

**FRV Walther Herwig III  
Cruise 462  
29.11. - 14.12.2022**

**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 seven areas in the North Sea and four areas in the Baltic Sea. A large range of fish samples were taken for subsequent analysis of radioactive contaminants and in addition Water samples were taken for quantification of the amount of adsorbed chemicals, more specifically TNT. In all but one area, video recordings of the seabed were made with an epibenthic video sledge. These video recordings enabled us for the first time to quantify the amount of marine litter in the North Sea and Baltic Sea using video images. 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. 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, using an Epibenthos Sledge equipped with a GoPro camera and a light system;
6. Collection of water samples for TNT quantification.

**Dates of the Cruise**

The RV "Walther Herwig III" departed from Bremerhaven on 29.11.2022 in the direction of the reference area GB1, where on the morning of 01.12. our work started with fisheries using the fishing gear GOV, followed by several deployments of the epibenthic video sledge. After this, the work program continued in the NS areas GB3, GB4, P02 ML01 and ML02. After gathering the required samples for the radioactive monitoring of the North Sea, we proceeded to the Baltic Sea, through the Skagerrak. On the way, water and fish samples were collected in the SK2 area.

In the morning of 07.12. we started our work in the Baltic Sea in the area B12 using the 140er fishing gear followed by multiple deployments of the epibenthic video sledge. The work program continued on the next day in the area B01. On day 9.12. Dr. Randel Kreitsberg, Dr. Tull Sepp and Johanna Kenkenberg disembark in Kiel. Due to a malfunction of the radar the departure from Kiel was delayed one day. The Survey continued on day 12.12. on the area B10. On the morning of day 13.12. after one fishery haul in the area B11 the work program was stopped due to a Corona case on board and the consequent danger of an outbreak on board. Immediately, preparations were done to return to Bremerhaven. On day 14.12.2022, the Walther Herwig III 462 survey finished upon the return to Bremerhaven.

The location of the study areas and the exact travel course is shown in Fig. 1 and Tab. 1 and 2. In the 11 study areas (Fig. 1), a total of 15 fishing hauls (trawling time, usually one hour) were carried out (Table 2). The GOV was used in the North Sea and the 140's in the Baltic Sea. Hydrographic measurements were carried out at 13 stations (Tab. 2). 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 8.

### **Participants:**

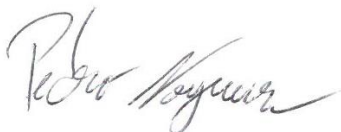
1. Dr. Pedro Miguel Agostinho Nogueira (Scientist in Charge), TI-FI Bremerhaven
2. Wolfgang Lindemann, TI-FI Bremerhaven
3. Annika Elsheimer, TI-SF Bremerhaven
4. Alexandra Poell, TI-FI Bremerhaven
5. Johanna Kenkenberg, University of Hanover
6. Murielle Muesfeldt (Student)
7. Benedikt Merk (Student)
8. Gregor Langmeier (Student)
9. Dr. Tuul Sepp, University of Tartu, Estonia
10. Dr. Randel Kreitsberg, University of Tartu, Estonia

### **Preliminary results:**

The preliminary results of this cruise show that in in agreement with the past survey's results and values reported by HELCOM, the Baltic Sea continues to be more contaminated with Cs-137 than the North Sea. It was also observed that the Cs-137 activity is strongly dependent of the fish species.

