ALKOR–Berichte

Baltic Cod

Cruise No. AL556

14 May – 28 May 2021
Kiel (Germany) – Kiel (Germany)

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1 Cruise Summary

1.1 Summary in English

The cruise AL556 "Baltic Cod" focused on the status of the Eastern Baltic cod stock, along with its prey field (zooplankton and pelagic fish prey) and hydrographic boundary conditions. The cruise extended a 35yr long-term data series on (eco-)system composition and functioning of the Baltic Sea, with a focus on the deeper basins. The resulting data- and sample sets supported ongoing projects in the Research Unit Marine Evolutionary Ecology at GEOMAR, in particular research within the DFG funded research training group (RTG) Translational Evolutionary Research /subproject "fisheries induced evolution", and several international collaborations. The spatial focus lay on the Bornholm Basin as most important spawning area of Baltic cod, but also covered parts of the pronounced salinity gradient of the Baltic Sea and included the Western Baltic Sea, Arkona Basin, Gdansk Deep, and Stolpe Trench.

Specific investigations included a detailed hydrological survey (oxygen, salinity, temperature) of the cruise area, plankton surveys (zoo- and ichthyoplankton including jellyfish) to determine the composition and the abundance and vertical and horizontal distribution of species, and pelagic fishery hauls. The latter served to determine stock structure, gonadal maturation, stomach contents, and egg production of sprat and cod, and to sample tissue and otolith samples for individual-level genomic and ecological analyses of cod (*Gadus morhua*). The abundance and distribution of fishes in the cruise area was also assessed with hydroacoustic methods. Additional cruise components were: (i) cod gonad and liver sampling for fecundity and parasite studies (in collaboration with DTU Aqua, Kopenhagen, Denmark), (ii) sampling of blue green algae (genus *Ostreococcus*) and their viruses (collaboration with Dr. Luisa Listmann /University Hamburg).

Due to the Covid 19-situation, AL556 could only run with 7 scientists berth which required us to substantially scale down the scientific program that was originally planned in the cruise application. All deployments of the Underwater Fish Observatory were cancelled. The cruise track was also shortened and the Gotland Basin was omitted.

Preliminary results were that (i) cod nutritional condition is not significantly improving, while (ii) the size structure of the stock is still very critical, with most individuals (>98%) smaller than 50 cm in length and (iii) there is still no genetic mixing occurring among Eastern and Western Baltic cod gene pools which make the former an ideal test case to study genomic changes imposed by overharvesting.

1.2 Deutsche Zusammenfassung

Die Fahrt AL556 "Baltic Cod" konzentrierte sich auf den Zustand des Dorschbestands in der östlichen Ostsee, zusammen mit seinem Beutefeld (Zooplankton und pelagische Fischbeute) und den hydrographischen Randbedingungen. Die Fahrt verlängerte eine 35 Jahre lange Datenreihe über die Zusammensetzung und Funktionsweise des (Öko-)Systems der Ostsee, wobei der Schwerpunkt auf den tieferen Becken lag. Die resultierenden Daten- und Probensätze unterstützten laufende Projekte in der Forschergruppe Marine Evolutionsökologie am GEOMAR, insbesondere die Forschung im Rahmen des DFG-geförderten Graduiertenkollegs (GRK) Translationale Evolutionsforschung / Teilprojekt "Fischereiinduzierte Evolution", sowie mehrere internationale Kooperationen. Der räumliche Schwerpunkt lag auf dem Bornholmer Becken als wichtigstem Laichgebiet des Ostseedorsches, umfasste aber auch Teile des ausgeprägten Salzgehaltsgradienten der Ostsee und schloss die westliche Ostsee, das Arkonabecken, das Danziger Tief und den Stolper Graben ein.

Zu den spezifischen Untersuchungen gehörten eine detaillierte hydrologische Untersuchung (Sauerstoff, Salzgehalt, Temperatur) des Fahrtgebiets, Planktonuntersuchungen (Zoo- und Ichthyoplankton einschließlich gelatinösem Plankton (Quallen), mit dem Ziel, die Zusammensetzung und die Abundanz sowie die vertikale und horizontale Verteilung der Arten zu bestimmen und Proben für spätere Messungen des Ernährungszustands zu nehmen). Pelagische Fischereihols dienten insbesondere der Bestimmung der Bestandsstruktur, der Gonadenreifung, des Mageninhalts und der Eiproduktion von Sprotte und Kabeljau sowie der Entnahme von Gewebe- und Otolithenproben für genomische und ökologische Analysen auf individueller Ebene beim Dorsch (*Gadus morhua*). Die Abundanz und Verteilung von Fischen im Fahrtgebiet wurde auch mit hydroakustischen Methoden untersucht. Weitere Bestandteile der Fahrt waren: (i) Probenahme von Dorsch-Gonaden und -Lebern für Fekunditäts- und Parasitenstudien (in Zusammenarbeit mit DTU Aqua, Kopenhagen, Dänemark), (ii) Probenahme von Blaualgen (Gattung *Ostreococcus*) und deren Viren (Zusammenarbeit mit Dr. Luisa Listmann /Universität Hamburg).

Aufgrund der Covid 19-Situation konnte AL556 nur mit 7 Wissenschaftlern an Bord durchgeführt werden, was uns dazu zwang, das ursprünglich im Fahrtantrag vorgesehene wissenschaftliche Programm erheblich zu reduzieren. Alle Einsätze des Unterwasser-Fischobservatoriums wurden gestrichen. Auch die Fahrtroute wurde verkürzt und das Gotland-Becken ausgelassen.

Vorläufige Ergebnisse waren, dass (i) sich der Ernährungszustand des Dorsches nicht wesentlich verbessert, während die Größenstruktur des Bestandes immer noch sehr kritisch ist, (ii) die meisten Individuen (>98 %) kleiner als 50 cm sind und (iii) es immer noch keine genetische Vermischung zwischen den Genpools der östlichen und westlichen Ostsee gibt, was den ersteren zu einem idealen Testfall für die Untersuchung genomischer Veränderungen durch Überfischung macht.

2 Participants

2.1 Scientific Party

Name	Discipline	Institution[1]
Prof. Thorsten Reusch	Chief Scientist	GEOMAR
Dr. Elvita Eglite	zooplankton /fisheries (Postdoc)	GEOMAR
Kwi Young Han	fisheries/genomics (doctoral student)	GEOMAR
Peter Hornetz	zooplankton /fisheries (Msc student)	IMF-UHAM
Stefanie Kurbjuweit	zooplankton /fisheries (Msc student)	IMF-UHAM
Merlin Weichler	zooplankton /fisheries (Msc student)	GEOMAR
Nis Hansen	zooplankton /fisheries (Msc student)	GEOMAR

[1]Abbreviations explained under Section 2.2.

2.2 Participating Institutions

Abbreviation	Full name
GEOMAR	Helmholtz-Centre for Ocean Research Kiel, Germany
IMF-UHAM	The Institute of Marine Ecosystem and Fishery Science University of Hamburg

3 Research Program

Although the Baltic Sea, and in particular its central parts, is species poor, it nevertheless provides ecosystems services to the Baltic nations in terms of primary productivity and harvestable fish stocks. Understanding the interactions among major ecosystem components such as fish and their major prey, zooplankton on the one hand, and climatic forcing impinging on these populations, such as salinity, oxygen supply and climate forcing on the other, is the central research question of the ALKOR May (and April) cruise. At the same time, the central Baltic Sea is one of the systems most affected by the combination of global (including climate) and local anthropogenic changes, and has undergone strong hydrographic and biological shifts in the past decades.

