

**FRV Walther Herwig III
Cruise 315
29.08. – 19.09.2008**

**Biological Effects of Contaminants and Fish Diseases
in the North Sea and at Iceland**

Scientist in Charge: Dr. Thomas Lang

Summary

As part of the integrated monitoring programme of the vTI Institute of Fishery Ecology on contaminants and biological effects (incl. fish diseases) in marine fish species, studies were conducted in 8 North Sea and 2 Icelandic sampling areas. Six of the 10 areas were visited as part of the international project 'Integrated Assessment of Contaminant Impacts on the North Sea, ICON' carried out in collaboration with institutes from countries around the North Sea and beyond. In addition to the examination of dab (*Limanda limanda*) and other fish species for macroscopically visible external and internal diseases and parasites, a comprehensive sampling programme was carried out for studies on contaminant concentrations and biological effects (biomarkers) in dab and haddock (*Melanogrammus aeglefinus*). In addition, fish samples were frozen for the detection of contaminants (incl. radioactive substances), also in the framework of national legislation and international monitoring programmes (OSPAR). Also sediments samples for contaminant analysis and subsequent bioassays were taken in the 2 Icelandic sampling areas. In addition, hydrographical measurements were carried out (water temperature, salinity, oxygen content, turbidity). Regarding the occurrence of externally visible diseases and parasites as well as of pathological liver changes in dab there were some new findings: the prevalence of lymphocystis and hyperpigmentation in the German Bight was exceptionally low compared to previous surveys. For the first time, dab examined at the Dogger Bank site were free of liver nodules. The 2 Icelandic sampling areas differed in disease prevalence from each other and from the North Sea sites. Diseases were more prevalent in dab from area I16 than from area I20. The prevalences of lymphocystis and skin ulcers in area I16 were higher than those in the North Sea sampling areas. Dab from both Icelandic sites were not affected by hyperpigmentation, the parasite *Acanthochoondria cornuta* and liver nodules.

Participants:

Name	Function	Institution
Dr. Thomas Lang	Scientist in Charge	vTI FOE, Cuxhaven
Thomas Tepperies	Technician	vTI FOE, Cuxhaven
Paul Kotterba	Student	University Hamburg
Nico Geveke	Student	University Oldenburg
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Hilke Alberts-Hubatsch	Student	University Oldenburg
Dr. Alexandras Rybakovas	Scientist	University Vilnius, Lithuania
Felix Baumgart	Scientist	University Rostock
Ole Meyer-Klaeden	Scientist	University Kiel
Bastian Kulscheski	Student	University Bremen
Bjørn Skei	Scientist	University Oslo, Norway
Ursula Kürschner	Technician	vTI FOE, Cuxhaven

Objectives of the Cruise

1. Participation on the International project 'Integrated Assessment of Contaminant Impacts on the North Sea (ICON)';
2. Studies on biological effects of contaminants;
3. Studies on the prevalence and spatial distribution of fish diseases and parasites;
4. Sampling of livers and other fish organs for subsequent histological and biochemical studies;
5. Sampling of fish for chemical analysis of radioactive substances, trace metals and organic contaminants (in the framework of national and OSPAR monitoring);
6. Hydrographical measurements (salinity, temperature, oxygen, turbidity);
7. Sediment sampling for contaminant analysis and bioassays.

Dates of the Cruise

RV Walther Herwig III left Bremerhaven on 29.08. and fishing and sampling started in the morning of 30.08 in sampling area N11. On the following days, sampling continued in areas P01 and N04. On 02.09., equipment was taken on board off Stonehaven, east Scotland, delivered by the Scottish FRS research catamaran Temora. WH III proceeded to the Icelandic sampling areas (I16, I20) that were visited for the last time more than 10 years ago and which were selected as reference areas for the North Sea studies. The programme at Iceland was carried out in the period 05.-07.09. WH III berthed in Reykjavik on the 07.09. and, on the 08.09., a meeting took place with collaborating scientists from the University of Iceland. WH III left Iceland in the morning of 09.09 and sailed back to the North Sea to Aberdeen port, where an exchange of equipment and samples was done on 12.09. Work continued in area N06 on 13.09. and subsequently in areas P02, GB3, N01 and finally GB1. The cruise ended according to plan in the morning of 19.09.

The location of the sampling areas and the cruise dates are shown in Figure 1 and Tables 1a, 1b and 1c.

