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Short Cruise Report

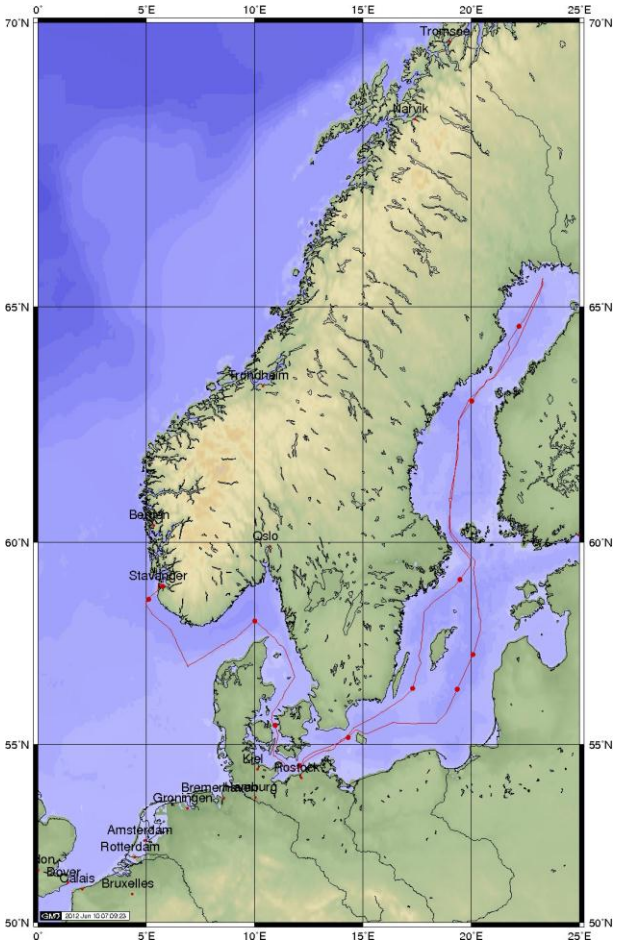
RV METEOR M87-3a

Stavanger, Norway – Rostock, Germany

29.05.2012 - 10.06.2012

Chief Scientist: PD Dr. Matthias Labrenz

Captain: Michael Schneider



Objectives

The Baltic Sea with its natural gradients and strong reactions to climate change and anthropogenic activity can be used in an ideal way to examine basic ecological processes and their variability in marine ecosystems. The most striking characteristics of the Baltic Sea are the extended gradients in primary (topography, energy, salinity) and secondary (organisms, matter flux, oxygen, nutrients, sediments) environmental properties as a result of different dynamical processes.

Leg M87/3a investigated the impact of salinity gradients on degradation of terrestrial dissolved organic matter (tDOC), microbially mediated processes, and on the structure and function of pelagic microbial communities in the Baltic Sea. Following aims were central to this study:

(1) Assessment of structure and (selected) functions of pelagic microbial communities (*Bacteria*, *Archaea*, Zooplankton) in order to examine whether salinity-related phylogenetic shifts in microbial communities imply relevant functional changes. It provides the general background for the more specific question of decomposition dynamics of imported terrigenous compounds.

(1a) Water sampling using the newly developed Automatic Fixation – Injection Sampler (AFIS). Traditional water-sampling procedures like Free-flow bottles or Pump-CTD influence the relative abundance of transcripts in microbial transcriptomes, resulting in biased conclusions regarding the relevance of different microbially driven biogeochemical cycles in the studied habitat. The AFIS-system conserves the original microbial expression profile of the environment and by this guarantees a proper assessment of microbial functions based on gene expression analyses. Leg M87/3a provided the opportunity to use it the first time throughout the whole horizontal and vertical Baltic salinity gradient with depths down to 430 m. These samples are the basis for the coming generation of non-biased in *situ* metabolic fingerprints for the different Baltic Sea environments.