Cruise AL556 is part of a 35-year effort to collect long-term data series on hydrography, zooplankton and fish species composition along the salinity gradient of the Baltic Sea, with an emphasis on the central Baltic Sea. The cruise series is dating back to 1987 by the GEOMAR Helmholtz Centre for Ocean Research (and its predecessors IFM-GEOMAR Kiel and IFM Kiel). The rationale for the specific spatial focus "Bornholm Basin" results from the importance of this area as the only major remaining spawning ground of Eastern Baltic cod. However, the cruise also included the western Baltic Sea, Arkona Basin and Gdansk Deep (Figure 3.1), thus covering ICES subdivisions (SD) 22, 24, 25, and 26 (Figure 3.2).

The cruise integrated oceanographic and biological sampling, permitting a later time series analysis as to how Baltic pelagic food webs and (fish) species across the environmental gradients of the Baltic Sea change in response to both, environmental forcing and human exploitation. Data sets and samples obtained during cruise AL556 are essential for a number of projects, including the large-scale international project EU Horizon 2020 GoJelly and collaborations with the Technical University of Denmark, National Institute of Aquatic Resources (DTU Aqua), Stockholm University, and the University of Hamburg. Moreover, the cruise delivered first data on Western Baltic cod recruitment for the upcoming DAM funded SpaCeParti project (with member institutes CAU, GEOMAR and IMF-UHAM).

Figure 3.1 Cruise track of AL556

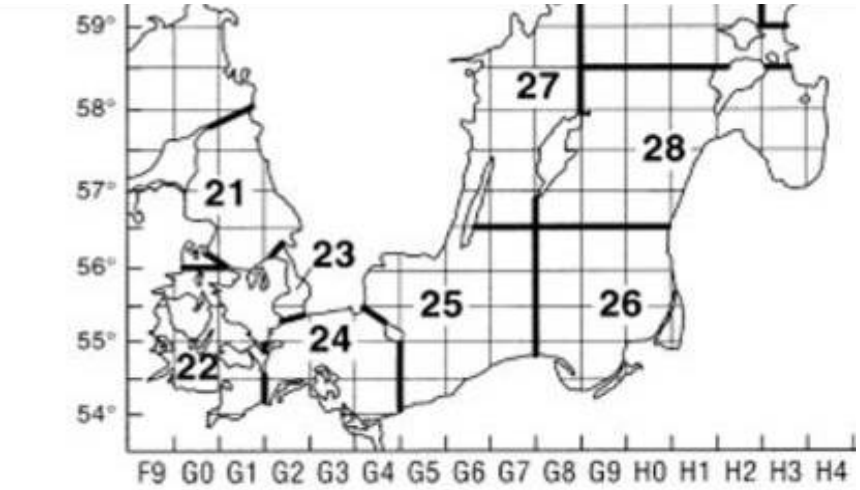

Figure 3.2 ICES subdivisions in the cruise area (Source: ICES). ICES SD22 corresponds to Kiel Bight = KB, SD24 to Arkona Basin = AB, SD25 to Bornholm Basin = BB and Stolpe Trench = SR, SD26 to Gdansk Deep = GD and Southern Gotland Basin (GB).

Specific investigations during AL556 included (1) a detailed hydrographic survey (oxygen, salinity, temperature) (2) zoo- and ichthyoplankton surveys to determine the composition, abundance, vertical and horizontal distribution and nutritional status of species as well as patterns of plankton phenology (3) sampling of important food web components including nutrients, seston, phyto-, zoo- (including jellyfish) and ichthyoplankton, (4) benthic and pelagic fishery hauls.

Fisheries hauls served to determine size distributions, maturity status, and length – weight relationships of the three dominant fish species in the pelagic system of the Baltic, cod (*Gadus morhua*), herring (*Clupea harengus*) and sprat (*Sprattus sprattus*) as well as flatfishes including flounder (*Plathichthys flesus*). Secondly, various samples for more detailed analyses back on land were obtained, including cod gonads, livers and otoliths, herring and sprat stomachs and whole samples for dietary analyses, and tissue samples of cod, flounder, whiting, plaice and other species for genetic and stable isotope analysis. In addition, hydroacoustic data were collected continuously along the cruise track for later analysis of fish abundance and distribution.

Additional work lines carried out in the context of collaborations with external groups included sampling and on-board experiments on photosynthesis and respiration rates of different phytoplankton fractions.

4 Narrative of the Cruise

RV ALKOR was loaded on the days prior to the onset of the cruise. ALKOR then departed from the GEOMAR Westshore pier on 14 May 2021 at 10:00 am (all times board time) and headed to the first research area in Kiel Bight (SD22). Owing to the Covid-19 restrictions, the cruise could only be run with 7 instead of 12 scientists. Hence, the work laid out in the original cruise program had to be shortened. This was accomplished by completely removing the pilot trials with the UFO fish observatory (the development of which was also delayed by Covid restrictions), and by shortening the cruise track to focus on key areas of Eastern Baltic cod only (i.e. Bornholm Basin, Gdansk Deep).

After covering a station in the Kiel Fjord, the first sampling of ichthyo- and zooplankton (plus hydrography) took place in Kiel and Mecklenburg Bight on 15 and 16 May 2021. In the latter, the first 4 fishery hauls were also carried out in cooperation with the IMF of the University of HH to sample populations of the western cod stock.

After a day of fishing in the southern part of the Bornholm Basin with the juvenile fish trawl on 17 May, the first stop on this trip was made at the permanent station BB23 (18 May). Extensive

sampling of various plankton fractions took place there in cooperation with IFO (Dr. Jörg Dutz, Dr. Caroline Paul). Afterwards we carried out the "Bongogrid" (bongonet and CTD hauls on a grid of 45 stations), a quasi-synoptic survey of the zooplankton and fish larvae situation in the entire Bornholm Basin on a 45 point grid of 10 nm edge length. This was successfully completed on 21 May. At the same time, sampling for marine viruses in the mixed surface layer was carried out at 6 of these stations (cooperation with Dr. Luisa Listmann, IMF, Uni HH). On 22 May, a research fishery with the pelagic juvenile fish trawl took place in the northern sections of the Bornholm Basin. Fortunately, the target of 300 animals including sampling for otoliths, genomics (finclips) and stable isotopes could be met as far as the sampling of cod in the core spawning area at spawning time 2021 is concerned, so that the Corona-related data gap from 2020 could be closed. Gonad samples were also obtained from a subset of fish in cooperation with Dr Jonna Tomkiewicz (DTU Aqua, Copenhagen) to conduct fertility studies.

We then conducted zooplankton station work within several stations in the Gdansk deep as well as several pelagic fisheries hauls (23/24 May) and used the transit time to do Bongo hauls in Stolpe Trench. On 25 May we arrived back in Bornholm Basin to conduct another round of vertically resolved zooplankton samples using the Multinet Maxi at BB23 on 25-26 May. We then started to steam back and sampled zooplankton in Arkona Basin on 27 May. The cruise ended on the morning of 28 May in Kiel.

As in previous years, the central deep station BB23 in Bornholm Basin was intensively sampled on two occasions, early in the cruise on 18 May (including CTD casts, zooplankton sampling with Bongo, Apstein and WP-2 nets, oxygen measurements of water samples obtained with the rosette water sampler with the Winkler method for the calibration of oxygen probe measurements, and phytoplankton sampling) and late in the cruise on 24/25 May (same sampling as on 18 May, followed by the detailed vertically and temporally resolved sampling of plankton communities by four towed Multinet MAXI and four vertical Multinet MIDI hauls over a 24 hour period, covering the water column in 5 m and 10 m depth layers, respectively). Additional sampling was carried out throughout the cruise area for the special projects on phytoplankton communities (surface water samples at 5 stations, collaboration with UHAM - IMF).

Table 4.1 Overview of all gear deployments during AL556. Mesh sizes of all nets are given in brackets. For location designations are KB=Kiel Bay and Mecklenburg Bay (SD 22), AB=Arkona Basin (SD 24), BB=Bornholm Basin (SD 25), GD=Gdansk Deep (SD 26). Numbers designate the Baltic Sea subdivisions SD.

