

Cruise report Alkor AL544

Goal of the cruise was to investigate the biological oceanography of the Baltic Sea along the extended salinity gradient from intermediate saline SW Baltic Sea waters towards low saline north eastern stations in the Gotland Basin. Apart from teaching a diverse set of biological oceanographic sampling techniques, the aim was to characterize the macro-zooplankton and ichthyo-plankton community. We observed large accumulations of native and invasive macrozooplankton species in different areas of the Baltic Sea as well as extended anoxia in bottom waters. Due to unstable weather conditions, we had to modify the cruise plan along the way and instead of investigating the northern and eastern Gotland Basin, we focused on an intensified station grid in the SW Baltic Sea. In short, we conducted a station grid covering 75 stations of which >60 were investigated with a depth stratified sampling design using the hydrobios multineets midi and maxi with 5 and 9 discrete net samplings per station, respectively. Additionally, Bongo and WP2 nets were employed to characterize the plankton community. In the SW Baltic Sea we observed large quantities of the invasive comb jelly *Mnemiopsis leidyi*, while at northern stations we observed the native moon jellyfish *Aurelia aurita*. We did not observe *M. leidyi* at stations north of the Bornholm Basin.

In summary, large parts of the salinity gradient of the Baltic Sea have been investigated, with very interesting results, especially concerning anoxic conditions in bottom waters. Also, the high resolution investigation of the SW Baltic Sea has to date not been conducted before, where we investigated stations with a depth stratified sampling design. The students received a sophisticated training to conduct biological oceanographic investigations, covering the physical and chemical oceanography as well as biological aspects, especially focusing on life analyses of plankton samples.

Note: Due to the current Corona Pandemie, the scientific staff had been reduced by 50%, which makes 24h work impossible and the teaching and work program very demanding. Given that the situation remains for the coming year, I am skeptical that a such a cruise is feasible to be conducted with 5 students. Hence my recommendation to increase the number of participants to at least 10 scientists/students.

Work program

Daily activities are outlined below and include operation of different gear, both from a practical and theoretical perspective, analyzing samples alive for macrozooplankton and ichthyoplankton as well as teaching basic principals in sample handling, analyses and preservation. Practical work has been followed up by lectures and student presentations. Each student was holding a 15-30 min presentation about a selected topic which was prepared before the cruise. All students gave excellent presentations and have fulfilled all requirements for gaining credit for this practical.

Due to heavy weather conditions, the investigation area changed slightly and includes now a station grid in the SW Baltic Sea (see Fig. 1).

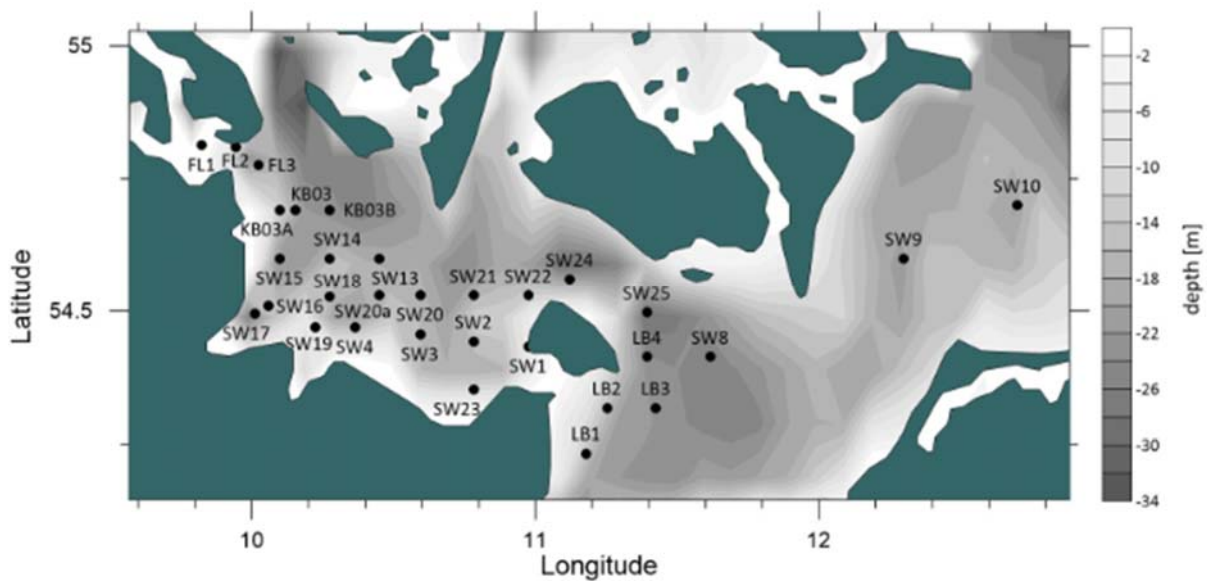


Fig. 1 Stations in the SW Baltic Sea.