(2) Quantification, chemical characterization and decomposition of discharged terrestrial DOC from Northern (arctic) soils in relation to microbial diversity. The aim is to assess the decomposition capacity for organic matter, particularly the degradation potential for introduced terrestrial carbon compounds, along the horizontal salinity gradient of the Baltic Sea. The overall aim of these studies is to gain a comprehensive understanding of the effect of imported terrigenous and autigenous organic material on microbial decomposition processes within the salinity and gradients of the Baltic Sea. In addition to first experiments during cruise M86-1, the influence of UV-C as well as flagellates on microbial decomposition of DOC was also investigated.

Narrative

To reach the above described goals, water, fixed water, zooplankton, as well as sediment samples were taken throughout a transect of 27 stations (Fig. 1), covering the whole Baltic salinity gradient.

In the morning of May 29th RV Meteor left Stavanger, Norway, towards the first working area. After 12 h transit busy with installing the scientific equipment and setting up the various biological, chemical, and geological laboratories we arrived the at first station in the western Skagerrak that focused on sampling the water column by the AFIS-CTD-Rosette and marking the start of the horizontal transect from the Skagerrak to the Bothnian Bay.

Continuous measurement of methane, carbon dioxide, and accordant isotopes in surface waters were started. Water samples of the horizontal salinity gradient were generally taken from up to 6 depths. From these samples data were generated on board or will be generated later in home labs concerning nucleic acid analyses (microbial diversity and function based), total cell numbers, biomass, gene probe analyses, nutrients, salinity, and temperature.

As important ATKiM-station („Abbaubarkeit von arktischem, terrigenem Kohlenstoff im Meer“ - decomposition of terrigeneous carbon compounds in the sea), we performed extensive sampling of the water column at the second station At1 in the central Skagerrak. Large-volume water samples were taken (Giant Water Sampler) representing the marine end-member-station to start shipboard biological experiments as schematically shown in Figure 2.

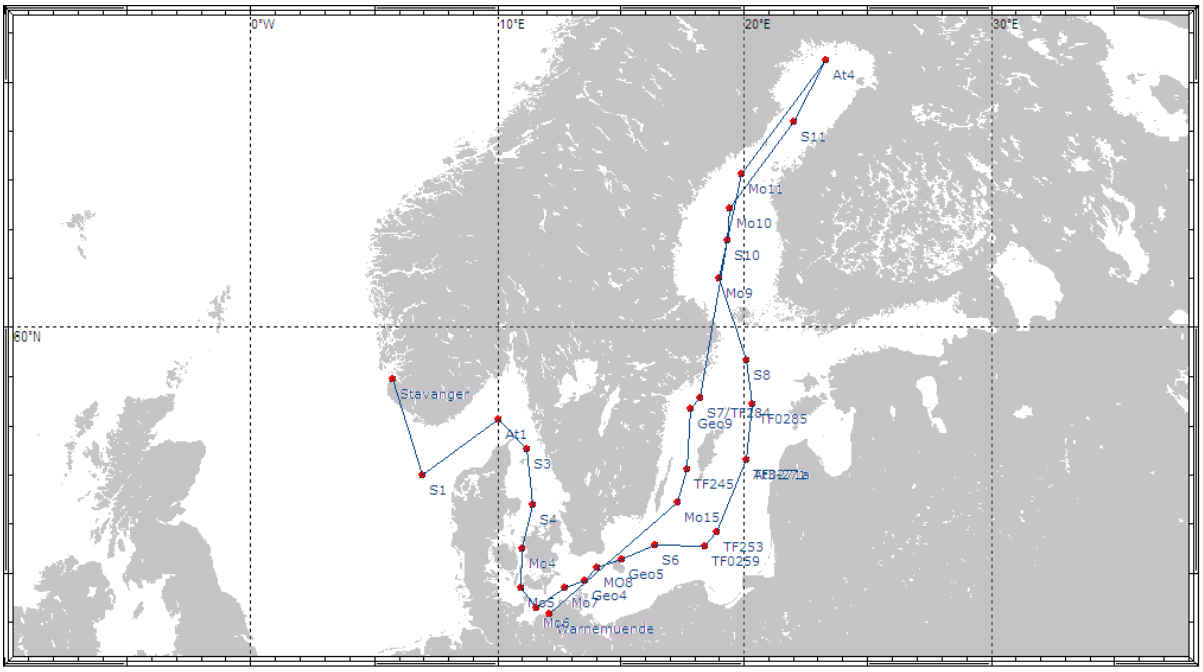


Figure 1. Track chart and stations of M87-3a (29.05.-10.06.2012).

