

**FRV Walther Herwig III
Cruise 432
2.12. - 20.12.2019**

**Studies on Fish Diseases and Biological Effects of Contaminants
in the North Sea and Irish Sea**

Scientist in Charge: Dr. Pedro Miguel Agostinho Nogueira

Summary

As part of the integrated monitoring programme of the Thünen Institute of Fisheries Ecology (FI) on contaminants and biological effects (incl. fish diseases), studies were carried out in six reference areas in the North Sea and three reference areas in the Irish Sea. In addition to the onboard examination of dab (*Limanda limanda*) and cod (*Gadus morhua*) for macroscopical externally and internally visible diseases and parasites, a large range of fish samples were taken for a subsequent analysis of radioactive contaminants and the presence of plastic particles in the stomach and intestine of fish (PlasM project). Furthermore, sediment samples were taken and hydrographical measurements were carried out (water temperature, salinity, oxygen content, turbidity). A neuston net was operated to sample litter particles at the water surface, and macro litter particles in the bottom trawl were classified and quantified for each fishery haul. The following preliminary findings were noted:

Dab: It was observed that hyperpigmentation and *Stephanostomum baccatum* in the North Sea is significantly higher in comparison with the Irish Sea. In the case of skeletal deformities the opposite was observed. For all other registered diseases no trend was observed.

Cod: Overall low prevalence of acute/healing skin ulcerations (with exception for the area GB1) and no skeletal deformities were observed. In both North Sea and Irish Sea it was observed generally high prevalence of the gill parasite *Loma morhua*.

Objectives of the Cruise

1. Studies on biological effects of contaminants;
2. Studies on the occurrence of fish diseases and parasites;
3. Obtaining fish samples for the analysis of radioactive substances, heavy metals and organic pollutants (within the framework of BLMP, Radiation Protection Prevention Act, OSPAR and research projects);
4. Tissue sampling of livers and other organs for subsequent histological and biochemical analyses;
5. Hydrographical measurements (salinity, temperature, oxygen, turbidity);
6. Documentation of marine litter fished during the trawling;
7. Video and photos from marine litter on the Sea bottom;
8. Sampling for the PlasM project;
9. Water sampling for a measurement intercomparison of the International Atomic Energy Agency;
10. Sea surface trawling for plastic particles using a Neuston net;
11. Sediment sampling with a "Gemini Corer" and a van Veen grab.

Dates of the Cruise

On the afternoon of day 2.12.2019 we departure Bremerhaven in the direction of the North Sea, where on the morning of 03.12. our work started in the study area GB1. On the next day's our survey proceed on the areas N01 and GB3. Due to the weather forecast of extreme bad wetter conditions in the North Sea, on day 6.12. we started our travel to the Irish Sea through the English Channel.

On day 10.12. we reach the Irish Sea, where fishing activities, sediment and water sampling were continued in the areas E02, E01 and G05. After successfully concluding our survey of the Irish Sea study areas we returned to the North Sea through the Pentland Firth. Upon arriving in the North Sea the survey was continued in the areas P02, GB4, P01 and GB1. On day 20.12. our travel ended in Bremerhaven two day's early as planned.

The location of the study areas and the exact travel course can be seen in Fig. 1 and Tab. 1a and 1b. In the 14 study areas (Fig. 1), a total of 23 fishing hauls (trawling time, usually one hour) were carried out (Table 1a). The GOV was used in the North Sea and the 140 trawl in the Irish Sea. Hydrographic measurements were carried out at 29 stations (Tab. 1b), sediment samples were taken in the Irish Sea with a Gemini Corer and with a van Veen bottom grab (Tab. 1b). A single Neuston trawl sampling for microplastic in the Sea surface was performed in the area N01 (geographical coordinates in Tab. 1d).

Preliminary Results

1 Dab (*Limanda limanda*)

In total, 2848 dab from the North Sea areas P02, P01, N01, GB3, GB4 and the Irish Sea areas G05 and E02 were examined for the occurrence of externally visible diseases and parasites (Tab. 4) and 117 dab (≥ 20 cm) for the occurrence of liver anomalies (Tab. 5).

