Cruise report – EMB-143

Leibniz Institute for Baltic Sea Research Warnemünde,
Germany

Warnemünde, 02.02.2017

Content

Basic information

Ship: r/v **Elisabeth Mann Borgese**, cruise EMB-143,
Date: 02 November – 14 November 2016,
Chief scientist: Prof. Dr. Joanna Waniek

Objectives

The cruise EMB-143 was carried out as a joined cruise of the environmental monitoring programme of the Federal Maritime and Hydrographic Agency (BSH) and the Baltic Sea long-term observation programme of the Leibniz Institute for Baltic Sea Research Warnemünde (IOW). It was the final cruise in 2016 in a series of five expeditions performed each year.

The acquired data are used for the regular national and international assessments of the state of the Baltic Sea, and provide the scientific basis for measures to be taken for the protection of the Baltic Sea ecosystem. A special focus of the cruise was to monitor the consequences of the series of Major Baltic Inflows that occurred between 2014 and 2016 for the environmental conditions of the central Baltic.

Staff and area of investigation

	Name	On-board	Institution	Assignments
1.	Waniek, Joanna	03.11.-14.11.16	IOW, Physical Oceanogr.	Chief Scientist
2.	Abraham, Marion	03.11.-14.11.16	IOW, Marine Chemistry	Quality management
3.	Donath, Jan	03.11.-14.11.16	IOW, Physical Oceanogr.	Hydrography, data processing
4.	Sadkowiak, Birgit	03.11.-14.11.16	IOW, Marine Chemistry	Nutrient analyses
5.	Hand, Ines	03.11.-14.11.16	IOW, Marine Chemistry	Nutrients analyses
6.	Schöne, Susanne	03.11.-14.11.16	IOW, Marine Chemistry	Filtration
7.	Weinreben, Stefan	03.11.-14.11.16	IOW, Physical Oceanogr.	Hydrography, CTD
8.	Otto, Stefan	03.11.-14.11.16	IOW, Marine Chemistry	Gas sampling
9.	Schubert, Stefanie	03.11.-05.11.16	IOW, Marine Biology	Benthos sampling
10	Pötzsch, Michael	03.11.-14.11.16	IOW, Marine Biology	Phyto- and Zooplankton sampling
11	Hehl, Uwe	03.11.-14.11.16	IOW, Marine Biology	Moorings e.g. Gone, SF
12	Peterson-Floth, Mareike	05.11.-14.11.16	IOW, Marine Chemistry	Moorings e.g. GODESS
13	Jeziorny, Przemyslaw	03.11.-14.11.16	OIRM (Szczecin, PL)	Polish Observer

The cruise EMB-143 was carried out in the frame of the Baltic monitoring programme (BMP), and is related to the Baltic long term observation programme of the (IOW). Data collection covered the western and central Baltic from the Kiel Bight to the northern Gotland Basin. The majority of stations are located in the German territorial waters and along the thalweg transect of the Baltic Sea. The thalweg stretches from the Darss sill via the Arkona Sea, the Bornholm Sea, and the eastern Gotland Sea basin to the northern Gotland Sea and the Landsort Deep. Along the southern rim of the eastern Gotland Basin a west to east transect of CTD stations was carried out, in order to gather information about the spatial distribution of the saline water masses of recent MBIs. Additionally, a number of CTD casts were carried out at selected stations in the northern Gotland Sea to figure out the fate of the

inflowing water (Fig.1-3, and the list of stations in the Appendix).

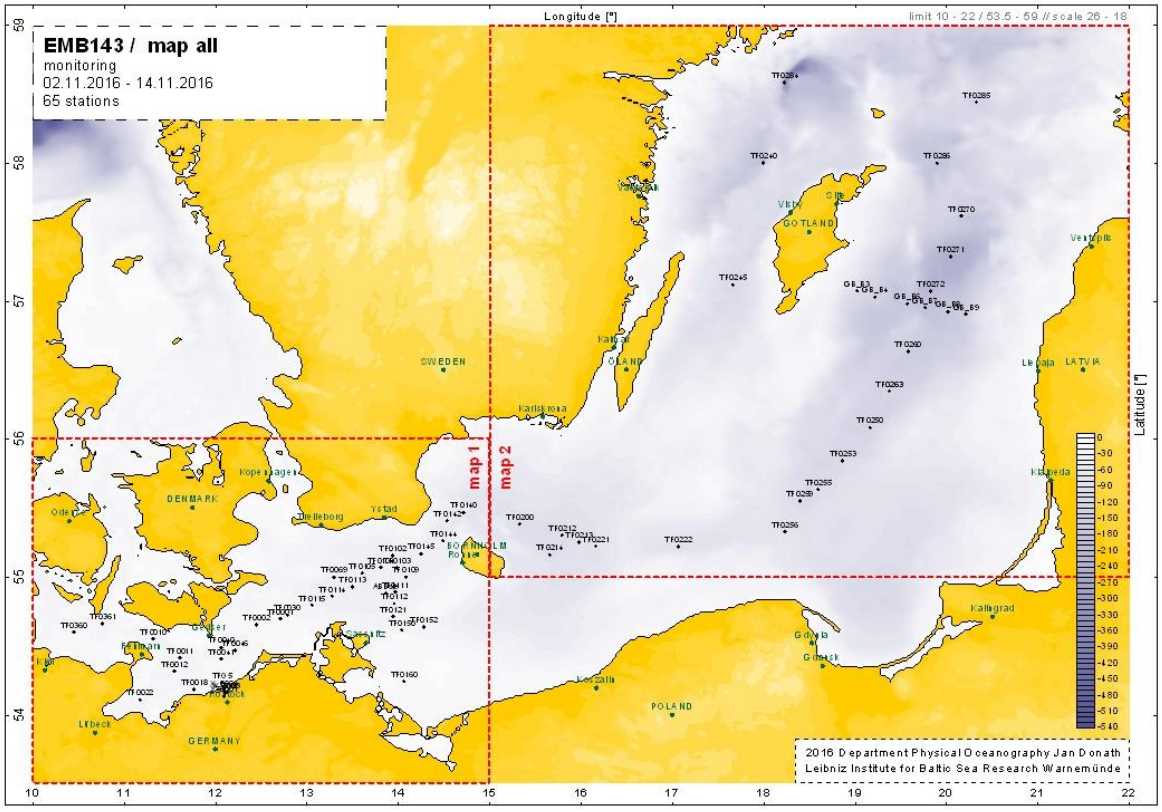

Figure 1: Stations (black crosses) occupied during the cruise EMB-143 from 3nd – 14th November 2016.