1.9.2020 Tuesday

8:00 Boarding of students after negative corona test and departure to Kiel Bight for station work.

Station SW4: 9:30 Start with work program at SW4

- CTD (small with fast oxygen sensor)
- Calibration of pressure unit
- Plankton net cast: Bongo

Station KB03

- Plankton net cast: Bongo
- CTD (small with fast oxygen sensor)

Station KB12

- CTD (small with fast oxygen sensor)
- Plankton net cast: Bongo

Station SW14

- Plankton net cast: Bongo
- CTD (small with fast oxygen sensor)

Station work in SW Baltic finished and cruising towards Arkona Basin

Wednesday 2.9.2020

station work started at 6:00 in the Arkona Basin

Station BY1

- CTD
- Bongo

Station H18

- Bongo
- CTD

Station BY2

- CTD
- Wasserschöpfer
- Bongo

Station H14

- Bongo
- Water rousette collector
- CTD

Thursday 3.9.2020

Due to heavy weather, over.night stay off SW Bornholm and continuation towards northern Gotland Basin at 6:00 – first station off south western Øland at 14:00

During the morning 8:00-13:00 was used to deepen the understanding about the physical and biological oceanography of the Baltic Sea with lectures and student presentations.

Station T8

- CTD
- Multinetz midi (towed)

Station T7

- Multinetz midi (towed)
- CTD

Station T6

- CTD
- Multinetz midi (towed)

After station work continuation to HELCOM monitoring station BY32, north east of Gotland.

Friday 4.9.2020 station work started at 6:00 on

Station **BY32** (205m bottom depth)

- Multinet **Maxi** (towed) – to 190m
- Water rousette collector – up to bottom
- CTD small with fast oxygen sensor (only up to 100m)

Station **T4**

- CTD (small) with fast oxygen sensor
- Multinet **midi** (towed)

Station **T5**

- CTD (small) with fast oxygen sensor
- Multinetz **maxi** (towed)

Due to bad weather and worsening of the situation, northern Stations were skipped, eastern Gotland stations as well and instead SW Baltic Sea targeted as intensive working area. The successful transect along the Swedish coast was extremely timely due to large anoxic events in bottom waters in the extended investigation area. Steaming after successful conduction of Station T5 to SW Arkona Basin, arrival around noon on.

Afternoon and evening was used to conduct Chl a extractions/measurements. The students also got familiar with oxygen measurements and winkler titration for CTD calibrations.

Saturday 5.9.2020 with station work at

Station **SW10**

- CTD
- WP2
- Multinetz midi (towed)

Station **SW9**

- Multinetz midi (towed)
- CTD
- WP2

Station **SW8**

- WP2
- CTD
- Multinetz midi (towed)

Sunday 6.9.2020 with station work at Stations within the SW Baltic Sea as outlined on Fig. 1

Station LB1

- Multinetz midi (towed)
- CTD
- WP2

Station LB3

- Multinetz midi (towed)
- WP2
- CTD

Station LB2

- Multinetz midi (towed)
- CTD
- WP2

Station LB4

- Multinetz midi (towed)
- WP2
- CTD

Station SW25

- Multinetz midi (towed)
- CTD
- WP2

Station SW 24

- Multinetz midi (towed)
- WP2
- CTD

Lectures in the evening along with student presentations.

Monday 7.9.2020 with station work at

Station SW23

- Multinetz midi (towed)
- CTD
- WP2

Station SW1

- Multinetz midi (towed)
- WP2
- CTD

Station SW2

- Multinetz midi (towed)

- CTD
- WP2

Station SW22

- Multinetz midi (towed)
- WP2
- CTD

Station SW21

- Multinetz midi (towed)
- CTD
- WP2

Station SW 3

- Multinetz midi (towed)
- WP2
- CTD

Station SW20

- Multinetz midi (towed)
- CTD
- WP2

Tuesday 8.9.2020 with station work Flensburg Fjord

Station FL1

- Multinetz midi (towed)
- WP2
- CTD

Station FL2

- Multinetz midi (towed)
- CTD
- WP2

Station FL3

- Multinetz midi (towed)
- WP2
- CTD

Station KB03A

- Multinetz midi (towed)
- CTD
- WP2

Station KB03

- Multinetz midi (towed)
- WP2
- CTD

Station KB03B

- Multinetz midi (towed)
- CTD
- WP2

Station KB06

- Multinetz midi (towed)
- WP2
- CTD

Station SW13

- Multinetz midi (towed)
- CTD
- WP2

Station SW14

- Multinetz midi (towed)
- WP2
- CTD

Due to heavy weather conditions, the investigation area changed slightly and includes now a station grid in the SW Baltic Sea (see Fig. 1).

