Thünen-Institute
of Fisheries Ecology

THÜNEN

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FRV Walther Herwig III
Cruise 459
23.08. - 09.09.2022

Integrated Monitoring of Contaminants and their Biological Effects (INMON)

Scientist in Charge: Dr. Klaus Wysujack

Summary

Within the framework of the monitoring programme of the Thünen Institute for Fisheries Ecology (FI) on the health status and contamination of fish in the North Sea and Baltic Sea with heavy metals and organic pollutants, investigations were carried out in six Baltic Sea and seven North Sea areas as well as one station in the Skagerrak. In addition to recording macroscopically visible external and internal diseases and parasites in dab (*Limanda limanda*), flounder (*Platichthys flesus*) and cod (*Gadus morhua*) on board, samples were collected for subsequent studies on pollutant levels (organic, inorganic, radioactive substances) and biological pollutant effects. Furthermore, a test of a newly constructed combination of the Isaacs-Kidd Midwater Trawl (IKMT) with a multi-net was carried out in cooperation with the group "Fisheries and Survey Technology" of the Institute of Baltic Sea Fisheries. In addition, accompanying hydrographic investigations (water temperature, salinity, oxygen content) were carried out.
The cruise was accompanied by two employees of the Federal Audit Office.

The following preliminary findings were noted:

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

Baltic cod: Overall, continued 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: Decreasing level of prevalence of lymphocystis in the Baltic Sea.

Participants:

Name	Function	Institution
Dr. Klaus Wysujack	Scientist in Charge	TI Fisheries Ecology
Dr. Daniel Stepputtis	Scientist	TI Baltic Sea Fisheries (only 31.08.)
Alexandra Poell	Technician	TI Fisheries Ecology
Oguz Senmeyvaci	Technician	TI Fisheries Ecology
Nadine Römer	Technician	TI Fisheries Ecology
Sarah-Jane Reyelt	Technician	TI Fisheries Ecology
Wojciech Wilczynski	Guest scientist/Observer	Warsaw University
Hanna Robitschko	Student	TI Fisheries Ecology
Murielle Muesfeldt	Student	TI Fisheries Ecology

Objectives of the Cruise

1. Studies on biological effects of contaminants;
2. Studies on the occurrence of fish diseases and parasites;
3. Collection of fish samples for analysis of radioactive substances, heavy metals and organic pollutants (within the framework of BLMP, Radiation Protection Act, OSPAR/HELCOM and research projects);
4. Tissue sampling of livers for subsequent histological and biochemical analyses;
5. Assessment and documentation of litter items in the bottom trawls according to ICES protocol;
6. Hydrographical measurements (salinity, temperature, oxygen, turbidity);
7. Testing of a newly designed combination of an Isaacs-Kidd Midwater Trawl (IKMT) with a multi-net.

Dates of the Cruise

At noon on 23.08.2022, FFS Walther Herwig III left Bremerhaven and made its way around Skagen towards the Baltic Sea. On 25 August, work began in area B01 in the Bay of Kiel. On the following days, the areas B12 (Mecklenburg Bay) and B11 (Arkona Sea), B09 (Gdansk Bay) and the ammunition dumping area B13 (Bornholm) were worked on. On the evening of 29 August, the two auditors of the Federal Audit Office in Sassnitz left the ship. On 30.08. the work in area B10 (Adlergrund) was continued. In the morning of 31.08. Dr. Stepputtis (OF, fishing technology) came on board. During the day, a test of the newly designed combination of the Isaacs-Kidd Midwater Trawl (IKMT) with a multi-net was successfully carried out. In the evening, Dr Stepputtis and the Polish observer/guest scientist left the ship in Rostock. Afterwards, the ship set course towards the Skagerrak, where samples were taken in area SK2 on 2 September. Afterwards, the cruise continued to the North Sea, where the stations P01 and GB4 (Duck's Bill) were sampled on 3 September. In the following days, the areas P02 (Ekofisk), N11 (Horns Riff), N01 (former dumping area in the German Bight), GB1 (inner German Bight, buoy E3) and GB3 (German Bight) were sampled.
On 4 September, the WHIII took part in a rescue exercise (helicopter operation) in area P02 with employees of the Norwegian oil platforms in this area (Ekofisk).
Furthermore, the ship took part in a Germany-wide measurement exercise for the Integrated Measurement and Information System for Monitoring Radioactivity in the Environment (IMIS) according to the Radiation Protection Act. This exercise followed the scenario of an incident