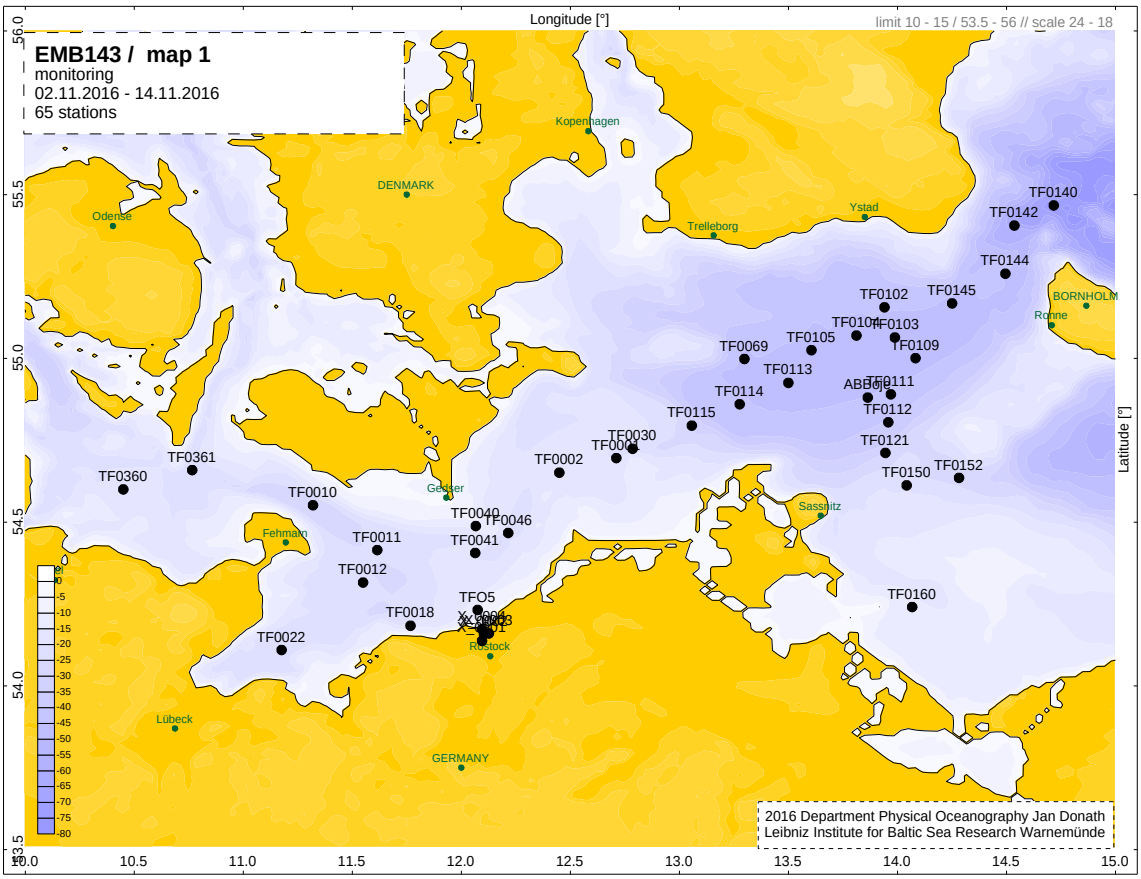

Figure 2: Stations (black dots) in the western Baltic Sea and the Arkona Sea during the cruise EMB-143.

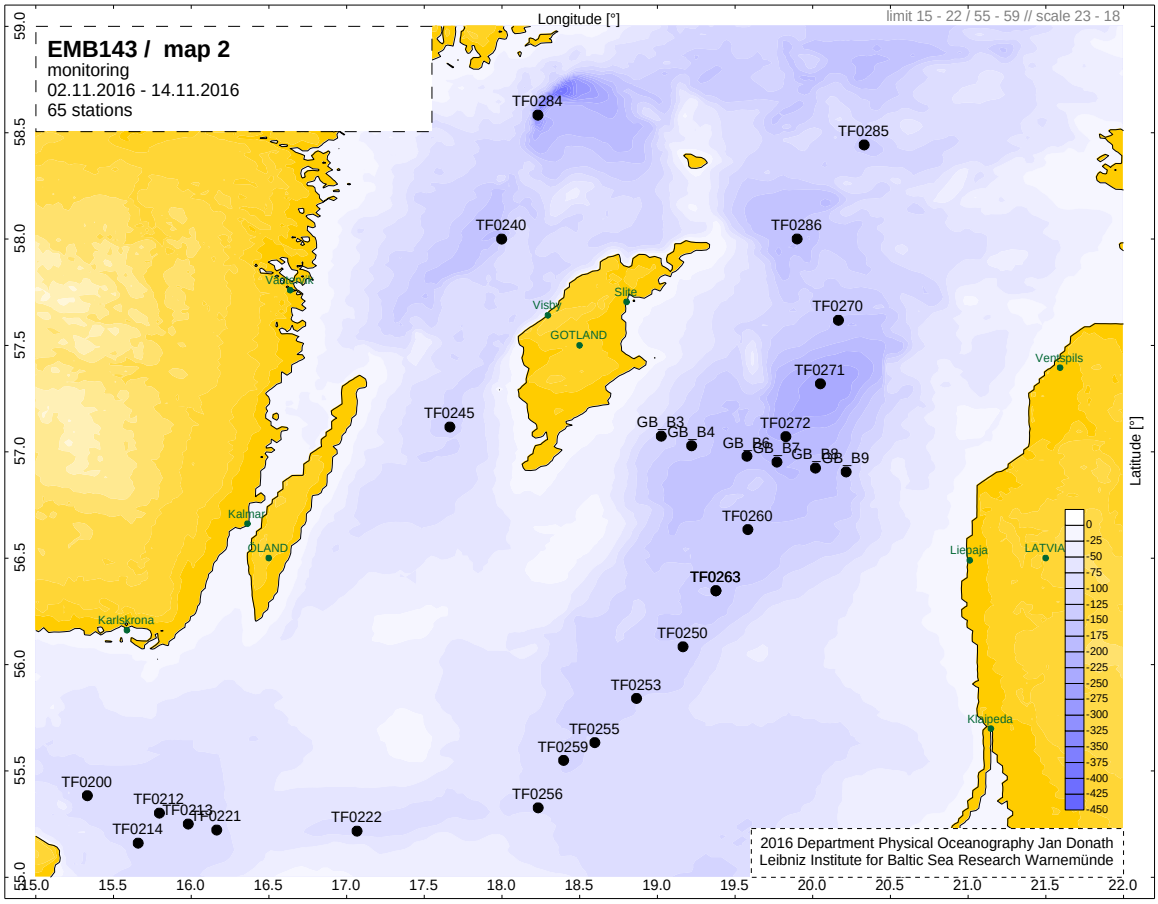

Figure 3: Stations (black dots) in the Bornholm Sea and the Gotland Sea during the cruise EMB-143.