### **Acknowledgements**

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

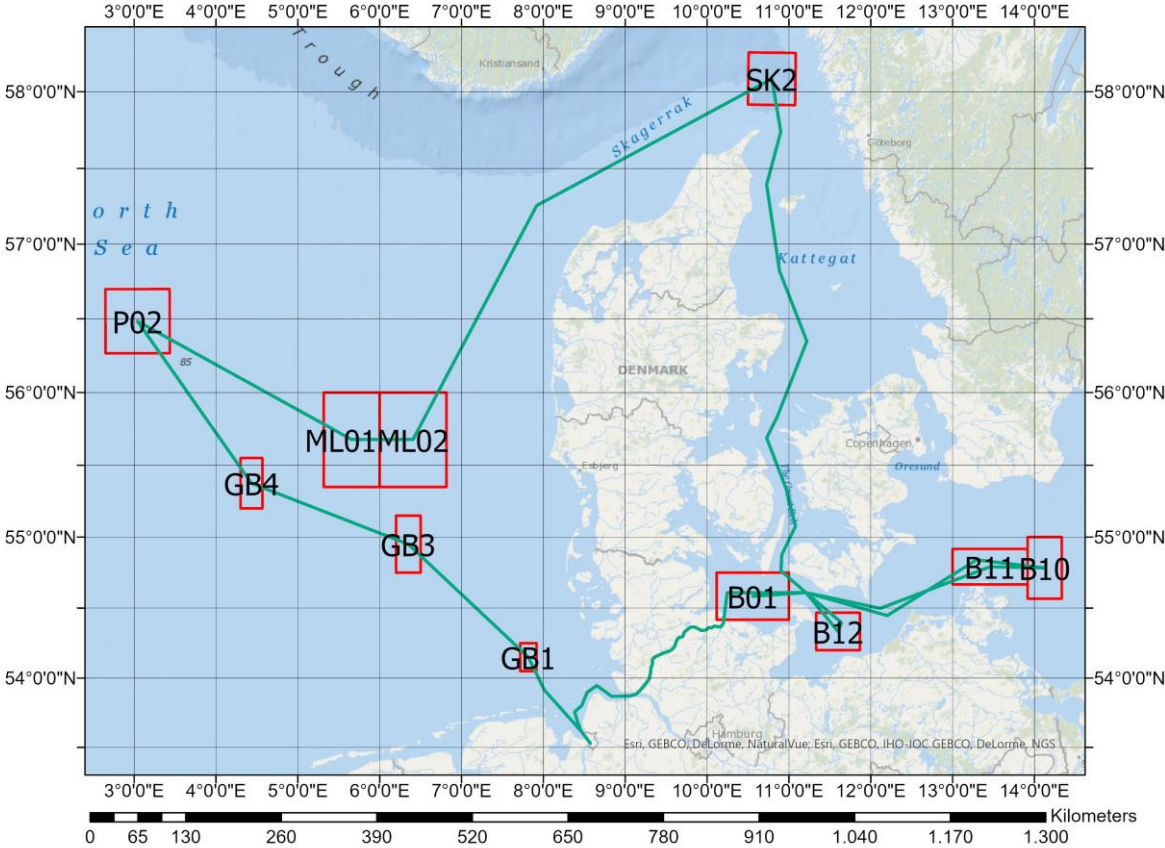


Dr. Pedro Miguel Agostinho Nogueira

(Scientist in Charge)

**Appendix:** 1 Figure and 8 Tables

**Fig. 1:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Location of sampling sites and travel route in the North Sea and Baltic Sea



**Tab. 1:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Geographical coordinates of trawling stations in the North Sea and Baltic Sea

Date	LOG-Station	Station	Area	Latitude	Longitude	Duration (min)	Net
01.12.21	286	1	GB1	54°04,502N	007°54,030E	60	GOV, 50m Stander
01.12.21	287	2	N01	54°16,446N	007°30,725E	60	GOV, 50m Stander
04.12.21	290	5	B01	54°32,881N	010°46,398E	60	140 Fuß-Netz
04.12.21	291	6	B01	54°32,049N	010°37,515E	60	140 Fuß-Netz
04.12.21	292	7	B01	54°32,944N	010°46,842E	60	140 Fuß-Netz
04.12.21	293	8	B01	54°33,908N	010°30,463E	60	140 Fuß-Netz
04.12.21	294	9	B01	54°31,889N	010°36,567E	60	140 Fuß-Netz
04.12.21	295	10	B01	54°32,881N	010°46,398E	60	140 Fuß-Netz
05.12.21	296	11	B12	54°23,142N	011°25,328E	60	140 Fuß-Netz
05.12.21	297	12	B12	54°17,797N	011°34,886E	60	140 Fuß-Netz
05.12.21	299	14	B12	54°20,155N	011°42,525E	60	140 Fuß-Netz
05.12.21	299	14	B12	54°16,440N	011°37,927E	60	140 Fuß-Netz
05.12.21	300	15	B12	54°15,052N	011°39,854E	60	140 Fuß-Netz
05.12.21	301	16	B12	54°12,694N	011°39,813E	60	140 Fuß-Netz
06.12.21	302	17	B11	54°43,253N	013°17,999E	60	140 Fuß-Netz
07.12.21	303	18	B09	55°09,667N	018°13,934E	60	140 Fuß-Netz
07.12.21	304	19	B09	55°14,659N	018°10,232E	60	140 Fuß-Netz
07.12.21	305	20	B09	55°12,572N	018°21,624E	60	140 Fuß-Netz
07.12.21	306	21	B09	55°08,227N	018°19,266E	60	140 Fuß-Netz
07.12.21	307	22	B09	55°07,438N	018°11,060E	60	140 Fuß-Netz
07.12.21	308	23	B09	55°13,991N	018°10,560E	60	140 Fuß-Netz
08.12.21	309	24	B 09	55°07,291N	018°15,753E	60	140 Fuß-Netz
09.12.21	310	25	B25	58°40,361N	021°40,286E	60	140 Fuß-Netz

