

**FRV Walther Herwig III
Cruise 367
28.08. – 12.09.2013**

**Integrated Monitoring of Contaminants and their Biological Effects
(INMON), CHEMSEA Project**

Scientist in Charge: Dr. Thomas Lang

Summary

As part of the integrated monitoring programme of the Thünen Institute of Fisheries Ecology (FI) on contaminants and biological effects (incl. fish diseases) in marine fish species and in the framework of the EU-funded CHEMSEA project (Chemical Munitions - Search and Assessment), studies were conducted in five Baltic Sea and four North Sea sampling areas. In addition to the onboard examination of dab (*Limanda limanda*), flounder (*Platichthys flesus*) and cod (*Gadus morhua*) for externally visible diseases and parasites, a large range of fish samples were taken for a subsequent analysis of contaminants (incl. radioactive substances) and their biological effects in the framework of national legislation (BLMP) and international monitoring programmes (OSPAR, HELCOM). Extensive samples for the CHEMSEA project were taken for measurements on dumped chemical weapons and their biological effects. In particular, cod samples were taken for the CHEMSEA project in areas B13 (dumpsite of chemical munitions at Bornholm) and B09 (reference site outside the Gulf of Gdansk). Hydrographical measurements were carried out (water temperature, salinity, oxygen content, turbidity). The following preliminary findings were noted:

Dab: low prevalences of lymphocystis and epidermal hyperplasia/papilloma in the German Bight, North Sea (areas N01 northwest of Helgoland and GB1 in the inner German Bight); increasing prevalence of some diseases on a north-westerly transect in the German North Sea EEZ from the inner German Bight to the Dogger Bank.

Flounder: disease prevalences in the Baltic Sea and North Sea in the normal range;

Baltic cod: prevalence of acute/healing skin ulcerations in the normal range; high prevalence of gill parasites (*Loma* sp.) and nematodes in the body cavity in cod from the eastern sampling areas B13 and B09.

Participants:

Name	Function	Institution
Dr. Thomas Lang	Scientist in Charge	TI-FI Cuxhaven
Nicolai Fricke	Scientist	TI-FI Cuxhaven
Thomas Tepperies	Technician	TI-FI Cuxhaven
Jennifer Ipse	Technician	TI-FI Cuxhaven
Dr. Marc-Oliver Aust	Scientist	TI-FI Hamburg
Alexander Schulz	Technician	TI-FI Hamburg
Marc Faber	Student	University Berlin
Friederike Engel	Student	University Kiel
Lina Weirup	Volunteer	University Hamburg
Bastian Rosin	Volunteer	University Rostock
Christoph Rummel	Volunteer	University Mainz

Objectives of the Cruise

1. Studies on biological effects of contaminants;
2. Studies on the prevalence and spatial distribution of fish diseases and parasites;
3. Sampling of fish for chemical analysis of radioactive substances, trace metals and organic contaminants (in the framework of national and OSPAR/HELCOM monitoring and research projects);
4. Studies and sampling for the project CHEMSEA (CHEMical Munitions SEarch and Assessment)
5. Hydrographical measurements (salinity, temperature, oxygen, turbidity).

Dates of the Cruise

FRV Walther Herwig III left Bremerhaven with a delay of one day (due to technical problems) in the morning of 29.08. The scientific crew already boarded in the evening of 27.08. After the passage of Kiel Channel, the vessel sailed to the first sampling areas in the Baltic Sea, where work started in the morning of 30.08. in area B01. In the following days, sampling was conducted in the areas of B10, B11, B13 and B09.

On 06.09., after the end of the Baltic Sea programme, WH III again passed Kiel Channel, where one scientist disembarked. In the period 07.-12.09., sampling was continued in four North Sea areas (GB1, N01, GB3, GB4). The cruise ended according to schedule in the morning of 12.09. in Bremerhaven.

The location of the sampling areas and the cruise dates are shown in Fig. 1, Fig. 2 and Tab. 1. In 9 sampling areas (Fig. 1), a total of 36 fishing hauls was performed (towing time 30–60 min. each) (geographical coordinates in Tab. 1, catch composition in Tab. 2). In the Baltic Sea, a 140 ft bottom trawl and a pelagic PSN 205 net were used, in the North Sea a GOV net, all with standard configuration. Hydrographical measurements were made at all 36 fishery stations (geographical coordinates in Tab. 1a, results in Tab. 3).