Count of gear	Column Labels				
Row Labels	22 - KB	24 - AB	25 - BB	26 - GD	Grand Total
AMD-CTD	1				1
Apstein			6		6
Bongo	24	12	57		93
CTD	24	12	58	10	104
CTD			1		1
CTD-WS	1		2		3
IKS-80				10	10
JFT	4	2	7	2	15
MN-Maxi			6		6
WP2			6		6
WS klein	1		5		6
Grand Total	**55**	**26**	**148**	**22**	**251**

5 Preliminary Results

5.1 Ichthyo– and zooplankton sampling

Zooplankton samples were taken along the entire salinity gradient from Kiel Bight to Gotland Basin. The sampling effort west of the Arkona basin was enhanced as a preparation for collecting spatially resolved data within the SpaCePari project (DAM funded, "Küstenfischerei, Biodiversität, räumliche Nutzung und Klimawandel: Ein partizipativer Ansatz zur Navigation der Westlichen Ostsee in eine nachhaltige Zukunft ") that addresses as one of the major objectives the regionally resolved status of the Western Baltic cod stock.
Another target area was the Bornholm Basin where the “Bongo-Grid” was taken, a quasi-synoptic survey of the entire basin on a grid spanning stations at 10 nm intervals. Bongo- and Baby-Bongo hauls covered Kiel Bight (10 hauls), Mecklenburg Bight (14 hauls), Arkona Basin (12 hauls), and Bornholm Basin including the western part of Stolpe Trench (57 hauls).
In total, identifiable larvae of 9 different species were caught. As the most abundant larvae, individuals of sprat (*Sprattus sprattus*; n = 681), flounder (*Plathichthys flesus*; n = 345) and common seasnail (*Liparis liparis*; n = 3) were picked from the 500 µm bongo-samples and 300 µm Multinet samples and immediately conserved at -80 °C for subsequent RNA/DNA, stable isotope and genetic analyses.
As in the April AL553 cruise, a low number (n = 1) of cod (*Gadus morhua*) larvae was found in the Eastern part of the covered area (Bornholm basin), which is consistent with the continual shift of the spawning period of Eastern Baltic cod stock towards later in the year (i.e, summer). In contrast, we found a total of 62 juvenile cod in the Kiel Bight /Mecklenburg Bight area.

All zooplankton net catches were checked for the presence of gelatinous zooplankton. Ephyrae (larvae) and small adults of scyphozoan jellyfish (identified on board as *Cyanea capillata,* potentially low numbers of *Aurelia aurita*) were present in much higher abundances than in previous years. 635 individuals of the lions mane jellyfish, *Cyanea capillata*, were caught. In contrast, the invasive comb jelly (Ctenophora) *Mnemiopsis leidyi* remained rare. Here, only 5 individuals in total were caught in deep layers (>50 m depth) of Bornholm basin BB23 during the vertically resolved multinet-hauls.

After removing fish larvae and jellyfish, all zooplankton catches samples were conserved in 4% buffered formalin solution in sweater for later analysis, and are available for the determination of species composition and abundance of zoo- and ichthyoplankton throughout the 30-yr time series.

Stations in the eastern part of Stolpe trench and in the Gdansk Deep were sampled with IKS-80 nets instead of Bongo nets to ensure the compatibility of data with a long-term IKS-80 sampling series maintained by the Latvian Fish Resources Agency (LATFRA; Andrei Makarcuks).

At our key central Bornholm Basin station BB23 Multinet MAXI (300 µm, towed, sampling of the water column in 5 m layers) casts were performed over a one-day period on 25/26 May to assess diurnally resolved vertical distributions of ichthyo- and zooplankton. We obtained results of the depth distribution of different species of jellyfish and of the diel vertical migration of fish larvae.

5.2 Pelagic fisheries and the status of Eastern Baltic Cod

As oxygen conditions near the bottom were generally low to sustain higher life including fish at water depth >70m, most hauls (except those in Kiel and Mecklenburg Bay) were done within or slightly above the halocline, i.e. in the pelagic zone. Fishery hauls were conducted in Kiel Bight (1 haul), Mecklenburg Bight (3 hauls) Arkona Basin (3 hauls), Bornholm Basin (6 hauls), and Gdansk Deep (3 hauls). The overall catch composition is shown in Table 5.2.1.

In the Arkona-Basin, but also in western parts of the Bornholm basin, the whiting population seems to further increase in abundance compared to earlier years. Approximately twice the biomass /number of individuals were caught in 2021 compared to 2 yrs before, despite slightly less catch effort. Individualized samples of whiting (otoliths, fin clips for genetic analysis, gonads and livers) were taken from a total of 200 individuals, and of a further 755 were length /weight were recorded. For cod, single fish data (length, weight, sex and maturity stage) and samples (otoliths, fin clips for genetic analysis, gonads and livers) were obtained for 927 individuals in total. Length and weight were measured for additional individuals. The condition of animals, assessed as Fulton's K, has not significantly improved compared to previous years, but is also not further declining.

Table 5.2.1 Fish catch composition for AL556. Single fish measurement and samples were taken for 965 cod and 755 whiting individuals. For herring and sprat, sub-samples were taken at each station. For flatfishes and all other species, measurements and fin clips of all individuals were taken.

Row Labels	Catch weight(kg)	individ. Count
cod	279.9	965
cod (juvenile)	0.1	3
three-spined stickleback	0.0	1
flounder	2.7	17
greater sandeel	0.4	26
lesser sandlace	0.8	51
brill	0.3	1
herring	206.5	5621
dab	22.7	186
plaice	0.8	6
common sole	0.0	1
sprat	641.4	60550
turbot	0.9	2
whiting	145.7	755
Grand Total	**1302.2**	**68185**

In Bornholm Basin, the main remaining spawning area of the Eastern Baltic cod stock, the mean standard length of individuals was very small (Figure 5.2.1ab. and 5.2.2), and larger individuals >50 cm, which were frequently observed in past decades, were mostly absent from the population. Both of these observations are consistent with temporal trends over past years Fig. 5.2.1.b). In 2021, we evn found more individuals in the smallest size class 20-25 com as in previous years (Fig. 5.2.1b) Further analyses, including full genome sequencing of a random samples spanning time points from 1996 until 2021 will address the causes for the dramatic decline in fish size, in particular the hypothesis that ongoing strong size selective fishing "bred" small individuals owing to fisheries induced selection. For the same individuals, we are also conducting stable isotope analyses of muscle tissue to identify the likely food items (benthic invertebrates vs. pelagic fish) in the weeks prior to catch to assess possible correlations among nutritional state and size at maturity of targeted individuals. Even more important are novel approaches to ageing Eastern Baltic cod developed by DTU Aqua (Dr. Karin Hussy) which will allow, for the first time, to assess whether individuals are small and mature since they grew slowly, or whether they display maturity at an earlier age.