**Tab. 2:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Geographical coordinates of hydrography stations in the North Sea and Baltic Sea

Date	LOG Station	Trawling Station	Area	Latitude	Longitude
30.11.22	616	1	GB1	54°03,853N	007°53,859E
01.12.22	621	6	GB3	54°55,981N	006°16,400E
02.12.22	627	12	GB4	55°23,097N	004°26,123E
03.12.22	633	18	P02	56°20,654N	003°00,784E
06.12.22	650	35	SK2	58°06,708N	010°31,729E
06.12.22	651	36	SK2	58°01,192N	010°39,694E
07.12.22	652	37	B12	54°26,779N	011°22,885E
07.12.22	655	40	B12	54°18,676N	011°25,787E
08.12.22	659	44	B01	54°33,137N	010°47,886E
08.12.22	662	47	B10	54°33,651N	010°31,071E
12.12.22	667	52	B10	54°38,923N	014°02,261E
12.12.22	670	55	B10	54°36,389N	014°02,610E
13.12.22	674	59	B11	54°45,930N	013°28,406E

**Tab. 3:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Mean catches of selected abundant fish species in the North and Baltic Sea (weight (kg) per 1 h trawling)

Area	Station	Cod	Dab	Plaice	Herring	Sprat	Flounder	Whiting	Mackerel
GB1	1	0,00	5,11	0,49	4,90	0,01	0,00	691,57	0,00
GB3	6	0,28	61,71	11,52	16,49	31,33	0,00	134,79	0,00
GB4	12	0,34	205,60	35,03	10,23	5,00	0,00	33,50	72,23
P01	18	0,00	129,77	6,13	17,15	1,52	0,00	35,04	3,37
SK2	35	7,73	0,00	0,00	0,63	0,00	0,00	154,21	0,00
SK2	36	5,03	0,00	0,00	0,00	0,00	0,00	56,18	0,00
B21	37	0,24	89,93	107,61	0,02	6,16	4,49	0,00	0,00
B12	40	6,33	47,02	102,97	0,14	2,98	2,34	0,91	0,00
B01	44	12,28	89,41	69,38	0,18	0,06	1,85	1,71	0,00
B01	47	0,06	41,99	43,86	0,34	0,26	0,74	10,60	0,17
B10	52	6,96	0,00	0,36	1,01	0,00	22,92	0,00	0,00
B10	53	18,67	0,00	0,77	45,67	2,42	21,33	3,55	0,00
B10	54	16,51	0,00	1,36	32,35	1,13	26,62	3,51	0,00
B10	55	46,70	0,00	0,11	0,66	0,00	5,44	0,00	0,00
B11	59	27,88	0,97	1,48	0,45	0,55	30,48	0,64	0,00

**Tab. 4:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Mean catches of selected abundant fish species in the North Sea and Baltic Sea (number per 1 h trawling)