Preliminary Results

1 Dab (*Limanda limanda*)

In total, 3,299 dab from one Baltic Sea (B01) and four North Sea areas were examined for the occurrence of externally visible diseases and parasites (Tab. 4) and 409 dab for the occurrence of liver anomalies (Tab. 5).

The disease prevalences in the North Sea were low in general. The prevalences of lymphocystis and epidermal hyperplasia/papilloma were particularly low in areas GB1 (lymphocystis: 0.3 %, epidermal hyperplasia/papilloma: 0.19 %) and N01 (lymphocystis: 1.5 %, epidermal hyperplasia/papilloma: 2.0 %) in the German Bight. For the majority of diseases, there was a prevalence gradient in the German EEZ in north-westerly direction, with increasing values from the inner German Bight (area GB1) to the Dogger Bank (area GB4) (see Fig. 3. and Tab. 4). When interpreting this finding, it has to be taken into account that the mean total length of the dab examined increased in north-westerly direction, too, possibly affecting the prevalence.

The prevalence of liver nodules >2 mm (= tumours and pre-stages) in North Sea dab was low and in the normal range of previous years. The highest prevalence was recorded in dab from area GB4 (size group 20-24 cm: 5.7 %; size group \geq 25 cm: 40.0 %; here, the small sample size has to be taken into account) (Tab. 5).

2 Flounder (*Platichthys flesus*)

1,170 flounder from four Baltic Sea areas and two of the North Sea areas (N01, GB1) were examined for the occurrence of externally visible diseases and parasites (Tab. 6) and, out of these, 138 specimens for liver anomalies (Tab. 7). The prevalence of lymphocystis in the Arkona Sea was comparatively low (area B10: 11.3 %; area B11: 10.2 %): in previous years, it regularly exceeded 20.0 %. Liver nodules >2 mm (tumours and pre-stages) were only recorded in flounder from the Baltic Sea area B11.

3 Cod (*Gadus morhua*)

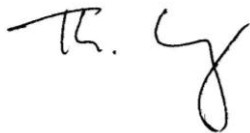
In total, 2,252 cod from five Baltic Sea areas (B01, B10, B11, B13, B09) were examined for externally visible diseases and parasites and for nematodes in the body cavity (Tab. 8). The prevalences of acute/healing skin ulcerations (maximum value 10.9 % in area B09 outside the Gulf of Gdansk) and most of the other diseases were comparable to those of previous years. The prevalence of the gill parasite *Loma* sp. and of nematodes in the body cavity was high in cod from the eastern sampling areas B13 and B09.

4 Miscellaneous

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

Acknowledgements

Thanks are due to Captain Vandrei and his crew and to the scientific staff for constructive and hard work and a very good atmosphere on board.



Dr. Thomas Lang
(Scientist in Charge)