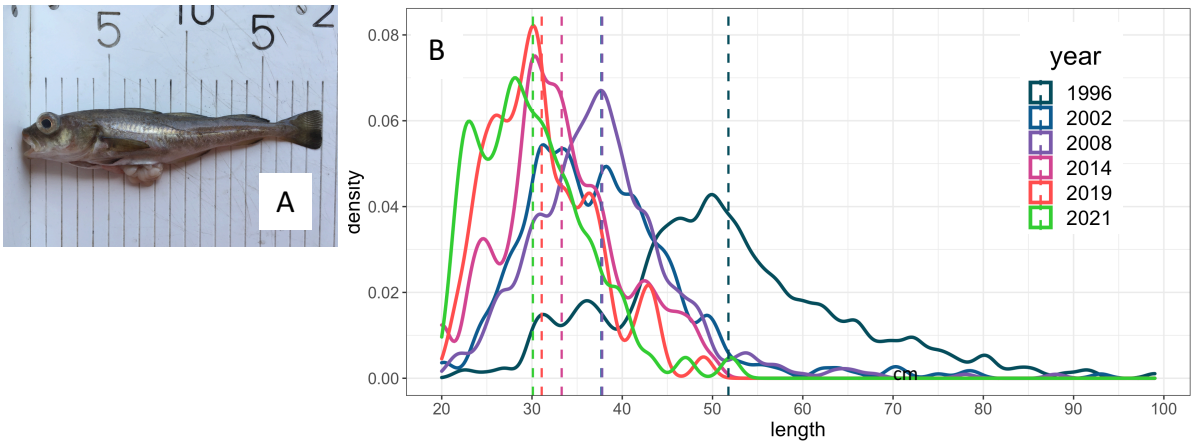

Figure 5.2.1a During AL556 Many male and female cod *Gadus morhua* individuals were already found to be fully mature / ready to spawn at around 20 cm of standard length. **b** temporal trend of cod *G. morhua* standard length (cm) distribution in Bornholm basin in 2021 (as density) compared to population samples obtained during past ALKOR cruises (analysis Kwi Young Han).

For sprat and herring, detailed stock size structures were recorded for maximally 200 randomly picked individuals. For these zooplanktivorous species, stomach samples (sprat: 10 per 1 cm length class; herring: 20 per 2 cm length class) as well as 2 kg frost samples were taken at each fisheries station.

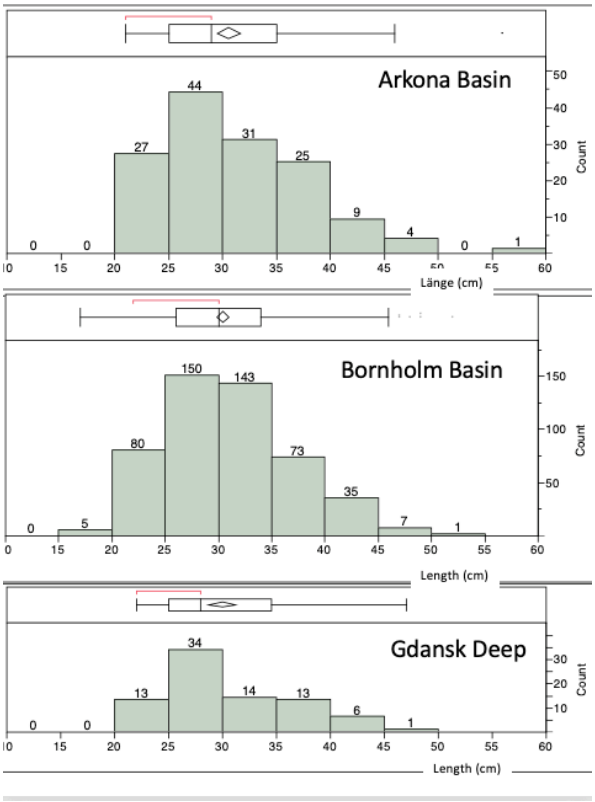

Figure 5.2.2 Cod individual size distribution (in cm standard length) in May 2021 in the three main catch areas. Note that <1% of individuals had a standard length of >50 cm. This even applies to catches from the Arkona Basin that are a mixed area between Eastern and Western Baltic cod stock.

5.2.1. Genetic population Structure of Eastern /Western Baltic cod in the study area

In order to assess potential selection processes within the Eastern Baltic cod stock, it is paramount to test for admixture of the genetically distinct Western Baltic cod stock towards the eastern

spawning areas. To this end, finclips obtained from AL556 were immediately subjected to a SNP (single nucleotide polymorphism panel) genotyping analysis in the GEOMAR molecular genetic lab in June 2021. The SNP panel comprised 80 genetic markers custom designed to distinguish Western from Eastern Baltic cod. This was done during the Msc-course "Marine Molecular Ecology" as advanced student project.

The resulting principal component analysis (PCA) also comprised samples taken at nearly the same stations 2 yrs ago during AL 522 (Fig. 5.2.3). Clearly, two genetic clusters are visible with hardly any overlap, the left hand one being the cluster of the Eastern Baltic cod where individuals contribute from different locations (mainly Gdansk Deep /Bornholm Basin) including some caught in Arkona Basin. This implies that Eastern Baltic cod migrates to areas West of Bornholm. However, all fish belonging to the Western Baltic cod cluster (right hand side Fig. 5.2.3) were never caught in Bornholm Basin nor Gdansk Deep but only in Arkona Basin or even further west in Kiel Bight. Further data (not shown) reveal, in accordance with earlier analyses, that there is no genetic mixing, only physical co-occurrence of both gene pools of Baltic cod.

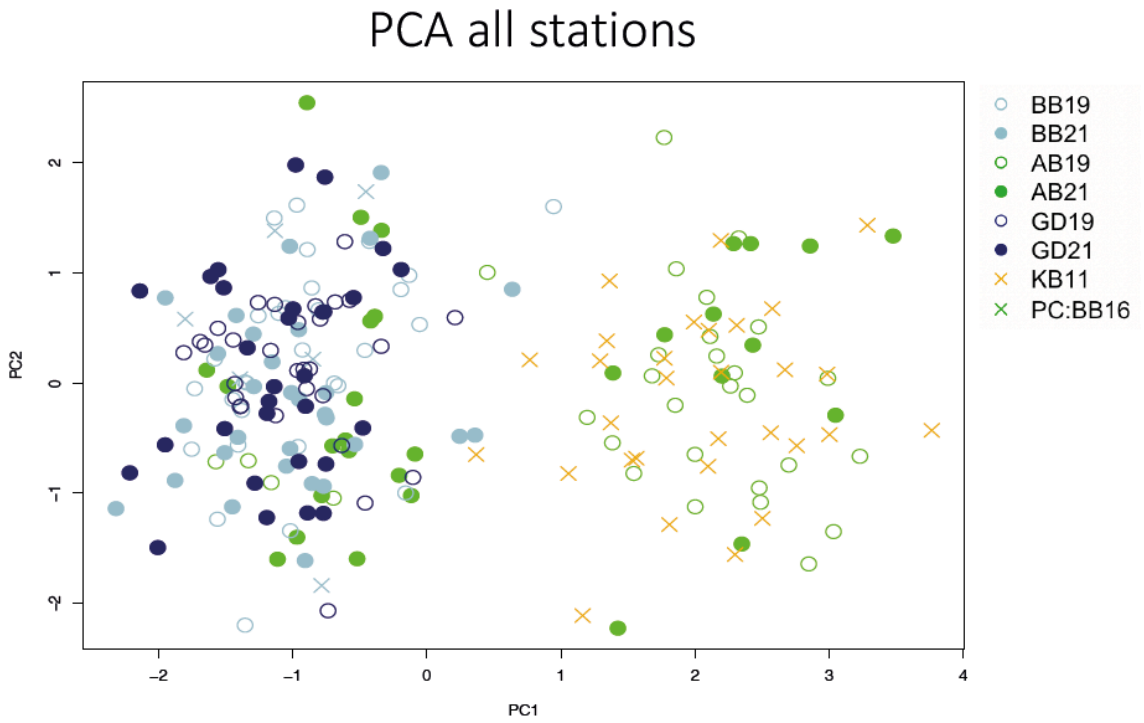

Figure 5.2.3 Principal component analysis based on 80 custom designed SNPs showing the two main genetic clusters of cod (*Gadus morhua*) in the Baltic Sea. Catch locations: BB = Bornholm Basin, GD = Gdansk Deep, AB = Arkona Basin, KB = Kieler Bucht. The left-hand cluster is the Eastern Baltic Cod gene pool with a mixed catch origin, not to be confused with genomic affiliation. The right hand, Western Baltic cod gene pool is only occurring at catch locations west of Bornholm. The pattern is stable over at least 3 years.