Work on-board and data acquisition with quality assurance

Equipment

Data acquisition was carried out using the following devices

On stations:

1. CTD SBE 911+ with rosette water sampler
2. Phytoplankton nets, Apstein net, Secci disk
3. Zooplankton net (WP2)
4. Van Veen grab and dregde

Continuous measurements along the cruise track:

1. Underway measurements of surface water properties (Thermosalinograph)
2. Ship weather station

Laboratory work:

1. Autoanalyser (FlowSys, Alliance-Instruments, Ainring, Germany)
2. UV-VIS-Spektrophotometer UVmini 1240 (Shimadzu)
3. Titrino (Metrohm)

Station work

The station name is complemented for the respective cruise EMB-143 by a station number. The station number is based on a consecutive numbering of all stations during the cruise. The station work usually started with a CTD cast and already programmed sampling on standard depth levels. Then other CTD casts followed to meet the water sample requirements on the respective station. Net sampling, depth of visibility determinations by means of a Secci disk, and phyto/zooplankton net were taken on selected stations as well as sediment sampling by means of van Veen grab and dredge.

CTD and Sampling

The CTD-system "SBE 911plus" (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, Photosynthetic Active Radiation in water (PAR), and above the sea (SPAR). The Rosette water sampler was equipped with 13 Free Flow bottles of 5 L volume each. The CTD sensors were checked during the cruise by comparison measurements. In detail, for temperature a high precision thermometer SBE RT35 was used. Salinity samples were taken for measurement after the cruise by means of a salinometer. Slope and offset of the oxygen sensors SBE 43 are determined by comparison with Winkler titration.

Underway measurements

The FS Elisabeth Mann Borgese is equipped with sensors to measure weather parameters, surface water properties by means of a surface water pumping system with attached sensors (e.g., thermosalinograph, fluorometer), navigation information, rope length, winch speed etc.

Inorganic nutrients

Nitrate, nitrite, phosphate, and silicate were analysed using standard colorimetric methods by means of an autoanalyser (FlowSys, Alliance-Instruments, Ainring, Germany) and Ammonium was determined manually as indophenole blue (Grasshoff et al., 1999) from water filtered through glass-fiber filters GF/F immediately after sampling.

Oxygen and Hydrogensulfide

Oxygen was analysed by Winkler titration and hydrogensulfide was determined spectrophotometrically by Methylene Blue reaction (Grasshoff et al., 1999). For comparison, H_2S concentration was transformed to negative oxygen values according to its reduction capacity: $H_2S + 2\ O_2 \rightarrow H_2SO_4$. During CTD casts the SBE 43 oxygen sensor (duplicate installation) recorded oxygen values that are validated by Winkler titration results.

Plankton sampling

Plankton sampling was performed by means of a rosette sampler (combined with CTD) as well as with a small phytoplankton net and the zooplankton nets WP2 and Apstein. Samples were taken in a tight follow up of depths levels in order to get representative data from the euphotic zone. Additionally, samples for microbiological analyses were taken at some stations in the central Baltic, the Gotland Deep and Landsort Deep.

Long term investigations of CH_4, N_2O and CO_2 distribution

Sampling for simultaneous CH4 and N2O observation was carried out in frame of an accompanying

project for long term data collection. All samples were fixed with 500 µL saturated HgCl2-solution to prevent microbiological activity and stored dark. Responsibility for this data lies by Prof. Gregor Rehder.

One complete depth profile was sampled at station TF0271 for the long term data collection of CT, AT, and pH. Also these samples were fixed with 500 µL saturated HgCl2-solution to prevent microbiological activity and stored dark (Responsible Scientist: Dr. B. Schneider).

Mooring work

In total three moorings in the eastern Gotland Basin were maintained during the cruise (for positions see Appendix 1). The moorings GONE and SF were turned around, whereas GODESS was deployed for a three month period and will collect data by lifting the instruments every 16h between 180 m and 30 m depth.

Narrative of the cruise

Embarkation of the scientific crew was on 3rd November at 7:00 AM. The research campaign started at 8:00 AM in Rostock-Marienehe with CTD cast within the Warnow River for the PHOSPHAM Project at preselected stations. The ship headed than north for the first stations until the Cadet Furrow and then to the west to cover stations in Mecklenburg Bay and Kiel Bay. Afterwards we turned to Southeast to reach Lübeck Bay as the next working area. Station work usually comprises hydrographic measurements by means of a CTD and oxygen determinations by Winkler titration, dissolved and particulate nutrient as well as organic carbon determinations on selected stations. During the first hours of the cruise the wind was stronger than 6 Bft.

On 3rd November the wind and see conditions improved and we continue our work in the western Baltic Sea and subsequently continued in the Arkona Sea. On 4th November under good wind and sea conditions we continued the work in the eastern Arkona Sea and in the northern Bornholm Sea.
In the morning on 5th November Elisabeth Mann Borgese headed towards Sassnitz where a change in the scientific crew was scheduled for noon time. After the crew member change with the working boat the ship headed towards stations lying on the border between the Polish and Danish territorial waters. Those stations were occupied under good weather conditions allowing good progress in schedule work. The Polish observer witnessed the work in the CTD laboratory and on deck. He showed interest in the station work and the technical equipment used.

Due to weather prediction we decided to continue our work in the western Gotland Sea and Landsort Deep before heading to the eastern part of the Gotland Basin. One station (TF260) was abandoned due to bad weather and high sea on our way towards North. On 9th of November the ship arrived in the eastern Gotland Basin at station TF271. Here a number of CTD casts and other instruments were run and three moorings were installed. On the 10th of November first the mooring GONE was recovered, instruments changed and deployed again at 57°21.939'N, 20°20.623'E and secondly the SF mooring containing a sediment trap was turned around (57°18.375'N, 20°04.854'E). The last mooring to be installed was GODESS. The mooring was deployed on 11th November 2016 at 57°19.036'N, 20°08.033'E and the ship continued with hydrographic station at the southern edge of the central Gotland Sea basin (Fig. 3). After completing the work in the Gotland Basin Elisabeth Mann Borgese headed south. On the way back home station TF260 abandoned at the beginning of the cruise was occupied and the work completed under calm weather and sea conditions. The ship continued towards Rostock and final few stations were completed (Appendix 1).

On November 14th at 8:00 AM the ship reached Rostock-Marienehe and the cruise EMB-143 terminated. Cruise participants started uploading the instruments and equipment immediately after

the custom inspection. All gear was of the ship at 11:00 AM and participants drove to IOW.

Preliminary results

The results presented in the following section are preliminary and many samples taken are to be analysed and interpreted during the next weeks and months. The aim of this section is to give a first impression on the collected data set. An advanced data analysis will follow after all validated data sets are available.