2 Cod (*Gadus morhua*)

In total, 15 cod's from North Sea and Irish Sea were examined for externally visible diseases and parasites, additionally they were inspected for nematodes in the body cavity (Tab. 6).

3 Miscellaneous

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

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Acknowledgements

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



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Annex: 2 Figures and 11 Tables



Fig. 1: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Location of sampling sites in the North Sea and Irish Sea

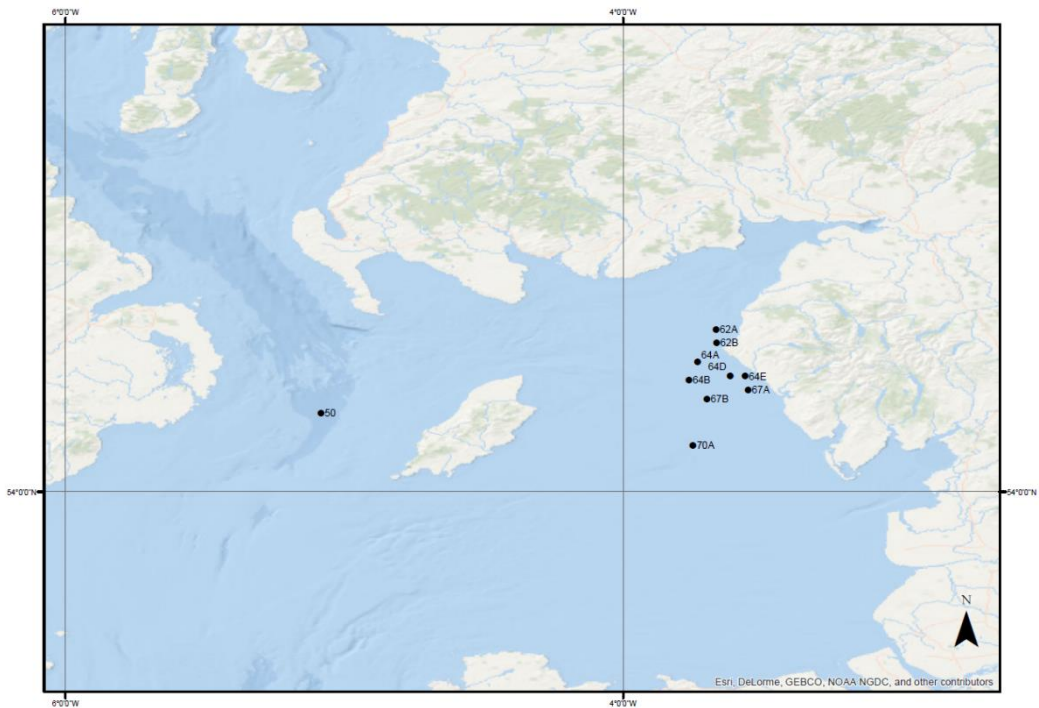


Fig. 2: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Location of the sediment sampling sites in the Irish Sea

Tab. 1: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019:
Geographical coordinates of trawling stations in the North Sea and Irish Sea

Date	LOG-Station	Station	Area	Latitude	Longitude	Duration (min)	Net
03.12.19	287	1	GB1	54°05,026N	007°51,892E	60	GOV
03.12.19	288	2	GB1	54°06,899N	007°45,898E	60	GOV
03.12.19	289	3	GB1	54°04,494N	007°53,300E	60	GOV
04.12.19	290	4	N01	54°15,499N	007°29,645E	60	GOV
04.12.19	291	5	N01	54°20,575N	007°27,986E	60	GOV
04.12.19	293	6	N01	54°20,077N	007°30,310E	60	GOV
05.12.19	294	7	GB3	54°55,888N	006°16,576E	60	GOV
05.12.19	295	8	GB3	54°58,827N	006°23,337E	60	GOV
10.12.19	299	9	E02	52°39,407N	006°01,830W	60	140er
11.12.19	300	10	E01	53°45,077N	005°46,152W	60	140er
11.12.19	301	11	E01	53°45,861N	005°49,449W	60	140er
12.12.19	303	12	G05	54°20,115N	003°52,914W	60	140er
12.12.19	304	13	G05	54°20,017N	003°54,461W	60	140er
13.12.19	307	14	G05	54°20,193N	003°55,434W	60	140er
13.12.19	308	15	G05	54°20,115N	003°52,179W	60	140er
17.12.19	316	16	P02	56°30,825N	002°54,709E	60	GOV
17.12.19	317	17	P02	56°34,405N	003°04,286E	60	GOV
18.12.19	318	18	GB4	55°23,111N	004°33,677E	60	GOV
18.12.19	319	19	GB4	55°23,708N	004°25,521E	60	GOV
18.12.19	320	20	P01	55°22,731N	004°59,001E	60	GOV
18.12.19	321	21	P01	55°26,558N	005°07,728E	60	GOV
19.12.19	322	22	GB1	54°04,586N	007°53,089E	60	GOV
19.12.19	323	23	GB1	54°07,223N	007°45,158E	60	GOV