5.3 Hydrography

During AL 556, CTD profiles were obtained with the ADM-CTD at 102 stations and the rosette water sampler with attached CTD (14 stations). Two additional vertical oxygen profiles were obtained for calibration purposes at the deep central Bornholm Basin station BB23 by determining oxygen concentrations in depth resolved water samples taken with the water sampler using the Winkler method on 19 and 24 May.

Regarding the oxygen conditions, we encountered the typical concentrations in the deeper layers of Bornholm Basin but also Gdansk Deep of 0 ml/l for most of the parts below the halocline in 70-75m depth. Consequently, the fisheries had to be modified and the trawling happened 15-35m above bottom (=pelagic trawls). Owing to these peculiar oxygen conditions, flatfish had to adopt a pelagic life style and were often caught in the free water column, in particular flounder, plaice and dab (Table 5.2.1). A detailed analysis is underway as to how quickly the oxygen content of oxygenated inflow is respired away, as a function of the rising water temperatures below the halocline that was observed in the past decades.

5.4. **Marine microbes and viruses of the Baltic Sea under climate change** (Luisa Listmann, Hamburg University IMF)

As part of this project on the ecological and evolutionary effects of different temperatures and salinities in the Baltic Sea on the green algae *Ostreococcus* and its viruses, we aim to answer the following questions: a) From which regions of the Baltic Sea can we isolate *Ostreococcus* sp. and its associated viruses? b) How do the infection dynamics change in space and time (comparing samples of different cruises of the last two years)? The latter question will be answered upon isolation success in the laboratory of IMF in Hamburg.
To answer these questions, we took surface water samples in the Bornholm Basin at seven stations along the cruise track of AL556. On board, water samples of all stations were filtered to below 0.45µm and 2µm to isolate viruses and picoplankton back in the laboratory at the institute in Hamburg. Water samples are in the process of isolating viruses with the 0.45µm size fraction.

6 Station List

The list and additional cruise data are also permanently available via the GEOMAR OSIS data portal under the link:
https://portal.geomar.de/metadata/cruise/show/348649

ship cruise ID	station ID	ship_station nr	gear	gear deploym nr	Latitude	Longitude	time start	time end	date_start	yearx	bottom_depth_min	bottom_depth_max
AL556	GKW	1	AMD-CTD	1	542044	101027	09:47		14.05.21	2021	13	13
AL556	GKW	1	CTD-WS	1	542043	101024	09:55	10:21	14.05.21	2021	11	11
AL556	GS7	2	Bongo	1	542900	102039	11:49	11:51	14.05.21	2021	19	19
AL556	GS7	2	CTD	2	542889	102007	11:33	11:55	14.05.21	2021	19	19
AL556	GS1	3	CTD	3	543078	100129	13:00	13:10	14.05.21	2021	27	27
AL556	GS1	3	Bongo	2	543076	100127	13:14	13:18	14.05.21	2021	27	27
AL556	GS2	4	Bongo	3	543296	100698	13:46	13:49	14.05.21	2021	22	22
AL556	GS2	4	CTD	4	543297	100735	13:54	13:56	14.05.21	2021	22	22
AL556	GS3	5	CTD	5	543779	100935	14:28	14:29	14.05.21	2021	22	22
AL556	GS3	5	Bongo	4	543787	100930	14:32	14:35	14.05.21	2021	22	22
AL556	GS6	6	Bongo	5	543569	102043	15:14	15:16	14.05.21	2021	16	16
AL556	GS6	6	CTD	6	543565	102007	15:20	15:21	14.05.21	2021	16	16
AL556	GS9	7	CTD	7	543418	103000	15:58	15:59	14.05.21	2021	18	18
AL556	GS9	7	Bongo	6	543426	103006	16:04	16:05	14.05.21	2021	18	18
AL556	GS12	8	Bongo	7	543290	104025	16:41	16:43	14.05.21	2021	20	20
AL556	GS12	8	Kl. WaSch	1	543289	103996	16:46	16:48	14.05.21	2021	20	20
AL556	GS15	8	CTD	8	543288	103969	16:56	16:57	14.05.21	2021	20	20
AL556	GS15	9	CTD	9	543267	105004	17:55	17:57	14.05.21	2021	21	21
AL556	GS17	9	Bongo	8	543265	104994	18:00	18:03	14.05.21	2021	21	21
AL556	GS17	10	Bongo	9	543631	110021	18:51	18:54	14.05.21	2021	27	27
AL556	GS18	10	CTD	10	543616	105990	18:58	19:01	14.05.21	2021	37	37
AL556	GS18	11	CTD	11	543459	110833	19:34	19:36	14.05.21	2021	27	27
AL556	GS18	11	Bongo	10	543458	110824	19:40	19:43	14.05.21	2021	27	27
AL556	GS19	12	Bongo	11	543198	111963	07:56	08:00	15.05.21	2021	30	30
AL556	GS19	12	CTD	12	543187	111918	08:05	08:06	15.05.21	2021	30	30
AL556	GS20	13	CTD	13	542526	112269	08:44	08:50	15.05.21	2021	20	20
AL556	GS20	13	Bongo	12	542516	112269	08:54	08:56	15.05.21	2021	20	20

AL556	GS21	14	Bongo	13	542007	112261	09:27	09:29	15.05.21	2021	21	21
AL556	GS21	14	CTD	14	541978	112261	09:34	09:36	15.05.21	2021	21	21
AL556	GS22	15	CTD	15	541466	112083	10:10	10:11	15.05.21	2021	20	20
AL556	GS22	15	Bongo	14	541461	112088	10:14	10:17	15.05.21	2021	20	20
AL556	GS23	16	Bongo	15	540854	111753	10:54	10:58	15.05.21	2021	25	25
AL556	GS23	16	CTD	16	540842	111733	11:00	11:03	15.05.21	2021	25	25
AL556	GS24	17	CTD	17	541019	112452	11:33	11:35	15.05.21	2021	23	23
AL556	GS24	17	Bongo	16	541022	112450	11:38	11:43	15.05.21	2021	23	23
AL556	GS25	18	Bongo	17	541196	113223	12:14	12:17	15.05.21	2021	24	24
AL556	GS25	18	CTD	18	541195	113264	12:20	12:22	15.05.21	2021	24	24
AL556	GS32	19	CTD	19	541250	114052	12:54	12:56	15.05.21	2021	24	24
AL556	GS32	19	Bongo	18	541252	114052	12:59	13:03	15.05.21	2021	24	24
AL556	GS33	20	Bongo	19	541252	114927	13:34	13:37	15.05.21	2021	20	20
AL556	GS33	20	CTD	20	541250	114961	13:40	13:42	15.05.21	2021	20	20
AL556	GS34	21	CTD	21	541797	114955	14:18	14:19	15.05.21	2021	22	22
AL556	GS34	21	Bongo	20	541792	114943	14:22	14:25	15.05.21	2021	23	23
AL556	GS31	22	Bongo	21	541744	114065	14:55	14:57	15.05.21	2021	25	25
AL556	GS31	22	CTD	22	541742	114035	15:01	15:03	15.05.21	2021	25	25
AL556	GS30	23	CTD	23	542170	114058	15:30	15:32	15.05.21	2021	25	25
AL556	GS30	23	Bongo	22	542166	114048	15:35	15:37	15.05.21	2021	25	25
AL556	GS27	24	Bongo	23	542213	113288	16:05	16:08	15.05.21	2021	24	24
AL556	GS27	24	CTD	24	542214	113249	16:12	16:14	15.05.21	2021	24	24
AL556	GS26	25	CTD	25	541741	113238	16:44	16:46	15.05.21	2021	24	24
AL556	GS26	25	Bongo	24	541739	113254	16:50	16:53	15.05.21	2021	24	24
AL556	TW7	26	JFT	1	541099	112773	08:16	08:46	16.05.21	2021	24	24
AL556	xx/27	27	JFT	2	541751	115429	11:27	11:37	16.05.21	2021	20	20
AL556	xx/28	28	JFT	3	541479	114963	12:41	13:11	16.05.21	2021	23	23
AL556	xx/29	29	JFT	4	541595	115130	13:40	14:25	16.05.21	2021	20	20
AL556	BB41	30	CTD	26	544417	151192	07:28	07:33	17.05.21	2021	65	65
AL556	BB41	30	JFT	5	544423	151185	07:46	08:16	17.05.21	2021	65	65
AL556	BB40	31	CTD	27	544705	152695	11:38	11:43	17.05.21	2021	72	72
AL556	BB40	32	JFT	6	544720	152806	11:56	12:27	17.05.21	2021	72	72
AL556	BB23	33	CTD	28	551750	154499	07:32		18.05.21	2021	95	95
AL556	BB23	33	Apstein	1	551749	154499	07:54	08:10	18.05.21	2021	95	95

