

ELISABETH MANN BORGESE-Berichte

Baltic Sea Long-term Observation Programme

Cruise No. EMB392

25. March – 08. April 2026

Rostock – Rostock

BalticObs



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Table of Contents

1	Cruise Summary	3
1.1	Summary in English.....	3
1.2	Zusammenfassung.....	3
2	Participants.....	4
2.1	Principal Investigators.....	4
2.2	Scientific Party.....	4
2.3	Participating Institutions	4
3	Research Program	5
3.1	Description of the Work Area	5
3.2	Aims of the Cruise	5
3.3	Agenda of the Cruise	6
4	Narrative of the Cruise	7
5	Preliminary Results	11
5.1	Meteorological Conditions.....	11
5.2	Properties of Surface Waters.....	14
5.3	Observations at Main Stations	17
5.4	Baltic Thalweg Transect	20
5.5	Southern Gotland Basin Transect	26
5.6	Gotland Transect.....	27
5.7	Microstructure Observations (Eastern Gotland Transect).....	28
5.8	Long-Term Investigations of CH ₄ , N ₂ O and CO ₂ Distribution.....	28
5.9	Long-Term Observation of the Microbiological Habitat of the Redoxcline.....	28
5.10	Plankton Sampling	29
5.11	eDNA Sampling.....	29
6	Ship's Meteorological Station	30
7	Station Lists EMB392.....	30
7.1	Overall Station List	30
7.2	Microstructure Profiler Deployments	35
7.3	ScanFish Deployment List	35
7.4	Mooring Deployment List.....	35
8	Data and Sample Storage and Availability.....	36
9	Acknowledgements	36
10	References	37
11	Appendix.....	38
11.1	Station Labels.....	38
11.2	CTD-Operation	38
11.3	Vessel Mounted ADCPs	40
11.4	ScanFish Towed CTD.....	40
11.5	Underway Measurements.....	41

1 Cruise Summary

1.1 Summary in English

The EMB392 expedition was conducted as part of the Baltic Sea Long-Term Observation Program of the Leibniz Institute for Baltic Sea Research in Warnemünde and is integrated into the IOW's research area "Coastal Seas in Transition." A central element of the program is the continuous collection of data on key parameters at stations in the western and central Baltic Sea, which has been ongoing since 1969. Since 2024, the program has been expanded to include the Gulf of Bothnia. The hydrographic, chemical, and biological data obtained form the basis for interdisciplinary research on the natural variability of the Baltic Sea ecosystem, anthropogenic influences, and the effects of climate change on the Baltic Sea. In February 2026, a moderate inflow of saltwater into the Baltic Sea occurred, and its effects on the western Baltic Sea were also investigated. Due to weather conditions, the voyage began with a delay of several hours. Work was first carried out in the western Baltic Sea and then continued along the Baltic Sea's thalweg transect into the eastern Gotland Basin. Here, a temporary mooring was deployed to track the saltwater inflow in the central Baltic Sea, and three long-term moorings were maintained. With weather conditions remaining favorable, the stations in the northern Gotland Sea were also processed. In the second half of the voyage, several episodes of strong winds hindered the work, resulting in further downtime. Few planned stations in the western Gotland Sea and in the Pomeranian Bay were not processed due to weather-related constraints. Nevertheless, the planned scientific program for the voyage was largely carried out.

1.2 Zusammenfassung

Die Expedition EMB392 wurde im Rahmen des Ostsee Langzeitbeobachtungsprogramms des Leibniz-Institut für Ostseeforschung Warnemünde durchgeführt und ist im IOW Forschungsbereich "Küstenmeere im Wandel" integriert. Zentrales Element des Programmes ist eine seit 1969 initiierte, kontinuierlich durchgeführte Datenerhebung von Schlüsselparametern an Stationen in der westlichen und zentralen Ostsee. Seit 2024 wird das Programm durch eine Erweiterung in den Bottnischen Meerbusen ergänzt. Die gewonnenen hydrographischen, chemischen und biologischen Daten bilden die Basis der interdisziplinären Forschung zur natürlichen Variabilität des Ostsee-Ökosystems, zu anthropogenen Einflüssen und zu den Auswirkungen des Klimawandels auf die Ostsee. Im Februar 2026 fand ein moderater Salzwassereinstrom in die Ostsee statt, dessen Auswirkungen auf die westliche Ostsee ebenfalls untersucht wurden. Wetterbedingt begann die Reise mit einigen Stunden Verzögerung. Zunächst wurden die Arbeiten in der westlichen Ostsee durchgeführt und danach entlang des Thalweg-Transektes der Ostsee weiter bis in das östliche Gotlandbecken fortgesetzt. Hier wurde eine temporäre Verankerung gesetzt um den Salzwassereinstrom in der zentralen Ostsee zu verfolgen und drei Langzeit Verankerungen gewartet. Unter weiterhin guten Wetterbedingungen konnten auch die Stationen in der nördlichen Gotlandsee bearbeitet werden. In der zweiten Hälfte der Reise behinderten mehrere Starkwindereignisse die Arbeit so dass es zu weiteren Ausfallzeiten kam. Einige geplante Stationen in der westlichen Gotlandsee und in der Oderbucht wurden wegen der Wetterbedingten Einschränkungen nicht bearbeitet. Trotzdem konnte das vorgesehene wissenschaftliche Programm der Reise weitgehend umgesetzt werden.

2 Participants

2.1 Principal Investigators

Name	Program	Institution
Mohrholz, Volker, Dr.	Hydrography	IOW
Kuss, Joachim, Dr.	Marine Chemistry	IOW
Dutz, Jörg, Dr.	Biology	IOW
Rehder, Gregor, Prof.	Trace gasses	IOW
Labrenz, Matthias, Prof.	eDNA sampling	IOW

2.2 Scientific Party

Name	Discipline	Institution
Mohrholz, Volker, Dr.	Phys. Oceanogr. / Chief Scientist	IOW
Clauder, Emma	Phys. Oceanogr.	UniHRO
Dierken, Madleen	Marine Chemistry	IOW
Hehl, Uwe	Biology	IOW
Heene, Toralf	Phys. Oceanogr.	IOW
Köhler, Anne	Biology	IOW
Kurzweg, Kai	OceanObs	IOW
Otto, Stefan	Marine Chemistry	IOW
Petre, Emanuel	Biology	IOW
Radisch, Jonas	Marine Chemistry	IOW
Raschke, Robin	Biology	UniHRO
Schöne, Susanne	Marine Chemistry	IOW

2.3 Participating Institutions

IOW	Leibniz-Institute for Baltic Sea Research Warnemünde, Germany
UniHRO	University of Rostock, Germany

3 Research Program

3.1 Description of the Work Area

The Baltic Sea is a marginal sea of the Atlantic Ocean, to which it is connected via the Belt Sea, the Öresund, and the North Sea. Due to the heavy inflow of river water, it is one of the largest brackish water areas. Its ecosystem is characterized by strong vertical stratification and depends crucially on the water exchange with the North Sea. Morphologically, the Baltic Sea is divided into a chain of basins separated by sills. The study area lies along the trough that connects the individual basins from the western Baltic Sea to the central Baltic Sea. Along this trough, the saltwater flowing in from the North Sea spreads out and contributes to the renewal of the Baltic Sea's deep water. Mixing with surrounding water masses along this path alters the properties of the inflowing water. The slow vertical transport of salt into the surface water flowing out of the Baltic Sea closes the estuarine cycle. The southern and central Baltic Sea is suffering from persistent eutrophication. Because water remains in the system for approximately 30 years, fundamental changes in ecosystem parameters occur over long time scales.

The observations performed during the research cruise EMB392 covered the western and central regions of the Baltic Sea, spanning from the Bay of Kiel to the northern Gotland Basin. Most of the measurement stations were located along the thalweg transect of the Baltic Sea, crossing the Arkona Basin, the Bornholm Basin, the Slupsk Channel and the Gotland Basin. Observations in the southern Baltic Sea extended to the western part of the Pomeranian Bay, as well as a few additional stations in the Arkona Basin. A key focus of the expedition was the Eastern Gotland Basin (EGB). In order to gather information on the distribution of hydrographic parameters across the largest basin of the Baltic Sea with high spatial resolution, a transect running from east to west across the center of the basin was surveyed.

3.2 Aims of the Cruise

The EMB392 research cruise was conducted as part of the Baltic Sea Long-Term Observation Programme at the Leibniz Institute for Baltic Sea Research Warnemünde (IOW). This was the second of five annual expeditions under this program.

The data collected will form the basis of long-term scientific studies on the state of the Baltic Sea and long-term changes in the region. The data also serve as baseline information for various time-limited scientific projects and are used to validate numerical Baltic Sea models. Additionally, the observational data collected during the expedition are employed in regular national and international assessments of the Baltic Sea's condition, providing the scientific basis for measures to protect the Baltic Sea ecosystem. To this end, hydrographic, chemical, and biological data were collected along the Baltic Sea Thalweg transect. The focus was on the state of the ecosystem under spring conditions, when the various stages of the emerging phytoplankton bloom can be observed along the trough.

Another objective of the expedition was to monitor the spread of the saline water that had flowed into the western Baltic Sea during the moderate inflow of saltwater in February. Although the volume of saline inflow water will not be sufficient to significantly improve the aeration of the deep water in the central Baltic Sea, the inflow will cause significant changes in the deep water of the southern Baltic Sea. The unusually cold winter in the southern Baltic Sea led to a significant cooling of the surface water and the formation of ice near the coast. The

impact of these processes on the onset of seasonal stratification in the surface water is another focus of the observations.

3.3 Agenda of the Cruise

The work packages of the cruise were subsequently conducted. We began with the measurements of IOW's long-term observation program in the western Baltic Sea, before continuing in the southern and central Baltic Sea. This program mainly consists of CTD casts and water sampling for nutrient analysis, as well as net sampling of phytoplankton and zooplankton. Additional sampling for eDNA investigations was taken in German waters. At two locations in the Kiel Bight surface sediment samples were taken with Multicorer. In the eastern Gotland Basin, the program was supplemented by a high-resolution CTD transect from the Latvian coast to Gotland Island, crossing the Gotland Deep. A short section of this transect was also covered with MSS casts. On the way back to Rostock, a few key stations in the western Gotland Basin were visited, including the Landsort Deep and the Karlsö Deep. Some CTD stations from the long-term observation program in the southern Baltic were revisited to improve the temporal resolution of the long-term data. An additional sampling program was conducted for long-term trace gas observations at the main Baltic stations in the Arkona Basin, the Bornholm Basin, the Eastern Gotland Basin and the Faro Deep. An overview of the locations of CTD stations, ScanFish transects, and the cruise track is given in Fig. 3.1. A station list is given in Table 7.1.

The marine environment was less disturbed by performed scientific tasks. No sampling in marine protected areas was carried out. Mainly sensor measurements and water sampling in the water column for chemical analysis were done. Any waste of chemical analysis and other scientific work was collected and processed onshore after the cruise. High frequency hydro acoustic measurements were done by current profilers along the ship. Due to the high frequency (>150kHz) of the used devices Marine mammals were not affected by these measurements.

Equipment

Data acquisition was carried out using the following devices and measuring platforms.

At stations and transects:

- CTD SBE 911+ with rosette water sampler (CTD)
- Towed CTD ScanFish (SCF)
- EK80 water column echo sounder
- Phytoplankton net (APNET)
- Zooplankton net (WP2)
- Multicorer (MUC)
- Secci disk (SD)
- Microstructure Profiler (MSS)
- Hydrographic moorings (Moor)

(The abbreviations in brackets indicate the device short names used in the DSHIP data base)

Continuous measurements were performed with:

- Vessel mounted ADCP 150kHz Ocean Surveyor (at selected transects)
- Vessel mounted ADCP 300kHz WorkHorse (at selected transects)
- Underway measurements of surface water properties
- Ship weather station

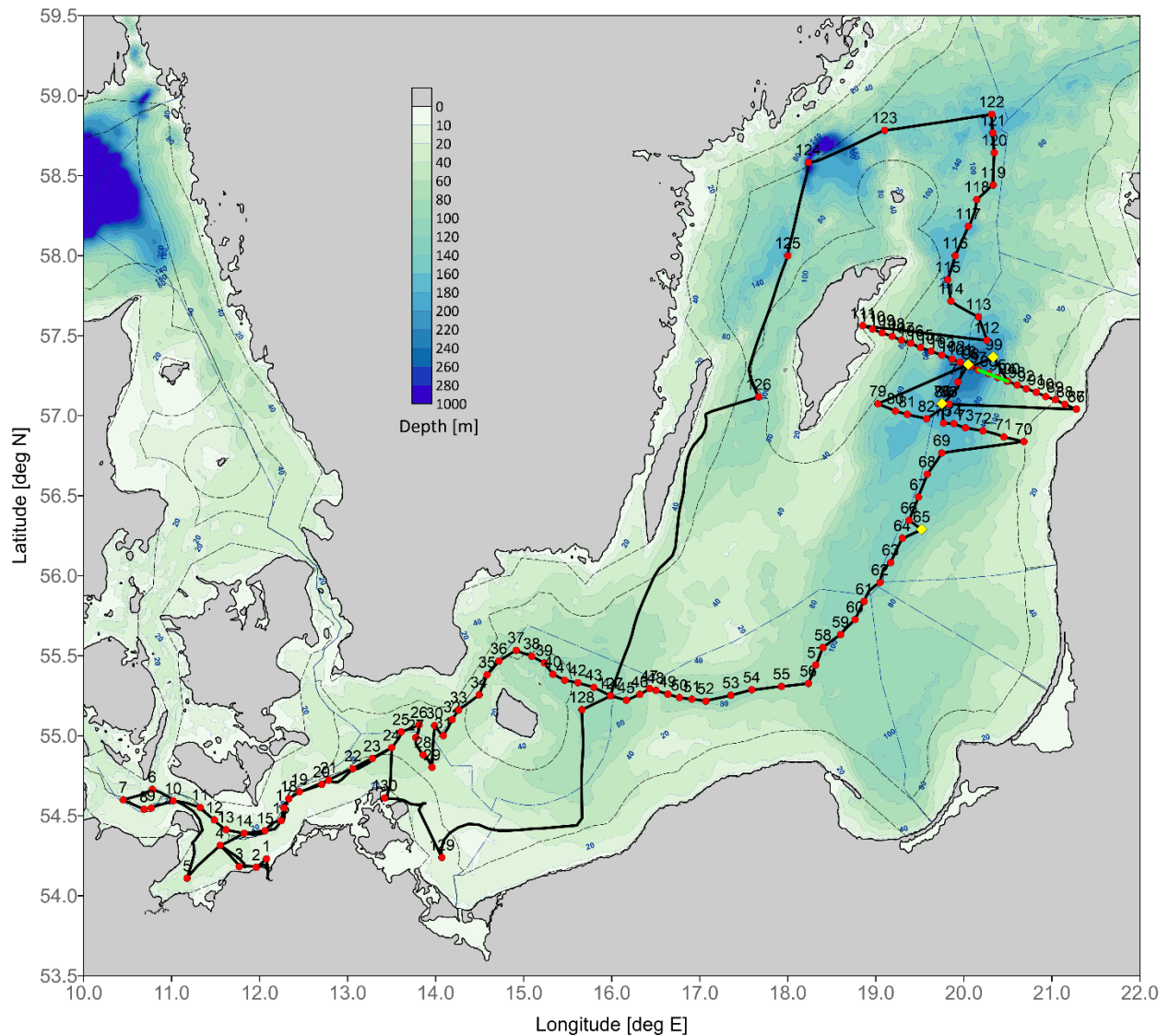


Fig. 3.1 Map of stations and ship track of cruise EMB392 from 25. March – 8. April 2026. Red dots and black labels indicate the positions and names of CTD stations. The green section along the cruise track depicts the short MSS transect in the Eastern Gotland basin. The yellow diamonds mark the locations of the moorings deployed and maintained during the cruise.

4 Narrative of the Cruise

The cruise EMB392 was the second cruise of IOW Baltic Long-term Observation Program in 2026. On 24th April the final preparations for the cruise started with the loading of scientific equipment and with installing the lab devices on the ship in port of Rostock. On Wednesday

morning, strong westerly winds prevented the ship from setting sail as scheduled at 8:30 a.m. In consultation with the captain, the departure was postponed until 6:00 p.m. In the morning, a safety briefing and a brief pre-voyage meeting were held. In the afternoon, the mandatory safety drill took place. The time spent in port was used to prepare the equipment. The wind speed dropped slightly in the evening, allowing us to set sail around 7 p.m. We first worked three stations near the coast before continuing on to the Bay of Mecklenburg. During the night, the wind picked up briefly once more. However, we were still able to carry out the two planned stations in the Bay of Mecklenburg. With stronger winds, we continued into the Bay of Kiel in the morning.

The gradually decreasing wind allowed us to begin station work around noon. In the Bay of Kiel, we sampled four stations with the CTD by evening and collected sediment samples at two stations using the multicorer. Early Thursday evening, we began the measurements along the thalweg transect. We passed through the Fehmarn Belt late that evening, heading east. Around 9:30 p.m., the thermosalinograph malfunctioned. The problem was resolved shortly after midnight.

With the wind continuing to die down, we reached the Darss Sill early Friday morning. No active inflow of saline North Sea water was detected. The weather was sunny with relatively low air temperatures around 5°C. By noon, we had sampled additional stations along the thalweg transect. We reached the central station TF0113 in the Arkona basin around noon. The now calm weather allowed for continuous work. While deploying the plankton nets, a problem arose with the hydraulics of the main crane. Nevertheless, the work was successfully completed. In the afternoon, station work continued in the eastern part of the Arkona basin. We followed the Baltic Thalweg eastward, conducting station work, and passed through the Bornholmgat around 3 a.m. on Saturday morning. The wind picked up slightly overnight but did not hinder our work. Around 11 a.m., we reached station TF0213 in the center of the Bornholm Sea. Here, we carried out an extended biological sampling using several WP2 net hauls and an Apstein net. The deep water was strongly stratified. The salt-rich water that had flowed in at the Darßer Schwelle in February had replaced the old warm bottom water and raised it by about 10 meters.

In the afternoon, the wind continued to die down, reaching speeds of between 5 and 7 ms⁻¹ by evening. We continued our station work along the thalweg in an easterly direction. We reached the Stolpe Sill at 5:00 p.m. No saline bottom water was found on the sill. At the time of the CTD measurement, there was no active overflow across the sill. Near the Russian EEZ, the standard GPS system began malfunctioning at 11:15 p.m., displaying an incorrect location near Kaliningrad. The problem was resolved shortly thereafter by switching to an alternative GPS device. From 23:15 to 23:58 UTC, the erroneous GPS readings were recorded in the Dship database. We passed the Stolper Channel and reached its eastern end shortly after midnight. At 2:00 a.m., the ship's time was advanced by one hour to 3:00 a.m., and we switched from CET to CEST. On Sunday morning, the wind began to pick up again gradually and reached 10 ms⁻¹ by early afternoon. We continued our CTD station work along the thalweg transect, and reached the position for the planned short-term mooring at the entrance to the southern Gotland Basin around 3:00 p.m. Deploying the mooring went smoothly. This work was successfully completed at 4:10 p.m. After that, we resumed our CTD sampling. During the night leading into Monday, we covered the eastern section of the zonal transect in the southern Gotland Sea.

