

## Report R.V. Alkor cruise No. 206

**Institute:** Institute of Hydrobiology and Fishery Science, Department of Fisheries Science / Biological Oceanography, Hamburg University

**Date:** from 01.07.2002 to 16.07.2002

**Area:** Baltic Sea ( Bornholm Basin )  
North Sea ( Doggerbank, German Bight )

### **Participants:**

Jens Floeter (chief scientist)	LIFECO	IHF UniHH
Daniel Carstensen	GLOBEC	IfM Kiel
Rudi Lüthje	GLOBEC	IfM Kiel
Katrin Roth	LIFECO	IHF UniHH
Silke Ruseler	LIFECO	IHF UniHH
Annett Seehagen	GLOBEC	IfM Kiel
Anne Sell	LIFECO	IHF UniHH
Jörn Schmidt (from 08. July 2002)	GLOBEC	IfM Kiel
Jan Schröder	GLOBEC	IfM Kiel
Nadine Uhlig (until 06. July 2002)	LIFECO	IHF UniHH

### **Objectives of the cruise:**

Within the framework of the research projects: „**GLOBEC**, Germany Trophische Wechselwirkung zwischen Zooplankton und Fischen unter dem Einfluß physikalischer Prozesse“ and "**LIFECO** Linking hydrographic frontal activity to ecosystem dynamics in the North Sea and Skagerrak: Importance to fish stock recruitment“ (EUQ5RS-2000-30183:) the following objectives have been addressed during the cruise:

#### **GLOBEC:**

- Hydrographic situation and current system in the Bornholm Basin, including the BMP monitoring station.
- Horizontal and vertical meso-scale distribution and abundance of sprat eggs and larvae as well as other ichthyo-, zoo- and phytoplankton in the Bornholm Basin, including the BMP monitoring station.
- Growth and mortality of sprat larvae.
- Sampling for biochemical analysis of nutritional condition and food web biomarkers of zooplankton and sprat larvae.

#### **LIFECO:**

This cruise focused on investigating how hydrographic frontal systems in the North Sea impact the recruitment success of commercially important North Sea fish stocks such as those of cod (*Gadus morhua*), whiting (*Merlangius merlangus*), sandeels (*Ammodytes* sp.) and herring (*Clupea harengus*). Cruise no. 206 of RV ALKOR was the last cruise of an intensive field programme, which had been performed during LIFECO. The following objectives have been addressed during the cruise:

- Determine the location of the tidal front in the Doggerbank area and assess its spatio-temporal variability.

- Resolve the upper micro to macro scale horizontal and vertical distribution and abundance of key zooplankton in frontal and adjacent non-frontal regions, using the Video Plankton Recorder (VPR).
- Resolve the upper meso to macro scale horizontal distribution and abundance of key fish species/life stages in frontal and adjacent non-frontal regions.
- Resolve the impact of predation on the abundance of zooplankton as well as larval and early juvenile fish by planktivorous and piscivorous predators in frontal regions relative to stratified non-frontal regimes via the analysis of stomach contents and the utilisation of food web biomarkers.
- Obtain life fish (*Eutrigla gurnadus* and sandeels) for consumption rate experiments in the IHF Hamburg University laboratory.

### **Work at sea, area of investigation, and first scientific results:**

With help of an excellent cooperation with the crew of RV Alkor and good weather conditions sampling on the Alkor cruise 206 was successful.

However, due to a new law on weekly working hour limits of the ship's crew, which surprisingly became effective July 1<sup>st</sup> 2002, the cruise had to be interrupted for two days. This shortage in time severely affected the research on the second cruise leg: The LIFECO objective of resolving the impact of predation on the abundance of zooplankton as well as larval and early juvenile fish by planktivorous and piscivorous predators in frontal regions relative to stratified non-frontal regimes had to be omitted almost completely.

## **GLOBEC**

### Hydrography

The physical measurements of the first cruise leg were designed to investigate, apart from some standard meteorological parameters, the quasi-synoptic three-dimensional distribution of temperature, salinity, oxygen and PAR light intensity within the Bornholm Basin. These physical observations can be used in future to analyse the three-dimensional distribution of biological parameters (zooplankton, fish egg and larvae abundance) with respect to variability of the physical environmental conditions. A total number of 53 CTD casts were performed within the Bornholm Basin. In order to quantify the depth interval where successful cod and sprat egg development takes place, highly vertically resolved measurements of the oxygen concentrations within and below the halocline were conducted.

### Ichthyo-, zoo- and phytoplankton

The coarse taxonomic composition of the phytoplankton community in the Bornholm Basin was measured by a multispectral fluorescence sensor mounted on the CTD.

On 52 of all 53 stations covered in the Bornholm Basin, ichthyo- and mesozooplankton was sampled with a Bongo (60 cm in diameter, equipped with two 335 µm nets) and a Babybongo (20 cm diameter, equipped with 150 µm nets and a 50 µm liner) by means of double oblique hauls. A single Bongo haul at station 39 had to be skipped because of temporarily bad weather conditions. On 32 stations one of the two 335 µm Bongo samples was used for collecting samples for biochemical analyses of nutritional condition and/or food web biomarkers of sprat larvae, while the samples from the second net were preserved for quantification of biomass. On 7 stations the same net was used for collecting samples for analyses of food web biomarkers of *Pseudocalanus elongatus*. The copepod samples will be analysed by Prof. Dr. M. St. John (IHF, Hamburg University), the sprat samples will be analysed by Dr. C. Clemmesen (IfM Kiel).