9.9.2020 Wednesday

Finishing up work in the SW Baltic Sea. Special focus was devoted towards occurrence of the invasive hydromedusae *Blackfordia virginica* – which was caught on station SW19B.

Station SW17

- Multinetz midi (towed)
- CTD
- WP2

Station SW15

- Multinetz midi (towed)
- WP2
- CTD

Station SW14A

- Multinetz midi (towed)
- CTD
- WP2

Station SW18

- Multinetz midi (towed)
- WP2
- CTD

Station SW20A

- Multinetz midi (towed)
- CTD
- WP2

Station SW 19

- Multinetz midi (towed)
- WP2
- CTD

Station SW19B

- Multinetz midi (towed)
- CTD
- WP2

Continuation along the German Baltic Sea coast covering the Lübecker- and Mecklenburger Bight (see Fig. 2 for updated Station grid).

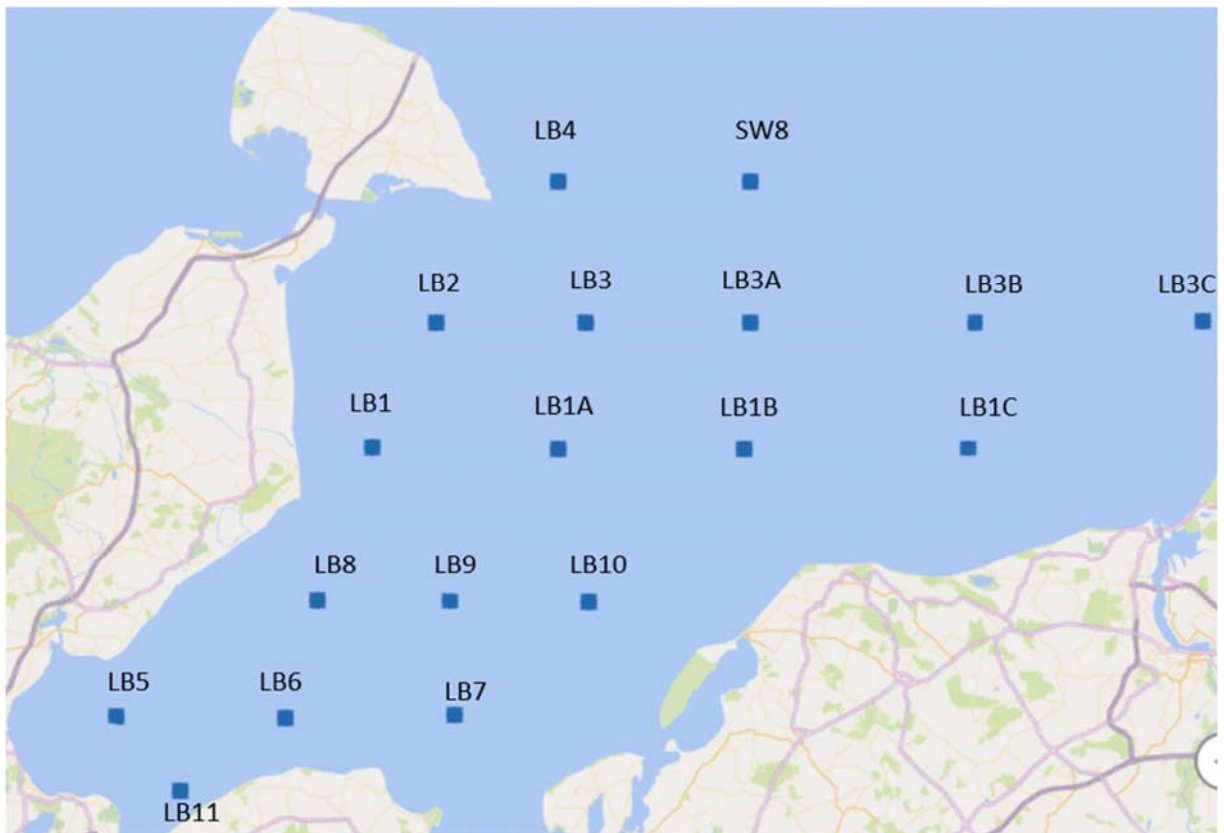


Fig. 2: Station grid in the Lübecker Bight / Mecklenburger Bight which was conducted due to heavy weather conditions in Northern and Eastern parts of the Baltic Sea, which made a change in the cruise plan necessary.