On Monday morning at 7 a.m., we reached the Gotland SW mooring position. The wind had picked up slightly. Visibility was occasionally reduced by fog. At 8 a.m. we began the mooring

operations. The mooring was successfully released with the first trial and floated to the surface. The head buoy was recovered. However, the mooring's recovery line consisted only of the line drum and two buoyancy bodies. The lower section of the mooring, containing the measuring instruments, was missing. The most likely cause of the breakage is a failure of the thimble on the lower line of the mooring. Since there are no buoyancy bodies on the lower section of the mooring, this part could not be recovered by triggering the second release. Due to unfavorable weather conditions, we decided to postpone another recovery attempt until Tuesday morning, when the weather forecast predicted better conditions. We drove on to the EGB central station (TF0271) and began taking measurements there shortly before noon. Extensive sampling was conducted here, with a total of 9 CTD casts. Work at the station was completed around 3 p.m. We then continued station work on the western part of the zonal transect in the southern Gotland Sea. By Tuesday morning, 5 additional CTD stations had been processed. Around 7 a.m., we reached the GOSI mooring position and prepared to attempt to retrieve the mooring. Weather conditions were good. There was only a light breeze. Wave height was around 0.5 m. A towed "Igel" was used for the recovery. The first recovery attempt at 8 a.m. was unsuccessful. After two further unsuccessful attempts, the mooring's position was triangulated using the remaining release device. The new position differed by 16 m from the original position. By noon, two further recovery attempts were carried out by towing in a southerly direction. These attempts were also unsuccessful. In the early afternoon, we conducted another attempt in an east-west direction. During this attempt, the mooring was located and recovered shortly thereafter. With the exception of two oxygen loggers, all equipment was recovered undamaged. Afterward, the new mooring was deployed, and work at the station was completed around 3:30 p.m. We then proceeded to the Latvian coast to begin the planned ScanFish transect through the central Gotland Basin. At 9:30 p.m., the ScanFish was deployed. Already during the first minutes of the operation, the ScanFish's pressure sensor showed malfunctions and then failed completely. As a result, the ScanFish lost its depth control and sank to the bottom. The impact with the seafloor at a speed of 6 knots damaged the device's housing. A repair using onboard equipment was not possible. Measurements on the central transect were then carried out using the standard CTD at closely spaced stations. By Wednesday morning, we reached the position of the GOC mooring in the Gotland Deep. The wind picked up slightly overnight to 5 ms^{-1} . Work on the transect was interrupted to recover the GOC and GONE moorings in daylight and redeploy them. The recovery of the GOC mooring proceeded without issues in light winds and light fog. After maintenance, the mooring was redeployed at 10 a.m. We then proceeded to the position of the GONE mooring, which is about 10 nautical miles away. This mooring was also retrieved without any problems. After maintenance, the mooring was redeployed at 2 p.m. Upon completion of the work, we returned to the transect and repeated the measurements on a short section of the eastern slope of the basin using the MSS. In the CTD data, a lateral inflow of suboxic water into the halocline was observed in this area. This section of the transect was surveyed at high resolution using the MSS to investigate the turbulent mixing of this water mass. The MSS measurements began at 5:00 p.m. and were completed the following day at 4:30 a.m. Afterward, we resumed CTD measurements in the western part of the transect. Work on the transect was completed on Thursday afternoon. The wind remained moderate at around 5 ms^{-1} . Toward evening, we reached the Thalweg transect and began continuing station work toward the north. Shortly after midnight, we reached station TF0286 in the Farö Deep. With conditions remaining favorable, though with some fog, we were able to complete the work on the Thalweg transect late morning of April 3.

The weather forecast for the coming days predicted strong winds, which would severely limit further work. In order to still be able to cover the most important stations of the long-term program, only the focus stations in the western Gotland Sea were surveyed.

From the end of the Thalweg transect, we headed west to station TF0283 north of Gotland. After completing this station, we reached the Landsort Deep around 5:00 p.m. and conducted an intensive sampling campaign with 5 CTD casts. After two and a half hours, we headed south to the two remaining stations in the western Gotland Sea. Even before reaching the last station, TF0245, in the Karlsö Deep, the wind began to pick up. We finished work at the station at 5:30 p.m. and sailed against the wind toward the island of Öland to continue slowly southward under its shelter. By noon, the wind had increased to 20 ms^{-1} . Some wind gusts exceeded 25 ms^{-1} . Sailing at reduced speed, we reached the southern tip of the island of Öland late in the evening. Overnight, the wind died down slightly, allowing us to work the central stations TF0213 and TF214 in the Bornholm Sea early in the morning.

Around 8 a.m., the wind picked up again. We set a direct course for the Polish coast to sail westward into the Bay of Pomerania in its lee. With increasing westerly winds, we reached station TF0160 west of the Oder Bank around 8 p.m. Our attempt to also work Station TF0150 was thwarted by the rapidly increasing wind. Shortly before midnight, we decided to head for Tromper Wiek and wait there, sheltered by the land, for the weather conditions to improve.

On the morning of Easter Monday, the wind had picked up even more. Even sheltered by land, it averaged 15 to 16 ms^{-1} with a significant wave height of 1 m . We used the time to conduct some test measurements with the MSS and the ScanFish, as both devices had been experiencing some issues. The strong wind persisted throughout the day. In the evening, the Artemis 2 mission reached the Moon. It was the first time in more than half a century that humans had traveled so far from Earth.

At 5 a.m. on Tuesday morning, we set course for station TF0113 in the Arkona Sea. By the time we reached the station around 8 a.m., the wind and waves had calmed down enough for us to resume our work. After completing Station TF0113, we continued our work along the Darss Sill and the Kadet Trench. At three additional stations, we conducted biological sampling using nets in addition to the CTD. As weather conditions improved, we finished our work at the stations around midnight.

On the morning of April 8, a final CTD station was conducted off Nienhagen, which serves as a reference measurement for the buoys anchored there. We completed our scientific observations on the cruise in the early hours of 8 April. Afterwards, we began the short transit back to Rostock.

We arrived at the Marienehe pier at 9 am. After the customs procedure, we began packing and unloading the scientific equipment. The cruise ended with the disembarkation of the scientific crew at noon. Despite a few problems, the expedition was very successful. Even though strong winds prevented scientific work from being carried out in the water column for about two and a half days, the expedition's scientific program was carried out almost in its entirety. Only Station TF0150 in the Pomeranian Bay could not be surveyed. The cooperation between the captain, the crew, and the scientific participants was excellent throughout the entire voyage and made our work much easier.

5 Preliminary Results

The results presented in the following section are preliminary and incomplete, as they are based in most cases on raw data that has not yet been validated! The purpose of this section is to provide an initial overview of the collected dataset. A detailed data analysis will follow once all validated datasets are available.

5.1 Meteorological Conditions

The meteorological conditions during the cruise were characterised by moderate to strong winds and partly cloudy skies, with some sunny days. These conditions were typical of late March to early April in spring.

The cruise started on 25th March with strong winds that lasted till the evening of the following day. Maximum wind speed of about 15 ms^{-1} during noon on 25th. The departure therefore had to be postponed until the evening. Afterwards a longer period of moderate wind speed followed. Until 29 March, the mean wind speed ranged from 5 to 10 ms^{-1} , with predominantly westerly wind directions that later changed to southerly (Fig. 5.1).

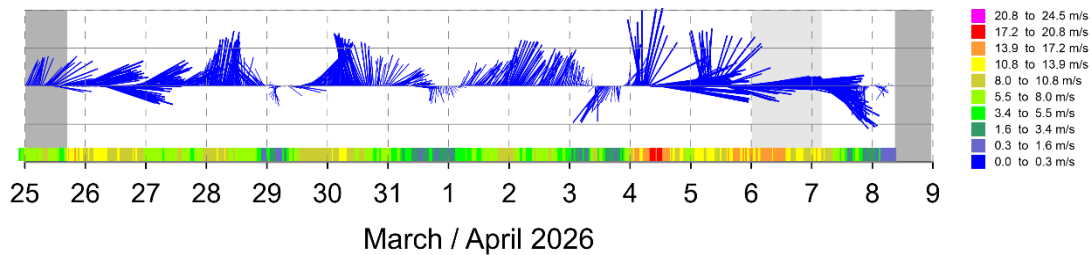


Fig. 5.1 Stick plot of wind vector measured by the ship weather station of RV ELISABETH MANN BORGESE. The grey shaded areas indicate periods when the ship was in port.

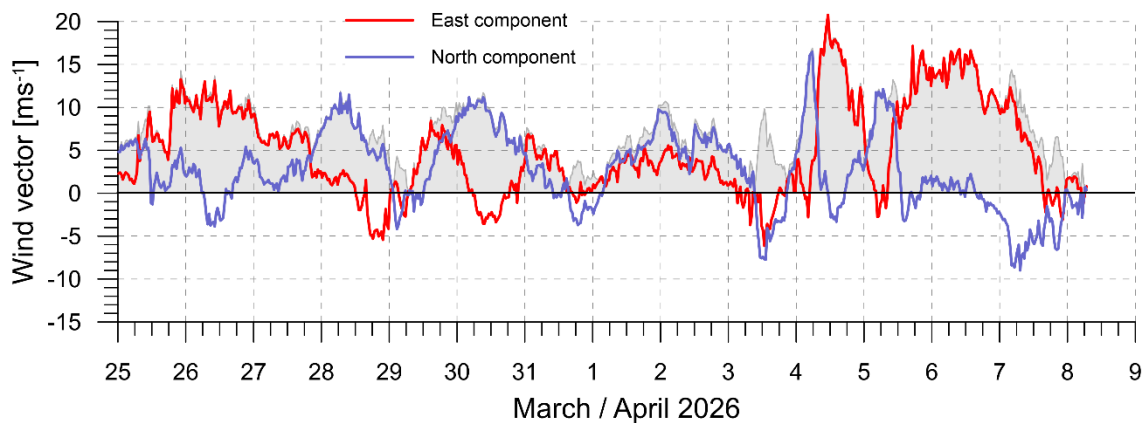


Fig. 5.2 Wind vector east and north measured by the ship weather station of RV ELISABETH MANN BORGESE (30 min averaged values).

When we reached the southern edge of the Gotland Basin, the wind increased again, reaching around 12 ms^{-1} overnight on 30 March. At noon, the wind calmed down, followed by a period of moderate to low winds. This lasted till the late night of 3rd April when we reached our northern most position of the cruise. During the following night the wind turned to southerly directions and speed up again. On 4th April at noon it reached its maximum of more than 20 ms^{-1} .

Afterwards the wind direction changed to west, but the wind speed remained between 12 and 15 ms⁻¹ of the next three days. On 7th April the wind speed relaxed strongly and to almost calm conditions in the late evening (Fig. 5.2).

The air temperature in the Baltic was below the long-term average for March and April. It dropped on the 25th March from 12°C to 4 to 5°C when we left the port of Rostock. In the western and southern Baltic the air temperature ranged between 3.5 and 4°C without a pronounced daily cycle. The air temperature dropped significantly to 2°C when we reached the eastern Gotland basin on 29th March. It decreased further while we were cruising north. During the night to the 1st April the temperature minimum was below the freezing point. Afterwards, an increase to 4°C was observed on the way to the northern Gotland Basin. Still no pronounced diurnal cycle of air temperature was present (Fig. 5.3). The air temperature increased slightly when the ship reached the western Gotland Basin. Here the air temperatures ranged between 4°C during the nights and 8°C around noon. The air temperatures remained at that level till the end of the cruise.

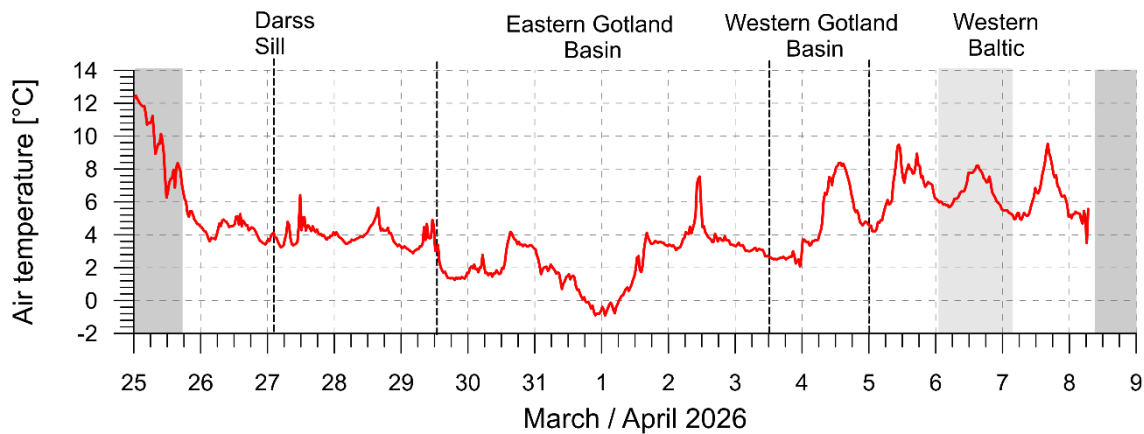


Fig. 5.3 Air temperature measured by the ship weather station of RV ELISABETH MANN BORGESE (30 min averaged values).

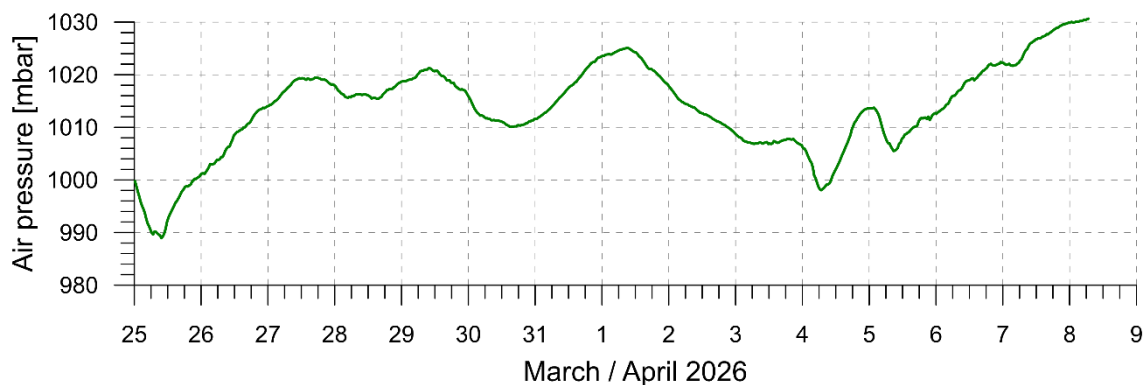


Fig. 5.4 Air pressure measured by the ship weather station of RV ELISABETH MANN BORGESE (30 min averaged values).

The air pressure variations during the cruise were characterized by the passing low-pressure systems. The cruise started during such a phase with minimum air pressure of 989mbar on 25th March. Afterwards the air pressure increased rapidly to values of about 1020mbar on the 27th

March. It followed a longer period of high air pressure till the 1st April. Then a passing low-pressure system caused a drop of air pressure. A further decrease to 1000mbar was observed on 4th April with the rapid increase in wind speed. After this frontal system has passed on 5th April the air pressure increased continuously towards the end of the cruise and reached its maximum of 1030mbar when we reached the port of Rostock. The humidity depicted a pronounced variability and ranged between 50 and almost 100% (Fig. 5.5) during our work in the eastern Gotland basin. There foggy conditions lasted during longer periods, also during daytime. The mean humidity during the first half of the cruise was about 80%, significantly higher than expected for this season. The station changed slightly when we reached the western Gotland basin. With the onset of the strong winds on 5th April also the humidity dropped. Till the end of the cruise it ranged between 60 and 80%, with high night values and minimum values during the afternoons.

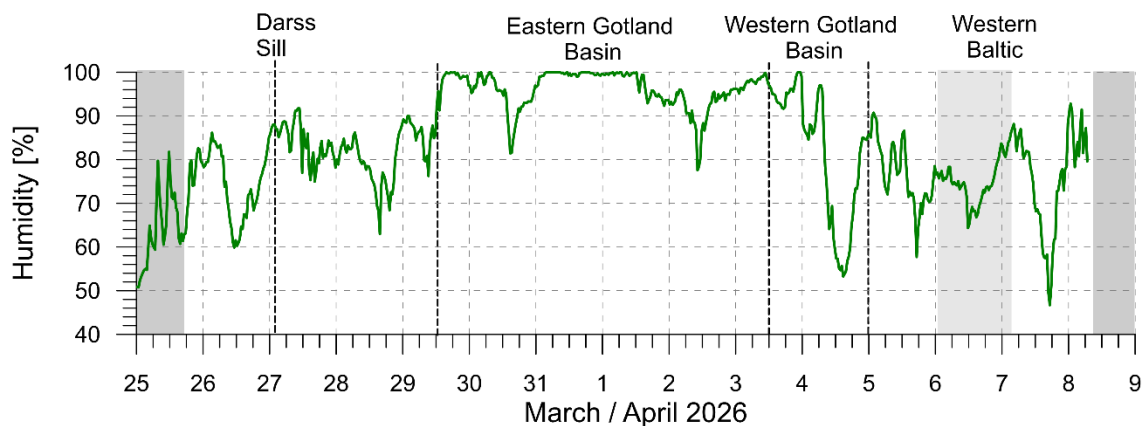


Fig. 5.5 Air humidity measured by the ship weather station of RV ELISABETH MANN BORGESE (30 min averaged values).

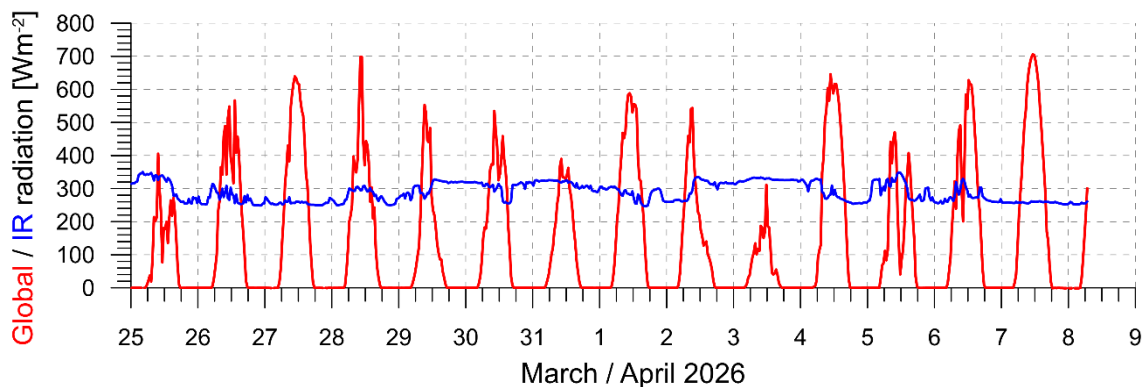


Fig. 5.6 Global and infrared radiation measured by the ship weather station of RV ELISABETH MANN BORGESE (10 min averaged values).