Baltic thalweg transect

The profiles of the stations that were aligned along the thalweg during the cruise EMB-143 from the Danish Straits, through the western Baltic Sea, and further towards the northern Gotland basin were combined to a respective contour plots for salinity, dissolved oxygen, and temperature (Figure 4). This transect provides good overview of the hydrographic and environmental state of the entire Baltic Sea. It appears that in the central Gotland basin stagnation period has begun and oxygen consumption takes place below about 70 m depth. Low concentrations of dissolved oxygen (below 1 ml/L) are recorded in the Gotland Deep below 110 m, however it needs to be noted that H_2S is not included here as the CTD has just an oxygen sensor and is not able to detect H_2S.

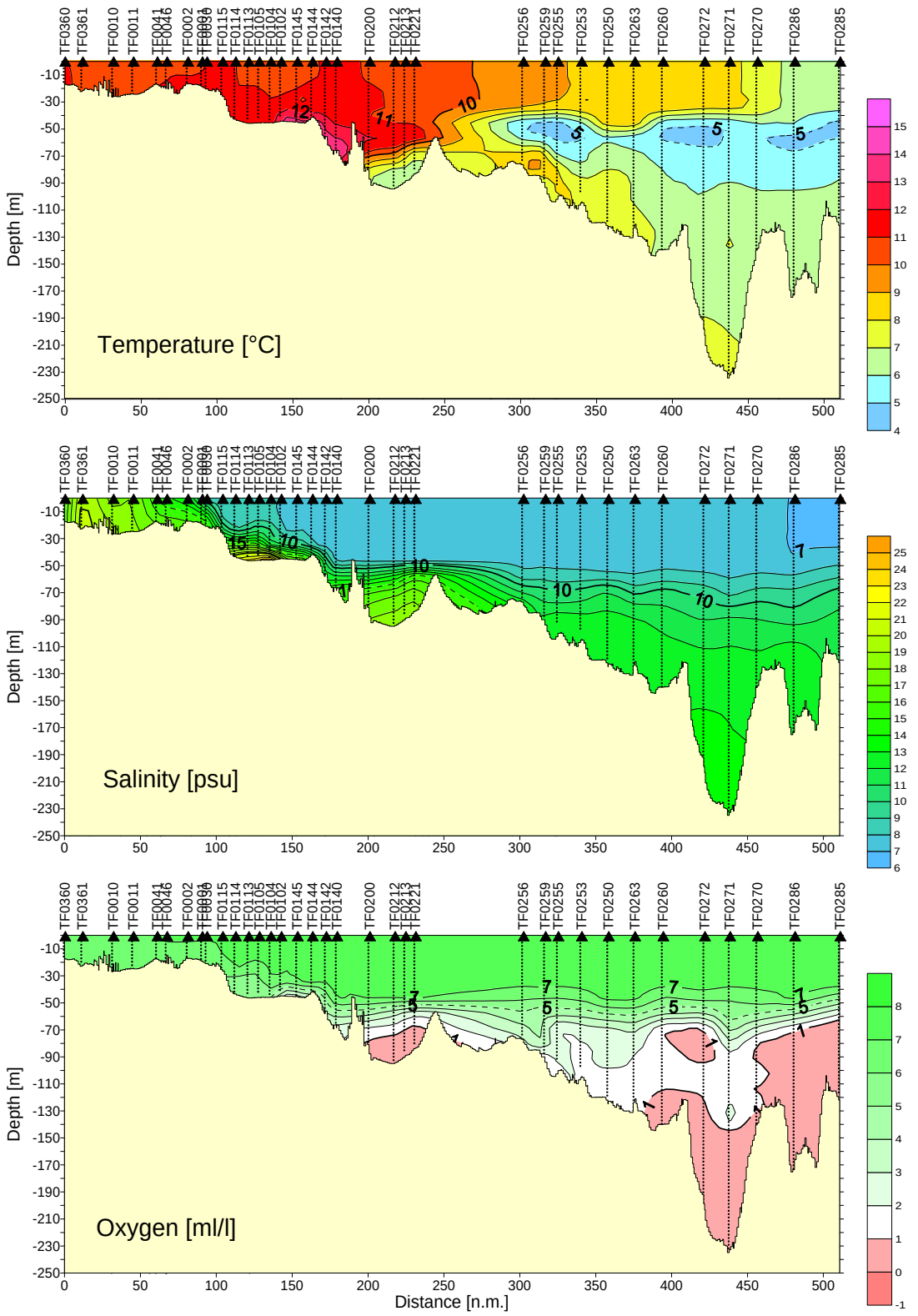

Figure 4: Distribution of temperature, salinity and dissolved oxygen along the thalweg of the Baltic Sea from the Kiel bight to the eastern Gotland Basin. The figure is based on the preliminary CTD data measured during the EMB143 cruise.

Development of Baltic Sea water masses - data of this campaign compared to previous cruises

Salinity

After a series of major Baltic inflows (MBI) that started in November 2014, with the strongest MBI being the Christmas MBI 2015, the temperature and salinity changes are propagating through the Baltic Sea. The salinity, temperature, nutrient and oxygen conditions are compared to previous measurements to emphasize the meaning of the inflow events for the Baltic Sea after a long stagnation period with extended anoxic areas in the Baltic deep waters. The salinity in the bottom layer is shown in comparison to data from selected previous cruises in 2014, 2015 and 2016 in Table 1. Unfortunately, because of persistent strong winds no data for the Farö Deep was collected in August 2016.

Table 1: Bottom water salinity of Baltic Sea deeps of this cruise (Nov16) compared to the last two years and from previous campaigns of this year (based on CTD data).

	Jul-14	Jul-15	Feb-16	Mar-16	May-16	Aug-16	**Nov-16**
Gotland Deep	12.25	13.42	13.84	13.85	13.77	13.80	**13.44**
Farö Deep	11.58	12.23	-	12.36	12.70	- **12.67**	
Landsort Deep	10.41	10.86	11.03	10.99	10.99	11.26	**11.28**
Karlsö Deep	9.58	9.65	9.97	9.94	9.87	10.32	**10.10**

It can be seen that salinity in Gotland Deep water reduced for the first time since July 2014, whereas in contrast an increase of salinity in Landsort Deep the Karlsö Deep continued.

Table 2: Bottom water temperature (°C, CTD data) of Baltic Sea deeps of this cruise (Nov-16) compared to the last two years, to previous campaigns of this year, and to a former long-term average (last raw) calculated over the period 1971-1990.