In 10 sampling areas (Fig. 1), a total of 43 fishing hauls was performed (towing time 30 – 60 min. each) (see Table 1a). In the North Sea, the GOV was used, at Iceland a 140 ft bottom trawl with rock hoppers, both according to the standard configuration for fish stock surveys. Hydrographical measurements were made at 26 stations (see Table 1b) and sediment samples were taken at 16 stations near Iceland (see Table 1c).

Preliminary Results

1 Dab (*Limanda limanda*)

In total, 6.150 dab were examined for the occurrence of externally visible diseases and parasites and 758 dab for the occurrence of liver anomalies. Results are provided in Tables 4 and 5.

The prevalence of lymphocystis in the North Sea sampling areas was lower than in summer 2007. Values > 20 % did not occur in any of the areas, the highest prevalences were in the range of 14.5 % (area P02) to 16.9 % (area N06). Interestingly, the highest prevalence of lymphocystis (23.6 %) was recorded in the Icelandic area I16. The lowest values of 1.3 % (area N01) and 0.3 % (area GB1) were recorded in the German Bight. Thus, the trend of a low prevalence of lymphocystis continued in this region. There were no changes in prevalence of epidermal hyperplasia/papilloma, prevalences were low and in range of 0.3 % (area GB1) to 3.2 % (area N06). Skin ulcers were recorded at prevalences of 0.0 % (area GB1) to 7.2 % (area I16) and were, thus, comparable to data from summer 2007. Interestingly and as with lymphocystis, the highest prevalence was recorded in area I16 off Iceland. The prevalences of hyperpigmentation ranged from 0.0 % (areas I16, I20) to 41.0 % (area N04) and were similar to the summer 2007 values. However, the

prevalence in area N01 in the German Bight (5.2 %) has dropped considerably compared to previous years when it partly exceeded 50 %. Icelandic dab were not affected at all. There were no major changes in prevalence of the three parasites *Stephanostomum baccatum*, *Lepeophtheirus pectoralis* and *Acanthochoondria cornuta* in the North Sea. Only *A. cornuta* was absent in the Icelandic dab.

The prevalence of liver nodules (Tab. 5) was low in general. For the first time since investigation started in 1988, the dab from area N04 on the Dogger Bank were free of liver nodules. This area used to be one of the hot spot areas for the occurrence of liver nodules/tumours throughout the study period. Fish from the Icelandic sampling sites were not affected, too. The prevalences of livers with green discoloration (due to a parasitic icterus), liver nematodes and acanthocephaleans did not change significantly compared to last year.

2 Haddock (*Merlangius merlangus*)

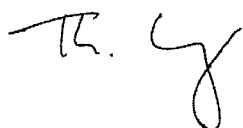
Haddock was examined in the Iceland areas I16 and I20 only (see Table 6). In the other sampling areas they were either too rare or too small. The fish examined were mostly affected by parasitic copepods, in particular by *Lernaecocera branchialis*. Skin ulcers and skeletal deformities were rare.

Miscellaneous

The mean catch data of the most frequent fish species are provided in Table 2; Tables 3a and 3b give results of the hydrographical measurements.