10.9.2020 Thursday**Station LB1A**

- Multinetz midi (towed)
- CTD
- WP2

Station LB9

- Multinetz midi (towed)
- WP2
- CTD

Station LB8

- Multinetz midi (towed)
- CTD
- WP2

Station LB5

- Multinetz midi (towed)
- WP2
- CTD

Station LB11

- Multinetz midi (towed)
- CTD
- WP2

Station LB6

- Multinetz midi (towed)
- WP2
- CTD

Station LB7

- Multinetz midi (towed)
- CTD
- WP2

Station LB10

- Multinetz midi (towed)
- WP2
- CTD

Steaming towards the Bornholm Basin to continue station work on the most important spawning ground for cod in the Baltic Sea to investigate the spatial and temporal overlap between gelatinous macrozooplankton and ichthyoplankton – especially considering cod and sprat larvae. To contribute to ongoing monitoring activities and convey the importance of spatial and temporal high resolution investigations for addressing scientific questions. The students also received a theoretical introduction to most important species being present, their taxonomy, morphological identification and recruitment processes.

11.9.2020 Friday

Investigation of 9 stations in the central Baltic Sea on the BB station grid. On each station, CTD and Bongo tows have been conducted. Additionally, the depth distribution of zooplankton was studied in depth on station BB30 - with 18 discrete multinet samples as outlined below:

Station BB30 (Cod larvae focus station)

- Water rosette sampler for discrete water samples to conduct O₂ titration and Chl a determination.
- CTD
- Multinetz Maxi (towed in 5m depth intervals with 18 nets in total to get depth stratified fish larvae abundance data as well as distribution of gelatinous macrozooplankton and general zooplankton community composition)
- Bongo

Leaving Bornholm Basin at 22:30 to finish the high resolution investigation of the German Baltic Sea coast for gelatinous macrozooplankton and ichthyoplankton – east of Rügen (Fig. 3).

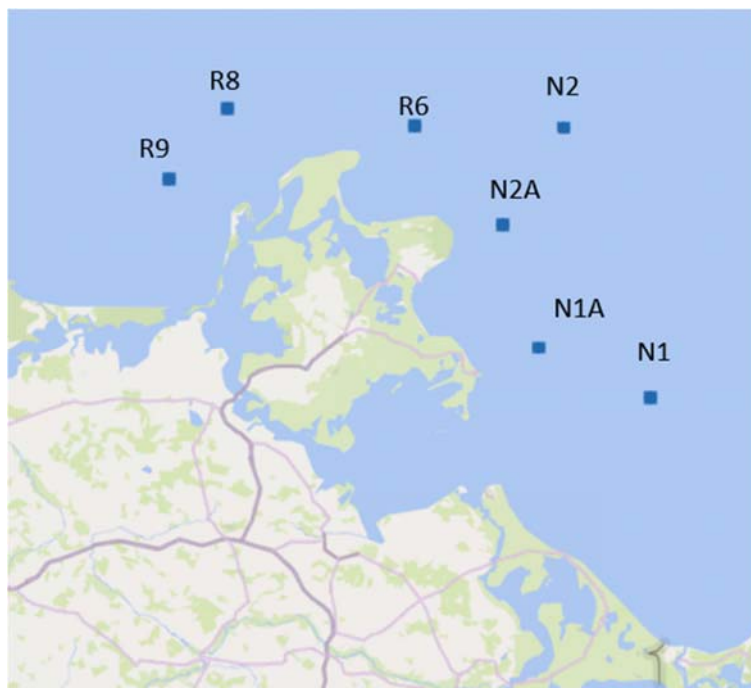


Fig. 1: Investigation area in the eastern part of the German Baltic Sea coast around Rügen.

12.9.2020 Saturday**Station N1**

- Multinetz midi (towed)
- CTD
- WP2

Station N1A

- Multinetz midi (towed)
- WP2
- CTD

Station N2A

- Multinetz midi (towed)
- CTD
- WP2

Station N2

- Multinetz midi (towed)
- WP2
- CTD

Station R6

- Multinetz midi (towed)
- CTD
- WP2

Station R8

- Multinetz midi (towed)
- WP2
- CTD

Station R9

- Multinetz midi (towed)
- CTD
- WP2

13.9.2020 Sunday

Finishing station work in the Arkona and Meckenburger Bight. In total 75 stations have been covered with 50+ depth resolved multinet stations, which has in this breath never been conducted in the SW Baltic Sea before.

Station LB3C

- Multinetz midi (towed)
- CTD
- WP2

Station LB3B

- Multinetz midi (towed)
- WP2
- CTD

Station LB1C

- Multinetz midi (towed)
- CTD
- WP2

Station LB1B

- Multinetz midi (towed)
- WP2
- CTD

Station LB3A

- Multinetz midi (towed)
- CTD
- WP2

14.9.2020 Monday

Toll inspection and unloading of scientific equipment. Cleaning and finishing up of field work.

15.9.2020 Tuesday

Sorting and unloading of all frozen samples and organization of storage and transport to the cooperating institutions.

End of the cruise.