	Jul-14	Jul-15	Feb-16	Mar-16	May-16	Aug-16	**Nov-16**	
Bornholm Deep	5.90	7.01	8.39	5.72	7.00	6.56	**6.69**	6.12
Gotland Deep	6.00	6.87	7.86	7.62	6.88	7.50	**7.13**	5.62
Farö Deep	5.90	6.58	n/s	6.55	6.50	-	**6.58**	5.2
Landsort Deep	5.20	5.68	5.84	5.81	5.42	6.02	**6.03**	4.76
Karlsö Deep	5.20	5.02	5.22	5.22	5.01	5.43	**5.36**	4.18

Temperatures changed slightly in the bottom waters from August to November 2016 in the Bornholm Deep and Karlsö Deep by 0.1 K but remained stable in Landsort Deep. In contrast deep water in the Gotland Deep cooled slightly from 7.5°C to 7.13°C. At all selected stations within the individual basins an increase of temperatures is continuing compared to the long term average (Tab. 2).

Table 3: Bottom water oxygen concentration (ml/l) of Baltic Sea deeps of this cruise (Nov-16) compared to the last two years, and to previous campaigns of this year.

	Jul-14	Jul-15	Feb-16	Mar-16	May-16	Aug-16	**Nov-16**
Gotland Deep	0.37	0.86	1.7	0.34	0.08	-0.79	**0.03**
Farö Deep	-5.33	-1.54	n/s	0.43	0.05	-	**0.03**
Landsort Deep	-3.29	-0.88	-1.28	0.67	-1.05	-0.92	**-0.00**
Karlsö Deep	-2.44	-1.22	-0.9	0.22	-1.13	-1.82	**0.04**

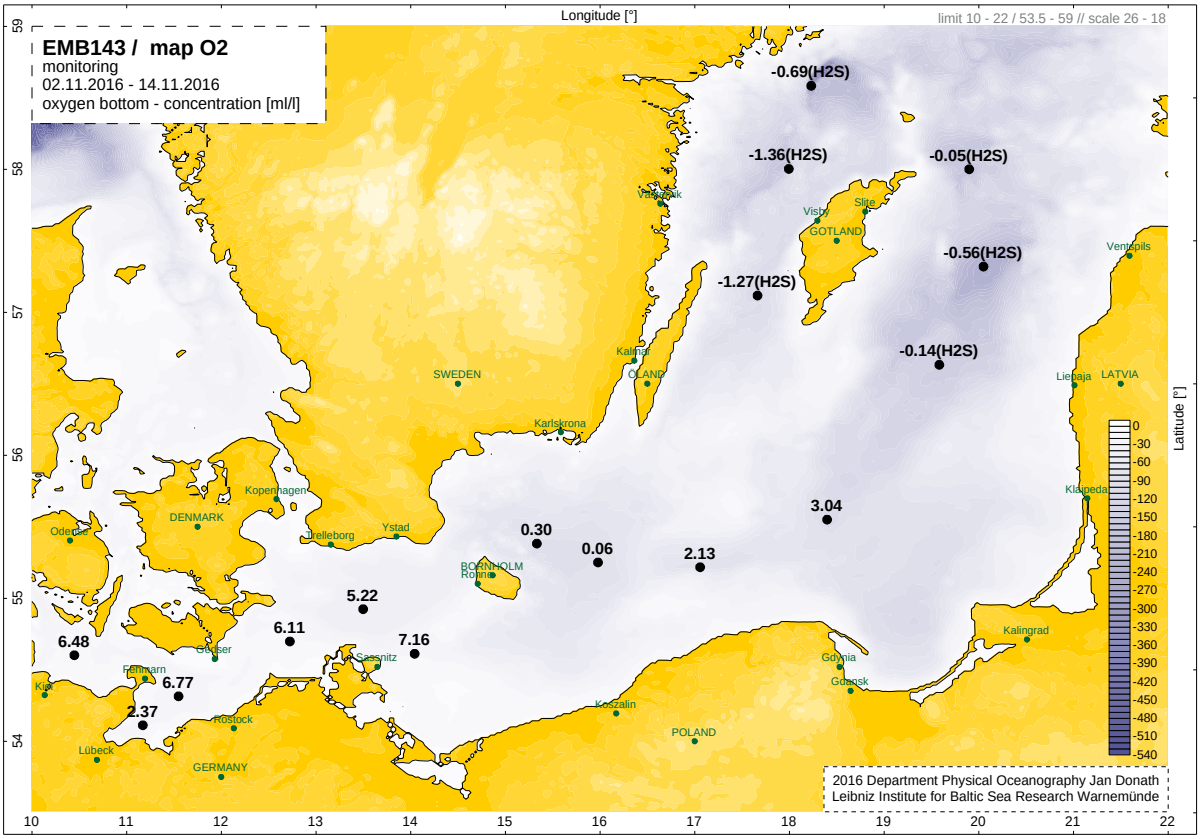

Figure 5: Oxygen concentration (ml/l) in bottom waters of selected Baltic Sea stations (H_2S is included as negative oxygen concentration) based on Winkler titration.

Oxygen

The development of the oxygen concentrations in the deep water layer is most interesting (Table 3). Observed changes deviate significantly between the individual deeps. The deep water in the Gotland Deep is almost stable in the last month with regard to salinity and it appears that oxygen consumption already in August 2016 caused an oxygen deficit. However, the November 2016 observation indicate oxygen concentrations just above zero in the Gotland Deep, the Farö Deep and Karlsö Deep, whereas in the Landsort Deep the oxygen deficit further reduced, but was still existing (-0.00 ml/l).

Nutrients

In the bottom-near layer, the environmental conditions are permanently changing following the inflow of oxygenated water: in the Gotland Deep from August 2016 to November nitrate concentration increased slightly. Same development was observed in the Landsort Deep, the Farö Deep and the Karlsö Deep, whereas a reduction of nitrate was measured in the Bornholm Basin. Phosphate shoved different pattern: its concentrations increased in the Bornholm Deep compared to August 2016 and most likely Farö Deep, but reduced in the deep waters of the Landsort Deep, the Gottland Deep and Karlsö Deep comparing to previous cruises (Table 4).

Table 4: Bottom water nitrate (upper part) and phosphate (lower part) concentration (µM) of Baltic Sea deeps of this cruise (Nov-16) compared to the last two years, and to previous campaigns of this year; n/s-not sampled.