Acknowledgements

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



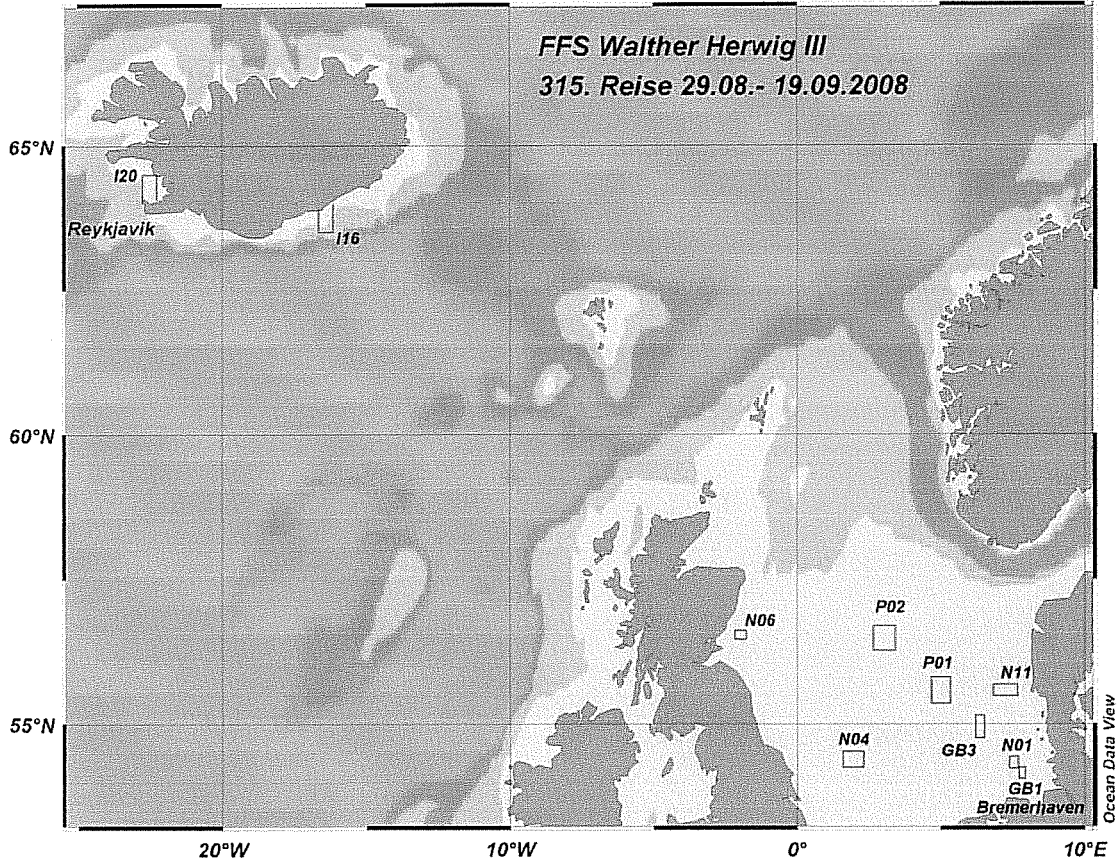
Dr. Thomas Lang

(Scientist in Charge)

Annex

1 Figure, 6 Tables

Fig. 1: Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008
Location of sampling sites in the North Sea and at Iceland



Tab. 1a: Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008:
Geographical coordinates (gear at ground) of trawling sites in the North Sea and at Iceland

DATE	STATION	AREA	ICES RECTANGLE	LATITUDE	LONGITUDE
30.08.08	001	N11	40F7	55°30,91N	07°07,94E
30.08.08	002	N11	40F7	55°39,23N	07°01,13E
30.08.08	003	N11	40F7	55°35,35N	07°01,40E
30.08.08	004	N11	40F7	55°36,89N	07°04,68E
31.08.08	005	P01	40F5	55°41,83N	05°03,36E
31.08.08	006	P01	40F4	55°30,07N	04°58,32E
31.08.08	007	P01	39F5	55°29,83N	05°12,05E
31.08.08	008	P01	39F5	55°26,15N	05°07,79E
01.09.08	009	N04	38F2	54°49,21N	02°19,93E
01.09.08	010	N04	38F2	54°47,63N	02°16,05E
01.09.08	011	N04	38F2	54°38,24N	02°16,81E
01.09.08	012	N04	38F2	54°42,59N	02°08,98E
01.09.08	013	N04	38F2	54°47,00N	02°01,33E
05.09.08	014	I16	56D3	63°46,40N	16°30,54W
05.09.08	015	I16	56D3	63°46,71N	16°30,43W
05.09.08	016	I16	56D3	63°45,73N	16°30,53W
05.09.08	017	I16	56D3	63°46,34N	16°27,67W
06.09.08	018	I20	57C7	64°10,00N	22°24,88W
06.09.08	019	I20	57C7	64°10,39N	22°17,25W
07.09.08	020	I20	57C7	64°06,48N	22°22,28W
07.09.08	021	I20	57C7	64°07,21N	22°18,70W
13.09.08	022	N06	41E7	56°17,24N	02°03,29W
13.09.08	023	N06	41E7	56°17,19N	02°04,62W
13.09.08	024	N06	41E7	56°18,54N	02°04,91W
13.09.08	025	N06	41E8	56°17,56N	01°57,54W
13.09.08	026	N06	41E7	56°18,17N	02°02,75W
13.09.08	027	N06	41E7	56°19,95N	02°01,73W
14.09.08	028	P02	41F3	56°21,16N	03°02,03E
14.09.08	029	P02	41F3	56°25,36N	03°08,53E
14.09.08	030	P02	42F2	56°30,99N	02°59,51E
15.09.08	031	GB3	38F6	54°56,40N	06°16,18E
15.09.08	032	GB3	39F6	55°01,03N	06°18,52E
15.09.08	033	GB3	38F6	54°55,64N	06°16,23E
15.09.08	034	GB3	38F6	54°58,81N	06°23,12E
16.09.08	035	N01	37F7	54°23,31N	07°35,68E
16.09.08	036	N01	37F7	54°18,77N	07°30,41E
16.09.08	037	N01	37F7	54°18,48N	07°28,17E
16.09.08	038	N01	37F7	54°16,07N	07°27,79E
16.09.08	039	N01	37F7	54°15,89N	07°30,23E
17.09.08	040	GB1	37F7	54°04,69N	07°53,03E
17.09.08	041	GB1	37F7	54°06,30N	07°46,93E
17.09.08	042	GB1	37F7	54°04,79N	07°52,37E
17.09.08	043	GB1	37F7	54°07,12N	07°45,87E