The global radiation was strongly related to the cloud coverage and the latitude. During the first days of the cruise the cloud coverage decreased and led to higher values of global radiation. On 28th March we reached about 700Wm^{-2} at noon. From the next day onwards the cloud coverage increased continuously. Thus, the global radiation dropped rapidly minimum of daily peak values was reached on 3rd April with only 300Wm^{-2} , which was less than the outgoing long wave radiation. On the next day the cloud coverage decreased significantly. The maximum global radiation of 710Wm^{-2} was observed at noon on 7th April, when we had a nearly clear sky.

During the cruise the long wave radiation ranged between 280 and 320 Wm^{-2} (Fig. 5.6). The lower values were observed on sunny days with less clouds. The overall radiation budget was balances and caused a stagnation the seasonal warming of the surface water.

5.2 Properties of Surface Waters

Sea surface temperature, salinity, chlorophyll-a fluorescence and turbidity distributions in the investigation area were compiled from data gathered with the Surface water Monitoring Box (JSMB). The distributions shown in Fig. 5.7 and Fig. 5.10 are based on unvalidated data. As expected for early spring conditions there was a strong temperature gradient between the shallower areas in the western Baltic and the Baltic Proper. Due to the cooler than average air temperatures in January and February the sea surface temperatures (SST) were below the climatological mean value for March throughout the Baltic. From the Kiel Bight and the Mecklenburg Bight to the Darss Sill the SST ranged between 3.5 to 5.5 °C in the last week of March. Similar values were also observed in the western Arkona Basin and in the shallow areas of the Pomeranian Bight. The Bornholm Basin depicted a SST of 3.0 to 3.5°C (Fig. 5.7). Towards north the SST dropped very slowly along the Baltic Thalweg to 3.0°C in the southern Gotland Basin. Further north a minor increase in SST was observed. In the eastern Gotland Basin the SST was 3.2°C. The same level was found in the western Gotland Basin (Fig. 5.8). In the begin of April the SST in the western Baltic has increased to about 6°C.

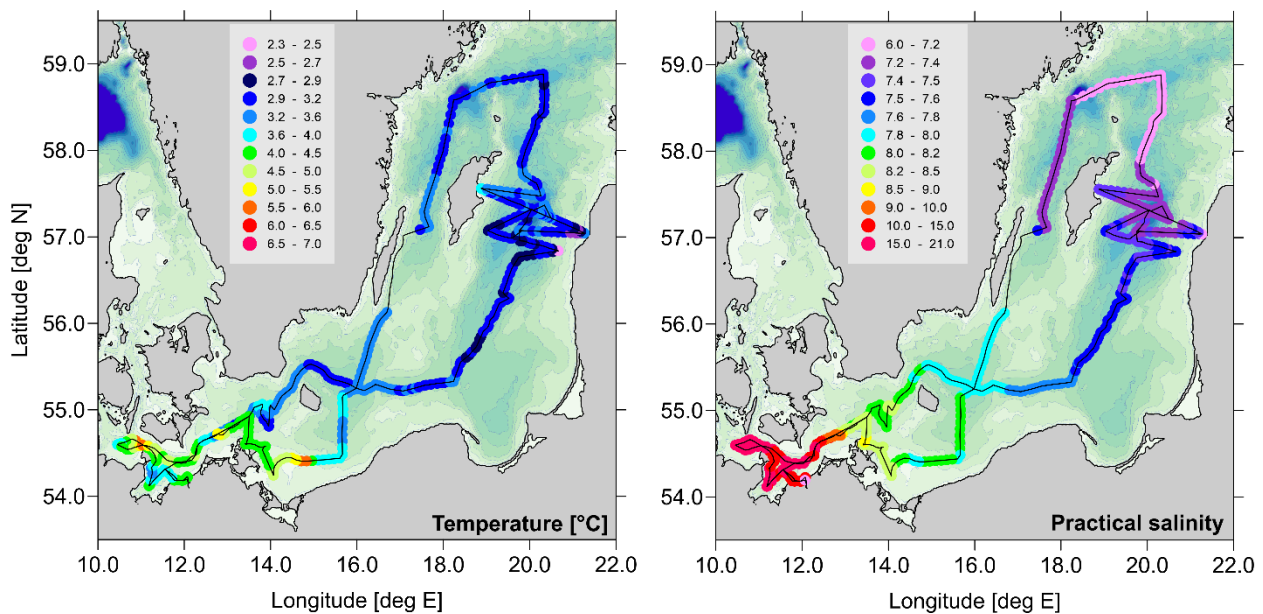


Fig. 5.7 Surface temperature (left) and surface salinity distribution (right panel) of cruise EMB392. Based on 30 min averaged values.

The maximum surface salinity (SSS) west of the Darss Sill was 21gkg^{-1} , with a mean SSS of about 16gkg^{-1} . This indicated an inflow of saline water from the North Sea (Fig. 5.9). The SSS dropped rapidly to about 8gkg^{-1} at the Darss Sill. Here the saline water subducts to deeper layers. The Arkona Basin depicted an SSS about 8gkg^{-1} . Similar values were found in the Pomeranian Bight. Along the Thalweg from the eastern Arkona Basin till the southern Gotland Basin SSS values decreased northward from 8.0 to 7.2gkg^{-1} . The lowest SSS was found in the

northern Gotland basin with about 7.0 gkg^{-1} . The inflow signal west of the Darss Sill was again observed on the way back to Rostock. There the surface salinity was still between 14 and 16 gkg^{-1} .

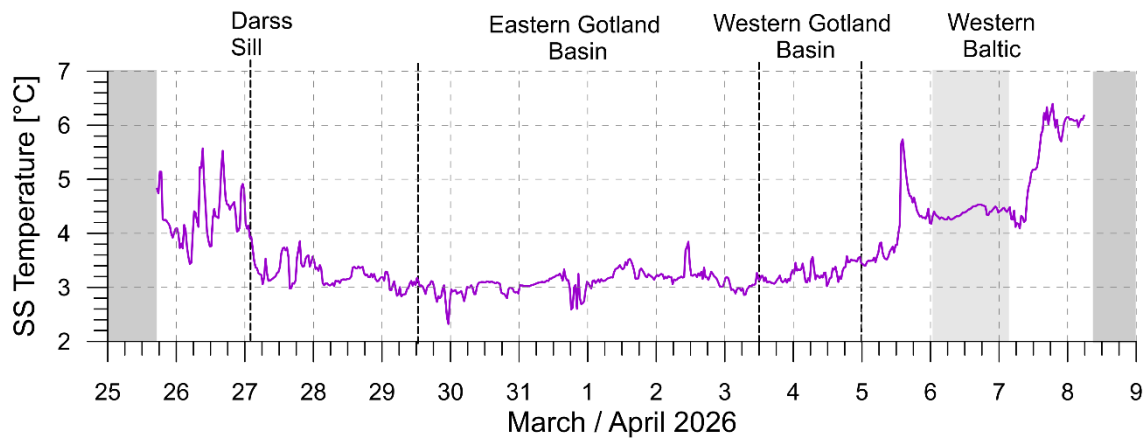


Fig. 5.8 Surface temperature measured with the ship thermosalinograph of RV ELISABETH MANN BORGESE. The gray shaded area indicates the range below the density maximum at the sea surface.

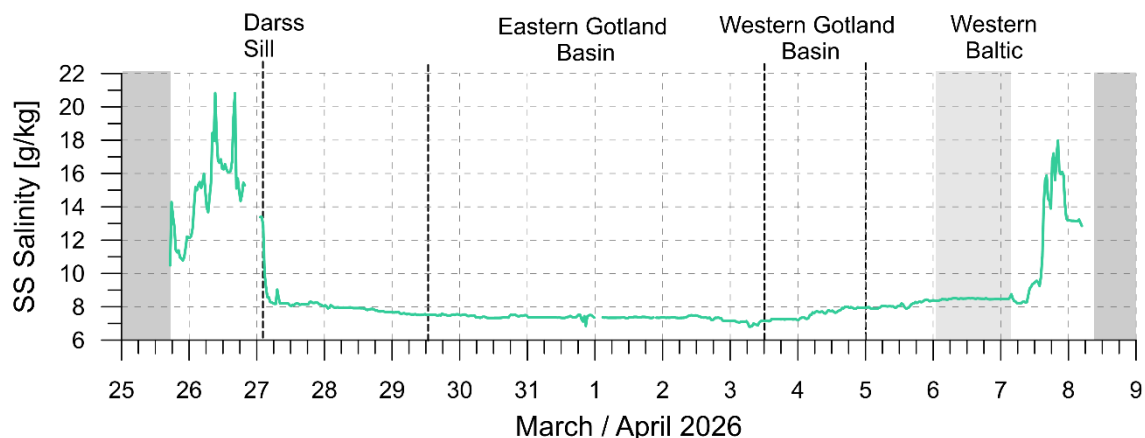


Fig. 5.9 Surface salinity measured with the ship thermosalinograph of RV ELISABETH MANN BORGESE.

The surface distribution of Chlorophyll-a fluorescence depicts patchy pattern of the early spring bloom (Fig. 5.10 and Fig. 5.11). In the western Baltic the surface Chlorophyll-a fluorescence was extremely weak. It increased in the Bornholm Basin, but decreased again in the Slupsk Furrow and the southern Gotland Basin. Further north in the shallow areas off the Latvian coast an enhanced Chlorophyll-a fluorescence was observed, whereas in the deep areas of the eastern Gotland basin the values were still low. In the northern Gotland Basin the onset of the spring bloom has already started. The highest Chlorophyll-a fluorescence was observed at the northernmost position of the cruise. The sea surface turbidity depicted a general increase with time throughout the cruise (Fig. 5.12). This drift is most probably a bias. Although, we could not detect the reason for it. The short-term variability of the turbidity correlates with the Chlorophyll-a fluorescence. However, the turbidity data has to be used with caution.

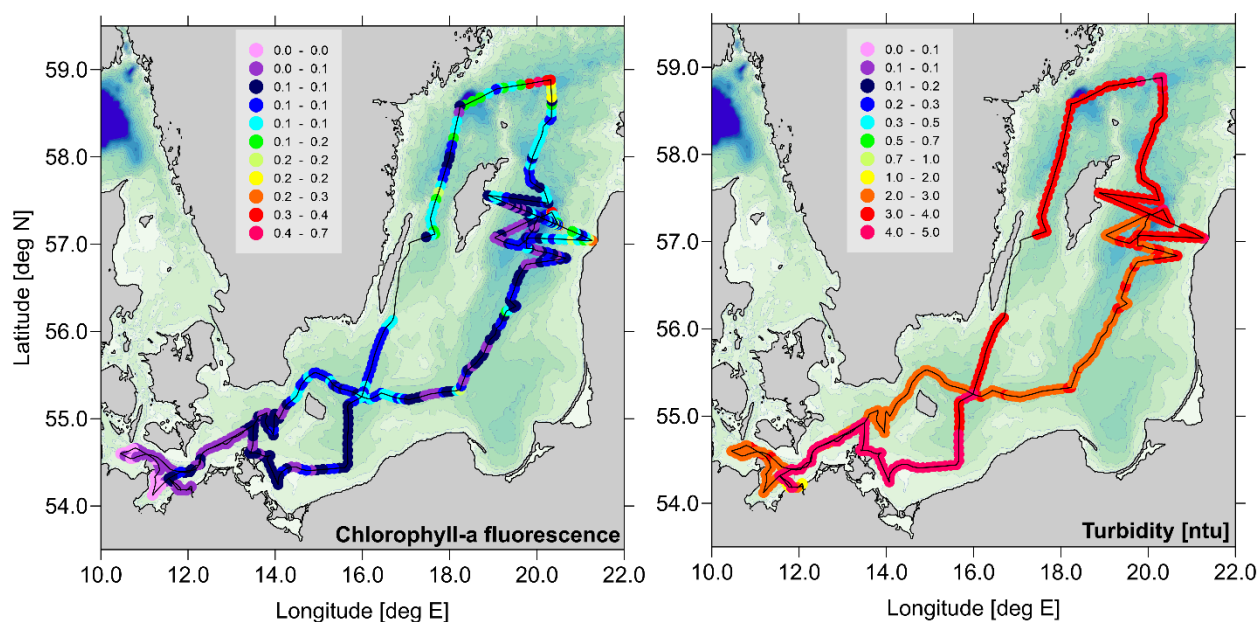


Fig. 5.10 Surface chlorophyll-a fluorescence distribution (left) and distribution of surface turbidity (right panel) along the cruise track of EMB392 in the Baltic (30 min averaged values).

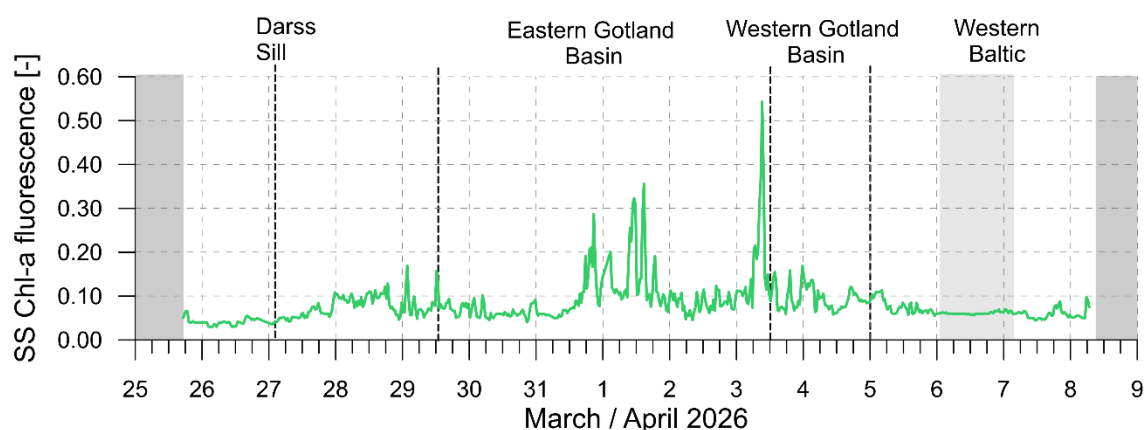


Fig. 5.11 Surface chlorophyll-a fluorescence measured with the flow through fluorometer of RV ELISABETH MANN BORGESE.

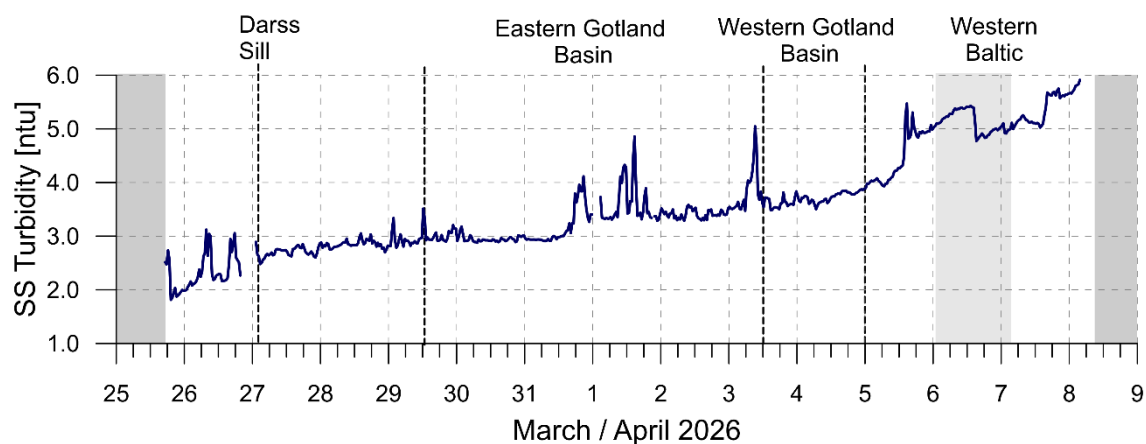


Fig. 5.12 Surface turbidity measured with the flow through fluorometer of RV ELISABETH MANN BORGESE.

5.3 Observations at Main Stations

The following tables contain the values at the surface (Table 5.1) and near the seabed (Table 5.2) for the most important hydrographic and chemical parameters measured at the main monitoring stations of the Baltic Sea Long-Term Observation Program. The positions of the individual stations are shown in Fig. 3.1 and Table 7.1. In the ‘Depth’ column, the number in brackets and in italics indicates the bottle ID of the corresponding sample. The values marked in blue in the ‘Oxygen’ column are hydrogen sulphide concentrations. The oxygen values in brackets and in italics represent the raw measurements from CTD oxygen sensor 0.

Conversion factors:

$$\begin{array}{lll} \mu\text{mol l}^{-1} \text{H}_2\text{S} & * -0.0448 & = \text{negative oxygen equivalent ml l}^{-1} \text{O}_2 \\ \mu\text{mol l}^{-1} \text{O}_2 & * 0.0224 & = \text{ml l}^{-1} \text{O}_2 \end{array}$$

The low nutrient concentrations in the western Baltic were typical of spring conditions in surface water after the spring bloom had started. The nitrate has been completely exhausted. Phosphate concentrations remained low in the Kiel Bight, the Mecklenburg Bight and at the Darss Sill. Conversely, phosphate concentrations increased along the Baltic Thalweg, from the Arkona Basin and the Bornholm Basin to the Slupsk Furrow and the eastern Gotland Basin. The highest phosphate concentrations were detected in the Western Gotland Basin. However, in its southern part at the Karlsö Deep the phosphate concentration drop slightly. This may be due to its close connection to the Bornholm Basin, where concentrations were lower.

Silicate concentrations in the surface waters of the Kiel and Mecklenburg Bights were low. At the Darss Sill, silicate concentrations in the surface waters increased significantly to $11 \mu\text{mol l}^{-1}$, a level also observed in the Arkona Basin. Surface waters in the central Baltic had higher silicate concentrations of around $20 \mu\text{mol l}^{-1}$.

The concentrations of nutrients at the bottom are mainly controlled by the vertical position of the redox cline and oxygen conditions. In the shallow areas of the western Baltic, the bottom water had low nutrient concentrations since a mixture of brackish surface water and saline inflow waters from the North Sea dominated the area in Spring.

In the southern Baltic Sea, specifically in the Arkona Basin, Bornholm Deep, Slupsk Furrow and southern Gotland Basin, the concentrations of nitrates and phosphates at the bottom were high. The silicate concentrations were also significantly higher than in the western Baltic. This can be attributed to the saline inflow that occurred in February 2026. These waters covered the bottom layer of the Arkona and Bornholm basins. The halocline water in the Bornholm Basin was pushed eastwards to the bottom layer of the Slupsk Furrow and the southern edge of the Eastern Gotland Basin. In the anoxic basins of the Central Baltic, the bottom concentration of phosphate increased significantly and reached a maximum of $6.38 \mu\text{mol l}^{-1}$ in the Gotland Deep, where the highest concentrations of silicate were also detected. Nitrate was completely removed from the waters below the redox cline in the central Baltic. In the western Gotland basin, the bottom concentrations of phosphate and silicate decreased to $4 \mu\text{mol l}^{-1}$ and $70 \mu\text{mol l}^{-1}$ respectively. A similar pattern was observed for H_2S bottom concentrations, which decreased from a maximum of $335 \mu\text{mol l}^{-1}$ in the Gotland Deep to $58 \mu\text{mol l}^{-1}$ in the Karlsö Deep.

Table 5.1 Surface values of main hydrographic parameters at the main stations.