Tab. 1a: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Geographical coordinates of hydrography stations in the North Sea and Irish Sea

Date	LOG Station	Trawling Station	Area	Latitude	Longitude
03.12.19	287	1	GB1	54°07,665N	007°44,585E
03.12.19	288	2	GB1	54°07,333N	007°44,924E
03.12.19	288	3	GB1	54°04,125N	007°54,271E
04.12.19	290	4	N01	54°15,062N	007°29,964E
04.12.19	291	5	N01	54°20,599N	007°26,872E
04.12.19	293	6	N01	54°20,887N	007°30,512E
05.12.19	294	7	GB3	54°55,638N	006°16,378E
05.12.19	295	8	GB3	54°58,983N	006°23,703E
07.12.19	296		G08	50°40,613N	000°48,900E
09.12.19	297		G06	49°49,272N	005°30,022W
10.12.19	298		E03	51°17,598N	006°22,633W
10.12.19	299	9	E02	52°36,049N	006°03,625W
11.12.19	300	10	E01	53°45,829N	005°46,939W
11.12.19	301	11	E01	53°46,218N	005°48,629W

Tab. 1a: cont.

12.12.19	303	12	G05	54°19,414N	003°51,637W
12.12.19	304	13	G05	54°20,148N	003°54,566W
12.12.19	305		G05	54°23,713N	003°56,576W
13.12.19	307	14	G05	54°20,159N	003°54,533W
13.12.19	308	15	G05	54°20,000N	003°51,135W
15.12.19	314		G04	55°50,613N	007°07,044W
15.12.19	315		G01	58°50,552N	004°56,204W
17.12.19	316	16	P02	56°30,843N	002°52,910E
17.12.19	317	17	P02	56°34,990N	003°04,818E
18.12.19	318	18	GB4	55°23,281N	004°33,770E
18.12.19	319	19	GB4	55°23,687N	004°25,171E
18.12.19	320	20	P01	55°22,691N	004°57,749E
18.12.19	321	21	P01	55°27,217N	005°07,778E
19.12.19	322	22	GB1	54°04,638N	007°53,490E
19.12.19	323	23	GB1	54°07,718N	007°44,265E

Tab. 1b: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019:
Geographical coordinates of sediment sampling stations in the Irish Sea

Date	LOG-Station	Device	Area	Latitude	Longitude
11.12.19	302	Gemini Corer	BSH50	54°16,993N	005°04,921W
12.12.19	306	Gemini Corer	BSH64A	54°28,030N	003°44,110W
13.12.19	309	Gemini Corer	BSH64B	54°24,043N	003°45,809W
13.12.19	310	Gemini Corer	BSH64D	54°25,001N	003°36,926W
13.12.19	311	Gemini Corer	BSH67B	54°20,019N	003°41,936W
13.12.19	312	van Veen Gräber	BSH67A	54°21,940N	003°32,969W
13.12.19	313	van Veen grab	BSH62B	54°32,159N	003°39,919W

Tab. 1c: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019:
Geographical coordinates of Neuston trawl sampling stations in the North Sea