Nitrate (µM)	Jul-14	Jul-15	Feb-16	Mar-16	May-16	Aug-16	**Nov-16**
Bornholm Deep	11.2	13.8	8.9	9.0	11.7	10.65	**8.06**
Gotland Deep	0.0	12.3	8.5	10.2	12.5	0.00	**0.07**
Farö Deep	0.0	0.0	n/s	0.0	4.9	n/s	**0.01**
Landsort Deep	0.0	0.0	0.0	0.0	0.0	0.00	**0.16**

Karlsö Deep	0.0	0.0	0.0	0.0	0.0	0.00	**0.08**

Phosphate (µM)	Jul-14	Jul-15	Feb-16	Mar-16	May-16	Aug-16	**Nov-16**
Bornholm Deep	1.2	2.0	1.9	1.5	1.7	2.19	**2.52**
Gotland Deep	2.5	2.4	2.1	2.3	2.5	3.90	**0.71**
Farö Deep	4.3	3.0	n/s	2.8	2.6	n/s	**2.98**
Landsort Deep	3.3	3.3	3.5	3.8	3.2	3.13	**0.58**
Karlsö Deep	3.1	3.6	3.8	4.7	4.8	4.30	**0.73**

Attachments

Station list

Station	Date	Time	Position Lat	Position Lon	Depth/m	Gear
EMB143/001-1	02.11.2016	07:39	54° 8.22' N	12° 5.72' E	8.2	Rosette water sampler
EMB143/002-1	02.11.2016	08:31	54° 9.49' N	12° 6.24' E	12.4	Rosette water sampler
EMB143/003-1	02.11.2016	08:55	54° 9.59' N	12° 7.62' E	11.8	Rosette water sampler
EMB143/004-1	02.11.2016	09:37	54° 10.36' N	12° 5.77' E	7.8	Rosette water sampler
EMB143/005-1	02.11.2016	10:24	54° 13.85' N	12° 4.52' E	9.1	Rosette water sampler
EMB143/005-2	02.11.2016	10:27	54° 13.88' N	12° 4.50' E	9.7	Secchi disc
EMB143/006-1	02.11.2016	12:15	54° 10.98' N	11° 46.07' E	17.9	Rosette water sampler
EMB143/006-2	02.11.2016	12:28	54° 11.00' N	11° 46.02' E	18.3	van Veen grab
EMB143/006-3	02.11.2016	13:08	54° 11.04' N	11° 45.87' E	16.8	Dredge
EMB143/006-3	02.11.2016	13:11	54° 11.12' N	11° 45.75' E	17.4	Dredge
EMB143/007-1	02.11.2016	14:40	54° 18.92' N	11° 32.99' E	21.7	Rosette water sampler
EMB143/007-2	02.11.2016	15:00	54° 18.88' N	11° 32.98' E	21.9	Plankton net
EMB143/007-3	02.11.2016	15:18	54° 18.87' N	11° 33.05' E	21.4	van Veen grab
EMB143/007-3	02.11.2016	15:24	54° 18.90' N	11° 33.04' E	22.1	van Veen grab
EMB143/007-4	02.11.2016	15:58	54° 18.90' N	11° 33.02' E	22.2	Dredge
EMB143/008-1	02.11.2016	17:15	54° 24.80' N	11° 36.94' E	22.7	Rosette water sampler
EMB143/009-1	02.11.2016	19:53	54° 6.58' N	11° 10.60' E	20.9	Rosette water sampler
EMB143/009-2	02.11.2016	19:55	54° 6.57' N	11° 10.58' E	20.6	Plankton net
EMB143/009-3	02.11.2016	19:59	54° 6.56' N	11° 10.57' E	20.4	Secchi disc
EMB143/010-1	03.11.2016	01:35	54° 39.49' N	10° 46.07' E	20.4	Rosette water sampler
EMB143/011-1	03.11.2016	03:05	54° 35.96' N	10° 27.09' E	15.6	Rosette water sampler
EMB143/011-2	03.11.2016	03:22	54° 36.00' N	10° 26.95' E	15.6	Plankton net
EMB143/011-3	03.11.2016	03:51	54° 36.02' N	10° 26.99' E	15.6	van Veen grab
EMB143/011-4	03.11.2016	04:20	54° 36.05' N	10° 26.87' E	15.7	Dredge
EMB143/012-1	03.11.2016	07:30	54° 33.07' N	11° 19.26' E	0	Rosette water sampler
EMB143/012-2	03.11.2016	07:47	54° 33.08' N	11° 19.25' E	25.6	van Veen grab
EMB143/012-2	03.11.2016	07:49	54° 33.08' N	11° 19.25' E	25.6	van Veen grab
EMB143/012-3	03.11.2016	08:21	54° 33.10' N	11° 19.25' E	25.6	Dredge
EMB143/012-3	03.11.2016	08:23	54° 33.14' N	11° 19.18' E	25.4	Dredge
EMB143/012-3	03.11.2016	08:25	54° 33.19' N	11° 19.10' E	25.6	Dredge
EMB143/012-3	03.11.2016	08:29	54° 33.28' N	11° 18.95' E	25.4	Dredge
EMB143/012-3	03.11.2016	08:32	54° 33.35' N	11° 18.84' E	25.4	Dredge
EMB143/012-3	03.11.2016	08:34	54° 33.39' N	11° 18.76' E	25.6	Dredge
EMB143/013-1	03.11.2016	11:30	54° 24.37' N	12° 3.72' E	16.2	Rosette water sampler
EMB143/014-1	03.11.2016	12:45	54° 29.22' N	12° 4.00' E	9	Rosette water sampler
EMB143/015-1	03.11.2016	13:50	54° 27.98' N	12° 12.95' E	20.5	Rosette water sampler
EMB143/015-2	03.11.2016	13:58	54° 27.98' N	12° 12.90' E	22.7	Hand net
EMB143/015-3	03.11.2016	14:08	54° 27.98' N	12° 12.88' E	23.3	Zooplankton net
EMB143/016-1	03.11.2016	15:40	54° 39.03' N	12° 27.03' E	14.9	Rosette water sampler
EMB143/017-1	03.11.2016	16:53	54° 41.73' N	12° 42.69' E	18.2	Rosette water sampler
EMB143/018-1	03.11.2016	17:37	54° 43.42' N	12° 47.18' E	19.7	Rosette water sampler
EMB143/018-2	03.11.2016	17:55	54° 43.38' N	12° 46.99' E	19.6	Plankton net
EMB143/018-3	03.11.2016	18:07	54° 43.41' N	12° 46.92' E	19.6	van Veen grab
EMB143/018-4	03.11.2016	18:36	54° 43.32' N	12° 46.80' E	19.6	Dredge