On 36 stations early life stages of zooplankton and phytoplankton were sampled by an Apstein net (50 µm).

Copepod egg production experiments with *Pseudocalanus elongatus* taken from the WP-2 samples were conducted with ambient water at ambient temperature (approx. 5°C) on board RV Alkor by Dr. Anne Sell. Incubation water samples were taken from the water bottle rosette hauls.

Two BIOMOC hauls were conducted to test the operational readiness of the lately repaired gear, and to obtain samples for the analysis of food web biomarkers of *Pseudocalanus elongatus*.

The station grid applied in the Bornholm Basin covered the area enclosed by the 60 m isobath with some extensions into shallower waters in the southern and northern area to take the expanded spawning area of sprat into account. Stations were regularly spaced with a distance of 10 nm in N/S- and 8.5 nm in E/W- direction (see Annex; Fig. 1).

In total, the activities at 53 stations in the Bornholm Basin can be summarised as follows:

- 53 CTD casts
- 52 Bongo net hauls
- 36 Apstein net hauls
- 4 WP-2 hauls
- 4 Water bottle rosette hauls
- 2 BIOMOC hauls

A detailed compilation of station data is summarised in the station log in the Annex (Tab. 1) and had been entered in the GLOBAN Database onboard RV Alkor.

## LIFECO

It was planned that scientific work on RV ALKOR covered intensive fine-scale sampling of phytoplankton, zooplankton and micronekton along a transect - station grid combination, including a core transect (T 14) according to the LIFECO field sampling programme (see Fig. 2). However, due to the unexpected shortage in ship time, research was focussed on resolving the upper micro- to macro scale horizontal and vertical distribution and abundance of key zooplankton in frontal and adjacent non-frontal regions at T14 by using the Video Plankton Recorder (VPR).

Hydrographic measurements on the second cruise leg were directed to the determination of a tidal front on a transect in the Doggerbank area of the North Sea, which was app. orthogonal to the isobaths.

The frontal zone was successfully determined by analysing the CTD results of a first long VPR transect from 54° 55' N / 002° 45' E to 55° 50' N / 002° 45' E.

The VPR was successfully deployed in triangular transect schemes of two different spatio-temporal dimensions (see Fig. 3). The centre of the triangular transect schemes was set the around the frontal zone at 55° 30' N / 002° 45' E. Preliminary results of the onboard analysis of the physical data from the first long VPR transect are depicted in Figures 4 - 10.

In order to obtain ground truth data for the validation of the VPR plankton data, three blocks of plankton net sampling with the Longhurst Hardy Plankton Recorder (LHPR; 200µm & 55 µm) and the WP-2 net were performed in the inshore, frontal and offshore region of T14. In order to avoid diurnal effects all three plankton blocks were conducted at approx. 08:00 local time. Net sampling was accompanied by CTD casts and phytoplankton water bottle samples.

A multispectral fluorescence sensor mounted on the CTD was deployed to obtain pigment fluorescence signatures as an index to the taxonomic structure of phytoplankton communities in the different water masses.

Two Isaac Kid Midwater Trawl (IKMT, 6m<sup>2</sup>, 1000µm) hauls were conducted in the inshore and offshore region of T14, the planned third haul in the frontal region had to be omitted because of technical problems with the winch.

To obtain relative fish density distributions along T14 hydroacoustic measurements were conducted in parallel to the VPR-transects, using the scientific echosounder Simrad EK 60 at 38kHz.

Life fish (grey gurnard (*Eutrigla gurnadus*) and greater sandeel (*Hyperoplus immaculatus*)) were successfully caught with the Kombitrawl at the surroundings of the Weiße Bank area. The fish was transferred to the Institut für Hydrobiologie und Fischereiwissenschaft in Hamburg, where it will be used in bioenergetic and consumption rate experiments.

**Time schedule:**

Mo 01.07.02 10:00 Departure to the Bornholm Basin from Kiel

Tu 02.07.02  
05:00 Arrival in the working area  
Start of station work on the Bornholm Basin grid  
A detailed compilation of station data is summarised in the station lists in the Annex (see Tab. 1).

Fr 05.07.02  
19:00 End of the station work on the Bornholm Basin grid  
Departure to Kiel

Sa 06.07. 02  
11:00 Arrival in Kiel  
Intermission of the cruise AL 206  
  
Due to a new law on weekly working hour limits of the ship's crew, which surprisingly became effective July 1<sup>st</sup> 2002, the cruise had to be interrupted for two days.

Su 07.07. 02 Intermission of the cruise AL 206

Mo 08.07. 02 Intermission of the cruise AL 206

Tu 09.07.02 07:30 Continuation of the cruise AL 206  
Departure to the Doggerbank via the Kiel Canal

We 10.07.02  
13:00 Arrival in the working area at the Doggerbank (T14; see Annex ; Fig. 1)  
Start of station and transect work on Transect T14  
  
A detailed station log of the work on Transect 14 is provided in the Annex (see Tab. 2, Figs. 2 & 3)

Su 14.07.02  
00:00 End of station and transect work on Transect T14  
Departure to the Weiße Bank area for fishing  
  
