

**FRV Walther Herwig III
Cruise 441
30.11. - 20.12.2020**

**Studies on Biological Effects of Contaminants
in the North Sea and Baltic 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, studies were carried out in two areas in the North Sea and twelve areas in the Baltic Sea. In addition to the onboard examination of dabs (*Limanda limanda*) and flounders (*Platichthys flesus*) for macroscopical externally and internally visible diseases, a large range of fish samples were taken for subsequent analysis of radioactive contaminants. Furthermore, hydrographical measurements were carried out (water temperature, salinity, oxygen content and turbidity).

Objectives of the Cruise

1. Obtaining fish samples for the analysis of radioactive substances;
2. Determination of externally visible fish diseases and tissue sampling of livers and other organs for subsequent histological and biochemical analyses;
3. Hydrographical measurements (salinity, temperature, oxygen, turbidity);
4. Documentation of marine litter fished during the trawling;
5. Video and photos from marine litter on the Sea bottom;
6. Test of the IKMT-Net and video recording with the ROTV-Juli;
7. Collection of water samples for eDNA analysis.

Dates of the Cruise

The RV "Walther Herwig III" departed from Bremerhaven on 01.12.2020 in the direction of the reference area GB1, where on the morning of 02.12. our work started with the setting of the ROTV-Juli for the acquisition of video and photos from marine litter on the seabed. Unfortunately, due to a malfunction on the connection cable between the control panel and the ROTV-Juli, the acquisition of images was not possible. As a consequence, the deployment of the IKMT-net was cancelled, since the acquisition of the video material was not possible. The worked continue with fisheries using the GOV-net in the area's GB1 and N01.

After acquiring several samples for the radioactive monitoring of the North Sea, the FRV Walther Herwig III proceeded to the Baltic Sea through the Skagerrak. On day 4.12. we arrived Rostock, where the ROTV-Juli was unloaded and Mr. Böttcher left us.

The work program continued on the next day in the area B01 and after this in the areas B10, B11, B09, B25, B26 and B27. On day 11.12. Dr. Randel Kreitsberg was transported to Tallin together with his samples.

On day 12.12. the survey continued on the areas B23 and B22, BP3 and finished on B12. On day 16.12. we returned to the North Sea through the NOK and the Walther Herwig III 441 survey finished upon the safe return to Bremerhaven on day 17.12.

The location of the study areas and the exact travel course is shown 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's in the Baltic Sea. Hydrographic measurements were carried out at 23 stations (Tab. 1b). The preliminary results relative to the anthropogenic Caesium 137 (Cs-137) and natural Potassium 40 (K-40) measured in the different fish samples can be found in table 5.

Participants:


1. Dr. Pedro Miguel Agostinho Nogueira (Scientist in Charge), TI-FI Bremerhaven
2. Ulf Böttcher, TI-OF Rostock
3. Dr. Randel Kreitsberg, University of Tartu, Estonia
4. Alexander Knorrn (Student)
5. Murielle Muesfeldt (Student)
6. Aaron Cordes (Student)
7. Peter Horntz (Student)

Preliminary results:

The preliminary results of this cruise show that there is a significant higher Cs-137 activity in the North areas of the Baltic Sea, see table 5. This is in agreement with the past survey's results and values reported by HELCOM. It was also observed that the Cs-137 activity is strongly dependent of the fish species.

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.



Dr. Pedro Miguel Agostinho Nogueira

(Scientist in Charge)