EMB143/019-1	03.11.2016	20:03	54° 47.69' N	13° 3.49' E	27	Rosette water sampler
EMB143/020-1	03.11.2016	21:30	54° 51.61' N	13° 16.69' E	42.1	Rosette water sampler
EMB143/021-1	03.11.2016	22:55	54° 59.89' N	13° 17.95' E	43.6	Rosette water sampler
EMB143/022-1	04.11.2016	00:10	54° 55.54' N	13° 30.00' E	44.6	Rosette water sampler
EMB143/022-2	04.11.2016	00:12	54° 55.51' N	13° 30.02' E	44.3	Hand net
EMB143/022-1	04.11.2016	00:37	54° 55.47' N	13° 29.97' E	44.8	Rosette water sampler
EMB143/022-3	04.11.2016	01:25	54° 55.39' N	13° 30.15' E	44.4	Zooplankton net
EMB143/023-1	04.11.2016	02:20	55° 1.45' N	13° 36.26' E	43.8	Rosette water sampler
EMB143/024-1	04.11.2016	03:27	55° 4.21' N	13° 48.76' E	43.9	Rosette water sampler
EMB143/024-1	04.11.2016	03:36	55° 4.15' N	13° 48.80' E	44.2	Rosette water sampler
EMB143/025-1	04.11.2016	04:31	55° 9.34' N	13° 56.43' E	42.4	Rosette water sampler
EMB143/026-1	04.11.2016	10:08	55° 23.00' N	15° 19.92' E	89.9	Rosette water sampler
EMB143/027-1	04.11.2016	12:45	55° 28.01' N	14° 43.08' E	67.4	Rosette water sampler
EMB143/028-1	04.11.2016	14:00	55° 24.33' N	14° 32.24' E	57.8	Rosette water sampler
EMB143/029-1	04.11.2016	15:37	55° 15.49' N	14° 29.75' E	42.8	Rosette water sampler
EMB143/030-1	04.11.2016	17:35	55° 10.11' N	14° 15.12' E	44	Rosette water sampler
EMB143/031-1	04.11.2016	19:43	55° 3.80' N	13° 59.33' E	44.9	Rosette water sampler
EMB143/032-1	04.11.2016	20:49	55° 0.03' N	14° 5.06' E	45.2	Rosette water sampler
EMB143/032-2	04.11.2016	20:51	55° 0.03' N	14° 5.02' E	45.8	Hand net
EMB143/032-3	04.11.2016	21:06	55° 0.02' N	14° 5.02' E	46.1	Zooplankton net
EMB143/032-4	04.11.2016	21:21	55° 0.01' N	14° 5.01' E	46.1	Rosette water sampler
EMB143/032-5	04.11.2016	21:40	55° 0.00' N	14° 5.00' E	46.9	van Veen grab
EMB143/032-6	04.11.2016	22:20	54° 59.96' N	14° 4.96' E	45.2	Dredge
EMB143/032-6	04.11.2016	22:21	54° 59.94' N	14° 4.93' E	45.4	Dredge
EMB143/033-1	04.11.2016	23:30	54° 53.40' N	13° 58.17' E	42	Rosette water sampler
EMB143/034-1	05.11.2016	00:25	54° 52.82' N	13° 51.89' E	42.9	Rosette water sampler
EMB143/035-1	05.11.2016	01:25	54° 48.26' N	13° 57.51' E	37.9	Rosette water sampler
EMB143/036-1	05.11.2016	02:30	54° 42.70' N	13° 56.72' E	27.7	Rosette water sampler
EMB143/037-1	05.11.2016	03:30	54° 36.73' N	14° 2.57' E	19.1	Rosette water sampler
EMB143/038-1	05.11.2016	04:42	54° 38.10' N	14° 16.99' E	28.5	Rosette water sampler
EMB143/038-2	05.11.2016	04:58	54° 38.04' N	14° 16.98' E	28.3	van Veen grab
EMB143/038-3	05.11.2016	05:30	54° 38.04' N	14° 16.84' E	28.6	Dredge
EMB143/039-1	05.11.2016	08:25	54° 14.41' N	14° 4.10' E	11.4	Rosette water sampler
EMB143/039-2	05.11.2016	08:39	54° 14.42' N	14° 4.09' E	11.4	van Veen grab
EMB143/039-3	05.11.2016	08:59	54° 14.39' N	14° 4.14' E	11.5	Dredge
EMB143/039-3	05.11.2016	09:01	54° 14.32' N	14° 4.20' E	11.2	Dredge
EMB143/040-1	05.11.2016	22:07	55° 9.61' N	15° 39.53' E	92.9	Rosette water sampler
EMB143/041-1	05.11.2016	23:40	55° 18.04' N	15° 47.66' E	94.5	Rosette water sampler
EMB143/042-1	06.11.2016	01:00	55° 15.02' N	15° 58.84' E	88.7	Rosette water sampler
EMB143/042-2	06.11.2016	01:17	55° 15.01' N	15° 58.87' E	89	Hand net
EMB143/042-3	06.11.2016	01:37	55° 15.00' N	15° 58.94' E	88.4	Rosette water sampler
EMB143/042-4	06.11.2016	02:00	55° 14.99' N	15° 58.93' E	88.1	Zooplankton net
EMB143/043-1	06.11.2016	03:38	55° 14.97' N	15° 58.93' E	87.7	Rosette water sampler
EMB143/044-1	06.11.2016	04:42	55° 13.34' N	16° 9.87' E	81.5	Rosette water sampler
EMB143/045-1	06.11.2016	08:20	55° 13.00' N	17° 4.05' E	90.3	Rosette water sampler
EMB143/046-1	06.11.2016	13:15	55° 19.57' N	18° 13.99' E	76.1	Rosette water sampler
EMB143/047-1	06.11.2016	15:19	55° 32.93' N	18° 23.87' E	88.8	Rosette water sampler