Area Date	St. name St. no.	Depth [m]	Temp [°C]	Sal [psu]	O ₂ / H ₂ S [μmol l ⁻¹]	PO ₄ [μmol l ⁻¹]	NO ₃ [μmol l ⁻¹]	SiO ₄ [μmol l ⁻¹]
Kiel Bight 26.03.2026	TF0360 EMB392_7	1.4 (258)	3.74	16.13	390 (370)	0.20	0.0	6.3
Meckl. Bight 25.03.2026	TF0012 EMB392_4	1.6 (101)	4.07	12.06	397 (376)	0.13	0.0	6.1
Darss Sill 27.03.2026	TF0001 EMB392_20	1.6 (676)	3.53	9.25	404 (388)	0.27	0.0	11.4
Arkona Basin 27.03.2026	TF0113 EMB392_24	1.6 (801)	3.10	8.10	423 (410)	0.38	0.0	11.3
Bornholm Deep 28.03.2026	TF0213 EMB392_44	2.0 (1426)	3.12	7.82	408 (404)	0.46	0.0	15.8
Slupsk Furrow 28.03.2026	TF0222 EMB392_52	2.3 (1651)	3.17	7.62	405 (395)	0.55	0.99	18.0
SE Gotland Basin 29.03.2026	TF0259 EMB392_58	1.9 (1851)	3.11	7.52	406 (398)	0.54	1.37	19.1
SC Gotland Basin 29.03.2026	TF0260 EMB392_68	2.3 (2101)	3.08	7.50	415 (397)	0.52	1.06	19.5
Gotland Deep 30.03.2026	TF0271 EMB392_78	2.5 (2477)	3.08	7.23	409 (395)	0.65	2.42	20.7
Fårö Deep 02.04.2026	TF0286 EMB392_116	2.1 (3626)	3.00	7.06	420 (397)	0.64	2.41	21.1
Landsort Deep 03.04.2026	TF0284 EMB392_124	1.9 (3953)	3.07	7.17	416 (395)	0.68	2.11	20.8
W Gotland Basin 03.04.2026	TF0240 EMB392_125	2.2 (4001)	3.15	7.16	416 (395)	0.70	2.23	21.4
Karlsö Deep 04.04.2026	TF0245 EMB392_126	1.5 (4026)	3.43	7.18	428 (398)	0.57	0.24	20.9

Table 5.2 Bottom values of main hydrographic parameters at the main stations.

Area Date	St. name St. no.	Depth [m]	Temp [°C]	Sal [psu]	O ₂ / H ₂ S [μmol l ⁻¹]	PO ₄ [μmol l ⁻¹]	NO ₃ [μmol l ⁻¹]	SiO ₄ [μmol l ⁻¹]
Kiel Bight 26.03.2026	TF0360 EMB392_7	16.8 (253)	3.87	23.27	340 (287)	0.40	0.0	4.7
Meckl. Bight 25.03.2026	TF0012 EMB392_4	23.3 (104)	5.12	27.10	266 (250)	0.56	3.31	13.1
Darss Sill 27.03.2026	TF0001 EMB392_20	20.8 (679)	2.90	18.02	363 (351)	0.25	0.0	4.9
Arkona Basin 27.03.2026	TF0113 EMB392_24	46.3 (807)	4.41	20.73	260 (239)	0.54	1.68	12.0
Bornholm Deep 28.03.2026	TF0213 EMB392_44	87.9 (1435)	3.43	17.47	296 (278)	1.28	4.88	21.6
Slupsk Furrow 28.03.2026	TF0222 EMB392_52	89.1 (1657)	7.51	13.38	99 (93)	1.73	6.84	48.5
SE Gotland Basin 29.03.2026	TF0259 EMB392_58	87.3 (1857)	6.58	10.89	78 (94)	2.33	3.98	48.2

SC Gotland Basin 29.03.2026	TF0260 EMB392_68	140.5 (2109)	7.23	12.01	105 (0)	4.83	0.0	79.8
Gotland Deep 30.03.2026	TF0271 EMB392_78	233.5 (2411)	7.28	12.42	335 (0)	6.38	0.0	106.5
Fårö Deep 02.04.2026	TF0286 EMB392_116	189.4 (3613)	7.21	11.99	84 (0)	4.80	0.0	83.0
Landsort Deep 03.04.2026	TF0284 EMB392_124	436.4 (3912)	6.56	10.75	65 (0)	3.95	0.0	68.5
W Gotland Basin 03.04.2026	TF0240 EMB392_125	166.1 (4010)	6.15	10.21	67 (0)	4.15	0.0	71.8
Karlsö Deep 04.04.2026	TF0245 EMB392_126	107.1 (4033)	6.07	10.10	58 (0)	4.15	0.0	71.0

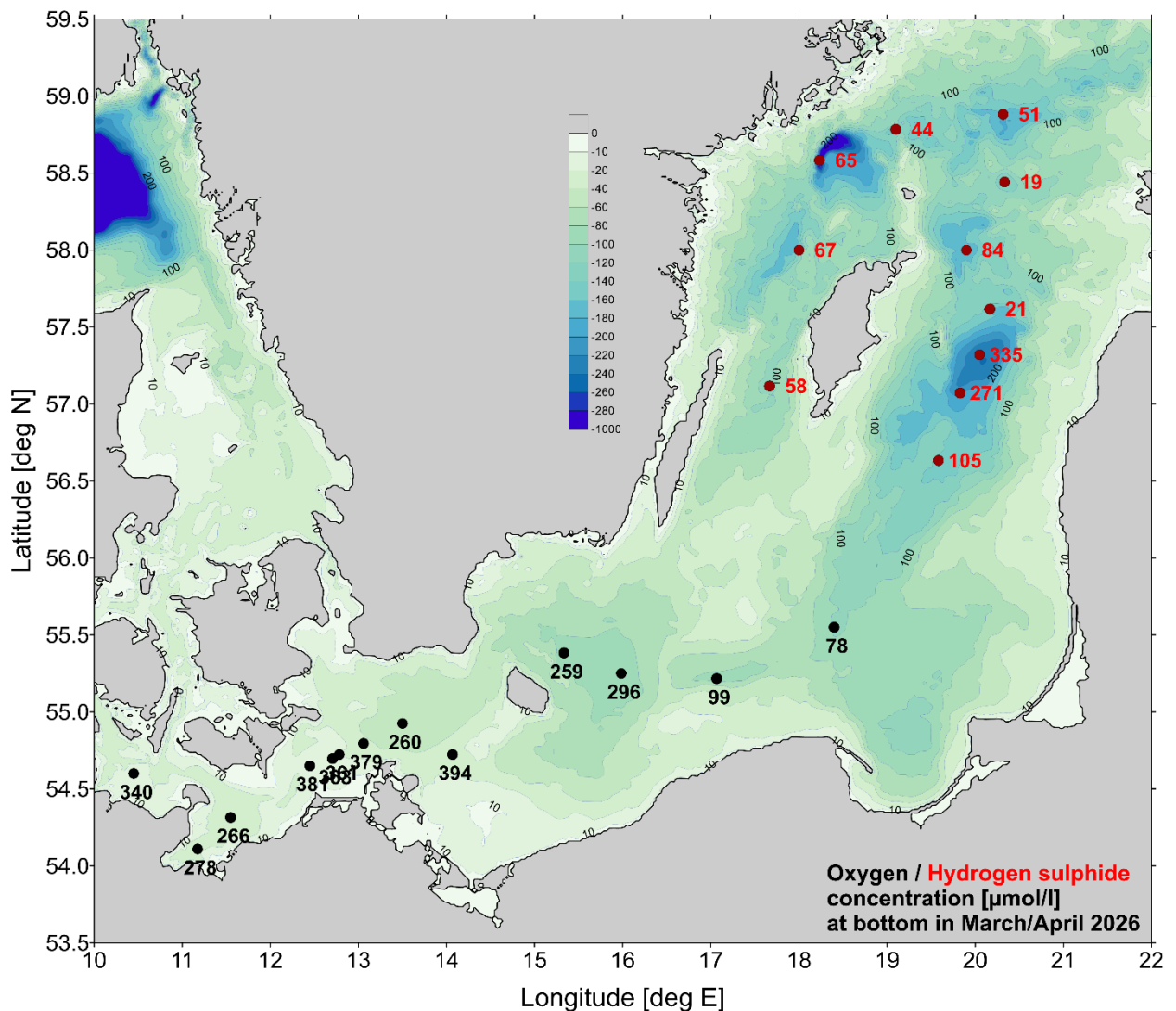


Fig. 5.13 Distribution of oxygen (black labels) and hydrogen sulphide concentrations (red labels) near bottom at main stations of the long-term observation program.

Fig. 5.13 shows the spatial distribution of bottom oxygen conditions derived from water bottle samples. Due to the moderate inflow event in February 2026, the bottom water in the western Baltic remained oxygenated. Bottom oxygen concentrations in the Bornholm Basin were high, as its deep water also consisted of new saline inflow waters. In contrast, the Slupsk Furrow and the

Southern Gotland Basin exhibited low levels of bottom oxygen. The bottom waters in the Central Baltic were anoxic and contained high concentrations of hydrogen sulphide. The highest H_2S concentrations were found in the Eastern Gotland Basin, at around $335 \mu\text{mol l}^{-1}$ in the Gotland Deep. In contrast, the deep layers of the northern and western Gotland basins showed much lower H_2S levels (Table 5.2).

5.4 Baltic Thalweg Transect

The Baltic Thalweg Transect follows the deep-water way from the entrance at Danish straits, through the western Baltic Sea, the Bornholm basin, the Slupsk Furrow, and further north towards the northern Gotland basin. During the cruise 73 CTD stations were aligned along the thalweg transect, which supplies an excellent overview about the hydrographic and environmental state of the western and central Baltic Sea. The thalweg transect is one of the standard transects of the IOW Long-Term Observation Program. The transect was worked as a nearly continuous sequence of stations, starting on 26th March in the Belt Sea and finished at 3rd April in the northern Gotland Basin. The data supplies a quasi-synoptic picture of the hydrographic patterns along the Thalweg.

The observations cover the early spring conditions during the onset of the seasonal thermocline (Fig. 5.14 and Fig. 5.15). The late winter season of 2025/2026 was cooler than usual, compared to the recent decades. A long-lasting east wind phase during January and February caused a continuous transport of cold continental and polar air masses into the Baltic region. This led to a long outflow of surface water into the North Sea, resulting in the lowest water level observed at sea gauge Landsort Norra since 1880. The cooling of the sea surface lowered the surface temperature below the temperature of maximum density. Thus, the first heating of the surface water in early spring led to convection in the surface layer. This is seen in the temperature distribution as an unusual deep surface layer, that reached a thickness of up to 40m in the southern and central Baltic.

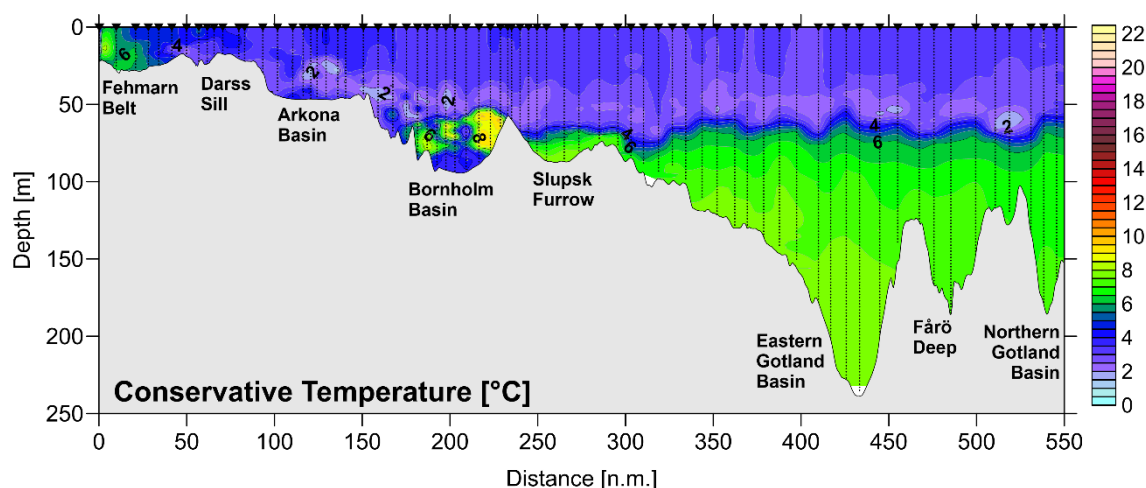


Fig. 5.14 Distribution of conservative temperature along the thalweg of the Baltic Sea from the Kiel bight to the northern Gotland Basin. The figure is based on the preliminary CTD data gathered from 26.03. - 03.04.2026.

Only a weak seasonal thermocline has developed between the surface layer and the intermediate water. The surface temperatures of the southern and central Baltic were close to the

long term mean (1900-2005) for March/April. In the western Baltic from the Fehmarn Belt to the Arkona Basin the surface water temperature ranged from 4.7°C in the Belt Sea to 3.1°C in the Arkona Basin. The temperatures in the surface layer decreasing only slightly towards east and north and the thermocline depth increased to about 40 to 45m. SST of about 3.1°C was found in the Bornholm basin. The upper layer temperature in the eastern Gotland Basin dropped to 3.05°C at the station TF0271 (long-term mean: 2.6°C). At the Fårö Deep and in the northern Gotland Basin about 3.0°C were measured in the surface layer. Below the thermocline the water temperature ranged between 2.5 and 5.0°C in the western Baltic. The temperature dropped in the core of intermediate winter water to 2.4°C in the Bornholm Basin and 2.0°C in the eastern Gotland Basin. Below the halocline the water temperature increased and varied between 6 and nearly 8°C. Only in the eastern Bornholm Basin higher temperatures of 9.6°C were observed in the upper deep water. This water body was a mixture of the warm water that entered the Baltic with barocline summer inflows and saline inflow waters from February 2026. At the bottom of the of the Slupsk Furrow the temperature was 7.5°C.

In the bottom layer of the southern Gotland Basin a warm water patch was detected. This depicts the warm waters of the barocline summer and autumn inflows of 2025. The temperature maximum in the eastern Gotland Basin was found at 191m with 7.29°C. Towards the bottom the temperature decreased very slightly and was constant at 7.27°C in the bottom layer of the Gotland deep. This value hardly changed during the recent year, typically of the long-lasting stagnation period. The bottom water in the Fårö Deep depicted a value of 7.21°C in a 8m thick bottom layer. This was also the maximum temperature at this station.

The extreme low filling stage of the Baltic in the begin of February 2026 caused a medium size barotropic inflow of saline water in February and March. However, since this was a unusual slow inflow, its waters were strongly diluted by mixing with ambient deep water. At the time of the cruise the salinity distribution in the western Baltic depicted the typical pattern for a baroclinic circulation, with outflowing brackish surface water and high saline water in the deep layer. The highest salinity along the thalweg was observed west of the Fehmarn Belt at station TF0361 with a bottom salinity of 26.5 gkg⁻¹. Towards the Darss Sill the salinity decreased to about 18.0 gkg⁻¹. This high bottom salinity indicates an ongoing overflow at the Darss Sill. In the the Arkona Basin a saline bottom layer of 10 to 15 m thickness was found. At station TF0113 the maximum bottom salinity of 21.3 gkg⁻¹ was measured. This high saline water has entered the Baltic through the Öresound. The saline waters from the Darss Sill covered the midwater layer. Its salinity ranged between 13 and 18 gkg⁻¹. The temperature of this water body was about 2.8°C.

The inflow waters has already reached the Bornholm Basin. Here the bottom salinity in the was considerably increased. The inflow waters covered a 10m thick bottom layer with maximum salinity and temperature of 17.4 gkg⁻¹ and 3.5°C respectively (Fig. 5.15). The inflow waters lifted the former deep water towards the halocline. That shifted the halocline depth to about 51 m, that is 4 m above the sill depth of the Slupsk Sill. That will force an overflow of halocline water from the Bornholm Basin into the Slupsk Furrow. However, an active overflow of the sill was not observed when the ship crosses the Slupsk Sill. The inflow waters has not reached the Slupsk Furrow yet. The bottom salinity at station TF0222 at the center of the Slupsk Furrow was 13.38 gkg⁻¹. The bottom water temperature of 7.5°C point to deep water origin from the summer and autumn barocline inflows.

The deep and bottom layer of the eastern Gotland basin was still covered by high saline waters from inflow series of the recent years. In the Gotland Deep bottom salinity of 12.4 gkg⁻¹

was observed. Compared to the previous year it is a decrease of 0.2 g kg^{-1} . The bottom salinity in the Gotland Deep decreases slowly, but continuously by mixing with the less saline deep water above. In the Fårö Deep the bottom salinity has not changed compared to the recent observations and was still at about 12.0 g kg^{-1} .

The halocline in the central Baltic was found at a depth 66m in the eastern Gotland Basin and at 69m in the Fårö Deep. The vertical salinity gradient of the halocline decreases towards northern end of the transect.

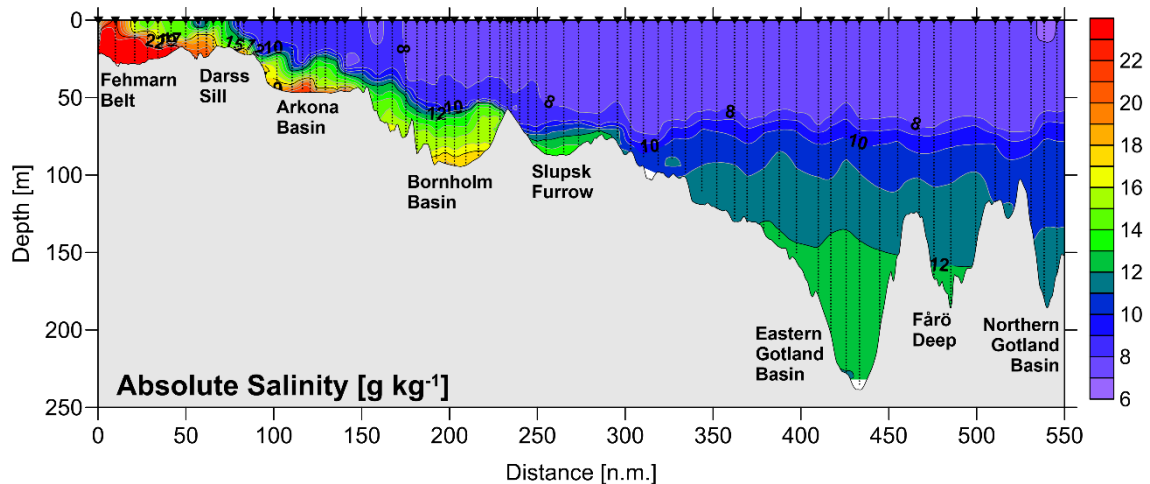


Fig. 5.15 Distribution of Absolute salinity along the talweg of the Baltic Sea from the Kiel bight to the northern Gotland Basin. The figure is based on the preliminary CTD data gathered from 26.03. - 03.04.2026.

The oxygen distribution along the central transect is shown in Fig. 5.16. Due to the medium size barotropic inflow in February/March 2026 the western Baltic was well ventilated. The oxygen rich inflow waters have reached the Bornholm Basin where they mixed up with the halocline and old bottom waters in the Bornholm Basin and caused a patchy distribution of oxygen concentration in and below the halocline. The deep water depicted a high oxygen concentration between 240 and $280 \mu\text{mol kg}^{-1}$ dissolved oxygen.