In addition, MUC and CTD samples to study diversity changes of pelagic and benthic protistan communities, as well as zooplankton net samples to investigate zooplankton and fish communities were taken. In total, at 10 stations along the horizontal salinity gradient of the Baltic Sea MUC- and associated water samples were taken.

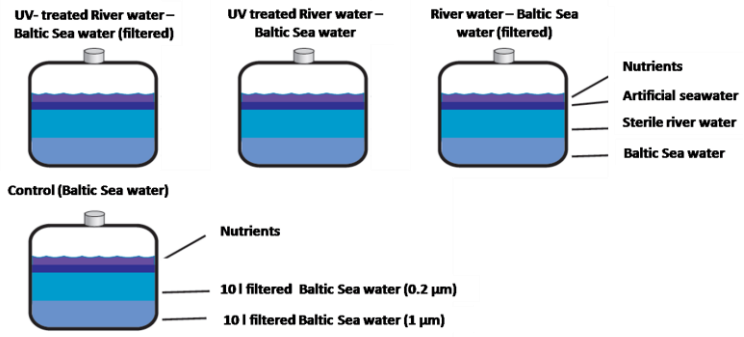


Figure 2. General experimental set up of the ATKiM-project. The stimulation experiments included a setup where the terrigenous dissolved organic carbon (tDOC) was treated with UV-C and flagellates excluded, a treatment with UV treated tDOC that included flagellates and a treatment where tDOC was untreated but flagellates were excluded. A set up where no tDOC was added served as control.

Station work (AFIS-CTD/Rosette, MUC, and zooplankton) continued under relatively stable weather conditions along the horizontal transect towards the Baltic proper, allowing sampling of 13 additional stations along the horizontal salinity gradient. At stormy conditions we arrived at the second ATKiM station At3/TF0271 at the Gotland Deep on June 2nd. Due to the

unfavourable weather conditions it took several hours to recover and re-deploy a mooring system in order to continue the time series established since 1995 by the Leibniz-Institute for Baltic Sea Research. Another mooring system was deployed and will be recovered during M87-4. From there, water column and surface sediment sampling continued on three stations to reach the northernmost ATKiM station At4 at 65°26.7' N / 23°17.9' E on June 5th. Finishing station work at At4 R/V METEOR slowly moved towards the river mouth of the Kalix/Torne allowing CO_2 and CH_4 concentration measurements at salinities around 1.5.

At the Landsort Deep station TF284, the AFIS-CTD system was successfully used at depths around 430 m. Thus, for the first time it could be demonstrated that this system is robust enough to sample the whole pelagic Baltic Sea. After 3 additional stations RV METEOR reached the harbour Rostock, Germany, where the experiments of the first leg of the cruise M87-3 practically ended on June 10th.

Acknowledgements
A major part of the scientific program of the cruise is embedded in the WGL-PAKT Project ATKiM funded by the German federal and regional governments. Funding comes also from grants from the German Research Funding Agency - DFG. We are grateful to the "DFG - Senatskommission für Ozeanographie" and the "Leitstelle Deutsche Forschungsschiffe" for making this cruise happen. We also acknowledge the permissions of Denmark, Sweden, Poland, and Latvia to conduct research in their territorial waters of the Baltic Sea. Finally, we thank Captain Michael Schneider and his crew for the overall success of the cruise M87-3a.