Date	LOG-Station	Device	Area	Latitude	Longitude	Speed	Duration
04.12.19	292	Neuston	N01	54°22,696N	007°34,517E	5 Knot	15 min

Tab. 2: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Mean catches of selected abundant fish species in the North Sea and Irish Sea (weight (kg) per 1 h trawling)

Area	Cod	Dab	Plaice	Herring	Sprat	Flounder	Whiting	Mackerel
GB1		5,02	0,29	11,29	12,28		230,00	0,04
N01	1,22	9,63	0,10	74,83	623,07	0,21	126,16	4,79
GB3		34,72		8,87	3,04		24,70	0,04
E02	6,13	5,14	0,72	0,59	3,06			
E01			1,08	2,29			307,75	0,05
G05		1,63	7,83	5,41	2,72		89,02	0,03
P02	0,16	33,33	0,17	0,54	0,05		6,72	0,05
GB4		33,60	1,59	125,51	398,33		1,19	
P01		8,11	0,85	82,42	648,78		12,30	2,15

Tab. 2a: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Mean catches of selected abundant fish species in the North Sea and Irish Sea (number per 1 h trawling)

Area	Cod	Dab	Plaice	Herring	Sprat	Flounder	Whiting	Mackerel
GB1		79,91	4,79	175,75	1694,61		6022,07	0,20
N01	0,33	128,67	1,94	12095,26	94237,26	0,67	1671,73	66,70
GB3		573,00		503,78	541,67		901,07	0,50
E02	4,00	50,00	5,00	0,59	601,00			
E01			5,47	58,09			6991,19	2,00
G05		32,00	47,05	129,34	766,10		1436,15	0,67
P02	0,51	533,50	0,81	9,70	2,64		493,65	1,32
GB4		515,50	15,49	6389,47	35254,22		49,98	
P01		101,50	5,50	5612,07	41984,23		393,41	19,00

Tab. 3a: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Water depth, temperature (T), salinity (S), O₂ in mg/l and O₂ saturation (%) in Baltic Sea and North Sea

Date	LOG Station	Trawling Station	Area	Depth (m)	T (°C)	S (PSU)	O ₂ (mg/l)	O ₂ Saturation (%)
03.12.19	287	1	GB1	38	9.934	33.3409	5.82	91.12
				2	9.875	33.2222	5.86	91.49
03.12.19	288	2	GB1	37	9.958	33.335	5.79	90.64
				2	9.977	33.1515	5.81	90.91
03.12.19	288	3	GB1	36	9.723	33.0397	5.84	90.71
				2	9.539	32.9448	5.91	91.49
04.12.19	290	4	N01	38	10.061	34.195	5.84	92.11
				2	10.052	34.181	5.82	91.72
04.12.19	291	5	N01	26	10.146	34.2256	5.79	91.56
				3	9.605	33.7394	5.97	92.9
04.12.19	293	6	N01	23	9.902	33.9093	5.85	91.83
				1	9.719	33.7651	5.93	92.58

Tab. 3a: cont.