Annex

3 Figures, 8 Tables

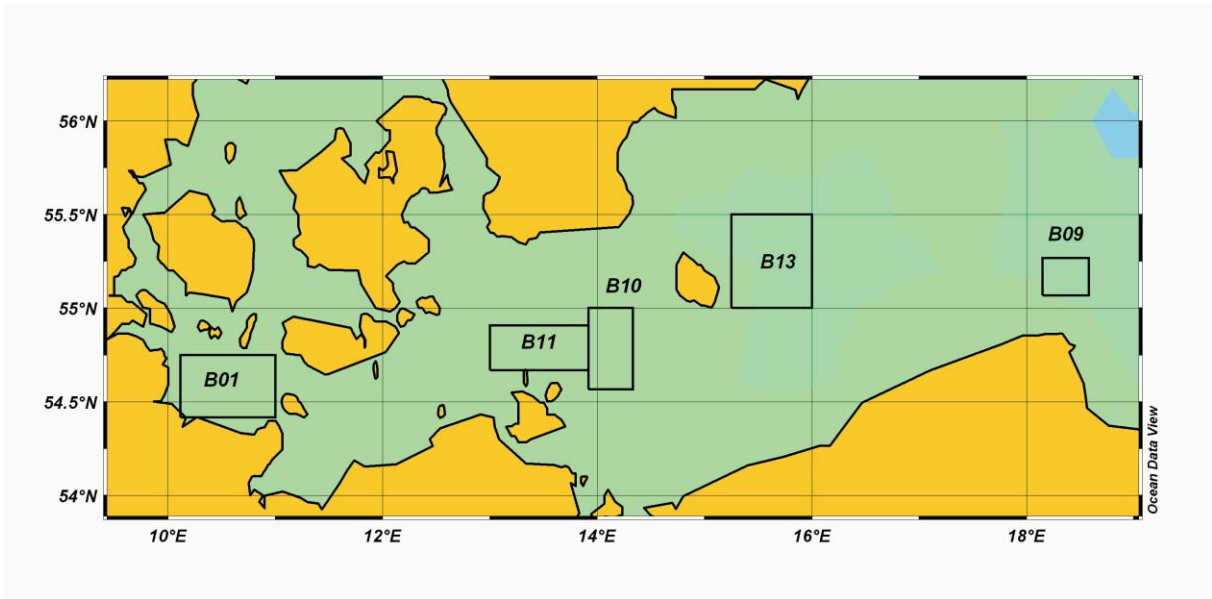


Fig. 1: *Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:*
 Location of sampling sites in the Baltic Sea