in a nuclear facility. In this context, on 6 September in area N01, the procedures for taking samples (fish samples) were practised using radiation protection measures and potential improvements for the research vessel were worked out in order to be able to better protect the crew after a real release of radioactive substances. The control centre for fish, fishery products, crustaceans and shellfish as well as marine aquatic plants is one of 11 federal control centres for the monitoring of radioactivity in the environment and is located at the Thünen Institute for Fishery Ecology and is responsible, among other things, for the monitoring of fish and other marine organisms in German marine areas.
At noon on 9 September, the WHIII arrived in Bremerhaven, where the cruise was completed on 12 September with unloading the vessel.
The location of the study areas and the exact course of the cruise can be seen in Fig. 1 and Fig. 2 as well as Tab. 1. In the 13 survey areas (Fig. 1 and Fig. 2), a total of 40 fishing hauls (towing time mostly 30 minutes, 3 hauls of 20 minutes each - one of which was part of the IMIS exercise) were carried out (coordinates in Tab. 1, catch composition in Tab. 2).
In most areas of the Baltic Sea the 140 ft bottom trawl was used, only in area B13 (Bornholm) the pelagic trawl (PSN205) was used. In the North Sea, the GOV was used in standard configuration. Hydrographic measurements were carried out at all fishing stations, except for the haul during the IMIS-exercise (coordinates in Tab. 1a, results in Table 3).

Preliminary Results

Dab (*Limanda limanda*)
A total of 2707 dab (total length ≥10 cm) from the Baltic Sea areas B01, B10, B11 and B12 and from seven North Sea areas (P01, GB4, P02, N11, GB1, N01 and GB3) were examined for externally visible diseases and parasites (Tab. 4). Of these, 815 individuals (total length ≥15 cm) were examined for the presence of liver abnormalities (Tab. 5).
The findings and infestation rates as well as their regional infestation patterns largely corresponded to those of previous cruises. The general decreasing trend of infestation rates of Lymphocystis in North Sea dab has been confirmed. The current values (0.3-6.1%) are in the range of the values of the last survey in 2020. In the Baltic Sea dab the values were even lower than in 2020 (current 0.0-3.8%). Compared to the North Sea, the Baltic dab show significantly lower infestation rates of externally visible parasites, with the exception of the trematode *Cryptocotyle lingua*, and the phenomenon of hyperpigmentation occurs extremely rarely in the Baltic Sea (cf. Table 4).
Within the study areas in the German North Sea EEZ (GB1, N01, GB3, GB4, P01), the distinct regional patterns of infestation rates already observed on previous trips could be confirmed. The infestation rates of Lymphocystis and especially of the parasite *Stephanostomum baccatum* (white cysts under the skin) increase in a northwesterly direction, while the rates of the parasites *Acanthochondria cornuta* and *Lepeophtheirus pectoralis* (both copepods, crustaceans) decrease.
The infestation rate of hyperpigmentation remained high in North Sea dab (Tab. 4); the highest value was recorded this year in area P02, where 48.5% of dab were affected. However, the differences between the stations further from the coast are very small (P02: 48.5 %, GB4: 45.2 %, P01: 43.7 % and GB3: 44.7 %). In contrast, the infestation rates in the areas somewhat closer to the coast are somewhat lower (N11: 38.9 %, N01: 36.9 %, GB1: 21.5 %). The causes for this phenomenon are still unknown.
There were no special features in the liver tumors; overall, the numbers were slightly lower than in previous years. The highest value was found in dab ≥25 cm in area N11 (42.9 %); however, only 7 fish of this size class were examined here. In the other study areas, the values were significantly lower at 0.0-5.4 %.

Cod (*Gadus morhua*)

A total of 551 cod from three Baltic Sea areas (B09, B10, B11) and one station in the Skagerrak (SK2) were examined for externally visible diseases and parasites, of which 335 fish were additionally examined for nematode larvae (Anisakidae) in the abdominal cavity (Table 6). No cod were caught in the North Sea. Surprisingly, the same applies to area B13 (Bornholm), where cod have been caught and examined regularly in the past years.

There were no differences in externally visible diseases compared to previous cruises. The incidence of acute/healing stages of skin ulceration in Baltic cod was again very low at 0.0-1.0%, although values of up to 11.1% had been recorded in 2020 - albeit in area B01 (Kiel Bight), where no cod were caught this year. Skeletal deformities were as rare as the other diseases considered, with values not exceeding 0.8%.
Nematode larvae in the abdominal cavity were detected in cod from all Baltic Sea areas, but with low infestation rates of 0.3-9.3%, with the highest value recorded in the easternmost area (B09).
The gill parasite *Loma morhua* (Microspora) occurred quite frequently in all Baltic Sea areas and the Skagerrak with infestation rates of 29.7 - 83.3 %. The highest value was detected in the Skagerrak, but on the basis of a comparatively small number of fish examined (n=24). Within the pure Baltic Sea areas, the highest infestation rate of 74.4% was found in the easternmost area (B09), which is consistent with previous findings. The infestation level remained relatively constant, with some fluctuations (B09: 2017 - 85.1%, 2018 - 72.7%, 2019 - 83.8%, 2022 - 74.4%; B11: 2017 - 29.8%, 2018 - 18.0%, 2019 - 59.0%, 2020 - 48.0%, 2022 - 29.7%),