Participants

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17	Christoph	Humborg	Natural isotopes	BNI
18	Marc	Geibel	Natural isotopes	BNI
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20	Valeska	Borges	Zooplankton	DZMB
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22	Jana	Woelk	Microbiology	IOW
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Institutes

BNI
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Station list

Date	UTC Time	Station ME873/	Station M87/3a	Alias	Gear*	Latitude °N	Longitude °E	Water depth [m]	Comments
29.05.2012	22:30	763-1	1001-1	S1	CTD-AFIS	56° 59,97	6° 55,13	37,8	clean ship, eigene Winde
	23:27	763-1	1001-2	S1	CTD-AFIS	56° 59,97	6° 55,13	37,4	
	23:43	764-1		S1	PLA	56° 59,99	6° 55,06	38,3	clean ship, Bb-Kran, FüG 2-3kn
30.05.2012	10:49	765-1		At1	GWS	58° 7,99	10° 0,02	238,5	clean ship, Bordkran
	11:50	766-1	1-1	At1	CTD/RO	58° 8,00	10° 0,00	242,3	SL max=243m
	12:17	766-1	1-2	At1	CTD/RO	58° 8,00	10° 0,00	240,2	SL=241m
	12:47	767-1		At1	MUC	58° 8,00	10° 0,00	239,4	SL max=253m
	12:48	767-1		At1	MUC	58° 8,00	10° 0,00	240,6	SZ max=7,5kN
	13:11	768-1		At1	MUC	58° 8,00	10° 0,00	239,4	SL max=262m
	13:13	768-1		At1	MUC	58° 8,00	10° 0,00	239,9	SZ max=8,8kN
	13:29	769-1		At1	PLA	58° 7,99	9° 59,93	240,5	Bb-Kran, FüG=2kn
	18:49	770-1	2-2	S3	CTD/RO	57° 32,11	11° 10,80	38,5	SLmax=39m, jojo
	19:29	771-1	1002-1	S3	CTD-AFIS	57° 32,00	11° 10,99	37	eigene Winde
	19:32	771-1		S3	CTD-AFIS	57° 32,00	11° 10,99	36,8	Geräteprobleme
	19:39	771-1		S3	CTD-AFIS	57° 32,00	11° 10,99	37,7	
	19:54	772-1		S3	PLA	57° 31,99	11° 11,01	37,3	Bb-Kran