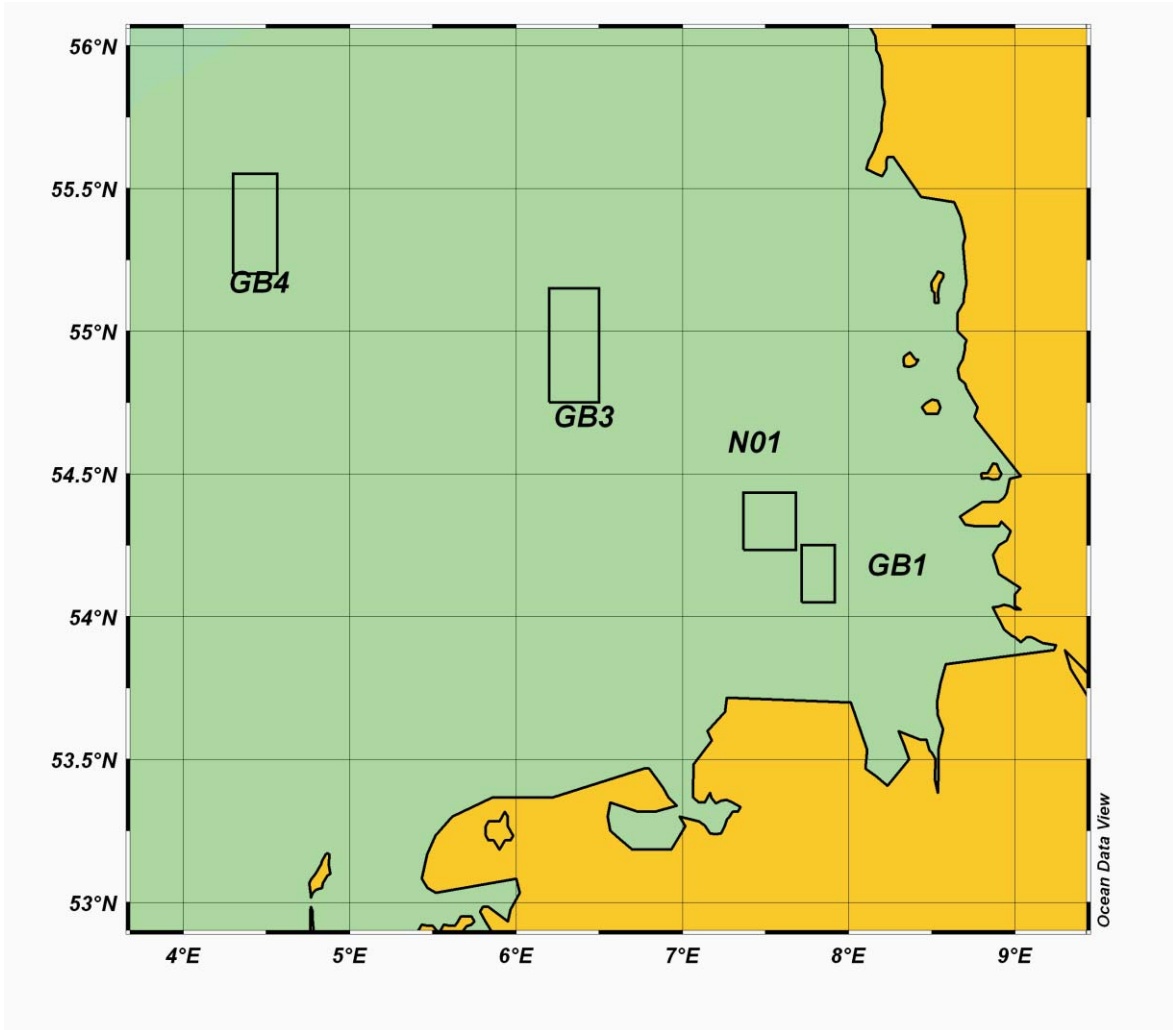


Fig. 2: *Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:*
 Location of sampling sites in the North Sea

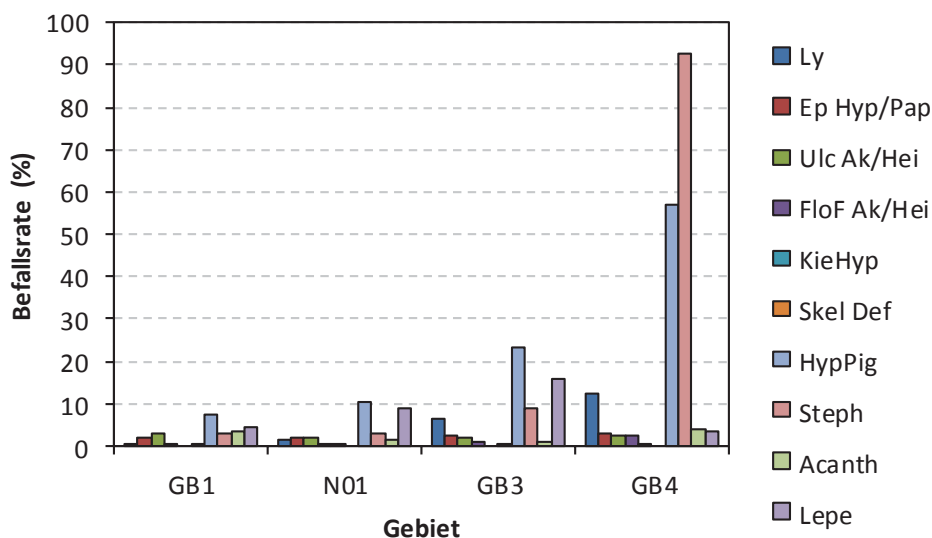


Fig. 3: *Cruise 367 RV 'Walther Herwig III', 23.08. – 12.09.2013:*
Prevalence (%) of dab diseases on a NW transect in the German EEZ in the North Sea (location of areas Abb. 2, prevalence Tab. 5; abbreviations in the legend at the end of the report)

Tab. 1: *Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:*
Geographical coordinates of trawling stations in the Baltic Sea and North Sea

DATE	STATION	Area	ICES-RECTANGLE	Latitude	Longitude
30.08.13	001	B01	38G0	54°44,20N	10°13,29E
30.08.13	002	B01	38G0	54°36,65N	10°24,28E
30.08.13	003	B01	38G0	54°31,93N	10°37,28E
30.08.13	004	B01	38G0	54°30,51N	10°40,48E
30.08.13	005	B01	38G0	54°32,20N	10°40,47E
31.08.13	006	B10	38G3	54°41,01N	13°56,95E
31.08.13	007	B10	38G4	54°53,00N	14°04,12E
31.08.13	008	B10	38G3	54°47,05N	13°57,35E
31.08.13	009	B10	38G4	54°50,96N	14°03,16E
01.09.13	010	B11	38G3	54°46,25N	13°18,73E
01.09.13	011	B11	38G3	54°47,98N	13°12,20E
01.09.13	012	B11	38G3	54°45,91N	13°25,59E
01.09.13	013	B11	38G3	54°46,17N	13°40,80E
02.09.13	014	B13	39G5	55°20,72N	15°35,20E
03.09.13	015	B13	39G5	55°20,83N	15°34,30E
03.09.13	016	B13	39G5	55°22,88N	15°34,85E
03.09.13	017	B13	39G5	55°22,64N	15°35,98E
03.09.13	018	B13	39G5	55°22,29N	15°38,06E
04.09.13	019	B09	39G8	55°11,54N	18°29,88E
04.09.13	020	B09	39G8	55°08,18N	18°11,76E

Tab.1: cont.