Flounder (*Platichthys flesus*)

A total of 192 flounder from the Baltic Sea areas B10 and B1 were examined for externally visible diseases and parasites (Tab. 7). Since only flounder from two relatively close areas were examined this year, general statements are difficult. In the Baltic Sea, Lymphocystis is still the predominant externally visible disease. However, the level of infestation, with regional variations, has decreased significantly in recent years (Arkona Sea, B11: 2015 - 15.3%, 2017 - 32.8%, 2019 - 17.0%, 2020 - 12.3%, 2022 - 7.9%; Adlergrund, B10: 2015 - 16.7%, 2017 - 31.1%, 2020 - 20.3%, 2022 - 1.5%). The level of infestation with the trematode Cryptocotyle has also remained constant. Skeletal deformities were only found to a very small extent.

Miscellaneous

Tab. 2 shows the mean catches of the most common fish species and Tab. 3 the results of the hydrographic surveys.

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

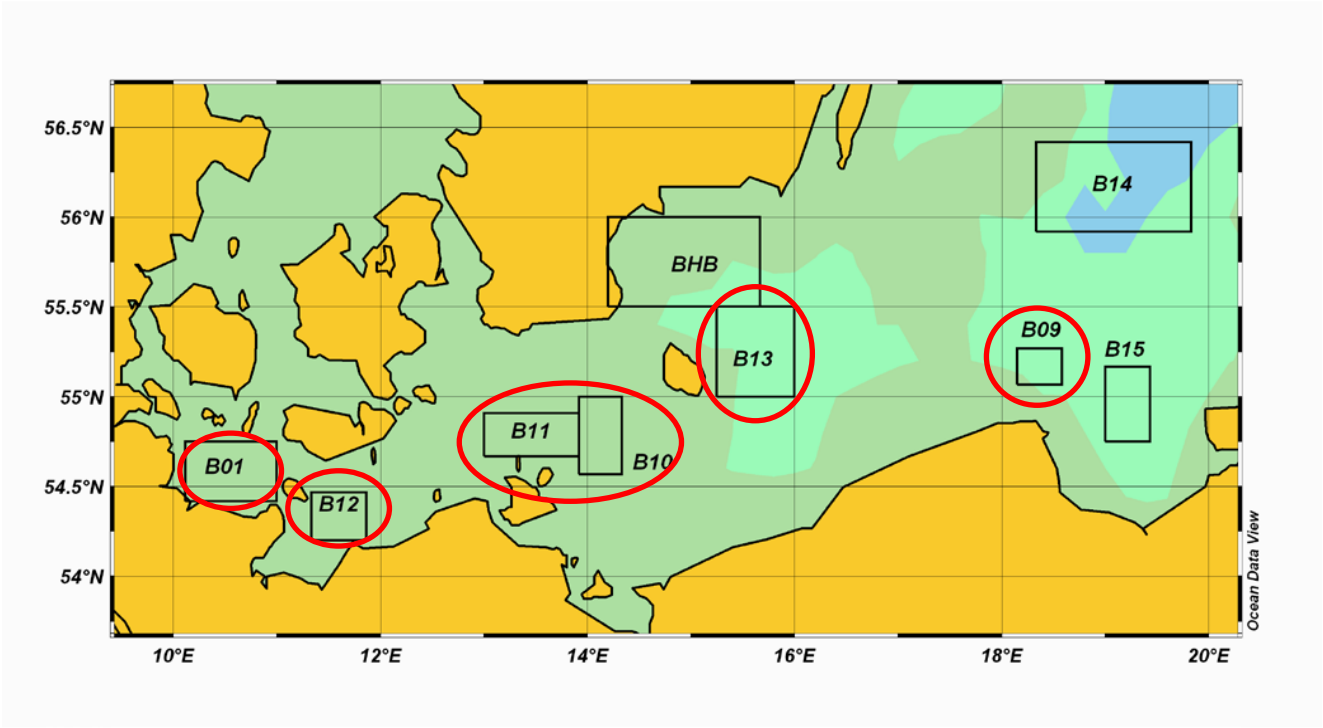

Fig. 1: Cruise 459 FRV 'Walther Herwig III', 23.08. – 09.09.2022: Location of sampling sites in the Baltic Sea