AL556	BB23	33	Apstein	2	551749	154499	08:11	08:26	18.05.21	2021	95	95
AL556	BB23	33	Apstein	3	551750	154499	08:29	08:42	18.05.21	2021	95	95
AL556	BB23	33	WP2	1	551750	154499	08:46	08:53	18.05.21	2021	95	95
AL556	BB23	33	WP2	2	551750	154499	08:56	09:03	18.05.21	2021	95	95
AL556	BB23	33	WP2	3	551750	154498	09:06	09:13	18.05.21	2021	95	95
AL556	BB23	33	CTD-WS	2	551750	154499	09:18	09:34	18.05.21	2021	95	95
AL556	BB23	33	CTD-WS	3	551748	154493	10:13	10:27	18.05.21	2021	95	95
AL556	BB23	33	Bongo	25	551747	154507	10:32	10:45	18.05.21	2021	95	95
AL556	BB23	33	Bongo	26	551737	154587	10:56	11:08	18.05.21	2021	95	95
AL556	BB23	33	JFT	7	551672	154429	11:53	12:23	18.05.21	2021	75	75
AL556	BB30	34	JFT	8	550826	154512	13:38	14:08	18.05.21	2021	75	75
AL556	BB30	35	JFT	9	550623	154702	15:10	15:50	18.05.21	2021	88	88
AL556	BB13	36	CTD	29	552750	162698	06:12	06:14	19.05.21	2021	58	58
AL556	BB13	36	Bongo	27	552751	162987	06:19	06:25	19.05.21	2021	59	59
AL556	BB12	37	Bongo	28	553753	163087	07:23	07:30	19.05.21	2021	62	62
AL556	BB12	37	CTD	30	553750	163007	07:35	07:40	19.05.21	2021	62	62
AL556	BB11	38	CTD	31	554747	163006	08:39	08:42	19.05.21	2021	57	57
AL556	BB11	38	Bongo	29	554750	162978	08:48	08:53	19.05.21	2021	57	57
AL556	BB09	39	Bongo	30	554749	161598	09:38	09:45	19.05.21	2021	60	60
AL556	BB09	39	CTD	32	554748	161509	09:50	09:54	19.05.21	2021	60	60
AL556	BB08	40	CTD	33	554749	160002	10:44	10:48	19.05.21	2021	62	62
AL556	BB08	40	Bongo	31	554747	155987	10:51	10:58	19.05.21	2021	62	62
AL556	BB07	41	Bongo	32	553757	160075	11:55	12:07	19.05.21	2021	74	74
AL556	BB07	41	WS kl.	2	553752	155977	12:09	12:14	19.05.21	2021	74	74
AL556	BB07	41	CTD	34	553752	155977	12:18	12:23	19.05.21	2021	74	74
AL556	BB10	42	CTD	35	553746	161507			19.05.21	2021	74	74
AL556	BB10	42	Bongo	33	553748	161503	13:23	13:34	19.05.21	2021	74	74
AL556	BB14	43	Bongo	34	552750	161614	14:32	14:43	19.05.21	2021	74	74
AL556	BB14	43	CTD	36	552747	161513	14:45	14:49	19.05.21	2021	74	74
AL556	BB15	44	CTD	37	552750	155999	15:43	15:49	19.05.21	2021	83	83
AL556	BB15	44	Bongo	35	552743	155983	15:53	16:04	19.05.21	2021	83	83
AL556	BB16	45	Bongo	36	552763	154625	16:49	17:00	19.05.21	2021	85	85
AL556	BB16	45	CTD	38	552748	154507	17:03		19.05.21	2021	85	85
AL556	BB06	46	CTD	39	553746	154502	18:09	18:13	19.05.21	2021	69	69

AL556	BB06	46	Bongo	37	553740	154477	18:17	18:26	19.05.21	2021	69	69
AL556	BB05	47	Bongo	38	553769	153093	19:13	19:21	19.05.21	2021	67	67
AL556	BB05	47	CTD	40	553751	152996	19:25	19:30	19.05.21	2021	67	67
AL556	BB04	48	CTD	41	553742	151516	20:21	20:27	19.05.21	2021	72	72
AL556	BB04	48	WS kl.	3	553742	151513	20:30	20:32	19.05.21	2021	72	72
AL556	BB04	48	Bongo	39	553736	151495	20:33	20:42	19.05.21	2021	72	72
AL556	BB03	49	Bongo	40	553786	150079	21:29	21:37	19.05.21	2021	75	75
AL556	BB03	49	CTD	42	553752	150003	21:41	21:46	19.05.21	2021	75	75
AL556	BB02	50	CTD	43	553748	144506	22:38	22:42	19.05.21	2021	68	68
AL556	BB02	50	Bongo	41	553738	144499	22:45	22:54	19.05.21	2021	69	69
AL556	BB01	51	Bongo	42	552799	144504	23:57	00:07	19.05.21	2021	69	69
AL556	BB01	51	CTD	44	552738	144497	00:09	00:15	20.05.21	2021	69	69
AL556	BB19	52	CTD	45	552747	150017	01:09	01:15	20.05.21	2021	78	78
AL556	BB19	52	Bongo	43	552737	150021	01:19	01:31	20.05.21	2021	77	77
AL556	BB18	53	Bongo	44	552764	151367	02:18	02:34	20.05.21	2021	91	91
AL556	BB18	53	CTD	46	552748	151514	02:37	02:40	20.05.21	2021	90	90
AL556	BB17	54	CTD	47	552748	153003	03:37	03:43	20.05.21	2021	85	85
AL556	BB17	54	Bongo	45	552739	153006	03:47	04:00	20.05.21	2021	85	85
AL556	BB23	55	Bongo	46	551819	154454	05:12	05:26	20.05.21	2021	95	95
AL556	BB23	55	CTD	48	551744	154498	05:29	05:36	20.05.21	2021	95	95
AL556	BB30	56	CTD	49	550748	154516	06:35		20.05.21	2021	89	89
AL556	BB30	56	Bongo	47	550738	154517	06:44	06:55	20.05.21	2021	89	89
AL556	BB35	57	Bongo	48	545778	154584	07:47	07:57	20.05.21	2021	79	79
AL556	BB35	57	CTD	50	545748	154495	08:02	08:08	20.05.21	2021	81	81
AL556	BB34	58	CTD	51	545749	153007	08:59	09:04	20.05.21	2021	77	77
AL556	BB34	58	Bongo	49	545747	152989	09:08	09:17	20.05.21	2021	77	77
AL556	BB31	59	Bongo	50	570744	153106	10:17		20.05.21	2021	69	69
AL556	BB31	59	CTD	52	550748	153001	10:29	10:34	20.05.21	2021	68	68
AL556	BB22	60	CTD	53	551751	153009	11:33	11:39	20.05.21	2021	93	93
AL556	BB22	60	Bongo	51	551747	152997	11:42	11:56	20.05.21	2021	93	93
AL556	BB21	61	Bongo	52	551780	151847	12:36	12:49	20.05.21	2021	91	91
AL556	BB21	61	CTD	54	551751	151689	12:54	13:00	20.05.21	2021	88	88
AL556	BB20	62	CTD	55	551747	150009	14:03	14:08	20.05.21	2021	72	72
AL556	BB20	62	Bongo	53	551743	150001	14:12	14:22	20.05.21	2021	71	71