Tab. 1b: *Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008:*
Geographical coordinates of hydrography stations in the North Sea and at Iceland

DATE	STATION	AREA	ICES RECTANGLE	LATITUDE	LONGITUDE
30.08.08	001	N11	40F7	55°35,15N	07°05,57E
30.08.08	002	N11	40F7	55°33,35N	07°07,62E
31.08.08	003	N11	39F5	55°27,17N	05°04,52E
31.08.08	004	N11	39F5	55°22,35N	05°07,67E
01.09.08	005	P01	38F2	54°44,48N	02°22,06E
01.09.08	006	P01	38F2	54°46,04N	02°02,77E
05.09.08	007	P01	56D3	63°46,43N	16°30,21W
05.09.08	008	P01	56D3	63°46,14N	16°25,29W
05.09.08	009	N04	56D3	63°45,64N	16°22,12W
06.09.08	010	N04	57C7	64°09,24N	22°19,37W
06.09.08	011	N04	57C7	64°09,61N	22°11,53W
07.09.08	012	N04	57C7	64°06,23N	22°22,94W
07.09.08	013	N04	57C7	64°08,17N	22°16,04W
07.09.08	014	I16	57C7	64°06,66N	22°17,13W
13.09.08	015	I16	41E7	56°19,09N	02°02,58W
13.09.08	016	I16	41E7	56°17,29N	02°01,64W
13.09.08	017	I16	41E7	56°20,10N	02°00,09W
14.09.08	018	I20	41F3	56°27,73N	03°08,60E
14.09.08	019	I20	42F3	56°33,29N	03°01,44E
15.09.08	020	I20	38F6	54°56,50N	06°18,68E
15.09.08	021	I20	38F6	54°56,47N	06°16,23E
16.09.08	022	N06	37F7	54°16,27N	07°30,79E
16.09.08	023	N06	37F7	54°17,34N	07°31,41E
16.09.08	024	N06	37F7	54°20,51N	07°27,93E
17.09.08	025	N06	37F7	54°04,47N	07°54,65E
17.09.08	026	N06	37F7	54°05,07N	07°51,89E

Tab. 1c: *Cruise 315 RV „Walther Herwig III“, 29.08. – 19.09.2008:*
 Geographical coordinates of sediment sample stations in the North Sea and at
 Iceland

DATUM	STATION	GEBIET	ICES- RECTANGLE	GEO- BREITE	GEO- LÄNGE
05.09.08	001	I16	56D3	63°46,10N	16°32,17W
05.09.08	002	I16	56D3	63°45,88N	16°26,84W
05.09.08	003	I16	56D3	63°44,86N	16°24,58W
05.09.08	004	I16	56D3	63°45,63N	16°23,37W
05.09.08	005	I16	56D3	63°45,76N	16°23,53W
05.09.08	006	I16	56D3	63°45,85N	16°23,94W
06.09.08	007	I20	57C7	64°09,27N	22°19,08W
06.09.08	008	I20	57C7	64°08,51N	22°23,65W
06.09.08	009	I20	57C7	64°09,40N	22°19,06W
06.09.08	010	I20	57C7	64°10,56N	22°18,36W
06.09.08	011	I20	57C7	64°09,43N	22°11,81W
06.09.08	012	I20	57C7	64°09,47N	22°11,68W
06.09.08	013	I20	57C7	64°09,53N	22°11,58W
06.09.08	014	I20	57C7	64°09,59N	22°11,42W
06.09.08	015	I20	57C7	64°09,64N	22°11,26W
06.09.08	016	I20	57C7	64°09,67N	22°11,08W