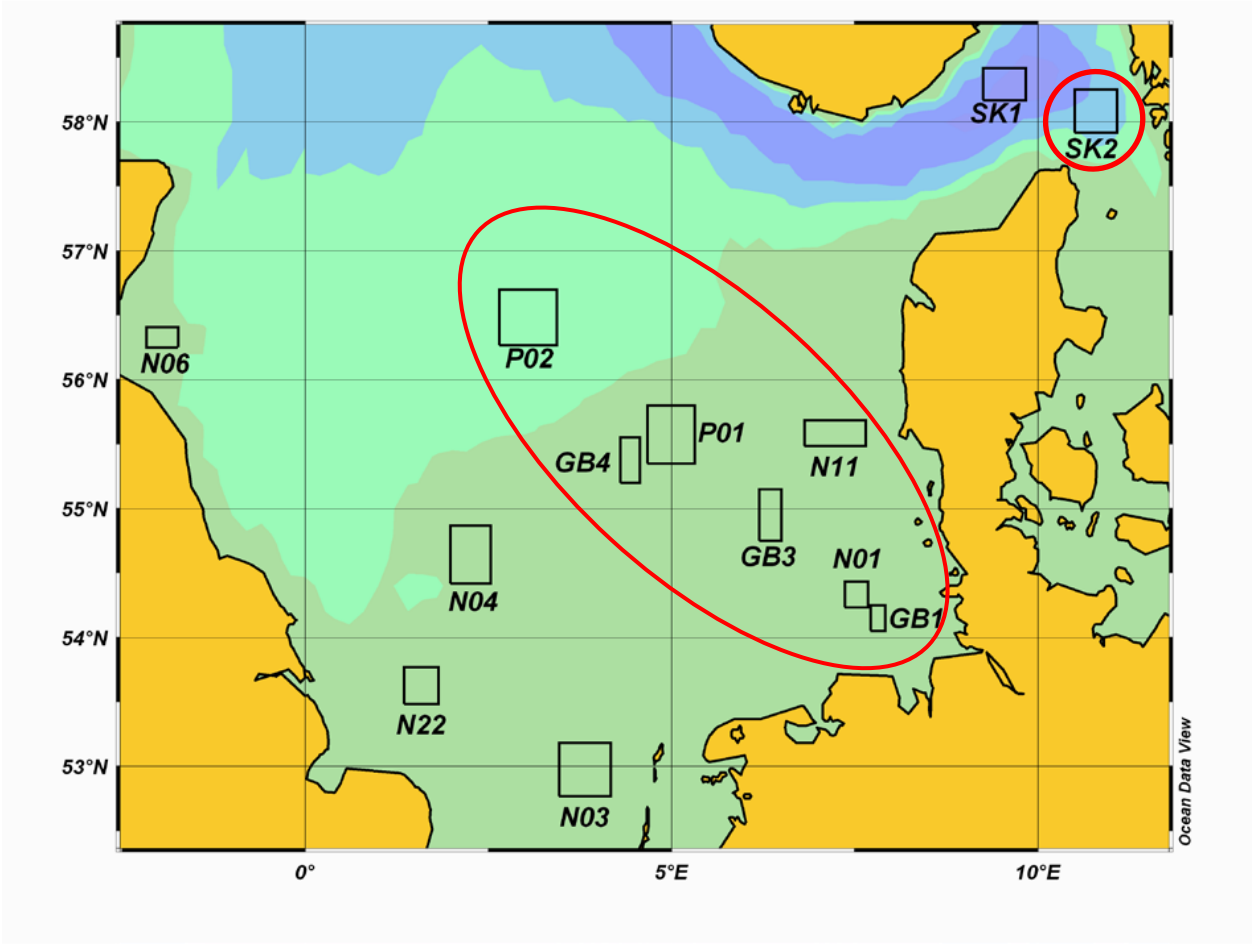

Fig. 2: Cruise 459 FRV 'Walther Herwig III', 23.08. – 09.09.2022: Location of sampling sites in the North Sea and in the Skagerrak

Tab. 1: Cruise 459 FRV 'Walther Herwig III', 23.08. – 09.09.2022: Geographical coordinates of trawling stations in the Baltic Sea and North Sea with trawling time and gear type

