



07.11.2006

**Cruise Report
Cruise 291 FRS 'Walther Herwig III'
22.08. - 08.09.2006**

**Integrated Monitoring of Biological Effects of Contaminants,
Fish Diseases and Chemical Pollutants
in the North Sea and the Baltic Sea**

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1 Abstract

As part of the regular activities of the Institute of Fishery Ecology of the Federal Research Centre for Fisheries, an integrated monitoring programme on contaminants, biological effects of contaminants and diseases in marine fish species, studies were conducted in 9 North Sea and 4 Baltic Sea areas. In addition to the examination of North Sea dab (*Limanda limanda*), Baltic cod (*Gadus morhua*) and Baltic flounder (*Platichthys flesus*) for macroscopically visible external and internal diseases and parasites, numerous samples were taken for studies on histopathological alterations in liver and spleen, contaminant-induced changes in enzyme activities (EROD), inorganic and organic contaminants and their metabolites (trace metals, organochlorines, PAH metabolites), age composition, condition factors, and organosomatic indices. In addition, hydrographical measurements were carried out (water temperature, salinity, oxygen content). Fish samples were frozen for the detection of radioactive substances and for measurements of contaminants in the framework of the OSPAR JAMP/CEMP and HELCOM /Combine monitoring programmes and research programmes.

The results of the examination of dab for macroscopic lesions largely confirmed with only few exceptions last year's findings. The prevalence of lymphocystis in dab from the North Sea and Baltic Sea has slightly increased. and the prevalence of liver tumours in North Sea dab has significantly increased compared to last years. The prevalence of hyperpigmentation remained still on an elevated level for the North Sea with the exception of the German Bight showing decreasing rates.

The prevalences of acute skin ulcerations in Baltic Sea cod varied depending on the investigation area between 0.0 % and 11.0 % and were thus comparable to the previous year. More results will be available after subsequent lab analyses of samples.

2 Objectives of the Cruise

1. Studies on biological effects of contaminants in fish
2. Studies on the occurrence of fish diseases and parasites
3. Sampling of fish for chemical analysis of radioactive substances, trace metals and organic contaminants
4. Hydrographical measurements (salinity, temperature, oxygen)
5. Sampling of livers and other organs of fish for subsequent histological and biochemical studies at 27 stations (see Table 1b).

3 Dates of the Cruise

FRS 'Walther Herwig III' left Bremerhaven on 23.08.06. Station work was started at noon in area GB1 in the German Bight and continued in 8 other North Sea areas until 02.09.06. On Sunday 03.09. FRS 'Walther Herwig III' crossed the Kiel Channel, and work was continued in the Baltic Sea in four areas, starting on 04.09. in area B12 (Meckenburg Bight). Having finished the programme in the Kiel Bight, FRS 'Walther Herwig III' returned to the North Sea and, according to plan, the cruise ended in the morning of 08.09.2006 in Bremerhaven.

The location of the sampling areas and the cruise track as well as the cruise dates are shown in Figure 1, and Table 1a and 1b respectively. The scientific programme was interrupted by a short stay in Aberdeen to pick up a hydrographic device at Fisheries Research Services (FRS Aberdeen), which had been lost by FRS 'Walther Herwig III' in February 2005 and found by a Scottish fisherman.

In the 13 sampling areas (Fig. 1), a total of 53 fishing hauls was performed (towing time 1 h) (see Table 1a). In the North Sea, the GOV was used, in the Baltic Sea a 140 ft bottom trawl with rock hoppers. Hydrographical measurements were conducted at 27 stations (coordinates see Tab. 1b, results in Tab. 2).

4 Preliminary Results

4.1 Dab (*Limanda limanda*)

In total, 6,573 dab were examined for the occurrence of externally visible diseases and parasites and 964 dab for the occurrence of macroscopic liver anomalies. Results are given in Table 4 and 5. Compared to the summer cruise in 2005, in some of the North Sea areas a slight increase of the prevalence of lymphocystis in dab could be observed with values of 1.7 % in area GB 1 (German Bight) up to 21.8 % in area P02 (Ekofisk Oil Field). Also for liver nodules > 2 mm diameter rates increased: for dab \geq 25 cm total length between 7.3% (area N06, outer Firth of Forth) and 30.8% (N22, Sole Pit Gas Field) were determined; for the German Bight (area JMP/N01) the prevalence of 26.6 % was also significantly higher as in the previous year (9%).