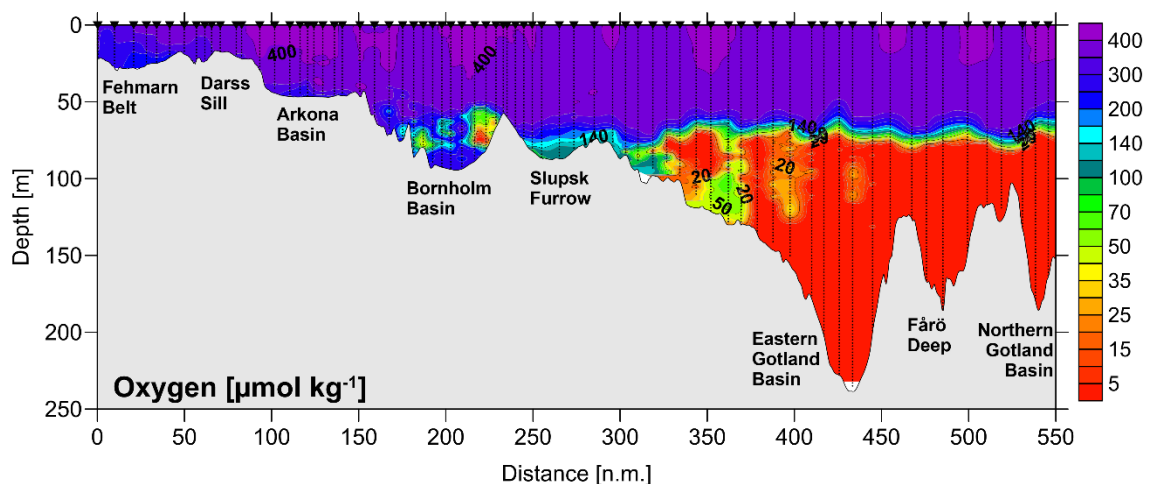


Fig. 5.16 Distribution of oxygen concentration along the talweg of the Baltic Sea from the Kiel bight to the northern Gotland Basin. The figure is based on the preliminary CTD data gathered from 26.03. - 03.04.2026.

The oxygen distribution in the Slupsk Furrow deep water was quite uniform. Here the oxygen concentrations ranged between $140 \mu\text{mol kg}^{-1}$ in the halocline and $90 \mu\text{mol kg}^{-1}$ near bottom. At the eastern outlet of the Slupsk Furrow an active overflow was visible.

The front of eastward traveling oxygenated water has reached the rim of the eastern Gotland Basin. This water mass consists of a mixture of former deep water from the Slupsk Furrow and ambient water masses. The highest bottom water oxygen concentrations were found in the southern Gotland Basin at station TF0255 with $110 \mu\text{mol kg}^{-1}$. A second patch of oxygenated water was found at the southern rim of the eastern Gotland Basin at station TF0262. This water depicted an oxygen concentration of $60 \mu\text{mol kg}^{-1}$. Its high temperature pointed to an origin from the warm summer and autumn inflows 2025. In the eastern Gotland Basin a sharp oxycline was observed that coincided with the upper halocline. At station Gotland Deep (TF0271) oxygen decreased rapidly below 70m depth. However, down to a depth of 115 m small amounts of oxygen were detected in the upper deep water. Free hydrogen sulfide was found water samples below that layer. In the Fårö Deep (TF0286) and the northern Gotland Basin (TF0282) the anoxic waters start at below halocline at about the depths of about 75 m.

The surface layer of the Baltic was well ventilated, due to thermal convection and wind induced deep mixing during the winter and spring season.

The Chlorophyll-a fluorescence along the transect depicted a patchy distribution. In the western Baltic the Chlorophyll-a fluorescence was low. It increased in the Bornholm Basin, where a more uniform distribution was found. The Chlorophyll-a fluorescence covered the entire surface layer. This indicated the begin of the spring bloom when the nutrients were still mixed over the whole surface layer (Fig. 5.17). Towards north the Chlorophyll-a fluorescence distribution becomes more patchy and decreased towards the northern Gotland Basin.

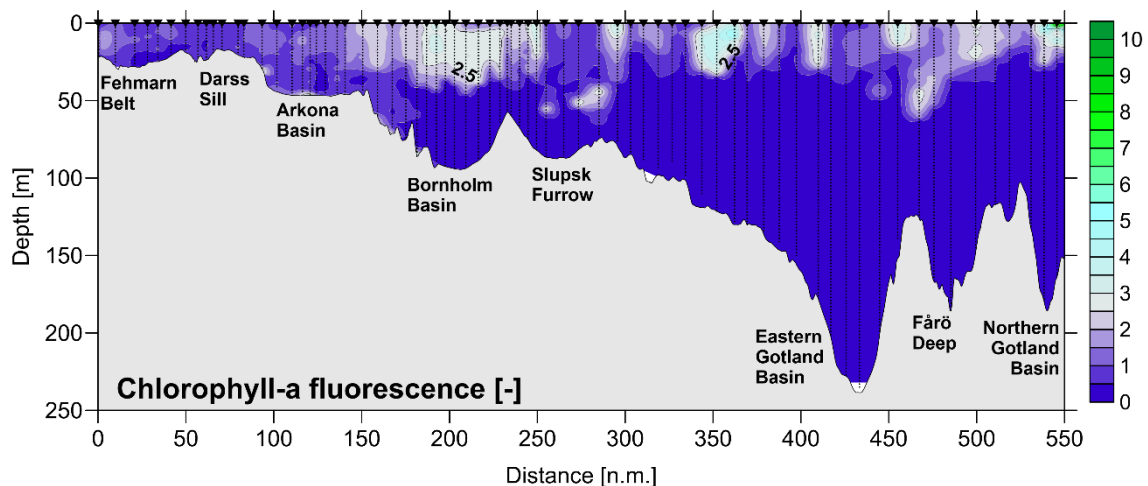


Fig. 5.17 Distribution of Chlorophyll-a fluorescence along the talweg of the Baltic Sea from the Kiel bight to the northern Gotland Basin. The figure is based on the preliminary CTD data gathered from 26.03. - 03.04.2026.

The turbidity distribution in the western Baltic Sea area follows to the pattern of high saline water. Higher turbidity values indicate the inflow water. This continued to the east where high turbidity indicated the spreading of inflow water along the bottom of the Slupsk Furrow and further into the southern Gotland Basin. In the in the central Baltic the patterns of high turbidity were found below the halocline at locations of interfaces between oxic, suboxic and anoxic

waters. These turbidity patches indicate inflowing water patches and the depth level of the redoxcline between 80 and 140m. (Fig. 5.18).

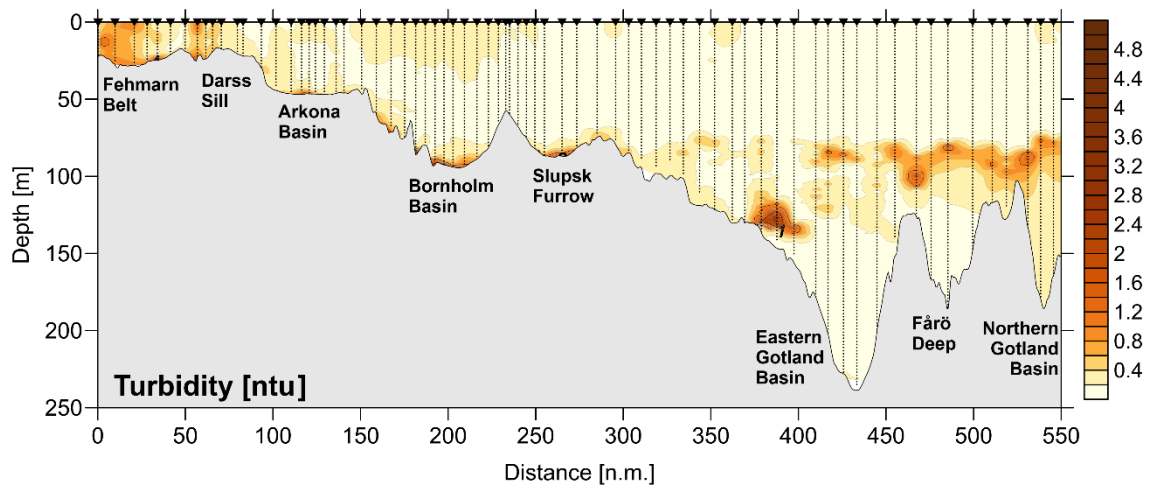


Fig. 5.18 Distribution of turbidity along the talweg of the Baltic Sea from the Kiel bight to the northern Gotland Basin. The figure is based on the preliminary CTD data gathered from 26.03. - 03.04.2026.

Fig. 5.19 depicts the vertical profiles of temperature, salinity and oxygen concentration at the four main stations in the central Baltic. The surface water temperature in the eastern Gotland basin, the Fårö Deep and the Landsort Deep were at a similar level of about 3.0°C. Only at Karlsö Deep a slightly higher SST of 3.45°C was observed. The surface temperatures indicated the onset of seasonal thermocline in the central Baltic. The depth of the thermocline was about 25 m. At the Gotland Deep, the Fårö Deep and the Landsort Deep the entire surface layer was well mixed, in contrast to the Karlsö Deep, where the mixed layer was only 10 m deep. The core of the winter water layer was found between 40 and 60m depth (A). Its minimum temperature varied between 1.8°C at the Gotland deep and 2.94°C at Landsort Deep. The strength of vertical thermohaline gradient at the halocline was comparable throughout the stations in the central Baltic. However, the depth of the upper halocline changed from 64 m at Gotland Deep and Farö Deep to 70 m at Landsort Deep and 58 m at Karlsö Deep (B). The vertical gradients in the deep layer varied strongly between the four stations (C). The weakest vertical Gradient was found at Karlsö Deep. The highest salinity gradient was observed at the Gotland Deep. The observed hydrographic conditions in the deep water of the central Baltic were established in the course of moderate inflow events during the years before 2018. Since then, no fresh saline water has reached the deep water of the eastern Gotland Basin. The bottom temperatures and salinities at all stations are considerably higher than average. The warm barocline summer inflows have reached the halocline layer between 90 to 120m depth, indicated by the higher temperature and low oxygen concentrations at the Gotland deep (D). Below 117 m the deep water at the eastern Gotland Basin was still anoxic. The oxycline at Farö Deep and in the western Gotland basin (Landsort Deep and Karlsö Deep) is confined to the halocline. The deep-water layer in the central Baltic is characterized by the long-lasting stagnation and euxinic conditions (E) established after the MBI of 2014.

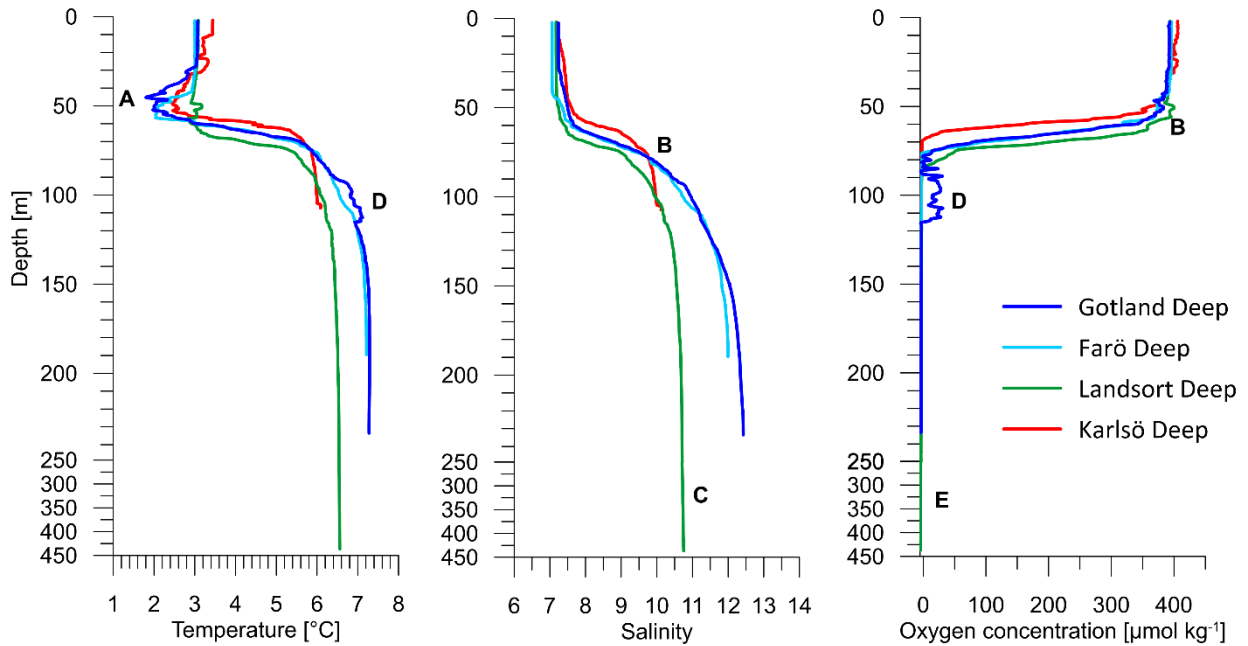


Fig. 5.19 Vertical profiles of temperature, salinity and oxygen concentration (CTD data) at the main stations in the central Baltic. Gotland Deep TF0271 (blue), Fårö Deep TF0286 (cyan), Landsort Deep TF0284 (green), and Karlsö Deep TF0245 (red).

The different water masses observed during the cruise can be clearly identified by their temperature, salinity and oxygen signatures. Fig. 5.20 provides an overview of the various water masses in two-state diagrams. The following water bodies were identified and depicted in the figure:

A - Western Baltic surface water
 B – Fehmarn Belt bottom water
 C - Central Baltic surface water
 D - Bornholm Basin bottom water
 E - Bornholm Basin halocline water

F - Slupsk Furrow bottom water
 G - EGB halocline water
 H - EGB deep water
 I - EGB bottom water

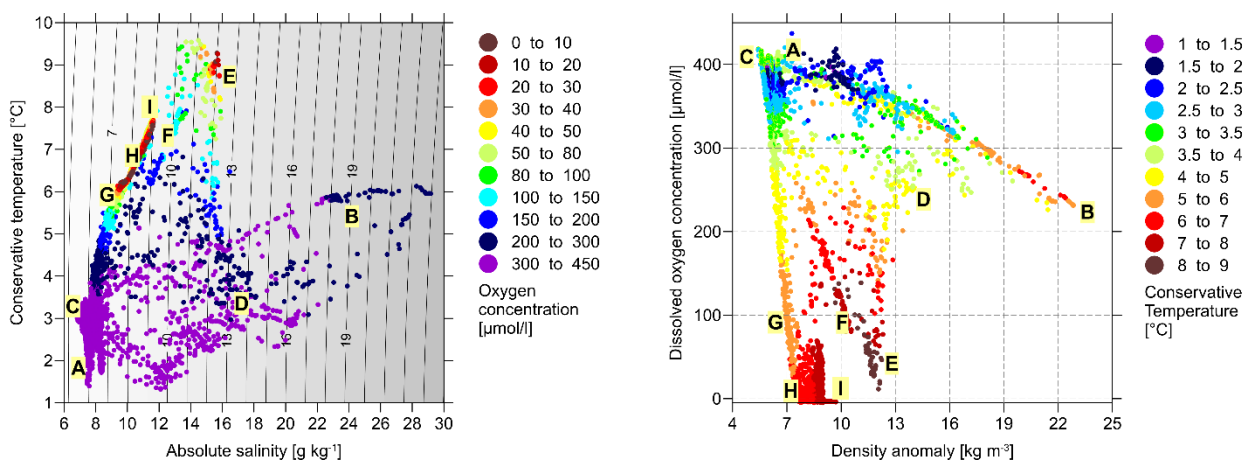


Fig. 5.20 TS-diagram (left) and Oσ-diagram (right) of the Baltic transect. The capital letters indicate the different water masses (see text).

5.5 Southern Gotland Basin Transect

At the southern rim of the Eastern Gotland Basin (compare Fig. 3.1) a zonal CTD transect was performed from 29th to 30th March, to obtain information about the hydrographic conditions at the entrance of the Eastern Gotland Basin. The thickness of the surface water decreased from 40 m in the west to about 30 m at the Latvian coast. Its temperature was close to 3.0°C. The development of the seasonal thermocline has just started, thus the vertical gradient between the surface water and the winter water layer were weak. The core of the winter water depicted temperatures of about 2.2°C, which was relatively low compared to the previous years. The halocline was found between 70m and 65 m depth, separating the intermediate winter water from the warm and salty deep water, that depicted a temperature and salinity of 7.0 to 7.3°C and 9 to 12.3 gkg⁻¹, respectively (Fig. 5.21). At the eastern rim of the transect weak signs of intrusions were indicated by elevated isotherms at 110 to 130m depth. This water originated from the barocline summer and autumn inflows. In the center of the transect vertical displaced isotherms and isohalines point to an eddy like structure.

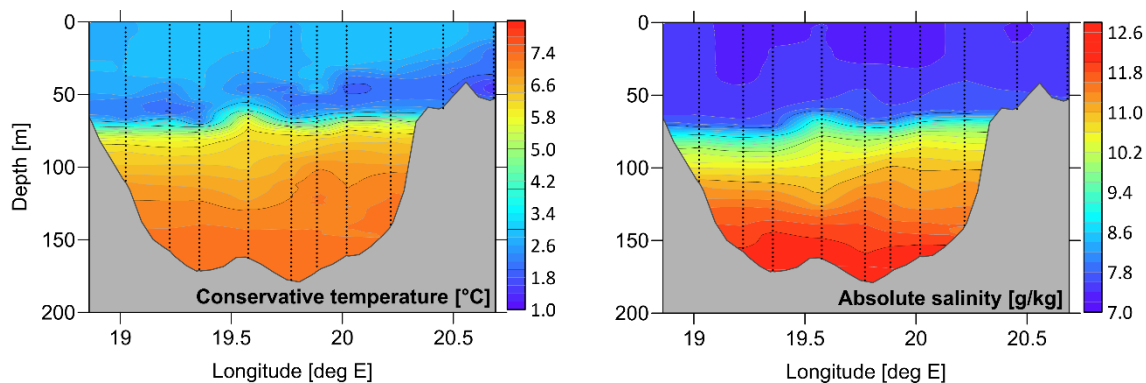


Fig. 5.21 Temperature and salinity distribution along the zonal transect at the southern rim of the Eastern Gotland Basin (based on preliminary CTD data, 29.03 to 30.03.2026).

This is also visible in the distribution of oxygen concentration. The strong density gradient of the halocline hampers the diapycnal mixing. Thus, the upper layer is well ventilated due to the exchange with the atmosphere. At the halocline the oxygen concentration dropped rapidly. The deep water was anoxic below 90m depth.