Annex: 1 Figures and 7 Tables

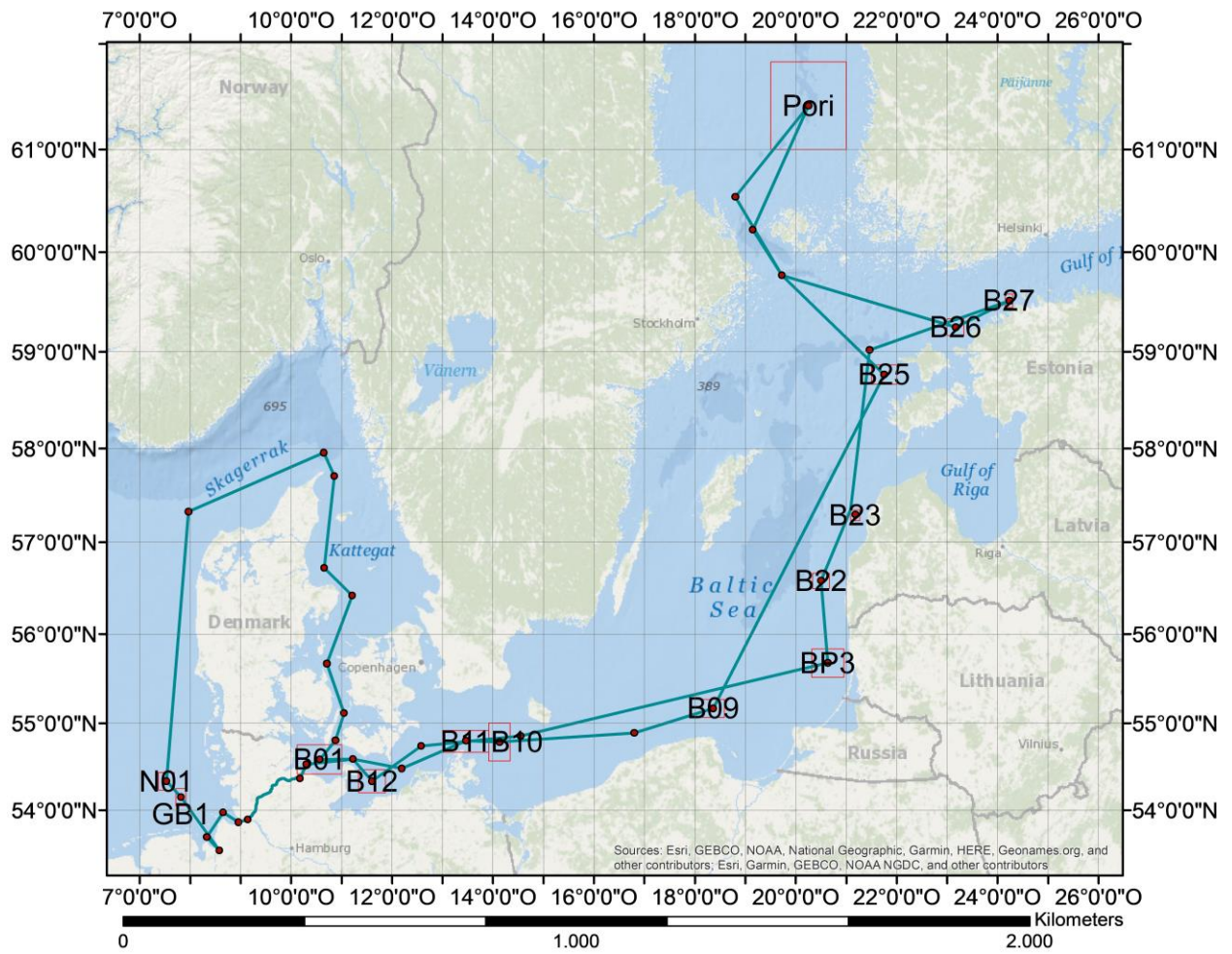


Fig. 1: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020:
Location of sampling sites and travel route in the North Sea and Baltic Sea

Tab. 1: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020:
Geographical coordinates of trawling stations in the North Sea and Baltic Sea

Date	LOG-Station	Station	Area	Latitude	Longitude	Duration (min)	Net
02.12.20	838	1	GB1	54°04,562N	007°53,000E	60	GOV, 50m Stander
02.12.20	839	2	N01	54°15,803N	007°29,831E	60	GOV, 50m Stander
05.12.20	840	3	B01	54°32,960N	010°46,830E	60	140 Fuß-Netz
05.12.20	841	4	B01	54°34,021N	010°31,006E	60	140 Fuß-Netz
06.12.20	842	5	B10	54°49,580N	013°56,124E	60	140 Fuß-Netz
06.12.20	843	6	B11	54°47,243N	013°51,070E	60	140 Fuß-Netz
07.12.20	844	7	B09	55°07,519N	018°10,881E	60	140 Fuß-Netz
07.12.20	845	8	B09	55°14,207N	018°10,320E	60	140 Fuß-Netz
08.12.20	846	9	B25	58°45,235N	021°48,424E	60	140 Fuß-Netz
08.12.20	847	10	B25	58°40,760N	021°48,241E	60	140 Fuß-Netz
09.12.20	848	11	Pori	61°13,003N	019°43,109E	30	140 Fuß-Netz
10.12.20	849	12	B26	59°16,640N	023°09,492E	60	140 Fuß-Netz
10.12.20	850	13	B26	59°14,964N	023°01,748E	60	140 Fuß-Netz
10.12.20	851	14	B27	59°33,532N	024°07,256E	60	140 Fuß-Netz
12.12.20	852	15	B23	57°20,216N	021°15,016E	60	140 Fuß-Netz
12.12.20	853	16	B22	56°27,362N	020°26,839E	60	140 Fuß-Netz
12.12.20	854	17	B22	56°24,188N	020°20,209E	60	140 Fuß-Netz
13.12.20	855	18	BP3	55°31,346N	020°30,960E	60	140 Fuß-Netz
13.12.20	856	19	BP3	55°35,338N	020°28,292E	60	140 Fuß-Netz
13.12.20	857	20	BP3	55°47,417N	020°28,969E	60	140 Fuß-Netz
15.12.20	858	21	B12	54°13,958N	011°46,487E	60	140 Fuß-Netz
15.12.20	859	22	B12	54°19,441N	011°26,426E	60	140 Fuß-Netz
15.12.20	860	23	B12	54°17,917N	011°34,876E	60	140 Fuß-Netz