The prevalence of acute stages of skin ulcerations was slightly increased compared to 2005, while the rest of the diseases/parasitoses recorded were similarly prevalent compared to previous years.

Prevalences of skin hyperpigmentation (increased aggregation of green to black pigment spots) were still on a high level with values between 4.5% (area P02) and 52.1% (area N06). However, in the German Bight a decrease was observed down to 17.2% for area JMP/N01. The prevalence rates of other investigated fish diseases remained on a relatively low and constant level.

In the Baltic Sea areas B01 and B12, prevalences of all diseases except lymphocystis were on a comparable lower level.

A variety of samples were taken for subsequent chemical analysis of contaminants as well as for biological effects measurements. More comprehensive results will be available after all samples obtained have been processed.

4.2 Cod (*Gadus morhua*)

1,263 cod from the Baltic Sea were examined for the occurrence of externally visible diseases and parasites (see Table 6). For the North Sea, only in area P01 a sufficient number of cod had been caught to be able to perform these investigations (see Tab. 5). The prevalences of acute/healing skin ulcerations were in the range of 0.0 % (area B01) to 11.9 % (area B12), and were thus for Baltic cod comparable to 2005.

4.3 Flounder (*Platichthys flesus*)

380 Baltic flounders were examined for externally visible diseases (Tab. 7). The prevalence of lymphocystis showed rates in the normally observed range from 0% (area B01) to 30.9% (area B11); acute/healing stages of skin ulcerations were found between 0% (areas B01, B12) and 3.7% (area B11). Prevalence of *Cryptocotyle* sp. was high in all areas.

5 Hazardous substances

For subsequent analysis of hazardous substances (chlorinated organic pollutants, heavy metals and radionuclides) in the land-based laboratories, samples were immediately frozen (metal analysis) or dissected on board to get (sub-)samples of mainly liver and fillet after the biological data had been recorded. For the institute's programme, 190 samples were taken from 12 areas for analysis of organic substances (all dab samples = 84% dissected on board) and 165 samples from 11 areas for trace metal analysis, including the German core areas investigated in the framework of the international monitoring programmes of OSPAR and HELCOM for hazardous substances in biota from open sea areas. In addition, samples were taken for research projects (i) of the Federal Environmental Agency (UBA, Berlin), 175 dab from 7 areas, dissected: liver, fillet and gastrointestinal tract, otoliths, (ii) the Agency for Consumer Protection and Food Safety of Lower Saxony (LAVES, Cuxhaven) 12 pooled samples from 9 areas, and (iii) Federal Institute for Materials Research and Testing (BAM, Berlin) a large pooled sample for preparation of reference material. For the determination of radionuclides, 29 pooled samples from 11 areas were taken.

6 Miscellaneous

The mean catch data of the most frequent fish species are provided in Table 2; Table 3 gives results of the hydrographic measurements.

7 Scientific participants

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8 Acknowledgements

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(Chief Scientist)

Annex: 7 Tables and 2 Figures

Fig. 1: 291. Cruise FRS „Walther Herwig III“, 22.08.- 08.09.2006:
Location of sampling areas and cruise track



Tab. 1a: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Geographical coordinates of trawling sites (trawl at bottom)

DATE	STATION	AREA	ICES-RECTANGLE	LATITUDE	LONGITUDE
NORTH SEA					
23.08.06	001	GB1	37F7	54°04,44N	07°52,51E
23.08.06	002	GB1	37F7	54°06,88N	07°46,29E
23.08.06	003	GB1	37F7	54°04,83N	07°51,47E
24.08.06	004	GB3	38F6	54°58,66N	06°22,25E
24.08.06	005	GB3	38F6	54°57,84N	06°18,75E
24.08.06	006	GB3	38F6	54°58,68N	06°21,08E
24.08.06	007	GB3	38F6	54°56,56N	06°16,70E
25.08.06	008	N11	40F7	55°32,00N	07°08,95E
25.08.06	009	N11	40F7	55°35,02N	07°08,31E
25.08.06	010	N11	40F7	55°32,70N	07°07,86E
25.08.06	011	N11	40F7	55°38,87N	07°01,74E
26.08.06	012	P01	39F5	55°22,24N	05°08,00E
26.08.06	013	P01	39F5	55°26,40N	05°13,98E
26.08.06	014	P01	40F5	55°35,34N	05°04,11E
26.08.06	015	P01	39F4	55°29,67N	04°59,32E

