

**FRV Walther Herwig III
Cruise 438
20.08. - 04.09.2020**

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

Scientist in Charge: Dr. Klaus Wysujack

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 fish from the North Sea and Baltic Sea, studies were carried out in four Baltic Sea and five North Sea areas. In addition to the onboard examination of dab (*Limanda limanda*), flounder (*Platichthys flesus*) and cod (*Gadus morhua*) for macroscopic externally and internally visible diseases and parasites, a large range of fish samples were taken for a subsequent analysis of contaminants (organic, inorganic and radioactive substances) and their biological effects. Samples were also taken for the PlasM project on the contamination of fish with microplastics, as well as for the Fish Genome project. Samples of fish and other organisms were taken for a project at the Helmholtz Center Geesthacht on the "Occurrence and distribution of UV filters and stabilizer substances in the food chain of the Baltic and North Sea". Furthermore, hydrographical measurements were carried out (water temperature, salinity, oxygen content) and water samples were taken for measurement of radioactive substances.

The following preliminary findings were noted:

Dab: again, low prevalence of "classical" infectious diseases (lymphocystis, epidermal hyperplasia/papilloma, skin ulcerations) especially in the North Sea; continuing increased prevalence of hyperpigmentation in the North Sea; slightly decreased prevalence of liver nodules (tumours and pre-stages).

Baltic cod: again, low prevalence of skin ulcerations and skeletal deformities; low infestation rates with nematodes in the body cavity in the Baltic Sea areas; once more generally high prevalence of the gill parasite *Loma morhua*.

Flounder: stable level of prevalence of lymphocystis in the Baltic Sea.

Participants:

Name	Function	Institution
Dr. Klaus Wysujack	Scientist in Charge	TI Fisheries Ecology
Dr. Jörn Scharsack	Scientist	TI Fisheries Ecology
Ivo Int-Veen	Scientist	TI Fisheries Ecology
Wolfgang Lindemann	Technician	TI Fisheries Ecology
Alexandra Poell	Technician	TI Fisheries Ecology
Marcellus Rödiger	IT/Data group	TI Fisheries Ecology
Oguz Senmeyvacı	Technician	TI Fisheries Ecology
Maike Siegmund	Technician	TI Fisheries Ecology
Andreas Wittmann	Guest scientist	Helmholtz-Zentrum Geesthacht

Objectives of the Cruise

1. Studies on biological effects of contaminants;
2. Studies on the occurrence of fish diseases and parasites;
3. Sampling of fish for chemical analysis of contaminants;
4. Tissue sampling of livers for subsequent histological and biochemical analyses;
5. Studies and sampling for the project PlasM (microplastics in fish);
6. Sampling of different biota to study occurrence and concentration of UV filter and stabilizer substances (cooperation with Helmholtz-Zentrum Geesthacht);
7. Assessment and documentation of litter items in the bottom trawls;
8. Hydrographical measurements (salinity, temperature, oxygen, turbidity).

Dates of the Cruise

At noon (1:00 p.m.) on 08/20/2020, the FRV Walther Herwig III left Bremerhaven heading for the Baltic Sea via the Skagerrak. On 08/22/2020, work started in area B01 in Kiel Bight, continuing to 08/23. During the following days, the Baltic Sea areas B12 (Mecklenburg Bight), B10 (Adlergrund) and B11 (Arkonasee) were worked on. Afterwards, the bottom trawl typically used for the North Sea (GOV) was attached in order to carry out two comparative hauls in area B12, which was possible without problems.

On 08/27, the vessel took off through the Skagerrak in the direction of the North Sea, where on August 29th, work began in area P02 (Ekofisk). On the following days, work was continued in the areas GB4 (south-eastern Dogger Bank), GB3 (German Bight), GB1 (inner German Bight) and in the vicinity of N01 (German Bight, former dumpsite for waste of the titanium dioxide production, area ID N01B). Fishing in area N01 was not possible because of commercial fishing activities. In the afternoon of September 4th WHIII arrived in Bremerhaven, where the cruise ended on 09/05 with unloading of the vessel.