DATE	STATION	AREA	LATIDUDE	LONGITUDE	GEAR	TRAWLING TIME (min)
25.08.22	1	B01	54°33,100N	10°47,341E	140 Fuß-Netz	30
25.08.22	2	B01	54°33,902N	10°32,046E	140 Fuß-Netz	30
26.08.22	3	B12	54°26,945N	11°22,732E	140 Fuß-Netz	30
26.08.22	4	B12	54°23,014N	11°25,328E	140 Fuß-Netz	30
26:08.22	5	B12	54°18,182N	11°36,140E	140 Fuß-Netz	30
26.08.22	6	B12	54°24,536N	11°23,465E	140 Fuß-Netz	30
27.08.22	7	B11	54°46,513N	13°12,484E	140 Fuß-Netz	30
27.08.22	8	B11	54°46,042N	13°21,430E	140 Fuß-Netz	30
27.08.22	9	B11	54°43,652N	13°39,532E	140 Fuß-Netz	30
27.08.22	10	B11	54°48,860N	13°48,333E	140 Fuß-Netz	30
27.08.22	11	B11	54°51,450N	13°45,950E	140 Fuß-Netz	30
28.08.22	12	B09	55°14,241N	18°11,275E	140 Fuß-Netz	30
28.08.22	13	B09	55°12,272N	18°22,648E	140 Fuß-Netz	30
29.08.22	14	B13	55°07,458N	15°20,326E	PSN205	30
29.08.22	15	B13	55°08,843N	15°24,384E	PSN205	30
30.08.22	16	B10	54°58,270N	13°55,919E	140 Fuß-Netz	30
30.08.22	17	B10	54°52,265N	13°56,144E	140 Fuß-Netz	30
30.08.22	18	B10	54°45,098N	14°01,702E	140 Fuß-Netz	30
30.08.22	19	B10	54°34,932N	14°01,066E	140 Fuß-Netz	30
02.09.22	20	SK2	58°06,770N	10°44,065E	140 Fuß-Netz	30
02.09.22	21	SK2	58°04,842N	10°43,026E	140 Fuß-Netz	30
02.09.22	22	SK2	58°07,600N	10°51,668E	140 Fuß-Netz	30
03.09.22	23	P01	55°44,910N	05°17,475E	GOV	30
03.09.22	24	P01	55°41,611N	05°02,529E	GOV	30
03.09.22	25	GB4	55°23,399N	04°32,234E	GOV	30
03.09.22	26	GB4	55°23,016N	04°26,999E	GOV	**20**
04.09.22	27	P02	56°40,694N	03°11,903E	GOV	30
04.09.22	28	P02	56°34,023N	03°03,908E	GOV	30
04.09.22	29	P02	56°30,564N	03°20,171E	GOV	**20**
05.09.22	30	N11	55°39,501N	07°00,874E	GOV	30
05.09.22	31	N11	55°37,526N	07°03,844E	GOV	30
06.09.22	32	GB1	54°06,999N	07°46,475E	GOV	30
06.09.22	33	GB1	54°05,310N	07°49,856E	GOV	30
06.09.22	34	GB1	54°04,609N	07°53,264E	GOV	30
06.09.22	35*	GB1	54°06,707N	07°46,605E	GOV	**20 (*IMIS-Exercise)**
07.09.22	36	N01	54°15,388N	07°32,036E	GOV	30
07.09.22	37	N01	54°15,276N	07°36,733E	GOV	30
07.09.22	38	N01	54°17,764N	07°35,317E	GOV	30
07.09.22	39	N01	54°16,019N	07°38,634E	GOV	30
08.09.22	40	GB3	55°00,926	06°18,570E	GOV	30

Tab. 1a: Cruise 459 RV 'Walther Herwig III', 23.08. – 09.09.2022: Geographical coordinates of hydrography stations in the Baltic Sea and North Sea