DATE	STATION	AREA	ICES-RECTANGLE	LATITUDE	LONGITUDE
NORTH SEA					
26.08.06	016	P01	40F5	55°31,32N	05°06,12E
27.08.06	017	P02	41F3	56°25,07N	03°08,41E
27.08.06	018	P02	41F3	56°27,69N	03°24,58E
27.08.06	019	P02	42F3	56°40,42N	03°12,06E
29.08.06	020	N06	41E7	56°23,42N	02°08,85W
29.08.06	021	N06	41E7	56°24,25N	02°00,02W
29.08.06	022	N06	41E7	56°20,01N	02°00,26W
29.08.06	023	N06	41E7	56°17,28N	02°03,84W
30.08.06	024	N22	36F1	53°43,49N	01°38,92E
30.08.06	025	N22	36F1	53°41,89N	01°38,38E
30.08.06	026	N22	36F1	53°41,92N	01°39,22E
30.08.06	027	N22	36F1	53°38,64N	01°44,29E
30.08.06	028	N22	36F1	53°39,70N	01°44,60E
31.08.06	029	N04	38F2	54°46,32N	02°02,32E
31.08.06	030	N04	38F2	54°40,91N	02°10,09E
31.08.06	031	N04	38F2	54°34,40N	02°13,63E
31.08.06	032	N04	37F2	54°27,13N	02°09,95E
01.09.06	033	JMP/N01	37F7	54°24,63N	07°01,96E
01.09.06	034	JMP/N01	37F7	54°22,18N	07°03,23E
01.09.06	035	JMP/N01	37F7	54°17,61N	07°06,08E
01.09.06	036	JMP/N01	37F7	54°19,22N	07°14,86E
02.09.06	037	JMP/N01	37F7	54°21,17N	07°29,63E
02.09.06	038	JMP/N01	37F7	54°19,52N	07°30,34E
02.09.06	039	JMP/N01	37F7	54°19,36N	07°27,49E
BALTIC SEA					
04.09.06	040	B12	37G1	54°26,88N	11°22,46E
04.09.06	041	B12	37G1	54°26,06N	11°23,56E
04.09.06	042	B12	37G1	54°17,53N	11°34,87E
04.09.06	043	B12	37G1	54°15,06N	11°39,51E
04.09.06	044	B12	37G1	54°13,65N	11°39,13E
05.09.06	045	BMP	38G4	54°56,75N	14°13,93E
05.09.06	046	BMP	38G4	54°50,63N	14°02,26E
06.09.06	047	B11	38G3	54°41,80N	13°49,06E
06.09.06	048	B11	38G3	54°50,24N	13°59,98E
06.09.06	049	B11	38G3	54°49,24N	13°53,84E
06.09.06	050	B11	38G3	54°45,93N	13°28,34E
07.09.06	051	B01	38G0	54°41,94N	10°18,43E
07.09.06	052	B01	38G0	54°32,15N	10°37,57E
07.09.06	053	B01	38G0	54°32,84N	10°45,47E

Tab. 1b: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Geographical coordinates of hydrography stations

DATE	STATION	AREA	ICES-RECTANGLE	LATITUDE	LONGITUDE
NORTH SEA					
23.08.06	001	GB1	37F7	54°06,70N	07°45,48E
23.08.06	002	GB1	37F7	54°04,98N	07°51,55E
24.08.06	003	GB3	39F6	55°01,92N	06°18,80E
24.08.06	004	GB3	38F6	54°58,68N	06°23,22E
25.08.06	005	N11	40F7	55°30,08N	07°08,25E
25.08.06	006	N11	40F7	55°35,32N	07°05,31E
26.08.06	007	P01	40F5	55°30,22N	05°11,16E
26.08.06	008	P01	39F5	55°27,74N	05°04,36E
27.08.06	009	P02	41F3	56°29,31N	03°09,18E
27.08.06	010	P02	42F3	56°36,44N	03°13,38E
29.08.06	011	N06	41E7	56°20,31N	02°02,05W
29.08.06	012	N06	41E8	56°17,63N	01°56,17W
30.08.06	013	N22	36F1	53°37,02N	01°41,28E
30.08.06	014	N22	36F1	53°41,86N	01°39,39E
31.08.06	015	N04	38F2	54°38,34N	02°17,43E
31.08.06	016	N04	37F2	54°27,02N	02°17,62E
01.09.06	017	JMP/N01	37F7	54°24,15N	07°09,29E
01.09.06	018	JMP/N01	37F7	54°22,54N	07°19,95E
02.09.06	019	JMP/N01	37F7	54°23,58N	07°36,02E
02.09.06	020	JMP/N01	37F7	54°16,35N	07°30,08E
BALTIC SEA					
04.09.06	021	B12	37G1	54°21,84N	11°26,01E
04.09.06	022	B12	37G1	54°13,68N	11°46,99E
05.09.06	023	BMP	38G4	54°46,69N	14°00,90E
06.09.06	024	B11	38G3	54°49,06N	13°52,38E
06.09.06	025	B11	38G3	54°46,15N	13°21,03E
07.09.06	026	B01	37G0	54°01,08N	10°25,97E
07.09.06	027	B01	38G0	54°31,94N	10°37,59E