11:00 Arrival in the fishing area at the Weiße Bank  
Fisheries Block 1

Mo 15.07.02  
01:00 Fisheries Block 2  
  
16:00 Fisheries Block 3  
  
18:30 End of Fisheries and end of work on the AL 206  
  
A detailed station log of the fishing operations is provided in the Annex (see Tab. 3)  
Departure to Kiel via the Kiel Canal

Tu 16.07.02  
12:00 Arrival in Kiel End of the Alkor cruise AL 206

**Annex:**

Table 1. Station list of the GLOBEC cruise leg in the Bornholm Basin in the sequence of sampling

Station	Latitude	Longitude	Gear deployed
1	55.275	14.45	CTD, Apstein-Net, Bongo
2	55.375	14.45	CTD, Apstein-Net, Bongo
3	55.375	15.00	CTD, Apstein-Net, Bongo,
4	55.375	15.15	CTD, Bongo, Niskin bottles, WP-2
5	55.375	15.30	CTD, Apstein-Net, Bongo
6	55.375	15.45	CTD, Apstein-Net, Bongo
7	55.375	16.00	CTD, Bongo
8	55.475	16.00	CTD, Apstein-Net, Bongo
9	55.475	16.15	CTD, Bongo
11	55.475	16.30	CTD, Apstein-Net, Bongo
11a	55.475	16.45	CTD, Apstein-Net, Bongo
11b	55.475	17.00	CTD, Apstein-Net, Bongo
12b	55.375	17.00	CTD, Apstein-Net, Bongo
12a	55.375	16.45	CTD, Apstein-Net, Bongo
12	55.375	16.30	CTD, Apstein-Net, Bongo
10	55.375	16.15	CTD, Apstein-Net, Bongo
13	55.275	16.30	CTD, Bongo
14	55.275	16.15	CTD, Apstein-Net, Bongo
15	55.275	16.00	CTD, Bongo
16	55.275	15.45	CTD, Niskin bottles, Bongo WP-2, Apstein-Net
17	55.275	15.30	CTD, Bongo,
18	55.275	15.15	CTD, Apstein-Net, Bongo
19	55.275	15.00	CTD, Bongo
20	55.175	15.00	CTD, Apstein-Net, Bongo
21	55.175	15.17	CTD, Apstein-Net, Bongo
22	55.175	15.30	CTD, Bongo
23	55.175	15.45	CTD, Apstein-Net, Bongo
24	55.175	16.00	CTD, Apstein-Net, Bongo
K2	55.150	16.00	CTD, Apstein-Net, Bongo
25	55.175	16.15	CTD, Bongo
26	55.175	16.30	CTD, Apstein-Net, Bongo
27	55.075	16.30	CTD, Apstein-Net, Bongo
28	55.075	16.15	CTD, Bongo
29	55.075	16.00	CTD, Apstein-Net, Bongo
30	55.075	15.45	CTD, Bongo, Niskin bottles, WP-2
31	55.075	15.30	CTD, Apstein-Net, Bongo
32	55.075	15.15	CTD, Apstein-Net, Bongo

Table 1. Station list of the GLOBEC cruise leg in the Bornholm Basin (cont.)

Station	Latitude	Longitude	Gear deployed
33	54.575	15.15	CTD, Apstein-Net, Bongo
42b	54.475	14.45	CTD, Apstein-Net, Bongo
42	54.475	15.00	CTD, Bongo
41	54.475	15.15	CTD, Apstein-Net, Bongo
40	54.475	15.30	CTD, Bongo
34	54.575	15.30	CTD, Bongo
35	54.575	15.45	CTD, Apstein-Net, Bongo
36	54.575	16.00	CTD, Bongo, Niskin bottles, WP-2
37	54.575	16.15	CTD, Apstein-Net, Bongo
38	54.475	16.00	CTD, Apstein-Net, Bongo
39	54.475	15.45	CTD
45	54.375	15.45	CTD, Apstein-Net, Bongo
44	54.375	15.30	CTD, Bongo
43	54.375	15.15	CTD, Apstein-Net, Bongo
43a	54.375	15.00	CTD, Apstein-Net, Bongo
43b	54.375	14.45	CTD, Apstein-Net, Bongo

Figure 1: Bornholm Basin GLOBEC station grid sampled during the 1<sup>st</sup> cruise leg of AL 206