The location of the sampling areas and the cruise dates are shown in Fig. 1 and 2 and Tab. 1. In the 9 sampling areas (Fig. 1, 2), a total of 30 fishing hauls was performed (towing time 30–60 min. each) (geographical coordinates in Tab. 1, catch composition in Tab. 2).

The 140 ft bottom trawl was used in most areas of the Baltic Sea; in addition, in area B12 for test purposes the GOV was used (without problems). The GOV was used in the North Sea (in standard configuration). Finally, the 140 ft bottom trawl (usually used in the Baltic Sea) was successfully deployed in area GB1 in the North Sea for test and comparison.

Hydrographical measurements were made at almost all fishery stations (geographical coordinates in Tab. 1a, results in Tab. 3).

Preliminary Results

Dab (*Limanda limanda*)

In total, 3574 dab (total length ≥ 10 cm) from Baltic Sea areas B01, B10, B11 and B12 and five North Sea areas (P02, GB4, GB3, GB1, N01B) were examined for the occurrence of externally visible diseases and parasites (Tab. 4) and, in addition, 484 dab (total length ≥ 20 cm) for the occurrence of liver anomalies (Tab. 5).

The diseases and their prevalence as well as the regional prevalence patterns largely corresponded to findings from previous surveys. The generally decreasing trend in lymphocystis prevalence of North Sea dab has continued; current values were low (0.2-7.3 %). In the Baltic Sea, the values were lower than in the previous year (0.0-6.4 %). In general, compared to the North Sea, the prevalence of grossly visible parasites is lower in the Baltic Sea, with the exception of the trematode *Cryptocotyle lingua*, and the phenomenon of hyperpigmentation is currently very rare (see Tab. 4).

In the four areas of the German North Sea EEZ (GB1, N01B, GB3, GB4), the marked spatial patterns in disease prevalence already identified during previous cruises were confirmed. The prevalence of lymphocystis and, in particular, of the parasite *Stephanostomum baccatum* (white cysts under the skin) increased in north-westerly direction, while the prevalence of the parasites *Acanthochondria cornuta* and *Lepeophtheirus pectoralis* (both copepods, crustaceans) apparently decreased.

The high prevalence of hyperpigmentation in North Sea dab was confirmed. The highest prevalence was again recorded in area and GB4 (49.9 %). The causes of this phenomenon are still unknown.

There were no major new findings for liver tumors; overall, the numbers were slightly lower than in previous years. The highest value was found in dab ≥ 25 cm in area GB3 (21.7%).

Cod (*Gadus morhua*)

In total, 444 cod from two Baltic Sea areas (B01, B10) were examined for externally visible diseases and parasites, out of which 130 specimens were inspected for the presence of larval nematodes in the body cavity (Tab. 6). In the North Sea, only very few cod were caught and not examined for diseases and parasites.

The prevalence of externally visible diseases largely corresponded to previous cruises. The prevalence of acute/healing skin ulcerations was again low and ranged from 1.7 % to 11.1 %. However, the value for B01 (11.1 %) is based on a rather low sampling number (n=27). With values in the range of 0.0 % to 1.0 %, skeletal deformities were rare, as well as all other diseases.

Larval nematodes in the body cavity, in particular on the liver surface, were recorded in cod from all sampling areas in the Baltic Sea, yet, with low prevalence (1.6 – 2.4 %).

The gill parasite *Loma morhua* (Microspora) was prevalent in both areas, with values of 48.0 and 48.1 %. A comparison with previous years is difficult because in 2018/2019 cod were mainly caught in other areas, some of which are located significantly further to the east (B09, B13). In the closest comparison area (B11), infestation rates of 18.0% (2018) and 59.0% (2019) were registered in previous years, so that the current value of 48.0% confirms the previous year's level. In the areas further to the east, significantly higher numbers had been documented in the previous year (B09: 84.4%, B13: 80.9%).