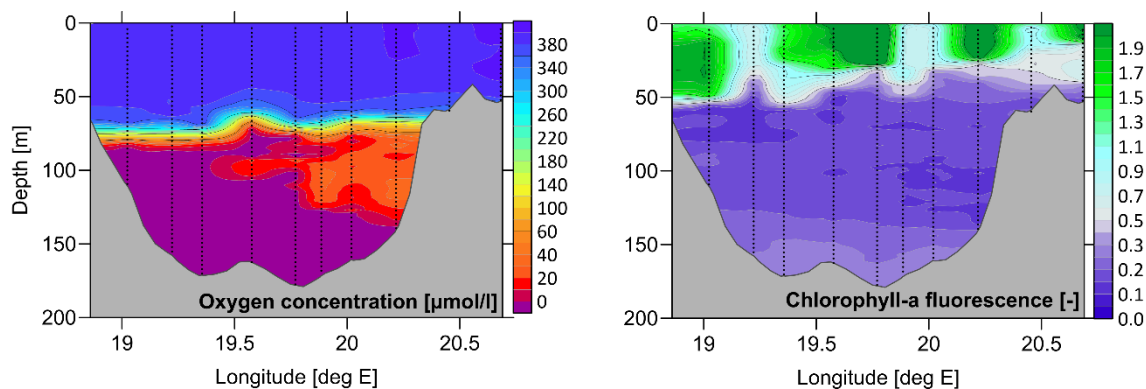


Fig. 5.22 Dissolved oxygen and Chlorophyll-a fluorescence distribution along the zonal transect at the southern rim of the Eastern Gotland Basin (based on preliminary CTD data, 29.03 to 30.03.2026).

At the eastern rim of the basin the oxygen concentration was above zero below the halocline and 140 m depth, indicating the inflow water body. The Chlorophyll-a fluorescence values in the surface layer were high and showed a patchy distribution, pointing to the begin of spring. The depth of the productive layer decreased from 50 in the west to only 20 m above the shallower areas off the Latvian coast in the east (Fig. 5.22).

5.6 Gotland Transect

Part of IOWs long term observation program are also high-resolution measurements of the hydrography in the Gotland Basin. Usually, these observations are performed with a ScanFish towed CTD system. Shortly after start of the transect the ScanFish measurements have to stopped due to technical problems. Thus, we performed the observations with the standard CTD instead. The transect crosses eastern Gotland Basin at the latitude of the Klintsbank and the Gotland Deep. These data will be not discussed in detail here, since they are quite similar to the southern Gotland Basin transect discussed in the previous section. The main hydrographic parameters are depicted in Fig. 5.23 and Fig. 5.24.

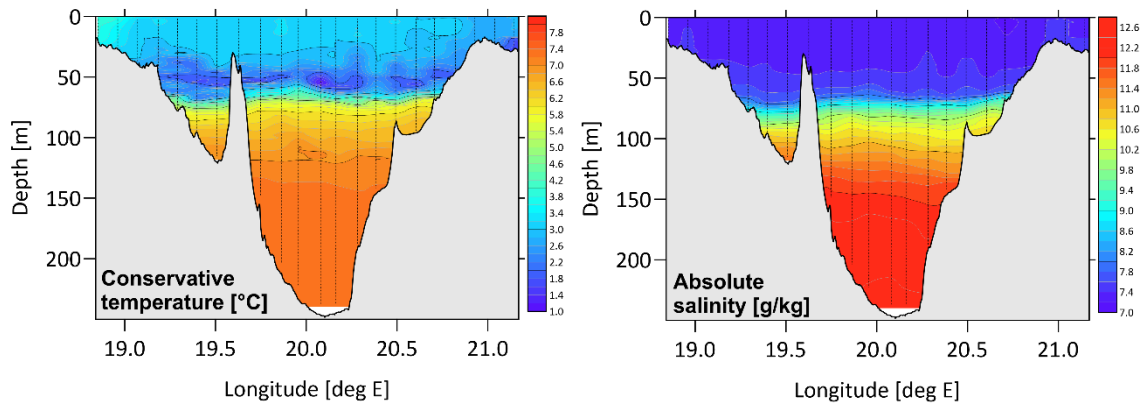


Fig. 5.23 Temperature (left) and salinity distribution (right) along the ScanFish transect across the eastern Gotland basin, performed on 09./10.05.2025.

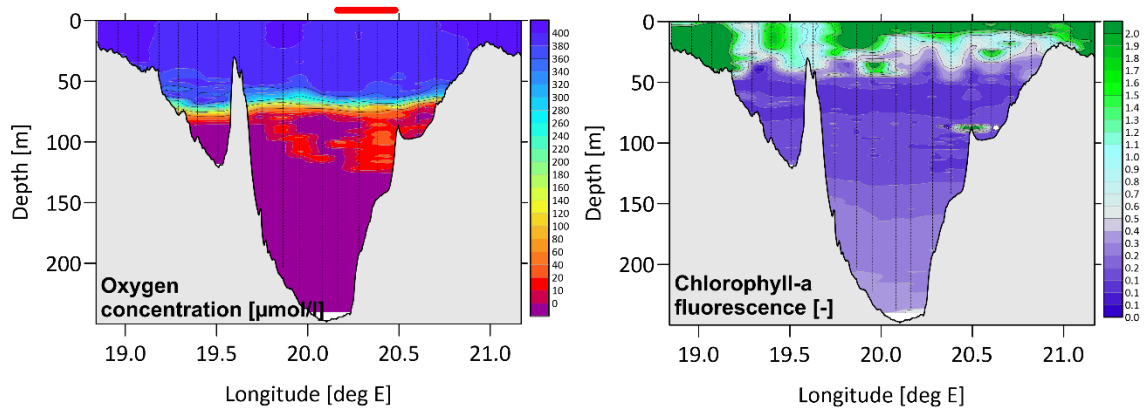


Fig. 5.24 Distribution of dissolved oxygen (left) and Chlorophyll-a fluorescence (right) along the ScanFish transect across the eastern Gotland basin, performed on 09./10.05.2025.

5.7 Microstructure Observations (Eastern Gotland Transect)

As seen in Fig. 5.22 and Fig. 5.24 waters of the summer and autumn inflows enter the eastern Gotland Basin along its eastern rim. Although, these waters carry only a small amount of oxygen into the upper deep water they change the redox conditions significantly. Thus, we performed high resolution microstructure observations at a small subsection of the Gotland Transect. The location of this subsection is indicated in the as red line above the left panel of Fig. 5.24. The aim of the MSS observations was to detect the fine structure of the oxygenated water body and to localize mixing regions between the inflow water and the anoxic water in the upper deep water. The observed oxygen distribution and the patterns of eddy diffusivity are shown in Fig. 5.25. The inflow water was confined to a 60 m thick layer at the eastern rim of the deep basin, covering the entire water column between the halocline and the bottom. Towards the basin center the inflow water detached from the bottom. Its distribution becomes thinner and patchy. The turbulent mixing within the inflow water body is extremely weak. Only at its upper interface at the halocline and at the bottom the mixing was slightly enhanced.

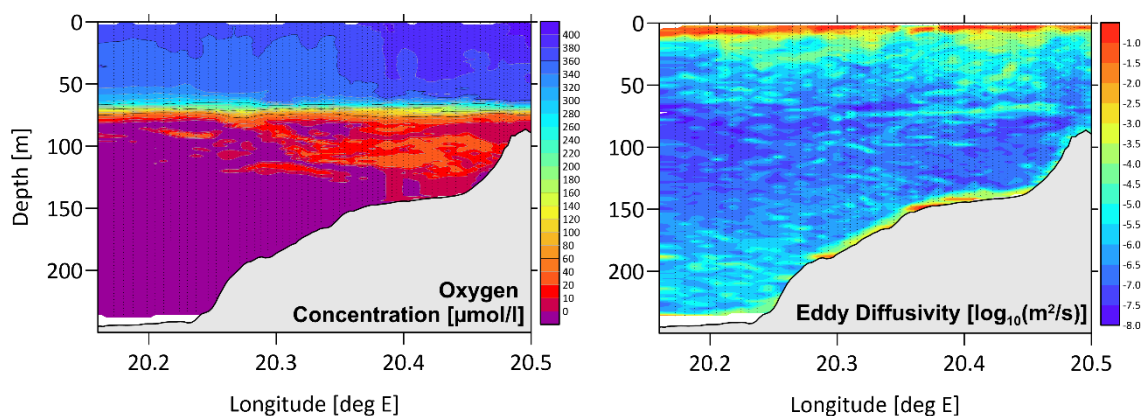


Fig. 5.25 Oxygen distribution and patterns of eddy diffusivity along the microstructure transect across the southern Åland Sea.

5.8 Long-Term Investigations of CH₄, N₂O and CO₂ Distribution

Simultaneous sampling of CH₄, N₂O and CO₂ was carried out as part of an extension to the long-term data collection programme at four central stations in the Arkona Basin, Bornholm Basin, Eastern Gotland Basin and Fårö Deep. The sampled stations are indicated in Table 7.1 by the abbreviation 'TG'. One complete depth profile was sampled at station TF0271 for long-term CT, AT and pH data collection. These samples were fixed with a 500 μ L saturated HgCl₂ solution to prevent microbiological activity and were stored in the dark.

5.9 Long-Term Observation of the Microbiological Habitat of the Redoxcline

Insights into changes in the microbial food web of the redoxcline are obtained through high-resolution vertical sampling at the Gotland Deep (TF0271) and Landsort Deep (TF0284) stations during each monitoring cruise. Samples were taken in the redoxcline and at six depths above and below it, in depth intervals of 2 m. These samples were prepared for microbiological analysis (FISH and DNA) and determination of pigments using CTD/water sampling bottles. The responsible scientist at IOW is Prof. Dr. Klaus Jürgens.

5.10 Plankton Sampling

Plankton sampling was performed using a rosette sampler combined with a CTD, as well as small phytoplankton nets (PLA and APNET) and a zooplankton net (WP2). Samples were taken at different depths to obtain representative data from the euphotic zone. Additionally, samples for microbiological analysis were collected at some stations in the central Baltic. These samples will be analysed after the cruise. Therefore, no preliminary results from this programme are presented here. The responsible scientists at IOW are Dr Anke Kremp (phytoplankton) and Dr Jörg Dutz (zooplankton).

5.11 eDNA Sampling

During the cruise, environmental DNA (eDNA) samples were collected in German territorial waters and the Exclusive Economic Zone (EEZ) for analysis.

Prokaryotic microbes and bacteria (including cyanobacteria and archaea) are important drivers of carbon and nutrient biogeochemistry, accounting for a large proportion of pelagic biomass and productivity. However, with the exception of filamentous cyanobacteria (see, for example, HELCOM), which are mainly monitored for their socio-economic importance, microbes and the fundamental processes they drive are generally overlooked as environmental indicators in the Baltic Sea. Microbes are present in the pelagic zone in an annually recurring spatial and temporal pattern, as has been convincingly demonstrated by current molecular methods. Due to their different growth requirements and high turnover rate, marine microbial communities react dynamically and rapidly to environmental changes. As the combined gene pool maintained and expressed by microbes can now be identified using modern molecular techniques, it is possible to identify biogeochemical pathways and informative indicator genes that are closely linked to environmental conditions and nutrient biogeochemistry in the different basins of the Baltic Sea. The aim of eDNA sampling is to utilise this information in future monitoring approaches, using microbial characteristics as an indicator of the health of the German Baltic Sea.

For the eDNA Bioarchive, surface and deep-water samples are filtered using either Nalgene Bottletop filtration units or the ‘SciFi’ (the simple scientific filtration device) via 0.45 µm cellulose acetate filters (Ø47 mm) and 0.2 µm polycarbonate filters (Ø47 mm). Two filters of each size were collected per station and water depth. The 0.45 µm filter processes 1 litre of water, while the 0.2 µm filter processes 250 ml. Additionally, a metazoan bioarchive has been set up for which 2 litres of surface water were filtered through 0.45 µm nitrocellulose filters at each station. These water volumes were obtained from regular station CTDs; no additional CTD casts were performed.

To establish a microbiome bioarchive of the Baltic Sea for the metaproteomic recording of anthropogenic environmental changes, 60 litres of surface water were filtered sequentially through 10 µm, 3 µm, and 0.2 µm polycarbonate filters (Ø 142 mm). This filtration was operated in parallel with three compressed air pumps. An extra CTD was performed for this large volume of water. Sampling was conducted at three stations.

All the filters collected were frozen at -20 °C on the research vessel and then stored at -80 °C. Processing and analysis of the filters will be performed after the cruise at the IOW. The stations where eDNA was sampled are indicated in Table 7.1.

6 Ship's Meteorological Station

Not applicable on EMB. The meteorological conditions during the cruise are described in section 5.1, based on data of the automatic weather station of the ship.

7 Station Lists EMB392

7.1 Overall Station List

Table 7.1 list all stations and deployments carried out during the cruise EMB392. Standard sampling consisted of a single CTD cast. Nutrient samples at fixed standard depth were taken at selected stations, indicated by N. At some stations a number of additional chemical and biological samplings were performed. These tasks are indicated in the last column of Table 7.1.

Used gears:	CTD	- CTD probe with rosette water sampler
	SD	- Secci disk
	PLA	- Phytoplankton net
	WP2	- WP2 net for Zooplankton sampling
	SCF	- ScanFish undulating CTD deployment
	MSS	- Microstructure profiler
	MUC	- Multicorer
	Moor	- Mooring

Additional sampling program on selected stations:

CC	- Comparison measurements for CTD data quality assurance
N	- Nutrient sampling (NO ₃ , NO ₄ , NH ₄ , PO ₄ , SiO ₄ , O ₂)
HS	- H ₂ S sampling
TG	- Trace gas sampling (CH ₄ , N ₂ O and CO ₂)
eDNA	- environmental DNA sampling

Table 7.1 List of stations and gears

Station No.	Station name	Gear	Date/Time	Latitude	Longitude	Water Depth	Remarks
EMB	IOW		[UTC]			[m]	
EMB392_1-1	TFO5	CTD	25.03.2026 19:16	54° 13.89'N	012° 04.65'E	9.0	N, eDNA
EMB392_2-1	NHBoje	CTD	25.03.2026 20:30	54° 10.69'N	011° 57.68'E	8.0	
EMB392_3-1	TF0018	CTD	25.03.2026 21:43	54° 11.01'N	011° 46.11'E	17.0	
EMB392_4-1	TF0012	CTD	25.03.2026 23:22	54° 18.90'N	011° 33.06'E	22.0	N, eDNA
EMB392_4-2	TF0012	PLA	25.03.2026 23:24	54° 18.90'N	011° 33.05'E	22.0	
EMB392_4-3	TF0012	WP2	25.03.2026 23:46	54° 18.90'N	011° 33.01'E	22.0	
EMB392_4-4	TF0012	WP2	25.03.2026 23:56	54° 18.89'N	011° 33.01'E	22.0	
EMB392_4-5	TF0012	CTD	26.03.2026 00:12	54° 18.89'N	011° 33.02'E	22.0	TG
EMB392_4-6	TF0012	CTD	26.03.2026 00:37	54° 18.89'N	011° 33.01'E	22.0	
EMB392_5-1	TF0022	CTD	26.03.2026 03:00	54° 06.59'N	011° 10.58'E	20.0	N, TG
EMB392_6-1	TF0361	CTD	26.03.2026 09:55	54° 39.87'N	010° 46.80'E	21.0	

Station No.	Station name	Gear	Date/Time	Latitude	Longitude	Water Depth	Remarks
EMB	IOW		[UTC]			[m]	
EMB392_7-1	TF0360	CTD	26.03.2026 11:43	54° 35.99'N	010° 27.10'E	15.0	N
EMB392_7-2	TF0360	SD	26.03.2026 11:44	54° 35.99'N	010° 27.09'E	15.0	
EMB392_7-3	TF0360	PLA	26.03.2026 11:48	54° 35.99'N	010° 27.07'E	15.0	
EMB392_7-4	TF0360	WP2	26.03.2026 12:06	54° 35.98'N	010° 27.02'E	15.0	
EMB392_8-1	FB_F17	CTD	26.03.2026 13:29	54° 32.48'N	010° 41.16'E	20.0	
EMB392_8-2	FB_F17	MUC	26.03.2026 13:42	54° 32.49'N	010° 41.14'E	20.0	
EMB392_9-1	FB_F18	CTD	26.03.2026 14:21	54° 32.94'N	010° 46.14'E	20.0	
EMB392_9-2	FB_F18	MUC	26.03.2026 14:30	54° 32.93'N	010° 46.12'E	20.0	
EMB392_10-1	TF0014	CTD	26.03.2026 16:03	54° 35.60'N	011° 01.00'E	24.0	eDNA
EMB392_11-1	TF0010	CTD	26.03.2026 17:20	54° 33.13'N	011° 19.41'E	25.0	N, eDNA
EMB392_12-1	TF0013	CTD	26.03.2026 18:19	54° 28.43'N	011° 29.15'E	24.0	
EMB392_12-2	TF0013	CTD	26.03.2026 18:35	54° 28.30'N	011° 29.14'E	23.0	
EMB392_13-1	TF0011	CTD	26.03.2026 19:23	54° 24.78'N	011° 36.99'E	22.0	
EMB392_14-1	TF0017	CTD	26.03.2026 20:25	54° 23.47'N	011° 49.48'E	19.0	
EMB392_15-1	TF0041	CTD	26.03.2026 21:35	54° 24.41'N	012° 03.77'E	16.0	N
EMB392_16-1	TF0046	CTD	26.03.2026 22:50	54° 28.21'N	012° 14.63'E	26.0	N, eDNA
EMB392_16-2	TF0046	PLA	26.03.2026 22:50	54° 28.21'N	012° 14.62'E	26.0	
EMB392_16-3	TF0046	WP2	26.03.2026 23:12	54° 28.20'N	012° 14.59'E	26.0	
EMB392_16-4	TF0046	CTD	26.03.2026 23:27	54° 28.19'N	012° 14.57'E	26.0	
EMB392_17-1	TF0083	CTD	27.03.2026 00:23	54° 33.03'N	012° 16.58'E	23.0	
EMB392_18-1	TF0033	CTD	27.03.2026 01:05	54° 36.38'N	012° 19.87'E	17.0	
EMB392_19-1	TF0002	CTD	27.03.2026 01:52	54° 39.01'N	012° 27.08'E	15.0	N, eDNA
EMB392_20-1	TF0001	CTD	27.03.2026 03:03	54° 41.80'N	012° 42.22'E	18.0	N, eDNA
EMB392_21-1	TF0030	CTD	27.03.2026 03:44	54° 43.35'N	012° 47.10'E	20.0	N, eDNA
EMB392_21-2	TF0030	PLA	27.03.2026 03:47	54° 43.35'N	012° 47.08'E	20.0	
EMB392_21-3	TF0030	CTD	27.03.2026 04:19	54° 43.37'N	012° 47.00'E	20.0	
EMB392_22-1	TF0115	CTD	27.03.2026 05:37	54° 47.70'N	013° 03.51'E	28.0	N, eDNA
EMB392_23-1	TF0114	CTD	27.03.2026 06:48	54° 51.50'N	013° 16.71'E	43.0	N
EMB392_24-1	TF0113	CTD	27.03.2026 08:04	54° 55.50'N	013° 29.93'E	45.0	N, eDNA
EMB392_24-2	TF0113	SD	27.03.2026 08:06	54° 55.52'N	013° 29.93'E	46.0	
EMB392_24-3	TF0113	PLA	27.03.2026 08:07	54° 55.53'N	013° 29.93'E	45.0	
EMB392_24-4	TF0113	WP2	27.03.2026 08:30	54° 55.50'N	013° 29.95'E	45.0	
EMB392_24-5	TF0113	WP2	27.03.2026 08:39	54° 55.47'N	013° 29.96'E	45.0	
EMB392_24-6	TF0113	WP2	27.03.2026 08:46	54° 55.46'N	013° 29.96'E	45.0	
EMB392_24-7	TF0113	WP2	27.03.2026 08:54	54° 55.49'N	013° 29.95'E	45.0	
EMB392_24-8	TF0113	CTD	27.03.2026 09:10	54° 55.52'N	013° 29.95'E	45.0	
EMB392_25-1	TF0105	CTD	27.03.2026 12:06	55° 01.47'N	013° 36.41'E	45.0	N
EMB392_26-1	TF0104	CTD	27.03.2026 13:16	55° 04.08'N	013° 48.72'E	45.0	
EMB392_27-1	TF0122	CTD	27.03.2026 14:10	54° 59.33'N	013° 46.44'E	45.0	
EMB392_28-1	ABBoje	CTD	27.03.2026 15:52	54° 52.80'N	013° 51.46'E	43.0	
EMB392_29-1	TF0112	CTD	27.03.2026 16:48	54° 48.18'N	013° 57.59'E	39.0	N, eDNA
EMB392_29-2	TF0112	CTD	27.03.2026 17:11	54° 48.18'N	013° 57.50'E	39.0	
EMB392_30-1	TF0103	CTD	27.03.2026 19:00	55° 03.80'N	013° 59.33'E	45.0	N
EMB392_31-1	TF0109	CTD	27.03.2026 19:55	55° 00.08'N	014° 05.13'E	46.0	N
EMB392_31-2	TF0109	PLA	27.03.2026 20:08	55° 00.03'N	014° 05.08'E	46.0	
EMB392_31-3	TF0109	WP2	27.03.2026 20:25	55° 00.02'N	014° 05.03'E	46.0	
EMB392_31-4	TF0109	WP2	27.03.2026 20:34	55° 00.02'N	014° 05.02'E	46.0	
EMB392_31-5	TF0109	WP2	27.03.2026 20:39	55° 00.01'N	014° 05.02'E	46.0	
EMB392_32-1	TF0146_DK	CTD	27.03.2026 21:44	55° 06.12'N	014° 11.16'E	46.0	
EMB392_33-1	TF0145_DK	CTD	27.03.2026 22:33	55° 09.68'N	014° 15.64'E	45.0	N
EMB392_34-1	TF0144	CTD	27.03.2026 23:56	55° 15.37'N	014° 29.58'E	43.0	
EMB392_35-1	TF0142_DK	CTD	28.03.2026 01:09	55° 22.90'N	014° 35.06'E	70.0	N
EMB392_36-1	TF0140	CTD	28.03.2026 02:21	55° 28.04'N	014° 43.07'E	69.0	N