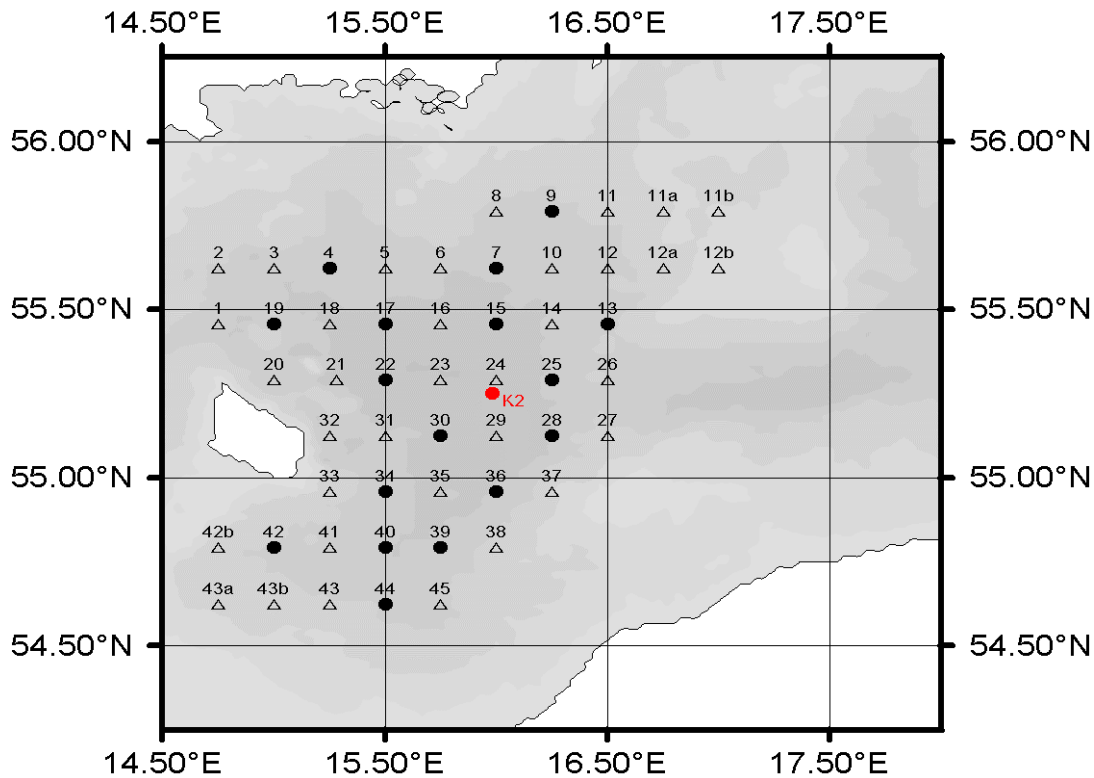


Table 2: Station Log of the LIFECON cruise leg in the Doggerbank area

Gear	Haul	Date	Local Time	Event	Latitude	Longitude	Comment
WP-2	1	10.07.02	13:10		54° 54,92' N	002° 45,07' E	Initial profiling
CTD	1	10.07.02	13:20		54° 54,92' N	002° 45,07' E	
VPR	1	10.07.02	13:40	Start	54° 55,00' N	002° 45,00' E	Long transect to determine the location of the frontal zone
		10.07.02		Change of direction	55° 50,00' N	002° 45,00' E	
		11.07.02	07:30	End	55° 30,00' N	002° 45,00' E	
WP-2	2	10.07.02	21:15		55°18,48' N	002° 45,35' E	Obtain life zooplankton to train the VPR
WP-2	3	10.07.02	21:25		55°18,48' N	002° 45,35' E	
CTD	2	11.07.02	07:41	Plankton Block 1	55°29,18' N	002° 44,94' E	Central position frontal zone
Water bottles	1	11.07.02	07:55		55° 29,13' N	002° 44,99' E	
WP-2	4	11.07.02	08:08		55° 29,04' N	002° 45,04' E	
LHPR	1	11.07.02	09:17		55° 28,99' N	002° 45,18' E	
VPR	2	11.07.02	09:40		Start	55° 30,00' N	
				Change of direction	55° 20,00' N	002° 45,00' E	Large Double Triangle centre South position
				Change of direction	55° 20,00' N	002° 38,00' E	Large Double Triangle South West position
				Change of direction	55° 30,00' N	002° 45,00' E	Large Double Triangle centre position
				Change of direction	55° 45,00' N	002° 45,00' E	Large Double Triangle centre North position
				Change of direction	55° 45,00' N	003° 00,00' E	Large Double Triangle North East position
				Change of direction	55° 30,00' N	002° 45,00' E	Large Double Triangle centre position
				Change of direction	55° 20,00' N	002° 45,00' E	Large Double Triangle centre South position
		12.07.02	08:07	End	55° 20,00' N	002° 55,00' E	Large Double Triangle South East position

Table 2: Station Log of the LIFEKO cruise leg in the Doggerbank area (continued)

Gear	Haul	Date	Local Time	Event	Latitude	Longitude	Comment
CTD	3	12.07.02	08:07	Plankton Block 2	55° 20,00' N	002° 55,03'	Large Double Triangle South East position inshore region vertically mixed water column
Water bottles	2	12.07.02	08:13		55° 19,94' N	002° 55,12'	
WP-2	5	12.07.02	08:26		55° 19,91' N	002° 55,35' E	
WP-2	6	12.07.02	08:36		55° 19,82' N	002° 55,62' E	
IKMT	1	12.07.02	08:45		55° 19,64' N	002° 55,57' E	
LHPR	2	12.07.0	09:10		55° 19,18' N	002° 55,66' E	
PR	3	12.07.02	09:45	Start	55° 20,00' N	002° 55,00' E	Large Double Triangle South East position
				Change of direction	55° 30,00' N	002° 45,00' E	Large Double Triangle centre position
				Change of direction	55° 45,00' N	002° 45,00' E	Large Double Triangle centre North position
				Change of direction	55° 45,00' N	002° 30,00' E	Large Double Triangle North West position
			22:30	End	55° 30,00' N	002° 45,00' E	Large Double Triangle centre position
VPR	4	12.07.02	23:00	Start	55° 30,00' N	002° 45,00' E	Large Double Triangle centre position
				Change of direction	55° 45,00' N	003° 00,00' E	Large Double Triangle North East position
		13.07.02	07:31	End	55° 45,00' N	002° 30,00' E	Large Double Triangle North West position
CTD	4	13.07.02	07:38	Plankton Block 3	55° 44,91' N	002° 29,85' E	Large Double Triangle North West position  offshore region vertically stratified water column
Water bottles	3	13.07.02	07:52		55° 44,94' N	002° 29,72' E	
WP-2	7	13.07.02	08:07		55° 45,03' N	002° 29,72' E	
WP-2	8	13.07.02	08:20		55° 45,03' N	002° 29,72' E	
IKMT	2	13.07.02	08:50		55° 45,25' N	002° 30,20' E	
LHPR	3	13.07.02	09:27		55° 45,18' N	002° 32,27' E	