Tab. 2: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Results of hydrographic measurements (T: water temperatur, S: salinity)

Date	Station	Area	Depth (m)	T (°C)	S (PSU)	O ₂ -Saturation
NORTH SEA						
23.08.2006	001	GB1	3	18.734	32.665	101.832
23.08.2006	001		36	18.198	32.796	78.509
23.08.2006	002		2	19.186	32.331	104.368
23.08.2006	002		37	18.563	32.715	89.687
24.08.2006	003	GB3	5	17.789	34.372	95.870
24.08.2006	003		41	13.381	34.680	76.058
24.08.2006	004		5	17.791	34.329	96.905
24.08.2006	004		40	14.045	34.623	72.167
25.08.2006	005	N11	5	18.610	32.414	98.586
25.08.2006	005		25	13.455	33.881	50.846
25.08.2006	006		3	19.041	32.482	99.156
25.08.2006	006		27	13.092	34.047	52.999
26.08.2006	007	P01	7	18.509	34.410	97.905
26.08.2006	007		38	9.103	34.839	83.800
26.08.2006	008		4	18.867	34.612	98.372
26.08.2006	008		40	9.244	34.839	83.404
27.08.2006	009	P02	3	17.888	35.136	95.602
27.08.2006	009		67	6.523	35.083	80.036
27.08.2006	010		2	17.772	35.056	96.235
27.08.2006	010		64	6.514	35.089	74.936
29.08.2006	011	N06	6	13.124	34.747	93.488
29.08.2006	011		50	12.234	34.737	86.412
29.08.2006	012		4	13.642	34.751	97.508
29.08.2006	012		44	12.593	34.762	88.994
30.08.2006	013	N22	5	15.740	34.701	95.447
30.08.2006	013		26	15.738	34.701	95.887
30.08.2006	014		7	15.168	34.566	96.947
30.08.2006	014		22	15.090	34.570	97.102
31.08.2006	015	N04	3	17.309	34.803	87.383
31.08.2006	015		21	17.310	34.804	94.230
31.08.2006	016		4	17.269	34.794	94.384
31.08.2006	016		13	17.261	34.794	94.798
01.09.2006	017	JMP/N01	3	17.770	32.926	85.689
01.09.2006	017		34	17.543	33.040	68.466
01.09.2006	018		4	17.625	32.888	83.795
01.09.2006	018		29	17.629	32.889	83.896
02.09.2006	019	JMP/N01	4	17.830	32.566	89.984
02.09.2006	019		23	17.737	32.677	87.946
02.09.2006	020		3	18.185	32.617	89.765
02.09.2006	020		37	18.059	32.649	86.883

Date	Station	Area	Depth (m)	T (°C)	S (PSU)	O ₂ -Saturation
BALTIC SEA						
04.09.2006	021	B12	2	17.750	16.994	94.145
04.09.2006	021		18	16.428	20.408	77.996
04.09.2006	022		4	17.645	15.698	93.825
04.09.2006	022		19	16.871	18.483	82.081
05.09.2006	023	BMP	2	17.435	7.966	89.342
05.09.2006	023		34	16.031	10.882	81.453
06.09.2006	024	B11	7	16.140	7.681	94.415
06.09.2006	024		38	14.816	12.612	85.974
06.09.2006	025		3	16.571	7.621	97.021
06.09.2006	025		36	16.890	15.014	71.721
07.09.2006	026	B01	3	17.445	17.468	95.024
07.09.2006	026		25	14.403	25.738	38.537
07.09.2006	027		2	17.396	15.959	92.979
07.09.2006	027		16	16.087	23.277	88.624