	20:47	773-1		S3	CTD-AFIS	57° 31,76	11° 11,35	38	eigene Winde, 500m neben der Position, Position durch Fischereifahrzeug blockiert
	21:08	773-1		S3	CTD-AFIS	57° 31,78	11° 11,35	37,4	
31.05.2012	04:13	774-1	3-1	S4	CTD/RO	56° 23,39	11° 26,27	13,9	SLmax = 16m
	04:32	775-1	1003-1	S4	CTD-AFIS	56° 23,39	11° 26,27	13,8	wiss. Winde, clean ship
	04:48	775-1		S4	CTD-AFIS	56° 23,39	11° 26,27	13,8	
	04:58	776-1		S4	PLA	56° 23,40	11° 26,22	14,3	Kran Bb-Seite
	10:58	777-1	1004-1	Mo4	CTD-AFIS	55° 30,00	10° 58,02	21,5	clean ship, eigene Winde
	11:21	777-1	1004-2	Mo4	CTD-AFIS	55° 30,00	10° 58,02	20,8	
	11:32	778-1		Mo4	PLA	55° 30,00	10° 58,01	20,6	Bb-Kran
	16:52	779-1	4-1	Mo5	CTD/RO	54° 42,01	10° 56,01	5,8	SLmax = 8m
	17:11	780-1	1005-1	Mo5	CTD-AFIS	54° 42,01	10° 55,99	6	
	17:28	780-1		Mo5	CTD-AFIS	54° 42,00	10° 55,99	5,7	
	17:35	781-1		Mo5	PLA	54° 42,00	10° 56,08	5,7	Bb-Kran, clean ship
	21:10	782-1	5-1	Mo6	CTD/RO	54° 17,00	11° 33,96	19,3	SLmax=21m
	21:26	783-1	1006-1	Mo6	CTD-AFIS	54° 17,00	11° 33,96	19,2	eigene Winde
	21:43	783-1		Mo6	CTD-AFIS	54° 17,00	11° 33,96	19,3	
	21:57	784-1		Mo6	MUC	54° 17,00	11° 33,96	19,1	SLmax=32m
	21:58	784-1		Mo6	MUC	54° 17,00	11° 33,96	19,3	SZmax=5,1kN
	22:07	785-1		Mo6	PLA	54° 17,08	11° 34,12	19,5	clean ship, Bb-Kran
01.06.2012	02:54	786-1	6-2	Mo7	CTD/RO	54° 41,99	12° 43,50	16	SLmax = 16m
	03:09	787-1	1007-1	Mo7	CTD-AFIS	54° 41,99	12° 43,50	16,1	clean ship. wiss. Winde
	03:22	787-1		Mo7	CTD-AFIS	54° 41,99	12° 43,50	16	
	03:41	788-1		Mo7	PLA	54° 41,95	12° 45,07	16,4	
	06:51	789-1	7-1	Geo4	CTD/RO	54° 50,33	13° 32,05	51,9	SLmax=42m
	07:11	790-1		Geo4	MUC	54° 50,33	13° 32,05	55,7	SLmax=56m
	07:11	790-1		Geo4	MUC	54° 50,33	13° 32,05	55,7	SZmax=5,7kN