Table 2: Station Log of the LIFECO cruise leg in the Doggerbank area (continued)

Gear	Haul	Date	Local Time	Event	Latitude	Longitude	Comment
VPR	5	13.07.02	10:23	Start	55° 40,00' N	002° 35,00' E	Small Double Triangle North West position
				Change of direction	55° 24,00' N	002° 50,00' E	Small Double Triangle South East position
				Change of direction	55° 24,00' N	002°40,00' E	Small Double Triangle South West position
				Change of direction	55° 40,00' N	002° 55,00' E	Small Double Triangle North East position
		14..07.02	00:00	End	55° 40,00' N	002° 35,00' E	Small Double Triangle North West position

Table 3: Station Log of the LIFECO Fishing operations deploying the Kombi10 - trawl

Station	Date	Haul	start	stop	start		stop	
			Time	Time	Latitude	Longitude	Latitude	Longitude
928	14.07.02	1	11:24	11:54	54° 59,84'N	005° 50,47'E	55° 01,20N	005° 52,12'E
929	14.07.02	2	12:30	13:00	55° 02,47'N	005° 53,69'E	55° 03,71N	005° 55,39'E
930	14.07.02	3	13:40	14:10	55° 05,21'N	005° 56,93'E	55° 06,37N	005° 58,12'E
931	14.07.02	4	14:45	15:15	55° 06,00'N	005° 58,73'E	55° 04,69N	005° 58,83'E
932	14.07.02	5	15:45	16:15	55° 03,34'N	005° 48,96'E	55° 02,10N	005° 58,02'E
933	14.07.02	6	16:40	17:10	55° 00,99'N	005° 50,21'E	54° 59,75N	005° 56,23'E
934	14.07.02	7	17:50	18:20	54° 58,39'N	005° 53,85'E	54° 57,90N	005° 51,50'E
935	15.07.02	8	01:10	01:40	55° 04,68'N	006° 49,53'E	55° 03,13N	006° 50,47'E
936	15.07.02	9	02:20	02:50	55° 00,79'N	006° 51,98'E	54° 59,24N	006° 52,36'E
937	15.07.02	10	03:25	02:50	54° 57,39'N	006° 52,38'E	54° 55,75N	006° 52,07'E
938	15.07.02	11	04:30	05:00	54° 53,93'N	006° 52,03'E	54° 52,32N	006° 51,79'E
939	15.07.02	12	05:30	06:01	54° 50,97'N	006° 51,32'E	54° 49,58N	006° 50,87'E
940	15.07.02	13	07:00	07:30	54° 49,81'N	006° 46,46'E	54° 51,37N	006° 45,29'E
941	15.07.02	14	08:12	08:45	54° 54,00'N	006° 43,71'E	54° 55,32N	006° 42,83'E
942	15.07.02	15	16:20	16:50	54° 29,85'N	007° 23,36'E	54° 29,73N	007° 20,79'E
943	15.07.02	16	17:30	18:10	54° 29,93'N	007° 21,75'E	54° 29,86N	007° 24,34'E

Figure 2: Working area of the 2<sup>nd</sup> cruise leg of AL 206 on the Doggerbank