DATE	STATION	Area	ICES-RECTANGLE	Latitude	Longitude
04.09.13	021	B09	39G8	55°12,88N	18°16,96E
04.09.13	022	B09	39G8	55°14,01N	18°10,41E
04.09.13	023	B09	39G8	55°12,32N	18°22,27E
07.09.13	024	GB1	37F7	54°04,72N	07°52,61E
07.09.13	025	GB1	37F7	54°06,59N	07°46,27E
07.09.13	026	GB1	37F7	54°04,69N	07°53,00E
07.09.13	027	GB1	37F7	54°06,21N	07°47,19E
08.09.13	028	N01	37F7	54°19,56N	07°30,11E
08.09.13	029	N01	37F7	54°19,52N	07°27,93E
09.09.13	031	N01	37F7	54°15,45N	07°30,22E
09.09.13	032	N01	37F7	54°18,85N	07°26,33E
10.09.13	033	GB3	38F6	54°56,02N	06°16,30E
10.09.13	034	GB3	38F6	54°58,06N	06°21,30E
10.09.13	035	GB3	38F6	54°58,14N	06°21,45E
11.09.13	036	GB4	39F4	55°23,00N	04°26,05E
11.09.13	037	GB4	39F4	55°23,17N	04°32,54E
11.09.13	038	GB4	39F4	55°23,45N	04°27,14E

Tab. 1a: *Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:*
Geographical coordinates of hydrography stations in the Baltic Sea and North Sea

DATE	STATION	FISHING STATION	AREA	ICES-RECTANGLE	LATITUDE	LONGITUDE
30.08.13	001	001	B01	38G0	54°43,85N	10°13,59E
30.08.13	002	002	B01	38G0	54°36,27N	10°24,22E
30.08.13	003	003	B01	38G0	54°31,78N	10°36,46E
30.08.13	004	004	B01	38G0	54°34,64N	10°38,68E
30.08.13	005	005	B01	38G0	54°32,20N	10°40,96E
31.08.13	006	006	B10	38G3	54°39,68N	13°57,11E
31.08.13	007	007	B10	38G4	54°53,48N	14°04,63E
31.08.13	008	008	B10	38G3	54°46,28N	13°56,83E
31.08.13	009	009	B10	38G4	54°51,10N	14°03,61E
01.09.13	010	010	B11	38G3	54°46,19N	13°19,81E
01.09.13	011	011	B11	38G3	54°48,06N	13°11,69E
01.09.13	012	012	B11	38G3	54°45,68N	13°30,87E
01.09.13	013	013	B11	38G3	54°46,20N	13°40,47E
02.09.13	014	014	B13	39G5	55°21,00N	15°34,07E
03.09.13	015	015	B13	39G5	55°18,10N	15°35,36E
03.09.13	016	016	B13	39G5	55°23,11N	15°34,17E
03.09.13	017	017	B13	39G5	55°23,31N	15°35,19E
03.09.13	018	018	B13	39G5	55°23,14N	15°37,10E

Tab. 1a: cont.