Tab. 3: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Mean catches of selected abundant fish species
(n = number, kg = weight per 1 h trawling)

AREA	Cod	Whiting	Haddock	Herring	Sprat	Mackerel	Dab	Plaice	Flounder	
NORTH SEA										
GB1	n	1	4793	-	175	44	1	482	29	21
	kg	< 0,5	108	-	1	< 0,5	< 0,5	19	5	68
GB3	n	3	628	-	8423	16071	29	408	22	1
	kg	1	29	-	126	228	7	49	4	1
N11	n	< 0,5	8	-	< 0,5	-	420	629	14	-
	kg	< 0,5	< 0,5	-	< 0,5	-	65	68	3	-
P01	n	17	52	6	15198	10548	3	433	10	-
	kg	35	3	< 0,5	762	175	< 0,5	42	2	-
P02	n	3	24	7	2	-	29	949	4	-
	kg	1	2	32	< 0,5	-	4	70	2	-
N06	n	7	717	3626	24	-	678	561	3	-
	kg	1	46	375	3	-	225	43	1	-
N22	n	< 0,5	10	-	1	54	144	347	3	-
	kg	< 0,5	1	-	< 0,5	1	30	29	1	-
N04	n	4	8	-	< 0,5	78	510	708	9	-
	kg	1	1	-	< 0,5	1	66	61	3	-
JMP/ N01	n	18	400	-	20571	44690	1029	538	17	-
	kg	1	10	-	244	535	177	33	3	-
BALTIC SEA										
B12	n	78	57	< 0,5	36	564	1	250	< 0,5	1
	kg	168	3	< 0,5	1	8	< 0,5	30	< 0,5	< 0,5
BMP	n	308	69	< 0,5	50	86	< 0,5	-	87	188
	kg	166	15	< 0,5	3	1	< 0,5	-	29	82

AREA	Cod	Whiting	Haddock	Herring	Sprat	Mackerel	Dab	Plaice	Flounder	
B11	n	158	117	-	213	656	7	2	82	274
	kg	59	13	-	13	10	3	1	23	83
B01	n	4	71	-	109	197	1	851	3	3
	kg	6	3	-	4	4	1	158	1	2

Tab. 4: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Prevalences (%) of externally visible diseases and parasites of dab (*Limanda limanda*) in the North Sea and Baltic Sea

AREA	N exam.	Ly	Ep Hyp/Pap	Ulc Ak/Hei	Flo Ak/Hei	KieHy	Skel Def	Hyp Pig	Steph	Acanth	Lepe
NORTH SEA											
GB1	526	1,7	2,5	1,9	0,2	0,0	0,2	5,7	7,4	0,8	7,2
GB3	545	7,3	5,0	2,8	1,1	0,0	0,2	15,6	36,9	2,8	22,4
N11	686	4,5	2,3	7,9	1,5	0,1	1,2	28,7	16,3	3,9	12,4
P01	680	19,4	2,8	16,6	0,9	1,5	0,9	10,0	85,3	7,2	6,2
P02	554	21,8	3,6	0,7	0,7	0,4	0,2	4,5	99,8	4,0	0,4
N06	610	19,8	6,4	9,0	0,8	2,1	0,5	52,1	73,9	5,7	2,0
N22	768	6,1	3,6	3,9	1,2	0,4	2,6	26,4	7,6	6,0	9,6
N04	633	5,7	2,4	5,2	0,8	0,0	1,1	28,9	30,5	5,7	19,6
JMP	916	2,7	2,3	3,6	0,4	0,0	0,3	17,2	5,9	4,5	11,6
BALTIC SEA											
B12	144	10,4	0,7	0,0	0,0	0,0	1,4	0,0	0,0	2,1	2,1
B01	511	8,2	0,4	0,4	0,2	0,0	0,2	0,0	0,0	0,2	1,4

Tab. 5: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Prevalences (%) of liver anomalies in dab (*Limanda limanda*) from the North Sea and Baltic Sea