Area	Station	Cod	Dab	Plaice	Herring	Sprat	Flounder	Whiting	Mackerel
GB1	1	0	98	14	98	14	0	16645	0
GB3	6	1	1021	122	452	4713	0	0	0
GB4	12	1	3742	0	0	468	0	0	2176
P01	18	0	2569	31	0	80	0	1176	105
SK2	35	11	0	0	1	0	0	71	0
SK2	36	13	0	0	0	0	0	30	0
B21	37	2	288	164	1	96	2	0	0
B12	40	2	125	298	4	111	5	3	0
B01	44	9	259	172	3	3	1	6	0
B01	47	1	368	522	10	35	2	104	2
B10	52	41	0	4	14	0	92	0	0
B10	53	79	0	4	530	157	81	23	0
B10	54	98	0	8	349	76	118	19	0
B10	55	867	0	1	5	0	19	0	0
B11	59	161	14	20	12	34	125	5	0

**Tab. 3:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Water depth, temperature (T), salinity (S), O<sub>2</sub> in mg/l and O<sub>2</sub> saturation (%) in Baltic Sea and North Sea

Date	LOG-Station	Trawling Station	Area	Depth (m)	T (°C)	S (PSU)	O <sub>2</sub> (mg/l)	O <sub>2</sub> Saturation (%)
30.12.2023	616	1	GB1	37	11,21	33,2451	5,74	92,24
				3	10,728	33,0869	5,85	93,01
01.12.2023	621	6	GB3	39	12,587	34,8288	5,63	94,1
				3	12,566	34,8272	5,63	94,02
02.12.2023	627	12	GB4	43	11,862	34,6956	5,75	94,59
				3	11,913	34,6221	5,77	94,96
03.12.2023	633	18	P02	73	9,386	34,8974	5,59	87,25
				3	9,732	34,776	5,9	92,7
06.12.2023	650	35	SK 2	177	8,061	35,1475	5,27	79,97
				3	6,915	26,8604	6,77	94,88
06.12.2023	651	36	SK 2	180	8,038	35,1406	5,22	79,2
				4	6,536	25,6593	6,83	94,06
07.12.2023	652	37	B 12	21	8,389	19,0464	6,48	89,34
				3	7,304	12,2494	7,32	94,05
07.12.2023	655	40	B 12	21	8,748	19,7944	6,33	88,43
				3	7,508	9,5559	7,31	92,75
08.12.2023	659	44	B01	23	7,962	20,7663	6,61	91,19
				3	6,588	13,417	7,25	92,29
08.12.2023	662	47	B01	18	7,94	20,7341	6,55	90,33
				3	6,185	12,5883	7,5	94,02
12.12.2023	667	52	B10	24	8,449	8,3621	6,88	88,66
				4	7,55	7,7705	7,33	91,96
12.12.2023	670	55	B10	21	7,571	7,9455	7,32	92,1
				4	7,57	7,946	7,31	91,96
13.12.2023	674	59	B11	41	8,674	12,1043	6,42	85,21
				4	7,11	8,4444	7,41	92,42

**Tab. 6:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Geographical coordinates of TNT water samples in the North Sea and Baltic Sea

Date	LOG Station	Trawling Station	Area	Latitude	Longitude	Depth (m)
30.11.2022	616	1	GB1	54°03,84N	007°53,82E	36
01.12.2022	621	6	GB3	54°55,98N	006°16,36E	38,9
01.12.2022	621	6	GB3	54°55,98N	006°16,36E	38,9
02.12.2022	627	12	GB4	55°23,09N	004°26,11E	42,7
03.12.2022	633	18	P02	56°20,66N	003°00,79E	71,1
06.12.2022	650	35	SK02	58°06,69N	010°31,67E	176,7
07.12.2022	652	37	B12	54°26,81N	011°22,87E	21,2
08.12.2022	659	44	B01	54°33,16N	010°47,95E	22,5
12.12.2022	667	52	B10	54°38,91N	014°02,22E	22,8
12.12.2022	670	55	B10	54°36,63N	014°02,59E	20,7
13.12.2022	674	59	B11	54°45,96N	013°28,44E	40,4

**Tab. 7:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Geographical coordinates of the epibenthos sledge stations in the North Sea and Baltic Sea