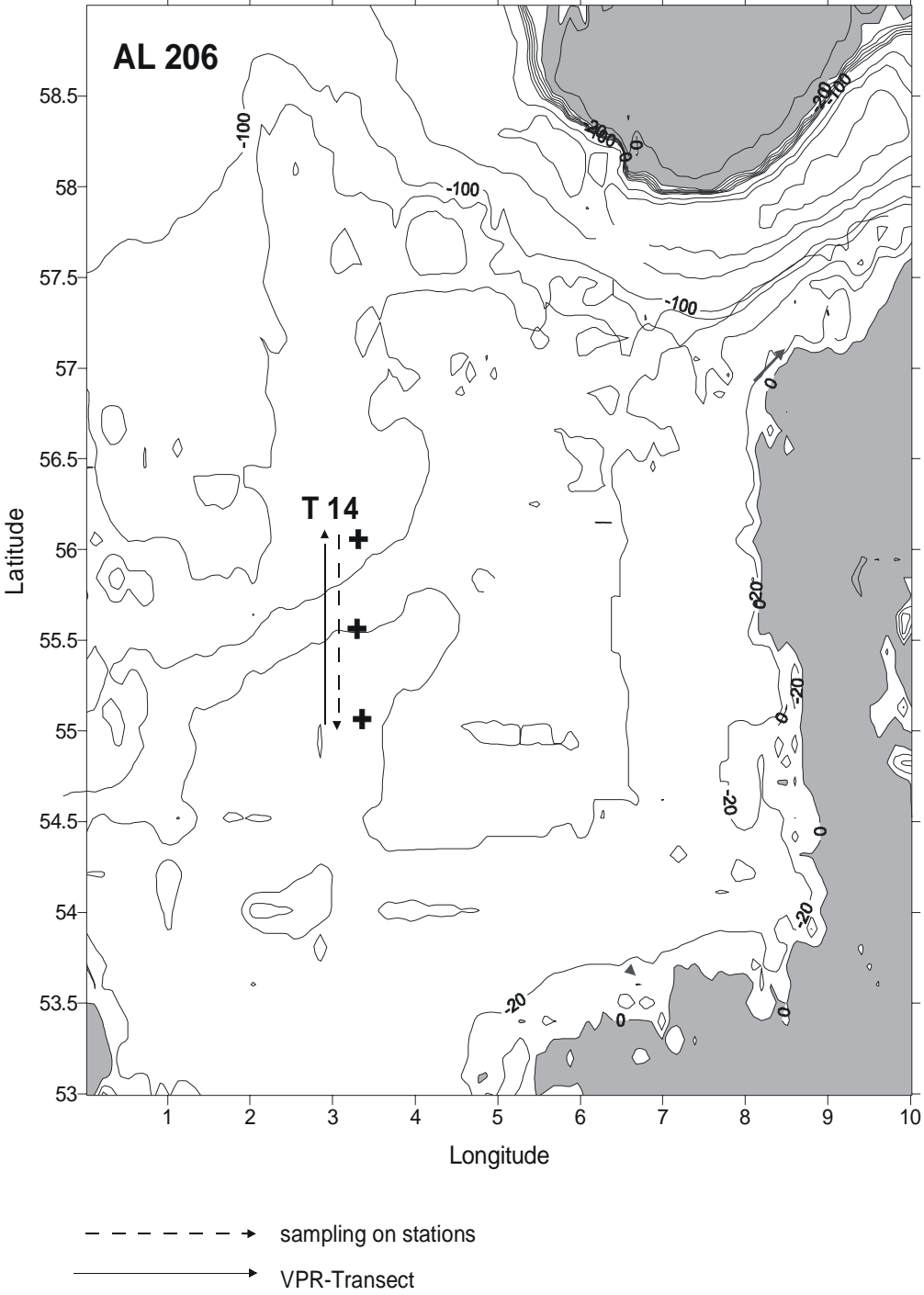


Figure 3: VPR Grid and dimensions (schematic) sampled at the Doggerbank. The triangles drawn with solid lines and broken lines refer to the "Large Double Triangle" and "Small Double Triangle" (compare Table 2).

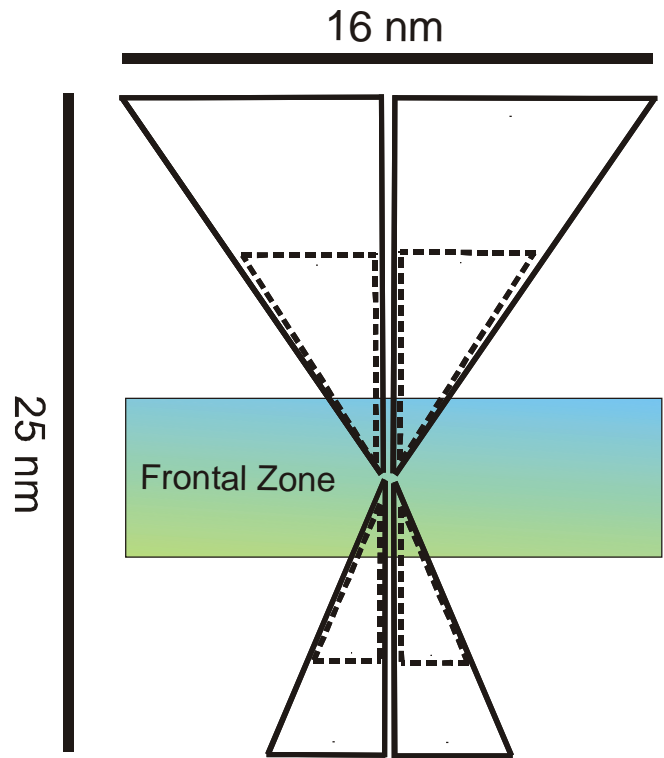


Figure 4: VPR Grid "Large Double Triangle" sampled at the Doggerbank. The red line refers to the transect plotted in Figures 5 - 6.

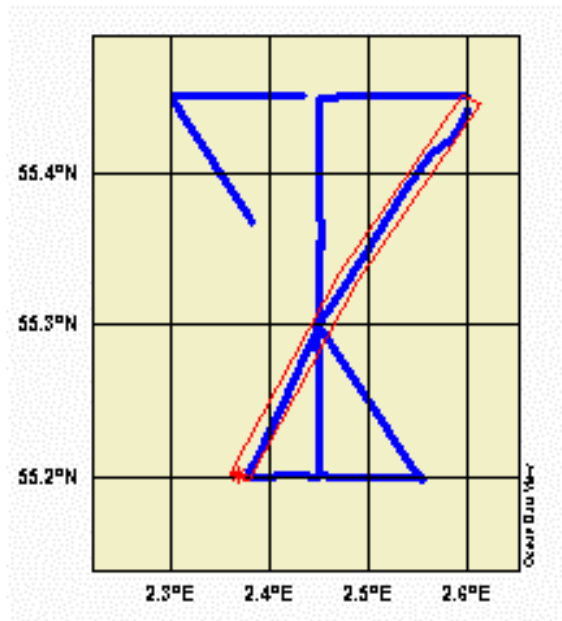


Figure 5: Temperature [°C] profile of the SW - NE diagonal transect of the VPR Grid "Large Double Triangle" sampled at the Doggerbank. The transect refers to the red line plotted in Figure 4. The centre position, i.e. the core frontal zone, was set at 55° 30' N.