05.12.19	294	7	GB3	34 2	10.763 10.745	34.6577 34.6529	5.8 5.8	93.11 93.07
05.12.19	295	8	GB3	40 2	10.771 10.736	34.7863 34.7423	5.81 5.8	93.41 93.18
07.12.19	296		G08	42 2	12.313 12.305	35.2573 35.2551	5.66 5.66	94.25 94.22
09.12.19	297		G06	85 2	11.897 11.882	35.1917 35.1927	5.68 5.7	93.73 93.99
10.12.19	298		E03	105 2	11.17 11.151	35.0407 35.042	5.62 5.61	91.24 91.16
10.12.19	299	9	E02	27 3	9.674 9.652	34.0521 34.0477	6.01 5.99	93.88 93.58
11.12.19	300	10	E01	60 2	11.721 11.261	34.3326 34.1767	5.63 5.73	92.18 92.68
11.12.19	301	11	E01	57 1	11.381 11.123	34.2197 34.1442	5.7 5.73	92.55 92.42
12.12.19	303	12	G05	34 2	8.906 8.739	33.0148 32.9634	6.09 6.08	92.95 92.5
12.12.19	304	13	G05	39 4	8.827 8.743	32.8703 32.8224	6.08 6.1	92.6 92.64
12.12.19	305		G05	36 3	8.985 8.963	32.9378 32.9025	6.06 6.07	92.58 92.63
13.12.19	307	14	G05	35 2	8.79 8.741	32.9813 32.9614	6.1 6.08	92.86 92.36
13.12.19	308	15	G05	37 5	8.817 8.721	32.991 32.9347	6.1 6.08	92.85 92.33
15.12.19	314		G04	53 4	10.133 10.111	35.1781 35.1772	5.82 5.81	92.47 92.29
15.12.19	315		G01	76 2	9.912 9.853	34.7637 34.7307	5.83 5.83	91.94 91.86
17.12.19	316	16	P02	70 2	8.149 8.126	34.8535 34.8551	6 5.98	91.17 90.79
17.12.19	317	17	P02	69 4	8.082 8.076	34.8555 34.8563	6 6	90.95 90.99
18.12.19	318	18	GB4	42 3	8.214 8.436	34.7508 34.7277	6.07 6.05	92.24 92.43
18.12.19	319	19	GB4	42 4	8.123 8.118	34.7426 34.7427	6.08 6.07	92.23 92.12
18.12.19	320	20	P01	45 4	8.586 8.916	34.7003 34.6902	6.03 6.03	92.41 93.05
18.12.19	321	21	P01	40 2	8.601 8.626	34.6924 34.6926	6.04 6.02	92.51 92.27
19.12.19	322	22	GB1	38 2	8.251 7.873	33.4848 33.0289	6.1 6.17	92.11 92.05
19.12.19	323	23	GB1	37 3	8.309 8.27	33.3385 33.3171	6.07 6.09	91.58 91.77

Tab. 4: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Prevalences (%) of externally visible diseases and parasites in dab (*Limanda limanda*) from the North Sea and Irish Sea

Area	N unt	Ly	Ulc AkHei	FloF AkHei	KieHy	Mel	Skel	Steph	Acanth	Lepe	Cryp
P02	521	6,7	0,8	0,2		46,8	0,2	98,7	0,4	0,2	
P01	204	2,9	1	0,5	1	53,4		80,4	2,9	5,9	
G05	230	2,2	0,9	2,2		13	1,7	12,2	4,3	13	
GB3	500	2,2	1,4	2,8		56,4	0,2	6,8	7,2	9,4	
N01	364	1,9	3,8	6,3	0,3	76,1		1,9	12,4	17,9	
GB4	531	6		0,8	0,4	53,3	0,2	62,5	3,4	4,5	
GB1	448	5,1	2,7	4	0,4	65		17,4	8,9	17	
E02	50	8				18	2			4	
Sum	2848										

Tab. 5: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Prevalences (%) of liver anomalies in dab (*Limanda limanda*) from the North Sea and Irish Sea

Area	Length (cm)	N unt	LK0210	LK0205	LK0609	LK1000	Green	Nematodes	Kratz
GB1	20 to 24	10							20
GB1	25 to 40	1							
GB4	20 to 24	39	7,7	5,1		2,6			2,6
GB4	25 to 40	6	16,7	16,7					16,7
P01	20 to 24	18	16,7	5,6	5,6	5,6		5,6	5,6
P01	25 to 40	6	16,7		16,7				16,7
P02	20 to 24	32	3,1	3,1					
P02	25 to 40	5	20		20				
Sum		117							

Tab. 6: Cruise 432 RV 'Walther Herwig III', 2.12. – 20.12.2019: Prevalences (%) of externally visible diseases and parasites in cod (*Gadus morhua*) from the North Sea and Irish Sea

Area	N unt	Ly	Ulc AkHei	FloF AkHei	Skel	PBT	Cryp	Locera	Loma	N unt (Anis)	Anis
E01	2								50	2	
E02	3			33,3			33,3		100	3	
G05	2								50	1	
GB1	4		25							4	
GB3	1									1	
N01	2								50	2	
P02	1								100	1	
Sum	15									15	

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 ulceration, 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>