Station No.	Station name	Gear	Date/Time	Latitude	Longitude	Water Depth	Remarks
EMB	IOW		[UTC]			[m]	
EMB392_37-1	TF0206	CTD	28.03.2026 03:28	55° 32.07'N	014° 54.83'E	76.0	
EMB392_38-1	TF0207	CTD	28.03.2026 04:27	55° 29.86'N	015° 05.51'E	86.0	
EMB392_39-1	TF0208	CTD	28.03.2026 05:20	55° 27.30'N	015° 14.04'E	92.0	
EMB392_40-1	TF0200	CTD	28.03.2026 06:15	55° 23.06'N	015° 19.96'E	92.0	N
EMB392_41-1	TF0209	CTD	28.03.2026 07:05	55° 20.86'N	015° 27.92'E	94.0	
EMB392_42-1	TF0211	CTD	28.03.2026 08:01	55° 19.86'N	015° 36.93'E	96.0	
EMB392_43-1	TF0212	CTD	28.03.2026 09:07	55° 18.15'N	015° 47.80'E	96.0	
EMB392_44-1	TF0213	CTD	28.03.2026 10:17	55° 15.03'N	015° 59.07'E	90.0	N
EMB392_44-2	TF0213	SD	28.03.2026 10:20	55° 15.02'N	015° 59.06'E	90.0	
EMB392_44-3	TF0213	PLA	28.03.2026 10:32	55° 15.01'N	015° 59.04'E	89.0	
EMB392_44-4	TF0213	CTD	28.03.2026 10:55	55° 15.02'N	015° 59.01'E	90.0	TG
EMB392_44-5	TF0213	WP2	28.03.2026 11:12	55° 15.02'N	015° 59.03'E	90.0	
EMB392_44-6	TF0213	WP2	28.03.2026 11:24	55° 15.02'N	015° 59.02'E	90.0	
EMB392_44-7	TF0213	WP2	28.03.2026 11:36	55° 15.02'N	015° 59.01'E	89.0	
EMB392_44-8	TF0213	WP2	28.03.2026 11:45	55° 15.02'N	015° 59.02'E	90.0	
EMB392_44-9	TF0213	WP2	28.03.2026 11:57	55° 15.02'N	015° 59.00'E	89.0	
EMB392_44-10	TF0213	APNET	28.03.2026 12:16	55° 15.02'N	015° 59.01'E	89.0	
EMB392_44-11	TF0213	APNET	28.03.2026 12:31	55° 15.02'N	015° 59.02'E	90.0	
EMB392_44-12	TF0213	APNET	28.03.2026 12:46	55° 15.01'N	015° 59.00'E	90.0	
EMB392_45-1	TF0221	CTD	28.03.2026 13:58	55° 13.33'N	016° 10.01'E	82.0	
EMB392_46-1	TF0225	CTD	28.03.2026 14:56	55° 15.51'N	016° 19.18'E	65.0	
EMB392_47-1	TF0226	CTD	28.03.2026 15:42	55° 17.75'N	016° 25.78'E	57.0	
EMB392_48-1	TF0224	CTD	28.03.2026 16:16	55° 16.97'N	016° 30.06'E	61.0	
EMB392_49-1	TF0227	CTD	28.03.2026 17:05	55° 15.65'N	016° 38.23'E	69.0	
EMB392_50-1	TF0228	CTD	28.03.2026 17:55	55° 14.29'N	016° 46.21'E	76.0	
EMB392_51-1	TF0229	CTD	28.03.2026 18:45	55° 13.69'N	016° 54.64'E	85.0	
EMB392_52-1	TF0222	CTD	28.03.2026 19:41	55° 13.01'N	017° 04.05'E	91.0	N
EMB392_53-1	TF0266	CTD	28.03.2026 21:09	55° 15.21'N	017° 21.25'E	89.0	
EMB392_54-1	TF0267	CTD	28.03.2026 22:27	55° 17.24'N	017° 35.43'E	84.0	
EMB392_55-1	TF0268	CTD	29.03.2026 00:07	55° 18.49'N	017° 55.74'E	75.0	
EMB392_56-1	TF0256	CTD	29.03.2026 01:37	55° 19.62'N	018° 14.03'E	78.0	
EMB392_57-1	TF0257	CTD	29.03.2026 02:49	55° 26.54'N	018° 19.08'E	87.0	
EMB392_58-1	TF0259	CTD	29.03.2026 03:59	55° 33.06'N	018° 23.99'E	90.0	N
EMB392_58-2	TF0259	SD	29.03.2026 04:21	55° 33.09'N	018° 23.94'E	90.0	
EMB392_58-3	TF0259	PLA	29.03.2026 04:22	55° 33.09'N	018° 23.94'E	91.0	
EMB392_59-1	TF0255	CTD	29.03.2026 05:41	55° 38.01'N	018° 36.00'E	96.0	
EMB392_60-1	TF0258	CTD	29.03.2026 06:51	55° 43.56'N	018° 45.80'E	92.0	
EMB392_61-1	TF0253	CTD	29.03.2026 08:02	55° 50.36'N	018° 52.05'E	101.0	
EMB392_62-1	TF0265	CTD	29.03.2026 09:23	55° 57.50'N	019° 02.83'E	112.0	
EMB392_63-1	TF0250	CTD	29.03.2026 10:46	56° 04.97'N	019° 10.09'E	125.0	
EMB392_64-1	TF0262	CTD	29.03.2026 12:15	56° 14.08'N	019° 18.04'E	132.0	
EMB392_65-1	MoorGOSI	CTD	29.03.2026 13:35	56° 17.40'N	019° 31.29'E	121.0	
EMB392_65-2	MoorGOSI	MOOR	29.03.2026 13:52	56° 17.40'N	019° 31.29'E	121.0	
EMB392_66-1	TF0263	CTD	29.03.2026 14:59	56° 20.80'N	019° 22.73'E	134.0	
EMB392_67-1	TF0261	CTD	29.03.2026 16:23	56° 29.48'N	019° 28.98'E	145.0	
EMB392_68-1	TF0260	CTD	29.03.2026 17:45	56° 38.03'N	019° 35.08'E	145.0	N, HS
EMB392_69-1	TF0274	CTD	29.03.2026 19:14	56° 46.03'N	019° 44.98'E	156.0	
EMB392_70-1	TF0411	CTD	29.03.2026 22:50	56° 50.31'N	020° 40.88'E	56.0	
EMB392_71-1	TF0410	CTD	30.03.2026 00:08	56° 52.03'N	020° 27.27'E	60.0	
EMB392_72-1	TF0409	CTD	30.03.2026 01:28	56° 54.34'N	020° 13.08'E	146.0	
EMB392_73-1	TF0408	CTD	30.03.2026 02:43	56° 55.49'N	020° 01.14'E	168.0	
EMB392_74-1	TF0407	CTD	30.03.2026 03:40	56° 57.06'N	019° 53.12'E	178.0	

Station No.	Station name	Gear	Date/Time	Latitude	Longitude	Water Depth	Remarks
EMB	IOW		[UTC]			[m]	
EMB392_75-1	TF0273	CTD	30.03.2026 04:33	56° 57.17'N	019° 46.20'E	186.0	
EMB392_76-1	MoorGOSW	CTD	30.03.2026 05:47	57° 04.47'N	019° 45.55'E	217.0	
EMB392_76-2	MoorGOSW	MOOR	30.03.2026 06:13	57° 04.45'N	019° 45.62'E	216.0	
EMB392_77-1	TF0271	CTD	30.03.2026 08:15	57° 12.65'N	019° 55.81'E	231.0	
EMB392_78-1	TF0271	CTD	30.03.2026 09:36	57° 19.26'N	020° 02.98'E	243.0	N, HS
EMB392_78-2	TF0271	CTD	30.03.2026 10:23	57° 19.24'N	020° 02.99'E	243.0	TG
EMB392_78-3	TF0271	SD	30.03.2026 10:25	57° 19.25'N	020° 02.99'E	243.0	
EMB392_78-4	TF0271	PLA	30.03.2026 10:28	57° 19.24'N	020° 02.99'E	243.0	
EMB392_78-5	TF0271	CTD	30.03.2026 11:08	57° 19.25'N	020° 03.00'E	243.0	
EMB392_78-6	TF0271	CTD	30.03.2026 11:45	57° 19.24'N	020° 02.99'E	243.0	
EMB392_78-7	TF0271	CTD	30.03.2026 12:18	57° 19.24'N	020° 03.00'E	243.0	
EMB392_78-8	TF0271	CTD	30.03.2026 12:52	57° 19.23'N	020° 02.98'E	242.0	
EMB392_78-9	TF0271	CTD	30.03.2026 13:18	57° 19.22'N	020° 03.00'E	242.0	
EMB392_78-10	TF0271	CTD	30.03.2026 13:47	57° 19.23'N	020° 03.00'E	243.0	
EMB392_78-11	TF0271	CTD	30.03.2026 14:47	57° 19.19'N	020° 03.03'E	242.0	
EMB392_79-1	TF0403	CTD	30.03.2026 19:29	57° 04.49'N	019° 01.46'E	115.0	
EMB392_80-1	TF0404	CTD	30.03.2026 20:38	57° 01.71'N	019° 13.31'E	164.0	
EMB392_81-1	TF0405	CTD	30.03.2026 21:35	57° 00.50'N	019° 21.36'E	178.0	
EMB392_82-1	TF0406	CTD	30.03.2026 22:56	56° 58.83'N	019° 34.61'E	169.0	
EMB392_83-1	TF0272	CTD	31.03.2026 00:25	57° 04.32'N	019° 49.85'E	210.0	
EMB392_84-1	MoorGOSW	MOOR	31.03.2026 06:05	57° 04.23'N	019° 45.69'E	214.0	
EMB392_84-2	MoorGOSW	MOOR	31.03.2026 08:16	57° 04.03'N	019° 45.63'E	213.0	
EMB392_84-3	MoorGOSW	MOOR	31.03.2026 09:06	57° 04.25'N	019° 45.62'E	215.0	
EMB392_84-4	MoorGOSW	MOOR	31.03.2026 10:38	57° 04.24'N	019° 45.60'E	214.0	
EMB392_84-5	MoorGOSW	MOOR	31.03.2026 11:42	57° 04.23'N	019° 45.70'E	214.0	
EMB392_84-6	MoorGOSW	MOOR	31.03.2026 13:20	57° 04.23'N	019° 45.62'E	214.0	
EMB392_85-1	TF0272	CTD	31.03.2026 14:02	57° 04.36'N	019° 49.88'E	210.0	HS
EMB392_86-1	SF022EGB	SCF	31.03.2026 19:30	57° 02.50'N	021° 16.75'E	19.0	
EMB392_87-1	SF022EGB	CTD	31.03.2026 20:42	57° 02.47'N	021° 16.61'E	19.0	
EMB392_88-1	SF021EGB	CTD	31.03.2026 21:28	57° 04.25'N	021° 08.83'E	27.0	
EMB392_89-1	SF020EGB	CTD	31.03.2026 22:12	57° 06.01'N	021° 02.40'E	22.0	
EMB392_90-1	SF019EGB	CTD	31.03.2026 22:55	57° 07.18'N	020° 55.80'E	22.0	
EMB392_91-1	SF018EGB	CTD	31.03.2026 23:36	57° 08.80'N	020° 49.36'E	47.0	
EMB392_92-1	SF017EGB	CTD	01.04.2026 00:22	57° 10.15'N	020° 42.46'E	69.0	
EMB392_93-1	SF016EGB	CTD	01.04.2026 01:06	57° 11.55'N	020° 36.33'E	97.0	
EMB392_94-1	SF015EGB	CTD	01.04.2026 01:49	57° 13.00'N	020° 29.58'E	88.0	
EMB392_95-1	SF014EGB	CTD	01.04.2026 02:31	57° 14.34'N	020° 23.04'E	148.0	
EMB392_96-1	SF013EGB	CTD	01.04.2026 03:16	57° 15.73'N	020° 16.99'E	195.0	
EMB392_97-1	SF012EGB	CTD	01.04.2026 04:42	57° 17.15'N	020° 09.89'E	246.0	
EMB392_98-1	MoorGOC	CTD	01.04.2026 05:29	57° 18.48'N	020° 04.91'E	247.0	
EMB392_98-2	MoorGOC	MOOR	01.04.2026 05:58	57° 18.47'N	020° 04.91'E	247.0	
EMB392_98-3	MoorGOC	MOOR	01.04.2026 08:07	57° 18.41'N	020° 04.86'E	247.0	
EMB392_99-1	MoorGONE	MOOR	01.04.2026 09:16	57° 22.00'N	020° 20.58'E	219.0	
EMB392_99-2	MoorGONE	CTD	01.04.2026 10:51	57° 21.97'N	020° 20.70'E	219.0	
EMB392_99-3	MoorGONE	MOOR	01.04.2026 11:34	57° 22.00'N	020° 20.50'E	220.0	
EMB392_100-1	SF015EGB	MSS	01.04.2026 14:57	57° 12.90'N	020° 29.83'E	87.0	
EMB392_101-1	SF011EGB	CTD	02.04.2026 03:15	57° 20.11'N	019° 57.23'E	230.0	
EMB392_102-1	SF010EGB	CTD	02.04.2026 04:02	57° 21.25'N	019° 51.94'E	211.0	
EMB392_103-1	SF009EGB	CTD	02.04.2026 04:55	57° 22.69'N	019° 44.94'E	154.0	
EMB392_104-1	SF008EGB	CTD	02.04.2026 05:44	57° 24.20'N	019° 37.60'E	46.0	
EMB392_105-1	SF007EGB	CTD	02.04.2026 06:27	57° 25.55'N	019° 30.54'E	121.0	
EMB392_106-1	SF006EGB	CTD	02.04.2026 07:15	57° 27.14'N	019° 23.77'E	99.0	