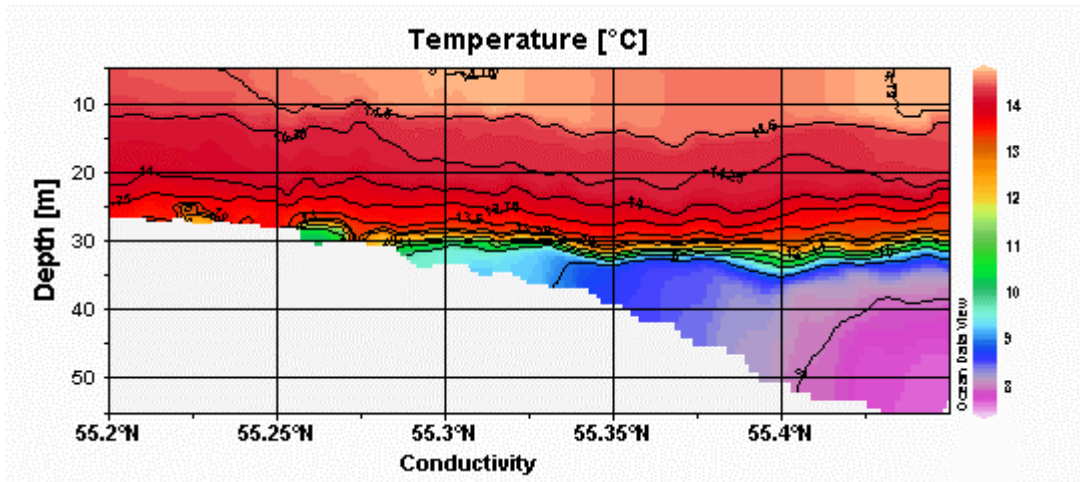


Figure 6: Fluorescence profile of the SW - NE diagonal transect of the VPR Grid "Large Double Triangle" sampled at the Doggerbank. The transect refers to the red line plotted in Figure 4.

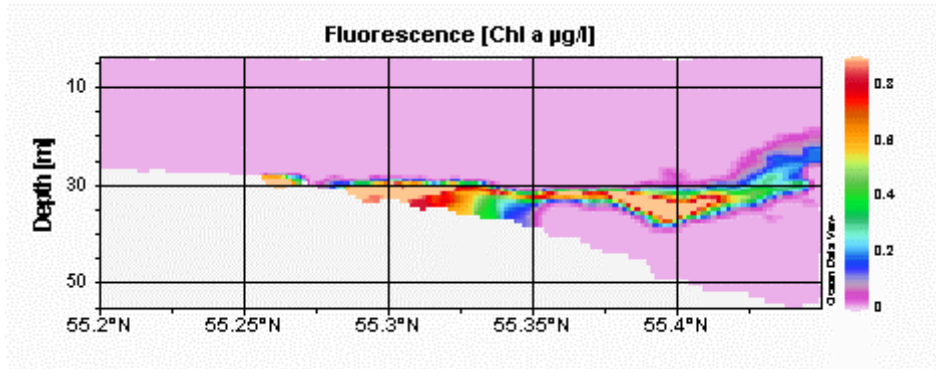


Figure 7: Optical backscatter profile of the SW - NE diagonal transect of the VPR Grid "Large Double Triangle" sampled at the Doggerbank. The transect refers to the red line plotted in Figure 4.

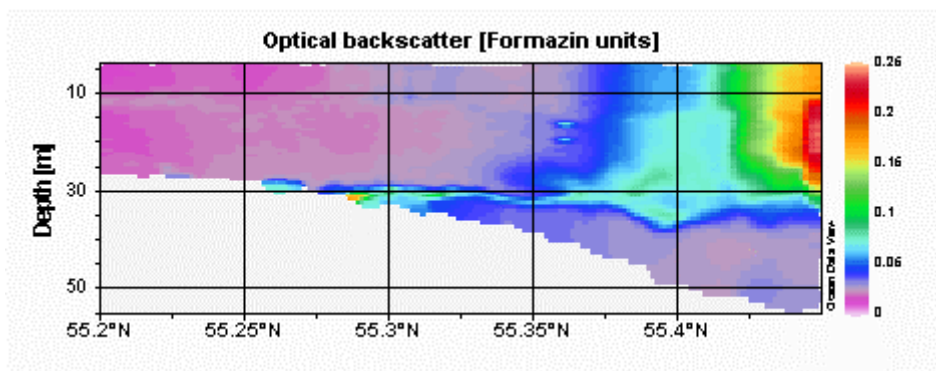


Figure 8: Temperature [°C] profile of the SW and central part of the VPR Grid "Large Double Triangle" sampled at the Doggerbank. The centre position, i.e. the core frontal zone, was set at 55.50° N.