	09:38	791-1	8-1	Mo8	CTD/RO	55° 6,00	14° 0,02	52	SLmax=43m
	09:56	792-1	1008-1	Mo8	CTD-AFIS	55° 6,00	14° 0,02	42,5	eigene Winde
	10:15	792-1		Mo8	CTD-AFIS	55° 6,00	14° 0,02	51,9	
	10:22	793-1		Mo8	PLA	55° 6,00	13° 59,98	50,8	clean ship, Bb-Kran, FüG 2-3kn
	14:59	794-1	9-2	Geo5	CTD/RO	55° 16,94	15° 2,82	65,8	SLmax = 67m
	15:22	795-1	1009-1	Geo5	CTD-AFIS	55° 16,94	15° 2,83	66,3	
	15:41	795-1		Geo5	CTD-AFIS	55° 16,94	15° 2,83	65,9	
	20:06	796-1	10-1	S6	CTD	55° 34,00	16° 22,06	70	SLmax=70m
	20:26	797-1		S6	PLA	55° 34,05	16° 21,71	73,3	Bb.-Kran
02.06.2012	03:27	798-1	11-1	TF0259	CTD/RO	55° 32,99	18° 24,00	89	SLmax = 83m+
	03:47	799-1	1010-1	TF0259	CTD-AFIS	55° 32,99	18° 24,00	86,9	clean ship. wiss. Winde
	04:09	799-1		TF0259	CTD-AFIS	55° 32,99	18° 24,00	89,3	
	04:15	800-1		TF0259	PLA	55° 33,00	18° 23,99	92,3	Bb-Kran, clean ship
	07:29	801-1	12-1	TF253	CTD	55° 50,40	18° 52,04	96,5	SLmax=92m
	07:55	802-1		TF253	MUC	55° 50,39	18° 52,00	95,1	SLmax=118m
	07:57	802-1		TF253	MUC	55° 50,40	18° 52,00	95,7	SZmax=13,6KN
	17:34	803-1		271	MOR	57° 18,99	20° 5,98	240,1	Gotl.2-2012-06
	18:44	804-1		At3-271	GWS	57° 18,34	20° 4,72	236,7	Kran
	18:44	804-1		At3-271	GWS	57° 18,34	20° 4,72	236,7	Hauptkran
	18:53	804-1		At3-271	GWS	57° 18,35	20° 4,71	264,3	
	19:31	805-1	13-1	At3-271	CTD/RO	57° 18,35	20° 4,70	246,5	SLmax=237m
	20:10	806-1	1011-1	At3-271	CTD-AFIS	57° 18,35	20° 4,70	246,6	eigene Winde
	20:55	806-1		At3-271	CTD-AFIS	57° 18,34	20° 4,70	236,6	
	22:55	807-1	13-2	At3-271	CTD/RO	57° 18,34	20° 4,70	250,2	SL max=235m
	23:38	808-1		At3-271	PLA	57° 18,34	20° 4,70	250,9	W4, clean ship
	23:53	808-1		At3-271	PLA	57° 18,35	20° 4,75	235,7	SL max=100m
03.06.2012	00:36	809-1		At3-271	PLA	57° 18,36	20° 4,85	238,7	W4, clean ship
	00:47	809-1		At3-271	PLA	57° 18,36	20° 4,91	238,8	SL max=100m
	09:07	810-1		At3-271	MOR	57° 19,19	20° 7,29	250,5	
	11:54	811-1		At3-271	MOR	57° 18,34	20° 4,70	244,4	
	18:22	812-1	14-1	TF0285	CTD/RO	58° 26,50	20° 20,01	122,6	SLmax=116m
	18:58	813-1	1012-1	TF0285	CTD-AFIS	58° 26,50	20° 20,01	123,1	eigene Winde
	19:27	813-1		TF0285	CTD-AFIS	58° 26,50	20° 20,01	122,4	
	19:45	814-1		TF0285	MUC	58° 26,50	20° 20,01	123	SLmax=137m
	19:46	814-1		TF0285	MUC	58° 26,50	20° 20,01	122,9	SZmax=6,2kN
	20:02	815-1		TF0285	PLA	58° 26,45	20° 19,98	123,7	Bb-Kran
04.06.2012	01:43	816-1	15-1	S8	CTD/RO	59° 21,50	20° 6,00	44,3	SL max=44m
	12:07	818-1	16-1	Mo9	CTD/RO	60° 59,99	19° 0,00	91,7	SL max=87m
	12:26	819-1	1013-1	Mo9	CTD-AFIS	60° 59,99	19° 0,00	91,7	eigene Winde, clean ship
	12:51	819-1		Mo9	CTD-AFIS	60° 59,99	19° 0,00	91,5	
	12:59	820-1		Mo9	PLA	60° 59,86	19° 0,19	93,7	Bb-Kran, clean ship, FüG=3,5kn
05.06.2012	00:45	821-1	17-1	Mo11	CTD/RO	63° 7,99	19° 53,99	115,7	SL max=111m
	01:03	822-1	1014-1	Mo11	CTD-AFIS	63° 7,99	19° 53,99	115,6	clean ship, eigene Winde
	01:25	822-1		Mo11	CTD-AFIS	63° 7,99	19° 53,99	115,4	
	01:30	823-1		Mo11	PLA	63° 8,03	19° 54,07	115,2	clean ship, Bb-Kran, FüG=3,5kn
	16:46	824-1		At4	GWS	65° 26,71	23° 17,94	81,7	zum Spülen, Clean Ship