EMB143/047-2	06.11.2016	15:49	55° 32.94' N	18° 23.86' E	89.3	Rosette water sampler
EMB143/048-1	06.11.2016	17:00	55° 37.95' N	18° 35.85' E	95.4	Rosette water sampler
EMB143/049-1	06.11.2016	19:11	55° 50.41' N	18° 51.99' E	101.3	Rosette water sampler
EMB143/050-1	06.11.2016	22:06	56° 4.95' N	19° 9.94' E	123.6	Rosette water sampler
EMB143/050-2	06.11.2016	22:52	56° 5.00' N	19° 9.99' E	124.8	Rosette water sampler
EMB143/051-1	07.11.2016	01:40	56° 20.74' N	19° 22.66' E	17.1	Rosette water sampler
EMB143/052-1	07.11.2016	13:10	56° 38.06' N	19° 34.97' E	144.5	Rosette water sampler
EMB143/053-1	08.11.2016	02:59	57° 6.96' N	17° 40.01' E	110.6	Rosette water sampler
EMB143/054-1	08.11.2016	11:10	57° 59.91' N	17° 59.91' E	169.9	Rosette water sampler
EMB143/055-1	08.11.2016	15:48	58° 34.90' N	18° 13.91' E	452.9	Rosette water sampler
EMB143/055-2	08.11.2016	17:12	58° 34.94' N	18° 13.95' E	452.8	Rosette water sampler
EMB143/055-3	08.11.2016	18:01	58° 35.01' N	18° 13.98' E	452.8	Rosette water sampler
EMB143/055-4	08.11.2016	18:41	58° 34.98' N	18° 13.94' E	452.8	Rosette water sampler
EMB143/055-5	08.11.2016	19:15	58° 34.94' N	18° 13.84' E	455.6	Zooplankton net
EMB143/055-6	08.11.2016	19:23	58° 34.92' N	18° 13.85' E	455.6	Zooplankton net
EMB143/055-7	08.11.2016	19:48	58° 34.93' N	18° 13.90' E	455.6	Rosette water sampler
EMB143/056-1	09.11.2016	03:53	58° 26.50' N	20° 19.89' E	121.7	Rosette water sampler
EMB143/057-1	09.11.2016	07:12	58° 0.02' N	19° 54.01' E	195.8	Rosette water sampler
EMB143/057-3	09.11.2016	07:26	57° 59.99' N	19° 54.03' E	195.8	Secchi disc
EMB143/057-2	09.11.2016	08:05	57° 59.93' N	19° 54.03' E	195.6	Rosette water sampler
EMB143/057-4	09.11.2016	08:50	57° 59.98' N	19° 54.06' E	195.7	Zooplankton net
EMB143/057-5	09.11.2016	08:56	57° 59.98' N	19° 54.07' E	195.6	Zooplankton net
EMB143/057-6	09.11.2016	09:11	57° 59.99' N	19° 54.12' E	195.7	Rosette water sampler
EMB143/058-1	09.11.2016	12:20	57° 37.06' N	20° 9.95' E	144	Rosette water sampler
EMB143/058-1	09.11.2016	13:00	57° 37.02' N	20° 10.01' E	144.3	Rosette water sampler
EMB143/059-1	09.11.2016	15:30	57° 19.16' N	20° 3.02' E	241.4	Rosette water sampler
EMB143/059-2	09.11.2016	16:57	57° 19.24' N	20° 2.99' E	241.4	Rosette water sampler
EMB143/059-3	09.11.2016	17:27	57° 19.23' N	20° 3.01' E	241.4	Plankton net
EMB143/059-4	09.11.2016	17:52	57° 19.23' N	20° 2.95' E	241.4	Rosette water sampler
EMB143/059-5	09.11.2016	18:29	57° 19.20' N	20° 2.95' E	241.4	Plankton net
EMB143/059-6	09.11.2016	18:46	57° 19.20' N	20° 2.97' E	241.4	Zooplankton net
EMB143/059-7	09.11.2016	19:08	57° 19.23' N	20° 3.00' E	241.3	Rosette water sampler
EMB143/059-8	09.11.2016	19:31	57° 19.22' N	20° 2.96' E	241.4	Rosette water sampler
EMB143/059-9	10.11.2016	06:00	57° 19.19' N	20° 2.87' E	241.4	Rosette water sampler
EMB143/060-1	10.11.2016	17:07	57° 4.22' N	19° 49.65' E	207.9	Rosette water sampler
EMB143/060-2	10.11.2016	17:52	57° 4.32' N	19° 49.80' E	209.3	Rosette water sampler
EMB143/061-1	10.11.2016	22:45	56° 20.76' N	19° 22.72' E	133.4	Rosette water sampler
EMB143/061-1	10.11.2016	23:19	56° 20.80' N	19° 22.70' E	133.1	Rosette water sampler
EMB143/062-1	11.11.2016	06:07	57° 19.22' N	20° 3.02' E	241.4	Rosette water sampler
EMB143/062-2	11.11.2016	07:03	57° 19.23' N	20° 2.91' E	241.4	Rosette water sampler
EMB143/062-3	11.11.2016	08:00	57° 19.17' N	20° 3.02' E	241.4	Rosette water sampler
EMB143/063-1	11.11.2016	09:32	57° 19.17' N	20° 7.96' E	244.3	Rosette water sampler
EMB143/064-1	11.11.2016	13:55	57° 4.36' N	19° 1.62' E	114.3	Rosette water sampler
EMB143/065-1	11.11.2016	15:05	57° 1.66' N	19° 13.34' E	162.8	Rosette water sampler
EMB143/066-1	11.11.2016	16:44	56° 58.69' N	19° 34.60' E	167.9	Rosette water sampler
EMB143/067-1	11.11.2016	17:57	56° 57.05' N	19° 46.23' E	184.1	Rosette water sampler
EMB143/068-1	11.11.2016	19:19	56° 55.36' N	20° 1.17' E	166.2	Rosette water sampler

EMB143/069-1	11.11.2016	20:31	56° 54.26' N	20° 13.00' E	145.3	Rosette water sampler
EMB143/070-1	12.11.2016	06:44	55° 32.91' N	18° 24.00' E	88.9	Rosette water sampler
EMB143/070-2	12.11.2016	07:11	55° 32.98' N	18° 23.96' E	88.9	Rosette water sampler
EMB143/071-1	12.11.2016	16:56	55° 14.96' N	15° 59.05' E	88.6	Rosette water sampler
EMB143/071-2	12.11.2016	17:30	55° 14.98' N	15° 59.03' E	88.2	Rosette water sampler
EMB143/071-3	12.11.2016	18:00	55° 14.99' N	15° 59.01' E	88.3	Plankton net
EMB143/072-1	13.11.2016	03:18	0° 0.00' N	0° 0.00' E	0	Rosette water sampler
EMB143/073-1	13.11.2016	04:55	54° 55.40' N	13° 30.10' E	0	Rosette water sampler
EMB143/073-2	13.11.2016	05:16	54° 55.44' N	13° 30.10' E	0	Zooplankton net
EMB143/073-3	13.11.2016	05:25	54° 55.40' N	13° 30.10' E	0	Rosette water sampler
EMB143/073-3	13.11.2016	05:35	54° 55.44' N	13° 30.10' E	44.6	Rosette water sampler
EMB143/074-1	13.11.2016	09:13	54° 43.44' N	12° 47.07' E	19.6	Rosette water sampler
EMB143/074-3	13.11.2016	09:16	54° 43.42' N	12° 47.04' E	19.6	Secchi disc
EMB143/074-2	13.11.2016	09:18	54° 43.42' N	12° 47.03' E	19.5	Hand net
EMB143/074-3	13.11.2016	09:29	54° 43.43' N	12° 47.03' E	19.8	Secchi disc
EMB143/074-4	13.11.2016	09:33	54° 43.43' N	12° 47.03' E	19.6	Zooplankton net
EMB143/075-1	13.11.2016	13:20	54° 27.99' N	12° 13.02' E	22.1	Rosette water sampler
EMB143/075-1	13.11.2016	13:27	54° 28.00' N	12° 12.96' E	22.4	Rosette water sampler
EMB143/075-3	13.11.2016	13:43	54° 27.96' N	12° 12.99' E	22.2	Zooplankton net
EMB143/076-1	13.11.2016	16:57	54° 18.98' N	11° 33.02' E	21.4	Rosette water sampler
EMB143/076-2	13.11.2016	17:19	54° 18.94' N	11° 33.00' E	21.4	Plankton net