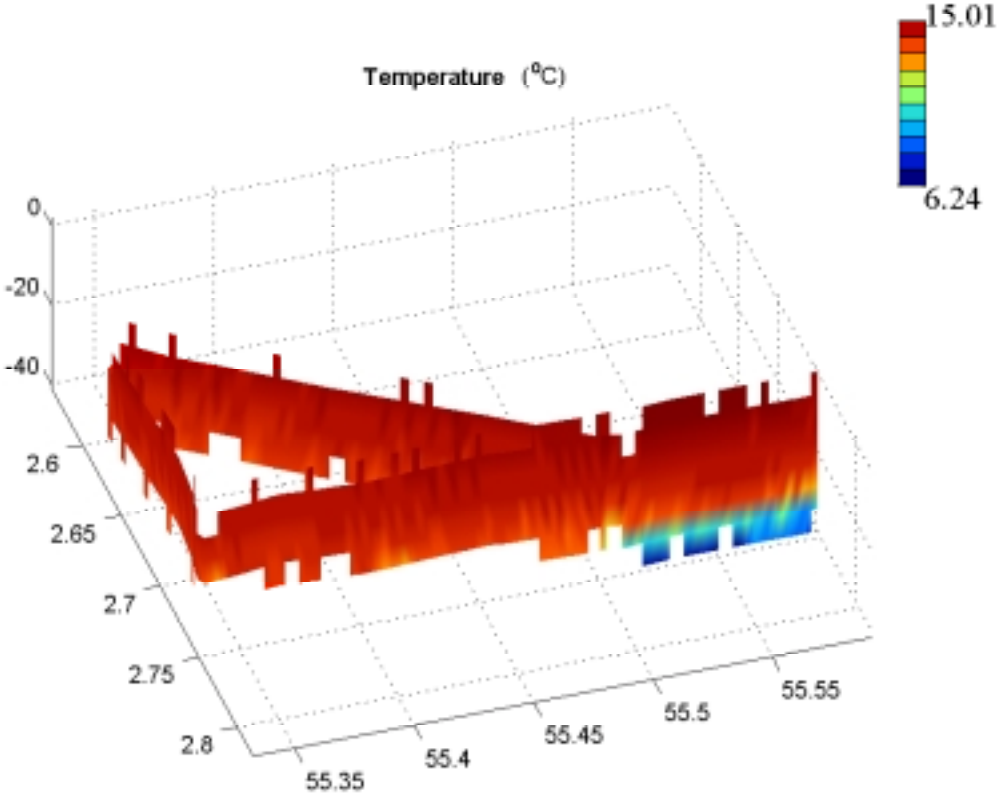


Figure 9: Density profile of the SW and central part of the VPR Grid "Large Double Triangle" sampled at the Doggerbank. The centre position, i.e. the core frontal zone, was set at 55.50° N.

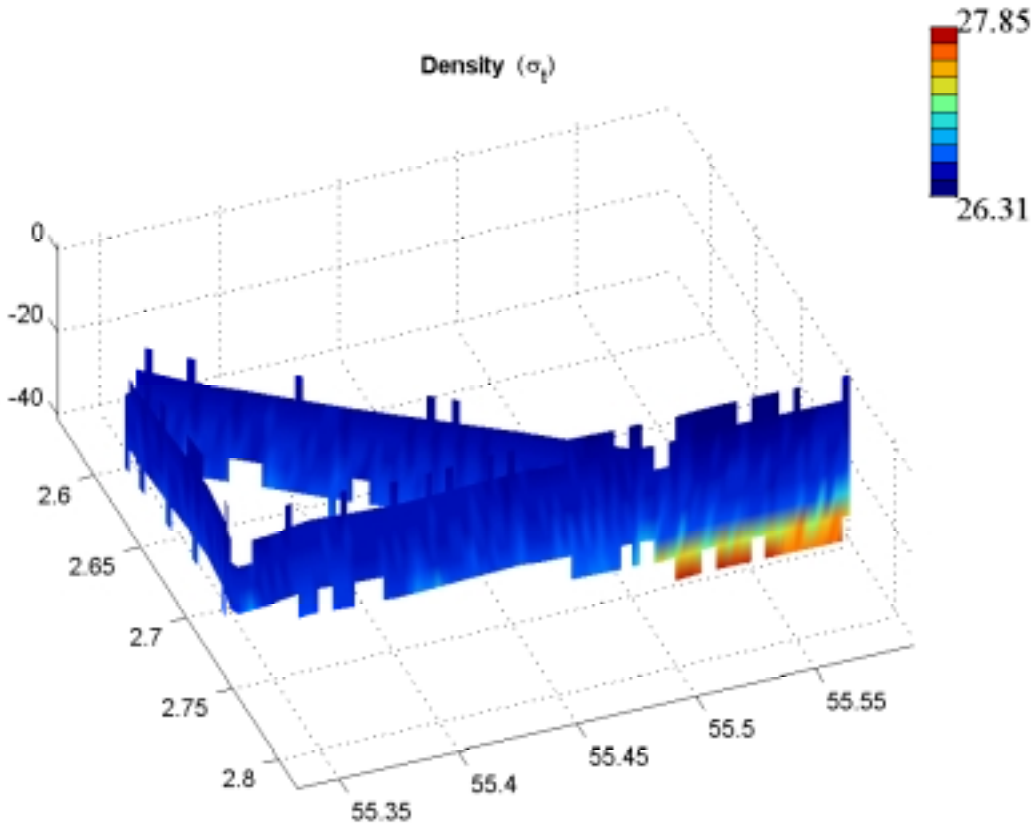


Figure 10: Salinity profile of the SW and central part of the VPR Grid "Large Double Triangle" sampled at the Doggerbank. The centre position, i.e. the core frontal zone, was set at 55.50° N.