DATE	STATION	FISHING STATION	AREA	ICES-RECTANGLE	LATITUDE	LONGITUDE
04.09.13	019	019	B09	39G8	55°11,30N	18°31,25E
04.09.13	020	020	B09	39G8	55°08,14N	18°11,11E
04.09.13	021	021	B09	39G8	55°12,85N	18°16,97E
04.09.13	022	022	B09	39G8	55°14,25N	18°09,84E
04.09.13	023	023	B09	39G8	55°12,48N	18°20,94E
07.09.13	024	024	GB1	37F7	54°04,58N	07°53,44E
07.09.13	025	025	GB1	37F7	54°07,06N	07°44,98E
07.09.13	026	026	GB1	37F7	54°04,48N	07°53,79E
07.09.13	027	027	GB1	37F7	54°06,44N	07°46,39E
08.09.13	028	028	N01	37F7	54°19,77N	07°29,25E
08.09.13	029	029	N01	37F7	54°20,51N	07°26,70E
08.09.13	030	-	N01	37F7	54°19,12N	07°25,91E
09.09.13	031	031	N01	37F7	54°14,68N	07°29,94E
09.09.13	032	032	N01	37F7	54°18,80N	07°26,86E
10.09.13	033	033	GB3	38F6	54°55,72N	06°15,61E
10.09.13	034	034	GB3	38F6	54°58,45N	06°22,35E
10.09.13	035	035	GB3	38F6	54°58,04N	06°23,04E
11.09.13	036	036	GB4	39F4	55°23,24N	04°25,47E
11.09.13	037	037	GB4	39F4	55°23,25N	04°33,85E
11.09.13	038	038	GB4	39F4	55°23,58N	04°26,01E

Tab. 2: *Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:*
Mean catches of selected abundant fish species in the Baltic Sea and North Sea
(n = number, kg = weight per 1 h trawling)

Area	Cod	Whiting	Haddock	Herring	Sprat	Mackerel	Dab	Plaice	Flounder
B01 n	15	81	-	41	24	14	889	32	2
kg	16	3	-	1	< 0,5	3	108	7	1
B10 n	275	92	-	575	457	-	-	73	854
kg	62	26	-	36	7	-	-	19	207
B11 n	196	154	-	752	2,207	1	5	234	815
kg	85	19	-	7	23	< 0,5	1	67	173
B13 n	421	-	-	6,558	33	-	-	-	-
kg	195	-	-	293	1	-	-	-	-
B09 n	272	-	-	20	-	-	-	-	2
kg	101	-	-	1	-	-	-	-	< 0,5
GB1 n	10	10,497	-	1,119	1,252	3	774	1	7
kg	< 0,5	213	-	5	7	1	28	< 0,5	2
N01 n	1	650	-	53,664	1,991	114	187	1	1
kg	< 0,5	16	-	503	25	21	11	< 0,5	< 0,5
GB3 n	16	1,777	-	177,058	140,187	331	1,637	62	-
kg	2	31	-	2,390	1,423	58	95	21	-
GB4 n	<1	71	-	15,665	90,170	-	301	32	-
kg	1	3	-	317	1,102	-	29	7	-

Tab. 3: *Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:*
 Water depth, temperature (T), salinity (S), O₂ in mg/l and O₂ saturation (%), Baltic Sea and North Sea

DATE	STATION	AREA	DEPTH (m)	T (°C)	S (PSU)	O ₂ (mg/L)	O ₂ -SATURATION (%)
30.08.2013	1	B01	3	14.985	18.303	8.75	101.76
			21	22,939	12.302	4.24	45.77
	2		3	13.851	18.798	8.80	102.63
			14	14,921	18.656	8.49	99.33
	3		3	9.294	17.831	8.86	98.61
			13	15,878	18.272	8.26	96.52
	4		2	9.617	17.963	9.06	101.27
			17	22,732	12.609	3.71	40.27
	5		3	9.723	17.828	9.29	103.61
			19	22,946	12.244	3.53	38.08
31.08.2013	6	B10	4	7.112	19.040	8.83	99.38
			21	9,165	10.638	8.13	77.50
	7		3	7.168	18.693	8.74	97.69
			37	11,186	12.159	6.43	64.20
	8		2	7.171	18.908	8.70	97.73
			34	10,442	11.680	6.92	68.12
	9		3	7.157	19.015	8.85	99.63
			36	10,804	11.667	6.58	64.84
01.09.2013	10	B11	3	7.372	18.368	8.97	99.79
			36	9,683	11.925	7.37	72.54
	11		4	7.461	18.340	8.86	98.51
			38	14,434	14.422	5.51	58.98
	12		3	7.496	18.416	8.90	99.11
			37	8,778	10.379	8.01	75.69
	13		3	7.151	18.564	8.66	96.54
			37	13,286	13.700	6.61	69.22
02.09.2013	14	B13	3	7.271	17.811	8.81	96.82
			89	15,656	4.888	0.98	8.48
03.09.2013	15	B13	3	7.254	17.807	8.72	95.82
			91	15,813	4.843	0.64	5.57
	16		3	7.259	17.737	8.79	96.47
			89	15,274	5.004	0.49	4.24
	17		3	7.251	17.883	8.95	98.45
			88	15,275	5.014	0.65	5.60
	18		3	7.247	18.094	9.01	99.60
			88	15,285	5.012	0.63	5.44