DATE	STATION	FISHERY STATION	AREA	LATIDUDE	LONGITUDE
25.08.22	1	1	B01	54°33,262N	10°48,523E
25.08.22	2	2	B01	54°34,992N	10°28,566E
26.08.22	3	3	B12	54°26,971N	11°22,686E
26.08.22	4	4	B12	54°23,450N	11°25,251E
26.08.22	5	5	B12	54°17,702N	11°35,609E
26.08.22	6	6	B12	54°23,794N	11°23,770E
27.08.22	7	7	B11	54°46,831N	13°11,602E
27.08.22	8	8	B11	54°46,097N	13°20,500E
27.08.22	9	9	B11	54°43,524N	13°38,435E
27.08.22	10	10	B11	54°50,740N	13°50,959E
27.08.22	11	11	B11	54°52,203N	13°41,845E
28.08.22	12	12	B09	55°14,484N	18°10,021E
28.08.22	13	13	B09	55°12,411N	18°21,099E
29.08.22	14	14	B13	55°09,155N	15°20,875E
29.08.22	15	15	B13	55°08,529N	15°23,955E
30.08.22	16	16	B10	54°58,362N	13°55,159E
30.08.22	17	17	B10	54°52,447N	13°55,348E
30.08.22	18	18	B10	54°45,599N	14°02,143E
30.08.22	19	19	B10	54°35,465N	14°01,383E
02.09.22	20	20	SK2	58°07,468N	10°44,299E
02.09.22	21	21	SK2	58°07,357N	10°44,091E
02.09.22	22	22	SK2	58°08,318N	10°51,791E
03.09.22	23	23	P01	55°44,574N	05°13,046E
03.09.22	24	24	P01	55°40,819N	04°58,185E
03.09.22	25	25	GB4	55°23,655N	04°33,262E
03.09.22	26	26	GB4	55°22,966N	04°25,564E
04.09.22	27	27	P02	56°41,510N	03°11,402E
04.09.22	28	28	P02	56°34,827N	03°04,657E
04.09.22	29	29	P02	56°31,427N	03°18,187E
05.09.22	30	30	N11	55°39,887N	06°59,873E
05.09.22	31	31	N11	55°37,951N	07°03,186E
06.09.22	32	32	GB1	54°07,370N	07°45,383E
06.09.22	33	33	GB1	54°03,893N	07°52,814E
06.09.22	34	34	GB1	54°05,960N	07°49,452E
07.09.22	35	36	N01	54°15,597N	07°30,568E
07.09.22	36	37	N01	54°14,710N	07°36,174E
07.09.22	37	38	N01	54°18,011N	07°34,690E
07.09.22	38	39	N01	54°14,427N	07°36,097E
08.09.22	39	40	GB3	55°01,630N	06°18,848E

Tab. 2: Cruise 459 RV 'Walther Herwig III', 23.08. – 09.09.2022: 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	39	61	---	555	448	1	818	570	2
	kg	0.3	2.6	---	5.5	3.8	0.4	70.4	56.6	0.3
B12	n	57	6	---	231	981	---	313	101	5
	kg	0.1	0.2	---	2.1	10.3	---	31.0	9.0	0.9
B11	n	68	103	---	157	3663	---	103	380	306
	kg	8.1	13.9	---	1.8	50.4	---	13.5	64.5	31.3
B09	n	463	---	---	19	8	---	---	4	40
	kg	120.9	---	---	0.9	0.1	---	---	0.4	7.9
B13	n	---	---	---	343	1414	---	---	---	---
	kg	---	---	---	13.6	20.2	---	---	---	---
B10	n	229	135	---	38	178	---	7	27	31
	kg	47.1	25.1	---	1.7	2.6	---	1.1	5.5	8.4
SK2	n	19	---	11	---	---	1	---	1	2
	kg	31.3	---	1.2	---	---	0.4	---	0.2	0.5
P01	n	---	6295	10989	7548	383	---	669	---	---
	kg	---	78.2	277.2	84.5	4.8	---	45.1	---	---
GB4	n	---	7562	22753	---	---	84	1655	12	---
	kg	---	607.6	863.6	---	---	14.0	81.7	2.0	---
P02	n	---	798	10031	383	---	5077	1129	9	---
	kg	---	19.3	162.7	29.7	---	29.5	69.8	3.0	---
N11	N	---	48	3052	---	---	2393	672	24	---
	kg	---	1.3	94.6	---	---	569.2	49.3	2.5	---
GB1*	n	---	13562	3394	130	1843	31	141	3	5
	kg	---	247.8	93.2	1.1	5.5	4.4	8.3	0.6	1.2
N01	n	---	4481	59	25982	4173	223	240	2	---
	kg	---	120.6	2.1	107.7	16.5	32.4	17.3	0.1	---
GB3	n	---	6538	170	46756	22896	---	642	10	
	kg	---	99.2	3.0	208.3	112.1	---	45.2	1.9	

* Haul 35 (IMIS-Exercise) not included.

Tab. 3: Cruise 459 RV 'Walther Herwig III', 23.08. – 09.09.2022: Water depth, temperature (T), salinity (S), O_2 in mg/l and O_2 saturation (%) in Baltic Sea and North Sea