	16:58	824-1		At4	GWS	65° 26,71	23° 17,91	84,7	zur Probenahme
	17:19	825-1	18-1	At4	CTD/RO	65° 26,71	23° 17,91	84,6	SLmax = 79m
	17:45	826-1	1015-1	At4	CTD-AFIS	65° 26,71	23° 17,91	84,9	mobile Winde
	18:10	826-1		At4	CTD-AFIS	65° 26,71	23° 17,91	84,6	
	18:17	827-1		At4	PLA	65° 26,71	23° 17,90	85,1	Bb-Kran
06.06.2012	03:17	828-1	19-1	S11	CTD/RO	64° 12,20	22° 1,68	123,7	SLmax = 110m
	03:37	829-1	1016-1	S11	CTD-AFIS	64° 12,20	22° 1,68	117,3	eigene Winde, clean ship
	03:59	829-1		S11	CTD-AFIS	64° 12,20	22° 1,68	117,7	
	04:13	830-1		S11	MUC	64° 12,20	22° 1,68	123,6	SLmax = 131m, SZmax = 5,6KN
	04:26	831-1		S11	PLA	64° 12,20	22° 1,63	120,3	
	16:12	832-1	20-1	Mo10	CTD/RO	62° 25,00	19° 25,00	90,7	SLmax = 91m
	16:32	833-1	1017-1	Mo10	CTD-AFIS	62° 25,00	19° 25,00	91	clean ship
	17:00	833-1		Mo10	CTD-AFIS	62° 25,00	19° 25,00	91,3	
	17:14	834-1		Mo10	MUC	62° 25,00	19° 25,00	90,7	SLmax = 108m, SZmax = 5,3KN
	17:23	835-1		Mo10	PLA	62° 25,00	19° 25,00	93	clean ship, Bb-Kran
	21:18	836-1	21-1	S10	CTD	61° 46,98	19° 17,60	54,1	SLmax=56m
07.06.2012	16:52	837-1	22-1	TF284[§]	CTD/RO	58° 35,01	18° 14,01	457,5	SLmax = 431m
	18:12	838-1	22-1	TF284	CTD/RO	58° 35,02	18° 14,01	456,5	SLmax=129m
	18:28	839-1		TF284	PLA	58° 35,00	18° 13,97	437	Bb-Kran
	19:14	840-1	1018-1	TF284	CTD-AFIS	58° 35,00	18° 14,03	457,1	W3
	19:41	840-1		TF284	CTD-AFIS	58° 35,01	18° 14,03	455,6	SLmax=438m
	19:56	840-1		TF284	CTD-AFIS	58° 35,01	18° 14,03	455,5	
	20:48	841-1	1018-2	TF284	CTD-AFIS	58° 35,01	18° 14,03	455,9	W3
	21:09	841-1		TF284	CTD-AFIS	58° 35,01	18° 14,03	455,2	SLmax=438m
	21:21	841-1		TF284	CTD-AFIS	58° 35,01	18° 14,03	455,6	
	23:22	842-1	23-1	Geo9	CTD/RO	58° 21,86	17° 50,06	115,1	SL max=105m
	23:48	843-1		Geo9	MUC	58° 21,86	17° 50,06	114,7	SL max=123m
	23:49	843-1		Geo9	MUC	58° 21,86	17° 50,06	114,8	SZ max=6,9kN
08.06.2012	06:42	844-1	24-1	TF245	CTD/RO	57° 7,01	17° 39,99	109,3	SLmax=106m
	07:10	845-1	1019-1	TF245	CTD-AFIS	57° 7,01	17° 39,98	109,8	W3
	07:23	845-1		TF245	CTD-AFIS	57° 7,01	17° 39,98	109,9	SLmax=105m
	07:39	845-1		TF245	CTD-AFIS	57° 7,01	17° 39,98	110,6	
	07:47	846-1		TF245	PLA	57° 6,89	17° 40,16	115,3	Bb.-Kran
	11:53	847-1	1020-1	Mo15	CTD-AFIS	56° 27,01	17° 17,06	48,4	W3
	12:05	847-1		Mo15	CTD-AFIS	56° 27,01	17° 17,00	49,5	SL max=51m
	12:13	847-1		Mo15	CTD-AFIS	56° 27,00	17° 17,00	49,9	
	12:36	848-1	25-1	Mo15	CTD/RO	56° 27,00	17° 17,00	49,8	SL max=52m
	12:54	849-1		Mo15	MUC	56° 27,00	17° 17,00	49,8	SL max=67m
	12:54	849-1		Mo15	MUC	56° 27,00	17° 17,00	49,8	SZ max=5,2kN
	13:03	850-1		Mo15	PLA	56° 27,00	17° 17,01	49,6	Bb-Kran, clean ship, FüG=3,0kn

*CTD-AFIS, CTD-AFIS water sampler; CTD/RO, CTD/rosette water sampler; GWS, Giant water sampler; MOR, Mooring; MUC, Multi corer; PLA, Plankton net
[§]TF284, S7/TF284