Flounder (*Platichthys flesus*)

In total, 300 flounder from four Baltic Sea areas (B01, B10, B11, B12) were examined for externally visible diseases and parasites (Tab. 7). In the Baltic Sea, lymphocystis continued to be the predominant disease.

The infestation level is stable with regional fluctuations (e.g. Arkonasee, B11: 2017 - 32.8%, 2019 - 17.0%, 2020 - 12.3%; B12: 2019 - 0.0%; 2020 - 20.5%). The level of infestation rates with the trematode *Cryptocotyle* has also remained constant. As in the previous year, an infestation with the skin parasite *Lepeophtheirus pectoralis* was only found in area B12 in the Baltic Sea.

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

I would like to thank Captain Arne Schwegmann and his crew as well as the scientific cruise participants for the smooth and constructive cooperation and the very good atmosphere on board.

Dr. Klaus Wysujack

(Scientist in Charge)

Annex

2 Figures, 7 Tables

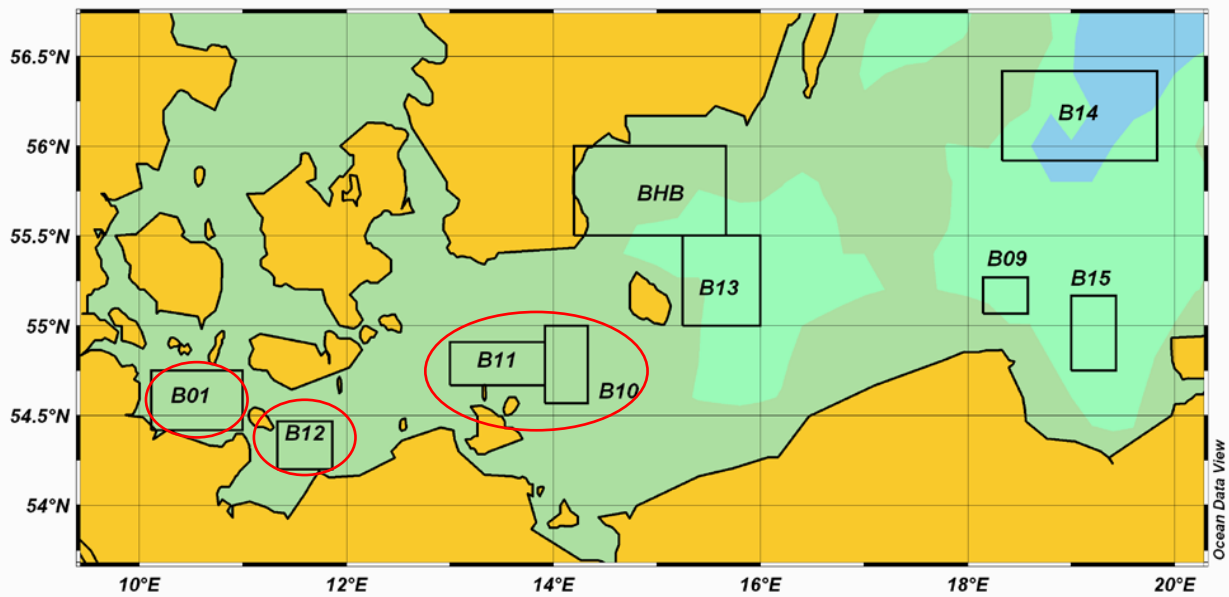


Fig. 1: Cruise 438 FRV 'Walther Herwig III', 20.08. – 04.09.2020:
Location of sampling sites in the Baltic Sea