Tab. 2: *Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008:*
 Mean catches of selected abundant fish species in the North Sea and at Iceland
 (n = number, kg = weight per 1 h trawling)

Area	Cod	Whiting	Haddock	Herring	Sprat	Mackerel	Dab	Plaice	Flounder
N11 n	-	4	-	-	-	2327	3548	185	-
kg	-	< 0,1	-	-	-	346,0	223,0	32,0	-
P01 n	25	78	26	8	14	1543	169	35	-
kg	120,0	2,0	1,0	1,0	< 0,1	283,0	14,0	10,0	-
N04 n	12	128	-	116	-	1921	1204	75	-
kg	4,0	12,0	-	19,0	-	301,0	68,0	23,0	-
I16 n	72	136	1999	5	-	-	182	26	-
kg	276,0	75,0	902,0	1,0	-	-	35,0	17,0	-
I20 n	20	940	3916	-	-	-	334	20	-
kg	112,0	269,0	2579,0	-	-	-	69,0	10,0	-
N06 n	1	227	980	36	-	2512	473	16	-
kg	< 0,1	17,0	33,0	5,0	-	673,0	25,0	2,0	-
P02 n	3	11	5	19	-	669	1897	2	-
kg	2,0	1,0	2,0	3,0	-	103,0	122,0	1,0	-
GB3 n	-	3520	-	672	9468	37	1946	52	-
kg	-	236,0	-	8,0	69,0	9,0	99,0	13,0	-
N01 n	1	261	-	3454	7979	191	699	14	3
kg	< 0,1	14,0	-	48,0	78,0	30,0	28,0	2,0	1,0
GB1 n	-	7760	-	1773	-	-	2326	54	66
kg	-	325,0	-	1,0	-	-	66,0	4,0	14,0

Tab. 3: *Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008:*
 Water depth, temperature (T), salinity (S) und O₂ saturation, North Sea and Iceland

DATE	STATION	AREA	DEPTH (m)	T (°C)	S (PSU)	O ₂ -SATURATION
30.08.2008	001	N11	2	17,871	33,616	96,97
			25	17,914	33,678	94,43
	002		2	18,439	33,580	96,14
			26	17,867	33,593	94,47
31.08.2008	003	P01	3	16,151	34,763	97,17
			38	9,868	34,801	75,96
	004		2	16,386	34,757	98,72
			41	10,775	34,607	71,27
01.09.2008	005	N04	2	16,657	34,506	98,10
			16	16,665	34,514	98,83
	006		2	16,522	34,496	96,63
			24	16,374	34,514	95,38

Tab. 3: continued

DATE	STATION	AREA	DEPTH (m)	T (°C)	S (PSU)	O ₂ -SATURATION
05.09.2008	007	I16	2	11,061	32,944	98,52
			59	8,709	35,237	86,52
	008		2	11,635	34,590	100,36
			54	8,623	35,247	84,03
	009		2	11,571	34,473	99,94
			83	8,537	35,240	83,83
06.09.2008	010	I20	2	12,110	34,302	103,97
			30	11,683	34,442	82,70
	011		2	12,105	34,302	103,84
			51	11,016	34,738	64,38
07.09.2008	012		2	11,990	34,332	94,40
			35	11,386	34,577	73,87
	013		2	11,908	34,297	96,64
			39	11,111	34,681	61,06
	014		2	11,951	34,317	97,93
			44	11,063	34,698	60,79
13.09.2008	015	N06	5	13,214	34,794	95,78
			47	12,673	34,828	88,82
	016		3	13,238	34,797	97,32
			49	12,501	34,863	87,72
	017		4	13,139	34,797	95,28
			51	13,047	34,802	93,80
14.09.2008	018	P02	2	14,860	34,868	97,19
			71	7,205	34,993	79,27
	019		3	14,689	34,871	96,69
			66	7,215	35,011	81,47
15.09.2008	020	GB3	4	17,046	34,410	95,45
			42	17,049	34,408	95,91
	021		2	17,126	34,404	95,38
			41	17,041	34,408	95,59
16.09.2008	022	N01	2	16,787	33,062	96,72
			35	17,292	33,970	91,42
	023		3	16,777	33,194	97,88
			38	17,350	33,906	90,18
	024		3	17,172	33,284	96,65
			21	17,188	33,483	94,49
17.09.2008	025	GB1	2	16,856	32,757	94,88
			34	17,355	33,268	90,60
	026		2	17,051	33,051	95,52
			38	17,373	33,425	87,53