Tab. 1a: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020:
Geographical coordinates of hydrography stations in the North Sea and Baltic Sea

Date	LOG Station	Trawling Station	Area	Latitude	Longitude
02.12.20	838	1	GB1	54°04,170N	007°53,895E
02.12.20	839	2	N01	54°15,566N	007°30,343E
05.12.20	840	3	B01	54°33,178N	010°48,088E
05.12.20	841	4	B01	54°33,921N	010°32,291E
06.12.20	842	5	B10	54°49,467N	013°55,743E
06.12.20	843	6	B11	54°47,484N	013°52,431E
07.12.20	844	7	B09	55°07,723N	018°10,150E
07.12.20	845	8	B09	55°14,896N	018°10,164E
08.12.20	846	9	B25	58°45,018N	021°48,770E
08.12.20	847	10	B25	58°40,907N	021°47,966E
09.12.20	848	11	Pori	61°13,814N	019°43,328E
10.12.20	849	12	B26	59°14,972N	023°01,281E

Tab. 1a: cont.

10.12.20	850	13	B26	59°16,855N	023°09,245E
11.12.19	851	14	B27	59°33,771N	024°07,261E
12.12.20	852	15	B23	57°20,798N	021°15,095E
12.12.20	853	16	B22	56°27,810N	020°27,589E
12.12.20	854	17	B22	56°24,648N	020°20,419E
13.12.20	855	18	BP3	55°31,214N	020°31,816E
13.12.20	856	19	BP3	55°35,853N	020°28,188E
13.12.20	857	20	BP3	55°47,288N	020°29,905E
15.12.20	858	21	B12	54°13,789N	011°47,972E
15.12.20	859	22	B12	54°18,751N	011°26,840E
15.12.20	860	23	B12	54°17,757N	011°34,333E

Tab. 2: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020:
Mean catches of selected abundant fish species in the North and Baltic Sea
(weight (kg) per 1 h trawling)

Area	Cod	Dab	Plaice	Herring	Sprat	Flounder	Whiting	Mackerel
GB1	4.36	8.94	0.28	5.04	3.76	0.59	752.13	0.18
B01	3.01	249.66	74.71	2.23	8.00	2.74	6.82	0.28
B10	111.37	4.50	8.56	20.79	1.66	3.86	35.70	
B11	4.35		0.70	265.67	33.60	17.63	19.91	
B09	69.80		0.34	2.12	0.17	3.09		
B25	4.16			1.58	6.89	38.27		
B26	1.27			1.37	3.90	12.41		
B27				0.56	0.41	0.74		
B23	5.27			0.47	0.27	319.15		
B22	36.04			4.14	0.09	116.28		
BP3	67.58			4.56	0.55	21.92		
B12	27.23	93.16	74.73	0.17	2.22	19.57	2.06	0.86

Tab. 2a: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020: 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	11.77	168.77	8.00	252.79	656.46	2.00	15582.10	2.00
B01	6.00	2607.83	565.33	188.50	645.67	6.08	98.31	4.04
B10	362.76	24.80	52.71	167.43	111.62	15.50	153.00	
B11	50.69		7.24	2375.31	3041.56	72.42	137.59	
B09	240.00		3.00	36.00	14.00	15.00		
B25	12.00			65.00	803.00	264.00		
B26	3.00			63.00	414.00	62.00		
B27				26.00	49.00	4.00		
B23	13.00			20.00	26.66	2439.63		
B22	40.00			96.00	8.00	82.00		
BP3	510.00			105.00	3.00	125.00		
B12	18.88	629.00	496.10	5.12	208.75	93.58	14.98	3.15