STATION	AREA	Total Depth (m)	SURFACE					BOTTOM				
			Measuring Depth (m)	T	S	O_2 (ml/l)	O_2 (%)	Measuring Depth (m)	T	S	O_2 (ml/l)	O_2 (%)
1	B01	24	5	20.316	13.335	5.55	94.94	22	14.659	22.924	3.14	50.86
2	B01	19	4	21.019	12.727	5.91	102.07	16	15.247	19.050	4.64	74.24
3	B12	22	3	19.614	9.932	6.06	100.27	18	14.017	20.048	2.30	36.16
4	B12	24	3	19.677	9.659	6.03	99.63	20	13.511	20.423	1.95	30.39
5	B12	26	6	17.584	9.057	5.44	86.04	22	12.964	21.005	1.83	28.25
6	B12	23	4	19.877	9.696	6.15	102.03	19	13.573	20.384	2.07	32.25
7	B11	41	3	20.951	7.695	5.79	97.08	36	12.437	10.558	4.48	64.14
8	B11	41	3	21.112	7.681	5.78	97.09	38	12.609	11.295	4.17	60.16
9	B11	40	4	21.589	7.675	5.63	95.42	38	13.022	12.519	3.05	44.76
10	B11	45	4	21.475	7.713	5.77	97.71	42	13.003	13.412	2.98	43.96
11	B11	46	4	21.719	7.718	5.95	101.09	44	11.714	15.204	0.53	7.67
12	B09	61	3	22.028	7.429	5.94	101.41	57	4.758	8.305	5.60	65.83
13	B09	79	3	21.904	7.439	5.90	100.47	75	5.971	10.253	3.84	47.14
14	B13	64	3	20.909	7.724	5.80	97.16	60	11.131	12.713	3.43	48.39
15	B13	70	4	20.898	7.715	5.82	97.37	67	10.247	13.740	2.65	36.98
16	B10	48	3	20.65	7.646	5.71	95.11	45	13.282	12.946	3.04	44.91
17	B10	45	4	20.636	7.634	5.68	94.48	43	12.677	11.791	3.18	46.10
18	B10	32	3	20.372	7.625	5.67	93.95	28	11.043	9.727	3.80	52.44
19	B10	21	5	20.638	7.730	5.69	94.78	17	8.980	8.417	5.51	71.85
20	SK2	235	4	17.616	32.926	5.28	96.36	230	7.831	35.139	5.44	82.20
21	SK2	240	4	17.503	32.687	5.31	96.62	235	7.830	35.135	5.42	81.95
22	SK2	175	50	9.444	35.011	5.32	82.23	171	7.862	35.121	5.39	81.53
23	P01	54	5	18.112	34.475	5.22	97.03	50	11.501	34.824	3.52	57.49
24	P01	43	4	17.939	34.849	5.23	97.23	40	12.926	34.823	4.48	75.39
25	GB4	46	5	18.034	35.013	5.19	96.76	42	12.377	34.835	3.72	61.82
26	GB4	46	5	17.959	35.011	5.19	96.61	43	11.919	34.834	3.87	63.70
27	P02	69	4	17.495	34.763	5.27	96.97	65	7.333	34.799	4.23	63.11
28	P02	73	4	17.328	34.917	5.30	97.46	69	7.411	34.797	4.16	62.17
29	P02	71	5	17.497	34.737	5.28	97.30	69	7.73	34.778	4.01	60.33
30	N11	32	4	17.762	33.217	5.22	95.64	29	13.595	33.774	3.30	55.89
31	N11	32	3	17.751	33.141	5.18	95.00	28	14.424	33.680	3.43	59.06
32	GB1	42	3	17.994	33.284	4.70	86.57	39	17.557	33.372	4.10	74.99
33	GB1	41	4	18.204	33.159	4.70	86.87	38	17.645	33.269	4.15	75.97
34	GB1	47	4	18.081	33.205	4.69	86.59	45	17.780	33.258	4.21	77.30
35	N01	44	4	18.208	33.520	4.89	90.52	41	17.005	33.685	3.97	71.87
36	N01	43	4	18.058	33.528	4.90	90.51	40	17.071	33.622	4.02	72.93
37	N01	37	5	18.119	33.547	5.00	92.54	33	16.998	33.649	3.97	71.86
38	N01	41	8	17.989	33.408	5.02	92.62	38	17.333	33.546	4.17	76.05
39	GB3	46	3	18.249	33.938	5.11	94.89	42	11.286	34.347	3.70	60.03

Tab. 4: Cruise 459 FRV 'Walther Herwig III', 23.08. – 09.09.2022: 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	264	1.5	1.5	0.8	0.0	0.0	1.1	0.4	0.8	0.4	0.8	8.0
B12	292	3.8	1.0	1.4	0.7	0.0	0.0	0.0	0.3	0.0	0.3	21.6
B11	172	1.2	0.0	0.6	0.0	0.0	1.7	1.2	0.0	0.0	0.0	1.7
B10	12	0.0	0.0	0.0	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0
P01	252	5.6	0.8	3.6	1.2	0.4	43.7	0.4	78.6	3.6	9.5	0.0
GB4	263	6.1	1.5	1.5	0.8	1.9	45.2	0.4	67.3	1.1	6.5	0.0
P02	334	3.6	0.6	0.0	0.6	0.3	48.5	0.3	99.1	1.8	0.0	0.0
N11	298	2.3	2.0	4.4	0.0	0.0	38.9	0.0	2.7	7.0	13.4	0.0
GB1	219	0.5	2.3	0.9	1.4	0.0	21.5	0.9	0.9	6.8	10.0	0.5
N01	328	0.3	2.1	4.0	2.4	0.0	36.9	0.3	0.6	6.1	10.1	0.9
GB3	273	1.8	2.2	1.8	2.2	0.0	44.7	0.4	1.1	2.9	15.4	0.7
SUM	**2707**											