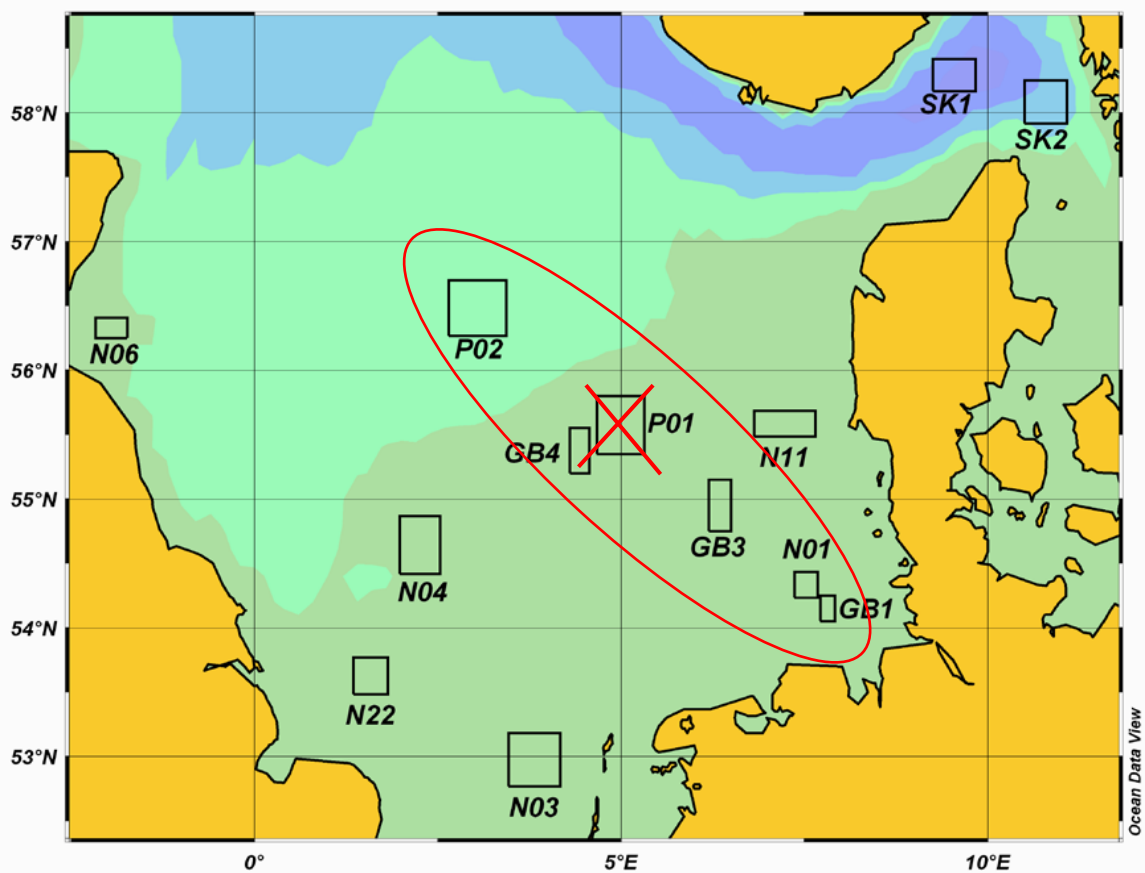


Fig. 2: Cruise 438 FRV 'Walther Herwig III', 20.08. – 04.09.2020:
Location of sampling sites in the North Sea

Tab. 1: Cruise 438 FRV 'Walther Herwig III', 20.08. – 04.09.2020:
Geographical coordinates of trawling stations in the Baltic Sea and North Sea
with trawling time and gear type