Date	LOG-Station	Station	Area	Latitude	Longitude	Depth (m)
30.11.22	617	3	GB1	54°07,412N	007°45,566E	40,60
30.11.22	618	4	GB1	54°07,027N	007°45,476E	40,40
30.11.22	619	5	GB1	54°07,838N	007°46,866E	41,20
30.11.22	620	6	GB1	54°06,154N	007°48,034E	42,80
01.12.22	622	9	GB3	54°57,554N	006°18,518E	43,90
01.12.22	623	10	GB3	54°57,616N	006°18,616E	43,70
01.12.22	624	11	GB3	54°59,229N	006°18,373E	44,30
01.12.22	625	12	GB3	55°00,034N	006°19,245E	44,90
01.12.22	626	13	GB3	55°00,070N	006°17,099E	45,00
02.12.22	628	16	GB4	55°23,106N	004°26,130E	45,50
02.12.22	629	17	GB4	55°22,872N	004°26,562E	45,80
02.12.22	630	18	GB4	55°23,121N	004°27,347E	45,60
02.12.22	631	19	GB4	55°23,681N	004°30,156E	44,90
02.12.22	632	20	GB4	55°22,370N	004°29,605E	46,20
03.12.22	634	23	P02	56°22,935N	003°02,870E	73,50
03.12.22	635	24	P02	56°24,548N	003°04,202E	73,30
03.12.22	636	25	P02	56°21,418N	002°59,083E	74,40
03.12.22	637	26	P02	56°22,478N	002°59,890E	74,30
03.12.22	638	27	P02	56°21,609N	003°03,365E	74,50
04.12.22	639	28	ML01	55°53,826N	005°41,160E	51,40
04.12.22	640	29	ML01	55°54,842N	005°42,834E	51,50
04.12.22	641	30	ML01	55°55,819N	005°44,028E	50,90
04.12.22	642	31	ML01	55°57,026N	005°45,761E	51,80
04.12.22	643	32	ML01	55°56,261N	005°53,159E	49,80
04.12.22	644	33	ML02	55°54,730N	006°00,446E	44,10
04.12.22	645	34	ML02	55°55,495N	006°01,777E	45,40
04.12.22	646	35	ML02	55°56,328N	006°03,439E	47,80
05.12.22	648	37	ML02	55°55,903N	006°33,297E	41,00
05.12.22	649	38	ML02	55°57,459N	006°34,034E	41,70
07.12.22	653	45	B12	54°21,637N	011°23,698E	22,80
07.12.22	654	46	B12	54°19,920N	011°24,581E	23,10
08.12.22	660	54	B01	54°31,988N	010°38,978E	19,80
08.12.22	661	55	B01	54°32,285N	010°41,728E	23,70
08.12.22	663	58	B01	54°36,820N	010°23,772E	20,10
08.12.22	664	59	B01	54°37,132N	010°22,328E	20,90
09.12.22	665	60	B01	54°30,267N	010°26,387E	15,20
09.12.22	666	61	B01	54°30,023N	010°26,100E	15,30
12.12.22	671	68	B10	54°34,607N	013°58,843E	20,90
12.12.22	672	69	B10	54°36,021N	013°57,674E	21,70
12.12.22	673	70	B10	54°36,402N	013°57,849E	22,10

**Tab. 8:** Cruise 462 RV 'Walther Herwig III', 29.11. – 14.12.2022: Anthropogenic Cs-137 and natural K-40 activities measured in the monitoring areas from the Baltic Sea, in Bq per Kg

Sample Number	Sea	Area	Species	Tissue	Cs-137		K-40	
					Activity (Bq/kg)	Uncert. (%)	Activity (Bq/kg)	Uncert. (%)
18395	Baltic Sea	B11	Flounder	Whole Fish	1,25	11,13	90,00	9,05
18363	North Sea	GB1	Dab	Whole Fish	0,057	9,79	96,64	5,78
18368	North Sea	GB4	Dab	Whole Fish	0,073	7,87	93,91	5,78
18362	North Sea	GB1	Whiting	Whole Fish	0,062	9,01	105,65	5,78
18366	North Sea	GB3	Herring	Whole Fish	0,174	7,11	165,15	5,78
18364	North Sea	GB3	Dab	Whole Fish	0,074	8,13	95,099	5,79
18367	North Sea	GB4	Plaice	Whole Fish	0,093	6,44	92,16	3,25
18369	North Sea	GB4	Herring	Whole Fish	0,112	4,63	111,88	3,18
18365	North Sea	GB3	Plaice	Whole Fish	0,058	8,72	86,87	5,79