Tab. 3: cont.

DATE	STATION	AREA	DEPTH (m)	T (°C)	S (PSU)	O ₂ (mg/L)	O ₂ -SATURATION (%)
04.09.2013	19	B09	3	7.129	17.817	8.74	96.05
			79	10,538	4.512	1.92	15.97
	20		3	7.049	17.479	8.95	97.59
			64	7,569	3.336	10.09	79.64
04.09.2013	21		3	7.088	17.463	9.14	99.70
			60	7,543	2.484	10.43	80.41
04.09.2013	22		2	7.094	17.607	9.16	100.11
			56	7,982	2.944	8.79	68.86
	23		2	7.094	17.776	9.24	101.41
			73	9,130	3.240	6.65	52.91
07.09.2013	24	GB1	3	32.165	18.342	8.27	106.64
			36	32,253	17.513	6.49	82.41
	25		3	32.237	17.816	7.51	95.91
			36	32,252	16.866	5.85	73.38
	26		3	32.229	18.373	8.46	109.17
			38	32,276	17.309	6.25	79.10
	27		3	31.356	18.029	8.41	107.24
			38	32,276	16.497	5.42	67.53
08.09.2013	28	N01	3	31.260	17.772	8.07	102.33
			30	32,599	16.763	6.25	78.41
	29		4	31.278	17.633	7.85	99.38
			23	32,386	16.844	6.35	79.69
	30		3	31.349	17.427	7.76	97.77
			38	32,705	16.447	5.89	73.49
09.09.2013	31	N01	3	31.092	17.409	7.42	93.32
			37	32,641	16.610	5.85	73.22
	32		3	31.389	17.467	7.96	100.43
			37	32,704	16.617	6.04	75.60
10.09.2013	33	GB3	3	33.778	17.206	7.57	96.44
			38	33,957	16.336	6.09	76.42
	34		3	33.833	17.068	7.65	97.29
			40	34,012	15.147	5.75	70.42
	35		3	33.736	17.039	7.78	98.74
			40	34,021	14.908	5.62	68.60
11.09.2013	36	GB4	3	34.722	16.602	7.88	99.85
			41	34,625	7.475	6.16	64.40
	37		3	34.691	16.708	7.91	100.42
			42	34,559	7.172	6.16	63.89
	38		4	34.752	16.562	7.81	98.90
			41	34,546	7.191	6.16	63.93

Tab. 4: Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:
Prevalences (%) of externally visible diseases and parasites in dab
(*Limanda limanda*) from the Baltic Sea and North Sea

Area	N unt	Ly	Ep Hyp/Pap	Ulc Ak/Hei	Flo Ak/Hei	KieHy	Skel Def	Hyp Pig	Steph	Acanth	Lepe
B01	573	6,3	1,6	1,9	0,3	0,5	0,2	0,0	0,0	0,0	1,7
GB1	646	0,3	1,9	2,8	0,3	0,0	0,2	7,4	2,8	3,4	4,5
N01	976	1,5	2,0	2,0	0,4	0,1	0,0	10,1	2,8	1,3	8,7
GB3	736	6,4	2,4	1,9	0,7	0,0	0,4	23,2	8,7	0,8	15,6
GB4	368	12,2	3,0	2,4	2,2	0,3	0,0	56,8	92,7	4,1	3,3
Sum	3,299										

Tab. 5: Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:
Prevalences (%) of liver anomalies in dab (*Limanda limanda*) from the Baltic Sea and North Sea