DATE	STATION	AREA	LATITUDE	LONGITUDE	GEAR	Trawling time (MIN.)
22.08.20	1	B01	54°32,947N	010°47,437E	140 Fuß-Netz	30
22.08.20	2	B01	54°32,367N	010°42,657E	140 Fuß-Netz	60
23.08.20	3	B01	54°44,066N	010°13,442E	140 Fuß-Netz	60
23.08.20	4	B01	54°36,845N	010°16,472E	140 Fuß-Netz	60
23.08.20	5	B01	54°35,537N	010°20,038E	140 Fuß-Netz	30
24.08.20	6	B12	54°23,110N	011°24,866E	140 Fuß-Netz	60
24.08.20	7	B12	54°14,940N	011°40,689E	140 Fuß-Netz	60
24.08.20	8	B12	54°13,530N	011°42,021E	140 Fuß-Netz	60
24.08.20	9	B12	54°14,585N	011°38,082E	140 Fuß-Netz	60
25.08.20	10	B10	54°36,945N	014°04,710E	140 Fuß-Netz	60
25.08.20	11	B10	54°39,782N	014°03,879E	140 Fuß-Netz	60
25.08.20	12	B10	54°34,458N	014°17,582E	140 Fuß-Netz	60
26.08.20	13	B11	54°43,589N	013°39,981E	140 Fuß-Netz	60
26.08.20	14	B11	54°46,460N	013°46,075E	140 Fuß-Netz	60
26.08.20	15	B11	54°44,830N	013°46,815E	140 Fuß-Netz	60
27.08.20	16	B12	54°19,137N	011°26,926E	GOV	60
27.08.20	17	B12	54°21,984N	011°22,851E	GOV	60
29.08.20	18	P02	56°36,764N	003°12,700E	GOV	60
29.08.20	19	P02	56°29,654N	003°09,272E	GOV	60
30.08.20	20	GB4	55°22,941N	004°26,304E	GOV	60
30.08.20	21	GB4	55°23,573N	004°26,112E	GOV	60
31.08.20	22	GB3	54°57,930N	006°21,983E	GOV	60
31.08.20	23	GB3	54°56,524N	006°16,826E	GOV	60
01.09.20	24	N01B	54°11,757N	007°36,744E	GOV	60
01.09.20	25	N01B	54°13,264N	007°28,123E	GOV	60
02.09.20	26	GB1	54°06,670N	007°45,787E	GOV	60
02.09.20	27	GB1	54°04,565N	007°53,538E	GOV	60
02.09.20	28	GB1	54°06,363N	007°46,971E	GOV	60
03.09.20	29	GB1	54°04,780N	007°51,926E	140 Fuß-Netz	60
03.09.20	30	GB1	54°07,246N	007°46,777E	140 Fuß-Netz	60

Tab. 1a: Cruise 438 RV 'Walther Herwig III', 20.08. – 04.09.2020:
Geographical coordinates of hydrography stations in the Baltic Sea and North Sea

DATEM	STATION	FISHERY-STATION	AREA	LATITUDE	LONGITUDE
22.08.20	1	1	B01	54°33,233N	010°48,325E
22.08.20	2	2	B01	54°32,092N	010°44,144E
23.08.20	3	3	B01	54°43,981N	010°12,368E
23.08.20	4	4	B01	54°37,119N	010°15,249E
23.08.20	5	5	B01	54°36,035N	010°18,794E
24.08.20	6	6	B12	54°23,817N	011°24,069E
24.08.20	7	7	B12	54°15,208N	011°39,520E
24.08.20	8	8	B12	54°13,598N	011°43,033E
25.08.20	9	10	B10	54°37,003N	014°03,506E
25.08.20	10	11	B10	54°39,447N	014°04,460E
25.08.20	11	12	B10	54°34,374N	014°18,544E
26.08.20	12	13	B11	54°43,319N	013°38,742E
26.08.20	13	14	B11	54°46,512N	013°46,979E
26.08.20	14	15	B11	54°44,984N	013°47,889E
27.08.20	15	16	B12	54°18,255N	011°26,485E
27.08.20	16	17	B12	54°21,403N	011°22,723E
29.08.20	17	18	P02	56°35,775N	003°13,096E
29.08.20	18	19	P02	56°30,889N	003°07,941E
30.08.20	19	20	GB4	55°22,757N	004°26,298E
30.08.20	20	21	GB4	55°23,817N	004°25,134E
31.08.20	21	22	GB3	54°58,927N	006°23,224E
31.08.20	22	23	GB3	54°56,103N	006°15,725E
01.09.20	23	24	N01B	54°11,821N	007°38,287E
01.09.20	24	25	N01B	54°13,287N	007°26,875E
02.09.20	25	26	GB1	54°06,778N	007°45,014E
02.09.20	26	27	GB1	54°04,340N	007°54,392E
02.09.20	27	28	GB1	54°06,940N	007°45,700E
03.09.20	28	29	GB1	54°04,703N	007°53,216E