Station No.	Station name	Gear	Date/Time	Latitude	Longitude	Water Depth	Remarks
EMB	IOW		[UTC]			[m]	
EMB392_107-1	SF005EGB	CTD	02.04.2026 08:00	57° 28.26'N	019° 17.50'E	78.0	
EMB392_108-1	SF004EGB	CTD	02.04.2026 08:45	57° 29.77'N	019° 11.13'E	43.0	
EMB392_109-1	SF003EGB	CTD	02.04.2026 09:30	57° 31.04'N	019° 04.32'E	40.0	
EMB392_110-1	SF002EGB	CTD	02.04.2026 10:11	57° 32.47'N	018° 57.73'E	27.0	
EMB392_111-1	SF001EGB	CTD	02.04.2026 11:00	57° 33.76'N	018° 51.15'E	20.0	
EMB392_112-1	TF0276	CTD	02.04.2026 16:02	57° 28.26'N	020° 15.52'E	208.0	
EMB392_113-1	TF0270	CTD	02.04.2026 17:28	57° 37.04'N	020° 09.96'E	145.0	HS
EMB392_114-1	TF0287	CTD	02.04.2026 19:08	57° 42.94'N	019° 51.24'E	130.0	
EMB392_115-1	TF0290	CTD	02.04.2026 20:26	57° 51.03'N	019° 49.04'E	172.0	
EMB392_116-1	TF0286	CTD	02.04.2026 21:57	58° 00.03'N	019° 54.06'E	196.0	N, HS
EMB392_116-2	TF0286	CTD	02.04.2026 22:43	58° 00.04'N	019° 54.03'E	196.0	TG
EMB392_116-3	TF0286	CTD	02.04.2026 23:07	58° 00.02'N	019° 54.03'E	196.0	
EMB392_117-1	TF0277	CTD	03.04.2026 01:19	58° 11.02'N	020° 03.01'E	163.0	
EMB392_118-1	TF0278	CTD	03.04.2026 02:47	58° 21.07'N	020° 08.80'E	122.0	
EMB392_119-1	TF0285	CTD	03.04.2026 04:01	58° 26.50'N	020° 19.97'E	123.0	HS
EMB392_120-1	TF0279	CTD	03.04.2026 05:37	58° 38.57'N	020° 20.75'E	165.0	
EMB392_121-1	TF0289	CTD	03.04.2026 06:52	58° 46.01'N	020° 19.81'E	197.0	
EMB392_122-1	TF0282	CTD	03.04.2026 08:07	58° 52.99'N	020° 18.92'E	166.0	HS
EMB392_123-1	TF0283	CTD	03.04.2026 11:45	58° 47.00'N	019° 05.99'E	121.0	HS
EMB392_124-1	TF0284	CTD	03.04.2026 14:44	58° 34.96'N	018° 13.92'E	453.0	N, HS
EMB392_124-2	TF0284	SD	03.04.2026 14:46	58° 34.97'N	018° 13.94'E	453.0	
EMB392_124-3	TF0284	PLA	03.04.2026 14:46	58° 34.97'N	018° 13.94'E	454.0	
EMB392_124-4	TF0284	CTD	03.04.2026 15:45	58° 34.95'N	018° 13.95'E	453.0	
EMB392_124-5	TF0284	CTD	03.04.2026 16:21	58° 35.00'N	018° 14.02'E	453.0	
EMB392_124-6	TF0284	CTD	03.04.2026 17:04	58° 34.99'N	018° 14.08'E	453.0	
EMB392_125-1	TF0240	CTD	03.04.2026 20:40	58° 00.01'N	017° 59.91'E	173.0	N, HS
EMB392_126-1	TF0245	CTD	04.04.2026 03:07	57° 07.05'N	017° 40.07'E	111.0	N, HS
EMB392_127-1	TF0213	CTD	05.04.2026 01:46	55° 14.97'N	015° 59.09'E	90.0	N
EMB392_127-2	TF0213	PLA	05.04.2026 01:47	55° 14.97'N	015° 59.09'E	90.0	
EMB392_127-3	TF0213	WP2	05.04.2026 02:10	55° 14.99'N	015° 58.97'E	89.0	
EMB392_127-4	TF0213	WP2	05.04.2026 02:23	55° 15.00'N	015° 58.88'E	90.0	
EMB392_127-5	TF0213	WP2	05.04.2026 02:38	55° 14.99'N	015° 58.98'E	90.0	
EMB392_127-6	TF0213	WP2	05.04.2026 02:50	55° 14.98'N	015° 59.03'E	90.0	
EMB392_127-7	TF0213	WP2	05.04.2026 03:01	55° 14.96'N	015° 59.03'E	90.0	
EMB392_127-8	TF0213	APNET	05.04.2026 03:21	55° 14.97'N	015° 58.99'E	90.0	
EMB392_127-9	TF0213	APNET	05.04.2026 03:33	55° 14.96'N	015° 58.96'E	90.0	
EMB392_127-10	TF0213	APNET	05.04.2026 03:45	55° 14.95'N	015° 58.94'E	90.0	
EMB392_128-1	TF0214	CTD	05.04.2026 05:24	55° 09.72'N	015° 39.60'E	94.0	N
EMB392_129-1	TF0160	CTD	05.04.2026 18:11	54° 14.40'N	014° 04.22'E	11.0	N
EMB392_130-1	TromperWk	SCF	06.04.2026 11:30	54° 36.69'N	013° 25.20'E	9.0	
EMB392_130-2	TromperWk	MSS	06.04.2026 12:20	54° 36.67'N	013° 25.22'E	9.0	
EMB392_131-1	TF0113	CTD	07.04.2026 05:57	54° 55.47'N	013° 30.08'E	46.0	
EMB392_131-2	TF0113	PLA	07.04.2026 06:00	54° 55.47'N	013° 30.07'E	46.0	
EMB392_131-3	TF0113	SD	07.04.2026 06:02	54° 55.47'N	013° 30.07'E	45.0	
EMB392_131-4	TF0113	WP2	07.04.2026 06:24	54° 55.47'N	013° 30.05'E	44.0	
EMB392_131-5	TF0113	WP2	07.04.2026 06:32	54° 55.48'N	013° 30.04'E	45.0	
EMB392_131-6	TF0113	WP2	07.04.2026 06:37	54° 55.49'N	013° 30.05'E	46.0	
EMB392_132-1	TF0114	CTD	07.04.2026 07:51	54° 51.61'N	013° 16.71'E	43.0	
EMB392_133-1	TF0115	CTD	07.04.2026 09:00	54° 47.54'N	013° 03.70'E	28.0	
EMB392_134-1	TF0030	CTD	07.04.2026 12:22	54° 43.36'N	012° 47.10'E	20.0	
EMB392_134-2	TF0030	SD	07.04.2026 12:27	54° 43.37'N	012° 47.06'E	20.0	
EMB392_134-3	TF0030	PLA	07.04.2026 12:31	54° 43.39'N	012° 47.05'E	20.0	

Station No.	Station name	Gear	Date/Time	Latitude	Longitude	Water Depth	Remarks
EMB	IOW		[UTC]			[m]	
EMB392_135-1	TF0031	CTD	07.04.2026 14:05	54° 40.21'N	012° 33.79'E	15.0	
EMB392_136-1	TF0002	CTD	07.04.2026 14:41	54° 39.01'N	012° 26.99'E	15.0	
EMB392_137-1	TF0033	CTD	07.04.2026 15:19	54° 36.34'N	012° 19.91'E	17.0	
EMB392_138-1	TF0083	CTD	07.04.2026 16:02	54° 33.05'N	012° 16.48'E	23.0	
EMB392_139-1	TF0046	CTD	07.04.2026 17:00	54° 28.20'N	012° 14.55'E	26.0	
EMB392_139-2	TF0046	SD	07.04.2026 17:01	54° 28.20'N	012° 14.54'E	26.0	
EMB392_139-3	TF0046	PLA	07.04.2026 17:01	54° 28.20'N	012° 14.54'E	26.0	
EMB392_139-4	TF0046	WP2	07.04.2026 17:16	54° 28.18'N	012° 14.47'E	26.0	
EMB392_140-1	TF0041	CTD	07.04.2026 18:23	54° 24.39'N	012° 03.69'E	16.0	
EMB392_141-1	TF0017	CTD	07.04.2026 19:46	54° 23.53'N	011° 49.42'E	19.0	
EMB392_142-1	TF0012	CTD	07.04.2026 21:10	54° 18.86'N	011° 33.07'E	22.0	
EMB392_142-2	TF0012	PLA	07.04.2026 21:12	54° 18.87'N	011° 33.04'E	22.0	
EMB392_142-3	TF0012	WP2	07.04.2026 21:27	54° 18.92'N	011° 33.04'E	22.0	
EMB392_143-1	NHBoje	CTD	08.04.2026 04:28	54° 10.68'N	011° 57.68'E	9.0	

7.2 Microstructure Profiler Deployments

Table 7.2 List of MSS-90 microstructure profiler deployments during the cruise EMB392

Deployment		time	Latitude	Longitude	Depth	Remarks
EMB		[UTC]	[UTC]	No.	[m]	
EMB392_100-1	begin	01.04.2026 14:57	57° 12.90'N	020° 29.83'E	87.0	Profiles 001-080
	end	02.04.2026 02:20	57° 17.14'N	020° 09.87'E	246.0	

7.3 ScanFish Deployment List

Table 7.3 List of ScanFish deployments during the cruise EMB392

Deployment		time	Latitude	Longitude	Depth	Remarks
EMB		[UTC]	[UTC]	No.	[m]	
EMB392_86-1	begin	31.03.2026 19:30	57° 02.50'N	021° 16.75'E	19.0	Transect 1 - EGB Stopped due to pressure sensor malfunction
	end	31.03.2026 19:52	57° 02.57'N	021° 13.05'E	19.0	

7.4 Mooring Deployment List

Table 7.4 List of mooring deployments during the cruise EMB392

Name	Latitude	Longitude	Deployed	Recovered	Depth	Remarks
			[UTC]	[UTC]	[m]	
GOSI	56° 17.40'N	19° 31.29'E	29.03.2026 13:52	Nov 2026	121	Successful deployed 150m ground rope
GOSW	57° 04.45'N	19° 45.62'E	Nov 2025	30.03.2026 06:13	216	First release worked only upper part was recovered
GOSW	57° 04.23'N	19° 45.70'E	Nov 2025	31.03.2026 11:42	214	Lower part of mooring recovered with 6 th dredging trial
GOSW	57° 04.23'N	19° 45.62'E	31.03.2026 13:20	Nov 2026	214	Successful deployed
GOC	57° 18.47'N	20° 04.91'E	Nov 2025	01.04.2026 06:01	247	Recovering with first release

Name	Latitude	Longitude	Deployed	Recovered	Depth	Remarks
			[UTC]	[UTC]	[m]	
GOC	57° 18.41'N	20° 04.85'E	01.04.2026 08:18	Nov 2026	247	Successful deployed
GONE	57° 22.03'N	20° 20.58'E	Nov 2025	01.04.2026 09:19	219	Recovering with first release
GONE	57° 21.99'N	20° 20.50'E	01.04.2026 11:43	Nov 2026	220	Successful deployed

8 Data and Sample Storage and Availability

All data gathered will be stored on a data repository in the IOW immediately after the cruise. Processed and validated data will be stored in the ODIN database (<https://odin2.iow.de>). In accordance with the IOW data policy and to facilitate the international exchange of data, all metadata will be made available under the international ISO 19115 standards for georeferenced metadata. Data from German waters will also be stored in the BSH MUDAB database.

Access to the data itself will be restricted for three years after data acquisition to protect the research process, including scientific analysis and publication. After this period the data becomes openly available to anyone or any organization who requests it, under the international Creative Commons Attribution 4.0 International licence (CC BY 4.0, (<https://creativecommons.org/licenses/by/4.0/>)). Further details can be found in the IOW data policy document.

Table 8.1 Overview of data availability

Type	Database	Available	Free Access	Contact
Hydrographic data	ODIN	01.07.2026	01.03.2028	volker.mohrholz@io-warnemuende.de
Nutrient samples	ODIN	01.07.2026	01.03.2029	joachim.kuss@io-warnemuende.de
Biological samples	ODIN	01.09.2026	01.03.2029	joerg.dutz@io-warnemuende.de

The underway sampling data set of navigation, meteorological and surface water sensors will be public available shortly after the cruise from the DSHIP webpage of the BSH (<http://dship.bsh.de>).

9 Acknowledgements

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10 **References**

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11 Appendix

11.1 Station Labels

All stations where scientific equipment was used were assigned a station name and a station number. The station name, also referred to as the 'position alias', identifies a geographical location. The station number is an alphanumeric value that increases for each new station. The numerical extension of the station number indicates each device deployment. Station numbers were applied according to the DSHIP's station numbering rules. For cruise EMB392, the first station number is EMB392_1.

11.2 CTD-Operation

The CTD-system "SBE 911plus", SN-1385, (SEABIRD-ELECTRONICS, USA) was used to measure the variables:

- Pressure
- Temperature (2x SBE 3)
- Conductivity (2x SBE 4)
- Oxygen concentration (2x SBE 43)
- Chlorophyll-a fluorescence (683nm)
- Turbidity
- Nitrate concentration (SUNA, OPUS)
- PAR
- SPAR

The CTD was equipped with a redundant sensor system for measuring temperature, conductivity and oxygen. Temperature is given on the ITS-90 scale. Salinity is calculated using the Practical Salinity Scale (1978) equations. To minimise salinity spikes, the temperature (SBE 3), conductivity (SBE 4) and oxygen (SBE 43) sensors are arranged within a tube system through which seawater is pumped at a constant velocity. Fluorescence and turbidity were measured using a downward-looking WET Labs fluorometer. Pressure is determined using a Paroscientific Digiquartz pressure sensor with a maximum range of 6,800 dbar.

Data were monitored during the casts and stored on a hard disk using Seasave Version 7 software. A configuration file (stationname.xmlcon) containing the complete parameter set, especially the sensor coefficients used to convert raw data to the standard output format, was written for each station.

The CTD probe was equipped with a Rosette water sampler containing 13 free-flow bottles, each with a volume of 5 litres. This design allows for closing of bottles automatically at predefined depths during down-casts. The closing depth and sensor values are aligned through the appropriate selection of parameters in the CTD software that generates the 'bottle files'. Additionally, a self-contained OPUS nitrate sensor was mounted on the rosette frame. The CTD is attached to a heave-compensating winch, which enables it to be nearly completely decoupled from the ship's heave and roll movements during a cast.

Sampling

Each CTD cast was started below the surface of the sea, with the pressure sensor typically positioned at a depth of around 5 metres to prevent air bubbles from entering the CTD pumping system. Data were collected at all stations down to about 1 m above the bottom. An altimeter was used to determine the distance to the bottom. The usual vertical speed during the descent was 0.3 ms^{-1} . The sampling rate of the CTD probe was 24 Hz. The data were displayed online to determine the appropriate sampling depth, and were also stored on a PC hard drive.

The probe shed water in its wake over a long distance. Therefore, only downcast registration was reliable. Upcast registration was only used for water sampling if the closing depth had been determined during the downcast. During the downcast, the bottles were closed while firing in auto-fire mode. For upcast sampling, the CTD was stopped and the bottles were closed manually after a 30-second adjustment period. Once the device was back on deck, oxygen and/or hydrogen sulphide samples were taken first, followed by water samples for salinity and nutrients, and then water samples for several biogeochemical analyses.

Field sensor checks

During the cruise, the CTD sensors were checked by taking comparison measurements. At stations with well-mixed water layers, the temperature was measured using a high-precision SBE 35 thermometer. Salinity samples were taken daily. These samples were stored in white glass bottles and will be analysed after the cruise using a salinometer (AUTOSAL Model 8400B, with an accuracy of 0.002). Most samples were taken from the near-surface layers; only a few deep, well-mixed layers were found.

The slope and offset of the SBE 43 oxygen sensors were determined using water samples. The oxygen content of the samples was determined using a titration set (Winkler method, with an accuracy of 0.02 ml/l). The oxygen concentration was calculated using the Seasoftware oxygen formula "1".

The pressure sensor was checked by measuring the pressure on deck before the cast. No calibration measurements were taken for the fluorometer data, since no quantitative phytoplankton analysis was performed and no SPM samples were taken during the cruise.

Table 11.1 Type and serial numbers of mounted CTD sensors

Sensor	Type	SN	Last calibration
Pressure	Digiquartz	0384	05.11.2002
Temperature 0	SBE 3	4219	12.12.2025
Temperature 1	SBE 3	4249	17.12.2025
Conductivity 0	SBE 4	2028	05.01.2026
Conductivity 1	SBE 4	1389	05.01.2026
Oxygen 0	SBE 43	0644	12.12.2025
Oxygen 1	SBE 43	4664	17.12.2025
Chl-a fluorescence / Turbidity	WET Labs - FLNTURTD	1223	10.06.2008
PAR sensor	Biospherical Licor Chelsea	70101	10.09.2006
SPAR	SPAR/Surface Irradiance	20364	12.08.2009
OPUS	Optical Nitrate sensor		

11.3 Vessel Mounted ADCPs

Two VMADCPs were used during the cruise. These were the ship's own vessel-mounted current meter, the OceanSurveyor 150 kHz, and a 300 kHz Acoustic Doppler Current Profiler (Work Horse, beam angle 20°), manufactured by RD Instruments. The 300 kHz ADCP was mounted facing downwards in the ship's moon pool. The ADCP data output was merged online with the corresponding navigation data and stored on the hard disc using the VMDAS program. Pitch, roll and heading data were converted from the TCP/IP protocol to the UDP protocol using a program running on the VMADCP control PC. Current data were collected in beam coordinates in order to apply all corrections during post-processing. The VMADCPs were operated along selected transects of the cruise track. The following configurations were used for data acquisition in the western and central Baltic.

Table 11.2 Configuration of 150kHz and the 300kHz VMADCP

Command	Parameter	150kHz	300kHz
WP	Broad band pings	1 ping/ens	1 ping/ens
WN	number of depth cells	65	80
WS	bin length	4m	2m
WF	blank after transmit	2m	1m
WV	Ambiguity velocity	6.5 ms ⁻¹	6.5 ms ⁻¹
BP	bottom track	1 ping/ens	1 ping/ens
BX	max bottom distance	300m	260m
WD	data output	u, corr, amp, PG	u, corr, amp, PG
TP	time between pings	0	0
EZ	sensor source	temp	temp
EX	co-ordinates (ENX)	beam	beam
ED	transducer depth	4m	4m
ES	salinity	10	10
Data option dialog of VMDAS software	heading source	Ext. Gyro	Ext. Gyro
	pitch / roll source	Ext. Phins	Ext. Phins
	navigation source	Ext. GPS	Ext. GPS
	time per ensemble	2s	2s
	time between pings	1s	1s
	heading alignment	0 deg	0 deg
	heading bias	0 deg	0 deg
	short term average	60s	60s
	long term average	300s	300s
	data screening	off	off

Post-processing of the VMADCP data was carried out using the IOW Matlab® ADCP toolbox. The final profiles are averages of the single ping profiles over 120 and 300 seconds. Where bottom tracking was available, the heading bias of the instrument was calculated. These values, along with the magnetic deviation, were applied during post-processing.

11.4 ScanFish Towed CTD

It was intended to perform two high resolution hydrographic transect with the ScanFish towed CTD (SF) in the eastern and western Gotland Basin. The ScanFish consists of a Seabird 911+

CTD mounted on a wing shaped body undulating between sea surface and about 130m depth when towed behind the ship. Additionally, to the usual CTD sensors, the probe is equipped with sensors for dissolved oxygen concentration, turbidity and Chlorophyll-a fluorescence. The details of the used sensors are given in Table 11.3. Hydrographic data are transmitted via a multi-conductor cable and stored in the lab on a computer disc.

We started the first deployment in the EGB near the Latvian coast on 31st March at 19:30. Shortly after the device was deployed, problems arose with the ScanFish's depth control. A malfunction in the SF's pressure sensor resulted in incorrect depth readings, which ultimately caused the SF to collide with the seafloor. Its outer hull was damaged so severely that the mission had to be aborted. The SF could no longer be used during the voyage.

During subsequent test measurements in Tromper Wiek, the SF's pressure sensor continued to malfunction at depths of 10 meters and below. It remained unclear whether the issue stemmed from problems with the connection cables and connectors or whether the pressure sensor itself was defective.

Table 11.3 Type and serial numbers of CTD sensors mounted on ScanFish

Sensor	Type	SN	Calibration date
Pressure	Digiquartz	0853	16.05.2006
Temperature 0	SBE 3	6266	08.01.2021
Temperature 1	SBE 3	2231	19.01.2024
Conductivity 0	SBE 4	4811	20.11.2023
Oxygen 0	SBE 43	0217	14.03.2024
Fast Oxygen	PyroSense		
Chl-a fluorescence / Turbidity	WET Labs - FLNTURTD	3274	10.06.2009

11.5 Underway Measurements

The RV ELISABETH MANN BORGESE is equipped with numerous sensors that continuously provide important environmental and navigation data. The available dataset consists of weather parameters, surface water properties, navigation information, rope length and winch speed, among other things. This data is collected by a DSHIP3 data acquisition system manufactured by WERUM. All data are stored in a database and can be extracted via a web interface. A description of all the parameters collected is provided in the DSHIP3 manual specific to this ship. All data are snapshots taken and stored every second. After the cruise, the full dataset was extracted. During the cruise, only a subset of the parameters were processed.

This data set consists of 30 minutes averages of:

- time (UTC)
- latitude and longitude
- ships heading
- depth
- air pressure
- air temperature
- humidity
- global radiation

- infrared radiation
- Surface conductivity
- Surface salinity (SSS)
- Surface water temperature (SST)
- Surface chlorophyll-a fluorescence
- Surface turbidity
- Wind direction
- Wind speed