Tab. 5: Cruise 459 FRV 'Walther Herwig III'. 23.08. – 09.09.2022: 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 (gesamt)	LK 2 - 5 mm	LK 6 - 9 mm	LK ≥10 mm	Grün	Nemato	Kratz
B01	15 bis 19	13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B01	20 bis 24	71	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B01	25 bis 40	16	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B12	15 bis 19	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B12	20 bis 24	52	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B12	25 bis 40	37	5.4	2.7	0.0	2.7	0.0	0.0	0.0
B11	15 bis 19	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B11	20 bis 24	69	1.4	0.0	1.4	0.0	0.0	0.0	0.0
B11	25 bis 40	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P01	15 bis 19	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P01	20 bis 24	18	0.0	0.0	0.0	0.0	0.0	5.6	0.0
GB4	15 bis 19	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GB4	20 bis 24	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GB4	25 bis 40	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P02	15 bis 19	64	1.6	1.6	0.0	0.0	34.4	9.4	0.0
P02	20 bis 24	31	3.2	3.2	0.0	0.0	41.9	6.5	0.0
P02	25 bis 40	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N11	15 bis 19	51	3.9	0.0	0.0	3.9	0.0	0.0	0.0
N11	20 bis 24	42	4.8	2.4	0.0	2.4	4.8	0.0	0.0
N11	25 bis 40	7	42.9	14.3	0.0	28.6	0.0	0.0	0.0
GB1	15 bis 19	45	0.0	0.0	0.0	0.0	0.0	2.2	0.0
GB1	20 bis 24	17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GB1	25 bis 40	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N01	15 bis 19	49	0.0	0.0	0.0	0.0	2.0	0.0	0.0
N01	20 bis 24	50	0.0	0.0	0.0	0.0	8.0	0.0	0.0
N01	25 bis 40	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GB3	15 bis 19	28	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GB3	20 bis 24	65	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GB3	25 bis 40	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM		**815**							

Tab. 6: Cruise 459 FRV 'Walther Herwig III'. 23.08. – 09.09.2020: Prevalences (%) of externally visible diseases and parasites in cod (*Gadus morhua)* from the Baltic Sea and the Skagerrak

AREA	N unt	Ulc Ak/Hei	Ulc Hae	FloF Ak/Hei	Ep Pap/Hyp	Skel	PBT	Cryp	Locera	Loma	N unt (Anis)	Anis
B09	125	0.0	0.8	0.0	0.0	0.8	0.0	0.8	0.0	74.4	125	9.3
B10	301	0.0	3.3	0.0	0.0	0.0	0.0	1.7	0.0	53.5	100	3.3
B11	101	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	29.7	86	0.3
SK2	24	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	83.3	24	2.7
SUMME	**551**										**335**	

Tab. 7: Cruise 459 FRV 'Walther Herwig III'. 23.08. – 09.09.2020: 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
B10	65	1.5	1.5	0.0	1.5	0.0	0.0
B11	127	7.9	0.0	0.0	1.6	0.0	23.6
SUMME	**192**						

Abbreviations:

N unt : Number examined
Ly : Lymphocystis
Ep Hyp/Pap : Epidermal hyperplasia/papilloma
Ulc Ak/Hei : Skin ulcerations. acute/healing
Ulc Hae : Skin ulcerations. haemorrhagic stage
Flo Ak/Hei : Fin rot/erosion. acute/healing
Kie Hyp : Gill hyperplasia. x-cell disease
Hyp Pig : Hyperpigmentation
Skel Def : Skeletal deformities
PBT : Pseudobranchial pseudotumour

Steph : *Stephanostomum baccatum*
Acanth : *Acanthochondria cornuta*
Lepe : *Lepeophtheirus pectoralis*
Locera : *Lernaeocera branchialis*
Cryp : *Cryptocotyle spp.*
Loma : *Loma sp.*
Anis : Nematodes in the bodx cavity
LK : Liver nodules > 2 mm in diameter
Nemato : Nematodes on the liver
Grün : green discolouration of the liver
Kratz : Acanthocephaleans on the liver