures top left to bottom right: Great working conditions in the Bay of Kiel, the students prepare zooplankton samples for preservation. Taking water samples from the crane water sampler for oxygen determination according to Winkler. Cod postlarvae/juvenile fish caught in the WP-3 net in the central Bornholm Basin. CTD profile from the Bornholm Basin, the temperature curve (red) shows a very strong thermocline.