AREA	Length(cm)		N unt	Liver Nodules (mm)			Green Livers	Nema-todes	Acanthoceph.
	von	bis		≥ 2	≥ 5	≥ 10			
B01	20	24	52	3,8	0,0	0,0	3,8	0,0	0,0
	25	40	33	6,1	6,1	0,0	3,0	0,0	0,0
GB1	20	24	57	3,5	1,8	0,0	0,0	1,8	0,0
	25	40	7	0,0	0,0	0,0	0,0	0,0	0,0
N01	20	24	63	3,2	1,6	0,0	3,2	1,6	0,0
	25	40	7	0,0	0,0	0,0	0,0	14,3	0,0
GB3	20	24	52	0,0	0,0	0,0	0,0	3,8	0,0
	20	24	45	15,6	8,9	4,4	0,0	2,2	2,2
GB4	20	24	53	5,7	1,9	0,0	0,0	1,9	1,9
	25	40	5	40,0	20,0	0,0	0,0	20,0	0,0
Sum			374						

Tab. 6: Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013:
Prevalences (%) of externally visible diseases and parasites in flounder
(*Platichthys flesus*) from the Baltic Sea and North Sea

Area	N unt	Ly	Ulc Ak/Hei	Flo Ak/Hei	Skel Def	Hyp Pig	Cryp	Lepe
B01	5	20,0	0,0	0,0	0,0	0,0	60,0	0,0
B10	532	11,3	3,2	0,8	0,6	0,0	67,3	0,0
B11	617	10,2	0,5	0,3	1,3	0,0	62,7	0,0
B09	2	0,0	0,0	0,0	0,0	0,0	0,0	0,0
GB1	10	0,0	20,0	0,0	0,0	0,0	10,0	100,0
Sum	1,170							

Tab. 7: Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013: Prevalences (%) of liver anomalies in flounder (*Platichthys flesus*) from the Baltic Sea and North Sea

Area	N unt	Liver Nodules (mm)			Green Livers	Nema- todes	Acantho- ceph.
		≥ 2	≥ 5	≥ 10			
B10	24	0,0	0,0	0,0	0,0	4,2	4,2
B11	100	2,0	0,0	0,0	0,0	1,0	13,0
GB1	10	0,0	0,0	0,0	0,0	0,0	10,0
N01	4	0,0	0,0	0,0	0,0	0,0	0,0
Sum	138						

Tab. 8: Cruise 367 RV 'Walther Herwig III', 28.08. – 12.09.2013: Prevalences (%) of externally visible diseases and parasites in cod (*Gadus morhua*) from the Baltic Sea

GEBIET	N unt	Ulc Ak/Hei	Skel Def	PBT	Locera	Clav	Cryp	Loma	Nemato
B01	22	4,5	0,0	0,0	0,0	0,0	77,3	50,0	40,9
B10	590	7,6	1,4	0,0	0,0	0,0	10,8	2,2	1,4
B11	472	3,4	2,3	0,0	0,8	0,0	22,0	1,5	4,0
B13	561	6,8	3,0	0,0	0,2	0,0	0,7	81,5	16,2
B09	607	10,9	2,8	0,0	0,0	0,0	0,0	79,7	12,5
Summe	2,252								

Abbreviations:

N unt	: Number examined	Acanthoceph.	: Acanthocephaleans, liver
Ly	: Lymphocystis	Steph	: <i>Stephanostomum baccatum</i>
Ep Hyp/Pap	: Epidermal hyperplasia/papilloma	Acanth	: <i>Acanthochondria cornuta</i>
Ulc Ak/Hei	: Skin ulcerationen, acute/healing	Lepe	: <i>Lepeophtheirus pectoralis</i>
Flo Ak/Hei	: Fin rot/erosion, acute/healing	Locera	: <i>Lernaeocera branchialis</i>
KieHy	: Gill hyperplasia, x-cell disease	Clav	: <i>Clavella adunca</i>
Hyp Pig	: Hyperpigmentation	Cryp	: <i>Cryptocotyle spp.</i>
Skel Def	: Skeletal deformities	Loma	: <i>Loma sp.</i>
PBT	: Pseudobranchial pseudotumour	Nemato	: Nematodes in the body cavity
LK >2 mm	: Liver nodules > 2 mm in diameter	Cryp	: <i>Cryptocotyle spp.</i>