Area	Length (cm)		N exam.	Liver nodules (mm)			Green Livers	Nema-todes	Acantho-cephaleans
	min	max		> 2	≥ 6	≥ 10			
NORTH SEA									
GB1	20	24	27	7,4	0,0	0,0	0,0	0,0	0,0
GB1	25	40	3	33,3	0,0	0,0	0,0	0,0	0,0
GB3	20	24	71	7,0	2,8	0,0	0,0	0,0	2,8
GB3	25	40	22	9,1	0,0	0,0	0,0	9,1	9,1
N11	20	24	51	7,8	2,0	0,0	0,0	2,0	3,9
N11	25	40	50	16,0	4,0	2,0	4,0	2,0	8,0
P01	20	24	43	7,0	0,0	0,0	0,0	2,3	2,3
P01	25	40	57	10,5	3,5	0,0	3,5	3,5	7,0
P02	20	24	52	9,6	0,0	0,0	76,9	15,4	5,8
P02	25	40	25	12,0	4,0	0,0	72,0	24,0	16,0
N06	20	24	50	6,0	2,0	0,0	20,0	92,0	6,0
N06	25	40	41	7,3	2,4	0,0	31,7	97,6	9,8
N22	20	24	50	4,0	2,0	2,0	0,0	10,0	0,0
N22	25	40	52	30,8	23,1	11,5	9,6	51,9	0,0
N04	20	24	50	4,0	0,0	0,0	4,0	20,0	0,0
N04	25	40	42	26,2	11,9	7,1	4,8	23,8	7,1
JMP	20	24	64	7,8	6,3	1,6	4,7	1,6	4,7
JMP	25	40	64	26,6	14,1	9,4	1,6	1,6	6,3
AREA	Length (cm)		N	Liver nodules (mm)			Green	Nema-	Acantho-

	min	max	exam.	> 2	≥ 6	≥ 10	Livers	todes	cephaleans
OSTSEE									
B12	20	24	20	0,0	0,0	0,0	0,0	0,0	0,0
B12	25	40	46	2,2	0,0	0,0	4,3	0,0	0,0
B01	20	24	52	0,0	0,0	0,0	0,0	0,0	0,0
B01	25	40	49	4,1	2,0	0,0	2,0	2,0	0,0

Tab. 6: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Prevalences (%) of diseases and parasites of cod (*Gadus morhua*)

AREA	N exam.	Ulc Ak/Hei	Skel Def	PBT	NetzAb	Locera	Clav	Cryp
NORTH SEA								
P01	55	1,8	1,8	0,0	0,0	0,0	12,7	10,9
BALTIC SEA								
B12	134	11,9	3,0	0,0	0,0	0,7	0,7	91,8
BMP	504	6,5	2,6	0,0	0,0	0,2	0,0	11,1
B11	558	9,5	5,0	0,0	0,0	0,4	0,0	22,2
B01	12	0,0	0,0	0,0	0,0	0,0	0,0	75,0

Tab. 7: 291. Cruise FRS „Walther Herwig III“, 22.08.-08.09.2006:
Prevalences (%) of diseases and parasites of flounder (*Platichthys flesus*)
in the Baltic Sea

AREA	N examined	Ly	Ulc Ak/Hei	FloAk/Hei	Skel Def	Cryp
NORTH SEA						
GB1	10	0,0	0,0	0,0	0,0	30,0
BALTIC SEA						
B12	9	11,1	0,0	11,1	11,1	55,6
BMP	170	30,0	3,5	1,2	0,0	80,0
B11	191	30,9	3,7	1,0	1,6	83,8
B01	10	0,0	0,0	0,0	0,0	30,0

Abbreviations:

N unt	: Number examined	PBT	: Pseudobranchial pseudotumour
Ly	: Lymphocystis	Netz Ab	: Net injury, healed
Ep Hyp/Pap	: Epidermal hyperplasia/papilloma	Steph	: <i>Stephanostomum baccatum</i>
Ulc Ak/Hei	: Skin ulcerationen, acute/healing	Acanth	: <i>Acanthochondria cornuta</i>
Flo Ak/Hei	: Fin rot/erosion, acute/healing	Lepe	: <i>Lepeophtheirus pectoralis</i>
KieHy	: Gill hyperplasia, x-cell disease	Locera	: <i>Lernaeocera branchialis</i>
Hyp Pig	: Hyperpigmentation	Clav	: <i>Clavella adunca</i>
Skel Def	: Skeletal deformities	Cryp	: <i>Cryptocotyle lingua</i>

Fig. 2: 291. Cruise FRS „Walther Herwig III“, 22.08.- 08.09.2006: Sampling sites for organic contaminants and trace metals in the North Sea and Baltic Sea