Tab. 1b: 438. Reise FFS „Walther Herwig III“, 20.08. – 04.09.2020:
Geographical coordinates of neuston sampling (neuston net after David/Hempel) in the Baltic Sea and North Sea

DATEM	STATION	AREA	LATITUDE	LONGITUDE	Towing time (MIN.)
25.08.20	1	B10	54°35,116N	014°11,020E	15
25.08.20	2	B10	54°34,085N	014°11,877E	15
01.09.20	3	N01B	54°13,118N	007°34,123E	15
01.09.20	4	N01B	54°13,972N	007°33,063E	15
02.09.20	5	GB1	54°04,276N	007°53,379E	15
02.09.20	6	GB1	54°04,734N	007°52,109E	15

Tab. 2: Cruise 438 RV 'Walther Herwig III', 20.08. – 04.09.2020: 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	1.7	43.4	---	130.8	453.8	14.5	274.2	26.0	2.0
	kg	1.8	1.8	---	83.4	7.3	2.8	34.0	5.9	0.6
B12	n	33.3	3.6	---	25.0	87.9	---	148.1	26.4	11.7
	kg	0.1	0.1	---	0.3	1.2	---	15.6	2.4	2.5
B10	n	454.9	---	---	259.0	14.4	1.0	4.3	48.6	39.4
	kg	218.8	---	---	12.4	0.1	0.4	0.5	13.0	11.6
B11	n	24.2	51.8	---	46.5	524.6	0.3	8.6	24.1	63.0
	kg	25.7	9.7	---	0.9	5.8	0.2	0.7	4.5	12.1
P02	n	9.7	1167.1	9197.0	592.1	203.3	182.7	700.7	---	---
	kg	1.5	95.7	607.0	82.3	3.1	30.7	53.3	---	---
GB4	n	---	112.9	219.9	159.2	460.0	---	872.7	---	---
	kg	---	3.9	0.7	10.4	6.9	---	75.1	---	---
GB3	n	---	2591.7	4.0	276.3	2292.9	20.4	903.1	53.6	---
	kg	---	46.7	0.1	5.3	16.1	4.5	74.1	6.7	---
N01B	n	---	23389.6	---	32712.5	35043.9	173.4	581.1	---	---
	kg	---	561.4	---	130.9	245.3	24.1	30.8	---	---
GB1	n	---	18992.3	---	1400.0	2055.0	106.1	109.3	2.0	6.0
	kg	---	493.8	---	4.2	12.3	17.5	6.7	0.1	1.6

Tab. 3: Cruise 438 RV 'Walther Herwig III', 20.08. – 04.09.2020:
Water depth, temperature (T), salinity (S), O₂ in mg/l and O₂ saturation (%)
in Baltic Sea and North Sea