AL556	BB32	63	Bongo	54	550763	151606	15:39	15:49	20.05.21	2021	62	62
AL556	BB32	63	CTD	56	550751	151514	15:51	15:57	20.05.21	2021	61	61
AL556	BB33	64	CTD	57	545749	151504	16:56	16:59	20.05.21	2021	43	43
AL556	BB33	64	Bongo	55	545745	151496	17:03	17:09	20.05.21	2021	43	43
AL556	BB41	65	Bongo	56	544791	151577	18:05	18:13	20.05.21	2021	67	67
AL556	BB41	65	WS kl.	4	544757	151516	18:18		20.05.21	2021	68	68
AL556	BB41	65	CTD	58	544755	151515	18:22	18:26	20.05.21	2021	67	67
AL556	BB42	66	CTD	59	544745	150016	19:20	19:24	20.05.21	2021	60	60
AL556	BB42	66	Bongo	57	544738	150018	19:27	19:34	20.05.21	2021	60	60
AL556	BB43	67	Bongo	58	543788	151440	20:43	20:49	20.05.21	2021	59	59
AL556	BB43	67	CTD	60	543756	151482	20:54	20:58	20.05.21	2021	59	59
AL556	BB44	68	CTD	61	543749	152994	21:49	21:53	20.05.21	2021	63	63
AL556	BB44	68	Bongo	59	553741	152977	21:56	22:03	20.05.21	2021	63	63
AL556	BB40	69	Bongo	60	544765	153112	23:04	23:13	20.05.21	2021	74	74
AL556	BB40	69	CTD	62	544745	153026	23:17	23:23	20.05.21	2021	73	73
AL556	BB39	70	CTD	63	544746	154506	00:14	00:19	21.05.21	2021	71	71
AL556	BB39	70	Bongo	61	544743	154501	00:22	00:34	21.05.21	2021	71	71
AL556	BB45	71	Bongo	62	543793	154533	01:29	01:37	21.05.21	2021	59	59
AL556	BB45	71	CTD	64	543751	154501	01:40	01:45	21.05.21	2021	59	59
AL556	BB38	72	CTD	65	544749	155999	03:04	03:09	21.05.21	2021	51	51
AL556	BB38	72	Bongo	63	544743	155994	03:13	03:20	21.05.21	2021	51	51
AL556	BB36	73	Bongo	64	545781	160093	04:22	04:32	21.05.21	2021	73	73
AL556	BB36	73	WS kl.	5	545752	160005	04:35	04:36	21.05.21	2021	73	73
AL556	BB36	73	CTD	66	545749	160000	04:41	04:46	21.05.21	2021	73	73
AL556	BB37	74	CTD	67	545749	161497	05:39	05:43	21.05.21	2021	49	49
AL556	BB37	74	Bongo	65	545747	161493	05:46		21.05.21	2021	49	49
AL556	BB27	75	Bongo	66	550786	163042	07:18	07:23	21.05.21	2021	51	51
AL556	BB27	75	CTD	68	550752	163010	07:28	07:32	21.05.21	2021	51	51
AL556	BB28	76	CTD	69	550747	161513	08:23	08:28	21.05.21	2021	79	79
AL556	BB28	76	Bongo	67	550737	161510	08:31	08:41	21.05.21	2021	79	79
AL556	BB29	77	Bongo	68	550798	155990	09:31	09:43	21.05.21	2021	87	87
AL556	BB29	77	CTD	70	550742	160011	09:47	09:52	21.05.21	2021	87	87
AL556	BB24	78	CTD	71	551752	155992	10:50	10:56	21.05.21	2021	89	89
AL556	BB24	78	Bongo	69	551746	160007	10:59	11:10	21.05.21	2021	89	89

AL556	BB25	79	Bongo	70	551766	161404	11:56	12:06	21.05.21	2021	75	75
AL556	BB25	79	CTD	72	551747	161495	12:09	12:14	21.05.21	2021	74	74
AL556	BB26	80	CTD	73	551747	163004	13:08	13:12	21.05.21	2021	61	61
AL556	BB26	80	Bongo	71	551746	163017	13:16	13:26	21.05.21	2021	63	63
AL556	BB46	81	Bongo	72	541407	164694	14:22	14:33	21.05.21	2021	78	78
AL556	BB46	81	WS kl.	6	551404	164788	14:36	14:36	21.05.21	2021	78	78
AL556	BB46	81	CTD	74	551403	164789	14:40	14:46	21.05.21	2021	78	78
AL556	BB55	82	CTD	75	552101	164794	15:28	15:32	21.05.21	2021	66	66
AL556	BB55	82	Bongo	73	552099	164801	15:36	15:44	21.05.21	2021	66	66
AL556	BB14	83	JFT	10	553287	162681	08:05	08:35	22.05.21	2021	69	69
AL556	BB14	83	JFT	11	553166	161979	09:10	10:00	22.05.21	2021	72	72
AL556	SR54	84	CTD	76	552100	170496	13:26	13:32	22.05.21	2021	67	67
AL556	SR54	84	Bongo	74	552101	170525	13:36	13:44	22.05.21	2021	67	67
AL556	SR53	85	Bongo	75	552094	172106	14:38	14:46	22.05.21	2021	71	71
AL556	SR53	85	CTD	77	552100	172198	14:50	14:55	22.05.21	2021	71	71
AL556	SR52	86	CTD	78	552502	173497	15:44	15:50	22.05.21	2021	66	66
AL556	SR52	86	Bongo	76	552498	173507	15:53	16:02	22.05.21	2021	67	67
AL556	SR51	87	Bongo	77	552917	175404	17:09	17:20	22.05.21	2021	68	68
AL556	SR51	87	CTD	79	592897	175497	17:23	17:28	22.05.21	2021	67	67
AL556	GD60a	88	CTD	80	544298	191704	07:53	08:00	23.05.21	2021	98	98
AL556	GD60a	88	IKS-80	1	544298	191705	08:04	08:09	23.05.21	2021	98	98
AL556	GD60a	88	JFT	12					23.05.21	2021	98	98
AL556	GD60	89	IKS-80	2	544901	190800	10:37	10:45	23.05.21	2021	103	103
AL556	GD60	89	CTD	81	544897	190796	10:50	10:56	23.05.21	2021	103	103
AL556	GD63	90	CTD	82	545399	191197	11:40	11:47	23.05.21	2021	107	107
AL556	GD63	90	IKS-80	3	545398	191198	11:50	11:57	23.05.21	2021	106	106
AL556	GD63	90	JFT	13					23.05.21	2021		
AL556	GD58	91	IKS-80	4	545991	190485			24.05.21	2021	101	101
AL556	GD58	91	CTD	83	545988	190485	08:09	08:15	24.05.21	2021	101	101
AL556	GD59	92	CTD	84	545408	185419	09:05	09:12	24.05.21	2021	99	99
AL556	GD59	92	IKS-80	5	545405	185418	09:15	09:22	24.05.21	2021	98	98
AL556	GD59a	93	IKS-80	6	545996	184108	10:18	10:26	24.05.21	2021	92	92
AL556	GD59a	93	CTD	85	545995	184117	10:32	10:38	24.05.21	2021	92	92
AL556	GD57	94	CTD	86	550998	184900	11:40	11:47	24.05.21	2021	91	91