Tab. 3: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020:
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 (%)
03.12.20	838	1	GB1	36	10.753	33.133	5.91	93.95
				2	10.721	33.132	5.92	94.07
03.12.20	839	2	N01	37	10.779	33.366	5.87	93.52
				2	10.767	33.365	5.93	94.47
03.12.20	840	3	B01	18	10.053	23.899	5.99	88.44
				2	7.114	19.632	7.09	95.2
04.12.20	841	4	B01	12	7.766	19.823	7	95.57
				2	7.771	19.822	7	95.62
04.12.20	842	5	B10	38	9.583	17.271	6.3	88.16
				2	9.01	8.068	7.19	93.65
04.12.20	843	6	B11	34	9.684	16.963	6.2	86.85
				2	7.008	8.137	7.75	96.21
05.12.20	844	7	B09	61	6.78	10.633	0.99	12.45
				2	7.577	7.841	7.29	91.59
05.12.20	845	8	B09	55	9.096	7.596	7.22	93.89
				2	9.134	7.577	7.23	94.19
07.12.20	846	9	B25	42	8.403	7.122	7.33	93.57
				2	8.383	7.121	7.42	94.61
09.12.20	847	10	B25	43	8.133	7.332	7.46	94.67
				3	8.196	7.326	7.45	94.66
10.12.20	848	11	Pori	77	4.54	6.448	5.37	62
				4	5.423	5.581	8.09	94.95
10.12.20	849	12	B26	71	7.486	7.113	6.01	75.05
				2	6.65	6.555	7.8	95.07
11.12.20	850	13	B26	65	7.887	6.672	7.43	93.31
				1	6.963	6.549	7.71	94.63
11.12.20	851	14	B27	77	6.736	7.547	3.41	41.85
				2	7.352	6.38	7.61	94.17
12.12.20	852	15	B23	44	7.905	7.483	7.44	94.05
				3	8.19	7.481	7.46	94.9
12.12.20	853	16	B22	38	8.201	7.505	7.51	95.63
				2	8.348	7.483	7.47	95.47
12.12.20	854	17	B22	41	8.327	7.516	7.5	95.74
				1	8.393	7.512	7.45	95.25
13.12.20	855	18	BP3	57	6.482	10.195	1.11	13.79
				2	7.876	7.503	7.45	94.13
13.12.20	856	19	BP3	64	6.908	10.996	0.52	6.53
				3	7.369	7.462	7.64	95.29
15.12.20	857	20	BP3	43	7.827	7.563	7.48	94.4
				3	7.831	7.566	7.48	94.46
15.12.20	858	21	B12	17	8.331	18.355	6.39	87.48
				2	7.251	9.249	7.58	95.41
17.12.20	859	22	B12	18	7.547	18.081	6.82	91.6
				2	7.116	11.81	7.41	94.56
17.12.20	860	23	B12	19	8.604	19.173	5.99	82.97
				2	7.278	9.399	7.55	95.15

Tab. 4: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020:
Geographical coordinates of eDNA water samples in the North Sea and Baltic Sea.

Date	LOG Station	Trawling Station	Area	Latitude	Longitude	Bottle's	Depth (m)
02.12.20	839	2	N01	54°15,566N	007°30,343E	2	35,8
05.12.20	840	3	B01	54°33,178N	010°48,088E	2	13,63
06.12.20	842	5	B10	54°49,467N	013°55,743E	2	35,75
06.12.20	843	6	B11	54°47,484N	013°52,431E	2	32,96
07.12.20	844	7	B09	55°07,723N	018°10,150E	2	58,13
08.12.20	846	9	B25	58°45,018N	021°48,770E	2	40,6
09.12.20	848	11	Pori	61°13,814N	019°43,328E	2	63,2
12.12.20	853	16	B22	56°27,810N	020°27,589E	2	35,6

Tab. 5: Cruise 441 RV 'Walther Herwig III', 30.11. – 20.12.2020:
Anthropogenic Cs-137 and natural K-40 activities measured in the monitoring areas from the Baltic Sea, in Bq per Kg

Area	Species	Tissue	Cs-137		K-40	
			Activity (Bq/kg)	Uncert. (%)	Activity (Bq/kg)	Uncert. (%)
B25	Flounder	Whole Fish	1.81	6.11	59.6	6.64
B25	Sprat	Whole Fish	2.55	6.1	112	6.63
B25	Cod	Whole Fish	3.96	6.1	140	6.63
B26	Flounder	Whole Fish	2.04	6.12	85.8	6.64
B23	Flounder	Whole Fish	2.21	6.09	79.4	6.62
B22	Flounder	Whole Fish	2.46	6.08	72.8	6.62
BP3	Flounder	Whole Fish	2.29	6.11	87.1	6.64
BP3	Cod	Whole Fish	2.04	10.35	94.9	8.98