STATION	AREA	Total depth (m)	Surface				Bottom					
			Measuring depth (m)	T	S	O ₂ (mg/l)	O ₂ (%)	Measuring depth (m)	T	S	O ₂ (mg/l)	O ₂ (%)
1	B01	21	3	18.646	14.277	5.47	91.16	20	12.606	22.969	1.53	23.72
2	B01	20	3	19.876	11.685	5.95	99.98	19	12.384	21.424	0.83	12.67
3	B01	24	3	20.461	13.336	5.66	97.14	21	12.902	22.338	1.60	24.83
4	B01	20	3	20.030	12.160	5.71	96.45	18	13.953	19.588	1.81	28.34
5	B01	17	3	20.182	11.816	5.81	98.20	15	17.570	16.627	3.84	63.56
6	B12	23	3	18.937	10.509	5.78	94.68	21	13.757	20.318	1.30	20.31
7	B12	26	3	19.110	10.422	5.81	95.38	24	12.634	23.317	0.87	13.49
8	B12	26	3	18.947	10.514	5.69	93.14	23	12.987	23.121	0.78	12.20
9	B10	26	3	20.493	7.799	5.55	92.19	18	14.319	8.231	4.03	59.26
10	B10	26	3	20.391	7.804	5.55	91.98	23	11.823	9.234	3.62	50.68
11	B10	23	3	19.420	7.741	5.89	95.74	19	9.911	7.946	5.25	69.84
12	B11	40	3	19.523	8.066	5.56	90.76	38	13.137	8.876	4.62	66.39
13	B11	46	3	19.550	8.177	5.70	93.15	39	12.354	10.703	3.61	51.59
14	B11	40	3	19.546	8.201	5.71	93.29	37	9.897	9.252	4.51	60.39
15	B12	24	3	18.338	12.987	5.48	90.01	19	13.260	21.610	1.10	17.18
16	B12	23	3	18.193	14.502	5.27	87.11	20	14.018	20.110	1.49	23.33
17	P02	69	3	15.602	34.980	5.36	95.34	67	7.531	34.977	4.76	71.31
18	P02	71	3	15.688	34.985	5.35	95.20	70	7.545	34.982	4.69	70.34
19	GB4	45	3	16.960	34.720	5.15	93.89	42	11.086	34.801	4.78	77.38
20	GB4	45	3	16.824	34.752	5.21	94.65	41	11.867	34.818	4.70	77.38
21	GB3	45	3	18.421	34.309	4.85	90.73	42	18.392	34.375	4.75	88.72
22	GB3	45	4	18.184	34.515	4.87	90.77	41	18.184	34.516	4.85	90.33
23	N01B	38	3	18.333	33.082	4.46	82.62	36	18.335	33.100	4.45	82.45
24	N01B	38	3	18.768	33.296	4.90	91.56	38	18.714	33.295	4.86	90.77
25	GB1	40	3	18.639	33.116	4.72	88.02	38	18.613	33.133	4.66	86.47
26	GB1	40	3	18.691	32.974	4.83	89.95	38	18.687	33.006	4.71	87.69
27	GB1	41	3	18.519	33.093	4.65	86.38	40	18.503	33.105	4.60	85.46
28	GB1	41	3	18.821	33.054	4.88	91.17	38	18.727	33.044	4.65	86.76

Tab. 4: Cruise 438 FRV 'Walther Herwig III', 20.08. – 04.09.2020:
Prevalences (%) of externally visible diseases and parasites in dab (*Limanda limanda*) from the Baltic Sea and North Sea

AREA	N unt	Ly	Ep Pap/Hyp	Ulc Ak/Hei	FloF Ak/Hei	KieHy	HypPig (Mel)	Skel	Steph	Acanth	Lepe	Cryp
B01	419	4.5	1.4	1.9	0.0	0.0	2.9	0.7	0.0	0.5	0.5	11.0
B11	28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6
B12	392	6.4	0.3	2.3	0.5	0.0	0.5	0.0	1.8	0.5	0.8	7.4
B10	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P02	507	7.3	2.0	0.2	0.0	0.0	44.4	0.6	99.8	2.2	0.8	0.0
GB4	593	5.1	1.3	3.0	0.3	0.3	49.9	0.2	69.1	2.4	4.7	0.0
GB3	553	1.1	2.0	1.3	0.9	0.2	45.2	0.2	2.5	2.7	23.3	0.4
GB1	555	0.2	1.3	2.2	0.4	0.0	22.3	0.0	1.3	5.2	8.5	0.2
N01B *	519	1.3	1.7	2.9	0.6	0.0	35.8	0.4	1.2	3.7	21.2	0.0
SUM	3574											