Tab. 4: Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008:
Prevalences (%) of externally visible diseases and parasites of dab
(*Limanda limanda*) in the North Sea and at Iceland

Area	N unt	Ly	Ep Hyp/Pap	Ulc Ak/Hei	Flo Ak/Hei	KieHy	Skel Def	Hyp Pig	Steph	Acanth	Lepe
N11	718	3,6	1,1	3,6	0,7	0,1	0,0	27,2	15,6	4,5	11,8
P01	619	14,5	1,6	4,2	0,5	0,2	0,5	15,0	88,7	2,7	5,5
N04	537	4,5	2,8	3,7	0,2	0,0	0,6	41,0	30,5	2,4	19,9
I16	237	23,6	2,5	7,2	2,1	0,0	0,0	0,0	67,1	0,0	1,7
I20	455	7,7	0,9	1,8	0,0	0,0	0,0	0,0	83,3	0,0	0,2
N06	616	16,9	3,2	1,3	0,2	2,4	0,8	38,0	84,4	2,3	1,5
P02	626	16,5	1,9	1,3	0,5	0,2	0,6	9,3	99,7	2,4	1,6
GB3	703	3,6	1,4	0,4	0,0	0,0	0,6	8,7	15,9	2,8	8,0
N01	847	1,3	0,8	0,8	0,1	0,0	0,1	5,2	2,0	2,1	7,0
GB1	792	0,3	0,3	0,0	0,3	0,0	0,5	1,6	1,5	1,9	1,3
Total	6,150										

Tab. 5: Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008:
Prevalences (%) of liver anomalies in dab (*Limanda limanda*) in the North Sea and
at Iceland

Area	Length (cm)		N unt	Liver nodules (mm)			Green Livers	Nema- todes	Acantho- ceph.
	von	bis		> 2	> 5	≥ 10			
N11	20	24	50	2,0	0,0	0,0	4,0	0,0	0,0
	25	40	56	26,8	7,1	7,1	1,8	1,8	0,0
P01	20	24	58	3,4	0,0	0,0	5,2	6,9	3,4
	25	40	19	21,1	10,5	5,3	5,3	0,0	0,0
N04	20	24	60	0,0	0,0	0,0	0,0	1,7	3,3
	25	40	30	0,0	0,0	0,0	6,7	6,7	3,3
I16	20	24	38	0,0	0,0	0,0	36,8	26,3	0,0
	25	40	61	0,0	0,0	0,0	36,1	49,2	1,6
I20	20	24	35	0,0	0,0	0,0	0,0	8,6	0,0
	25	40	27	0,0	0,0	0,0	3,7	11,1	0,0
N06	20	24	51	2,0	0,0	0,0	7,8	98,0	49,0
	25	40	2	0,0	0,0	0,0	50,0	100,0	100,0
P02	20	24	47	2,1	0,0	0,0	89,4	27,7	8,5
	25	40	3	33,3	0,0	0,0	100,0	66,7	33,3
GB3	20	24	54	5,6	1,9	1,9	0,0	3,7	0,0
	25	40	32	6,3	3,1	0,0	0,0	15,6	0,0
N01	20	24	52	3,8	0,0	0,0	1,9	3,8	0,0
	25	40	23	8,7	4,3	0,0	0,0	0,0	0,0
GB1	20	24	52	0,0	0,0	0,0	3,8	1,9	0,0
	25	40	8	0,0	0,0	0,0	0,0	0,0	0,0
Total			758						

Tab. 6: Cruise 315 RV 'Walther Herwig III', 29.08. – 19.09.2008:
Prevalences (%) of diseases and parasites of haddock (*Merlangius merlangus*)
at Iceland

Area	N unt	Ulc Ak/Hei	Skel Def	PBT	NetzAb	Locera	Clav	Cryp
I16	588	1,9	0,9	0,0	0,5	33,7	7,0	0,0
I20	554	0,2	0,7	0,0	0,0	23,3	4,5	1,6

Abbreviations:

N unt	: Number examined	PBT	: Pseudobranchial pseudotumour
Ly	: Lymphocystis	Acanthoceph.	: Acanthocephaleans, liver
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	Cryp	: <i>Cryptocotyle sp.</i>
Skel Def	: Skeletal deformities	LK >2 mm	: Liver nodules > 2 mm in diameter