AL556	GD57	94	IKS-80	7	550996	184905	11:51	11:58	24.05.21	2021	91	91
AL556	GD83	95	IKS-80	8	551502	183697	12:50	12:57	24.05.21	2021	75	75
AL556	GD83	95	CTD	87	551499	183702	12:59	13:04	24.05.21	2021	75	75
AL556	GD56	96	CTD	88	550901	182492	13:59	14:04	24.05.21	2021	79	79
AL556	GD56	96	IKS-80	9	550896	182490	14:06	14:11	24.05.21	2021	79	79
AL556	GD71	97	IKS-80	10	552300	181897	15:36	15:41	24.05.21	2021	83	83
AL556	GD71	97	CTD	89	552303	181903	15:44	15:48	24.05.21	2021	83	83
AL556	SR50	98	CTD	90	551403	175502	17:22	17:26	24.05.21	2021	63	63
AL556	SR50	98	Bongo	78	551405	175524	17:31	17:38	24.05.21	2021	62	62
AL556	SR49	99	Bongo	79	551499	173394	18:49	19:02	24.05.21	2021	83	83
AL556	SR49	99	CTD	91	551504	173507	19:04	19:11	24.05.21	2021	82	82
AL556	SR48	100	CTD	92	551402	172201	19:54	20:00	24.05.21	2021	89	89
AL556	SR48	100	Bongo	80	551400	172274	20:03	20:14	24.05.21	2021	89	89
AL556	SR47	101	Bongo	81	551512	170337	21:15	21:26	24.05.21	2021	83	83
AL556	SR47	102	CTD	93	551511	170504	21:28	21:34	24.05.21	2021	83	83
AL556	BB23	102	MN-Maxi	1	551741	154526	08:00	08:40	25.05.21	2021	95	95
AL556	BB23	102	MN-Maxi	2	551749	154495	09:03	09:41	25.05.21	2021	95	95
AL556	BB23	102	CTD	94	551748	154496	12:01	12:09	25.05.21	2021	95	95
AL556	BB23	102	Apstein	4	551749	154496	12:13		25.05.21	2021	95	95
AL556	BB23	102	Apstein	5	551748	154497	12:28		25.05.21	2021	95	95
AL556	BB23	102	Apstein	6	551747	154497	12:46		25.05.21	2021	95	95
AL556	BB23	102	WP2	4	551749	154498	13:04		25.05.21	2021	95	95
AL556	BB23	102	WP2	5	551749	154497	13:13		25.05.21	2021	95	95
AL556	BB23	102	WP2	6	551449	154498	13:22		25.05.21	2021	95	95
AL556	BB23	102	MN-Maxi	3	551745	154478	16:00	16:43	25.05.21	2021	95	95
AL556	BB23	102	MN-Maxi	4	551745	154505	17:06	17:44	25.05.21	2021	95	95
AL556	BB23	102	MN-Maxi	5	551688	154472	00:00	00:40	26.05.21	2021	95	95
AL556	BB23	102	MN-Maxi	6	551755	154503	01:37	02:11	26.05.21	2021	95	95
AL556	H22	103	JFT	14	545884	131768	11:30	12:30	26.05.21	2021	47	47
AL556	H22	104	JFT	15	545840	131601	14:50	15:21	26.05.21	2021	46	46
AL556	H10	105	Bongo	82	552101	143821	06:03	06:09	27.05.21	2021	54	54
AL556	H10	105	CTD	95	552071	143807	06:13	06:18	27.05.21	2021	53	53
AL556	H11	106	CTD	96	551500	142992	07:00	07:03	27.05.21	2021	44	44
AL556	H11	106	Bongo	83	541492	142999	07:07	07:11	27.05.21	2021	44	44

AL556	H12	107	Bongo	84	551085	142514	07:40	07:45	27.05.21	2021	44	44
AL556	H12	107	CTD	97	551050	142507	07:50	07:53	27.05.21	2021	45	45
AL556	H07	108	CTD	98	550705	141562	08:32		27.05.21	2021	48	48
AL556	H07	108	Bongo	85	550698	141554	08:39	08:44	27.05.21	2021	48	48
AL556	H17	109	Bongo	86	550084	140514	09:48	09:53	27.05.21	2021	48	48
AL556	H17	109	CTD	99	550056	140503	09:58	10:03	27.05.21	2021	48	48
AL556	H18	110	CTD	100	555652	134699	11:06	11:11	27.05.21	2021	46	46
AL556	H18	110	Bongo	87	545647	134701	11:13	11:19	27.05.21	2021	47	47
AL556	H21	111	Bongo	88	545651	133000	12:13	12:19	27.05.21	2021	47	47
AL556	H21	111	CTD	101	545643	132936	12:22	12:25	27.05.21	2021	46	46
AL556	H22	112	CTD	102	545751	131488	13:17	13:21	27.05.21	2021	46	46
AL556	H22	112	Bongo	89	545750	131477	13:24	13:30	27.05.21	2021		
AL556	H23	113	Bongo	90	545358	130455	14:10	14:14	27.05.21	2021	44	44
AL556	H23	113	CTD	103	545352	130501	14:18	14:20	27.05.21	2021	44	44
AL556	H25	114	CTD	104	544403	130246	15:17	15:19	27.05.21	2021	24	24
AL556	H25	114	Bongo	91	544394	130239	15:23	15:25	27.05.21	2021	24	24
AL556	H26	115	Bongo	92	544416	124784	16:12	16:14	27.05.21	2021	22	22
AL556	H26	115	CTD	105	544402	124760	16:18	16:20	27.05.21	2021	22	22
AL556	H29	116	CTD	106	544301	122945	17:19	17:21	27.05.21	2021	18	18
AL556	H29	116	Bongo	93	544797	122936	17:24	17:25	27.05.21	2021	18	18

7 Data and Sample Storage and Availability

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 Kiel Data Management Team (KDMT), and intended for permanent archiving of such data. The data are freely available via the link https://portal.geomar.de/metadata/cruise/show/348649 (keyword "AL556").

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

All hydrographic (CTD) data will be submitted to the ICES database within one year from the cruise. Moreover, the KDMT 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).

Genetic /genomic data will be submitted to the relevant data archives (Genbank /NCBI) during the process of publication.

All samples obtained during the cruise were labelled on board with a barcoding scheme, and all samples intended for longer-term storage 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 data base is currently being set up under the umbrella Mare Data Hub to contain all sample metadata of all zooplankton, fin-clip and other preserved biological samples

Table 7.1 Overview of data availability and persons responsible for specific data sets of AL522.

Type	**Database**	**Available**	**Free Access**	**Contact**
Hydrography (CTD data)	ICES database	Publicly by April 2022, earlier on request (see contact e-mail).	yes	Dr. Jan Dierking jdierking@geomar.de
Fishery data and food web sampling data	PANGAEA	Publicly at time of acceptance of the underlying peer-reviewed publication; or via request (see contact e-mail).	yes	Prof. T Reusch treusch@geomar.de
fish individual data (*Gadus morhua*, others)	NCBI /Genbank	Publicly at time of acceptance of the underlying peer-reviewed publication; or via request (see contact e-mail).	yes	Kwi Yong Han khan@geomar.de
Zooplankton metadata	GEOMAR internal /biodiversity storage centre	Publicly at time of acceptance of the underlying peer-reviewed publication; or via request (see contact e-mail).	yes	Dr. Felix Mittermayer fmittermayer@geomar.de
Ichthyoplankton data	PANGAEA	Publicly at time of acceptance of the underlying peer-reviewed publication; or via request (see contact e-mail).	yes	Dr. Catriona Clemmesen cclemmesen@geomar.de
Phytoplankton community sampling	PANGAEA	Inquire with collaboration partner (see contact e-mail).	yes	Dr. Luisa Listmann luisa.listmann@uni-hamburg.de

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9 Appendices

Electronic appendix E9.1 Station list of AL556.

Online, see at https://portal.geomar.de/metadata/cruise/show/358410