Tab. 5: Cruise 438 FRV 'Walther Herwig III'. 20.08. – 04.09.2020:
Prevalences (%) of liver anomalies in dab (*Limanda limanda*) from the Baltic Sea and North Sea

AREA	Total Length (cm)	N unt	LK 2 - >10 mm (total)	LK 2 - 5 mm	LK 6 - 9 mm	LK ≥10 mm	Grün	Nemato	Kratz
B01	20 - 24	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B01	25 - 40	51	5.9	2.0	2.0	2.0	0.0	0.0	0.0
B10	20 - 24	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B10	25 - 40	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B11	20 - 24	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B11	25 - 40	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B12	20 - 24	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B12	25 - 40	50	8.0	8.0	0.0	0.0	0.0	0.0	0.0
P02	20 - 24	22	4.5	4.5	0.0	0.0	0.0	0.0	0.0
GB1	20 - 24	51	2.0	0.0	0.0	2.0	0.0	0.0	0.0
GB1	25 - 40	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GB3	20 - 24	51	3.9	3.9	0.0	0.0	0.0	0.0	0.0
GB3	25 - 40	23	21.7	13.0	0.0	8.7	0.0	0.0	0.0
GB4	20 - 24	50	0.0	0.0	0.0	0.0	0.0	2.0	0.0
GB4	25 - 40	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N01B	20 - 24	53	5.7	1.9	0.0	3.8	0.0	0.0	0.0
N01B	20 - 24	53	5.7	1.9	0.0	3.8	0.0	0.0	0.0
N01B	25 - 40	17	5.9	5.9	0.0	0.0	0.0	0.0	0.0
SUM		484							

Tab. 6: Cruise 438 FRV 'Walther Herwig III'. 20.08. – 04.09.2020:
Prevalences (%) of externally visible diseases and parasites in cod
(*Gadus morhua*) from the Baltic Sea and North Sea

AREA	N unt	Ulc Ak/Hei	Ulc Hae	FloF Ak/Hei	Ep Pap/Hyp	Skel	PBT	Cryp	Locera	Loma	N unt (Anis)	Anis
B01	27	11.1	7.4	0.0	0.0	0.0	0.0	33.3	3.7	48.1	27	1.6
B10	417	1.7	0.0	0.2	0.0	1.0	0.0	3.1	0.0	48.0	103	2.4
SUM	444										130	

Tab. 7: Cruise 438 FRV 'Walther Herwig III'. 20.08. – 04.09.2020:
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	FloF Ak/Hei	Skel	Lepe	Cryp
B01	8	12.5	0.0	0.0	12.5	0.0	0.0
B10	69	20.3	0.0	0.0	1.4	0.0	20.3
B11	179	12.3	0.0	0.0	0.0	0.0	11.7
B12	44	20.5	0.0	0.0	0.0	15.9	29.5
SUM	300						

Abbreviations:

N unt	: Number examined	Steph	: <i>Stephanostomum baccatum</i>
Ly	: Lymphocystis	Acanth	: <i>Acanthochoondria cornuta</i>
Ep Hyp/Pap	: Epidermal hyperplasia/papilloma	Lepe	: <i>Lepeophtheirus pectoralis</i>
Ulc Ak/Hei	: Skin ulcerations. acute/healing	Locera	: <i>Lernaeocera branchialis</i>
Ulc Hae	: Skin ulcerations. haemorrhagic stage	Cryp	: <i>Cryptocotyle spp.</i>
Flo Ak/Hei	: Fin rot/erosion. acute/healing	Loma	: <i>Loma sp.</i>
Kie Hyp	: Gill hyperplasia. x-cell disease	Anis	: Nematodes in the bodx cavity
Hyp Pig	: Hyperpigmentation	LK	: Liver nodules > 2 mm in diameter
Skel Def	: Skeletal deformities	Nemato	: Nematodes on the liver
PBT	: Pseudobranchial pseudotumour	Grün	: green discolouration of the liver
		Kratz	: Acanthocephaleans on the liver